NTPC LIMITED

SCOPE COMPLEX, 7 INSTITUTIONAL AREA, LODHI ROAD, NEW DELHI-110003

REVISED MINING PLAN AND MINE CLOSURE PLAN

(1st Revision)

FOR

PAKRI BARWADIH COAL BLOCK

NorthKaranapura Coalfield, Distt. - Hazaribagh, Jharkhand

Opencast – 18.00 Mtpa

Block area - 4695 Ha

January – 2016

(Incorporating clarifications to the observations of Standing Committee)

Volume-I

Text & Annexures

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 340 (15)/2009-CPAM
Ministry of Coal, Govt. of India

Prepared By:

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(RQP NO.:34011/ (15)/2009 – CPAM)

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OBSERVATIONS

&

COMPLIANCE TO OBSERVATIONS

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011/(15)/2009-CPAM
Ministry of Coal, Govt. of India

Pointwise Compliance to MoC's observation issued vide letter no. 34011/05/2015/CPAM(Pt) dated 28th December 2015 on Revised Mining Plan & Mine Closure Plan – 1st Revision of Pakri Barwadih Coal Block

Sl. No	Ref Para	Observations	Compliance to the Observations
	Sum 1(h)	ROM to be produced per year as per the mining plan should also be envisaged	ROM to be produced per year is 18 Mt and the same has been incorporated in para 1(h) of Summarised Data ROM Quantity. • 503.38 Mt from West and East Quarry • 138.96 Mt from NW Quarry • Total = 642.34 Mt
2	Sum 1 (l) & 1 (m)	It appears from the annexure XIV that the lease has been acquired under CBA while at Summary item 1 (l) under the heading period for which mining lease has been granted it is indicated as not applicable. This needs to be reconciled	Mining Lease is not applicable since mining area land is being acquired by NTPC under CBA Act.
2	Sum 1 (l)	No Expiry has been indicated against the date of expiry of earlier mining lease while at para 2(d) date of expiry of the lease has been indicated as 2033. This needs to be reconciled	Mining Lease is not applicable since mining area land is being acquired by NTPC under CBA Act. The same has been reconciled at para 2(d) of Summarised Data
4	Sum 2 (f)	As per the calendar plan of the approved mining plan proposed year of start of production appears to be 2008 09, while at para 2(f) of	The proposed year of start of the production as per present Revised Mining Plan (1st Revision) is 2016 17

Sl. No	Ref Para	Observations	Compliance to the Observations
		summary item it is indicated as Mar 2017. This needs to be reconciled	
5	Sum 2 (m)	Reason for delay in starting of the project should be envisaged in the item under reference	Reasons for delay in starting of the project as per Approved Mining Plan are as under a) Delay in issuance of NoC on jungle jhari land by Distt Administration due to which Forest Clearance was delayed b) Revision of evacuation corridor on advice of FAC, MoEF c) Delay in land acquisition. There was delay in physical verification & Certification of land records, disbursement of land compensation by Hazaribagh Distt. Administration took more time due to old / non availability of land records, inadequate State manpower at Distt/Block level, law & order problem etc d) Non-performance by the earlier MDO. NTPC finally terminated the MDO contract wef 22.06.2014 The same has been now incorporated at para 2(m) of Summrised Data
6	Sum 2(o)	The reason for increase in Land area from 384 to 485 Ha and reduction in land area outside block from 299 Ha to 287 Ha should be elaborated in the reference para and chapter IX of the mining plan	There is a net increase in block area from 4626 Ha to 4695 Ha in comparison to the Approved Mining Plan as mentioned in the Table below (reference para considered is 2 (p)) Reasons for change Area is given below. Particulars | Approved Mining Plan | Revised Mining Plan | +/- (Ha) | Reason Block Area excluding Area A | 3943 | 3943 | | No Change Area A | 384 | 485 | 101 | Detailed survey of Area A at the time of detailed exploration has indicated total area as 485

Sl. No	Ref Para	Observations	Compliance to the Observations
			ha. Same has been notified under Section 7(1) of CBA
			Outside Block area (For OB Dumps and infrastructure) 299 267 -32 Decrease in area as per direction of restrictions of MoEF
			Total 4626 4695 69 Difference of 69 Ha is due to above two reasons
			The difference of 69 ha between the areas shown in the Approved Mining Plan and present Revised Mining Plan and Mine Closure Plan(1st Revision) is attributed due to increase of 101 ha in Area 'A' after demarcation & measurement, and reduction by 32 ha of the area taken for external dumping and infrastructure • The revised area of PB-NW (Sector 'A') has been certified by CMPDI (enclosed as Annexure –XIX) • The above details have been now incorporated in the reference para and Chapter IX (Land Requirement) of the Revised Mining Plan and Mine Closure Plan(1st Revision)
7	Sum 3 (i)	Reason for deviation from lease boundary / required boundary from the boundary demarcated by CMPDIL/ SECL/ NLC needs to be clarified	The block boundary considered for mining is the same as provided by the CMPDI However additional land has been envisaged and acquired for external dump and infrastructure such as Cross Country Conveyor Railway Siding etc outside the block boundary
8	Sum 4(l) & 4(m)	The Grade of Coal indicated at Para 4.4.2 at Table 4.12/4.13 and other relevant pages area on obsolete system of grading of Coal The GCV based grading of coal	GCV is calculated based on following formula Gross Calorific Value = (UHV + 3645 -75.4*M)/1.466 Accordingly GCV based garading is now provided at Table 4.12/4.13 and incorporated at all relevant pages of the Revised Mining Plan and Mine Closure Plan (1st Revision)

Sl. No	Ref Para	Observations	Compliance to the Observations
		should be provided at all the relevant pages	
9	Sum 4(o) & Chapter 5	Seamwise Geological Minable blocked and corresponding extractable reserve should be indicated in the para under reference	Geological Reserves are given in following table and incorporated in Table-1.6 of Chapter-1

million tonnes

Sl. No.	Reserves*	PB-West & East	PB-NW	Total
1	Net Geological	1436	137.6	1573.6
2	Amenable for Open Cast	707	121.03	828.03
3	Amenable for Underground	729	0	729
4	Mineable	503.39	138.98**	642.34

** Reserves up to 300m depth have been considered for opencast mining*

***33.18 Mt of coal shall be mined as Barren& Better Coal between PBW & PB-NW*

Seam wise Geological, Minable, blocked and corresponding extractable is now indicated in the reference para 4 (o) of summarized data and elaborated in **Chapter 5**

Net reserves and extractable reserves and losses

(in Mt.)

Sl. No	Ref Para	Observations	Compliance to the Observations

Seam	Net Reserve	Barrier Loss	Batter Loss	Mineable Reserves	Mining Loss	Extractable Reserve	% Extraction
V Top	22.29	0.72	1.57	19.99	0.59	19.40	87.06
V Bottom	15.56	0.51	1.10	13.96	0.41	13.55	87.06
V Combined	11.57	0.21	0.49	10.87	0.44	10.43	90.18
Seam - V	**49.42**	**1.44**	**3.16**	**44.82**	**1.44**	**43.38**	**87.78**
IV Top	19.82	0.64	2.23	16.95	0.60	16.40	83.01
IV Bottom	9.92	0.32	1.12	8.48	0.25	8.23	83.01
IV Combined	92.32	3.15	10.68	78.49	2.43	76.06	82.39
Seam - IV	**122.06**	**4.10**	**14.03**	**103.93**	**3.18**	**100.75**	**82.54**
III Top	27.45	1.21	2.04	24.20	0.70	23.49	85.59
III Bottom	9.83	0.43	0.73	8.65	0.25	8.41	85.59
III Combined	4.80	0.21	0.36	4.23	0.12	4.11	85.59
Seam - III	**42.08**	**1.85**	**3.13**	**37.10**	**1.08**	**36.02**	**85.59**
I Top	59.98	4.66	6.21	49.11	1.89	47.22	78.72
I Middle	139.75	11.83	11.24	116.68	3.83	112.50	80.75
II TM	78.09	7.28	5.53	65.18	1.77	63.40	80.70
I Bottom	116.05	10.76	9.50	95.39	2.89	92.50	79.71
II MB	17.90	1.71	1.32	14.86	0.42	14.44	80.70
II Combined	7.35	0.70	0.54	6.11	0.17	5.94	80.70

Sl. No	Ref Para	Observations	Compliance to the Observations

Seam- II	**417.13**	**36.95**	**34.85**	**345.33**	**10.97**	**334.36**	**80.16**
I Top	36.93	2.72	9.39	24.81	0.77	24.05	65.11
I Middle	72.97	5.27	18.20	49.49	1.66	47.84	65.56
I TM	2.51	0.23	0.79	1.49	0.04	1.45	57.80
I Bottom	35.60	2.52	8.69	24.39	0.52	23.87	67.06
I MB	14.85	1.35	4.67	8.83	0.24	8.58	57.80
I Combined	3.58	0.33	1.13	2.13	0.06	2.07	57.80
Seam- I	**166.44**	**12.42**	**42.88**	**111.14**	**3.26**	**107.86**	**64.81**
LL	2.60	0.10	0.35	2.15	0.11	2.04	78.62
K5	0.13	0.01	0.06	0.06	0.01	0.05	36.32
K4	4.21	0.13	1.11	2.97	0.11	2.86	67.83
K3	3.34	0.22	0.85	2.26	0.06	2.20	65.95
K2	5.38	0.27	1.14	3.97	0.07	3.90	72.40
K1	15.24	1.25	4.65	9.34	0.41	8.93	58.62
Seam-Local	**30.90**	**1.98**	**8.17**	**20.75**	**0.77**	**19.98**	**64.66**
Total	**828.03**	**58.74**	**106.22**	**663.07**	**20.72**	**642.35**	**77.58**

**Additional 20Mt of proved reserve had not been considered in the above table as the same is considered to be mined by u/g*

10	Sum 4(t)	*The percentage of extraction needs to be checked*	Percentage of extraction is 78% and the same has been now incorporated at para 4(t) of Summarised Data and Table-5.6 of Chapter-5

Sl No	Ref Para	Observations	Compliance to the Observations
11	Summary 5 (a)	The Schedule of starting of proposed underground mining at Para 1.6.2 is 20 year of start of mining operation, while at para 5.7 it is 10th year of start of mining operation., while for assessment of amount to be deposited into escrow account has been envisaged from 9th year of mining operation this needs to be reconciled	Schedule of start of underground mining operations has been envisaged from 10th year of mining operations (P10). Schedule of UG Operation is as follows **Schedule of Commencement PB (UG)** **Sl No. | Activity | Time schedule** 1 | Detailed exploration of the underground area | 4 years 2 | Preparation of G.R | 1 year 3 | Various Studies and Clearances | 3 year 4 | Preparation and approval of Mining Plan from MOC | 1 year 3 | Commencement of mining operations | 1 years **Total time | 10 years** Accordingly it has been now reconciled at para 1.6.2 and para 5.4 and Table 5.22 of **Chapter-5**.
12	Sum 5(c) & 5(e)	Quantum of coal to be produced indicated at para 5(d) is 616.20 Mte and extractible reserve indicated at para 4 (s) is 625.13	Total revised Quantum of coal to be produced from the block is 642.34 Mt and the same has been reconciled at para 5(d), extractable reserves and at para 4 (s)

Sl. No	Ref Para	Observations	Compliance to the Observations
		Mte. while production plan for only 609.19 mte has been envisaged This needs to be reconciled	
13	Sum 6(a)	Calculation for Coal requirement for the company and % of coal likely to be met from this project needs to be envisaged in the following table	Calculation for Coal requirement for the company and % of coal likely to be met from this project is given below:

Sl. No.	Parameter	Unit	Value
1	Thermal Power (Coal Commercial) Capacity as on 06.01.2016	MW	34425.00
2	Heat Rate	kCal/kWh	2386.00
3	Average GCV of blended coal (Domestic + Imported)	kcal/kg	3367.80
4	Sp. Coal Consp. blended coal (Domestic+Imported)	kg/kWh	0.71
5	PLF	%	0.80
6	Coal Consp (Domestic+Imported)	Million Tonnes	171.41
7	Coal Requirement (Domestic Coal) for 92% PLF	Million Tonnes	207.87
8	Coal availability from Pakri barwadih	MTPA	15.00
9	Other Blocks of NTPC	MTPA	0.00
10	Percentage of end use requirement to be met from Pakri Barwadih mine	%	9%

The same is also incorporated in Table-1.7 of **Chapter-1**

Sl. No	Ref Para	Observations	Compliance to the Observations
14	Chapter - V	There is some incoherency in coal production programme mentioned at table 5.36 & 5.37. This needs to be reconciled	Production Programme has been revised after considering the barrier & batter coal between North West quarry and West Quarry. The integrated calendar plan has now been incorporated in Table 5.16. Calendar Program of Pakri Barwadih is given in following page

Production Years	Coal Production (Mt)					OB Removal (Mm3)					Strip Ratio (m3/t)		
	West Quarry	East Quarry	PB West & East	NW Quarry	Total from PB	West Quarry	East Quarry	PB West & East	NW Quarry	Total PB Mm3	West & East Quarry	NW Quarry	PB
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]
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[illegible]	[illegible]		[illegible]	[illegible]	13	41.44		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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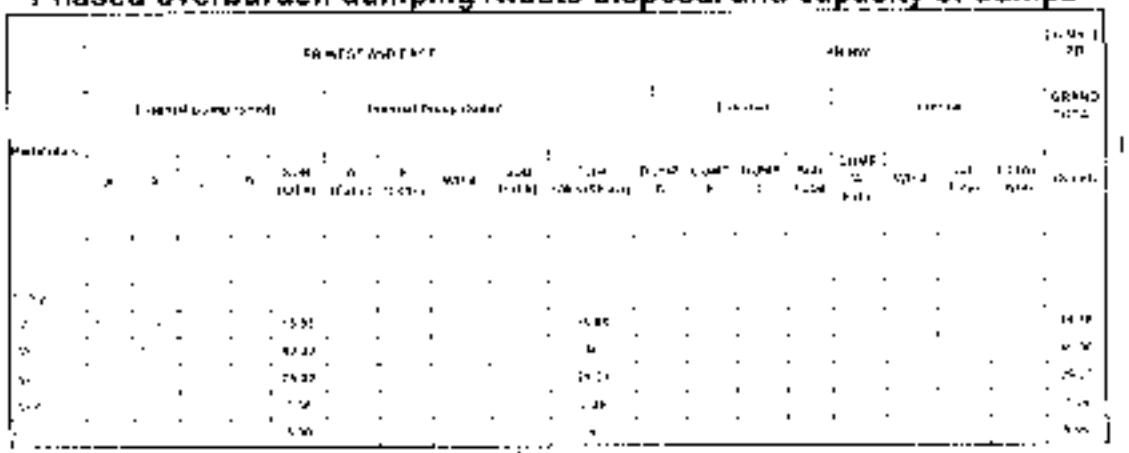
Sl. No	Ref Para	Observations	Compliance to the Observations

23	15		11	3	13	16		64	81	[illegible]	[illegible]	4.40	[illegible]	[illegible]	4.12
24	19		11	1	18	17		67	82	[illegible]	[illegible]	4.40	[illegible]	[illegible]	4.12
25	11	4	12	3	19	17	[illegible]	[illegible]	83	[illegible]	4.40	[illegible]	[illegible]	3.97
26	7	8	12	1	19	16	38.70	[illegible]	82	[illegible]	4.40	[illegible]	[illegible]	3.90
[illegible]	[illegible]	11.[illegible]	12	1	13	19	40.5	38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.12
29		16	13	1	14		60	70	92	[illegible]	4.40	[illegible]	[illegible]	4.17
30		16	13	3	18		64	89	[illegible]	[illegible]	4.40	3.80	[illegible]	4.32
31		16	17	2	18		66	86	[illegible]	[illegible]	4.40	3.80	[illegible]	4.30
32		16	14	1	15		67	87	[illegible]	[illegible]	4.40	3.80	[illegible]	4.30
33		19	13	3	16		86	88	[illegible]	[illegible]	4.40	3.80	[illegible]	4.36
34		19	13	3	16		66	88	[illegible]	[illegible]	4.40	3.80	[illegible]	4.36
35		19	14	3	16		65	86	[illegible]	[illegible]	4.40	3.80	[illegible]	4.30
36		19	15	3	16		67	88	[illegible]	[illegible]	4.40	3.80	[illegible]	4.30
37		19	15	3	18		66	88	[illegible]	[illegible]	4.40	3.80	[illegible]	4.36
38		19	13	1	13		66	69	10.[illegible]	26.3	[illegible]	3.41	[illegible]	[illegible]
39		3.[illegible]	[illegible]	2	[illegible]		[illegible]	[illegible]	10.04	[illegible]	[illegible]	[illegible]	[illegible]	3.26
40				3					[illegible]	[illegible]		3.03	[illegible]	2.00
41				3	[illegible]				9.00	[illegible]		3.03	[illegible]	3.32
42				3	3				9.00	[illegible]		3.03	[illegible]	3.36
43				3	3				9.00	[illegible]		3.03	[illegible]	3.30
44				3	3				9.00	[illegible]		3.03	[illegible]	[illegible]
45				3	3				9.00	[illegible]		3.03	[illegible]	3.30
46				3	3				9.00	[illegible]		3.03	[illegible]	3.30
47				3	3				9.00	[illegible]		3.03	[illegible]	3.30
48				2	2				[illegible]	[illegible]		3.03	[illegible]	3.07
49				3	3				9.00	[illegible]		3.03	[illegible]	[illegible]
50				1	1				[illegible]	[illegible]		1.02	[illegible]	1.02
51				1	[illegible]				[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
52				1.44	1.44				1.42	1.41		[illegible]	[illegible]	[illegible]
Total	311.70	191.68	503.38	138.96	642.34	1238.49	560.20	2098.78	437.97	2538.75	4.17	3.15	3.95	

Sl. No	Ref Para	Observations	Compliance to the Observations
15	Chapter - V	It is apparent from the details of the mining plan that the details of the mining plan has been envisaged in two parts one is for East- West quarry and another is for North west quarry but details of the complete block is missing in almost all chapters This needs to be corrected	Details of the mining plan earlier envisaged has now been integrated and presented in all relevant chapters Chapter V (Mining) has been now modified considering the barrier & batter coal between PB-West and PB-NW Additional 33 18 Mt of coal shall be mined out and life of mine shall be 52 years Other chapters such as Land Requirement Environment Management plan & Mine Closure Plan have also been presented in the same manner The details of the integration have also been shown in respective stage plans also and an additional stage plan (40th Year) has also been prepared and attached with this Revised Mining Plan & Mine Closure Plan (1st Revision)
16	Chapter - V	The dumping schedule indicated at Table 5 10 needs to be rechecked	Dumping schedule in Chapter V (Mining) has been rechecked and accordingly modified in Table 5 11 Revised Dumping schedule is given below. **Phased overburden dumping /waste disposal and capacity of dumps**



Sl. No	Ref Para	Observations	Compliance to the Observations

Sl. No	Ref Para	Observations	Compliance to the Observations
17	Chapter - V	Percentage of external dump for the project is 62.62 percent with 69.51 % in PB East West Quarry and 21.09 % in NW quarry. It appears that the percentage of external dump is significantly high. Possibility of reducing the external dump needs to be looked into	Out of total overburden of 2537.06 Mcum, 692.44 Mcum is envisaged to be placed externally and 1844.62 Mcum is envisaged to be backfilled as internal dumps. Accordingly the percentage of external dump works out to 27 % and 73% respectively. This has been depicted in Table 5.12 of chapter V. Waste Management has been elaborated in para 5.3.6 of chapter – V **Percentage Overburden Dumping** **PB West & East (Mm3)** / **PB NW(Mm3)** / **PB (Mm3)** / **PB West an East (%)** / **PB NW (%)** / **PB (%tage)** **External Dump**: 619.00 / 73.44 / 692.44 / 29.49% / 16.76% / 27.29% **Internal Dump**: 1479.63 / 364.79 / 1844.62 / 70.51% / 83.24% / 72.71% **Total**: 2098.63 / 438.23 / 2537.06 / 100.00% / 100.00% / 100.00%
18	Chapter - V	It appears that some of the coal is being locked in the barrier of NW Quarry and PB East – West Quarry. The liquidation plan for the same needs to be furnished	The details of the integration and liquidation scheme for the coal being locked in the barrier of NW Quarry and PB East – West Quarry has been elaborated in Chapter V (Mining) and the same has also been depicted in the Final Stage Quarry Plan and 40th year stage plan Additional 33.18 Mt of coal shall be mined out and life of mine shall be 52 years. Total extractable reserves have now increased from 609.18 to 642.34 Mt
19	Sum 7 (g) and Chapter - X	Monitoring schedule of some of major parameters viz air and noise are missing. this should be envisaged	Monitoring schedule of Air and Noise has been envisaged and has been accordingly mentioned at para Sum 7 (g) and Chapter – X (Environment Management plan) at Table 10.18

Sl. No	Ref Para	Observations	Compliance to the Observations
20	Sum 7 (b) and Chapter XI Para 11.20	The Land use pattern pre-mining during mining post mining and post closure should be furnished in a tabular form Justification for Proposed area UG entry etc should be envisaged The quantum of land likely to be damaged due to mining needs to be envisaged Further post mining land likely to be restored and their future use needs to be elaborated	Pre mining land use and use during mining, post mining land use and post closure land use pattern are presented in the following tables. Post mining land likely to be restored and their future use is elaborated in Chapter-9 Pre Mining Land Use Pattern Land Use Pattern Post Closure Type / Ha / Type / Coal Mining / Coal Not Fit / Agriculture (Coal Mining) / Plantation / Water Body / Public Use / Forest Land (Permanent) / Wasteland / Total

Sl. No	Ref Para	Observations	Compliance to the Observations
			[illegible] Backfill Percentage = 65.28% Plantation Area = 1272 ha
21	Chapter X	The Balance life of the mine is 41 years while for assessment of amount to be deposited in Escrow account life of 43 years has been considered This needs to be corrected	In view of mining of coal locked in barrier and batter between North West Quarry and West Quarry Life of the mine is now increased from 41 years to 52 years The mine closure cost and its deposition in the Escrow Account is accordingly revised and indicated in Table-11 18 of Chapter-XI of Mine Closure Plan

Sl. No	Ref Para	Observations	Compliance to the Observations

Year wise Closure Cost for Pakri Barwadih Mine

Closure Cost of PB Coal Block

Year	Average cost per annum on current cost (In Crores)			Year wise Expenditure with 5% escalation (In Crores)			Cumulative amount deposited in the Escrow account excluding interest (Rs Crores)	Maximum amount excluding interest to be released w.r.t expenditure incurred (Rs Crores)
	Opencast	Underground	Total	Opencast	Underground	Total		
P1	5.67	0.00	5.67	5.67	0.00	5.67	5.67	
P2	5.67	0.00	5.67	5.96	0.00	5.96	11.63	
P3	5.67	0.00	5.67	6.26	0.00	6.26	17.89	
P4	5.67	0.00	5.67	6.57	0.00	6.57	24.46	
P5	5.67	0.00	5.67	6.90	0.00	6.90	31.35	
P6	5.67	0.00	5.67	7.24	0.00	7.24	38.59	25.09
P7	5.67	0.00	5.67	7.60	0.00	7.60	46.19	
P8	5.67	0.00	5.67	7.98	0.00	7.98	54.16	
P9	5.67	0.00	5.67	8.38	0.00	8.38	62.54	
P10	5.67	0.78	6.46	8.80	0.78	9.58	72.14	
P11	5.67	0.78	6.46	9.24	0.82	10.07	82.21	32.64
P12	5.67	0.78	6.46	9.70	0.86	10.57	92.78	
P13	5.67	0.78	6.46	10.19	0.91	11.10	103.87	
P14	5.67	0.78	6.46	10.70	0.96	11.66	115.53	
P15	5.67	0.78	6.45	11.23	1.00	12.22	127.76	
P16	5.67	0.78	6.46	11.79	1.05	12.85	140.61	44.49
P17	5.67	0.78	6.46	12.38	1.10	13.49	154.10	
P18	5.67	0.78	6.46	13.00	1.16	14.16	168.26	
P19	5.67	0.78	6.45	13.65	1.22	14.86	183.13	

Sl. No	Ref Para	Observations	Compliance to the Observations								
			P20	5.67	0.76	6.46	14.34	1.26	15.61	199.74	
			P21	5.67	0.76	6.46	15.05	1.24	16.29	215.14	50.78
			P22	5.67	0.76	6.40	15.81	1.41	17.21	232.35	
			P23	5.67	0.79	6.46	16.62	1.46	18.08	250.44	
			P24	5.67	0.79	6.46	17.43	1.55	18.98	269.40	
			P25	5.67	0.79	6.46	18.30	1.62	19.92	289.33	
			P26	5.67	0.79	6.46	19.21	1.71	20.92	310.26	32.4
			P27	5.67	0.79	6.46	20.17	1.80	21.97	332.23	
			P28	5.67	0.74	6.46	21.18	1.88	23.07	355.30	
			P29	5.67	0.73	6.40	22.24	1.98	24.22	379.52	
			P30	5.67	0.78	6.46	23.35	2.08	25.43	404.95	
			P31	5.67	0.76	6.46	24.52	2.19	26.71	431.66	32.60
			P32	5.67	0.73	6.46	25.75	2.29	28.04	459.70	
			P33	5.67	0.76	6.46	27.02	2.41	29.44	489.14	
			P34	5.67	0.76	6.46	28.36	2.53	30.91	520.06	
			P35	5.67	0.76	6.46	29.80	2.66	32.46	552.52	
			P36	5.67	0.76	6.40	31.28	2.79	34.08	586.60	118.75
			P37	5.67	0.79	6.46	32.85	2.93	35.79	622.39	
			P38	5.67	0.79	6.46	34.50	3.08	37.58	659.97	
			P39	5.67	0.79	6.46	36.23	3.23	38.46	699.42	
			P40	5.67	0.00	5.67	38.04		38.04	737.46	
			P41	5.67	0.00	5.67	39.94		39.94	777.40	117.98
			P42	5.67	0.00	5.67	41.94		41.94	819.34	
			P43	5.67	0.00	5.67	44.03		44.03	863.37	
			P44	5.67	0.00	5.67	46.24		46.24	909.61	
			P45	5.67	0.00	5.67	48.55		48.55	958.16	
			P46	5.67	0.00	5.67	50.98		50.98	1009.13	119.38
			P47	5.67	0.00	5.67	53.52		53.52	1062.65	
			P48	5.67	0.00	5.67	56.20		56.20	1118.85	
			P49	5.67	0.00	5.67	59.01		59.01	1177.87	

Sl. No	Ref Para	Observations	Compliance to the Observations

P50	5.67	0.00	5.67	61.90		67.57	1248.83	
P51	5.67	0.00	5.67	65.06		65.06	1204.89	275.34
P52	5.67	0.00	5.67	68.3		68.31	1373.20	
End of Mine Closure								361.34
Total Cost	285.02	23.53	318.55	1321.09	52.12	1373.20		1373.20

Note

- *The above estimated closure cost is based on WPI for 'All commodities' as on November '2015. The WPI value for 'All Commodities' as downloaded from website of Office of Economic Advisor is enclosed as* ***Annexure XX***
- *Escrow Account has already been opened for area of 4626 ha corresponding mine closure cost is Rs. 759.19 Crores. (Copy of Approval of Mine Closure Plan (MoC) is enclosed at Annexure-XIII and the copy of Approved Mine Closure Plan (Report) is enclosed at Annexure XIIA*

Sl. No	Ref Para	Observations	Compliance to the Observations
22	Chapter XI Para 11.4	Against 1907.73 Ha of agricultural land only 466 Ha of agricultural land has been proposed to be restored post mining, which is significantly low. The possibility of optimisation for the same should be explored.	In the present Revised Mining Plan and Mine Closure Plan (1st Revision), an effort has been made for the restoration of agricultural land to the maximum considering the practical difficulties at the time of Mine Closure. However, the possibility of enhancing the agricultural land shall be explored after availability of dump area and quantum of restoration/reclamation. All efforts shall be made to enhance it during the Final Mine Closure Operations.
23	Chapter XI Para 11.20	Bar Chart indicating Action Plan & manpower requirement for closure activities should be indicated for the life of the project plus 3 years.	Bar Chart for additional 3 years beyond 52 years of mine life is placed at Table 11.21 of Chapter XI. **Manpower Requirement for Closure Activities**

Sl No.	Activities to be undertaken	Manpower of NTPC	P-6	P-11	P-16	P-21	P-26	P-31	P-36	P-41	P-46	P-51	P-52	P-53	P-54	P-55
1	Mined Area & Waste Management															

Sl. No	Ref Para	Observations	Compliance to the Observations
	1.1	Plantation along the block boundary, embankment, approach road, CHP, Cross country conveyor, Railway siding etc. and around the Mine infrastructure area	Outsourced under the supervision of NTPC's Environmental Engineer, Surveyor & Chairman
	1.2	Physical reclamation of internal and external dump (Leveling, Spreading of top soil, Re-wall formation, drain etc.)	
	1.3	Physical reclamation of land of haller and haul road	
	1.4	Bio reclamation of above items	
	1.5	Making safe approach up to the water lagoon for future uses	

Sanjiv

SANJIV KUMAR SINGH

Sl. No	Ref Para	Observations	Compliance to the Observations		
			1.6	Barbed wire fencing as per requirement	
			2	Environmental Management (Air, Water, Waste, Noise etc.)	
			2.1	Thorough inspection of external and stabilized internal dumps to find state of its stabilization & Bio-reclamation	Supervisors 2 in each shift Environmental Engineer 1 in each shift
			2.2	Action to stabilize & vegetate uncovered patches if any	Job Outsourced
			2.3	Inspection of garland drains & bunds around external dumps to prevent leachate water from entering natural water courses directly	Supervisors-2 in each shift Mining Engineer-1 in each shift
			2.4	Inspection of embankment to prevent entry of uncontrolled water to mine	Supervisors-2 in each shift, Engineer-1 in each shift

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Pointwise Compliance to MoC's observation issued vide letter no. 34011/05/2015/CPAM(Pt) dated 28th December 2015 on Revised Mining Plan & Mine Closure Plan – 1st Revision of Pakri Barwadih Coal Block

Sl. No	Ref Para	Observations	Compliance to the Observations		
	2.5		Strengthening of embankment		
	2.6		Quarterly sampling of water to know its quality status	Lab Assistant-1, Helper-1	
	2.7		Record keeping monitoring and reporting	Surveyor-1 Chainman 3	
	3		**Management of Infrastructure & Mining Machineries**		
	3.1		Decommissioning of structurals & semi permanent constructions		
	3.2		Renovation of Mine/Project office Canteen Training Centre Rest shelter etc.	Job Outsourced Civil Engineer-1 Supervisor-1	
	3.3		Cleaning of land for vegetation over the area	Surveyor-1 Chainman-2	

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Pointwise Compliance to MoC's observation issued vide letter no. 34011/05/2015/CPAM(Pt) dated 28th December 2015 on Revised Mining Plan & Mine Closure Plan – 1st Revision of Pakri Barwadih Coal Block

Sl. No	Ref Para	Observations	Compliance to the Observations	
	3.4	Dismantling of machineries		
	4	Actions for safety & security of local community due to abandonment of the mine or part of the mine		
	4.1	Regular inspection of the mined out area O.B. dumps for assessing the closure job.	Supervisor-2 in each shift. Mining Engineer 1 in each shift	
	4.2	Action if required for making safe, the drainage areas, mine areas etc		
	4.3	Making 2 metre high pucca wall on the slope of internal dumps along the estimated water level	Supervisor-1 in each shift. Civil Engineer-1 in each shift	
	4.4	Making 2 meter high pucca wall around the top edge of the mined out area where immediate void exists at the quarry edge		
	2.5			

Sl. No.	Ref Para	Observations	Compliance to the Observations		
			Making 2 meter high pucca wall around the external OB Dump		
	4.6		Closing with walling and gates in the haul road to prevent accidental entry into water lagoon	Supervisor-1 in each shift	
	4.7		Filling the haul road up to ground level from surface up to sealing gate		
	4.8		Survey of the total project area for updating mine plans Under Coal Mine Regulation	Supervisor-2 in each shift Mining Engineer-1 in each shift	
	5		Social & Economic Aspects		
	5.1		C.S.R activities	Engineer-1 HR executive staff-2	
	6		Execution & Supervisor		
	6.1				

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Sl. No	Ref Para	Observations	Compliance to the Observations		
			Purchasing/Hiring of equipment for closure activities etc.		
			6.2 Execution & Supervision of the activities by mining personal	Mining Engineer-1 HR executive staff-2	
			7 Miscellaneous charges including power cost, deployment of security personal 3 years post closure environmental monitoring, supervision , power cost etc	Engineer-2 HR executive staff-2	
			8 Underground Mining		
			8.1 Sealing of Mine entries for UG mine		
			8.2 Isolation stopping if required		

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Sl. No	Ref Para	Observations	Compliance to the Observations
			9.3 Withdrawal of machinery etc. [redacted] 9.4 Subsidence Management [redacted] 9.5 Post closure Subsidence Monitoring [redacted] 9.6 Miscellaneous charges including power cost supervision etc [redacted]
24	Chapter XI Para 11.21	As per the Calendar plan of the project the balance life of the mine is 41 Year for OC working while in the assessment of escrow account balance life of 43 years has been considered. This needs to be reconciled. Further the WPI as on base date should be taken for	Refer submission at Para 21 of this reply. WPI for the month of November '2015 has been considered for the calculation of amount to be deposited in escrow account against Mine Closure WPI as on August'09 — 129.60 WPI as on base date " November'15" — 177.60

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Sl. No	Ref Para	Observations	Compliance to the Observations
		escalation of amount to be deposited in Escrow account	Escalation rate of Closure cost: 1.37 Rate of compounding of Annual Closure Cost: 5.00% Amount to be deposited into Escrow Account after compounding @ of 5% "Rs. in Crs": 1373.200

Particulars	UG	OC
Base Rate of Closure Cost "Rs. Crs./Ha"	0.010	0.060
Closure Cost "Rs. Crs/Ha"	0.014	0.082
Lease Area	1106.96	3588.04
Amount to be deposited into Escrow Account "Rs. in Crs"	52.120	1321.090
Amount already deposited into Escrow Account "Rs. in Crs"	0.000	0.000
Net Amount to be deposited into Escrow Account "Rs. in Crs"	52.120	1321.090
Balance Life of the project "in Yrs"	30	52
Annual Closure Cost	1.737	25.406

Sl. No	Ref Para	Observations	Compliance to the Observations
25	Sum 8 (a) & Chapter XI	***The Mine closure activities required to be taken should be in coherence with the guidelines of the Mine Closure plan and also indicative cost with the basis of calculation of the cost of mine closure activities needs to be envisaged***	The Mine closure activities are now as per the guidelines and have been accordingly elaborated Table No 11 22 in the Chapter XI The estimated total expenditure for Mine Closure Activities in Sum- 8 (a) has also been accordingly modified in view of the revised mine life Tentative assessment of activitywise closure cost is given in following table

Provision for Expenditure for Mine Closure of Pakri Barwadih Coal Mining Block

Amount in Rs. Crores

Sl No.	Activities to be undertaken	P-6	P-11	P-16	P-21	P-26	P-31	P-36	P-41	P-46	P-51	P-55	Cost
1	**Mined Area & Waste Management**	[illegible]	10.20	8.24	[illegible]	[illegible]	[illegible]	12.69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0.00	[illegible]	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Physical reclamation of [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0.00	[illegible]
[illegible]	Physical reclamation of land [illegible]	[illegible]	[illegible]	[illegible]	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] testing as per requirement	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sl. No	Ref Para	Observations	Compliance to the Observations

2	**Environmental Management (Air, Water, Waste, Noise etc.)**	2.87	[illegible]	18.13	[illegible]	28.65	[illegible]	45.16	[illegible]	[illegible]	[illegible]	[illegible]	**381.14**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Action to stabilise & vegetate exposed patches, if any	0.00	2.64	3.10	4.94	[illegible]	4.57	3.08	4.00	4.15	[illegible]	[illegible]	[illegible]
[illegible]	Inspection of garland drains & bunds around external dumps to prevent [illegible] water from entering natural water courses directly	[illegible]	[illegible]	3.30	4.94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.6[illegible]	[illegible]
[illegible]	Inspection of [illegible] to prevent entry of [illegible] water to mine	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]
[illegible]	Strengthening of embankment	0.00	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0.00	[illegible]	[illegible]	[illegible]
[illegible]	Quarterly sampling of water to know its quality status	[illegible]	0.00	8.24	0.00	8.40	0.00	[illegible]	0.00	[illegible]	0.00	[illegible]	[illegible]
[illegible]	Record keeping, monitoring and reporting	[illegible]	[illegible]	[illegible]	2.47	[illegible]	[illegible]	2.74	2.00	[illegible]	[illegible]	[illegible]	20.34
3	**Management of Infrastructure & Mining Machineries**	0.00	10.20	[illegible]	0.00	16.85	24.34	25.38	25.95	[illegible]	[illegible]	64.08	**253.81**
[illegible]	[illegible] of structures & semi permanent [illegible]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Renovation of Mine/Project office, Canteen, Training Centre, Rest [illegible] etc.	[illegible]	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]

Sl. No	Ref Para	Observations	Compliance to the Observations
		Actions for safety & security of local community due to abandonment of the mine or part of the mine	197.19

Sl. No	Ref Para	Observations	Compliance to the Observations												
1.4		Survey of the lease plant area to establish mine plans under Coal Mine Regulations	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5		**Social & Economic Aspects**	[illegible]	5.10	5.24	[illegible]	5.47	0.00	12.59	10.00	[illegible]	0.00	[illegible]	52.01	
5.1		CSR activities	[illegible]	5.10	5.24	[illegible]	5.47	0.00	12.59	10.00	[illegible]	0.00	[illegible]	[illegible]	
6		**Execution & Supervision**	0.00	0.00	0.00	0.00	0.00	12.17	0.00	[illegible]	5.59	[illegible]	0.00	89.70	
6.1		Purchasing Hiring of equipment tools & accessories etc	0.00	[illegible]	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]		Execution & Supervision of the activities by mining persons	[illegible]	[illegible]	0.00	0.00	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
7		**Miscellaneous Charges**	0.00	0.00	0.00	[illegible]	0.00	0.00	0.54	2.00	[illegible]	[illegible]	5.44	17.167	
7.1		Mine [illegible] charges including power [illegible] deployment of security personnel [illegible] [illegible] supervision power cost etc.	[illegible]	0.00	0.00	0.00	[illegible]	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]	[illegible]	
8		**Underground Mining**	0	0	0	0	0	0	6.3488	9.9973	20.772	45.156	144.81	229.09	
8.1		Sealing of Mine entries in UG mine	0.00	[illegible]	0.00	[illegible]	0.00	0.00	[illegible]	0.00	[illegible]	0.00	[illegible]	[illegible]	
8.2		Isolation stopping required	[illegible]	0.00	[illegible]	0.00	0.00	[illegible]	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
8.3		Withdrawal of machinery etc	[illegible]	0.00	[illegible]	[illegible]	0.00	[illegible]	[illegible]	0.00	[illegible]	0.00	[illegible]	[illegible]	
8.4		Subsidence Management	[illegible]	[illegible]	[illegible]	0.00	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

Sl. No	Ref Para	Observations	Compliance to the Observations
			[illegible]
			[illegible]
			Total estimated expenditure incurred (In Rs Crore) 25.05 32.64 44.48 60.78 72.47 92.50 118.06 147.96 174.58 225.34 361.34 1373.21
26	Sum 9 (a)	The base date of the mining plan should be considered for assessment of balance life balance reserve and WPI as on that date should be considered for assessment of balance life to be deposited annually in the Escrow Account while in this case the base date is August 2015 and WPI as on June 2015 has been considered for assessment of amount to be deposited in escrow account This needs to be corrected	The WPI is issued one month prior to the current month on the website of office of Economic Advisor GoI Accordingly the base date considered in this Revised Mining Plan and Mine Closure Plan(1st Revision) for Monthly Wholesale Price Index for 'All Commodities' is November 2015 while the base date of the this Revised Mining Plan and Mine Closure Plan(1st Revision) has been considered as January 2016 Available WPI figures are placed at Annexure-XX of Mining Plan
27	Chapter - XI	The Mine Closure plan should be in line with the Guideline for the formulation of MCP uploaded in MoC website Some of the parameter namely Para – 6 to Para	Mine Closure plan Chapter – XI has been prepared in line with guidelines issued by MoC and all the parameters have been considered including para 6 to 8 namely Financial Assurance. Responsibility of the Mine owners and Provision for Mine Closure The same is now elaborated in the Chapter XI

Sl. No	Ref Para	Observations	Compliance to the Observations
		-8 needs to be incorporated in the Mining Closure portion of the mining plan	–
28		Before dumping over the dip side coal bearing area of the block the opencast production potential of that area should be re examined	As per the available information seams occur at a depth of more than 300m in the dip side area and can be mined out by U/G method. The opencast potential would however be re-examined
29		As per the current guideline all projects of capacity more than 2.50 Mtpa should have integrated washery. This needs to be elaborated in the mining plan.	Coal washability study has not yet been carried out for Pakri Barwadih Coal. Coal quality parameters obtained from the proximate analysis of coal revealed that ash percentage in all probability is likely to remain 34% or below which does not call for commissioning of coal washery. However space provision is kept for providing a Coal Washery at mine end in future, if required.
30		Reserves locked below nala should be included in the extractable reserve and should be planned for mining	Reserves below the nala have now been included in the mineable/extractable reserves and has been envisaged for mining. This has enhanced the mine life from 41 years to 52 years
		Annexure	
31		Most of the Annexures attached are not legible. Ligible copies of the same should be attached.	Legible copies of Annexures are now enclosed
32	Annexure - III	Annexure – III shown in the list of Annexure in missing in the mining plan document	Annexure - III (Copy of approved Mine Closure Plan) is now attached.

Sl. No	Ref Para	Observations	Compliance to the Observations
33		A certificate required as per the guideline regarding confirmation from RQP that he has verified the block area with the relevant plans supplied by CMPDI/ SCCL / NLC and area covered by the mining plan does not encroach on any other coal lignite block needs to be attached. The lining of the certificate should be in line with the guideline	Certificate is attached at Annexure – XVI-C
34		A certificate required as per the guideline that the mine will be developed as per the approval of the mining plan from Ministry of coal and all other approvals as required will be obtained from relevant authorities issued by the empowered representative of / or Block allottee / applicant should be attached The lining of the certificate should be in line with the guideline	Certificate is attached at Annexure XVII
35		The lining of the Annexure – XVI C & XVI D should be exactly the same as required in the guideline for formulation of Mining plan	The lining of the Annexure – XVI C & XVI D are now as per the guideline for formulation of Mining Plan
36		Certificate of CMPDIL that the block boundary considered in the Mining Plan is in line with the Block	Certificate is attached at Annexure – XIX

Sl. No	Ref Para	Observations	Compliance to the Observations
		allocated to the project proponent is to be attached	
37		On the basis of CMPDIL certificate, a certificate of RQP is to be attached certifying that the block boundary considered in the mining plan is exactly in line with the certificate issued by CMPDIL	Certificate of RQP is attached at Annexure – XVI-C
		Plates	
38		Pre Mining Land use plan should be enclosed showing distinctly Private land, Govt Land & Forest land	Pre Mining Land use plan showing distinctly different types of land is shown as Plate No. 4
39	Plate 6	The plan indicates the lease boundary and block boundary. The Mine boundary in distinct colour should also be indicated in the plan	Plate No 6 is now Plate No 7 and has been modified indicating the Lease Boundary and Block boundary with distinct colours
40	Plate - 6	The Area to be explored prior to dumping and also for proving of reserve and also the block boundary should be demarcated in distinct colour	Geological Plan (Plate No 6) is now Plate No. 7 has been modified indicating the Area to be explored prior to dumping and also for proving of reserve with distinct colour.
41		Cadastral plan showing total lease Area and Mine Boundary	Cadastral plan (Plate No 3) showing total lease Area and Mine Boundary superimposed over mine boundary and marked with distinct colours is attached

Sl No	Ref Para	Observations	Compliance to the Observations
		superimposed over it, should be attached	
42		Conceptual plan showing infrastructure facilities including colony, boundary of mining area, mine entries roads including road diversion, nala diversion, river diversion alignment etc. should be attached	Infrastructure facilities including colony, boundary of mining area, mine entries roads including road diversion, nala diversion, river diversion alignment etc. have been shown in Surface Master Plan. The modified Surface Master Plan (Conceptual Plan) is attached
43		A plan showing top soil management should be attached	Location of Top soil dumps have been shown in respective stage plans. The detail has been explained in Chapter - V at para 5.4.9 and 5.5.10.2 regarding generation, spreading and its management.
44		Post Mining land use plan should be attached	Post Mining land use plan has been attached as Plate No 32
45	Plate - 36	It is apparent from the plan that the final void on the NW quarry will be left as water body while in the mining chapter it is indicated that the lower seams will be taken by Underground method of mining. Development of water body is likely to sterilise the lower un-worked seam this needs to be reconciled.	All seams of PB-NW quarry shall be mined by open cast method and no underground mining has been envisaged

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2.	Copy of Approved Mining Plan & MoC's letter approval of Mining Plan	Annexure –III & Annexure-IIIA
3.	Copy of letter for submission of Mining Plan for PB North-West (Sector-A)	Annexure --IV
4.	Copy of letter for submission of Mining Plan for PB East	Annexure - V
5.	Copy of MoC's letter for submission of Revised Mining Plan and Mine Closure Plan	Annexure - VI
6.	Copy of letter of submission of Revised Mining Plan (1st Revision) to MoC	Annexure - VII
7.	Copy of letter for commencement of Mining from PB East	Annexure - VIII
8.	Copy of MoC's letter for submission of Revised Mining Plan incorporating the changes in sequence of mining operation	Annexure -IX
9.	Copy of MoC's letter granting recognition to RQP for preparation of Mining Plan.	Annexure -X
10.	Copy of letter from CMPDIL& MECL for procurement of GR	Annexure –XI& Annexure-XIA
11.	No dues certificate from CMPDIL regarding Exploration cost	Annexure -XII
12.	Copy of approval letter of Mine Closure Plan & Approved Mine Closure Plan(Jan' 2012)	Annexure –XIII & Annexure - XIIIA
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LIST OF ABBREVIATIONS

Sl. No.	Abbreviation	Full Form
1.	AMSL	Above Mean Sea Level
2.	bgl	Below ground level
3.	BH	Bore hole
4.	CBA	Coal Bearing Area
5.	CMPDIL	Central Mine Planning Design Institute Limited
6.	CSM	Continuous Surface Miner
7	Cum/Mil. cum.	Cubic metre/ Million cubic metre
8	DGMS	Director General Mines Safety
9.	E&M	Electrical and Mechanical
10.	EIA	Environmental Impact Assessment
11.	EMP	Environmental Management Plan
12	FC	Fixed Carbon
13.	FE Loader	Front End Loader
14.	GCV	Gross calorific value
15.	GoI	Government of India
16.	GR	Geological Report
17.	GSI	Geological Survey of India
18	HEMM	Heavy Earth Moving Machinery
19	HFL	High Flood Level
20.	IB	Inter burden
21.	I.E.	Indian Electricity
22.	IMD	India Meteorological Department
23.	K. Cal/kg	Kilo Calorie per Kilogram
24.	KL/Kl	Kilo Litre
25.	L/l	Litre
26.	m/Km	Metre/Kilometre
27.	m^3/Mm^3	Cubic metre/Million cubic metre
28.	MBCM	Million Bank Cubic Metre
29.	MCP	Mine Closure Plan
30	MECL	Mineral Exploration Corporation Limited
31.	ML	Mining Lease
32.	mld	Million litre per day
33.	MoC	Ministry of Coal
34.	MoEF	Ministry of Environment and Forests
35	Mt	Million Tonne
36	Mtpa	Million Tonne Per Annum
37.	OB	Overburden
38.	OC	Opencast
39.	PA	Per Annum
40.	PB	Pakri Barwadih
41.	RH	Relative Humidity
42	RPM	Respirable Particulate Matter
43.	RQP	Recognised Qualified Person
44.	RoM	Run of Mine
45.	SC	Scheduled Caste

46.	SH	State Highway
47.	SPM	Suspended Particulate Matter
48.	ST	Scheduled Tribe
49.	Tt	Tonne
50.	TPD	Tonne Per Day
51.	TS	Topsoil
52.	UHV	Useful Heat Value
53.	UG	Underground
54.	VM	Volatile Matter

SUMMARISED DATA

KUMAR SINGH
Qualified Person
(15/2009 CPAM
Coal of India

Summarized Data

1. **General**

a) Name and address of the Applicant Company	NTPC Ltd. (Govt. of India Enterprises) NTPC Bhavan,Core-7, Scope Complex, 7 Institutional Area, Lodhi Road New Delhi-110003 Tel No. 011-24387333/24387000 Fax No 011-24361018
b) Name and address of block Allottee	As above
c) Relationship between Applicant and Allottee company	Both Applicant and allottee company are one and the same.
d) Status of the Applicant Company	Public Sector Undertaking(PSU)
e) Name of the Coal Block together with name of Coalfield & State where located	Block : Pakri Barwadih Coal Block Coalfield : North Karanpura Coalfield State : Jharkhand
f) Date of allotment	Date: 11.10.2004 Letter No.: 13016/29/2003-CA-I
g) End Use of Coal as per Approval	For generation of Power. A basket Linkage exists for this Block.
h) ROM quantity proposed to be produced as per Mining Plan	ROM Quantity: 503.38 Mt from West and East Quarry 138 96 Mt from NW Quarry Total = 642.34 Mt
i) Norms adopted for calculating ROM quantity requirement in case it differs from the quantity indicated in the Allotment Order	N A (Basket Linkage)
j) Beneficiation required Yes/No	No
k) Requirement of Beneficiated Coal & expected availability thereof	Not Applicable
l) Period for which Mining Lease has been granted for	Since land for mining area is being acquired by NTPC under CBA Act Mining Lease Not Applicable
m) Date of expiry of earlier Mining Lease, if any	Since land for mining area is being acquired by NTPC under CBA Act Mining Lease Not Applicable
n) RQP who has prepared the Mining Plan	
Name: Address:	**Mr. Sanjiv Kumar Singh** 4th Floor, Core-5, NTPC Ltd, Scope Complex,7 Institutional Area, Lodhi Road, New Delhi-110003
Phone Nos	(+91) 011- 24387669 (O), 0120-2400372 (R)

Mobile:	(+91) 9650991396
Fax. Email ID:	(+91) 011-24367089, sanjivkumarsingh01@ntpc.co.in
Registration No of RQP: Date of grant of RQP status: Renewal of RQP Status: Validity:	34011/(15)/2009-CPAM 27.09.2010 10 years from the date of issue

2. Information regarding earlier approved Mining Plan

a) Approval Letter no. and Date	13016/29/2003-CA-I, Dated 25th August 2006 (Refer Annexure-II
b) Lease Area	4626 ha (Project Area)
c) Date of grant of Lease	Since land for mining area is being acquired by NTPC under CBA Act. Mining Lease Not Applicable
d) Date of expiry of Lease	Since land for mining area is being acquired by NTPC under CBA Act. Mining Lease Not Applicable
e) Targeted Production	15Mtpa
f) Proposed year of start of Production	
g) Proposed year of achieving the targeted production level	12th year of Mine Operation
h) Envisaged life of mine (in years)	41 Years (Including two years of construction period)
i) Date of actual commencement of Mining Operation, if operation is already started	Production not yet started
j) Likely date of Mining Operations, if operations not yet started & reasons for non commencement of operations	Likely date of Mining Operation- .
k) Planned production and actual levels achieved in last 3 years	N/A
l) Coal:- OB-	Open cast: N/A OB: N/A
m) Reasons for difference between planned and actual production levels	Reasons for delay in starting of the project are as under: a) Delay in issuance of NoC on jungle jhari land by Distt Admininstration due to which Forest Clearance was delayed. b) Revision of evacuation corridor on advice of FAC, MoEF c) Delay in land acquisition: There was delay in physical verification & Certification of land records, disbursement of land compensation by Hazaribagh Distt. Administration took more time due to old /

	non availability of land records, inadequate State manpower at Distt/Block level, law & order problem etc.
	f) Non-performance by the earlier MDO. NTPC finally terminated the MDO contract wef 22.06.2014.
n) Reason for revision of Mining Plan	MoC directed to submit Revised Mining Plan (1st Revision) including Mine Closure Plan as a whole instead of in parts, vide letter F.No.13016/29/2003-CA-1 (Part) dated 24.06.2015
o) Details of changes in new Mining Plan compared to earlier approval	1 Comparison between Approved and Revised plan:

	Approved Plan	Revised Plan
Lease Area	4626 Ha	4695 Ha
Block boundary	same	
Production level	15Mtpa from 12th Year	18Mtpa from 12th Year
Reserves	West Quarry 311.71Mt East Quarry 191.68 Mt	West Quarry 311.71 Mt East Quarry 191.68 Mt NW Quarry (Sector-A) 105.80 Mt
Mining Technology	Shovel Dumper combination with inclined slicing for coal and intervening parting and horizontal slicing method for top OB benches	Shovel Dumper combination with inclined slicing for coal and intervening parting and horizontal slicing method for top OB benches
Land use pattern	Forest: 1105.92 Ha	Forest: 1787.00Ha Non-forest

		Non-forest. 3519.92 Ha	2908.00 Ha
	Coal Stockpile	Not provided	Stockpile which can cater to one week production of the West, East and NW Quarry is envisaged.

p. Reasons for change in Lease Area is given below:

	Approved Mining Plan	Revised Mining Plan	+/- (ha)	Reason
Block Area excluding Area 'A'	3943	3943		No Change
Area 'A'	384	485	101	Detailed survey of Area 'A' at the time of detailed exploration has indicated total area as 485 ha. Same has been notified under Section 7(i) of CBA.
Outside Block area (For OB Dumps and infrastructure)	299	267	-32	Decrease in area as per direction of restrictions of MoEF.
Total	**4626**	**4695**	**69**	

- The difference of 69 ha between the lease areas shown in the Approved Mining Plan and present Revised Mining Plan (Rev 1) is attributed to increase of 101 ha in Area 'A' after demarcation & measurement, and reduction by 32 ha of the area taken for external dumping and infrastructure.
- The revised area of PB-NW (Sector 'A') has been certified by CMPDI (enclosed as Annexure -XIX).

q. Reasons for change in Forest Area and Non-forest Area:

i) Updation/Correction of forest records and land re-classification by State Govt./forest department.

ii) Increase in the area of sector -A (North-western part of Pakri Barwadih) which consists majority of forest land.

Details of forest/non forest along with variation with respect to Approved Mining Plan area as follows:

	Approved Mining Plan	Revised Mining Plan	Increase (ha)	Decrease (ha)
Forest Land	1126	1787	661	
Agricultural & Residential Land	2675	2520		155
Govt. Non-forest Land	825	388		437
Total	**4626**	**4695**	**661**	**592**

3. Location

a) Location of the block Taluka/Village/Khasra/Plot/Block Range etc.	North-Eastern part of North Karanpura CF, bounded by longitudes 85°9'19" to 85°15' 0"E and latitude 23°51'30" to 23°55'40" Taluka- Barkagaon etc. Village- Pakri Barwadih, Nagari, Arhara, Chepakalan, Jugra etc.
b) Name of the Coalfield	North Karanpura Coalfield
c) Particulars of adjacent blocks: North, South, East, West	North- Protected Forest South- Badmahi River & Barkagaon R.F East- BarkagaonR F. West- Kerendari 'C' Block
d) Area of the Allotted Block (hectares)	i) Geological Block Area:4428.92 ha ii) Mining Block Area :4428.92 ha
e) Reference no. of Plan of block boundary issued by CMPDI	Drawing. No: RI/III/6/5827 plate No II March 2004 Refer Annexure - XII.
f) Whether the lease boundary is same as demarcated by CMPDI	Yes: The block boundary considered for mining is the same as provided by the CMPDI. However additional land has been envisaged and acquired for external dump and infrastructure such as Cross Country Conveyor, Railway Siding etc. outside the block boundary.
g) Existing mining Lease Area in case of existing mines	Not Applicable
h) Applied/required Lease Area as per the Mining Plan under consideration (hectares)	Lease is not applicable however required area is given below: Total Area =4695 Ha Block Area – 4428.92 Ha Outside Block Area = 266.08 Ha
i) Whether the applied lease area falls within the allotted block	The area includes total allotted block area demarcated by CMPDI and an additional area of 266.08 Ha.
j) Area (hectares) which falls outside the block/sub-block delineated by CMPDI	266.08 Ha.
k) Details of outside area:	

- whether forms part of any other coal block	No
- whether it contains any coal reserves	No, as the detailed review of Geological Plan (vide drawing No. R-III/G/6206) of GR prepared by CMPDI reveals that the incrop of lower most seam of Barakar Formation Seam-IB is within the block boundary and no mineable coal, by opencast method, extend beyond that incrop line. Hence the area marked for dumping and infrastructure near the North-eastern side of the block is considered to be non-coal bearing area.
-Purpose for which it is required	OB Dumps and Mine Infrastructure: 193.85 Ha Evacuation corridor & siding: 77.23 Ha
l) Whether some part(s) of the allotted block has not been applied for mining lease	No
-Total area in hectares of such part(s)	Not Applicable
-Total reserves in such part(s)	Not Applicable
-Brief reasoning for leaving such part(s)	Not Applicable

m) Type of land involved in Hectares

Lease Area

Sl. No	Class of land		Area in ha
1.	Forest		1787
2.	Non-Forest	Govt.	388
		Tenancy	2520
	Total		**4695**

n) Broad Land use Pattern

Pre Mining Land Use					
Sl. No.	Type		PB West &East	PB NW	Total of PB
1	Tenancy	Agricultural Habitation Grazing Barren	2731.48	176.52	2908.00
2	Govt. Non Forest	Agricultural Habitation Grazing Barren			
3	Forest	Forest	1479.52	307.48	1787.00
	Total		4210.00	485.00	4695.00

Land use Post Closure

Sl. No.	Type	PB West &East	PB NW	Total of PB
1	Water body	494.00	44.50	501.50
2	Plantation	2844.00	290.00	3130.00
3	Road	2.00	8.00	10.00
4	Grazing	223.00	24.00	247.00
5	Agricultural	524	76	600.00
6	Public Use	105	47	152.00
7	Barren	44	3	25.00
8	For UG Mine	18.00	2.00	18.00
	Total	4210.00	485.00	4695.00

o) Proximity of public road/ railway line/ major water body if any and approximate distance	The entire block falls in the Hazaribagh district of Jharkhand State. The Hazaribagh – Khalari – Ranchi State highway passes through the eastern part of the block touching Barkagaon and Tandwa Villages. The nearest township is Hazaribagh located at a distance of around 25 kms from Barkagaon in the northern part of the block. The nearest rail stations are Ranchi Road of SE Railway around 70- 75 kms from the block. There are a number of seasonal streams/ nullah traversing the block and the prominent ones are Dumuhan, Hardara and Khora etc. flowing roughly north to south and carry huge load during rainy seasons. None of them are perennial in nature. They discharge their load into the Badmahi River flowing further south of the block which one of the important tributaries of the mighty Damodar River is flowing west to east in southern part of the North Karanpura Coalfield.
p) Toposheet No. with Latitude and Longitude	The block is covered by the Survey of India Toposheet No. 73 E/1 (RF 1:50,000) and special sheet no. 21, 23 & 24 on R.F. 1:10000. It is bounded by longitude 85°09'19" to 85°15'00"E and latitude 23°51'30" to 23°55'40"N.

4. Geology and Exploration

a) Name of the Geological Block	Pakri-Barwadih Coal Block located in the north eastern part of North Karanpura coal field bounded by longitudes 85° 09' 19" to

and area in hectare	85°15'00" N and latitude 23° 51' 30" to 23° 55' 40" E covered by the Survey of India Toposheet no. 73E/1 (R.F 1: 50000) and special sheets no. 21, 23 & 24 on R.F. 1:10000 is located in the state of Jharkhand and is around 120-130 km from the state capital Ranchi.
b) Name of the Geological Report (GR) with year of preparation	Two Geological Reports are available namely: a. Geological Report on Coal Exploration Pakri-Barwadih Block (Non-CIL captive block) North Karanpura Coal Field, Dist. Hazaribagh, Jharkhand; prepared in March 2005. b. Geological Report on Detailed Exploration for Coal Pakri Barwadih North West (Area - A Block), North Karanpura Coal Field, Dist. Hazaribagh, Jharkhand (State) October 2012.
c) Name of the agency which conducted the exploration and prepared GR	Two agencies were involved namely: a CMPDI for total PB Block except Area "A", North West part of Pakri Barwadih b. MECL for Area "A", North West part of Pakri Barwadih
d) Period of conducting exploration	Exploration by CMPDI was conducted in two phases: 1st Phase- 1999-01 2nd Phase- 2003-04 Exploration by MECL was conducted for PB "A" area: 2006-2012
e) Details of drilling by all agencies (Coring and Non-coring)	

Agency/ Type	Period of Drilling	Drilling	
		No. of Boreholes	Meterage
1 GSI / Regional	1961 to 1971	KB-1 to 26 (26 BHs)	8177.23
2. CMPDI			
a) Promotional (Semi-regional)	Dec 1999 to April 2001	CMKPB-1 to 38 (38 BHs)	10482.00

2) Non-CIL (detail drilling)	Jan., 2003 to June 2004	CNPB-1 to 135 (135 BHS)	21943.60
Sub -Total		**199**	**43602.83**
3 MECL for PB A	2006 to 2012	MNPB-1 to MNPB-1 (33 BHs)	4282.70
Total (1, 2 & 3)		**232**	**47885.53**

f) No. of Boreholes drilled within the block	196 BHs in PB 33 BHs in Area A (MECL) 03 BHs in Area A(CMPDIL) Total 232 BHs
g) Overall density within the block (no. /sq. km)	10 BHs/ sq. Km in Proved Reserve Area and 1 BHs/sq. km in Indicated Reserve area

h) Area covered by detailed exploration within the block (hectares)

Sl. No.	Area/Type	Area in Ha.
1	PB West and East (Explored)	1774.6
2	PB NW (Explored)	485.00
3	Regionally explored	2169.32
4	Outside Block Boundary	266.08
	Total Area	**4695.00**

i) Area covered by detailed exploration outside the block (hectares)	N/A
i) No. of boreholes drilled outside the block	*5 Boreholes in the area PB- A*
ii) Borehole density for outside area (no./sq. Km)	NA
j) Whether entire lease area is covered by 'detailed'	No

exploration

k) Further Exploration with timeframe (Tentative)

A. Exploratory drilling for no coal zone proving

The infrastructure facilities and external waste dumping areas (Dump-A and B) as shown in Plate No. 4 have been selected beyond the incrop of Seam-I Bottom as indicated in the GR. CMPDIL drilled eight boreholes in this area. Karharbari seams are encountered in 7 boreholes , however these seams are erratic and impersistent in nature and lacks opencast potentiality. No attempts were made to estimate the reserves however. If required negative probing boreholes will be drilled before starting of OB Dumping.

Period	No. of Bhs.	Location	Target
Pre-construction	30 (approx.)	Infrastructure sites and external waste dumps A & B	Negative proving of workable coal seams.

B. Exploratory drilling for production support

In order to delineate the incrop of Seam-I & II and support the production requirement as per stage plan, phase-wise exploration through core drilling in different sectors of the block have been proposed below:

Period	No. of BH	Location	Estimated meterage
Development	15	Bet. F14& Seam-IBottom incrop Bet F13 & F14 Bet F8 & F9	750
Production 1st year	15	Bet F12 & F13 Bet F10 & F11 Bet F7 & F8	1500
Production 2nd year	15	Bet F12 & F13 BetF11 & F 12 Bet F9 & F10	1500
Production 3rd Year	12	Bet F8 & F10 Bet F7 & F8	1500

Production 4th year	12	Bet F5 & F6	2200
		Bet F7 & F8	

C. **Exploration for area beyond 300m depth line**

The southern portion of the Pakri-Barwadih Block covering around 12 sq. km. area has also not been explored in details and only " indicated" category reserves of the order of 733.2 Mt are provisionally assessed by CMPDI. Therefore a detailed exploration programme has been proposed to convert the indicated reserve into proved category and to develop underground mine plan. This is detailed below:

i. Detailed exploration is to be carried out in this area, involving drilling of 55000-60000 m. as estimated by CMPDI.
ii. As per approved Mining Plan, 45000 m of drilling over 4 years in 12 sq. km area was indicated.
iii. Exploration in this area to be taken up in the 1st production year and completed in 4th Years.

I) i) No of Coal horizons	Barakar : 5 persistent coaly horizons Karharbari: 5 thin coaly horizons Local : 1 coaly horizon
ii) thickness range of coal seam	The five Barakar coal seams are splitted into several sections
iii) mean thickness of total coal horizon	Maximum thickness of individual seam–28 67 m, Seam II Comb (CNPB 32). Minimum thickness of individual seam- 0.05 m, Seam K – 2 (CNPB 124).
iii) Standard Deviation of the thickness	SD of individual coal seam thicknesses ranges from 0.35 - 10.2. Mean of thicknesses of total coal seams is >35 m
Minimum and Maximum depth of intersection of roof of the coal seam	Maximum : 304.30m (Seam K - 3) Minimum : 11.50 m (Seam II Top)

m) Gross Calorific Value (GCV in K Cal/ Kg) of Coal as per GR and Useful Heat Value (UHV in K. cal/ Kg), of coal as per GR:	GCV: Ranges from 2491 **(G-16)** to 6280 **(G-4)** Mean: 4385.5 **(G-10)**
Range	UHV: Ranges from 1368 to 5657
Mean	Mean: 3512.5
n) Quality (Grade) of coal as per GR	The range of Grade varies from B to G. The proved reserve fall mostly in D-F grade. (As per GR prepared by CMPDI).As per the average GCV, the grade of **West & East Quarry- G-10** **North West Quarry- G-8.**
o) Total Geological Reserves in the block (as per GR)	

Geological/Mineable Reserves of Pakri Barwadih

million tonnes

S.L.No.	Reserves*	PB-West & East	PB-NW	Total
1	Net Geological	1436	137.6	1573.6
2	Amenable for Open Cast	707	121.03	828.03
3	Amenable for Underground	729	0	729
4	Mineable	503.39	138.98**	642.34

** Reserves up to 300m depth have been considered for opencast mining.*
***33.18 Mt of coal shall be mined as Barrier& Batter Coal between PBW & PB-NW.*

Net reserves and extractable reserves and losses

(in Mt.)

Seam	Net Reserve	Barrier Loss	Batter Loss	Mineable Reserves	Mining Loss	Extractable Reserve	% Extraction
V Top	22.20	0.72	1.57	19.99	0.59	19.40	87.06
V Bottom	15.56	0.51	1.10	13.96	0.41	13.55	87.06
V Combined	11.57	0.23	0.49	10.87	0.44	10.43	90.16
Seam V	**49.42**	**1.44**	**3.16**	**44.82**	**1.44**	**43.38**	**87.78**
IV Top	19.82	0.54	2.23	16.95	0.50	16.46	83.01

IV Bottom	4.92	0.32	1.12	5.48	0.15	5.23	85.01
IV Combined	92.32	3.25	10.68	78.39	3.03	76.06	82.39
Seam - IV	**122.06**	**4.10**	**14.03**	**103.93**	**3.18**	**100.75**	**82.54**
III Top	27.45	1.21	2.01	24.20	0.70	23.49	85.59
III Bottom	9.83	0.43	0.73	8.66	0.25	8.41	85.59
III Combined	4.80	0.21	0.36	4.23	0.12	4.11	85.59
Seam - III	**42.08**	**1.85**	**3.13**	**37.10**	**1.08**	**36.02**	**85.59**
II Top	59.98	4.66	6.21	49.11	1.89	47.22	78.72
II Middle	139.75	11.83	11.24	116.68	3.83	112.86	80.75
II UM	76.09	7.28	5.63	63.18	1.77	61.40	80.76
II Bottom	126.05	10.76	9.90	95.39	2.89	92.50	79.21
II MB	17.61	1.71	1.32	14.56	0.42	14.44	80.70
II Combined	7.35	0.70	0.54	6.11	0.13	5.94	80.90
Seam-II	**417.13**	**36.95**	**34.85**	**345.33**	**10.97**	**334.36**	**80.16**
I Top	36.93	2.72	9.39	24.81	0.77	24.05	65.11
I Middle	72.91	5.27	18.20	49.49	1.66	47.84	65.56
I UM	2.51	0.23	0.39	1.49	0.04	1.45	57.80
I Bottom	35.60	2.32	8.69	24.39	0.52	23.87	67.06
I MB	14.85	1.35	4.67	8.83	0.24	8.58	57.80
I Combined	3.58	0.33	1.13	2.13	0.06	2.07	57.80
Seam- I	**166.44**	**12.42**	**42.88**	**111.14**	**3.28**	**107.86**	**64.81**
L1	2.60	0.10	0.35	2.15	0.11	2.04	78.62
K5	0.13	0.01	0.06	0.06	0.01	0.05	36.32
K4	1.24	0.13	1.11	2.97	0.11	2.86	67.83
K3	3.34	0.22	0.86	2.26	0.06	2.20	65.95
K2	5.38	0.27	1.14	3.97	0.07	3.90	72.40
K1	15.24	1.25	4.65	9.14	0.41	8.93	58.62
Seam-Local	**30.90**	**1.98**	**8.17**	**20.75**	**0.77**	**19.98**	**64.66**
Total	**828.03**	**58.74**	**106.22**	**663.07**	**20.72**	**642.35**	**77.58**

p) Depletion of reserves (in case of running mine)	Not applicable
q) Additional Reserves (in case of running mine)	Not applicable

r) Geological Reserves considered for mining	**PB** West & East: By opencast: 707.67 Mt (as per CMPDI GR).This is Net geological reserves from Seam-I to V and seam K-1 to K-5, including both proved and indicated reserves upto 300 m depth. PB North West: By opencast:137.584Mt (as per MECL GR).This is Net geological reserves from Seam-I to V, including both proved and indicated reserves upto 300 m depth.
s) Corresponding Extractable Reserve	**PB-East and West:** Open cast mineable reserve 503.38 Mt **PB-North West:** Open cast mineable reserve 138.96 Mt Total **642.34 Mt.**
t) Percentage Recovery w.r.t geological reserves	**Percentage Recovery w.r.t proved geological reserves:** Overall: 78%

5. Mining

a) Existing and Proposed method of mining Opencast Underground	Shovel dumper combination system with horizontal slicing pattern would be adopted in mining mass i.e. OB, coal and intervening parting. Bord and Pillar and Blasting gallery (which is a variation of Bord and Pillar) methods for this property.
b) The peak capacity as well in addition to targeted capacity in Mtpa when mine is fully developed and the year in which proposed to be achieved	Opencast: Targeted Capacity-18Mtpa Year of Achieving:12th
c) Life of mine Overall	- 52 Years - 27 years for West Quarry -15 years for East Quarry. -39 years overall for PB

	West and East (3 year overlapping period for East and West Quarries).
	52 years PB- A Quarry
Opencast workings :	All workings are Opencast
d) Quantum of production and expected grade:	642.34 Mt. **G-10**

e) Conceptual Calendar Program

Yr	Opencast Production Mt	OB (Mcum)	Stripping Ratio (Mcum/t)	ROM Coal (Mt)	Beneficiated Coal (Mt)	Washery rejects (Mt)
1	3.14	8.89	2.83	3.14	Not applicable	Not applicable
2	6.27	18.32	2.92	6.27		
12	18	52.20	2.90	18		
35	18	77.44	4.30	18		
52	1.46	1.48	1.01	1.46		
Conceptual	642.34	2536.75	3.95	**642.34**		

Dump C has been planned over the area where the coal is beyond 300 m depth line and thus suitable for exploitation by underground means. As such no coal shall get sterilized due to Dump C.

Dump D has been planned for PB East on non opencastable area where quarriable potential is not indicated in the GR.

f) Whether negative proving for coal in the proposed site for OB dump/ infrastructure has been done.	The infrastructure facilities and external waste dumping area (A, B) has been selected beyond the incrop of Seam-I Bottom as indicated in GR. CMPDIL drilled eight boreholes in this area. Karharbari seams are encountered in 7 boreholes, however these seams are erratic and impersistent in nature and lacks opencast potentiality. No attempts were made to estimate the reserves however, if required negative probing boreholes will be drilled before starting of OB Dumping. Incase any quarriable patch is found, the same will be mined before starting waste dumping. If deeper seams (viz. Karharbari group seams K1 to K5) are found during the negative proving of this area, such seams will be extracted by underground mining.

g) Proposed configuration of HEMM for OC (Coal and OB)

PB-West & East Quarry

Equipment	Open cast	
	OB	Coal/Parting
Shovel	20m³	8.3 m3
Dumper	170/190T	100/120 T
Drill	250 mm	160mm
Dozer	410 HP	410 HP

PB- NW Quarry

Equipment	Open cast	
	OB	Coal
Shovel	10 m³	5.5 m3
Dumper	100T	60 T
Drill	250 mm	160mm
Dozer	410 HP	410 HP

h) Mode of entry for Underground mines: Vertical Shaft

i) Operations that are proposed to be outsourced: As on date, an entire operation of Pakri Barwadih Coal Project will be outsourced.

j) Proposed coal evacuation facilities

Face to Surface: Excavator and dumper system for extracting coal and dumping the same at ROM pad and after primary crushing transporting it to Stockpile by Conveyor belts

Surface to end-use plants: By combination of Cross Country Conveyor and Railways for end-use plants

6. End-use of Coal

a) Capacity of the Basket linkage

approved end use plants and b) Coal required for end-use plant with grade	
c) %age of end use requirement to be met from this mine	Basket Linkage
d) If washing/beneficiation of the coal is planned to be conducted on site or adjacent to the extraction area	Coal washability study has not yet been carried out for Pakri Barwadih Coal. Coal quality parameters obtained from the proximate analysis of coal revealed that ash percentage in all probability is likely to remain 34% or below which does not call for commissioning of coal washery. However to cater for more stringent future quality stipulations, space allocation is earmarked for commissioning of Coal Washery at mine end to facilitate transport of washed coal to the power plants as per qualitative requirements.
e) Proposed use of Rejects/Middling	Not applicable

7. **Environmental Management**

a) Land area indicating the area likely to be degraded due to mining, dumping, roads, workshop, washery, township etc.

Type	PB West &East	PB NW	Total of PB
Mining Area	1600.00	382.00	1982.00
	0.00	0.00	0.00
Barrier zone	8.97	1.03	10.00
Proposed road on North side	12.55	1.45	14.00
Area under Nala/ River	45.00	25.00	70.00
External dump	825.76	14.45	840.21
Top soil dump	40.00	7.14	47.14
Settling pond	10.76	1.24	12.00
Infrastructure area	273.50	4.85	278.35
Rationalisation /Unutilized area	823.46	47.84	871.30
Area for UG *	570.00	0.00	570.00
Total	4210.00	485.00	4695.00

b) Existing land use pattern

Sl. No.	Class of land		Area in ha
1	Forest		1787
2	Non-forest	Govt.	388
		Private Land	2520
		Total	**4695**

c) Surface features over the block area: Refer to Plate No.-5

d) No. of villages/ houses to be shifted

S. No.	Name of Village	House Hold to be shifted (No's)
1	Arahara	242
2	Dadikalan	663
3	Chepakalan	460
4	Jugra	398
5	Lakura(P)	59
6	Itiz	125
7	Chirudih	10
8	Nagadi	261
9	Pakri-Barwadih	331
10	Urub	115
11	Deoria Khurd(P)	184
12	Churchu	254
13	Sonbarsa	242
14	Sinduari	228
15	Chepakhurd	278
16	Keri(P)	93
17	Langatu(P)	462
18	Barkagaon(P)	126
19	Deorikalan(P)	195
20	Sirma	17
21	Nawadih(P)	10
22	Basaria	22
23	Kandaber(P)	178
24	Jabra	8
25	Beltu(P)	6
26	Bariatu(P)	11

e) Population to be affected by the Project: 8339 Nos.

f) Year wise proposal for reclamation of land affected by mining

The table below shows the year wise proposal of reclamation of land

Yearly Details of reclamation of land

(West Quarry , East Quarry & NW Quarry)

Year	Dump Stabilization & Vegetation (Ha)
First Year Stage	-
3rd year Stage	19
5th year Stage	64
10th year Stage	177
20th year Stage	389
30th year Stage	557
40th year Stage	617
Final Stage	334

g) Monitoring schedules for different environmental components after the commencement of mining and other related activitres

The full-time environmental staff will conduct routine field monitoring and reporting to provide a close supervision on the surrounding natural environment and provide early warnings of any adverse changes that may be related to some dimension of the mining and allied operations. The schedule, duration and parameters to be monitored are shown in the following table.

Sl. No	Description of Parameters	Schedule and Duration of Monitoring
1	Slope Failure	Bi-Weekly
2	Land Erosion	Weekly
3	Drainage	Daily
4	Blasting effect	As per mine workings and blasting
5	Re-vegetation and Green belt development	Yearly
6	Monitor Plantation Measures	Yearly
7	Surface Subsidence	Bi-Weekly

8	Water Quality Monitoring(Ground & Surface) Water quality of Surface and ground water around the site (All parameters specified by JSPCB)	Monthly
9	Emissions and Air Quality (RPM,SO_2, NO_x,CO)	24 hourly samples with analysis carried out monthly all-round the year
10	Meteorological Station	Continuous
11	Air Quality	Continuous
12	Noise Quality	Continuous
11	Occupational Health	Bi-Weekly

8. Mine Closure Plan

a) Estimated total capital expenditure for Mine closure activities: Rs. 318.55 Crores(current cost)

b) Major closure Activities with proposed Capital Expenditure

Activities to be undertaken	Total (Rs.) in Cr
Total closure cost for opencast mine (compounding @ 5% escalation)	1321.08
Total closure cost for underground mine (compounding @ 5% escalation)	52.12
Total closure cost for Pakri Barwadih Mine	1373.20

9. Others

a) Base date of Mining Plan	November 2015
b) Calendar year from which the production will start from the zero date i.e. date of approval of mining plan.	2016
c) Results of any investigation carried out for scientific mining, conservation of minerals and protection of environment: future proposals	NA
d) Signature of RQP	

Date :

Place :

CHAPTER I

INTRODUCTION

CHAPTER I

INTRODUCTION

1.1 Overview

The Pakri Barwadih Coal Block is located in North Karanpura Coalfields in Hazaribagh district of Jharkhand state. The block has been allocated to NTPC Ltd., for captive mining for supply of coal to their super thermal power stations by Ministry of coal, Government of India vide letter no. 13016/29/2003-CA, New Delhi, dated 11th Oct 2004 & DO No.13016/29/2003-CA dated 24th August 2005 for a total area of 46.26 sq km. Copy of letter enclosed as **Annexure-I** and **Annexure-II.**

1.2 Background of NTPC Ltd.

The company was incorporated on 7th November, 1975 under the Companies Act, essentially to promote power generation in the Country. Subsequently, the name of the Company was changed to its present name NTPC Limited and a fresh certificate of incorporation was issued on October 28, 2005. The name of the Company was changed to reflect the diversification of business operations beyond thermal power generation to include, among others, generation of power from hydro, nuclear and renewable energy and undertaking coal mining and oil exploration activities.

The Company is not operating under any injunction or restraining order.

1.3 Installed Capacity of NTPC

Present installed capacity of NTPC is 45,548 MW (including 6,196 MW through JVs) comprising of 41 NTPC Stations (18 Coal based stations, 7 combined cycle gas/liquid fuel based stations, 1 Hydro based station), 7 Joint Venture stations (6 coal based and one gas based) and 8 renewable energy projects. Installed Capacity of NTPC is given in **Table 1.1**. Regional Spread of Generating Facilities is given in **Table 1.2.**

TABLE 1.1

Installed Capacity of NTPC

Sl.No.	NO. OF PLANTS	CAPACITY (MW)
NTPC Owned		
Coal	18	34,425
Gas/Liquid Fuel	7	4,017
Hydro	1	800
Renewable energy projects	8	110
Total	34	38,602
Owned By JVs		
Coal & Gas	7	6,196
Total	**41**	**45,548**

TABLE 1.2

Regional Spread of Generating Facilities

REGION	COAL	GAS/Liquid	Renewable	TOTAL
Northern	9,515	2,344	35	11,894
Western	10,840	1,313	50	12,203
Southern	4,600	360	10	4,970
Eastern	9,470	-	10	9,480
Islands	-	-	5	5
Hydro	-	-	-	800
JVs	4,229	1,967	-	6,196
Total	**37,904**	**5,984**	**110**	**45,548**

1.3.1 Coal Based of end-use plants:

With 18 coal based power stations, NTPC is the largest thermal power generating company in the country. The company has a coal based installed capacity of 34,425 MW. **Table 1.3** shows the existing power plants of NTPC with location and capacity.

Location of coal based end-use plants with capacity along with the installed capacity and the Coal Based Joint Ventures of NTPC is given in **Table 1.3 & 1.4** respectively.

TABLE 1.3

LOCATION OF END USE PLANTS

(Coal Based and Under Commercial Operation)

Sl. No.	COAL BASED STATION	STATE	COMMISSIONED CAPACITY(MW)
1	Singrauli	Uttar Pradesh	2,000
2	Korba	Chhattisgarh	2,600
3	Ramagundam	Telangana	2,600
4	Farakka	West Bengal	2,100
5	Vindhyachal	Madhya Pradesh	4,760
6	Rihand	Uttar Pradesh	3000
7	Kahalgaon	Bihar	2,340
8	Dadri	Uttar Pradesh	1,820
9	Talcher Kaniha	Odisha	3,000
10	Feroze Gandhi, Unchahar	Uttar Pradesh	1,050
11	Talcher Thermal	Odisha	460
12	Simhadri	Andhra Pradesh	2,000
13	Tanda	Uttar Pradesh	440
14	Badarpur	Delhi	705
15	Sipat	Chhattisgarh	2,980
16	Mouda	Maharashtra	1000
17	Barh	Bihar	1320
18	Bongiagaon	Assam	250
	Total Installed Capacity		**34,425**

TABLE 1.4

COAL BASED JOINT VENTURES

SL. NO	COAL BASED (Owned by JVs)	STATE	COMMISSIONED CAPACITY (MW)
1.	Durgapur	West Bengal	120
2	Rourkela	Orissa	120
3	Bhilai	Chhattisgarh	574
4	Kanti	Bihar	415
5	IGSTPP, Jhajjar	Haryana	1500
6	Vallur	Tamil Nadu	1500
	Total		4,229

1.3.2 Projects Under Implementation and Future Capacity Addition:

NTPC, India's largest power company, was set up in 1975. Present installed capacity is 45048 MW and additional 23504 MW(capacity is under construction. To realise the vision of becoming a world class power major, NTPC has plans to become 128000 MW company by 2032. Projects under implementation is given in **Table 1.5**. Capacity addition path is given in **Fig-1.1.**

TABLE 1.5

PROJECTS UNDER IMPLEMENTATION (Coal Based Thermal)

UNDER CONSTRUCTION	
COAL STAND ALONE	
BARH-I	1980
BONGAIGAON	500
VINDHYACHAL-V	500
KUDGI-I	2400
MAUDA-II	1320
SOLAPUR	1320
LARA-I	1600
GADARWARA	1600
UNCHAHAR-IV	500
DARLIPALI	1600
NORTH KARANPURA	1980
TANDA-II	1320
KHARGONE	1320
TOTAL	17940
SUBSIDIARY/JVs	
NABINAGAR (BRBCL)	1000

KANTI-II (KBUNL)	195
MEJA (MUNPL)	1320
NABINAGAR (NPGCPL)	1980
TOTAL	4495
TOTAL COAL	22435
HYDRO	
TAPOVAN VISHNUGAD	520
LATA TAPOVAN	171
RAMMAM	120
TOTAL HYDRO	811
RENEWABLE	
SINGRAULI HYDRO	8
AP SOLAR PV	250
TOTAL RE	258
GROUP TOTAL	23504

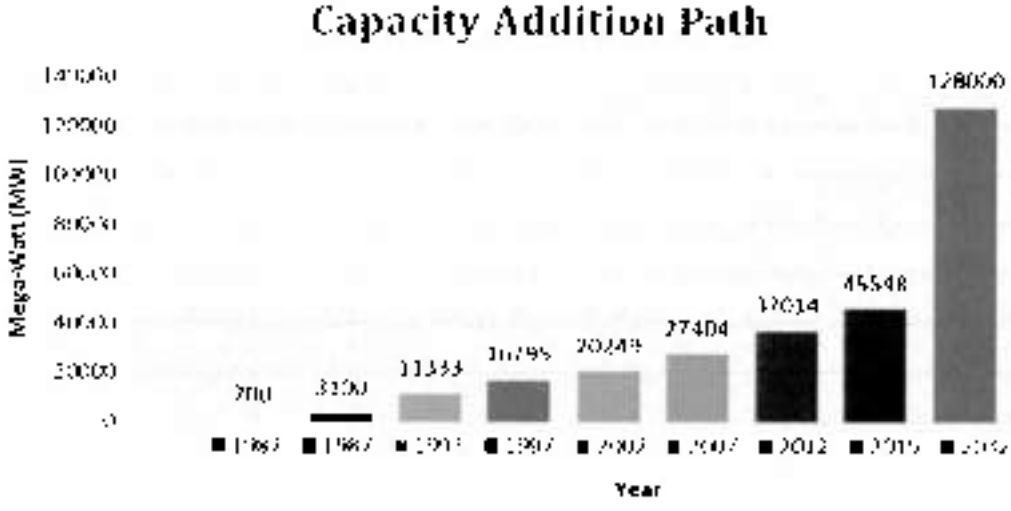

Fig 1.1.

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011/(15)/2009-CPAM
Ministry of Coal, Govt. of India

1.4 Coal Mining in Pakri Barwadih Block

Due to increase in plant load factor and future expansion program of NTPC, the gap between demand and supply of coal is continuously increasing. To elaborate it further, the existing power stations had been accorded with long-

term coal linkages on the then prevalent norms of Plant Load Factor (PLF), whereas as per Government norms these power stations are now required to perform at much higher level (>90%), as a result was foreseen that the gap between demand and availability of fuel would further increase. In addition to the above NTPC has ambitious plans for capacity augmentation as explained in **Table 1.5**. Considering the above, NTPC decided to diversify in the coal mining through backward integration. In this regard, Board of Director of NTPC modified its 'Memorandum of Association & Articles of Association' to accommodate the activities of Coal Mining from the fuel security point of view.

NTPC intends to work the entire property of allocated Pakri Barwadih block by mining of coal in scientific manner optimally with due regard to conservation, safety and environmental protection to enable NTPC to partly reduce the gap of demand and supply to NTPC power plants as indicated

Geological/Mineable Reserves of Pakri Barwadih are given in **Table: 1.6**.

TABLE 1.6

Geological/Mineable Reserves of Pakri Barwadih

million tonnes

Sl. No.	Reserves*	PB-West & East	PB-NW	Total
1	Net Geological	1436	137.6	1573.6
2	Amenable for Open Cast	707	121.03	828.03
3	Amenable for Underground	729	0	729
4	Mineable	503.39	138.95**	642.34

** Reserves up to 300m depth have been considered for opencast mining*

***33.18 Mt of coal shall be mined as Barren& Batter Coal between PBW & PB-NW.*

1.5 Revision of Mining Plan

1.5.1 Mining Plan of Pakri Barwadih

Mining plan of Pakri Barwadih coal block which covered mining of Western and Eastern Area of the block, has been approved by MoC vide letter no.13016/29/2003/CA – I dated 26.08.2006 **(Copy enclosed as Annexure-IIIA)**. North Western pan (Sector – A) was not covered as it was unexplored. Copy of letter enclosed as

1.5.2 Mining Plan of Pakri Barwadih North West Quarry (Sector-A)

As already explained at that time of preparation of Mining Plan for the Pakri Barwadih Block the present area on the north western side of the block, now referred to as "**Sector– A**" was not explored. In the Approved Mining Plan NTPC had committed to carry out a detailed exploration of the area and submit a separate Mining Plan within six (6) months of the preparation of the GR. As per the commitment, detailed exploration was carried out and "Geological report (GR) of Sector- A was submitted by MECL in October 2012.

As per the commitment given by NTPC a separate Mining Plan of North West part (Sector-A) of capacity 3 MTPA was prepared and submitted to MoC on 02.07.2013. Geological reserves are 137.584 Mt. out of which Opencast mineable reserves were envisaged to be 106.688 Mt and the underground reserves are 30.896 Mt. Copy of letter enclosed as **Annexure-IV.**

1.5.3 Mining Plan of Pakri Barwadih-East

In order to augment the coal production from Pakri Barwadih block NTPC proposed to simultaneously commence production from Eastern Part of the block. Mining Plan of East Quarry of Pakri Barwadih with production potential of 7 MTPA was prepared and submitted to MoC on 27.08.2013 for consideration of Standing Committee. Copy of letter enclosed as **Annexure-V.**

1.5.4 Revision of Mining Plan

Ministry of Coal vide its letter .No 13016/29/2003-CA-I(Part) dated 9th October 2014 advised NTPC to submit a Revised Mining Plan (1st Revision) including Mine Closure Plan as a whole instead of in parts. Copy of letter enclosed as **Annexure-VI.** NTPC vide letter no. CC: CM: ENGG: 7010: MP: 8 dated 03.04.2015 submitted Revised Mining Plan (1st Revision) to MoC for consideration. Copy of letter enclosed as **Annexure-VII.**

1.5.5 Present Revision of Mining Plan

To ward off the delay in commencement of mining operation NTPC decided to start up Eastern Quarry and run for a period of two years in the interim period till appointment of Mine Developer cum Operator (MDO) for commencement of mining operations from Western Quarry. NTPC informed its intentions to MoC vide letter No. CC:PEM:7010:MP:83 dated 22.05.2015 (Copy of letter enclosed as **Annexure-VIII**). Inter-alia acceptance of proposal MoC vide letter No1306/29/2003-CA-I (Part) dated 24.06.2015 directed NTPC to submit a

revised Mining Plan within a period of three months after incorporating the changes in sequence of operation (Copy of letter enclosed as **Annexure-IX**).

1.6 Present Revised Mining Plan

1.6.1 Compliance

In compliance to the advice of MoC an integrated Mining Plan has been prepared with a targeted capacity of **18 MTPA** after incorporating the changes in sequence of operation and is submitted herewith to MoC for consideration and approval.

1.6.2 Salient Features of Present Mining Plan

i. Present Mining Plan deals with exploitation of opencastable mineable reserves upto 300m depth only. Underground mining is envisaged from 10th years of Mining operations. A separate mining plan shall be submitted to MoC for consideration for the reserves amenable for underground mining, subsequent to completion of drilling/detailed exploration in the area proposed for underground mining.

ii. Three distinct quarries have been carved out of Pakri Barwadih coal block namely

   a. Pakri Barwadih West
   b. Pakri Barwadih East
   c. Pakri Barwadih North-West (Sector-A)

PB East and PB West shall commence simultaneously. PB North West quarry (Sector-A) shall commence on 4th year. Workings of PB East shall be stopped after two years of operations. PB West quarry and PB North West Quarry shall continue to work for their designated life. PB East shall be restarted after exhaustion of reserves of PB West. Sequence of operations in different quarries is given in **Fig-2**

Fig-2

Sequence of Operation for Pakri Barwadih Coal Mining Block (18 MTPA)

Production Years

Sl. No.	Name of Quarry	Peak Production
1	PB West	15 MTPA
2	PB East	15 MTPA
3	PB(NW) (Sector-A)	3 MTPA

Note:

1. *PB West shall continue mining operations till the end of 27 years.*
2. *PB east shall stop after two years of mining operations and shall restart on 25th years*
3. *There will be overlapping period of 3 years i.e. from 25th to 27th years*
4. *PB (NW) shall continue upto 41 years of mining operations*
5. *Total peak production from the block is 18 mtpa.*
6. *From 40 Years 52nd year coal of Barrier and Batter locked between PB-NW & PB-West shall be extracted*

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RQP No. 34011/(15)/2009-CPAM dated 27.09.10.

iii. Three dedicated and separate Access Trenches shall be driven for operation of abovementioned three quarries. Both Coal and OB shall be produced from these three quarries through these trenches. Sequence of driving of the trenches shall correspond to the sequence of operation of quarries. PB East and PB West quarries shall produce peak capacity of 15 MTPA throughout the life either separately or in conjunction, while PB North West Quarry shall produce peak capacity 3 MTPA which together constitutes Pakri Barwadih an **18 MTPA Mine**.

iv. Infrastructure is planned for PB West quarry and PB NW quarry. Infrastructure proposed for PB West quarry such as CHP, Sub Station, Workshop, administrative buildings etc. shall be utilised progressively for eastern quarry with the rising production, but the infrastructure/facilities which could not be shared with PB West Quarry shall be constructed separately for PB East Quarry for the period of two years such as Haul roads, culverts drainage system etc. Certain facilities such as coal sampling lab, environmental cell, vocational training centre, magazine etc. shall be common for all three quarries.

v. A Megalith falls in the PB East quarry area. As per EC no mining is permitted within 500m radius of the Megalith. While complying with the requirement of EC, it transpired that approximately 20Mt of coal shall be sterilized in the zone of influence. This 20Mt is considered lost coal in the present Revised Mining Plan but the loss has been compensated by adoption of following measures.

   i. The Pakwa nala shall be re-aligned along the periphery of East Quarry

   ii. Nala between North West quarry and west quarry shall be diverted along northern fringe of PB-NW Quarry after conducting required studies.

vi. Drilling & Blasting is proposed for preparation of coal and OB. Overburden of quarries shall be kept at designated locations. In pit dumping is proposed wherever the need arise. Top soil shall be kept at designated locations and shall be preserved. Crushing is proposed for reduction of coal from ROM to (-50) mm size. Trucks, Conveyors are proposed for transportation of coal, railway system is proposed for evacuation of coal, and provision of ancillary equipment needed for proper running of big opencast mine are kept in place.

vii. Separate set of HEMM is proposed for all three quarries. On cessation of PB West Quarry all the HEMM shall be deployed in PB East quarry except for the period of initial two years for which separate set of HEMM are proposed. Shovel dumpers are proposed for excavation, loading and in pit transportation. Primary and secondary crushers are proposed for crushing of coal to desired size. Cross country conveyor are proposed to transport the coal from mine end to Benadag siding. Coal shall be loaded in the railway wagon by Rapid Loading system from where coal shall be transported to designated power plants

viii. Coal washability study has not yet been carried out for Pakri Barwadih Coal. Coal quality parameters obtained from the proximate analysis of coal revealed that ash percentage in all probability is likely to remain 34% or below which does not call for commissioning of coal washery. However to cater for more stringent future quality stipulations, space allocation is earmarked for commissioning of Coal Washery at mine end to facilitate transport of washed coal to the power plants as per qualitative requirements.

ix. Detailed exploration of the area earmarked for extraction by underground mining below proposed Dump-C shall be carried out, much in advance so as not to jeopardise the reserves

x. Provision has been kept for Effluent Treatment Plant, Sewerage Treatment Plant, wet drilling, dust suppression & Fire Fighting arrangement in crushers and CHP arrangement etc in line with stipulation of Environmental Clearances.

xi. Environment Clearance (EC) and Forest Clearance (FC) have been accorded for PB West & PB East Quarry and Coal Conveyor Corridor. In the present Mining Plan NW Quarry along with its dedicated conveyor corridor is integrated for which EC and FC is not available. It is expected the above clearances may be obtained in 3-4 years' time frame, accordingly commencement of PB NW Quarry is deferred by three years.

1.7 PROSPECTING AGENCIES

Following agencies have carried out exploration for Pakri Barwadih Coal Block:

- Geological Survey of India, Kolkata
- Central Mine Planning & Design Institute Ltd, Gondwana Place, Kanke Road, Ranchi-834008

- Mineral Exploration Corporation Limited. Dr.Babasaheb Ambedkar Bhavan, Seminary Hills, Nagpur

1.8 PERIOD OF WHICH MINING LEASE ACQUIRED

Being Public Sector Organization NTPC is acquiring land under CBA (A&D) Act, 1957 within the Coal block area and for area outside the block boundary the area is acquired under "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013". LARR-2013/LA Act 1894, hence obtaining lease from the State Government is Not Applicable.

1.9 COAL SUPPLY FROM PAKRIBARWADIH COAL MINING PROJECT

Pakri Barwadih Coal Mine is having basket linkage and will make up for the shortfall in supply for coal in the existing and/or upcoming power projects of NTPC. Coal supply from PB block is not envisaged to replace any existing linkages. Calculation for Coal requirement for the company and % of coal likely to be met from this project is given in **Table-1.7.**

Table-1.7.
Coal Requirement and Meeting Coal Requirement

Sl. No.	Paramerer	Unit	Value
1	Thermal Power (Coal-Commercial) Capacity as on 31-Mar'15	MW	34425.00
2	Heat Rate	kCal/kWh	2386.00
3	Average GCV of blended coal (Domestic + Imported)	kcal/kg	3367.80
4	Sp. Coal Consp. blended coal (Domestic+Imported)	kg/kWh	0.71
5	PLF	%	0.80
6	Coal Consp. (Domestic+Imported)	Million Tonnes	171.41
7	Coal Requirement (Domestic Coal) for 92% PLF	Million Tonnes	207.81
8	Coal availability from Pakri barwadih	MTPA	18.00
9	Other Blocks of NTPC	MTPA	0.00
10	Percentage of end use requirement to be met from Pakri Barwadih mine	%	9%

1.10 DESPATCH OF COAL

ROM coal shall be crushed in two stages to final product size of (-50) mm. From the mine end (-50) mm shall be transported through cross country conveyor system up to the loading silos. Independent coal evacuation system by cross country coal conveyor system is envisaged for PB West quarry and PB North West Quarry. Coal produced from PB East shall be transported from the cross country conveyor envisaged for PB West quarry. NTPC shall construct Railway Siding at Banadag where the loading silos are located. From the silo, coal shall be transported though the Indian Railways network to the identified endues power stations of NTPC.Road transport is being envisaged till the completion of the proposed Cross Country Conveyor

1.11 NAME OF APPLICANT WITH COMPLETE ADDRESS

TABLE 1.8
NAME OF APPLICANT WITH COMPLETE ADDRESS

LOCAL OFFICE	REGISTERED OFFICE
NTPC Limited Sh R.S.Rathee, ED (PB/CB/KD) Pakri Barwadih Coal Mining Project Ujjwal Complex Pugmil Road, Hazaribagh, Jharkhand – 825301	NTPC Limited Sh Sharad Anand, Regional Executive Director, Coal Mining, 6th Floor, Core 6, NTPC Ltd. Scope Complex, Institutional Area, Lodhi Road, NewDelhi-110003
Ph:06546 - 270622, 9470575777 Fax:06546 – 270744 Email: rsrathee@ntpc.co.in	Ph:011-24362871 Fax 011-24367089 Email sharadanand@ntpc.co.in

1.12 BOARD OF DIRECTORS OF COMPANY

TABLE 1.9
BOARD OF DIRECTORS OF COMPANY

SL. NO.	NAME	DESIGNATION
1	Mr. A.K.Jha	CMD cum Director (Technical)
2	Mr. U.P.Pani	Director (HR)
3.	Mr. S.C.Pandey	Director (Projects)
4.	Mr. Kualmani Biswal	Director (Finance)
5.	Mr. K.K.Sharma	Director (Operations)
6.	Dr. Pradeep Kumar	Govt. Nominee

SL. NO.	NAME	DESIGNATION
7	Mr.Prashant Mehta	Independent Director
8	Mr. Rajesh Jain	Independent Director
9	Dr. Gaur. Trivedi	Independent Director

1.13 RECOGNISED QUALIFIED PERSON

MoC has accorded grant of recognition to Sh. Sanjiv Kumar Singh of NTPC as competent person to prepare Mining Plan for Coal Block/Lignite of NTPC only. Particulars of RQP are given in **Table-1.10**. Copy of letter enclosed as **Annexure-X.**

TABLE 1.10

RECOGNISED QUALIFIED PERSON

Name	:	**Mr. Sanjiv Kumar Singh**
Address (i) Office	:	4th Floor Core 5,NTPC Bhawan, SCOPE Complex 7 Institutional Area, Lodhi Road, New Delhi- 110 003
Fax	:	011-24377089
E-mail	:	sanjivkumarsingh01@ntpc.co.in
Registration Number	:	34011/(15)/2009-CPAM
Date of grant / renewal	:	27.09.2010
Phone	:	011-24387669 9650991396

CHAPTER II

DETAILS OF EARLIER APPROVED MINING PLAN

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34C (15)/2009-CPAM
Ministry of Coal, Govt. of India

CHAPTER II

EARLIER APPROVED MINING PLAN

2.1. EARLIER APPROVED MINING PLAN

Mining Plan for the Pakri Barwadih Coal Project was approved by Ministry of Coal vide letter number 13016/29/2003-CA-I dated 25th August, 2006. A copy of the Approved Mining Plan along with Approval Letter is enclosed as **Annexure-III** and **Annexure-III A**.

Salient features of Approved Mining Plan is given in Table 2.1.

Table-2.1
Salient features of the Approved Mining Plan

Sl. No.	Heads	Particulars		
	Name of Project	Pakri Barwadih Coal Block		
	Location	North Karanpura Coalfield. District: Hazaribagh , Jharkhand		
	Company	NTPC Ltd		
	Block Allotment Reference No.	Block allotted vide ref no 13016/29/2003-CA, New Delhi dated 11th October 2004 and DO no 13016/29/2003-CA dated 24.8.2005		
	Block Area	4626 Ha		
	Nearest Township	Hazaribagh		
	Nearest Railway Station	Ranchi Road and Chitarpur		
	Nearest Airport	Ranchi		
	No. of Workable Seam	12 workable splits in 5 seams		
	Seam Gradient	$10^0 - 20^0$		
	No. of faults	19		
	Total Geological Reserves within the block	1436 Mt		
	Proved	702.70 Mt		
	Indicated	733.20 Mt		
		Mineable Reserves (Mt)	Vol Of OB (M cum)	Av. S. R. (cum/t)

Reserves & Overburden	503.39	2098.78	4.16
Target Output (Mtpa)	15		
Quality of coal	Grade D – E (Avg. F)		
Specific gravity of coal (Avg.)	1.68 t/cum		
Method of Mining	Opencast (Shovel-Dumper combination)		
Main Customer	All power plants of NTPC Ltd		
Life of the Mine including Construction Period	39 Years		

	Equipment	Size	No
Main Equipment	Overburden		
	Electric Rope Shovel	20 Cum	7
	Electric Rope Shovel	10 Cum	5
	Electric hydraulic shovel	8.3 Cum	14
	Rear Dumper	170-190T	78
	Rear Dumper	120-150T	152
	RBH Drill	250 mm	24
	RBH Drill	160 mm	10
	Track Dozer	310 kW	30
	Coal		
	Electric hydraulic	4.5 Cum	9
	Rear Dumper	50 T	77
	RBH Drill	160 mm	15
	Track Dozer	310 kW	15
	Wagon drill	100 mm	3

Mine Parameters	West Quarry	East Quarry
Maximum Depth (m)	300	300
Maximum strike length (Km)	5.5	3.8
Maximum width (Km)	1.66	1.71

2.2. Compliance of Conditions imposed if any with approval of the mining plan

Sl. No	Compliance of Condition(s) imposed	Action
1(i)	The Mining Company shall achieve the 15 Mtpa production level from the opencast by 12th year.	The built up of production level for PB West has been kept the same as mentioned in the approved Mining Plan PB East is planned to commence with PB West .Operations of PB East shall cease after 2 years and will restart again from 25th year of Mining operation NTPC shall achieve 15 Mtpa production level from the opencast by 12th year
1(ii)	As regards of coal block that has also been allotted to ONGC for Coal Bed Methane extractions, the conditions laid down in the allotment letter shall be fully complied.	Will be complied during operation stages.
1(iii)	The approval of the Mining Plan is without prejudice to the requirement of approvals from competent/prescribed authority under the relevant rules/regulations etc.	All necessary approval under relevant rules/regulations shall be obtained without prejudice to the requirement of approvals from competent/prescribed authority
2	Two copies of the Approved Mining Plan duly signed by the competent authority are returned herewith with the request that a copy of the Approved Mining Plan may be submitted to the concerned state government for necessary action and also a photocopy of the Approved Mining Plan may be sent to the Coal Controller for monitoring of the block.	Complied

2.3. Status of Mining Plan submitted to MoC

Detailed in Clause No. 1.5 of Chapter-I

2.4. Revision of Mining Plan

Detailed in Clause No. 1.5.4 of Chapter-I

2.5. Present Mining Plan

Detailed in Clause No. 1.6 of Chapter-I.

2.6. Reasons for revision of Mining Plan

2.6.1 To fulfill the commitment given to Government regarding start of Coal Production and also keeping in view the likely time taking process of award of MDO for PB West Quarry because of densely populated /hostile villages and densely populated /hostile villages existing within PB. West Pit as well as connecting roads. NTPC has proposed to commence Mining Operations in the PB East Quarry (Shown as EP 1 in Surface Master Plan) area adjacent to main road where land is available.

2.6.2 OB removal and Coal production has been planned from a patch of PB East Quarry (Eastern Pit 1) for two years as Interim Arrangement. The Plans showing the proposed stage of working by the end of First Year and Second Year are given in respective Stage Plan. Proposed area for mining has been mainly selected due to the availability of land for mining as well as ease of approach from the State Highway.

2.6.3 As a result of early startup of PB East Quarry there is a variation in the calendar Programme and Land Use Pattern of the mine.

2.6.4 PB NW Quarry which was unexplored at the time of approval of mining plan is now integrated with the present Revised Mining Plan (1st Revision). Resultant coal evacuation facilities from road and coal handling plant and additional volumes of OB/coal mining shall change the calendar programme and Land Use Pattern.

2.6.5 MoC vide letter No1306/29/2003-CA-I (Part) dated 24.06.2015 directed NTPC to submit a revised Mining Plan within a period of three months after incorporating the changes in sequence of operation (Copy of letter enclosed as **Annexure-IX**)

2.7. Changes in Revised Mining Plan with respect to Approved Mining Plan.

2.7.1 Change in mining sequence

The proposed quarry area is part of PB East Quarry as per approved Mining Plan and is located in its North-Eastern part and is named Eastern Pit-1 (EP-1). The proposed quarry namely EP-1 is at a distance of approximately 850 m in North-West direction from the Tandwa-Barkagaon-Hazaribagh State Highway and is accessible by road connecting to Arhara village from the State Highway. However in variance with the approved Mining Plan, Eastern Quarry

is now planned to be started in 1st year of Mining Operations instead of 25th year. In the approved Mining Plan PB East Quarry was to start in 25th year of Mining operation

2.7.2 External Dump Area

The land for external dumps as per approved Mining Plan Dump A, B, C is presently not available. Accordingly, to start mining operations, External Dump has been envisaged in the available land in the north side of this quarry area. This area lies partly in the area earlier identified for coal evacuation facilities. The area has been shown in Surface Master Plan). Forest diversion of this external dump area has been obtained and change of land use of this area has been taken up with MoEF.

2.7.3 Variation in Coal Transportation Arrangement

As per earlier approved Mining Plan coal is planned to be transported through belt conveyor to Banadag Railway siding which are under construction. It is proposed that coal shall be transported to Banadag Siding by Road till the construction of cross country conveyor.

CHAPTER III

LOCATION, TOPOGRAPHY AND COMMUNICATION

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CHAPTER III

LOCATION, TOPOGRAPHY, DRAINAGE & COMMUNICATION

3.1. General

It is to mention that two separate Geological reports are prepared for Pakri Barwadih Block. The former is Geological Report for Pakri Barwadih and the later is Geological Report for Pakri Barwadih A. In the present Mining Plan i.e Revised Mining Plan of Pakri Barwadih (Rev-1), reference to Pakri Barwdih Mine/Block/Project includes Pakri Barwadih-A (PB-NW), Pakri Barwdih West and Pakri Barwadih East.

3.2. Location of Block

Pakri-Barwadih coal block is located in Hazaribagh district of Jharkhand State. The block is located in the north-eastern part of North-Karanpura Coalfield, bounded by

a. Longitudes	85^{0}09'19"E	to	85^{0}15' 00"E
b. Latitude	23^{0}51'30"N	to	23^0 55'40" N

It is covered by the Survey of India Toposheet no. **73E/1** (R.F 1: 50000) and special sheets no. ***21, 23 & 24*** on R.F. 1:10000

The entire block falls in the Hazaribagh district of Jharkhand State. The Hazaribagh – Khelari metal Road passes through the eastern part of the block touching Barkagaon and Tandwa Villages. The nearest township is Hazaribagh, located at a distance of about 24 kms from Barkagaon which is in the southern part of the block.Location is given at Fig-3.1.

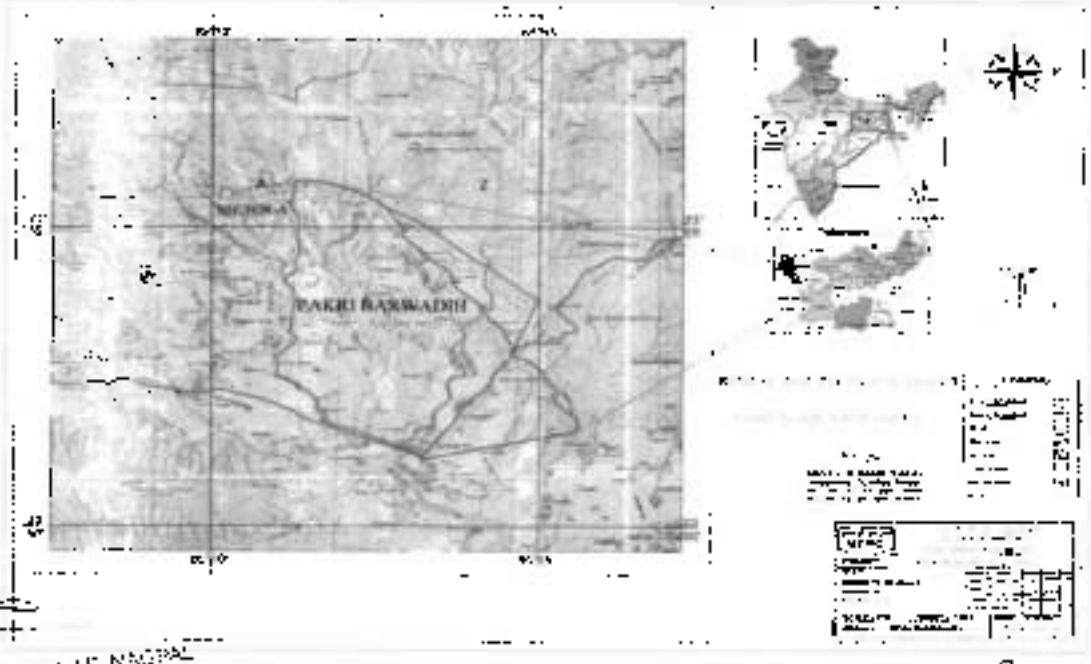

Fig-3.1.

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3.3. Communication

The block is well connected to nearest town city and state capital through all-weather road. Brief description on the accessibility of the block is given below

i **Rail Link:** The nearest rail stations are Ranchi Road and Chitarpur on the Gomoh Barkakana – Dehri-on-Sone loop lines of SE Railway both around 70- 75 km from the block

ii **Road Link:** The Block is well connected to the district headquarter Hazaribagh via Barkagaon at a distance of 40 km by all-weather road. The block is located at a distance of 10 km from Barkagaon Township The Hazaribagh - Khelari State Highway passes 5 Km south of the block via Barkagaon and Tandwa village. The area is also connected to Patratu Township by all-weather road via Urimari .

a A PWD Road exists between Hazaribagh & Barkagaon, Tandwa – Khalari. Our approach will be take-off from this road and will go from eastern to western part of the property The total approach will be about 10 km from take-off point to mine entry point.

b This PWD road passes through the east quarry of the quarriable block, which shall be shifted to other route only after exhaustion of West Quarry but before mining operation of East quarry. is started.

iii **Air Link:** Nearest Airport is at Ranchi which is about 130 km from the block.

3.4. North Karnapura Coalfields

Pakri Barwadih Coal Block falls in the North Karnapura Coalfield under CCL command area of CIL The North Karanpura Coalfield (1230 km2) as the name implies forms the northern part of the main Karanpura basin. It is separated from the South Karanpura CF by a east west elongated metamorphic patch However, they are interconnected near Bachra and Hindegir village by a narrow strip of Talcher formation. It is bounded by Latitude 23039' and 23060' (N) and 840 46' and 850 24' (E) longitude spreads over to Hazaribagh Ranchi, Chatra and Palamau districts with Pakri-Barwadih block located in .as mentioned above Hazaribagh district.

The North-Karanpura coalfield lies close to Hazaribagh town, the head quarter of the district bearing the same name Barkagaon, an important locality in the north-eastern part of the coalfield is also located on the southern fringe of the Pakri-Barwadih Block under review. This locality is connected from Hazaribagh by an all-weather 24 Km metalled road which has been extended along the northern & western part of the coalfield touching Kerendari and Tandwa This can serve as a useful road link from Pakri-Barwadih to Tandwa where proposed STPS of NTPC is located This metalled road passes through the East sector of Pakri-Barwadih and divides the sector into two parts. The

Ranchi- Chandwa – Chatra – Barhi highway passess close to the western margin of the Coalfield. Several places in the western and southern parts of the field are connected with Ranchi- Lohardaga and Ranchi – Daltanganj State Highway. The eastern Railway Branch Line from Dhanbad to Gomoh and Dehri-on-Sone runs along the southern part of the coalfield. This railway line also passes through Chandrapur, Bokaro & Patratu Thermal Power Stations. However the western, northern and eastern part of the coalfield is presently devoid of railway lines. The coalfield is likely to be connected by a new railway network under initial phases of execution from Gomoh Daltanganj railway line of SE Rly.

The location plan of the area have been shown in drg no 7010-199-POM-J-001 and area covering buffer zone of 10 km radius all around the allocated block is presented at key plan in drg no. 7010-199-POM-J-002

3.5. Block area

Total area of the Parkri Barwadih Coal Block is 46.95 Sq. Km. Subsequently to the allocation of the block NTPC has applied for acquisition of land u/s 4(i) of CBA Act (1957) for mining of above mentioned coal bearing area together with an additional area of 2.99 sq km on the north- eastern side of allocated block for accommodating infrastructure facilities Braekup of Mine Area is given in **Table 3.1.**

Table 3.1

Breakup of Mine Area

Sl. No.	Particulars of Area	Area in (Sq. Km.)
1.	Explored (PB E & PB W)	39.43
2.	Explored (PB N W)	4.85
3.	Coal bearing area (1+2)	44.28
4.	Additional Acquisition for OB Dump	2.66
	Total (3+4)	**46.95**

3.6. Climate & Rainfall

3.6.1 Temperature:

The area experiences a subtropical climate with very hot and dry in summer and well-distributed rainfall in the southwest monsoon season. Annual mean rainfall recorded at IMD's Observatory, Hazaribagh is 1277.90 mm and maximum temperature is 43 °C in summer and minimum temperature is 3 °C in winter season. It has three distinguishable seasons:

i) The summer season starts from mid - March to mid – June. The temperatures varies from 16.5°C to 41.1°C

SANJAY KUMAR SINGH

ii) The rainy season starts from the mid June to September with an average annual mean rainfall of 1277.90 mm with the total number of rainy days being 67.

iii) Winter season commences from the November to February The temperature varies from 4°C to 31°C.

3.6.2 Relative Humidity:

Since the climate is dry & hot, the relative humidity is generally moderate. The annual mean daily humidity is 61%.

3.6.3 Rainfall:

Pakri-Barwadih block being a virgin block has no rain gauging station. The nearest station is at Barkagaon Block office where daily rainfall is recorded The records available in the block office from year 1979 to 2004 shows that the maximum annual rainfall of 2037.50 mm was recorded in the year 1994 and minimum was 656.20 mm in the year 2002. The average annual rainfall is about 1182 mm.The rainfall does not show any cyclic occurrences: and shows wide and erratic variations. The average annual rainfall recorded at Barkagaon office for the year 1979 to 2004 ranged between 656.2 to 2037.50mm (Mean is 1181.5mm). The monsoon season is spread over the months from June to September. Rainfall records at IMD Hazaribagh is given at **Table 3.2**

Table 3.2

Rainfall records at IMD Hazaribagh.

Month	Monthly total (mm)	No. of rainy days	Maximum Rainfall in 24 hrs.(in mm) with date	
January	2.5	1.7	68.1	6-1945
February	16.2	1.4	63.5	23-1927
March	18.4	1.7	44.2	20-1946
April	17.0	1.4	60.5	22-1925
May	43.4	2.9	84.1	27-1887
June	177.1	9.2	249.2	24-1911
July	310.0	16.2	221.7	6-1953

August	320.1	16.2	180.1	17-1988
September	260.9	11.6	167.4	28-1963
October	80.6	4.1	149.4	24-1963
November	5.5	0.4	95.0	8-1924
December	5.2	0.4	39.4	13-1885
No of years data	29			

3.6.4 Vegetation:

At one time, the area, especially the hills and plateaus were covered with dense forest comprising mainly Sal, Mahua etc. With progressive increase of population and felling of trees, the forest areas have now reduced to isolated patches mostly occupying the upper parts of the hill. Other trees that grow in the area are Palash, Khair, Bair, Amla, Simul, Sisiu, Karanj etc.

About 50% of area of the north west part of the block is covered by forest. The plantation of orchards of mango, mahua, kaju and other common trees are found scattered in the block. However, forest comprising mainly of Sal, Assan and Kusum trees occupies the southern, north-eastern to eastern part of the block. The important wild lives found are bear fox, Jackal, Hyena, Monkey and rabbits

3.7. Topography

Topographically the area is rather hilly and undulating in northern and north-west part of the block. The central and eastern part of the block is characterized by more or less flat terrain with gentle undulations. The ground in general slopes towards south. In western part the maximum elevation of 501 m is noticed in northern part near borehole CNPB- 109 and minimum elevation of 402 m in southern part near borehole CMKPB –32. In the central part the maximum elevation of 459 m is noticed in the northern part near borehole CMKP –30 and the minimum elevation of 396 m near borehole CMKP-30 in south –eastern part. In eastern part the maximum elevation of 480 m is noticed in north-eastern part near borehole CNPB –55 and minimum elevation of 405 m near borehole CMKPB –12 in southern part.

The north western part of the block exhibits undulating topography with general slope towards south. Due to presence of numerous ravines in the eastern half of the block, the topography is highly rugged, rendering the area unapproachable. In general the elevation of ground varies from 430m to 460m above mean sea level

3.8. Drainage

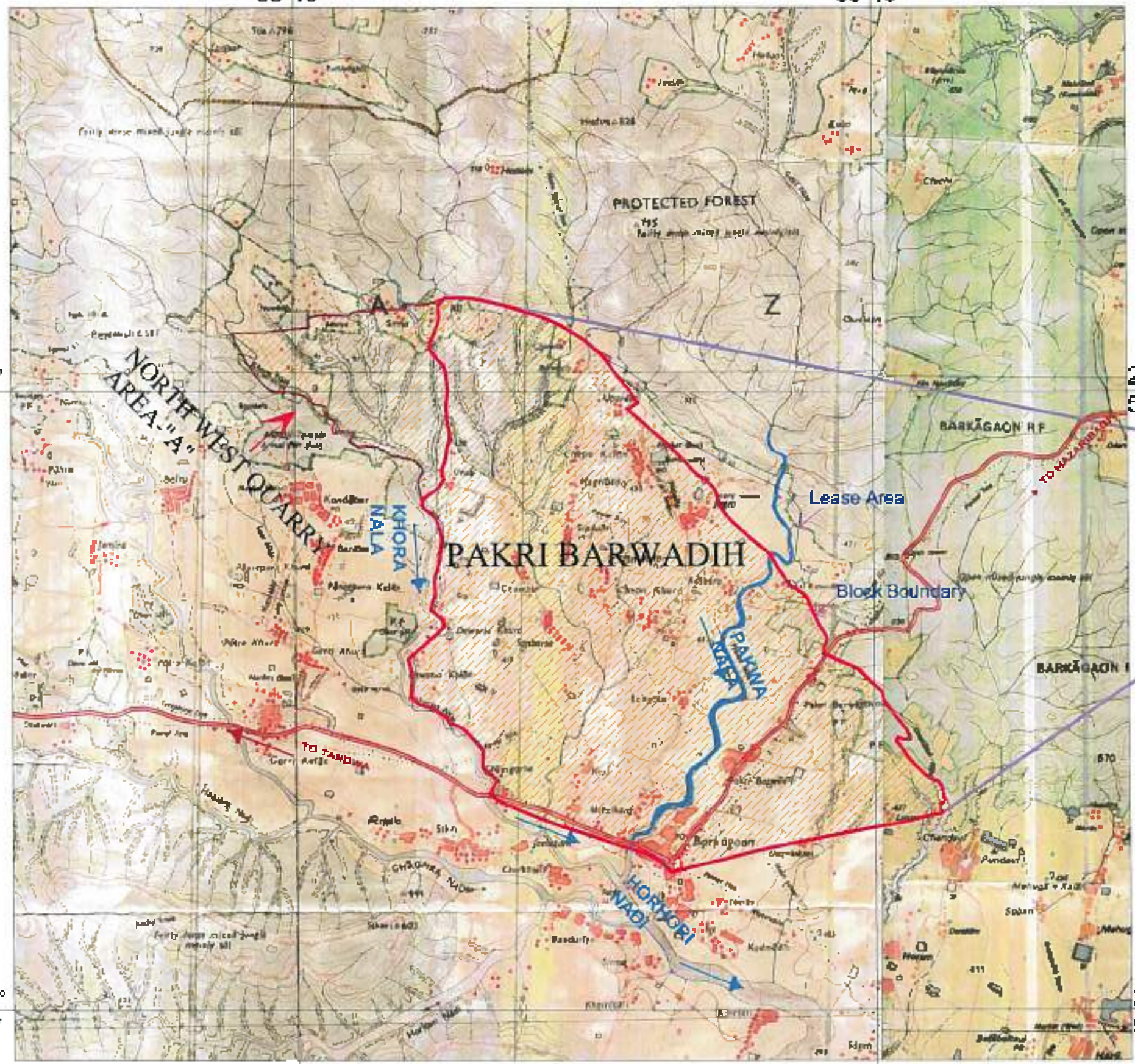
The drainage of the block is controlled by Sunrah river, which finally joins to Badmahi river, which is one of the major tributary of Damodar river flowing in south central part of coalfield. Three major nallahs flowing north to south are Khora, Dumuhani and Hardara (Pakawa). Besides these nallahs of the block, there are many small streams & stream lets, which discharge their load into these major nallahs. All the nallahs of the block are seasonal and become dry during summer.

The shape of north western part of the block is triangular. On two sides, block boundary is defined by tributaries of Khora Nala, which discharges its load Lathorwa Nala. The drainage of the block is controlled by Khora Nala, which flows into Lathorwa/Khora Nala which in-turn joins to Haharo Nadi, which is one of the major tributary of Damodar River flowing in south central part of coalfield. Besides, Khora nala of the block, there are many small Streams & streamlet, which discharge their load into this major nala. All the nalas of the block are seasonal and become dry during summers. (Plate No.5).

None of the nalas/tributaries were planned for diversion except straightening of Khora Nala – B at NW part of the block. During mining, adequate clearance from high bank of nala are left on the active pit side, to prevent seepage/flooding of water to mine. Embankments are also planned to prevent inrush of water during rainy season or otherwise.

3.9. Population

The entire coal-field is low to moderately populated except Barkagaon, Kerendari & Tandwa, which are the most populated villages in the northern & Western part of the coal-field.



TOPO SHEET INDEX

CERTIFIED THAT THE PLAN IS CORRECT

SANJIV KUMAR SINGH (R.Q.P.)

Sanjiv

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011/(15)/2009-CPAM
Ministry of Coal, Govt. of India

LEGEND

- BLOCK BOUNDARY (APPLIED)
- BLOCK BOUNDARY (ALLOCATED)
- ROAD
- RIVER/NALA
- VILLAGE
- POWER LINE
- WATER BODY

एन टी पी सी
NTPC

N.T.P.C. LIMITED
(A GOVT. OF INDIA ENTERPRISE)
(COAL MINING ENGINEERING)

PROJECT: PAKRI BARWADIH COAL BLOCK

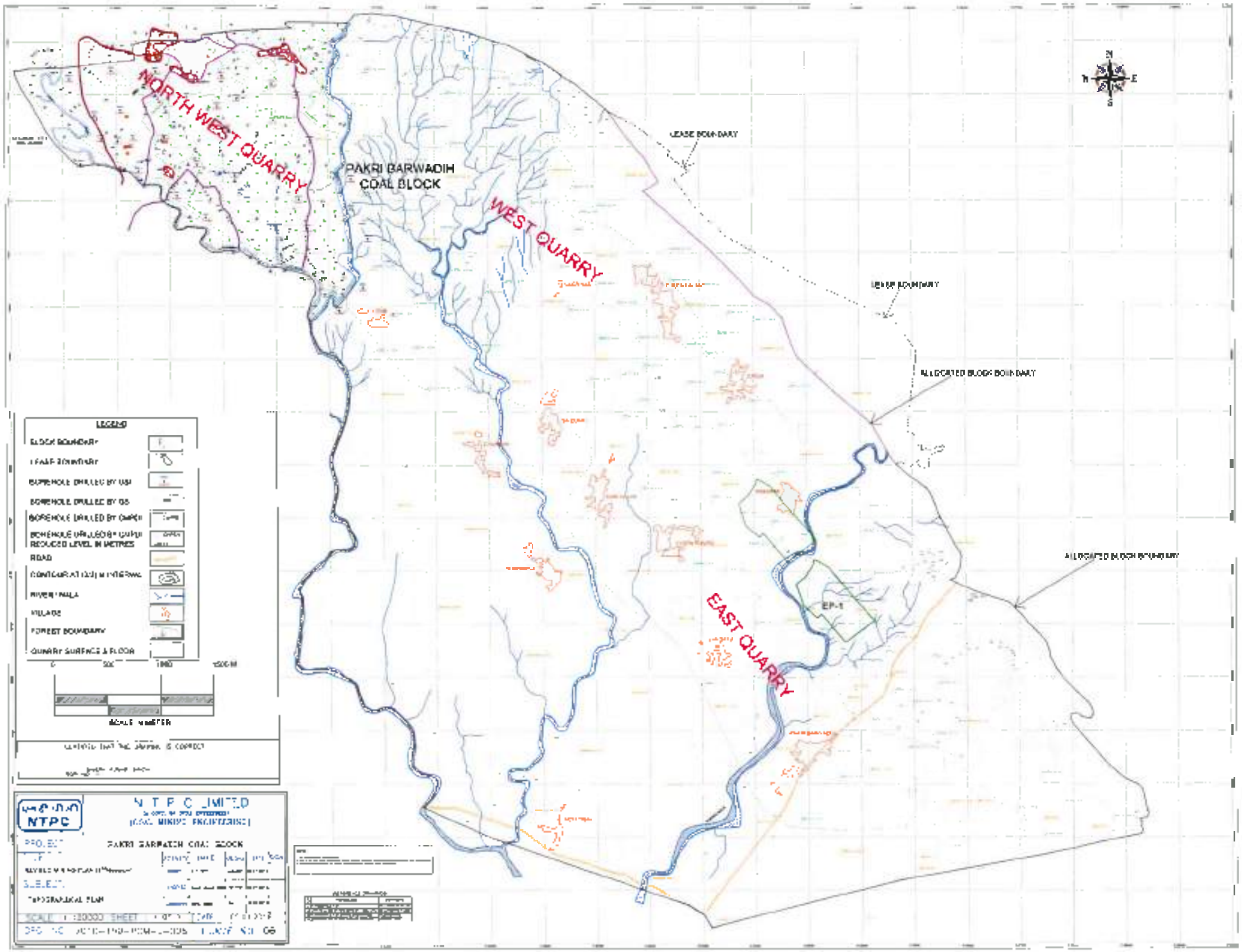
TITLE: REVISED MINING PLAN (1st Revision)

SUBJECT: LOCATION PLAN

ACTIVITY	NAME	DESIG	DATE	SIGN
DESIGN				
DRAWN				
CHECKED				
APPROVED				

SCALE : NTS SHEET : 1 OF 1 DATE: 30.12.2016

DRG.NO: 7010-199-POM-J-001 SHEET NO. 01



आई० पी० नागपाल/I.P. NAGPAL
अवर सचिव/Under Secretary
कोयला मंत्रालय/Ministry of Coal
शास्त्री भवन/Shastri Bhawan
भारत सरकार/Govt. of India
नई दिल्ली/New Delhi-110021

SANJIV KUMAR SINGH
Recognised Qualified Person
No 34011/(15)/2009-CPAM
Ministry of Coal, Govt. of India

CHAPTER IV

EXPLORATION,

GEOLOGY, SEAM SEQUENCE, COAL QUALITY AND RESERVES

CHAPTER-IV

GEOLOGY

4.1 General

4.1.1 Pakri Barwadih (PB) coal block is located in the north eastern part of North Karanpura Coal Field bounded by Longitudes 85° 09'19" to 85° 15' 00" E and Latitude 23° 51' 30' to 23° 55' 40' N and covered by the Survey of India Topo sheet No73 E/1 (RF 1:50000) and special Sheets No 21,23 & 24 (RF 1 10000). The Block is located in the state of Jharkhand and is around 120-130 km from the state Capital Ranchi.

4.1.2 As per the Guidelines issued by MoC for preparation of Mining Plan for the coal blocks issued vide Letter No. 34011/(48)/2009-CPAM dated 15.07.2015, MoC directed to enclose additional item:

"Certificate from CMPDI that the Geological Coordinates (Longitude and Latitude) used in preparation of Mining Plan in accordance with the Vesting Order and Geological Coordinates covered by the Mining Plan do not encroach into any other/adjacent coal block"

Pakri Barwadih coal mining block was allocated to NTPC through Government Dispensation route in the year 2004. The block was retained with NTPC since Honourable Supreme Court had not de-allocated the same. Hence certificate from CMPDI is not applicable in this context. However boundary certified by CMPDI for notification under CBA Act is attached as **Annexure-XIX**

4.2 Geological Report

Two Geological Report were prepared for this Block. NTPC has procured Geological Report (GR) of the block from CMPDIL vide letter No DG/693(A)/095-96 dated 04/05/2005 (Copy of letter enclosed as **Annexure-XI**). It pertains to the exploration of Western and Eastern part of the block. In compliance to the commitment to MoC, Geological Report of PB North West (Sector-A) was prepared by NTPC through MECL, which pertains to the exploration of North Western part of the block. The brief is as following:

A Memorandum of Understanding (MoU) was signed between Mineral Exploration Corporation Limited (MECL) and NTPC Ltd, on 12.06.2006 for conducting detailed exploration for coal in Pakri Barwadih North West

(Sector-A) Coal Block. The exploration work was awarded to MECL as per Letter of Award (LOA) No.CS-7010-708-9CY-LOA dated 14.07.2006.

MECL has carried out a detailed exploration for coal and allied geological activities including sampling and chemical analysis etc in the said block based on the relevant standards.

Exploratory work carried out by MECL intermittently rather than continuous due to local problems. Villagers nearby hindered the work which contributed delay in completion of exploration work. Geological report was submitted to NTPC on 30.10.2012. (Copy of letter enclosed as **Annexure-XIA**)

The above two Geological Reports have been considered for preparation of present Mining Plan "Revised Mining Plan (1st Revision) Pakri Barwadih Coal Block".

4.2.1. Connection with National Grid

Pakri Barwadih Coal Block is connected with the national grid.

4.2.2. Payments of Exploration Cost vis a vis cost of Geological Report

NTPC has paid full amount for the cost of the above mentioned Exploration/Geological Report raised by GSI, CMPDIL and MECL.

MoC vide letter No. 13016/29/2003/CA-I (Part) dated 18.08.2015 confirmed that no additional amount is due with NTPC. (Copy of letters enclosed as **Annexure-XII**)

4.3 Details of exploration

4.3.1 Core / Non-Core drilling

Drilling activity is carried out in two different phases for Pakri Barwadih west, east and Pakri Barwadih North West (Sector-A) block. A total of 196 boreholes have been drilled by GSI & CMPDI in Pakri Barwadih Block whereas in Pakri Barwadih North West MECL has drilled 33 boreholes and CMPDIL has drilled 3 borehole. In total 232 boreholes have been drilled in the whole block. The boreholes drilled during different phases in Pakri Barwadih Block as per break up given in **Table 4.1** The seam wise borehole intersections and density is given in **Table 4.2**. The Location Plan of these boreholes have been shown **Plate No.7**.

Table 4.1

Phase wise Agency wise exploration status

Agency/ Type	Period of Drilling	Drilling	
		No. of Boreholes	Meterage
1. GSI / Regional	1961 to 1971	KB-1 to 26 (26 BHs)	8177.23
2 CMPDI a) Promotional (Semi-regional)	Dec. '1999 to April , 2001	*CMKPB-1 to 38 (38 BHs)	10482.00
b) Non-CIL (detail drilling)	Jan., 2003 to June 2004	CNPB- 1 to 135 (135 BHS)	24943.60
Sub-Total (1 & 2)		**199**	43602.83
3. MECL for PB North West (Sector-A)	2006 to 2012	MNPB-1 to MNPB-1 (33 BHs)	4282.70
Total (1, 2 & 3)		**232**	**47885.53**

**CMKPB 24,25 & 38 are falling in PB (NW) quarry*

4.3.2 Seam wise borehole intersections and density

Table-4.2
Seam wise borehole intersections and density

Seam/Parting	No. of Boreholes considered	Seam/Parting	No. of Boreholes considered
Seam-V Top	55	Seam-II MB	12
Seam-V Bottom	58	Seam-II Comb.	3+1
Seam-V Comb	29	Seam-I Top	100
Seam-IV A	47	Seam-I Middle	97
Seam-IV Top	26	Seam-I TM	6
Seam-IV Bottom	26	Seam-I Bottom	72
Seam-IV Comb.	63	Seam-I MB	20
Seam-III Top	56	Seam-I Comb.	3+10

Seam-III Bottom	56	Local	90
Seam-III Comb.	31	Seam-K5	57+1
Seam-II Top	70	Seam-K4	58+1
Seam-II Middle	62	Seam-K3	56
Seam-II TM	46+10	Seam-K2	60
Seam-II Bottom	96+11	Seam-K1	75

4.3.3 Requirement of Further Exploration with time frame

4.3.3.1. Exploratory drilling for no coal zone proving

The infrastructure facilities and external waste dumping areas Dump-A, B and D) as shown in **Surface Master Plan (Plate No-5)** have been selected beyond the incrop of Seam-I Bottom. However, there is no specific mention of no-coal zone in the area. Therefore, before start of OB Dumping if required or insisted by Standing Committee the drilling for negative proving shall be carried out.

Period	No. of BH (Tentative)	Location	Estimated meterage	Target
Pre-construction (before start of OB dumping if required)	30	Infrastructure sites and external waste dump A & B	3000	Negative proving of workable coal seams
Pre-construction	10	Infrastructure sites and external waste dump D	1000	Negative proving of workable coal seams

4.3.3.2. Exploratory drilling for production support

In order to delineate the in-crop of seam I & II and to support the production requirement as per stage plan, phase-wise exploration through core drilling in different sectors of the block have been proposed **Table 4.3**

Table 4.3
Production support boreholes

Period	of BH	Location	timated meterage	Target
Pre-construction (2 years)	15	Bet. F14 & Seam IB incrop Bet F13 & F14 Bet F8 & F9	750	To delineate incrop of seam IB & IIB To support 1st & 2nd year production
1st year	15	Bet. F12 & F13 Bet. F10 & F11 Bet F7 & F8	500	To support 2nd & 3rd year production
2nd year	15	Bet. F12 & F13 Bet. F11 & F12 Bet F9 & F10	500	To support 3rd & 4th year production
3rd year	12	Bet. F8 & F10 Bet. F7 & F8	500	To support 4th & 5th year production
4th year	12	Bet. F5 & F6 Bet. F7 & F8	200	To support 5th to 6th year production

4.3.3.3. Exploration for area beyond 300m depth line

The southern portion of the Pakri Barwadih Block covering around 12 sq. km. area has also not been explored in details and only " indicated" category reserves of the order of 733.199 Mt are provisionally assessed by CMPDI Therefore a phase wise exploration programme has been proposed to convert the indicated reserved into proved category and to develop underground mine plan.Phasewise exploration program is given in **Table 4.3 A**.

Table-4.3 A
Phase wise exploration program

Period	No. of BH	Location	Estimated meterage	Target
1st year	25	Area beyond 300 m depth line	14000	To convert the indicated reserves into proved category and to develop underground mine plan
2nd year	25		14000	
3rd year	25		14500	
4th year	25		14500	
Total			55000-60000	

4.4 Regional Geological set up of the area

The North Karanpura Coalfield forms a prominent east-west trending valley between Hazaribagh plateau in the north and Ranchi plateau in the south. The Aswa Pahar in the south-east separates the North and South Karanpura Coalfields by east west elongated metamorphic patch. However, they are interconnected near Bachra and Hindegir village by a narrow tongue of Talcher outcrops. On the eastern side, North Karanpura Coalfield is separated from the West Bokaro Coalfield by a narrow stretch of metamorphic rocks having several outliers of Talcher formation. In the west, it is separated by a stretch of about 20 Km wide metamorphic belt from Auranga Coalfield

The generalized Stratigraphic Sequence of North Karanpura is given at **Table 4.4**.

Table 4.4
Geological Succession of North Karanpura Coalfield

Period	Group	Sub-group	Formation	Lithology
Recent	-		Alluvium	Detrital and alluvial soil and sub soil
Jurassic	-	Equivalent to Rajmahal Trap	Igneous Intrusive	Dolerite and Mica Peridotite
Triassic	Upper Gondwana		Mahadeva	Massive coarse to conglomeratic feldspathic ferruginous sandstone with shale intercalation
Upper Permian to Lower	Lower Gondwana		Panchet	Yellowish to white coarse grained sandstone, red, chocolate colour clastic clays.

Triassic				In the upper part, yellowish friable sandstone whereas lower part is greenish yellow
Upper Permian		Damuda	Raniganj	Fine to medium grained quartzo-feldspathic and quartzitic sandstone often micaceous and matured, interbanded shale and sandstone, carbonaceous shale and thin coal seam.
			Barren Measures	Dark Shale, sandy micaceous shale with sideritic interbanded shale and sandstones
Permo-Carboniferous			Barakar	Conglomerrate, sandstone, shale, intercalation siltstone and shale, carbonaceous shale, fireclay, coal seams.
			Karharbari	Dark mottled sandstone occasional shale bands, fireclay, chocolate coloured clays and coal seams
			Talchir	Rikba plants beds, boulders, conglomerate, varvites, sandstone, tilloids and tillites.
Unconformity				
Pre-Cambrian			Metamorphics	Granite, gneiss, pegmatite, phylittes, micashist and limestone, chromite bearing rocks, amphibolites and quartzite.

Out of 1230 sq. Km area of North Karanpura coalfield the coal bearing formations viz: Karharbari, Barakar and Raniganj crop-out over an area of about 500 sq. Km. The Karharbari formation is well developed in south-central and eastern part of the coalfield. It contains only one coal seam which occurs often in two to three sections. It comprises of very coarse grained gritty sandstone and at times has silicified sandstone, hard strata difficult to negotiate during drilling operation. The Barakar formation contains a number of coal seams and contributes the major bulk of reserves in this coalfield. Five persistent coal seams have been established in the coalfield. The total coal column is more or less around 30 to 40 meter in the major part of coalfield. Raniganj formation contains three or four impersistent coal seams which are generally shaly in nature

4.4.1 Local Geology

a. PB Block (East and West):

The Pakri-Barwadih block comprises of Talchir, Karharbari, Barakar, Barren Measures and Raniganj Formations belonging to Damudas, a Sub-Group of Lower Gondwana.Talchir Formation rest directly over the Pre-Cambrains. The Karharbans and Barkars are the main coal bearing formations in the block. Stratigraphic succession of the formations in the block is given in **Table 4.5.**

Table 4.5
Stratigraphic Sequence of Pakri-Barwadih Block

Period	Group	Sub-group	Formation	Thickness Range	Lithology
Recent	Lower Gondwana	Damuda	Alluvium	3.50 – 25.85	Detrital and Alluvial soil & subsoil
Upper Permian			Raniganj	1.50 – 324.50	Fine to medium grained micaceous sandstone, interbanded shale and sandstone,

					Carbonaceous shale & thin uneconomic Coal seams.
Upper Permian			Barren Measures	5.14 – 353.00	Dark shale, sandy shale & interbanded shale & sandstone.
			Barakar	12.50 - 268.85	Fine to coarse grained sandstone, Shale, Conglomerate, Carbonaceous shale & Coal seams.
			Karharbari	10.00 – 81.60	Medium to coarse grained sandstone, Shale, silicified quartzite rock & thin coal seams.
Permo Carboniferous	--	–	Talcher	0.80 – 13.50	Green coloured shale, Boulder & Congolomerate
----------Unconformity----------					
Pre-Cambrian	--	--	Metamorphics	--	Granite, Gneisses & Quartzites

There are a few small outliers of Barakar/ Karharbari/ Talchir Formations occurring over the Pre-Cambrian Basements immediately north of the Pakri-Barwadih Block.

b. **PB Block (North West):**

However in PB North West (sector-A) area small exposures of sand stone and coal seam are found near the bank of Khora Nala in the western margin of the block. At places Karharbari Formation also rest directly over metamorphic. The geological

succession established in the PB North West area (sector-A) of the block from sub-surface exploration data is given in **Table 4.6**

TABLE 4.6
STRATIGRAPHIC SUCCESSION OF PB NW (SECTOR-A) AREA OF COAL BLOCK

Period	Group	Sub-Group	Formation (Thickness)	Lithology
Recent & Sub-Recent			Alluvium (3.00 to 23.00m)	Soil & Sub-soil
----------Unconformity----------				
Middle Permian			Barren Measure (44.00 – 138.70m)	Predominantly shale with intercalation of sandstone and shale and arenaceous shale
Lower Permian	Lower Gondwana	amuda	Barakar (19.07m – 137.10m)	Fine to coarse grained sand-stones, shale, carbonaceous shale and coal seams.
			Karharbari (5.14m to 91.52m)	Fine to coarse grained sandstone with bands of shale and coal seams
Permo - Carboniferous			Talchir 0.65m to 4.64m)	Green coloured shale, boulders and conglomerates
----------Unconformity----------				
Precambrian			Metamorphics (2.80-11.00m)	Gniesses, granites and quartzites

4.4.2 Structure

a. Structure of PB (East and West)

Structurally the North Karanpura coalfield is a major broad syncline with its axis trending east to west and plunging towards east. The Pakri-Barwadih is located in the NE part of northern limb. The northern boundary of the block

appears to have normal contacts with Talcher and basement metamorphics. The southern boundary of the Eastern sector is marked by a major fault of about 250m throw towards south. This has resulted in bringing the Barakar formations including coal seams in juxtaposition with Raniganj formation.

The block is generally traversed by NW-SE/SE-EW trending faults with northerly throw causing step like configuration. The strike of the strata is generally NW-SE and the dip of the strata varies from 10^0 to 20^0 (1 in 3 to 1 in 5.5) but generally 10^0 to 15^0 towards south-west.

Nineteen faults with throw ranging up to 170m have been deciphered based on exploration carried out in the block. The throw of most of the faults ranges from 10-40m

It may be mentioned here that the geological structure of the block is primarily based on CMPDI GR in general and in particular in the north and north central part of West Quarry i.e. north of fault F10 –F10, giving due cognizance to the long field association of CMPDI during exploration.

The fault F5 which is of distinctive nature has been considered as the boundary for division of the block into West & East Quarry. The details of faults are given in **Table 4.7**

Table 4.7

Fault Details of PB West & East Block

Fault	Trend	Dip	Throw	Remarks
F1 -F1	East- West	Northerly	20-60m	Omission of (i)Seam-II in KB-16 (ii) Seam-II Top to Seam-IV in CMKPB 29 (iii) Reduction in parting between Seam-II MT & Middle in CMKPB-12

F2 -F2	NW-SE	North-easterly	10-100m	Omission of (i) Seam-I in CMKPB 10 (ii) Seam-II Bottom & V in CMKPB 35 (iii) Seam-III Top & Bottom in CMKPB-12
F3 –F3	NW-SE& Curvilinear fault trending NW-SE and gradually swerving to N-S	Northerly	80–170 m	Intersected in (i) CNPB – 107 (Omission of Seam-I Bottom to Seam-V Top). (ii) Based on Stratum Contours
F4 –F4	NW-SE dies out near borehole CNPB- 52	North–East	0 –20m	Omission of (i) Seam-I Bottom to Seam-II Bottom in CNPB – 49. (ii) Seam-IVA & IV in CNPB- 15 (iii) Seam-II Top & (iv) Seam-III in CNPB-21& Seam-IV in CNPB –64.
F5 -F5	NW-SE to swerving to E-W	North-Easterly/ Northerly	40–140 m	Omission of (i) Seam-I & II in CNPB-92, (ii) Seam-III Bottom in CNPB-93, (iii) Seam-III in CNPB-95, (iv) Seam-III Bottom to V top in KB-11 (v) Seam –II to V top in CNPB-16 (vi) Based on Stratum contour.
F6 -F6	NW-SE abuts against fault F5-F5 near BHs CNPB-93.	North Easterly	10 – 40 m	(i) CNPB-39 Omission of Seam-II Top, Middle & Bottom), (ii) CNPB- 29 Omission of Seam-I Top to I Bottom (iii) Based on Stratum contour.
F7 -F7	Almost E-W Abuts against fault F6-F6 near BH CNPB-28	Northerly	20-80 m	(i) Omission of Seam-III in boreholes CNPB-28, 20& 68. (ii) CNPB – 61 Omission of Seam-II Top to Seam-I Bottom (iii) CNPB-25 Omission of seam floor of Seam-II MB to Seam-I Bottom (iv) CNPB – 29 Omission of Seam-I Top to Seam-I Bottom.
F8 –F8	NW-SE	North Easterly	10-20m	(i) Reduction in parting between Seam II Top & III in CNPB–

				94&KB- 17. (ii) Omission of Seam-IVA &Seam-IV in CNPB – 40. (iii) Seam –III Top to Seam-IV A in CNPB – 38 (iv) Seam- III Bottom in CNPB-32 &(v) Seam-II in CMKPB-11
F9 - F9	E–W, Abuts against fault F-8 near BH CNPB -30	Northerly	20 – 40m	Based on stratum contour plan
F10 – F10	NW – SE curvilinear fault trending almost E-W	Northerly	20 – 60m	Omission of (i) Seam-II Bottom to IVA in CNPB-78 (ii) Based on stratum contour.
F11– F11	Curvilinear fault Trending almost E-W	Northerly	20 – 60m	(i) Based on Stratum Contour plan (ii) Omission of Seam-I in boreholes CNPB – 83 & CNPB – 135.
F12– F12	Curvilinear fault Trending almost E-W	Northerly	20m	(i) Intersected in Borehole CNPB – 80 where Seam- I Top & Middle is faulted (ii) Based on Stratum Contour Plan
F13- F13	E – W	Northerly	20 - 40 m	(i) Roof of Seam – II Top & Middle Combined is faulted in borehole CMKPB- 5. (ii) Based on Stratum Contour Plan.
F14- F14	E-W	Northerly	40-60m	(i) Roof of Seam II Top & Middle combined is faulted in borehole CMKPB-5. (ii) Based on stratum contour plan.
F15– F15	Limits the southern boundary of Eastern Sector of the block Major fault trending almost E-W.	Southerly	More than 200 m throw	Raniganj and Barren Measure formations are in juxtaposition with Barakar
NEW FAULTS				

FN-16	WNW-ESE	NEN	20M	1) Redelineation of incrop of seam 1 2)Cross Section 3. Revision of Floor contours of seam I
FN-17	NW-SE tion in the East Sector within the quarriable zone.	NE	5M	1 &2 same as above 3. Revision of Floor Continuor plan 4. Geological Cross Section additional.
FN 18	NW-SE Location in the Central sector	NE	Amount of throw could not be establis hed	Geological Cross Section
FN –19	WNW-ESE	NNE		Geological Cross Section

b. Structure of PB (North West)

Pakri Barwadih North West (Sector-A) area of the Block, the general strike of the formation in the block is almost east-west. The local swing in the strike at places is due to rolling dip. The strata are dipping at 10° to 12° southerly.

The block is traversed by 8 numbers of faults. Among these, 3 faults are varying from 0 m to 50 m. Fault F1 is the major fault varying in through from 160m to 180m. This fault runs approximately along southern to western boundary of the block. The trend of the fault is NW-SE and except faults F7 & F8, all are extending in metamorphic terrain. The description of faults is presented in the **Table 4.8**.

Table 4.8

DESCRIPTION OF FAULTS INTERPRETED IN PB NW (Sector-A)

FAULT NO.	LOCATION	NATURE	TREND & THROW (m)	BH. NO.	DEPTH (m.)	EVIDENCES
F_1 – F_1	Located near southern to western boundary	Oblique fault	NW-SE & 160 – 180m	MNPB - 25	274.50	• Seam K-1 to K-5 & Local -I, faulted in borehole MNPB-25 • Interpreted based on level difference of seam on either side of fault • Metamorphics has come in juxtaposition of Gondwana in north western part of the block • Equivalent to fault F_3 of western section of Pakri-Barwadih block
F_2 – F_2	Located in Central part of the block	Oblique fault	NW-SE & 0 – 40	MNPB-4	170.00	• Seam K-1 & K-2 faulted in MNPB-4 • Interpreted based on level difference of seam on either side of fault
F_3 – F_3	Located in Central part of the block	Oblique fault	NW-SE & 30 – 55	MNPB-7 MNPB-26	29.00 316.60	• Seam K2 faulted in MNPB-7 • Seam K-1 and contact of Karharbari and metamorphic faulted in borehole MNPB-26 • Interpreted based on level difference of seam on either side of fault • Equivalent to F_5

RQP No. 34011/ (15)/2009-CPAM dated 27.09.10.

FAULT NO.	LOCATION	NATURE	TREND & THROW (m)	BH. NO.	DEPTH (m.)	EVIDENCES
						of western sector of Pakri-Barwadih
F_4 – F_4	Located in north-eastern part of the block	Oblique fault	NW-SE& 10 – 50	MNPB-11	87.00	• Seam K-1 to K-4 faulted in Borehole MNPB-11 • Interpreted based on • level difference of seam • on either side of fault • Equivalent to F_{10} of western sector of Pakri Barwadih
F_5 – F_5	Located in north - eastern corner of the block	Oblique fault	NW-SE & 10			Extending from western sector of Pakri-Barwadih (equivalent to fault F_{12})
F_7 – F_7	Located in the eastern part of the block	Oblique fault	NW-SE & 0 – 10	MNPB-24	205	Seam K-3 faulted in borehole MNPB-24 equivalent to fault F_8 of Pakri-Barwadih Block
F_8 - F_8	Located in the eastern part of the block	Oblique fault	NW-SE & 0 – 5	MNPB-5 MNPB-10	100 28	• Seam K-2 faulted • Seam K-5 faulted

4.4.3 Stratigraphic Sequences

Stratigraphic Sequences of PB West & East

The Barakar formation contains five persistent coal seams numbered Seam-I to Seam-V in ascending order. Out of these, Seam-I & Seam-II have spitted into 3 sections, whereas Seam-III, Seam-IV and Seam-V spitted in two sections each. The split sections are designated as top, middle & bottom. The split sections of the seams merge to form composite seams designated for example as II TM for II Top & Middle combined and MB for Middle and Bottom combined.

The Karharbari formations underlies the Barakar formation and contain 5 thin non-workable coal seams namely Seam-K1 to Seam-K5. The average thickness of these coal seams is less than 1 m.

The summarized sequence and details of coal seams in the block are given in **Table 4.9** and seams have been shown in geological plan **(Plate No. 7)**

Table 4.9
Sequence & details of coal seams

Seam/Parting	Thickness range (m)		General thickness (m)	No of BH considered
	Minimum	Maximum		
Seam-V Top	0.39 (CNPB – 34)	3.91 (CMKPB 13)	1.50	55
Parting	0.80 (CNPB – 32)	12.41 (CMKPB 13)		
Seam -V Bottom	0.18 (CNPB –113)	2.20 (CMKPB 29)	1.00	58
Seam-V Comb	0.73 (CMKPB 37)	6.00 (CMKPB 11)	1.50	19
Parting	2.16 (CNPB– 95)	29.11 (CNPB – 64)		
Seam-IV A	0.20 (CNPB – 95)	3.13 (CNPB –105)	1.25	47
Parting	0.64	12.37		

Seam/Parting	Thickness range (m)		General	No of BH
	(CMKPB –4)	(CMKPB – 30)		
Seam-IV Top	0.90 (CNPB – 26)	7.68 (CNPB – 68)	3.00	26
Parting	0.90 (CNPB – 105)	17.59 (CNPB – 53)		
Seam-IV Bottom	0.65 (CNPB – 86)	7.64 (CNPB –134)	2.50	26
Seam-IV Comb	2.10 (CNPB – 131)	14.61 (CNPB – 144)	8.00	53
Parting	0.98 (MNPB – 25)	44.31 (CMKPB 37)		
Seam-III Top	0.46 (CMKPB 12)	3.75 (CMKPB 10)	1.50	56
Parting	0.94 (CMKPB 15)	28.88 (CMKPB 10)		
Seam-III Bottom	0.16 (CNPB – 85)	3.10 (CNPB – 22)	1.25	56
Seam-III Comb	0.46 (CNPB – 7)	3.74 (CNPB – 37)	1.50	31
Parting	1.97 (CNPB – 48)	45.97 (CNPB-91)		
Seam-II Top	0.25 (CMKPB –4)	15.46 (CMKPB 10)	8.00	60
Parting	Nil	31.93 (CNPB-31)		
Seam-II Middle	2.98 (CMKPB 30)	20.04 (CNPB – 34)	8.00	56
Seam-II TM	10.28	20.26	12.00	39

Seam/Parting	Thickness range (m)		General	No of BH
	(CNPB– 17)	(MNPB-22)		
Parting	0.77	10.75		
	(CNPB –131)	(CNPB-72)		-
Seam-II	1.40	14.56	7.00	80
Bottom	(CNPB – 38)	(CMKPB 10)		
Seam-II MB	13.85	22.51	16.00	12
	(CMKPB 29)	(CNPB-30)		
Seam-II Comb	17.70	28.67		3
	(CMKPB–8)	(CNPB-32)		
Seam-I Top	0.21	11.36	2.50	81
	(CMKPB 12)	(CNPB-124)		
Parting	1.00	18.77		
	(CNPB –110)	(CNPB-91)		
Seam-I Middle	0.42	10.13	2.50	90
	(CNPB – 106)	(CNPB-110)		
Seam-I TM	3.85	11.95		6
	(CNPB – 90)	(CNPB-125)		
Parting	0.85	23.62		
	(CNPB - 44)	(CNPB-72)		
Seam-I	0.20	6.10	2.00	64
Bottom	(CNPB –108)	(CNPB-134)		
Seam-I MB	4.70	11.88		6
	(MNPB –11)	(CMKPB-25)		
Seam-I Comb	7.96	13.76		3
	(CNPB – 78)	(CMKPB-35)		
Parting	1.80	35.75		
	(CNPB – 72)	(CNPB-73)		
Local	0.06	5.56	1.50	72

Seam/Parting	Thickness range (m)		General	No of BH
	(MNPB – 38)	(CMKPB-5)		
Parting	4.72	78.89		
	(CNPB – 69)	(CNPB-88)		
Seam-K5	0.08	2.22	0.75	39
	(MNPB –38)	(CNPB-79)		
Parting	2.27	81.25		
	(CNPB – 80)	(CNPB-124)		
Seam-K4	0.09	3.04	0.75	34
	(CNPB –124)	(CNPB-90)		
Parting	1.20	29.75		
	(CNPB –106)	(CMKPB-36)		
Seam-K3	0.08	2.46	1.25	33
	(CNPB – 90)	(CNPB-116)		
Parting	0.50	33.40		
	(CNPB –110)	(CMKPB-20)		
Seam-K2	0.05	4.80	1.25	36
	(CNPB –124)	(CNPB-123)		
Parting	1.04	48.00		
	(CNPB –101)	(CNPB-128)		
Seam –K1	0.10	6.45	1.50	50
	(CNPB – 52)	(CNPB-105)		

Note: (i) TM stands for Top & Middle Merged.
(ii) MB stands for Middle & Bottom Merged.

The details of the thickness of different coal seams, partings and OB is given in **Table 4.10 & Table 4.11**.

Table 4.10

Thickness of Coal Seams & Partings in PB (West East)

Particulars	West Quarry		East Quarry	
	Max	Min	Max	Min
Over Burden	251.55	10.39	266.81	6
Seam-V Top	3.24	0.36	3.91	0.84
Parting	7.19	0.8	4.89	0.62
Seam-V Bottom	3	0.29	2.04	0.21
Parting	24.97	2.16	19.95	5.88
Seam-IV Top	7.88	0.9	6.57	2.34
Parting	6.76	0.9	17.59	16.38
Seam-IV Bottom	7.64	0.65	6.56	0.87
Parting	44.31	5.1	22.93	5.31
Seam-III Top	3.75	0.23	3.22	0.49
Parting	24.75	1.1	16.94	0.94
Seam-III Bottom	3.1	0.16	2.41	0.21
Parting	45.97	3.39	33.72	1.97
Seam-II Top	12.7	0.74	11.22	0.25
Parting	31.93	1.2	28.12	1.34
Seam-II Middle	20.04	1.75	10.98	3.5
Parting	6.28	0	5.8	0.97
Seam II Bottom	11.4	1.4	14.02	1.99
Parting	30.43	6.21	27.94	4.74
Seam-I Top	11.36	0.45	4.95	0.42
Parting	18.77	1	14.73	1.6
Seam-I Middle	10.13	0.42	6.71	0.87
Parting	16.35	0.95	18.7	0.85
Seam-I Bottom	8.1	0.2	4.8	0.25

Table 4.11

Thickness of Coal Seams & Partings in PB (North West)

Sl. No.	Seam /Parting	Min.	Max.
1	V COMB	3.24	5.9
2	Parting	3.72	27.16
3	IV COMB	5.15	10.04
4	Parting	0.98	30.55

Sl. No.	Seam /Parting	Min.	Max.
5	II TOP	6.90	10.61
6	Parting	1.09	5.12
7	II MID	7.17	11.68
8	Parting	0	0
9	II T+M	15.97	20.26
10	Parting	1.4	24.22
11	II BOT	2.85	6.3
12	Parting	5.89	15
13	I TOP	0.42	3.79
14	Parting	0.52	4.51
15	I MID	1.15	8.73
16	Parting	0.17	4.19
17	I BOT	1.01	4.17
18	Parting	0	0
19	I M+B	4.7	11.88
20	Parting	16.8	27.68
21	LOCAL(L)	0.06	2.35
22	Parting	26.39	29.67
23	K-5	0.08	1.32
24	Parting	4.74	12.65
25	K-4	0.28	1.74
26	Parting	4.4	9.85
27	K-3	0.45	1.06
28	Parting	8.45	19.58
29	K-2	0.06	2.99
30	Parting	3.95	13.84
31	K-1	1.19	4.68

4.4.3.1 General characteristics of Lithological units (coal seams/ parting/ overburden)

(i) The Seam-II and its splits are the most potential seams in the block both from resource and grade of coal but seam II Top & Middle is found as coalesced seam in the eastern part of the block i.e. PB North-West(sector-A) area.

(ii) Seam-I is highly discontinuous and occur mostly in patches. Seam I Bottom and I Middle is found as combined seam in the eastern part of the block.

(iii) In Pakri Barwadih block all Barakar seams of the block are highly inter banded and inferior in nature except Kraharbari seams. Where as Karaharbari formation are well developed in the PB North West (sector-A) area except in few small patches. The Barakar coal seams (seam I to V) are medium to high ash, non-coking bituminous type. The moisture and ash of these coals normally ranges between 3% to 5% and 25% to 45% respectively on inclusion of all dirt bands less than 1m in thickness.

(iv) Overall proximate analysis on 60% RH and 40°C has been carried out for selected boreholes to determine Moisture, Ash and Volatile Matter (VM) on samples excluding carbonaceous shale & all other dirt bands (BCS) and including dirt bands up to 30 cm (I_{30}) and including dirt bands up to 1m (I_{100}) thickness. However all non-combustibles dirt bands such as Grey Shale, Arenaceous Shale, Sandstone samples more than 5 cm have been excluded for estimations of quality and reserves in all cases.

(v) In the boreholes where seam overall proximate analysis has not been determined, Ash & Moisture have been calculated by weighted average method from band by band data. Useful Heat Value (UHV) of coal has been calculated by using the formula 8900-138 x (A%+M %) for determination of grade as per present standard of commercial coal grading system.

(vi) The other special test such as Ultimate Analysis, Ash Analysis, Ash Fusion Range, Petrographic Analysis, Mineralogical Study and Selective Reactivity test have been carried out to ascertain different industrial properties of coal in case of selected seams/sample.

(vii) The Partings of the coal seams are comprises of sandstone, alternate shale & sandstone, shale, carbonaceous shale, etc. The bulk of the OB rocks comprise of sandstones and shale and their intermediate varieties. The soil and weathered rock varies 6 to 24 m thick but generally varies from 6 - 18m.

4.5 Seam wise Quality Parameters of PB Block

The generalized range of quality of coal including dirt bands is given in **Table-4.12.**

Table 4.12
Range of Quality details of Coal seams, PB (West East)

Seam	M%	ASH%	VM%	UHV (K.Cal/Kg.)	Grade (Based on UHV)	CV (K.Cal/Kg.)	Grade (Based on GCV)	CV (Dmmf) (K.Cal/Kg.)
Seam-V Top	3.5-6.8	22.4-52.2	17.8-22.3	1144-4880	D-G (E-F)	3040-5466	G7-G15	6932-7765
Seam - V Bottom	3.9-7.3	15.7-48.7	20.1-21.9	1648-6015	B-G (E-F)	3409-6321	G4-G13	7012-8361
Seam-V Comb	3.4-7.1	17.9-51.8	18.5-24.70	1236-5472	C-Ungr (E-F)	3136-5858	G5-G14	7054-7794
Seam-IV A	3.4-5.2	25.2-49.9	18.5-19.6	1510-4750	D-G (E-F)	3329-5475	G7-G14	7167-7830
Seam-IV Top	3.1-5.8	31.3-43.6	20.4-23.7	2255-3969	E-G (E-F)	3788-4999	G8-G12	7306-7778
Seam-IV Bottom	3.7-5.3	21.6-50.2	18.2-23.8	1626-5225	C-G (D-F)	3438-6070	G5-G13	7307-8191
Seam-IV Comb	2.6-6.7	31.2-48.2	17.9-27.1	1641-3863	E-G (E-F)	3000-4832	G9-G15	5714-7825

Seam	M%	ASH%	VM%	UHV (K.Cal/Kg.)	Grade (Based on UHV)	CV (K.Cal/Kg.)	Grade (Based on GCV)	CV (Dmmf) (K.Cal/Kg.)
Seam-III Top	2.6-5.5	17.2-51.2	18.7-25.7	1365-5767	B-G (C-E)	3200-6136	G4-G14	7048-8672
Seam-III Bottom	2.8-5.7	16.6-50.0	22.7-27.1	1616-5818	B-G (D-E)	3447-6160	G4-G13	7299-7924
Seam-III Comb	3.4-5.8	25.9-37.9	-	3021-5055	D-F (E)	4037-5529	G6-G11	7264-7919
Seam-II Top	2.7-6.7	23.3-52.7	18.0-25.3	1158-5059	C-G (D-F)	3130-5724	G6-G14	7129-7931
Seam-II Middle	2.0-6.9	23.1-43.2	20.7-28.5	2621-5132	C-F (D-F)	4520-5789	G6-G10	7635-8107
Seam-II TM	2.6-5.8	27.2-45.9	21.9-26.2	2206-4650	D-E	3854-5550	C6-G12	7485-8809
Seam-II Bottom	1.6-5.6	26.9-47.2	21.2-26.3	2082-5183	C-G(D-F)	3736-5578	G6-G12	7223-8142
Seam-II MB	2.3-4.0	29.7-35.3	23.3-24.0	3711-4178	D-E	4820-5214	G7-G9	7652-7661

Seam	M%	ASH%	VM%	UHV (K.Cal/Kg.)	Grade (Based on UHV)	CV (K.Cal/Kg.)	Grade (Based on GCV)	CV (Dmmf) (K.Cal/Kg.)
Seam-II Comb	3.8-4.6	28.9-36.6	22.9-23.0	3324-4398	D-F (E-F)	4620-5292	G7-G9	7751-8057
Seam-I Top	1.5-5.7	18.7-51.1	20.8-29.6	1368-5657	B-G (D-F)	3525-6280	G4-G13	7435-8209
Seam-I Middle	1.8-5.3	18.6-50.8	18.0-27.7	1599-5602	C-G (D-F)	3400-5459	G7-G13	7365-7977
Seam-I TM	2.9-4.3	27.2-46.0	20.5	2151-4544	D-G (E-F)	3903-5363	G7-G12	7440-7836
Seam-I Bottom	1.5-4.1	20.1-53.9	18.3-27.6	1172-5208	C-Ungr (E-F)	2491-6071	G5-G17	7217-8006
Seam-I MB	2.8-5.2	33.5-43.8	-	2459-3642	E-F	4016-4716	G9-G11	7531-7727
Seam-I Comb	2.9-3.6	30.9-49.4	20.1	1682-4128	E-G (F-G)	3484-5114	G8-G13	7303-7818
Local	2.3-5.7	15.7-52.8	17.6-26.5	1213-5984	B-G (E-G)	2867-6286	G4-G15	6945-7970
Seam-K5	2.5-5.8	8.0-49.9	-	1677-7603	A-G (C-E)	3502-6753	G2-G13	7301-8090

Seam	M%	ASH%	VM%	UHV (K.Cal/Kg.)	Grade (Based on UHV)	CV (K.Cal/ Kg.)	Grade (Based on GCV)	CV (Dmmf) (K.Cal/ Kg.)
Seam-K4	2.8-6.2	6.4 - 45.9	-	2116-7492	A-G (B-D)	3761-6963	G2-G12	7397-8117
Seam-K3	2.3-6.1	7.1-48.7	15.1-31.40	1820-7244	A-G (B-D)	3400-7145	G1-G13	6981-8154
Seam-K2	2.3-5.6	6.5-47.4	22.4	1996-7299	A-G (B-D)	3712-7056	G1-G12	7428-8128
Seam-K1	1.0-5.1	8.4-49.8	19.3-28.7	1773-7230	A-G (B-D)	3603-7213	G1-G13	7515-8254

Note: *(i) TM Stands for Top & Middle Merged.*
(ii) MB stands for Middle & Bottom Merged.

An exercise has been carried out to assess the coal reserves under D&E grade which together may give an overall ash of nearly 34% and that of F grade & inferior coals with higher ash content. It will be observed that the grade of coal seams generally range between D to G with average of E grade. The reserves in grade D & E constitute over 85% and grade F to G coal accounts for the balance 15% of the total quarriable reserves up to 100 m depth. The corresponding data for total reserves in grade D and E are nearly 70% in the depth range 100 to 300m. From the quality details as available, the reserves available in the block are suitable for power generation.

4.6 RESERVE ESTIMATION:

4.6.1 Reserve Estimation for Pakri Barwadih (West & East)

4.6.1.1 Methodology of Reserve Estimation

Reserves for all the potential coal seams of Barakar formation i.e Seams I bottom – Seam V top except IV-A & Local Seams have been estimated by utilizing isochore of individual coal seams. In this isochore method, the areas between successive isochores were determined with the help of digital planimeter which has been multiplied with the average thickness of successive isochores to arrive at volume of chore. The specific gravity of 1.28 + 1% of ash% has been considered for estimation of tonnage of different coal seams.

4.6.1.2 Seam-wise Grade-wise Geological Reserve:

Grade-wise reserves were also computed by measuring area between iso-grad (UI IV contours).

4.6.1.3 Category wise Net geological reserves

The reserves so estimated have been categorized as Proved and Indicated reserves based on density of boreholes. The reserves of Southern and South-Western part of the block have been placed under Indicated category, whereas the entire reserve of north - eastern part of the block is placed under Proved category. Further these reserves are also classified under UNFC guidelines considering the economic, feasibility and geological axis.

Summarized details of coal reserves are furnished in **Table 4.13** and Summary of Coal Reserve in Million tonnes is given in **Table 4.14**

Table 4.13

Seam-wise Grade-wise Geological Reserve

Seam Name	Area Sq. Km.	Grades							
		B	C	D	E	F	G	Ungr.	Total
PROVED RESERVES									
Area less than 100m Depth									
EASTERN SECTOR									
Seam-V Top	0.128	0.128				0.004	0.328		
Seam-V Bot	0.214	0.214				0.465			
Seam-	0.841	0.841				4.883	2.386	0.077	

Seam Name	Area Sq. Km.	Grades							
		B	C	D	E	F	G	Ungr.	Total
IV Comb									
Seam-III Top	0.438	0.438			0.874	0.423	0.052		
Seam-III Comb	0.067	0.067				0.192			
Seam-II Top	1.644	1.644			0.549	2.340	3.468		
Seam-II Mid	1.580	1.580			9.877	6.295			
Seam-II Bot	1.642	1.642			0.388	10.443	1.603		
Seam-II MB	0.063	0.063				1.415			
Seam-I Top	1.771	1.771		2.253	1.400	0.019			
Seam-I Mid	2.551	2.551				1.502	2.964	5.290	
Seam-I Bot	0.782	0.782			0.613	1.227	0.877	1.380	
Total				**2.253**	**13.701**	**29.208**	**11.678**	**6.747**	
Area Between 100m & 300m Depth									
Seam-V Top	1.575			0.044	0.047	5.304	0.206		5.601
Seam-V Bot	1.497				2.534	0.746			3.280
Seam-V Comb	0.170				0.579				0.579
Seam-IV Comb	1.590				6.095	6.332	0.276		12.703
Seam-III Top	1.687		1.091	3.632	0.529	0.131			5.383
Seam-IIIBot	0.171					0.312			0.312
Seam-III Comb	0.097				0.419				0.419
Seam-II Top	1.256		0.337	0.588	1.801	3.408	0.143		6.277

Seam Name	Area Sq. Km.	Grades							
		B	C	D	E	F	G	Ungr.	Total
Seam-II Mid	1.642			16.659	3.020				19.679
Seam-II Bot	1.558			0.392	11.643	0.080			12.115
Seam-II MB	0.015				0.336				0.336
Seam-I Top	1.465	0.103	0.595	1.773	0.537	0.079			3.087
Seam-I Mid	1.726					2.732	3.927		6.659
Seam-I Bot	1.130					1.151	2.067		3.218
Total		**0.103**	**2.023**	**23.088**	**27.540**	**20.275**	**6.619**		**79.648**
Total for EASTERN SECTOR		**0.103**	**4.276**	**36.789**	**56.748**	**31.953**	**13.366**		**143.235**
CENTRAL SECTOR									
Area less than 100m Depth									
Seam-V Top	0.013					0.038	0.012		0.050
Seam-IV Top	0.172					0.776			0.776
Seam-IV Bot	0.178			0.234	0.270				0.504
Seam-IV Comb	0.069				0.565				0.565
Seam-III Top	0.382			0.080	0.376	0.236			0.692
Seam-III Bot	0.441			0.592	0.502				1.094
Seam-II Top	0.860			1.720	1.529				3.249
Seam-II Mid	0.900			2.249	10.939				13.188
Seam-IITM	0.761			5.227	5.379				10.606
Seam-II Bot	1.615			0.487	6.953	3.094	0.159		10.693
Seam-II MB	0.240				5.738				5.738

Seam Name	Area Sq. Km.	Grades							
		B	C	D	E	F	G	Ungr.	Total
Seam-II MB	0.240				5.738				5.738
Seam I Top	1.053			0.339	0.776	0.588	0.691		2.394
Seam I Mid	1.746			0.013	0.320	1.200	4.010		5.543
Seam-I TM	0.149					0.287	2.154		2.441
Seam-I Bot	0.552			0.071	0.267	0.511	0.373		1.322
Seam-I Comb	0.024						0.038		0.038
Total				**11.012**	**33.614**	**6.830**	**7.437**		**58.893**
Area Between 100m & 300m Depth									
Seam-V Top	2.056			0.443	1.023	3.187	1.939		6.592
Seam-V Bot	2.092			0.074	0.153	3.036	1.664		4.927
Seam-V Comb	0.995		0.203	0.271	0.606	0.783	0.591		2.459
Seam-IV Top	0.639				0.706	1.914	0.154		2.774
Seam-IV Bot	0.784			0.254	0.334	0.538	0.334		1.460
Seam IV Comb	3.199				1.233	26.630	1.723		29.586
Seam-III Top	3.090		0.350	2.127	2.859	0.190			5.526
Seam-III Bot	1.180		0.550	1.070	0.869				2.489
Seam-III Comb	0.240			0.168		0.675			0.843
Seam-II Top	3.070		0.071	2.574	4.221	1.203	0.292		8.361
Seam-II Mid	3.327		1.475	43.298	6.393				51.166
Seam-IITM	0.941			12.451	5.465				17.916
Seam-II	3.592			1.210	21.87	6.638	0.164		29.885

Seam Name	Area Sq. Km.	Grades							
		B	C	D	E	F	G	Ungr.	Total
Bot					3				
Seam-II MB	0.487				11.580				11.580
Seam II Comb	0.199				5.551				5.551
Seam-I Top	2.649			0.595	1.350	2.236	1.174		5.355
Seam-I Mid	3.378				0.095	3.796	3.726		7.617
Seam-I TM	0.004						0.066		0.066
Seam-I Bot	1.157					1.436	2.108		3.544
Seam-I Comb	0.231						2.675		2.675
Total			**2.655**	**64.535**	**64.310**	**52.262**	**16.610**		**200.372**
Area beyond 300m Depth									
Seam V Top	0.519					1.483	0.608		2.091
Seam-V Bot	0.648				0.125	2.085			2.210
Seam-V Comb	0.445		0.221	0.266	0.285	0.275			1.047
Seam-IV Top	0.222					0.580			0.580
Seam-IV Bot	0.222					0.623			0.623
Seam-IV Comb	1.587					16.216	0.594		16.810
Seam III Top	1.053			0.149	1.357	0.271	0.137		1.914
Seam-III Bot	0.051			0.081	0.018				0.099
Seam-II Top	1.486			0.592	1.836	1.229	1.151	0.254	5.062
Seam-II Mid	1.490			10.994	9.362				20.356
Seam-II Bot	1.482			0.216	4.545	5.434			10.195

Seam-II Comb	0.045				1.256			1.256
Seam-I Top	0.688			0.022	0.079	0.843	0.634	1.578
Seam-I Mid	0.808					1.339	0.862	2.201
Seam I Bot	0.572					0.893	0.428	1.321
Total			**0.221**	**12.320**	**18.863**	**31.271**	**4.414**	**0.254**	**67.343**
Total For CENTRAL SECTOR			**3.876**	**88.867**	**117.787**	**91.363**	**29.461**	**1.254**	**327.608**

WESTERN SECTOR

Area less than 100m Depth

Seam-III Top	0.507						1.068	1.068
Seam-III Bot	0.377				0.574	0.189		0.763
Seam-IITM	1.470			6.063	17.010			23.073
Seam-II Bot	1.661			0.374	4.048	3.912		8.334
Seam-I Top	1.710	0.485	1.192	1.023	1.775	0.669		5.144
Seam-I Mid	2.217		2.511	3.804	2.744	0.394		9.453
Seam-I Bot	1.242			0.714	2.235	1.965		4.914
Seam-I MB	1.018				1.782			1.782
Total		**0.485**	**3.703**	**11.978**	**36.168**	**7.129**	**1.068**	**60.531**

Area Between 100m & 300m Depth

Seam-V Top	0.902				0.139	1.145	1.868	3.152
Seam-V Bot	0.387					0.939		0.939
Seam-V Comb	0.469				0.722	0.896		1.618
Seam-IV Top	1.195				0.685	7.551		8.236

Seam-IV Bot	1.192		0.570	2.516	0.968	0.348	4.402
Seam-IV Comb	1.061			0.643	12.158	0.219	13.020
Seam-III Top	1.107	0.524	0.759	0.632	0.563	0.412	2.890
Seam-III Bot	0.188			0.409			0.409
Seam-III Comb	0.502		0.605	0.964			1.569
Seam-II Top	0.583		1.791	0.909			2.700
Seam-II Mid	0.901	0.224	8.190	2.801			11.215
Seam-IITM	1.906		4.047	25.424			29.471
Seam-II Bot	2.421		4.350	12.278	3.185	0.078	19.891
Seam-II Comb	0.098		2.285				2.285
Seam-I Top	2.034		0.970	1.881	2.226	0.428	5.505
Seam-I Mid	2.563		0.399	3.546	6.382		10.327
Seam-I Bot	1.802			0.666	3.732	0.903	5.301
Seam-I MB	0.623				7.076		7.076
Seam-I Comb	0.069				0.871		0.871
Total		**0.748**	**23.966**	**54.215**	**47.692**	**4.256**	**130.877**
Area beyond 300m Depth							
Seam-V Top	0.334		0.409	0.346	0.397		1.154
Seam-V Bot	0.229				0.465		0.465
Seam-V Comb	0.121			0.432			0.432
Seam-IV Top	0.465				3.392		3.392
Seam-IV Bot	0.465			0.967	0.815	0.216	1.998

Seam-IV Comb	0.472			0.326	3.567			3.893
Seam-III Top	1.016	0.359	0.632	1.724	1.077	0.197		3.489
Seam-III Comb	0.581		1.281	0.275				1.556
Seam-II Top	0.030		0.138					0.138
Seam-II Mid	0.540		0.464	0.770				1.234
Seam-IITM	0.565		11.388	0.972				12.360
Seam-II Bot	0.474		0.660	3.429	0.299			4.388
Seam-I Top	0.436		0.025	0.416	0.828	0.214		1.483
Seam-I Mid	0.559			0.926	1.896			2.822
Seam-ITM	0.081			1.277				1.277
Seam I Bot	0.457				1.158	0.210		1.368
Total		**0.359**	**14.588**	**11.014**	**13.497**	**0.837**		**41.449**
Total for WESTERN SECTOR	**0.485**	**4.810**	**50.532**	**101.397**	**68.318**	**6.161**		**232.857**

INDICATED SECTOR

EASTERN SECTOR

Area Between 100m & 300m Depth

Seam-V Top	0.704				2.661			2.661
Seam-V Bot	0.679		0.193	0.980	1.672			2.845
Seam-IV Top	0.240			1.913				1.913
Seam-IV Bot	0.300	1.682						1.682
Seam-IV Comb	0.748			5.183	2.638			7.776
Seam-III Top	0.752		0.972	0.551	0.079			1.602
Seam-III Bot	0.073				0.161			0.161

Seam-III Comb	0.118				0.499				0.499
Seam-II Top	1.116			0.554	4.438	0.103			5.095
Seam-II Bot	1.270				10.347	0.484			10.831
Seam-I Top	0.527		0.095	0.708	0.314				1.117
Seam-I Mid	0.727				0.118	2.252	0.408		2.778
Seam I Bot	0.610					1.600	0.166		1.766
Total			**1.777**	**2.427**	**24.298**	**11.650**	**0.574**		**40.726**
Area beyond 300m Depth									
Seam-V Top	1.988					2.863	2.868		5.731
Seam-V Bot	2.213			0.716	2.126	2.254			5.096
Seam-IV Top	1.060				8.448				8.448
Seam-IV Bot	2.060		8.857						8.857
Seam-IV Comb	0.339				0.825	2.385			3.210
Seam-III Top	1.546			0.052	2.511	0.842			3.405
Seam-III Bot	0.823					2.080			2.080
Seam-II Top	3.694				10.653				10.653
Seam-II Mid	2.681			18.973	1.387				20.360
Seam-II Bot	2.685				15.257				15.257
Seam-I Top	1.387	0.221	1.363	1.281					2.865
Seam-I Mid	1.781					2.547	4.327		6.874
Seam-I Bot	1.290			0.013	0.116	1.751			1.880
Total		**0.221**	**10.220**	**21.035**	**41.323**	**14.722**	**7.195**		**94.716**
Total for EASTERN SECTOR		**0.221**	**11.997**	**23.462**	**65.621**	**26.372**	**7.769**		**135.442**
CENTRAL SECTOR									
Area Between 100m & 300m Depth									

Seam-V Top	0.258					0.575	0.167		0.742
Seam-V Bot	0.541					0.769	0.467		1.236
Seam-IV Top	0.317					2.605			2.605
Seam-IV Bot	0.317			0.084	0.568				0.652
IV Comb	1.495				9.410	6.147			15.557
III Top	0.326		0.105	0.172	0.461				0.738
Seam-III Bot	0.763				1.593				1.593
Seam-II Top	1.189				6.136	0.521	0.588		7.245
Seam-II Mid	0.632			7.401	0.670	0.075			8.146
Seam-II Bot	0.740			0.608	0.914	4.448			5.970
Seam I Top	1.163			0.749	0.105	1.103	1.202		2.659
Seam-I Mid	1.462				0.634	1.899	0.360		3.093
Seam-I Bot	1.126						1.723	0.881	2.604
Total			**0.105**	**8.514**	**20.691**	**18.142**	**4.507**	**0.881**	**52.840**

Area beyond 300m Depth

Seam-V Top	4.240					1.895	12.577	0.716	15.188
Seam-V Bot	4.670				3.262	5.778	0.196		9.236
Seam IV Top	1.814				4.235	10.657			14.892
Seam-IV Bot	1.814			0.560	1.269	4.370			6.205
Seam-IV Comb	2.488				1.887	8.281			10.168
Seam-III Top	2.985		0.090	0.935	3.767	1.574			6.276
Seam-III Bot	1.991			0.746	2.502	0.948			4.196
Seam-II Top	3.876			3.266	19.307	0.757	0.540		23.870
Seam-II Mid	4.230			10.874	12.771	0.243			23.888
Seam-II Bot	4.212			0.196	31.639	1.695			33.530

Seam-I Top	4.201			3.053	2.780	2.909	0.505	9.247
Seam-I Mid	4.390			1.620	3.541	4.853	1.474	6.327
Seam-I Bot	2.255					3.350	1.870	5.220
Total			**0.090**	**21.250**	**86.960**	**45.421**	**4.585**	**173.494**
Total for CENTRAL SECTOR			**0.195**	**29.764**	**107.651**	**65.286**	**8.250**	**226.334**

WESTERN SECTOR

Area Between 100m & 300m Depth

Seam-V Top	0.212					0.481		0.481
Seam-V Comb	0.025					0.067		0.067
Seam-IV Top	0.546					5.277		5.277
Seam-IV Bot	0.596			0.245	0.920	0.933		2.098
Seam-IV Comb	0.105					1.184		1.184
Seam-III Top	0.243				0.880			0.880
Seam-III Bot	0.191			0.386				0.000
Seam-II Top	0.348				2.483			2.493
Seam-II Mid	0.253		0.448	1.190	1.640			3.279
Seam II Bot	0.095				0.599			0.599
Seam-I Top	0.368			0.261	0.690			0.951
Seam-I Mid	0.331					1.616		1.616
Seam-I Bot	0.285					0.559	0.095	0.654
Total			**0.448**	**2.082**	**7.212**	**10.117**	**0.095**	**19.954**

Area beyond 300m Depth

Seam-V Top	8.271					5.151	15.534	20.685

Seam-V Bot	6.773				4.862	11.864			16.726
Seam-V Comb	0.231				0.082	0.545			0.627
Seam-IV Top	2.761					26.186			26.186
Seam-IV Bot	4.761			2.036	0.732	12.704			15.472
Seam-IV Comb	4.027					45.394			45.394
Seam-III Top	7.436				15.798				15.798
Seam-III Bot	5.962			12.059					12.059
Seam-II Top	6.387			2.024	28.227	0.685	0.145		31.081
Seam-II Mid	6.501			11.878	24.473				36.351
Seam-II Bot	6.383			0.379	60.520				60.899
Seam-I Top	7.133			0.020	9.419	7.547	1.117		18.103
Seam-I Mid	7.004			0.581	5.969	25.844			32.394
Seam-I Bot	4.785					7.130	3.966		11.096
Seam-I Comb	0.527				8.598				8.598
Total				**28.977**	**158.680**	**143.050**	**20.762**		**351.469**

Total for WESTERN SECTOR		0.448	31.050	165.892	153.170	20.857			371.423
Total Proved	0.588	11.962	175.188	274.932	190.634	47.988	0.294		702.700
Total Indicated	0.221	12.640	84.285	339.164	244.825	36.876			733.190

Table 4.14

Summary of Coal Reserve in Million tonnes

	Up to 300m depth	Beyond 300m depth	Total
Proved	594	109	703
Indicated	113	620	733
Total	707	729	1436

As per United Nations Framework Classification (UNFC) the reserves of Pakri-Barwadih can be classified as given in **Table 4.15**:

Table 4.15
Summary of Coal Reserve in Million tonnes

UNFC Code	Type	Million tonnes Net Coal Reserves
111	Proved Reserves	703
211	Feasibility Mineral Reserves	630
222	Indicated Mineral Reserves	733
	Total(111+222)	**1436**

4.6.2 RESERVES of PB North West Area

4.6.2.1 GENERAL

a. The procedure adopted for estimation of reserves of coal in Pakri Barwadih North West (sector-A) Coal Block is fundamentally based on the specific geological factors which determine the extent to which correlation, interpolation of data can be projected for building up a stratigraphic and structural model of the lay and disposition of the coal seams.

b. The structural model is depicted in various plates illustrating vertical cross sections and floor contour plans. The dimensional model with quality overalls are presented in the individual seam folio plans.

c. Detailed exploration in Pakri – Barwadih - A Coal Block, District Hazaribagh, Jharkhand has established the presence of 10 Nos. of seams, 5 each coal bearing horizons belonging to Barakar formations and Karharbari formation respectively. In ascending order these are seam K-1,K-2,K-3,K-4,K-5 in Kharharbari Formation and Local(L),I,II,IV & V in

Barakar Formation. Seam I splits into 3 sections viz. I Top, I Middle & I Bottom at places. Seam I Bottom and I Middle combined and form single seam namely I Bottom + Middle. Similarly Seam II also splits into 3 sections viz. II Top, II Middle and II Bottom. Seam II Top and II Middle coalesce to form single seam as II Top + II Middle in eastern part. In Pakri Barwadih North West (Sector-A) Coal Block Seam V & IV occur as a combined seam.

d. The dimensional and quality aspects of the seams viewed in the spatial framework with reference to the ground surface have indicated the potentiality for mining of Seams Seam I - Bottom, I - Bottom + I - Middle, I - Middle, I-Top, II-Bottom, II Middle, II Top, II Top + Middle, IV Combined & V Combined together as the opencast proposition, while Seam-Local (L) & K-1 to K-5 can be mined by underground method. The entire quarriable area considering seam-I as base seam occurs in less than 300 m depth.

e. In borehole MNPB-13 located outside northern boundary, Seam K1 & K2 of Karharbari Formation are intersected at shallower depth. Besides, as per structure evolved, coal seams (K1 to K5) of Karharbari are likely to extend outside the northern boundary of the block in the northeastern area.

4.6.2.2 BASIC ASSUMPTIONS AND NORMS FOLLOWED

The following basic assumptions and norms have been taken into account for reserves calculation:

i) The isochores, isograde and the floor contours have been drawn by using MINEX software. It is assumed that the variation between any two points of observation is uniform and gradual.

ii) The underground reserves for the seams have been estimated based on I-30 thickness and quality of the seam. The I-30 thickness has been delineated including carbonaceous shale bands upto 0.30m and non-combustible bands upto 0.05m thickness. However, all non-combustible bands (NCB) of >0.05m thickness and carbonaceous bands of > 0.30 m have been excluded. The quarriable reserves have been estimated on the basis of I-100 thickness where the carbonaceous bands up to 1m thickness have been included in the seam and dirt bands more than 1 m. in thickness & obvious bands more than 0.05m in thickness have been excluded.

iii) The minimum workable thickness for the estimation of open cast and underground reserves of the seam has been considered as 1.00 m and 0.90m/1.20m respectively.

iv) In open cast reserves have been estimated at 1.00 m. thickness interval while in underground reserves have been estimated at 0.90m to 1.20m,1.20m to 1.50m, 1.50m to 1.80m, 1.80m to 2.00m, 2.00m to 2.50m, 2.50m to 3.00m, 3.00m to 3.50m, 3.50m to 5.00m, 5.00m to 10.00m thickness ranges and above 10.00m interval

v) The seams having UHV less than 1300 K/Cal/Kg have been considered as ungraded coal and have been marked in seam folio of respective seam Ungraded coal zones have been included in over burden.

vi) Areas have been identified where the seams are not developed at all. The limits of these zones of non-development have been marked by taking half of the influence of the boreholes with positive seam intersection. These limits have also been considered to be the line of zero seam thickness and the workable limits were delineated accordingly. The areas falling within < 1.00 m thickness zone have not been considered for estimation of opencast reserves in case of underground reserves areas <0.90 m. / 1.20 m. have not been taken in account for reserves estimation.

vii) Line of split has been considered as 1.00m parting between two sections. Though in few cases the parting between two consecutive seams is less than 1m, seam is considered split as it occurs in small patches. Likewise if the seam is found coalesced in a small patch has been considered split.

viii) 40m barrier have been drawn from Khora Nala, its tributary and road.

ix) No barrier has been drawn along the kucha roads which connect the different parts of the block and small nalas.

x) The reserves have been estimated upto the trace of the floor of the incropping coal seams within the block.

xi) In incrop region while estimating the reserves, average of thickness has been considered.

xii) An overall deduction of 10% is applied to the gross tonnage from each seam to arrive at the net-in-situ reserves of coal to account for data gaps, wash out zones, abrupt change in seam thickness and the reserves have been rounded off to the nearest multiple of 1000 tonnes.

xiii) Heave zone of respective seam has excluded while estimating reserves.

xiv) All volumes of coal are estimated by isochore method.

4.6.2.3 ISOCHORE METHOD OF RESERVES ESTIMATION

a. In order to estimate the underground reserves the isochores of seam thickness excluding all dirt bands having thickness > 0.30 m and all non-combustible bands having thickness > 0.05m have been drawn while for estimation of open cast reserves the isochores have been drawn by excluding dirt band of more than 1 m. thickness and obvious bands of >0.05m thickness Isograde for different grades have been drawn. The intersections of all these lines have generated large number of small areas each with a specific combination of seam parameters and imposed limitations.

b. The reserves of the seam have been calculated by using MINEX Software.

c. The standard formula which is universally accepted has been used for calculating the gross reserves :

R = A x Th x Sp Gr.

Where,

R = Gross Reserves in thousand tones

A = Area in Sq.m

Th = Thickness in metre

Sp. Gr. = Specific Gravity of coal for a specific grade

4.6.2.4 OVERBURDEN

a. **Nature of overburden:** Overburden consists predominantly sandstone with minor amount of shale, carbonaceous shale, ungraded coal and thin coal bands (< 1m in thickness) Besides, the overburden also includes soil, weathered rocks, obvious bands of any thickness and dirt bands of >1m thickness.

b. **Calculation of Overburden:** Overburden plan, total iso-patchytes plan, coal to overburden plan and iso-excavation plan on floor of Seam I Bottom and I Middle + Bottom have been prepared by using MINEX Software Programme. Total Volume has been calculated by software.

c. The volume of overburden has been calculated by applying the formula:

V = A x Th

Where,

V = Volume of overburden in cubic meter.

A = Area in sq. m.

Th = Average thickness of iso-pachytes of overburden in m / iso-pachytes of parting.

4.6.2.5 COAL TO OVERBUREN RATIO

The coal packet from Seam-I Bottom to V Combined together forms the opencast potentiality. Near the incrop of Seam-I Bottom, coal to overburden ratio is more than 1:5. But after the inclusion of younger seams the ratio improves to 1:1. With the increase of quarry depth, ratio decreases to 1:4. In the major part of the block coal to overburden ration varies from 1:1 to 1:4.

4.6.2.6 STRIPPING RATIO

Stripping ratio is obtained after dividing total volume of overburden by tonnage of coal available in the same area. Volume of overburden and stripping ratio-wise and depth-wise reserves are given in **Table 4.16.**

TABLE 4.16
SECTOR WISE, DEPTH WISE RESERVES, OVERBURDEN AND STRIPPING RATIO

SECTOR	DEPTH (m)	RATIO	AREA (m^2)	REERVE ('000 TONNES)	VOLUME ('000 m^3)	STRIPPING RATIO (m^3/t)
	0 - 50	<1:1	3700	95	53.599	0.564
		1:1 – 1:2	6800	87	137.412	1.579
		1:2 – 1:3	6600	99	156.579	1.582
	Depth Total		**17100**	**281**	**347.590**	**1.237**
	50 - 100	<1:1	41400	1887	1194.583	0.633
		1:1 – 1:2	13600	835	675.558	0.809
	Depth Total		**55000**	**281**	**1870.141**	**0.687**
	100 - 150	1:1 – 1:2	18000	1162	1116.640	0.961
	Depth Total		**18000**	**1162**	**1116.640**	**0.961**
	Sector Total		**90100**	**4165**	**3334.371**	**0.801**
	0 - 50	<1:1	2600	38	16.072	0.423
		1:1 – 1:2	22400	348	505.270	1.452

SECTOR	DEPTH (m)	RATIO	AREA (m^2)	REERVE ('000 TONNES)	VOLUME ('000 m^3)	STRIPPING RATIO (m^3/t)
		1:2 – 1:3	116800	1565	2962.689	1.893
		1:3 – 1:4	68300	870	1962.472	2.256
		1:4 – 1:5	15300	177	451.181	2.549
		>1:5	60800	319	1431.425	4.487
	Depth Total		**286200**	**3317**	**7329.109**	**2.210**
II	50 - 100	<1:1	7700	239	208.826	0.874
		1:1 – 1:2	384300	17512	17461.220	0.997
		1:2 – 1:3	11500	382	433.705	1.135
		1:3 – 1:4	1300	62	51.524	0.831
	Depth Total		**404800**	**18195**	**18155.280**	**0.998**
	100 - 150	1:1 – 1:2	106400	5984	7723.825	1.291
		1:2 – 1:3	135700	7633	12041.560	1.578
	Depth Total		**242100**	**13617**	**19765.380**	**1.452**
	150 - 200	1:2 – 1:3	116800	7754	14392.920	1.856
		1:3 – 1:4	122600	7619	17445.210	2.290
	Depth Total		**241400**	**15373**	**31838.130**	**2.071**
	200 - 250	1:2 – 1:3	100	7	14.998	2.143
		1:3 – 1:4	80800	5755	13679.360	2.377
		1:4 – 1:5	9900	778	1897.294	2.439
	Depth Total		**90800**	**6540**	**15591.650**	**2.384**
	250 - 300	1:4 – 1:5	700	53	143.101	2.700
	Depth Total		**700**	**53**	**143.101**	**2.700**
	Sector Total		**1266000**	**57095**	**92822.650**	**1.626**
	0 - 50	1:1 –	400	2	5.370	2.685

SECTOR	DEPTH (m)	RATIO	AREA (m^2)	REERVE ('000 TONNES)	VOLUME ('000 m^3)	STRIPPING RATIO (m^3/t)
III		1:2				
		1:2 – 1:3	21600	259	547.525	2.114
		1:3 – 1:4	28000	317	799.808	2.523
		1.4 – 1:5	17400	184	568.847	3.092
		>1:5	3900	27	113.712	4.212
	Depth Total		**71300**	**789**	**2035.262**	**2.580**
	50 - 100	<1:1	1100	69	30.245	0.438
		1 1 – 1:2	97700	3906	4805.997	1.230
		1:2 – 1:3	63600	2550	4001.816	1.569
		1:3 – 1:4	22900	569	1015.282	1.784
		1:4 – 1:5	14500	376	754.994	2.008
		>1:5	100	1	4.316	4.316
	Depth Total		**199900**	**7471**	**10612.650**	**1.421**
	100 - 150	1:1 – 1 2	18900	1096	1298.116	1.184
		1:2 – 1:3	174800	9133	15262.440	1.671
		1:3 – 1:4	22900	1122	2483.796	2.214
	Depth Total		**216600**	**11351**	**19044.360**	**1.678**
	150 - 200	1:2 – 1 3	3100	251	351.135	1.399
		1:3 – 1:4	145800	8342	19787.450	2.372
		1:4 – 1:5	200	11	32.013	2.910
	Depth Total		**149100**	**8604**	**20170.600**	**2.344**
	200 - 250	1:3 – 1.4	30700	2115	5093.640	2.408
		1:4 – 1:5	11400	743	1945.827	2.619

SECTOR	DEPTH (m)	RATIO	AREA (m^2)	REERVE ('000 TONNES)	VOLUME ('000 m^3)	STRIPPING RATIO (m^3/t)
	Depth Total		**42100**	**2858**	**7039.467**	**2.463**
	Sector Total		**679000**	**31073**	**58902.340**	**1.896**
	0 - 50	<1:1	100	69	2.100	0.030
		1:2 – 1:3	18100	293	559.562	1.910
		1:3 – 1:4	40400	579	1181.780	2.041
		1:4 – 1:5	14800	133	400.486	3.011
		>1:5	5900	67	140.887	2.103
	Depth Total		**79300**	**1141**	**2284.815**	**2.002**
	50 - 100	<1:1	7200	224	201.456	0.899
IV		1:1 – 1:2	82100	3353	3386.862	1.010
		1:2 – 1:3	28300	1193	1725.109	1.446
		1:3 – 1:4	20300	577	842.583	1.460
	Depth Total		**137900**	**5347**	**6156.010**	**1.151**
	100 - 150	1:1 – 1:2	100	5	6.663	1.333
	Depth Total		**100**	**5**	**6.663**	**1.333**
	Sector Total		**217300**	**6493**	**8447.488**	**1.301**
	0 - 50	1:1 – 1:2	100	30	2.573	0.086
		1:2 – 1:3	5200	80	156.494	1.956
		1:3 – 1:4	32400	516	1013.048	1.963
		1:4 – 1:5	34500	356	1064.945	2.991
V		>1:5	26500	213	805.907	3.784
	Depth Total		**98700**	**1195**	**3042.967**	**2.546**
	50 - 100	<1:1	400	12	11.901	0.992
		1:1 – 1:2	82300	3146	3736.673	1.188
		1:2 – 1:3	18800	806	1164.137	1.444

SECTOR	DEPTH (m)	RATIO	AREA (m^2)	REERVE ('000 TONNES)	VOLUME ('000 m^3)	STRIPPING RATIO (m^3/t)
		1:3 – 1:4	16900	436	753.228	1.728
		1:4 – 1:5	19000	493	929.143	1.885
		>1:5	2200	140	100.593	0.719
	Depth Total		**139600**	**5033**	**6695.675**	**1.330**
	100 - 150	1:2 – 1:3	1200	54	83.737	1.551
		>1:5	1000	51	88.450	1.734
	Depth Total		**2200**	**105**	**172.187**	**1.640**
	Sector Total		**240500**	**6333**	**9910.828**	**1.565**
GRAND TOTAL		<1:1	64200	2633	1718.782	0.653
		1:1 – 1:2	833100	37466	40862.180	1.091
		1:2 – 1:3	724200	32059	53854.410	1.680
		1:3 – 1:4	633300	28879	66109.180	2.289
		1:4 – 1:5	137700	3304	8187.831	2.478
		>1:5	100400	818	2685.290	3.283
		TOTAL	**2492900**	**105159**	**173417.700**	**1.649**

4.6.2.7 SECTORS FOR RESERVE ESTIMATION

Based on structural set up, the block has been divided into 6 sectors. Descriptions of sectors are given in **Table 4.17**. Category wise Geological Reserve of PB North West Quarry are given in **Table 4.18**. Seamwise and Gradewise reserves are given in **Table 4.19**.

TABLE 4.17
DESCRIPTION OF SECTORS

SECTOR	DESCRIPTION
Sector I	Located in the southern part of the block bounded by southern, western and eastern boundary of the block and up thrown trace of fault F_1-F_1

Sector II	Located to the north of Sector-I, bounded by down thrown trace of fault F_1-F_3 in the south, upthrown trace of fault F_4-F_2 in north and by block boundary
Sector III	Located in the central part bounded by down thrown trace of Fault F_3-F_4, upthrown trace of fault F_4-F_4 in the north and by block boundary
Sector IV	Located in the north eastern part of the block, bounded by down thrown trace of fault F_4-F_4, in the south and up thrown trace of fault F_6-F_8 in the north and block boundary.
Sector V	Located in the north eastern part of the block bounded by block boundary, up thrown trace of fault F_5-F_7 in the north, block boundary in the east and down thrown trace of fault F_6-F_8 in the south and west
Sector VI	A small triangular patch located in the extreme north-eastern part, bounded by block boundary in north & east, and down thrown trace of fault F_5-F_7 in the south and west

A total of 137.584 million tonnes of coal reserves varying in grade from 'G' to 'A' has been established in Pakri Barwadih North West (Sector-A) Coal Block, out of which 134.470 m.t falls in proved category and 3.114 m.t in 'Indicated Category'.

Table 4.18

Category wise Geological Reserve of PB North West Quarry

Property	Reserves in Million Tonnes		
	Category		Total
	Proved	Indicated	Total
Opencast	106.263	0.425	106.688
Underground	28.207	2.689	30.896
Total	**134.470**	**3.114**	**137.584**

Table 4.19

SEAM WISE AND GRADE WISE GEOLOGICAL RESERVES

(In '000 Tonnes)

SEAM/ GRADE	A	B	C	D	E	F	G	TOTAL
V COMB	0	0	0	0	175	6010	0	6185
IV COMB	0	0	0	0	3547	8174	0	11721

SEAM/ GRADE	A	B	C	D	E	F	G	TOTAL
II TOP	0	0	0	699	9673	0	0	10372
II MID	0	0	0	9623	2610	0	0	12233
II T+M	0	0	0	8459	12825	1347	0	22631
II BOT	0	0	0	1481	9913	703	1	12098
I TOP	0	0	277	2829	3188	805	0	7099
I MID	0	0	402	984	2593	435	0	4414
I BOT	0	0	416	499	484	389	85	1873
I M+B	0	0	0	0	7256	10806	0	18062
LOCAL	0	0	59	1414	733	391	0	2597
K - 5	97	0	4	0	1	26	0	128
K – 4	1958	1044	723	486	0	0	0	4211
K – 3	1159	947	988	249	0	0	0	3343
K – 2	3841	534	390	403	207	0	0	5375
K – 1	6301	4870	2142	1197	606	126	0	15242
TOTAL	13356	7395	5401	28323	53821	29212	86	137594

Seam wise and Depthwise Geological Reserve of PB North West Quarry are given in **Table 4.20.** Seamwise and Depthwise Underground reserves are given in **Table 4.21.**

Table 4.20

SEAM WISE AND DEPTH WISE OPENCAST RESERVES

(In '000 Tonnes)

SEAM/DEPTH	0 - 50	50 - 100	100 - 150	150 - 200	200 - 250	250 - 300	TOTAL
V COMB	26	891	2150	2312	803	3	**6185**
IV COMB	32	2657	4106	3430	1485	11	**11721**
II TOP	35	3611	2897	2592	1226	11	**10372**
II MID	220	4297	3190	2999	1514	13	**12233**
II T+M	389	10758	5631	4660	1193	0	**22631**

SEAM/DEPTH	0 - 50	50 - 100	100 - 150	150 - 200	200 - 250	250 - 300	TOTAL
II BOT	695	5011	2630	2639	1117	6	**12098**
I TOP	1081	2927	1355	1240	496	0	**7099**
I MID	1485	1670	1039	216	2	2	**4414**
I BOT	862	629	276	104	1	1	**1873**
I M+B	2366	6632	3407	4115	1537	5	**18062**
TOTAL	**7191**	**39083**	**26681**	**24307**	**9374**	**52**	**106688**

Table 4.21

SEAM WISE AND DEPTH WISE UNDERGROUND RESERVES PB (NW)

(in '000 Tonnes)

SEAM/DEPTH	<300	>300	TOTAL
LOCAL	0	2597	**2597**
K - 5	128	0	**128**
K – 4	4209	2	**4211**
K – 3	3334	9	**3343**
K – 2	5355	20	**5375**
K – 1	15023	219	**15242**
TOTAL	**28049**	**2847**	**30896**

4.7 Total Reserves

Total reserves of Pakri Barwadih Coal Block is given in **Table 4.22**.

Table No 4.22

Total Reserve in Pakri Barwadih Block

Sl. No.	Reserve Category	PB West & East	PB NW	Total(Reserve in Million Tones)
1	Proved	703	134.470	837.470
2	Indicated	733	3.114	736.114
	Total	1436	137.584	1573.584

CHAPTER V

MINING

CHAPTER V
MINING

5.1. GENERAL

5.1.1. Pakri Barwadih coal mining block covers an area of 46.95 Sq km and located in North Karanpura Coalfield. Present Mining Plan covers entire area of the block including an area of 2.66 sq km falling outside block between Barakar seams and metamorphic on the rise side for OB dumps, proposed mine infrastructure, evacuation corridor and railway siding. Underground Mining is also proposed for which separate mining plan shall be submitted on 9th year from the commencement of Opencast Mining operations. Details of area is given in **Table 5.1**.

Table 5.1
Area of the Block

Sl. No.	Particulars	Area in Sq. Km
1	Pakri Barwadih West and East	39.43
2	Pakri Barwadih North West	4.86
3	Additional area for OB dump, Infra, Evacuation	2.66
	Total	**46.95**

5.1.2. Total 27 number of villages are located in the coal block. Villages namely Itiz, Chirudih, Nagadi, Dadi Kalan, Chepa Kalan, Arahara, Pakri Barwadih, Sinduari, Sonbersa, Churchu, Jugra, Chepa Khurd, Keri, Langatu, Deoria Khurd, Urub, Barkagaon, Bariatu, Beltu, Karudaber, Nawadih, Sirma, Basariya and Jabra. Sirma, Basariya and Nawadih are located in the northern part of the block. Jabra village is towards Southwest of the block.

Cumulative population of approximately 8339 Project Affected Persons (PAPs) were estimated for the block. These PAPs shall be relocated at Rehabilitation and Resettlement Colony which shall be constructed near Donga Village on the South Eastern part of the Block.

5.2. MINE DESIGN STRATEGY

5.2.1. Out of 44.28 sq Km block area of Pakri Barwadih Block, 29.28 Sq Km is fully explored and rest 15 sq km is regionally explored. 266.08 Ha of land falls outside of the block boundary. Two nos. of Geological Reports have been prepared, the first GR which was prepared by CMPDI covered West and East part of the block while the other GR prepared by MECL covered North West sector. Total area of the block is 46.95 Sq. Km. Estimated coal reserves are

1573 million tonnes. Data from both the GRs have been used for preparation of Present Mining Plan.

5.2.2. Pakri Barwadih Block is designed to produce 18 MTPA (Peak Capacity) of coal for captive usage of NTPC Power Plants located at different parts of country. As block area is virgin/Greenfield and no coal evacuation infrastructure is available at present, requisite infrastructure is also planned

5.2.3. In the present Mining Plan, coal from Pakri Barwadih blocks is envisaged for extraction of coal by Open Cast method of mining. Coal shall be extracted up to 300 meter depth line only by mixed slicing method through deployment of Shovel-Dumper combination. Horizontal slicing method shall be adopted to extract coal from PB North West and East quarry while combination of inclined and horizontal slicing method shall be adopted to extract coal from PB West quarry

Underground Mining is proposed for which separate mining plan shall be submitted on 9th year from the commencement of opencast mining operations.

5.2.4. Initially two box cuts namely Box cut-West & Box cut – East shall be simultaneously driven for Pakri Barwadih West, Pakri Barwadih East respectively. PB East quarry shall be worked for two years initially. On 4th year to facilitate augmentation of coal extraction one more box cut in the quarry PB North West shall be driven. During 25th year when the PB-West quarry ceases to operate, previously driven (Box Cut-East) shall be restarted and continued for extraction of coal from PB East quarry in the remaining life of PB East mine.

5.2.5. Mining Operations shall be carried out in three quarries namely PB West, PB East and PB North West PB West quarry shall commence production on 1st operating year shall produce peak production of 15 MTPA in 12th operating year. PB East quarry shall also commence on the 1st operating year and shall produce peak production 1.1 MTPA for initial two years only. However, while PB West Quarry shall still be operational PB East quarry shall be restarted after 25th year. Throughout the period of 37 operational years PB West Quarry and PB East together shall be producing 15 MTPA of Peak production.

PB North West quarry shall commence production on 4th operating year and produce peak production of 3 MTPA up to 50th year.

The combined peak production of Pakri Barwadih shall be 18 MTPA from 12th to 37th operational year. Total life of Pakri barwadih coal mine is 52 years

5.2.6. For optimisation of internal dumping in PB West quarry, 4 pits shall be created namely WP-1, WP-2 WP-3 and WP-4 to progressively all these pits shall be worked and filled by in pit dumping in succession. For operation of PB East only one pit shall be created PB North West quarry shall be worked by making two pits namely PIT-1, PIT-2 and in later years PIT-1 shall be filled by in pit dumping.

5.2.7. Scrapping of Top soil, face preparation, marking of holes, drilling, charging of holes blasting, loading through excavators, transportation of OB & coal to the destination, observance of safety requirements, dust suppression, deployment of statutory personnel, haul roads preparation, grading, environment management, wildlife preservation etc. shall be routine operations observed during extraction of mineral.

5.2.8. Useful Top soil shall be scrapped and stacked separately before preparation of OB for reclamation purposes. Drilling and Blasting shall be performed by deployment of large diameter drilling machines and SMS/emulsion explosives. Excavated OB shall be loaded by High capacity Excavators in High capacity Dumpers. This OB shall be dumped either in allocated external dumps or designated in pit dumps

5.2.9. In initial years OB shall have to be exclusively dumped in the external dump. Dump A, B & C are earmarked to dump Overburden produced from PB West quarry. Dump D is earmarked to dump Overburden produced from PB East quarry for two years only. During the course of mining in the Western Quarry, in pit dumping shall also be carried out when sufficient de-coaled area is available. In the later years i.e after 25 years entire Overburden of PB East quarry shall be dumped in the void created by workings of PB West quarry. Here also intermittent in pit dumping shall be performed. Therefore no re-handling of OB shall take place for PB-West and PB East quarry. It is not proposed to re handle external dumps created by PB West & PB East Quarry

5.2.10. For PB-NW quarry three external dumping location have been identified name A, B and C. External dump A shall be re-handled to facilitate extraction from PIT-2. Dump-C shall be re-handled and filled in the void of PB West quarry to facilitate extraction of coal locked beneath it. Dump heights varying from 60m-90m shall be maintained

5.2.11. Nallahs namely Khora, Dumuha, Pakwa Nalla, Hardara are traversing through the block.

It is proposed to construct a catchment canal from the northern periphery of the block as per the diversion study report prepared by CWPRS, Pune. The above drain shall also serve the purpose of catchment canal for rainwater and runoff from northern hills.

Lathorva nalla which flows from western side of PB NW quarry shall not be diverted but realigned/straightened if necessary emboldened to carry additional load of diverted Khora Nalla.

Before restart of exploitation of East Quarry reserves Hardara Nalla shall be diverted in the periphery of PB East Quarry which shall meet its own course further downstream within the block boundary.

General slope for diverted channel shall be kept as 1 in 500-1000, side slopes shall be kept limited to 2H to 1V and free board shall be maintained to 1.5m.

It is amply clear from the above that all nallas flowing through the blocks and interfering with the production regime shall be diverted preferably to the northern fringe of the block to free up the locked reserves so as to ensure minimum or no sterilization of coal.

5.2.12. There shall not be any barrier between PB NW, PB West, PB East quarries hence no coal shall be sterlilized. Reserves are blocked only in the barrier left against the adjacent mines and batters which shall be governed by prevailing design standards.

5.2.13. Detailed exploration of regionally explored area below planned Dump C where underground mining is proposed shall be carried out and finished before commencement of actual dumping operations in such a manner not to jeopardise the underground mining operations

5.2.14. ROM coal transportation shall be effected by dumper brought up to receiving hopper of primary Crusher. Coal shall be reduced up to ( ) 50mm size by the deployment of Primary and Secondary crushing units. Crushed coal from West and East Quarry shall be fed by mine end conveyor system either to stock yard having stacking & reclaiming system or directly to 14 km Cross Country conveyor transporting coal from mine to Silo at Bandag railway siding.. Within mining lease (-) 50 mm coal shall be transported from PB NW to stacking and reclaiming system by trucks.

5.2.15. Loading silos of concrete construction. shall load the coal in the Railway 60T/other specification wagons through Rapid Loading System, weighment arrangement of coal at conveyors and in motion weigh bridges shall be provided

pre & post loading points. Through Indian Railway system coal shall be transported to its destination.

5.2.16. Coal washability study has not yet been carried out for Pakri Barwadih Coal. Coal quality parameters obtained from the proximate analysis of coal revealed that ash percentage in all probability is likely to remain 34% or below which does not call for commissioning of coal washery. However to cater for more stringent future quality stipulations, space allocation is earmarked for commissioning of Coal Washery at mine end to facilitate transport of washed coal to the power plants as per qualitative requirements

5.2.17. Permanent source of electrical power is identified as Patratu Thermal Power station transmission lines shall be drawn at 220KV. The 220/33/11KV main receiving station is being envisaged by NTPC for providing power for mining operations. Two nos. of 33KV independent feeders are provided from 33KV switchgear for each quarry i.e for PB West, PB East and PB North West quarry. Further power distribution to infrastructure and other facilities for both the quarries shall through 33KV transmission Lines. High capacity DG sets have been envisaged for backup power.

5.2.18. Hazaribagh-Tandwa Road which passes through eastern part of the block is identified as approach road to connect the mine from Sate Highway. Nearly 10 km road upto Mine entry shall be constructed/strengthened for transportation of HEMM during commissioning. Existing Hazaribagh- Tandwa Road shall be diverted at the periphery of PB East quarry during 18th year of mining operation to facilitate extraction coal from East quarry.

5.2.19. Requisite infrastructure is planned for PB West & East quarry and NW quarry. Infrastructure proposed for PB West such as CHP, Sub Station, Workshop, administrative buildings etc. shall be utilised also for PB East quarry., Some infrastructure/facilities such as haul roads, culverts drainage system etc. shall be made separately for eastern quarry. Certain facilities such as coal sampling lab, environmental cell, vocational training centre, magazine etc. shall be common for both the quarries.

5.2.20. Environment clearance, forest clearance, nalla diversion study, SES study have been completed for PB West and PB East quarry. However, Environment clearance, Forest clearance, Nalla diversion study, SES study shall be carried out separately for PB NW quarry. Slope stability and wash ability study (if required) shall be carried out for entire block.

5.2.21. During mine closure there shall be two voids. The first in the order shall be in the North West side while the second shall be on the eastern side of the block. Re-handling of internal & external dump overburden for reduction of void is not

envisaged in the present mining plan. The voids so left shall serve for the purpose of water storage reservoir for use society and shall also facilitate groundwater recharge. Overburden dumps shall be planted, as far as possible the other area shall be levelled and planted and handed over the state government. Dangerous infrastructures shall be dismantled, manpower shall be shifted to other operating mine of NTPC. Roads and buildings shall be handed over to the state government for public use.

5.3. MINING

As already explained extraction of reserves shall be carried out from three distinct quarries of Pakri Barwadih Coal Block. The mining system is explained under following different heads.

i) Characteristics of Deposit
ii) Quarry boundary
iii) Opening up of Deposit
iv) Quarry Design Strategy
v) Mineable Reserves and Stripping Ratio
vi) Mining Method and Choice of Technology
vii) System Parameters
viii) Drilling and Blasting
ix) Disposal of Waste
x) Projected Production Plan/Calendar Program
xi) Equipment Requirement
xii) Annual Capacity and Life of Quarry
xiii) Quarry Drainage

5.3.1. Characteristics of Deposit

PB West & East

The geological & mining characteristics of the PB West & East depicts total 12 workable splits contained in 5 seams i.e. Seam-I to V is considered for open cast mining. Seam I occurrence is not reported in most of the boreholes, as a result mining shall be carried out in patches. In general, the coal seams are dipping at 1 in 3 to 1 in 5 towards south. As per Geological Report prepared by CMPDI, the Karharbari formations containfive thin non workable seams namely K1 – K5. The average thicknes of these seams are less than 1m. GR indicated four coal seams (Seam-II to V with 9 distinct splits) amenable for opencast mining. On critical analysis taking mineral conservation as top priority, patches of seam I is also considered in the planning. Advance drilling shall be carried out to prove the extent of Seam-I for opencast mining. The seam can be taken with the same Haul Road in pockets.

PB (North West)

The geological & mining characteristics of PB North West depicts a basinal structure particularly in the, area north and west which are Precambrian inlier.

The older formations are exposed along the periphery of the coalfield while the youngest Mahadevas occur in the axial region. The axis of syncline runs almost east-west. The general strike of the formation is almost east-west. The local swing in the strike at places is due to rolling dip. The strata are dipping at 10° to 12° southerly.

The block is traversed by 8 numbers of faults. Among these, 3 faults are varying from 0 m to 50 m. Fault F1 is the major fault varying in through from 160m to 180m. This fault runs approximately along southern to western boundary of the block. The trend of the fault is NW-SE and except faults F7 & F8, all are extending in metamorphic terrain.

There are total 10 nos. of coal seams, 5 each coal bearing horizons belonging to Barakar & Karharbari formation respectively. In ascending order these are seam K-1,K-2,K-3,K-4,K-5 in Karharbari Formation and Local(L), I, II, IV & V in Barakar Formation. Seam I splits into 3 sections viz. I Top, I Middle & I Bottom. At places Seam I Bottom and I Middle combined and form single seam namely I Bottom + Middle. Similarly, Seam II also splits into 3 sections viz. II Top, II Middle and II Bottom. Seam II Top and II Middle coalesce to form single seam as II Top + II Middle in eastern part. Seam V & IV occur as a combined seam.

In the proposed Mining Plan, the entire property is envisaged to be mined by opencast method from the view of conservation of coal.

The mining & geological characteristics of the PB West East quarriable block for OCP are given in **Table 5.2A. The mining & geological characteristics of the PB West East** quarriable block for OCP are given in **Table 5.2B.**

Table 5.2A

Mining and Geological Characteristics of PB West & East Quarriable Block

Sl No	Particulars	Unit	WEST QUARRY WP-1	WP-2	WP-3	WP-4	EAST QUARRY
			Thickness range of Coal Seam				
I	Seams/ Splits						
1	1B	m	3.27 6.03	0.20 – 6.69	0.25 – 5.44	0.22 – 8.1	0.25 – 4.8
2	1M	m	2.2 – 10.13	1.7 – 5.5	1 – 4.95	0.42 – 5.9	0.87-6.71
3	1T	m	2.65 – 5.98	0.45 – 3.23	0.93 -11.36	0.6 – 5.35	0.42 – 4.95
4	IIB	m		2.84 8.82	2.68-11.26	1.4 – 11.4	1.99 – 14.02
5	IIM	m		1.75 – 6.82	5.14 – 11.25	5.9 – 20.04	3.5 – 10.98
6	IIT	m		0.74 – 8.49	0.98 – 5.2	1.54 – 12.7	0.23 – 2.85
7	IIIB	m		0.23 – 2.85	0.28 – 3.1	0.16 – 2.30	0.21 – 2.41
8	IIIT	m		1.3 – 2.01	0.67 – 2.53	0.23 – 3.75	0.49 – 3.22
9	IVB	m			0.86- 3.59	0.65 – 7.64	0.87 – 6.56
10	IVT	m			0.9 – 4.26	1.8 – 7.88	2.34 – 6.57
11	VB	m			0.29 – 3.0	0.37 – 3.0	0.21 – 2.04
12	VT	m			0.3 – 3.0	0.36 – 3.24	0.84-3.91
			Average thickness overburden				
II	Top OB (Avg.)	m	22.96	26.72	27.37	91.16	74.57
III	Partings		Thickness range of Parting				

	Part bet IB & IM	m	2.29 – 3.62	0.95 – 10.56	1.13 – 16.35	0.95 – 11.96	0.85 – 18.7
	Part bet IM & IT	m	1.0 – 2.60	1.66 – 3.71	1.01 – 15.8	1.02 – 18.77	1.6 – 14.73
	Part bet IT & IIB	m	1	7.43 – 25.5	1.21 – 30.06	6.21 – 30.43	4.74 – 27.94
	Part bet IIB & IIM	m		1.5 – 6.28	0 – 2.85	0.85 – 4.65	0.97 – 5.8
	Part bet IIM & IIT	m		10.46 – 10.46	19.04 – 29.42	1.2 – 31.93	1.34 – 28.12
	Part bet IIT & IIIB	m		10.16-20.30	10.24 – 33.67	3.39 – 45.97	1.97 – 33.72
	Part bet IIIB & IIIT	m		4.38 24.75	2.48 – 17.29	1.1 – 20.2	0.94 – 16.94
	Part bet IIIT & IVB	m			8.58 – 29.23	5.1 – 44.31	5.31 – 22.93
	Part bet IVB & IVT	m			1.23 – 6.54	0.9 – 6.76	16.38 – 17.59
	Part bet IVT & VB	m			23.08	2.16 – 24.97	5.88 – 19.95
	Part bet VB & VT	m				0.8 – 7.19	0.82 – 4.89
IV	Quarry parameters						
	Dip of Seams		1 in 4 to 1 in 6	1 in 4 to 1 in 5.5	1 in 4	1 in 4	1 in 3
	Surface Strike Length	m	1800	2200	1600	5500	3800
	Surface width	m	400	800	400	1800	1400
	Maximum depth	m	100	150	125	300	300
	Area of excavation *	Ha	59.98	140.7	113.6	605.29	662.65

Table 5.2 B

Mining and Geological Characteristics of PB NW Quarriable Block

Sl.no	Particulars	Units	PIT 1	PIT 2
	Seam /Parting			
1	V COMB	m	3.24-5.9	3.24-5.9
2	IV COMB	m	5.15-10.04	5.15-10.04
3	II TOP	m	6.96-10.61	6.96-10.61
4	II MID	m	7.17-11.68	7.17-11.68
5	II T+M	m	15.97-20.26	15.97-20.26
6	II BOT	m	2.85-6.3	2.85-6.3
7	I TOP	m	0.42-3.79	0.42-3.79
8	I MID	m	1.15-8.73	1.15-8.73
9	I BOT	m	1.01-4.17	1.01-4.17
10	I M+B	m	4.7-11.88	4.7-11.88
11	LOCAL(L)	m	0.06-2.35	0.06-2.35
12	K-5	m	0.08-1.32	0.08-1.32
13	K-4	m	0.28-1.74	0.28-1.74
14	K-3	m	0.45-1.96	0.45-1.96
15	K-2	m	0.06-2.99	0.06-2.99
16	K-1	m	1.19-4.68	1.19-4.68
	Top OB (Avg.)		Average thickness overburden	
		m	25	45

	Parting			
1	Par bet V COMB & IV COMB	m	3.72	27.16
2	Par bet IV COMB & II TOP	m	0.28	20.55
3	Par bet II TOP & II MID	m	1.09	5.17
4	Par bet II MID & II T+M	m	0	0
5	Par bet II T+M & II BOT	m	1.4	24.22
6	Par bet II BOT & I TOP	m	5.89	15
7	Par bet I TOP & I MID	m	0.52	4.51
8	Par bet I MID & I BOT	m	0.17	4.19
9	Par bet I BOT & I M+B	m	0	0
10	Par bet I M+B & LOCAL(L)	m	16.8	27.68
11	Par bet LOCAL(L) & K-5	m	10.39	23.67
12	Par bet K-5 & K-4	m	4.74	12.05
13	Par bet K-4 & K-3	m	4.4	9.85
14	Par bet K-3 & K-2	m	8.45	10.58
15	Par bet K-2 & K-1	m	1.95	14.84
	Quarry parameters			
1	Quarry floor area	ha	167	158
2	Quarry surface area	ha	267	175
3	No. of seams	no	14	14
4	Life in years	no	24	28
5	Gradient		10° to 12°	10° to 12°
6	Strike length (along floor)			
	a) Maximum	m	3180	1060
	b) Minimum	m	565	270
7	Strike length (along surface)			
	a) Maximum	m	1410	1050
	b) Minimum	m	1060	290
	Depth		280	280

Note:
Total quarriable area for all the pits=1982 ha (919.2 (West quarry) + 662.85 (East quarry) = 1582 ha Out of 1582ha, 42 ha is common because of excavation to be done in phases. Hence net quarriable area for West & East quarries is 1540 ha).

5.3.2. Mine/Quarry boundary

The boundaries of PB West and PB East Quarry are delineated and given in Table-5.3.

Table 5.3
Boundaries up to 300 m depth line

Particulars	WEST QUARRY				EAST QUARRY	NORTH WEST QUARRY	
	WP-1	WP-2	WP-3	WP-4		PIT-1	PIT-2
North West Boundary	Incrop of seam I	[illegible] and Incrop of seam	Incrop of seam	Incrop of seam	[illegible]	[illegible]	[illegible]
West Boundary	Khora Nala and Incrop of seam F_{11} &	Khora Nala and Incrop of seam	Arbitrary line	Khora Nala	F_{11}	[illegible] Khora Nala	[illegible] Nala
East Boundary	Incrop of seam I	F_{10}, F_{11}	F_5	F_5	F_1, F_2, F_3, F_4	[illegible] Khora Nala	[illegible] Nala
South East Boundary	[illegible]	F_{10} & F_{11}	F_5 dis. FRL of 300 Seam-II	300 m depth from FRL of 1.0 m Seam I	300 m depth & FRL of 120 m of Seam I	Quarry surface has been projected at 45° on the surface as well as on the confluence of Khora Nala - A & B	Quarry surface has been projected at 45° on the surface as well as on the confluence of Khora Nala - A & B

Note: 7.5m space width is left from the outer boundary of PB NW quarry

5.3.3. Opening up of Deposit

Advance action activities would be implemented before starting Box-Cut operation in WP–1, WP–2 and WP–3 and EP in 1st year of quarry operation. These activities include

i) Land acquisition and possession.

ii) Construction of canal on the rise side of the proposed West Quarry to control inflow of surface water of the area on the rise side. This canal joins Hardara (Pakwa) nala in the east and Khora nala in turn Lathorva Nalla in the west.

iii) Bringing power line to the project and construction of electrical sub-station.

iv) Construction of the workshop for commissioning of HEMM and other necessary civil constructions.

v) Construction of essential Residential Buildings.

vi) Railway siding and coal loading arrangement for coal dispatch.

Details are shown in Surface Master Plan (SMP).

NW-Pit 1 shall be opened first by opening a box cut near the borehole MNPB - 7 in the incrop of Seam K - 1 at a gradient of 6% to touch the seam floor. The bottom seams are workable in this area. Initially the quarry shall be advanced towards southern block boundary in south and **NW-Pit 2** commences from an arbitrary line adjoining Pit - 1 in north. During later years the mine shall be advanced towards south in the dip side. Coal production shall start in P–4. During P – 6 of mining operations shall be shifted further west ward to accommodate the overburden in-pit dumping and the earlier mine opening

shall cease to operate. At the P–28. OB and Coal shall be transported to and from Pit – 2 through western most corner of the block. Temporary pit workshop shall cease to operate and permanent workshop shall be used for various purposes

5.3.4. Quarry Design Strategy

PB-West and PB East

i) The rated capacity shall be achieved at the end of 12th year by increasing the production in gradual manner in order to create the space for internal dumping.

ii) A total of 9 workable splits contained in four seams i e. Seam –II to V is considered for open cast mining excluding three distinct splits of Seam – 1 which is having three distinct splits has also been considered for mining in patches. Wherever required, advance drilling (if required) shall be carried out to prove the extent seam 1.

iii) It has been envisaged that quarry operation shall be started by creating three separate pits viz WP-1, WP-2 & WP-3 simultaneously in west quarry area to create the internal dump space along the area bounded by up throw faults.

iv) Due to the small size of pits, in the initial period, mine production shall be limited and gradually start producing 10 Mt by 5th year of production after about 3 km strike length in pit WP-4 gets developed.

v) The mine production shall again start increasing from 11th year of operation gradually when the WP-2, WP – 3 and WP - 4 shall merge leading to longer strike length of more than 5 km.

vi) The western quarry shall achieve a rated capacity of 15 Mt/yr from 12th year of operation and shall continue till 24th year (Stage Plans are enclosed). Further capacity enhancement is not possible due to the following reasons:

- Property is intervened by 19 Nos. of strike faults resulting into reduced strike length as well as dislocation of Seam II.
- Steep gradient of coal seams needs adoption of modified inclined slicing method of working in mining mass.
- Problem of internal dump stability at the floor gradient of 1 in 3 to 1 in 5.
- Large volume of overburden handling (Avg. SR 1: 4.16)
- Limited dump space available outside the mining mass where maximum dump height of 90 m has been considered.
- Most of the coal seams are thin with thickness ranging between 1 m to 4 m except seam II B & II M which are 6 to 9 m
- Highly splitted seams with variable parting.

- Congestion of mining equipment at overburden benches. As the maximum possible per day dumping just matches with the dumping requirement at 15 MTPA.
- Considerably high rate of face advancement of the order of 60 m and 103 m in West and East quarry respectively in down dip direction to achieve 15 MTPA

The above is depicted in Final Stage Quarry Plan.

vii) The magnitude of OB dumping can be judged from the fact that about 2098.78 million cubic meter of OB shall have to be excavated and dumped suitably for mining 503.40 Mt of coal from the total mine block upto a depth of 300 m.

viii) The total dumping outside the quarry shall be accommodated in dumps A and B on the northern side in non-forest area Dump C on southern side of the open-cast limit line and Dump D on northern side of PB East limit line. The ratio of external dumping on the surface as compared to total quantity shall be about 31% for the whole opencastable mine block.

ix) Attempt has been made to reduce external dumping by raising the height of back-filled dumps in WP-1, WP-2 & WP-3 and merging these with surface dumps A & B on the northern side so as to maximise total dump capacity. Details are shown in Final Stage Dump Plan.

x) The PB West quarry has been planned to achieve a rated capacity of 15 MTPA from 12th year onwards. The production from PB West quarry shall taper from 25th year and opencastable reserves of West quarry shall be completely exhausted by the end of 27th year. The production from PB North West quarry shall commence from 4th year onwards of production plan of Pakri Barwadih Block. PB East Quarry shall restart producing from 25th year with an overlap of 3 years so as to reach the full capacity before the exhaustion of PB West Quarry and maintain the rated capacity of 15 Mt/yr till its exhaustion. The de-coaled space of West quarry shall be utilised to accommodate remaining quantity of OB/waste to be generated in PB East quarry internally.

xi) The quarriable block for West and East Part of Pakri Barwadih have total 12 workable splits contained in 5 seams i.e Seam – I to V is considered for open cast mining. Seam I occurrence is not reported in most of the boreholes, as a result mining shall be carried out in patches. In general, the coal seams are dipping at 1 in 3 to 1 in 5 towards south.

xii) Before restart of PB East quarry, Hardara (Pakwa) nallah on the eastern side shall be diverted towards dump filled area. The main road linking Hazaribagh and Barkagaon shall also be diverted along the diverted course of above mentioned nallah (South-eastern boundary of block). This shall enable release of blocked coal underneath the Hardara (Pakwa) nallah & the existing road.

xiii) A canal has been planned along the north-eastern boundary of the block to catch the rain water & small streamlets ahead of the quarriable area for smooth operation of mine during rainy season. }

- **PB-North West**

i) Availability of numerous seams/splits (14nos.) at amenable depth (280m) and also reasonable coal overburden ratio (3.15 m3/t) presents a favourable situation to develop a mechanised opencast mine in the coal block under reference.

ii) The entire property is envisaged to mine by opencast method from the view of conservation of and exploitation of high grade coal.

iii) To the east of PB North West quarry adjoins PB Western Quarry which has an important bearing on design of PB North West Quarry mine Road passing through northern fringe of the PB shall serve as approach road for PB North west. This road shall meet with Hazaribagh - Tandwa State Highway.

iv) Khora nala defines two sides of block boundary. Meandering part of Lathorva Nala – B at the western side of the block approximately 1 km in length is planned for straightening. Khora Nallah shall be diverted along the northern fringe of PB-NW part which shall discharge its load on Lathorva Nalla. Study of such diversion shall be carried out before commencement of PB-NW quarry. An embankment suitably sloped on both sides shall be constructed to prevent in-rush during rainy season and flash flood A road of 5m wide shall run all alongside the embankment.

v) . Initial Mine entry shall be made near borehole No. MNID – 13. Floor of seam K - 1 shall be mine floor. Entire coal of the block in envisaged for extraction. Due to paucity of land for OB dumping the mine is divided into two Pits namely Pit - 1 & Pit - 2. Fault F5 - F5 (throw 150m), shall serves as a natural arbitrary line of division of two pits. Pit – 2 is planned as an extension of Pit–1 in 28th year of mining operation

vi) As land outside the block is unavailable all generated waste shall be dumped inside the coal block boundary in three locations namely Dump - A, Dump - B & Dump C. Dump - A shall not be re-handled while Dump B and Dump C shall be temporary and progressively re-handled at later years of mine life. Rehandling shall facilitate release of additional area for excavation of coal from Pit–2 and from Barrier between PB-NW and PB-West (Total 33.18 Mt. 10.95Mt of PB West & 22.23Mt of PB North west), Plate No.4.

vii) Coal from the mine shall be brought to the surface by 60T coal body dumpers. ROM coal shall be reduced through primary and secondary crushing to (-) 50mm size Crushed coal shall be transported by road upto a coal stock pile near TP - 1 from where it shall be brought to NTPC's

Benadag Yard by conveyors and shall be loaded on railway wagons by fast loading silo and dispatched to end use plants through Indian Railway.

viii) Taking into account the extraction of coal in the barrier between PB-NW and PB-West envisaged life of PB-NW quarry is 52 years including 3 years of construction period.

ix) Environmental clearance (EC) has already been obtained for PB block (West & East Quarries) vide MoEF letter no.J-11015/692/2007-IA, II(M) dated 19.05.2009 for rated production of 15Mtpa. At present, base line data generated previously are used to address environment management chapter. However, fresh EIA/EMP shall be carried out for this block and MoEF clearance shall be obtained.

x) The area is sparsely populated as revealed during site visit, approximately 150 PAP's have been considered for preparation of Mining Plan. Site is conducting SFS study based on which Rehabilitation and Resettlement Plan shall be drawn for PAPs as per NPRR and other relevant policies

5.3.5. Mineable Reserves, OB and Stripping Ratio

The total mineable reserve of **PB West and East Quarry** is estimated as 503.39 Mts up to the 300m depth line i.e. FRL of 120 m of seam II bottom and mineable coal reserves of seam I, which is found suitable for mining by the open cast method, especially in the western part of PB West Quarry and PB East Quarry. The corresponding OB removal estimated as 2098.78 Mm3 at an average stripping ratio of 4.16 m3/t. Percentage extraction with respect to net geological reserves for seam II to V is also given in the same table. Due to the discontinuous nature of Seam I it has been planned that mining shall be done in patches.

Total geological coal reserve of **PB NW Quarry** as per GR is estimated to be about 137.584 Mt. It is estimated that 105.78 Mt of mineable coal would be available against overburden of 348.24 Mm^3 within the mine boundaries However additional reserves of barrier 33.18 Mt. and additional OB of 90 Mm3 shall also be excavated is kept at present in Pit-2 account. The average stripping ratio works out to 3.30m^3/t. Extractable reserves of PB West & East is given in **Table-5.4**. The detailed break-up of quarry wise and sub-quarry wise mineable reserves is given in **Table 5.5**.

Table 5.4
Extractable Reserves

Sl No.	Description	Reserves (Mt)
	Total geological reserve up to 300 m depth line	
1	Seam I to V Net geological reserves as per (CMPDI GR)	707.67
2	Seam I to V Net geological reserves as per geological model based on Bore Hole data	696.78
3	Difference	1.5 %
	As per GR, seam I has not been considered opencastable	
4	Net geological reserves Seam II to Seam V (upto 300 m depth line) amenable to opencast mining	540 *
5	Additional coal reserves available beyond 300m depth line on high wall slice as considered in Mining plan	15.45
6	Total reserves arrived for proposed quarry upto pit depth(4+5)	555.45
7	Less Reserves transferred to UG property due to (a) Enclosed between Nallah and fault F-3 (b) Coal falling South of fault F-5	48.05
8	Less .Coal Reserves in crushed zones between faults F1 & F2 having very steep gradient, narrow patch and cannot be worked hence kept outside pit boundary	16.50
9	**Net opencastable Reserves Seam II to seam V (9 -10-11)**	**490.90**
10	To be extracted from Eastern & Western Quarry	437.01
11	Barrier against Khora Nallah to be opencasted later along with North-West patch "A".	10.95
12	**Net Extractable reserve (seam II to seam V)**	**447.96**
13	**Percentage extraction (seam II to seam V)**	91.25 %
	Reserve balance of seam I , a part of which has been considered for opencast mining in the present mining plan	
14	**As per GR. Total reserve of seam I up to 300 m depth line**	**135**
15	Reserves transferred to UG property	17.24
16	Coal Reserves in crushed zones between fault F1 & F2	2
17	**Net opencastable Reserves of Seam I (14 -15-16)**	**115.76**
18	To be extracted from Eastern & Western Quarry as per calendar plan	66.39
19	Barrier against Khora Nallah to be opencasted later along with North-West patch "A"	5
20	Net extractable reserve of seam I as per mining plan (18+19)	71.39
21	Balance reserve(Part of which may be extracted later after proving by production support drilling)	39.37
22	**Total extractable reserve for West & East Quarries**	**503.37**
23	**Total Extractable reserve for NW Quarry**	**138.96**
23	**Total extractable reserve for PB Block (22+23)**	**642.35**

* As per table 5.4.1(pg 169) of GR indicating sectorwise and depthwise volume of total excavation recasted at table 04.09 of mining plan the assessed volume of coal up to 300 m depth line of seam I.

bottom is 329 Mm3 which compares favorably with volume estimates through geological model i.e. 327.27 Mm³ (equivalent to 540 Mt considering average sp. gravity of 1.65)

Table 5.5
Mineable Coal Reserves, Volume of OBR, Stripping ratio

Quarry	Extractable reserves in Mt	OB including Access trench in Mm3	Strip ratio cum/t
WEST QUARRY(Seam I-V)			
WP -I	6.65	25.9	3.89
WP -II	28.47	82.57	3.01
WP -III	18.51	62.57	3.38
WP -IV	258.09	1067.44	4.14
Subtotal (West Quarry)	311.71	1238.49	3.97
EAST QUARRY (EP-1)(Seam I-V)	191.68	860.29	4.49
Subtotal (East Quarry)	191.68	860.29	4.49
***Subtotal (West and East Quarry)**	503.39	2098.78	4.17
NORTH WEST QUARRY (All Seam)			
PIT 1	68.6	201	2.94
PIT 2	70.36	237.24	3.96
****Subtotal (NW Quarry)**	138.96	438.24	3.15
TOTAL (block)	642.34	2537.02	3.95

Remarks:

**Up to 300 m depth line, OB estimated as per GR = 1441 Mm³. In the GR, the OB estimation is based on considering vertical wall along 300 m depth line*

i In the Mining-Plan, the final stage-working plan envisages inclined pit slope due to benching and for stability. Hence the total OB in quarries area works out to 2098 Mm³ considering pit slope for both Western & Eastern quarries combined and extraction of Seam-I in certain patches

ii In the Mining-Plan certain patches of Seam-I is planned to be extracted by opencast. For this additional overburden, parting between Seam I top to HW of Seam-II is required to be evacuated for extracting Seam-I. Total quantity 186 Million m³ (I to I)

iii Additional excavation done along high wall to provide for inclined pit slope providing stability to the high wall as well as for better roads 471 Million m³ (This 471 Million m³ constitutes 22.45 % of total excavation i.e. 2098 Million m³)

Hence additional excavation required to be done on account of above two reasons is 186 Million m³ + 471 Million m³ = 657 Million m³

Thus total OB removal excavation required to be done = 1441 Million m³ + 657 Million m³ = 2098 Million m

***The Geological Report indicated that the coal reserves given upto Seam - I are 316.386 Mt with an OB Coal ratio of 1.649*
In the present Mining Plan, the lower seams also have been considered for OC mining due to two reasons first Good quality of coal in Karharbari seams and the second the stripping ratio for the workable area (>1m) of these seams comes around 2.5-4 m3/t for all the seams combined together

i. The equipment selection and operating methods have been designed considering the volume and nature of overburden and disposition of coal seams.

ii. Additional reserves of 32.18 Mt from barrier & batter, and nominal OB of 90 mm3 shall also be excavated is kept at present in PR 2 account

Extractable Reserves:

Net opencastable reserves of Pakri Barwadih is 808.23 Mt, barrier loass and batter loss worked out as 58.74 Mt and 106.22 Mt. Taking into account of mining losses of 20.72 Mt extractable reserves worked out as 642.35 Mt. Percentage of extraction by opencast mine is 78%. Net reserves and extractable reserves alongwith losses are given in **Table -5.6.**

Table -5.6
Net reserves and extractable reserves and losses

(in Mt.)

Seam	Net Reserve	Barrier Loss	Batter Loss	Mineable Reserves	Mining Loss	Extractable Reserve	% Extraction
V Top	22.29	0.72	1.57	19.99	0.59	19.40	87.06
V Bottom	15.56	0.51	1.10	13.96	0.41	13.55	87.06
V Combined	11.57	0.21	0.49	10.87	0.44	10.43	90.16
Seam - V	**49.42**	**1.44**	**3.16**	**44.82**	**1.44**	**43.38**	**87.78**
IV Top	19.82	0.64	2.23	16.95	0.50	16.46	83.01
IV Bottom	9.92	0.32	1.12	8.48	0.25	8.23	83.01
IV Combined	92.32	3.15	10.68	78.49	2.43	76.06	82.39
Seam - IV	**122.06**	**4.10**	**14.03**	**103.93**	**3.18**	**100.75**	**82.54**
III Top	27.45	1.21	2.04	24.20	0.70	23.49	85.59
III Bottom	9.83	0.43	0.73	8.66	0.25	8.41	85.59
III Combined	4.80	0.21	0.36	4.23	0.12	4.11	85.59
Seam - III	**42.08**	**1.85**	**3.13**	**37.10**	**1.08**	**36.02**	**85.59**
II Top	59.98	4.66	6.21	49.11	1.89	47.22	78.72
II Middle	139.75	11.83	11.24	116.68	3.83	112.86	80.75
II TM	76.09	7.28	5.63	63.18	1.77	61.40	80.70
II Bottom	116.05	10.76	9.90	95.39	2.89	92.50	79.71
II MB	17.90	1.71	1.32	14.86	0.42	14.44	80.70
II Combined	7.35	0.70	0.54	6.11	0.17	5.94	80.70
Seam- II	**417.13**	**36.95**	**34.85**	**345.33**	**10.97**	**334.36**	**80.16**
I Top	36.93	2.72	9.39	24.81	0.77	24.05	65.11
I Middle	72.97	5.27	18.20	49.49	1.66	47.84	65.56
I TM	2.51	0.23	0.79	1.49	0.04	1.45	57.80
I Bottom	35.60	2.52	8.69	24.39	0.52	23.87	67.06
I MB	14.85	1.35	4.67	8.83	0.24	8.58	57.80

Seam	Net Reserve	Barrier Loss	Batter Loss	Mineable Reserves	Mining Loss	Extractable Reserve	% Extraction
I Combined	3.58	0.33	1.13	2.13	0.06	2.07	57.80
Seam- I	**166.44**	**12.42**	**42.88**	**111.14**	**3.28**	**107.86**	**64.81**
LL	2.60	0.10	0.35	2.15	0.11	2.04	78.62
K5	0.13	0.01	0.06	0.06	0.01	0.05	36.37
K4	4.21	0.13	1.11	2.97	0.11	2.86	67.83
K3	3.34	0.22	0.86	2.26	0.06	2.20	65.95
K2	5.38	0.27	1.14	3.97	0.07	3.90	72.40
K1	15.24	1.25	4.65	9.34	0.41	8.93	58.62
Seam-Local	**30.90**	**1.98**	**8.17**	**20.75**	**0.77**	**19.98**	**64.66**
Total	***828.03**	**58.74**	**106.22**	**663.07**	**20.72**	**642.34**	**77.58**

**Additional 20Mt of proved reserve had not been considered in the above table as the same is considered to be mined by u/g*

5.3.6. Mining Method and Choice of Technology

Opencast Mining

Opencast mining method for the targeted reserves has been adopted due to following reasons

a. The coal seams are in cropping at a shallow depth;
b. The OB : Coal ratio is favorable (3.15 : 1) for opencast mining;
c. Higher percentage of recovery as compared to underground system
d. The mining by opencast method shall be economical against underground method
e. The opencast mining operations are comparatively safer and ensure higher recovery of coal resource.(Final Stage Quarry Plan is enclosed)

Selection of mining technology

Following types of equipment systems available for opencast mining:

a) Bucket wheel mining
b) Dragline mining
c) Continuous surface miner (CSM)
d) Shovel dumper combination

Technical feasibility for deployment of each of the above technology has been studied in details, based upon the prevalent conditions existing therein in North-Western Coal Mining Project. shovel dumper combination owing to its flexibility recommended as most favourable method of mining. Brief of each of the system is explained:

(a) Bucket Wheel Excavator

Bucket Wheel Excavator (BWE) alternative has not been considered due to following reasons

i. The strata below the upper most weathered mantle are hard and strong requiring blasting hence bucket wheel is not viable.

ii. Presence of large number of seams and interburden layers of mostly of small thickness, which shall be uneconomic in this alternative.

iii. Requirement of precision selective mining which shall not be possible by bucket wheels especially for thin seams and partings.

In view of the above this option is not recommended.

(b) Dragline

Dragline has not been recommended due to following reasons

i. Steep gradient of seams

ii. Multiplicity of seams and that the lower most seam is thin and the OB parting lying over is also thin due to which neither the advantage of long reach can be taken nor adequate OB material shall be available from the overlying OB layer for direct casting

In view of the above this option is not recommended.

(c) Continuous Surface Miner (CSM)

CSM has not been recommended due to following reasons:

i. Depth of mine is 300m depth (approx.) and seams are dipping at 1 in 3 to 1 in 5. these machines cannot be deployed exclusively due to limitation of mobility /flexibility.

ii. These machines also require wider benches which shall require comparatively higher volumes of OB to be removed in the initial stages leading to higher cost of production and imbalance in equipment utilization due to subsequently decreasing OB: coal ratio

iii. Over and above, marginal grade improvement shall be of much use in this specific case.

In view of the above this option is not recommended.

(d) Shovel & Dumper

Shovel & dumper combination is recommended due to following reasons:

i. In view of multiple seams and equal nos. of inter burden layers to be tackled, an equipment system which is capable of dealing many layers

at a time (flexibility) of operations with the help of smaller units has been recommended as shovel dumper combination.

ii. The quality problem can be handled with the help of hydraulic excavators, which have three-dimensional movement of bucket. They are capable of carrying out selective mining.

iii. Furthermore, to tackle about 15 Mty coal & 66 Mcum of OB from West & East Quarry and 3 Mty and 12 Mm^3 OB from several locations in the mine, comparatively medium and higher size shovels of upto 20 m^3 bucket capacity have been envisaged along with matching capacity of rear dumpers.

iv Flexibility in operation shall be available due to such equipment system.

In view of the above this option is recommended.

(e) The main objectives of mine development have been

i. To design an economical production of required coal quality;

ii To minimise transportation distance for coal and waste;

iii. To minimise adverse effects on environment; and

iv. Non - sterilizing the remaining potential reserves for future mining.

5.3.7. System Parameters

Some major system parameters are given in Table-5.7.

Table-5.7

Sl. No.	Particulars	PB-West & East	PB -NW
1.	Maximum Bench Height		
	Top OB	15m	15m
	Coal and Intervening parting	5 - 15m	5 - 15m
2	Proposed minimum Bench Width		
	Working Bench	50m	40m
	Non Working Bench Width	25m	25m
3.	Width of the permanent haul road	30m	25m
4	Width of the temporary transport ramp	10m	10m
5.	Usual height of the spoil dump bench (1Tier)	30m	30m
6.	Width of the active dump bench	30m	30m
7	Bench Slope		

5.3.8. Drilling and Blasting

For PB West and East Quarry Drilling & Blasting shall be required both in OB and Coal benches before excavation by shovels. Top OB benches shall be developed in horizontal/inclined slicing method. 20 m3 rope shovel along with 170-190 T class of dumpers shall be deployed. A part workload of Top OB shall also be handled by 8.3 cum Hydraulic shovels with 120-150T class of dumpers.

Partings and coal seams shall also be worked in horizontal slices using a combination of hydraulic front end and backhoes machines to minimise intermixing of waste with coal with intermediate benches of 5m.

Thin seams (Seam V T and V B, Seam III T and III B, thin partings between Seam V T and V B, between IV T and IV B, II M and II B shall be ripped, dozed and piled by 850 hp/510kW dozers. The piled material shall be taken by 5 cum wheel loaders, loading onto 120-150T trucks.

Based on the workload of the above sections, it is expected that about 5% of the OB workload and about 10% of the coal workload shall be ripped. The balance material shall have to be blasted.

For PB NW Quarry Drilling & Blasting shall be required both in OB and Coal benches before excavation by shovels. Top OB benches shall be developed in horizontal slicing method. 10 m3 shovel along with 100 T class of dumpers shall be deployed. A part workload of Top OB shall also be handled by 5.5 cum Hydraulic shovels with 60 T class of dumpers.

Partings and coal seams shall also be worked in horizontal slices using a combination of hydraulic front end and backhoes machines to minimise intermixing of waste with coal with intermediate benches of 5m.

Thin seams (Seam V T and V B , Seam III T and III B, thin partings between Seam V T and V B, between IV T and IV B, II M and II B shall be ripped, dozed and piled by 410 hp dozers. The piled material shall be taken by 8-10 cum wheel loaders, loading onto 100 T trucks.

Based on the workload of the above sections, it is expected that about 5% of the OB workload and about 10% of the coal workload shall be ripped. The balance material shall have to be blasted.

5.3.8.1. Drilling & Blasting in Overburden

For PB West and East Quarry top O.B benches shall be of 15 m height where 250 mm Blast hole drill shall be used for drilling blast holes. For thin partings & thick wedges, 160 mm Blast hole drill shall be used.

Blasting pattern depends upon the nature and hardness of rock and varies from mine to mine. Expert agency shall be engaged to design and optimize the blast patterns after field trials.

For PB NW Quarry Top O.B benches shall be of 15 m height where 250 mm Blast hole drill shall be used for drilling blast holes. For thin partings & thick wedges, 160 mm Blast hole drill shall be used.

Blasting pattern depends upon the nature and hardness of rock and varies from mine to mine. Expert agency shall be engaged to design and optimize the blast patterns after field trials.

Suggested pattern is given below in **Table-5.8**

Table-5.8

Pattern of Drilling in Overburden

Sl. No.	Particular	1MTY	3 MTY	10 MTY	15 MTY
1	Average Annual OB including top and parting (mm^3)	6	18	40	66
2	Weekly OB Removal (000 mm^3)	120	350	700	1270
3	Weekly Explosive Required (tonnes)	50	150	300	500
4	Blast Hole Spacing (meters)	8 to 10	8 to 10	8 to 10	8 to 10
5	Blast Hole Burden (meters)	7 to 8	7 to 8	7 to 8	7 to 8
6	Powder Factor assumed (m^3/Kg of explosives)	2.5	2.5	2.5	2.5
7	Type of Explosives	Bulk Explosives slurry/emulsion			

Blast holes shall be suitably drilled to provide sufficient OB to each shovel unit for one week's work load.

5.3.8.2. Drilling & Blasting in Coal

For PB West and East Quarry Coal benches planned are of 10m or less in height. 160 mm drill shall be used for drilling blast holes in Coal benches. Blasting shall be done once in 3 days in Coal benches. **Field** trials shall be required by expert agency for designing best suited pattern in coal.

For PB NW Quarry Coal benches are planned for 10 m or to the thickness of seams, whichever is less. **160 mm drill** shall be used **for** drilling blast holes in Coal benches . **Field** trials shall be required by expert agency for designing best suited pattern in coal.

Suggested pattern for blasting in coal is given below in **Table-5.9**

Pattern of Drilling in Coal

Table-5.9

Sl. No.	Particular	1MTY	3 MTY	10 MTY	15 MTY
1	Annual Coal Production (Mt)	1	3	10	15
2	Three days Coal Production considering 330 days a year (000 T)	10	30	100	150
3	Explosives required for 3 days coal production (tones)	1.7	6	17	25
4	Blast Hole Spacing (meters)	6	6	6	6
5	Blast Hole Burden (meters)	5	5	5	5
6	Powder Factor assumed (m^3/Kg of explosives)	6t/kg of explosive	6t/kg of explosive	6t/kg of explosive	6t/kg of explosive
7	Type of Explosives	Bulk Explosives slurry/emulsion			

Effort shall be made to suitably distribute drilling in all coal benches to provide 3 days work load to each shovel.

Powder factor of 0.3 kg/cum for OB and 0.2 kg/cum for coal has been assumed for Explosive consumption.

5.3.8.3. Control of ground vibrations due to blasting

Ground vibration due to blasting shall be controlled by following:

- Reducing the explosive charged per delay
- Reducing the spacing and burden per blast

- Reducing the amount of explosive charged per blast
- Proper controlled rock movement during blast by using suitable initiating sequence and delay.

5.3.8.4. Storage of explosive

It is envisaged that the blasting operation shall be carried out by Emulsion/SMS (Site Mix Slurry) and shall be transported to the mine site by the explosive agency located centrally for the North Karanpura coalfield.

For PB-West & East Quarry A cluster of 3T magazines, 3 in nos (total capacity 9T) is provided for storing detonating fuses, detonators etc. and other explosives for secondary blasting if necessary

For PB-NW Quarry A 3T magazines, 1 in nos. (Total capacity 3T) is provided for storing detonating fuses, detonators etc. and other explosives for secondary blasting if necessary.

Magazines shall be located as shown in the Surface Master Plan at place generally not interfered with public or employees

If required additional Magazines capacity shall be provide to improve operational efficiency

5.3.9. Disposal of Waste

5.3.9.1. Overburden Management

For PB West and East Quarry Proposed quarries namely PB West and East are to be opened in Barakar formations, which consist of alluvium soil, sandstone and shale. The thickness of soil/weathered mantle generally varies from 6-18 m. It is commonly dirty-white to reddish-brown in colour and carbonaceous shale generally constitutes bulk of inseam burden

The overburden / Waste stripping operation shall start first with top soil removal which shall be stacked separately for reclamation purposes from both the quarries. The top soil dump has been planned over the non-coal bearing areas of eastern quarry. The external dumps "A", "B" for PB West Quarry and external dump "D" for PB East have been planned on non-opencastable coal area where quarrable potential is not indicated in the GR

The OB from WP-1, WP-2 & WP-3 would be dumped externally up to 5th year of quarry operation in external dumps A & B. Whereas the OB from EP1 would

be dumped externally up to 2nd year of quarry operation in external dump D. The assessed OBR (solid) **capacities are 10.3 Mm^3 (Dump A), 67 Mm^3 (Dump B) and 6 Mm^3 (Dump D) respectively which corresponds to loose capacities of 12 Mm^3, 80 Mm^3 and 7.2 Mm^3 respectively for dump A, B & D. About 21 Mm^3 of OB shall be transported to the area earmarked for dump 'C' in the 4th year of operation.** The WP-1, after de-coaling in 7th year, shall accommodate internal dumping. Subsequently, WP-2 and WP-3 shall also be ready to accommodate internal dumping after its de-coaling i.e. 8th year and 10th year respectively. After two years of mining operation in PB (East) quarry no dumping shall be resorted to external dump D.

From 7th to 11th year, OB shall be accommodated in the de-coaled area of WP-1, WP-2 and WP-3. As soon as de-coaled area is created in the floor of Seam-II within WP-4, internal dump shall be formed after leaving a safety distance of 100-150m from advancing lower most coal bench of high wall side of the OCP. This safety distance shall be reduced if step up fault is met while advancing. The high wall face, because of step up fault, shall act as a retaining wall for holding the slope of dump. However, a scientific study shall be undertaken before going for implementation. In addition to it, a safety distance of 100-150 m shall be kept against the haul road to accommodate conveyor system for transporting coal also.

After accommodating OB in the floor of WP-4 (Internal Dumping), balance OB from 12th year onwards shall be accommodated in Dump 'C'. Afterwards the OB shall be accommodated in maximum possible space available within WP-4 but major share of OB shall still have to be accommodated in dump 'C'. The capacity of dump 'C' has been assessed as 563 Mm3. Dump C has been planned over the area where the coal is beyond 300m depth line and thus suitable for exploitation by underground means only for which tentative scheme for mining has been envisaged and included in the Approved Mining Plan. Reserves beyond 300 m depth line are under "Indicated" category and shall be subjected to detailed exploration. As such no coal shall thus get sterilized due to dump 'C'.

ONGC/IOC programme of CBM exploration/exploitation shall be taken care of while dumping in dump 'C'. A corridor of about 40-50m width shall be marked from WP-4 upto the dump 'C' location in consultation with ONGC/IOC and a haul road shall be developed to connect with dump C.

After exhaustion of WP-1 quarry, East Quarry shall be restarted. Entire remaining OB of East Quarry shall be dumped into voids of West Quarry.

Final stage dump plan, as well as other stage plans also show the location of external/internal dumps in respective stage plans including height as well as volume of dump.

The total non-forest land available in south side of the quarriable block is 15 sq. km in which 7.7 sq. km is available for Dump "C", balance 7.3 Sq.km covers, safety distance of 300m against the high wall side of the OCP, two different locations of pair shafts for approaching coal seams lying at depth, two villages which are densely populated and area kept for further advancing of high wall side of the OCP in future, if need arises. This shall be decided at a later date for extending the quarry beyond 300 m depth line if feasible.

Small area of non-forest land falling on north side of the quarriable block has been proposed to be utilized for infrastructure of the OCP, leaving forest area in which only a magazine is proposed to be located. Most of the forest area is having hilly terrain hence dump formation over the hilly terrain is not feasible.

PB North West quarry is dotted with hillocks on its north , on the west & south side, the block is surrounded by Kerandari 'C' coal block. Above constraints restricts the availability of land outside the block. No space outside the block is envisaged for dumping of overburden. Entire overburden generated during the life of the mine shall be dumped inside the block boundary.

OB generated shall be dumped at the three locations viz. Dump 'A', Dump 'B' and Dump 'C'.

External Dump A'

It is located on the north western side on non-coal bearing area. From 1st to 3rd year of mining operation, OB shall be dumped in 3 benches of 30m each. The OB shall be rehandled at the closing stages of the mine life for reclamation purposes. Total volume accommodated in this dump is 11.00Mm^3 and the area of the dump is 16.23 Ha.

External Dump B':

It is located on the western side of coal bearing zone i.e. Pit – 2.From 6th to 28th year of mining operation, OB shall be dumped in two benches of 30m each. This OB shall be rehandled from 28th year onwards and dumped in the void of Pit-1 and void created by PB west pit. This arrangement shall facilitate release of coal progressively for simultaneous excavation. Entire OB shall be

rehandled for concurrent reclamation. Total volume accommodated at peak in this dump is 49.75Mm^3 and the area of the dump is 123 Ha.

External Dump C':

It is located on the south side of the coal bearing zone at the confluence of Khora Nala A & B. From 16th to 19th year of mining operation i.e. for 4 years, OB shall be dumped in three benches of 30m, 20m, and 10m height respectively. The OB shall be re-handled during 40th year to free up the blocked reserves beneath it. Coal below this dump shall be taken alongwith the locked coal of barrier between PB West and this quarry. Total volume accommodated at peak in this dump is 3.50Mm^3 and the area of the dump is 10 Ha.

In Pit Dumping:

Above three dumps together accommodate 73.44 Mm^3 out of 438 Mm^3 generated during the life of the mine. About 9.19Mm^3 of OB is utilized for creation of embankment along nala which is accounted in Dump A and remaining 364.79 Mm^3 of OB shall be accommodate in in-pit dumping during different stages of mine.

OB removal and its phasing from Pakri Barwadih is given in **Table- 5.10 & Table 5.11** respectively. Percentage dumping of overburden in internal and External dumps are given in **Table 5.12**

Table 5.10

Year wise proposed OB Removal from PB (Mm^3)

Prod. Year	OBR (West Quarry)	Cum OBR (West Quarry)	OBR (East Quarry)	Cum OBR (West Quarry)	Total OBR (West & East)	OBR (NW Quarry)	Cum OBR (NW Quarry)	Total OBR (PB Block)
1	5.94	5.94	2.95	2.95	8.89		0	8.89
2	15.27	21.21	3.05	6	18.32		0	18.32
3	21.12	42.33		6	21.12		0	21.12
4	26.11	68.44		6	26.11	4.08	4.08	30.19
5	25.03	93.47		6	25.03	8.15	12.23	33.18
6	35.51	128.98		6	35.51	11.69	23.92	47.2
7	41.44	170.42		6	41.44	12.03	35.95	53.47
8	41.52	211.94		6	41.52	12.03	47.98	53.55
9	41.5	253.44		6	41.5	12.03	60.01	53.53
10	41.5	294.94		6	41.5	8.22	68.23	49.72

Prod. Year	OBR (West Quarry)	Cum OBR (West Quarry)	OBR (East Quarry)	Cum OBR (West Quarry)	Total OBR (West & East)	OBR (NW Quarry)	Cum OBR (NW Quarry)	Total OBR (PB Block)
11	44	338.94		6	44	8.22	76.45	52.22
12	44	382.94		6	44	8.22	84.67	52.22
13	52.76	435.7		6	52.76	8.22	92.89	60.98
14	66.04	501.74		6	66.04	8.22	101.11	74.26
15	66	567.74		6	66	8.22	109.33	74.22
16	66	633.74		6	66	8.22	117.55	74.22
17	66	699.74		6	66	8.21	125.76	74.21
18	66.01	765.75		6	66.01	8.21	133.97	74.22
19	66.01	831.76		6	66.01	8.21	142.18	74.22
20	66.01	897.77		6	66.01	8.21	150.39	74.22
21	66.01	963.78		6	66.01	8.21	158.6	74.22
22	66.01	1029.79		6	66.01	8.21	166.81	74.22
23	66	1095.79		6	66	8.22	175.03	74.22
24	66	1161.79		6	66	8.23	183.26	74.23
25	31.2	1192.99	31.85	37.85	63.05	8.23	191.49	71.28
26	26	1218.99	30.95	74.8	62.95	8.23	199.72	71.18
27	19.5	1238.49	46.5	121.3	66	8.23	207.95	74.23
28		1238.49	66	187.3	66	9.17	217.12	75.17
29		1238.49	66	253.3	66	11.36	228.48	77.36
30		1238.49	66	319.3	66	11.36	239.84	77.36
31		1238.49	66	385.3	66	11.36	251.2	77.36
32		1238.49	66	451.3	66	11.36	262.56	77.36
33		1238.49	66	517.3	66	11.37	273.93	77.37
34		1238.49	66	583.3	66	11.43	285.36	77.43
35		1238.49	66	649.3	66	11.43	296.79	77.43
36		1238.49	66	715.3	66	11.43	308.22	77.43
37		1238.49	66	781.3	66	11.43	319.65	77.43
38		1238.49	66	847.3	66	10.32	329.97	76.32
39		1238.49	12.99	860.29	12.99	10.04	340.01	23.03
40						9.00	349.01	9
41						9.00	358.01	9
42						9.00	367.01	9
43						9.00	376.01	9
44						9.00	385.01	9
45						9.00	394.01	9
46						9.00	403.01	9
47						9.00	412.01	9
48						8.50	420.51	8.5
49						7.00	427.51	7

Prod. Year	OBR (West Quarry)	Cum OBR (West Quarry)	OBR (East Quarry)	Cum OBR (West Quarry)	Total OBR (West & East)	OBR (NW Quarry)	Cum OBR (NW Quarry)	Total OBR (PB Block)
50						5.75	433.26	5.75
51						3.50	436.76	3.5
52						1.48	438.24	1.48
Total	1238.49		860.29		2098.78	438.24		2537.02

Table 5.11
Phased overburden dumping /waste disposal and capacity of dumps

(in Mm³)

Particulars	PB WEST AND EAST										PB NW								PB GRAND TOTAL (Solid)
	External Dump (Solid)					Internal Dump (Solid)					External					Internal			
	A	B	C	D	SUB TOTAL	A (Extn.)	B (Extn.)	WP-4	SUB TOTAL	Total (West&East)	DUMP 'A'	DUMP 'B'	DUMP 'C'	Sub Total	DUMP 'A' Extn.	WP-4	Sub Total	TOTAL (NW)	
1 - 5 yrs																			
WP1	0.33	6.55			16.88					16.88									16.88
WP2		40.00			40.00					40									40.00
WP3		8.23	21.00		29.23					29.23									29.23
WP4		7.36			7.36					7.36									7.36
EP1				6.00	6.00					6									6.00
PIT-1											9.06			9.06	3.15		3.15	12.23	12.23
PIT-2																			
6 - 10 yrs																			
WP1						0.06			9.36	9.36									9.36
WP2		4.86			4.86	38.38			38.38	43.24									43.24
WP3						33.15			33.15	33.15									33.15
WP4						15.7			115.71	115.71									115.71
PIT-1											0.61	4.00		10.8	45.39		45.39	56	56.00
PIT-2																			

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(in Mm³)

Particulars	PB WEST AND EAST										PB NW								PB GRAND TOTAL (Solid)
	External Dump (Solid)					Internal Dump (Solid)					External				Internal				
	A	B	C	D	SUB TOTAL	A (Extn.)	B (Extn.)	WP-4	SUB TOTAL	Total (West&East)	DUMP 'A'	DUMP 'B'	DUMP 'C'	Sub Total	DUMP 'A' Extn.	WP-4	Sub Total	TOTAL (NW)	
11 - 15 yrs																			
WP-4			169.00		169.00		130.2		130.8	299.8									299.80
PIT-1											4.00	7.00		14	27.10		27.1	41.1	41.10
PIT-2																			
16 - 20 yrs																			
WP-4			206.00		206.00	37.00	2.00	79.00	118	324									324.00
PIT-1															10.93		10.93	10.93	10.93
PIT-2											1.50	13.00	2.00	16.5	13.63		13.63	30.13	30.13
21 - 25 yrs																			
WP-4 East Quarry			167.00		167.00			163.05	163.05	330.05									330.05
PIT-1											2.00	1.50	13.5	27.60			27.6	41.1	41.10
PIT-2																			
26 - 30 yrs																			
PIT-1											8.75		8.75	12.46	27.14		39.6	48.35	48.35
PIT-2																			

RQP No. 34011/(15)/2009-CPAM dated 27.09.10.

(in Mm³)

Particulars	PB WEST AND EAST												PB NW					PB GRAND TOTAL
	External Dump (Solid)					Internal Dump (Solid)				External				Internal				
	A	B	C	D	SUB TOTAL	A (Extn)	B (Extn)	WP-4	SUB TOTAL	Total (West&East)	DUMP 'A'	DUMP 'B'	DUMP 'C'	Sub Total	DUMP 'A' Extn	WP-4	Sub Total	TOTAL (NW)	(Solid)
WP-1 East Quarry 31 - 35 yrs								330.00	330	330									330.00
East Quarry PIT-1 PIT-2 36 - 39 yrs								330.00	330	330									330.00
East Quarry PIT-1 PIT-2								184.00	184	184		1.00		1	21.72	34.23	55.95	56.95	56.95
40 - 52 yrs PIT-1 PIT-2																			184.00
															22.86	20.36	43.22	43.22	43.22
															0.00	98.22	98.22	98.22	98.22
Total	10.33	07.00	583.00	6.00	646.33	233.60	132.60	1086.05	1452.45	2098.78	20.19	49.75	3.50	73.44	184.84	178.95	364.79	438.23	2537.01

Table 5.12
Percentage Overburden Dumping

	PB West & East (Mm3)	PB NW(Mm^3)	PB (Mm^3)	PB West an East (%)	PB NW (%)	PB (%)
External Dump	619.00	73.44	692.44	29.49%	16.76%	27.29%
Internal Dump	1479.83	364.79	1844.62	70.51%	83.24%	72.71%
Total	2098.83	438.23	2537.06	100.00%	100.00%	100.00%

5.3.9.2.Top Soil Management

For PB-WEST & EAST Quarry during Operating life of mine 5.81 Mm^3 of top soil shall be generated. This figure is arrived at by considering 1 m (approx.) thickness of top soil, as because unlike PB-NW Quarry considerable deposition has not taken place in the block.

For the initial 5 years of Mining operation, top soil shall be stacked at a designated location over coal bearing area, as shown in **Surface Master Plan**. Estimated land requirement for stacking is 1 Ha. The requirement of land shall cease to operate from 10th year onwards as because scrapped top soil shall be spread over the dump for land reclamation.

Stacking of top soil shall be achieved in two tiers. The bottom tier shall be of 3m in height while top tier shall be of 2m or shall below height not exceeding the limit as per prescribed norms.

Stack of top soil shall be grassed to retain fertility if required. Besides this, top soil stack them shall be made use of concurrent filling without bringing the scrapped top soil to the stack.

For PB-NW Quarry during Operating life of mine 5.81 Mm^3 of top soil shall be generated. This figure is arrived at by considering 1.5m (approx.) thickness of top soil, as because presence of ravines and surrounding nalas considerable deposition has taken place in the block.

For the initial 5 years of Mining operation, top soil shall be stacked at a designated location over Pit – 2, as shown in **Plate No.5** Estimated land requirement for stacking is 1 Ha. The requirement of land shall cease to operate from 10th year onwards as because scrapped top soil shall be spread over the dump for land reclamation.

Stacking of top soil shall be achieved in two tiers. The bottom tier shall be of 3m in height while top tier shall be of 2m or shall below height not exceeding the limit as per prescribed norms.

Top soil scrapping: Scrappers shall be deployed to scrap the top soil off the surface. With the help of front end loader, top soil shall be loaded on the tripper of 10T capacity and transported to top soil stock yard. In the event of non-stacking system, top soil shall be transported directly to the desired location.

Top soil spreading: Front end loader shall load on to the trippers and transported to desired location and spread with the help of dozer/graders.

Stack of top soil shall be grassed to retain fertility if required. Besides this, top soil stack them shall be made use of concurrent filling without bringing the scrapped top soil to the stack. Year wise quantity schedule of management of top soil excavated and spread is given in **Table 5.13** and Summerised data for Top Soil Management is given in **Table 5.14.**

Table 5.13

Management of top soil

Year	PB West and East				PB-NW			
	Area of TS removal (Ha)	Prog. Top Soil (Mm^3)	Prog. Spread (Ha)	prog. Spread (Mm^3)	Area of TS removal (Ha)	Prog. Top Soil (Mm^3)	Prog. Spread (Ha)	Prog. Spread (Mm^3)
P-1	70.88	0.57	0.00	0.00	0.00	0.00	0.00	0.00
P-2	88.60	0.71	0.00	0.00	0.00	0.00	0.00	0.00
P-3	106.32	0.85	0.00	0.00	0.00	0.00	0.00	0.00
P-4	124.04	0.99	0.00	0.00	15.48	0.23	0.00	0.00
P-5	141.76	1.13	0.00	0.00	19.35	0.29	0.00	0.00
P-6	159.48	1.28	5.32	0.07	23.22	0.35	0.00	0.00
P-7	177.20	1.42	5.32	0.07	27.09	0.41	0.00	0.00
P-8	35.44	0.28	5.32	0.07	30.96	0.46	0.00	0.00
P-9	35.44	0.28	5.32	0.07	34.83	0.52	1.00	0.03
P-10	35.44	0.28	5.32	0.07	38.70	0.58	1.00	0.03

	PB West and East				PB-NW			
Year	Area of TS removal (Ha)	Prog. Top Soil (Mm^3)	Prog. Spread (Ha)	prog. Spread (Mm^3)	Area of TS removal (Ha)	Prog. Top Soil (Mm^3)	Prog. Spread (Ha)	Prog. Spread (Mm^3)
P-11	35.44	0.28	5.32	0.07	7.74	0.12	1.00	0.03
P-12	35.44	0.28	10.63	0.14	7.74	0.12	1.00	0.03
P-13	35.44	0.28	10.63	0.14	7.74	0.12	1.00	0.03
P-14	35.44	0.28	10.63	0.14	7.74	0.12	1.00	0.03
P-15	35.44	0.28	10.63	0.14	7.74	0.12	1.00	0.03
P-16	35.44	0.28	10.63	0.14	7.74	0.12	1.00	0.03
P-17	35.44	0.28	15.95	0.21	7.74	0.12	1.00	0.03
P-18	35.44	0.28	15.95	0.21	7.74	0.12	2.00	0.06
P-19	35.44	0.28	15.95	0.21	7.74	0.12	2.00	0.06
P-20	35.44	0.28	15.95	0.21	7.74	0.12	3.00	0.09
P-21	35.44	0.28	15.95	0.21	7.74	0.12	3.00	0.09
P-22	35.44	0.28	15.95	0.21	7.74	0.12	3.00	0.09
P-23	35.44	0.28	15.95	0.21	7.74	0.12	3.00	0.09
P-24	35.44	0.28	21.26	0.28	7.74	0.12	3.00	0.09
P-25	35.44	0.28	21.26	0.28	7.74	0.12	3.00	0.09
P-26	35.44	0.28	31.90	0.43	7.74	0.12	3.00	0.09
P-27	26.58	0.21	31.90	0.43	7.74	0.12	4.00	0.12
P-28	26.58	0.21	31.90	0.43	7.74	0.12	4.00	0.12
P-29	26.58	0.21	31.90	0.43	7.74	0.12	4.00	0.12
P-30	26.58	0.21	31.90	0.43	5.81	0.09	4.00	0.12
P-31	26.58	0.21	31.90	0.43	5.81	0.09	4.00	0.12
P-32	17.72	0.14	53.16	0.71	5.81	0.09	4.00	0.12
P-33	17.72	0.14	53.16	0.71	5.81	0.09	4.00	0.12
P-34	17.72	0.14	53.16	0.71	5.81	0.09	4.00	0.12
P-35	8.86	0.07	74.42	0.99	3.87	0.06	4.00	0.12
P-36	8.86	0.07	74.42	0.99	3.87	0.06	4.00	0.12
P-37	8.86	0.07	74.42	0.99	3.87	0.06	4.00	0.12
P-38	8.86	0.07	74.42	0.99	1.94	0.03	6.00	0.17
P-39	8.86	0.07	74.42	0.99	1.94	0.03	6.00	0.17
P-40	0.00	0.00	53.16	0.71	1.94	0.03	6.00	0.17
P-41	0.00	0.00	21.26	0.28	1.94	0.03	6.00	0.17
P-42	0.00	0.00	26.58	0.35	1.94	0.03	6.00	0.17
P-43	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.17
P-44	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.17

Year	PB West and East				PB-NW			
	Area of TS removal (Ha)	Prog. Top Soil (Mm^3)	Prog. Spread (Ha)	prog. Spread (Mm^3)	Area of TS removal (Ha)	Prog. Top Soil (Mm^3)	Prog. Spread (Ha)	Prog. Spread (Mm^3)
P-45	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.17
P-46	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.23
P-47	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.23
P-48	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.23
P-49	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.29
P-50	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.29
P-51	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.29
P-52	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.23
P-53	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.23
P-54	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.06
P-55	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.06
TOTAL	1772	14.176	1063.2	14.176	387.02	5.8053	200	5.81

Table 5.14
Summerised data for Top Soil Management is given in

Sl. No.	Particular	PB West & East	PB -NW
1	Total Area disturbed (Ha)	1772	387.02
2	Thickness of Top Soil Cover (m)	0.8	1.5
3	Volume of Top Soil (Mm3)	14.176	5.8053
4	Commencement of TiSoil Removal	P-1	P-4
5	Storage period in Years	5	5
6	Reclaimed area through Spread (Ha)	1063.2	200
7	Thickness of Top Soil in Reclaimed Area (m)	1.33	2.90

5.3.10. Projected Production Plan/Calendar Program

The Pit-Wise planned production programme from PB West quarry, PB East Quarry and PB North-West, is given in **Table 5.15**. Calander Programme is given in **Table-5.16**

Table 5.15

Pit-Wise production programme (Coal in Mt)

Year	PB West Quarry					PB East Quarry		PB NW			
	WP-1	WP-2	WP-3	WP-4	Sub Total PB-West	EP1	Sub Total PB-East	PIT-1	PIT-2	Sub Total PB-NW	Total
1st Yr	0.4	1.2	0.74		2.34	0.8	**0.8**				**3.14**
2nd Yr	0.8	2.4	1.97		5.17	1.1	**1.1**				**6.27**
3rd Yr	1.2	3.6	2.98	0.7	**8.48**		**0**				**8.48**
4th Yr	1.2	3.6	3.5	1.2	**9.5**		**0**	0.5		0.5	**10**
5th Yr	1.2	3.6	2.5	2.7	**10**		**0**	1		1	**11**
6th Yr	1	4.8	1.5	2.7	**10**		**0**	2		2	**12**
7th Yr	0.85	4.79	1.5	2.86	**10**		**0**	3		3	**13**
8th Yr		4.48	1.5	4.03	**10.01**		**0**	3		3	**13.01**
9th Yr			1.5	8.5	**10**		**0**	3		3	**13**
10th Yr			0.82	8.18	**9**		**0**	3		3	**12**
11th Yr				12	**12**		**0**	3		3	**15**
12th Yr to 24th Yr.				15	**15**		**0**	3		3	**18**
25th Yr				11	**11**	4	**4**	3		3	**18**
26th Yr				7	**7**	8	**8**	3		3	**18**
27th Yr				1.21	**1.21**	13.79	**13.79**	3		3	**18**
28th Yr						15	**15**	2.[illegible]	0.0	3	**18**
29th Yr to 37th Yr						15	**15**		3	3	**18**
38th Yr						10	**10**		3	3	**13**
39th Yr						3.99	**3.99**		3	3	**6.99**
40th Yr to 50th Yr							**0**		3	3	**3**
51st Yr									2	1.28	**1.28**
52nd Yr									1.46	1.28	**1.28**

Table 5.16
Calendar Program of Pakri Barwadih

Production Years	Coal Production (Mt)					OB Removal (Mm3)					Strip Ratio (m3/t)		
	West Quarry	East Quarry	PB West & East	NW Quarry	Total from PB	West Quarry	East Quarry	PB West & East	NW Quarry	Total PB Mm3)	West & East Quarry	NW Quarry	PB
1	2.34	0.8	3.14		3.14	5.94	2.95	8.89		8.89	2.83		2.83
2	5.17	1.1	6.27		6.27	15.27	3.05	18.32		18.32	2.92		2.92
3	8.48		8.48		8.48	21.12		21.12		21.12	2.49		2.49
4	9.5		9.5	0.5	10	26.11		26.11	4.1	30.21	2.75	8.20	3.02
5	10		10	1	11	25.03		25.03	8.2	33.23	2.50	8.20	3.02
6	10		10	2	12	35.51		35.51	11.7	47.21	3.55	5.85	3.93
7	10		10	3	13	41.44		41.44	12	53.44	4.14	4.00	4.11
8	10		10	3	13	41.52		41.52	12	53.52	4.15	4.00	4.12
9	10		10	3	13	41.5		41.5	12	53.5	4.15	4.00	4.12
10	10		10	3	13	41.5		41.5	8.2	49.7	4.15	2.73	3.82
11	12		12	3	15	44		44	8.2	52.2	3.67	2.73	3.48
12	15		15	3	18	44		44	8.2	52.2	2.93	2.73	2.90
13	15		15	3	18	52.76		52.76	8.2	60.96	3.52	2.73	3.39
14	15		15	3	18	66.04		66.04	8.2	74.24	4.40	2.73	4.12
15	15		15	3	18	66		66	8.2	74.2	4.40	2.73	4.12
16	15		15	3	18	66		66	8.2	74.2	4.40	2.73	4.12
17	15		15	3	18	66		66	8.2	74.2	4.40	2.73	4.12
18	15		15	3	18	66.01		66.01	8.2	74.21	4.40	2.73	4.12
19	15		15	3	18	66.01		66.01	8.2	74.21	4.40	2.73	4.12
20	15		15	3	18	66.01		66.01	8.2	74.21	4.40	2.73	4.12
21	15		15	3	18	66.01		66.01	8.2	74.21	4.40	2.73	4.12
22	15		15	3	18	66.01		66.01	8.2	74.21	4.40	2.73	4.12
23	15		15	3	18	66		66	8.2	74.2	4.40	2.73	4.12
24	15		15	3	18	66		66	8.2	74.2	4.40	2.73	4.12

Production Years	Coal Production (Mt)					OB Removal (Mm3)					Strip Ratio (m3/t)		
	West Quarry	East Quarry	PB. West & East	NW Quarry	Total from PB	West Quarry	East Quarry	PB West & East	NW Quarry	Total PB Mm3)	West & East Quarry	NW Quarry	PB
25	11	4	15	3	18	31.2	31.85	63.05	8.2	71.25	4.20	2.73	3.95
26	7	8	15	3	18	26	36.95	62.95	8.2	71.15	4.20	2.73	3.95
27	1.21	13.79	15	3	18	19.5	46.5	66	8.2	74.2	4.40	2.73	4.12
28		15	15	3	18		66	66	9.2	75.2	4.40	3.07	4.18
29		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
30		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
31		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
32		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
33		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
34		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
35		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
36		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
37		15	15	3	18		66	66	11.4	77.4	4.40	3.80	4.30
38		10	10	3	13		66	66	10.3	76.3	6.60	3.43	5.87
39		3.99	3.99	3	6.99		12.99	12.99	10.04	23.03	3.26	3.35	3.29
40				3	3				9.00	9		3.00	3.00
41				3	3				9.00	9		3.00	3.00
42				3	3				9.00	9		3.00	3.00
43				3	3				9.00	9		3.00	3.00
44				3	3				9.00	9		3.00	3.00
45				3	3				9.00	9		3.00	3.00
46				3	3				9.00	9		3.00	3.00
47				3	3				9.00	9		3.00	3.00
48				3	3				8.50	8.5		2.83	2.83
49				3	3				7.00	7		2.33	2.33
50				3	3				5.75	5.75		1.92	1.92

Production Years	Coal Production (Mt)					OB Removal (Mm3)					Strip Ratio (m3/t)		
	West Quarry	East Quarry	PB West & East	NW Quarry	Total from PB	West Quarry	East Quarry	PB West & East	NW Quarry	Total PB Mm3)	West & East Quarry	NW Quarry	PB
51				2	2				3.50	3.5		1.75	1.75
52				1.46	1.46				1.48	1.48		1.01	1.01
Total	**311.70**	**191.68**	**503.38**	**138.96**	**642.34**	**1238.49**	**860.29**	**2098.78**	**437.97**	**2536.75**	**4.17**	**3.15**	**3.95**

5.3.11. Equipment Requirement

5.3.11.1 Design criteria

The design criteria adopted is as follows.

- Number of annual working days : 330
- Number of shifts /day : 3
- Duration of shift hours : 8

The number of equipment has been calculated on the basis of availability and utilization norms adopted for coal mines by CMPDI and is presented below in **Table No 5.17** for shovels and dumpers.

Table 5.17
Norms of Equipment Availability and Utilization

Sl. No.	Equipment	Availability	Utilization
1	Shovels	80%	58% 61%
2	Dumpers	67%-72%	50%-54%

5.3.11.2 CATEGORY OF EXCAVATION

Following categories of excavation have been assumed.

i)	Top soil	Cat. I
ii)	Overburden	50%Cat III + 50%Cat.IV
iii)	Coal	Cat. III

5.3.11.3 PRODUCTIVITY OF EXCAVATORS

Productivity of excavators is presented in **Table-5.18**. Productivity of dumpers is presented in **Table-5.19**

Table 5.18
Productivity of excavators

Sl. No.	Description	Productivity (Mm3)
A	OVERBURDEN	
1	5.5m3 Hydraulic shovel with 60T rear dumper	1.5

Sl. No.	Description	Productivity (Mm3)
2	10m3 Hydraulic shovel with 100T rear dumper	2.6
3	20 m3 rope shovel + RD 170 T	4.015
4	10 m3 rope shovel + RD 120 T	2.08
5	8.3 m3 hyd shovel + RD 120 T	2.18
B	COAL	
1	8.3 m3 hyd. shovel + RD 120 T	2.2
2	4.5 m3 hyd. shovel + RD 50 T	1.18
3	5.5m3 Hydraulic shovel with 60T rear dumper	1.65

Table-5.19

Productivity of dumpers for Lead

Different Combination	1 Km	1.5 Km	2 Km	2.5 Km	3 Km	3.5 Km	4 Km	4.5 Km
RD 170 T + 20 m3 shovel	0.7524	0.6390	0.5671	0.5181	0.4696	0.4322	0.4252	0.3852
RD 120+ 10m3 rope shovel	.5018	.4288	.3835	.3524	.3214	.2972	.275	.262
RD 120 T+ 8.3 m3 hyd. shovel	.566	.4845	.433	.398	.363	.336	.311	.296
RD 50 T + 4.5 m3 shovel	0.2126	0.1801	0.1603	0.1471	0.1335	0.1232	0.120	0.112
5.5m3 Hydraulic shovel with 60T rear dumper	0.2312	0.1971	0.1762	0.1623	0.1477	0.1365	0.143	
10m3 Hydraulic shovel with 100T rear dumper	0.4456	0.3758	0.3341	0.3062	0.2777	0.2559	0.2386	

The requirement of dumpers has been worked based on the annual workload, deployment of equipment, lead assessed from the stage plan of pit operations for 1st to 5th yr, 10th yr, , 20th yr, 30th yr. 40th yr and final stage along with dumping plan

It is suggested that the dumpers deployed in coal and OB to a have suitable dump bodies for optimum utilisation of the dumper payload

5.3.11.4 Equipment selection for PB West and PB East Quarries.

The geo-mining conditions warrant that the equipment deployed in partings and coal to alternate between the coal seam and partings. Thus, in the

process of selection of mining equipment, two major equipment combinations have been proposed. One for Top OB and the other for the coal seams and the partings.

20 cum Electric Rope Shovels operating with 170T-190T class of dumpers shall be deployed in Top OB and 10 cum Electric/Diesel Hydraulic shovel/ backhoe operating with 100-120T class of dumpers in partings and Coal. The size has been decided to meet the twin objective of effective deployment, optimal utilization of the equipment and at the same time keeping the fleet size to manageable levels. This equipment size shall also offer a choice from a variety of vendors during the procurement and facilitate better inventory management.

In the initial years, the mine shall be opened by 10 cum hydraulic shovel/backhoe working with 100-120 T rear dumpers. This is proposed, as this combination shall have much smaller lead time for deployment. Deployment of 20 cum Electric rope shovels shall start as soon as the load for top OB increases.

A part of the Top OB workload is also proposed to be handled by 10 cum hydraulic shovel/backhoe operating with 100-120T rear dumpers. This has been done in years where there isn't enough consistent workload for a deployment of a new 20 cum rope shovel. This gives flexibility to the operations and also ensures better equipment utilization.

It is also proposed to work out the thin seams/partings with the help of high capacity ripper dozers (510hp).

5.3.11.5 Equipment selection for PB NW Quarries.

The geo-mining conditions warrant that the equipment deployed in partings and coal to alternate between the coal seam and partings. Thus, in the process of selection of mining equipment, two major equipment combinations have been proposed. One for Top OB and the other for the coal seams and the partings.

10 cum Electric Rope Shovels operating with 100T class of dumpers shall be deployed in Top OB and 5.5 cum Electric/Diesel Hydraulic shovel/ backhoe operating with 60 T class of dumpers in partings and Coal. The size has been decided to meet the twin objective of effective deployment, optimal utilization of the equipment and at the same time keeping the fleet size to manageable levels. This equipment size shall also offer a choice from a variety of vendors during the procurement and facilitate better inventory management.

In the initial years, the mine shall be opened by 5.5 cum hydraulic shovel/backhoe working with 60 T rear dumpers. This is proposed, as this

combination shall have much smaller lead time for deployment. Deployment of 10 cum Electric rope shovels shall start as soon as the load for top OB increases.

A part of the Top OB workload is also proposed to be handled by 5.5 cum hydraulic shovel/backhoe operating with 60T rear dumpers. This has been done in years where there isn't enough consistent workload for a deployment of a new 10 cum hydraulic shovel. This gives flexibility to the operations and also ensures better equipment utilization.

It is also proposed to work out the thin seams/partings with the help of high capacity ripper dozers (410hp). These machines shall rip the material, doze to form a heap to be handled by 10 cum front end loaders with 100 T class dumpers.Proposed.

5.3.11.6 Proposed HEMM

Size of HEMM are minimum and may vary in size as per requirement of site conditions. Proposed list of HEMM is given in **Table 5.20.**

Table 5.20
Proposed list of HEMM FOR PB WEST AND PB EAST

PB WEST AND EAST				PB-NW			
Sl. No.	Equipment	Size /capacity	Nos.	Sl. No.	Equipment	Size /capacity	Nos.
			COAL				
1	Elec. Hydraulic shovel	4.5 m³	9	1	Diesel Hydraulic Shovel with Backhoe attachment	5.5 m³	2
2	Rear Dumper	40-60 T	77	2	Rear Dumper	60 T	18
3	RBH Drill	160 mm	15	3	RBH Drill (Electric)	160 mm	2
4	Track Dozer	310 kW	15	4	Dozer with Ripper attachments	410 HP	2
5	Back hoe hyd shovel	2.8m³	6	5	Wheel Dozer	410 HP	1
6	Wagon drill	100mm	3	6	Coal Tippers (Coal Body)	20T	25
			TOP OB/PATING/INTERBURDEN				
1	Elec. Rope Shovel	20 m³	7	1	Hydraulic Shovel	5.5 m³	3
2	Elec. Rope Shovel	10 m³	5	2	Hydraulic Shovel	10.0 m³	3
3	Elec. Hydraulic shovel	8.3 m³	14	3	Rear Dumpor	60 T	20

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PB WEST AND EAST				PB-NW			
Sl. No	Equipment	Size /capacity	Nos.	Sl. No.	Equipment	Size /capacity	Nos.
5	Rear Dumper	170-190 T	78	4	Rear Dumper	100 T	8
6	Rear Dumper	120-150 T	152	5	RBH Drill (Electric)	250 mm	3
7	RBH Drill	250 mm	24	6	Dozer with ripper attachments	410 HP	4
8	RBH Drill	160mm	10	7	Dozer with ripper attachments	850HP	4
9	Track Dozer	310 kw	30				
COMMON /AUXILIARY EQUIPMENT							
1	Dozer with Ripper	510 kW	5	1	Water Sprinkler (wide spray system)	70 KL	3
2	Motor Grader	205 kW	14	2	Truck Mounted DTH Drill	100-120mm	1
3	Wheel Loader	5 m³	4	3	Mobile Rough Terrain Crane	70T	1
4	Diesel crane	75 T	2	4	R. T. Crane	30T	1
5	Hyd. Rough terrain crane	30 T	5	5	R. T. Crane	87	
6	Hyd. Rough terrain crane	12 T	6	6	F.E Loader	10 Cum	
7	Diesel Hyd. Pickup Crane	8 T	8	7	Hydraulic shovel with Backhoe (Diesel)	1.2-2.2 m³	1
8	Wheel Dozer	280 kW	6	8	Wagon drill	100-120mm	
9	Water Sprinkler	28 kL	14	9	Diesel Browser	16KL	1
10	Tyre Handler		4	10	Rock Breaker		1
				11	Fire Tender		1
				12	Cable Handler		1
				13	Tyre Handler		1
				14	Tipping trucks	10 T	6
				15	Maintenance Van		1
				16	Heavy Duty Toeing truck		1
Haul Road Equipment							
				1	Grader	280 HP	2
				2	Vibratory Compactor	30TH	1
				3	Wheel Dozer	460 HP	1
Reclamation							
				1	F.E Loader	10 m³	1
				2	Water Sprinkler (wide spray system)	28 KL	2

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PB WEST AND EAST				PB-NW			
Sl. No.	Equipment	Size /capacity	Nos.	Sl. No.	Equipment	Size /capacity	Nos.
				3	Rear Dumper	60T	3
				4	Dozer (With ripper Attachment)	410 HP	1
				5	Farm Track/tractor with trolley		1

In the initial two years of mining operation of PB East quarry, separate set of smaller equipment are proposed. After completion of the said period these equipment shall be disposed of suitably. The proposed list of major equipment are mentioned in **Table 5.21**.

Proposed list of HEMM FOR PB EAST FOR INITIAL TWO YEARS

Table 5.21

Sl No	Equipment Type	Size/Cap	Population
1	Shovel	4.5 Cum	3
2	Dumper	35 T	30
3	Dozer	320 Hp	3
4	Drill Machine	160 mm	3
5	Grader	145 Hp	1
6	Water sprinkler	28 Kl	1

The size and the equipment indicated above may vary depending upon their market availability and technology upgaradtion.

5.3.12. Annual Capacity and Life of Quarry

The life of the PB OCP is estimated as 52 years. No construction period is considered. PB-NW quarry shall commence mining operation on 4th year. After 39 year peak capacity of mine shall be 3 MTPA and shall be limited to extraction of coal of barrier.

Annual peak capcity and life quarrywise and for PB mine is given in **Table 5.22**.

Table 5.22
Annual Capacity and Life of Quarry

Sl. No.	Quarry	From	To	Life	Capacity (MTPA)
1	PB-West	P-1	P-27	27	15
2	PB-East initial	P-1	P-2	2	1

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3	PB East Later	P-25	P-39	15	15
4	PB-NW	P-4	P52	48	3
	PB Mine	**P-1**	**P-52**	**52**	**18**

5.3.13. Quarry Drainage

5.3.13.1 Quarry Dewatering

Sufficient numbers of inpit sumps as required PB West and East Quarry and all necessary in pit drainage channels to facilitate pit dewatering to comply with the Water Management Plan. A suitable number of large mining pumps (some mounted on pontoons) shall ensure adequate capacity to pump water from the mine during and after the "monsoon" season. The mine shall be so designed that it allows all water falling on the working areas to be directed to major sumps located strategically at the bottom of each pit. During very high rainfall periods production focus shall be on the drier upper benches.

Sufficient temporary and permanent inpit and expit pipework and drainage channels shall be provided for to ensure adequate dewatering can take place both during and after the monsoon period. Annual planning shall ensure that mining from lower benches is minimised during the monsoon so that disruptions to production due to flooded lower areas of the pit can be minimised also. Time to dewater the lower areas of the pit during and after the monsoon season is allowed for in the mine plan. Lower areas of the mine shall be mined during the dryer months

5.3.13.2 Water Management Plan

The main areas of water management in the Quarry shall be:-

- Surface water flow around the mine through Garland Drains
- In pit accumulation caused by intense rainfall during the monsoon season and plans for managing this rainfall by utilising sumps, diversion ditches and pumps.
- Groundwater flow into the pit and the construction, maintenance and operation of mine dewatering plant to handle this groundwater.
- Non potable water required for construction and mining services around the mine site including fire protection.
- Potable water required for drinking purposes at both the mine site and the colony.
- Discharge of decanted water into the seasonal streams which traverse the mining lease.

5.3.13.3 Surface Water Flow

NTPC had appointed Central Water and Power Research Station (CWPRS), Pune for conducting an area-drainage study. As recommended by CWPRS, the central nallah flowing across PB block, shall be tapped at the northern boundary of the block to transfer the flow to the eastern and western nallas through diversion canals

Water flow from this canal is directed towards both the Lathorva Nallah and Hardara (Pakwa) Nallah. Additionally collector and diversion drains shall be constructed around the outside of the pit, predominantly along the base of the waste dumps to intercept over land flow and water shed from the waste dumps. This captured water shall be diverted via the drains and sediment ponds to existing nallahs to take the water away from the mine. All collection and diversion drains shall be bunded to increase drain capacity. The alignment of the proposed canal and layout of these drains and sediment ponds are shown in the "Surface Master Plan"

Garland drains all around the periphery of the excavation zone shall be dug with the help of low capacity backhoe. This garland drain shall be connected to nearest natural nala. Such garland drains and their inter-connection shall be ever shifting and unlined. Preferably, 2m wide and 1m deep cross section is presumed to carry rain water to the nearest natural drainage.

Adequate sump capacity to cater to the ground water seepage and direct rainfall water during rainy season shall be created at all point of time in the mine life. Additional water shall be dewatered with the help of pump installed near sump at elevated location. Pipe ranges shall discharge water to the settling tank on the surface. In the settling tank/pond clear water shall be pumped to nearest natural nala.

For keeping the working face and benches during monsoon season, benches shall be mildly sloped toward sump side/dip side to allow water to percolate at the bottom most coal benches and finally lead to sump. Diesel operate face sump and slurry pumps shall be installed for occasional running for drying up faces.

Pump out water from the mine shall be brought to the settling pond located by the north of Khora/Lathorva Nala (A). Furrows suitable to arrest the siltation if any before finally pumping the clean water to nala. Settling pond shall be 2m (approx.) deep and around which bund shall be erected. Settling pond measuring approx 1 Ha shall be sloped southward to facilitate natural flow of water.

Drained mine water as explained above shall be carried to Lathorwa nala which finally meets Ghagra river on south side of the block.

5.3.13.4 In pit Storm water from Monsoon rainfall

In pit storm water runoff shall be intercepted at various levels within the pits to minimise the amount of water reaching the base of the pit. This shall involve the following system:

- Bund walls at specified levels within the pit to create a multilevel series of small holding dams
- Corresponding bench drains for interception of surface and ground water flow and its subsequent diversion to holding dams
- High volume discharge pumps at each holding dam level to discharge collected storm water. These shall be on an automatic start float system.

5.3.13.5 Groundwater Flows

Groundwater shall be controlled by the installation of dewatering wells along the perimeter of the pit which shall intercept groundwater flow and reduce the risk of excessive flows into the pit. The dewatering system shall be progressive and shall be brought on in stages as the mine develops. The system shall utilise 100 mm diameter submersible pumps in 150 mm diameter PVC well screens and casing and the wells shall be at approximately 150 m centres.

The details of the groundwater dewatering system shall be refined on the basis of data collected from specialised pump tests to be conducted along the northern pit limit of the West Quarry (between the proposed canal and the pit limit). In addition, groundwater monitoring boreholes shall be established at 500 m centres to collect data on a continuous basis, which shall be used along with geotechnical monitoring systems to assess slope stability parameters on a continual basis

5.3.13.6 Non Potable Water Requirements

Water from the dewatering wells shall be piped to a water storage facility. From here the water shall be piped to various locations around the mine site for use in construction, dust suppression at the mine and coal handling plant, sewerage system at the mine infrastructure and Colony, green belt irrigation, fire protection and for miscellaneous washing purposes.

5.3.13.7 Potable Water Requirements

Water from the storage facility shall be piped to a water treatment plant to produce potable water. This water shall then be piped around the mine site infrastructure and to the Colony. Borewell shall also be drilled to meet

requirement of drinking water and water requirement during construction stage.

5.3.13.8 Discharged Water

Excess water from the mine shall be discharged into the existing nallahs via Sediment Ponds. The ponds shall be 300m x 300m with a depth of 1.5 to 2.0 metres and internal bunding to control flow movement

5.3.13.9 Pumping of Mine Water

The pumping system has been planned separately for each pit considering simultaneous working. Mine has been planned in such a way that working faces and haul road shall remain dry as far as possible. Layout of quarry provides suitable gradient along quarry floor and benches to facilitate self-drainage of water to lowest level of quarry.

Proper drains shall be dug along both sides of haul road to keep the haul roads dry. Main sump at the lowest-point of quarry shall have sufficient capacity to accommodate entire make of water.

Water accumulated in the sump shall be pumped out of the mine at suitable point so that it drains away to canal and to Main River. Suitable sedimentation tank shall be made where quarry water shall be discharged and then after proper sedimentation, water shall flow to the nallahs. Pumping requirement has been assessed on the basis of.

(i) Meteorological data from nearby area concerning maximum rainfall.

(ii) Catchment area and depth of quarry.

Assuming 20 hours of pumping and six days to pump out the total water, the required pumping rate shall be 7726 cum/hr. selecting 540m3/hr pumps, the requirement is as given below. Initially 60 m head pumps shall be used for pumping out water from main Sump. As the quarries advance on dip side lower head pumps shall be replaced by higher head pumps.

a) Main Pumps [160 lps x 60 to 300 m head]: Complete with 6.6 KV 365KW electricals and starters.4% Pump sets with electricals to be kept as standby for emergency.

b) Diesel operating Pumps:

- 80 lps X 60 m head
- 35 lps X 60 m head

c) Face pumps 11 lps X 30 m head

d) Pipes: Sufficient length of pipes of dia 406 mm, 300 mm, 219 mm and 100 mm have been envisaged for above pumps depending upon capacityofpumps.

5.4. CONCEPTUAL UNDERGROUND MINING

5.4.1 Pakri-Barwadih (PB) Block has been divided into two portions, one for opencast upto a depth of 300 meters for deepest Seam, Seam-I and the other for underground mining. No underground mining shall be carried out in the PB-NW and PB-East as all the seams are extracted by opencast working. Thickness of mining block between floors of bottom most seam to roof of top most seam varies from about 120 m to about 170 m, average being about 140 m. The maximum depth of the Pakri-Barwadih block is about 600 m. Thus, the mining depth of proposed underground mining shall vary from about 160 m to 600 m. Such a property is ideally approached by an incline for coal raising and two shafts for ventilation and man and material transport. However, an incline through quarry bottom is not possible as this shall prevent or at least greatly limit back filling of over-burden in the worked out quarry and hence underground mines shall be developed through shafts only.

As per Geological data available, the underground area of the Pakri-Barwadih block contains about 728 millions tones (Mt) of coal reserves out of which only 109 Mt are 'Proved' and balance are 'indicated'. This calls for detailed exploration and formulation of geological report before action oriented Project is prepared. The detailed exploration programme for this area has already been discussed elsewhere in the document. Deailed exploration shall be completed before start of actual dumping operations over underground area. The time frame for exploration and exploitation of underground area and submission of mining plan for the same is given below.

Zero date of Commencement of exploration work for the area - from the commencement of opencast mining operations. Commencement of mining operations shall be reckoned from commencement of shaft sinking. Schedule of commencement is given in **Table 5.23.**

Table 5.23
Schedule of Commencement PB (UG)

Sl No.	Activity	Time schedule
1	Detailed exploration of the underground area	4 years
2	Preparation of G.R.	1 year
3	Various Studies and Clearances	3 year
4	Preparation and approval of Mining Plan from MOC	1 year
5	Commencement of mining operations	1 years

Total time	10 years

This chapter, therefore, deals with only a conceptual approach for exploitation of the deposit through underground mining. It may, however, be mentioned here that exploration and detailed mine planning activity are so timed and executed that it should be possible to start underground mine development activity at the earliest. This is necessary because underground mine development work, namely shaft sinking pit-bottom, winding arrangements, pump house and sump, horizon development and finally development of production panels take a long time.

5.4.2 Tentative Calendar Program:

Considering the production from area beyond 300 m depth line i.e. reserve amenable to underground mining a projected production plan is summarised in **Table 5.24.**

Table 5.24
Projected production plan

Year	UG mining (Projected) (Mt)	Cumulative (Mt)
10th Yr	0.5	0.5
11th Yr	1	1.5
13th Yr	3.6	5.1
14th Yr	3.6	8.7
15th Yr	3.6	12.3
20th Yr	3.6	30.3
25th Yr	3.6	48.3
30th Yr	3.6	66.3
35th Yr	3.6	84.3
40th Yr	3.6	102.3
45th Yr	3.6	120.3
50th Yr	3.6	138.3
51st Yr	3.6	141.9
52nd Yr	3.6	145.5

5.4.3 Mine development

The underground mining area shall be developed through two pairs of shafts, one pair for the Western sector and the other for the Central sector of the Block (there being practically no area in the Eastern sector for coal of depth of more than 300 Mining from surface for development of a separate underground mine). These shafts shall be at least 400 m away from overburden dumps to ensure that infrastructure created near the shaft is not affected by any accidental slide of dumps. Shafts shall be sunk up-to a depth of about 430 m with landing arrangements at about 400 meter from surface.

From each shaft, two level cross-measure roadways (in fact marginally rising for drainage of water to shaft) shall be driven to touch initially the top-most seam but later on to all seams as need arises. There shall thus be two main intakes and two main returns. Thereafter, all development shall be in coal. At shaft bottom, the following facilities shall be developed in stone and shall serve all the seams throughout the life of the mine:

1. Pump house and Sump
2. Sub-station both at downcast (DC) shaft
3. Skip loading arrangements at upcast (UC) shaft.
4. 150-200 t coal surge bunker before skip loading arrangements.

The upcast shaft shall be suitably covered to prevent short-circuiting of air. This shaft shall be connected to main mine exhaust fans (two in number-one working, one stand-by) through a fan-drift.

The upcast shaft shall be equipped with 15-tonne skip winding system with automatic loading of coal at shaft-bottom and automatic unloading of coal at shaft-top. The winding cycle shall be of about two minutes capable of giving 30 cycles per hour. Arrangements shall be made for man-winding in skip shaft in case of emergency.

The downcast shall be equipped with cages for man and material winding.

Both winding systems shall be operated through ground mounted Koepe winders. Shafts shall be equipped with rigid guides for smooth winding of skips and cages. Both shafts shall be of 6.5 m dia, finished and shall be about 60 m apart.

For initial development both shafts shall have temporary headgears and winders equipped with cage and mine car systems. Once facilities in rock are developed, permanent-winding facilities shall be installed as mentioned above.

Up-cast and down-cast shafts shall be connected only through one gallery in stone to restrict short circuiting of mine air. Development faces shall mainly be ventilated by auxiliary fans and tubing.

For stone work, compressed air shall be supplied from compressors installed on surface supplying compressed air to working forces through pipes and houses Side discharge loaders of about 2 m3 bucket capacity, shall be used for loading blasted rock in mine cars. On surface, these cars shall be taken to a tippler from where a conveyor shall take the muck or the mined rock to a bunker for loading dump trucks, for dumping the mined rock in overburden dump of the opencast mine.

All workings in rock shall be rock-bolted and gunited. Arches or wall-girder support shall be provided only where found necessary.

No underground working shall be permitted within 60 m of worked out opencast mine, thus maintaining minimum 60 m solid barrier between underground and opencast as this is necessary on safety consideration.

5.4.4 Development in coal

Once the four cross-measure roadways of 400 m horizon touch a coal seam rest of the mine development shall be in coal. Seams shall be developed and extracted top downwards. Two main intakes and two main return air roadways shall be developed on both sides of cross-measure roadways. Thus, there shall be a set of four main roadways for each seam or each group of seams. From these roadways, panels shall be developed on rise and dip-side. Scheme of development is shown in fig. 1& 2. Solid barrier shall be left between a panel and main trunk roadways. Return and intake roadways shall be connected at as few places as possible to reduce the number of stoppings and to prevent leakage. Development shall be done with the help of side- discharge loaders and conveyors, which shall initially load mine cars but later on skip loading conveyor. 2.5 t capacity mine cars shall be used for development before all conveyor system is established.

Main trunk roadways shall be 4.8 m wide, roof-bolted. Centre to centre distance between roadways shall 48 m. Panel development emanating from these trunk roadways shall be according to the final method of coal extraction. Height of trunk roadways shall be equal to seam thickness or a maximum of 3 m. There shall be only one set of trunk roadways for each group of seams. If any seam has top, middle and bottom sections, trunk roadways for them shall only be one set in located a suitable horizon. Similarly if any two seams have less than 9 m parting between them, trunk roadways shall only be in one of them only.

Main trunk return air and intake air roadways shall have as few connections as possible. When not in use, these inter-connections shall be cut off by stoppings One intake-airway shall be used for conveyors and travelling the other for material supply rail track equipped with endless haulage

Each seam shall have its own small sump and pumping station which shall pump water to main sump of the mine.

5.4.5 Mine development includes:

1. Working in stone as shown in the area bound by dotted line.
2. Shafts 4 nos. of cross-measure drifts, sub-station. Pump house. sump. skip drift. bunker, skip loading arrangements are in stone and for all seams. All other development is in coal seam.
3. Seams are extracted top downwards.
4. Coal transport is through bolt in intake except from main intake to skip loading station which is in return
5. Seams are touched by cross-measure drifts 4 nos. – 2 intake 2 returns
6. Initial development shall be through cages, mine-cars and haulages

5.4.6 Method of coal extraction

There are basically three methods of underground coal extractions.-

1. Board and pillar.
2. Room and Pillar. and
3. Longwall.

Normally for such deep mines as in this case Powered support Longwall is the appropriate method of coal extraction provided the deposit is near uniform and roof is not hard to cave. If the seam thickness varies considerably, more them one set of powered support are needed to cover the entire property. Even for one panel, double telescopic powered supports may be required to cover the entire seam thickness variation. Such supports are very costly The geological data available indicated that each seam has considerable thickness variation.

Coming to geological structure in the underground area, the same is yet to be confirmed by detailed exploration as the area mostly contains "Indicated reserves". There are a large number of faults in the opencast area and if similar structure is considered for dip-side underground area, formation of long panels (an essential requirement of powered support longwall) for 150 to 200 m long face shall not be possible.

Further, geological information has revealed that roof rocks are very hard in nature and to cave them properly heavy duty and costly supports shall be needed and yet caving may not be proper and regular without blasting in goaf.

For the reasons mentioned above longwall – Technology is ruled out for coal extraction.

Coming to Room and Pillar system of mining seam gradient is a bottle neck here. Gradient of seams is indicated as 1 in 3 to 1 in 5 (100 to 150). This rules out use of shuttle cars with continuous miners. Use of continuous haulage with continuous miner is a possibility but this technology has not yet been tried in India and is not widely practiced even in those countries, which extensively use Room and Pillar system of mining. Further this system cannot effectively extract coal from seams that are more than 4.5m thick. As per geological information available out of over (12) twelve mineable coal seams and twenty (20) coal sections those (including top, middle, bottom top and middle, middle and bottom, and total combined sections etc.), as many as 15 have coal thickness more than 5 m in different areas. Such a deposit cannot be efficiently worked by Room and Pillar technology.

We thus have no alternative but to adopt Board and Pillar and Gallery Blasting (which is a variation of Board and Pillar) methods for this property. However deep properties like the area in question, require high output and high productivity. This can be achieved by using higher capacity side discharge loaders, universal drilling machines (both for roof bolting and to obtain longer pull per blast by long hole drilling and by mechanization of support system in pillar extraction.

Sequence of extraction shall be as follows.-

a) If two seams have a parting of less than 3m between them the thicker seams shall be worked and the thinner shall be left in-site unused.

b) If parting between two seams is 3 to 6 m both seams shall be developed and extracted simultaneously.

c) If parting between two seams is more than 6 m upper seams shall first be extracted.
All seams shall be extracted by caving.
Thickness less than 1.5m shall not be worked.
Seams of thickness 1.5 to 4.0 shall be extracted by Slice and Rib (SR) method and of thickness more than 4 m by Blasting Gallery (BG) method.

5.4.7 Panel Size

Since the depth of opencast mine shall be 300m from surface for the lower most seams, in the underground mine the upper-seams in some area shall have depth less than 300m depth. For area of depth less then 240m panels shall have 9 level galleries and 8 pillars of size 30.5 x30.5m centre to centre with 4.2m wide galleries. Panel shall as long as possible. For long panels system of sub-panelling shall be adopted, if required. For during extraction stage.

For depths between 240 and 360 m a panel shall be of 7 level and 6 pillars of size of 39.5 x 39.5 centre to centre.

For depths beyond 360 m a panel shall have 6 level and 5 pillars of size 45m x 45m m centre to centre.

The above is as per requirements of Coal Mines Regulation. 99. However it is proposed to approach Directorate General of Mines Safety to permit pillars of Factor of safety 2.5 as it has been scientifically established that pillar of Factor of safety 2 and more have long term stability. If the proposal is accepted by DGMS, pillar size can be much smaller than presently required under Law. With smaller pillars there shall be more number of faces and depillaring shall also be facilitated.

Each panel shall be equipped with 3 side-discharge loaders (SDLs) 2m³ bucket capacity, 3 universal drilling Machines (UDMs) and at least 3 face conveyors, 2 gathering conveyors and one gate conveyor.

In order to improve percentage of extraction and to reduce number of stopping, this solid barrier shall be left between panels. Thickness of such barrier shall be scientifically determined.

5.4.8 Mine Output

On an average a panel with 3 SDLs (2m³ bucket capacity) shall give a production of 600 tonnes per day. Such ten panels shall be worked at a time, six in upper seams and 4 in the lower seams Where BG method shall be worked, SDLs shall have remote controlled facility. The projected mine output is thus 6000 tonnes per day.

5.4.9 Total Output

With working of two underground mines, each producing 6000 tonnes per day the total annual output works out to 3.6 million tonnes a year considering 300 working days in a year.

5.4.10 Coal Disposal

Initially, skips of a mine shall unload coal to a small bunker which shall load a conveyor. This conveyor shall carry coal to 200 T capacity overhead bunkers for truck transport of coal to railway siding of the opencast mine. Later on, a conveyor shall be installed on surface to take coal from 200 T bunker to a 1000 T bunker at a point central to both underground mines. Similar facilities shall be created for the second underground mine From two close by 1000 T bunkers a conveyor, which shall be laid on the leveled of over-bunker of western sector opencast mine, shall carry coal to main bunker of opencast mine for rail movement of coal.

5.4.11 Environment protection

In a multi –seam mining situation two factors need special attention. They are

1. Risk of underground fire, and

2. Heavy subsidence on surface.

These problems shall be tackled in following manner.

A. Underground Fire

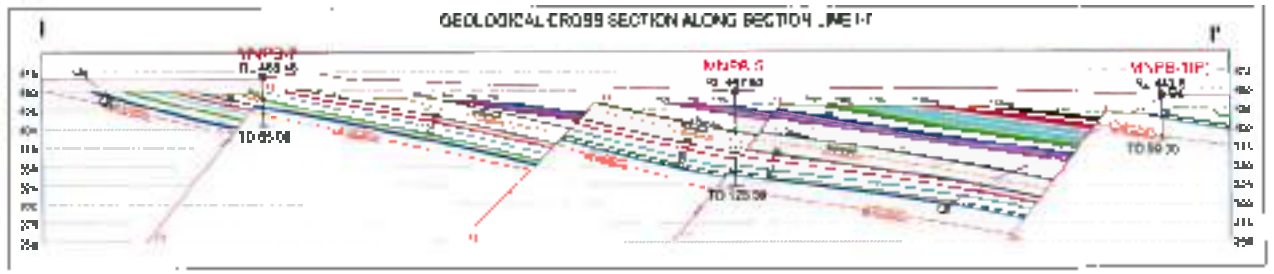
Solid coal barriers shall be left between panels so that problem of one panel is contained within the same. Wherever required (due to incubation period considerations) sub-paneling shall be done.

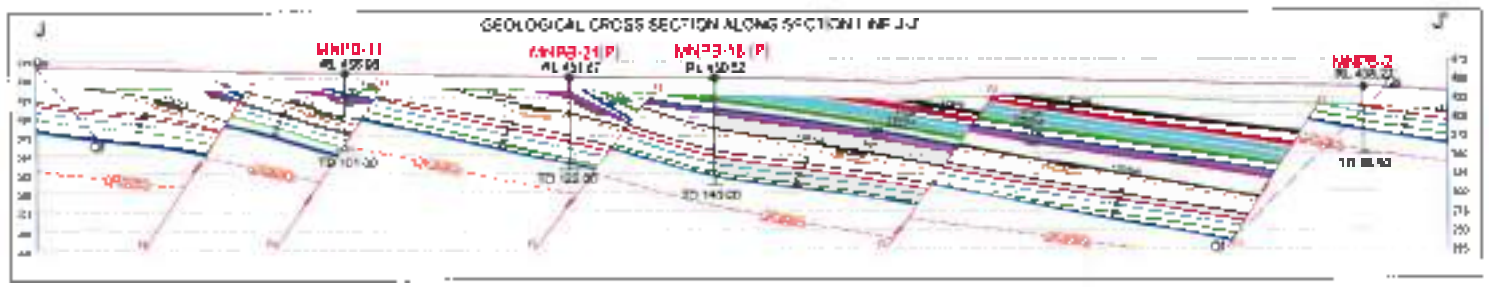
Working panels shall have minimum connections with trunk roadways so that they can be isolated quickly in case of fire.

Automatic monitoring system shall be installed at strategic points underground to give audio-visual alarm in control room on surface for abnormal rise in values of CO, CH4 and temperature

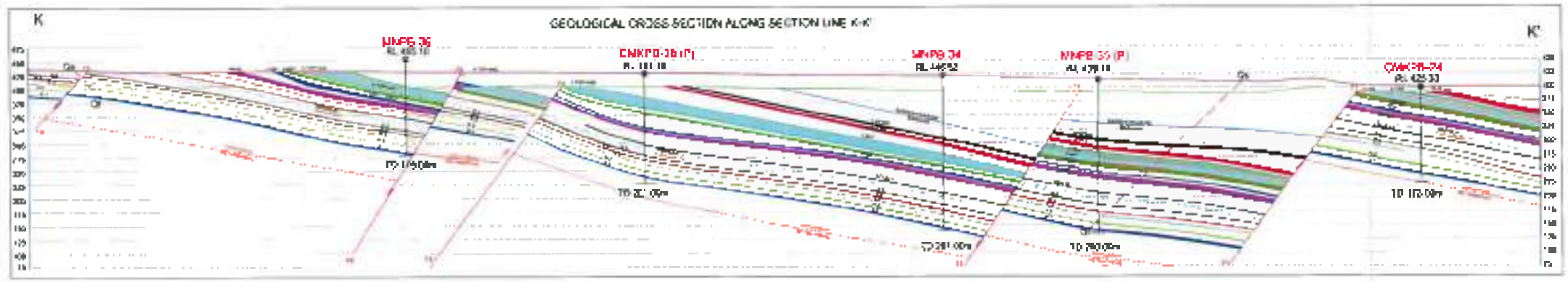
B. Damage to surface

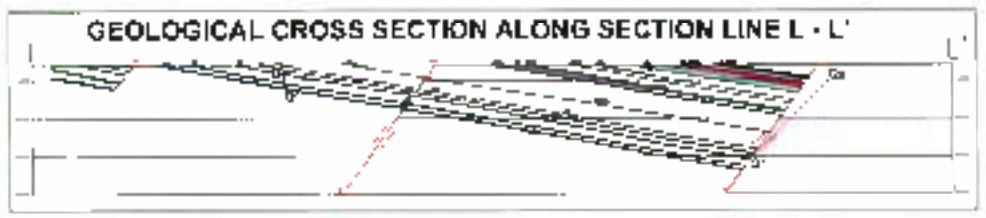
Since the underground mine area is yet to be covered by detailed exploration, panel layouts, exact thickness of coal extraction and subsidence due to such extraction cannot be projected at this stage.





LEGEND		SEAM LEGEND	
MNPB-36	BORE HOLE DRILLED BY NCL	V COAL	
RL 494.13	REDUCED LEVEL IN METRES	IV COAL	
	FAULT WITH NUMBER	III COAL	
TD 101.00m	TOTAL DEPTH DRILLED IN METRES	II COAL	
	BLOCK BOUNDARY	I COAL	
QS	QUARRY SURFACE	I TOP	
QF	QUARRY FLOOR		
	SURFACE		





NOTES :
1. ALL DIMENSIONS ARE IN METRE
2. THIS SECTION IS SUBJECT TO MINOR MODIFICATIONS TO SUIT LOCAL CONDITION

Certified that the plan is correct

SANJIV KUMAR SINGH (R.Q.P.)

NTPC

N T P C LIMITED

PROJECT: SAKTI DIPARCHI COAL BLOCK

SUBJECT

PLATE NO. 12

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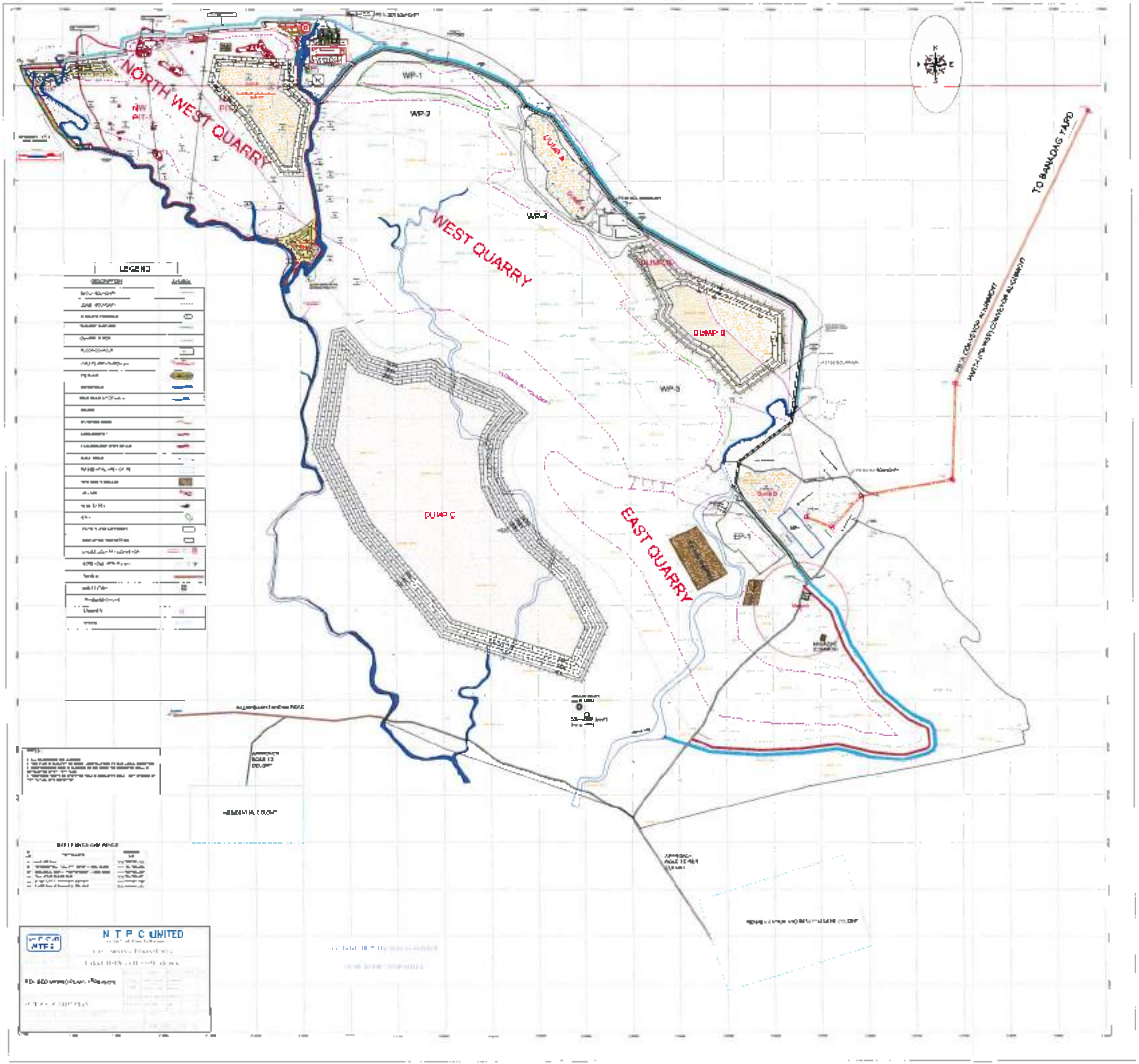

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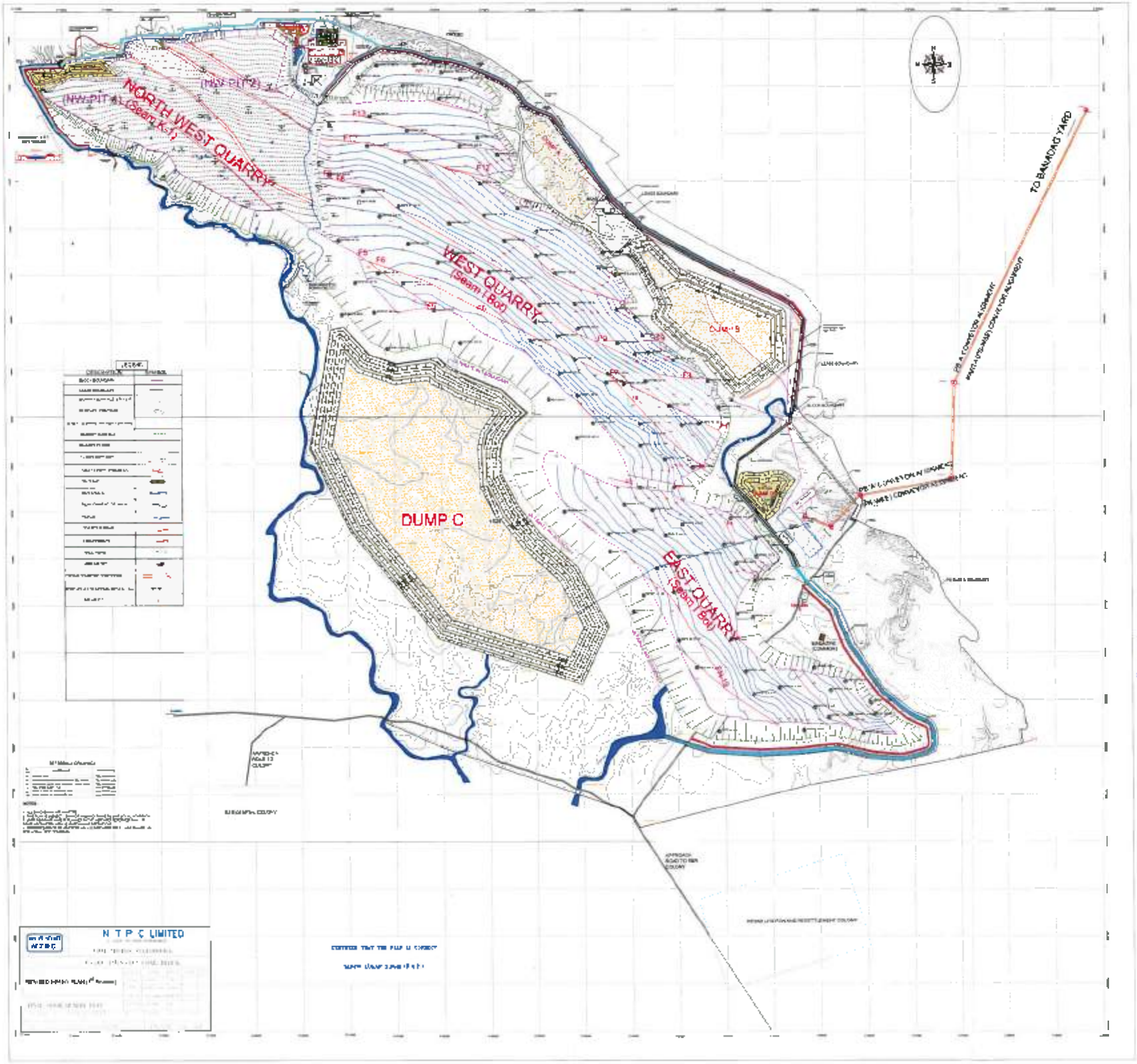

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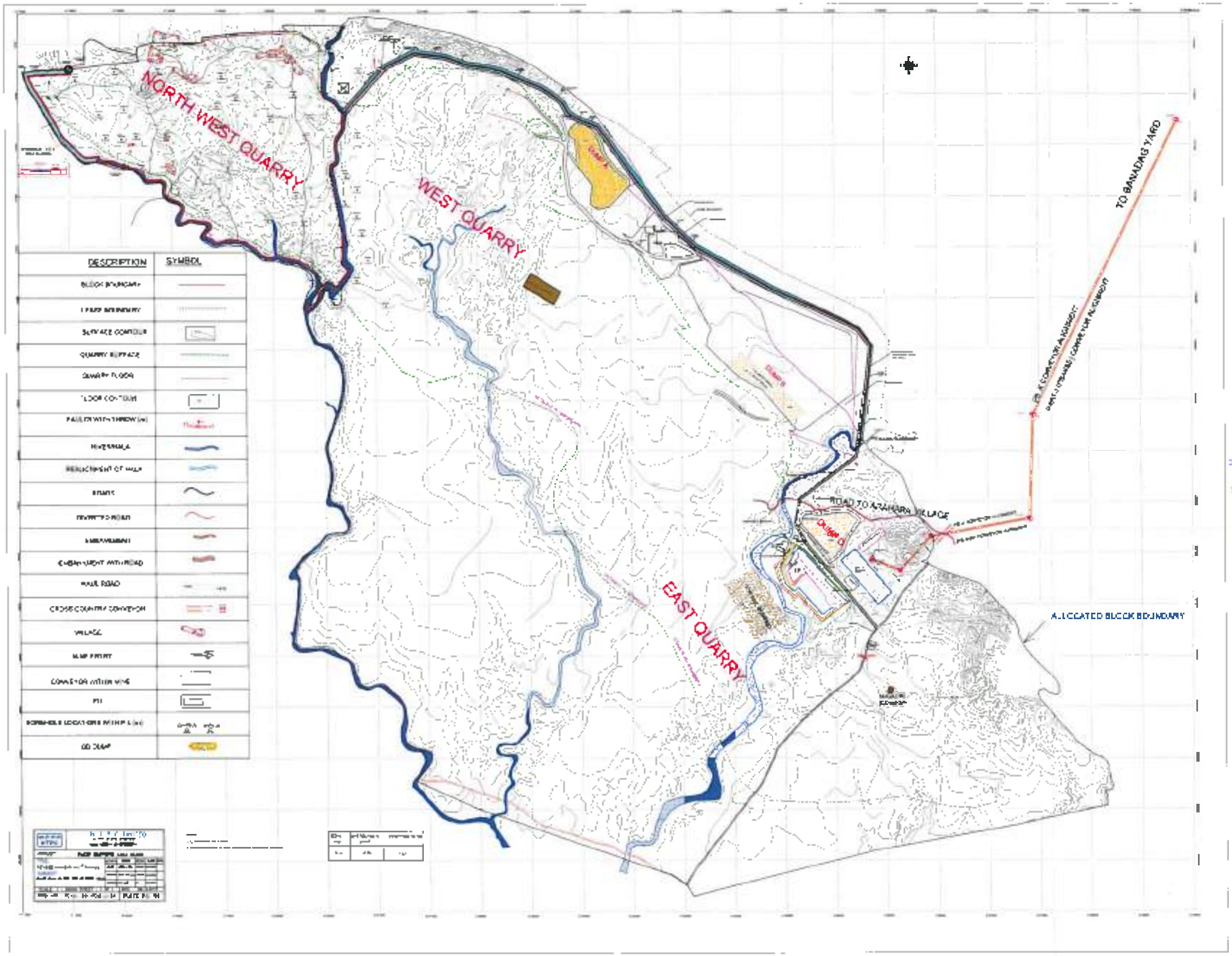

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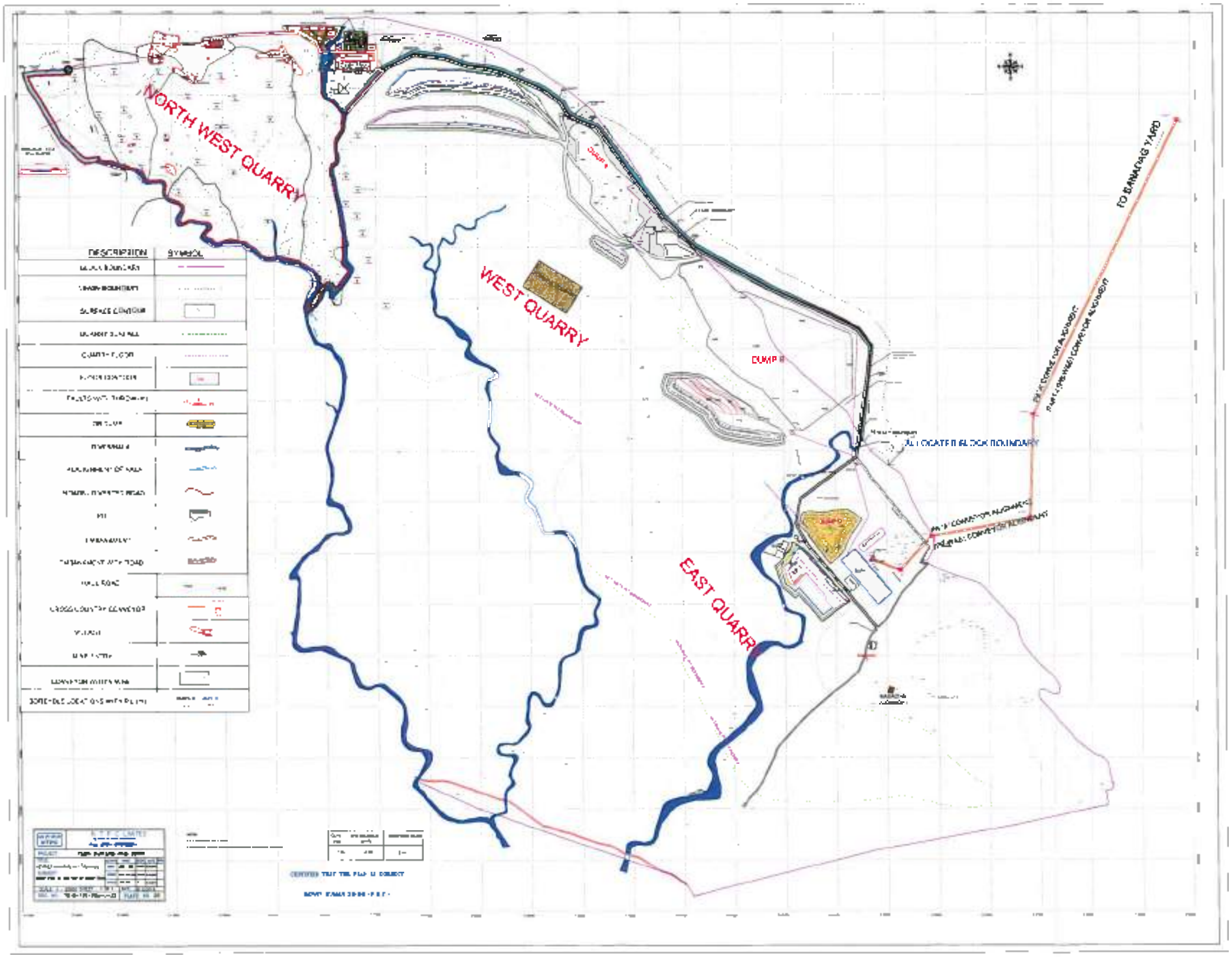

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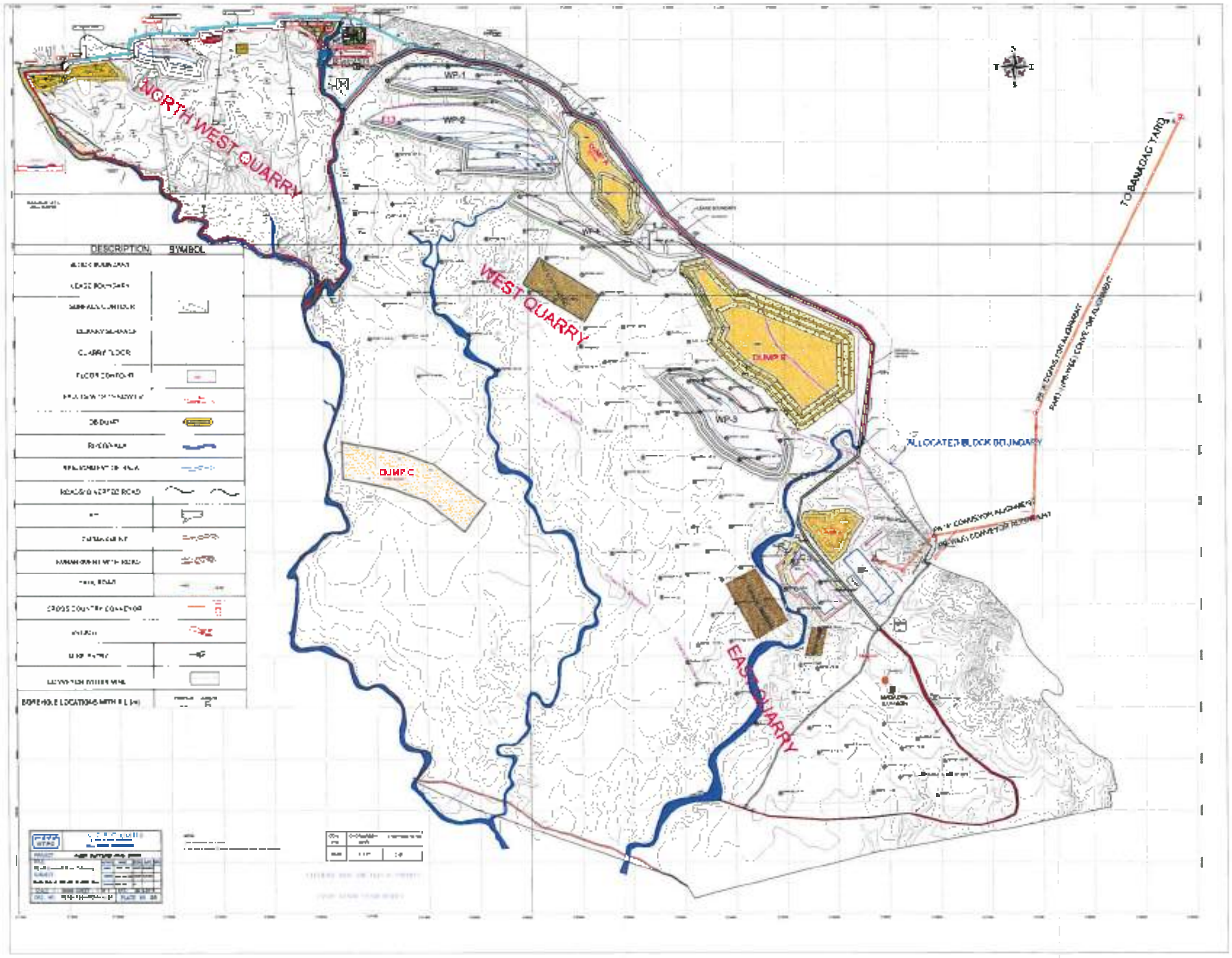
Ministry of Coal, Govt. of India



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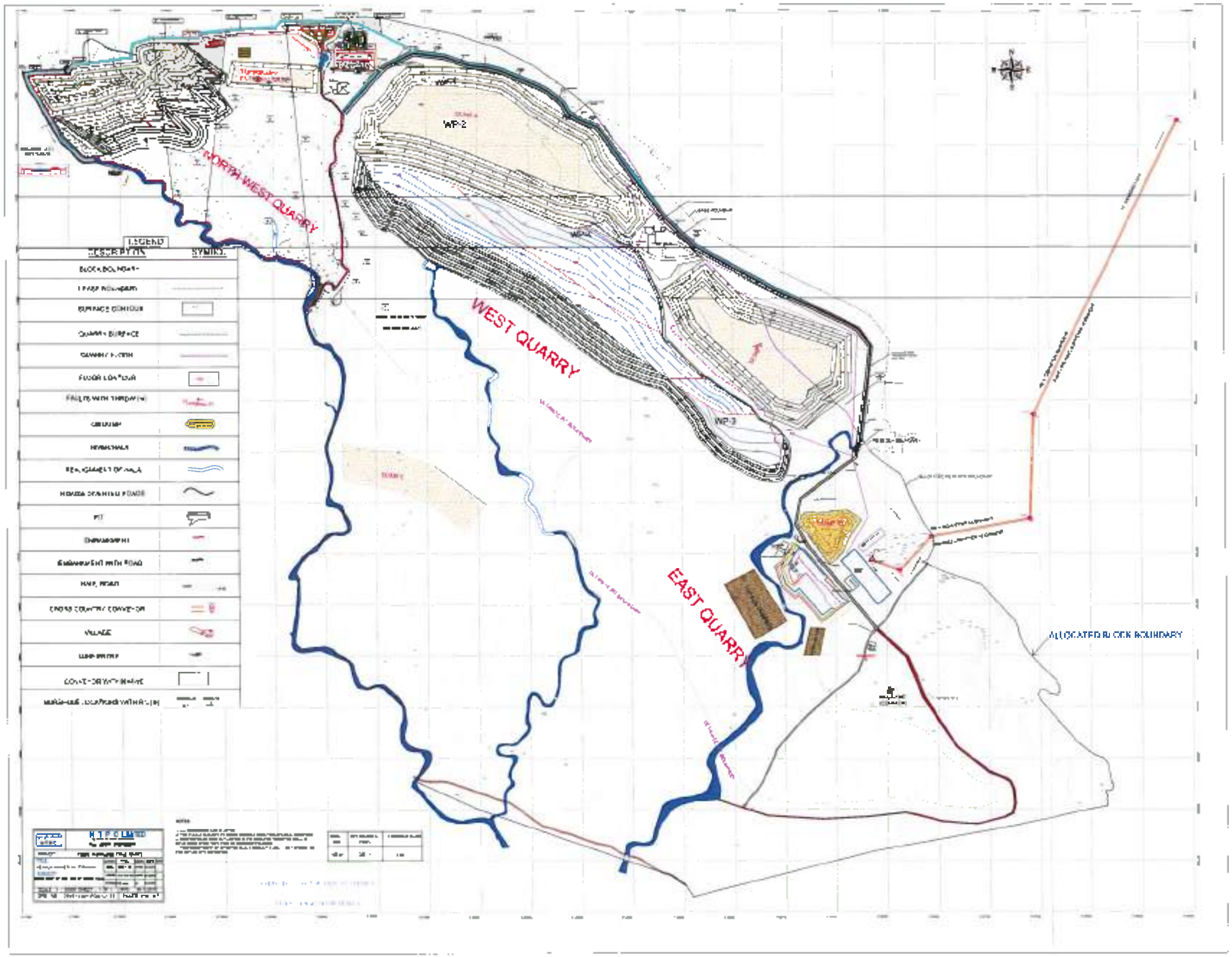

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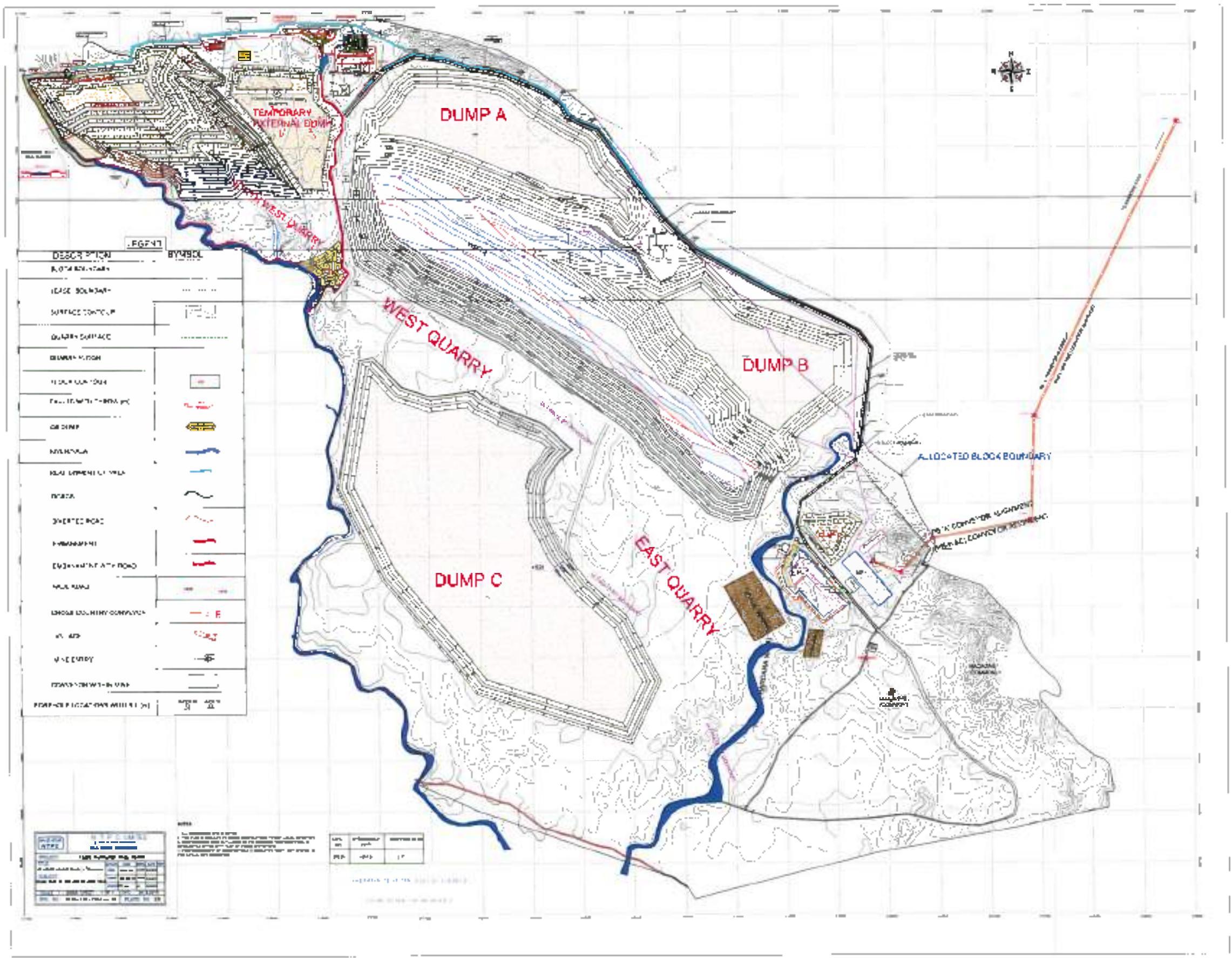

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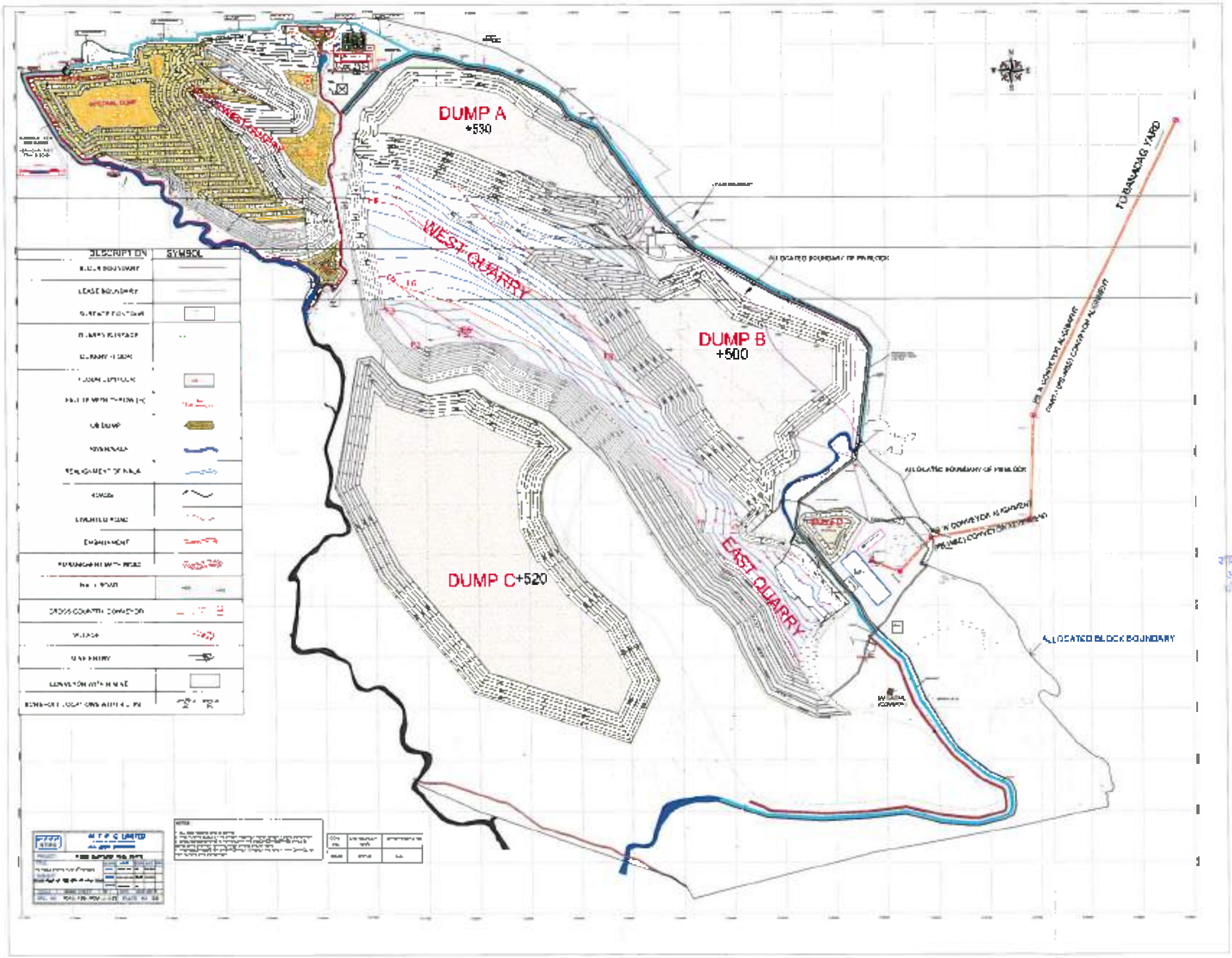

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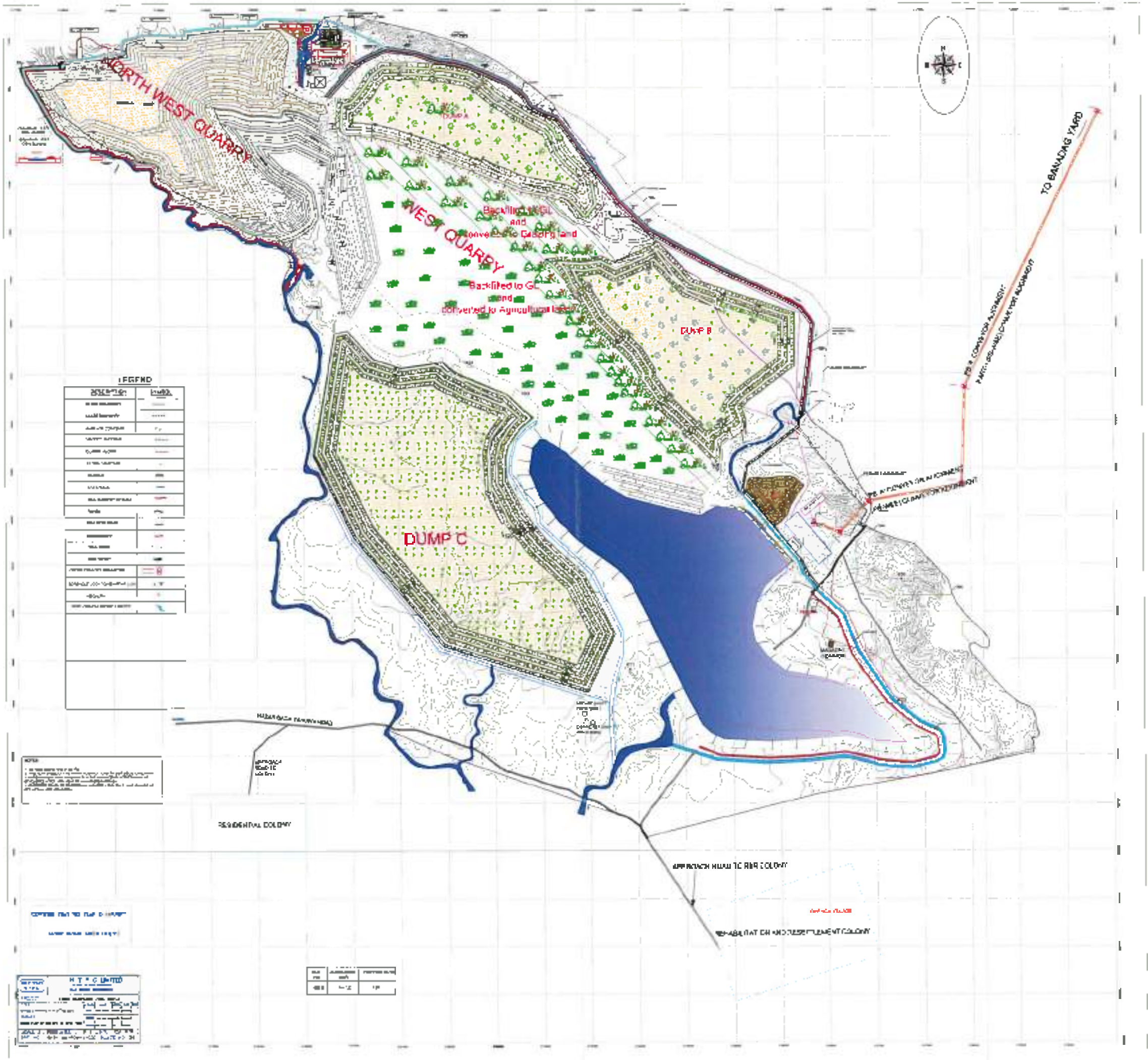

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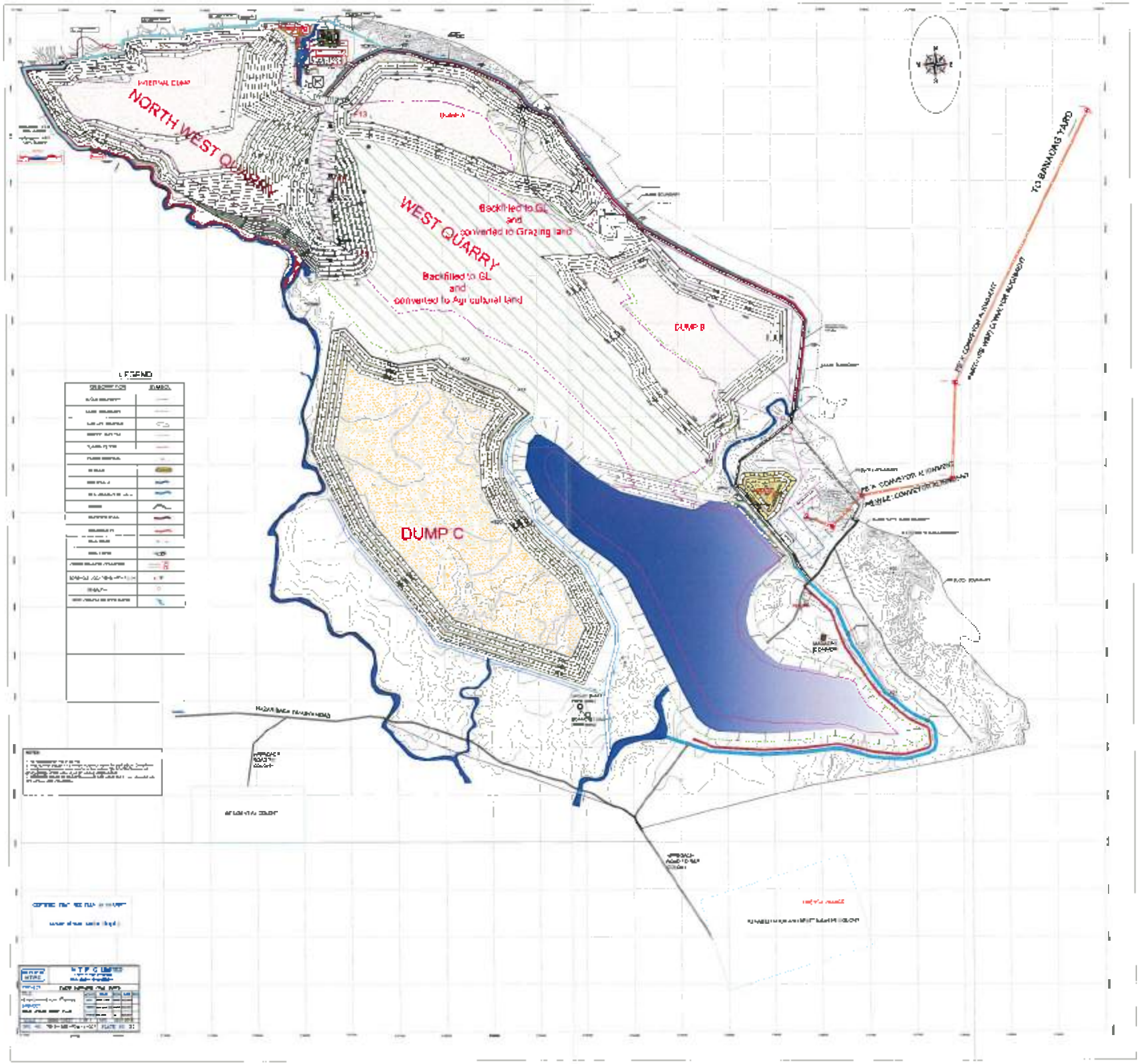

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CHAPTER VI

MANPOWER, SAFETY AND SUPERVISION

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CHAPTER VI

MANPOWER, SAFETY AND SUPERVISION

6.1 INTRODUCTION

6.1.1 Life of the mine shall be approximately 52 years as per the calendar programme. Besides maintaining large fleet of HEMM and ancillary equipment, there is need to employ sufficient manpower to improve overall availability/utilization of the mining equipment , extraction transportation & despatch of coal, administration & welfare of the personnel employed, for safe and economic exploitation of mineral. The manpower has been provided to achieve the above objective.

6.1.2 Requisite manpower is provided for PB West and PB NW quarry. Manpower proposed for PB North West quarry shall be utilized for managing the affairs of PB North West quarry exclusively. As already explained in Chapter-5 PB East quarry shall be operated in two distinct phases the first phase shall last for initial two years while the second phase shall commence from 25th year till end of life of quarry.

In the second phase of PB East Quarry manpower proposed for PB West Quarry shall be utilized for managing the affairs of PB East Quarry progressively, commensurate with the fall & rise of production from West Quarry and East Quarry respectively. In the first phase of PB East Quarry separate set of manpower is proposed for managing the affairs of PB East Quarry. At the conclusion of first phase of PB East Quarry the proposed manpower shall be suitably deployed by NTPC in its establishments

For the common Infrastructure and ancillary facilities (Explained in Chapter-VIII) separate fleet of manpower shall be provided which shall serve the purpose of managing common affairs of quarries

6.1.3 Manpower planning and scheduling has been done in compliance with Mine Act 1952, Mine Rules 1955, Coal Mine Regulation 1957, Mine Vocational Training Rules 1966 and all other rules and regulations applied to Indian Coal Mines, apart from compliance to the directives/circulars issued by DGMS (Directorate General of Mine Safety) issued time to time.

6.1.4 Abiding by the aforementioned statutes organisation chart for the mine shall be drawn. The positions of statutory manpower such as Mine Manager Assistant Mine Manager, Safety Officer, Labour Officer, Welfare Officer, V.I. Manager, mine officials, workman inspectors, Supervisors, set of competent persons etc., have been clearly identified and shall be deployed in consultation with DGMS. Qualifying requirement shall be drawn up and

suitably qualified and experienced persons wherever warranted shall be deployed in the post to ensure adequate management, control and supervision.

6.1.5 Potential of local/regional personnel shall be explored preferably land losers who shall be recruited in unskilled, semi-skilled, office assistant or similar categories. These personnel will need training and orientation before project starts. Besides some I.T.I qualified young people from the region can be recruited for operation and maintenance job of plant and machineries after proper training. The employment of local people in primary and secondary sectors of project shall upgrade the prosperity of the region. Skilled and highly skilled personnel shall also be required who shall be recruited as per NTPC appointment and recruitment norms.

6.1.6 The required manpower is categorised broadly in four different categories,

a) Supervision
b) Operation
c) Maintenance
d) Other services

Following are the different categories of Supervisory manpower:

a) Management
b) Operations
c) Human Resource
d) Fixed Plant
e) Finance and Procurement
f) Technical Services

Additional statutory manpower will be inducted wherever required by DGMS.

6.1.7 As per the prevailing industrial practices, the Positions mandated by DGMS are given in **Table 6.1**.

TABLE 6.1
Statutory Persons

Head	Category	Statutory (DGMS)
Management	General Manager	*Agent*
Management	Manager - Mine Operation	*Mine Manager*
Management	Manager - Maintenance	*Colliery Engineer*
Operations	Deputy Manager - Safety	*Safety Officer*
HR & Admin	IR Officer	*Welfare Officer*
HR & Admin	Training and Development Manager	*Training Officer*
Fixed Plant	Fixed Plant Manager -CHP	*Colliery Engineer CHP*

6.2 Requirement of Man Power

6.2.1 Requirement of Departmental Manpower is given in Table-6.2

TABLE 6.2
MAN POWER REQUIREMENT FOR PAKRI BARWADIH PROJECT

Sl.No	Category	PB West & East Quarry	PB NW	Total
1	OB Direct	345	267	612
2	Coal			
	Coal Direct	479	211	690
	CHP	136	42	178
	Loading & Despatch	12	4	16
		627	257	884
3	Common Services			
	Excv Supervision	108	13	121
	E&M Supervision	42	13	55
	Excv P&M maintenance	242	220	462
	E&M Maintenance	91	20	111
	Support Equipment/Other Operations	114	45	159
	Safety, Production & Quality Control	72	17	89
	CGM Office / Project Office cum Planning Division	51	10	61

	Training Centre	5	5	10
	Communication	17	12	29
	Finance & Accounts	16	11	27
	Personnel & Welfare	9	7	16
	Stores	24	10	34
	Civil & Town Administration	11	22	33
	Medical & Sanitation	24	17	41
	Survey	12	9	21
	Transport	22	33	55
	Watch & Ward	1	1	2
	Sub-Total	**861**	**465**	**1326**
5	**Reclamation & Environment**	**22**	**19**	**41**
	Total	1855	1008	2863

6.2.2 Requirement of outsourced Manpower

In Addition to the Manpower cited as above, the requirement of following category of manpower will be met through Outsourcing. The approximate number of such manpower shall be approximately 120 however details shall be worked out during project implementation stage preparation.

a Security, Watch & Ward
b Canteen
c Rest House/Guest House
d Water Supply
e Coal Laboratory
f Environment Laboratory
g Water Supply
h Vehicles for Transport
i Cleaning & Sanitation

6.2.3 Requirement of Manpower for PB East Quarry in the Initial Phase (2 Years

In Addition to the Manpower cited at clause no. 6.2.1 above, the requirement of following category of manpower is estimated for the period of two years only for operation of PB East Quarry. Requirement of Manpower for PB East Quarry in the initial years is given in **Table 6.3**.

TABLE 6.3
MAN POWER REQUIREMENT FOR PB EAST PROJECT

Sl.No	Category	Number
1	**OB Direct**	**120**
2	**Coal**	
	Coal Direct	65
	CHP	27
	Loading & Despatch	4
		96
3	**Common Services**	
	Excv Supervision	22
	E&M Supervision	9
	Excv P&M maintenance	49
	E&M Maintenance	19
	Support Equipment/Other Operations	23
	Safety, Production &Quality Control	15
	Training Centre	
	Finance & Accounts	3
	Survey	3
	Transport	4
	Sub-Total	**147**
5	**Reclamation & Env. Mgmt.**	**4**
	Total	**367**

6.3 SAFETY ASPECTS

6.3.1 GENERAL

6.3.1.1. Designated Owner in person by name of the mine has to be notified by the Board Secretary on advice of the Board of Directors of company. The designated Owner shall notify Agent of the mine. The Agent shall notify employment of the Manager of the mine. Company will appoint Under Manager, Asst Manager, Safety Officer, V.T Officer, Welfare Officer, Surveyor, all excavation and E & M Engineers including Chief Excavation Engineer and Chief E & M Engineer, Overmen, Mining Sirdars, attendance Clerks, electrical supervisors and mechanical foremen. The Mine will be inspected daily, as far as practicable, and also in odd hours by the Manager and the Agent and deficiencies in safety noted during inspection are to be rectified on priority basis. Under the above broad administrative setup, the

arrangements shall be discussed with DGMS and modification suggested by DGMS, if any, shall be incorporated.

6.3.1.2. Under the above set-up, all safety precautions during the mining operation, posting of sufficient number of officials and persons, maintenance of all records/registers as per statute, disaster management framing of bye-laws and code of practices shall be undertaken. Manager shall have the authority to order withdrawal of persons/ suspension of operation in case of any emergency like fire/inundation and he shall issue such order, if found fit, in consultation with the Agent and it is subject to the provision of CMR, 1957. Mining is a hazardous industry and hence, necessary measures shall be taken to prevent accident due to following anticipated hazardous/risk prone activities.

- Slope failure
- Handling of explosives
- Fly-rocks during heavy blasting
- Movement of HEMM
- Inundation due to surface water
- Dust hazards
- Fire hazards due to spontaneous heating of coal
- Hazards associated with use of electricity
- Flooding of lower benches

6.3.2 STATUTORY RULES

6.3.2.1. Deployment of HEMM in any mine for excavation of coal/ OB needs planning of various activities in conformation with the prevailing statutory provisions, as per Mines Act 1952, CMR 1957, various DGMS circulars & bye-laws.

6.3.2.2. All applicable statutory rules, regulations, bye-laws etc and statutory requirement related to Govt. licenses, workers compensation, insurance, etc, including Minimum Wage Act for workers employed by the outside agency shall have to be adhered to. Any other rule imposed by local/State/Central authorities shall also be complied with by user of HEMM/equipment and then shall have to supply various protective equipment viz. helmets, shoes, safety gear for welding, working at height, electrical apparatus handling, etc. to the workmen at their cost.

6.3.2.3. It is recommended that code of practice as parted out in Cl.6.2.1.2 to be prepared by Company will be based on following.

1. ILO code of Safety and Health and in opencast Mines (1991)
2. Coal Mines Regulation 1957
3. Mines Act 1952
4. Mines Rules 1966
5. Vocational Training Rules 1966
6. Indian Electricity Rules 1956
7. DGMS circulars from 1948 upto date
8. Factories Act 1948 (as applicable to mines)
9. Conditions attached to statutory permissions and exemptions granted by DGMS.
10. Recommendations of National Safety Conferences, Tripartite Safety Review Committees.
11. Special guide lines issued by DGMS following accident enquiries etc.
12. Any prevailing directive of Central or State government in their region

6.3.3 SAFETY FOR HEMM/EQUIPMENT AND WORKERS

6.3.3.1. Special precaution shall be taken while deploying the HEMM and workers in the mine. Some of the major safety aspects before deploying of workers & HEMM to the mine are enumerated as follows:

(A) For workers

- No worker shall be deployed unless he is skilled enough to take up the designated assignment and trained at VTC.
- Records in Form- B and Form- D shall be maintained.
- Records of Vocational training Certificate and driving license of operators shall be kept by owner.
- No persons shall be employed unless person holds VTC certificate A record of it shall be maintained.
- Adequate supervision shall be maintained by qualified competent persons.
- Safety guidelines and safety instruction will be followed.
- All drivers shall obey traffic rules prepared by the management.
- Before deploying workers, they must be trained and briefed about safety aspects in opencast mine.

However during course of execution of the work, if any accident occurs, whether major or minor, the matter shall have to be immediately informed to the mine management i.e. Colliery Manager/Agent/GM of Area so that Notices of accidents in a accordance with (Reg.9 of CMR 1957) and Section

23 of Mines Act 1952 may be given and other necessary steps may be taken in accordance with the Mines Act 1952.

(B) For machineries as recommended by DGMS Cir. (Tech.) 1 of 1999:

- All machineries to be deployed in mines shall be checked before deployment by the relevant Chief Engineer (mine) of the MDO.
- Regular checking of machines deployed by outside agency shall be done. No unfit machine shall be deployed before the defect is rectified.
- A proper record of repair and maintenance along with inspection done by manager and defect pointed out shall be maintained and signed by authorized person.
- The HEMM shall be provided with Audio visual alarms, proper light for use at night and during period when natural light is not sufficient. Also audio-visual alarms for reversing of HEMM shall be provided.
- RTO certificate photo copies of all vehicles shall be submitted to manager.
- Regular inspection of HEMM shall be done by the agency's mechanic as directed by the manager.
- Machine manufacturers shall be asked to give risk analysis details in respect machines deployed.
- Suitable fire extinguishers shall be provided in every machine.
- Risk Management Plan of HEMM shall be made and implemented.
- Transport system will be deployed in such a way so as to minimize pollution in the mine and keep the environmental status as recommended under the approved EMP.

6.3.4 STABILITY OF BENCHES, QUARRY HIGH WALLS AND SPOIL DUMPS

6.3.4.1. During quarry operations, it is necessary to adopt suggested mining parameters for the stability of benches, high-wals and spoil dumps. It is also mandatory to examine systematically the fencing of mine working, land slides and cracks between benches. It is required to maintain well graded and wide roads on benches keeping the width of working areas sufficient for spreading of blasted rock and movement of the mining and transport equipment.

6.3.4.2. During actual mining operation, systematic observations and regular monitoring of the condition of benches, high-wall slopes and spoil dumps shall be carried out and the dimensions shall be modified if necessary, to suit the local conditions. Recommended bench geometry for different HEMM has been found suitable in existing opencast mines in the country.

6.3.4.3. Following slopes have been recommended in this report considering the practices in the other mines.

Overall (Ultimate) pit slope	-	37^0
OB Bench	-	70^0
Coal Bench	-	70^0
Dump bench	-	37^0

6.3.4.4. Company should get studies of physico-mechanical properties of rocks done at IITs/ISM/CMRI/CMPDI or other institutes so that further stability study can be performed by expert.

6.3.5 PRECAUTIONS AGAINST DANGER OF INUNDATION FROM SURFACE WATER

6.3.5.1. A careful assessment is to be made against the danger from surface water before the onset of rainy season. The necessary precautions shall be clearly laid down and implemented. A garland drain needs to be provided to drain away the surface rain water from coming into the mine. Garland drain shall be provided around OB dumps and working mines to course the rain water to main streams.

6.3.5.2. Inspections for any accumulation of rain water, obstruction in normal drainage

6.3.5.3. Standing order for withdrawal of working persons in case of apprehended danger.

6.3.5.4. During heavy rain inspection of vulnerable points is essential. In case of any danger persons are to be withdrawn to safer places.

6.3.5.5. The nearest nala is Khora nala A & B and already discussed are flowing either side of the Block. There may be possibility of inrush of rain water from flooding of nalas into the opencast mine pit. However any such possibility is eliminated as all the nalas are planned to be straightened systematically.

6.3.5.6. Any excavation under such circumstances would inundate the mine if nala is not straightened. Hence, straightening of nala has been proposed before 3rd year of mining operation. So there is no risk of flooding from these water streams.

6.3.5.7. Moreover in order to control the in-rush of water into the quarry in rainy season from the surface or through seepage from the strata, sufficient garland drains will be made around the opencast excavation as proposed. Besides, pumps of required capacity and HP will be installed to pump out the seepage and rain water continuously. A stand by diesel generator will be provided for un-interrupted supply of power to the pumps in the event of failure of power.

6.3.6 PREVENTION OF FLOODING OF EQUIPMENT DEPLOYED AT BOTTOM HORIZONS

6.3.6.1. During the heavy monsoon period, the mining operation in the lower-most benches may have to be stopped. Adequate pumping capacity on the basis of historical data of maximum rainfall and distribution of rainfall has been designed. But in case of unprecedented rainfall, machineries may have to be withdrawn from lower benches temporarily and redeployed after dewatering in the lower benches again. Meanwhile they will be gainfully employed in the upper benches.

6.3.6.2. For ensuring safety of the equipment while working out bottom horizons with no access to surface profile, the following measures shall be taken:

1. Drivage of initial trenches and coal cutting on bottom benches shall be done during the dry season of the year.
2. Ramps shall be made for quick shifting of equipment from bottom horizons, liable to be flooded during monsoon period to the top horizons.

6.3.7 PREVENTION OF ELECTRIC SHOCKS

6.3.7.1. During mining operations, all the statutory provisions of the Indian Electricity Rules 1956, and Indian Standards for installation and maintenance of electrical equipment etc. shall be observed.

- For protection from electric shocks to persons, from electrical equipment with voltage up to 1000V Earth Leakage Relay shall be provided which will automatically disconnect electrical circuits.
- Closed mobile substations and switchgears shall be mechanically interlocked which exclude the possibility of opening the door when oil switch and air circuit breakers are in operation.
- All metal parts of electrical equipment shall be properly earthed to avoid failure of insulation.

- All H.T. lines and cables located within the blasting zones shall be disconnected during blasting operations

6.3.8 DUST SUPPRESSION & DILUTION OF EXHAUST FUMES

6.3.8.1. The following measures shall be adopted for dust suppression at all quarry working places, dump, haul roads, CHP and near other auxiliary mining operations

- Water sprinklers shall be deployed in haul road. Additionally, chemical additives are recommended to form consolidated crust. This can be first tried on certain length and then extended for the entire length, if found suitable
- Spraying with water on all working faces by special spraying machines.
- While drilling holes, it is necessary to use dust extraction devices.
- Installation of local dust suppression and air conditioning devices in cabins of excavators and drilling rigs will be considered.
- Levelling of spoil dump surface.
- Separate dust suppression arrangement shall be provided for CHP.
- To prevent collection of harmful mixtures in the atmosphere, from the different sections of quarry working, it is recommended.
- Maintaining the engine and exhaust conditioners properly, so as to keep emission gasses within limits and regular checking of exhaust and recording the same.

6.3.9 FIRE FIGHTING AND FIRE PREVENTION

6.3.9.1. In addition to statutory provisions, the measures for fire fighting and prevention of fires are as follows:

- Efforts are to be made not to lose any coal in O.B benches, and specially ledges of coal in inclined slicing system.
- Organization of special cell for systematic observation to examine and prevent fire.
- Removal of spillage of coal on benches and cleaning of coal horizons to prevent cases of coal heating.
- Storage of lubricants and cotton waste in enclosed fire proof containers in working places
- Provision of fire extinguishers and fire tenders.

- Delivery range of pump should have nozzles, strategically located, to tap water in case of emergency. Emergency organization shall be formed to deal with emergency during fire. The organization shall have names of responsible person along with their telephone numbers. Their duties shall be clearly specified and the persons shall be properly trained. Mock – rehearsals shall be held. A disaster management plan shall be prepared by the management and a CMG (Crisis Management Group) consisting of highly skilled & decision making persons shall be identified within the organization to tackle with such extreme situations.

6.3.10 MEASURES DURING DRILLING AND BLASTING

6.3.10.1. Following measures shall be taken while drilling and blasting operations in the quarry:

1) Drilling and Blasting in quarry shall be done in accordance with the provisions of Mines Act, rules and regulations.

2) Adequate safety measures have to be taken during blasting operations in the quarry so that men/machines are not affected.

3) Ground vibration due to blasting will be controlled by following:

   - Reducing the explosive charge per delay. 2-5 millisecond of delay interval per meter of burden has been recommended.
   - Spacing and burden are to be optimized by the blasting engineer.
   - Reducing the amount of explosive charged per blast
   - Proper controlled rock movement during blast by using suitable initiating sequence and delay.
   - Pit blasting engineer will optimize powder factor, watch out for quantity of oversize and secondary blasting, improve utilization of Shovel and reduce damage of bucket teeth

4) Sub-drill depth may be 0.2 times the distance between adjacent holes stemming depth will be 0.7 to 1.0 times the burden. It should be recommended that if burden is less, there will be venting of explosive gases with loss of efficiency and generation of fly rock. More burden results in back break and poor fragmentation. Too close spacing causes crushing and crater forming between holes, boulder in burden area and excessive toes. Too wide spacing results in inadequate fracturing between hole accompanied by bumps on the face and toe problem between the holes.

6.4 RISK ASSESSMENT

6.4.1 INTRODUCTION

6.4.1.1. Mining activities are associated with several potential hazards both to the employees and the public at large. A worker in a mine should be able to work under conditions that are adequately safe and healthy. At the same time the environmental conditions should be such as not to impair his working efficiency. The various safeguards will be taken to ensure the safety of the mine and that of employees are provided in the Mines Act, 1952

6.4.2 IDENTIFICATION OF HAZARDS

6.4.2.1. There are various factors, which can cause disaster in the mines. These hazards are as follows:

i. Drilling
ii. Blasting
iii. Overburden handling
iv Heavy Machinery and
v Explosives storage.

6.4.3 DRILLING AND BLASTING

6.4.3.1. Most of the accidents from blasting occur due to the projectiles, as they may some times go even beyond the danger zone, mainly due to over charging of the shot holes as a result of certain special features of the local ground. Flying rocks are encountered during initial and final blasting operations. Vibrations also lead to displacement of adjoining areas. Dust and noise are also problems commonly encountered during blasting operations.

6.4.4 OVERBURDEN HANDLING

6.4.4.1. The overburden dumps may cause landslides. High overburden dumps created at the quarry edge may cause sliding of the overburden dump or may cause failure of the pit slope due to excessive loading, thereby causing loss of life and property. Siltation of surface water may also cause run-off from overburden dumps.

6.4.5 HEAVY MACHINERY

6.4.5.1. Most of the accidents during transport of dumpers, trucks, poclains, ripper dozers and other heavy vehicles are often attributable to mechanical failures and human errors

6.4.6 EXPLOSIVE STORAGE

6.4.6.1. Most of the accidents occur during, transportation, storage, handling and use. Accidents often attributed to failure of workman to observe safety rules and regulations

6.5 DISASTER MANAGEMENT

6.5.1 MEASURES SUGGESTED TO AVOID ACCIDENTS DUE TO BLASTING HAZARDS

- Shots shall not be fired except during the hours of day light or until adequate provision is made for artificial lighting and the holes charged on a particular day shall be fired on the same day;
- Shots, if fired after hours of daylight, should be muffled so that the flying fragments from the blasting material do not project beyond a distance of 10 m from the place of blasting;
- Adequate shelters or other protective structures shall be provided to the workers at all times;
- The shot fired shall give sufficient warning by effective signal over the entire area falling within a radius of 500m.
- Where any permanent building or structure is damaged within the danger zone, the aggregate maximum charge in all the holes fired at any particular time shall not exceed 2 kg.
- If a single shot exploder is used or if blasting is done with ordinary detonator, the shot-firer shall not fire more than fifty shots in one shift, but if multi-shot exploder is used the number can go up to eighty;
- During the approach and progress of an electrical storm, adequate precaution shall be taken;
- No shot hole shall be drilled in the overburden above the underground galleries.

6.5.2 MEASURES TO PREVENT THE DANGER OF OVERBURDEN

- A stone wall should be built around the toe of each active dump at a distance of about 50m from the toe;
- To prevent the failure of overburden slopes, especially during the rainy

season, the following precautions shall be taken:

- Proper terracing of the dump slopes, with a maximum dump height of 10 m should be maintained;
- In flat areas where the dumping operations have come to an end, the slope angle should be flattened by about 5° lower than the angle of repose, which varies from site to site but not less than 25°;
- Planting vegetation as early as possible over the overburden dump slopes;
- Provide drainage channels along the overburden dump toe for additional protection, in such a way that a distance of 15m should be maintained left between the overburden dump and the bench; and
- If a mine is abandoned, the bench and overburden dump should be separated from each other by digging a trench of 6 to 10 m width.

6.5.3 MEASURES TO PREVENT ACCIDENTS DUE TO TRUCKS AND DUMPERS

- All transportation within the main working area should be carried out under the direct supervision and control of the management;
- The vehicles must be maintained in good repairs and checked thoroughly at least once a week by a competent person authorized for this purpose by the management;
- Broad signs should be provided at each and every turning point, specially for the guidance of the drivers at night;
- To avoid dangers while reversing the trackless vehicles, especially at the embankment and tripping points, all areas for reversing of lorries should, as far as possible, be made man free, and there should be a light and sound device to indicate reversing of trucks; and
- A statutory provision of the fence, constant education, training etc will go a long way in reducing the incidence of such accidents.

6.5.4 STORAGE OF FUELS AND EXPLOSIVE MATERIALS

- The explosives will be stored in a magazine of 4T capacity.
- Based on the study of accidents in chemical industry in India over a few decades, a specific legislation was enacted and enforced by the Government of India (GOI) in 1989 in conjunction with Environment

Protection Act, 1986, referred to as "GOI rules 1989". These rules are for the purpose of identifying major hazardous installations applying certain criteria on toxic, flammable and explosive properties of chemicals.

- Besides, the criteria list of hazardous substances with their threshold quantities is provided in part II of schedule I of the rules.
- Schedule-II of the rules sets out the threshold quantities for isolated storage units.
- Schedule-III gives a list of hazardous chemicals with their threshold quantities. In this schedule different chemicals are classified into different sub group viz. Group 1 - Toxic substances, Group 2 - Toxic substances, Group 3 - Highly reactive substances, Group 4 - Explosive substances and Group 5 - Flammable substances.
- Schedule-IV of the rules indicates various operations, which are hazardous during production, processing or treatment of organic and inorganic chemicals
- The of storage of flammable and explosive materials used in mines to determine the Threshold quantities as notified GoI Rules 1989 and the applicable rules are identified. The results are summarized in **Table 6.4.** The major hazardous materials stored and used in the mines are Diesel, Ammonium nitrate and Nitroglycerine.

TABLE 6.4

APPLICABILITY OF GOI RULES TO HAZARDOUS MATERIALS STORAGE

Sl. No.	Chemical	Annual Requirement/storage	Listed in Schedule No.	Threshold Qty as per GOI Rules (application of rules)	
1	Diesel	40 KL (10 KL storage)	1(2)	*(5, 7-9, 13 - 15 12)* 25 MT	*10 -* 200 MT
2	Ammonium Nitrate	540 T (25 T Magazine)	1(2)	*(4,5 7-9 15)* 350 2500 T	*10 -* T

Since the storages of all hazardous materials in Pakri Barwadih - A Mines are much less, when compared with threshold storage quantities, the mine management advised to follow the Indian Explosive Act and Rules 1983 for handling of explosives.

6.6 RECOMMENDATIONS

i. It is recommended to carry out slope stability study before/during mining operation warranting storage of Overburden dump and stability of benches.

ii. It is recommended the Blasting Pattern shall be designed in consultation with CMPDI or a contemporary agency before conducting any blasting for the purpose of winning coal

iii. Prevailing statute at the time of commencement of mining operation shall be observed regarding storage of hazardous material within the mining lease area

iv. Area Drainage Study/Nalla Diversion Study for PB North West (Sector A) had not been carried out. Straightening of nalla for a distance of 1km is proposed in this mining plan. However in the favour of safety it is recommended to carry out study and its approval before commencement of mining operations to prevent potential inundation hazard.

v. In the present Mining Plan diversion/alignment of Khora Nala–A is envisaged to be explored during 25th year of mining operation over the back filled area of PB west to enable extraction of additional 33.18 Mt (10.95 of PB West & 22.23 of PB North West) coal blocked under barrier between the two quarries (PB & PB NW) & coal blocked under Dump C after 38th year of mining operation It is recommended to carryout separate study for said diversion at appropriate time.

vi. Forest clearance of PB North West (Sector A) had not been obtained. As approximately 65% of land of this sector falls in forest land category it is recommended to obtain clearance from MoEF&CC before commencement of mining operations

vii. EIA/EMP clearance PB North West (Sector-A) had not been obtained. As more than 65% of land of this sector is forest land approximately it is recommended to carry out EIA/EMP study and obtain its approval from MoEF &CC before commencement of mining operations

CHAPTER VII

COAL HANDLING, WASHING & MODE OF DISPATCH

CHAPTER VII

COAL HANDLING, WASHING & DISPATCH OF COAL

7.1. Use of Mineral

Pakri Barwadih block has been allocated to NTPC to undertake coal mining for exclusive use of coal for its power plants. Coal linkages already in place shall not be disturbed and NTPC shall continue to honour its commitments towards long-term linkages from nationalised companies to its thermal power plants.

All coal mined from the block, shall be used in NTPC power plants and no coal shall be disposed of in any other manner, whatsoever, without prior permission, in writing, of the Govt. of India

NTPC has presently planned Open Cast. Underground mining shall also be planned to extract the reserves below 300 meters at later date. This project is planned for produce 18 million tonnes of coal out of which 15 million tonnes shall be produced by PB West & East Quarry while 3 million tonnes shall be produced by PB NW Quarry. The produced ROM coal shall be D-E grade (G-8) from PB North West while D F grade / (G-8) from PB West & East. Coal produced from all the three quarries shall be power grade coal.

7.2. Mineral Processing

NTPC power plants have been designed to accept F grade coal. The entire coal production from the mine has been basket linked to different power houses. Rom coal directly received from the mine is expected to have 1000-1200 mm size, ROM coal shall be screened and oversize coal shall be reduced to -50mm. The ROM coal shall be crushed in two stages, at initial stage (Primary Crushing) size shall be reduced from 1000-1200 mm to 200-250 mm and in the subsequent stage (Secondary Crushing), size shall be reduced from 200-250 mm to (-) 50mm. If necessary suitable de-shaling/dry de-shaling arrangement will be provided, as may be required from time to time.

The above processing arrangement shall be installed at the pit head of the mine. Further processing if necessary shall take place at the power plant end

7.3. Surface Transport of Coal

ROM Coal shall be transported from active faces of all three quarries namely PB West, PB East and PB NW, in coal body dumpers (60T) to their respective pit head Coal Handling Plant (CHP) hoppers. CHP of PB West shall be dismantled at the exhaustion of coal from the same. Each of CHP hoppers are designed to cater to the requirement of volume of production of respective quarries and provided with enough space for unloading of two dumpers.

The processed coal shall be fed to the Cross country conveyors which in turn convey the coal to Benadag Yard being constructed by NTPC. Benadag Yard is located at approx. 14 km from the project boundary.

Indian Railway wagons shall be loaded by rapid loading system provided in loading silos. Onward transportation of coal shall be through Indian Railway to identified power plants of NTPC.

Cross Country Conveyor System from the mine to Benadag Siding is presently under construction. Till the completion of the conveyor system coal shall be transported to the nearest Railway siding (Benadag) by road.

7.4. Coal Handling Plant for Western & Eastern Quarry

As per this Mining Plan built up period for western quarry is 12 years, CHP shall be commissioned phase wise to handle 15 million tonnes of coal initially for western quarry. During period of full production this CHP shall be handling entire coal production from western quarry. During the overlapping period of 3 years separate CHP shall be installed to handle the coal from Eastern quarry. As coal production from western quarry diminishes, and coal production from PB East quarry surges the CHP of Western quarry shall be dismantled and simultaneously installed for Eastern quarry in phases. Brief of working philosophy of CHP of PB West and PB East is described below:

7.4.1. GENERAL

The coal handling plant has been designed to crush the ROM (-) 1000-1200mm feed from different pits to produce (–) 50 mm sized coal. The major process facilities of proposed CHP will comprise of the following:

a. In-pit Skid mounted crusher: Crusher equipped with apron feeder and hopper
b. Long distance belt conveyor
c. Secondary crushing
d. Product stockpiling & reclaiming
e. Cross country conveyor from Reclaimer to Railway Loading point
f. Loading & dispatch

The coal from different benches will be transported by dumpers and will be fed to the in-pit crushers / Crushers through apron feeders, placed at suitable locations in different pits to generate (-) 250 mm product. The crushed coal will be brought to long distance belt conveyor through conveyors. The long distance belt conveyor running along the north-eastern periphery of the pits will transport the crushed coal to secondary crushers/ Crushers to further reduce the product size to (-) 50 mm. The sized coal will be further conveyed to product stockpile, where it will be stacked and reclaimed through stacker reclaimer unit, or will be directly discharged into the cross country conveyor. The cross country conveyor shall transport the sized coal and directly load into the railway wagon through silos. The CHP has been planned to handle ultimate total capacity of 15 Mty of coal. Initially, all the 3 skid mounted primary Crushers will be installed along with one circuit of long distance belt conveyor, 1 set of stacker reclaimer, 2 circuits of cross country conveyor and 1 no. silo has been envisaged to be commissioned in the first phase. Subsequently, the 2nd circuit of LDBC will be ready by 4th year of production, second set of stacker reclaimer, cross country conveyor and second silo will be commissioned by 10/11th year to meet the rated capacity of 15 Mty.

7.4.2. DESIGN PARAMETERS

a. BASIC DATA

- Production capacity in MTY - 15.0
- No. of working days / annum - 330
- No. of working shifts / day - 3
- Duration of each shift (hours) - 8
- Feed size of R.O.M coal (mm) - (-) 1000-1200
- Product size in mm - (-) 50

b. CHP WORKING SCHEDULE

Crushing, storage and loading will be done in three shifts per day and seven days a week.

c. SYSTEM CAPACITY

The handling capacity of the CHP has been decided to match with the production capacity of the mine. In order to meet the fluctuations of coal output from the mine due to irregularities of despatch / transport system

and seasonal fluctuations, the design capacity of the CHP has been fixed accordingly

7.4.3. SALIENT FEATURES

The proposed CHP consist of the following units:

- Three no. of Skid mounted Crushing station equipped with apron feeder and receiving hopper Apron feeders will feed coal into primary Crusher.
- 3 nos. of Crushers (Primary) of 1600 TPH at receiving hopper to crush coal from 1200 mm to 250 mm size.
- Two streams of 1800mm wide Conveyor systems upto the secondary crushing station.
- 4 nos. of Crushers (Secondary) of 1200 TPH each with vibro feeders at Secondary crushing house to crush coal from 250 mm to 50 mm size.
- Conveyor systems of 1800 mm width and 2200 tph from secondary crushing station upto the stockyard.
- Two numbers of Stacker Reclaimer of 2500 tonnes per hour capacity each.
- Three circuits of 1800mm wide belt conveyors of 2500 TPH each capacity upto loading point
- Two nos. of 4000 te capacity Silo each containing 2sets of 5500 TPH capacity Rapid loading system with 2x72te capacity pre-weigh hoppers
- One numbers of magnetic separators in each flow.
- One numbers of metal detectors in each flow.
- One numbers of belt weighers to weigh the coal in each flow after secondary crushing.
- Miscellaneous facilities like dust control system, firefighting and ventilation system. Plant cleaning and Infrastructure for preventive maintenance are also envisaged. Necessary Electrical, interlocking, signalling and communication facilities.

7.4.4. IN-PIT SKID MOUNTED SEMI - MOBILE CRUSHING STATION

Coal receiving unit will be of 200 te capacity, semi-mobile, skid mounted consisting of Apron/Chain feeder of 1600 TPH capacity with matching suitable electric drive motor. Adequate height skirt plates will be installed on the apron/ chain feeder in

such a way that the assembly acts as a receiving hopper to receive coal from tipping trucks. The apron/ chain feeder will be of robust construction, heavy duty type and suitable for round the clock continuous operation. It will be suitable for use in adverse environmental conditions and dusty surroundings. The feeder will be capable of absorbing the impact of falling lumps of maximum lump size. It must be capable of receiving the direct impact of coal from tippers.

The R.O.M. coal brought from the quarry by tippers will discharge into the said sizing plant. The unit will be complete in all respect, could be easily dismantled, shifted and installed at new location. Major components of the unit are as under

Low height roll Crusher (preferably double roll) has been envisaged to size the coal to (-) 250 mm size with matching suitable electric motor drive. The sizing roll will be fitted with replaceable sizing teeth which shall slide over the slots provided in the shaft with picks (heavy duty). The Crusher design will be such that it be able to have round the clock continuous operation. It will be suitable for dusty condition. It will be able to start at full load conditions and robust enough.

Suitable lifting devices will be provided for ease in installation, dismantling and taking out components for maintenance. The components/ parts will also be provided with lifting lugs.

Unit will be designed to provide suitable maintenance platform for inspection, maintenance etc. It will also have an operator's cabin installed at a suitable location for the operator of the machine. Operator should be able to view the crushing operation.

Suitable dust suppression system will be provided to suppress dust particles during discharge of coal by tipping trucks etc and also at transfer points. Portable type fire extinguishers of different type will be provided in the Crushing unit to prevent fire hazards.

The electrical system of the semi-mobile sizing units consist of the A.C drives and related Motor Control Centre for Apron / Chain feeder, Crushers etc. Along with this the power supply arrangement should also cater for dust suppression system, electrical hoists, illumination (Plant & Peripheral) and other sub system. Power at 3.3/6.6 kV will be made available up to the sizing units

7.4.5. SPECIFICATION OF SECONDARY CRUSHER

• Nos. :	04 (Four)
• Material to be handled:	Coal
• Feed size of ROM. coal (in mm):	(-) 250
• Product size (in mm):	(-) 50
• Average HGI of coal	45 (max.)
• Bulk density of coal:	1000 kg/m3
• Crushing capacity:	Rated-1600tph
• Designed:	1850 tph
• Moisture content:	upto 10%
• Ambient temperature:	50 deg C
• Duty:	Continuous,
Hrs/day:	20
Per Year:	350
• Power Supply	3.3kV. 3phase, 50Hz,

7.4.6. CRUSHER LOCATION

Considering the gradual increase of production from 2.34 Mt to 10 Mt in the first 5 years, the required nos. of Crushers will be added at different pits starting from the second year of construction period as indicated in the table showing phasing of CHP. These Crushers will be located at the mouth of the different pits viz WP-1, WP-2, WP-3 & WP-4 in the initial period. Further enhancement of capacity from 10 Mt to 15 Mt. will start in the 11th year of production from WP-IV pit. Two no of Crushers from pit WP-I, WP-2 and WP-3 will be shifted to pit WP-4 in the 8th year and 10th year respectively.

On advancement of faces at WP-4 pit, the Crushers will be shifted and located at suitable places to keep the dumper lead minimum

7.4.7. CONVEYING ARRANGEMENTS

The sized coal will be discharged to collecting-cum-elevating conveyor which in turn will discharge it to the long distance belt conveyor having length of about 5 km. The entire product will be conveyed to the secondary crushing station where coal will be crushed to (-) 50mm. Finally coal will be reclaimed through 2 no of 1800mm wide belt conveyors and conveyed to the product stockpile. Two circuits of long

distance belt conveyor (LDBC) with each having 2500 TPH capacity has been envisaged up to the product stockpile. Stacker & Reclaimers have been proposed for stacking the coal on the ground and loading on the cross country conveyors. Stacker and Reclaimer shall be installed at the terminal point of the long distance belt conveyor and starting point of cross country conveyor for carrying coal to Silo for fast loading into the rakes. These (-)50 mm coal will be transported to the Silos located at loading point through two circuits of cross country belt conveyors having a length of about 14 km of above mentioned specification.

7.4.8. Product Stockpile

Open air product stockpile of 800m x 400m dimension has been proposed with facility of stacking and reclaiming through rail mounted Stackers & Reclaimers with capacity of 2500 tph each. There will be a bypass arrangement at product stock pile wherein the sized coal can be directly fed to the cross country conveyor, without stacking, for loading into the wagons through silos. The product stockpile can accommodate 4 lakh tons of coal ie about 10 day production of the mine at rated capacity.

7.4.9. BROAD TECHNICAL PARAMETERS OF STACKER-RECLAIMER

The main characteristics of the Stacker-Reclaimer shall be as follows.

- Type: Rail mounted, self-propelled, luffable, slewable. Boom type Stacker cum Bucket wheel Reclaimer
- Nos. : 02 (Two)
- Material to be handled: Coal
- Duty: Continuous, 20 hrs. /day. 350 days a year.
- Capacity, tph: Stacking
  Rated: 2500, Designed: 2875
  Reclaiming
  Rated: 2500, Designed: 2875
- Power Supply:
  3.3kV, 3phase, 50Hz, through Flexible Cables and Cable Reeling Drums.
- Boom length, m: To suit the stock-pile width
- Track centres: 6.0 m
- Length of travel: 750m

- Travel speed: Forward 0-20 m/min stepless
- Hoisting speed: 2 m/min (approx.)
  /Lufting Range to suit the stock-pile width/length
  (With respect to discharge pulley)
- Cross section of the stock file: Triangular
- Bottom width of stock pile: 25 m
- Height of stock: 10-15 m Pile w.r.t. to rail level.

7.4.10. WAGON LOADING SYSTEM

Fast loading Silo having 4000 T capacity suitable for flood loading of Indian Railway Rakes 58 Box 'N' or long 116 Box 'N' has been proposed. Silo shall be of RCC construction each fitted with two nos. pre-weigh bins and telescopic swing chutes suitable for loading at the rate of 5000 TPH.

The brief specification of silos is as follows

i) Capacity selected	4000 T
i) Diameter (approx.)	20 m
iii) Height (approx.)	55 – 60 m

7.5. Coal Handling Plant for PB North-West (NW) Quarry

7.5.1. Introduction

The rated coal production of 3.0 Crusher from PB North West (Sector-A) Coal Block is required to be fully processed through separate Coal Handling Plant (CHP) to ensure consistent size and continuous supply of coal to thermal power station (TPS).

Coal from the Quarry NW shall be transported upto the receiving hopper, in the CHP ROM coal shall be reduced to -50mm size and stored in the truck loading hoppers. 20-40 tonner trucks shall be loaded through truck loading system and transported upto surge bunker located near PB East & West surge bunker. Reclaim conveyor shall load the coal in the cross country conveyor. Through a separate stream of conveyor, coal shall be conveyed upto loading silo located at Benadag Yard. Rapid loading system installed in the Loading Silo shall load the coal in the Railway wagons from where the coal shall be despatched to the identified power plant of NTPC.

However, detail feasibility study is recommended to finalise the following:

a. Coal evacuation system for PB (NW) Quarry adjacent to cross country conveyor of PB(West &East)
b. Location and capacity of Rapid Loading System for PB (NW) Quarry

7.5.2. **General**

The coal handling plant has been designed to crush the ROM (-) 1000-1200mm feed from different pits to produce (–) 50 mm sized coal. The major process facilities of proposed CHP will comprise of the following:

- Receiving hopper
- Primary / Crusher equipped with apron feeder and hopper
- Long distance belt conveyor
- Secondary crushing
- Product stockpiling & Reclaiming
- Cross country conveyor from reclaimer to Railway Loading point
- Loading & dispatch

The coal from active faces/different benches will be transported by 60T dumpers and fed to the s / Crushers through apron feeders, placed at suitable locations in the surface to generate (-)250 mm product. The belt conveyor will transport the crushed coal to secondary s/ Crushers to further reduce the product size to (-) 50 mm. The CHP has been planned to handle ultimate total capacity of 3 Mty of coal

7.5.3. DESIGN PARAMETERS

7.5.3.1 BASIC DATA

- Production capacity in MTY - 3.0
- No. of working days / annum - 330
- No. of working shifts / day - 3
- Duration of each shift (hours) - 8
- Feed size of R.O.M coal (mm)- 1200
- Product size in mm - (-) 50

7.5.3.2 CHP WORKING SCHEDULE

Crushing, storage and loading will be done in three shifts per day and seven days a week.

7.5.3.3 SYSTEM CAPACITY

The handling capacity of the CHP has been decided to match with the production capacity of the mine. In order to meet the fluctuations of coal output from the mine due to irregularities of despatch / transport system and seasonal fluctuations, the design capacity of the CHP has been fixed accordingly.

7.5.4. SALIENT FEATURES

The proposed PB-NW Quarry CHP consist of the following units.

- Two no of Primary Crushing station equipped with apron feeder and receiving hopper. Apron feeders will feed coal into primary Crusher
- 4 nos. of Crushers (Secondary) of 300 TPH each with vibro feeders at Secondary crushing house to crush coal from 250 mm to 50 mm size.
- Conveyor systems of 800 mm width and 300 tph
- Two numbers of Stacker Reclaimer of 600 tonnes per hour capacity each.
- One no. of 2000 te capacity Silo each containing one sets of 3500 TPH capacity Rapid loading system with 2x72 te capacity pre-weigh hoppers
- One numbers of magnetic separators in each flow.
- One numbers of metal detectors in each flow
- One numbers of belt weighers to weigh the coal in each flow after secondary crushing.
- Miscellaneous facilities like dust control system firefighting and ventilation system Plant cleaning and Infrastructure for preventive maintenance are also envisaged. Necessary Electrical, interlocking, signalling and communication facilities.

7.5.5. COAL RECIEPT AND PRIMARY CRUSHING

Run of Mine (RoM), 1000-1200 mm coal from the mine shall be transported by 60 T dumpers to crushing arrangement located at pit head. The RoM coal shall be reduced to (-) 200-250mm size through primary crushing arrangement located at the pit head.

SPECIFICATION OF PRIMARY CRUSHER

• Nos.	02
• Material to be handled:	Coal
• Feed size of ROM. coal (in mm)	1200
• Product size (in mm)	(-) 250
• Average HGI of coal	45 (max.)
• Bulk density of coal	1000 kg/m3
• Crushing capacity	Rated-300tph
• Designed	350 tph
• Moisture content	upto 10%
• Ambient temperature	50 deg C
• Duty	Continuous.
Hrs. /day	20
Days a year	350
• Power Supply:	3.3kV, 3phase, 50Hz,

7.5.6. SECONDARY CRUSHING

Crushed Coal of (-) 200-250 mm size from primary shall be fed directly onto the secondary crushing arrangement for further sizing of coal to (-) 50mm. The crushed coal shall be transported to surface hoppers through conveyor system.

SPECIFICATION OF SECONDARY CRUSHER

• Nos.	04 (Four)
• Material to be handled	Coal
• Feed size of ROM. coal (in mm)	(-) 250
• Product size (in mm)	(-) 50
• Average HGI of coal	45 (max.)
• Bulk density of coal	1000 kg/m3
• Crushing capacity	Rated-300tph
• Designed	350 tph

▪ Moisture content	upto 10%
▪ Ambient temperature	50 deg C
▪ Duty	Continuous,
Hrs. /day	20
Days a year	350
▪ Power Supply:	3.3kV, 3phase 50Hz.

7.5.7. Product stockpile

Open air product stockpile of 400m x 200m dimension has been proposed with facility of stacking and reclaiming through rail mounted stackers & reclaimers with capacity of 600 tph each. There will be a bypass arrangement at product stock pile wherein the sized coal can be directly fed to the cross country conveyor, without stacking, for loading into the wagons through silos. The product stockpile can accommodate 1 lakh tons of coal ie. about 10 day production of the mine at rated capacity

BROAD TECHNICAL PARAMETERS OF STACKER-RECLAIMER

The main characteristics of the Stacker Reclaimer shall be as follows.

1) Type : Rail mounted, self propelled, luffable, slewable. Boom type Stacker cum Bucket wheel Reclaimer.

2) Nos. : 02 (Two)

3) Material to be handled: Coal

4) Duty: Continuous, 20 hrs/day, 350 days a year.

5) Capacity, tph: Stacking
   Rated: 600, Designed: 650
   Reclaiming
   Rated: 600, Designed: 650

6) Power Supply:
   3.3kV, 3phase, 50Hz, through Flexible Cables and Cable Reeling Drums.

7) Boom length: To suit the stock-pile width

8) Track centres: 6.0 m

9) Length of travel: 250m

10) Travel speed: Forward 0-20 m/ min stepless

11) Hoisting speed: 2 m/min (approx)
/Luffing Range to suit the stock-pile width/ length
(With respect to discharge pulley)

12) Cross section of the stock file: Triangular

13) Bottom width of stock pile: 25 m

14) Height of stock: 10-15 m Pile w.r.t. to rail level.

7.5.8. Wagon loading system

Fast loading Silo having 2000 T capacity suitable for flood loading of Indian Railway Rakes 58 Box 'N' or long 116 Box 'N' has been proposed. Silo shall be of RCC construction each fitted with two nos. pre-weigh bins and telescopic swing chutes suitable for loading at the rate of 3500 TPH

The brief specification of silos is as follows

i) Capacity selected	2000 T
ii) Diameter (apprx.)	18 m
iii) Height (apprx.)	25 – 30 m

7.6. DUST CONTROL SYSTEM

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

7.7. NOISE CONTROL

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

7.8. FIRE FIGHTING SYSTEM

Necessary firefighting system has also envisaged for the plant, which includes fire hydrant tees at strategic locations at equal spacing of 25 to 35 meters with suitable water supply pipe lines. Also portable type fire extinguishers to deal with electrical / oil /ordinary fires shall be provided at all strategic locations in the plant

7.9. 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.

7.10. PLANT PREVENTIVE MAINTENANCE

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

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

A control desk cum mimic panel will be provided in the control room from where the entire plant from crushing to ground stacking will be controlled. However for loading operation from silo, separate control desk cum panel shall be provided in the control room at rapid loading station. At the time of start, an alarm through

hooter will be blown to warn the working personnel

7.11. ELECTRICALS

The main switching station for the coal handling plant shall be suitably located and will receive power from the Project substation.

The electrical system shall comprise

- Power reception and distribution system
- Centralized sequence control–cum–interlocking, automation, signaling and instrumentation system
- Illumination of plant and adjacent area Illumination shall be provided as per Indian Electricity Rules.
- Contralized welding circuit
- Earthing arrangement for the plant shall be provided as per Indian Electricity Rules.

7.12. COAL SAMPLING

It is proposed to install automatic sampling system in the CHP. Coal from conveyors shall be collected by the sampler at pre- determined intervals to assess the quality of the coal being dispatched. The coal samplers shall be suitably located. The samples collected shall be sent to the laboratory for further analysis.

7.13. CIVIL & STRUCTURALS

The civil and structural work shall cover all aspects of civil and structural design based on detailed survey, soil and hydrological investigations, seismic data, etc.

7.14. MODE OF DESPATCH

RAILWAY SIDING

Considering the topography of the area, site near Banka Village, located at a distance of about 14 km from the block has been selected for the Railway Siding. Benadag Railway siding shall be constructed by NTPC This Railway siding is under construction which shall be connected with Hazaribagh Railway Station at approx. 9 km from Benadag Siding.

Three no. of Loading silos shall be constructed on the over the tracks out of which two silos of 4000T each capacity shall cater to the PB West & East Quarry the third shall be of 2000T capacity which will cater to the requirement of PB-NW Quarry.

ROAD TRANSPORTATION

Cross Country Conveyor System from the mine to Benadag Siding is presently under construction. Till the completion of the conveyor system coal shall be transported to the nearest Railway siding (Benadag) by road.

7.15. WASHING

Coal Block was explored during the period 2003-04 and no washability studies were conducted. As per the Geological Report average grade of the coal is G-10 (Grade –E) with a calculated GCV of about 4300 Kcal/kg. Based on the Geological Report the range of ash percentage varies from 16-51% in PB West & East Quarry and 7-50% in North West Quarry. The average ash for the mined out coal is estimated to be about 34%, hence no provision for coal washery has been made as of now.

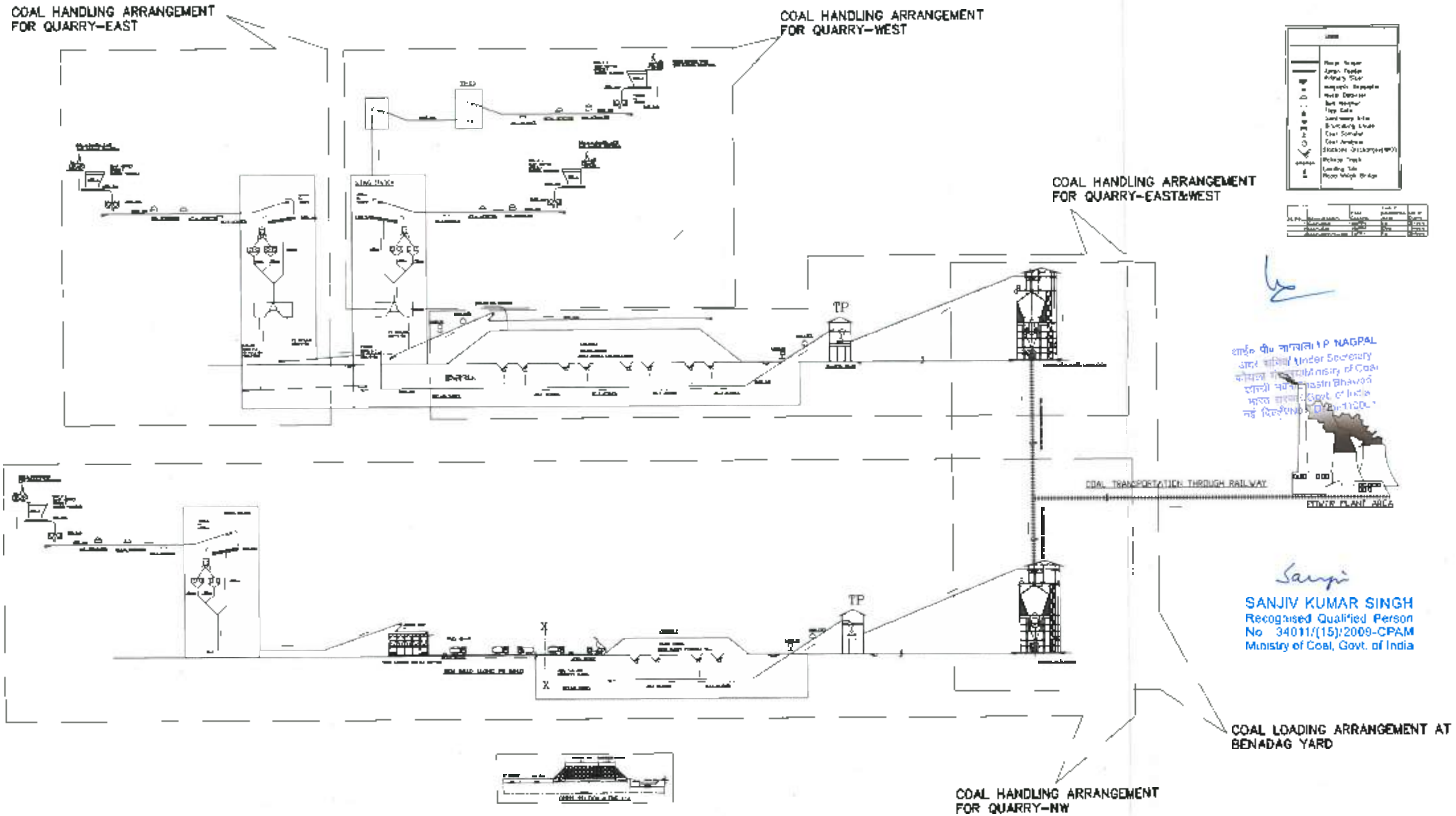
It is proposed to dispatch the ROM sized coal (-50mm) by conveyor followed by rail to the End Use Plants (EUPs).

7.16. COAL QUALITY MONITORING LABORATORY

For quality assurance and control, it is proposed to establish a Coal Laboratory with all the necessary equipment for daily analysis of the coal quality at Mine end.

7.17. DRAWINGS

A Coal flow diagram for proposed CHP has been given in the drawing.



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SANJIV KUMAR SINGH
Recognised Qualified Person
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Ministry of Coal, Govt. of India

Note:

1. Pakri Barwadih is the nearest source of coal for HBPC power Plants
2. Provisions of two ground barkers have been made one each for Quarry-NW and Quarry West(Coal.
3. The coal flow diagram is tentative and may change during implementation stage
4. Two coaling Silos shall be provided to load the coal for Quarry West & East. One loading Silo shall be provided to load the coal of Quarry-N
5. There shall be two streams of cross country conveyors both working for Quarry-East & West
6. There shall be one streams of cross country conveyor for Quarry-NW
7. Size of coal loaded on the Railway wagon shall be (-25mm)
8. Length of Cross country Conveyors shall be 14km(approx) the overall point shall be on the Northern side of block see shall terminate at Benadag Yard
9. Coal Handling plant at west quarry shall be used for coal quarry , which shall be dismantled in phases on exhaustion of NP-1 & NW-4.

NTPC LIMITED
(A Government of India Enterprise)
(NTPC PLANNING & DESIGN)

PROJECT: PAKRI BARWADIH COAL BLOCK

TITLE: REVISED MINING PLAN (4th Revision)

SUBJECT: COAL HANDLING PLANT/COAL FLOW DIAGRAM

SCALE: NTS SHEET 1 OF 1

DWG. NO: 7210-199-PCN-J-42 PLATE NO. 42

CHAPTER VIII

INFRASTRUCTURE FACILITIES PROPOSED AND THEIR LOCATION

CHAPTER-VIII

MINING INFRASTRUCTURE & FACILITIES

8.1 Introduction

Pakri Barwadih mine is planned to produce 18 Mt of coal per annum by Open Cast method of mining. Life of the mine shall be approximately 52 years as per the calendar programme. Besides maintaining large fleet of HEMM and ancillary equipment, it will employ approximately 2863 manpower including 367 manpower for operation of PB East in the initial two years. To improve overall availability/utilization of the mining equipment there is a need for flawless extraction of coal and OB, transportation and despatch of coal to the end use plant. Further to ensure proper administration and welfare of the personnel employed, there is a need to construct the infrastructure for safe and economic exploitation of coal. The layout has been designed to achieve the above objectives. All necessary facilities have been provided in the workshop to cater the need of the project.

Mostly separate infrastructure is planned for PB West quarry and PB NW Quarry. Infrastructure proposed for PB West quarry such as CHP, substation, workshop, administrative buildings etc. shall be utilised progressively for PB East quarry on restart after 25th years of Mining Operation and proportionate to the production. But the infrastructure/facilities which could not be shared with PB West quarry shall be constructed separately for initial two year as well as after the restart of PB East quarry (haul roads, culverts drainage system etc.) Certain facilities such as coal sampling lab, environmental cell, vocational training centre etc. shall be common for all quarries.

The target capacity & water requirements for each quarry are given in **Table 8.1**

Table 8.1

Sl. No.	Quarry Name	Target Capacity in MTPA	Water Demand in MGD
1.	PB West &East Quarry	15	0.91
2	PB North-West Quarry	3	0.2
	Total for PB Mine	**18**	**1.11**

As explained above separate infrastructure is proposed for PB-West & East quarry and PB- NW, details are as following.

8.2 Infrastructure and facilities for PB West & East Quarry

8.2.1 Infrastructure facilities proposed

The area for the infrastructure facilities will be secured by a boundary fence and a soil bund on the edge of the mine. The proposed major buildings within and precincts of the mine boundary are as follows:

1. Heavy Earth Moving Machinery (HEMM) Workshop
   - a Welding Shop
   - b Tool Store
   - c Electrical Shop
   - d Office space for workshop management
   - e Shift in change room
   - f Washing facilities and toilets
2. Light Vehicle (LV) Workshop
3. Tyre Workshop & Tyre Storage Bay (open area)
4. Equipment Washing Facility
5. Office Building
6. Worker's Bathhouse and Canteen
7. Dispensary
8. Store
9. Engineering Section
10. Security Office
11. Fuel Depot
12. Coal Evacuation System and Coal Handling Plant
13. Electrical Power supply
14. Mobile Service Van
15. Approach Roads
16. Other roads and culverts
17. Domestic and Industrial water supply & sewerage
    - a Sources of water
    - b Industrial water supply
    - c Effluent Treatment Plant
    - d Industrial Sewerage
    - e Sewage Treatment Plant
18. Temporary Workshop

1. Heavy Earth Moving Machinery (HEMM) Workshop (Maintenance Workshop)

The Maintenance Workshop shall have a concrete grade slab that is designed to support the loads by the next larger size of the heaviest unloaded vehicle in the quarry's fleet. It shall have minimum of six vehicle maintenance bays to handle the next larger size of the largest vehicle in the quarry equipment fleet. At least four of the six bays shall be "drive through" to allow the trucks to be serviced.

The Maintenance Workshop shall also provide separate space, of adequate size for the equipment being maintained.

A minimum of two bays shall be provided with rails embedded in the concrete grade slab. These rails shall be spaced to support all of the tracked equipment off of the concrete and the supporting rebar mat membrane shall be design to distribute this load without the concrete cracking.

The facilities shall include overhead crane(s) sized for the largest of the largest component load of the next largest size of the largest truck or the currently planned truck. The crane(s) shall service all of the maintenance bays and run the length of bays as required for positioning components for the vehicles being maintained.

The Maintenance Workshop shall primarily be an open frame steel structure without walls and with a roof height sufficient for truck/overhead crane clearance. Work areas which are sequestered from the main area (for reasons of safety, security etc.) shall be petitioned from the main areas with masonry walls. The facility shall have walls as required to frame in the crane and to provide a complete roof above the truck maintenance level. The roof shall include Control of rain runoff away from main access areas

The ground level maintenance bays shall be an open structure except where access limitations have been described. A full building skin shall be provided at a level sufficient for truck clearance of the next largest of the largest truck in the mine fleet.

a. Welding Shop

Welding shop for repair of shovels, buckets, equipment etc. will be part of the HEMM Workshop.

b. Tool Store

Tool store will be provided in the HEMM Workshop to store the tools.

c. Electrical shop

Electrical shop will be provided as part of the HEMM Workshop for repairing

of electrical parts.

Apart from the above, office space for the workshop management, shift change room, washing facilities and toilets shall also be provided. In addition to the Main Workshop, a temporary workshop has also been envisaged to cater to daily maintenance and routine checking of HEMM deployed in the mine.

d. Office space for workshop management

Office space in the separate building equipped with computers, communication facilities stationary and furniture shall be provided for workshop management. Office climate control shall also be provided based on the prevailing ergonomics.

e. Shift in change room

A separate shift in-charge room along with the office of Mine Time Keeper shall be provided. This room shall be equipped with computers, communication facilities stationary and furniture for manpower management during the shift operations. Office climate control shall also be provided based on the prevailing ergonomics.

f. Washing facilities and toilets

Washing facilities and toilets shall be provided as per requirement

2. Light Vehicle Workshops

A separate maintenance workshop for highway vehicles shall consist of a minimum of six bays with a separate office and a secure storage room for parts and tools. This facility shall include a concrete grade slab, and primarily framed from steel with reinforced masonry walls. No garage doors are required but the facility shall have walls on two sides and shall have a complete roof. The roof shall include control of rain runoff away from main access areas.

3. Tyre Workshop

This facility shall consist of a heavy floor slab sufficient to support the haul track and the forces induced from a floor jack or lifts as required to change wheels tyres on the haul truck. This facility shall also include a complete roof to control rain runoff away from main access areas. The facility shall also incorporate a secure tool storage room locker with benches to allow workmen to change from their work clothing, a toilet and an office.

4. Equipment Washing Facility

This facility shall include a large concrete grade slab with rail embedded to protect the slab from tracked equipment. The slab shall be sloped to direct water to the settlement basins. This facility shall include the washing

equipment, including water cannon; access platforms; setting tanks; oil traps and oil collecting tanks. The settling tanks shall be designed to allow a small pay loader to drive in to the tank to collect large deposits of silt or other materials deposited from washing the vehicles.

5. **Office Building with Medical Clinic**

A single-story Office Building shall be provided to serve mine support functions such as; engineering; mine supervisors and managers; the canteen; document storage; information Technologies (IT) and computer backup; mine administration; secret ration, secretarial and other support staff. The building shall also provide a minimum of four meeting rooms and have a waiting room. This office building will also include First Aid Medical clinic.

6. **Worker's Bathhouse and Canteen**

A separate canteen for the hourly staff shall be provided. It shall have showers, changing areas, toilets, kitchen, a canteen serving area and an area for recreation. For employee morale, plans for this facility shall include features that make this a facility that the workers enjoy.

7. **Medical unit (Dispensary)**

This facility shall comprise of containers for first aid and handling medical emergencies, offices for doctors & nursing staff, emergency ward, ward for patients, toilets, kitchen, medicine room, ambulance van etc. It shall be equipped for treating the medical emergencies.

8. **Ware house and warehouse building (Store)**

The ware house shall be an open two-story facility with extensive fenced storage yard adjacent to the facility. Access to the fenced storage and the main equipment storage entry shall be controlled through a gate. A tool shop, the main switchboard, radio room, offices, toilets and meeting rooms shall be provided within this facility. Office space shall be provided to supplement the main office building.

9. **Engineering Section**

This is broadly divided in to five sub-sections

i. Machine shop

ii. Electrical repair shop

iii. Welding & structural shop

iv CHP & Mechanical repair shop

v. Repair shop for Pumps and Pipes

The Engineering section is also equipped with a small workshop substation, scrap yard etc. A common 10/5 t capacity EOT has been envisaged to serve all the above mentioned shops of Engineering section to facilitate inter-shop equipment movement smoothly.

10. Security Office

Security offices shall be provided where access to the mine is required to be controlled. Suitable monitoring, recording and secure access controls shall be provided as appropriate where items stored are dangerous or easily removed

11. Fuel Depot

A fuel storage facility shall be provided to ensure that the mine can operate for a period of about one month during an interruption of fuel delivery

The facilities shall include containment walls of sufficient height to assure if any one tank is compromised any fuel stored shall that may be spilled shall be contained. The facility shall also include perimeter collection concrete culverts that drain to an oil interceptor which shall be design to collect localize spills that occur during normal fuelling. The trucks are to be fuelled on a concrete grade slab which is surrounded by the concrete culverts. Continuous grating shall be installed over the culverts which shall support any vehicle in the mine fleet

12. Coal Evacuation System and Coal Handling Plant

Proposed coal evacuation system and coal handling plant has been elaborated in **Chapter VII**.

13. Electrical Power Supply

13.1 Construction Power Supply

It is proposed to arrange construction power at 11 kV from JSEB, Langatu substation located at about approx. 4 km from the project site before establishment of permanent power supply arrangement.

The 11 kV switchgear will be envisaged at main receiving substation for receiving construction power at 11 kV. The power supply for all construction activities, mine office and other amenity buildings can be fed at 11 kV. Provision of DG sets has also been made in the report to meet the construction power requirement at the time of power failure.

13.2 Intermediate Power Supply

It is anticipated that construction of 220 KV line from Patratu Thermal Power Station of JSEB may get delayed due to administrative & statutory requirements and therefore a provision has been kept for intermediate power supply by drawing power at 33kV from Langatu sub-station of JSEB to charge 33KV switchgear of Main Receiving Sub-station. This will support the requirement of 5 MVA power during initial period of mine operation

13.3 Permanent Power Supply Arrangement, Main Substations and Power Distribution:

The maximum power demand estimated for the mine including CHP will be 32 MVA. The source of power will be made available is from JSEB, Patratu at 220 KV. Main receiving Substation of 220/33/11 KV will be constructed at Pakri Barwadih Coal Block

Other substations like Coal Substation, OB Substation, Colony Substation and CHP substations are also being proposed for further distribution of power inside mine block. All the 33kV substations will receive power at 33kV from the double circuit power line originated from the 33KV switchgear of Main Receiving substation.

Layout of the proposed Sub-stations and power supply system broadly covers the following:

1. Power reception & distribution system.
2. Illumination of workshop and adjacent area.
3. Earthing

The power for workshop shall be made available from project sub-station.

Quarry area is proposed to be illuminated by 'HIGH-MAST-TOWERS" located along quarry periphery with Sodium Vapour Lamps on each lower haul Road and inside quarry shall be illuminated by Mobile Towers with Metal-Halide lamps. Proper earthling has been envisaged for Electrical System. All electrical System will have protection from lightening and high voltage surges

14. Mobile Service Van

Provision of a mobile service van has been envisaged to cater the need of repair of heavy equipment at site itself. Following equipment will be required to be installed:

- Welding Transformer, Gas cutting complete set
- Air compressor two stage displacement .Tyre Inflation gauge

- Water container for drinking water
- Work table. Bench vice to be fitted on work table (1 no.)
- Lighting, Mechanical crane lifting device capacity 1 t
- Hand lamp 100 watts with 25 meters long wire
- Generator set complete with Engine Alternator coupling etc.
- 12/24 Volts D.C. Generator. Distribution board
- Hand operated pneumatic Grinder, Hand operated pneumatic drill
- Fire Extinguisher. First aid box

15. Approach Road

Hazaribagh -Tandwa road passes through eastern part of the block and this road shall be used as main approach road for the block. During operation of Quarry east this road shall be diverted to the easternmost periphery of the block. Approximate distance of road for connecting to quarry west is 10 km.

16. Other Roads & Culverts

16.1 Haul Road

For both the technological options, the length of double lane haul road has been estimated as 10.25 Km for plying of largest dumpers. Another haul road to the dump site having an estimated length of 4km has also been envisaged.

16.2 Heavy duty Road

The dumpers deployed in the benches will also go to the workshop for maintenance. Hence a provision of heavy duty road of 0.25Km has been envisaged in the present report.

16.3 Approach road to the Township

Approximately 10km long. 7.5m wide black top road connecting to the Residential colony has been envisaged

16.4 Approach road to Magazine

The proposed magazine building has been envisaged to be located at a suitable location keeping in view safety and security requirements. Provision for 1.0Km magazine road has been envisaged in the present report.

16.5 Road along CCT conveyor

A 14 km long. 3.75m wide black top road from block to Banadag yard has been envisaged as road along CCT conveyor.

Additionally, Strengthening of 4 nos. of bridges / culverts on Hazaribagh PKB Highway has also been envisaged.

17. Water Supply & Sewerage

The Water demand assessed for PB West and PB East Quarry is indicated in **Table 8.2**.

Table 8.2.
The Water demand

Potable Water Demand in MGD for OCP	Industrial Water Demand in MGD for OCP	Total Water Demand in MGD
0.31	0.60	0.91

Separate sewerage system for domestic & industrial sewage has been envisaged for the Project.

17.1 Source of water

Three sources of groundwater have been identified.

i. Surface water such as existing ponds, reservoir, nalla or river
ii. Borewells
iii. Mine sump water

During construction years, there is actually no excavation taking place for extraction of coal, but water will be required for building of infrastructure. drinking & service purposes. During first year of operation sump water is not available as mine shall not intersect the aquifer due to lesser depth of the mine. For above period bore wells shall be drilled exclusively to draw water for meeting the water requirement of mine & residential colony. As the mine goes deeper & wider during later year of mining operation the sump water availability vis a vis water requirement of mine shall increase and the water requirement in these operational years shall be met by both sump water & ground water (Bore well water).From this period & beyond when the mine shall be producing 15 MTPA and water requirement expected to reach approx. 4000 m3/day, entire water requirement shall be met with the sump water. Sump water shall also be treated for drinking water purposes and bore well water shall be ceased to use.

As Permission/clearance for drawl and use of groundwater is in place revised Permission/clearance for drawl and use of groundwater shall be obtained from Central Ground Water Board. If necessary Hydrogeological study shall be carried out to assess availability of ground water

17.2 Industrial water supply

For both the options, ground water in the construction period and mine water has been envisaged as source of water for the project. For the initial years, ground water shall be drawn from bore wells. Afterwards, mine water shall be used. Raw water shall be stored in a bulk water reservoir from which water shall be treated and stored in a separate reservoir. From this reservoir, water will be taken to individual overhead tanks for consumption through pipe network at different points through gravity flow

For firefighting purposes in the industrial areas like workshops, stores and quarry area, separate distribution networks have been proposed from the ground reservoir Provision towards requirement of water for public utilities like garden, afforestation etc. has been made in this report. It has been envisaged that the distribution network for firefighting purposes shall also be utilized for these purposes.

17.3 Effluent Treatment Plant (ETP)

Effluent treatment Plant (ETP) of requisite capacity for treatment of industrial sewerage shall be installed

17.4 Industrial sewerage

It has been considered that the industrial waste from workshop and other industrial establishments would be led through oil & grease traps. The effluent coming out of the industrial premises is proposed to be treated and fed to the settling tank and to be recycled for various industrial uses of this project. The domestic sewage generated in the industrial premise has been considered to be dealt through sewerage disposal system.

Furthermore, to divert run off water for the northern side catchment area, a nallah along the northern boundary has been envisaged.

17.5 Sewerage Treatment Plant (STP)

Sewerage treatment Plant (STP) of requisite capacity for treatment of industrial sewerage shall be installed.

18. Temporary Workshop

In addition to the Main Workshop, a field workshop has been envisaged to cater to daily maintenance and routine checking of HEMM deployed in the mine. This workshop shall be shifting as the mine advances and preferably kept in the near proximity to the access of quarry. This workshop shall constitute bays of Daily Maintenance shop occupying requisite area. The shop area is enough to deal with 4 to 5 dumpers at a time, which will meet the requirement of total number of dumpers to be dealt in each shift

Dumpers after being washed at the washing station shall enter these sheds and daily maintenance requirement like checking nuts & bolts, tyre pressure checking, inspection of hydraulic systems for any leakages and their rectification, electrical system general check-up, battery check-up shall be carried out. Similarly dumpers after complete washing / cleaning will move to the Daily Schedule Maintenance where they will have oil levels checked, lubrication points greased, air cleaner, dust pans cleaned, water level and / or anti-freeze checked. The air, oil and fuel filters will be changed if required as per the maintenance schedule and tyres inflated if necessary.

Besides providing Parking space for HEMM specific jobs to be performed in the Temporary Workshop are as follows:

i. Daily maintenance & washing of HEMM.
ii. Scheduled maintenance, lubrication & inspection of equipment
iii. Fuelling of dumpers and dozers etc.
iv. Air system check
v. Hydraulic system check
vi. Electrical check
vii. Mechanical check

If on inspection, repair of any component / assembly is required, and then the machine will be sent to Dumper repair shed in the main workshop.

8.3 Infrastructure and facilities for PB North West Quarry

8.3.1 Infrastructure facilities proposed

In line with the infrastructure facilities for PB West & East Quarry the area for the infrastructure facilities will be secured by a boundary fence and a soil bund on the edge of the mine. Distance between PB-West quarry is approximately 3 Km, . from the viewpoint of ensuring better management, control and ease of access some of the facilities have been planned separate for PB-NW Quarry The broad specifications shall be in line with the specifications adopted for PB-

West & East Quarry. Proposed infrastructure within and precincts of the mine boundary are as follows:

1. Heavy Earth Moving Machinery (HEMM) Workshop
   a Welding Shop
   b Tool Store
   c Electrical Shop
   d Office space for workshop management
   e Shift change room
   f Washing facilities and toilets
2. Light Vehicle (LV) Workshop
3. Tyre Workshop & Tyre Storage Bay (open area)
4. Equipment Washing Facility
5. Office Building
6. Worker's Bathhouse and Canteen
7. Dispensary
8. Store
9. Engineering Section
10. Security Office
11. Fuel Depot
12. Coal Evacuation System and Coal Handling Plant
13. Electrical Power supply
14. Mobile Van
15. Approach Road
16. Other roads and culverts
17. Water Supply and Sewerage
    a Source of Water
    b Industrial water supply
    c Effluent Treatment Plant
    d Industrial sewerage
    e Sewage Treatment Plant
18. Temporary Workshop

1. Heavy Earth Moving Machinery (HEMM) Workshop (Maintenance Workshop)

In line with the Maintenance Workshop proposed for PB West & East Quarry, separate Maintenance Workshop shall be provided for NW quarry also.

2. Light Vehicle Workshops

In line with the Light Vehicle Workshop proposed for PB West & East Quarry, separate Light Vehicle Workshop shall be provided for NW quarry also.

3. **Tyre Workshop**

In line with the Tyre Workshop proposed for PB West & East Quarry, separate Tyre Workshop shall be provided for NW quarry also.

4. **Equipment Washing Facility**

In line with the Equipment Washing Facility proposed for PB West & East Quarry, separate Equipment Washing Facility shall be provided for NW quarry also.

5. **Office Building with Medical Clinic**

In line with the Office Building with Medical Clinic Facility proposed for PB West & East Quarry, separate Office Building with Medical Clinic Facility shall be provided for NW quarry also.

6. **Worker's Bathhouse and Canteen**

In line with the Office Building with Worker's Bathhouse and Canteen Facility proposed for PB West & East Quarry, separate Worker's Bathhouse and Canteen Facility shall be provided for NW quarry also.

7. **Medical unit (Dispensary)**

In line with the Dispensary proposed for PB West & East Quarry, separate Dispensary shall be provided for NW quarry also.

8. **Ware house and warehouse building (Stores)**

In line with the ware house and warehouse building proposed for PB West & East Quarry, separate ware house and warehouse building shall be provided for NW quarry also.

9. **Engineering Section**

In line with the Engineering Section proposed for PB West & PB East Quarry, separate Engineering Section shall be provided for NW quarry also.

10. **Security Office**

In line with the Security office proposed for PB West & PB East Quarry, separate Security office shall be provided for NW quarry also.

11. Fuel Depot

In line with the Fuel Depot proposed for PB West & PB East Quarry, separate Fuel Depot depending upon the magnitude of consumption of oil & lubricants shall be provided for NW quarry also.

12. Coal Evacuation System and Coal Handling Plant

Proposed coal evacuation system and coal handling plant has been elaborated in **Chapter VII**.

13. Electrical Power Supply

The maximum power demand for mine including **CHP** shall be **15MVA**.

Electrical Power Supply system shall broadly cover the following;

1. Power reception & distribution system.
2. Illumination of workshop and adjacent area.
3. Earthing.

In line with the Electrical Power Supply system proposed for **PB** West & East Quarry, separate Electrical Power Supply system depending upon the magnitude of consumption of electrical power shall be provided for NW quarry also. The identified source of construction Power, Intermediate power and permanent power proposed for **PB** West & PB East Quarry, shall remain same for NW quarry also.

The power for workshop, **HEMM**, buildings, facilities, illumination etc. shall be made available from PB-NW project sub-station. Power shall be drawn from 33KV switchgear of PB west main receiving substation through O/H lines running on the northern **periphery** of PB West Quarry.

14. Mobile Service Van

In line with the Mobile Service Van proposed for PB West & East Quarry, separate Mobile Service Van shall be provided for NW quarry also to cater the need of repair of heavy equipment at site itself.

15. Approach Road

The approach road for **PB** West Quarry will be used to access PB-NW Quarry. The proposed approach road for PB West Quarry shall be extended upto PB NW (sector A) quarry form northern periphery of PB West Quarry.

16. Other Roads & Culverts

In line with the other roads such as haul roads, heavy duty roads, culvers on such roads and bridges proposed for PB West & East Quarry, separate other roads such as haul roads, heavy duty roads, culvers on such roads and bridges shall be provided for NW quarry also for transportation of coal/OB/topsoil/other purposes.

Road along CCT conveyor

In addition to the 14 km long, 3.75m wide black top road from block to Banadag yard proposed for PB West & PB East Quarry CCT a separate 14 km long, 3.75m wide black top road along with culverts/bridges as required from block to Banadag yard shall be provided for NW quarry also.

17. Water Supply & Sewerage

The Water demand assessed for the NW Quarry is indicated in the following Table. 8.2.

Table. 8.2

Water Demand for the NW Quarry

Potable Water Demand in MLD	Industrial Water Demand in MGD	Total Water Demand in MLD
0.55	1.5	2.05

In line with the sewerage system for industrial sewage proposed for PB West & East Quarry, separate sewerage system for industrial sewage shall be provided for NW quarry also

a Source of water

Three sources of groundwater have been identified.

i. Surface water such as existing ponds, reservoir, nalla or river

ii. Borewells

iii. Mine sump water

During construction years, there is actually no excavation taking place for extraction of coal, but water will be required for building of infrastructure, drinking & service purposes. During first year of operation sump water is not

available as mine shall not intersect the aquifer due to lesser depth of the mine. For above period bore wells shall be drilled exclusively to draw water for meeting the water requirement of mine & residential colony. As the mine goes deeper & wider during later year of mining operation the sump water availability vis a vis water requirement of mine shall increase and the water requirement in these operational years shall be met by both sump water & ground water (Bore well water).From this period & beyond when the mine shall be producing 3 MTPA and water requirement expected to reach approx. 2000 m^3/day, entire water requirement shall be met with the sump water. Sump water shall also be treated for drinking water purposes and bore well water shall be ceased to use

As Permission/clearance for drawl and use of groundwater is in place revised Permission/clearance for drawl and use of groundwater shall be obtained from Central Ground Water Board. If necessary Hydrogeological study shall be carried out to assess availability of ground water.

b Industrial water supply

In line with the industrial water supply system proposed for PB West & PB East Quarry, separate industrial water supply system for industrial sewage shall be provided for NW quarry also.

c Effluent Treatment Plant (ETP)

Effluent treatment Plant (ETP) of requisite capacity for treatment of industrial sewerage shall be installed.

d Industrial sewerage

In line with the industrial sewerage system proposed for PB West & East Quarry, separate industrial sewerage system shall be provided for NW quarry also.

e Sewerage Treatment Plant(STP)

In line with the industrial sewerage system proposed for PB West & East Quarry, Sewerage treatment Plant (STP) of requisite capacity for treatment of industrial sewerage shall be installed.

18. Temporary Workshop

In line with the Temporary Workshop proposed for PB West & East Quarry, separate industrial sewerage system shall be provided for NW quarry also.

8.4 Common Infrastructure and facilities

The area for the common infrastructure facilities will be secured by a boundary fence and a soil bund on the edge of the mine. The proposed major buildings intended for common usage within and outside the precincts of the mine boundary are as follows.

1. Residential Colony
2. Magazine
3. Core Shed
4. Coal Laboratory
5. Disaster Management Cell
6. Environmental Laboratory
7. Vocational Training Centre
8. Community Buildings
9. Communication System
10. Rehabilitation & Resettlement Colony
11. Coal Washery

1. Residential colony

a General Connectivity

The block is connected by Hazaribagh -- Khelari metal Road. The nearest railway stations are Ranchi Road and Chatarpur on the Gomoh Barkakana – Dehri-on-Sone loop lines of SE Railway and are about 70- 75 kms from the block. Ranchi, which is the state capital of Jharkhand, is about 125 kms from the block.

The nearest township is Hazaribagh; located at a distance of about 24 kms from Barkagaon located in the southern part of the block. It has been envisaged that the proposed colony shall come at Village Sikri near Barkagaon on the Tandwa road.

A residential colony suitable for living condition with proper ventilation, drainage shall be provided to officers, staff and workman employed in the mine as per prevailing statute. The colony shall be an integrated residential facility with PB block which shall be situated within 5 km from the block.

As this colony has been proposed to be located near Barkagaon Town on Tandwa Road thereby enabling the residents to avail the facilities of the Town as well as making it easy for them to reach the project site. The proposed project has been envisaged as highly mechanised mine needing skilled manpower. This manpower is required to be housed near the project site for smooth and continuous operation of the mine. With this background, 55% housing satisfaction has been considered for the project.

Residential colony has been considered for 1561 persons. Separate provisions have been made for colony and industrial water. It has been envisaged that there will be separate bulk reservoirs, water treatment plants and treated water reservoirs. From these treated water reservoirs, water shall be taken to the colony and for industrial purposes.

Relevant Standard Specifications shall be adopted for the construction of residential and service buildings. Requirement of residential units are given in **Table 8.3**.

Table 8.3

Requirement of residential units

Manpower for OC Project	Total No. of residential units
2863	1575 including 36 Unit Hostel

Hostel accommodation has been proposed as 20% of type -A quarters, and reduction in proposed type – A quarters has been made accordingly.

The buildings have been envisaged as RCC-cum-brick masonry structures.

b **Colony water supply**

Ground water has been envisaged as source of water for the colony. This water shall be stored in a bulk water reservoir, would be treated through treatment plant and stored in ground reservoir. From these ground reservoirs, water would be pumped to overhead reservoir from which water will be distributed to the points of consumption through gravity flow.

c **Colony sewerage**

Colony sewage has been proposed to be dealt through sewerage disposal system. Sewerage treatment Plant (STP) of requisite capacity for treatment of colony sewerage shall be installed.

d **Colony Roads**

The 3.75 m wide trunk and 10m wide gate roads of length as per requirement shall be provided for residential colony. Provisions have also been made towards culverts/bridges, tree guards and drains along these roads.

2. Magazine

A magazine having storage capacity of 12 tonnes of explosive will be provided for this coal block. This shall be constructed as per the design approved by Chief Controller of Explosive and shall at all times be kept in state of good repair (or maintained in good condition). Magazine shall be constructed at ground level only and it will be a single storey building. Safety distance shall be kept as per prescribed norms. It shall be made of heavy construction, i.e. steel, reinforced concrete, brick, stone or preformed concrete blocks. Maximum security is attainable only with steel or reinforced concrete structures. The internal dimensions of the magazine shall be such that there is ready access to all explosives. Suitable traverse or mound i.e. a solid mass of earth, sand, concrete or a brick work around the magazine shall be erected to prevent protection against effects of explosion. A distance of 15 metres surrounding the magazine shall be kept clear of dried grass or bush or flammable materials.

Magazine shall have attached thereto one or more efficient lightning conductors designed and erected in accordance with specification laid down by Bureau of Indian Standards. A cemented trough at least fifteen centimetres deep shall be provided near each entrance of magazine and shall be kept filled with clean water. Magazine shall be provided with a shelter for the security guard(s) on duty near the magazine at a suitable location not less than thirty metres away from the magazine. The magazine shall be kept securely closed or locked at all times except when goods are being placed in or taken from it or when it must be kept open for some other purpose in connection with the management of such premises.

Magazine shall be used only for keeping explosives specified in the licence and of receptacles, tools or implements for work connected with the keeping of such explosives. At the end of every month a return in Form RE-6 shall be submitted to the District Magistrate, Superintendent or Commissioner of Police in whose jurisdiction the magazine is situated in the proforma prescribed from time to time so as to reach the above authorities by 10th day of the succeeding month.

3. Core shed

The Core shed shall be a minimal facility used to store and prepare coal samples.

All facilities shall include lighting via windows and light fixtures, bollards, electrical connections and shall be design to all in the purpose the facility is designated to be used for.

4. **Coal Laboratory**

The Coal Laboratory shall include two offices, toilet with extensive washing facilities and a separate testing room. The testing room shall have independent ventilation equipment. One of the offices shall be for the chief technician and the other shall to house all other technical staff

5. **Disaster Management Cell**

A Control Room shall be set up within mining lease, which shall work round the clock. The control Room shall be provided with manpower, communication system and other equipment so as to deal with any disaster and provide necessary help affected persons.

The Control room shall also be provided with communication system to call for help from other Govt. or private organisation at the time of major disaster.

6. **Environmental Laboratory**

A fully equipped laboratory to carry out testing and analysis as per the prscribed norm for quality of water, soil, air and other mandatory environmental parameters will be provided as common facility of all the quarries. The testing room apart from state of the art equipment's shall have independent ventilation equipment.

7. **Vocational Training centre**

- Training facility for the employees shall be provided comprising of training rooms, workstations, offices for training personnel, toilets, kitchen etc. This facility shall house safety and include a mobile equipment simulator if needed. This building shall be constructed from reinforced masonry.

8. **Community Buildings**

Facilities required to have a healthy living for the employees have been envisaged and shall be provided as common facility for all the quarries.

9. **Communication System**

For effective management of different production, service units and for ensuring safety, the following communication facilities have been envisaged:

- Voice Communication
- Data Communication System

- Truck Despatching System

a) EXTERNAL COMMUNICATION SYSTEM (ECS)

Twenty telephone lines have been provided for BSNL 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, workshop, etc. Besides fixed line BSNL telephones, 20 nos. of BSNL cell one Mobile connection with sets may also be provided to important personnel of the project.

b) PLANT COMMUNICATION SYSTEM (PCS)

A 25-point Plant Communication System is proposed for voice communication in the CHP. 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 loud speaking facility

c) MOBILE COMMUNICATION SYSTEM (MCS)

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

d) TRUCK DESPATCH SYSTEM (TDS)

To achieve optimum utilisation of the HEMM in O/C mines, there is a need to provide an efficient means of data acquisition & control system. With the advancement in the TDS, the use of GPS for determining the points of different moving vehicles & automatic data transmission system for efficient control of vehicles has been found quite efficient & viable in Opencast mines.

10. REHABILITATION AND RESETTLEMENT COLONY

The resettlement colony shall be considered where the PAPs are those HSOs who have not opted for self-resettlement. The land for Rehabilitation Colony

shall be made available by NTPC free of any encumbrances preferably at one place Government land for RC is preferable. The cost in that case will also be borne by NTPC. Location of the RC could be decided in consultation of the project and could be slightly away but in the vicinity of the project. Basic infrastructure facilities for CD works will be provided in RCs

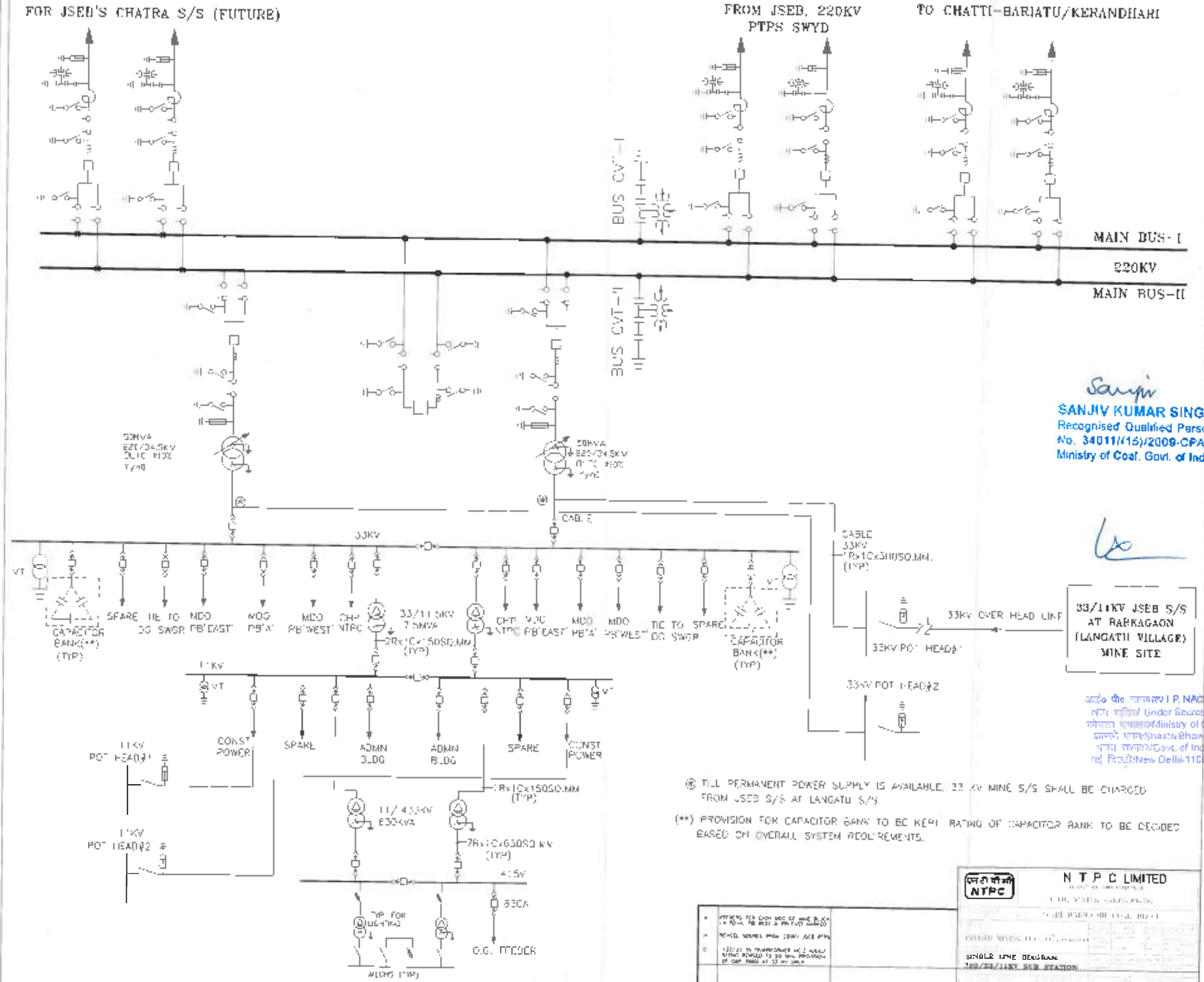
The infrastructure facilities and basic minimum amenities shall be augmented in the RCs, the project affected villages and in the vicinity of the project to ensure that the displaced population (HSOs) in the resettlement colony or the village may secure for themselves a reasonable standard of community life.

The facilities/ amenities will vary depending upon local requirements. The focus areas would be Connectivity, Drinking Water, Sanitation apart from Education and Health related infrastructure. These may include the following:

a. Internal and the approach roads with proper drainage, with preference for concrete roads
b. One or more sources of safe drinking water like hand pump, borewells with water outlet platforms etc., as per need and requirement
c. Tree plantation including fruit trees
d. Community halls/ Panchayat Ghar
e. Primary educational facilities
f. Primary health facilities
g. Street lighting in the Resettlement Colonies
h. Public cremation ground/ burial ground
i. Common grazing land/ small distributaries for irrigation
j. Drainage
k. Sanitation
l. Drinking water for cattle
m. Community Ponds
n. Children playground

11. COAL WASHERY

Coal washability study has not yet been carried out for Pakri Barwadih Coal. Coal quality parameters obtained from the proximate analysis of coal revealed that ash percentage in all probability is likely to remain 34% or below which does not call for commissioning of coal washery. However space provision is kept for providing a Coal Washery at mine end in future, if required.


FOR JSEB'S CHATRA S/S (FUTURE)
FROM JSEB, 220KV PTPS SWYD
TO CHATTI-BARIATU/KERANDHARI
BUS CVT-I
BUS CVT-II
MAIN BUS-I
220KV
MAIN BUS-II
50MVA 220/34.5KV
50MVA 220/34.5KV
CAB. E
33KV
CABLE 33KV 1Rx1Cx3110/50.MM. (TYP)
VT
CAPACITOR BANK(**) (TYP)
SPARE
TIE TO DG SWGR
MDO PB'EAST
MDO PB'A'
MDO PB'WEST
CHP NTPC
33/11.5KV 7.5MVA
2Rx1Cx150/50.MM (TYP)
CHP NTPC
VOC PB'EAST
MDO PB'A'
MDO PB'WEST
TIE TO DG SWGR
SPARE
CAPACITOR BANK(**) (TYP)
33KV OVER HEAD LINE
33/11KV JSEB S/S AT BABRAGAON (LANGATU VILLAGE) MINE SITE
33KV POT HEAD#1
33KV POT HEAD#2
11KV
CONST POWER
SPARE
ADMN B.DG
ADMN B.DG
SPARE
CONST POWER
11KV POT HEAD#1
11KV POT HEAD#2
1Rx1Cx150/50.MM (TYP)
11/4.15KV 630KVA
7Rx1Cx630/50 MM (TYP)
4.15V
SECA
TIE FOR UG FEED
O.G. FEEDER
MCCB (TYP)
SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011/(15)/2009-CPAM
Ministry of Coal, Govt. of India
I.P. NAGPAL
Under Secretary
Ministry of Coal
Shastri Bhawan
Govt. of India
New Delhi-110001
(*) TILL PERMANENT POWER SUPPLY IS AVAILABLE, 33 KV MINE S/S SHALL BE CHARGED FROM JSEB S/S AT LANGATU S/S
(**) PROVISION FOR CAPACITOR BANK TO BE KEPT. RATING OF CAPACITOR BANK TO BE DECIDED BASED ON OVERALL SYSTEM REQUIREMENTS.
NTPC
N.T.P.C LIMITED
SINGLE LINE DIAGRAM
33/11KV SUB STATION

CHAPTER IX

LAND REQUIREMENT

CHAPTER IX

LAND REQUIREMENT

9.1 Village wise land

4695 Ha of land is proposed for the Open cast project, which would be utilized for different purposes to carry out extraction of coal. There are 27 villages identified in the core zone of Pakri Barwadih coal block. The list of the villages along with area (ha) in the core zone are given in the **Table-9.1**

Table 9.1
Village wise Land in the Core Zone

Sl. No.	Name of Village	Total Area within core zone (ha)
1	Deona Kalan	87.00
2	Dewna Khurd	56.00
3	Urub	321.00
4	Jti	49.00
5	Chirudih	234.00
6	Nagri	218.00
7	Dankalan	282.00
8	Chepa-Khurd	100.00
9	Jugra	170.00
10	Arahara	296.00
11	Pakri-Barwadih	625.00
12	Barkagaon	166.00
13	Langatu	369.00
14	Sonbarsa	197.00
15	Sindwari	109.00
16	Churchu	145.00
17	Keri	197.00
18	Lakura	214.54
19	Chepa- Kalan	316.00
20	Banatu	212.00
21	Basara	46.13
22	Betu	16.57
23	Jabra	12.85
24	Kandaber	65.18
25	Nawadih	43.42
26	Sirma	45.37
27	[illegible]	41.56
28	Orma	38.46
	Total	**4695.00**

9.2 Category wise existing land use pattern

Out of total project area of 4695 ha 38.06% is designated as forest land. Tenancy land and Government non forest land for which breakup is not presently available constitutes 2713 ha which constitutes 61.93%. Category wise pre mining (existing) land use pattern is given in **Table 9.2**.

Table 9.2

Pre Mining Land Use Pattern

Sl. No.	Type			PB West & East (including u/g)	PB NW	Total of PB
1	Tenancy		Agricultural Habitation Grazing Barren	2721.48	186.52	2908.00
2	Govt Forest	Non	Agricultural Habitation Grazing Barren			
3	Forest		Forest	1488.52	298.48	1787.00
	Total			**4210.00**	**485.00**	**4695.00**

9.3 Land Use during mining and Post Mining:

Land Use During Mining

Actual excavation shall take place over 1982 ha which is 42% of total area of the project 29% of total project area shall be unutilized due to various reasons such as presence of hills and rationalization etc. Top soil dump is planned in flatter land over an area of 47 ha

Post Mining (End of Life) Land Use Pattern

Mining operations has an impact on the land use pattern In the proposed project the impact on the land is due to.

- Overburden removal and extraction of coal
- Dumping of overburden as well as Coal
- Construction of infrastructure and facilities such as workshop, office road etc. coal handling plant within and outside project area

Post mining the land use pattern shall be very different from pre mining land use pattern. Due to Mining, dumping, diversion of nallas/rivers and wter filled reservoirs aesthetic appearance of landform shall be changed.

Even after maximization of in pit dumping void shall remain over 668 ha and backfilled area consisting of hillocks shall be over 1294 ha of area. Various buildings, coal handling plants, sub stations & other statutory facilities shall be occupying around 291 ha and

9.4 Post Closure Land Use Pattern

Although progressive mine closure activities shall be carried out during various stages of mining operations. Final mine closure activities shall commence from 52nd year of mining operations and shall continue upto 55th year. Mine shall be closed as per Mine Closure Plan. Overall land use Pattern is given in **Table 9.3.**

Table 9.3
Overall land use Pattern

Area in Ha

Pre Mining Land Use "Ha"		Land Use "Ha"									
				Post Closure							
Type	Ha	Type	During Mining	End of Life	Agricultural	Plantation	Water Body	Public Use	Forest Land (Returned)	Undisturbed	Total
[illegible]	[illegible]										
[illegible]	[illegible]	Excavation Area	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		Backfilled Area	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		Safety Zone	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		Haul Road									
[illegible]		[illegible]	[illegible]					[illegible]		[illegible]	
[illegible]		[illegible]	[illegible]					[illegible]			[illegible]
[illegible]	[illegible]	[illegible]									
[illegible]		[illegible]	[illegible]	[illegible]					[illegible]		
[illegible]		[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]		[illegible]									
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]		[illegible]									
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]							

[illegible]									
Green Belt									
Water Reservoir									
Near-all									
[illegible]									
Construction/Mining Right for LG									
Revenue Land									
Agricultural Land									
[illegible]	4575.00	3595.00	[illegible]	1772.00	700.00	159.00	[illegible]	[illegible]	

* Within excavation area

9.5 Land Restoration

Efforts will be made to restore the land to the original land use to the extent possible. Post closure land use will serve following purposes

1. Voids shall be made safer by erection of fencing and development of Ghats. This shall also be a source of water for nearby locality and a picnic spots for use of general public.

2. Water from the voids shall be used for irrigation, watering the forest at early stage which is expected to attract avifauna.

3. As per present plan the depth of the void is 280 m (approx.). As per the direction of MoEF, if necessary, post mining, depth of the void shall be reduced to the recommended level.

4. Industrial, residential and other buildings used for the purpose of project will be handed over to the state government.

5. The civil or mechanical installations prejudicial to the safety of the general public will be dismantled or suitably disposed or transferred to other locations as deemed fit by NTPC

6. Roads will be thrown open for public use under the observation of state/local government

7. Agricultural land shall be developed over 713 ha land and handed over to the state/local government at their disposal.

8. Substantially thick plantations will be developed in the identified areas to improve aesthetic look of the surroundings.

9. Overburden dump both external & interna will be planted and afforested with the local varieties of trees in consultation with Forest Department Government. Backfill Percentage = 65.28% Plantation Area = 1772 ha

Year wise land restoration Plan is given in **Table -9.4**.

Table -9.4
Year wise land restoration Plan

Area in Ha

Stage	Cumulative area(Ha)							Cumulative Plantation area(Ha)				Agriculture/ Grazing land	Total
	Excavation	Backfilling	Void	Topsoil dump	Ext. dump	Others	Total	Backfill	Dump	Green area	Infrastructure		
Y1	57.18	0.00	57.18	26.25	84.30	4577.27	4645.00	0.00	0.00				0.00
Y3	141.98	0.00	141.98	30.00	171.98	4523.79	4695.00	0.00	19.00				19.00
Y5	292.59	0.00	292.59	47.13	361.67	4033.67	4695.00	0.00	83.00	15.00			83.00
Y10	750.13	289.76	460.38	25.18	316.61	3603.07	4605.00	0.00	260.00	10.00			260.00
Y20	1275.34	512.34	513.00	25.18	911.67	3783.41	4695.00	57.00	456.00	15.00			523.00
Y30	1541.81	608.39	933.42	0.00	915.54	2239.65	4695.00	311.00	669.00	20.00			980.00
Y40	2120.00	1192.00	743.00	0.00	885.00	1875.00	4695.00	524.00	885.00	58.00	124.00	663.00	2074.00
Y52	2512.00	1294.00	688.00	0.00	885.00	1828.00	4695.00	581.00	885.00	48.00	258.00	48.00	2485.00

CHAPTER X

ENVIRONMENT MANAGEMENT PLAN

CHAPTER X

ENVIRONMENTAL MANAGEMENT PLAN

10.1 General

Pakri Barwadih Mine is designed to produce 18 MTPA of coal for the estimated life of 52 years which may have potential to release harmful substances into the soil, air, and water. The environmental impact of Pakri Barwadih mining includes erosion, formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater, surface water by chemicals from mining processes. Besides creating environmental damage, the contamination resulting from leakage of chemicals may also affect the health of the local population. NTPC is required to follow environmental conditions mandated by EC and rehabilitation and resettlement standards as per R&R plan.

Erosion of exposed hillsides, mine dumps, tailings dams and resultant siltation of drainages, creeks and rivers can significantly impact the surrounding areas. It may also cause destruction and disturbance of ecosystems and habitats and in areas of farming it may disturb or destroy procuctive grazing and croplands. It may also may produce noise pollution, dust pollution and visual pollution.

To maintain ecological balance and to check / mitigate harmful effects due to mining and allied activities at Pakri-Barwadih Mine environmental control measures have been integrated into the process of mine planning. Many of the areas of environmental management planning require multidisciplinary approach.

The changes warranted as per site specific conditions are to be accounted for, during actual implementation. Further, in the light of experience likely to be gained during the initial years of operation, proposed schemes shall be periodically modified/ updated. Physical, chemical, biological and socio-economic control measures shall be taken in various areas to implement most effective environment control throughout the life of mining operation.

10.2 Environmental Clearance

Ministry of Environment, Forest and Climate Change, vide letter no. No J-11015/692/2007-IA.II(M), dated 19th May 2009 accorded EC for Pakri Barwadih Coal Mine Project for a production capacity of 15 MTPA in a total lease area of

3319.42 ha, which consists of Phase-I of 39 years of operation and comprises of opencast operations only. Copy of EC is placed at **Annexure-XII**.

The present mining plan is envisaged for rated production of 18 MTPA for the life of 52 years and includes PB NW quarry additional area also. Thus present mining plan is at a variance with the EC.

It is recommended to seek EC for PB NW Quarry for rated production of 3 MTPA

Further Baseline Environmental Data have not yet generated for PB NW area, the available Baseline Environmental Data as per study of PB West and PB East Quarry, shall be used to assess the environmental impacts for PB NW Quarry and accordingly checks/mitigative environmental measures are suggested.

10.3 Baseline status of Environment

Different element of environment namely land, water, air and ambient noise status of the area was studied in winter, 2005-06 (supplemented with data from June, 2006). All attempts have been made to gather the available data on the present environment in the study area which is the area within 10 km radius of the proposed mine site

10.3.1 Existing Land Use pattern

Existing (pre-mining) land use in lease area is given in Chapter-9 "Land Requirement" is reproduced below.

		Forest	Non-Forest		
			Govt.	Private	Total
1.0	**Within the block**				
1.1	***Opencast Area***				
1.1.1	Excavation & Dump Area				**2866.0**
1.1.2	Infrastructure & undisturbed				**635.0**
	Sub-total(1.1)	1252.44	275.24	1973.31	**3501.0**
1.2	Underground	89.88	81.54	399.38	**570.8**
1.3	Unutilized Area	357.08			**357.08**
	Sub-total(1.0)	1699.4	356.78	2372.69	**4428.9**
2.0	Outside Block (External Dump, Coal Evacuation	87.6	31.02	147.46	**266.08**

		Forest	Non-Forest		
1.0	Within the block		Govt.	Private	Total
	Corridor, Railway Siding, Mine Infra)				
	Grand-total	1787	388	2520	4695

10.3.2 Soil Quality

To assess the quality of soil in and around the mining area, soil samples were collected from eight locations during June, 2005 (before the onset of monsoons) as well as during November, 2005 for physicochemical analysis. **Table 10.1** lists the soil sampling locations.

Table 10.1

List of Soil Sampling Locations

Sample No.	Location	Type of Land
S1	Village Pakri-Barwadih	Forest Land
S2	Village Chiradhi	Forest Land
S3	Village Chepakhurd	Agricultural Land
S4	Horam	Agricultural Land
S5	Barkagaon	Fallow Land
S6	Kanrtari	Sediment From Haharo river
S7	Mahugain Khurd	Fallow Land
S8	Kandaber	Agricultural land

The results of analysis are given in Tables 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9, 10.10, and 10.11

Table 10.2

Physical Properties of Soil in June, 2005

Sample No.	Texture Analysis*			Type of Soil
S1	Sand: 6	Silt: 18	Clay: 76	Clay Loam
S2	Sand:8.5	Silt:12.8	Clay: 78.7	Clay Loam
S3	Sand: 12.5	Silt: 62.5	Clay:25	Silt Loam
S4	Sand: 9.4	Silt: 37.5	Clay:53.1	Clay Loam
S5	Sand: 3.9	Silt: 21.6	Clay: 74.5	Clay Loam
S6	Sand: 6.1	Silt: 20.4	Clay: 73.5	Clay Loam
S7	Sand: 13.6	Silt: 17.8	Clay:68.6	Clay Loam
S8	Sand: 6.2	Silt: 8.8	Clay: 75	Clay Loam

* All values in %

Table 10.3

Physical Properties of Soil in November, 2005

Sample No.	Texture Analysis*			Type of Soil
S1	Sand: 7.9	Silt: 13.1	Clay: 79	Clay Loam
S2	Sand:8.5	Silt: 14	Clay: 74	Clay Loam
S3	Sand: 15	Silt: 15	Clay: 70	Silt Loam
S4	Sand: 16.7	Silt: 14.6	Clay: 68.7	Silty Clay Loam
S5	Sand: 14	Silt: 8	Clay: 78	Loamy Sand
S6	Sand: 16.3	Silt: 6.1	Clay: 77.6	Silt Loam
S7	Sand: 8.9	Silt: 31.3	Clay: 60	Sand
S8	Sand: 14.3	Silt: 9.5	Clay: 76.2	Sandy Loam

* All values in %

Table 10.4

Chemical Properties of Soil during June, 2005

Parameters	S1	S2	S3	S4	S5	S6	S7	S8
pH (1:5) at 25° C	6.85	6.86	6.64	6.52	6.85	7.8	6.3	7.01
Electrical Conductivity (1:5)in (µs/cm) at 25 ° C	89.06	79.95	70.71	97.78	342	132.7	182	158

Table 10.5

Chemical Properties of Soil during November, 2005

Parameters	S1	S2	S3	S4	S5	S6	S7	S8
pH (1:5) at 25 ° C	6.94	6.74	6.9	6.31	7.09	7.56	6.46	7.09
Electrical Conductivity (1:5) in (µs/cm) at 25 °C	138	141	149	93	103	147	167	119

Soil pH plays an important role in the availability of nutrients. Soil microbial activity is also dependent on pH. In the study area the soil pH is slightly acidic to slightly alkaline (6.30<pH<7.80 in summer; 6.31<pH<7.56 in winter).

Electrical conductivity (EC) is a measure of the soluble salts and ionic activity in the soil. In the collected soil samples the conductivity ranged from 70.7 to 158.01 µs/cm in summer and from 93 to 167 µs/cm in winter.

Table 10.6

Available NPK Contents in Soil in June, 2005

Parameters	S1	S2	S3	S4	S5	S6	S7	S8
Organic Carbon in % & Rating	0.21	0.33	0.33	0.76	0.7	1.11	1.08	0.17
	Low	Low	Low	High	Medium	High	High	Low
	245.86	215.13	282.74	364.16	357.5	276.6	461.78	208.98

Parameters	S1	S2	S3	S4	S5	S6	S7	S8
Available Nitrogen in g/ha & rating	Low	Low	Medium	Medium	Medium	Low	Medium	Low
Available	370.72	164.64	179.2	163.52	265.08	306.88	222.62	448
Potassium in kg/ha & Rating	High	Medium	Medium	Medium	Medium	High	Medium	High
Available	1.43	2.09	1.98	1.65	41.34	1.87	41.88	1.1
Phosphorous in kg/ha & rating	Low	Low	Low	Low	High	Low	High	Low

Rating based on.			
Available Nitrogen	<280 Low	280 560 -Medium	>560 - High
Organic carbon	<0.50- Low	0.5-0.75 - Medium	> 0.75 High
Available Phosphorus	<10 - Low	10 – 25 - Medium	>25 - High
Available Potassium	<120 - Low	120 - 280 -Medium	>280 – High

Table 10.7

Available NPK Contents in Soil in November, 2005

Parameters	S1	S2	S3	S4	S5	S6	S7	S8
Organic Carbon in % & Rating	0.35	0.25	0.46	0.63	0.75	0.96	0.24	0.38
	Low	Low	Low	Medium	Medium	High	Low	Low
Available Nitrogen in g/ha & rating	175.18	212.06	371.86	304.25	248.94	227.42	221.28	239.72
	Low	Low	Medium	Medium	Low	Low	Low	Low
Available	285.60	239.68	691.60	143.81	360.08	234.08	274.40	228.48
Potassium in kg/ha & Rating	High	Low	High	Low	High	Medium	Medium	Medium
Available	6.74	6.06	4.97	3.96	10.11	33.85	7.59	1.09
Phosphorous in kg/ha & rating	Low	Low	Low	Low	Medium	High	Low	Low

Rating based on:			
Available Nitrogen	<280 - Low	280- 560 -Medium	>560 - High
Organic carbon	<0.50- Low	0.5-0.75 - Medium	> 0.75 - High
Available Phosphorus	<10 - Low	10 – 25 - Medium	>25 - High
Available Potassium	<120 - Low	120 - 280 -Medium	>280 – High

Phosphorus and Nitrogen are limiting nutrients, especially phosphorus. During June, 2005, in the tested soil samples, availability of phosphorus is low except in S5 and S7, where it is high; available Nitrogen is low to medium, organic carbon content is low to high while potassium content is low to high. During November, 2005 except in S5 and S6 availability of phosphorus is low; available Nitrogen is low to medium; organic carbon content is low to high while potassium content is low to high.

Table 10.8

Exchangeable Soil Cations in June, 2005

Parameters	S1	S2	S3	S4	S5	S6	S7	S8
Calcium (meq/100gm)	20.91	22.81	64.64	18.24	18.24	45.62	9.6	26.61
	(74.7)	(74)	(68.4)	(61.7)	(70.5)	(67.5)	(67.5)	(67.5)
Magnesium (meq/100gm)	11.48	11.48	47.86	51.69	6.77	36.37	9.67	19.15
	(23.5)	(21.7)	(28.2)	(33.3)	(26.6)	(29)	(29)	(29)
Sodium (meq/100gm)	0.23	0.34	0.8	0.34	2.04	1.36	1.7	0.8
	(1.3)	(2.2)	(2.5)	(2.5)	(1.3)	(1.6)	(1.6)	(1.6)
Potassium (meq/100gm)	21.16	9.4	9.59	9.34	7.57	17.52	6.33	25.58
	(0.5)	(2.1)	(0.9)	(2.5)	(1.6)	(1.9)	(1.9)	(1.9)

Figures in ( ) gives the % contribution of the respective ions to base saturation

Table 10.9

Exchangeable Soil Cations in November, 2005.

Parameters	S1	S2	S3	S4	S5	S6	S7	S8
Calcium (meq/100gm)	70.70	82.80	60.60	68.68	70.70	76.75	58.58	45.45
	(56.1)	(56.8)	(50.3)	(49.8)	(52.1)	(52.3)	(55.2)	(55.7)
Magnesium (meq/100gm)	50.30	53.29	37.22	62.57	58.34	61.42	42.25	33.20
	(39.9)	(36.5)	(34.6)	(45.2)	(43.0)	(41.3)	(39.8)	(40.7)
Sodium (meq/100gm)	0.81	0.97	0.91	0.81	0.91	0.86	0.70	0.70
	(0.64)	(0.67)	(0.85)	(0.59)	(0.67)	(0.59)	(0.66)	(0.86)
Potassium (meq/100gm)	4.25	8.79	8.96	6.11	5.63	7.62	4.64	2.21
	(3.4)	(6.0)	(8.3)	(4.4)	(4.15)	(5.2)	(4.37)	(2.7)

Figures in ( ) gives the % contribution of the respective ions to base saturation.

The above results show that the tested soil samples have high proportions of calcium and magnesium whereas proportions of exchangeable sodium and potassium were low.

Table 10.10

Available Micronutrients in Soil in June, 2005

Parameters	S1	S2	S3	S4	S5	S6	S7	S8
Copper	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	0.041	0.060	0.042	0.032	<0.013	0.030	0.022	0.031
Iron	20	47.5	29.25	35.10	0.57	31.29	2.39	37.14

(Values in mg/kg).

Table 10.11

Available Micronutrients in Soil in November, 2005

Paramete	S1	S2	S3	S4	S5	S6	S7	S8
Copper	1.8	2.22	3.14	1.06	2.24	2.08	1.14	1.24
Zinc	6.88	24.73	11.42	8.44	8.38	9.26	5.94	7.48
Iron	20.70	31.50	32.99	24.30	23.60	22.90	15.70	15

(Values in mg/kg).

Soil micro-nutrients also play an important role in plant growth and can act as limiting nutrients. Soil micro-nutrient analysis can be employed as a diagnostic tool for predicting the possibility of deficiency of a nutrient and the profitability of its application. For this, it is essential to fix the critical limits. The critical limit of micro-nutrient in a soil is that content of extractable nutrient at or below which plantation practiced on it will produce a positive response to its application. The critical limits of copper, zinc and iron are 0.20-0.66 mg/kg, 0.50-0.65 mg/kg and 4.5-6.0 mg/kg respectively.

From the above Tables it can be seen that during June, 2005 in all the soil samples, micro-nutrient levels, other than that of iron, are very low; iron levels are very high. During November, 2005, availability of all the tested micro-nutrients was high in all the samples. Excessive micro-nutrients are detrimental to plant growth as excess of one more micro-nutrients adversely affects the uptake of other micro-nutrients. Excess of copper affects uptake of Molybdenum, another micro-nutrient. Excess of Zinc, Manganese and Copper affect Iron uptake. Excess Iron, Copper and Zinc affect Manganese uptake. Thus due to the antagonistic effect of some micro-nutrients, uptake of other nutrients is adversely affected which hampers plant growth i.e. the fertility of soils in the study area are low.

10.3.3 Quality of Air, Ambient Noise and Water

The existing quality of Air and Water are discussed in 11.4 and 11.3 respectively.

a. Ambient Noise Levels

In order to have an idea about the existing noise level of the study area, noise monitoring has been carried out at five locations listed in **Table 10.12**.

Table 10.12

Ambient Noise Monitoring Stations

Stn. No.	Location	Core Zone/ Buffer Zone	Distance & Direction (from Centre of proposed project)
N1	Pakri-Barwadih	Core	-
N2	Chepa Khurd	Core	-
N3	Pundaul	Buffer	.0 Km south-east of Core one
N4	Road, just outside lease area	Core	-
N5	Sirma	Core	-
N6	Kandaber	Buffer	.1 Km west of Core Zone
N7	Garrikalan	Buffer	.1 Km west of Core Zone
N8	Horam	Buffer	.0 Km south-east of Core one
N9	Sikri	Buffer	.0 Km south-west of Core one
N10	Kadmadih	Buffer	.1 Km south of Core zone

b. **Noise Monitoring Frequency**

Monitoring was carried out once during June, 2005. At each ambient noise monitoring station, Leq. Noise level has been recorded at hourly intervals for 24 hours continuously by operating the noise-recording instrument for fifteen (15) minutes during each hour. At work-zone noise monitoring stations, Leq. noise was recorded at hourly intervals for 8 hours continuously by operating the noise-recording instrument for fifteen (15) minutes during each hour.

c. **Results and Discussions**

The summarised results of ambient noise monitoring in June, 2005 are given in **Tables 10.13**. The results have been compared with the standard specified in Noise 2000 Standards in Environmental Protection Rules given in **Table 10.14**.

Table 10.13

Summarised Results of Noise Monitoring During June 2005

Stn. No.	Location	Results					
		Day (0600-2200 hr.)			Night (2200-0600 hr.)		
		Max	Min	Mean *	Max	Min	Mean *
N1	Pakri Barwadih	66	36	58.3	48	29	40.2
N2	Chepa Khurd	62	30	55.3	52	22	43.9
N3	Pundaul	67	35	59.8	45	26	37.3
N4	Road, just outside	69	40	62.9	44	28	39.1
N5	Sirma	52	30	49.7	28	24	27.9
N6	Kandaber	58	32	52.8	42	24	35.0
N7	Garrikalan	74	48	66.8	66	30	57.1
N8	Horam	68	41	60.8	46	30	40.8
N9	Sikri	54	37	50.8	38	23	31.4
N10	Kadmadih	58	34	54.2	44	25	36.0

* Logarithmic Averages
All Values in dB (A).

Table 10.14

Ambient Air Quality norms in respect of Noise

(As Per Schedule III, Rule 3 of Environment Protection Rules)

Type of Area	Day (0600 - 2200 hrs.)	Night (2200 – 0600 hrs.)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

All Values in dB (A)

All the noise monitoring stations are "Residential Areas". (There are no areas of the other types in the study area). During day time, the noise levels were high in some locations due to movement of traffic and village activities. At

night, the noise levels were mostly within the norms, except at one location (N7 – Garnkalan) because of operation of a DG Set in the village

10.4 Environmental Impact Assessment

An essential step in Environmental Impact Assessment (EIA) is to identify all potential environmental impacts (both beneficial and adverse). The identified impacts due to mining and associated activities have been studied in relation to the following areas:

10.4.1 Impact on land use

Existing (pre-mining) land use in lease area is given in "Land Requirement" Chapter-IX. Mining, dumping, road, built area etc. will change the existing land use pattern by degrading/utilizing forest and non-forest land. Plantation/utilization break-ups have been given in "Land Requirement" **Chapter-IX**.

10.4.2 Impact on water quality

Washing of coal has not been envisaged at present.

10.4.3 Impact on noise levels

The noise level in and around the mine may increase in future due to mechanized mining operation, blasting and operation of crusher However, the noise levels in and around the area is expected to be below 75 dB (A)

10.4.4 Impact on Air Environment

Mining operations such as excavation, loading and unloading, movement of dumpers on haul roads, back filling, crushing screening and also drilling and blasting are expected to generate airborne fugitive dusts. Emission of pollutants like nitrous fumes (Nox), Sulphur oxides (SOx), carbon monoxide (CO) etc. from diesel operated equipment will also have little contribution.

The ambient air quality of the area shows that the pollutants like SPM, SOx, Nox CO and dust fall are well within the specified tolerance limits. As such the air environment of the mine is not likely to be adversely affected during the five years period.

10.4.5 Vibration levels (due to blasting)

Blasting pattern has been designed to minimise the vibration levels. However, vibration levels will be studied once the blasting is done in the lease area

10.4.6 Impact on Water regime

The mining operation starting from western side of the coal block will affect Dumuhani Nallah and its tributary streams and streamlets joining it from northern part of the block. The Nallah flows in more or less NNE to SSW direction across the western part of the lease and finally joins the Haro Nadi outside the southern part of lease. Ground water level of the area varies from 25 to 35 m from the surface. The opencast mining below ground water level shall involve release of water in the order of 500 m^3/hr through pumping which will be discharged to the proposed garland nallah along north eastern boundary of lease. The drawl of this quantity of water is expected to be recharged through rains during monsoon which is 200-800 mm in monsoon and 100 – 200 mm in post & pre monsoon season. In addition water requirement of 526 m^3 /day for the domestic purposes shall also be met through bore wells. Industrial water requirement for drilling, spraying over road, washing of machinery etc. shall be met through creating a small reservoir on Dumuhani nallah at eastern boundary of the lease and drawl through pumping.

The active mining activity for the five years period does not encounter any stream/ nallah As such accumulation of surface water is not envisaged in any quarry even during rainy season. Suitable storm water drains will be made above the top bench to channelise the surface run-off during rainy season.

10.4.7 Impact on Socio-economics

Displacement of human settlement will be involved due to the proposed mining activities. Adequate settlement and rehabilitation schemes will be implemented as per the guidelines of State/Central Govt. Mining activities will have a positive effect on the socio-economic condition of the people nearby, as it is a steady source of income for them. With the continuation of mining operation

employment opportunities, communication, medical facilities, schooling etc will be improved further.

10.4.8 Historical Monuments

There is no historical monument in and around the mining lease boundary other than a Megalith Structure at PB East Quarry. As directed by MoEF 500m radius is left for its preservation. No coal shall be mined beneath the influence zone.

10.5 Environment Management

10.5.1. Year-wise program for reclamation of affected land

As per the year wise excavation programme envisaged in the mining plan, the mine benches will remain active till the end of first five years of operation. Accordingly, the reclamation of mined out area will not be possible during first five years. However, the back filling of mined out area will start after 6th year of mine operation in western pit. Once the internal dumping in the mined out area starts, limited quantity will be dumped at the external dump. Mining benches will be filled upto 450 mRL in the western pit of the Block and subsequently raised to 540 mRL. Yearly coverage of reclamation areas are given below in **Table 10.15**.

Table 10.15

Yearly Details of reclamation of land

Stage	Reclamation Area (Ha)
1st year Stage	-
3rd year Stage	19
5th year Stage	64
10th year Stage	177
20th year Stage	389

Stage	Reclamation Area (Ha)
30th year Stage	557
40th year Stage	617
Final Stage	334

10.5.2. Afforestation Programme

During first four years period of mine planning a total of 487 Ha (in non-forest) of land will be broken in western part of the Block both for Mining and Dumping. To compensate for the above, plantation over 100 ha area will be undertaken during first 5 Years as per the following plantation schedule.

Table 10.16

Year	Area to be covered (ha)	Number of trees to be planted (@ 1250 saplings/ha), 75 % survival rate
First year	15	18750 (all around the lease boundary, along the access road, facilities)
Second year	20	25000 (Along the access road, outside the dump area and compensate the plant died)
Third year	20	25000 (On the external dump/mine periphery & along road)
Fourth Year	20	25000 (On the external dump/mine periphery & along road)
Fifth Year	25	31250 (On the external dump/mine periphery & along road)

10.5.3. Stabilization, vegetation and management of dumps

The quantities of OB, Parting (Excluding of Topsoil) to be dumped during first five years for West & East Quarry have been estimated at 99.47 Mm^3.The external waste dump will be stabilized by terracing the slopes. Plantation will be

carried out over the stabilized external dump to increase the stability of dump & also to make the surroundings more eco-friendly. Only local species will be planted under the gurdance of state forest department

A 1.5 m high barrier wall will be erected along the outer edge of external dump at a distance of 15 m form dump toe to arrest the rolling stones down the dump edge. A drainage channel will be dug inside the wall to channelize the rain water falling over the dump area. The channel will be cleaned periodically particularly before the onset of monsoon. Dozer has been envisaged for terracing of dump slopes as well as maintaining the drainage. The details of year wise stabilization and vegetation of dumps is given in **Table 10.17.**

Table 10.17

Yearly stabilization and vegetation of dump

Year	Dump Stabilization & Vegetation (Ha)
First Year Stage	-
3rd year Stage	19
5th year Stage	64
10th year Stage	177
20th year Stage	389
30th year Stage	557
40th year Stage	617
Final Stage	334

10.5.4. Measures to control erosion/sedimentation of water courses

Continuous monitoring will be done to remove overburden material and loose sediments from the working mine benches and excavation zone to avoid rolling of the same into the water course and thereby prevent the erosion and sedimentation. Retention wall will be constructed around the dump to prevent rolling down of loose sediments. Settling pits will be constructed at appropriate

locations along the water channels to arrest sediments and clean water will be allowed to flow into natural water course.

10.5.5. Treatment and disposal of water from mine

The water inside the mine pit is expected from the rain water during rainy season. Entire precipitation over the pit will be channelised systematically into natural drainage. In order to ensure the discharge of clean water into the natural drainage, sedimentation ponds will be made at suitable location to arrest the sludge. Accumulated sludge will be scraped off time to time to maintain the proper mine water discharge. In order to monitor and subsequent management of water quality, monitoring stations will be located near settling pit. Effluent treatment plant is envisaged for treatment of water discharge from workshop as well as domestic waste.

10.5.6. Management of air quality

In the proposed lease area, the existing air quality is within the norms as specified by the National Ambient Air Quality Standards (NAAQS). Fugitive dust shall be generated in open cast mine due to drilling, blasting, handling of overburden & coal. To control dust from various operations following measures will be resorted to.

- Drilling area will be wetted prior to drilling
- Water will be sprayed during loading/unloading of OB and ore
- Periodical water spraying will be done on haul road, overburden dump & stacks of coal
- Trees will be planted on road side.
- Dumps will be stabilised by planting grass/trees

It has been proposed that all mining and ore processing equipment will have dust extraction and separation attachment to minimise air pollution. In order to monitor and subsequent management of air quality, monitoring stations will be located near dust generating areas such as haul road, OB dump, coal handling plant etc.

10.5.7. Protective measures for ground vibration/air blast caused by blasting

Loosening of rock mass will be done by the blasting of 10 to 15 m deep and 160/250 mm diameter blast holes. Burden and spacing have been proposed as 4.5 m and 5.0 m respectively. Milli-second delay detonators have been envisaged to minimise the ground vibration. Use of non-electric detonators will be used wherever required Blast vibration studies will be conducted to optimise the burden & spacing and explosive requirement so as to minimise the vibration effect due to the blasting.

Blasting will be carried out in a periodical manner so as to minimize the impact on the local habitants and the faunal species

10.5.8. Measures for protecting historical monuments and for rehabilitation of human settlements

Historical monuments do not exist within 5 km radius of the proposed ML area. Adequate scheme for rehabilitation for human settlement within the leasehold area, will be implemented in line with the policies of Central/State Govt.

10.5.9. Socio-economic benefits arising out of mining

The activities involved in mining and subsequent preparation of coal at proposed leasehold area will generate employment potential both directly or indirectly. As the proposed mining and transportation has been envisaged through contractual means. through Mine Developer & Operator (MDO), local

people will have employment opportunities as skilled, semi-skilled and unskilled labourers in mining, transportation and allied activities. Thus there will be overall improvement in the socio-economic status of the people of the surrounding areas. Mining activities will have a positive effect on the socio-economic condition of the people nearby, as it is a steady source of income for them. With the continuation of mining operation employment opportunities, communication, medical facilities, schooling etc will be improved further

10.5.10. Monitoring schedules for different environmental components right from the commencement of mining and other related activities

The environmental staff will make and conduct routine field monitoring and inspections and interact closely with operations personnel. The necessary planning of environmental field activities such as topsoil removal, storage and replacement will be performed by the environmental staff.

Environmental monitoring and reporting will be conducted to provide a close supervision on the surrounding natural environment and provide early warnings of any adverse changes that may be related to some dimension of the mining and allied operations. The activity can be categorised into routine tasks.
In order to carry out routine tasks in a systematic manner. Environmental group will practice the following:

- Plan a site-based strategy to control pollution. The strategy should include formulation of code of actions for controlling air, water, noise, soil pollution, managing blasting effects, phase wise afforestation scheme and actions to be taken in respect of socio economic development. Frequency of monitoring/ sampling and inspection of various parameters / factors will also be planned.
- Oversee environmental control measures are implemented as per approved action plan
- Plan conservation programmes in respect of water and energy.

- Identify and record the constraints in respect of environmental planning and implementation
- Systematically document all the field monitoring and laboratory analysis results. Analyse the monitoring results and inspection findings. The results can be compared with various standards/ Norms. Prepare periodic progress reports, which will include the analysis and inspection results. Environmental audit results and actions taken should also be systematically documented.

Monitoring and compliance shall be done as per Environmental, Forest and other statutory clearances accorded for the project. However, tentative monitoring schedules are provided in **Table 10.18**.

Table 10.18

Monitoring Schedule

Sl. No.	Description of Parameters	Schedule and Duration of Monitoring
1	Slope Failure	Bi-Weekly
2	Land Erosion	Weekly
3	Drainage	Daily
4	Blasting effect	As per mine workings and blasting
5	Re-vegetation and Green belt development	Yearly
6	Monitor Plantation Measures	Yearly
7	Surface Subsidence	Bi-Weekly
8	Water Quality Monitoring(Ground & Surface)	
	Water quality of Surface and ground water around the site (All parameters specified by JSPCB)	Monthly
9	Emissions and Air Quality (RPM,SO_2 NO_x,CO)	24 hourly samples with analysis carried out

Sl. No.	Description of Parameters	Schedule and Duration of Monitoring
		monthly all-round the year.
10	Meteorological Station	Continuous
11	Air Quality	Continuous
12	Noise Quality	Continuous
11	Occupational Health	Bi-Weekly

10.6 ENVIRONMENT MANAGEMENT OF PAKRI BARWADIH NORTH WEST (SECTOR-A) QUARRY

Environmental Clearance for Pakri Barwadih Project (covering Western and Eastern Part of the Block) was accorded by MoEF on 19.05.2009 for rated production of 15 MTPA. At that time the North Western (Sector-A) part of this block was unexplored. Subsequent to detailed exploration, NTPC submitted Mining Plan which could not be presented to MoC. In compliance to the MoC letter no- 13013/29/2003- CA-I dated 09.10.2014 NTPC is submitting Mining Plan of Pakri Barwadih (Rev.1) for consideration of. MoC. Base line environmental data is unavailable for this part of the block.

In the present Pakri Bawadih West & East and Pakri Barwadih NW are integrated as a result this mine shall be producing 18 MTPA. As the clearance is already obtained for 15 MTPA. NTPC shall conduct EIA/EMP for PB-NW part and submit proposal to MoEF & CC for consideration.

The environmental management plan shall include the evaluation of impacts of carrying out mining activities, mitigation of environmental pollution and monitoring of environmental parameters such as land, water, air etc.

Environmental mitigation measures and monitoring and control of environmental parameters shall be carried out in line with that proposed for Pakri Barwadih West and East Quarry.

Salient features of the PB NW Quarry (sector-A) for planning the study are briefly given in **Table 10.19**

Table 10.19

Salient Features of PB NW (Sector-A) Quarry

a)	Applied Lease area	485 ha (Equal to Block area)
b)	Core Zone	485 ha Block area
c)	Nature of land	Habitated land, Agricultural land, waste land, Forest land and Water bodies
d)	Mineral to be mined	Coal
e)	Scale of operation	The capacity of proposed mine is 3.00 million tonnes per annum (Mtpa)
f)	Anticipated life of mine	38 years (excluding two years of construction period)
g)	Method of mining	Opencast
h)	Surface transport	By trucks and CHP within the ML, by combination of road, CHP and railways from pit head to the thermal power plant

10.6.1 SOCIO ECONOMIC STUDY

Socio Economic Survey Study is under process and the findings of the study will be incorporated after finalization of SES report.

10.6.2 EXISTING LAND USE PATTERN

Mining, dumping, road, built area etc. will change the existing land use pattern by degrading/utilizing forest and non-forest land. Post mining land use pattern is given in **Chapter-IX**.

CHAPTER XI

PROGRESSIVE AND FINAL MINE CLOSURE PLAN

CHAPTER-XI
MINE CLOSURE PLAN

11.1 Introduction on Mine Closure Plan

The present Mine Closure Plan is prepared for 4695 Ha, which includes PB West, PB East and PB North West Quarries. This Mine Closure Plan covers extraction area, external OB dump area, facilities, diversion/realignment of nallah & road, colony and coal evacuation through cross country conveyor

Mine Closure Plan based on the Approved Mining Plan has already been approved by MoC as separate document vide letter No. 34011/09/2011-CPAM dated 20.04.2012 (Copy of approval letter is placed as **Annexure-XIII**).

The Mine Closure Plan is integrated with present Mining Plan of Pakri Barwadih Mining Plan (1st Revision). Mine Closure Plan consists of two parts namely "Progressive Mine Closure Plan" and "Final Mine Closure Plan". Final Mine Closure Plan shall be prepared five years before closure of mine. Present Progressive Mine Closure Plan is in line with the MoC guidelines issued in this regard includes all aspects covered in approved Mine Closure Plan.

11.1.1 Reasons for Closure

Mine shall be closed either

- after exhaustion of coal reserves or,
- by any order of government or,
- by any violation of statutory obligation or,
- any other unforeseen reason

11.1.2 Statutory Obligations

All applicable statutory rules, regulations, bye-laws etc. and statutory requirement related to Government Licenses, workers' compensation, insurance, etc. including Minimum Wage Act for the workers employed by the outside agencies shall be adhered to. Following statutory rules, regulations, bye-laws etc. shall be adhered to:

a. Coal Mines Regulation 1957
b. Mines Act 1952
c. Mines Rules 1966
d. Vocational Training Rules 1966
e. Indian Electricity Rules 1956
f. DGMS circulars from 1948 (up-to-date)
g. Factories Act1948 (as applicable to mines)
h. Explosive Act and Rules
i Conditions attached to statutory permissions and exemptions granted by DGMS to Mines of CIL.
j Recommendations of National Safety Conferences. Tripartite Safety Review
k. Special guidelines issued by DGMS following accident enquiries etc
l. ILO code of Safety and Health and in open cast Mines (1991).

Special conditions imposed while execution of lease deed, approval of Mining Plan, directive issued by the Ministry of Coal, conditions imposed by the MoEF, State Pollution Control Board or by any other statutory organizations shall be followed. All conditions stipulated in the Approved Mining Plan, Environmental clearance, Forest clearance and other future clearances shall be complied List of clearance along with their status is given in **Table 11.1**

Table 11.1

LIST OF CLEARANCES FOR PB EAST, WEST and NORTH WEST QUARRY

Sl. No.	Clearances	Status for PB West & East Quarry	Status for NW Quarry
1.	Approval of Mining Plan by MoC	Approved	Not Approved
2.	Revised Mining Plan (1st Revision) and Mine Closure Plan	Under approval	Integrated with PB West and East as one mine mine

3.	Public Hearing conducted by SPCB	Completed	Not done
4.	Environment clearance by MoEF	Obtained	Not Available
5.	Forest clearance by MOEF(Stage I and Stage II)	Obtained	In Process
6.	Permission for Diversion of Nalla passing through West Quarry of PB from Govt. of Jharkhand	Obtained	Not Available
7.	Permission for Withdrawal of Ground Water from CGWA	Obtained	In Process
8.	Land Acquisition / surface rights - State Govt /Govt. of India	In Process (Section 11 under CBA Act has been notified)	In Process
9.	Clearance for use of explosives and construction of magazine	In Process	Integrated with PB WE as one mine mine
10.	Permission for opening of coal mine from DGMS	Obtained	In Process

11.1.3 CLOSURE PLAN PREPARATION

Conceptual Final Mine Closure Plan has been prepared. However, Final

Mine Closure plan shall be prepared 5 years before the likely cessation of mining operations shall continue for 3 years after likely cessation of mining operations and will have the approval of the Board of Directors.

11.2 MINE DESCRIPTION

The entire coal block has been considered for opencast mining in the interest of conservation of reserves and techno economic considerations.

The minimum workable in-band thickness of seam for opencast mining has been taken as 1.00 m. In case of opencast potentiality, a seam has been considered as splitted if the parting between the two sections has attained a thickness of more than 1.00 m and is persistent.

During the course of mining operations, Khora, Dumuhani and Hardara Nala will need to be diverted at different stages of mining operations to ensure safety of mine workings as also for releasing the coal reserves which otherwise would be lost in the safety barriers required to be left against this water channel. Care would also be necessary to provide suitable garland drains as well as embankment along diverted nala route to avoid any inundation of opencast mine workings.

11.2.1 Mine Boundaries

It is proposed to mine maximum area leaving a barrier of 7.5 m on surface from block boundary which is a statutory requirement. The boundaries of PB West & East Quarry PB-NW Quarry are delineated and given in Table-11.2

Mine parameters for the delineated mine boundaries are shown below:

Table 11.2

Boundaries up to 300 m depth line

Particulars	WEST QUARRY				EAST QUARRY	NORTH WEST QUARRY	
	WP -1	WP -2	WP -3	WP -4		PIT-1	PIT-2
North West Boundary	Incrop of seam I	Incrop of seam I	Incrop of seam I	Incrop of seam I	Incrop of seam I	In-crop of A -1 seam Quarry surface has been projected at 45° on the surface, with respect to the quarry floor.	In-crop of A -1 seam Quarry surface has been projected at 45° on the surface with respect to the quarry floor.
West Boundary	Khora nala and Incrop of	Khora nala and Incrop of	Arbitrary line	Khora nala		20 m from the Khora – B Nala	20 m from the Khora – B Nala.

	seam	seam I					
East Boundary	F, & Incrop of seam I	F, F,	F,	F,	F, F, F, F,	60 m from the Khora A Nala	60 m from the Khora Nala A
South-East Boundary	F,	F, & F,	F, and FRL of 300 Seam II	300 m depth incr FRL of 120 m Seam II	300 m depth & FRL of 120 m of Seam I	Quarry surface has been projected at 45° on the surface as well as on the confluence of Khora Nala A & B	Quarry surface has been projected at 45° on the surface as well as on the confluence of Khora Nala A & B

Note: 7.5m space width is left from the outer boundary of PB NW quarry

Some major system parameters are given in **Table 11.3**

Table-11.3

System Parameters

Sl. No.	Particulars	PB-West & East	PB -NW
1.	Maximum Bench Height		
	Top OB	15m	15m
	Coal and Intervening parting	5 - 15m	5 - 15m
2	Proposed minimum Bench Width		
	Working Bench	50m	40m
	Non-Working Bench Width	25m	25m
3.	Width of the permanent haul road	30m	25m
4.	Width of the temporary transport ramp	10m	10m
5	Usual height of the spoil dump bench (1Tier)	30m	30m
6.	Width of the active dump bench	30m	30m
7.	Bench Slope		
	OB Bench	70°	70°
	Coal Bench		70°
	Dump bench	37°	37°
	Overall (Ultimate) pit slope	37° (300 m depth)	43° (155 m depth)

11.2.2 Geology

The Pakri-Barwadih block (East & West Quarry) comprises of Talchir, Karharbari, Barakar, Barren Measures and Raniganj Formations belonging to Damudas, a Sub-Group of Lower Gondwana.Talchir Formation rest directly over the Pre-Cambrains. The Karharbaris and Barkars are the main coal bearing formations in the block. Stratigraphic succession of the formations in the PB West & East and PB NW is given in the following **Table-11.4 A**.

Table-11.4 A

Stratigraphic Sequence of Pakri-Barwadih Block

Period	Group	Sub-group	Formation	Thickness Range	Lithology
Recent	Lower Gondwana	Damuda	Alluvium	3.50 – 25.85	Detrital and Alluvial soil & subsoil
Upper Permian			Raniganj	1.50 – 324.50	Fine to medium grained micaceous sandstone, interbanded shale and sandstone, Carbonaceous shale & thin uneconomic Coal seams.
Upper Permian			Barren Measures	5.14 – 353.00	Dark shale, sandy shale & interbanded shale & sandstone.

			Barakar	12.50 - 268.85	Fine to coarse grained sandstone, Shale, Conglomerate. Carbonaceous shale & Coal seams
			Karharbari	10.00 – 81.60	Medium to coarse grained sandstone, Shale, silicified quartzite rock & thin coal seams.
Permo Carboniferous	--	--	Talcher	0.80 – 13.50	Green coloured shale, Boulder & Congolomerate
Unconformity					
Pre-Cambrian	--	--	Metamorphics	--	Granite, Gneisses & Quartizites

There are a few small outliers of Barakar/ Karharbari/ Talchir Formations occurring over the Pre-Cambrian Basements immediately north of the Pakri-Barwadih Block.

However, in PB North West (sector-A) area small exposures of sand stone and coal seam are found near the bank of Khora Nala in the western margin of the block. At places Karharbari Formation also rest directly over metamorphic. The geological succession established in the PB North West area (sector-A) of the block from sub-surface exploration data is given in Table **11.4 B.**

Table-11.4 B

STRATIGRAPHIC SUCCESSION OF PB NW (SECTOR-A) AREA OF COAL BLOCK

Period	Group	Sub-Group	Formation (Thickness)	Lithology
Recent & Sub-Recent			Alluvium (3.00 to 23.00m)	Soil & Sub-soil
----------Unconformity----------				
Middle Permian			Barren Measure (44.00 – 138.70m)	Predominantly shale with intercalation of sandstone and shale and arenaceous shale
Lower Permian	Lower Gondwana	amuda	Barakar (19.07m – 137.10m)	Fine to coarse grained sand-stones shale, carbonaceous shale and coal seams.
			Karharbari (5.14m to 91.52m)	Fine to coarse grained sandstone with bands of shale and coal seams
Permo - Carboniferous			Talchir 0.65m to 4.64m)	Green coloured shale, boulders and conglomerates
----------Unconformity----------				
Precambrian			Metamorphics (2.80-11.00m)	Gniesses, granites and quartzites

As per the geological report, no major, minor and trace elemental analysis of different rock types was available. The chemical analysis of coal indicates presence of nontoxic minerals. The sandstones of Barakar Formation constitute major part of area forms a principal aquifer. The chemical analysis of ground water shows the trace element like Cu, Mn, Hg, Cd, Se, As, Pb, Zn, Cr, Al and B are present below deduction limit

The ground water quality indirectly infers the source rocks characters hence, the rock of Pakri-Barwadih Coal block contains no toxic elements.

11.2.3 Reserves

As per United Nations Framework Classification (UNFC) the geological reserves of Pakri-Barwadih (East & West Quarry) can be classified as given in **Table 11.5.**

Table 11.5

Summary of Coal Reserve in Million tonnes

UNFC Code	Type	Net Coal Reserves
111	Proved Reserves	703
211	Feasibility Mineral Reserves	636
222	Indicated Mineral Reserves	733
	Total(111+222)	**1436**

A total of 137.584 million tonnes of coal reserves has been established in Pakri Barwadih North West (Sector-A) Coal Block, out of which 134.470 m.t falls in proved category and 3.114 m.t in 'Indicated Category'. Category wise Geological Reserve of PB North West Quarry is given in **Table 11.6**

Table 11.6

Category wise Geological Reserve of PB North West Quarry

Property	Reserves in Million Tonnes		
	Category		Total
	Proved	Indicated	Total
Opencast	106.283	0.425	106.688
Underground	28.207	2.689	30.896
Total	**134.470**	**3.114**	**137.584**

The seam wise, grade wise and depth wise geological reserves have been provided in Geology chapter.

Net opencastable reserves of Pakri Barwadih is 808.23 Mt. barrier loss and batter loss worked out as 58.74 Mt and 106.22 Mt. Taking into account of mining losses of 20.72 Mt extractable reserves worked out as 642.34 Mt. Percentage of extraction by opencast mine is 78%. Net reserves and extractable reserves along with losses are given in **Table -11.7**.

Table -11.7

Net reserves and extractable reserves and losses

Seam	Net Reserve	Barrier Loss	Batter Loss	Mineable Reserves	Mining Loss	Extractable Reserve	% Extraction
	In Mt						
V Top	22.29	0.72	1.57	19.99	0.59	19.40	87.06
V Bottom	15.55	0.51	1.10	13.96	0.41	13.55	87.06
V Combined	11.57	0.21	0.49	10.87	0.44	10.43	90.16
Seam - V	**49.42**	**1.44**	**3.16**	**44.82**	**1.44**	**43.38**	**87.78**
IV Top	19.82	0.64	2.23	16.95	0.50	16.46	83.01
IV Bottom	9.92	0.32	1.12	8.48	0.25	8.23	83.01
IV Combined	92.32	3.15	10.68	78.49	2.43	76.06	82.39
Seam - IV	**122.06**	**4.10**	**14.03**	**103.93**	**3.18**	**100.75**	**82.54**
III Top	27.45	1.21	2.04	24.20	0.70	23.49	85.59
III Bottom	9.83	0.43	0.73	8.66	0.25	8.41	85.59
III Combined	4.80	0.21	0.36	4.23	0.12	4.11	85.59

Seam	Net Reserve	Barrier Loss	Batter Loss	Mineable Reserves	Mining Loss	Extractable Reserve	% Extraction
	In Mt						
Seam - III	**42.08**	**1.85**	**3.13**	**37.10**	**1.08**	**36.02**	**85.59**
II Top	59.98	4.66	6.21	49.11	1.89	47.22	78.72
II Middle	139.75	11.83	11.24	116.68	3.83	112.86	80.75
II TM	76.09	7.28	5.63	63.18	1.77	61.40	80.70
II Bottom	116.06	10.76	9.90	95.39	2.89	92.50	79.71
II MB	17.90	1.71	1.32	14.86	0.42	14.44	80.70
II Combined	7.35	0.70	0.54	6.11	0.17	5.94	80.70
Seam- II	**417.13**	**36.95**	**34.85**	**345.33**	**10.97**	**334.36**	**80.16**
I Top	36.93	2.72	9.39	24.81	0.77	24.05	65.11
I Middle	72.97	5.27	18.20	49.49	1.66	47.84	65.56
I TM	2.51	0.23	0.79	1.49	0.04	1.45	57.80
I Bottom	35.60	2.52	8.69	24.39	0.52	23.87	67.06
I MB	14.85	1.35	4.67	8.83	0.24	8.58	57.80
I Combined	3.58	0.33	1.13	2.13	0.06	2.07	57.80
Seam- I	**166.44**	**12.42**	**42.88**	**111.14**	**3.28**	**107.86**	**64.81**
LL	2.60	0.10	0.35	2.15	0.11	2.04	78.62
K5	0.13	0.01	0.06	0.06	0.01	0.05	36.32
K4	4.21	0.13	1.11	2.97	0.11	2.86	67.83
K3	3.34	0.22	0.86	2.26	0.06	2.20	65.95
K2	5.38	0.27	1.14	3.97	0.07	3.90	72.40

Seam	Net Reserve	Barrier Loss	Batter Loss	Mineable Reserves	Mining Loss	Extractable Reserve	% Extraction
				In Mt			
K1	15.24	1.25	4.65	9.34	0.41	8.93	58.62
Seam-Local	30.90	1.98	8.17	20.75	0.77	19.98	64.66
Total	828.03	58.74	106.22	663.07	20.72	642.34	77.58

11.2.4 Mining Method

Opencast mining method for the targeted reserves has been adopted due to following reasons

a. The coal seams are in cropping at a shallow depth;
b. The OB . Coal ratio is favorable (3.15 : 1) for opencast mining;
c. Higher percentage of recovery as compared to underground system.
d. The mining by opencast method shall be economical against underground method
e. The opencast mining operations are comparatively safer and ensure higher recovery of coal resource.

Shovel & dumper combination is recommended for this block to mine the coal due to following reasons:

i. In view of multiple seams and equal nos. of inter burden layers to be tackled, an equipment system which is capable of dealing many layers at a time (flexibility) of operations with the help of smaller units has been recommended as shovel dumper combination.

ii. The quality problem can be handled with the help of hydraulic excavators, which have three-dimensional movement of bucket They are capable of carrying out selective mining.

iii. Furthermore, to tackle about 15 Mty coal & 66 Mcum of OB from West & East Quarry and 3 Mty and 12 Mm^3 OB from several locations in the mine, comparatively medium and higher size shovels of upto 20 m^3 bucket capacity have been envisaged along with matching capacity of rear dumpers.

iv. Flexibility in operation shall be available due to such equipment system.

11.2.5 Equipment Selection

A. Equipment selection for PB West and PB East Quarries

The geo-mining conditions warrant that the equipment deployed in partings and coal to alternate between the coal seam and partings. Thus, in the process of selection of mining equipment, two major equipment combinations have been proposed. One for Top OB and the other for the coal seams and the partings.

20 cum Electric Rope Shovels operating with 170T-190T class of dumpers shall be deployed in Top OB and 10 cum Electric/Diesel Hydraulic shovel/ backhoe operating with 100-120T class of dumpers in partings and Coal. The size has been decided to meet the twin objective of effective deployment, optimal utilization of the equipment and at the same time keeping the fleet size to manageable levels. This equipment size shall also offer a choice from a variety of vendors during the procurement and facilitate better inventory management.

In the initial years, the mine shall be opened by 10 cum hydraulic shovel/backhoe working with 100-120 T rear dumpers. This is proposed, as this combination shall have much smaller load time for deployment. Deployment of 20 cum Electric rope shovels shall start as soon as the load for top OB increases.

A part of the Top OB workload is also proposed to be handled by 10 cum hydraulic shovel/backhoe operating with 100-120T rear dumpers. This has been done in years where there isn't enough consistent workload for a deployment of a new 20 cum rope shovel. This gives flexibility to the operations and also ensures better equipment utilization.

It is also proposed to work out the thin seams/partings with the help of high capacity ripper dozers (510hp).

B. Equipment selection for PB NW Quarries.

The geo-mining conditions warrant that the equipment deployed in partings and coal to alternate between the coal seam and partings. Thus, in the process of selection of mining equipment, two major equipment combinations have been proposed. One for Top OB and the other for the coal seams and the partings.

10 cum Electric Rope Shovels operating with 100T class of dumpers shall be deployed in Top OB and 5.5 cum Electric/Diesel Hydraulic shovel/ backhoe operating with 60 T class of dumpers in partings and Coal. The size has been

decided to meet the twin objective of effective deployment, optimal utilization of the equipment and at the same time keeping the fleet size to manageable levels. This equipment size shall also offer a choice from a variety of vendors during the procurement and facilitate better inventory management.

In the initial years, the mine shall be opened by 5.5 cum hydraulic shovel/backhoe working with 60 T rear dumpers. This is proposed, as this combination shall have much smaller lead time for deployment. Deployment of 10 cum Electric rope shovels shall start as soon as the load for top OB increases.

A part of the Top OB workload is also proposed to be handled by 5.5 cum hydraulic shovel/backhoe operating with 60T rear dumpers. This has been done in years where there isn't enough consistent workload for a deployment of a new 10 cum hydraulic shovel. This gives flexibility to the operations and also ensures better equipment utilization

It is also proposed to work out the thin seams/partings with the help of high capacity ripper dozers (410hp). These machines shall rip the material, doze to form a heap to be handled by 10 cum front end loaders with 100 T class dumpers.

Detailed list of HEMM deployment has been provided in Chapter-V "Mining".

11.2.6 Mined - Out Land

The opening of a mine, irrespective of the method of mining, has impact on the land use pattern. In the proposed project, the impact on the land is expected due to following activities:-

- Extraction of Coal and Overburden removal,
- Dumping of overburden as well as Coal,
- Construction of infrastructural facilities such as, workshop, office, road etc. within the project area.
- Diversion of Nalla, stream etc.

Mining, dumping, road, built area etc. shall change the existing land use pattern by degrading/utilizing forest and non-forest land. Post mining land use pattern is given in **Table 11.8**.

TABLE 11.8

POST MINING LAND USE PATTERN

SL. NO.	TYPE OF LAND USE	AREA IN PB WEST & EAST QUARRY (Ha)	AREA IN PB NORTH WEST QUARRY (Ha)	TOTAL (Ha)
1	Plantation	2844	286	3130
2	Water Body	596	104	700
3	Public Use	105	47	152
4	Grazing	223	24	247
5	Agriculture and Greenbelt	442	24	466
6	Total	4210	485	4695

11.2.7 Water Quality Management

Water is an essential element for sustenance of life supporting system on the earth. It is an essential requirement for all human activities right from survival to the development. Therefore, quality and quantity of water are the utmost important factors for survival and sustainable development. Hydro-geologically, the district is mainly confined to Precambrian crystalline ground water and Gondwana ground water province.

11.2.7.1 Existing Surface and Groundwater bodies

A. Surface Water Resources

The source of the surface water is mainly River, Nallahs and Ponds. The drainage system of the study area is dendrites to sub-dendritic type and well developed. The drainage of the block is controlled by Sunrah River in the east, which finally joins to Badmahi River, which is one of the major tributary of Damodar River flowing in south central part of coalfield. Three major nallahs flows north to south of the area viz. Khora, Dumuhani and Hardara (Pakwah). Besides these major nallahs of the block, there are many small Streams & streamlet, which discharge their load into this major nallahs. All the nallahs of the block are seasonal and become dry during summers.

B. Ground water sources

The groundwater in sedimentary formation occurs under confined conditions and is limited to the thickness of the formation. The Barakar formation acts as a good aquifer due to high porosity and permeability in the formation. Predominantly western part of the study area comprises of hills and rugged topography, the water level is at great depth as compared to the Pedi plain areas. Mostly the rainwater gets run-off in this area and hence the percentage of recharge of ground water is very less. The water table of this area varies from 5m to 20m; in the valley-fill areas, the water table is at shallow depth. The ground recharge in these areas is very high. The major source of drinking water is dug wells and hand pumps, which are available in almost all the villages in the study area

11.2.7.2 Existing Water Quality (Surface and Groundwater)

Water quality monitoring was carried out in order to collect baseline data on existing water quality, which can be used to predict the impacts due to the project on water regime. Samples were collected from fifteen (15) locations within the block area.

The results of analysis of surface water is given in **Table 11.9**. The results have been compared with the IS. 10500 It can be seen that at all seven monitoring stations, water from these sources can be used for drinking after conventional treatment and disinfection.

Table 11.9

Results of Surface Water Analysis

Sl. No	Parameters	Results						
		SW1	SW2	SW3	SW4	SW5	SW6	SW7
1	Colour, Hazen Units	30	<70	20	30	40	20	50
2	Odour	#	#	#	#	#	#	#
3	Turbidity, NTU	30	100	700	1400	1500	1000	340
4	pH at 30oC	7.1	7.25	7.7	7.68	7.34	7.34	7.33
5	Dissolved Oxygen, mg/l	2.06	3.29	5.36	5.05	5.56	5.25	0.3
6	Iron(as Fe), mg/l	5.8	4.48	21.48	13.61	105.89	53.96	12.57
7	Floating Matter (TSS) in mg/l	65	124	720	1480	1840	1140	380
8	Chloride(as Cl), mg/l	14.24	9.5	18.99	9.5	11.87	18.99	56.98
9	Fluoride (as F), mg/l	0.63	0.53	0.42	0.41	0.28	0.13	0.67
10	Total Dissolved Solids, mg/l	130	94	152	122	92	74	310
11	Copper (as Cu), in mg/l	<0.01	<0.01	<0.01	0.026	0.026	0.02	<0.01
12	Sulphate (as SO4), mg/l	22.4	20	33.6	18.8	24.22	16	40
13	Nitrates (as NO3), mg/l	0.39	1.65	0.71	2.38	0.56	0.66	0.27
14	BOD (3 days at 27°C), mg/l	40	44	27	28	24	46	54

15	Phenolic Compound (as C_6H_5OH) in mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
16	Cadmium (as Cd) in mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
17	Selenium (as	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
18	Arsenic (as As) in mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
19	Lead (as Pb) in mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Zinc (as Zn) in mg/l	<0.005	<0.005	0.03	0.077	0.026	0.03	0.156
21	Anionic Detergent (MBAS) in mg/l	0.11	0.16	0.49	0.6	0.62	0.46	0.25
22	Hexavalent Chromium (as Cr+6) in mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
23	O. &Grease in mg/l	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
24	Total coliform org. MPN/100 ml	36	230	210	73	91	36	2400
#Unobjectionable								

The results of analysis of ground water are given as **Tables 11.10 A**, **11.10 B** and **11.10 C**. The results have been compared with the drinking Water Quality standards specified in IS 10500. From the results it transpires that the ground water quality parameters meet the prescribed norms.

Table 11.10A
Results of Ground Water Analysis

Sl. No.	Parameter	Norms		Results			
		Desirable limits *	Permissible limits **	GW1	GW2	GW3	GW4
Essential Characteristics							
1	Colour	5	25	<5.0	<5.0	<5.0	<5.0
2	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Odour	#	#	#	#	#	#
4	Turbidity as NTU	5max.	10	<1.0	<1.0	2.0	<1.0
5	pH	6.5-8.5	6.5-8.5	7.52	7.41	7.67	7.32
6	Total Hardness (as CaCO3) in mg/l	300	600	233.17	297.92	219.52	246.96
7	Iron (as Fe) in mg/l	0.3	1	<0.1	<0.1	0.14	<0.1
8	Chlorides (as Cl) in mg/l	250	1000	33.11	85.53	17.47	47.82
9	Fluoride(as F) in mg/l	1	1.5	0.16	0.56	0.4	0.19
10	Residual Free Chlorine in mg/l	0.2	-	NIL	Nil	N.L	NIL
Desirable Characters							
11	Total Dissolved Solids in mg/l	500	2000	320	428	262	324
12	Calcium (as Ca) in mg/l	75	200	59.58	73.7	68.99	61.15
13	Magnesium (as Mg) in mg/l	30	100	21.64	27.28	11.20	22.58
14	Copper (as Cu) in mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01
15	Manganese (as Mn) in mg/l	0.1	0.3	<0.01	<0.01	<0.01	<0.01
16	Sulphate (as SO4) in mg/l	200	400	6	30.8	2	21.2

17	Nitrates (as NO3) in mg/	45	100	<0.1	<0.1	<0.1	<0.1
18	Phenolic Compound (as C6H5OH) in mg/l	0.001	0.002	<0.001	<0.001	<0.001	<0.001
19	Mercury (as Hg) in mg/l	0.001	0.001	<0.0005	<0.0005	<0.0005	<0.0005
20	Cadmium (as Cd) in mg/l	0.01	0.01	<0.005	<0.005	<0.005	<0.005
21	Selenium (as Se) in mg/l	0.01	0.01	<0.005	<0.005	<0.005	<0.005
22	Arsenic (as As) in mg/l	0.05	0.05	<0.03	<0.03	<0.03	<0.03
23	Lead (as Pb) in mg/l	0.05	0.05	<0.05	<0.05	<0.05	<0.05
24	Zinc (as Zn) in mg/l	5	15	<0.005	<0.005	<0.005	<0.005
25	Anionic Detergent (MBAS) in mg/l	0.2	1	NIL	NIL	NIL	NIL
26	Hexavalent Chromium (as Cr+6) in mg/	0.05	0.05	<0.01	<0.01	<0.01	<0.01
27	M-Alkalinity (as CaCO3) in mg/l	200	600	254.8	156.8	229.32	203.84
28	Aluminium (as Al) in mg/	0.03	0.2	<0.01	<0.01	<0.01	<0.01
29	Boron (as B) in mg/l		5	0.26	0.86	2.84	3.73
30	Cyanide (as CN) in mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01
31	MineralOil, mg/l	0.01	0.03	<0.01	<0.01	<0.01	<0.01

*:Requirement(Desirable limits),#:Unobjectionable

**:Permissible limits in the absence of alternate source

Table 11.10 B
Results of Ground Water Analysis

Sl. No	Parameter	Norms: Desirable limits *	Norms: Permissible limits **	Results: GW5	Results: GW6	Results: GW7	Results: GW8
				10.06.05	10.06.05	12.06.05	12.06.05
Essential Characteristics							
1	Colour	5	25	<5.0	<5.0	<5.0	<5.0
2	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Odour	#	#	#	#	#	#
4	Turbidity as NTU	5	25	1.7	<1.0	3.5	1.6
5	pH	6.5-8.5	6.5-8.5	7.37	7.47	7.27	7.52
6	Total Hardness (as CaCO3) in mg/l	300	600	235.2	211.68	301.84	348.88
7	Iron (as Fe) in mg/l	0.3	1	<0.1	0.12	0.53	0.76
8	Chlorides (as Cl) in mg/l	250	1000	68.05	20.23	44.14	93.81
9	Fluoride(as F) in mg/l	1	1.5	0.38	0.47	0.072	0.092
10	Residual Free Chlorine in mg/l	0.2	.	NIL	NIL	NIL	NIL
Desirable Characters							
11	Total Dissolved Solids in mg/l	500	2000	235.2	211.68	301.84	348.88
12	Calcium (as Ca) in mg/l	75	200	61.15	65.86	98.78	106.82
13	Magnesium (as Mg) in mg/l	30	100	19.75	11.29	13.17	19.75

14	Copper (as Cu) in mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01
15	Manganese (as Mn) in mg/l	0.1	0.3	<0.01	<0.01	<0.01	<0.01
16	Sulphate (as SO4) in mg/l	200	400	61.15	65.86	98.78	106.62
17	Nitrates (as NO3) in mg/l	45	100	< 0.1	< 0.1	< 0.1	< 0.1
18	Phenolic Compound (as C6H5OH) in mg/l	0.001	0.002	<0.001	<0.001	<0.001	<0.001
19	Mercury (as Hg) in mg/l	0.001	0.001	<0.0005	<0.0005	<0.0005	<0.0005
20	Cadmium (as Cd) in mg/l	0.01	0.01	<0.05	<0.05	<0.05	<0.05
21	Selenium (as Se) in mg/l	0.01	0.01	<0.05	<0.05	<0.05	<0.05
22	Arsenic (as As) in mg/l	0.05	0.05	<0.03	<0.03	<0.03	<0.03
23	Lead (as Pb) in mg/l	0.05	0.05	<0.05	<0.05	<0.05	<0.05
24	Zinc (as Zn) in mg/l	5	15	<0.005	<0.005	<0.005	<0.005
25	Anionic Detergent (MBAS) in mg/l	0.2	1	NIL	NIL	NIL	NIL
26	Hexavalent Chromium (as Cr+6) in mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01
27	M-Alkalinity (as CaCO3) in mg/l	200	600	188.16	203.84	260.68	184.24
28	Aluminium (as Al) in mg/l	0.03	0.2	<0.01	<0.01	<0.01	<0.01
29	Boron (as B) in mg/l	1	5	3.77	1	1.42	1.20

30	Cyanide (as CN) in mg/l	0.05	0.05	<0.01	<0.01	<0.01	<0.01
31	Mineral Oil mg/l	0.01	0.03	<0.01	<0.01	<0.01	<0.01

* Requirement(Desirable limits), # Unobjectionable

** Permissible limits in the absence of alternate source

Table 11.10 C
Results of Ground Water Analysis

Sl. No.	Parameter	Norms		Results		
		Desirable limits *	Permissible limits **	Sinduari	Pakri-Barwadih	Deoria-Khurd
				15.12.05	15.12.05	16.12.05
Essential Characteristics						
1	Colour	5	25	<5	<5	<5
2	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Odour	#	#	#	#	#
4	Turbidity as NTU	5 max	10	<1	5.2	<1
5	pH	6.5-8.5	6.5 8.5	7.97	7.73	7.99
6	Total Hardness (as CaCO3) in mg/l	300	600	355.52	298.96	246.44
7	Iron (as Fe) in mg/l	0.3	1	0.37	0.25	BDL
8	Chlorides (as Cl) in mg/l	250	1000	81.29	79.15	38.5
9	Fluoride(as F) in mg/l	1	1.5	0.23	0.15	BDL
10	Residual free Chlorine in mg/l	0.2		NIL	NIL	NIL
Desirable Characters						

11	Total Dissolved Solids in mg/l	500	2000	390	3	248
12	Calcium (as Ca) in mg/l	75	200	87.26	64.64	72.72
13	Magnesium (as Mg) in mg/l	30	100	32.96	32.97	16.51
14	Copper (as Cu) in mg/l	0.05	1.5	BDL	BDL	BDL
15	Manganese (as Mn) in mg/l	0.1	0.3	BDL	BDL	BDL
16	Sulphate (as SO4) in mg/l	200	400	22.88	7.49	3.74
17	Nitrates (as NO3) in mg/l	45	100	10.38	6.05	5.19
18	Phenolic Compound (as C6H5OH) in mg/l	0.001	0.002	BDL	BDL	BDL
19	Mercury (as Hg) in mg/l	0.001	0.001	BDL	BDL	BDL
20	Cadmium (as Cd) in mg/l	0.01	0.01	BDL	BDL	BDL
21	Selenium (as Se) in mg/l	0.01	0.01	BDL	BDL	BDL
22	Arsenic (as As) in mg/l	0.05	0.05	BDL	BDL	BDL
23	Lead (as Pb) in mg/l	0.05	0.05	BDL	BDL	BDL
24	Zinc (as Zn) in mg/l	5	15	0.05	BDL	BDL
25	Anionic Detergent (MBAS) in mg/l	0.2	1	NIL	NIL	NIL
26	Hexavalent Chromium (as Cr-6) in mg/l	0.05	0.05	BDL	BDL	BDL
27	M Alkalinity (as	200	600	232	199.52	160.96

	$CaCO_3$) in mg/l					
28	Aluminium (as Al) in mg/l	0.03	0.2	BDL	BDL	BDL
29	Boron (as B) in mg/l		5	BDL	1.25	BDL
30	Cyanide (as CN) in mg/l	0.05	0.05	BDL	BDL	BDL
31	Mineral Oil, mg/l	0.01	0.03			NIL

*:Requirement(Desirable limits).# Unobjectionable

**:Permissible limits in the absence of alternate source

11.2.7.3 Ground Water

Groundwater occurrence and storage in study area are mainly controlled by the geological set up of the area. The ability of geological formation to store and transmit water is dependent on its formation parameters, such as porosity and hydraulic conductivity.

Ground water in unconsolidated rocks circulated to a limited extent through the secondary openings represented by joints, cracks, fissures and such other planes of discontinuity. The weathered residuum of the hard rocks as well as the fractures, joints, fissures, faults and other zones of discontinuity are the principle repositories of groundwater in the area. Ground water in the weathered and fracture zones of hard rocks occur under unconfined condition. Depth of the water-table in the hard rock of the area generally ranges from 2.0 m to 15.0 m below ground level. The Gondwana sediments form the semi-consolidated formations and are better water potential zone. Gondwana sandstones are known to constitute good aquifers and ground water occurs at 7-14 m as observed in the dug wells. Depth of water level for pre-monsoon period varies from 5-7 mbgl around the block to some places it stretches to a deeper depth of 7-12 m.

Hydrogeological condition together with climate and topography influences the occurrence and movement of ground water in this region. The major source of the water in the region is south-west monsoon during summer and very small contribution from the north-east during the winter season.

In the study area ground water is withdrawn usually by means of open dug-wells and small diameter hand operated tube-wells. The tube-wells are most often deeper (18 m–58 m) than the dug wells and tap the fractures below the weathered mantle. During the wet monsoon seasons, the net evaporation is less than the precipitation, resulting in surplus water which loss through either surface runoff or being part of the subsurface storage.

In order to calculate the water potential and impact of proposed mining activity, the sub-watershed has been demarcated. The sub-watershed confining the contributing and receiving steams has been studied. Physical characteristics of the sub-water shed are given at **Table 11.11.**

Groundwater levels in the open wells of the villages surrounding the core zone were measured during June (Summer Season) and October (Post-Monsoon season), 2005. The measured water levels are given in **Table 11.12.**

Table 11.11
Physical Characteristics Sub-Water Shed

Sl. No.	Characteristics	Value
1.	Area	176.46
2.	Drainage density	5.3
3	Length of river/ stream in sub- watershed	Ghagra Nadi
4	Elevation variation	405–681

Table11.12

Ground Water Levels in Open Wells

Sl. No.	Village	Pre-monsoon (June' 2005) (m)	Post-monsoon (Oct' 2005) (m)	Fluctuation (m)
1	Garri Ka'an	8.23	2.44	5.79
2	Jamira (S)	6.71	3.35	3.36
3	Jamira (N)	15.25	6.71	8.54
4	Mataji	14.64	8.54	6.1
5	Khdabar	9.15	2.13	7.02
6	GarriKhurd	9.15	2.44	6.71
7	DeonaKhurd	4.57	2.44	2.13
8	Darri Kalan	8.85	3.05	5.8
9	Karrigada	9.15	2.44	6.71
10	Changara	3.05	1.52	1.53
11	Sikri	6.41	3.05	3.36
12	Chandol	7.32	2.44	4.88
13	Pandual	10.67	3.05	7.62
14	Badam	5.79	2.13	3.66
15	Ambajit	8.23	2.13	6.1
16	Pipradih	5.79	2.44	3.35
17	Pakri	6.41	2.74	3.67
18	Chepa Khurd	7.62	2.44	5.18
19	Jugra	8.54	3.05	5.49
20	Chepa Kalan	6.71	1.83	4.88
21	Upardari	6.49	3.05	2.44
22	Barwadih	10.67	4.57	6.1
23	Nagribad	4.25	2.13	2.12
24	Sinduari	5.49	1.52	3.97
25	Sanbarsa	7.93	3.35	4.58
26	Rajhar	7.93	2.74	5.19
27	Palah	9.15	2.13	7.02
28	Horam	7.62	1.52	6.1
29	Harli	7.62	1.52	6.1
30	Bisrampur	6.1	2.13	3.97
31	Balta	11.89	4.88	7.01
32	Pahre	10.98	3.05	7.93
	Average	8.04	2.9	5.14

11.2.7.4 Impact on water quality due to Mining

Washing of coal has not been envisaged at present.

11.2.7.5 Impact on Surface Water

The surface water quality is likely to be affected with higher load of suspended solids by the following.

- Wash off from dumps
- Soil erosion from mine and roads
- Pumping out mine water to surface water channels

The outside dump may contribute to the pollution of surface water in terms of suspended solids. Since dumping location proposed to be carried out at a safe distance from nallahs, it shall have negligible impact on water pollution.

The pumped out water during dewatering may carry higher levels of suspended solids. Other sources of pollution are by oil spillage at the pit head and at the facilities viz. Workshop resulting in oil and grease contamination of surface water if appropriate control measures are not adopted.

Ground water pollution can take place only if dumps and stockpiles contain harmful chemical substances, which may get leached by precipitation of water and percolate to the ground water table, thus causing water pollution.

However, this is not the case with this mine, as neither the coal nor the OB, contains any harmful ingredients which may leach down to the water table and pollute it. Therefore, no adverse impact on ground water quality is anticipated considering this aspect. The leaching down of pollutants (oil, grease etc) to the ground water may render the water non-potable and hence cannot be used by the local people The percolation of sewage waste from the pit head as well as colony area shall also pollute the ground water if control measures are not adopted as envisaged in the management plan.

11.2.7.6 Impact on water regime

The mining operation starting from western side of the coal block shall affect Dumuhani Nallah, Khora Nallah and distributary streams and streamlets joining it from northern part of the block. The nallah flows in more or less NNE to SSW direction across the western part of the lease and finally joins the Haharo-Nadi outside the southern part of lease. Groundwater level of the area varies from 25 to 35 m from the surface. The opencast mining below ground water level shall involve release of water in order of 500 m^3/hr. through pumping, which shall be discharged to the proposed garland nallah along north-eastern boundary of lease. The drawl of this quantity of water is expected to be recharged through rains during monsoon which is 200-800 mm in monsoon and 100–200 mm in post & pre-monsoon season.

In addition, water requirement of 526 m^3/ day for PB West Quarry and 553 m^3/ day for PB North West Quarry for the domestic purposes shall also be met through bore wells. Industrial water requirement for drilling, spraying over road, washing of machinery etc. shall be met through creating a small reservoir on Dumuahani Nallah, at eastern boundary of the lease and drawl through pumping.

11.2.7.7 Water Requirement

A. PB West and PB East Quarry:

The average daily demand of water for the proposed mine shall be 4576 m^3/d whereas peak daily demand shall be 5256 m^3/d. Of the 5256 m^3/d of water (peak daily demand) to be consumed in the project, 4730 m^3/d of industrial water requirement shall be met by utilizing treated mine discharge water (650 m^3/d of water shall be the recycled second used water generated from pit head bath and equipment washing) Balance 526 m^3/d of water required for drinking and for domestic purposes in the township, shall be drawn from bore-wells. The water requirement and source of water are given in Table 11.6 and Table 11.7 respectively

B. PB North West Quarry:

The average daily demand of water for the proposed mine shall be 1089 m^3/d. Of the 1089 m^3/d of water to be consumed in the project, 537 m^3/d of industrial water requirement shall be met by utilizing treated mine discharge water Balance 553m^3/d of water required for drinking and for

domestic purposes in the township, shall be drawn from bore-wells. The water requirement is given in Table **11.13A and Table** 11.13B. Source of Water Supply for PB West & East Quarry is given in **Table 11.14.**

Table 11.13 A

Water Requirement (m^3/day) for West & East Quarry

Purpose	Avg. Demand	Peak Demand
A. Mine site		
1. Mine operation		
a) Drilling & Spraying	*1200*	*1500*
2. Land reclamation	*Included in above*	*Included in above*
3. Dust suppression	*Included in above*	*Included in above*
4. Drinking	*526*	*5*
5. Green Belt	*1750*	*20*
6. Beneficiation	*Not Applicable*	*Not Applicable*
7. Washery	*Not Applicable*	*Not Applicable*
8. Fire Service	*Nil*	*1*
9. Others		
a. Pit Head Bath	*200*	*2*
b. Equipment Washing	*700*	*0*
c. Misc.	*200*	*0*
B. Township		
1. Green Belt	*Included under sl.4/5*	*Included under sl.4/5*
2. Domestic	*Included under sl 4*	*Included under*

3 Other(specify)	Not Applicable	Not Applicable
Total	4576	52

TABLE 11.13 B
WATER REQUIREMENT FOR PB NORTH WEST QUARRY

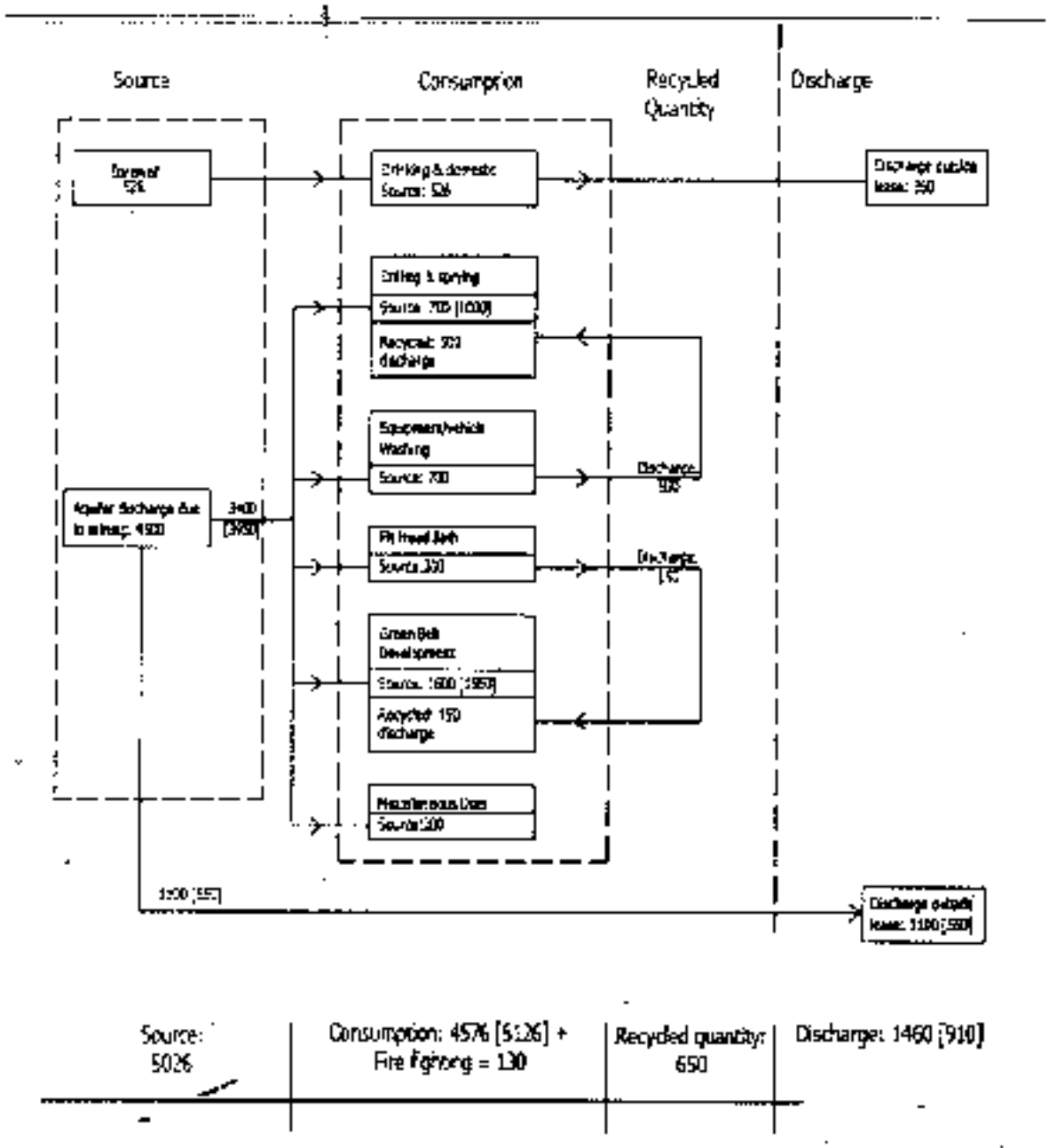
SL. NO.	PARTICULARS	m^3/day (Avg.)
1	Drinking Water Demand	553
2	Non- Drinking Water Demand	537
	Total water demand (1+2)	**1090**

Table 11.14
Source of Water Supply for PB West & East Quarry

Sl. No.	Source	m^3/day (Avg.)
1	River (Specify)	
2	Ground water	526
3	Mine water (sump/ pit)	*3400 Treated Mine Discharge Water + 650 Treated Effluents (2ndUse)*
4	Other surface water bodies (specify)	*Nil*

11.2.7.8 Water Balance Diagram

(a) Water Balance chart for PB West and East Quarry is **Fig-11.1**:



1. Figures are in m³/d
2. Figures outside ( ) corresponds to average daily water demand.
3. Figures within [ ] corresponds to daily demand in peak season. [ ] values are indicated only when peak demand is different than average demand; Otherwise daily demand in peak season and average daily demand should be taken as equal.

Fig-11.1

Water Balance chart for PB West and East Quarry

(b) Water Balance chart for PB North West Quarry is given in **Fig-11.2**

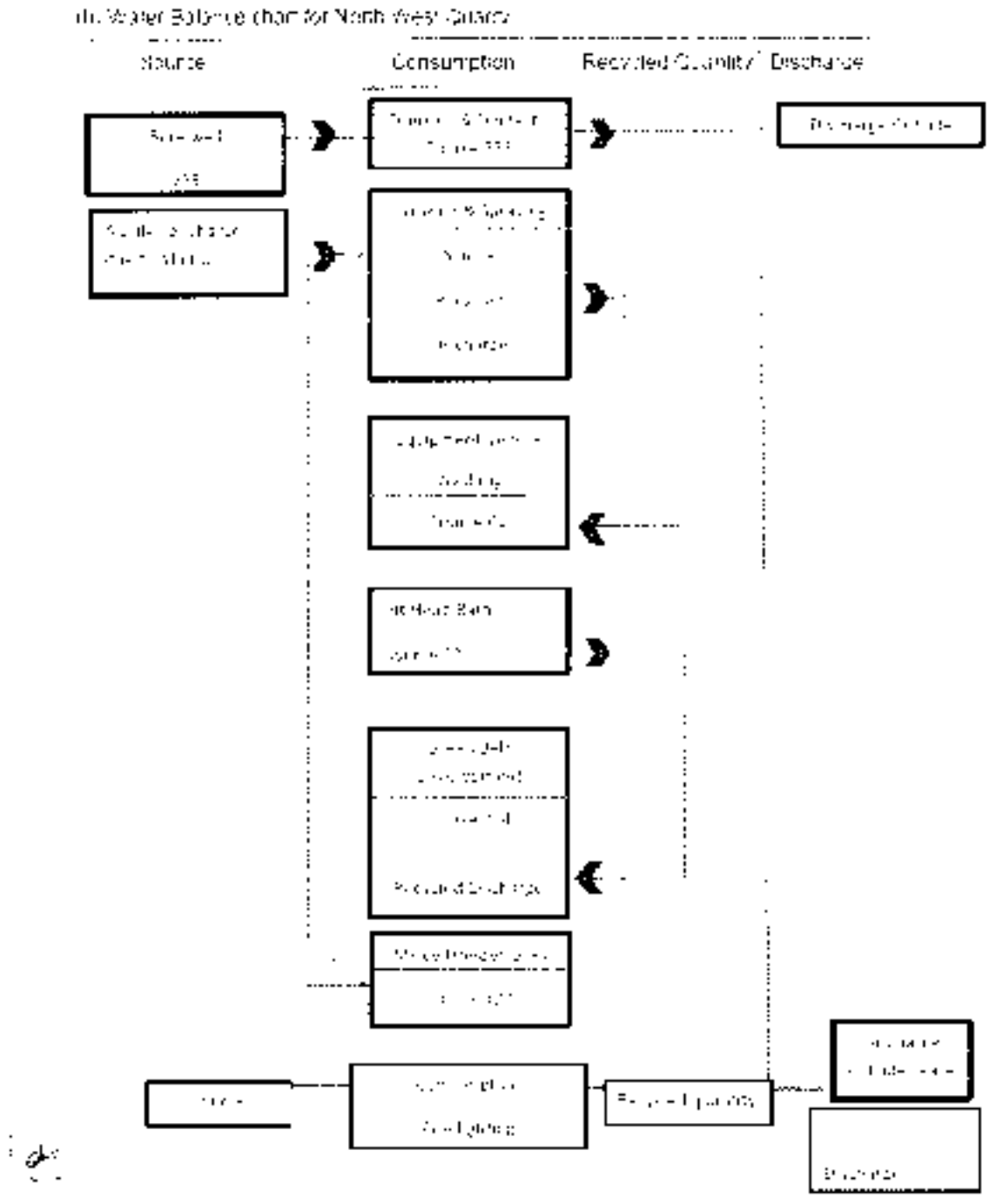


Fig-11.2

Water Balance chart for PB NW Quarry

11.2.7.9 Water Pollution Control Measures

A **Measures to control erosion/sedimentation of water courses**

Continuous monitoring shall be done to remove overburden material and loose sediments from the working mine benches and excavation zone to avoid rolling of the same into the water course and thereby prevent the erosion and sedimentation. Retention wall shall be constructed around the dump to prevent rolling down of loose sediments. Settling pits shall be constructed at appropriate locations along the water channels to arrest sediments and clean water shall be allowed to flow into natural water course.

B **Treatment and disposal of water from mine**

The water inside the mine pit is expected from the rain water during rainy season. Entire precipitation over the pit shall be channelized systematically into natural drainage. In order to ensure the discharge of clean water into the natural drainage, sedimentation ponds shall be made at suitable location to arrest the sludge. Accumulated sludge shall be scraped off time to time to maintain the proper mine water discharge. In order to monitor and subsequent management of water quality monitoring stations shall be located near settling pit. Effluent treatment plant is envisaged for treatment of water discharge from workshop as well as domestic waste.

Garland drains around the quarry with settling tanks shall arrest suspended solid matter. Effluents from the workshop and the CHP shall be collected and treated before discharge.

C. **Measure to minimize adverse effects on water regime**

During the process of mine rehabilitation and with the completion of backfilling a water body shall be created in the mined out pit which shall act as water reservoir improving the ground water recharge, source of attraction for fauna and shall help in the maintenance of afforested areas. To enhance aesthetic appearance, parks and lawns shall be made around the water body.

Selected water quality parameters of ground and surface water resources within 10 km radius of the study area have been studied for assessing the water environment and evaluate anticipated impact of the proposed project. Secondary data shows that water quality in ground water sources is within permissible limits.

11.2.7.10 Proposed Nallah Diversion / Construction of catchment canal

A. PB West and East Quarry:

The study area has dendritic pattern of drainage. Three different nallahs viz Khora/ Lathorwa (Western), Dumuhani (Central) and Pakwa (Eastern) Nallah traverse through the coal mining block. The **Table 11.15** below gives the particulars of three nallahs.

Table 11.15
Details of Nallah

Sl. No.	Name of the Nallah	Length of Nallah (km)	Catchment area (Sq. km)
1	Western	18.35	54.86
2	Central		25.64
3	Eastern	18.75	51.92

Central nallah originates at a small distance upstream of the northern boundary of the coal mining block and traverses towards south. The mining activity would be carried out in such a way that the catchment area of the central nallah shall go on reducing towards south. Water entering the central nallah from the upper catchment at the northern boundary of the coal mining block would be diverted through canals constructed along the boundary of the mining block to eastern and western nallah.

Precipitation falling within the mining block from the catchment area of central nallah would be pumped to the eastern and western nallah progressively. All the three nallahs rise in the hills on northern side of the coal mining block and flow towards south. The nallah pass through steep falls in the range of 5 to10 m spread over a length of about 600 to 800 m.

Investigations for locating the check dam on eastern and western nallahs have been carried out and six sites each on Khora Nallah and Pakwa

Nallah have been identified. Attempts were made to ensure that there is no change in the alignment and location of all three nallahs in coal mining block.

It is proposed to tap the discharge of central nallah at the northern boundary of the coal mining block and transfer flows to eastern and western nallahs through diversion canals to be constructed near the outer boundary of the mining block. The alignment is more or less along 460 m contour. The eastern arm of diversion canal would continue to traverse a distance of about 5100 m before reaching the outfall point in Pakwa Nallah. Similarly, western arm would flow for a length of about 800 m up to outfall in Khora Nallah. A fall structure with height of fall equal to difference in elevation of canal bed and nallah bed is to be provided at the end of canal alignment.

Catchment area of central nallah up stream of diversion canal is 7.6 sq. Km and maximum flood discharge component from this area was derived as 57.44 m3/s. Out of this flow only 90% is proposed to be diverted to eastern nallah i.e. 51.7 m3/s and remaining would be diverted to western nallah. Component of discharge from the catchment of eastern nallah that would get blocked due to diversion canal was estimated as 1.81 m3/s. Thus total discharge in eastern canal would be 53.51 m3/s and the design discharge for the eastern part of the diversion canal was computed as 58.86 m3/s.

Component of discharge from the catchment of western nallah was estimated as 1.5 m3/s. Thus total discharge in western canal would be 7.24 m3/s and by adding 10% to account for safety, the design discharge for the western arm of the diversion canal was computed as 7.94m3/s.

The diversion canal is required to be designed for the maximum discharge derived above and aligned along the north-eastern boundary of the mining block. As the canal is proposed in are mostly hilly area near reserve forest and the bed material consisting of boulders; maintenance of the canal would be difficult. So, an unlined canal is suggested. The details of a typical section of eastern arm of diversion canal derived for two different bed slopes are in **Table 11.16**

Table 11.16

Details of Eastern Arm of Diversion Canal

Design discharge (m^3/s)	60	60
Slope	1 in 1000	1 in 500
Bed width (m)	5	5
Side slope (m)	2 H to 1 V	2 H to1 V
Depth off low (m)	3.24	2.74
Manning's (n)	0.03	0.03
Velocity (m/s)	1 62	2.09
Freeboard (m)	1 5	1.5

The dimensions of western arm of diversion nallah were also derived on the similar lines of eastern arm

B. PB North West Quarry:

The study area has dendritic pattern of drainage. Two different nallahs viz Khora A & B on the western and eastern sides traverse through the coal mining block.

Both nallah originates at a small distance upstream of the northern boundary of the coal mining block and traverses towards south The mining activity would be carried out in such a way that the catchment area of the nallah shall go on reducing towards south.

Meandering part of Khora Nala – B at the western side of the block approximately 1 km in length is planned for straightening Except this re-alignment rest part of nala shall not be disturbed. An embankment suitably sloped both sides shall be constructed to prevent in-rush during rainy season and flash flood. A road of 5m wide shall run all alongside the embankment

After 25th year of mine operation, Khora Nala – A is envisaged to be diverted on the back filled area of PB. A separate study for diversion shall be conducted at appropriate time and recommendation after approval

from relevant competent authority shall be implemented. This shall help in releasing approximately 32Mt of coal in the barrier and batter of PB – A and PB (west) mines.

11.2.7.11 Impact on villagers due to Nala diversion

Three nalas viz. western nala (Khora/Lathorwa), central nala (Dumuhani) and eastern nala (Pakwa) traverse through Pakri Barwadih coal mining block and outfall into Haharo River one Km south of lease area, near Barkagaon village. The eastern and western nalas originate upstream of the coal mining boundary on north side. It is proposed to divert flow of the central nala outside the boundary through canals constructed along the boundary of the Western Quarry of the mining block to eastern and western nala. Since the water flow in the central nala shall outfall into Haharo River through canals at same point where it was joining that before diversion. Hence there shall be no effect of diversion downstream the lease area. The lease area shall also be evacuated for mining operations Hence there shall also be no effect on villagers living in the lease area.

11.2.8 Air Quality Management

There shall be constant monitoring of air quality to keep within the prescribed norms. Dust pollutants are generated during blasting and while operating diesel equipment and these shall be kept at minimum levels by ensuring good blast design and good equipment maintenance. Dust suppression system and dust extraction System shall be in operative. Plantation around the quarry and CHP shall put up a green belt for mitigating air pollution.

11.2.8.1 Existing air quality status

To quantify the impact of the proposed mining and allied activities on the ambient air quality, it is necessary at first to evaluate the existing ambient air quality of the core and the buffer zones. The existing ambient air quality, in terms of Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Sulphur-dioxide (SO2), Oxides of Nitrogen (NOx), Carbon Monoxide (CO), Lead (Pb) and Dust fall has been measured through a planned field monitoring.

To assess the ambient air quality level, 15 (fifteen) monitoring stations (includes 4 from core zone) were set up to a maximum distance of 10.0 km from core zone limit (Buffer Zone). **Table 11.17** gives summarised ambient air quality results.

The results when compared with National Ambient Air Quality Standards (NAAQS) of Central Pollution Control Board (CPCB) for "Residential and Rural Areas" shows that the ambient air quality is within the stipulated limit except with respect to SPM at a number of stations. Dust blowing from the unpaved roads and dry agricultural fields account for the high SPM levels.

Dust fall rates were recorded as 30 days average during monitoring periods at twelve

(12) AAQ monitoring stations. The results are given in **Table 11.18**.

In absence of Indian Norms, the results have been compared with the German norm published in TA Luft, 1986 which is as follows:

98 percentile value . 0.65 $g/m^2/d$

The above results indicate that the dust fall rates at all the stations, except at Pundaul and are within the compared German standards.

Table 11.17 - Summarized Ambient Air Quality Results

Parameters		SP			RP			SO			NOx			CO			Lead		
Permissible AAQ standard(CPB		200			100			80			80			0.4			1.00		
		500			150			120			120			0.4			1.50		
		150			75			30			30			0.4			0.75		
Monitoring Location	Category	Min.	Max	Arth Mea	Min.	Max	Arth. Mea	Min.	Max	Arth. Mea	Min.	Max	Arth. Mea	Min.	Max.	Arth. Mea	Min.	Max.	Arth. Mean
Barkagaon	R	142	318	251.9	64	147	108.5	<10	10.6	<10	21.4	37.8	30.7	<0.00	<0.00	<0.00	0.051	0.042	0.047
Sinduari	R	139	340	254.9	59	131	104	<10	11.2	<10	41.9	88.8	31.7	<0.00	<0.00	<0.00	0.013	<0.003	0.007
Pundaul	R	146	349	260.6	63	139	104.8	<10	10.3	<10	20.6	38.2	30.2	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Sirma	R	175	184	179.3	62	85	79	<10	<10	<10	19.5	34.6	25.8	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Hesaoar	R	104	201	252.5	45	78	61.5	<10	<10	<10	15.0	23.6	20.1	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Kandabar	R	155	387	281.4	62	172	119.4	<10	11.3	<10	16.0	38.5	23.5	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Rajhar	R	116	204	176.5	49	92	69.1	<10	<10	<10	14.3	27.3	21.5	<0.00	<0.00	<0.00	0.034	0.022	0.028
Garriklan	R	172	398	314.5	80	180	103.4	<10	12.8	<10	24.0	52.9	40.0	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Sikri	R	114	314	224.9	45	129	89.8	<10	<10	<10	15.7	38.4	25.6	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Kantar	R	152	373	271.5	70	155	112.3	<10	<10	<10	161.0	35.9	24.4	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Bisarmpur	R	142	417	306.3	68	182	124.6	<10	13.4	<10	25.5	56.5	28.8	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Badam	R	158	405	258.3	57	197	111.8	<10	<10	<10	18.1	32.7	27.4	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Sukulkhap	R	112	314	200.5	50	124	84.3	<10	<10	<10	15.7	31.5	24.0	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Deunakhur	R	268	346	296.5	101	133	119.5	<10	<10	<10	21.5	27.7	24.9	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003
Uparcri	R	118	351	213.3	54	162	99.3	<10	<10	<10	17.6	32.5	24.6	<0.00	<0.00	<0.00	<0.00	<0.003	<0.003

Table 11.18
Measurement of Dust fall Rate

Station Location	Station No.	Results($g/m^2/d$)
Barkagaon	A1	0.468
Sinduari	A2	0.599
Pundaul	A3	1.528
Sirma	A4	0.185
Kandabar	A5	0.576
Rajhar	A6	0.128
Garrikalan	A7	2.415
Sikri	A8	0.238
Kanrtari	A9	0.424
Bisrampur	A10	0.511
Badam	A11	0.382
Deuriakhurd	A12	0.476

11.2.8.2 Impact on Air Quality due to Mining

A. Construction Phase

Impacts of construction activities on air quality are cause for concern mainly in the dry months due to dust particles. The main sources of emission during the construction period are the movement of equipment at site and dust emitted during the levelling, grading, earthworks, foundation works and other construction related activities. The dust emitted during the above mentioned activities depend upon the type of soil being excavated. The dust generated during the construction activities shall however, settle quickly. Therefore, the impact shall be for short duration and confined locally to the construction site. The composition of dust in this kind of operation is, however, mostly inorganic and non-toxic in nature.

Exhaust emissions from vehicles and equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO2, NOx, SPM, CO and unburnt hydrocarbons. It may, therefore, be deduced that construction activities may cause changes in the SPM levels locally. The impact shall, however, be reversible, marginal, and temporary in nature.

The impact of such activities would be temporary and restricted to the

construction phase. The impact shall be confined within the project boundary and is expected to be negligible outside the ML boundaries. Proper upkeep and maintenance of vehicles, sprinkling of water on roads and construction site, providing sufficient vegetation etc. are some of the measures that would greatly reduce the impacts during the construction phase.

B. **Operation Phase**

The main activities, which generally contribute to air pollution in mining industry, are:

- Drilling and blasting
- Excavation and loading
- Transportation
- Crushing at CHP

The excavation / loading of the OB/coal shall be done by hydraulic shovels. The transportation of OB and coal shall be carried out in the same way as is generally done in OC mining i.e. by dumpers. Dust generation by this is anticipated. Coal crushing at CHP shall also generate dust.

The opencast mining operations are generally prone to generation of high levels of SPM and to a limited extent SO2, NOx and CO due to fossil fuel based vehicles, machines and blasting using explosive and fuel combustion etc. Air pollution due to SO2, NOx and SPM may result in irritation and inflammation of eyes and congestion of throat and oedema of lungs. Carbon monoxide can cause loss of hemoglobin in blood and subsequently stresses on those suffering from Cardio-Vascular and pulmonary diseases. High level of CO in the air is dangerous and may be fatal.

11.2.8.3 Air pollution mitigation measures

In the proposed lease area, the existing air quality is within the norms as specified by the National Ambient Air Quality Standards (NAAQS). Fugitive dust shall be generated in open cast mine due to drilling, blasting, handling of overburden & coal. To control dust from various operations following measures will be resorted to

- Drilling area will be wetted prior to drilling
- Water will be sprayed during loading/unloading of OB and ore

- Periodical water spraying will be done on haul road, overburden dump & stacks of coal
- Trees will be planted on road side.
- Dumps will be stabilized by planting grass/trees

It has been proposed that all mining and ore processing equipment will have dust extraction and separation attachment to minimize air pollution. In order to monitor and subsequent management of air quality, monitoring stations will be located near dust generating areas such as haul road, OB dump, coal handling plant etc.

11.2.8.4 Measures to control noise pollution

The following control measures shall be adopted to keep the ambient noise levels below permissible limits:

i. Provision of protective devices like ear muffs/ear plugs to those workers who cannot be isolated from the source of noise.
ii. Confining the noise by isolating the source of noise
iii. Reducing the exposure time of workers to the higher noise levels

Precautions shall be taken as per conditions imposed by MoEF or other statutory bodies.

11.2.8.5 Measures to reduce ground vibrations due to blasting and prevent fly rocks

The vibrations due to blasting shall be studied before the commencement of mining operations and the recommendations/suggestion given as per the result of the said study shall be strictly adhered to especially the charge per delay.

11.2.9 Waste management

11.2.9.1 Type of Rocks

The block is mostly covered with Barakar formation. This formation constitutes fine to coarse grained, white to grey feldspathic, micaceous sandstone, shale, fire clay and carbonaceous shale with economic coal horizons. The Karharbari formation is noticed towards the east of Pakri Barwadih Coal Block. The rocks are mostly coarse to gritty, carbonaceous sandstone pebbly at places with unaltered fresh pink feldspar and quartz pieces. Few very thin carbonaceous shale and coal bands are also intersected in some boreholes. The Barren Measures which is characterized by fine grained sandstone, shale and sandy

shale is noticed towards the north-west part of the block and Sector –A . The block is free from any igneous intrusions

As per the geological report, no major, minor and trace elemental analysis of different rock types was available. The chemical analysis of coal indicates presence of nontoxic minerals. The sandstones of Barakar Formation constitute major part of area forms a principal aquifer. The chemical analysis of ground water shows the trace element like Cu, Mn, Hg, Cd. Se. As, Pb. Zn, Cr, Al and B are present below deduction limit

The ground water quality indirectly infers the source rocks characters hence, the rock of Pakri-Barwadih Coal block contains no toxic elements

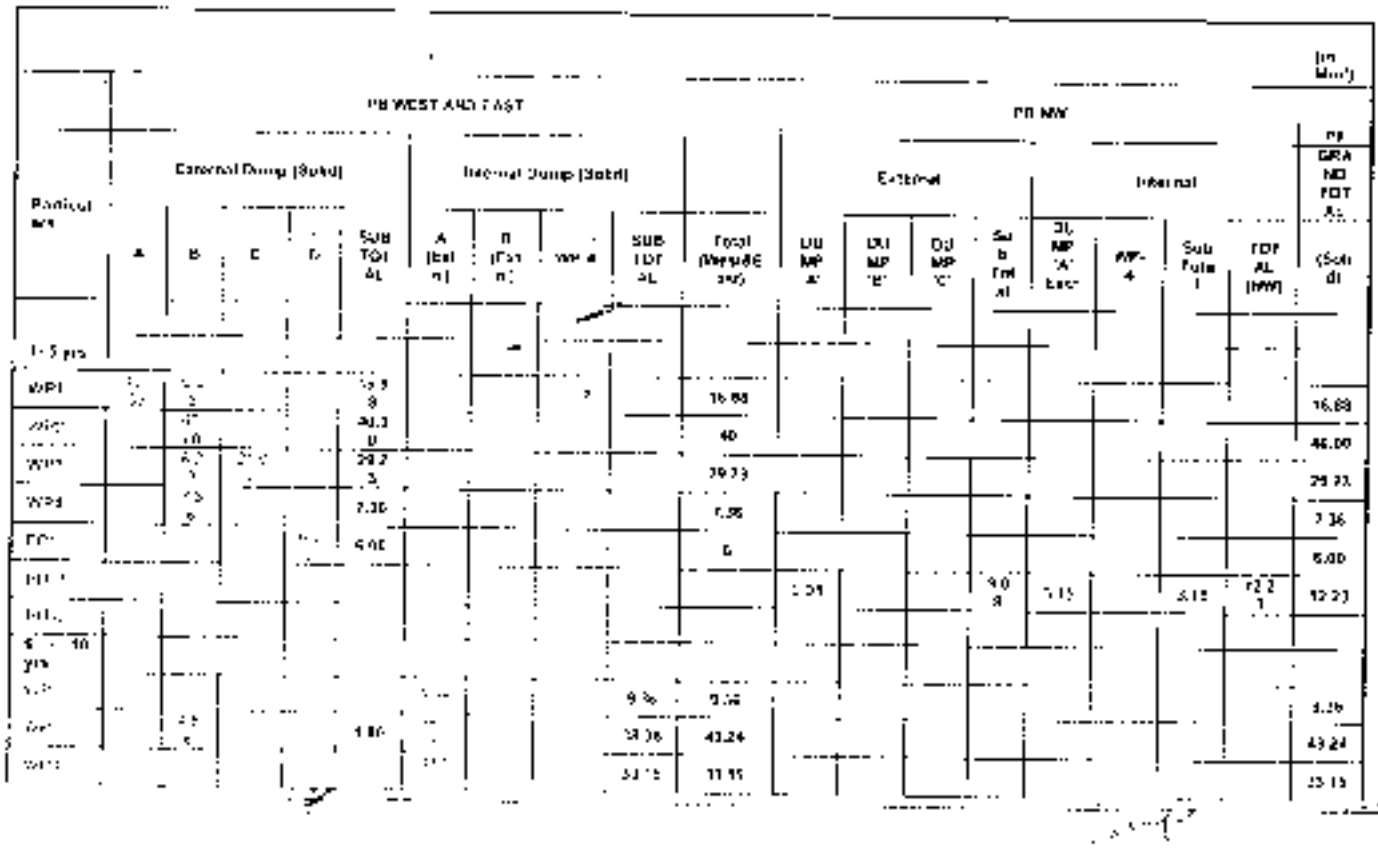
11.2.9.2 Removal of Overburden

For PB West and East Quarry Proposed quarries namely PB West and PB East are to be opened in Barakar formations. which consist of alluvium soil, sandstone and shale. The thickness of soil/weathered mantle generally varies from 6-18 m. It is commonly dirty-white to reddish-brown in colour and carbonaceous shale generally constitutes bulk of inseam burden.

OB removal and its phasing from Pakri Barwadih is detailed **Chapter 5 "Mining"**. yearwise dumping schedule of overburden in internal and external dumps are given in **Table-11.19**

Table-11.19

Schedule of Overburden Dumping



APC																				
PIT-1																				
PIT-2																				
11 - 15 yrs																				
WP-4																				
PIT-1																				
PIT-2																				
16 - 20 yrs																				
AS-4																				
PIT-1																				
PIT-2																				
21 - 25 yrs																				
WP 4 Exu Quary																				
PIT-1																				
PIT 2																				
26 - 30 yrs																				
PIT-1																				
PIT 2																				
WP 4 Exu Quary																				
31 - 35 yrs																				
Exu Quary																				
PIT-1																				
PIT 2																				
36 - 40 yrs																				
Exu Quary																				
PIT 1																				
PIT 2																				
41 - 52 yrs																				
PIT-1																				
PIT-2																				
Total																				

Final stage dump plan, as well as other stage plans also show the location of external/internal dumps in respective stage plans including height as well as volume of dump.

11.2.9.3 Types of Solid Waste

Four types of solid waste are likely to be generated through mining activities. These are:

a) Overburden (both topsoil and waste)
b) Sludge from washing HEMM

c) Sludge created by mine water in settling pond
d) Municipal solid waste

Protective measures

The dump shall be stabilized and afforested. The top soil shall be used for spreading over backfilled area and over OB dump for plantation. The area of top soil stack shall be afforested.

The area of ground disturbance shall be minimized by progressively rehabilitating disturbed land.

Reclamation of land shall be carried out by landscaping, re-vegetation etc. As far as possible the reclamation activities shall be taken up concurrently with the mining operations. For re-vegetation, the native plants and saplings suitable for the existing soils and site conditions shall be considered.

A. Steps to be taken to avoid Dump Slides

- Dumping of top soil shall be avoided at the bottom of the dump as it leads to instability. Dumping of soil and clayey material shall be done away from the working area that is on farther end of the dump so that formation of weak planes is avoided.
- Afforestation by planting trees shall helped a lot in improving stability of dumps by preventing erosion.
- Construction of retaining walls
- Construction of drains for drainage
- Provision of jute mesh for facilitating grass or vegetative growth on slopes
- Provision of good soil mixed with manure and subsequent irrigation for growth of grass for anchorage on slopes. Plantation mixed with indigenous and fast growing plant species.
- The degraded area shall be reclaimed and rehabilitated with local species of plantation in a phased manner.
- Plantation shall be carried out on waste dumps.
- A belt of trees with thick canopy shall be created along the mine boundary to intercept dust, gaseous pollutants and noise.

The void area of the excavated pit shall ultimately become a water reservoir. The depth of the void shall be reduced in the post mining stage by filling it with waste. This void area shall also be suitably sloped, bunded and fenced.

B. **Management of Sludge**

- **Management of Sludge from Oil/Water separator**

  Effluent from workshops, vehicle washing etc. shall be passed through impermeable drains and shall be treated in the oil/water separator. The treated effluent will be re-circulated in the workshop.

- **Management of Sludge created by mine water in settling pond**

  Sludge from the mine water settling pond shall be removed periodically and shall be backfilled along with the OB.

- **Sludge from domestic waste**

  Sludge from the domestic waste shall be utilized as manure for the plantation in the mine lease area and on dump.

- **Management of Municipal solid waste**

  The municipal solid waste e.g. from canteen, etc shall be composted and used as manure for plantation along with the domestic sludge.

11.2.9.4 Topsoil management

A. For **PB-WEST and EAST Quarry** during Operating life of mine 5.81 Mm^3 of top soil shall be generated. This figure is arrived at by considering **1 m** (approx.) thickness of top soil, as because unlike PB-NW Quarry considerable deposition has not taken place in the block.

For the initial 5 years of Mining operation, top soil shall be stacked at a designated location over coal bearing area, as shown in **Surface Master Plan**. Estimated land requirement for stacking is 1 Ha. The requirement of land shall cease to operate from 10th year onwards as because scrapped top soil shall be spread over the dump for land reclamation.

Stacking of top soil shall be achieved in two tiers. The bottom tier shall be of 3m in height while top tier shall be of 2m or shall below height not exceeding the limit as per prescribed norms.

Stack of top soil shall be grassed to retain fertility if required. Besides this, top soil stack them shall be made use of concurrent filling without bringing the scrapped top soil to the stack.

B. **For PB-NW Quarry** during Operating life of mine 5.81 Mm^3 of top soil shall be

generated. This figure is arrived at by considering 1.5m (approx.) thickness of top soil, as because presence of ravines and surrounding nalas considerable deposition has taken place in the block.

For the initial 5 years of Mining operation, top soil shall be stacked at a designated location over Pit – 2, as shown in **Plate No.4**. Estimated land requirement for stacking is 1 Ha. The requirement of land shall cease to operate from 10th year onwards as because scrapped top soil shall be spread over the dump for land reclamation.

Stacking of top soil shall be achieved in two tiers. The bottom tier shall be of 3m in height while top tier shall be of 2m or shall below height not exceeding the limit as per prescribed norms.

C. **Top Soil Scrapping:** Scrappers shall be deployed to scrap the top soil off the surface. With the help of front end loader, top soil shall be loaded on the tripper of 10T capacity and transported to top soil stock yard. In the event of non-stacking system, top soil shall be transported directly to the desired location.

D. **Top Soil Spreading:** Front end loader shall load on to the trippers and transported to desired location and spread with the help of dozer/graders.

Stack of top soil shall be grassed to retain fertility if required. Besides this, top soil stack them shall be made use of concurrent filling without bringing the scrapped top soil to the stack. Year wise quantity schedule of management of top soil excavated and spread and summerised data for Top Soil Management is given in **Chapter 5 "Mining"**.

11.2.10 Management of Coal rejects from Washery

Not applicable

11.2.11 Decommissioning of Infrastructure

The infrastructure consists of substation, CHP, Workshops, Mine office, blasting shelters, rest shelters etc. The mine office & related infrastructure shall be handed over to state govt. for public use. The probable list of facilities which shall be dismantled and those which shall be retained has been furnished in **Table 11.20**

Table 11.20

List of facilities to be dismantled or retained at the end of Life of PB Coal Block

Sl.No.	Facilities	Remarks(Dismantled/Retained)
1	Service buildings/Infrastructure	
a	Project/Mine Office	To be retained.
b	Workshop	Dismantled
c	Store	Dismantled
d	Canteen	To be retained.
e	First aid center	To be retained.
f	Rest shelter	To be retained.
g	Training Centre	To be retained.
h	Firefighting station	To be retained.
i	Pit head bath	Dismantled
j	Magazines	Dismantled.
k	Environmental laboratory	To be retained.
l	Dispensary	To be retained.
2	Mining Machinery	i) Usable: - to be moved to any other units ii) Non-usable:- auctioned.
3	Pumps used in mines	Dismantled
4	Electrical/mechanical equipment used in workshop or other places	Dismantled
5	CHP, conveyors and railway siding	Dismantled.
6	Sub-station	Dismantled
7	Furniture	To be retained.
8	Approach road and Culverts	To be retained.
9	Haul road and Culverts	Restricted Entry
10	Water supply arrangement	To be retained.
11	Permanent Manpower	To be transferred to any other projects of NTPC or options for VRS or as per company's existing policy.
	Corpus fund for maintenance	**Provision has been made in fund requirements as provided**

11.2.12 Disposal of Mining Machinery

Nearly all the mining machinery shall be moved to other units of the owner. Only the scraps and non-usable machines, if any, shall be auctioned.

11.2.13 Safety & Security

a. Closure of Mine Entries

After closure of the mining activities, all the entries to the mine shall be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. Underground worksites with surface openings, shall be effectively sealed.
The area that is not reclaimed shall be properly fenced and/ sealed to prevent any unauthorized entry into the area.

Security Personnel shall be detained for a period of three years after mine closure for protecting new plantations in the reclamation area and look after the protective fence around the boundary of the mine to prevent any stray animal/man entering the area.

b. Disaster Management and Risk Assessment

Provisions under coal mines regulation and rules made there under and different circulars of DGMS shall be strictly followed, Safety training shall be imparted in the vocational training center to the workers for protection against landslide/fall, moving equipment and precautions during blasting, electrical shock protection and accidental fire.

c. Care and Maintenance during temporary discontinuation

During such period round the clock security guard shall be provided to prevent stray animal or persons entering mining area. Temporary fencing with proper signage about danger shall be erected.

11.2.14 Economic Repercussions of Closure of Mine

The mine shall be one of the highly mechanized open cast mines and shall require services of highly skilled and semi-skilled work force.

As far as possible local population shall be given employment in semi-skilled and unskilled category

In lieu of employment, an annuity of around Rs. 36,000 per acre per annum for 30 years for those losing one acre or more land which is to be escalated by Rs. 1000 every two years (limited to maximum for 5 acres) and those losing land less than 1 acre then annuity of around Rs. 30,000 per annum for 30 years which is

to be escalated by Rs. 750 every two years is proposed. This shall help the annuitants residing in the peripheral area of coal block to make them self-sustainable after the closure of the mine.

Persons engaged in satellite occupations connected to mining industry shall have access/ market in other industries of the mine owner. They shall be given preference or they shall have to opt for other related engagement similar to their occupation

After closure of mining operations, local residents employed in the mine may be offered jobs elsewhere in the running projects of NTPC
To mitigate any hardship, the following things are being done or shall be done

1 R&R plan pertaining to NTPC mining projects in Jharkhand has already been prepared in consultation and participation of stakeholders which is in line with the state R&R policy. This include among others provisions and activities pertaining to preference in employment subject to suitability and availability, vocational / self-employment opportunities, education, health, skill development and training programs for various focused groups.

2 In addition to the preference in direct and indirect gainful employment opportunities to affected families / locals through contracting agencies etc. and otherwise subject to suitability and availability, NTPC has committed to build a Greenfield ITI in the vicinity of these mining projects of Jharkhand for capacity building, skill development which shall also result in improving the employability of the affected families / locals

3. Skill of the unskilled workers shall be developed through structured programme to the extent possible so that they can be absorbed in other units or they can follow some self-employment

4 Employees who would be retrenched would get adequate compensation as per existing labour laws/ golden hand sack / VRS or any other scheme of the Company prevailing at the time of mine closure.

NTPC would endeavour for harmonious relations with PAPs, not only during mining operation but there after also. But it would be prudent to develop their own ability to sustain their present life standard after the closure of the mine by self-employment. NTPC would like continuance of the social welfare amenities created for the employees and PAPs and try to meet the expectation of the society under the given financial constraints. The persons shall be imparted lectures on the financial mechanism for its sustenance after the mine closure

11.3 Time Scheduling for Abandonment

Tentative details of likely closing activities with manpower requirement as envisaged below has been estimated based on the present mine closure plan. Actual closing activities and manpower requirement may change during the preparation of Final Mine Closure Plan which shall be prepared 5 years before the likely cessation of mining operation. A time schedule for abandonment along with tentative manpower requirement has been shown in the bar chart given in **Table 11.21**.

Table 11.21

Manpower Requirement for Closure Activities

Sl. No	Activities to be undertaken	Manpower of NTPC	P-6	P-11	P-16	P-21	P-26	P-31	P-36	P-41	P-46	P-51	P-52	P-53	P-54	P-55
1	**Mined Area & Waste Management**															
1.1	Plantation along the block boundary embankment approach road CHP Cross country conveyor Railway siding etc and around the mine infrastructure area	Outsourced under the supervision of NTPC) Environment al Engr-1, Surveyor-2 Chainman-4														
1.2	Physical reclamation of internal and external dump (leveling Spreading of top soil top soil formation drain etc.)															
1.3	Physical reclamation of land of water and haul road															
1.4	Bio reclamation of above items															
1.5	Making safe approach up to [illegible]															

Sl. No	Activities to be undertaken	Manpower of NTPC	P-6	P-11	P-16	P-21	P-26	P-31	P-36	P-41	P-46	P-51	P-52	P-53	P-54	P-55
	the water lagoon for future uses															
1.6	Barbed wire fencing as per requirement															
2	**Environmental Management (Air, Water, Waste, Noise etc.)**															
2.1	Thorough inspection of external and stabilized internal dumps to find state of its stabilization & bio-reclamation	Supervisors-2 in each shift Environmental Engineer-1 in each shift														
2.2	Action to stabilize & vegetate uncovered patches, if any	Job Outsourced														
2.3	Inspection of garland drains & bunds around external dumps to prevent leachate water from entering natural water courses directly	Supervisors 2 in each shift Mining Engineer-1 in each shift														
2.4	Inspection of embankment to prevent entry of uncontrolled water to mine	Supervisors-2 in each shift Engineer-1 in each shift														
2.5	Strengthening of embankment															
2.6	Quarterly sampling of water to know its quality status	Lab Assistant 1 Hr per-1														
2.7	Record keeping monitoring and reporting	Surveyor-1 Chainman-3														
3	**Management of Infrastructure & Mining Machineries**															

Sl. No	Activities to be undertaken	Manpower of NTPC	P. 5	P. 11	P. 16	P. 21	P. 26	P. 31	P. 36	P. 41	P. 46	P. 51	P. 52	P. 53	P. 54	P. 55
3.1	Decommissioning of structures & semi permanent constructions												[redacted]			
3.2	Renovation of Mine/Project office, Canteen, Training Centre, Rest shelter etc.	200 Outsourced Civil Engineer-1, Supervisor-1, Surveyor-1, Chainman-2											[redacted]			
3.3	Cleaning of land for vegetation over the area												[redacted]			
3.4	Dismantling of machineries												[redacted]			
4	**Actions for safety & security of local community due to abandonment of the mine or part of the mine**															
4.1	Regular inspection of the mined out area, O.B. dumps for assessing the post mine job	Supervisors-2 in each shift, Mining Engineer-1 in each shift	[redacted]													
4.2	Action, if required, for making safe, the drainage areas, fire areas etc.		[redacted]													
4.3	Making 2 metre high pucca wall on the slope of internal dumps along the estimated water level													[redacted]		
4.4	Making 2 meter high pucca wall around the top edge of the mined out area where mined out void exists at the quarry edge	Supervisor-1 in each shift, Civil Engineer-1 in each shift						[redacted]								
4.5	Making 2 meter high pucca wall		[redacted]													

Sl. No	Activities to be undertaken	Manpower of NTPC	P. 6	P. 11	P. 16	P. 21	P. 26	P. 31	P. 36	P. 41	P. 46	P. 51	P. 52	P. 53	P. 54	P. 55
4.6	around the external OB Dump Closing with walling and gates in the haul road to prevent advertent entry into water lagoon	Supervisor 1 in each shift														
4.7	Filling the haul road up to ground level from surface up to sealing gate															
4.8	Survey of the total project area for updating mine plans Under Coal Mine Regulation	Supervisors 2 in each shift, Mining Engineer 1 in each shift														
5	**Social & Economic Aspects**															
5.1	C.S.R activities.	Engineer 1, HR executive/ staff-2														
6	**Execution & Supervisor**															
6.1	Purchasing/ hiring of equipment for closure activities etc															
6.2	Execution & Supervision of the activities by mining personal	Mining Engineer-1 HR executive/ staff-2														
7	**Miscellaneous charges including power cost, deployment of security personal 3 years post closure environmental monitoring, supervision , power cost etc.**	Engineer-2 HR executive/ staff-3														
8	Underground Mining															

Sl. No	Activities to be undertaken	Manpower of NTPC	P 5	P. 11	P. 16	P. 21	P. 26	P 31	P. 36	P. 41	P. 46	P. 51	P 52	P. 53	P. 54	P 55
8.1	Sealing of Mine entries for UG mine															
8.2	Isolation stopping if required															
8.3	Withdrawal of machinery etc															
8.4	Subsidence Management															
8.5	Post closure Subsidence Monitoring															
8.6	Miscellaneous charges including power cost, supervision etc															

Other manpower shall be deployed or outsourced as per actual requirement

11.4 Abandonment Cost

Tentative cost of likely closing activities as envisaged below has been estimated considering base date as December 2015 at current cost. Actual closing activities and activity wise costs may change during the preparation of Final Mine Closure Plan which shall be prepared before the likely cessation of mining operation. A time schedule for abandonment including post 3 years of likely cessation of mining operation along with tentative fund requirement has been shown in the bar chart given at **Table 11.22**.

Table-11.22

Provision for Expenditure for Mine Closure of Pakri Barwadih Coal Mining Block

Amount in Rs. Crore

Sl No	Activities to be undertaken	P-6	P-11	P-16	P-21	P-26	P-31	P-36	P-41	P-46	P-51	P-55	Cost
1	**Mined Area & Waste Management**												[illegible]
	Plantation along the block boundary embankment approach road CHP Cross country conveyor Railway siding etc and around the mine infrastructure area												
	Physical reclamation of internal and external dump (Leveling, Spreading of top soil toe wall formation, drain etc.)												
	Physical reclamation of land of batter and haul road												
	Bio reclamation of above items												
	Making safe approach up to the water lagoon for future uses												
	Barbed wire fencing as per requirement												

2	**Environmental Management (Air, Water, Waste, Noise etc.)**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23.29	[illegible]	[illegible]	[illegible]	291.14
[illegible]	Thorough inspection of external and stabilized internal dumps to find state of its stabilization & Bio- reclamation	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Action to stabilize & vegetate uncovered patches, if any	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Inspection of garland drains & bunds around external dumps to prevent leachate water from entering natural water courses directly	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Inspection of embankment to prevent entry of uncontrolled water to mine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Strengthening of embankment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Quarterly sampling of water to know its quality status	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Record keeping, monitoring and reporting	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	**Management of Infrastructure & Mining Machineries**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	261.80
[illegible]	Decommissioning of structurals & semi-permanent constructions									[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Removal on of							[illegible]					

Mine Project office, Canteen, Training Centre, Rest shelter etc.

Cleaning of land for vegetation over the area

Dismantling of machineries

Actions for safety & security of local community due to abandonment of the mine or part of the mine

Regular inspection of the mined out area, O.B dumps for assessing the closure job

Action if required, for making safe, the drainage areas, fire areas etc.

Making 2 metre high pucca wall on the slope of internal dumps, along the estimated water level

Making 2 meter high pucca wall around the top edge of the mined out area, where immediate void exists at the quarry edge.

Making 2 meter high pucca wall around the external OB Dump

	Closing with walling and gates in the haul road. to prevent inadvertant entry into water lagoon.													
	Filling the haul road up to ground level from surface up to sealing gate													
	Survey of the total project area for updating mine plans Under Coal Mine Regulation													
5	**Social & Economic Aspects**	7.17					2.00	12.09	10.00	10.21				62.07
	C S R activities													
6	**Execution & Supervisor**	0.00				5.00	12.1	0.00	15.00	15.5				69.70
	Purchasing/Hiring of equipment for closure activities etc.													
	Executor & Supervision of the activities by mining personal													
7	**Miscellaneous Charges**	0.00					0.00	2.54	2.00	2.05				17.167
	Miscellaneous charges including power cost, deployment of security personal 3 years post closure environmental monitoring supervision													

power cost etc

b **Underground Mining**	0	0	0	0	0	0	6.146 8	9.991 7	25.77 2	41.15 8	144.8 1	225.09
Sealing of Mine entries for UG mine												
Isolation stopping if required												
Withdrawal of machinery etc												
Subsidence Management												
Post closure Subsidence Monitoring												
Miscellaneous charges including power cost, supervision etc.												
Total estimated expenditure incurred (In Rs Crore)	75.0 8	92.6 4	44.4 5	56.7 8	72.4 1	92.5 0	118.0 6	147.9 0	176.5 0	225.2 1	381.3 4	1073.2 1

11.5 Annual Closure Cost

The annual closure cost has been calculated as per guidelines issued by MoC (vide letter no 55011/12/2009-CPAM dated 27/08/2009, 18.02.2011, 07.06.2011, 11.01.2012, & 07.01.13)

A. For Opencast

As per circulated guidelines of MoC the closure cost for an opencast mine is to be modified based on the Wholesale Price Index (WPI) as notified by Govt. of India.

The WPI for all commodities issued from Office of Economic Advisor, Ministry of Commerce and Industry, Govt. of India (Base date: 2004-05) was 129.60 in

Aug'09 and 177.60 in November 2015. The closure cost was Rs 6.00 Lakhs per Ha in Aug 09. The current closure cost has been arrived by multiplying Rs 6.00 Lakhs per Ha by the ratio of WPI in November '15 and WPI in Aug'09 which comes to be Rs 8.22 Lakhs per Ha. The calculation methodology is given in **Table 11.23.**

Table-11.23

Methodology of Calculation of Annual Closure Cost (Opencast)

A	Lease hold area for West Quarry (including area for Infrastructure outside the block boundary). Unutilised area	3103.04 Ha
B	Lease hold area for Eastern Quarry	
C	Lease hold area for Pakri Barwadih 'A	485.00 Ha
D	Total lease hold area for opencast (West Quarry, East Quarry, area for infrastructure outside the block boundary, Unutilised area and North West(Sector-A) considered for mine closure (A+B+C)	3588.04 Ha
E	Mine closure cost per Ha for opencast mine in Aug 09	6.00 Lakhs
F	Mine closure cost per Ha for opencast mine in November 15	8.22 Lakhs
G	Life of the mine	52 years
H	Annual base price [(D X F)/G] (for 1st year)	Rs. 567.34 Lakhs
I	Total closure cost for opencast mine (Compounding @ 5% annual escalation)	Rs 1321.09 Cr.

B. For Underground

As per calculated guidelines of MoC the closure cost for an underground mine is to be modified based on the Wholesale Price Index (WPI) as notified by Govt. of India

The WPI for all commodities issued from Office of Economic Advisor Ministry of Commerce and Industry, Govt of India (Base date 2004-05) was 129.60 in Aug 09 and 177.60 in November '2015. The closure cost was 1.00 Lakhs per Ha

in Aug'09. The current closure cost has been arrived by multiplying Rs 1.00 Lakhs per Ha by the ratio of WPI in November '15 and WPI in August'09 which comes to be Rs 1.37 Lakhs per Ha. The base cost has been escalated to arrive the mine closure cost of land for underground area in year P-10@5% annually. The calculation methodology is given in **Table 11.24**:

Table-11.24

Methodology of Calculation of Annual Closure Cost (Underground)

A	Total lease hold area considered for mine closure	1106.96 Ha
B	Mine closure cost per Ha for underground area in Aug'09	Rs. 1.00 Lakhs
C	Mine closure cost per Ha for underground area in November ' 2015	Rs. 1.37 Lakhs
D	Rate per Ha (1.37 Lakhs per ha – escalated up to P-10th year @ 5% PA)	Rs. 2.13 Lakhs
E	Life of Mine (P-10 to P-39)	30 year
F	Annual base price [(A X D)/E] (for 1st year of underground operation i.e. P-10)	Rs. 78.44 Lakhs
G	Total closure cost for underground mine (Compounding @ 5% annual escalation)	Rs 52.12 Crores

The year wise closure cost for opencast and underground is tabulated in **Table 11.25.**

Table 11.25

Year wise Closure Cost for Pakri Barwadih Mine

Closure Cost of PB Coal Block								
Year	Average cost per annum on current cost (In Crores)			Year wise Expenditure with 5 % escalation(In Crores)			Cummulative amount deposited in the Escrow account excluding interest (Rs Crore)	Maximum amount excluding Interest to be released w.r.t. expenditure incurred (Rs Crore)
	Opencast	Underground	Total	Opencast	Underground	Total		
P1	5.67	0.00	5.67	5.67	0.00	5.67	5.67	
P2	5.67	0.00	5.67	5.96	0.00	5.96	11.63	
P3	5.67	0.00	5.67	6.25	0.00	6.25	17.89	
P4	5.67	0.00	5.67	6.57	0.00	6.57	24.45	
P5	5.67	0.00	5.67	6.90	0.00	6.90	31.35	
P6	5.67	0.00	5.67	7.24	0.00	7.24	38.59	25.08
P7	5.67	0.00	5.67	7.60	0.00	7.60	46.19	
P8	5.67	0.00	5.67	7.98	0.00	7.98	54.18	
P9	5.67	0.00	5.67	8.38	0.00	8.38	62.56	
P10	5.67	0.78	6.46	8.80	0.78	9.59	72.14	
P11	5.67	0.78	6.46	9.24	0.82	10.07	82.21	32.64
P12	5.67	0.78	6.46	9.70	0.86	10.57	92.78	
P13	5.67	0.78	6.46	10.19	0.91	11.10	103.87	
P14	5.67	0.78	6.46	10.70	0.95	11.65	115.53	
P15	5.67	0.78	6.46	11.23	1.00	12.23	127.76	
P16	5.67	0.78	6.46	11.79	1.05	12.85	140.61	44.49
P17	5.67	0.78	6.46	12.38	1.10	13.49	154.09	
P18	5.67	0.78	6.46	13.00	1.16	14.16	168.26	
P19	5.67	0.78	6.46	13.65	1.22	14.87	183.13	
P20	5.67	0.78	6.46	14.34	1.28	15.61	198.74	
P21	5.67	0.78	6.46	15.05	1.34	16.39	215.14	56.78
P22	5.67	0.78	6.46	15.81	1.41	17.21	232.35	
P23	5.67	0.78	6.46	16.60	1.48	18.08	250.43	
P24	5.67	0.78	6.46	17.43	1.55	18.98	269.40	

P25	5.67	0.78	6.46	18.30	1.63	19.93	289.33	
P26	5.67	0.78	6.46	19.21	1.71	20.92	310.26	72.17
P27	5.67	0.78	6.46	20.17	1.80	21.97	332.23	
P28	5.67	0.78	6.46	21.18	1.89	23.07	355.30	
P29	5.67	0.78	6.46	22.24	1.98	24.22	379.52	
P30	5.67	0.78	6.46	23.35	2.08	25.43	404.95	
P31	5.67	0.78	6.46	24.52	2.19	26.71	431.66	92.50
P32	5.67	0.78	6.46	25.75	2.29	28.04	459.70	
P33	5.67	0.78	6.46	27.03	2.41	29.44	489.14	
P34	5.67	0.78	6.46	28.39	2.53	30.91	520.06	
P35	5.67	0.78	6.46	29.80	2.66	32.46	552.52	
P36	5.67	0.78	6.46	31.29	2.79	34.08	586.60	118.05
P37	5.67	0.78	6.46	32.86	2.93	35.79	622.39	
P38	5.67	0.78	6.46	34.50	3.08	37.58	659.97	
P39	5.67	0.78	6.46	36.23	3.23	39.46	699.42	
P40	5.67	0.00	5.67	38.04		38.04	737.46	
P41	5.67	0.00	5.67	39.94		39.94	777.40	147.96
P42	5.67	0.00	5.67	41.94		41.94	819.34	
P43	5.67	0.00	5.67	44.03		44.03	863.37	
P44	5.67	0.00	5.67	46.24		46.24	909.61	
P45	5.67	0.00	5.67	48.55		48.55	958.16	
P46	5.67	0.00	5.67	50.98		50.98	1009.13	176.56
P47	5.67	0.00	5.67	53.52		53.52	1062.66	
P48	5.67	0.00	5.67	56.20		56.20	1118.86	
P49	5.67	0.00	5.67	59.01		59.01	1177.87	
P50	5.67	0.00	5.67	61.96		61.96	1239.83	
P51	5.67	0.00	5.67	65.06		65.06	1304.89	225.34
P52	5.67	0.00	5.67	68.31		68.31	1373.20	
End of Mine Closure								381.34
Total Cost	**295.02**	**23.53**	**318.55**	**1321.09**	**52.12**	**1373.20**		**1373.20**

Note:

- The above estimated closure cost is based on WPI for "All commodities" as on November 2015. The WPI value for "All Commodities" as downloaded from website of "Office of Economic Advisor" is enclosed as **Annexure XX**.
- Escrow Account has already been opened for area of 4628 ha corresponding mine closure cost is Rs. 799.19 Crores. (Copy of Approval of Mine Closure Plan (MoC) is enclosed at **Annexure-XIII** and the copy of Approved Mine Closure Plan (Report) is enclosed at **Annexure XIIIA**.

11.6 Financial Assurance

As per guidelines for Mine Closure Plan. NTPC shall take following actions for ensuring the financial assurance to complete the mine closure activities:

11.6.1 Opening of an Escrow Account

The proponent has already opened an escrow Account with the Scheduled Bank. The beneficiary of this account is Coal Controller Organization (on behalf of central Government). The proponent shall deposit the amount detailed in previous chapter, on yearly basis into this Escrow account.

11.6.2 Condition for operating the Escrow Account

An agreement, outlining detailed terms and conditions of operating the Escrow account, has been finalized and executed amongst the project owners, concerned Bank and the Coal Controller.

11.6.3 Release of Funds from Escrow Account

Mining shall be carried out in a phased manner initiating afforestation/ work in the mined out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo mining condition of the mine. Up to 80% of the total deposited amount including interest accrued in the escrow account shall be released after every five years in line with the periodic examination of the Closure Plan as per Clause 3.1 of the Annexure of the Guidelines.

The amount released shall be equal to the expenditure incurred in the Progressive Mine Closure in past five years or 80% whichever is less. The balance amount at the end of the Final Mine Closure shall be released to mine owner / lease holder on compliance of all provisions of closure plan duly signed by the lessee. It shall be certified that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Govt, statutory organizations, court etc and duly certified by the Coal Controller.

11.7 Responsibilities of the owner

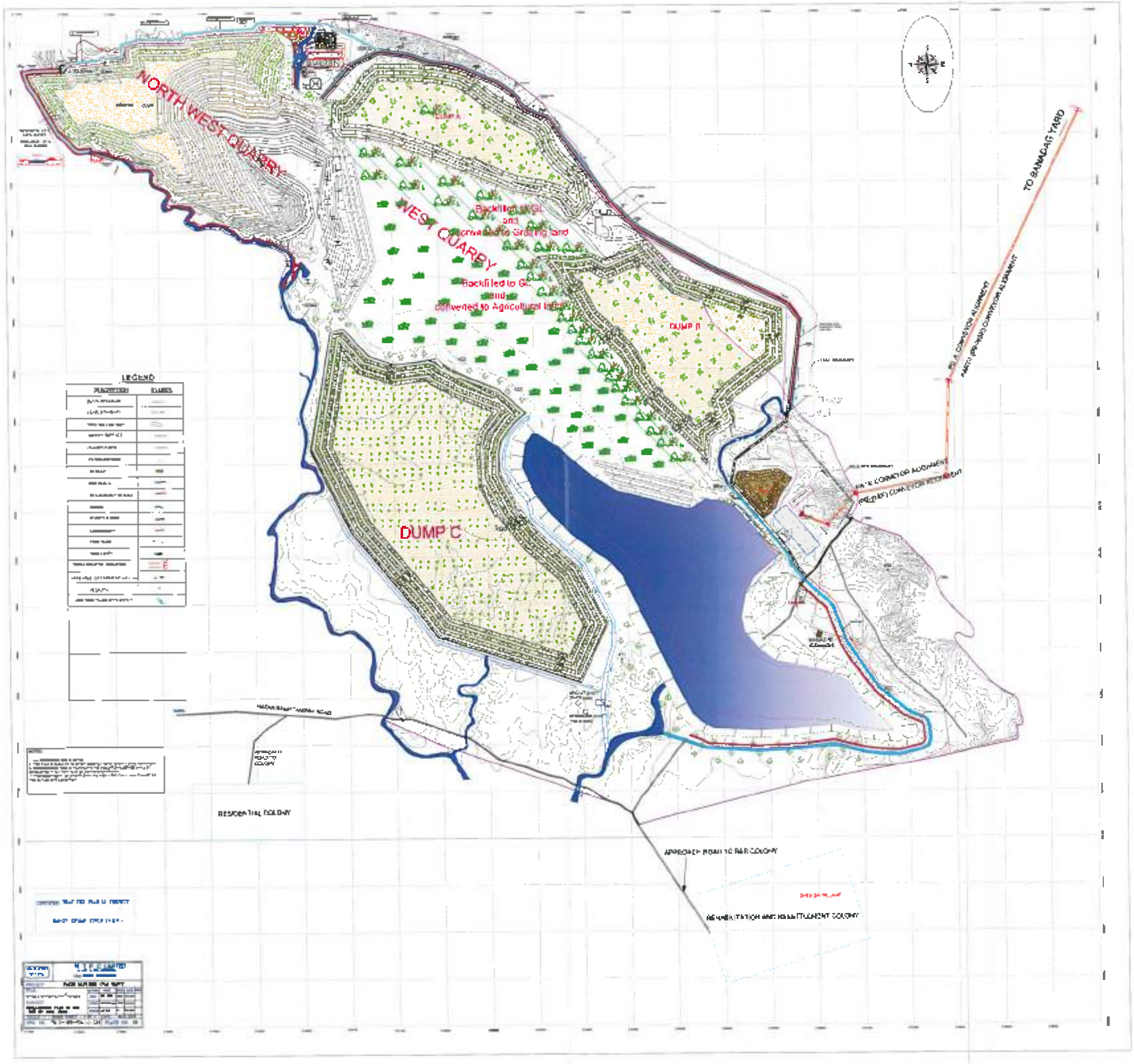
NTPC shall ensure that protective measures contained in the Mine Closure Plan including reclamation and rehabilitation works are carried out in accordance with the approved Mine Closure Plan and Final Mine Closure Plan.

NTPC shall submit to the coal controller a yearly report before 1st July every year setting forth the extent of protective and rehabilitative works carried out as envisaged in the approved Mine Closure Plans. (Progressive and Final Closure Plans). Details of physical progress of the closure activities and expenses incurred shall be included in the yearly report.

11.8 Provision for Mine Closure

NTPC shall obtain a mine closure certificate from Coal Controller to the effect that the protective, reclamation and rehabilitation works have been carried out in accordance with the Mine Closure Plan/Final Mine Closure Plan for surrendering the reclaimed land to the State Government concerned.
After the closure of the mine, the reclaimed leasehold area and any structure thereon, which is not to be utilized by NTPC, shall be surrendered to the state Govt. concerned following a laid down procedure as in vogue at that point of time.

The balance amount at the end of the final Mine Closure shall be released to NTPC on compliance of all provisions of Closure Plan duly signed by the mine owner to the effect that said closure of mine complied with all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court etc. and duly certified by the Coal Controller. This should also indicate the estimated extractable coal reserves and coal actually mined out
If the Coal Controller has reasonable grounds for believing that the protective, reclamation and rehabilitation measures as envisaged in the approved mine closure plan in respect of which financial assurance was given has not been or will not be carried out in accordance with mine closure plan either fully or partially, the Coal controller shall give the mine owner a written notice of his intention to issue the orders for forfeiting the sum assured at least thirty days prior to the date of the order to be issued after giving an opportunity to be heard.



आई. पी. नागपाल / I.P. NAGPAL
अवर सचिव / Under Secretary
कोयला मंत्रालय / Ministry of Coal
शास्त्री भवन / Shastri Bhawan
नई दिल्ली / New Delhi-110001

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011/(15)/2009-CPAM
Ministry of Coal, Govt. of India

ANNEXURES

LIST OF ANNEXURES

SL. NO.	PARTICULAR	ANNEXURE
1	Copy of block allotment letter & MoC Letter dated 24th August 2005	Annexure – I & Annexure-II
2.	Copy of Approved Mining Plan & MoC s letter approval of Mining Plan	Annexure –III & Annexure-IIIA
3.	Copy of letter for submission of Mining Plan for PB North-West (Sector-A)	Annexure –IV
4.	Copy of letter for submission of Mining Plan for PB East	Annexure - V
5.	Copy of MoC's letter for submission of Revised Mining Plan and Mine Closure Plan	Annexure - VI
6.	Copy of letter of submission of Revised Mining Plan (1st Revision) to MoC	Annexure - VII
7.	Copy of letter for commencement of Mining from PB East	Annexure - VIII
8	Copy of MoC's letter for submission of Revised Mining Plan incorporating the changes in sequence of mining operation	Annexure -IX
9.	Copy of MoC's letter granting recognition to RQP for preparation of Mining Plan.	Annexure -X
10.	Copy of letter from CMPDIL& MECL for procurement of GR	Annexure –XI& Annexure-XIA
11	No dues certificate from CMPDIL regarding Exploration cost	Annexure -XII
12.	Copy of approval letter of Mine Closure Plan & Approved Mine Closure Plan(Jan' 2012)	Annexure –XIII & Annexure - XIIIA
13.	Notification under Section 7 (1) of CBA (A&D) Act	Annexure - XIV
14.	Co-ordinates boreholes of Pakri Barwadih	Annexure - XV
15	Letter of authorization by the Block Allottee to the RQP	Annexure – XVI
16.	Certificates by the RQP regarding observance of guidelines of Mining Plan	Annexure – XVI A
17.	Certificates by the RQP regarding coverage of block area.	Annexure – XVI B
18	Certificates by the RQP regarding block boundary as per MoC letter	Annexure – XVI C

ANNEXURE-I

No. 13016/39/2003-CA
Government of India
Ministry of Coal and Mines
Department of Coal

New Delhi, the 11.10.2004

To

The Chairman & Managing Director,
National Thermal Power Corporation Ltd.,
NTPC Bhawan, Scope Complex,
7 Institutional Area, Lodhi Road,
New Delhi.

Subject :- Allotment of Pakri Barwadih Coal block in favour of National Thermal Power Corporation Ltd. to undertake coal mining for exclusive use of coal in their power plants.

S

I am directed to refer to your letter No. D1/CMC W/MOC/067-623 dated 9.8.2004 on the subject mentioned above and hereby convey the 'in principle' consent of the Government of India to the working of Pakri Barwadih coal block by the National Thermal Power Corporation Limited within the provision of Central Government Company dispensation under Section 3(3)(a) (i) of the Coal Mines (Nationalisation) Act, 1973 subject to the following conditions :-

i) Coal mining shall be carried on by NTPC or a separate company to be created with NTPC's participation provided such separate company is a Central Government company with coal mining as an object in its Memorandum of Association. This condition is necessitated under S. 3(3)(a)(i) of the Coal Mines (Nationalisation) Act, 1973 which allows coal mining to a Central Government Company.

ii) Coal linkages from CIL/SCCL would not be disturbed in any way with coal mined from Pakri Barwadih block. NTPC shall continue to honour its commitment towards long term linkage from these nationalized coal companies to their thermal power stations through FSAs.

iii) All coal mined from the block including any middlings or rejects etc, if washing is resorted to, shall be used in NTPC power plants. No coal will be disposed off in any other manner, whatsoever without prior permission, in writing, of the Department of Coal.

iv) NTPC would plan for both Open cast and underground mining in Pakri Barwadih coal block so as to extract the reserves below 300 meters as well as later cate

v) NTPC will do coal mining in accordance with the provisions of the Coal Mines (Nationalisation) Act 1973, the MMDR Act, 1957, the Contract Labour (Regulation & Abolition) Act, 1970 and in compliance with all other mineral, environmental and labour laws and regulations governing the Indian Coal Industry.

vi) The mining lease will be executed in the name of the NTPC or such separate Government company which may be formed with equity participation by NTPC

vii) Violation of any of the conditions imposed above on the separate Government Company, in mining and disposing o Barwadih coal block will render the mining lease liable for cance

viii) NTPC may approach the CMPDIL to obtain the geologica payment of necessary exploration cost and obtain a mining leas per the provisions of the MM (D&R) Act, 1957

Yours faithfully,

(S. K. Kakkar)
Under Secretary

ANNEXURE-II

Sujit Gulati
Director
Tel. [illegible]

D.O. No. 13010/2/2003-CA I
Government of India
Ministry of Coal
Shastri Bhawan
New Delhi

Date: 24th August, 2005

Dear Shri Choudhary,

Kindly refer to your letter dated 20/24.5.2005. It has been decided in the Ministry that the block boundary to be indicated to NTPC should be the entire block of Pakri Barwadih, including the CBM area as also the unexplored lowermost portion marked as 'A' in the map supplied by you and accepted to this issue.

Since, there is an overlap between CBM exploration areas given to ONGC/JOC and the coal block given to NTPC, this boundary will be communicated to NTPC with the condition that they shall render all necessary cooperation for proper exploration of CBM by the allocattees of CBM blocks without any financial liability or other liabilities on the part of those who have CBM exploration licence.

Further, in order to have a harmonious and coordinated development of the area, both for coal mining as well as exploration/exploitation of CBM, this matter will be referred to the Joint Committee between the Ministry of Coal and Ministry of Petroleum and Natural Gas set up under the MOU of 1997 so that necessary information can be fed to the Joint Committee both by ONGC/JOC and NTPC about their plans so that proper coordinated planning can be done and issues, if any, sorted out in time. You may also inform NTPC accordingly.

With regards.

Yours sincerely,

(Sujit Gulati)

Shri S. Choudhary
Chairman/Managing Director
CMPDIL
Kanke Road
Ranchi

Copy to the Chairman, NTPC, SCOPE Complex, Lodhi road, New Delhi for information. The allocation of Pakri Barwadih coal block to M/s NTPC shall be subject to their rendering all necessary assistance and cooperation to the allocattees of the overlapping CBM block for exploration/exploitation without any financial liability on the allocattees of the CBM block and to render all necessary information/ cooperation to the Joint Committee for coordinated exploitation/exploration of coal and CBM in the block of Pakri Barwadih.

([illegible])
Section Officer

S. D. Sahai
Recognised Qualified Person
RQP No. 34011/(16)/2004-CPAM

SANJIV KUMAR
Recognised Qualified Person
No. 34011/(16)/2004-CPAM
Ministry of Coal, New Delhi

ANNEXURE-III

No. 13016/29/2003-CA-I
Government of India
Ministry of Coal

New Delhi, the 28th August 2006.

To

The Chairman-cum-Managing Director,
National Thermal Power Corporation Limited,
NTPC Bhawan,
SCOPE Complex, Lodhi Road,
New Delhi – 110 003.

Subject : Approval of Mining Plan in respect of Pakri-Barwadih coal mining block (June, 2006) of NTPC Limited

Sir,

I am directed to refer to your letter No. NTPC:CM:MP:2006:180106 dated 18.01.2006 submitting mining plan of Pakri-Barwadih coal mining block for approval of the Central Government and to state that the mining plan of Pakri-Barwadih coal mining block has been considered and the approval of the Central Government thereon is hereby conveyed under Section 5 (2) (b) of the Mines & Minerals (Development & Regulation) Act, 1957 subject to the following conditions :-

i) The Mining Company shall achieve the 15 Mty production level from the opencast operation by 12th year.

ii) As regards part of coal block that has also been allotted to ONGC for Coal Bed Methane extractions, the conditions laid down in the allotment letter shall be fully complied with.

iii) The approval of the mining plan is without prejudice to the requirement of approvals from competent/prescribed authority under the relevant rules/regulations etc.

2 Two copies of the approved mining plans duly signed by the competent authority are returned herewith, with the request that a copy of the approved mining plan may be submitted to the concerned State Government for necessary action and also a photocopy of the approved mining plan may be sent to the Coal Controller for monitoring of the block.

Yours faithfully,

(V.S. Rana)
Under Secretary to the Govt. of India.

Encls : As above

ANNEXURE-IV

एन टी पी सी लिमिटेड
NTPC Limited

Ref NTPC/PE MP&J/ 7513

Date 02/07/2013

To
The Section Officer (CA-I)
Ministry of Coal,
Shastri Bhawan
New Delhi

Sub **Submission of Mining Plan and Mine Closure Plan of Pakri Barwadih 'A' which is a part of Pakri Barwadih Coal Block of NTPC Ltd. for Approval of MoC**

Dear Sir,

NTPC Ltd was allotted Pakri Barwadih Coal Block in North Karanpura Coalfield in the State of Jharkhand vide MoC letter No 13016/29/2003-CA-I dated 11th oct/2004, New Delhi. Mining Plan for the Block has been approved by MoC vide letter no 13016/29/2003-CA-I dated 25th Aug/2005. As Area 'A' of the Block was not explored at that time, NTPC has given commitment to carry out detailed exploration of the area and to submit a separate Mining Plan for this.

Detailed exploration of the area has been now been carried out and a separate Mining Plan and Mine Closure Plan for this has been prepared as per MMDR Act 1957 and Rule 22 (4) of Mineral Concession Rules, 1960 and enclosed in two volumes i.e

Volume I	Text
Volume II	Drawings

Four copies of Mining Plan and Mine Closure Plan are enclosed for kind perusal and according necessary approval Please

Thanking You

Yours Sincerely

A K Dash
Addl GM (PE-Mine Planning & Design)
5th Floor, Engineering Office Complex, Sector 24
NTPC Ltd., NOIDA 201301
Telno 0120-2410187
Email akdash@ntpccebo.co.in

Enc. Four Copies of Mining Plan in two volumes (Text & Drawings)

Copy for kind information GM(PE-MP&D)/ GM(PE-Mech)/ GM(Coal Mining)/ GM(P&M)/ CD (Engg)/ LD(T)/ ED-STA & D(T)

ANNEXURE-V

एन टी पी सी लिमिटेड
NTPC Limited

[illegible]

[illegible] Mining Plan and Mine Closure Plan of Pakri Barwadih East Quarry which [illegible] Pakri Barwadih Coal Block [illegible] for Approval of MoC

[illegible]

[illegible]

[illegible]

[illegible]

ANNEXURE-VI

SPEED POST

[illegible]
[illegible]
[illegible]

[illegible]
Dated the [illegible]

To

Shri A.K. Dash,
[illegible]
[illegible]
[illegible]
[illegible]

Subject:- Submission of Revised Mine plan and Mine Closure Plan of Pakri Barwadih coal Block of NTPC for approval of MoC.

Sir,

[illegible]

(i) [illegible]

(ii) Mining Plan of Pakri Barwadih [illegible]

(iii) [illegible] Pakri Barwadih [illegible]

[illegible]

[illegible]

Yours faithfully

(A. SANJAY SAHAY)
[illegible]
[illegible]

Copy [illegible] Director (Tech) Ministry of Coal.

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011(15)/2009-CPAM
Ministry of Coal, Govt. of India

ANNEXURE-VI

NTPC Limited

[illegible] Date: [illegible] 2018

[illegible]
[illegible]
New Delhi

Sub: Submission of revised Mining Plan & [illegible] Plan (1st Revision) [illegible]
of Pakri Barwadih [illegible] for Approval [illegible]

[illegible]

[illegible] Annexure [illegible]

[illegible]

NTPC

To
The Section Officer (CPAM)
Ministry of Coal
Shastri Bhawan
New Delhi- 110001

शाखा :
कोयला मं
नई

Sub: Deviations/Variations with respect to approved Mining Plan

Relocation of Initial Quarry (from Barwadih Coal Mining Block [illegible] and Relocation of Internal Dump in Quarry [illegible] Area [illegible] of Pakri Barwadih Coal Mining Block

Ref: Approval of Mining Plan [illegible] 26.08.2006

Dear Sir,

[illegible] Coal Block, Dist. Hazaribagh, Jharkhand for captive mining by Ministry of Coal, Government of India vide letter no. [illegible]/2003-CA, New Delhi, dated [illegible] 2004 & [illegible] No. [illegible]/2003-CA dated 24th August 2005 (copy enclosed). The Mining plan of Pakri Barwadih Coal Block which covered mining of Western and Eastern Area of the block was approved by MoC vide letter no. [illegible] dated 26.08.2006 for targeted capacity of 10 Mtpa.

As per approved Mining Plan, West and East Quarry of Pakri Barwadih Coal Mining Project were envisaged to be worked in sequence i.e. West Quarry, followed by East Quarry, Western Quarry (Yr. 1 to Yr. [illegible]) & Eastern Quarry (Yr. 25 to Yr. [illegible]). Access Pit was envisaged to be opened at four places namely WP-1, [illegible] and WP-4. External Dumps were planned to be placed at three designated places namely Dump A, B, C. Backfilling of the Eastern Quarry was planned to be done with the waste of Western Quarry. Advancing mining in the above manner and external dumps is shown in the drawing placed at **Annexure - 1 (Plate No. I)**

To fulfil the commitment given to Government of India, Ministry of Coal, Government of India also keeping in view the likely time taken in grant of MoC's approval for Variation Plan and timely evacuation of coal, [illegible] connecting roads, NTPC has proposed to commence Mining Operations in the Eastern Pit area adjacent to main [illegible] Quarry. [illegible] of Coal

SANJIV KUMAR SI[illegible]
Recognised Qualified P[illegible]
No. 34011/(15)/2009-Ci[illegible]
Ministry of Coal, Govt. of In[illegible]

production has been planned from a point of Eastern Quarry for the years as **Interim Arrangement**. The Plans showing the proposed stage of work in the end of First Year and Second Year are given in **Plate No. II and III (Annexure III)** respectively. Proposed area for mining has been mainly selected due to the available land for mining as well as ease of approach from the State Highway.

Due to the above mentioned interim arrangement there are certain variations with respect to approved Mining Plan as mentioned below:

i) **Change in mining sequence and External Dump Area:** The proposed Quarry area is part of Eastern Pit as per approved Mining Plan in its North Eastern part. The proposed quarry is at a distance of approximately 650 m in North West direction from the Tandwa Rohtagarha Hazaribagh State Highway and is accessible by coal crossing in Arhara village from the State Highway. However in variance with the approved Mining Plan Eastern Quarry is now planned to be started in 1st year of Mining Operations instead of 25th year.

The land for external dumps as per approved Mining Plan Dump A in Q-4 is presently not available. Accordingly to start mining operations **External Dump** has been planned in the available land in the north side of the quarry and this area lies partly in the area earlier identified for coal evacuation routes. This dump area mainly consists of demarcated and non demarcated forest land. (The [illegible] **Plate No. II**. [illegible] has been obtained and change of land use of the area has been taken up with MoEF.

ii) **Variation in Coal Transportation Arrangement:** As per approved Mining Plan coal is planned to be transported through belt conveyor to Balwadih Railway Siding which are under construction. It is pertinent that coal shall be transported to Balwadih Siding by road till the completion of cross country conveyor.

There is no change in calendar program and mining lease area with respect to the approved Mining Plan.

The Site plans duly signed by RQP is enclosed as Annexure II for your kind consideration please.

Thanking you.

Yours faithfully

SANJIV KUMAR SINGH
Recognised Qualified Person
No. [illegible]
Ministry of Coal, Govt. of India

Sunil Jumdel
General Manager
Coal Mining (Engg)
Fax No. 011-24367089

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011/(15)/2009-CP (V)
Ministry of Coal, Govt. of India

Annexure

Annexure - I

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011/(15)/2009-CTAM
Ministry of Coal, Govt. of India

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 2401/(15)/2009 CPAM
Ministry of Coal, Govt. of India

AREA 'A'
SANJIV KUMAR GI
Recognised Qualified P
No. 34011/(15)/2009-C
Ministry of Coal, Govt. of India

AREA 'A'

SANJIV KUMAR SINGH
Recognised Qualified Person
Ministry of Coal, Govt. of India

ANNEXURE-IX

[illegible]

[illegible] [illegible] Bridge & Mining Sequence and External Dump Area [illegible]
[illegible] for [illegible] [illegible]

[illegible]

[illegible]

ANNEXURE - IA

Sujit Gulati
Director
to Director

D.O. No. 13016/2/2003-CA I
Government of India
Ministry of Coal
Shastri Bhawan
New Delhi

Date: 24th August, 2005

Dear Shri Choudhary,

Kindly refer to your letter dated 23/24.5.2005. It has been decided in the Ministry that the block boundary to be indicated to NTPC should be the entire block of Pakri Barwadih including the CBM area as also the unexplored western portion marked as 'A' in the map supplied by you and annexed to this letter.

Since, there is an overlap between CBM exploration areas given to ONGC/GIPC and the coal block given to NTPC, this boundary will be communicated to NTPC with the condition that they shall render all necessary cooperation for proper exploration of CBM by the allocatees of CBM blocks without any financial liability or other liabilities on the part of those who have CBM exploration licence.

Further, in order to have a harmonious and coordinated development of the area, both for coal mining as well as exploration/exploitation of CBM, this matter will be referred to the Joint Committee between the Ministry of Coal and Ministry of Petroleum and Natural Gas set up under the MOU of 1997 so that necessary information can be fed to the Joint Committee both by ONGC/GIPC and NTPC about their plans so that proper coordinated planning can be done and issues, if any, sorted out in time. You may also inform NTPC accordingly.

With regards,

Yours sincerely,

(Sujit Gulati)

Shri S. Choudhary
Chairman/Managing Director
CMPDIL
Kanke Road
Ranchi

Copy to the Chairman, NTPC, SCOPE Complex, Lodhi road, New Delhi for information. The allocation of Pakri Barwadih coal block to M/s NTPC shall be subject to their rendering all necessary assistance and cooperation to the allocatees of the overlapping CBM block for exploration/exploitation without any financial liability on the allocatees of the CBM block and to render all necessary information/ cooperation to the Joint Committee for coordinated exploration/exploitation of coal and CBM in the block of Pakri Barwadih.

Section Officer

S. D. Sahai
Recognised Qualified Person
CGP NO. 3/011/(16)/2004-CPAM

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 3/011/(15)/2009-CPAM
Ministry of Coal, Govt. of India

Sample

ANNEXURE-X

ANNEXURE-XI

CMPDI
ISO 9001 Company

सेन्ट्रल माइन प्लानिंग एण्ड डिजाइन इन्स्टीट्यूट लिमिटेड
गोन्डवाना प्लेस, कांके रोड, राँची - 834 008 (झारखण्ड) इण्डिया
Central Mine Planning & Design Institute Limited
Gondwana Place, Kanke Road, Ranchi - 834 008 (Jharkhand), INDIA

Ref. No. DG/693(A)/ /095-96 Dt. 4th May'05

To
Sri S.K. Gupta
AGM(I/c-FM-CM)
National Thermal Power Corpn. Ltd.
Engineering Office Complex
Plot No. A-8A, Sector-24,
Post Box No. 13,
NOIDA (U.P)
Pin-201301

Sub : **Geological Report of Pakri Barwadih Block**
Ref : *Your letter Nil dt. 2.5.05*

Dear Sir,

The copy of the Geological Report of Pakri Barwadih block is hereby being handed over to your representative. You are requested to kindly note that the above report may neither be reproduced in any form nor a copy of the same be handed over to any other person. However, you will be required to pay the full exploration cost once you hear from CMPDI in this regard.

Yours faithfully,

(A. Mukherjee)
Chief of Geology & Drilling

Dr. D. Sahai
Recognised Qualified Person
RQP No.-34011/(16)/2004-CPAM

☎ : (+91) 651 2230238, 2231852, 2231950, Fax : (+91) 651 2231851, 2231447, E-Mail : cmpdihq@cmpdi.co.in
Visit CMPDI Web page http://www.cmpdi.co.in

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 34011/(15)/2009-CPAM
Ministry of Coal, Govt. of India

ANNEX-D/ 1/2.

ANNEXURE-XI

cmpdi

Central Mine Planning & Design Institute Limited

पत्रांक सरला/सीएनपीडीआई/सीजी/कैपटीव/30-1153 दिनांक 12.08.2016

सेवा में,

श्री मनीष उनियाल,

SO, CA-I

भारत सरकार,

कोयला मंत्रालय,

शास्त्री भवन,

नई दिल्ली - 110 115

Sub: Exploration cost of CMPDIL for Pakri Barwadih coal block – additional payment reg.

महाशय

With reference to your letter No 13016/09/2016-CA-I (Part) dated 15th July, 2016 on the above subject, it may be mentioned that CMPDI vide letter No CMPDI/CG/Captive/39/752 dated 23.05.2016 addressed to Mr A Sanjay Sahay, Under Secretary (Coal), MoC had communicated that Rs 1,50,80,373.00 is outstanding against NTPC on the basis of information available at that point of time. However, after receipt of the instant letter the matter was re-investigated and it was found that no additional payment is due with NTPC since the payment of Rs.15,60,29,462/- only has been demanded by NTPC before the datum line set by CMPDI vide its letter dated 14/15.02.2006. The matter may also be communicated to NTPC.

धन्यवाद,

भवदीय

12.08.2016

(अभिलाभ राय)

महाप्रबन्धक (अन्वेषण)

Central Mine Planning & Design Institute Limited
Regd. Office: Gondwana Place, Kanke Road, Ranchi - 834 031, Jharkhand (INDIA)
CORPORATE IDENTITY NUMBER - U14292JH1975GOI001229
Website Address: www.cmpdi.co.in

ANNEXURE-XI

No 34011/09/2011-CPAM
Government of India
Ministry of Coal

Shastri Bhavan
New Delhi, 20th April 2012

To

Shri A K Dash
Additional General Manager (PE-MPD)
6th Floor Engineering Office Complex, Sector-24
NTPC Limited, Noida -201301.
Fax No.0120-2410136, 37, Tele : 0120-2410102

Subject :	Approval of Mine Closure Plan (January, 2012) for Pakri Barwadih Coal Block, District Hazaribagh, Jharkhand submitted by M/s NTPC Ltd.

Sir,

I am directed to refer to your letter No CC:PEM:7010:MP:09 dated 31-01-2012 on the subject mentioned above and to say that the Mine Closure Plan (January 2012) to be read along with the party's letter dated 31-01-2012 has been considered by the Standing Committee and the approval of the Central Government is hereby conveyed under Section 5(2)(b) of the Mines & Minerals (Development & Regulation) Act, 1957 subject to the following conditions

(i) The mining company shall take all necessary precautions regarding safety of mine workings, persons deployed therein during the implementation of the Mine Closure Plan;

(ii) Mining lease to be acquired shall not encroach into any other coal block.

(iii) The approval of the mine closure plan is without prejudice to the requirement of approvals from competent/prescribed authority under the relevant rules/regulations, etc

Two copies of the approved Mine Closure Plan duly signed by the competent authority are returned herewith with request that a copy of the approved Mine Closure Plan may be submitted to concerned State Government for necessary action and also a photocopy of the approved Mine Closure plan may be sent to the Coal Controller for the purpose of monitoring

(V S Rana)
Under Secretary (CPAM)
Tele 011 23073937
Fax 011 23073922
Email: uscpam.mcc@nic.in

Encls as above

Copy to (i) The Under Secretary (CA-I) One copy of the approved Mine Closure Plan (January 2012) and company's letters dated 31-01-2012 are forwarded herewith

(ii) The Director Coal Controller 1-Council House Street Kolkata

रजिस्ट्री सं. डी. एल. (एन) 04/0067/2003–05

REGD. NO. D. L. (N)04/0007/2003–05

भारत का राजपत्र
The Gazette of India

प्राधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

साप्ताहिक

WEEKLY

सं. 25] नई दिल्ली, जून 17— जून 23, 2012, शनिवार/ज्येष्ठ 27—आषाढ़ 2, 1934

No. 25] NEW DELHI, JUNE 17—JUNE 23, 2012, SATURDAY/JYAISTHA 27—ASADHA 2, 1934

भाग में भिन्न पृष्ठ संख्या दी जाती है जिससे कि वह पृथक संकलन के रूप में रखा जा सके

Separate Paging is given to this Part in order that it may be filed as a separate compilation

भाग II—खण्ड 3—उप खण्ड (ii)

PART II—Section 3—Sub-section (ii)

भारत सरकार के मंत्रालयों (रक्षा मंत्रालय को छोड़कर) द्वारा जारी किए गए सांविधिक आदेश और अधिसूचनाएं

Statutory Orders and Notifications Issued by the Ministries of the Government of India

(Other than the Ministry of Defence)

विधि और न्याय मंत्रालय

(विधि कार्य विभाग)

शुद्धि-पत्र

नई दिल्ली, 9 जून, 2012

का.आ. 2048.—भारत के उच्चतम न्यायालय में भारत के अपर महाधिवक्ता (प्रत्यक्ष कर) के पद से श्री विवेक के. तनेजा, वरिष्ठ अधिवक्ता की नियुक्ति 11.4.2012 से अनुमोदन किए जाने के बाद में जारी की गई इस विभाग की अधिसूचना सं. एफ. 18(5)/2009-न्यायिक में भाग II, खण्ड 3, उप खण्ड (ii) में प्रकाशित करते हुए, त्यागपत्र स्वीकार किए जाने की तारीख 11.4.2012 को स्थान पर 16.4.2012 पढ़ी जाए।

[सं. एफ. 18(5)/2009-न्यायिक]

सुरेश चन्द्र, संयुक्त सचिव एवं विधि सलाहकार

MINISTRY OF LAW AND JUSTICE

(Department of Legal Affairs)

CORRIGENDUM

New Delhi, the 9th June, 2012

S.O. 2048.—In partial modification of this Department's Notification F.No.18(5)/2009-Judl. dated 30th May, 2012 accepting resignation of Sh. Vivek K. Tankha, Senior Advocate as Additional Solicitor General of India (Direct Taxes) in the Supreme Court w.e.f. 11-4-2012, the date of acceptance of resignation may be read as 16-4-2012, instead of 11-4-2012.

[No. F. 18(5)/2009-Judl.]

SURESH CHANDRA, Jt. Secy. and Legal Advisor

वित्त मंत्रालय

(वित्तीय सेवाएं विभाग)

नई दिल्ली, 12 जून, 2012

का.आ. 2049.—बैंककारी विनियमन अधिनियम, 1949 (1949 का 10) की धारा 53 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, केन्द्र सरकार, भारतीय रिजर्व बैंक की सिफारिश पर, एतद्द्वारा घोषणा करती है कि उक्त अधिनियम की धारा 10 की उप धारा (1) के खण्ड (b) के उप खण्ड (ii) के उपबंध, ऐसिस्टेंस बैंक ऑफ कामर्स पर लागू नहीं होंगे जहां तक उक्त बैंक के अध्यक्ष एवं प्रबंध निदेशक श्री एस. एल. बंगाल के बैंक एसोसिएशन ऑफ कामर्स लिमिटेड के साथ के आपसी पैरा कार्यपालक के रूप में नियुक्ति होने से है।

[फा. सं. 15/2/2012-बीओ-II]

विनय कुमार, अवर सचिव

(5021)

SANJIV KUMAR SINGH
Recognised Qualified Person
No. 24011/(15)/2000-CPAM
Ministry of Corp. Govt. of India

B-C Line passes through western part of village Chirapani, along partly common boundary of villages Bhamraso Chirapani, Bhandaria-Siguni, southern part of village Siguni, eastern part of village Amraha and meets at point C on the common boundary of villages Amraha-Pathahai.

C-D Line passes through western part of villages Pathahai and meets at point D on the common boundary of villages Pathahai-Belmanya.

D-A Line passes along part of common boundary of villages Kelunariya Dalhara, western part of village Kelunariya and meets at starting point A.

[F. No. 43011/[illegible]/2011-OR-I]

A. K. [illegible], Director

नई दिल्ली, 12 जून, 2012

का.आ. 2096.—केन्द्रीय सरकार ने कोयला धारक क्षेत्र (अर्जन और विकास) अधिनियम, 1957 (1957 का 20) की धारा 4 की उप-धारा (1) में यथा संशोधित उक्त अधिनियम कहा गया है) की धारा 9 की उप-धारा (1) के अधीन जारी भारत के राजपत्र, भाग II, खंड 3, उपखंड (ii) में तारीख 26 अगस्त, 2011 में प्रकाशित भारत सरकार की अधिसूचना संख्यांक का.आ. 2263, तारीख 17 अगस्त, 2011 द्वारा इस अधिसूचना से उपाबद्ध अनुसूची में विनिर्दिष्ट परिक्षेत्र की भूमि में, जिसका माप 240.11 हेक्टेयर (लगभग) या 590.02 एकड़ (लगभग) है, कोयले का पूर्वेक्षण करने के अपने आशय की सूचना दी थी ;

और, केन्द्रीय सरकार का यह समाधान हो गया है कि इस अधिसूचना से संलग्न अनुसूची में वर्णित उक्त भूमियों में कोयला अभिप्राप्य है ;

अतः, अब, केन्द्रीय सरकार, कोयला धारक क्षेत्र (अर्जन और विकास) अधिनियम, 1957 (1957 का 20) की धारा 9 की उप-धारा (1) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, उससे संलग्न अनुसूची में वर्णित 670.95 हेक्टेयर (लगभग) या 1728.77 एकड़ (लगभग) माप की भूमि में सभी अधिकारों का अर्जन करने के अपने आशय की सूचना देती है ।

टिप्पण 1 : इस अधिसूचना के अंतर्गत आने वाले क्षेत्र के रेखांक संख्या एसईसीएल/सीएमपी/मेकन/2011/01 तारीख 20 सितम्बर, 2011 का निरीक्षण उपायुक्त, हजारीबाग (झारखंड राज्य) के कार्यालय में या कोयला नियंत्रक, 1, कार्टिन हाउस स्ट्रीट, कोलकाता-700001 के कार्यालय में या कार्यपालक निदेशक, (ईआर सर्वे) एसईसीएल लिमिटेड, बिलासपुर, आर एण्ड डी भवन सेक्टर-2, बिलासपुर-495001 या उप महाप्रबंधक, एसईसीएल लिमिटेड, एकड़ी बचरवीरा कोल माइनिंग प्रोजेक्ट, डिप्लाटन कार्यालय, पोस्ट बिरसा नगर, हजारीबाग-825301 (झारखंड) के कार्यालय में या मुख्य महाप्रबंधक (पर्यावरण मेकन), मेकॉन भवन, डोरंडा, मुख्य विपणन इकाई-मुख्य, नामकुम एवं, नामकुम रांची या कोयला नियंत्रक, 1, कार्टिन हाउस स्ट्रीट, कोलकाता-700001 या किसी कार्यालय और परिसर, जिला-हजारीबाग, झारखंड के कार्यालय में किया जा सकता ;

टिप्पण 2 : उक्त अधिनियम की धारा 9 के उपबंधों की ओर ध्यान आकृष्ट किया जाता है जो निम्न प्रकार है :

अर्जन के प्रति आक्षेप :

"9(1) कोई व्यक्ति, जो किसी भूमि जिसके संबंध में धारा 7 की उप-धारा (1) के अधीन कोई अधिसूचना जारी की गई है, अधिसूचना जारी किए जाने के तीस दिन के भीतर सम्पूर्ण भूमि या उसके किसी भाग या ऐसी भूमि में या उस पर के किन्हीं अधिकारों का अर्जन किए जाने के बारे में आक्षेप कर सकता है ।

स्पष्टीकरण :

(1) इस धारा के अधीन किए गए आक्षेप में यह आक्षेप नहीं होगा कि कोई व्यक्ति किसी भूमि में कोयला उत्पादन के लिए अपने व्यवसाय में लगा है और ऐसी गतिविधियां केन्द्रीय सरकार या किसी अन्य व्यक्ति को नहीं करनी चाहिए ।

(2) धारा 8 की उप-धारा (1) के अधीन प्रत्येक आक्षेप, सक्षम प्राधिकारी को लिखित रूप में किया जाएगा और सक्षम प्राधिकारी, आक्षेपकर्ता को स्वयं सुने जाने का या विधि व्यवसायी द्वारा सुने जाने का अवसर देगा और ऐसी सभी आपत्तियों को सुनने के पश्चात् और सभी अन्वेषणों (यदि कोई हों) करने के पश्चात् यह यह अवधारण करेगा, कि यह या नहीं धारा 7 की उप-धारा (1) के अधीन अधिसूचित भूमि में या उस पर के सभी या किसी अधिकारों के अर्जन के बारे में या ऐसी भूमि के विभिन्न टुकड़ों या ऐसी भूमि में या उस पर के अधिकारों के संबंध में भिन्नतया या अलग किए जाने वाले किन्हीं अधिकारों के अर्जन के बारे में आक्षेप को स्वीकार करे या अस्वीकार करे और ऐसे आक्षेप पर अपने निष्कर्षों के कारणों से युक्त एक रिपोर्ट केन्द्रीय सरकार को उसके विनिश्चय के लिए देगा ।

(3) इस धारा के प्रयोजनों के लिए यह स्पष्ट किया जाता है कि किसी भूमि में हितबद्ध व्यक्ति के अंतर्गत वह व्यक्ति है जो मुआवजे का दावा करने का हकदार होगा यदि भूमि या किसी ऐसी भूमि में या उस पर के अधिकारों का इस अधिनियम के अधीन अर्जन किया जाए ।"

विज्ञापन 2. : केन्द्रीय सरकार ने कोयला नियंत्रक, कोयला भवन, झारखण्ड स्टेट, कोयलांचल (कोयलांचल) को उक्त अधिनियम की धारा 3 के अधीन भारत के राजपत्र भाग II, खण्ड 3, उपखण्ड (ii) तारीख 9 सितम्बर 2010 में प्रकाशित अधिसूचना सं. का. आ. 2510 (अ) जिसे कोयला धारक क्षेत्र के अर्जन में प्रयोग में लाया गया है, खण्ड 3, उपखण्ड (ii) में प्रकाशित का. आ. 2593 तारीख 15 अगस्त, 2011 द्वारा सक्षम किया गया था, द्वारा सक्षम प्राधिकारी के रूप में नियुक्त किया है ;

अनुसूची

पश्चिमी झरिया कोयला परियोजना ब्लॉक पैकेज-V

जारी अन्तर्गत कोयलांचल
जिला-हजारीबाग, झारखंड

(रेखांक संख्या एल.डी.सी.डी.एम.सी.एल.(V) सी.पी.टी.ओ.सी.एल./एस.डी.ओ./2011, तारीख 26 दिसम्बर 2011)

सभी अधिकार :

(क) राजस्व भूमि :

क्रम सं.	गांव का नाम	थाना सं.	थाना	जिला	क्षेत्रफल हेक्टेयर	क्षेत्रफल एकड़	टिप्पणी
1.	बन्दा	32	कोडरमा	हजारीबाग	7.20	3.00	भाग
2.	कदमाटांड़	34	कोडरमा	हजारीबाग	91.54	[illegible]	भाग
3.	मोहराडीह	40	कोडरमा	हजारीबाग	12.87	[illegible]	भाग
4.	[illegible]	43	कोडरमा	हजारीबाग	[illegible]	[illegible]	भाग
5.	बलरोया	44	कोडरमा	हजारीबाग	20.23	[illegible]	भाग
6.	[illegible]	45	कोडरमा	हजारीबाग	[illegible]	[illegible]	भाग
7.	सिरका	46	कोडरमा	हजारीबाग	53.45	[illegible]	भाग
8.	पश्चिमी [illegible]	56	[illegible]	हजारीबाग	106.46	[illegible]	[illegible]
			कुल (क)		364.96	[illegible]	

(ख) वन भूमि (अधिसूचित/गैर-अधिसूचित/जोनल-[illegible]) :

क्रम सं.	गांव का नाम	थाना सं.	थाना	जिला	क्षेत्रफल हेक्टेयर	क्षेत्रफल एकड़	टिप्पणी
	[illegible]	32	कोडरमा	हजारीबाग	[illegible]	[illegible]	भाग
2.	[illegible]	33	कोडरमा	हजारीबाग	20.[illegible]	[illegible]	भाग
3.	[illegible]	42	कोडरमा	हजारीबाग	204.22	[illegible]	भाग
4.	[illegible]	43	कोडरमा	हजारीबाग	[illegible]	[illegible]	भाग
5.	[illegible]	44	कोडरमा	हजारीबाग	[illegible]	[illegible]	भाग
6.	[illegible]	45	कोडरमा	हजारीबाग	[illegible]	[illegible]	भाग
7.	[illegible]	46	कोडरमा	हजारीबाग	[illegible]	[illegible]	भाग
8.	[illegible]	56	[illegible]	हजारीबाग	[illegible]	[illegible]	[illegible]
			कुल (ख)		[illegible]	[illegible]	

[illegible]

(ख) कुल राजस्व भूमि [illegible] (लगभग) [illegible] एकड़ (लगभग)

(ग) कुल वन भूमि [illegible] हेक्टेयर (लगभग) [illegible] एकड़ (लगभग)

[illegible] : [illegible] हेक्टेयर (लगभग) [illegible] एकड़ (लगभग)

प्रभावित राजस्व गांवों की सूची

1. [illegible] : [illegible]
2. [illegible] : [illegible]
3. [illegible] : [illegible]
4. [illegible] : [illegible]
5. [illegible] : [illegible]
6. [illegible] : [illegible]
7. [illegible] : [illegible]
8. [illegible] : [illegible]

अर्जन क्षेत्र की भूमि धारियों की सूची

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]

अर्जित किये जाने वाले क्षेत्र का सीमा वर्णन

[illegible] सीमा वर्णन

1. [illegible]
2. [illegible]
3. [illegible]

[illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

5. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible]-पूर्वी किनारे पर स्थित है और स्थान संख्या [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

6. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] के उत्तर किनारे पर स्थित है और [illegible]-पूर्व की ओर [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

7. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के उत्तरी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

8. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के उत्तरी-पूर्वी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

9. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के उत्तरी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

10. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के उत्तर किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

11. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के पूर्वी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

12. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के दक्षिण-पूर्वी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

13. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के दक्षिण-पूर्वी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

14. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के उत्तर-पूर्वी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

15. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के उत्तर-पूर्वी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

16. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के पूर्व किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

17. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के पूर्वी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

18. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के पूर्वी किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

19. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

20. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

21. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

22. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

23. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

24. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

25. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

26. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

27. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

28. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

29. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

30. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

31. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

32. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

33. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

34. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

35. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

36. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

37. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

38. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

39. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

40. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

41. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

42. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

43. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

44. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

45. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

46. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

47. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

48. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

49. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

50. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

51. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

52. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

53. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

54. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

55. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

56. रेखा [illegible] रेखा बिन्दु "[illegible]" [illegible] मार्ग के [illegible] किनारे पर स्थित है और [illegible] से गुजरती हुई उक्त मार्ग के बिन्दु "[illegible]" पर समाप्त होती है ।

24. रेखा ऐ24-ऐ24:- रेखा बिन्दु "ऐ23" बरियामु गांव के दक्षिण पश्चिम किनारे पर स्थित है और उत्तर-पूर्व दिशा की ओर प्लॉट संख्या [illegible] से गुजरती हुई इसी गांव के बिन्दु "ऐ24" पर समाप्त होती है।

25. रेखा ऐ24-ऐ25:- रेखा बिन्दु "ऐ24" बरियामु गांव के पश्चिम किनारे पर स्थित है और उत्तर गांव के दक्षिण पश्चिम की ओर पूर्व की ओर प्लॉट संख्या 130, 113, 109, 108, 102, 98 से गुजरती हुई बरियामु गांव के बिन्दु "ऐ25" पर समाप्त होती है।

26. रेखा ऐ25-ऐ26:- रेखा बिन्दु "ऐ25" गांव उत्तर के दक्षिण-पश्चिम किनारे पर स्थित है और दक्षिण-पश्चिम की ओर केंदुआ गांव के प्लॉट संख्या 682, 685, 684 से गुजरती हुई केंदुआ गांव के बिन्दु "ऐ26" पर समाप्त होती है।

27. रेखा ऐ26-ऐ27:- रेखा बिन्दु "ऐ26" गांव केंदुआ के दक्षिण किनारे पर स्थित है और उत्तर-पश्चिम की ओर बलतु गांव के प्लॉट संख्या 60, 1975, 52, 63, 64, 68, 69 और 60 से गुजरती हुई बलतु गांव के बिन्दु "ऐ27" पर समाप्त होती है।

28. रेखा ऐ27-ऐ28:- रेखा बिन्दु "ऐ27" गांव बलतु के उत्तर पश्चिमी किनारे पर स्थित है और उत्तर-पश्चिम की ओर जहानाबाद के प्लॉट संख्या 484, 519, 520, 521, 513, 515, 484 से गुजरती हुई इसी गांव के बिन्दु "ऐ28" पर समाप्त होती है।

29. रेखा ऐ28-ऐ29:- रेखा बिन्दु "ऐ28" गांव जहानाबाद के पश्चिमी किनारे पर स्थित है और उत्तर-पश्चिम की ओर बलतु गांव के प्लॉट संख्या 60, 174, 84, 121, 120, 119, 105, 102, 107, 104, 110, 143 से गुजरती हुई इसी गांव के बिन्दु "ऐ29" पर समाप्त होती है।

30. रेखा ऐ29-ऐ:- रेखा बिन्दु "ऐ29" गांव बलतु के उत्तर-पश्चिम किनारे पर स्थित है और उत्तर-पश्चिम की ओर जहानाबाद गांव के प्लॉट संख्या 304, 414, 436 से गुजरती हुई इसी गांव के बिन्दु "ऐ" पर समाप्त होती है।

"बी-सी" का मौजा खतियान-

1. रेखा बी बी1:- रेखा बिन्दु "बी" गांव पकरी बरवाडीह के उत्तरी-पश्चिमी किनारे पर स्थित है और इसी गांव के पूर्व की ओर प्लॉट संख्या 1450, 1411 से गुजरती हुई इसी गांव के बिन्दु "बी1" पर समाप्त होती है।

2. रेखा बी1-बी2:- रेखा बिन्दु "बी1" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के उत्तर-पूर्व की ओर प्लॉट संख्या 1920, 1921, 1918 से गुजरती हुई इसी गांव के बिन्दु "बी2" पर समाप्त होती है।

3. रेखा बी2-बी3:- रेखा बिन्दु "बी2" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के उत्तर-पूर्व की ओर प्लॉट संख्या 1918, 1919, 1920 से गुजरती हुई इसी गांव के बिन्दु "बी3" पर समाप्त होती है।

4. रेखा बी3-बी4:- रेखा बिन्दु "बी3" गांव पकरी बरवाडीह के उत्तरी-पश्चिमी किनारे पर स्थित है और इसी गांव के दक्षिण की ओर प्लॉट संख्या 1920, 1921 से गुजरती हुई इसी गांव के बिन्दु "बी4" पर समाप्त होती है।

5. रेखा बी4-बी5:- रेखा बिन्दु "बी4" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के दक्षिण पूर्व की ओर प्लॉट संख्या 1918, 1921, 1922, 1923 से गुजरती हुई इसी गांव के बिन्दु "बी5" पर समाप्त होती है।

6. रेखा बी5-बी6:- रेखा बिन्दु "बी5" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के दक्षिण की ओर प्लॉट संख्या 1917, 1957, 1946, 1944, 1964, 1963, 1946, 1947, 1906, 1929 से गुजरती हुई इसी गांव के बिन्दु "बी6" पर समाप्त होती है।

7. रेखा बी6-बी7:- रेखा बिन्दु "बी6" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के दक्षिण की ओर प्लॉट संख्या 1907, 1940 से गुजरती हुई इसी गांव के बिन्दु "बी7" पर समाप्त होती है।

8. रेखा बी7-बी8:- रेखा बिन्दु "बी7" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के दक्षिणी पूर्व की ओर प्लॉट संख्या 1950, 1951, 1953, 1952 से गुजरती हुई इसी गांव के बिन्दु "बी8" पर समाप्त होती है।

9. रेखा बी8-बी9:- रेखा बिन्दु "बी8" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के दक्षिणी पूर्व की ओर प्लॉट संख्या 1950, 1951, 1961, 1955 से गुजरती हुई इसी गांव के बिन्दु "बी9" पर समाप्त होती है।

10. रेखा बी9-बी10:- रेखा बिन्दु "बी9" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के दक्षिणी-पूर्व की ओर प्लॉट संख्या 1942, 1740 से गुजरती हुई इसी गांव के बिन्दु "बी10" पर समाप्त होती है।

11. रेखा बी10-बी11:- रेखा बिन्दु "बी10" गांव पकरी बरवाडीह के उत्तरी पश्चिमी किनारे पर स्थित है और इसी गांव के दक्षिणी पूर्व की ओर प्लॉट संख्या 1942, 1743, 1741, 2125 से गुजरती हुई इसी गांव के बिन्दु "बी11" पर समाप्त होती है।

SANJIV KUMAR SINGH
Recognised Qualified Person
No. [illegible]
Ministry of Coal, Govt. of India

12. रेखा बी11, बी12 – रेखा बिन्दु "बी 11" ग्राम पकरी बरवाडीह के [illegible] किनारे पर स्थित है और इसी गांव के [illegible] 2125, 2127, 2910, [illegible] 1, 3 से गुजरती हुई इसी गांव के बिन्दु "बी 12" पर समाप्त होती है।

13. रेखा बी12 बी13 – रेखा बिन्दु "बी 12" ग्राम पकरी बरवाडीह के [illegible] किनारे पर स्थित है और इसी गांव के [illegible] 1, 12, 1319, [illegible] से गुजरती हुई इसी गांव के बिन्दु "बी 13" पर समाप्त होती है।

14. रेखा बी13 बी14 – रेखा बिन्दु "बी 13" ग्राम पकरी बरवाडीह के [illegible] किनारे पर स्थित है और इसी गांव के [illegible] 1, 26, 104 से गुजरती हुई इसी गांव के बिन्दु "बी 14" पर समाप्त होती है।

15. रेखा बी14 बी15 – रेखा बिन्दु "बी 14" ग्राम पकरी बरवाडीह के पूर्व किनारे पर स्थित है [illegible] संख्या [illegible] से गुजरती हुई इसी गांव के बिन्दु "बी 15" पर समाप्त होती है।

16. रेखा बी15 बी16 – रेखा बिन्दु "बी 15" ग्राम पकरी बरवाडीह के पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1041, 1432 से गुजरती हुई इसी गांव के बिन्दु "बी 16" पर समाप्त होती है।

17. रेखा बी16 बी17 – रेखा बिन्दु "बी 16" ग्राम पकरी बरवाडीह के पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1432, 1449 से गुजरती हुई इसी गांव के बिन्दु "बी 17" पर समाप्त होती है।

18. रेखा बी17 बी18 – रेखा बिन्दु "बी 17" ग्राम पकरी बरवाडीह के पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1462 से गुजरती हुई इसी गांव के बिन्दु "बी 18" पर समाप्त होती है।

19. रेखा बी18 बी19 – रेखा बिन्दु "बी 18" ग्राम पकरी बरवाडीह के दक्षिणी पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1462 से गुजरती हुई इसी गांव के बिन्दु "बी 19" पर समाप्त होती है।

20. रेखा बी19 बी20 – रेखा बिन्दु "बी 19" ग्राम पकरी बरवाडीह के दक्षिणी पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1439 से गुजरती हुई इसी गांव के बिन्दु "बी 20" पर समाप्त होती है।

21. रेखा बी20 बी21 – रेखा बिन्दु "बी 20" ग्राम पकरी बरवाडीह के दक्षिणी पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1440 से गुजरती हुई इसी गांव के बिन्दु "बी 21" पर समाप्त होती है।

22. रेखा बी21 बी22 – रेखा बिन्दु "बी 21" ग्राम पकरी बरवाडीह के दक्षिणी पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1444 से गुजरती हुई इसी गांव के बिन्दु "बी 22" पर समाप्त होती है।

23. रेखा बी22 बी23 – रेखा बिन्दु "बी 22" ग्राम पकरी बरवाडीह के दक्षिणी पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1444 से गुजरती हुई इसी गांव के बिन्दु "बी 23" पर समाप्त होती है।

24. रेखा बी23 बी24 – रेखा बिन्दु "बी 23" ग्राम पकरी बरवाडीह के दक्षिणी पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1444, 1464 से गुजरती हुई इसी गांव के बिन्दु "बी 24" पर समाप्त होती है।

25. रेखा बी24 बी25 – रेखा बिन्दु "बी 24" ग्राम पकरी बरवाडीह के दक्षिणी पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1444 से गुजरती हुई इसी गांव के बिन्दु "बी 25" पर समाप्त होती है।

26. रेखा बी25 बी26 – रेखा बिन्दु "बी 25" ग्राम पकरी बरवाडीह के दक्षिणी पूर्व किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1444, 1445, 1446, 1470 से गुजरती हुई इसी गांव के बिन्दु "बी 26" पर समाप्त होती है।

27. रेखा बी26 बी27 – रेखा बिन्दु "बी 26" ग्राम पकरी बरवाडीह के दक्षिणी किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1370, 1371, 1442 से गुजरती हुई इसी गांव के बिन्दु "बी 27" पर समाप्त होती है।

28. रेखा बी27 बी28 – रेखा बिन्दु "बी 27" ग्राम पकरी बरवाडीह के दक्षिणी किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1444, 1371, 1366 से गुजरती हुई इसी गांव के बिन्दु "बी 28" पर समाप्त होती है।

29. रेखा बी28 बी29 – रेखा बिन्दु "बी 28" ग्राम पकरी बरवाडीह के दक्षिणी किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1444, 1365, 1362 से गुजरती हुई इसी गांव के बिन्दु "बी 29" पर समाप्त होती है।

30. रेखा बी29 बी30 – रेखा बिन्दु "बी 29" ग्राम पकरी बरवाडीह के दक्षिणी किनारे पर स्थित है और इसी गांव के [illegible] संख्या 1444, 1352, 1353, 1354 से गुजरती हुई इसी गांव के बिन्दु "बी 30" पर समाप्त होती है।

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

New Delhi, the [illegible] June, 2012

S.O. 2090.— Whereas by the notification of the Government of India in the Ministry of [illegible] S.O. 2267 dated 28th August, 2011 issued under sub-section (1) of Section 9 of the Coal Bearing Areas (Acquisition and Development) Act, 1957 (20 of 1957) (hereinafter referred to as the said Act) published in the Gazette of India, Part II Section 3 sub-section (ii) dated 27th August, 2011, the Central Government gave notice of its intention to prospect for coal in the lands in the locality specified in the schedule appended to the said notification;

And whereas the Central Government has satisfied itself that coal is available in the lands in the said locality and it is expedient to acquire the lands in the said locality for the purpose of prospecting for coal therein;

Now, therefore, in exercise of the powers conferred by sub-section (1) of Section 9 of the Coal Bearing Areas (Acquisition & Development) Act, 1957 (20 of 1957), the Central Government hereby gives notice of its intention to acquire the land measuring [illegible] hectares (approximately), [illegible] acres (approximately) in the locality specified in the schedule appended hereto.

Note 1. The plan bearing number NTPC/CMNL/Dr. CHANDRAPURA/Coal dis./2011-12, [illegible] may be inspected at the office of the Deputy Commissioner, [illegible] Chief Manager (Land & R&R), Northern Coalfields Limited, Singrauli, [illegible] Road, [illegible] the office of the DD (Coal Security), NTPC Limited, [illegible] Block, [illegible] Office of the Chief General Manager, [illegible] Plaza, Kasturba Gandhi Marg, [illegible] Road, [illegible] Block, [illegible] Street, Kolkata-700001 or at the office of the Collector, [illegible]

Note 1: Attention is hereby invited to the provision of Section 8 of the said Act which provides as follows:

Objection to acquisition.

8(1) Any person interested in any land in respect of which a notification under section 7(1) has been issued may, within thirty days of the issue of the notification, object to the acquisition of the whole or any part of the land or of any rights in or over such land.

Explanation:-

(1) It shall not be an objection, within the meaning of this section for any person to say that he himself desires to undertake mining operations in the land for the production of the coal and these operations should not be undertaken by the Central Government or by any other person.

(2) Every objection under sub-section (1) shall be made to the Competent Authority in writing, and the Competent Authority shall give the objector an opportunity of being heard either in person or by a legal practitioner and shall, after hearing all such objections and after making such further enquiry, if any, as he thinks necessary, either make a report in respect of the land which has been notified under sub-section (1) of Section 7 or of rights in or over such land, or make different reports in respect of different parcels of such lands or of rights in or over such land, to the Central Government, containing his recommendations on the objections together with the record of proceedings held by him for the decision of that Government.

(3) For the purpose of this section, a person shall be deemed to be interested in land who would be entitled to claim an interest in compensation if the land or any rights in or over such land were acquired under this Act.

Note 2: The Coal Controller, 1, Council House Street, Kolkata 700001 has been appointed by the Central Government as the Competent Authority under the Section 3 of the said Act vide notification number S.O. [illegible] published in part II Section 3, sub-section (ii) of the Gazette of India dated [illegible] September 2005 which was subsequently amended vide notification number S.O. [illegible] published in part II Section 3 sub-section (ii) of the Gazette of India dated [illegible] August 2007.

SCHEDULE

Pakri Barwadih Coal Mining Block Phase-[illegible]

North Karanpura Coalfields

District: Hazaribagh, Jharkhand

(plan bearing number [illegible] dated the 20th December, 2011)

All Rights

(A) [illegible] LANDS

Sl. No.	Village	Thana number	Thana	District	Area in approximately (hectares)	Area in approximately (acres)	Remarks
[illegible]	[illegible]	[illegible]	Keredari	Hazaribagh	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	Keredari	Hazaribagh	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Keredari	Hazaribagh	62.82	[illegible]	Part
[illegible]	[illegible]	[illegible]	Keredari	Hazaribagh	[illegible]	[illegible]	Part
[illegible]	[illegible]	44	Keredari	Hazaribagh	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Keredari	Hazaribagh	[illegible]	[illegible]	Part
[illegible]	[illegible]	46	Keredari	Hazaribagh	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Keredari	Hazaribagh	[illegible]	[illegible]	[illegible]
			Total (approximately)		[illegible]	[illegible]	

(ii) FOREST LAND (Non-SeC/ Un-Notified/ Jungle/ Bush)

Sl. No	Village	Khata number	Thana	District	Area (approximately) hectare	acre	Remarks
1	Dolo	32	Keredari	Hazaribagh	6.48	16.01	[illegible]
2	Kandabar	33	Keredari	Hazaribagh	20.11	49.69	[illegible]
3	Barma	42	Keredari	Hazaribagh	252.28	623.53	Part
4	Jahra	45	Keredari	Hazaribagh	6.92	17.10	[illegible]
5	Bawru	44	Keredari	Hazaribagh	30.98	76.57	[illegible]
6	Newadih	45	Keredari	Hazaribagh	20.23	50.00	[illegible]
7	Siuna	47	Keredari	Hazaribagh	21.48	53.07	[illegible]
8	Pakri Barwadih	56	Bokaro	Hazaribagh	4.59	11.35	Part
			Total (approximately)		313.00	773.42	

SUMMARY

(A) TOTAL REVENUE LAND: 364.08 hectares (approximately) or [illegible] acres (approximately)

(B) TOTAL FOREST LAND: 313.00 hectares (approximately) or 773.42 acres (approximately)

GRAND TOTAL (A+B): 677.08 hectares (approximately) or 1724.72 acres (approximately)

LIST OF REVENUE PLOTS TO BE ACQUIRED:

1. Village Bebo - 60P, 63, 64P, 65 to 67, 68P, 69P, 25, 26, 28 to 105, 106P, 107P, 108, 109, 110P, 111, 114P, 119P, 120P, 121P, 122, 123, 124P.
2. Village Kandabar - 185P, 188, 190, 190 to 196, 198 to 219, 213 to 239, 240P, 241 to 254, 255P, 257P, 258, 259, 260P, 261P, 454P, 455P, 456 to 467, 468P, 470, 472P, 473 to 485, 484P, 485 to 492, 494 to 512, 513, 514, [illegible] to 526, 528 to 564, 566 to 624, 626 to 633, 635 to 639, 643 to 681, 682P, 684P.
3. Village Barma - 5 to 29, 32 to 49, 51 to 62, 165P, 166 to 168, 168P, 169P to 169.
4. Village Jahra - 1, 3 to 52, 98P, 99 to 105, 106P, 109P, 113 to 120.
5. Village Bawru - 92, 130, 24 to 28, 230, 240, 250, 26, 28 to 31, 33.
6. Village Newadih - 42P, 481, 482, 483P, 484P, 485, 486P, 487, 488, 489, 490P, 491P, 492P, 493, 494, 495P, 496P, 498, 499P, 500, 501P, 502 to 504.
7. Village Siuna - 139, 140P, 141P, 142, 145P, 146P, 147, 148P, 149P, 150P, 151P, 152P, 153P, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243P, 244, 246, 248 to 290, 292 to 295.
8. Village Pakri Barwadih - 1431 to 1432, 1442 to 1446, 1448 to [illegible], 2438 to 2447, 2469, 2516, 2518.

LIST OF DEPENDENT PLOTS TO BE ACQUIRED:

1. Village Bebo - 622, 668P, 67, 147P, 149P.
2. Village Kandabar - 197, 202, 493, 527, 565, 625, 634, 686, 687P.
3. Village Barma - [illegible] 23, 30, 231, 233P, 1643P, 1686.
4. Village Jahra - [illegible] 102.
5. Village Bawru - 129, 231P, 232, 241.
6. Village Newadih - 422P, 505P.

SANJIV KUMAR SINGH
Designated Competent Person
No. 34011/[illegible]/2009-CPAM
Ministry of Coal, Govt. of India

Village Survey No: [illegible] 245, 247, 251, 256

A. Village Boundary Description: [illegible] 1947, 2464

Boundary Description of the area to be notified:

Boundary Description for "Point A"

[illegible] The line starts at point 'A' located on North-West corner of village Kandalsar which [illegible] towards North-East corner of the village. It continues passing through plot no. [illegible] 455, 454, 453, 452, 451, 448, [illegible] 471, 472, 255, 240, 193, 194, 195, 197, 198, 200 and ends at point 'B' of the village Kandalsar.

[illegible] The line starts at point 'B' located on North corner of village [illegible] which [illegible] towards North-East of the village Nawadli passing through plot numbers 922 and 565 and ends at point 'C' of the village Nawadli.

[illegible] The line starts at point 'C' located on North corner of village Nawadli which [illegible] towards North-East of the village Nawadli passing through plot number 505 and ends at point 'D' of the village Nawadli.

[illegible] The line starts at point 'D' located on North-East corner of village Nawadli which [illegible] towards North-East of the village Nawadli passing through plot numbers 500, 477, 484, 483, 482, 481, 486, 487, 488, 490, 491, 492, 493, 494, 495, 497, 498, 499, 500, [illegible] and ends at point 'E' of the village Nawadli.

[illegible] The line starts at point 'E' located on North-East corner of village Nawadli which [illegible] towards North-East of the village Nawadli passing through plot numbers 43, 27, 12, 24, 25 and ends at point 'F' of the village Nawadli.

[illegible] The line starts at point 'F' located on North-East corner of village Bhawara which [illegible] towards North-East of the village Bhawara passing through plot numbers 27, [illegible] 29 and ends at point 'G' of the village Bhawara.

[illegible] The line starts at point 'G' located on North-East corner of village Bhawara passing through [illegible] village Bhawara passing through plot number 17 and ends at point 'H' of the village Bhawara.

[illegible] The line starts at point 'H' located on North-East corner of village Bhawara which [illegible] village Bhawara passing through plot numbers 90, 147, [illegible] 152, [illegible] and ends at point 'A' of the village Sirona.

[illegible] The line starts at point 'A' located on North-East corner of village Sirona which [illegible] North-West of the village Sirona passing through plot numbers 843, 849, 850, 841, 853 and ends at point 'A' of the village Sirona.

[illegible] The line starts at point 'A' located on North-East corner of village Sirona which [illegible] towards East of the village Sirona passing through plot numbers 113, 114, 141, 144, 243 and ends at point 'A' of the village Sirona.

[illegible] The line starts at point 'A' located on South-East corner of village Sirona which [illegible] towards South of the village Sirona passing through plot numbers [illegible] and ends at point 'A' of the village Sirona.

[illegible] The line starts at point 'A' located on South-East corner of village Sirona which [illegible] towards West of the village Sirona passing through plot numbers 247, 242, [illegible] 251, 253, 254, 255, 256, 257, 258, 259, 260, 261 and ends at point 'A' of the village Sirona.

[illegible] The line starts at point 'A' located on South-East corner of village Sirona which [illegible] towards South-East of the village Sirona passing through plot number 646 and ends at point 'A' of the village Sirona.

[illegible] The line starts at point 'A' located on South-East corner of village Sirona which [illegible] towards East of the village Sirona passing through plot numbers 666, 667, 667 and ends at point 'A' of the village Sirona.

[illegible] The line starts at point 'A' located on South-East corner of village Sirona which [illegible] towards North of the village Sirona passing through plot numbers 692, 693, 1093, 1094 and ends at point 'A' of the village Sirona.

(16) Line A15-A16 The line starts at point 'A15' located on East corner of village Bariatu which moves towards South of the village Bariatu passing through plot number 1686 and ends at point 'A16' of the village Bariatu

(17) Line A16-A17 The line starts at point 'A16' located on South-East corner of village Bariatu which moves towards South-West of the village Bariatu passing through plot numbers 1686 and 1685 and ends at point 'A17' of the village Bariatu

(18) Line A17-A18 The line starts at point 'A17' located on South-East corner of village Bariatu which moves towards South of the village Bariatu passing through plot number 1643 and ends at point 'A18' of the village Bariatu.

(19) Line A18-A19 The line starts at point 'A18' located on South corner of village Bariatu which moves towards West of the village Bariatu passing through plot number 1643 and ends at point 'A19' of the village Bariatu

(20) Line A19-A20 The line starts at point 'A19' located on South corner of village Bariatu which moves towards North of village Bariatu passing through plot numbers 1643 and 1651 and ends at point 'A20' of village Bariatu

(21) Line A20-A21 The line starts at point 'A20' located on South corner of village Bariatu which moves towards South-West of the village Bariatu passing through plot number 232 and ends at point 'A21' of the village Bariatu.

(22) Line A21-A22 The line starts at point 'A21' located on South-West corner of village Bariatu which moves towards North-West passing through plot number 62 and ends at point 'A22' of the village Bariatu

(23) Line A22-A23 The line starts at point 'A22' located on South-West corner of village Bariatu which moves towards South-West of the village Bariatu passing through plot number 6 and ends at point 'A23' of the village Bariatu.

(24) Line A23-A24 The line starts at point 'A23' located on South-West corner of village Bariatu which moves towards North-West of the village Bariatu passing through number 63 and ends at point 'A24' of the village Bariatu.

(25) Line A24-A25 The line starts at point 'A24' starting at the West side of village Bariatu and point is in South West direction through village Jalwa passing through plot numbers 139, 113, 109, 108, 107, 98 and ends at point 'A25' of village Bariatu

(26) Line A25-A26 The line starts at point 'A25' located on South-West corner of village Jalwa which moves towards South-West of village Kandaber passing through plot numbers 682, 683, 684 and ends at point 'A26' of village Kandaber.

(27) Line A26-A27 The line starts at point 'A26' located on South corner of village Kandaber which moves towards North-West of the village Belta passing through plot numbers 60, 1075, 62, 63, 66, 68, 69 and 60 and ends at point 'A27' of the village Belta

(28) Line A27-A28 The line starts at point 'A27' located on North-West corner of village Belta which moves towards North-West of the village Kandaber passing through plot numbers 464, 519, 520, 514, 513, 515, 983 and ends at point 'A28' of the village Kandaber.

(29) Line A28-A29 The line starts at point 'A28' located on West corner of village Kandaber which moves towards North-West of the village Belta passing through plot numbers 60, 121, 84, 121, 120, 119, 105, 106, 107, 114 and 113 and ends at point 'A29' of the village Belta

(30) Line A29-A The line starts at point 'A29' located on North-West corner of village Belta which moves towards North-West of the village Kandaber passing through plot numbers 424, 454, 455 and ends at point 'A' of the village Kandaber.

Boundary Description for "Part B"

(31) Line H-H1 The line starts at point 'H' located on North-West of village Paku Barwadih which moves towards East corner of the village Paku Barwadih passing through plot numbers 1950, 1933 and ends at point 'H1' of the village Paku Barwadih

(32) Line H1-H2 The line starts at point 'H1' located on North-West corner of village Paku Barwadih which moves towards North-East of the village Paku Barwadih passing through plot numbers 1933, 1921, 1918 and ends at point 'H2' of the village Paku Barwadih.

SANJIV KUMAR SINGH
Recognized Building Person
No. [illegible]
Ministry of Coal, Govt. of India

(7) Line [illegible] — The line starts at point 'B6' located on North-West corner of village Pakri Barwadi [illegible] towards South-East of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B7' of the village Pakri Barwadi.

(8) Line [illegible] — The line starts at point 'B7' located on North-West corner of village Pakri Barwadi [illegible] towards South of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B8' of the village Pakri Barwadi.

(9) Line [illegible] — The line starts at point 'B8' located on North-West corner of village Pakri Barwadi [illegible] towards South-East village Pakri Barwadi through plot numbers [illegible] and ends at point 'B9' of the village Pakri Barwadi.

(10) Line [illegible] — The line starts at point 'B9' located on North-West corner of village Pakri Barwadi [illegible] towards North of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B10' of the village Pakri Barwadi.

(11) Line [illegible] — The line starts at point 'B10' located on South-West corner of village Pakri Barwadi [illegible] towards South-East of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B11' of the village Pakri Barwadi.

(12) Line [illegible] — The line starts at point 'B11' located on North-West corner of village Pakri Barwadi [illegible] towards North-East of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B12' of the village Pakri Barwadi.

(13) Line [illegible] — The line starts at point 'B12' located on North corner of village Pakri Barwadi [illegible] of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B13' of the village Pakri Barwadi.

(14) Line [illegible] — The line starts at point 'B13' located on North corner of village Pakri Barwadi [illegible] South-East of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B14' of the village Pakri Barwadi.

(15) Line [illegible] — The line starts at point 'B14' located on North-East corner of village Pakri Barwadi [illegible] towards South-East of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B15' of the village Pakri Barwadi.

(16) Line [illegible] — The line starts at point 'B15' located on East corner of village Pakri Barwadi [illegible] South-West of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B16' of the village Pakri Barwadi.

(17) Line [illegible] — The line starts at point 'B16' located on East corner of village Pakri Barwadi [illegible] South of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B17' of the village Pakri Barwadi.

(18) Line [illegible] — The line starts at point 'B17' located on East corner of village Pakri Barwadi [illegible] South-West of the village Pakri Barwadi passing through plot numbers [illegible] and ends at point 'B18' of the village Pakri Barwadi.

(19) Line B18-B19: The line starts at point 'B 18' located on East corner of village Pakri Barwadih which moves towards South-West of the village Pakri Barwadih passing through plot number 1449 and ends at point 'B 19' of the village Pakri Barwadih

(20) Line B19-B20: The line starts at point 'B 19' located on South-East corner of village Pakri Barwadih which moves towards South-West of village Pakri Barwadih passing through plot numbers 1449 and ends at point 'B20' of village Pakri Barwadih

(21) Line B20-B21: The line starts at point 'B 20' located on South-East corner of village Pakri Barwadih which moves towards South-West of the village Pakri Barwadih passing through plot number 1449 and ends at point 'B21' of the village Pakri Barwadih.

(22) Line B21-B22: The line starts at point 'B21' located on South-East corner of village Pakri Barwadih which moves towards North-West of the village Pakri Barwadih passing through plot number 1449 and ends at point 'B22' of the village Pakri Barwadih.

(23) Line B22-B23: The line starts at point 'B 22' located on South-East corner of village Pakri Barwadih which moves towards South of the village Pakri Barwadih passing through plot number 1449 and ends at point 'B23' of the village Pakri Barwadih

(24) Line B23-B24: The line starts at point 'B23' located on South-East corner of village Pakri Barwadih which moves towards West of the village Pakri Barwadih passing through numbers 1449, 2464 and ends at point 'B24' of the village Pakri Barwadih

(25) Line B24-B25: The line starts at point 'B24' located at the South-East side of village Pakri Barwadih and passing in North-East direction through village Pakri Barwadih passing through plot number 2464 and ends at point 'B25' of village Pakri Barwadih

(26) Line B25-B26: The line starts at point 'B25' located on South-East corner of village Pakri Barwadih which moves towards North-West of village Pakri Barwadih passing through plot numbers 2464, 2438, 2436, 2519 and ends at point 'B26' of village Pakri Barwadih

(27) Line B26-B27: The line starts at point 'B26' located on South corner of village Pakri Barwadih which moves towards South-West of the village Pakri Barwadih passing through plot numbers 2329, 2335, 2468 and ends at point 'B27' of the village Pakri Barwadih.

(28) Line B27-B28: The line starts at point 'B27' located on South corner of village Pakri Barwadih which moves towards West of the village Pakri Barwadih passing through plot numbers 2468, 2334, 2464 and ends at point 'B28' of the village Pakri Barwadih.

(29) Line B28-B29: The line starts at point 'B28' located on South corner of village Pakri Barwadih which moves towards North-West of the village Pakri Barwadih passing through plot numbers 2553, 2462 and ends at point 'B29' of the village Pakri Barwadih

(30) Line B29-B30: The line starts at point 'B29' located on South corner of village Pakri Barwadih which moves towards North-West of the village Pakri Barwadih passing through plot numbers 2362, 2364, 2336, 2330, 2334 and ends at point 'A30' of the village Pakri Barwadih

(31) Line B30-B31: The line starts at point 'B30' located on South corner of village Pakri Barwadih which moves towards North-West of the village Pakri Barwadih passing through plot numbers 2334, 2323, 2318, 2225, 2221, 2273 and ends at point 'A31' of the village Pakri Barwadih

(32) Line B31-B32: The line starts at point 'B31' located on South-West corner of village Pakri Barwadih which moves towards North-East of the village Pakri Barwadih passing through plot numbers 2221, 2174 and ends at point 'A32' of the village Pakri Barwadih

(33) Line B32-B33: The line starts at point 'B32' located on South-West corner of village Pakri Barwadih which moves towards North-West of the village Pakri Barwadih passing through plot numbers 2221, 2231, 2[illegible] and ends at point 'A33' of the village Pakri Barwadih.

(34) Line B33-B34: The line starts at point 'B33' located on South-West corner of village Pakri Barwadih which moves towards North-East of the village Pakri Barwadih passing through plot numbers 2169, 2168 and ends at point 'A34' of the village Pakri Barwadih

Sanjiv

SANJIV KUMAR SINGH
Recognised Qualified Person
No. [illegible]/2009-CPAM
Ministry of Coal, Govt. of India

(12) Line 12-13 The line starts at point '1234' located on South-West corner of village Paki Barwadih which moves towards North-West of the village Paki Barwadih passing through plot numbers 1265, 1255, 2230 and ends at point '1237' of the village Paki Barwadih.

(13) Line 13-14 The line starts at point '1237' located on South-West corner of village Paki Barwadih which moves towards North-West of the village Paki Barwadih passing through plot numbers 2210, 1219, 2219, 2217, 2017, 2129, 2129 and ends at point '1236' of the village Paki Barwadih.

(14) Line 14-15 The line starts at point '1236' located on South-West corner of village Paki Barwadih which moves towards South-West of the village Paki Barwadih passing through plot numbers 2029, 2025, 2026, 2022, 2021, 2020 and ends at point '1237' of the village Paki Barwadih.

(15) Line 15-16 The line starts at point '1237' located on South-West corner of village Paki Barwadih which moves towards West of the village Paki Barwadih passing through plot numbers 2021, 2017, [illegible] and ends at point '1238' of the village Paki Barwadih.

(16) Line 16-17 The line starts at point '1238' located on South-West corner of village Paki Barwadih which moves towards North-West of the village Paki Barwadih passing through plot number 1250 and ends at point '1239' of the village Paki Barwadih.

(17) Line 17-18 The line starts at point '1239' located on West corner of village Paki Barwadih which moves towards North-West of the village Paki Barwadih passing through plot number 1950 and ends at point '1234' of the village Paki Barwadih.

[illegible]

A. K. [illegible], IAS, Under Secy.

पेट्रोलियम और प्राकृतिक गैस मंत्रालय

नई दिल्ली, [illegible]

का. आ. [illegible].—केन्द्रीय सरकार, पेट्रोलियम और खनिज पाइपलाइन (भूमि में उपयोग के अधिकार का अर्जन) अधिनियम, [illegible] की धारा 3 की उपधारा (1) के अनुसरण में नीचे दी गई अनुसूची में वर्णित [illegible] के बारे में अनुसूची के समक्ष में दिखाई गई तारीखों को, पेट्रोलियम और प्राकृतिक गैस के परिवहन में उपयोग के लिए अधिनियम के अधीन उपयोग अधिकार के कुओं को निर्दिष्ट करने के लिए घोषित करती है, अर्थात्

अनुसूची

[illegible]	अधिकारिता के क्षेत्र
[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

ANNEXURE-V

STATEMENT SHOWING LATITUDE, DEPARTURE & TOTAL DEPTH WITH DATE OF COMMENCEMENT & CLOSURE OF BOREHOLES

ORISSA BY MSU

BLOCK: PARSI-PARWATIK
COAL FIELD: NORTH KARANPURA

DISTRICT: HAZARIBAGH
STATE: JHARKHAND

SL NO	BOREHOLE NO	E.P.S. (MSL)	TOTAL DEPTH DRILLED (M)	LATITUDE (M)	DEPARTURE (M)	DATE OF COMMENCEMENT	DATE OF CLOSURE
1	NKPB-1	462.51	96.00	1101042.956	311.2068.939	04/12/06	15/12/06
2	NKPB-2	438.27	85.50	1100836.217	311934[illegible].249	19/12/06	26/12/06
3	NKPB-3	451.79	175.00	1101238.766	311925[illegible].150	26.12.06	12/01/07
4	NKPB-4	455.01	179.00	1101236.416	311[illegible].500	16/01/07	08/02/07
5	NKPB-5	447.63	121.50	1101596.572	311[illegible]944.193	23/01/07	06/02/07
6	NKPB-6	450.52	97.00	1.01600[illegible].165	311[illegible]486.451	10/02/07	12/02/07
7	NKPB-7	448.46	65.35	1102216.914	311[illegible]869.827	11/02/10	23/02/10
8	NKPB-8	459.47	76.50	1101472.654	311[illegible]166.861	18/02/10	25/02/10
9	NKPB-9	454.19	22.00	1102222.626	311[illegible]446.265	03/03/10	05/03/10
10	NKPB-10	455.54	77.00	1111450.948	311[illegible].183	06/03/10	12/03/10
11	NKPB-11	456.25	101.00	1102179.012	311[illegible].374	08/03/10	17/03/10
12	NKPB-12	458.15	106.00	1101577.984	311[illegible].567	12/03/10	18/03/10
13	NKPB-13	465.97	17.00	1102366.941	311[illegible].159	15/03/10	16/03/10
14	NKPB-14	452.16	42.00	1101279.518	311[illegible].538	20/03/10	20/03/10
15	NKPB-15	453.32	94.00	1101963.228	311[illegible].112	27/03/10	31/03/10
16	NKPB-16	462.53	27.10	1102147.138	311[illegible].096	28/03/10	31/03/10
17	NKPB-17	453.76	126.00	1101507.631	311[illegible].658	03/04/10	10/04/10
18	NKPB-18	450.52	140.00	1101608.066	311[illegible].434	04/04/10	16/04/10
19	NKPB-19	457.27	28.00	1101242.293	311[illegible].615	12/04/10	16/04/10
20	NKPB-20	464.46	77.00	1101804.602	311[illegible].362	17/04/10	2[illegible]/04/10
21	NKPB-21	461.67	124.00	1101804.635	311[illegible].066	18/04/10	03/05/10
22	NKPB-22	441.29	159.40	1100922.994	312[illegible].914	20/04/10	24/05/10
23	NKPB-23	425.69	217.00	1099959.620	312[illegible].153	09/05/10	31/05/10
24	NKPB-24	434.80	230.40	1101196.591	312[illegible].350	06/06/10	14/07/10
25	NKPB-25	456.51	279.50	1120172.594	312[illegible].164	29/06/10	30/07/10
26	NKPB-26	430.35	319.00	1100635.175	312[illegible].544	09/07/10	09/08/10
27	NKPB-27	456.71	125.00	1101559.887	311[illegible].492	09/10/10	23/10/11
28	NKPB-28	440.52	291.00	1100307.198	312[illegible].200	12/01/12	05/03/12
29	NKPB-29	419.16	280.00	1100330.670	312[illegible].112	20/03/12	09/04/12
30	NKPB-30	425.10	175.00	1101444.270	312[illegible].530	16/03/12	2/04/12
31	NKPB-31	411.15	127.30	1101[illegible].560	311[illegible].460	14/04/12	[illegible]/05/12
32	NKPB-32	424.59	169.00	1100294.460	311[illegible].620	12/04/12	30/04/12
33	NKPB-33	453.74	71.00	1101874.690	312[illegible].260	26/05/12	29/05/12

ANNEXURE-X

STATEMENT SHOWING THE CO-ORDINATES AND REDUCED LEVELS OF BOREHOLES, PAKRI BARWADIH BLOCK, NORTH KARANPURA CF.

Borehole No	Latitude (m)	Departure (m)	R.L. (m)	Total Depth
EASTERN				
BOREHOLES DRILLED BY G.S.I				
KB01	3778.22	28073.35	423.07	[illegible]
KB02	4069.56	28742.98	405.30	706.20
KB03	3809.13	28451.29	430.31	120.42
KB04	3401.97	27721.46	417.82	219.26
KB05	3569.[illegible]	28016.33	420.15	237.04
KB06	2449.25	30022.00	421.81	159.60
KB07	2701.21	29205.64	422.48	145.85
KB08	1911.35	29690.47	415.24	645.90
KB09	1957.19	28442.24	408.30	376.44
KB10	3198.30	27341.32	407.76	435.40
KB18	2189.63	28701.55	411.3[illegible]	297.09
KB19	2759.41	29431.50	422.32	527.05
KB22	3189.07	27622.67	396.25	194.18
KB23	2498.35	27149.27	411.50	501.55
KB25	2064.20	28668.35	408.30	384.15
KB28	2532.54	29853.22	424.84	230.30
BOREHOLES DRILLED BY C.M.P.D.I.				
CMKPB01	28995.90	4490.93	428.58	195.50
CMKPB03	28006.62	5120.67	449.08	31.00
CMKPB12	27950.17	2224.46	408.92	351.00
CMKPB13	2821[illegible].11	2995.34	412.43	192.00
CMKPB14	28969.59	2097.57	414.22	194.00
CMKPB18	29117.02	3443.64	427.33	107.00
CMKPB30	28155.89	1959.50	402.31	543.00
CMKPB31	26769.55	1580.90	405.44	344.50
CNPB001	28380.67	4105.38	425.71	101.00
CNPB002	28601.25	4238.52	428.55	89.00
CNPB003	28240.23	4151.95	421.34	119.50
CNPB004	27871.41	4382.63	424.38	231.00
CNPB005	27931.94	3742.42	416.89	252.00
CNPB006	28200.19	3879.42	421.93	177.50
CNPB007	27968.16	4579.08	424.67	182.00
CNPB008	28246.57	3489.24	419.22	142.50
CNPB009	27768.70	3779.28	416.68	194.00
CNPB011	28563.22	3208.19	420.81	137.50
CNPB012	28755.34	2959.28	418.37	137.50
CNPB015	28585.96	2791.54	414.27	146.50
CNPB016	28471.40	2547.47	411.58	197.50
CNPB021	28735.25	2890.48	415.32	152.50
CNPB023	28908.53	3059.91	422.05	104.50

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Borehole No.	Latitude (m)	Departure (m)	R.L. (m)	Total Depth
CNPB045	28532.00	3632.34	433.14	160.50
CNPB047	28730.93	4060.07	432.10	110.50
CNPB048	28464.18	3746.18	429.84	153.50
CNPB049	27857.00	4122.61	407.45	224.50
CNPB050	27261.15	2556.95	410.43	329.00
CNPB052	27827.18	4519.11	415.64	242.50
CNPB054	27944.05	4671.16	424.48	140.50
CNPB055	28273.15	4843.12	433.89	110.55
CNPB056	27649.46	4790.56	413.74	104.00
CNPB057	28322.87	4085.42	430.72	118.50
CNPB058	28175.41	4246.98	424.22	107.50
CNPB059	28312.79	4400.72	428.78	191.00
CNPB060	28218.54	5475.87	426.16	113.00
CNPB062	28878.41	3606.56	436.17	121.00
CNPB063	29846.61	3330.68	427.10	146.00
CNPB064	27745.25	4311.79	406.73	247.00
CNPB065	29254.53	3152.04	423.46	141.00
CNPB066	27952.06	5649.47	416.54	146.50
CNPB067	29173.55	2844.95	422.26	182.00
CNPB069	29639.66	2966.85	430.90	110.00
CNPB070	29814.02	2537.93	422.93	175.00
CNPB072	27061.81	2379.87	424.83	221.00
CNPB074	27851.89	3166.78	414.82	258.00
CNPB075	29091.83	2515.15	417.45	168.50
CNPB111	29594.28	2058.36	407.83	178.00
CNPB112	27938.65	2929.58	413.10	147.00
CNPB114	28532.25	4727.14	432.49	59.50
CNPB115	30510.57	2549.52	425.38	102.50
CNPB127	30197.08	2693.35	426.71	125.50
CNPB131	28864.56	2274.63	412.12	217.50
CNPB132	27587.91	2415.39	410.71	230.00
CNPB133	27025.61	4005.65	408.95	32.00

CENTRAL

BOREHOLES DRILLED BY G.S.I

KB11	5088.02	26731.92	411.35	327.85
KB12	2851.33	26289.80	415.70	471.20
KB13	8029.08	25778.17	427.94	401.30
KB14	3718.31	25972.28	415.12	448.00
KB15	4399.11	27431.86	410.54	300.00
KB18	5653.49	26650.17	431.31	256.00
KB20	5676.57	26841.98	425.28	271.50
KB21	4411.27	26422.30	413.96	514.00

BOREHOLES DRILLED BY C.M.P.D.L

CMKPB04	24540.47	6641.12	429.30	386.00
CMKPB07	25680.51	7830.74	443.29	173.00

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Borehole No.	Latitude (m)	Departure (m)	R.L. (m)	Total Depth
CMKPB11	26694.39	6527.81	432.19	248.00
CMKPB15	26756.71	3584.11	413.91	335.00
CMKPB17	27532.81	5956.52	416.30	173.00
CMKPB18	26487.84	7370.36	442.39	115.00
CMKPB19	27224.30	6959.60	433.39	47.00
CMKPB20	25948.54	8587.31	453.94	76.50
CMKPB21	28076.00	8532.71	429.17	14.00
CMKPB25	25638.01	4857.74	417.47	356.00
CMKPB27	25313.91	5789.61	425.14	422.00
CMKPB28	28476.54	2161.38	413.74	512.00
CMKPB29	25053.95	2601.70	407.12	535.00
CMKPB36	25149.08	7396.16	436.63	390.00
CMKPB37	26244.79	5795.21	425.01	355.00
CNPB010	27190.36	4721.27	418.77	214.00
CNPB013	27012.76	4608.01	419.47	204.00
CNPB014	26869.55	4678.48	418.57	185.00
CNPB016	27099.99	5116.43	419.39	211.00
CNPB017	27036.88	5413.11	419.60	233.00
CNPB019	28471.40	2547.47	420.03	249.00
CNPB020	27305.78	5327.81	419.98	172.00
CNPB022	26806.11	6235.55	427.57	164.00
CNPB024	26743.06	5787.82	422.08	159.50
CNPB025	28569.45	6219.83	427.78	235.00
CNPB026	27191.89	5775.65	421.46	175.00
CNPB027	26779.09	6723.46	424.78	158.50
CNPB028	28389.29	6228.77	425.36	214.00
CNPB029	28410.42	6216.87	428.84	222.00
CNPB030	26509.88	9643.38	430.50	146.50
CNPB031	26034.39	6085.09	429.17	276.00
CNPB032	26096.63	6799.40	428.58	170.50
CNPB033	26019.37	5470.83	428.54	226.00
CNPB034	26060.28	7063.90	437.88	159.50
CNPB035	25876.19	6717.50	432.18	238.00
CNPB036	25895.49	6320.17	432.37	292.50
CNPB037	25850.47	7385.52	439.35	186.50
CNPB038	25674.86	7050.96	435.95	197.00
CNPB039	25599.28	6605.12	432.44	287.00
CNPB040	25395.51	7122.16	438.55	155.00
CNPB041	25920.10	4262.23	417.42	305.00
CNPB042	26586.70	3800.26	415.97	308.50
CNPB043	25671.79	4604.86	416.25	250.00
CNPB044	25572.12	4931.25	415.77	243.00
CNPB046	27148.41	4378.46	414.82	243.00
CNPB051	26773.89	3972.27	417.60	345.00
CNPB053	28406.32	4617.65	415.67	325.00
CNPB061	27554.17	5527.29	416.71	153.00
CNPB065	27583.75	5204.50	415.92	209.50
CNPB071	27061.61	5943.79	423.43	158.50

Borehole No.	Latitude (m)	Departure (m)	R.L. (m)	Total Depth
CNPB073	27368.30	5792.91	421.70	293.00
CNPB078	25314.43	7727.39	442.36	221.00
CNPB080	25448.58	8482.13	453.90	175.00
CNPB081	25456.89	8077.35	447.77	206.00
CNPB083	25880.27	8309.66	448.95	142.00
CNPB085	25690.47	7568.67	448.51	197.00
CNPB086	25260.23	7585.96	451.39	132.00
CNPB087	26951.40	7604.03	446.24	[illegible]
CNPB088	25504.25	7504.09	436.50	200.00
CNPB089	26642.08	7551.89	446.01	138.50
CNPB090	26813.64	7108.28	436.43	95.00
CNPB116	26897.15	7303.42	442.22	141.00
CNPB117	27[illegible]	7235.24	439.18	69.30
CNPB120	27150.02	8497.51	467.94	305.00
CNPB122	27476.16	5607.13	431.48	88.00
CNPB123	27468.14	6241.55	427.60	209.00
CNPB124	27102.65	6468.96	432.22	211.00
CNPB125	26843.05	5543.20	434.19	238.00
CNPB129	26077.98	5639.35	422.15	299.00
CNPB130	26897.18	5920.45	433.72	172.00
CNPB135	26500.03	8043.17	450.17	125.00

WESTERN

BOREHOLES DRILLED BY G.S.I.

KB17	6132.64	23779.07	438.92	330.00
KB24	5421.78	23772.80	425.13	475.85

BOREHOLES DRILLED BY C.M.P.D.I

CMKPB02	25710.57	4246.72	411.62	525.50
CMKPB05	25239.51	8637.54	455.30	188.50
CMKPB06	24234.26	7281.13	424.34	550.00
CMKPB08	23992.45	7984.09	428.79	259.00
CMKPB09	24729.48	7911.83	443.03	184.30
CMKPB10	23828.81	6517.58	432.56	305.00
CMKPB22	24262.02	5571.35	449.52	170.00
CMKPB23	24301.50	8155.46	428.25	431.30
CMKPB24	22014.54	7507.32	425.33	173.00
CMKPB25	22581.83	5121.94	430.72	132.00
CMKPB32	24985.52	4061.09	413.03	258.50
CMKPB33	25384.32	4823.21	417.80	461.00
CMKPB34	24146.78	4507.73	420.98	250.50
CMKPB35	24411.36	5249.51	422.88	419.00
CMKPB38	22952.75	8925.75	451.15	201.00
CNPB076	24087.79	8761.25	449.50	10.00
CNPB077	20742.28	9010.43	448.11	3.30
CNPB079	25055.54	5032.34	449.57	198.00
CNPB082	24768.03	7565.80	432.59	293.00
CNPB084	25035.71	8817.09	447.72	188.00

ANNEXURE XVI

CONSENT LETTER FROM THE APPLICANT

1. I hereby authorize Sri. Sanjiv Kumar Singh RQP, Registration No. 34011 (15) 2009 – CPAM, to prepare the Revised Mining Plan and Mine Closure Plan (1st Revision) of Pakri Barwadih Coal Block located in the District of Hazaribagh of Jharkhand

2. I hereby undertake that all the conditions so made in the Revised Mining Plan and Mine Closure Plan (1st Revision) by the recognized person be deemed to have been made with my knowledge and consent and shall be acceptable to me and binding on me in all respect.

Signature of the Applicant in full

(Authorized signatory)

Name in full Sunil Jumde

Address: Coal Mining - Engg. 1 Floor Core 7

NTPC Limited, Lodhi Road,

New Delhi-110003

Tel: 011-24365709 9650991561

Fax 011-24367089

E-mail: suniljumde@ntpc.co.in

Place: New Delhi

ANNEXURE XVI- A

CERTIFICATE

1 Certified that the guidelines issued by MoC vide letter no. 34011/(48)/2009-CPAM dated 04.04.2011 have been observed in the preparation of Revised Mining Plan and Mine Closure Plan (1st Revision) in respect of Pakri Barwadih Coal Block, which has been allocated to M/s NTPC Limited, and whenever specific permissions are required, the applicant will approach the concerned authorities.

2 Certified that the information furnished in this Revised Mining Plan and Mine Closure Plan (1st Revision) are true and correct to the best of my knowledge

Sanjiv Kumar Singh
(Recognized Qualified Person)
RQP No. 34011 (15) 2009 – CPAM
Coal Mining Engg., 4th Floor, Core-5
NTPC Ltd., Scope Complex, 7
Institutional Area, Lodhi Road, New
Delhi-110003
Tel: 011-24387669, 9650991396
Fax: 011-24367089
E-mail

ANNEXURE XVI-B

CERTIFICATE

It is to certify that the area for which this Revised Mining Plan and Mine Closure Plan (1st Revision) has been prepared covers the area allocated to M/s NTPC Limited by the Government of India vide letter No 13016/29/2003-CA-I dated 11 October, 2004

Sanjiv Kumar Singh
(Recognized Qualified Person)
RQP No. 34011 (15) 2009 – CPAM
Coal Mining Engg., 4 Floor, Core-5
NTPC Ltd Scope Complex, 7
Institutional Area Lodhi Road, New
Delhi-110003
Tel 011-24367669, 9650991396
Fax: 011-24367089
E-mail:sanjivkumarsingh01@ntpc.

ANNEXURE XVI-C

CERTIFICATE

It is to certify that the Block area has been verified with the plan supplied by M/s CMPDIL and it is in line with the Plan issued by M/s CMPDI (Plan issued by M/s CMPDI is enclosed at Annexure XIX). The area covered in the Revised Mining Plan and Mine Closure Plan (1st Revision) does not encroach on any other Coal Block.

Sanjiv Kumar Singh
(Recognized Qualified Person)
RQP No. 34011 (15) 2009 – CPAM
Coal Mining Engg., 4 Floor, Core-5
NTPC Ltd Scope Complex, 7
Institutional Area Lodhi Road New
Delhi-110003
Tel 011-24387669,9650991396
Fax:011-24367089
E-mail: sanjivkumarsingh01@ntpc.co.in

ANNEXURE XVI-D

CERTIFICATE

It is to certify that the provisions of all relevant Rules and Regulations have been considered while preparing the Revised Mining Plan and Mine Closure Plan (1st Revision) of Pakri Barwadih Coal Block

Sanjiv Kumar Singh
(Recognized Qualified Person)
RQP No. 34011 (15) 2009 – CPAM
Coal Mining Engg. 4th Floor, Core-5
NTPC Ltd Scope Complex, 7
Institutional Area, Lodhi Road, New
Delhi-110003
Tel 011-24387669,9650991396
Fax:011 24367089
E-mail sanjivkumarsingh01@ntpc.co.in

ANNEXURE XVI- E

CERTIFICATE

It is to certify that the total quarriable coal down to Seam K-[illegible] / Seam I (whichever is applicable) the lowest workable seams in the allocated Coal Block at Pakri Barwadih, is planned for extraction in the Revised Mining Plan and Mine Closure Plan (1st Revision).

Sanjiv Kumar Singh
(Recognized Qualified Person)
RQP No 34011 (15) 2009 – CPAM
Coal Mining Engg. 4 Floor, Core-5
NTPC Ltd, Scope Complex, 7
Institutional Area, Lodhi Road, New
Delhi-110003.
Tel.. 011-24387669,9650991398
Fax:011-24367089
E-mail [illegible]

ANNEXURE XVI- F

CERTIFICATE

This is to certify that I have been duly authorised by NTPC Ltd. to prepare this Revised Mining Plan and Mine Closure Plan (1st Revision) of Pakri Barwadih Coal Block. I have a valid recognition from MoC under MCR 1960 to prepare Mining Plan and Mine Closure Plan and the provisions of all relevant rules and regulations have been considered while preparing the Mining Plan.

Sanjiv Kumar Singh
(Recognized Qualified Person)
RQP No. 34011 (15) 2009 - CPAM
Coal Mining Engg. 4 Floor Core-5
NTPC Ltd. Scope Complex, 7
Institutional Area, Lodhi Road, New
Delhi-110003
Tel. 011-24387669, 9650991396
Fax: 011-24367089
E-mail:

ANNEXURE XVII

CERTIFICATE BY THE APPLICANT

Certified that the Revised Mining Plan (1st Revision) of Pakri Barwadih Coal Block has been prepared by Sh. Sanjiv Kumar Singh, Registration No 34011 (15) 2009 - CPAM of NTPC Limited, Coal Mining-Engg.4th Floor, Core-5, Scope Complex, Lodhi Road, New Delhi –110003 in full consultation with knowledge and consent of the undersigned

The mine will be developed as per the approval of the Revised Mining Plan and Mine Closure Plan (1st Revision) of Pakri Barwadih Coal Block from Ministry of Coal and all other approvals as required will be obtained from relevant authorities.

Signature of the Applicant in full

(Authorized signatory)

Name in full: Sunil Jumde

Address: Coal Mining Engg. 1st Floor, Core 7,
NTPC Limited, Lodhi Road,
New Delhi-110003
Tel 011-24365709, 9650991561
Fax. 011-24367089
E-mail: sunildumde@ntpc.co.in

Place. New Delhi

एनटीपीसी
NTPC

एन टी पी सी लिमिटेड
(भारत सरकार का उपक्रम)
NTPC Limited
(A Govt. of India Enterprise)

नेहरू ऊर्जा व्यवसाय केन्द्र
Nehru Business Corporate Centre

No. NTPC/CM/ENGG/01/CMP/[illegible] Date: 21.01.2016

To

Advisor (Projects)
Ministry of Coal
Shastri Bhawan
New Delhi - 110 001

Sub: Approval of Revised Mining Plan & Mine Closure Plan (1st Revision) of Pakri Barwadih Coal Block.

Sir

With reference to letter Ref. No. 34011/03/2015/CPAM/PC dated 28.12.2015 from Ministry of Coal regarding submission of Revised Mining Plan and Mine Closure Plan (1st Revision) for Pakri Barwadih Coal Block incorporating modifications to the observations of standing committee, the Revised Mining Plan (1st Revision) has been prepared and is enclosed herewith.

As per the guidelines regarding preparation of Mining Plan / Mine Closure Plan issued by MoC these plans require approval of Board of Directors of the allottee company.

Further, Board of Directors of NTPC vide resolution item no. 417.2.13, dated 25.02.2015 has authorized Regional Executive Director (Coal Mining) to approve the Mining Plans/Mine Closure Plans associated documents pertaining to these plans for Coal Mining Projects and any subsequent revision/ opinion thereof to be submitted to Ministry of Coal or any statutory authority in connection with development of coal mining projects.

In line with the resolution, Revised Mining Plan (1st Revision) and Mine Closure Plan of Pakri Barwadih Coal Block as prepared by ROP Shri Sanjiv Kumar Singh (RQP no. 34011/15/2009-CPAM) has been approved by the undersigned for submission to MoC for approval. This will be implemented as per approval and amendments/ modifications suggested by MoC from time to time.

Copy of Board Resolution is enclosed for your kind information please.

With Kind Regards

Yours Sincerely

(Sharad Anand)
RED(Coal Mining)

[illegible]
NTPC Bhawan, 7, Institutional Area, Lodhi Road, New Delhi-110003, [illegible]
[illegible] 00048E Campus, [illegible] New Delhi-110003, [illegible]

EXTRACTS FROM THE MINUTES OF 417th MEETING OF THE BOARD OF DIRECTORS HELD ON WEDNESDAY, 25th FEBRUARY 2015

Item No.417.2.13 **Approval of Mining Plan & Mine Closure Plans of Coal Mining Projects of NTPC and nomination of "Owner" as per the Mines Act 1952 for Pakri-Barwadih and all other coal mining blocks allocated / to be re-allocated /to be formally allocated to NTPC**

XX	XX	XX	XX	XX	XX
XX	XX	XX	XX	XX	XX

The Board, after discussions, passed the following resolution:

Resolved that Regional Executive Director (Coal Mining) be and is hereby authorised to approve the Mining Plans/Mine Closure Plans, associated documents pertaining to these plans for Coal Mining Projects and any subsequent revision/updation thereof, to be submitted to Ministry of Coal or any statutory authority in connection with development of coal mine projects.

Further resolved that Shri Sharad Anand, Regional Executive Director (Coal Mining) be nominated as "Owner" as per the Mines Act, 1952 for Pakri-Barwadih and for all other coal mining blocks already allocated / to be re-allocated /to be formally allocated to NTPC.

*****

CERTIFIED TRUE COPY

सेन्ट्रल माईन प्लानिंग एण्ड डिजाईन इंस्टीट्यूट लिमिटेड
कोल इण्डिया लिमिटेड की अनुषंगी कम्पनी - भारत सरकार का एक लघु रत्न
गोन्डवाना प्लेस, कांके रोड, रांची - 834 031, झारखण्ड (भारत)
Central Mine Planning & Design Institute Limited
A Subsidiary of Coal India Limited - Govt. of India's Public Sector Undertaking
Gondwana Place, Kanke Road, Ranchi - 834 031, Jharkhand (INDIA)

पत्रांक संख्या:सीएमपीडीआई/डीजी-Captive/139/ 1311 दिनांक 16.10.2015

To,

Executive Director,
PB,CB & KD CMP's,
NTPC Limited,
Ujjwal Complex,
Pugmil Road,
Hazaribagh-825301.

Sub : Certification of Block Boundary of Pakri Barwadih Coal Block of NTPC Ltd., Hazaribagh

महोदय,

With reference to your letter No.7010/PBCMP/GM/14 dt. 03.04.2014 and subsequent discussions thereafter, please find enclosed herewith the certified block boundaries (3 copies) of Pakri Barwadih Coal Block.

धन्यवाद,

भवदीय,

Enc: as above

16.10.2015

महाप्रबन्धक (गवेषणा)

NTPC LIMITED

MAP SHOWING THE AREA TO BE NOTIFIED
UNDER SECTION 4(1) OF CBA (A&D) ACT 1957

MAP SHOWING THE AREA TO BE NOTIFIED UNDER SECTION 4(1) OF CBA (A&D) ACT, 1957 OF PAKRI BARWADIH COAL MINING PROJECT

N

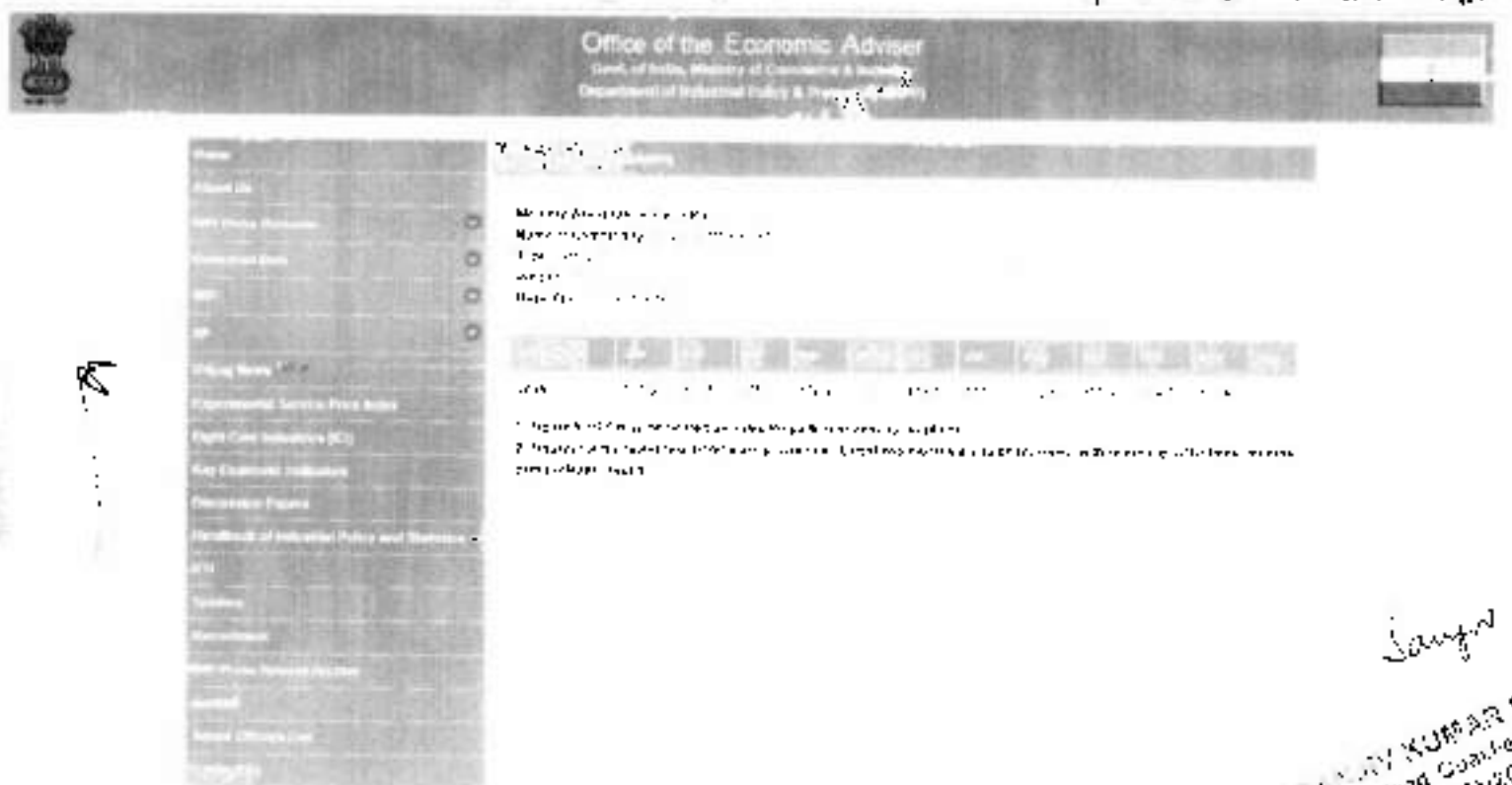
W E

S

LEGEND

Annexure XX

The WPI value for "All Commodities" as downloaded from website of "Office of Economic Advisor"



Sanjay

SANJAY KUMAR SINGH
Deputed Coal Field
No. 3(01)/(15)/2009-CPAM
Ministry of Coal Govt. of India