EXPANSION PROJECT REPORT
FOR
DUDHICHUA OPENCAST PROJECT
(10 Mtpa to 20 Mtpa)
(Normative Production - 20 Mtpa)
(Peak Production – 25 Mtpa)

नार्दर्न कोलफील्ड्स लिमिटेड
NORTHERN COALFIELDS LIMITED

MAY - 2016

cmpdi
A Mini Ratna Company
क्षेत्रीय संस्थान–6/Regional Institute-VI
P.O. Jayant Colliery, Dist-Singrauli (MP) – 486890

EXPANSION PROJECT REPORT
DUDHICHUA OPENCAST PROJECT (20 Mtpa)
(From 10 Mtpa to 20 Mtpa)
C O N T E N T S

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EXPANSION PROJECT REPORT
DUDHICHUA OPENCAST PROJECT (20 Mtpa)
(From 10 Mtpa to 20 Mtpa)
LIST OF APPENDICES

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2	Statement showing the Estimated Capital Expenditure on Land	A.1	2x	2y
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5	Statement showing the Capital Expenditure on Residential Buildings	A.2.2	8x	8y
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9	Estimated Capital Investment on Plant & Machinery – Electrical (Summary)	A.3.2	15x	15y
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11	Estimated Capital Investment on Workshop & Store P&M (Details)	A.3.3	21x-23x	20y-22y
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13	Statement showing Capital Investment on Coal Handling Plant (Summary)	A.3.5	25x	24y
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15	Statement showing the Capital Investment on Coal Handling Plant – (Mechanical P & M)	A.3.5.2	27x	26y
16	Statement showing Capital Investment on Other P&M	A.3.6	28x	27y
17	Statement showing Capital Investment on Furniture & Fittings	A.4	29x	28y
18	Statement showing Estimated Capital Investment on Railway Siding	A.5	30x	29y

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20	Statement showing the Capital expenditure on Capital Outlay in Mines	A.8.1	32x	31y
21	Statement showing the Capital expenditure on Capital Outlay in Mines	A.8.1.1	33x	32y
22	Statement showing Capital Investment on – Roads & Culverts	A.8.2	34x-35x	33y-34y
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24	Statement showing Capital Investment on Colony Water Supply arrangement	A.8.3.1	37x	36y
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27	Statement showing Capital Investment on Industrial sewerage	A.8.3.4	41x	39y
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30	Statement showing Category-wise/Scale-wise Manpower	B.1	54x	52y
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32	Statement showing average cost of production	C	60x	58y
33	Statement showing Year-wise operating cost at 100% capacity utilization	C.1	61x	59y
34	Statement showing Year-wise operating cost at 85% capacity utilization	C.2	62x	60y
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36	Statement showing Sensitivity of IRR	C.4	64x	62y
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EPR FOR DUDHICHUA OCP (20MTPA)
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EPR FOR DUDHICHUA OCP (20MTPA)
(10MTPA TO 20MTPA)
SALIENT FEATURES OF BOTH THE OPTIONS

	Particulars	Unit	Latest Sanctioned (10Mtpa)	Without Expn. (10Mtpa)	Option-I		Option-II	
					Integrated (20Mtpa)	Incremental (10 Mtpa)	Integrated (20 Mtpa)	Incremental (10 Mtpa)
1	Coal Production	Mtpa	10.00	10.00	20.00	10.00	20.00	10.00
2	OB Removal - Peak	Mm^3	36.30	43.81	100.00	56.19	100.00	56.19
3	Total Capital Outlay	`crs.	1281.39	1463.20	6418.74	4955.54	2507.40	1044.20
4	Specific Investment	`/t	1281.39	1463.20	3209.37	4955.54	1253.70	1044.20
5	Cost of Production							
	100% Prodn. Level	`/t	376.74	779.88	978.76	1110.11	774.90	791.80
	85% Prodn. Level		417.82	881.77	1104.28	1249.63	851.04	837.41
6	Weighted Average Selling Price	`/t	512.39	948.87	948.87	948.87	948.87	948.87
7	Profitability(`/t)							
	100% Prodn. Level		135.65	168.99	-29.89	-161.24	173.97	157.07
	85% Prodn. Level		94.57	67.10	-155.41	-300.76	97.83	111.46
8	Financial IRR (%)							
	100% Prodn. Level		13.89	24.80	2.00	-6.08	25.37	24.54
	85% Prodn. Level		8.68	10.09	-4.28	-10.98	12.92	16.42
9	Desired selling price to yield 12% FIRR (`/t)							
	12% FIRR							
	100% Prodn. Level		-	857.66	1078.32	1340.92	847.41	862.61
	85% Prodn. Level		-	971.64	1219.82	1514.67	933.88	914.15
10	NPV at 12% (` Lakhs)							
	100% Prodn. Level		-	67758.63	-171499.36	-207433.84	122220.05	47276.62
	85% Prodn. Level		-	-14380.05	-298767.86	-254462.69	10387.52	17251.51
11	Outsourcing Rate (`/B.m3)							
	OB Insitu (Excluding blasting)		-		80.94			
12	Manpower	No.	3018	2270	3440	1170	2775	505
13	OMS	t	14.14	17.48	22.89	33.14	28.64	79.24
14	EMS	`	458.68	2200.03	2177.15	2132.75	2176.04	2068.17

Option-I : Total Departmental

Option-II : Partial OB Outsourcing (Dragline Departmental)

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EPR FOR DUDHICHUA OCP (20 Mtpa)

(10 Mtpa to 20 Mtpa)

Summarised Data

Sl. No.	Particulars	Unit	Value
A	**GENERAL**		
1	Name of the Project		Dudhichua OCP Expansion
2	Name of the Area/Company		Northern Coalfields Limited
3	Nearest Railway Station from the Project	Name	Shaktinagar
		Km	5
4	Nearest National Highway/Approach Road	Name	NH-75 Ranchi-Rewa Highway
		Km	1
B	**GEOLOGICAL**		
1	Name of the Geological Blocks considered	Name	Dudhichua & Bundela Block
2	Area of the Geological Block considered	Sq. Km	14.92 (8.68+6.24)
3	Borehole Density within Block	BH/Sq. Km	14 (Total 142+66=208 BHs)
4	Description of all coal seams within the Block		

Strategraphic Sequence	**Thickness(m)**		**No. of BH Inter-section**	**Geological Reserves (Mt)**
	Min.	**Max.**		Dudhichua & Bundela
Purewa Top Seam	1.95	10.45	109	92.19
Purewa Bottom Seam	5.97	15.20	121	178.09
Turra Seam	15.45	25.75	163	362.98
Total				633.26

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Sl. No.	Particulars	Unit	Value	
C	**TECHNICAL**			
1	Surface Area of proposed Expn. OCP	Sq.Km	10.96	
2	Borehole density within mine area	BH/ Sq.Km	11	
3	Quarry Parameters		Western Section	Eastern Section
	Average Strike length of quarry along Turra Seam Floor	Km	1.80	1.90
	Average Strike length of quarry along Surface	Km	2.00	2.30
	Dip-rise width of the quarry on Turra Seam floor	Km	2.20	2.00
	Dip-rise width of the quarry on Surface	Km	2.60	2.40
	Maximum depth of the quarry from surface	m	290	310
	Quarry surface area (Expn.) from existing face	Sq. Km	10.96	
	Total quarry surface area (Existing & Expansion)	Sq. Km	16.82	

4 **Description of Coal Seam proposed to be worked alongwith the parting details**

Coal Seam	Seam Thickness Range (m)	Parting Thick-ness (m)	Av. Grade GCV(UHV) (K.Cal/Kg)	Av. Gra-dient	Geological Re-serves (Mt)
Purewa Top	1.95-10.45	40-210	3110-5240 (786-5008)	2^{o}-3^{o}	63.22
Purewa Bottom	5.97-15.20	27.08-45.20	3160-5280 (1572-4691)		115.33
Turra	15.45-25.75	48.50-63.05	3360-5390 (1903-4953)		196.70
Total			G8-G11 (Av-G10)		**375.25**

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Sl. No.	Particulars	Unit	Value
5	**Balance Mineable Coal Reserves, Volume of OBR & Stripping Ratio as on 31.03.2015**		

Particulars	Unit	Latest Sanctioned (10Mtpa)	Without Expansion (10Mtpa)	Incre-mental (10 Mtpa)	Integrated (20 Mtpa)
Purewa Top	Mt	50.91	15.59	41.31	56.90
Purewa Bottom	Mt	91.37	25.98	81.29	107.27
Turra	Mt	202.68	62.36	120.57	182.93
Total Coal	Mt	344.96	103.93	243.17	347.10
Volume of OBR	Mm^3	1134.92	500.83	1102.95	1603.78
Average Stripping Ratio	m^3/t	3.29	4.82	4.54	4.62

6	Method of Mining	Combined system of Mining deploying Draglines and Shovel-Dumpers	
7	Target Output		
	Normative Production Capacity at 100%	Mtpa	20.00
8	Year of achieving target production (from Zero Date)	Year	6th Year (2020-21)

9 Production Phasing from Zero date (2015-16) upto target year

Year	Unit	15-16	16-17	17-18	18-19	19-20	20-21
Coal	Mt	13.00	13.00	15.00	16.00	18.00	20.00
OB	Mm^3	60.30	61.25	68.50	73.05	84.25	94.80

10	Total Mine life at nominal production capacity		20 Years
	Production Build-up period	Years	5

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Sl. No.	Particulars	Unit	Value
	Production period at target rate	Years	12
	Tapering down period	Years	3

11	Major HEMM Deployed for Coal winning						
	HEMM	Cap/ Size	Latest Sanction (10Mtpa) (Upgraded)	Option-I		Option-II	
				Incremental (10Mtp)	Integrated (20Mtpa)	Incremental (10Mtpa)	Inte-grated (20 Mtpa)
	Elect. Rope Shovel	10 m^3	4	2	6	2	6
	Diesel Hyd. Shovel	10-12 m^3	-	2	2	2	2
	Rear Dumper	100 T	24	28	52	28	52
	RBH Drill	160 mm	8	4	12	4	12
	Dozer	410 HP	8	-	8	-	8
12	Major HEMM Deployed for OB Removal						
	Dragline	24m^3/88mR	4	-	4	-	4
	Elect. Rope Shovel	20 m^3	7	13	20	-	7
	Dumper	190 T	56	104	160	-	56
	RBH Drill	311 mm	4	-	4	-	4
	RBH Drill	250 mm	14	26	40	-	14
	Dozer	850 HP	7	13	20	-	7
	Dozer	410 HP	8	-	8	-	8
13	Weighted Average grade of ROM Coal (Non-coking/Coking)			Grade		Non-Coking G8-G11 (Av-G10)	

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Sl. No.	Particulars	Unit	Value
14	Presence of major surface constraints (Nalla, road, power line, etc.)		NA
15	Coal Transport within the mine	Type	Rear Dumpers
16	Surface coal transport to siding/ despatch point and mode of despatch		Coal Handling Plant/ Silo/ MGR & Railway
17	Any railway siding & distance	Km	MGR & Public Railway Siding, 2.0 Km
18	Name of specific customer/ Industry		Basket Linkage

D ENVIRONMENT & OTHERS

Civil Construction

	Particulars	Unit	Existing no. of Qtrs.	Option-I		Option-II	
				Incremental (10 Mtpa)	Integrated (20 Mtpa)	Incremental (10Mtpa)	Integrated (20 Mtpa)
1	Residential Houses	No.	2296	140	2436	45	2341
	House Satisfaction	%		71		84	
2	Total Land to be acquired						
	Non-Forest land	Ha	55.913				
	Forest land	Ha	467.809				
3	Land to be acquired within mine-take area (Excavation area)						
	Non-Forest land	Ha	30.913				
	Forest land	Ha	410.809				

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Sl. No.	Particulars	Unit	Value
4	Land to be acquired outside mine take area(beyond excavation area e.g. Safety zone, approach road, infrastructure, colony, etc.		
	Non-Forest land	Ha	25
	Forest land	Ha	57
5	Land to be acquired for external dump		
	Non-Forest land	Ha	NIL
	Forest land	Ha	NIL
6	Habitation & Rehabilitation		
	No. of PAFs to be rehabilitated	No.	502
7	Cost of land & rehabilitation		
	R&R & Land Cost	` Lakhs	8310.77

8	Total land reclamation capital						
	Particulars	**Unit**	**Without Expn. (10Mtpa)**	**Option-I**		**Option-II**	
				Incremental (10Mtpa)	**Integrated (20Mtpa)**	**Incremental (10 Mtpa)**	**Integrated (20Mtpa)**
	Total Land Reclamation Capital	` Lakhs	1539.54	3579.64	5119.18	3579.64	5119.18
9	Make of Water	m^3/day	54184				
10	Total installed pumping capacity	m^3/Hr	2709				
11	Drainage of the area		Natural Drainage				

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E	**FINANCIAL**							
	Particulars	**Unit**	**Latest Sanctioned (10Mtpa)**	**Without Expn. (10Mtpa)**	**Option-I**		**Option-II**	
					Inte-grated (20Mtpa)	**Incre-mental (10 Mtpa)**	**Inte-grated (20Mtpa)**	**Incre-mental (10 Mtpa)**
1	Coal Production	Mtpa	10.00	10.00	20.00	10.00	20.00	10.00
2	OB Removal - Peak	Mm^3	36.30	43.81	100.00	56.19	100.00	56.19
3	Total Capital Outlay	`Crs.	1281.39	1463.20	6418.74	4955.54	2507.40	1044.20
4	Specific Investment	`/t	1281.39	1463.20	3209.37	4955.54	1253.70	1044.20
5	Cost of Production (`/t)							
	100% Prodn. Level	`/t	376.74	779.88	978.76	1110.11	774.90	791.80
	85% Prodn. Level		417.82	881.77	1104.28	1249.63	851.04	837.41
6	Weighted Average Selling Price	`/t	512.39	948.87	948.87	948.87	948.87	948.87
7	Profitability(`/t)							
	100% Prodn. Level		135.65	168.99	-29.89	-161.24	173.97	157.07
	85% Prodn. Level		94.57	67.10	-155.41	-300.76	97.83	111.46
8	Financial IRR (%)							
	100% Prodn. Level		13.89	24.80	2.00	-6.08	25.37	24.54
	85% Prodn. Level		8.68	10.09	-4.28	-10.98	12.92	16.42
9	Desired selling price to yield 12% FIRR (`/t)							
	12% FIRR							
	100% Prodn. Level		-	857.66	1078.32	1340.92	862.61	847.41
	85% Prodn. Level		-	971.64	1219.82	1514.67	914.15	933.88
10	NPV at 12% (` Lakhs)							
	100% Prodn. Level		-	67758.63	-171499.36	-207433.84	122220.05	47276.62
	85% Prodn. Level		-	-14380.05	-298767.86	-254462.69	10387.52	17251.51
11	Outsourcing Rate (`/$B.m^3$)							
	OB Insitu (Excluding blasting)		-	-	80.94			
12	Manpower	No.	3018	2270	3455	1185	2790	520
13	OMS	t	14.14	17.48	22.78	32.71	28.48	76.83
14	EMS	`	458.68	2200.03	2176.14	2130.37	2174.79	2064.61

Option-I : Total Departmental Option-II : Partial OB Outsourcing (Dragline Departmental)

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CHAPTER-I

INTRODUCTION

1.1 INTRODUCTION

1.1.1 Feasibility Report for Dudhichua Opencast Project

Feasibility Study of Singrauli Coalfield prepared by CMPDI in collaboration with erstwhile Soviet Experts in 1974 identified Dudhichua Opencast Project with a rated capacity of 10 Mtpa.

Feasibility Report for Dudhichua OCP was prepared by CMPDI in June, 81 for a rated capacity of 10 Mtpa and processed for approval.

During the appraisal stage, it was decided by IMG meeting held on 11th January, 1982 that the project may be developed in two stages, Stage-I of 5 Mtpa and ultimate stage of 10 Mtpa.

1.1.2 Feasibility Report for Dudhichua OCP (5 Mtpa)-Phase-I

The Feasibility Report for Dudhichua OCP for the rated capacity of 5 Mtpa was prepared by CMPDI in August, 1982 and sanctioned by the Govt. in February, 1984 vide letter No.CPP/43011/48/81, dated 27.2.84 for a capital investment of `289.68 crores. The implementation of the project was taken up with the World Bank Assistance of US $ 151 million and the project was to achieve the rated production of 5 Mtpa in 1993-94.

1.1.3 Feasibility Report for Dudhichua OCP (5 Mtpa)-Phase-II

With the increased demand of coal from Singrauli Coalfield, it had become necessary to expand Dudhichua OCP for an additional 5 Mtpa of ROM coal to its ultimate stage to meet the enhanced coal requirement.

Accordingly, the PR for Dudhichua Opencast Project Phase-II for an additional output of 5 Mtpa of ROM coal from Dudhichua mine was prepared by CMPDI in December, 1989 and submitted for its sanction.

As desired by IMG, the economics of Dudhichua Phase-I and Phase-II was presented in a composite manner (Base Date: August, 1991).

The EPR for Dudhichua OCP (10 Mtpa) was sanctioned by the Govt. on 25.08.1992 for a capital investment of `868.93 crores.

The scheduled date of completion of the EPR (10 Mtpa) was March, 1998. However, implementation of the project could not be started in full swing due to fund constraints.

1.1.4 **RCE for Dudhichua OCP (10 Mtpa)**

As mentioned above, the project could not be developed as per approved schedule due to fund constraints resulting in time over run and consequently cost overrun. The World Bank Assistance for the project had been finalized in March, 1998. The above necessitated the preparation of Revised Cost Estimates (RCE) for Dudhichua OCP (10 Mtpa). Accordingly, RCE for Dudhichua OCP (10 Mtpa) was prepared for a capital investment of `1281.39 crores (Base Date: December, 2000) and approved by Govt. in March, 2001 vide letter No. 43011/35/99-CPAM dated 26.03.2001.

1.1.5 **COMPLETION REPORT (10 Mtpa)**

The RCE of Dudhichua Project (10 Mtpa) has been completed as per schedule in March, 2004 at an initial capital cost of `1267.97 crores against the sanctioned provision of `1281.39 crores.

Head-wise breakup of the initial capital as per sanctioned provision, actual completion capital and existing assets as on 31.03.2015 are shown in Table No.-1.1.

Table No.1.1
STATUS OF CAPITAL PROVISION
(RCE/COMPLETION REPORT & EXISTING AS ON 31.03.2015))

(Amt. in `Lakhs)

Sl. No.	Particualrs	Provision as per Sanctioned RCE(2001)	Provision as per Compln. Report (2004)	Existing Assets as on 31.03.2015
1	Land	677	774	1609
2	Buildings			
	Residential	4842	6114	4489
	Service	4650	4532	6082
3	Plant & Machinery			

	HEMM	83932	83462	102697
	CHP	14396	15950	18608
	Electrical	4299	5642	2921
	Pumps & Pipes	618		227
	Workshop	1694		1392
	Other P&M	1040		34
4	Furniture & Fittings	180	180	233
5	Vehicles	389	414	353
6	Railway Siding	1415	2044	3123
7	Prospecting & Boring	30	30	-
8	Development			
8.1	Capital Outlay in Mines	2385	1543	702
8.2	Roads & Culverts	2701	2274	1670
8.3	Water Supply	1366	607	640
8.4	PR Preparation & Other Scientific Research	1428	860	-
9	Revenue expenses capitalized during development period	1237	1237	-
10	Land Reclamation	860	422	1540
11	ESMP Expenses	-	712	-
	Total	128139	126797	146320

1.1.6 Emergency Coal Production Plan (ECPP) of CIL

Under ECPP additional 30.00 Mm^3 of OB was to be removed through outsourcing during a period of 3 years, starting from the year 2006-07 to 2008-09 to achieve the additional coal production of 5.50 Mt over and above the PR proposal.

1.1.7 Scheme for Outsourcing of OBR

NCL Board has approved 116 Mm^3 (27.85Mm^3+68.07Mm^3+20.08Mm^3) of additional OB outsourcing in three different proposals from 2014-15 to 2017-18 to achieve the planned coal production target for three years at Dudhichua Opencast Project. Out of 116 Mm^3, 3.39 Mm^3 has been actually excavated (2014-15) and the balance sanctioned outsourcing quantity 112.61 Mm^3 OB has been considered in the EPR from 2015-16 to 2017-18.

1.2 EMP Status

EMP for 15.50 Mtpa capacity from the leasehold boundary of 10 Mtpa project for Dudhichua OCP was cleared by MOEF vide letter No.J-11015/ 382/2008-IA.II (M) dated 10.12.2008.

1.3 PRESENT STATUS OF THE PROJECT

The project started mining operation with OB removal from the year 1982-83 and coal production started from 1987-88. The project has produced 202.02 Mt. of coal along with 635.22 Mm^3 of OB removal till 31.03.2015.

The actual coal production and OB removal of the project vis-à-vis the sanctioned provision is given in Table No.-1.2.

Table No. 1.2

PRODUCTION OF COAL & OBR (AS PER EPR VIS-À-VIS ACTUAL)

Years	As per Sanctioned RCE/ ECPP/EPR			Actual Performance (as reported by the project)		
	Coal (Mt)	OB (Mm^3)	Av. SR (m^3/t)	Coal (Mt)	OB (Mm^3)	Av. SR (m^3/t)
Upto 99-00	49.67	185.64	3.74	49.66	185.62	3.74
00-01	7.00	29.40	4.20	7.92	29.38	3.71
01-02	8.00	34.93	4.37	8.50	30.45	3.58
02-03	9.00	36.30	4.03	9.25	32.00	3.46
03-04	10.00	36.30	3.63	9.36	31.75	3.39
04-05	10.00	36.30	3.63	10.20	26.97	2.64
05-06	10.00	35.26	3.53	10.41	26.24	2.52
06-07	11.50 (10.00+1.5**)	44.26 (34.26+10.0**)	3.85	10.89	28.57 (27.18+1.39**)	2.62
07-08	12.00 (10.00+2.0**)	41.50 (31.50+10.00**)	3.46	12.79	36.07 (25.42+10.65**)	2.82
08-09	12.00 (10.00+2.0**)	41.50 (31.50+10.00**)	3.46	13.27	34.36 (23.97+10.39**)	2.59
09-10	12.00	41.50 31.50+10.00*	3.46	13.31	28.79 (21.07+7.72*)	2.16
10-11	13.00	39.25 (32.07+7.18*)	3.02	10.50	26.41 (22.64+3.77*)	2.52
11-12	14.00	49.77 (33.94+15.83*)	3.56	11.73	31.15 (18.78+12.37*)	2.66

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12-13	15.00	59.86 (37.59+22.27*)	3.99	12.23	30.62 (17.76+12.86*)	2.50
13-14	15.00	65.08 (37.68+27.40*)	4.34	11.17	31.45 (14.97+16.48*)	2.82
14-15	15.00	65.08 (137.68+27.40*)	4.34	10.82	25.39 (15.92+9.47*)	2.35
Total	**223.17**	**841.93** (701.85+140.08*)	**3.77**	**212.02**	**635.22** (59.59+75.63*)	**2.99**

* Under scheme of outsourcing of OBR
** As per ECPP of CIL

The position of major HEMM existing at the project as on 31.03.2015 vis-à-vis provision as per sanctioned RCE are given in Table No.-1.3.

Table No.1.3

MAJOR HEMM

Sl. No.	HEMM	Size/ Capacity	**Sanctioned** RCE Provision (10 Mtpa)	Existing As on 31.03.15 (10 Mtpa)
A	**OB Removal**			
1	Dragline	24m^3/88mR	4	4
2	Elect. Rope Shovel	20m^3	-	1
3	Elect. Rope Shovel	10m^3	14	8+4*
4	Hyd. Shovel	5.5m^3	2	-
5	RBH Drill	311mm	4	4
6	RBH Drill	250mm	16	9+4*
7	Rear Dumper	190-210T	-	-
8	Rear Dumper	120T	38	32+11*
9	Rear Dumper	100T	-	36
10	Rear Dumper	85T	72	-
11	Dozer with Ripper	770/850 HP	5	4+2*
12	Dozer	410 HP	13	13
B	**Coal Winning**			
1	Elect. Rope Shovel	10m^3	4	4
2	Diesel Hyd shovel	10-12 m^3	-	-
3	RBH Drill	160mm	8	7
4	Rear Dumper	100T	-	4
5	Rear Dumper	85T	28	24
6	Dozer	410 HP	8	4
C	**Common**			
1	Motor Grader	550 HP	-	-
2	Motor Grader	280 HP	8	6
3	Crane	120 T	-	1
4	Crane	60-90 T	2	1
5	Crane	40-60 T	1	2

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6	Crane	18-20 T	-	2
7	Crane	9-10T	-	2
8	Hyd.Shovel/ Back-hoe	3.2/3.8m^3	-	-
9	FE Loader	10-12m^3	-	1
10	FE Loader	5.74/6.1m^3	3	1
11	Dozer	410 HP	-	-
12	Wheel Dozer	300HP	8	-
13	Wheel Dozer	410/450HP	-	2
D	**Reclamation**			
1	Dozer	410 HP	5	2
2	Motor Grader	280 HP	2	2
3	Hyd. Backhoe	3.2/3.8m^3	-	-
4	Tipping Truck	8m^3	-	-
5	Water Sprinkler	28 KL	6	5+4*
6	Water Sprinkler	70KL	-	1
7	Road Sweeping Machine		-	-

* Surveyed off but working

1.4 EPR FOR DUDHICHUA OCP (20 Mtpa)

To meet the growing demand of coal, it has been now proposed to increase the production capacity of Dudhichua OCP. To augment the production and for an optimum life of the project, it is necessary to encompass the additional coal reserves on the dip side mainly from the Bundela and small part in Ruhela Geological Block.

Earlier, EPR for Dudhichua OCP was prepared in Feb. 2008 and submitted for an incremental capacity of 5 Mtpa (from 10 Mtpa to 15 Mtpa), which was approved by NCL Board on 28.07.2008, for incremental capital investment of `326.57 Crores for Option-II (total coal production departmental, partial OB outsourcing and Dragline departmental).

EPR of 15 Mtpa requires forest clearance for diversion of forest land for its implementation. Forest Clearance of the EPR is under process.

Further, NCL desired the revision of EPR for increased total capacity of 20 Mtpa within the boundary of earlier EPR of 15 Mtpa.

The Draft EPR for Dudhichua OCP had been prepared for an incremental capacity of 10 Mtpa (from 10 Mtpa to 20 Mtpa) for the following two options:

Option – I, Total Departmental

Option – II, Partial OB Outsourcing (Dragline Departmental)

In both the options, total coal production is to be done departmentally.

The Draft EPR (20 Mtpa) was presented before CMD, Directors and CGMs/GMs in CMPDI (HQ), Ranchi on 27.02.2016 for obtaining guidance for finalization of the report. The directives given vide minutes of the meeting letter No. PAD/G-43/2016/E-7598, dated 02.03.2016 have been incorporated in the report. The comments of other departments of CMPDI (HQ) have also been incorporated in the report. The minutes of the meeting is enclosed as Annexure-I.

The Draft EPR (20 Mtpa) was also presented in the Planning Committee meeting of NCL before CMD, Directors and CGMs/GMs in NCL (HQ), Singrauli on 05.03.2016. The directives given vide minutes of the meeting letter No.NCL/CP/DCH-EPR/184, dated 15.03.2016 have been incorporated in the report. The minutes of the meeting is enclosed as Annexure-II.

Minutes of the meeting vide letter No. NCL/CP/DCH-EPR/214, dated 30.03.2016 regarding the location of Receiving Pits of the Inpit Crushing and Conveying System has been incorporated in the report and is enclosed as Annexure-III.

Accordingly, the EPR for Dudhichua OCP (20 Mtpa) has been prepared for the following two options:

Option – I, Total Departmental

Option – II, Partial OB Outsourcing (Dragline Departmental)

In both the options, total coal production is to be done departmentally.

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CHAPTER-II

MARKETABILITY & LINKAGE

2.1 DEMAND & AVAILABILITY

Dudhichua Opencast Project (10 Mtpa) has been sanctioned as a Basket linkage mine. Coal production from Dudhichua OCP serves as Basket Linkage mine. The demand projection consumer-wise and coal production Programme of NCL is given in Table No.2.1 and Table No.2.2 respectively. Table No.2.3 shows the gap between production, availability and demand. This project serves as a Basket linkage mine for pit head power stations of NTPC & UPRVUNL in Singrauli Coalfield to meet any shortfall from respective linked mines. It also serves as a Basket Linkage mine to power stations to Western/Northern India.

2.2 Justification

It is evident from the Table No.2.3 that there will be shortfall in coal supply from NCL even if contributions from the projects under approval are considered. The expansion of the existing Dudhichua OCP is, therefore, justified in view of the above and also to meet the growing demand of coal in the country.

Table No.2.1

Demand Projection on NCL
(Consumer-wise Coal Demand as per LT/CEA Projection)

(Fig. in Mt.)

Sl.No.	Name of Power House	Cap. (MW)	LT/CEA Qty. (Mtpa)	XII Plan		
				2014-15	2015-16	2016-17
1	SSTPS	2000	11.00	12.100	12.100	12.100
2	VSTPS	3260	17.200	18.920	18.920	18.920
3	RhSTPS	2000	10.500	11.550	11.550	11.550
	Badarpur TPS (Addl. From NCL)			1.500	1.500	1.500

	Sub-Total NTPC		**38.700**	**44.070**	**44.070**	**44.070**
4	OTPS	1262	5.000	5.000	5.000	5.000
5	ATPS	1630	8.500	8.500	8.500	8.500
6	Paricha	640	1.141	1.141	1.141	1.141
	Sub-Total UPRVUNL		14.641	14.641	14.641	14.641
7	**Rajghat TPS**	**135**	**0.800**	**0.940**	**0.940**	**0.940**
8	Kota TPS	1045	1.650	1.740	1.740	1.740
9	Suratgarh TPS	1250	2.000	2.110	2.110	2.110
	Sub-Total RRVUNL		**3.650**	**3.850**	**3.850**	**3.850**
10	TDL TPS	1360	1.600	1.880	1.880	1.880
	Total Power Utility - Existing		**59.391**	**65.381**	**65.381**	**65.381**
	PU/IPP through LoA rounte					
11	Lanco Anpara TPS	1200	4.180	4.182	4.182	4.182
12	Anpara-D	1000	3.370	3.370	3.370	3.370
13	Proyagraj Power(Bara)	1980	7.020	7.020	7.020	7.020
14	Sangam Power(Karchana)	1320	4.680	4.680	4.680	4.680
15	VSTPS(Stage-IV)	1000	3.190	3.190	3.190	3.190
16	Obra Extn(Phase-I)	500	1.770	1.770	1.770	1.770
17	RhSTPS (Stage-III)	1000	3.370	3.370	3.370	3.370
18	DB Power Ltd., Deosar	1320	2.100	2.100	2.100	2.100
19	VSTPS(Stage-V)	500	1.770		1.770	1.770
20	SSTPS (Stage-II)	500	1.770		1.770	1.770
	Sub-Total		**33.220**	**29.682**	**33.222**	**33.222**
	Total Power		**92.611**	**95.063**	**98.603**	**98.603**
	Power Captive - Existing					

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21	HIL (RPD) 1-8 Units		2.700	2.500	2.500	2.500
22	HIL Co-Gen		0.236	0.236	0.236	0.236
23	Kanoria Chemicals(St-I & II)		0.252	0.252	0.252	0.252
24	HIL (9th & 10th) Units		1.250	0.710	0.710	0.710
25	HIL Co-Gen Expn.	40	0.194	0.180	0.180	0.180
	Total CPP - Existing		**4.632**	**3.878**	**3.878**	**3.878**
	New CPP through LoA route					
26	JP Associates(Dalla Cement)		0.1220	0.1220	0.1220	0.1220
27	JP Associates(Chunar Cement)		0.1640	0.1640	0.1640	0.1640
28	JP Associates(Sidhi)		0.1510	0.1510	0.1510	0.1510
	Sub-Total		**0.4370**	**0.4370**	**0.4370**	**0.4370**
	New Sponge Iron Units - LoA route					
29	Shri Baba Vishwanath Pvt.Ltd. VNS		0.009	0.009	0.009	0.009
30	Shri Baba Vishwanath Pvt.Ltd. VNS		0.009	0.009	0.009	0.009
31	Trimula Industries Ltd. Sidhi		0.126	0.126	0.126	0.126
32	Shri Shanti Gopal Concast Mirzapur		0.072	0.072	0.072	0.072
	Sub-Total		**0.216**	**0.216**	**0.216**	**0.216**
	Alluminium Priority					
33	HIL Alluminium		0.252	0.252	0.252	0.252
34	Linked Insutries		0.433	0.433	0.433	0.433
	Sub-Total		**0.685**	**0.685**	**0.685**	**0.685**
	Total Allocation		**98.58**	**100.28**	**103.82**	**103.82**

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Table No. 2.2

AVAILABILITY OF COAL FROM NCL

(Fig. in Mt)

SL NO.	NAME OF MINE / PROJECTS	TYPE OF MINE (UG/OC)	TYPE OF COAL	SANC. CAP. (Mty)	PROJ. XII PLAN		XIII PLAN (1 BT Plan)		
					2015-16 (Target)	2016-17	2017-18	2018-19	2019-20
A	**EXISTING / COMPLETED PROJECTS**								
1	Jhingurdah	OC	Non Coking	3.00	1.60	1.20			
2	Jayant	OC		10.00	10.00	10.00	10.00	10.00	10.00
3	Dudhichua Expn.	OC		10.00	10.00	10.00	10.00	10.00	10.00
4	Kakri	OC		3.00	1.50	1.30	-	-	-
5	Bina Extn.	OC		6.00	7.00	7.50	7.50	6.00	6.00
	SUB-TOTAL			**32.00**	**30.10**	**30.00**	**27.50**	**26.00**	**26.00**
B	**ON GOING PROJECTS**								
1	Khadia Expn.	OC	Non Coking	10.00	6.00	8.00	10.00	10.00	12.00
2	Krishnashila	OC		4.00	5.00	5.00	5.00	5.00	5.00
3	Amlohri Expn.	OC		10.00	10.00	10.53	12.00	12.00	12.00
4	Nigahi Expn.	OC		15.00	15.00	15.00	17.00	17.50	18.00
5	Block-B	OC		3.50	5.00	5.47	5.00	3.50	3.50
	SUB-TOTAL			**42.50**	**41.00**	**44.00**	**49.00**	**48.00**	**50.50**
C	**FUTURE / NEW PROJECTS**								
C1.	IDENTIFIED - UNDER APPROVAL / FORMULATION								
1	Jayant Expn.	OC	Non Coking	10.00	4.00	5.00	6.00	8.00	10.00
2	Dudhichua	OC		10.00	3.00	3.00	5.00	6.00	8.00

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3	Jhingurdah Bottom Seam	OC		2.00	-	-	-	1.00	2.00
4	Semaria	OC		2.00	-	-	-	1.00	2.00
5	Block-B Extn.	OC		4.50	-	-	2.00	4.50	4.50
6	Bina-Kakri Amalgamation	OC		4.00	-	-	-	2.00	3.00
	SUB-TOTAL			**32.50**	**7.00**	**8.00**	**13.00**	**22.50**	**29.50**
C2	**YET TO BE TAKEN-UP FOR SUSTAINING PRODUCTION**								
1	From Main Basin						0.50	2.50	4.00
	SUB-TOTAL						**0.50**	**2.50**	**4.00**
	GRAND TOTAL			**107.00**	**78.10**	**82.00**	**90.00**	**99.00**	**110.00**

Table No. 2.3

DEMAND VIS-À-VIS AVAILABILITY ON NCL

Sl. No.	Details	PROJ. XII Plan		PROJ. XIII Plan		
		2015-16 (Target)	2016-17	2017-18	2018-19	2019-20
1	Production	78.10	82.00	90.00	99.00	110.00
2	Total Demand	103.82	103.82	119.25	115.30	116.50
3	Surplus/ Deficit	-25.72	-21.82	-29.25	-16.30	-6.50

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CHAPTER-III

PROJECT SITE INFORMATION

3.1 LOCATION & COMMUNICATION

Dudhichua Opencast Project is located on the east of Jayant Opencast Mine and on the west of Khadia Opencast Mine in Singrauli Coalfield. The inter-state boundary between MP and UP passes through the existing project area and thus project is partly in the Singrauli district in MP and partly in the Sonebhadra district in UP. The expansion proposal is totally in Singrauli district of Madhya Pradesh.

Geographic coordinates of the expansion area are bounded by Longitude $82^{o}41'3.27"E$ to $82^{o}40'2.3"E$ and Latitude $24^{o}9'12.23"N$ to $24^{o}9'20.28"N$, whereas southern latitude of leasehold boundary is $24^{o}7'19.83"N$ to $24^{o}10'56.40"N$. The area is covered in Survey of India Topo sheet No.63L/12 (RF 1:50000) and special Toposheet No.6 to 9.

3.2 COMMUNICATION

The project is well connected by both road and rail. Nearest railway station, Shaktinagar is at a distance of about 5 km and approachable by all weather metalled road. The project is at a distance of 63 km by road from Renukut in UP and 18 km from Waidhan in MP by Ranchi-Rewa highway.

3.3 PHYSIOGRAPHY

Dudhichua Opencast Block stands out on a plateau above plains on its south-east part of Singrauli coalfield. The average elevation at the foot of the plateau is 325 m above MSL. The highest elevation reaches about 504 m.

The plateau is defined by a steep escarpment (facing south-west), rising from the elevation of 320-430m. The escarpment is characterized by thick growth of vegetation rolled-boulders and is disected by numerous small seasonal streams. The area on the top of the plateau is undulating with elevation varying from 375-430 m with occasional high hills rising to 504m.

The most important stream in around is Ballia Nalla. The drainage of the area is controlled by seasonal streams which discharge into Ballia Nalla , which ultimately drains into Govind Ballabh Pant Sagar in the south. Similarly, towards north, the drainage is through seasonal streams which ultimately join Bijul Nalla.

3.4 CLIMATE

The climate of the area is tropical. The summer months are severe and prevail from March to June. Generally the minimum and maximum temperature during summer are 21^{o}C and 48^{o}C respectively. The temperature in winter during the month of November to February varies between 4^{o}C to 21^{o}C. The average annual rainfall is about 1200mm out of which about 88% precipitation is during rainy season from June to September only. The details of the rainfall data obtained from the Meteorological Station Jhingurdah (1972-2014) are given in Table No.3.1.

Table No. 3.1

[illegible] RAINFALL DATA OF JHINGURDAH RAINGAUGE STATION (mm)

[illegible]	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
	1.60		41.40	100.30		313.20	136.80	62.90	38.90	744.30
	1		3	8	0	9	15	6	2	50
		14.80	25.50	131.90	198.90	265.80	98.30			768.90
		1	4	13	11	18	7			60
	11.00	13.10	25.00	320.80	236.00	238.10	22.40	3.70	5.60	885.60
	2	2	4	20	14	4	2	1	1	52
			107.10	400.00	739.20	137.30	118.30			1540.80
			9	18	23	13	9			85
	31.10		64.00	369.60	421.80	319.90	0.00			1239.30
	4		4	21	21	11				64
	27.20	8.20	417.00	573.40	282.00	443.60	61.10	23.00		1848.20
	3	3	12	23	14	15	3	4		80
			299.10	455.90	336.00	765.60	36.00	14.00	12.70	2193.10
			10	21	23	15	2	1	1	85
	4.80		96.60	171.00	227.00	48.80		26.80		711.90
	2		5	16	12	8		3		59
		2.20	568.60	323.40	417.80	233.70			19.00	1601.10
		1	12	23	28	13			2	85
	57.60	6.40	180.60	321.00	178.50	145.90		2.30		944.80
	2	1	4	22	14	9		1		56
			90.20	236.50	456.50	43.20		4.60	21.80	991.70
			4	16	28	10		2	1	70
		49.90	66.80	268.30	203.00	324.60	46.20			960.30
		2	2	19	15	20	3			62
		16.70	156.20	324.60	533.30	119.00	27.50		18.30	1326.90
		2	11	14	21	10	5		1	75
	4.00	3.20	101.20	331.50	490.10	238.20	33.90			1278.40
	1	1	7	21	16	13	3			66
	15.50	2.80	138.70	148.90	277.10	68.50	41.70		74.20	866.00
	1	2	10	14	16	7	2		4	63
			10.80	311.90	456.80	550.80	97.00			1467.10
			3	10	10	15	4			45
	4.00		376.00	493.00	117.00	85.00	28.00			1135.50
	1		10	10	13	4	1			43
			291.00	338.40	242.10	176.90		33.80	8.80	1122.00
			15	16	12	10		1	2	64
		61.20	227.00	260.60	173.00	207.70	5.20			1029.00
		3	18	18	18	15	1			77
		26.00	141.50	141.00	666.00	258.00	17.00			1344.00
		2	5	7	22	15	3			62
			26.70	270.40	573.40	91.50	59.60			1021.60
			4	17	19	10	3			53
		3.20	217.10	297.80	297.10	394.30				1109.50
		1	19	18	19	12				59
	6.80	12.60	306.80	220.40	340.60	220.30				1107.50
	1	1	21	16	24	15				78
		19.90	340.90	360.80	300.70	210.50				1232.80
		1	16	17	15	10				59
		18.90	397.80	414.30	180.60	221.30				1232.90
		3	20	26	14	16				79
			195.70	221.90	265.30	205.60	81.40	23.20	10.30	1034.10
			14	14	20	16	10	4	2	85
	22.30	40.60	116.50	279.30	469.60	207.40		38.20		1281.40
	2	2	7	11	18	11		1		62
		16.00	284.40	532.00	321.40	450.10	137.60			1741.50
		2	. 13	17	21	16	5			74
		10.30	156.80	373.00	77.20	346.10	59.60		21.50	1051.70
		1	8	21	6	12	1		1	51
	12.80	48.50	303.20	505.10	17.50					908.60
	2	3	13	16	2					39
		22.30	122.50	126.50	440.90	283.90	44.50		3.20	1081.20
		3	6	7	21	12	2		1	55
	50.10		161.70	264.30	301.30	501.70	92.40		10.30	1478.90
	2		14	18	22	23	7		2	95
	15.20	2.00	197.60	350.00	458.10	104.30	7.20			1154.70
	3	1	16	20	24	6	2			77
	4.80	9.60	320.50	220.20	267.20	190.20	9.20		0.80	1163.40
	65.20	46.90	88.20	324.10	326.10	54.20	116.90	8.80		1115.50
	4.80	9.80	98.70	235.50	232.90	183.80			1.60	867.40
	2	2	10	14	18	12			1	68
		50.9	331.00	329.30	27.90					800.30
		5	19	22	6					56
	2.00	24.6	43.80	318.10	241.30	132.90	42.20	64.40	1.60	877.30
	1	2	4	14	16	8	4	4	1	57
		55.7	51.80	347.70	308.80	254.60				1031.40
		2	3	14	10	12				44
	34.00	14.30	414.20	273.80	373.60	400.00	-	-	1.60	1518.30
	3	2	18	17	21	16	-	-	1	81
	-	-	24.00	500.00	388.50	220.70	10.40	18.30	13.60	1214.50
	-	-	5	20	18	14	2	1	2	66
	17.10	8.00	138.00	295.20	370.70	107.10	184.30	0.00	0.00	1226.30
	11.90	23.90	100.20	279.70	197.30	259.30	46.10	0.00	11.20	1082.50

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CHAPTER-IV

GEOLOGY

4.1 REGIONAL GEOLOGY

The Singrauli Coalfield, the northern most member of the Central Indian Coalfields, is composed of two techtono-sedimentary domains viz. the western part, covering an area of 1890 sq.km known as Main Basin and the northeastern part, covering an area of 312 sq km known as Moher sub-basin. These two basins are separated by a NW-SE trending basement high almost parallel to Kachan Nala. Moher sub-basin is the most promising area and, at present, mining of coal is confined in this part of Singrauli Coalfield. Dudhichua OCP is located in the south central part of Moher Sub-basin.

The general stratigraphic sequence of Singrauli Coalfield (after GSI, 1977) is as follows: Table No.-4.1.A

General Stratigraphic Succession, Singrauli Coalfield

Age	Group	Formation	Lithology	Thickness (m)
Cretaceous		Intrusive	Dolerite dykes and sills	Not estimated
Upper Triassic	Upper Gondwana	Mahadeva	Coarse grained, ferruginous sandstone with bands of shale, clay and conglomerate	Not estimated
Lower Triassic	Lower Gondwana	Panchet (?)	White, greenish white and pink micaceous, medium to coarse grained sandstones with red beds, greenish brown silty shales and conglomerates	Not estimated
Upper Permian		Raniganj	Fine grained sandstones and shales with coal seams.	215-403
Middle Permian		Barren Measures	Very coarse grained ferruginous sandstones, green clay and shales	125-300
Lower Permain		Barakar	Medium to coarse grained sandstones, shales, clays and coal seams	325-600
Upper Carboniferous (?)		Talchir	Tillites, sandstones, siltstones, needle shales	75-130
---------- Unconformity----------				
Precambrian	Phyllites, quartzites, schists and gneisses.			

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The general strike of the bed is more or less east-west except in Block-B in the west and Bina & Kakri blocks in the east where the strike is nearly north-south. The bed has a corresponding centripetal dip. The amount of dip in general is about 2 to 3 degree. However, higher dips of about 8^{o}-13^{o} have been observed in the eastern part and western part of the basin.

4.2 EXPLORATION

The present report is prepared for the existing working limit (floor Turra seam) of Dudhichua project as in the south to the surface limits of the proposed mining block in the east, north and west. The area comprises part of Dudhichua, Bundela and a small portion of Ruhela geological blocks for mining purposes. The area of Dudhichua Geological Block is 8.68 sq.km and that of Bundela Block is 6.24 sq km. The total boreholes drilled in the area are 142 and 66 respectively. The borehole density in both the blocks comes to 14. The expansion area from existing face to proposed surface limit of Dudhichua Expn. OCP (20 Mtpa) is 10.77 sq.km.

The area was regionally explored by GSI and IBM. They drilled SNK, SRK and SGR series of boreholes, out of which 2, 11, and 5 Nos. of boreholes of SNK, SGR and SRK respectively fall within proposed mining area. CMPDI carried out detailed drilling in phases in and adjacent to the mining block comprising CMDR, CMSBL,CMSDD and CMMH series of boreholes. Meterage drilled in the proposed mining block is 23516.68m, in 101 boreholes. Agency-wise total number of boreholes considered for the preparation of geological note and meterage drilled in the block are furnished at Table No.4.2.

Table No.4.2

Agency-wise number of boreholes considered for the Geological Note

Exploration Agency	Drilling period	B.H. Series	No. of borehole drilled	Meterage
CMPDIL	1990-92, 1995-97	CM	61	14939.50

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	1975-76	CM	10	2293.90
		CM	10	906.85
	1988-2000	CM	3	553.35
	1993-2010	CM	1	329.55
	1998-1999	CM	4	962.00
With the consideration of 20 boreholes in adjoining area, the borehole density in the propo				
GSI	1975-78	SNK	3	880.75
IBM	1961-63	SGR	5	1790.34
		SRK	4	860.44
Total			**101**	**23516.68**

4.3 GEOLOGY OF THE BLOCK

Entire block area is covered by the sediments of Barakar Formation with a thin cover of soil and alluvium at places. The stratigraphic sequence of rocks within Barakars based on data of drill holes is given in Table No.4.3.

Table No.4.3
Stratigraphic sequence of rocks and coal seams

Lithology	Thickness Range	
	Minimum	Maximum
Soil/weathered mantle	0.00	79.40
Sandstone &shale	0.00	200.35
Purewa Top	1.90 (CMSSD-39)	10.00 (CMSBL-47)
Sandstone &shale	27.08	45.20
Purewa Bottom	5.97 (CMDR-83)	15.20 (CMSBL-17)
Sandstone &shale	48.50	63.05
Turra	15.45 (CMSBL-30)	23.65 (CMDR-81)

The Barakar sequence mainly consists of fine to coarse grained, light grey, felspathic sandstone, shale, clay and coal seams. Kaolinised felsper is usually the cementing material. Two to three clay beds occur within the upper horizon of the Barakars. The shale bands generally occur as inter banded with coal and constitutes most of the dirt bands within the seams. Presence of thin shale bands has also been observed within sandstone at places.

The major lithofacies of the Barakar Formation, comprising the coal seams belong to the arenaceous facies of varying grain sizes, but predominantly of the coarse grained sandstone. Argillaceous facies amounts to about 5% of the total column of the rocks in a vertical section. The sandstones are felspathic, at times kaolinised and rarely micaceous. The coal, shaly coal and carb shales constitute the coal horizon.

4.4 GEOLOGICAL STRUCTURE

The sandstone exposures and the topography do not reveal much on the geological structure of the area.

The entire structural set-up, therefore, have been worked out on sub-surface data generated from drill holes of Dudhichua, Bundela and adjoining blocks.

The block is situated at the beginning of the eastern arm of the crescent shaped Moher sub-basin. In conformity to the regional set-up, the beds have a general NNW-SSE to WNW-ESE trend with Northerly dip in general. The dip is generally 2^{o} to 3^{o}.

Seven significant faults have affected the concerned area. A brief description of faults has been presented in Table No.4.4

Table No.4.4

Details of Faults

SN	Fau	Trend	Throw		Extent/Location
			Direction	Distan (m)	
1	FF	E-W	S	5	Between CMDR-9 & 10
2	F7-F7	NW-SE	NE	5-10	South of CMSBL-10,55,88,44A
3	F6-F6	NW-SE	SW	10	Between CMSBL-38-23
4	F5-F5	NW-SE	SW	5-10	Between CMSBL-3 & CMSBL-20
5	F3-F3	NW-SE	SW	5-10	Between CMSBL-11 & 17
6	F10/F1	NW-SE	NE	40	Between CMSBL-7 &50
7	F2/F12	WNW-ESE	SW	5	Between CMSBL-7 & 24A

4.5 DESCRIPTION OF COAL SEAMS

4.5.1 Turra Seam

Turra seam represents the most potential and bottom-most workable coal horizon, below Purewa Bottom seam. The full thickness of Turra seam including all dirt bands varies from 15.45 m to 25.75 m; the effective thickness variation is from 11.30 m to 24.35 metre.

The immediate roof and floor of the Turra seam is generally represented by fine to coarse grained sandstone and sandy shale, carbonaceous shale, alternate bands of shale & sandstone respectively.

The seam is having both combustible and non-combustible bands. Dirt bands of 1 m and above in thickness have been found in 67 boreholes.

Out of 67, 33 boreholes have 2-3 no. dirt bands. Maximum cumulative thickness of >1m dirt band is 5.05m.The bands are normally represented by carbonaceous shale and shale.

The details of dirt bands are given in Table No.-4.5.1.:

Table No.4.5.1

Thickness and Dirt bands in Turra seam

Particulars	Stratigraphic Thick.(m)	Effective thick.(m)*	<1m band		>1m band	
			No.	Thick(	No.	Thick(
Range	15.45-25.75	11.30-24.35	0-	0.20-	0-3	0-5.05
Mean	19.97	17.74				
Std. Dev.	1.71	1.96				
No of Inter-sections	82		66		68	

*excluding 1m and above band

4.5.1.1 Coal Quality

The seam in general contains grade E coal for I_{100} samples. The quality parameters of Turra Seam are given in the following tables.

Table No.4.5.1.1A
Proximate Analysis of Turra Seam

Sam-ple	Particulars	M%	A%	VM%	GCV (k.cal/kg)	Grade GCV	UHV (k.cal/kg)	Grade UHV
B	Range	4.0-8.7	16.1-45.5	22.5-31.7	3360-7880	G1-G14	1903-5643	G-B
	Mean	7.2	25.9	27.3	4981	G8	4340	D
	Std. Dev	0.8	5.7	1.9	644		734	
	No. of Samples	52			49		52	
I_1		4.0-8.1	21.1-45.5	22.5-31.6	3360-5390	G7-G13	1903-4953	G-C
	Mean	6.8	30.0	26.4	4578	G10	3827	
	Std. Dev	0.7	5.2	2.0	469		674	
	No. of Samples	49		43	39		49	

Ultimate Analysis:

The ultimate analysis on dmmf basis is given in Table No.4.5.1.1B

Table No.4.6.1.1.B
Ultimate Analysis (on dmmf Basis) of Turra Seam

Particulars		C%	H%	N%	S%	O%
B	Range	77.49-82.38	4.31-4.96	1.32-2.01	0.29-1.31	10.94-14.18
	Mean	80.35	4.69	1.70	0.65	12.63
	Std.Dev.	0.97	0.21	0.23	0.28	0.80
	No. of Sample	15				
I	Range	79.38-81.00	4.31-5.00	1.38-2.00	0.31-1.31	11.13-14.18
	Mean	80.15	4.80	1.82	0.80	12.62
	Std. Dev.	0.52	0.18	0.17	0.27	0.78
	No. of Sample	37				

Hardgrove Grindability Index

The Hardgrove Grindability Index (HGI) for Turra seam is furnished in table 4.5.1.1C below.

Table No.4.5.1.1C

Hardgrove Grindability Index of Turra Seam

Sample type	Hardgrove Grindability Index
BCS	54 – 59
Sample No.	24
I_{100}	55-60
Sample No.	43

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Ash Fusion Temperature Range:

Ash fusion temperature range of Turra Seam is given below.

Table No.4.5.1.1D

Ash fusion temperature range of Turra Seam

Sample type	Ash fusion range (at MRA) ^{o} C		
	IDT	HT	FT
BCS	1170 - >1500	1270 - >1500	>1500
No. of Samples	24		
I_{100}	1190 - >1400	1240 - >1500	>1500
No. of Samples	43		

Ash Analysis

Chemical analysis of coal ash is furnished in the table below.

Table No.4.6.1.1E

Chemical Composition of coal ash of Turra Seam

Particulars		SiO_2	Al_2O_3	Fe_2O_3	TiO_2	P_2O_5	MnO	CaO	MgO	SO_3	Alkalis by Diff.
BCS	Range	58.60-63.49	23.62-29.45	1.67 - 9.58	1.42-1.84	0.17-0.61	Trace	0.97-3.44	0.54-1.64	0.37-1.45	0.94-2.88
	Mean	60.95	27	4.03	1.	0.48		2.	1.	0.	2.04
	Std. Dev.	1.	1.	2.38	0.	0.11		0.	0.	0.	0.57
	No of sample	16								13	14
I_1	Range	59.32-64.82	24.51-29.45	1.67-8.78	1.42-1.85	0.11-0.64		0.67-3.82	0.33-1.89	0.77-1.45	0.99-2.88
	Mean	61.96	26.22	3.88	1.67	0.48		2.06	1.19	0.58	2.00
	Std. Dev.	1.	1.	1.78	0.	0.13		0.	0.	0.	0.55
	No of sample	35									

4.6.2 PUREWA BOTTOM SEAM

Purewa Bottom seam is the middle workable coal horizon in the area. The maximum depth of seam occurrence is 240 m. The full thickness of the Purewa Bottom seam including all dirt bands varies from 7.35m to 15.20 m. Roof of the seam is generally composed of medium to coarse grained sandstone with occasional shale/clay bands. Immediate floor is also marked by fine to coarse grained sandstone and at some places by grey shale.

The seam is highly interbanded in nature. These bands are generally represented by carbonaceous and grey shales. The details of dirt bands are given in Table No.-4.6.2.

Table No.4.6.2
Thickness and Dirt Band in Purewa Bottom Seam

Particulars	Stratigraphic Thick.(m)	Effective Thick(m)*	<1m band		>1m band	
			No.	Thick(m)	No.	Thick(m)
Range	5.97-15.20	5.75-15.20	0-10	0.00-3.67	0-2	0.00-5.65
Mean	11.42	10.43				
Std. Dev.	1.50	1.80				
No. of BH	96		77		50	

*excluding 1m and above band

4.6.2.1 **Coal quality**

The quality of I_{100} sample of the seam varies between grades G to D. In general, the seam contains grade F coal. Summary of quality details of the seam is given in following table.

Table No.4.6.2.1A
Proximate analysis of Purewa Bottom Seam

Samples	Particular	M	A%	VM	GCV (k.cal/kg)	Grade GCV	UHV (k.cal/kg)	Grade UHV
BCS	Range	5.7-9.4	18.3-41.46	24.1-30.3	3650-5450	G7-G13	2373-5077	G-C
	Mean	7.	27.	27.	478	G9	4106	E
	Std.Dev	0.	4.7	1.4	367		576	
	No. of BH/ Samples	59			56		59	
I_{100}	Range	4.2-8.5	22.0-48.2	21.1-29.1	3160-5280	G7-G14	1572.4691	G-D
	Mean	6.	33.	25.	430	G10	3334	F
	Std.Dev	0.	5.7	1.9	484		701	
	No.of BH/ Samples	58		50	46		58	

Ultimate Analysis

The ultimate analysis on dmmf basis is given in Table No. 4.6.2.1B

Table No. 4.6.2.1B

Ultimate analysis (on dmmf Basis) of Purewa Bottom Seam

Particulars		C%	H%	N%	S%	O%
BC	Range	77.70-90.98	4.37-5.04	1.11-2.00	0.33-1.04	11.60-15.82
	Mean	80.22	4.79	1.68	0.69	13.02
	Std. Dev.	2.29	0.18	0.30	0.18	1.08
	No. of BH/ Samples	26				
I_{100}	Range	78.60-81.00	4.73-4.99	1.22-2.00	0.57-1.31	11.48-15.14
	Mean	80.10	4.84	1.86	0.90	12.54
	Std. Dev.	0.55	0.12	0.19	0.24	0.87
	No. of BH/ Samples	15				

Hardgrove Grindability Index:

Hardgrove Grindability Index of Purewa Bottom is given in Table No. 4.6.2.1C

Table No.4.6.2.1C

Hardgrove Grindability Index of Purewa Bottom Seam

Sample type	Hardgrove Grindability Index
Bcs	54 - 59
Samples	21
I_{100}	54-60
Sample	16

Ash Fusion Temprature Range:

Ash fusion temperature range of Purewa Bottom seam is given in Table No. 4.6.2.1D

Table No.4.6.2.1D

Ash fusion temperature range of Purewa Bottom Seam

Sample type	Ash fusion range (at MRA) ^{o} C		
	IDT	HT	FT
Bcs	1210 - >1400	1290 - >1400	>1400
Samples	29		
I_{100}	1170 - >1400	1320 - >1400	>1400
Samples	18		

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Ash Analysis:

Chemical Composition of Coal Ash,Purewa Bottom Seam is given below:

Table No.4.6.2.1E

Chemical Composition of Coal Ash, Purewa Bottom Seam

Sample	Particulars	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	P_2O_5	MnO	CaO	MgO	SO_3	Alkalis by Diff.
BC	Range	60.16-68.00	21.06-28.88	2.02-11.78	1.41-1.88	0.11-0.61	Trace	0.94-3.49	0.51-1.64	0.37-1.52	1.06-2.39
	Mean	61	26	3.	1	0		2	1	0	1.
	Std.	1.	2.	2.	0	0		0	0	0	0.
	No. of BH/ Samples	16									
I_{100}	Range	60.10-68.12	20.32-29.84	1.80-6.14	1.44-1.77	0.27-0.66		0.94-3.14	0.64-1.64	0.39-1.75	1.06-3.33
	Mean	62	26	3.	1	0		2	1	0	2.
	Std.	1.	2.	1.	0	0		0	0	0	0.
	No. of BH/ Samples	14									

4.6.3 **Purewa Top Seam**

Purewa Top Seam represents the top most workable coal horizon in the area. The full thickness of the seam including all dirt bands varies from 1.95m to 10.00m.

Roof of the seam is generally composed of medium to coarse grained sandstone with occasional shale/clay bands. Immediate floor is also marked by fine to coarse grained sandstone; at places grey shale also constitutes immediate floor.

This seam is also interbanded in nature. The dirt bands are generally represented by carbonaceous and grey shale. Bands of >1m thickness have been found in 47 borehole. The details of dirt bands are given in Table No.- 4.6.3A.

Table No.4.6.3A

Thickness and Dirt bands of Purewa Top Seam

Particulars	Stratigraphic Thick.(m)	Effective Thick.(m)*	<1m band		>1m band	
			No.	Thick(m)	No.	Thick(m)
Range	1.95-10.00	1.95-9.90	0-9	0.00-2.80	0-2	0.00-2.75
Mean	6.63	5.68				
Std. Dev.	2.08	1.89				
No. of BH	98		63		47	

*excluding 1m and above band

4.6.3.1 **Coal Quality**

In general I_{100}, samples of the seam contain grade F coal. Quality parameters of Purewa Top seam are summarized in following tables.

Table No.4.6.3.1A

Proximate analysis of Purewa Top Seam

Particulars		M	A%	VM	GCV (k.cal/kg)	Grade GCV	UHV (k.cal/kg)	Grade UHV
BCS	Range	4.9-9.6	18.0-46.1	21.7-45.0	3360-5420	G7-G14	1669-5464	G-C
	Mean	7.5	29.	27.6	4570	G10	3837	E
	Std.Dev	0.8	6.8	3.3	535		860	
	No.of BH/Samples	59			57		57	
I100	Range	2.9-9.6	20.5-53.2	19.7-31.4	3110-5240		786-5008	UG
	Mean	6.8	35.	25.6	4056	G7–G14	3047	F
	Std.Dev	1.2	8.9	2.7	813	G11	1093	
	No.of BH/ Samples	61		45	46		61	

Ultimate Analysis

Ultimate analysis (on dmmf Basis) for Purewa Top seam is given in Table No. 4.6.3.1B

Table No.4.6.3.1B

Ultimate analysis (on dmmf Basis), Purewa Top Seam

Particulars		C%	H%	N%	S%	O%
BC	Range	77.81-81.00	4.20-5.10	1.17-3.09	0.35-1.04	11.41-16.07
	Mean	79.51	4.75	1.69	0.67	13.38
	Std. Dev.	0.96	0.23	0.42	0.20	1.38

	No. of Sample			22		
I_{100}	Range	78.71-81.51	4.38-5.00	1.23-3.09	0.35-1.19	11.41-14.95
	Mean	80.03	4.81	1.88	0.80	12.68
	Std. Dev.	0.84	0.17	0.44	0.25	1.23
	No. of Sample			15		

Hardgrove Grindability Index

Hardgrove Grindability Index of Purewa Top seam is given in Table No.4.6.3.1C.

Table No.4.6.3.1C

Hardgrove Grindability Index of Purewa Top Seam

Sample type	Hardgrove Grindability Index
Bcs	54 - 60
Samples	19
I_{100}	57 - 62
Samples	10

Ash Fusion Temrature Range

Ash fusion temperature range of Purewa Top seam is given in Table No. 4.6.3.1D.

Table No.4.6.3.1D
Ash fusion temperature range of Purewa Top Seam

Sample type	Ash fusion range (at MRA) ^{o} C		
	IDT	HT	FT
Bcs	1190 – >1400	1290 - >1400	>1400
Samples	28		
I_{100}	1170 - >1400	1290 - >1400	>1400
Samples	12		

Ash Analysis

Chemical Composition of Coal Ash of Purewa Top seam is given in Table No. 4.6.3.1E.

Table No.4.6.3.1E
Chemical Composition of Coal Ash of Purewa Top Seam

Particulars		SiO_2	Al_2O_3	Fe_2O_3	TiO_2	P_2O_5	MnO	CaO	MgO	SO_3	Alkalis by Diff.
B	Range	58.41-71.00	21.83-29.95	1.60-4.97	1.42-1.80	0.09-0.61	Trace	0.84-3.42	0.44-1.49	0.44-1.61	0.51-2.58
	Mea	62.	26	3	1	0.4		1.9	0	0	1.9
	Std.	3.4	2.	1	0	0.1		0.8	0	0	0.6

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	No. of Sample	13									
I_1	Range	58.41-64.32	24.12-29.95	2.14-5.87	1.37-1.70	0.17-0.67		0.74-3.42	0.39-1.74	0.32-0.64	1.47-2.69
	Mea	62.	26	3	1	0.4		2.1	1	0	2.0
	Std.	1.4	2.	1	0	0.1		0.9	0	0	0.3
	No. of Sample	12									

4.7 Mining activity

All the three coal seams, namely Turra, Purewa Bottom and Purewa Top, are under extensive exploitation in existing Dudhichua opencast project.

4.8 Physico-mechanical properties

The physico-mechanical properties of the rocks were determined from the cores of borehole CMDR-8, 14, 38 & 75 and determined properties are being furnished in the Table below:

Table No.4.8A

Physico-mechanical Properties

Lithology	Strength (Kg/cm^2)		
	Compressive	Tensi	She
Very coarse grained sandstone	12-14		
Coarse grained sandstone	18-105	76-98	22-
Coarse grained ferruginous sandstone	57-179	10-38	23-
Medium grained sandstone	33-157	13-25	16-
Fine grained sandstone	45-380	10-34	14-
Alternate shale/sandstone	45-259	15-44	19-
Grey shale	179-372	9-43	
Shaly sandstone	163-210	7-37	

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Carbonaceous shaly sandstone	33-445	5-47	38-
Carbonaceous shale	35-761	19-56	31-
Shaly sandstone	55-275	4-36	
Coal	70-696	5-42	11

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CHAPTER-V
MINE BOUNDARY, RESERVE & MINE LIFE

5.1 DESCRIPTION OF THE MINEFIELD

Dudhichua OCP is existing mine under sanctioned Dudhichua OCP (10 Mtpa). The project has EMP clearance for 15.50 Mtpa within the leasehold boundary of sanctioned Project Report of 10 Mtpa.

Expansion of the Dudhichua OCP from 10 Mtpa to 20 Mtpa has been envisaged with inclusion of the dip side of existing Dudhichua Block i.e. Bundela Block and a small part of Ruhela Block. Dudhichua Block having an area of 8.68 sq.km is located in the central part of Moher Sub-basin of Singrauli Coalfield. Bundela Geological Block having an area of 6.24 Sq.km lies in the dip side of Dudhichua Geological Block.

Dudhichua OCP is located in the north-east part of Singrauli Coalfield. Existing Jayant Opencast mine lies in the west of the block and Khadia OCP on the east. The terrain of opencast minefield represent the hilly plateau with steep escarpment facing with south with RLs of 375m to 400m with occasional hills rising upto 504m. The average elevation at the foot of the plateau is 325m above MSL.

The drainage of the area is controlled by many seasonal streams which discharge into Balia Nalla which ultimately drains into the GBP Sagar in south. Similarly, towards north drainage is through seasonal streams which ultimately join into the Bijul Nalla.

Three coal seams viz. Turra (20m), Purewa Bottom (12m) and Purewa Top (7m) are proposed for extraction. The seams are dipping 2-3^{o} towards north-east. The parting between Turra & Purewa Bottom seams is 49m- 63m, Purewa Bottom & Purewa Top is 27m-45m and Top OB above Purewa Top Seam is 40-210m.

5.2 PIT FORMULATION STRATEGY

Dudhichua OCP is an operating mine under sanctioned Dudhichua OCP (10 Mtpa), on its western side, Jayant OCP is located and Khadia OCP on the Eastern side.

The criteria for fixing the quarry boundaries is given below:

Southern Boundary: The southern boundary is the existing working limit of existing Dudhichua Mine as on 31.03.2015.

Eastern & Western Boundary: Dudhichua Mining Block shares the boundary with Jayant Opencast Mine on the west and Khadia Opencast Mine in the east (along Turra seam floor as per sanctioned reports), as identified in the "Feasibility Study of Singrauli Coalfield". While deciding the western and eastern boundary of the opencast minefield as per expansion project report, the following factors have been taken into consideration:

- For Western boundary, the advancement of Jayant Opencast Mine with respect to existing working front of both the mines;
- For eastern boundary, the advancement of Khadia Opencast Mine with respect to existing working front of both the mines;
- The gap between the existing working fronts of both the mines on both the sides;
- Considering the existing working of Jayant east section and Dudhichua west section and also the gap between the working front of both the mines, it is not possible to follow the working limit as per sanctioned boundaries and about 200m strike length is being left by Dudhichua West section from the sanctioned boundary. So, there is presently common boundary on the floor of Purewa Bottom Seam. As Jayant is a leading mine, there will not be any restriction for the working of Jayant Opencast Mine. The working limit of Dudhichua mine will be restricted upto the working limit of Purewa Bottom seam. On the east, the project will follow

the sanctioned boundary as this mine will be a leading mine and Khadia will lag on the eastern side.

The position of faces in west section of Dudhichua Opencast vis-à-vis east section of Jayant Opencast and east section of Dudhichua Opencast vis-à-vis west section of Khadia Opencast have been so planned as to maintain a sufficient lag for maintaining the transport horizon from advance benches to the spoil dumps.

5.3 MINE BOUNDARIES

Considering the factors in Para-5.2, the boundaries of Dudhichua OCP (20 Mtpa) has been delineated and fixed as follows:

i) **Southern Boundary** (Rise side): Southern boundary of existing working faces of existing Dudhichua Opencast Mine (10 Mtpa) forms the southern boundary of Dudhichua Expansion OCP;

ii) **Northern Boundary**: The northern floor boundary has been fixed along the down throw fault F_1-F_1 (B) (throw 25-40m) in Bundela Block considering the drainage of dragline cut. Quarry Bottom edge on the dip side has been adjusted so as to facilitate the drainage of the water towards the central sump and alignment of dragline cuts.

iii) **Eastern Boundary**: The existing floor boundary has been extended in the dip side and shares common boundary on the floor of Turra seam with Khadia OCP.

iv) **Western Boundary**: The western boundary has been extended in the dip side and as detailed in Para-5.2, shares common boundary on the floor of Purewa Bottom seam with Jayant OCP.

5.3.1 Mining Losses

The seam-wise operational losses for Dudhichua project is summarized in the Table No.5.1 given below:

Table No.5.1

Name of Losses	Operational Losses(%)		
	Turra	Purewa Bottom	Purewa Top
Losses in the seam roof	1.20	1.65	2.80
Losses in the seam floor	1.00	1.25	2.10
Losses during selective extraction of dirt bands	0.40	0.70	2.60
Losses during trimming of coal bench slope for Turra Seam by dragline	2.50	-	-
Losses in the fault zone	1.10	2.70	1.80
Losses during drilling & blasting operations.	0.60	0.60	0.60
Losses during Loading & Transportation of coal	0.20	0.10	0.10
Total	7.00	7.00	10.00

The above operational losses have been considered to arrive at mineable reserve.

5.3.2 Sectorization

Dudhichua OCP is being worked in two sections namely East and West Section. For the purpose of estimation of mineable reserves and overburden volume, the entire quarry has been divided into three sectors in East section and West section along the floor of Turra Seam which are shown on final quarry lay out plan (Plate No. MIN-VII).

These sector positions have been marked on Turra Seam floor of each of the eleven cross-sections (A-A', B-B', C-C', D-D', E-E', F-F', G-G', H-H', I-I', J-J' & K-K') and elements of mining have been drawn on each of the cross-sections corresponding to each sector limit.

Mineable reserves and overburden volume have been estimated for each sector in each section.

5.4 GEOLOGICAL RESERVES & MINEABLE RESERVES

5.4.1 Account of Reserves

For furnishing account of reserves, geological and mineable reserves have been defined as follows:

Geological Reserves (GR): The reserves have been estimated upto lower most Turra seam within delineated quarry.

GR= Seam area x Av. Seam Thickness x Tonnage factor x 0.90 factor.

= Insitu Reserve x 0.90 factor

Factor of 0.90 is adopted to account for unforeseen geological factors.

Mineable Reserves (MR): A part of net geological reserve (GR) is lost during process of exploitation. Therefore, the part of GR that can be exploited is termed as mineable reserves (MR).

(Mineable Reserve=Extraction Factor x Geological Reserve)

Extraction factor or mining loss has been taken as given in Table 5.1.

5.4.2 **Geological Reserves**

Dudhichua Expansion OCP (20 Mtpa) falls mainly in two geological blocks namely, Dudhichua Block (geological reserves- 336.29 Mt) and Bundela Block (geological reserves – 302.10 Mt) and small part of Ruhela Block. The PR for expansion considers the entire geological reserves of Dudhichua Block, part of Bundela Block and small reserve of Ruhela Block. The projectised Geological Reserve from different Blocks considered in EPR are as follows:

GR of Dudhichua Block	336.29 Mt
Part of GR of Bundela	268.03 Mt
Small Part of GR of Ruhela	29.00 Mt
Total Projectised GR	633.32 Mt

GR considered in 10Mtpa PR	370.36 Mt
GR considered in Expansion area	262.96 Mt
Total GR Projectised	633.32 Mt

The seam-wise balance GR as on 31.03.2015 in sanctioned 10Mtpa, incremental in expansion area and total GR considered in EPR (20 Mtpa) are as follows:

Table No.-5.2

Seam	Geological Reserve (Mt)			
	Sanctioned (10 Mtpa)	Balance as on 31.03.2015	Incremental in expansion area	Total in EPR as on 31.03.2015
Turra	214.47	67.05	129.65	196.70
Purewa Bottom	99.32	27.92	87.41	115.33
Purewa Top	56.57	17.32	45.90	63.22
Total	370.36	112.29	262.96	375.25

On dip side of considered mine boundary in the EPR (20 Mtpa), coal reserves are available in Baghela, Tipa Jharia Geological Block, which will be exploited either by further expansion of Dudhichua OCP or Bina-Kakri Amalgamation OCP whichever will be the advancing mine.

The combined plan showing floor contour of Turra Seam of Dudhichua OCP (20 Mtpa), Jayant OCP (20 Mtpa), Khadia OCP (10 Mtpa), Krishnashila OCP (4 Mtpa) and Bina-Kakri Amalgamation OCP (10 Mtpa) is given in Plate No. MIN-XIV.

5.4.3 Mineable Reserves

In the existing sanctioned Dudhichua (10 Mtpa), the total mineable coal reserves were estimated as 344.96 Mt along with total volume of OBR as 1133.41 Mm^3 with an average stripping ratio of 3.29m^3/t.

Considering the balance coal reserves in existing Dudhichua OCP (10.00 Mtpa) and up to the planned quarry boundary in Bundela & small part of Ruhela Block, the estimated Geological Reserve is 375.25 Mt and mineable coal reserves is 347.10 Mt as given in the Table No.5.3. Seam-wise, Sector-wise & GCV-wise Mineable Reserve is given in Table No.5.4.

Table No.5.3

Seam-wise & Sector-wise GR & MR

SECTOR	SEAM	Geological Reserve(GR) (Mt)			Mineable Reserve(MR) (Mt)		
		West Section	East Section	Total	West Section	East Section	Total
SECTOR-1	PURT	16.87	10.50	27.37	15.18	9.45	24.63
	PURB	24.40	18.89	43.29	22.69	17.57	40.26
	TURRA	44.35	35.88	80.23	41.25	33.37	74.62
	TOTAL	**85.62**	**65.27**	**150.89**	**79.12**	**60.39**	**139.51**
SECTOR-2	PURT	11.96	10.39	22.35	10.76	9.36	20.12
	PURB	19.02	19.19	38.21	17.69	17.85	35.54
	TURRA	27.81	29.59	57.40	25.86	27.52	53.38
	TOTAL	**58.79**	**59.17**	**117.96**	**54.31**	**54.73**	**109.04**
SECTOR-3	PURT	6.43	7.07	13.50	5.79	6.36	12.15
	PURB	15.33	18.50	33.83	14.26	17.21	31.47
	TURRA	29.21	29.86	59.07	27.16	27.77	54.93
	TOTAL	**50.97**	**55.43**	**106.40**	**47.21**	**51.34**	**98.55**
TOTAL	PURT	35.26	27.96	63.22	31.73	25.17	56.90
	PURB	58.75	56.58	115.33	54.64	52.63	107.27
	TURRA	101.37	95.33	196.70	94.27	88.66	182.93
	TOTAL	**195.38**	**179.87**	**375.25**	**180.64**	**166.46**	**347.10**

Table No.5.4

SECTOR	GCV RANGE (Kcal/Kg)	5500-5800	5200-5500	4900-5200	4600-4900	4300-4600	4000-4300	3700-4000	3400-3700	3100-3400	2800-3100	Total	Overall GCV	
		G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15			
	SEAM													
SECTOR-1	PURT			0.09	2.37	4.99	7.30	5.57	3.56	0.76		24.63	4089	G-11
	PURB			1.53	9.94	16.35	10.81	1.63				40.26	4442	G-10
	TURRA	1.93	7.66	16.91	31.76	14.84	0.99	0.54				74.62	4829	G-9
	TOTAL	1.93	7.66	18.53	44.06	36.17	19.10	7.73	3.56	0.76		139.51	4587	G-10
SECTOR-2	PURT		0.02	1.18	3.11	4.57	2.19	3.29	3.28	2.20	0.28	20.12	4103	G-11
	PURB			0.27	6.92	9.71	10.48	5.69	1.88	0.58		35.54	4261	G-11
	TURRA	0.01	0.74	9.16	18.71	17.78	5.75	1.23				53.38	4625	G-9
	TOTAL	0.01	0.76	10.61	28.74	32.06	18.42	10.21	5.16	2.78	0.28	109.04	4410	G-10
ECTOR-3	PURT		0.04	0.58	3.03	3.32	1.89	2.38	0.87	0.02		12.15	4326	G-10
	PURB			2.78	5.62	7.79	10.62	4.11	0.41	0.14		31.47	4360	G-10

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		TURRA			3.15	22.78	19.23	6.31	2.75	0.72			54.93	4533	G-10
		TOTAL		0.04	6.51	31.44	30.34	18.82	9.23	2.00	0.16		98.55	4452	G-10
	TOTAL	PURT	0.00	0.06	1.85	8.50	12.88	11.38	11.24	7.71	2.98	0.28	56.90	4144	G-11
		PURB	0.00	0.00	4.58	22.49	33.85	31.92	11.42	2.29	0.73		107.27	4358	G-10
		TURRA	1.94	8.40	29.22	73.25	51.85	13.05	4.51	0.72			182.93	4680	G-9
		TOTAL	1.94	8.46	35.65	104.24	98.58	56.35	27.18	10.72	3.70	0.28	347.10	4493	G-10

Seam-wise, Sector-wise & GCV-wise Mineable Coal Reserve (Mt)

5.4.4 MINEABLE RESERVES (MR), OBR & AVERAGE STRIPPING RATIO

The total MR is 347.10 Mt and total OBR is 1603.78 Mm^3 with average stripping ratio of 4.62m^3/t. The section-wise MR, OBR & Average Striping Ratio are given in Table No.5.5.

Table No.5.5
Section-wise MR, OBR & Av. SR

Particulars	West Section	East Section	Total
Mineable Coal Reserves (Mt)			
Purewa Top Seam	31.73	25.17	**56.90**
Purewa Bottom Seam	54.64	52.63	**107.27**
Turra Seam	94.27	88.66	**182.93**
Total	**180.64**	**166.46**	**347.10**
Volume of OBR (Mm^3)			
Top OB	380.16	498.79	**878.95**
Parting between Purewa Top and Purewa Bottom Seams.	127.90	145.12	**273.02**
Parting between Purewa Bottom and Turra Seams.	213.25	238.56	**451.81**
Total	**721.31**	**882.47**	**1603.78**
Average Stripping Ratio (m^3/t)	**3.99**	**5.30**	**4.62**

Section-wise and seam-wise mineable reserves, sector-wise and parting-wise overburden volume and sector-wise stripping ratio have been given in Table No.5.6.

Table No. 5.6

Seam-wise, Sector-wise MR, OBR & SR

SECTOR	SEAM	MR (Mt)	TOTAL OB (Mm^3)	SR (m^3/t)	MR (Mt)	TOTAL OB (Mm^3)	SR (m^3/t)	MR (Mt)	TOTAL OB (Mm^3)	SR (m^3/t)
		WEST SECTION			EAST SECTION			TOTAL		
SECTOR-1	PURT	15.18	140.33	9.24	9.45	189.16	20.02	24.63	329.49	13.38
	PURB	22.69	53.82	2.37	17.57	53.04	3.02	40.26	106.86	2.65
	TURRA	41.25	91.99	2.23	33.37	90.64	2.72	74.62	182.63	2.45
	TOTAL	**79.12**	**286.14**	**3.62**	**60.39**	**332.84**	**5.51**	**139.51**	**618.98**	**4.44**
SECTOR-2	PURT	10.76	142.14	13.21	9.36	204.24	21.82	20.12	346.38	17.22
	PURB	17.69	40.87	2.31	17.85	50.39	2.82	35.54	91.26	2.57
	TURRA	25.86	62.05	2.40	27.52	77.48	2.82	53.38	139.53	2.61
	TOTAL	**54.31**	**245.06**	**4.51**	**54.73**	**332.11**	**6.07**	**109.04**	**577.17**	**5.29**
SECTOR-3	PURT	5.79	97.69	16.87	6.36	105.39	16.57	12.15	203.08	16.71
	PURB	14.26	33.21	2.33	17.21	41.69	2.42	31.47	74.90	2.38
	TURRA	27.16	59.21	2.18	27.77	70.44	2.54	54.93	129.65	2.36
	TOTAL	**47.21**	**190.11**	**4.03**	**51.34**	**217.52**	**4.24**	**98.55**	**407.63**	**4.14**
TOTAL	PURT	31.73	380.16	11.98	25.17	498.79	19.82	56.90	878.95	15.45
	PURB	54.64	127.90	2.34	52.63	145.12	2.76	107.27	273.02	2.55
	TURRA	94.27	213.25	2.26	88.66	238.56	2.69	182.93	451.81	2.47
	TOTAL	**180.64**	**721.31**	**3.99**	**166.46**	**882.47**	**5.30**	**347.10**	**1603.78**	**4.62**

5.5 PRODUCTION TARGET AND LIFE OF PROJECT

5.5.1 PRODUCTION TARGET

Considering the above coal reserves, deployment of HEMM and other operational parameters, a coal production of 20 Mtpa has been envisaged from the Dudhichua Expansion OCP, thus, giving an incremental coal production of 10 Mtpa over and above the approved Dudhichua OCP (10 Mtpa). To meet the increased demand of coal from NCL, the EPR for Dudhichua OCP for a rated capacity of 20 Mtpa of coal per annum has been prepared.

There is scope of enhancement in mine capacity by 25% by way of improvement in availability & utilization of equipment, additional OB outsourcing, etc. Thus, peak mine capacity will become 25 Mtpa (20.0 Mtpa + 25%) and production life of the mine will reduce accordingly.

However, economic evaluation of the project has been done only on 20.00 Mtpa.

5.5.2 SCHEDULE OF QUARRY OPERATION

The quarry will operate on the basis of 330 days in a year, 3 shifts per day and 8 hours a shift. Both OB and coal will be excavated and transported on the above 3 shifts/day operation basis.

5.5.3 ZERO DATE

Dudhichua OCP (10 Mtpa) is an existing mine. The zero date of PR for proposed Dudhichua OCP Expansion (20 Mtpa) has been considered as the approval of the PR by the Competent Authority.

The balance life of the Dudhichua Expansion Project has been estimated as 20 years from 31.03.2015, considering the following:

a) The mineable coal reserves of 347.10 Mt as on 31.03.2015;
b) Rated capacity of 20 Mtpa of the mine and
c) period of gradual build-up during expansion period and tapering down at the end of mining operations;

Total project life as on 31.03.2015 is given in Table No.5.7 below:

Table No. 5.7

Sl. No.	Particulars	Project Year	Value
1	Mineable Reserve (Mt)		347.01
2	Production Capacity(Mt)		20.00
3	Quarry Life		
	Period of build-up of production from 13 to 18 Mtpa)	Yr-1 to Yr-5	(5 Years)
	Period of production level at 20Mtpa	Yr-6 to Yr-17	(12 Years)
	Period of tapering down prodn.	Yr-18 to Yr-20	(3 Years)
	Total production/quarry life	Yr-1 to Yr-20	(20 Years)
4	Total project duration	Yr-1 to Yr-20	(20 Years)

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CHAPTER-VI

METHOD OF MINING

6.1 GENERAL

The non-replenishable deposits of fossil fuels require proper methodology for their successful exploitation with minimum loss. However, the selection between underground and opencast methodology is based mainly on economic and geo-mining criteria i.e. extent of mineable area, grade of coal and depth of coal seam (i.e. incropping/outcropping or occurs at depth), their disposition, thickness range of seam, presence of geological disturbances, stripping ratio, etc. Application of opencast method is best of all known methods considering safety and conservation aspects, etc. The other criteria for choosing opencast method for Dudhichua OCP Expansion (20 Mtpa) are as follows:

i) Occurrence of moderately thick Turra seam of thickness in the range of 15.45m-25.75m (Average – 20m) and existence of two more seams namely Purewa Bottom and Purewa Top seams of thickness range 5.97-15.20m (average 11.4m) and 1.95-10.00m (Average 6.63m) respectively, leads to an average stripping ratio of 4.62m^3/t in the entire quarry area.

ii) The average parting between Turra and Purewa Bottom seam varies from 49m to 63m. This makes mining by combined system of mining deploying dragline and shovel-dumper, a feasible option.

iii) Dudhichua OCP (10 Mtpa) is an existing mine and the Dudhichua OCP Expansion (20 Mtpa) has been proposed to work by extending the same in the dip side property of the Bundela and small part of Ruhela Geological Block.

iv) The present methodology in existing Dudhichua OCP (10 Mtpa) is operating successfully.

The deposit has been proposed for mining by opencast method.

6.2 Geo-mining Characteristics

The geological and mining characteristics of the mining block are given in Table No.6.1.

Table No.6.1

GEOLOGICAL AND MINING CHARACTERISTICS

Sl. No.	Particulars	Unit	Value	
1	Thickness of Coal Seam (Full seam thickness zone)			
	Seam		Stratigraphic Th.	Effective Th.
	a) Turra seam	m	15.45-25.75 (19.97)	11.30-24.35 (17.74)
	b) Purewa Bottom Seam	m	5.97-15.20 (11.42)	5.75-15.20 (10.43)
	c) Purewa Top Seam	m	1.95-10.00 (6.63)	1.95-9.90 (5.68)
2	Thickness of OB and Partings			
	a) OB above Purewa Top	m	40- 210	
	b) Parting between Purewa Bottom & Purewa Top Seams	m	27.08-45.20	
	c) Parting between Turra & Purewa Bottom seams	m	48.50-63.05	
3	Seam Gradient	Deg.	2-3	
4	Volume weight of Coal			
	a) Turra Seam	t/cum	1.55	
	b) Purewa Bottom Seam	t/cum	1.62	
	c) Purewa Top Seam	t/cum	1.69	
5	Volume Weight of OB	t/cum	2.35	
6	Volume Weight of dirt bands	t/cum	2.00	
7	Excavation Category			
	a) Coal		Cat-III - 90% Cat-IV –10%	
	b) Overburden		Cat-III - 90% Cat-IV –10%	
8	Total mineable reserves of EPR for Dudhichua OCP (20 Mtpa) as on 31.03.2015	Mt	347.10	
9	Total OB of EPR for Dudhichua OCP (20 Mtpa) as on 31.03.2015.	Mm^3	1603.78	
10	Average Stripping Ratio	m^3/t	4.62	

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6.2.1 **Characteristics of Coal & OB**

Turra (20m), Purewa Bottom (11.40m) and Purewa Top (6.63m) seams are proposed to be quarried by opencast mining. The figures within bracket in Table No.6.1 indicate the average mean thickness within the proposed quarry boundaries. The roof and floor of the seams are composed mainly of coarse grained sandstone and occasionally of shale.

The coal seams contain dirt bands, which are represented by coaly shale and carb sandy shales. Seam sections having ash and moisture content more than 55% have been considered as dirt bands.

The bulk of the overburden is represented by sand stones, which form 80 to 90% and shales from 6 to 10% of the OB. Soil and clay constitutes 4 to 10% of the OB. Shales present in block are grey shale or sandy shale or carbonaceous shale and are normally associated with the floor and roof strata of the coal seams. Sandstones are generally grey to white, medium to coarse grained and are often gritty.

The coal seams are dipping at low angles (2^{o}-3^{o}) towards the north and their bedding is complicated by 3 faults in existing Dudhichua Block with throw 4 to 15m and 7 faults in Bundela Block with throw 7m to 70m.

The relief is undulating and is cut by numerous ravines and nalla in the region of Turra seam incrop, the most prominent of them being Balia Nalla in the west. The surface RL of the opencast minefield varies within the range of 375m to 430m with occasionally high hills rising to 504m. The FRL of Turra seam floor varies from 250m to 120m in the balance expansion quarry area as on 31.03.2015.

Reference of Plans

The Final Quarry Layout Plan for the proposed expansion area is shown vide Plate No. MIN-VII. Final Stage Dump Plan is shown in Plate No. MIN-XI.

For west and east sections, the quarry cross-section viz. A-A' to B-B', C-C'- E-E', F-F' to H-H', and I-I' to K-K' alongwith existing and proposed mining system are given in Plate No.MIN-VI(A) to MIN-VI(D).

6.3 MINE PARAMETERS

Table No.6.2

Sl. No.	Particulars	Unit	Western	Eastern	Total
1	Average strike length of quarry along Turra seam floor	Km	1.80	1.90	3.70
2	Average strike length of quarry along surface	Km	2.00	2.30	4.30
3	Average Dip-Rise Width of the quarry on Turra Seam floor from existing face	Km	2.20	2.00	2.20
4	Average Dip-Rise Width of the quarry on surface from existing face	Km	2.60	2.40	2.60
5	Maximum depth of the quarry from surface	m	290	310	310
6	Quarry Surface Area (Expansion) from existing face	Sq. Km	10.77		10.77
7	Total quarry Surface Area (Existing & Expansion)	Sq. Km	16.40		16.40

6.4 CHOICE OF TECHNOLOGY

Considering the mining and geological conditions such as:

a) Flat gradient of 2^o-3^o of the coal seam;

b) Mining of multiple seams viz. Turra (20m), Purewa Bottom(11.4m) and Purewa Top (6.6m);

c) Parting of 49m to 63m between Turra and Purewa Bottom Seam and

d) Large scope of work including 20 Mt of ROM coal and peak 100.00 Mm^3 of OB per annum;

Dudhichua OCP has been working for last 33 years with combined system of mining using Dragline and shovel-dumper combination. The existing system has been proposed to be continued with up-gradation of equipment size for achieving higher production level.

Surface Miners have been introduced in NCL mines including Dudhichua OCP as a Pilot Project. After the success of the Pilot Project, application of Surface Miner may be considered in future for its implementation.

6.5 MINING SYSTEM & SYSTEM PARAMETERS

Elements of mining system have been determined in accordance with the parameters of excavation, transport equipment and the parameters of drilling and blasting.

The minefield is being developed in two sections namely Western Section and Eastern Section.

With due consideration to geo-mining characteristics of the deposit, the mine is proposed to be worked by combined system of mining using dragline and shovel-dumper combination. All the OB of expansion area will be dumped in internal dump. Coal in both sections is proposed to be extracted by shovels and transported to receiving pits/coal stock yards by 100 T rear dumpers. While designing the mining system, safety at work places and techno-economic feasibility of the system have been taken care of. On the basis of geo-mining characteristics of the deposit, mining system parameters like slope of the quarry batter, bench height, bench width, dump height; final dump slope and slope of the working benches have been decided. Design of mining system has been done considering technical parameters of HEMM and safety guidelines of Directorate General of Mines Safety (DGMS). However, during mine operations, the safety rules, regulations and various circulars issued by DGMS should be strictly followed and adhered to.

The height of main OB bench over Turra seam, proposed to be sidecast by dragline in the previous decoaled cut, would vary from 33m to 40m at production level of 20 Mtpa. The existing dragline cut width is 75m and same has been adopted in the EPR (20 Mtpa).

The element of mining system using dragline and shovel-dumper combination is shown in Plate No. MIN-IX.

The upper OB benches are proposed to be worked by 20m^3 Elect Rope Shovels working in conjunction with 190-210 T rear dumpers. The width of the cut of the OB shovel benches has been adopted as 20m. The height of the shovel-benches varies from 15-18m. With two way traffic along the bench, the width of the working benches varies from 57-63m (20m cut width, 12m throw, 21m haul road, 6m for power supply arrangement on alternate benches and 4m safety berm) ,whereas the width of non-working benches varies from 37-43m. Considering the flat dip (2^o-3^o) of the seams, it is proposed to excavate the OB from advance benches by inclined layers parallel to seam floor. This eliminates the need to cut new horizons from the side of seam roof and simplifies water drainage from the benches to central sump.

The thickness of Turra seam varies from 16m to 20m in most of the area and it is proposed to be worked in two sub-benches by 10m^3 Elect. Rope Shovel in conjunction with 100 T rear dumpers. The thickness of Purewa Bottom seam varies from 6m to 15m and that for Purewa Top seam 2m to 10m. It is suggested that these two seams should be worked in single bench by using 10m^3 Elect. Rope shovel and 10-12 m^3 Diesel Hyd. Shovel in conjunction with 100 T dumpers.

Persistent bands of thickness more than 1m present in coal seam are proposed to be mined separately. 2 Nos. 10-12 m^3 FE loader has also been provided for this purpose and other miscellaneous jobs.

System Parameters are tabulated and given below:

Table No.6.3

System Parameters

Sl. No.	Particulars	Unit	Overburden		Coal
			D/L	Shovel	
1	Bench Height	m	33-40	15-18	10-15
2	Working Bench Width	m	75	57-63	45
3	Non-working Bench Width	m	75	37-43	25
4	Bench Slope	Deg.	70	70	80

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5	Blast Hole Dia	mm	311	250	160
6	Inclination of Boreholes		Inclined	Vertical	Vertical
7	Powder Factor	Kg/m^3	0.6	0.3	0.2

The width of cut for coal benches has been adopted as 20m. The width of working bench in coal seam has been considered as 45m while width of non-working benches has been kept at 25m. The slope of each bench is proposed as 70^o in OB and 80^o in coal. But the overall running slope in working faces are about 15^o -18^o.

The above mining system and system parameters have been proposed for departmental HEMM deployed for coal winning and OB removal as proposed in Option-I & Option-II. For outsourcing of OB as proposed in Option-II (partial OB outsourcing), mining system parameters depends upon the size of equipment deployed by outsourcing agency. In the light of experience gained, the elements of mining system can be modified during the actual mining operation depending upon the physical and mechanical properties of the rock and the permission acquired from DGMS regarding the maximum permissible dragline sidecast OB dump height & other parameters.

OB Dump Benches

Bench height of OB dumps formed by Shovel-Dumper system will be 30m and slope of individual dump benches will be 37^o (equal to angle of natural repose of OB material). Width of berm between two adjacent benches will be 40m. Overall slope of dump works out to 28^o.

6.6 Balancing diagrams for Dragline combination

The Dudhichua OCP is being worked in two sections namely Western Section and Eastern Section. Presently, 2 Nos. of $24m^3$/88mR draglines are working in Western Section and 2 Nos. of $24m^3$/88mR draglines are working in Eastern Section.

The dragline balancing diagrams for cut width of 75m and different bench heights for the working of 2 Nos. 24 m^3/88mR draglines for single bench blasting have been drawn (Refer Plate No. MIN-VIII) and presented in the EPR.

The coal exposure, dragline load along with the quantity of re-handling for different bench heights are given in Table No.6.4.

Table No.6.4

Parameters of Single Bench Blasting

Bench Height (m)	Coal Exposure (Mt)	Dragline Load* (Mm^3)			Re-handling (Mm^3)	%age of Re-handling
		Insitu	Throw Blast	Total		
30	6.46	7.15	0.57	7.72	0.71	8.00
35	5.37	6.92	0.57	7.49	0.96	11.00
40	4.57	6.71	0.57	7.28	1.20	14.00
45	3.96	6.52	0.57	7.09	1.41	16.00

* Dragline load includes the volume of OB due to throw blast, which will not be handled by draglines

Dragline deployment scheme with single bench blasting is being presently practised and the same has been envisaged in the EPR. The dragline deployment scheme envisages leaving of coal rib in the balancing diagrams as per permission of DGMS. It is suggested to extract the coal rib to the extent possible while coming back after finishing the cut so that there is no chance of accumulation of water against the coal rib causing hydraulic thrust on the dump.

6.7 EQUIPMENT SELECTION

A combined system of mining with the use of Dragline and Shovel-Dumper combination is the most suitable option of OB removal and coal winning for the project.

Two options have been considered as given below:

Option-I : Total Departmental

Option-II : Partial OB Outsourcing (Dragline Departmental)

In both the options, coal winning has been proposed departmentally. However, sanctioned outsourcing OB volume has been taken into account in Option-I. For selection of size and population of departmental HEMM, due consideration has been given to proposed method of mining, general technology-culture, standardization of equipment, geo-mining character-ristics of the deposit, annual workload, equipment deployment and equipment life.

6.7.1 OB Removal

In the sanctioned PR of Dudhichua OCP (10Mtpa), 4 Nos. of 24m^3/88mR draglines and 14 Nos. of 10m^3 Elect. Rope Shovel in conjunction with 120/85 T rear dumpers had been envisaged for excavation of overburden.

It is proposed to use the same set of draglines and 20m^3 Electric Rope Shovels with combination of 190-210 T rear dumper for overburden removal. In the EPR (20 Mtpa), it is proposed to replace all the existing 10m^3 electric rope shovels deployed in OBR with 7 Nos. of 20m^3 Electric Rope Shovels after their survey off. Similarly, all the existing 85/100/120 T rear dumpers deployed in OBR are proposed to be replaced by equivalent numbers of 190-210 T rear dumpers after their survey off.

6.7.2 Coal Winning

In the sanctioned PR of Dudhichua OCP (10 Mtpa), 10m^3 Elect. Rope Shovel in conjunction with 85 T rear dumpers had been envisaged for coal production. It is proposed to use the 10m^3 Elect. Rope Shovel and 10-12m^3 Diesel Hyd. Shovel in conjunction with 100 T rear dumpers for coal winning. Some of 85 T dumpers have already been upgraded to 100T and the remaining existing 85T rear dumpers are proposed to be replaced by equivalent numbers of 100 T rear dumpers after their survey off.

6.7.3 Requirement of HEMM

Number of shovels, dumpers, drills, dozers & other HEMM as per Sanctioned PR (10 Mtpa) have been considered for replacement and up-gradation to equivalent numbers of shovels, dumpers, etc. after completion of their standard working hours/life. With this consideration, number of

upgraded HEMM, additional incremental HEMM required and total requirement of HEMM for both the options of Dudhichua Opencast Project Expansion (20 Mtpa) are given in Table No.6.5 for Option-I and in Table No. 6.6 for Option-II.

Table No. 6.5

Status of HEMM (Existing 10 Mtpa & Incremental 10 Mtpa)

Option-I (Total Departmental)

Sl. No.	HEMM	Size/ Capacity	**Sanctioned** Provision (10 Mtpa)	Existing As on 31.03.15 (10 Mtpa)	Option-I (Total Departmental)		
					Existing (10Mtpa) (Upgraded)	Incremental (10 Mtpa)	Total (20Mtpa)
A	**OB Removal**						
1	Dragline	$24m^3$/88mR	4	4	4	-	4
2	Elect. Rope Shovel	$20m^3$	-	1	7	13	20
3	Elect. Rope Shovel	$10m^3$	14	8+4*	-	-	-
4	Hyd. Shovel	$5.5m^3$	2	-	-	-	-
5	RBH Drill	311mm	4	4	4	-	4
6	RBH Drill	250mm	16	9+4*	14	26	40
7	Rear Dumper	190-210T	-	-	56	104	160
8	Rear Dumper	120T	38	32+11*	-	-	-
9	Rear Dumper	100T	-	36	-	-	-
10	Rear Dumper	85T	72	-	-	-	-
11	Dozer with Ripper	770/850 HP	5	4+2*	7	13	20
12	Dozer	410 HP	13	13	8	-	8
B	**Coal Winning**						
1	Elect. Rope Shovel	$10m^3$	4	4	4	2	6
2	Diesel Hyd shovel	10-12 m^3	-	-	-	2	2
3	RBH Drill	160mm	8	7	8	4	12
4	Rear Dumper	100T	-	4	24	28	52
5	Rear Dumper	85T	28	24	-	-	-
6	Dozer	410 HP	8	4	8	-	8
C	**Common**						
1	Motor Grader	550 HP	-	-	2	2	4
2	Motor Grader	280 HP	8	6	4	-	4
3	Crane	120 T	-	1	1	1	2
4	Crane	60-90 T	2	1	1	1	2
5	Crane	40-60 T	1	2	2	-	2
6	Crane	18-20 T	-	2	2	1	3
7	Crane	9-10T	-	2	2	2	4
8	Hyd.Shovel/ Back-hoe	$3.2/3.8m^3$	-	-	-	3	3

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9	FE Loader	10-12m^3	-	1	1	1	2
10	FE Loader	5.74/6.1m^3	3	1	2	-	2
11	Dozer	410 HP	-	-	2	-	2
12	Wheel Dozer	300HP	8	-	-	-	-
13	Wheel Dozer	410/450HP	-	2	4	-	4
D	**Reclamation**						
1	Dozer	410 HP	5	2	5	-	5
2	Motor Grader	280 HP	2	2	2	-	2
3	Hyd. Backhoe	3.2/3.8m^3	-	-	-	1	1
4	Tipping Truck	8m^3	-	-	-	5	5
5	Water Sprinkler	28 KL	6	5+4*	2	-	2
6	Water Sprinkler	70KL	-	1	2	7	9
7	Road Sweeping Machine		-	-	-	2	2

* Survey off but in use

Table No.6.6

Status of HEMM (Existing 10 Mtpa & Incremental 10 Mtpa)
Option-II (Partial OB Outsourcing)

Sl. No.	HEMM	Size/ Capacity	**Sanctioned** Provision (10 Mtpa)	Existing As on 31.03.15 (10 Mtpa)	Option-II (Partial OB Outsourcing)		
					Existing (10Mtpa) (Upgraded)	Incremental (10 Mtpa)	Total (20Mtpa)
A	**OB Removal**						
1	Dragline	24m^3/88mR	4	4	4	-	4
2	Elect. Rope Shovel	20m^3	-	1	7	-	7
3	Elect. Rope Shovel	10m^3	14	8+4*	-	-	-
4	Hyd. Shovel	5.5m^3	2	-	-	-	-
5	RBH Drill	311mm	4	4	4	-	4
6	RBH Drill	250mm	16	9+4*	14	-	14
7	Rear Dumper	190-210T	-	-	56	-	56
8	Rear Dumper	120T	38	32+11*	-	-	-
9	Rear Dumper	100T	-	36	-	-	-
10	Rear Dumper	85T	72	-	-	-	-
11	Dozer with Ripper	770/850 HP	5	4+2*	7	-	7
12	Dozer	410 HP	13	13	8	-	8
B	**Coal Winning**						
1	Elect. Rope Shovel	10m^3	4	4	4	2	6
2	Diesel Hyd shovel	10-12 m^3	-	-	-	2	2
3	RBH Drill	160mm	8	7	8	4	12
4	Rear Dumper	100T	-	4	24	28	52
5	Rear Dumper	85T	28	24	-	-	-

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6	Dozer	410 HP	8	4	8	-	8
C	**Common**						
1	Motor Grader	550 HP	-	-	2	2	4
2	Motor Grader	280 HP	8	6	4	-	4
3	Crane	120 T	-	1	1	1	2
4	Crane	60-90 T	2	1	1	1	2
5	Crane	40-60 T	1	2	2	-	2
6	Crane	18-20 T	-	2	2	1	3
7	Crane	9-10T	-	2	2	2	4
8	Hyd. Shovel/ Back-hoe	3.2/3.8m^3	-	-	-	3	3
9	FE Loader	10-12m^3	-	1	1	1	2
10	FE Loader	5.74/6.1m^3	3	1	2	-	2
11	Dozer	410 HP	-	-	2	-	2
12	Wheel Dozer	300 HP	8	-	-	-	-
13	Wheel Dozer	410/450HP	-	2	4	-	4
D	**Reclamation**						
1	Dozer	410 HP	5	2	5	-	5
2	Motor Grader	280 HP	2	2	2	-	2
3	Hyd. Backhoe	3.2/3.8m^3	-	-	-	1	1
4	Tipping Truck	8m^3	-	-	-	5	5
5	Water Sprinkler	28 KL	6	5+4*	2	-	2
6	Water Sprinkler	70KL	-	1	2	7	9
7	Road Sweeping Machine		-	-	-	2	2

* Survey off but in use

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CHAPTER-VII
MINING & DUMPING STRATEGY

7.1 CONSTRAINTS ON MINE DEVELOPMENT

The following surface constraints have to be overcome for implementation of Dudhichua OCP Expansion (20 Mtpa):

i) Diversion of forest land and its possession;

iii) Rehabilitation of about 502 Private Houses/families from the northern dip side of mining area.

7.2 Mine development Strategy & Mining Sequence

7.2.1 Mine Development Strategy

Dudhichua OCP (10Mtpa) is existing working mine. The EPR for Dudhichua OCP (20Mtpa) has been proposed to be worked by extending the existing workings in the dip side of Bundela Block and small part of Ruhela Block. The Dudhichua OCP expansion (20 Mtpa) is being worked and also envisaged to be worked in two sections viz. Eastern and Western Sections with the application of 2 Nos. of Draglines in each Section. Coal from Turra seam will be extracted by 10m^3 Elect. Rope shovel working in conjunction with 100T rear dumper and transported through main Central Entry to receiving pit of existing main CHP. Purewa Bottom & Purewa Top will be extracted by 10m^3 Elect. Rope shovel and 10-12m^3 Diesel Hyd. Shovel working in conjunction with 100T rear dumper and transported through flank roads to Receiving Pit of proposed Semi-mobile Crusher to be installed in both the sections. The flank roads are proposed to be used for OB transportation to internal dumps and for coal transportation from Purewa Bottom and Purewa Top seams to receiving pits of proposed semi-mobile crusher. The final stage quarry plan has been shown vide Plate No. MIN-VII.

7.2.2 Production Build-up

The Expansion Project is planned to achieve its target capacity of 20 Mtpa of ROM coal in 6th year (2020-21) considering 2015-16 as Year-1. The

production programme up to achieving the rated capacity of 20 Mtpa is given below:

Table No.7.1

PRODUCTION BUILD-UP

Years of Production		Coal(Mtpa)	OB(Mm^3)	SR(m^3/t)
Yr-1	2015-16	13.00	60.30	4.64
Yr-2	2016-17	13.00	61.25	4.71
Yr-3	2017-18	15.00	68.50	4.57
Yr-4	2018-19	16.00	73.05	4.57
Yr-5	2019-20	18.00	84.25	4.68
Yr-6	2020-21	20.00	94.80	4.74

7.2.3 Sequence of Mining

At present, east and west sections are being developed simultaneously with the deployment of 2 Nos. of 24 m^3/88mR draglines in East Section and 2 Nos. of 24m^3/88mR in West Section with central sump located near the central entry. Both the sections are advancing from rise to dip simultaneously. The same sequence is proposed to be continued in the expansion stage also. Presently, the working of East section is leading and West section is lagging by one cut of 75m.

7.2.4 General Scheme of Operations

Considering the flat dip (2^o-3^o) of the seams, it is proposed to excavate the OB from advanced benches by inclined layers parallel to the seam floor. This system eliminates the need to cut new horizons from the roof of seam and simplifies water drainage from the benches to the central sump.

As mentioned earlier, the minefield is being developed in two sections namely western section and eastern section. Coal from Turra seam face in both the sections is planned to be transported by dumper along the floor through existing central haul road and mid-entries from both the sections to receiving pit of existing main CHP.

Coal from Purewa seams in both the sections will be transported by dumper along the flank roads to the receiving pits of proposed semi-mobile crushers, which will be installed in flanks of both the sections, and from there to ground bunkers by sets of conveyors.

Total overburden is proposed to be transported to internal dumps along the flank roads in both the sections.

The slope angle of the working benches is adopted as 80^{o} for coal and 70^{0} for OB, while that for the OB dump is adopted as 37^{o}. In the light of the experience gained, the elements of mining system can be modified during the actual mining operations depending upon the physical and mechanical properties of the rock.

7.2.5 Excavation, Transport & Dumping

7.2.5.1 OB Excavation

All the OB benches above dragline bench horizon is proposed to be excavated by $20m^3$ Elect. Rope Shovel. The OB immediately above Turra Seam roof will be sidecast by using 2 Nos. of $24m^3$/88mR Dragline in East Section and 2 Nos. $24m^3$/88mR Dragline in West Section in vertical tandem in each section.

The height of main bench over Turra seam excavated by draglines varies according to the requirement of coal exposure from Turra Seam. 33-40m bench height at production level of 20 Mtpa has been proposed for dragline working. The dragline cut width is adopted as 75m.

The overburden from the upper benches is proposed to be removed by 20 m^3 electric rope shovels working in conjunction with 190-210T rear dumpers.

7.2.5.2 OB Transportation

For OB transportation, 190-210T rear dumpers are proposed to be deployed. The dumper provision in the EPR for Dudhichua OCP (20Mtpa) has been made for an estimated average transport lead of 3.50 Km.

However, for partial OB outsourcing option (Option-II), the lead will vary from year to year and therefore, fresh assessment of lead will have to be done on year to year basis for finalization of rate of OB transportation.

7.2.5.3 Coal Production

Coal from Turra seam will be extracted by $10m^3$ Elect. Rope shovel and Purewa Bottom & Purewa Top seams will be extracted by $10m^3$ Elect.

Rope Shovel and 10-12m^3 Diesel Hyd. Shovel working in conjunction with 100 T rear dumpers.

All the three coal seams namely Turra, Purewa Bottom and Purewa Top seams are proposed to be worked in single bench upto a thickness of 15 m. If the thickness of coal seam exceeds 15 m, it is proposed to work in two sub-benches.

7.2.5.4 **Coal Transportation**

For coal transportation, 100 T rear dumpers are proposed to be deployed and the weighted average lead of 3.50Km has been considered for estimating the number of dumpers required for coal transportation.

Coal from Turra seam face in both the sections is planned to be transported by dumper along the Turra seam floor through existing central haul road and mid-entries to receiving pit of existing main CHP. Coal from Purewa seams in both the sections will be transported by dumper along the flank roads to the receiving pits of proposed semi-mobile crushers to be installed in flanks of both the sections and from there to ground bunkers by sets of conveyors. Overall 3.50 Km weighted average lead has been considered for departmental dumper estimation.

7.2.5.5 **Dumping**

Main OB bench overlying Turra seam is to be excavated by dragline system and proposed to be sidecast in the decoaled area of previous cut. The OB from upper benches will be handled by Shovel-dumper system and is proposed to be stacked over the dragline sidecast spoil within the pit.

The volume of OB to be handled as per EPR is 1603.78 Mm^3 out of which 272.94 Mm^3 OB will be directly sidecast by draglines including throw blast of 21.09 Mm^3 in the decoaled cut and balance 1330.84 Mm^3 is proposed to be removed and dumped by shovel-dumper system in the internal dumps. The mine is being worked since 1982 and 635.22 Mm^3 of OB has been dumped in external (134.00 Mm^3) and internal OB dump (501.22 Mm^3). The final stage dump plan shows that apart from existing dump volume of 635.22 Mm^3, further 1378.78 Mm^3 will be accommodated and therefore, there is shortage of space for dump quantity to the tune of about 225 Mm^3

which may be dumped in adjoining Khadia OCP after exhaustion of its coal reserves. Out of 225 Mm^3, about 35 Mm^3 of OB of may be accommodated by heightening of internal OB dumps by one tier of 30m above average ground level of adjoining area.

Shovel-dumper spoil dumps will be formed in benches of 30m in height. For the formation of dumps and leveling of dump, 850 HP dozers have been envisaged. The annual productivity of dozers is estimated as 6.30 Mm^3 for 850 HP dozers and 2.10 Mm^3 for 410 HP dozers. A total number of 20 dozers of 850 HP, 23 Nos. of 410 HP dozers and 4 Nos. of 410/450 HP Wheel dozers have been provided in Option-I for dumping purpose, face cleaning in OBR, coal, haul road and reclamation purposes as shown in the HEMM list in Chapter-6 and calendar programme of excavation in Chapter-8.

The Tier-wise OB volume of internal dumps is given below.

Table No.7.2

Sl. No.	Tier (RL)	Volume (Mm^3)
A	**WEST SECTION**	
1	Dragline Dump	142.59
2	Upto 220 & 220-250	51.28
3	250-280	62.07
4	280-310	63.17
5	310-340	64.15
6	340-370	65.85
7	370-400	58.58
8	400-430	51.81
9	430-460	42.81
10	460-490	35.04
11	490-520	22.63
TOTAL WEST (A)		659.98
B	**EAST SECTION**	
1	Dragline Dump	130.35
2	Upto 220 & 220-250	59.93
3	250-280	62.83

4	280-310	63.38
5	310-340	64.01
6	340-370	73.50
7	370-400	71.65
8	400-430	60.70
9	430-460	50.98
10	460-490	47.92
11	490-520	33.55
TOTAL EAST (B)		718.80
GRAND TOTAL (A+B)		1378.78

Since inception, 635.22 Mm^3 of OB has already been dumped in the internal dumps of the mine. Apart from the above OB, the volume of OB estimated in the EPR (20 Mtpa) is 1603.78 Mm^3, out of which only 1378.78 Mm^3 can be accommodated in the internal dumps. Thus, there is a shortage of dumping space for OB to the tune of about 225 Mm^3.

The final stage dump plan has been shown vide Plate No. MIN-XI.

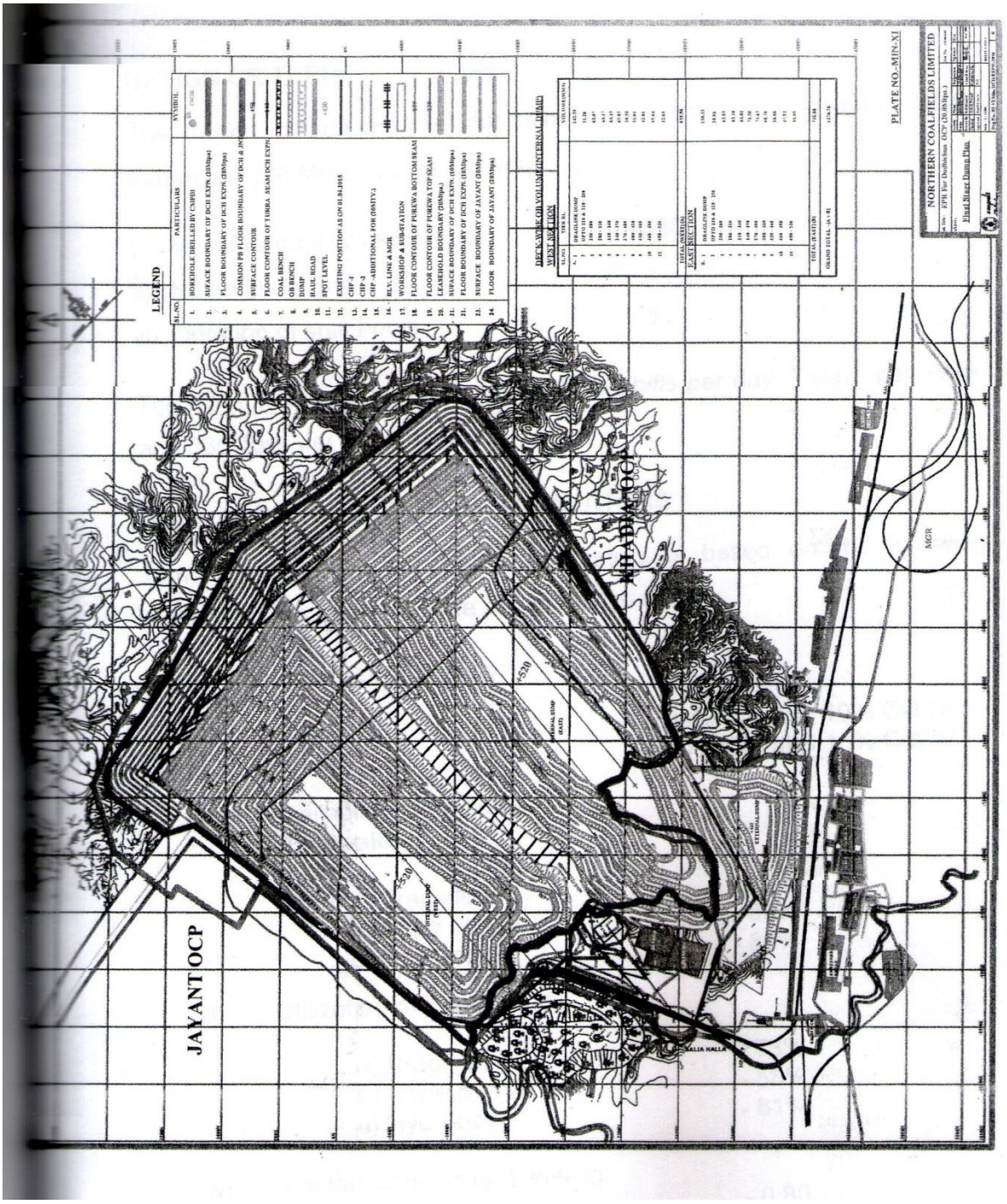
7.2.5.6 **OB Dump Benches**

Shovel-dumper spoil dumps will be formed in benches of 30m and slope of individual dump bench will be 37^o (equal to angle of natural repose of OB material). The width of berm between two adjacent benches will be 40m. Overall slope of dump works out to 28^o. Top soil wherever available will be stacked separately which will be used up for spreading over the completed OB dumps. For the formation of dumps and leveling of dumps 410/850 HP dozers have been envisaged as detailed above.

During operation of mine, OB dump stability, high-wall slope stability for OB bench parameters, OB dump height including dragline dump should be adopted and changed as per the scientific study and DGMS permission. The fund for the scientific study has been provided.

7.3 **FLEXIBILITY**

Flexibility in the implementation stage may be exercised within the approved cost estimates to respond to improvement in technology and equipment which would result in improved profitability and productivity measures.



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CHAPTER-VIII
MINING SCHEDULE & EQUIPMENT PHASING

8.1 DESIGN CRITERIA

The design criteria adopted for mining operations of Dudhichua OCP Expansion (20 Mtpa) are as follows:

i) No. of Annual Working Days - 330

ii) No. of Daily Shifts - 3

iii) Duration of shift hours - 8

The mine is to be worked on above three shifts per day, 7 days per week and 330 days per annum schedule.

8.2 ANNUAL PRODUCTIVITY OF EXCAVATORS

Annual productivity of various excavators is based on the following considerations apart from the above design criteria:

i) Excavation Category:
- OB - 90% Cat-III & 10% Cat-IV
- Coal - 90% Cat-III & 10% Cat-IV

ii) Availability of Equipment:
- Excavator
  - a) Dragline - 85%
  - b) Rope Shovel - 80%
  - c) Hyd Shovel - 80%

iii) Utilization of Equipment:
  - a) Dragline - 73%
  - b) Rope Shovel - 58%
  - c) Hyd Shovel - 61%

iv) Factors allowed for traveling:
  - a) Dragline - 0.80
  - b) Rope Shovel - 0.80
  - c) Hyd Shovel - 0.85

The main mining and transport equipment viz. Elect. Rope Shovels, Diesel Hyd. Shovels, Draglines, Dumpers and Dozers will be operating on the three shifts per day and seven days per week schedule. The number of operating days per year has been adopted as 330. Based on the above operating condition and norms, Standard Annual Productivity of various excavators as per CIL Norm are as given below:

Table No.-8.1

Sl. No.	Equipment	Annual Productivity
1	Dragline 24m^3/88mR	
	- 90^0 Swing	4.10 Mm^3
	- 120^0 Swing	3.70 Mm^3
	- 180^0 Swing	3.09 Mm^3
2	20 m^3 Elect. Rope Shovel working with 190 T Rear Dumpers	4.46 Mm^3
3	20 m^3 Elect. Rope Shovel working with 120 T Rear Dumpers	3.94 Mm^3
4	10 m^3 Elect. Rope Shovel working with 120 T Rear Dumpers	2.18 Mm^3
5	10 m^3 Elect. Rope Shovel working with 85 T Rear Dumpers	2.07 Mm^3
6	10 m^3 Elect. Rope Shovel working with 100 T Rear Dumpers	2.13 Mm^3
7	10 m^3 Diesel Hyd Shovel working with 100 T Rear Dumpers	2.78 Mm^3

8.3 Calendar Plan of Mining Operations

The calendar plan of mining operations has been formulated based on the adopted sequence of opencast minefield development, optimum conditions of mining operations for the entire life of the planned opencast mine.

Final Stage Quarry Plan on the floor of Turra seam has been given in Plate No. MIN-VII.

The Calendar programme for West Section & East Section are given in Table no- 8.2 & 8.3. The summarized calendar programme for composite West & East Section is given in Table no- 8.4. The calendar programme of excavation for the existing 10 Mtpa and for incremental 10 Mtpa is given in Table No.8.7.

The target capacity of 20 Mt of ROM coal will be achieved in the 6th year i.e. in year 2020-21. Out of the total parting of 49 to 63m between Purewa Bottom and Turra seams, the draglines are envisaged to remove upto a maximum height of 33 to 40m in both the sections. The balance is to be removed by shovel-dumper system.

The peak volume of OB excavation is 100.00 Mm^3 per annum. Out of 100.00 Mm^3 of OB, 14.90 Mm^3 is envisaged to be removed by dragline system and the balance 85.10 Mm^3 to be removed by shovel-dumper system. The peak stripping ratio after initial period for Yr-8 to Yr-13 is 5.00m^3/t. From Yr-14 of project life, OB excavation decreases gradually as given in the Calendar Plan.

8.4 EQUIPMENT SCHEDULE

Based on Calendar Plan of coal production and OB excavation, the year-wise population and deployment of draglines, shovels, dumpers, drills, dozers, etc. have been shown in Table No.8.5 (Option-I) and Table No.8.6 (Option-II).

Calendar Programme of Excavation (West Section)

Sl. No.	Particulars		YEAR OF QUARRY OPERATION																			
			Total	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20
I	Coal Production (Mt)	Coal Production Seam wise																				
		Total Coal	180.64	6.00	6.00	7.50	8.00	9.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	8.04	6.10
		PT	31.73	1.15	1.15	1.44	1.53	1.73	1.92	1.92	1.92	1.92	1.96	1.98	1.98	1.98	1.98	1.75	1.23	1.23	1.23	0.98	0.75
		PB	54.64	1.72	1.72	2.15	2.29	2.58	2.87	2.87	2.87	2.87	3.15	3.26	3.26	3.26	3.26	3.18	3.02	3.02	3.02	2.43	1.84
		TURRA	94.27	3.13	3.13	3.91	4.18	4.89	5.21	5.21	5.21	5.21	4.89	4.76	4.76	4.76	4.76	5.07	5.75	5.75	5.75	4.63	3.51
II	Natural volume of OBR (Mm^3)	OBR Parting wise Natural																				
		Total OB	721.31	21.70	21.70	27.14	28.93	32.54	36.17	36.17	36.17	36.17	42.77	45.13	45.13	45.13	45.13	43.64	40.26	40.26	40.26	32.38	24.53
		Top OB above PT	380.16	10.64	10.64	13.30	14.19	15.96	17.74	17.74	17.74	17.74	23.96	26.17	26.17	26.17	26.17	24.49	20.69	20.69	20.69	16.64	12.63
		Parting bet. PT & PB	127.90	4.08	4.08	5.12	5.44	6.12	6.80	6.80	6.80	6.80	7.33	7.53	7.53	7.53	7.53	7.38	7.03	7.03	7.03	5.66	4.28
		Parting bet. PB & TURRA	213.25	6.98	6.98	8.72	9.30	10.46	11.63	11.63	11.63	11.63	11.48	11.43	11.43	11.43	11.43	11.77	12.54	12.54	12.54	10.08	7.62
III	Av. SR (m^3/t)	Av. Stripping Ratio (Natural) (m^3/t)	3.99	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	4.28	4.51	4.51	4.51	4.51	4.36	4.03	4.03	4.03	4.03	4.02
IV	Adjusted volume of OBR (Mm^3)	OBR Parting wise Adjusted																				
		Total OB	721.31	21.70	21.70	27.14	28.93	32.54	36.17	36.17	36.17	36.17	42.77	45.13	45.13	45.13	45.13	43.64	40.26	40.26	40.26	32.64	24.27
		Top OB above PT	380.16	10.64	10.64	13.30	14.19	15.96	17.74	17.74	17.74	17.74	23.96	26.17	26.17	26.17	26.17	24.49	20.69	20.69	20.69	16.90	12.37
		Parting bet. PT & PB	127.90	4.08	4.08	5.12	5.44	6.12	6.80	6.80	6.80	6.80	7.33	7.53	7.53	7.53	7.53	7.38	7.03	7.03	7.03	5.66	4.28
		Parting bet. PB & TURRA	213.25	6.98	6.98	8.72	9.30	10.46	11.63	11.63	11.63	11.63	11.48	11.43	11.43	11.43	11.43	11.77	12.54	12.54	12.54	10.08	7.62
V	Av. SR (m^3/t)	Av. Stripping Ratio (Adusted) (m^3/t)	3.99	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	4.28	4.51	4.51	4.51	4.51	4.36	4.03	4.03	4.03	4.06	3.98
VI	System-wise OBR (Mm^3)	Total OBR Adjusted	721.31	21.70	21.70	27.14	28.93	32.54	36.17	36.17	36.17	36.17	42.77	45.13	45.13	45.13	45.13	43.64	40.26	40.26	40.26	32.64	24.27
		By Dragline System	131.55	5.21	5.22	6.52	6.60	6.75	6.88	6.88	6.88	6.88	6.79	6.79	6.79	6.79	6.79	6.88	7.01	7.01	7.01	6.75	5.12
		Throw Blast	11.03	0.46	0.46	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.43
		Total Dragline System	142.58	5.67	5.68	7.09	7.17	7.32	7.45	7.45	7.45	7.45	7.36	7.36	7.36	7.36	7.36	7.45	7.58	7.58	7.58	7.32	5.55
		BY Shovel+Dumper	541.51	5.43	3.30	7.64	20.27	25.22	28.72	28.72	28.72	28.72	35.41	37.77	37.77	37.77	37.77	36.19	32.68	32.68	32.68	25.32	18.72
		Sanctioned Outsourcing	37.22	10.60	12.72	12.41	1.49																
VII	Rehand-ling (Mm^3)	Rehandling																					
		Total	21.30	1.13	1.13	1.41	1.33	1.15	1.01	1.01	1.01	1.01	1.10	1.10	1.10	1.10	1.10	1.01	0.86	0.86	0.86	1.15	0.87
		By Dragline System	21.30	1.13	1.13	1.41	1.33	1.15	1.01	1.01	1.01	1.01	1.1	1.1	1.1	1.1	1.1	1.01	0.86	0.86	0.86	1.15	0.87
		BY Shovel+Dumper																					
VIII		Dragline Bench Height (m)		40	40	40	40	39	36	36	36	36	38	38	38	38	38	36	33	33	33	39	39
		Strike length (m)		1640	1640	1640	1640	1640	1640	1640	1640	1775	1775	1775	1775	1775	1915	1915	1915	1915	1915	1915	1915
		Advancement (m/Yr)		79	80	99	101	106	117	117	117	108	101	101	101	101	93	100	111	111	111	90	69

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EPR for Dudhichua OCP (20 Mtpa)

Calendar Programme of Excavation (East Section)

Sl. No.	Particulars		YEAR OF QUARRY OPERATION																	
		Total	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19
I	Coal Production Seam wise																				
	Coal Production (Mt) Total Coal	166.46	7.00	7.00	7.50	8.00	9.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	6.00	1.96
	PT	25.17	1.10	1.10	1.17	1.25	1.41	1.56	1.56	1.69	1.71	1.71	1.71	1.71	1.55	1.24	1.24	1.24	1.24	0.74	0.24
	PB	52.63	2.04	2.04	2.18	2.33	2.62	2.91	2.91	3.20	3.26	3.26	3.26	3.26	3.29	3.35	3.35	3.35	3.35	2.01	0.66
	TURRA	88.66	3.86	3.86	4.15	4.42	4.97	5.53	5.53	5.11	5.03	5.03	5.03	5.03	5.16	5.41	5.41	5.41	5.41	3.25	1.06
II	Natural volume of OBR (Mm^3) OBR Parting wise Natural																				
	Total OB	882.47	38.60	38.60	41.34	44.10	49.80	55.11	55.11	59.63	60.69	60.69	60.69	60.69	54.49	42.36	42.37	42.37	42.37	25.42	8.24
	Top OB above PT	498.79	21.94	21.94	23.49	25.06	28.19	31.32	31.32	36.18	37.32	37.32	37.32	37.32	31.64	20.52	20.53	20.53	20.53	12.32	4.00
	Parting bet. PT & PB	145.12	6.15	6.15	6.59	7.03	7.90	8.78	8.78	9.13	9.21	9.21	9.21	9.21	8.84	8.12	8.12	8.12	8.12	4.87	1.58
	Parting bet. PB & TURRA	238.56	10.51	10.51	11.26	12.01	13.51	15.01	15.01	14.32	14.16	14.16	14.16	14.16	14.01	13.72	13.72	13.72	13.72	8.23	2.66
III	Av. SR (m^3/t) Av. Stripping Ratio (Natural) (m^3/t)	5.30	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.96	6.07	6.07	6.07	6.07	5.45	4.24	4.24	4.24	4.24	4.24	4.20
IV	Adjusted volume of OBR (Mm^3) OBR Parting wise Adjusted																				
	Total OB	882.47	38.60	39.55	41.36	44.12	51.71	58.63	58.63	63.83	63.83	57.23	54.87	54.87	54.87	42.37	42.36	42.39	42.39	25.44	5.42
	Top OB above PT	498.79	21.94	22.89	23.51	25.08	30.30	34.84	34.84	40.38	40.46	33.86	31.50	31.50	32.02	20.53	20.52	20.55	20.55	12.34	1.18
	Parting bet. PT & PB	145.12	6.15	6.15	6.59	7.03	7.90	8.78	8.78	9.13	9.21	9.21	9.21	9.21	8.84	8.12	8.12	8.12	8.12	4.87	1.58
	Parting bet. PB & TURRA	238.56	10.51	10.51	11.26	12.01	13.51	15.01	15.01	14.32	14.16	14.16	14.16	14.16	14.01	13.72	13.72	13.72	13.72	8.23	2.66
V	Av. SR (m3/t) Av. Stripping Ratio (Adusted) (m^3/t)	5.30	5.51	5.65	5.51	5.52	5.75	5.86	5.86	6.38	6.38	5.72	5.49	5.49	5.49	4.24	4.24	4.24	4.24	4.24	2.77
VI	System-wise OBR (Mm^3) Total OBR Adjusted	882.47	38.60	39.55	41.36	44.12	51.71	58.63	58.63	63.83	63.83	57.23	54.87	54.87	54.87	42.37	42.36	42.39	42.39	25.44	5.42
	By Dragline System	120.29	5.21	5.21	6.6	6.67	6.84	6.97	6.97	6.88	6.84	6.84	6.84	6.84	6.88	6.97	6.97	6.97	6.97	5.21	1.60
	Throw Blast	10.06	0.46	0.46	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.46	0.14
	Total Dragline System	130.35	5.67	5.67	7.17	7.24	7.41	7.54	7.54	7.45	7.41	7.41	7.41	7.41	7.45	7.54	7.54	7.54	7.54	5.67	1.74
	BY Shovel+Dumper	676.73	5.84	7.97	13.29	35.39	44.30	51.09	51.09	56.38	56.42	49.82	47.46	47.46	47.42	34.83	34.82	34.85	34.85	19.77	3.68
	Sanctioned Outsourcing	75.39	27.09	25.91	20.90	1.49															
VII	Rehand-ling (Mm^3) REHANDLING																				
	Total	18.33	1.13	1.13	1.33	1.24	1.06	0.91	0.91	1.01	1.06	1.06	1.06	1.06	1.01	0.91	0.91	0.91	0.91	0.55	0.18
	By Dragline System	18.33	1.13	1.13	1.33	1.24	1.06	0.91	0.91	1.01	1.06	1.06	1.06	1.06	1.01	0.91	0.91	0.91	0.91	0.55	0.18
	BY Shovel+Dumper																				
VIII	Dragline Bench Height (m)		40	40	40	40	37	34	34	36	37	37	37	37	36	34	34	34	34	34	34
	Strike length (m)		1860	1860	1860	1860	1860	1860	1860	1860	1910	1910	1910	1910	1910	1950	1950	1950	1950	1950	1950
	Advancement (m/Yr)		70	70	89	90	99	110	110	103	97	97	97	97	100	105	105	105	105	79	24

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M. K. Prasad
General Manager
Dudhichua Project
Khadia, Sonebhadra (U P)

Table No.8.4
EPR for Dudhichua OCP (20 Mtpa)
Calendar Programme of Excavation (East & West Sections)

Sl. No.	Particulars		Total	YEAR OF QUARRY OPERATION																				
				Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20
I	Coal Production	Coal Production Seam wise																					
		Total Coal	347.10	13.00	13.00	16.00	16.00	18.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	16.00	10.00	6.10	
		PT	56.90	2.25	2.25	2.61	2.78	3.14	3.48	3.61	3.63	3.67	3.69	3.69	3.53	3.22	2.89	2.47	2.47	1.97	1.22	0.75	
		PB	107.27	3.76	3.76	4.33	4.62	5.20	5.78	6.07	6.13	6.41	6.52	6.52	6.55	6.61	6.53	6.37	6.37	5.03	3.09	1.84	
		TURRA	182.93	6.99	6.99	8.06	8.60	9.66	10.74	10.74	10.32	10.24	9.92	9.79	9.79	9.92	10.17	10.48	11.16	11.16	9.00	5.69	3.51
II	Natural volume of OBR (Mm^3)	OBR Parting wise Natural																					
		Total OB	1603.78	60.30	60.30	68.48	73.03	82.14	91.28	91.28	96.80	96.86	105.46	105.82	105.82	99.62	87.49	86.01	82.83	82.63	65.68	40.62	24.53
		Top OB above PT	878.95	32.58	32.58	38.79	39.25	44.15	49.06	49.06	53.92	55.06	61.28	63.49	63.49	57.81	46.69	45.02	41.22	41.22	33.01	20.64	12.63
		Parting bet. PT & PB	273.02	10.23	10.23	11.71	12.47	14.02	15.58	15.58	15.93	16.01	16.54	16.74	16.74	16.37	15.65	15.50	15.15	15.15	11.90	7.24	4.28
		Parting bet. PB & TURRA	451.81	17.49	17.49	19.98	21.31	23.97	26.64	26.64	25.95	25.79	25.84	25.59	25.59	25.44	25.15	25.49	26.26	26.26	20.77	12.74	7.62
III	Av. SR (m^3/t)	Av. Stripping Ratio (Natural) (m3/t)	4.62	4.64	4.64	4.57	4.56	4.56	4.56	4.56	4.79	4.84	5.17	5.29	5.29	4.98	4.37	4.30	4.13	4.13	4.11	4.06	4.02
IV	Adjusted volume of OBR (Mm^3)	OBR Parting wise Adjusted																					
		Total OB	1603.78	60.30	61.25	68.50	73.05	84.25	94.80	94.80	100.00	100.00	100.00	100.00	100.00	87.50	86.00	82.65	82.65	65.70	38.06	24.27	
		Top OB above PT	878.95	32.58	33.53	36.81	39.27	46.26	52.58	52.58	58.12	58.20	57.85	57.67	57.67	46.70	45.01	41.24	41.24	33.03	18.08	12.37	
		Parting bet. PT & PB	273.02	10.23	10.23	11.71	12.47	14.02	15.58	15.58	15.93	16.01	16.54	16.74	16.74	16.37	15.65	15.50	15.15	15.15	11.90	7.24	4.28
		Parting bet. PB & TURRA	451.81	17.49	17.49	19.98	21.31	23.97	26.64	26.64	25.95	25.79	25.84	25.59	25.59	25.44	25.15	25.49	26.26	26.26	20.77	12.74	7.62
V	Av. SR (m^3/t)	Av. Stripping Ratio (Adusted) (m^3/t)	4.62	4.64	4.71	4.57	4.57	4.68	4.74	4.74	5.00	5.00	5.00	5.29	5.29	4.98	4.37	4.30	4.13	4.13	4.11	4.06	4.02
VI	System-wise OBR (Mm^3)	Total OBR Adjusted	1603.78	60.30	61.25	68.50	73.05	84.25	94.80	94.80	100.00	100.00	100.00	100.00	100.00	87.50	86.00	82.65	82.65	65.70	38.06	24.27	
		By Dragline System	251.84	10.43	10.43	13.12	13.27	13.59	13.85	13.85	13.76	13.72	13.63	13.63	13.63	13.67	13.76	13.85	13.98	13.98	12.22	8.35	5.12
		Throw Blast	21.09	0.91	0.91	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.03	0.71	0.43
		Total Dragline System	272.94	11.34	11.35	14.26	14.41	14.73	14.99	14.99	14.9	14.86	14.77	14.77	14.77	14.81	14.9	14.99	15.12	15.12	13.25	9.06	5.55
		BY Shovel+Dumper	1218.23	11.27	11.27	20.93	55.66	69.52	79.81	79.81	85.10	85.14	85.23	85.23	85.23	85.19	72.60	71.01	67.53	67.53	52.45	29.00	18.72
		Sanctioned Outsourcing	112.61	37.69	38.63	33.31	2.98																
VII	Rehand-ling (Mm^3)	Rehandling																					
		Total	39.63	2.26	2.26	2.74	2.57	2.21	1.92	1.92	2.02	2.07	2.16	2.16	2.16	2.11	2.01	1.92	1.77	1.77	1.41	1.33	0.87
		By Dragline System	39.63	2.256	2.256	2.74	2.57	2.21	1.92	1.92	2.02	2.07	2.16	2.16	2.16	2.11	2.01	1.92	1.77	1.77	1.41	1.33	0.87
		BY Shovel+Dumper																					

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M. K. Prasad
General Manager
Dudhichua Project
Khadia, Sonebhadra (U P)

Table No.8.4
EPR for Dudhichua OCP (20 Mtpa)
Calendar Programme of Excavation (East & West Sections)

Sl. No.	Particulars		Total	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20
			YEAR OF QUARRY OPERATION																				
I	Coal Production (Mt)	Coal Production Seam wise																					
		Total Coal	347.10	13.00	13.00	15.00	16.00	18.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	16.00	10.00	6.10	
		PT	56.90	2.25	2.25	2.61	3.14	3.48	3.48	3.61	3.63	3.67	3.69	3.69	3.53	3.22	2.89	2.47	2.47	1.97	1.22	0.75	
		PB	107.27	3.76	3.76	4.33	5.20	5.78	5.78	6.07	6.13	6.41	6.52	6.52	6.55	6.61	6.53	6.37	6.37	5.03	3.09	1.84	
		TURRA	182.93	6.99	6.99	8.06	9.66	10.74	10.74	10.32	10.24	9.92	9.79	9.79	9.92	10.17	10.48	11.16	11.16	9.00	5.69	3.51	
II	Natural volume of OBR (Mm³)	OBR Parting wise Natural																					
		Total OB	1603.78	60.30	60.30	68.40	73.03	82.14	91.28	91.28	98.80	96.86	105.48	105.82	105.82	99.62	87.49	86.01	82.63	82.63	65.68	40.62	24.53
		Top OB above PT	878.95	32.58	32.58	36.79	39.25	44.15	49.06	49.06	53.92	55.06	61.28	63.49	63.49	57.81	49.69	45.02	41.22	41.22	33.01	20.64	12.63
		Parting bet. PT & PB	273.02	10.23	10.23	11.71	12.47	14.02	15.58	15.58	15.93	16.01	16.54	16.74	16.74	16.37	15.65	15.50	15.15	15.15	11.90	7.24	4.28
		Parting bet. PB & TURRA	451.81	17.49	17.49	19.98	21.31	23.97	26.64	26.64	25.95	25.79	25.54	25.59	25.59	25.44	25.15	25.49	26.26	26.26	20.77	12.74	7.62
III	Av. SR (m³/t)	Av. Stripping Ratio (Natural)	4.62	4.64	4.64	4.57	4.56	4.56	4.56	4.56	4.79	4.84	5.17	5.29	5.29	4.98	4.37	4.30	4.13	4.13	4.11	4.06	4.02
	(m3/t)	OBR Parting wise Adjusted																					
IV	Adjusted volume of OBR (Mm³)	Total OB	1603.78	60.30	61.25	68.50	73.05	84.25	94.80	94.80	100.00	100.00	100.00	100.00	100.00	87.50	86.00	82.65	82.65	65.70	38.06	24.27	
		Top OB above PT	878.95	32.58	33.53	36.81	39.27	46.26	52.58	52.58	58.12	58.20	57.85	57.67	57.67	58.19	46.70	45.01	41.24	41.24	33.03	18.08	12.37
		Parting bet. PT & PB	273.02	10.23	10.23	11.71	12.47	14.02	15.58	15.58	15.93	16.01	16.54	16.74	16.74	16.37	15.65	15.50	15.15	15.15	11.90	7.24	4.28
V	Av. SR (m³/t)	Parting bet. PB & TURRA	451.81	17.49	17.49	19.98	21.31	23.97	26.64	26.64	25.95	25.79	25.54	25.59	25.59	25.44	25.15	25.49	26.26	26.26	20.77	12.74	7.62
		Av. Stripping Ratio (Adusted)	4.62	4.64	4.71	4.57	4.57	4.68	4.74	4.74	5.00	5.00	5.00	5.29	5.29	4.98	4.37	4.30	4.13	4.13	4.11	4.06	4.02
	(m³/t)	Total OBR Adjusted	1603.78	60.30	61.25	68.50	73.05	84.25	94.80	94.80	100.00	100.00	100.00	100.00	100.00	87.50	86.00	82.65	82.65	65.70	38.06	24.27	
VI	System-wise OBR (Mm³)	By Dragline System	251.84	10.43	10.43	13.12	13.27	13.59	13.85	13.76	13.72	13.53	13.63	13.67	13.67	13.76	13.85	13.98	13.98	12.22	8.35	5.12	
		Throw Blast	21.09	0.91	0.91	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.03	0.71	0.43	
		Total Dragline System	272.94	11.34	11.35	14.26	14.41	14.73	14.99	14.99	14.9	14.86	14.77	14.77	14.81	14.9	14.99	15.12	15.12	13.25	9.06	5.55	
		BY Shovel+Dumper	1218.23	11.27	11.27	20.93	55.86	69.52	79.81	79.81	85.10	85.14	85.23	85.23	85.23	85.19	72.60	71.01	67.53	67.53	52.45	29.00	18.72
		Sanctioned Outsourcing																					
VII	Rehand-ling (Mm³)	Rehandling	112.61	37.69	38.63	33.31	2.98																
		Total	39.63	2.26	2.26	2.74	2.57	2.21	1.92	1.92	2.02	2.07	2.16	2.16	2.11	2.01	1.92	1.77	1.77	1.41	1.33	0.87	
		By Dragline System	39.63	2.256	2.256	2.74	2.57	2.21	1.92	1.92	2.02	2.07	2.16	2.16	2.11	2.01	1.92	1.77	1.77	1.41	1.33	0.87	
		BY Shovel+Dumper																					

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Table No. 8.6
EPR for Dudhichua OCP (20 Mtpa)
SUMMARISED CALENDAR PLAN & HEMM PHASING

OPTION-II (PARTIAL O.B. OUTSOURCING)

Sl. No.	Particulars		Year Total	15-16 Yr-1	16-17 Yr-2	17-18 Yr-3	18-19 Yr-4	19-20 Yr-5	20-21 Yr-6	21-22 Yr-7	22-23 Yr-8	23-24 Yr-9	24-25 Yr-10	25-26 Yr-11	26-27 Yr-12	27-28 Yr-13	28-29 Yr-14	29-30 Yr-15	30-31 Yr-16	31-32 Yr-17	32-33 Yr-18	33-34 Yr-19	34-35 Yr-20
I	Coal Production (Mt)	Coal Production Seam wise																				
		Total Coal	347.10	13.00	13.00	16.00	16.00	18.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	16.00	10.00	6.10
		PT	66.90	2.25	2.25	2.61	2.78	3.14	3.48	3.48	3.61	3.63	3.67	3.69	3.69	3.53	3.22	2.99	2.47	2.47	1.97	1.22	0.75
		PB	107.27	3.76	3.76	4.33	4.62	5.20	5.78	5.78	6.07	6.13	6.41	6.52	6.52	6.55	6.61	6.53	6.37	6.37	5.03	3.09	1.84
		TURRA	182.93	6.99	6.99	8.06	8.60	9.66	10.74	10.74	10.32	10.24	9.92	9.79	9.79	9.92	10.17	10.48	11.16	11.16	9.00	5.69	3.51
II	Adjusted volume of OBR (Mm³)	OBR Parting wise Adjusted																				
		Total OB	1603.78	60.30	61.25	68.50	73.05	84.25	94.80	94.80	100.00	100.00	100.00	100.00	100.00	100.00	87.50	86.00	82.65	82.65	65.70	38.06	24.27
		Top OB above PT	878.96	32.58	33.53	36.81	39.27	46.26	52.58	52.58	58.12	58.20	57.82	57.67	57.67	58.19	46.70	45.01	41.24	41.24	33.03	18.08	12.37
		Parting bet. PT & PB	273.02	10.23	10.23	11.71	12.47	14.02	15.58	15.58	15.93	16.01	16.54	16.74	16.74	16.37	15.65	15.50	15.15	15.15	11.90	7.24	4.28
		Parting bet. PB & TURRA	451.81	17.49	17.49	19.98	21.31	23.97	26.64	26.64	25.95	25.79	25.64	25.59	25.59	25.44	25.15	25.49	26.26	26.26	20.77	12.74	7.62
III	Av. SR (m³/t)	Av. Stripping Ratio (Adjusted) (m³/t)	4.62	4.64	4.71	4.57	4.57	4.68	4.74	4.74	5.00	5.00	5.00	5.00	5.00	5.00	4.38	4.30	4.13	4.13	4.11	3.81	3.98
IV	Total OBR (Mm³)	Total OBR Adjusted	1603.78	60.30	61.25	68.50	73.05	84.25	94.80	94.80	100.00	100.00	100.00	100.00	100.00	100.00	87.50	86.00	82.65	82.65	65.70	38.06	24.27
V	Depart-mental OBR (Mm³)	By Dragline System	261.84	10.43	10.43	13.12	13.27	13.59	13.85	13.85	13.76	13.72	13.63	13.63	13.63	13.67	13.76	13.85	13.98	13.98	12.22	8.35	5.12
		Throw Blast	21.09	0.91	0.91	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.03	0.71	0.43
		Total Dragline System	272.84	11.34	11.35	14.26	14.41	14.73	14.99	14.99	14.90	14.86	14.77	14.77	14.77	14.81	14.90	14.99	15.12	15.12	13.25	9.06	5.55
		BY Shovel+Dumper	612.20	11.27	11.27	20.93	24.00	24.00	28.00	28.00	28.00	28.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	18.72
		Total deptt OBR	785.13	22.61	22.62	35.19	38.41	38.73	42.99	42.99	42.90	42.86	43.77	43.77	43.77	43.81	43.90	43.99	44.12	44.12	42.25	38.06	24.27
VI	Outsour-cing	Sanctioned Outsourcing	112.81	37.69	38.63	33.31	2.98																
		Additional O.B. Outsourcing	706.04				31.66	45.52	51.81	51.81	57.10	57.14	56.23	56.23	56.23	56.19	43.60	42.01	38.53	38.53	23.45	0.00	0.00
		Totall O.B. Outsourcing	818.85	37.69	38.63	33.31	34.64	45.52	51.81	51.81	57.10	57.14	56.23	56.23	56.23	56.19	43.60	42.01	38.53	38.53	23.45	0.00	0.00
VII	Rehandling (Mm³)	Rehandling	39.83	2.26	2.26	2.74	2.57	2.21	1.92	1.92	2.02	2.07	2.16	2.16	2.16	2.11	2.01	1.92	1.77	1.77	1.41	1.33	0.87
		Total	39.83	2.26	2.26	2.74	2.57	2.21	1.92	1.92	2.02	2.07	2.16	2.16	2.16	2.11	2.01	1.92	1.77	1.77	1.41	1.33	0.87
		By Dragline System																				
		BY Shovel+Dumper																				

HEMM PHASING

OPTION-II (PARTIAL O.B. OUTSOURCING)

VIII	HEMM	SIZE/CAP.	Sanctioned Provision (10 Mtpa)	Existing as on 31.03.15 (10 Mtpa)	Upgra-ded	Addl.	Total Provision (20 Mtpa)	Yr 15-16 Yr-1	16-17 Yr-2	17-18 Yr-3	18-19 Yr-4	19-20 Yr-5	20-21 Yr-6	21-22 Yr-7	22-23 Yr-8	23-24 Yr-9	24-25 Yr-10	25-26 Yr-11	26-27 Yr-12	27-28 Yr-13	28-29 Yr-14	29-30 Yr-15	30-31 Yr-16	31-32 Yr-17	32-33 Yr-18	33-34 Yr-19	34-35 Yr-20
A	OBR																										
1	Dragline	24m3/88mR	4	4	4	-	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
2	Elect. Rope Shovel	20m³	-	1	7	-	7	1	1	3	3	3	6	6	6	6	7	7	7	7	7	7	7	7	7	7	7
3	Elect. Rope Shovel	10m³	14	8+4*	-	-	-	8+4*	8+4*	8	8	8	2	2	2	2	-										
4	Hyd. Shovel	5.5 m³	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
5	RBH Drill	311 mm	4	4	4	-	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6	RBH Drill	250mm	16	9+4*	14	-	14	9+4*	9+4*	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
7	Rear Dumper	190-210 T	-	-	56	-	56	-	-	18	21	21	40	40	48	48	56	56	56	56	56	56	56	56	56	56	40
8	Rear Dumper	120 T	38	32+11*	-	-	-	32+11*	32+11*	18	18	18	-	-	-	-	-										
9	Rear Dumper	100T	-	36	-	-	-	36	36	36	36	36	14	14	14	14	-										
10	Rear Dumper	85 T	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
11	Dozer with Ripper	770/850 HP	5	4+2*	7	-	7	4+2*	4+2*	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
12	Dozer	410 HP	13	13	8	-	8	13	13	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Coal Winning																										
1	Elect Rope Shovel	10m³	4	4	4	2	6	4	4	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
2	Diesel Hyd Shovel	10-12m³	-	-		2	2	-		1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
3	RBH Drill	160 mm	8	7	8	4	12	7	8	9	9	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
4	Rear Dumper	85T	28	24	-	-		24	24	24																	
5	Rear Dumper	100T		4	24	28	52	4	4	22	44	48	52	52	52	52	52	52	52	52	52	52	52	52	48	28	20
6	Dozer	410 HP	8	4	8		8	4	5	6	6	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Common																										
1	Grader	550 HP	-	6	2	2	4	6	6	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
2	Grader	280 HP	8	1	4	-	4	1	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
3	Crane	120 T		1	1	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	Crane	60-90 T	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	Crane	40-60 T	1	2	2	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	Crane	18-20 T	-	2	2	1	3	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7	Crane	8-10T	-	-	2	2	4	-	[illegible]	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
8	Hyd. Shovel/Backhoe	3.2/3.8 m³	-	1	-	3	3	1	1	1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9	FE Loader	5.74/6.1 m³	-	1	2	-	2	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	FE Loader	10-12m3	3	-	1	1	2			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11	Dozer	410 HP	-		2	-	2			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	Wheel Dozer	300 HP	-																								
13	Wheel Dozer/Dozer	410/450 HP	8																								
	Reclamation			2	4	-	4	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	[illegible]	410 HP																									
	[illegible]	[illegible]																									
	[illegible]	[illegible]																									

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EPR for Dudhichua Opencast Project (20 Mtpa)

Calendar Programme of Excavation (Existing 10 Mtpa & Incremental 10 Mtpa)

	Years	Total (20 Mtpa)					Existing (10 Mtpa)										Incremental (10 Mtpa)						
		Coal (Mt)	Turra (Mt)	Purewa (Mt)	OBR (Mm^3)	SR (m^3/t)	Total Coal (Mt)	Turra (Mt)	Purewa (Mt)	Total OBR (Mm^3)	By D/L (Mm^3)	By Sh-D (Mm^3) Deptt.	Sanct. O/S	Total	Reh. (Mm^3)	SR (m^3/t)	Total Coal (Mt)	Turra (Mt)	Purewa (Mt)	Sanctioned Outsourcing OBR(Mm^3)	Proposed Outsourcing OBR(Mm^3)	Total Outsourcing OBR(Mm^3)	SR (m^3/t)
Yr-1	15-16	13.00	6.99	6.01	60.30	4.64	10.00	5.38	4.62	35.34	11.34	11.27	12.73	24.00	2.26	3.53	3.00	1.61	1.39	24.96		24.96	8.32
Yr-2	16-17	13.00	6.99	6.01	61.25	4.71	10.00	5.38	4.62	35.35	11.35	11.27	12.73	24.00	2.26	3.54	3.00	1.61	1.39	25.90		25.90	8.63
Yr-3	17-18	15.00	8.06	6.94	68.50	4.57	10.00	5.37	4.63	38.26	14.26	20.93	3.07	24.00	2.74	3.83	5.00	2.69	2.31	30.24		30.24	6.05
Yr-4	18-19	16.00	8.60	7.40	73.05	4.57	10.00	5.38	4.63	38.41	14.41	24.00		24.00	2.57	3.84	6.00	3.23	2.78	2.98	31.66	34.64	5.77
Yr-5	19-20	18.00	9.66	8.34	84.25	4.68	10.00	5.37	4.63	38.73	14.73	24.00		24.00	2.21	3.87	8.00	4.29	3.71		45.52	45.52	5.69
Yr-6	20-21	20.00	10.74	9.26	94.80	4.74	10.00	5.37	4.63	42.99	14.99	28.00		28.00	1.92	4.30	10.00	5.37	4.63		51.81	51.81	5.18
Yr-7	21-22	20.00	10.74	9.26	94.80	4.74	10.00	5.37	4.63	42.99	14.99	28.00		28.00	1.92	4.30	10.00	5.37	4.63		51.81	51.81	5.18
Yr-8	22-23	20.00	10.32	9.68	100.00	5.00	10.00	5.16	4.84	42.90	14.90	28.00		28.00	2.02	4.29	10.00	5.16	4.84		57.10	57.10	5.71
Yr-9	23-24	20.00	10.24	9.76	100.00	5.00	10.00	5.12	4.88	42.86	14.86	28.00		28.00	2.07	4.29	10.00	5.12	4.88		57.14	57.14	5.71
Yr-10	24-25	20.00	9.92	10.08	100.00	5.00	10.00	4.96	5.04	43.77	14.77	29.00		29.00	2.16	4.38	10.00	4.96	5.04		56.23	56.23	5.62
Yr-11	25-26	20.00	9.79	10.21	100.00	5.00	10.00	4.90	5.11	43.77	14.77	29.00		29.00	2.16	4.38	10.00	4.90	5.11		56.23	56.23	5.62
Yr-12	26-27	20.00	9.79	10.21	100.00	5.00	10.00	4.90	5.11	43.77	14.77	29.00		29.00	2.16	4.38	10.00	4.90	5.11		56.23	56.23	5.62
Yr-13	27-28	20.00	9.92	10.08	100.00	5.00	10.00	4.96	5.04	43.81	14.81	29.00		29.00	2.11	4.38	10.00	4.96	5.04		56.19	56.19	5.62
Yr-14	28-29	20.00	10.17	9.83	87.50	4.38	10.00	5.09	4.92	43.90	14.90	29.00		29.00	2.01	4.39	10.00	5.09	4.92		43.60	43.60	4.36
Yr-15	29-30	20.00	10.48	9.52	86.00	4.30	10.00	5.24	4.76	43.99	14.99	29.00		29.00	1.92	4.40	10.00	5.24	4.76		42.01	42.01	4.20
Yr-16	30-31	20.00	11.16	8.84	82.65	4.13	10.00	5.58	4.42	44.12	15.12	29.00		29.00	1.77	4.41	10.00	5.58	4.42		38.53	38.53	3.85
Yr-17	31-32	20.00	11.16	8.84	82.65	4.13	10.00	5.58	4.42	44.12	15.12	29.00		29.00	1.77	4.41	10.00	5.58	4.42		38.53	38.53	3.85
Yr-18	32-33	16.00	9.00	7.00	65.70	4.11	10.00	5.63	4.38	42.25	13.25	29.00		29.00	1.41	4.23	6.00	3.38	2.63		23.45	23.45	3.91
Yr-19	33-34	10.00	5.69	4.31	38.06	3.81	10.00	5.69	4.31	38.06	9.06	29.00		29.00	1.33	3.81							
Yr-20	34-35	6.10	3.51	2.59	24.27	3.98	6.10	3.51	2.59	24.27	5.55	18.72		18.72	0.87	3.98							
	Total	347.10	182.93	164.17	1603.78	4.62	196.10	103.91	92.19	813.66	[illegible]	[illegible]	[illegible]	[illegible]									

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8.5 Drilling and Blasting Operation

8.5.1 Category of Rocks for Drilling and types of Drilling Rigs

Drilling and blasting operations are necessary for loosening the OB and coal before excavation. Based on the physico-mechanical properties of coal and OB rocks, the excavation category for coal and OB is adopted as 90% Cat-III and 10% Cat-IV. The drilling category is VIII for Turra, Purewa Bottom and Purewa Top Seams and drilling Category for OB is Cat-X.

8.5.2 Drilling & Blasting

8.5.2.1 Selection of Drill

Following types of drills have been proposed in the EPR:

a) For OB dragline benches - 311 mm dia RBH Elect. Drill

b) For Shovel Dumper OB benches - 250 mm dia RBH Elect. Drill

c) For coal benches - 160 mm dia RBH Drill

8.5.2.2 Elements of Drilling & Blasting

The elements of drilling for OB would be decided during the actual course of mining operations. However, based on the available data from the existing practices, the burden and spacing would be 10mx10.5m for the shovel benches with a height of 18m.

For dragline benches, the burden and spacing would be 11mx11.10m

The elements of drilling in coal would be modified and firmed up during the actual course of mining. However, based on available data from the mine, a drilling pattern of 6.67mx6.67m for all the coal seams has been envisaged in the EPR.

8.5.2.3 Requirement of Drills

The requirement of drills has been assessed considering the following:

- Workload, as per calendar plan of excavation;
- Annual productivity of the drills;
- Yield of mass per running meter of hole drilled;
- Physical location of drills, within the operating sections and
- Planned cycle of repair and maintenance.

The drills provided to produce 20 Mtpa of ROM coal and 100.00 Mm^3 OB (Peak) from Dudhichua Mine are in Option-I:

- 4 Nos. of 311mm dia drills to be deployed in dragline benches;
- 40 Nos. of 250mm dia drills to be deployed in OB shovel Benches;
- 12 Nos. of 160 mm drills to be deployed in coal benches

The phased requirement of drills for Option-I & II is given in Table No.-8.5 & 8.6.

The following powder factor or specific consumption of explosives has been adopted for estimating the annual requirement of explosives:

OB from shovel benches	:	0.3 Kg per m^3
OB from dragline benches	:	0.6 Kg per m^3
For coal seams	:	0.2 Kg per m^3

The amount of secondary blasting is estimated as 4% of the total volume of explosives.

CHAPTER-IX
COAL QUALITY

9.1 INTRODUCTION

The quality of coal seams are primarily based on Geological Report on Dudhichua and Bundela Blocks as detailed in Geology (Chapter-IV). The coal from Dudhichua Opencast Mine is being supplied to SSTPS (2000MW) of NTPC and it is proposed to supply the incremental coal production of 10 Mtpa to proposed TPS viz. Bara TPS, Karchana, Anpara-D, etc. coming in the vicinity of Singrauli Coalfield.

9.2 ROM Coal Quality

EPR for Dudhichua OCP envisages extraction of Turra, Purewa Bottom and Purewa Top Seams coal. The grade based on GCV for Turra seam varies mainly from G-8 to G-12 and that for Purewa Top & Bottom seam from G-9 to G-11. The overall grade varies mainly from G8 to G11 and average product mix grade of all the three seams is G10. The Seam-wise, Sector- wise & GCV-wise Mineable Reserves are given in the Table-9.1.

Table No.9.1

Seam-wise, Sector-wise & GCV-wise Mineable Reserve (Mt)

SECTOR	GCV RANGE (Kcal/Kg)	5500-5800	5200-5500	4900-5200	4600-4900	4300-4600	4000-4300	3700-4000	3400-3700	3100-3400	2800-3100	Total	Sector-wise & Seam-wise (%)	Overall GCV	
		G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15				
	SEAM														
SECTOR-1	PURT			0.09	2.37	4.99	7.30	5.57	3.56	0.76		24.63	18	4089	G-11
	PURB			1.53	9.94	16.35	10.81	1.63				40.26	29	4442	G-10
	TURRA	1.93	7.66	16.91	31.76	14.84	0.99	0.54				74.62	53	4829	G-9
	TOTAL	1.93	7.66	18.53	44.06	36.17	19.10	7.73	3.56	0.76		139.51	100	4587	G-10
SECTOR-2	PURT		0.02	1.18	3.11	4.57	2.19	3.29	3.28	2.20	0.28	20.12	18	4103	G-11
	PURB			0.27	6.92	9.71	10.48	5.69	1.88	0.58		35.54	33	4261	G-11
	TURRA	0.01	0.74	9.16	18.71	17.78	5.75	1.23				53.38	49	4625	G-9
	TOTAL	0.01	0.76	10.61	28.74	32.06	18.42	10.21	5.16	2.78	0.28	109.05	100	4410	G-10
SECTOR-3	PURT		0.04	0.58	3.03	3.32	1.89	2.38	0.87	0.02		12.15	12	4326	G-10
	PURB			2.78	5.62	7.79	10.62	4.11	0.41	0.14		31.47	32	4360	G-10
	TURRA			3.15	22.78	19.23	6.31	2.75	0.72			54.93	56	4533	G-10
	TOTAL	0	0.04	6.51	31.44	30.34	18.82	9.23	2.00	0.16	0.00	98.55	100	4452	G-11
TOTAL	PURT	0.00	0.06	1.85	8.50	12.88	11.38	11.24	7.71	2.98	0.28	56.90	16	4144	G-10
	PURB	0.00	0.00	4.58	22.49	33.85	31.92	11.42	2.29	0.73	0.00	107.27	31	4358	G-9

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	TURRA	1.94	8.40	29.22	73.25	51.85	13.05	4.51	0.72			182.93	53	4680	G-10
	TOTAL	1.94	8.46	35.65	104.24	98.58	56.35	27.18	10.72	3.70	0.28	347.10	100	4493	G-10
Grade-wise (%)		0.56	2.44	10.27	30.03	28.40	16.23	7.83	3.09	1.07	0.08	100			

On the basis of the calendar programme of mining operations and the yearly advance of Turra and Purewa seams the year-wise quality of coal based on GCV has been summarized in Table No.9.2 & 9.3.

Table No.9.2

Seam-wise, Year- wise & GCV wise Quality of coal

Year		TURRA SEAM		PUREWA BOTTOM		PUREWA TOP		TOTAL	
		Prodn. (Mt)	GCV (Kcal./kg)	Prodn. (Mt)	GCV (Kcal./kg)	Prodn. (Mt)	GCV (Kcal./kg)	Prodn. (Mt)	GCV (Kcal./kg)
Yr-1	15-16	6.99	4829	3.76	4442	2.25	4089	13.00	4589
Yr-2	16-17	6.99	4829	3.76	4442	2.25	4089	13.00	4589
Yr-3	17-18	8.06	4829	4.33	4442	2.61	4089	15.00	4589
Yr-4	18-19	8.60	4829	4.62	4442	2.78	4089	16.00	4589
Yr-5	19-20	9.66	4829	5.20	4442	3.14	4089	18.00	4588
Yr-6	20-21	10.74	4829	5.78	4442	3.48	4089	20.00	4588
Yr-7	21-22	10.74	4829	5.78	4442	3.48	4089	20.00	4588
Yr-8	22-23	10.32	4829	6.07	4442	3.61	4089	20.00	4578
Yr-9	23-24	10.24	4675	6.13	4289	3.63	4099	20.00	4452
Yr-10	24-25	9.92	4625	6.41	4261	3.67	4103	20.00	4413
Yr-11	25-26	9.79	4625	6.52	4261	3.69	4103	20.00	4410
Yr-12	26-27	9.79	4625	6.52	4261	3.69	4103	20.00	4410
Yr-13	27-28	9.92	4625	6.55	4261	3.53	4103	20.00	4414
Yr-14	28-29	10.17	4589	6.61	4295	3.22	4122	20.00	4417
Yr-15	29-30	10.48	4533	6.53	4360	2.99	4326	20.00	4446
Yr-16	30-31	11.16	4533	6.37	4360	2.47	4326	20.00	4452
Yr-17	31-32	11.16	4533	6.37	4360	2.47	4326	20.00	4452
Yr-18	32-33	9.00	4533	5.03	4360	1.97	4326	16.00	4453
Yr-19	33-34	5.69	4533	3.09	4360	1.22	4326	10.00	4454
Yr-20	34-35	3.51	4533	1.84	4360	0.75	4326	6.10	4455
	Total	**182.93**		**107.27**		**56.90**		**347.10**	

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The categorization of grades depending upon the GCV range is given below:

G-1 = GCV Above 7000 K.Cal/kg
G-2 = GCV - 6701 – 7000 K.Cal/kg
G-3 = GCV - 6401 – 6700 K.Cal/kg
G-4 = GCV - 6101 – 6400 K.Cal/kg
G-5 = GCV - 5801 – 6100 K.Cal/kg
G-6 = GCV - 5501 – 5800 K.Cal/kg
G-7 = GCV - 5201 – 5500 K.Cal/kg
G-8 = GCV - 4901 – 5200 K.Cal/kg
G-9 = GCV - 4601 – 4900 K.Cal/kg
G-10 = GCV - 4301 – 4600 K.Cal/kg
G-11 = GCV - 4001 – 4300 K.Cal/kg
G-12 = GCV - 3701 – 4000 K.Cal/kg
G-13 = GCV - 3401 – 3700 K.Cal/kg
G-14 = GCV - 3101 – 3400 K.Cal/kg
G-15 = GCV - 2801 – 3100 K.Cal/kg
G-16 = GCV - 2501 – 2800 K.Cal/kg
G-17 = GCV - 2201 – 2500 K.Cal/kg

Seam-wise, Year-wise, GCV Grade-wise quality of coal are given below in Table No.9.3

Table No.9.3

Year		TURRA SEAM		PUREWA BOTTOM		PUREWA TOP		TOTAL	
		Prodn. (Mt)	GCV (Kcal./kg)	Prodn. (Mt)	GCV Kcal./kg)	Prodn. (Mt)	GCV (Kcal./kg)	Prodn. (Mt)	GCV (Kcal./kg)
Yr-1	15-16	6.99	G9	3.76	G10	2.25	G11	13.00	G9
Yr-2	16-17	6.99	G9	3.76	G10	2.25	G11	13.00	G9
Yr-3	17-18	8.06	G9	4.33	G10	2.61	G11	15.00	G9
Yr-4	18-19	8.60	G9	4.62	G10	2.78	G11	16.00	G9
Yr-5	19-20	9.66	G9	5.20	G10	3.14	G11	18.00	G9
Yr-6	20-21	10.74	G9	5.78	G10	3.48	G11	20.00	G9
Yr-7	21-22	10.74	G9	5.78	G10	3.48	G11	20.00	G9
Yr-8	22-23	10.32	G9	6.07	G10	3.61	G11	20.00	G9
Yr-9	23-24	10.24	G9	6.13	G11	3.63	G11	20.00	G10
Yr-10	24-25	9.92	G9	6.41	G11	3.67	G11	20.00	G10
Yr-11	25-26	9.79	G9	6.52	G11	3.69	G11	20.00	G10

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Yr-12	26-27	9.79	G9	6.52	G11	3.69	G11	20.00	G10
Yr-13	27-28	9.92	G9	6.55	G11	3.53	G11	20.00	G10
Yr-14	28-29	10.17	G10	6.61	G11	3.22	G11	20.00	G10
Yr-15	29-30	10.48	G10	6.53	G10	2.99	G10	20.00	G10
Yr-16	30-31	11.16	G10	6.37	G10	2.47	G10	20.00	G10
Yr-17	31-32	11.16	G10	6.37	G10	2.47	G10	20.00	G10
Yr-18	32-33	9.00	G10	5.03	G10	1.97	G10	16.00	G10
Yr-19	33-34	5.69	G10	3.09	G10	1.22	G10	10.00	G10
Yr-20	34-35	3.51	G10	1.84	G10	0.75	G10	6.10	G10
	Total	**182.93**		**107.27**		**56.90**		**347.10**	

The year-wise grade of ROM Coal of the seams has been adopted for cash flow analysis.

CHAPTER-X

PUMPING AND DRAINAGE

10.1 INTRODUCTION

The pumping system of Dudhichua Opencast Project has been planned to dewater the in-flow of water due to precipitation falling within the active pit limit during the monsoon season and strata water to enable the mining activity to continue round the year.

The planning of de-watering of the mine has been done in such a way that as far as possible the working faces and haul roads remain dry. The layout of the quarry provides suitable gradient along the quarry floors and the benches to facilitate self-drainage of water to the lowest level of the quarry.

The rain water precipitation to the opencast mine is non-uniform during the year. The maximum rain water intake will be during the period of about four months i.e., June to September in a year. During dry season, say October to May, seepage from strata is expected to be moderate and the same can be dealt by running a few number of pumps provided for monsoon pumping. During this period repair and overhauling of the pumps will be undertaken by rotation.

One main sump which is located in mid entry is proposed for collecting the rain as well as strata water inflow into the quarry workings in West & East sump section. The rain water inflow into the quarry workings will gravitate into this sump by natural drainage.

10.2 SOURCE OF WATER

In general, the sources of water accumulation inside the quarry area are as under:

- Rain water falling directly within the excavated area
- Inflow of rain water from back filled area
- Inflow of rain water from area beyond excavation
- Seepage of water from Strata/ Ground water

10.3 GENERAL CONSIDERATION

10.3.1 General Criteria

The general criteria for determining the number of pumps, layout and design of the pumping installation are as under:

a) Geographical location of the project.

b) General climatic conditions, surface feature of the terrain beyond the boundary of the mine.

c) Calendar Plan of excavation of quarry.

d) Geological characteristics of OB and coal seams.

e) Meteorological data of nearest rain gauge station.

f) Catchment areas, mined out areas beyond excavation, spoil dump area, maximum depth of the quarry, etc.

g) Maximum number of days to pump out the accumulated water in the quarry during peak rainfall in monsoon and number of pump operation hours per day.

h) Desired location at surface, where the quarry water can be discharged considering the surface drainage system.

10.3.2 Basic Data

The basic data considered for calculating make of water and pumping capacity is as under:

- Life of quarry
- Maximum rainfall in a day
- Stage-wise depth of operation
- Stage-wise Catchment areas
- Run-off coefficient
- Seepage/inflow of water into the mine
- Time required to dewater the accumulated water, etc.

10.4 Assessment of Maximum Rainfall in a day

The value of maximum daily precipitation has been determined from a probability curve drawn by extrapolating the recorded data received from the nearest meteorological station for a period of 10 years. Maximum daily rainfall data has been given in Table-10.1.

10.5 Assessment of volume of water to be pumped

Volume of rain water entering to the mine and accumulating in the quarry (make of water) has been assessed on the basis of the following formula:

$$\mathbf{Q = [\{(A_1 - A_3) \times h \times n_1\} + (A_2 \times h \times n_2) + (A_3 \times h \times n_3)]\ m^3/\ day}$$

Where, A_1 = Mined out area in m^2

A_2 = Area beyond excavation in m^2

A_3 = Internal Dump area in m^2

h = Maximum precipitation/ rainfall in a day in m

The run off co-efficient (n) has been considered as below:

For mined out area (n_1)	:	0.60
For area beyond excavation (n_2)	:	0.15
For internal dumped area (n_3)	:	0.10

Considering 10% seepage from strata the total water accumulation will be:

$$\mathbf{Q_1 = 1.1\ Q;}$$

Quantity of water accumulated by precipitation (rainfall) in a day with max rainfall and seepage from strata will be dewatered in 5 days at the pumping rate of 20 hours per day i.e., : (Q_1/100) Cum per hour.

TABLE- 10.1

Volume of Water Intake

Section	Catchment area (m^2)			Max. daily rainfall (mm)		Volume of water ('000 m^3/day)	
	Mined-out area (A_1)	Internal Dump area (A_3)	Area beyond excavation (A_2)	At 5.0% Probability	At 10% probability	At 5.0% probability	At 10% probability
Main Sump	1564989	2624421		205	190	270.92	251.10

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10.5.1 **Probability Curve**

The value of maximum daily precipitation has been determined from probability curve plotted based on data received from nearby meteorological station for 10 years from 1994 to 2004. The assessment has been made for maximum daily precipitation at probabilities of 10% and 5.0% which corresponds to repetition once in every 10 years and 20 years (life of the project) respectively.

The probability of occurrence of daily maximum rainfall is calculated by an expression

P(%) = ((N-0.3)/(M+0.4))*100

Where,

P is the percentage probability.

N is assigned serial no.

M is total no. of observations.

For calculating actual (observed) value of probability and rainfall, the following calculations are required step by step:

a) Calculation of Arithmatic mean (h_{am}) of the daily max rainfall:

$h_{am} = (\sum h_n)/M$

where, h_n is max daily precipitation.

b) Calculation of Modal coefficient (K) for each year:

$K = h_n/h_{am}$

Values of K & $(K-1)^2$ are calculated and tabulated in Table- 10.2. The probability for the entire series has been calculated and tabulated in Table-10.2.

TABLE-10.2

OBSERVED (ACTUAL) VALUE OF PROBABILITY AND RAINFALL

(ACTUAL MAX DAILY RAINFALL FROM 1994 TO 2004)

Sl. No. of Observations (N)	Maximum Daily Rainfall (h_n)	Modal Co-efficient $K = h_n/h_{am}$	K -1	$(K-1)^2$	% Probability $p(\%) = \frac{(N - 0.3)x100}{(M+0.4)}$
1	211.07	1.57	0.57	0.324	6.73
2	197.61	1.47	0.47	0.220	16.35
3	146.78	1.09	0.09	0.008	25.96
4	138.17	1.03	0.03	0.001	35.58
5	128.00	0.95	-0.05	0.002	45.19
6	112.10	0.83	-0.17	0.028	54.81
7	111.30	0.83	-0.17	0.030	64.42
8	105.80	0.79	-0.21	0.046	74.04
9	101.06	0.75	-0.25	0.062	83.65
10	93.10	0.69	-0.31	0.095	93.27
	1344.99			**0.815**	

M = 10

h_{am} = 134.50

For calculating theoretical value of probability and rainfall, the following calculations are done step by step:

a) Based on modal coefficient a variation ratio (C_v) and asymmetrical ratio (C_s) are calculated by expression;

$$C_v = [\{\sum(K-1)^2\}/(M-1)]^{0.5} \quad \text{and} \quad C_s = 3\,C_v .$$

b) Function asymmetrical ratio **[f(C_s)]** for calculated C_s and different theoretical probabilities is read from the Ribkin Chart and tabulated in Table- 10.3.

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c) Mean standard (M_s) is calculated by multiplying variation coefficient (C_v) by function asymmetrical ratio [$f(C_s)$] and tabulated in Table-10.3.

$$\mathbf{M_s = f(C_s) \times C_v}$$

d) Theoretical max daily rainfall (h) at different probabilities is calculated by the expression:

$\mathbf{h = h_{am} (M_s + 1)}$ and are tabulated in Table- 10.3.

TABLE-10.3

THEORETICAL VALUE OF PROBABILITY AND RAINFALL

Mean value of recorded maximum rainfall = 134.50

Co-efficient of Variation (C_V) = $\mathbf{[\{\sum(K-1)^2\}/(M-1)]^{0.5}}$ = 0.301

Co-efficient of Assymetrical ratio (Cs) = 3 x (C_V) = 0.903

% Probability » Parameters ¬	**0.1**	**1**	**5**	**10**	**30**	**50**	**75**	**95**	**99**	**99.9**
f(Cs)	4.38	2.96	1.86	1.34	0.40	-0.15	-0.73	-1.35	-1.68	-1.9
Ms = Φ x Cv = f(Cs) x Cv	1.32	0.89	0.56	0.40	0.12	-0.05	-0.22	-0.41	-0.51	-0.57
Ks = Ms + 1	2.32	1.89	1.56	1.40	1.12	0.95	0.78	0.59	0.49	0.43
h = Ks x h_{am}	**311.80**	**254.32**	**209.79**	**188.74**	**150.69**	**128.43**	**104.95**	**79.85**	**66.49**	**57.59**

Table-10.4 below gives the observed (actual) value of % Probability and Rainfall (Refer Table-10.2) and theoretical value of % Probability and Rainfall (Refer Table-10.3).**TABLE-10.4**

% Prob	**0.1**	**1**	**5**	**10**	**30**	**50**	**75**	**95**	**99**	**99.9**
Theoretical Rainfall (mm)	311.80	254.32	209.79	188.74	150.69	128.43	104.95	79.85	66.49	57.59
% Prob	**6.73**	**16.35**	**25.96**	**35.58**	**45.19**	**54.81**	**64.42**	**74.04**	**83.65**	**93.27**
Actual Rainfall (mm)	211.07	197.61	146.78	138.17	128.00	112.10	111.30	105.80	101.06	93.10

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The data of observed (actual) value of % Probability and Rainfall and theoretical value of % Probability and Rainfall are plotted separately on a probability graph to obtain actual and theoretical frequency curve. The actual and theoretical curve should match with actual curve.

Depending upon the life of the project, rainfall is calculated by the expression (%) probability = (1/life of the project) x 100.

The assessment has been made for maximum daily precipitation (rainfall) at probabilities of 10% and 5.00% which corresponds to repetition once in every 10 years and 20 years (life of the project) from the graph which comes to 190 mm and 205 mm respectively.

10.6 **Pumping Capacity**

Pumping system has been designed for the volume of water accumulated in the mine at 5.0 % probability which corresponds to project life of 20 years. Capacity of sump has been decided to accommodate rain water corresponding to maximum daily rainfall at 10% probability.

. Maximum pumping capacity worked out at 5.0 % probability**:270920 m^3 /day**
Above volume of water will be dewatered in 5 days at the rate of 20 hours pumping per day.

Pumping capacity per day thus worked out : **54184 m^3**

Pumping capacity per hour thus worked out : **2709 m^3**

Similarly, maximum pumping capacity worked out at 10% probability **: 251100 m^3 /day**

Above volume of water will be dewatered in 5 days at the rate of 20 hours pumping per day.

Pumping capacity per day thus worked out : **50220 m^3**

Pumping capacity per hour thus worked out : **2511 m^3**

Table-10.5 below gives the details of calculated catchment area and maximum daily rainfall, max volume of water accumulated per day and per hour at 5.0% and 10% probabilities respectively.

TABLE-10.5

Volume of Water Intake

Section	Catchment area (m2)			Max. daily rainfall (mm)		Max Volume of water accumulated per day (m3)		Volume of water to be pumped per hour (m3)	
	Mined-out area (A_1)	Internal Dump area (A_3)	Area beyond excavation (A_2)	At 5.0% Proba-bility	At 10% proba-bility	At 5.0% proba-bility	At 10% proba-bility	At4.5.0% proba-bility	At 10% proba-bility
Main sump	1564989	2624421	-	205	190	270920	251100	2709	2511

10.7 SELECTION OF PUMPS

10.7.1 Main Pumps & Auxiliary pumps

Pumping capacity per hour has been determined considering water accumulated in a day with max daily rainfall to be pumped out in 100 hours (5 days x 20 hours/day). Peak pumping capacity is 2709 m^3/hr at 5.0% probability.

For the proper quarry operation, in addition to existing main pumps, the following main pumps have been envisaged.

a) Two nos. additional high discharge, high head pumps of 1100 cum/hr (305 lps), 250-300m head, 1500kW and 6.6 kV supply voltage

b) Two nos of 650 cum/hr (180 lps), 200-240m head, 700kwand 6.6kv supply voltage

c) Two nos of 650 cum/hr(180lps), 125-200m head,600kw and 6.6kv supply voltage.

It has also been planned to utilize the low capacity, low head pumps in the initial years of working and with the increase in area and depth of the mine, high capacity and high head pumps will be deployed as per requirement.

Details of the proposed pumps with phased requirement and capital investment has been given in the Appendix-A.3.4. The deployment of the additional pumps may vary as per actual requirement of the mine.

10.7.2 **Slurry Pumps (Diesel/ Electrical)**

During the heavy rainfall, overburden may be washed away from the edges of slopes and internal dumps, needing pumps capable of handling slime/ slurry. For pumping slurry/sludge containing large solid particles, 4 nos. portable diesel/ electrical slurry pumps of 250m^3/hr (70 lps), 54m head with one or two channel impellers with free flow passages varying from 40 mm to 190 mm in diameter have also been envisaged. Brief details of the proposed slurry pumps along with investment details have been given in the Appendix-A.3.4.

10.7.3 **Face Pumps**

4 Nos. face pumps of 40cum/hr (11lps), 30 m head driven by 10 kw electric motor have been provided for carrying water from localized depression in the face area to main sumps. Phasing and investment on face pumps have been given in the Appendix-A.3.4

10.8 **PIPE & FITTINGS**

The delivery pipe lines from the pumping station are proposed to be taken out through the side of haul road provided in the middle of the quarry. These pipes are eventually brought to the surface from where, the water will be discharged to the natural drainage system. Suction and 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 ranges of pipes thus selected for pumps of 305 lps (1100 m^3/hr), 180lps (650 Cum/hr) and face pump/slurry pumps are of 500 mm, 300 mm and 150/100mm nominal diameter respectively.

10.9 **BRIEF SUMMARY**

Sl. No.	Items	Qty
1	Main Pump , 1100 m^3/hr (305 lps), 250-300m head, 1500kW	2 Nos
2	Main Pump , 650 m^3/hr (180 lps), 200-240m head, 700kW	2 Nos
3	Main Pump , 650 m^3/hr (180 lps), 125-200m head, 600kW	2 Nos
4	Face Pump, 40m^3/hr (11lps), 30m head, 10 kw	4 Nos

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5	Tanker filling pump, 54m^3/hr (15lps), 60 m head, 15kw	2 Nos
6	Diesel/ Electrical Slurry pump, 250 m^3/hr (70 lps), 54m head, 60 kW	4 Nos
7	Pipe fittings, bends, armoured suction, delivery hoses etc.	LS

10.10 CAPITAL INVESTMENT

The total capital requirement for pumps, pipes & fittings for Dudhichua OCP (20 Mtpa) has been estimated as `6.22 crores and additional capital requirement has been estimated as `3.95 crores. The details of capital requirement, along with phasing has been given in Appendix-A.3.4**.**

CHAPTER-XI

COAL HANDLING AND DESPATCH ARRANGEMENTS

11.1 INTRODUCTION

Existing CHP of 10 Mtpa (5Mtpa Ph-I and 5 Mtpa Ph-II) has already been constructed and is in operation. Existing CHP broadly has the facilities of three number of receiving and crushing complex, two number of bunkers for storage and reclamation, two silos with rapid loading system, and associated conveyor system. The existing 10 Mtpa CHP consists of the following features.

Phase I (5Mtpa)

- 2 nos of Receiving Pits,
- 2 Nos of Gyratory Crushers, 1 each in Receiving Pit of 1600 TPH capacity to crush ROM coal from (-) 1500 mm to (-)200 mm size,
- 2 Nos of Pedestal mounted rock breakers, 1 each in receiving pit to deal with oversize lump site of (+) 1500 mm.
- 2 Nos of Apron Feeders, 1 each in Receiving pit to feed crushed coal from Gyratory crusher to conveyors,

- 1 Nos of storage bunker of 25,000 te capacity each with twin type slit opening,
- 4 Nos of plough feeder, for reclamation of coal,
- 1 Nos of Silo (RLS), 4000te capacity,
- Associated belt conveyor.

Phase-II (5Mtpa)

- 1 no of Receiving Pit,
- 1 Nos of Gyratory Crushers, in Receiving Pit of 1600 TPH capacity to crush ROM coal from (-) 1500 mm to (-)200 mm size,
- 1 Nos of Pedestal mounted rock breakers, 1 each in receiving pit to deal with oversize lump site of (+) 1500 mm.
- 1 Nos of Apron Feeders, in Receiving pit to feed crushed coal from Gyratory crusher to conveyors,

- 1 Nos of storage bunker of 10,000 te capacity each with twin type slit opening,
- 4 Nos of plough feeder, for reclamation of coal,
- 1 Nos of Silo (RLS), 3000te capacity,
- Associated belt conveyor.

The EPR for Dudhichua OCP for a rated capacity of 20 Mtpa has been planned with extended mine boundary on the dip side of the property. For handling the above coal, a separate new coal handling system comprising of 4 Nos. of Semi-mobile crusher and 4 Nos. sizers of product size of (-) 100 mm two in each Section to be installed in east and west section coal with associated conveying and dispatch system has been envisaged. Total handling capacity of the CHP including existing and proposed will be 20 Mtpa (10 Mtpa existing + 10 Mtpa incremental proposed) which will cater the target coal of 20 Mtpa.

The coal handling system shall have the facilities for receiving ROM coal from rear discharge dumper/trucks of East Section & West Section,

crushing the coal to a specific size of (-) 100 mm, storage & reclamation, rapid loading system with silo and belt transport between the intermediately points. The ROM coal has to be crushed down from (-) 1500 mm size to a size of (-) 300 mm by primary semi mobile crushers and again crushed to (-) 100mm size by secondary twin shaft sizers before it is discharged in existing silo in Ph-II and stored in proposed ground bunker 10000te capacity.

As per advise of NCL, all the ongoing and future CHPs with (-)100mm crushing arrangement shall be envisaged.

In view of above, provision of three nos of secondary sizers of 1600 TPH capacity each will be installed in existing CHPs (Ph-I & Ph-II CHP) for (-) 100mm size coal.

i. Phase –I CHP (Existing):

The crushed (-) 200 mm size coal of existing conveyors 1.1C & 1.2C will be discharged on the proposed secondary sizers for crush down to (-) 100 mm size coal. After crushing to (-) 100 mm size, coal will discharge to existing 2.1C & 2.2C conveyors at existing transfer house TH1 for further transportation of (-) 100 mm size coal to existing silo via 25000te ground bunker. Necessary modification of chutes and installing new platform/structure from ground level and extension of house, as required of existing transfer house TH1, will be done.

ii. Phase-II CHP(Existing):

The (-) 200 mm size coal of conveyor 2A will be discharged on the proposed link conveyor L1 at proposed transfer house THA which will be constructed between existing drive house (Conveyor 2A) & existing Transfer House TH5. The coal of L1 conveyor will discharge on the proposed 1600 TPH of sizer at proposed transfer house THB for crushing down to (-) 100 mm size coal. After crushing to (-) 100 mm size, coal will discharge on another proposed link conveyor L2. The (-) 100mm size coal of proposed link conveyor L2 will discharge to existing

link conveyor 6A and existing conveyor 3A at existing transfer house TH5. Necessary modification of chute at existing Transfer House TH5, as required, will be done. The coal of 3A conveyor will discharge to existing bunker of 10000te capacity for further transportation to the 2nd silo for dispatch. The estimate for modification of 10 mtpa existing CHP for (-) 100 mm size has been given in Appendix-A.3.5.

11.2 DESIGN PARAMETERS OF INCREMENTAL NEW 10 Mtpa CHP

11.2.1 Basic data

- Production capacity in million tonnes : 10 (incremental)
- Number of working days per annum : 330
- Number of working shifts per day : 3
- Duration of each shift (Hours) : 5
- Type of Dumpers : 100 T Rear dumper
- Feed size of ROM coal in mm : (-) 1500 mm
- Product size in mm : (-) 300 mm (Primary crusher)
  (-) 100 mm (secondary crusher)

11.2.2 CHP Working Schedule

- Crushing and storage : 3 shifts/day
  (From receiving pit up to Bunker)
- Reclamation and loading :3 shifts/day and 7 days a week

11.2.3 System Capacity

The handling capacity of the CHP (for incremental 10 Mtpa) has been decided to match with the production capacity of the mine. Based on 330 working days per year and 5 hours per shift, and in order to meet the fluctuations of coal output from the mine due to irregularities of transport system and seasonal fluctuations, the system capacity of the CHP has been fixed at 2X1600 TPH.

11.2.4 Salient Features of CHP

- Two number of semi-mobile in pit crushing plant of 1600 TPH capacity comprising of receiving hopper- apron feeder and twin shaft sizer to crush ROM coal from (-) 1500 mm to (-) 300 mm size. The semi-mobile crushing unit will be located near existing 10,000te Bunker for West section.
- Two number of semi-mobile in pit crushing plant of 1600 TPH capacity comprising of receiving hopper- apron feeder and twin shaft sizer to crush ROM coal from (-) 1500 mm to (-) 300 mm size. The semi-mobile crushing unit will be located in East section.
- Two number of twin shaft sizer, feed size (-) 300mm and product size (-) 100 mm for West Section.
- Two number of twin shaft sizer, feed size (-) 300mm and product size (-) 100 mm for East Section.
- Four numbers of pedestal mounted rock breaker with receiving pit to deal with oversize lump size of (+) 1500 mm. for East section & West Section.

- One number of self-flowing storage overhead ground bunker of 10000 te capacity for East Section.
- Four number of plough feeder for reclamation of coal from the ground bunkerfor East section.
- Two number of silo loading conveyors of 1800 TPH capacity each below the ground bunker for East section of coal.
- Two number of silo loading conveyors of 1600 TPH capacity each from the secondary sizers to existing silo (Ph-II) for West section of coal.
- One number of Rapid load out systems comprising of 3000 te silo and two number of pre-weigh hoppers with flood loading chutes.
- Associated belt conveyors in double stream.

- Miscellaneous facilities like dust control system; fire fighting, ventilation system, plant cleaning and infrastructure for preventive maintenance are also envisaged.
- Necessary electrical, interlocking, signaling and communication facilities.

11.2.5 **System Description**

The coal handling plant of incremental 10 Mtpa capacity for Dudhichua OCP consists of four number of receiving pit with semi-mobile in pit crushing plant of 1600 TPH capacity comprising of receiving hopper-apron feeder and twin shaft sizer to crush ROM coal from (-) 1500 mm to (-) 300 mm size., four number of Secondary crusher (Twin shaft sizer) 1600 TPH to crush ROM coal from (-) 300 mm to (-) 100 mm size, one number of ground bunker of 10000 te capacity and one number silo of 3000 te capacity with associated belt conveyors and accessories.

11.2.6 **Plant Description**

11.2.6.1 **Receiving Pit and crusher complex (Semi mobile crusher & secondary crusher)**

The Run-off mine coal from the opencast mine project of west section shall be received into the receiving pits by means of rear discharge dumpers.

Receiving pits are provided with two nos of 150 te capacity hopper with apron feeder and twin shaft sizer of 1600 TPH for crushing of ROM coal from (-) 1500 mm down to (-) 300 mm size.

Two number pedestal mounted hydraulically operated rock breaker has been provided to rake and break oversize lumps. The crushed coal of west section from the crusher shall be discharged to the secondary crushers (twin shaft sizer) of 1600 TPH through a conveyor for crushing of coal from (-) 300 mm to (-) 100 mm size. The crushed coal of (-) 100 mm size shall be discharged directly in existing phase- II silo.

Similarly ROM coal of East section shall also be collected in the ground storage bunker through a set of conveyors after crushing of coal from (-) 1500 mm to (-) 100 mm size by two nos of Semi mobile crushesr and Secondary crushers (twin shaft sizer) of East section.

11.2.6.2 Storage bunker and Reclamation System

One number storage bunker of 10,000 te capacity has been proposed for East Section coal of Dudhichua CHP. The bunker shall be constructed of pre-cast concrete slabs with sides sloping at 55^0 to the horizontal. The bottom of bunker will have longitudinal slits with a long tunnel. Below the slit, plough feeders with reclaim conveyors shall be provided. The capacity of the reclaim conveyors and plough feeders shall be 1800 TPH each. The reclaim conveyor will discharge coal directly to silo.

11.2.6.3 Wagon Loading System

The Silo loading conveyors discharge coal in a 3000 te silo. Below the silo two numbers pre-weigh hoppers are provided with flood loading facility. The load out system shall be complete with power pack, level sensors and microprocessor based controls for the operation of the gates and chutes in a preset sequence for uniform and correct loading of wagons. The pre-weigh hopper filling capacity shall be selected in accordance with the type of railway wagons arriving under the loading station. The weighing capacity of pre-weigh hopper shall be 72 te.

The system shall permit loading of each wagon with pre-weighed quantity of coal, thereby eliminating the necessity of any wagon weighing equipment. The whole system shall be designed to operate either in fully automatic or in semiautomatic mode. In case of automatic mode closing and opening of different gates is done automatically during the entire loading operation until the rakes of wagon gets loaded. In semiautomatic mode, opening and closing of chute is done by the operator for each

wagon and all other operations viz., recording/displaying of weights, closing of chutes and filling of pre-weigh hopper is done automatically. The system is complete with all necessary facility needed for successful operation of the system.

The sampling unit consisting of automatic primary sampler, jaw crusher/hammer mill including sample collecting device shall be located adjacent to wagon loading silo. The sample collected shall be sent to laboratory for analysis.

11.2.6.4 Dust Extraction System

The objective of the system is to extract coal dust from various dust generating points, clean the dust laden air by trapping coal particles and finally discharge clean air into the atmosphere so that dust concentration in the CHP premises, even under the critical worst operating condition is less than stipulated limit.

11.2.6.5 Dust Suppression System

The objective of this system is to eliminate the air borne coal dust or suppresses the coal 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. Suitable control for dust suppression shall be provided and the system shall be so interlocked that it operates only when the conveyor system is operating or the loading operation is on.

11.2.6.6 Noise Control

It is well-accepted fact that noise pollution causes fatigue to operating personnel. Provision will be made to keep down the noise level to the extent it is feasible as per relevant IS/International standards. All machine mounting will have in their foundation 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 liners of various thicknesses as per design requirement and their suitability.

11.2.6.7 **Fire Fighting and Fire detection System**

Necessary fire fighting system along with fire detection & annunciation system have been envisaged for the plant. This includes fire hydrant tees at strategic locations at equal spacing of 30 meters with suitable water supply pipelines. The fire detection & annunciation unit shall be located at strategic location of the plant. In addition, portable fire extinguishers to deal with electrical/oil/ordinary fires shall be provided at all strategic locations in the plant.

11.2.6.8 **Plant cleaning System**

To facilitate cleaning at strategic locations ample number of high pressure water servicing points have been envisaged. These service points will be so located that with a 15/20 M long hose, any 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, 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.

11.2.6.9 **Plant Maintenance System**

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 electric hoists and chain pulley blocks at suitable points of adequate capacity will also be provided on various floors.

11.2.6.10 **Weighment**

For the purpose of weighment, belt weighers have been envisaged. In addition, for recording of weight of coal dispatched to the consumers, pre-weigh system of weighment has also been envisaged with the wagon loading system.

11.3 ELECTRICAL

The electrical system shall comprise of:

- Power reception and distribution system.
- Centralised sequence control-cum-interlocking, automation, signalling and instrumentation system.
- Illumination of plant and adjacent area.
- Centralised welding circuit.
- Earthing.

11.4 CAPITAL REQUIREMENT

The Estimated capital requirement for additional proposed 10 mtpa incremental CHP is `363.01 Crores and detail has been given in Appendix-A.3.5.

11.5 RAILWAY SIDING

The crushed coal (-100) from the West section coal of Dudhichua OCP will be dispatched by PR/MGR through existing phase-II silo and East section coal of Dudhichua OCP will be dispatched by PR/MGR through proposed silo. For East section coal of 5 Mtpa incremental 4 to 5 rakes of wagon will have to be loaded every day. The loading has been envisaged round the clock in all the three shifts per day by one loading point with RLS @5500 TPH with 3000 te silo. The proposed silo will be installed near the existing phase-I silo and three additional lines will be envisaged for proposed Silo. The proposed line will be connected with existing MGR/PR line.

Necessary provision for proposed interconnection and accommodation of full empty receiving and after load line has been made in EPR of Dudhichua OCP (20 Mtpa)

11.5.1 **CAPITAL**

The total length of proposed siding including link portion would be about 2.50 Kms. The total estimated capital requirement of railway siding in the EPR is given in Appendix-A.5**.**

CHAPTER -XII

WORKSHOP & STORES

12.1 BRIEF TEXT

12.1.1 INTRODUCTION

For maintenance and repair of equipment deployed in Dudhichua opencast mine two tier workshop facility has been envisaged.

a) Daily maintenance, scheduled maintenance, minor and medium repair in existing workshop and proposed project workshop of Dudhichua OCP.

b) Capital repair and major overhauling in Central workshop, Jayant.

The project workshop & store will have the following facilities:

- Maintenance and repair of various equipment and their assemblies and sub-assemblies deployed in the project.
- Mobile repair workshop and service unit for maintenance and repair of field equipment like shovels, drills, dozers, electrical installations, pumps, etc. at site.
- A well equipped store for storage of spare parts, float assemblies, consumables, POL, scraps etc.
- Space for future expansion of all functional shops.

In general, two shift working has been envisaged for the workshop. However, one section of workshop will run in 3rd shift also to meet the emergency maintenance and repair requirement.

Existing Workshop (10 Mtpa):

At present Dudhichua Opencast Project has a full-fledged Workshop and Project store having facilities to cater the repair and maintenance needs of HEMM, mining, electrical & mechanical equipment etc. deployed in Dudhichua OCP (10 Mtpa).

Proposed Workshop (Incremental 10 Mtpa):

For expansion of the Project from 10 Mtpa to 20 Mtpa coal production, EPR has envisaged 52 Nos. RD 100T & 160 Nos. RD 190T for Option-1 and 52 Nos. RD 100T & 56 Nos. RD 190T for Option-II. Existing RD 85T and RD 120T has been envisaged for replacement in equivalent numbers of RD 100T for coal transportation & RD190 T for OB removal respectively.

The existing bays for RD 85T & RD 120T both at Workshop will be used to meet the repair & maintenance requirement of above two types of dumpers. In addition to this, 10 numbers of new bays for option-1 & 6 numbers for Option-II for RD 190 T have been envisaged in workshop to cater the daily & schedule maintenance of entire fleet of dumpers. A face equipment repair shop has been envisaged in workshop for repair and maintenance of face equipment of the project. Along with this, a machine shop, auto electric shop, welding & structural shop, engine and radiator repair shop have also been provided in the workshop. Sufficient dumper parking space and additional dumper washing facility have also been provided in the workshop.

An additional store shed of 625 sq. m for Option-II & 1875 sq. m for Option-I has been provided in the existing store complex along with racking system to cater to the need of expansion of the project.

Capital repair requirement will be met by the existing Central Workshop, Jayant.

12.1.2 **Maintenance Facilities**

Maintenance and repair facility planning has been done based on a comprehensive maintenance programme to achieve the high level of availability, reliability and longer life of equipment.

Additional maintenance and repair load of workshop has been assessed on the basis of annual operating time of equipment, cyclic maintenance and man-hour requirement. Apart from the assessment of additional load on workshop and store, space requirement for parking, washing and maintenance of dumpers, dozers, shovel and drill assemblies, space for machining sections, open and covered storage space of project has also been worked out.

The proposed workshop at Dudhichua has been planned to cater the additional maintenance and ware housing requirement.

The additional workshop and store facilities for incremental 10 Mtpa coal production for option-I (Total Departmental) and option-II (Partial OB Outsourcing) will be as under:

Table No. 12.1

Particular		Shop Size	
		Option-I	**Option-II**
A. Workshop			
Dumper Maintenance/ Tyre shop	:	4800 sq.m	2880 sq.m
Dumper Washing Station	:	528 sq.m	528 sq.m
Pavement	:	7400 sq.m	3700 sq.m
Dozer maintenance/ repair shop	:	528 sq.m	528 sq.m
Dozer Washing Station	:	528 sq.m	528 sq.m
Store Shed		1875 sq. m	625 sq. m

12.1.3 **Scope of work**

Facility planning is based on following scope of services:

12.1.3.1 **Workshop**

a) Daily maintenance, routine lubrication, minor& incidental repair and bi-weekly washing of equipment.

b) Inspection

c) Incidental minor repairs of assemblies and sub-assemblies of mining and mechanical equipment, i.e. Dumper, Dozer, Shovel, RBH drill, etc.

d) Medium repair and replacement of assemblies and sub-assemblies, scheduled maintenance, washing of equipment, etc.

e) Mobile repair and maintenance facilities at site with maintenance crew for field equipment for option-I.

12.1.3.2 **E&M Workshop**

a) Minor repair, medium repair and replacement of components, assemblies and sub-assemblies of mechanical equipment such as CHP, pump, LMVs, etc.

b) Minor and medium repair of electrical equipment such as switch gear, motor, self-starter, etc.

c) Battery charging facilities and re-conditioning of batteries.

12.2 PROPOSED FACILITIES

Facilities required for Option-I & Option-II have been provided in Appendix-A.3.3 separately for both the options.

12.3 WORKSHOP & STORE LAYOUT

List of major HEMM proposed to be deployed in the project for option-I and Option-II is as under:

Table No. 12.2

List of major HEMM

S. N.	Particulars	Size/ Cap.	Option-I	Option-II
A.	**OBR**			
1	Dragline	24 m^3/88mR	4	4
2	Elect. Rope Shovel	20m3	20	7
3	RBH Elect. Drill	311mm	4	4
4	RBH Elect. Drill	250mm	40	14

5	Rear Dumper	190 T	160	56
6	Dozer with Ripper	770/850 HP	20	7
7	Dozer	410 HP	8	8
B.	**COAL WINNING**			
1	Elect. Rope Shovel	10m^3	6	6
2	Diesel Hyd Shovel	10-12m^3	2	2
3	Diesel RBH Drill	160mm	12	12
4	Rear Dumper	100 T	52	52
5	Dozer	410 HP	8	8
C.	**COMMON**			
1	Motor Grader	550 HP	4	4
2	Motor Grader	280 HP	4	4
3	Crane	120T	2	2
4	Crane	60/90T	2	2
5	Crane	40/60T	2	2
6	Crane	18-20T	3	3
7	Crane	9-10T	4	4
8	Diesel Hyd. Shovel/ Backhoe	3.2/3.8m^3	3	3
9	FE Loader	5.74/6.1m^3	2	2
10	FE Loader	10-12m^3	2	2
11	Dozer	410 HP	2	2
12	Wheel Dozer	450/410 HP	4	4
D.	**RECLAMATION**			
1	Dozer	410 HP	5	5
2	Motor Grader	280 HP	2	2
3	Diesel Hyd. Shovel/ Backhoe	3.2/3.8m^3	1	1
4	Tipping Truck	8 m3	5	5
5	Water Sprinkler	28 KL	2	2
6	Water Sprinkler	70 KL	9	9
7	Road Sweeping m/c		2	2

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M. K. Prasad
General Manager
Dudhichua Project
Khadia, Sonebhadra (U P)

- The maintenance and repair bays and other facilities for dumpers and other HEMM have been planned based on the prevailing CMPDI norms and OEMs recommendations.
- Workshop have been planned for maintenance and repair work of Dumpers, Dozers, Shovels, Drills, Loaders, Cranes, water sprinklers and other mining and mechanical equipment for option-I & Option-II separately and enhancement of facilities in the existing workshops and their expansions have been proposed as per requirement.

  The additional workshop and store facilities for incremental 10 Mtpa coal production for option-I (Total Departmental) and option-II (Partial OB Outsourcing) has been given in Table- 12.1.

12.4 WORKSHOP AND STORE P&M

- The selection of Workshop P&M (Machine tools) has been done in accordance with the maintenance programme of various equipment, job-wise requirement in respect of dimensions, nature of operations to be performed, frequency of such requirements and degree of precision.
- Provision of EOT cranes, mobile cranes, fork lift trucks, trolleys, electric hoist, chain pulley blocks, jacks, etc. has been made for quick and effective handling of heavy materials and tyres within and outside the shops.
- Assessed requirement of P&M for Workshop & Store is given in Appendix- A.3.3 & A.3.3.1 separately for option-I and option-II.

12.5 CAPITAL INVESTMENT

The additional capital requirement for workshop & store P&M for option-I & option-II has been estimated as `32.95 Crores and `27.51 Crores respectively and are given in Appendix- A.3.3) separately for both the options.

CHAPTER-XIII

POWER SUPPLY, ILLUMINATION AND COMMUNICATION

13.1 POWER SUPPLY

13.1.1 Existing Power Supply Arrangement

Dudhichua OCP is getting power at 33KV by double circuit transmission lines from 2x40MVA, 132/33KV Madhauli substation of NCL and township is getting power from Nawanagar Substation of MPEB. There are three sub-stations as stated below:-

- 2x10MVA, 33/6.6KV OB West Substation
- 2x10MVA, 33/6.6KV OB East Substation
- 2x10MVA, 33/6.6KV Coal Substation

The OB East and West Substations supply power to HEMM like draglines, shovels, drills, etc. The coal substation supplies power to HEMM deployed in coal section, pumping, CHP, workshop, etc.

For supplying power to colony, there is separate feeder of 33Kv from Nawanagar Substation of MPEB located nearby CMPDI,Colony.

13.2 PROPOSED POWER SUPPLY ARRANGEMENT

Two Options namely Option – I (Total Departmental) and Option-II (Partial OB outsourcing) have been envisaged while preparing the project report. Considering the prevailing practice in NCL for OB outsourcing all the equipment used are diesel driven. Therefore no additional electrical power is required for diesel driven HEMM for OB outsourcing and the analysis has been worked out accordingly.

13.2.1 General Description

13.2.2 Coal Substation

At 20 Mtpa stage, additional transformer of 33/6.6kV , 10 MVA will be required in existing sub-station because the installed transformer capacities of existing coal substation are not sufficient enough to cater to the power demand of 20 Mtpa stage.

13.2.3 OB Substation

To meet the maximum demand for additional loads coming under expansion project, it is proposed to add 33/6.6kV, 10 MVA transformer in OB East substation and 33/6.6kV, 10MVA transformer in OB West substation to meet the future demand. Considering the pattern of load growth, the transformers along with associated switchgears have been provided in third year of quarry operation.

13.2.4 Metering Arrangement

132KV power is purchased by NCL by single point metering arrangement at Madhauli substation. However, for the purpose of allocating energy charges for Dudhichua OCP, 33KV control panels have been provided with KWH meter, maximum demand indicator, volt meter and Ammeter.

13.2.5 Distribution & Utilisation Voltages

S. No.	Particulars	Voltage (KV)
1	Incoming Power Supply	33
2	Draglines	6.6
3	Shovels	6.6
4	311 mm Drills	6.6
5	250 mm Drills	6.6
6	Main Pumps	6.6
7	Auxiliary Pumps	415 V
8	Lighting	230 V
9	Incoming Power to CHP	6.6
10	Incoming Power to Workshop	6.6
11	Incoming Power to Colony	6.6

13.2.6 Power Factor Improvement

The maximum demand will be achieved after considering 80% diversity and improving the system power factor to 0.98 by providing capacitor banks of adequate capacity.

13.2.7 Protections

13.2.7.1 Transformer

The following protections for all the existing 10MVA transformers have been provided in the 33 KV circuit breakers controlling the HT side of the transformers.

- Percentage differential protection
- IDMT over current protection with the high set instantaneous element & IDMT earth fault protection

In addition to above, the following protecting accessories have been incorporated along with the transformer:

- Buchhloz Relay (Alarm and Trip)
- Winding Temperature Indicator
- Oil Temperature Indicator

13.2.7.2 Secondary Control of Transformers

6.6 KV circuit breakers controlling the secondary of transformers shall be provided with IDMT over current and E/F relays with high set instantaneous element and shall have provision to trip on all internal fault of the transformer which are sensed through the percentage differential and Buchhloz protections.

13.2.7.3 6.6 KV Outgoing feeders:

All the circuit breakers controlling the 6.6 KV outgoing feeders shall have the following protections:

- IDMT over current protection with high set instantaneous element
- Restricted earth leakage protection

13.2.8 Power Supply to Quarry

The HEMM like draglines, 20m^3 Elect. Rope Shovels which handle OB getting power from substation - East and substation - West by 6.6KV OHTL with ACSR wolf conductors.

The HEMM of coal section and main pumps will receive power from coal substation by 6.6 KV OHTL with ACSR wolf conductors. Near the

mine/quarry OHL will be terminated and power will be fed to field equipment through cable, field switch and trailing cables.

13.2.9 **Power Supply to Colony**

Power is supplied to colony form 33kV feeder, coming from Nawanagar Substation of MPEB

At 20 Mtpa stage, one additional transformer of capacity of 1X2MVA is proposed at existing colony substation for additional load and some additional 6600/415 V transformers will be installed. Sufficient provision has been provided for this work.

13.2.10 **Power Supply to Workshop**

Power is supplied to workshop at 6.6 KV from existing 2 x 10 MVA coal sub-station by OHL. At 20 Mtpa stage, workshop load will increase.

Hence, additional provision has been kept to cope up with the extra load. The workshop will continue to get power from coal sub-station.

13.2.11 **Power Supply to CHP**

Existing CHP is getting power from 2x10 MVA coal sub-station. At 20 Mtpa stage, CHP load will increase. Existing coal substation will be expanded with a capacity of 1X10 MVA to cope up with the additional load of CHP. This CHP will get power from coal substations.

13.3 **Illumination**

13.3.1 **Quarry Illumination**

The general area of the quarry would be illuminated by 8 Nos. of 2 x 4000 W HPSV lamps mounted on 15 m high fabricated tower installed all along the quarry workings and near substation. These would be fed from 25 KVA, 6.6 KV/230 V lighting transformers installed near the tower itself.

Coal face illumination shall be done by portable type telescope mast fitted with 2x400 W HPSV lamps.

13.3.2 **Haul Road Illumination**

The haul road would be illuminated by 400 W HPSV lamps mounted on poles all along the haul road. On each pole two fixtures would be installed

to illuminate both sides of the pole. Power supply to these lamps would be fed from 6.6/230 KV lighting transformers.

13.3.3 Spoil Dump Illumination

Spoil dumps would be illuminated by 250 HPSV flood lights installed on steel tubular poles fed from 6.6/230 KV lighting transformers.

Adequate provision has been made for lighting installation near industrial site roads, stores etc. with 2 x 250 W sodium vapour lamps. The general illumination of CHP complex, railway siding is taken care of in the CHP estimates. Wherever possible, all industrial site roads and roads from industrial site to colony complex would be illuminated with 150 W HPSV lamps and fittings fitted on street lighting poles. The power to these would be fed through underground cables of suitable sizes.

13.4.1 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.

13.4.2 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.

13.4.3 External communication

10 (ten) 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.

13.4.4 Voice and data networking

There shall be an IP exchange with a capacity of 500 lines. The proposed exchange shall be housed at project and shall be connected with existing exchange at Area(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 existing OFC network for voice and data communication.

13.5. Technical Specification

13.5.1 Technical Specification of IP Exchnage

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 420 analog extension and 80 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.

13.5.2 **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.

13.5.3 **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

13.5.4 **24 Port L3 Switch**

The managed L3 Switches 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 switches will be installed at project office and other important location of the 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 Million 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)

13.5.5 **L2 Switch(24 port 10/100 BASTEX+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.

13.5.6 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 utilisation, breakdown analysis, idle time analysis etc.
- Production, despatch schedule and variances.
- Accident records etc.
- Resource utilisation & 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 20 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 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 with the help of existing infrastructure available at Area Office and Project Office.

A 2/4 Mbps Leased Line is proposed for communication with Area HQ. This leased line shall be used both for voice and data communication with Area HQ.

13.5.7 OITDS (Operator independent truck despatch system)

The existing OITDS system is proposed for expansion to meet the future requirement.

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 connectivities shall be established to cater voice and data connectivity between maintenance and oprational 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.

13.5.8 **VHF Communication for Quarry operation**:

VHF dialling type Walkie-Talkie sets/trunked radio will be provided to important personnel for communication in the mine as mentioned in (outsourcing) option (Appendix-B). These will work in the band 150-174 MHz. with a channel spacing of 12.5 KHz/25KHz, with an output of 2W. Type of operation will be FM, simplex. The system shall have telephone patch facility for interfacing with the exchange. It should also have control channels for trunking facilities.

13.5.9 **Wireless Radio System**

2 sets of point to point and Point to Multipoint Radio (Base-1, Remote-5) are proposed for connecting the proposed LAN where cabling will not be possible.

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 : $0^{o}C$ - $55^{o}C$

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.

13.5.10 **GPS Based Truck Monitoring System**

An Integrated GPS-GPRS based vehicle tracking system along with RFID and other accessories is proposed for the mine.

The proposed system shall have the following features:

- The system shall help for real-time tracking of vehicles fixed with GPS-GPRS based VMU (Vehicle mounted unit) along with integrated RFID tags for tracking along the route as well as at the entry/exit points like Weigh Bridge, Railway Siding, Security gates etc. These fixed points shall be installed with RFID Reader and other accessories for Access Control.
- Different vehicle locations & routes for tracking the vehicles on Map.
- Automatic event logging (viz. start and end of trip(s), emergency halts, accidents, breakdown of vehicles etc.) along with Time Stamp.
- Provide alerts on unauthorized stoppage and /or non-stoppage of the vehicles at designated vehicle stops/weighbridges/dumping yards/ Railway sidings, the scheduled stoppage point and route deviation by

vehicles etc.

13.5.11 **IP Survillance 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.

13.5.12 **14 Biometric 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. The system should be equiped with fingure print/impage sensor alongwith the standared communication ports.

13.5.13 **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.

13.5.14 **UPS**

Uninterrupted Power Supply (UPS) shall be used in case of main power failure for LAN and Computer centre.

Specification of UPS

(1) Capacity : 10KVA, Single phase/3 Phase

(2) AC Input voltage : 220/230V, ± 15-20% variation

(3) Frequency : 50 Hz ± 5% (Auto sensing)

(4) AC outpur voltage : 230 VAC, Single phase/3 Phase

(5) Efficiency at Full Load 94%

(6) Regulation : both line and load ± 1%

(7) Wave form : Sinusoidal, < 5% THD

(8) Equipped with Maintenance By pass

(9) Charger: Constant voltage limited current type, charging time for 90% discharged battery maximum 10 hrs.

(10) Battery Back-up: 4hrs at full load.

(11) Certifications: EU/EN/UL/ISO 9001

(12) Rack mount Design: 19" mountable with sliding guides.

(13) Communication: RS232 interface port & Ethernet port with Web management supports.

Features:

(1) The 10 KVA UPS with 4 hrs. battery back-up & accessories shall have the facility of Input voltage cut off device to protect the 10 KVA UPS with 4 hrs. battery back-up & accessories against excessive over/under voltage conditions at the input side.

(2) The system shall have surge suppression to prevent hardware damage.

(3) The system shall have facility for continuous display of load and battery charging conditions and automatic cut off device to avoid over loading and over charging.

(4) The 10 KVA UPS with 4 hrs. battery back-up & accessories system shall be true on-line state of the art based system capable of providing precise sine wave out put to the load.

13.5.15 **Cost Estimate**

The Budgetary cost estimate are enclosed in Appendix A for option-I (Total Departmental) and B for option-II (Partial OB Outsourcing).

13.6 POWER & ENERGY INDICIES

The estimated peak power demand and annual energy consumption for 20 Mtpa is given below:

Option-I

Name of Substation	Installed Capacity (MVA)	Source	Peak Power Demand (KVA)	Annual Energy Consumption (MKWH)
OB West Substation	20	Madhauli S/Station	11521	58.26
OB East Substation	20		11521	58.26
Coal Substation	20		15306	88.64
Total Industrial	60		38348	205.16
Colony Substation		Nawanagar (MPSEB)	6110	10.17
Project Total	**60**		**44458**	**215.33**

Maximum Power Demand	=	44458 KVA
Annual Energy Consumption	=	215.33 MKWH
Power Factor	=	0.98 lagging average
MVA/Mt	=	2.22
KWH/Tonne of Coal	=	10.76
Power Cost (Rs./t)	=	56.49
Power Cost (Rs./KWH)	=	5.25

		Ind.	Domestic	Total
Maximum power Demand (KVA)	=	38348	6110	44458
Annual Energy Consumption (MKWH)	=	205.16	10.17	215.33

MPSEB Tariff (132 KV)

i) Industrial (132 KV tariff) - `5.15/kwh

ii) Industrial (33 KV tariff) - `5.25/kwh

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Based on the existing power tariff, the peak annual power bill will be `15798.36 lakhs.

Option-II

Name of Substation	Installed Capacity (MVA)	Source	Peak Power Demand (KVA)	Annual Energy Consumption (MKWH)
OB West Substation	20	Madhauli S/Station	7364	33.15
OB East Substation	20		7364	33.15
Coal Substation	20		14098	81.88
Total Industrial	60		28826	148.18
Colony Substation		Nawanagar (MPSEB)	4929	8.20
Project Total	**60**		**33775**	**156.38**

Maximum Power Demand	=	33775 KVA
Annual Energy Consumption	=	156.38 MKWH
Power Factor	=	0.98 lagging average
MVA/Mt	=	1.68
KWH/Tonne of Coal	=	7.81
Power Cost (`/t)	=	41.00
Power Cost (`/KWH)	=	5.25

		Ind.	Domestic	Total
Maximum power Demand (KVA)	=	28826	4929	33775
Annual Energy Consumption (MKWH)	=	148.18	8.20	156.38

MPSEB Tariff (132 KV)

i) Industrial (132 KV tariff) - `5.15/kwh

ii) Industrial (33 KV tariff) - `5.25/kwh

Based on the existing power tariff, the peak annual power bill will be `12063.94.

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13.7 ENERGY CONSERVATION

In order to reduce the electrical energy losses of Dudhichua OCP, the following proposals are made:

Use of ACSR Wolf Conductor for both 33 KV and 6.6 KV system throughout the mine will reduce line losses and improve voltage regularization.

Installation of capacitor banks in Coal, OB East and OB West substation will be made to improve PF to 0.98. This will reduce the line losses, voltage drops and maximum KVA demand.

Installation of energy meters at different points in the project and colony to monitor and check power consumption.

Installation of automatic 'ON' and 'OFF' devices for street lights, colony, approach roads, CHP, workshop etc. External lighting of service buildings with pre-set timing for switching 'ON' and 'OFF' of the lights, so that the energy would be saved by reducing the wasteful burning hours.

Water garland drains are to be made around the periphery of the mine so as to confine the catchments area within the garland drain. This will reduce the make of water which in turn will reduce the energy consumption for pumping.

Frequent starting and stopping of the main pumps should be avoided. For this, sump capacities are to be kept adequate. Also, pumping can be avoided at peak hours to reduce the maximum demand of the project.

CHP: Within the given parameters selection of layout is to be done to have minimum coal conveyance distance. High voltage drives are selected wherever possible to limit losses, motor and cable size.

Illumination

Low energy consuming and high lumen producing sodium vapour lighting of workshop, CHP and lighting of approach road, railway siding, haul roads etc. and 150 W HPSV lamps have been provided for lighting of colony

road, park, external lighting of recreation centers. Rest House, Shopping Centers etc.

The following actions are proposed which may reduce the energy consumption on lighting:

- Regular cleaning of lamps;
- Use of electronic choke in place of conventional choke
- Design of buildings to facilitate optimum use of natural light
- For interior walls of buildings, selection of proper colour with higher reflection factor is recommended for interior lighting and
- Provision of electronic regulators with domestic ceiling fans to avoid ohmic losses which occurs in conventional regulators.

13.8 CAPITAL INVESTMENT FOR ELECTRICAL P&M

Capital investment for the project for electrical power supply, distribution, illumination, earthing, automation and communication have been appended below:

(Amount in ` Lakh)

Sl. No.	Option	Existing Provision	Balance Provision	Total EPR Provision
1	Option-I	2921.19	3667.32	6588.51
2	Option-II	2921.19	1686.86	4608.05

The detailed breakup of estimate has been elaborated in Appendix-A.3.2 of respective variants.

CHAPTER –XIV

CIVIL CONSTRUCTION

14.1 GENERAL

Dudhichua OCP is a running project and most of the civil infrastructure construction works have been completed for its 10 Mtpa stage. Civil works involve mainly for residential buildings, non-residential/service structures, surface reorganization, roads and culverts, water supply and sewerage system for smooth operation of the mine for expansion of production from existing capacity of 10 Mtpa to 20 Mtpa under Option-I (Total Departmental) and Option-II (Partial OB Out sourcing).

14.1.1 Life and type of Specification

The existing township for the employees of the Dudhichua OCP (10 Mtpa) shall remain in use for the employees of EPR for Dudhichua OCP (20 Mtpa). The township has adequate infrastructure facilities. However, some additional B-type, C-type and D-type quarters for Option-I have been proposed in the township. Some additional C-type and D-type quarters for Option-II have been proposed in the township. The buildings of the quarters and offices are having specification of RCC roof (beam & column frame) structure. The life of permanent RCC buildings has been considered as 58 Years or actual life of the project.

14.1.2 Nature of Soil

The block and boundary for coal mining has been identified for mining and other activities. Majority of lands for different activities of mine have been settled and demarcated with boundary. However additional required land will also be demarked and fencing/boundary walls will be made for the proposed expansion of the OCP. The actual nature of soil shall be identified after the finalization of sites of different proposed structures and accordingly the soil tests shall be carried out. However, the area of the mine and township is on plateau and the actual soil has been deposited

due to sedimentation process and the nature of the soil is mixed type in the form of disintegrated rocks, sands and fine soils.

14.1.3 External Services

All proposed civil construction works shall be done through contractual system.

14.2 COST INDEX AND SPECIFICATION

Cost of Civil construction has been estimated on the basis of norms and calculations at the prevailing Cost Index at Singrauli. The Cost Index has been calculated as 3386 applicable as on January,2016 at Singrauli with respect to 100 base of CPWD, SOR at Delhi as on 1.10.1976 (shown in Appendix-A.2.3).

Specification of residential buildings and non-residential buildings should follow BIS, BPE, CPWD or NBC Norms.

14.3 SERVICE BUILDINGS

14.3.1 Provision of Service/Welfare Buildings

Existing service buildings shall remain in use for the proposed EPR. However, additional provision for expansion of GM Office along with Time & Security Office and boundary wall has been made in the Office complex. Additional Provision of welfare buildings such as Post Office, Bank, shopping centre, Staff Rest House, School, Bus shed, Garage, Cycle shed, Open Market, Community Centre, Stadium/ Play ground with suitable boundary walls has been made in colony area (Appendix-A.2.1). Provision for expansion of a sub-station has been made in the town ship.

14.3.2 Site for Service Buildings

Office buildings expansion has been proposed in the existing office complex in Dudhichua, additional provision of expansion in Base Workshop has been given as shown in Appendix- A.2.1 for Option-I &

Option-II. Some additional provision for the Shovel Erection Yard has also been made.

14.3.3 Salient features of important Service Buildings

14.3.3.1 Workshop

Normal maintenance and repairs of HEMM and other P&M have been proposed to be done in Project Field/Base workshop. Additional provision of fund for workshop & store are given in the base workshop for expansion of the project. Details of different structures required for the workshop have been shown in Appendix-A.2.1. The proposed civil facilities are based on economical and technological requirements considering planned normal coal production capacity of 20 Mtpa for EPR of Dudhichua OCP.

Dragline Erection Yard

Existing Dragline erection / shovel erection yard has to be utilized for future work. Additional provision of fund has been given under this head for smooth operation of expansion plan.

Magazine

Existing magazine shall to be utilized for the proposed expansion of project.

14.3.3.2 Store

Additional provision of fund for expansion of existing Store complex in the Workshop complex is given for expansion and details are shown in Appendix-A2.1.

14.3.3.3 Substation

Existing sub-stations of the mine shall remain in use for the proposed expansion of mine. Additional fund for two Substations for OB and one Substation for coal has been given in the mine area for Option-I. However, additional fund for one Substation for coal is given in the mine area for

Option-II. Fund for one Substation in Colony is given under both options (for Option-I or Option-II). Details are shown in Appendix-A.2.1.

14.3.4 Cost Estimate

Details of provision of Service buildings and cost investment on different heads have been shown in Appendix-A.2.1.

14.4 RESIDENTIAL BUILDINGS

14.4.1 Township

The requirement of residential quarters has been assessed as per manpower of the mine. Presently, Standard quarters (2296 Nos.) and Hostel rooms (86 Nos.) are available in the project township. The mine is smoothly operating with existing manpower of 2371 in different grades for 10 Mtpa planned production capacity. The Mine has surplus overall accommodation facilities for the existing OC mine.

The proposed manpower will be 3440 for Option-I of Expansion Project Report (20 Mtpa). Additional D type (14 Nos.) and C type (46 Nos.) quarters have been proposed for officers accommodation and B-type (80 Nos.) have been proposed for senior/ supervisory staff accommodation. 100 % accommodation for officers has been proposed as no suitable accommodation is available at nearby area for such employees and their services are promptly and urgently required. The actual overall quarter satisfaction comes to 70% for Option-I. The existing and proposed standard quarters in the township has been shown in the table below.

Option-I

Details of Quarters

Sl. No.	Manpower	Qtrs Type	Existing Nos. of Qtrs as on 31.03.16	Total Provision Nos. of Qtrs in EPR	Additional provision of Nos. of Qtrs in EPR
1	Daily wage/ monthly wage	MQ type/ A -Type	1222	1222	

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	level				
2	Monthly wage/ supervisory level	B-Type	920	1000	80
3	Officers Level	C-type D-type	108 46	154 60	46 14
	Total		**2296**	**2436**	**140**

The proposed manpower will be 2775 for Option-II Expansion Project Report (20 Mtpa). However additional D type (14 Nos.)and C type (46 Nos.) quarters have been proposed for officers accommodation considering 100 % accommodation of such employees as no suitable accommodation is available at nearby area for such employees and their services are promptly and urgently required. The actual overall quarter-satisfaction comes to 84% for Option-II. The existing and proposed standard quarters in the township has been shown in the table below –

Option-II

Details of Quarters

Sl. No.	Manpower	Qtrs Type	Existing Nos. of Qtrs	Total Provision Nos. of Qtrs in EPR	Additional provision of Nos. of Qtrs in EPR
1	Daily wage/ monthly wage level	MQ type/ A -Type	1222	1222	
2	Monthly wage/ supervisory level	B-Type	920	572	
3	Officers Level	C-type D-type	108 46	141 58	33 12
	Total		**2296**	**2341**	**45**

14.4.2 **Type of Construction**

The existing standard quarters (MQ, A, B, C and D-type) are RCC roof (beam-column frame) structure with permanent specifications. The proposed B-type or C-type & D-type quarters will be three storeyed RCC roof & beam- column frame structure.

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14.4.3 **Site for Township**

The existing Dudhichua township is located in the incrop side of the mine which is about 2 Km from the OCP mine exit. The proposed quarters will be constructed in the existing township.

14.4.4 **Cost estimate**

The capital investment on residential buildings has been shown in Appendix-A.2.2

14.5 **ROADS & CULVERTS**

Existing roads have been categorized into Colony road, Haul road, Road within Workshop, Approach road to Magazine, Heavy duty road connecting to Workshop, Feeder road connecting to CHP, Road from Dudhichua to Singrauli and Road from Dudhichua to Jhingurdah for the existing OCP.

Most of the road works have been completed in the existing mine. However, some additional provision for expansion/re-construction of roads has been given as per the need for smooth operation of Expansion Project. The existing and proposed capital investment on Roads & Culverts has been shown in Appendix-A.8.2.

14.5.1 Colony Road

All road works in the existing township have been constructed. Additional provision of 3 Km length of colony road has been made in Appendix-A.8.3 due to addition of some new quarters or reconstruction/reorganization of roads in the township.

14.5.2 Service Roads

Service roads include Haul road, Road within Workshop, Approach road to Magazine, Heavy duty road connecting to Workshop, Feeder road connecting to CHP, Approach Road from Dudhichua to Singrauli and Approach Road from Dudhichua to Jhingurdah for the existing OCP.

The construction works of most of these roads have already been completed. However, adequate additional fund has been given for expansion/reconstruction of these roads or improvement of existing roads as shown in Appendix A.8.2.

Haul Road

The OCP is smoothly running mine with existing road for 10 Mtpa production capacity. Haul road work has already been completed in the existing OCP and hence, no balance provision has been made in the EPR.

Road within the Workshop

Road work within the workshop has already been completed in the existing Workshop However, provision of roads (0.5 Km length) has been made in the EPR for expansion work of different additional workshop facilities.

Approach road to Magazine

Existing approach road has already been constructed from Mine to Magazine. However additional provision has been made for upgrading or improvement of existing roads for smooth operation of Expansion Project.

Heavy duty road connecting to Workshop

Heavy duty road connecting to Workshop had been completed for existing mine and the mine is smoothly operational. No provision in this account has made in the EPR.

Feeder road connecting to CHP

Feeder road has already been constructed for the existing OCP. However additional fund has been given for re-construction/ expansion of road for smooth movement of dumpers/trucks under the proposed expansion project.

Other Approach Roads

Approach road from Dudhichua to Singrauli has already been constructed for the existing OCP. However, additional provision has been made for the approach road from Dudhichua to Jhingurdah for good connectivity for the mine.

14.6 WATER SUPPLY AND SEWAGE DISPOSAL ARRANGEMENT

14.6.1 Water Supply

The permanent water supply arrangement for Dudhichua Opencast Project is covered in Phase-I of IWSS for Singrauli Coalfield. Drinking and non-drinking water requirement is to be fulfilled from existing supply of IWSS source.

Water Requirement

The normal requirement of water for domestic, industrial and fire fighting purposes for Dudhichua OCP EPR (20 Mtpa) production capacity has been calculated as:

a)	Potable water demand	0.80 MGD
b)	Industrial water demand	2.14 MGD
	Total Regular Water Demand	2.94 MGD
c)	Firefighting Water Demand	0.40 MG

The total requirement of potable water and industrial water is fulfilled from IWSS for Singrauli Coalfield. Water conservation and reuse of ETP water for industrial purpose should be done to minimize the use of water from IWSS. Local mine water should also be used as and where possible for industrial purpose as there is scarcity of IWSS water.

Drinking Water Demand

The treated potable water demand of the existing township is 0.80 MGD. Provision treated drinking water for quarters, Office & Service building, school, Market, canteen, dispensary, etc. has been made. Provision of

fund for additional items required in the existing water supply system of township for EPR has been given in Appendix - A.8.3.1.

Drinking water supply

The treated potable water from the colony bulk reservoir is pumped to overhead tanks suitably located in the colony area for supplying water to the individual units in the existing system of the township.

The water from the overhead tanks is distributed by gravity to the individual units through a distribution pipeline network. Fund for additional ground Reservoirs of 2x 300m^3 and three Overhead Tanks with suitable pipe line distribution system has been given in the EPR.

Industrial Water Demand

The total industrial water requirement for 20 Mtpa shall be about 2.14 MGD for different purposes like cleaning, firefighting, dust control, etc. in Workshop, CHP and Mines. Provision for fund for bulk ground water reservoir and different items required for industrial water distribution system for EPR has been given in Appendix-A.8.3.2.

Fire Fighting Demand

Requirement of water for firefighting has been assessed as 0.40 MG, which would be kept stored in industrial reservoirs and firefighting sump located at suitable place on high ground. Storage of three hour water required for firefighting has been considered for the Quarry, CHP and workshops while calculating the water demand. The demand has broadly been assessed as:

a)	Quarry fire fighting	0.15 MG
b)	Workshop	0.10 MG
c)	Coal Handling Plant	0.15 MG
	Total	0.40 MG

Water Supply Arrangements:

Existing total water requirement of Dudhichua project is fulfilled by the IWSS for Singrauli Coal Field. The Water from IWSS main supply pipe line system is stored in bulk reservoirs located in township and industrial area. Water required for the township is stored in the reservoir located in the township.

Similarly, water required for industrial purposes is stored in an industrial bulk reservoir located on a high ground close to the industrial area. From these reservoirs, water is distributed to various points of consumptions through a water supply network.

Considering the increase in industrial water demand, it has been proposed in the EPR that in at 20 Mtpa stage. Requirement of proposed additional industrial water supply arrangement with existing system shall be done after detailed study. The provision of fund for the pipeline, pumps, reservoirs, etc. has been given in Appendix-A.8.3.2.

Drinking water supply System

The treated potable water from the colony bulk reservoir is pumped to overhead tanks suitably located in the colony area for supplying water to the individual units in the existing system of the township. The water from the overhead tanks is distributed by gravity to the individual units through a distribution pipeline network. Fund for additional ground Reservoirs of 2 x 300m^3 and three Overhead Tanks with suitable pipe line distribution system has been given in the EPR.

Industrial Water Supply System

Presently, water for industrial and firefighting purposes is stored in an industrial bulk reservoir located on a high ground close to the industrial area for the existing mine. This reservoir receives water from IWSS. Due to increase in industrial water demand, an additional bulk reservoirs of 0.2 MG capacity has been proposed. These reservoirs shall be suitably located in industrial mining area and shall receive water from the IWSS.

Water from these reservoirs shall be delivered to various points of consumption within the industrial and mining area by pipeline network. Water shall also be pumped to the overhead tanks located at different points within the industrial area and would be distributed by gravity to points of use by distribution pipeline network.

Fire Fighting Supply system

The construction of reservoirs of firefighting systems has been completed for the existing Quarry, Workshop and CHP in the Mine area. Three hour water requirement for firefighting purposes for the industrial area has to be stored in the reservoirs. Total quantities of 0.4 MG industrial water are be stored in the different reservoirs at the suitable locations for quarry firefighting, workshop firefighting and CHP firefighting purpose. At the time of need, water from these reservoirs would be delivered through service water pipeline network system for CHP & workshop. Water for firefighting purpose would be delivered to quarry area from firefighting reservoirs by means of firefighting pumps or by gravity and service water pipeline network. Adequate additional provision of fund for water sump, pumps & pipe line system, etc. for firefighting in mines and industrial area has been proposed in the EPR as shown in Appendix A.8.3.2.

Sewerage system

Construction work of sewerage systems for the existing township has been completed. Existing sewage treatment Plant (STP) for domestic sewage of the township is in operation since long. Some additional fund has been given in Sewage treatment plant (STP) system for addition of domestic sewage from additional quarters and necessary renovation work in existing sewage disposal system in the township. Fund provision has been shown in Appendix A.8.3.3 for the EPR.

Industrial Sewerage:

Effluent Treatment Plant (ETP) has already been constructed at Dudhichua Project for treatment of industrial waste for 10 Mtpa stage. Additional provision of fund has been made for modification/addition in ETP to cater to the need at 20 Mtpa stage as shown in Appendix-A8.3.4. Provision has also been made for necessary pipeline network to collect and dispose the waste through the ETP.

Industrial waste from existing workshop, CHP and mine would be led to the effluent treatment and re-circulation plants (ETP) thereafter water would be recycled for industrial use. The domestic sewage generated in industrial premises would be treated in Septic tank and soak pits.

Capital Estimates

The total capital requirement for water supply and sewerage arrangement for Dudhichua Project has been given in Appendix-A.8.3.

14.7 SURFACE REORGANISATION AND REHABILITATION

Most of the development and surface reorganization work has been completed for the existing mine. Surface reorganization and rehabilitation work has been covered under the head of Capital Outlay in Mines. Head of Capital outlay includes mainly the job of development of land for the township and workshop area and community development, rehabilitation and compensation, retaining wall/Garland drain, compensatory afforestation etc. Most of the development works have already been completed in the township and industrial areas. Major provision of fund has been made for rehabilitation work and afforestation work. However, some additional provision of funds for the land development and earth work for workshop etc., development of open lungs, community development, Arboriculture, retaining walls, drains etc. fencing around the quarry have also been made as shown in Appendix-A.8.1.

Earth Work

Development works in the form of excavation, filling, leveling disposing of surplus earth materials for residential and industrial areas for setting up some additional structure in the mine has been considered. Proper cutting/ leveling is required for fixing all structures as per site conditions.

Provision of fund under the different heads has been shown in Appendix A.8.1.1.

Open Lungs

Open lungs/ park for recreation of inhabitants has already been considered in existing township. However additional fund has also been given for EPR.

Community Development

It has been desired to develop the adjoining villages. For the development of these villages, provision has been made for improvement of roads and drainage besides street lighting. It is proposed that the nearby villages will be taken up under the community development scheme to uplift the quality of the life under EPR provision.

Arboriculture

For arresting dust and protection of the environment against pollution, suitable plantation and green belt development have been proposed around the industrial and colony areas. Additional fund provision has been made in the EPR.

Village Rehabilitation & Compensation against R&R Policy

For the proposed expansion of mining activities, village population has to be rehabilitated as per R&R (Rehabilitation and Resettlement) Policy of CIL-2012 or State/ National Policy to ensure transparent, fair and justified process of land acquisition. However, proper detailed survey has to be

made for any such population which may exist in the proposed mine affected area. Provisional fund for compensation has been made against Rehabilitation & Resettlement (R&R) of project affected families (PAF) as applicable and has been shown in Appendix-A.8.1.

The actual amount shall be accessed as per detailed survey report/socio-economic survey report of Project affected People (PAP) population/ Project affected Families (PAF) as described in the recommended policy. Resettlement & Rehabilitation committee should be constituted at the project level under the chairmanship of Collector to get objectives as per the R&R Policy.

Environment impact assessment (EIA) of the affected area should also be carried out as per the rule and regulations and suitable implementation shall accordingly be made.

Provision of fund has been made for rehabilitation and resettlement for 502 PAP families @ `5.0 Lakhs per family lump sum amount for calculation point of view other than the due land compensation for or homestead acquisition. Employment compensation /subsistence /other benefits, training, etc. will be dealt separately from revenue expenditure of the mine. However the actual cost of implementation for rehabilitation and resettlement will be re-assessed after identification and detailed survey, studies evaluation etc. in the manner of justified, fair and transparent practice to the project affected person under applicable R& R policy. Social development for the displaced & rehabilitated persons should be done under corporate social responsibility (CSR) policy by the project.

Employment compensation /subsistence /other benefits will be dealt separately from revenue.

Compensatory Afforestation

Compensatory afforestation work has been completed for the existing 10 Mtpa mine and additional provision of fund for afforestation required as per the site conditions and applicable rules for the mine has been made for the EPR as shown in Appendix-A.8.1.1.

Garland drains/retaining walls in the mining area

The garland drain works and retaining wall works have been completed for the existing OCP. However additional fund for retaining wall/toe wall has been proposed for the EPR. The actual requirement of work will be accessed for construction as per the site conditions and survey of the site.

Fencing/boundary wall around the mine area

The fencing work of the existing mine has been complete for the running mine. However adequate fund provision has been made for the balance construction of fencing/boundary wall as and where required for EPR. The actual requirement of work will be accessed after the survey of site for the mine.

Water recharge & Rain water harvesting arrangement system

The Mine is running since long. The work of ground water recharge and rain water harvesting has to be done from revenue fund as and where required. The arrangement as per site/contour conditions shall be done to retain rain water to recharge ground water such that desired water table could be maintained. The ground water recharge structure has to be identified to suite at the different point/location in the project area and to be designed and constructed accordingly as per site conditions.

14.8 CONSTRUCTION MANPOWER

Provision of construction manpower for civil infrastructure has not been provided in the expansion project report. The civil construction work of the proposed EPR shall be done contractually through the supervisory team arranged by HQ, NCL as per site conditions.

CHAPTER-XV

SAFETY & CONSERVATION

15.1 While carrying out different mining operations in the opencast mine, the safety rules in force as per rules and regulations made under mine Act 1951 and various circulars issued by DGMS should be strictly followed and the desired safety measures adhered to. In order to ensure safety to the personnel and equipment of the mine, the EPR for Dudhichua OCP Expansion (20 Mtpa) envisages various measures which are mainly:

- ✓ To prevent industrial accidents;
- ✓ To ensure stability of benches, batters and OB dumps;
- ✓ To ensure safety of equipment;
- ✓ To control fire;
- ✓ To control dust and emission of noxious gases;
- ✓ To control inundation;
- ✓ To control pollution

During planning and design of the opencast mine and infrastructural facilities, provisions of safety rules in force and various DGMS circulars issued from time to time have been kept in mind and will need to be adhered to during mining operation.

All work force/employees and persons engaged by outsourcing agencies should be provided with adequate safety training, so that safety of the mine is ensured at all time. Regular supervision of all the mining operations, by executives and supervisors are to be carried out rigorously.

For Dudhichua OCP Expansion (20 Mtpa) special attentions are to be given in the following area:

15.1.1 Dust Suppression

Provision of regular water spraying on haul roads, benches and other dust generating places has been made to keep dust hazards within control.

Sufficient numbers of water sprinklers has been provided for this purpose. Dust extractors should be used with all the dust generating machines.

15.1.2 Safety against Fire and Spontaneous Heating

Due precaution has to be taken so as to prevent the fire in coal benches and also on coal stockyard.

15.1.3 Slope Stability

In opencast mine, slope failure takes place mainly due to:

i) Shearing effect on rocks and

ii) Ground water pressure

Shearing effect occurs due to gravity loading, shock and seismic vibration. Shock and seismic vibration can be minimized by adopting control blasting techniques. Gravity loading can be minimized by controlling the kinetic load of dumpers by preventing over speeding while running on the benches.

Bench parameters shall be adopted as mentioned in the Project Report. However, during actual mining operation, the condition of benches and dumps should be closely observed at regular intervals and the dimensions are to be modified as and when required. Working benches and spoil dumps shall be kept under constant vigil to mark any development of crack. Fund provision has been made for scientific Study for dragline OB bench parameters, dragline OB dump stability, high-wall slope stability, etc.

15.1.4 Haul Road Maintenance

Inside the quarry, haul road will be laid as per the alignment proposed in the project report and the prescribed uniform gradient and width should be maintained throughout the life of the mine. There will be zero gradient at turnings. Drain will be constructed alongside of the haul road. Proper lighting arrangement should be made at regular intervals for proper visibility and water spraying should be done regularly for dust suppression. Sufficient numbers of water sprinklers has been provided for this purpose.

15.1.5 Danger due to Blasting

Controlled blasting with muffling will be done whenever the place of blasting is lying within 300m from important surface features/structures etc. In order to determine the actual drilling and blasting pattern suitable for the coal/rocks of the project, field trials shall be conducted during the actual project operation.

All the precaution laid down under Regulation 170 of Coal Mines Regulation Act 1957, should be strictly followed.

15.1.6 Danger due to Inundation

To protect the opencast mine from inrush of water particularly during rainy season, garland drain around the mine periphery should be constructed. Adequate pumping capacity has been provided to pump out normal water accumulation as well as to preclude any eventual inrush of water.

15.1.7 General Lighting

Prescribed standard of lighting in the quarry and other working places as per DGMS Regulation/Circulars shall be made. Adequate capital provision for this purpose has been made.

15.1.8 Training

Intensive training is to be imparted to the operators of HEMM. Only suitably trained personnel in their jobs shall be deployed for operating HEMM.

NCL has a separate “Human Resources Development” department. Time bound training programme for various categories of workers, supervisors, staff and executives should be prepared and executed regularly for improving the quality of manpower so that target and quality envisaged in the project report may be achieved.

15.1.9 Additional Permission/Relaxation Required from DGMS

All statutory permission/relaxation will have to be obtained from DGMS as and when required, particularly regarding maximum permissible final dragline OB dump height and other quarry parameters.

15.2 CONSERVATION OF COAL

Measures have to be taken to minimize coal losses during mining operations. Selective mining of inseam dirt bands whenever bands of more than 1m are encountered has been envisaged in the Project Report. It is suggested to practice controlled blasting. It is proposed not to dump any spoil material over coal bearing area.

CHAPTER – XVI

ENVIRONMENTAL MANAGEMENT

16.1 INTRODUCTION

This chapter deals in brief the environmental aspect of Dudhichua Expn. OCP (20Mtpa) and the adjoining area.

Mining System

Dudhichua Expn. OCP (20Mtpa) has been planned for a targeted output of Normative 20.00 Mtpa of ROM coal. It is to be worked by combined system of mining deploying draglines and Shovel-Dumper both.

Location, Topography and Drainage

Dudhichua OCP is located in East of Jayant OCP and on the West of Khadia OCP of NCL. The interstate boundary between MP & UP passes through the existing project (15.50 Mtpa). Thus the project is partly in the Singrauli District of MP and partly in the Sonebhadra District of UP.

The project is covered under Topo sheet no. 63-L /12 between latitude 24^0 00' 00" to 24^0 10' 02" North and longitudes 82^0 39' 55" to 82^0 42' 34" East. The nearest railway station is Shakti Nagar located at a distance of 6 Km and the nearest airport is in Varanasi located at a distance of 240 Km.

The mining area is located on a plateau above plains on its South-West side. The plateau has an elevation varying from 375 m to 400 m above MSL, with occasional high hill rising to 504 m.

The drainage of the area is divided in two sections- One flowing towards North into Bijul Nalla through Mehrauli/Morwa Nalla, the other towards South into GBP Sagar through Ballia Nalla.

Climate

Climate of the area is tropical with three distinct seasons. The minimum & maximum temperature recorded is 40^o C and 48^oC respectively. The average annual rainfall in last 20 years is 1200 mm, 88% precipitation occurring during rainy season.

Meteorological Aspect

Micrometeorological study was carried out in Summer Season in the study area of Dudhichua OCP. The study reveals the following status:

Wind Direction: Predominant wind is from North West (NW) quadrant.

Temperature: Temperature values are ranging from 25.0 to 44.0^{o}C

Relative Humidity: The mean relative humidity values are in the range of 22.5 to 57.8 %

Cloud Cover: Mostly clear sky is predominant during the study period.

16.2 STATUS OF EMP

The project has environmental clearance from Ministry of Environment, Forest & Climate Change (MoEFCC) for a rated capacity of 15.50 Mtpa of coal production vide letter no. J-11015/381/2008-IA.II (M) dated 10th Dec., 2008.

16.3 LAND REQUIREMENT AND ITS STATUS

Type of Land	Required (Ha)	Possessed as on 31.03.2015	Balance to be possessed
Forest Land (Total)	1217.809	750.000	467.809
-UP	555.000	555.000	-
-MP	662.809	195.000	467.809
Govt. Land (UP)	366.00	366.000	-
Tenancy Land (Total)	806.913	751.000	55.913
-UP	636.000	636.000	0.000
-MP	170.913	115.000	55.913
Total	2390.722	1867.000	523.722

16.4 FLORA

As per the study report of existing Dudhichua OCP, the study area of Dudhichua OCP is covered by commercial trees, Timber trees, medicinal plants,shrubs & herbs. The common tree species are from Caseal pinaceae family (e.g. Apta, kachnar, Amaltas & Imli), Combretaceae family

(e.g. Dhawda, Ain), Ebenaceae family (e.g. Tendu), Fabaceae (e.g. Palas, Karanj, Bija), Meliaceae (e.g. Neem), etc.

The shrubs families present in the study area are Vrebenaceae (Nirgudi), Euphorblaceae (Eranda), Convolvulaceae (Besharam), etc. and the herbs families are like Graminae (Doob), Zygophyllaceae, Solanaceae, Mimosaceae, Martynceae, Euphorbiaceae, etc. There are no known Endemic, endangered and Migratory flora species in the study area.

NCL has planted exotic and indigenous plants in large numbers mainly on road side, unused land & over burden dumps of existing Dudhichua OCP.

16.5 FAUNA

As per the study report of existing Dudhichua OCP, diverse groups of birds were observed in the vicinity of river banks or marshy areas and in zudpi jungles. Some wild animals were observed other domesticated animals.

There are no ecologically sensitive/fragile areas such as Wild life Sanctuaries, National Parks, and adjoining National Monuments, areas of cultural heritage, ecologically fragile areas, areas rich in biological diversity, gene pool, etc located on the proposed stretch. There are no known rare, endangered or ecologically significant animal species.

After the end of mining operations, the area will be reclaimed and this may help the wild life to return to their earlier habitat.

16.6 IMPACT ON LAND

The break-up of land required for various mining operations and at the end of mine life is as follows:

Operational Land Use Pattern

Sl No	Land Details	Land (Ha)
1	Total quarry area	1682.000
2	External dump	152.000
3	Colony (Residential area)	198.000
4	Greenbelt	62.722

5	Infrastructure	116.000
6	Road + Railway	27.000
7	ETP	1.000
8	CHP	30.000
9	Safety Zone	82.000
10	Others	40.000
	Total	**2390.722**

Post Mining Land Use Pattern

Sl. No.	Type of land	Area (Ha)	Land Use
1	Reclaimed backfilled area	1358.000	Green Cover
2	Void with Batter	324.000	Water Body
3	External Dump	152.000	Green Cover
4	Infrastructure (including roads, railways, CHP, ETP, etc.)	174.000	Public Use
5	Safety zone	82	Undisturbed Land
6	Residential	198	Public Use
7	Green Belt	62.722	Green Cover
8.	Others	40.00	Green Cover
	Total	2390.722	

Opencast mining operations have positive/favorable as well as adverse impact on land involved, which is explained below:

Beneficial Impact

1) The non-forest land used for residential complex is mostly waste land with undulating terrain. Hence the construction of residential/ industrial

complex with green belt all around and garden & parks has improved greenery with aesthetic look as well as land use.

2) Out of 2390.722 Ha of total land, only 1217.809 Ha is forest land. With the proposed massive three tier plantation, area of green land will be 1612.722 Ha (i.e. 32.43% increase in green cover) and water body of 324 Ha in post mining land use. This will improve the density of green cover & water table in adjoining area by which the type of species will increase.
3) With the increase in vegetative cover, water retention capacity of soil will increase & its erosion will decrease.
4) In pre-mining, area involved in mining is highly undulated. During mining OB dumps & mined out area will be leveled and reclaimed.
5) This leveled area after sometime can be developed for agro forestry or forest with leveled and suitably graded surface relief.

Adverse Impact

1) Dumping of overlying rocks in reverse sequence at predetermined place will alter the soil profile.
2) Formation of external OB dumps till reclamation will affect aesthetic look.
3) Increase in soil erosion in the initial stage till consolidation and biological reclamation work is over.

The following measures are proposed to improve land use

1) Judicious planning to make best use of land surface.
2) Residential complex with multistoried buildings to minimize land area involved.
3) Green belt around colony, industrial complex etc to improve land use as well as aesthetic look with improved green cover.

OB Management

i) There is no external dumping in the proposed expansion. The total

OB generated would be backfilled internally.

ii) Existing external OB dump is located outside the minefield near escarpment of plateau in valley and has been properly reclaimed according to the existing EMP.

iii) Height of dumps has been restricted to match with original topography as far as practicable.

iv) Concurrent reclamation of OB dumps is proposed to restore quick vegetative cover. Provision of garland drains around minefield, drains around OB dumps, drains across dump slope & drains with silt arresters.

v) Gabion walls has been constructed all along the external OB dump.

vi) Slope stability study of high wall and OB dump would be carried out to ensure their stability and prevent any failure in future.

16.7 ENVIRONMENTAL QUALITY IMPACT AND CONTROL MEASURES AMBIENT AIR QUALITY

Ambient air quality for existing Dudhichua OCP is regularly monitored as per the MoEFCC/CPCB standards. Four stations each for the core and buffer zone has been established for assessing the ambient air quality status of the project. The parameters like suspended particulate matter (SPM), Respirable particulate matter (PM10), Fine Particulate Matter (PM2.5), Sulphur-dioxide (SO_2) and oxides of Nitrogen (NOx) are monitored on fortnightly basis to assess the ambient air quality in study area. Both in core and buffer zone, all SPM, RPM, PM 2.5, SO_2 and NO_x values are found well within the prescribed limits of CPCB for coal mines for industrial and residential area.

Sources of Air Pollution

Air pollution is caused due to generation of dust particles (SPM, RPM & PM 2.5) and emission of gaseous pollutants like NOx, SO_2, and

Hydrocarbons etc.

In an opencast mine dust particles are generated due to the following operations:

i) Drilling

ii) Blasting

iii) Loading and transportation of coal and OB

iv) Crushing, conveying and loading of coal in wagon/truck.

v) Working of dozer, dumpers and plying of other vehicular traffic.

vi) Dust generation from loose OB dumps, haul roads, coal stocks due to high wind velocity.

Gaseous pollutants are emitted due to the following operations:

i) Blasting

ii) Operation of diesel equipment

iii) Spontaneous heating of waste coal and fire in coal stock.

iv) Burning of coal for domestic use.

Impacts of Air Pollution

i) As the concentration of pollutants is within the permissible limits, mining operations if done employing effective control measures will not have appreciable impact on ambient air quality. This has insignificant impact on human health as seen from data obtained from local hospitals which shows no cases of respiratory problems.

ii) Deposition of dust on plant leaves affecting the growth.

Control Measures

The following control measures are proposed to restrict air pollution:

a) **Preventive measures**

i) Dust collectors in drills.

ii) Restricting the blasting during the period of high wind condition.

iii) Black topping of all service roads.

iv) Routine maintenance of HEMM to reduce gaseous emissions.

v) Limiting the speed of vehicle to reduce dust generation.

vi) Provision of air tight control rooms in CHP, telecommunication stations, electric sub-stations, HEMMs, Computer room.

vii) Thick green belt (with tall trees) around proposed OB dump around workshop, CHP and along roads and township, etc.

b) Suppressive Measures

i) Water spraying on haul roads, coal transportation road (from CHP to Railway siding), service roads, coal pile, etc. Mobile water sprinklers as well as static water sprinklers would be provided for this purpose.

ii) Proper operation and maintenance of dust extractors in CHP and other equipment.

iii) Green belt around colony and industrial complex.

iv) Concurrent reclamation of OB dumps to reduce dust generation from loose OB dump surface.

WATER QUALITY

Sources of Water Pollution

1) Effluent from residential buildings, other amenity centers if discharged without treatment.

2) Runoff from Mine Area & OB dumps:

Runoff from slopes of internal OB dumps, in-pit slopes, access road if not canalized will find its way into the mine sump. This runoff will not have any pollutant except high-suspended solids concentration.

3) Seepage & Leaching of chemical from OB dumps:

Part of rainwater infiltrates through OB dumps finds its way into mine sump. This water will not have any toxic chemicals except dissolved solids.

4) Effluent from Workshop & CHP:

For proper maintenance, HEMM's like dumpers, dozers, graders-are washed frequently in workshop. In addition, effluents from workshop constitute washing of floor & roads in workshop premises.

Impacts of Water Pollution

Anticipated impacts of water pollution are as follows:

1) Industrial effluent increases the concentration of TSS, Oil and grease etc. in natural water courses if discharged untreated.
2) Sump water, if discharged untreated, increases suspended solids, dissolved chemicals, oil/grease in natural water course.
3) Surface run-off causes soil erosion and siltation of water courses. Siltation affects the quality and productivity of soil.

CONTROL MEASURES

The project is planned considering the infrastructure of existing Dudhichua OCP. However, keeping in view the following control measures have been proposed.

i) **Domestic Effluent**

For domestic effluent, one Sewage Treatment Plant (STP) of 2 MLD capacity has already been constructed for treatment of domestic sewage for existing Dudhichua colony. The STP plant has the sufficient capacity to cater the need of expansion project. The sewage will be treated before being discharged in to natural streams. The treated water will be utilized for irrigation purposes by the farmers in downstream side.

ii) **Industrial Effluent**

For treatment of effluent generated from workshop and CHP an ETP of 30 MLD capacity has already been constructed. The ETP has sufficient capacity to cater the need of expansion project.

The industrial waste from the workshop, CHP and mine would be led to the effluent treatment and re-circulation plant. Thereafter, treated water will be re-cycled for industrial use.

iii) **Mine Water & Runoff from dump**

Pumped out water from mine will be settled in settling pond & treated in ETP thereafter treated water will be used for Industrial purpose.

iv) **Surface Run-off**

Runoff from OB dumps will flow through drain around OB dump with silt arrestors into a siltation pond (mine sump). It will then be discharged into nalla.

NOISE LEVEL

Sources of Noise Pollution

Sources of noise pollution during mining operations in Dudhichua OCP are:

1) Drilling & Blasting.
2) Operation of HEMM like dumpers, dozers, front end loaders, shovels and other motor vehicles.
4) Operation in CHP due to crushing, screening, loading & unloading operations.
5) Operation of workshop equipment like compressors, fans, drilling and other machines.
6) Running of other vehicular traffic.

Impact of Noise Pollution

As the noise levels at mine site are well below threshold value of 70 dB(A), the impact of noise generated due to different mining operations is insignificant.

Control Measures

1) Provision of noise proof cabins for operators of drills, dumpers, shovels, draglines, etc.

2) Routine maintenance of HEMM to reduce vibration.

3) Provision of ear muffs and ear plugs as and when required.

4) Restriction of speed of vehicle in colony & sensitive areas.

5) Colony has been constructed at a distance of 4 to 6 Km from mine area to minimize impact of noise due to mining activities.

6) It is suitably located with respect to main road which will also reduce the impact of noise pollution due to vehicular traffic.

7) Provision of thick green belt around colony. It has been observed that 40-50 meter thick green belt can be effective in attenuating noise level by 7-8 dB(A).

Existing Noise Level

Noise level at core zone and buffer zone at existing Dudhichua mine is being monitored at regular interval as per MoEFCC/CPCB/SPCB notification. The noise level in industrial and residential area is found within permissible limit.

GROUND VIBRATION

Blasting in which about 25% of the explosive energy is utilized in actual rock breaking process and the rest is dissipated through air and ground mainly causes ground vibration.

Cause and Impact of Ground Vibration

Factors affecting ground vibration due to blasting are as follows:

1) Rock properties, tectonics of rock medium i.e. presence of faults, natural planes of weakness.

2) Overcharging of blast holes,

3) Blast-hole geometry.

4) Distribution pattern of explosive in blast hole,

5) Length of stemming column.

6) Non-availability of free face.

7) Faulty Sequence of blasting, improper use of delay etc.

Impacts of ground vibration are as follows:

1) Physiological effect on human beings and other animal life.

2) Damage to buildings and other structures.

3) Lowering of water table due to excessive fracturing of strata and weakening of strata.

4) Poor or no vegetation in the adjoining areas due to lowering of water table.

5) Wild animals and birds get scared and are driven away due to ground vibration and noise.

Control Measures

The following control measures are proposed to control ground vibration:

General Guidelines

a) Design of optimum blasthole geometry considering bench height, diameter of hole, type of explosive, nature of rock, level of fragmentation required, etc.

b) Divide total charge/blast in several parts so as to keep minimum explosive/delay. For instance dividing total charge in the parts will reduce ground vibration to 1/4 compared to the total charge blasted without using delays.

c) Use of milli-second delay detonators & relays.

d) Reduce the depth of the holes (larger the depth, the ground vibration is felt over larger area). Sub grade drilling to be controlled.

e) Avoid concentration of explosive by using deck charging.

f) To provide artificial plane of weakness between the site of blast and the

important surface structures to provide damping affect.

g) Plaster shooting should be avoided to reduce air shock wave.

16.8 LAND RECLAMATION

Land reclamation can be divided into three stages - Technical Reclamation, Biological Reclamation and Hydro Reclamation. Reclamation procedures for both external and internal dumps have been given below:

Technical Reclamation

The total estimated OB of 1603.78 Mm^3, for expansion will be accommodated in the internal OB dumps. The area involved in internal OB dump is 1358 Ha. The formation of external and internal dumps will be in benches of 30 m height each. It is proposed to re-grade the dump slope to 28° whenever dump reaches the final profile.

Technical reclamation also includes leveling of dump tops. The dump top is given an inward gradient of 5% for proper drainage. Garland drains are proposed to be constructed around the toe of the dump to check the silt-laden rain wash off flowing directly into the natural courses.

Equipment for technical reclamation is given in the Project Report. The capital requirement for the technical reclamation has been estimated as `5119.18 lakhs.

In the external dump, decks of 30 m height each has been made and the overall slope of the dump has been kept at 28^o to avoid slope failure. For better stability of internal dumps, it is suggested to rip the mine floor in strips before back-filling. It is suggested to level the dumps and grade them outward properly to obviate water accumulation.

I. External dumps

At present the existing external dump has been fully reclaimed. This external dump of 152 ha has accommodated about 134 Mm^3 OB material. There is no external dumping proposed in the proposed expansion.

II. Internal dumps

There are two (2) nos. of internal OB dumps, which are active. The internal dumping will be done in the de-coaled area of quarry only. The total quantity of internal dump has been estimated as 1603.78 Mm^3.The technical and biological reclamation will continue till the life of the mine and the remaining portion will be reclaimed during post mining period also.

Equipment for technical reclamation is given in the Project Report. The capital requirement for the technical reclamation has been estimated and given in Appendix-E.

Biological Reclamation

Biological reclamation is an essential part of land reclamation. It includes selection of plant species, preparation of ground, treatment of OB, establishment of plantation & its maintenance.

Selection of plant species

Plantation on dump slopes is aimed at:

- Providing quick binding of OB material
- Providing basic nutrients like nitrogen, organic matter considering above factors it is proposed to plant following species:

  Khus, Munja, Agave, Prosopis juliflora, Neem, Karanj, Bamboo, Ber, Amla, Shisham, Khair, etc.

The criterion for selection of species in OB dump top is subject to mainly environmental as well as socio-economic factors.

Hence, it is proposed to plant species which given maximum production of wood, fruits, medicinal product etc. In the initial period, after first monsoon the seedlings of grasses should be spread so that it will provide basic nutrients for later plantation.

Preparation of Ground

This includes digging of small size pits 45cm x 45cmx 45cm on OB

surface. Digging should be done as late as possible after the season of winter rains in February/March.

Plantation Technique

This includes seed treatment, raising of seedling in nursery and plantation. Polythene bags are placed in the holes and gaps are filled with soil & organic manures.

The expenditure for biological reclamation would be met from revenue account (Rs. 6/te of coal produced has been allocated as revenue fund for plantation and other reclamation activities).

Hydro Reclamation:

At the end of mine life a void with batter of 324 Ha will be left as void in the excavated zone. The ultimate maximum depth of the void has been estimated as 310 m. In the final mine closure plan, voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation where possible and for hydro reclamation where feasible.

16.9 COMPENSATORY AFFORESTATION

In lieu of acquired forest land, compensatory afforestation (for the proposed expansion) over the area of 907.5 Ha has been proposed. Total capital provision in this EPR for compensatory afforestation is `5880 lakhs.

For the proposed expansion the balance provision for compensatory afforestation i.e. for 907.5 Ha of land, comes out to be `5599 lakhs.

16.10 GREEN BELT DEVELOPMENT

For arresting dust and protection of environment against visual pollution, plantation of trees is proposed along railway line, haul roads and approach roads, in and around residential complex, in mining areas where excavation is likely to commence after 10 years or so and on unaffected land. Green belt has already been developed in plain area of 116 Ha (up to year 2011). Green Belt of 62.722 Ha is further proposed in the proposed expansion plan.

16.11 **OPEN LUNGS**

Capital provision of `44.32 lakhs has been made for developing open lungs in Dudhichua Project.

16.12 **REHABILITATION**

502 families are estimated to be rehabilitated for which a fund of `2510 lakhs has been provided in this Expansion Project report. These families will be shifted/rehabilitated as per R&R policy of CIL/Govt.

16.13 **CORPORATE SOCIAL RESPONSIBILITY (CSR)**

This is basically undertaken for non-employees residing in the nearby villages. Under the CSR programme the project will arrange periodical health camps, immunization programme and family planning programme in the nearby villages. Construction of roads, water supply arrangement, schooling facilities are also undertaken.

16.14 **MANPOWER AND EQUIPMENT FOR ENVIRONMENT**

Total manpower for implementation of Environmental Control measures in Dudhichua OCP (Expansion) has been estimated as 54 Nos. Details of the manpower for the purpose of environment & reclamation is given in Appendix-B and reclamation Equipment details in Appendix-E.

16.15 **ECONOMICS**

The total capital requirement for environmental control measures for Dudhichua OCP (20 Mtpa) includes cost for technical reclamation, rehabilitation, pollution abatement, effluent treatment, compensatory afforestation, green belt development, community development and others including furniture and fittings, open lungs and vehicles.

The provision for the above has been made in Appendix-F.

16.16 **CONCLUSION**

With the increase in coal production and corresponding OB removal, atmospheric pollution is to increase. Hence, the various proposed pollution control measures must be implemented in order to mitigate this pollution.

CHAPTER-XVII

LAND REQUIREMENT

17.1 LAND ACQUISITION

The total land requirement for EPR of Dudhichua OCP (20 Mtpa) has been broadly assessed as 2390.722 Ha for expansion from existing 10 Mtpa to 20 Mtpa. The land requirement broadly includes the provision for quarry area, external dump, residential colony, safety zone and other infrastructure facilities, etc.

The head-wise break-up of land use is given below in Table No. 17.1:

Table No. 17.1

	Particulars	Total required Area (Ha)
1	Total quarry area	1682.000
2	External dump	152.000
3	Colony (Residential area)	198.000
4	Greenbelt	62.722
5	Infrastructure	116.000
6	Road + Railway	27.000
7	ETP	1.000
8	CHP	30.000
9	Safety Zone	82.000
10	Others	40.000
	Total :	**2390.722**

Out of the total requirement of 2390.722 Ha, the break-up for the type of the land is given below in Table No.17.2:

Table No.17.2

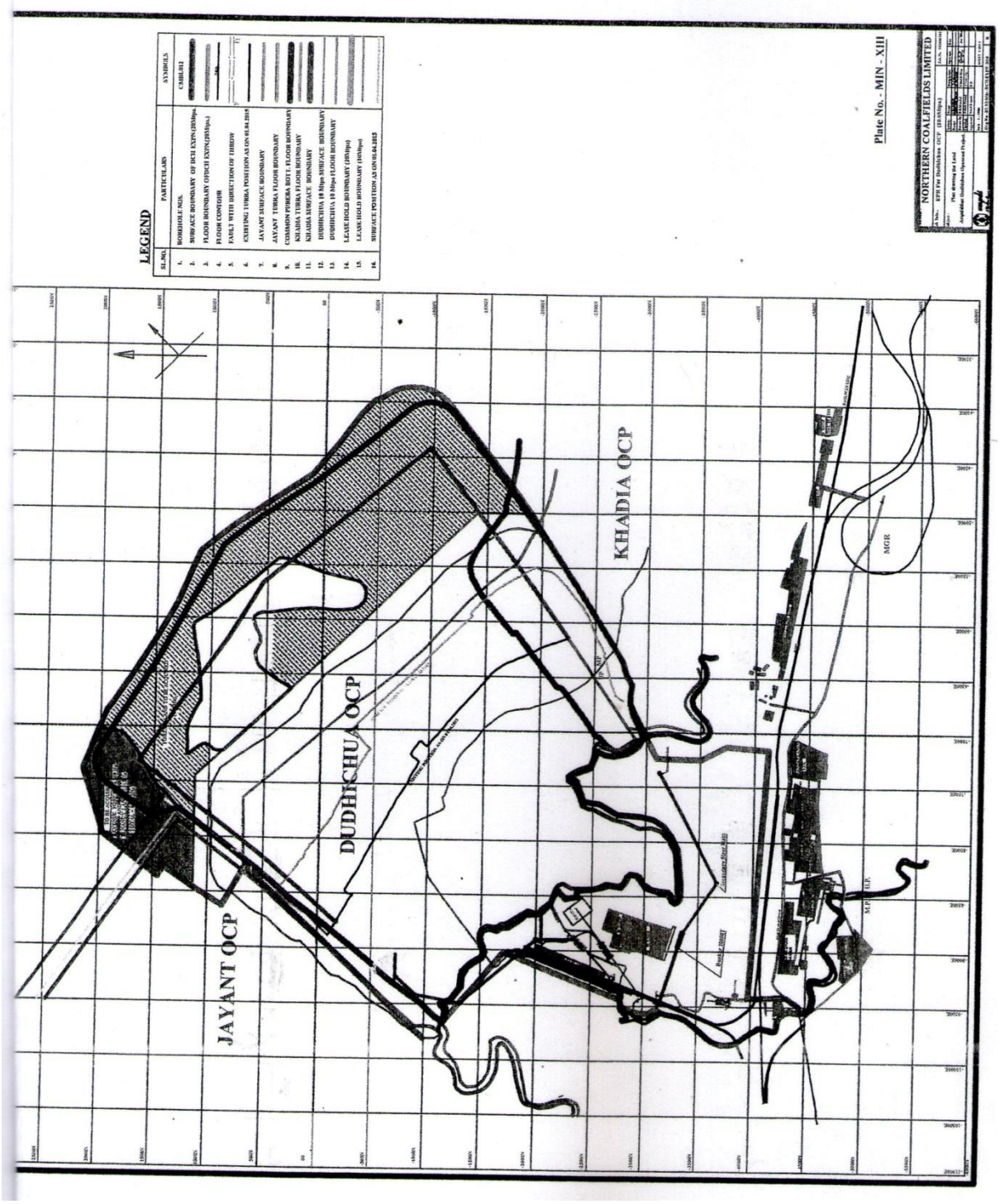
Type of Land	Total Requirement (Ha)	Possessed as on 31.03.2015 (Ha)	Balance to be acquired (Ha)
Forest Land (Total) -UP -MP	1217.809 555.000 662.809	750.000 555.000 195.000	467.809 - 467.809
Govt. Land (UP)	366.00	366.000	-
Tenancy Land (Total) -UP -MP	806.913 636.000 170.913	751.000 636.000 115.000	55.913 0.000 55.913
Total	2390.722	1867.000	523.722

Forest Land

467.809 Ha of additional forest land is required to be acquired for expansion from existing 10 Mtpa to 20 Mtpa (peak production – 25 Mtpa).

Non-Forest Land

Out of 1172.913 Ha of non-forest land, 1117 Ha of non-forest land (Govt. Land, 366 Ha + Tenancy land, 751 Ha) has already been acquired and balance 55.913 Ha of non-forest land (tenancy land) is to be acquired for expansion project. Provision for acquisition of balance land has been given in Appendix-A.1.



क्षेत्रीय निदेशक
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