MINING PLAN
AND MINE CLOSURE PLAN

FOR

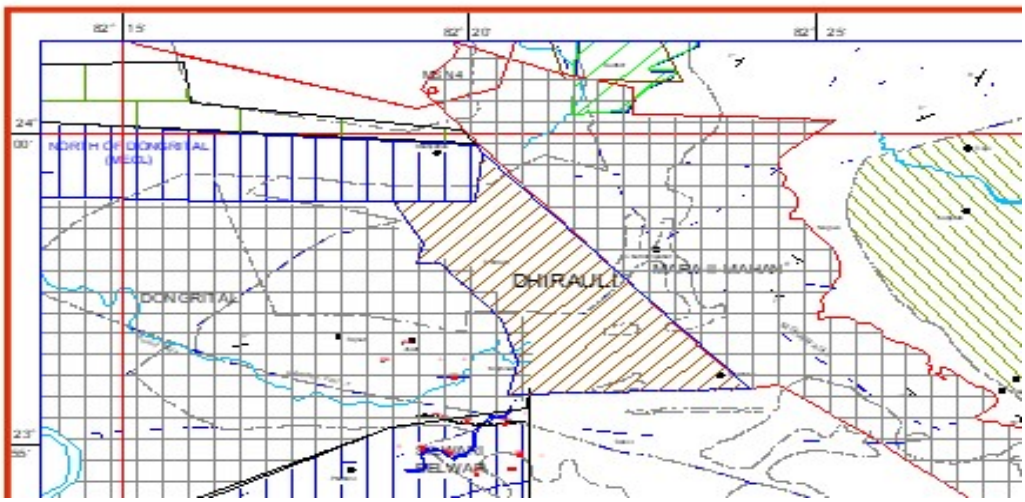
DHIRAULI OPENCAST COAL MINE

(AREA – 26.72 sq. km)

IN

SINGRAULI COALFIELD

DIST. – SINGRAULI, STATE – MADHYA PRADESH



APPLICANT

STRATATECH MINERAL RESOURCES PRIVATE LIMITED (SMRPL)

At. – Adani Corporate House, Shantigram, SG Highway
Dist. – Ahmedabad, State – Gujarat
PIN – 382421

Targeted Capacity – 6.5 Mty (Rated)/9.75Mty (Peak)

MARCH – 2021

(VOL: - I – TEXT & ANNEXURES)

PREPARED BY

KUMAR RAJESH SINGH

PROJECT COORDINATOR (PC)
MINING PLAN PREPARING AGENCY
Certificate No. NABET/APA-MPPA/IA/003 Dt. 25th Feb'21

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Annexure No.	Title	Remarks
Annexure I	Copy of allocation order /vesting order.	✓
Annexure II	Certificate of authorized person/agency if the project area is confined within the vested/allotted block boundary	✓
Annexure III	Approval of the Company Board	✓
Annexure IIIA	Commitment letter for complying with EC and FC conditions stipulated in respective clearances.	✓
Annexure IV	Copy of earlier approval of mining plan.	NA
Annexure V	Plan / chart showing schedule of Implementation of Mine closure activities (progressive and final closure) with duration of important activities	✓
Annexure VI	Non-refundable Application Fee	✓
Annexure VIII	Coal Block Development and Production Agreement (CBDPA)	✓

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ABBREVIATIONS

SMRPL	-	Stratatech Mineral Resources Private Limited
CV	-	Calorific Value
CMR	-	Coal Mines Regulation
cum	-	Cubic metre
CHP	-	Coal Handling Plant
DGMS	-	Directorate General of Mine Safety
DGM	-	Directorate of Geology and Mining
EC	-	Environmental Clearance
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
E&M	-	Electrical and Mechanical
EUP	-	End User Plant
FEL	-	Front End Loader
FC	-	Forest Clearance
GCV	-	Gross Calorific Value
GR	-	Geological Report
GSI	-	Geological Survey of India
GOI	-	Government of India
HEMM	-	Heavy Earth Moving Machinery
Ha	-	Hectare
HP	-	Horsepower
IB	-	Interburden
IMD	-	India Meteorological Department
K.Cal/kg	-	Kilo Calorie per Kilogram
KL	-	Kilolitre
Km	-	Kilometer
KW	-	Kilowatt
KV	-	KiloVolt
LS	-	Lump sum
MECL	-	Mineral Exploration Corporation Limited
MFA	-	Mine Functional Area
MIA	-	Mine Industrial Area

MTPA	-	Million Tonne Per Annum
M cum	-	Million cubic metre
MBCM	-	Million Bank Cubic Metre
m	-	Metre
mm	-	Millimetre
Mt	-	Million tonne
ML	-	Mining Lease
Mtpy	-	Million tonne per year
MOC	-	Ministry of Coal
Mcum.	-	Million cubic metre
MoEF&CC	-	Ministry of Environment, Forest and Climate Change
MW	-	Megawatt
NH	-	National Highway
OC	-	Opencast
OB	-	Overburden
MPPA	-	Mining Plan Preparing Agency
PC	-	Project Coordinator
ROM	-	Run of Mine
RH	-	Relative Humidity
RF	-	Representative Factor
SPM	-	Suspended Particulate Matter
SR	-	Stripping Ratio
T	-	Tonnage/Tonne
TPH	-	Tonne Per Hour
TPP	-	Thermal Power Plant
TS	-	Topsoil
UG	-	Underground

Check List

Details		(✓/X)
Text	Project Information	✓
Text	Exploration, Geology, Seam Sequence, Coal Quality and Reserve	✓
Text	Mining	✓
Text	Safety Management	✓
Text	Infrastructure Facilities proposed and their Location	✓
Text	Land Requirement	✓
Text	Environment Management	✓
Text	Progressive & Final Mine Closure Plan	✓
Annexure I	Copy of allotment order/ vesting order.	✓
Annexure II	Certificate of authorized person/agency if the project area is confined within the vested/allotted block boundary	✓
Annexure III	Approval of the Company Board	✓
Annexure IIIA	Commitment letter for complying with EC and FC conditions stipulated in respective clearances.	✓
Annexure IV	Copy of earlier approval of mining plan.	X
Annexure V	Plan / chart showing schedule of Implementation of Mine closure activities (progressive and final closure) with duration of important activities	✓
Annexure VI	Non-refundable application fee	✓
Annexure VIII	Coal Mine Development and Production Agreement (CMDPA)	✓
Plates- I	Location plan	✓
Plates- II	Plan certified by authorized person/agency if the project area is confined within the vested/allotted block boundary	✓
Plates- III	KML file of the proposed lease area, project area and geological block.	✓
Plates- IV	Plan showing approved block boundary vis-à-vis proposed/ existing mining lease & Mine boundary superimposed over it in distinct colour.	✓
Plates- V & VA	Geological plan showing all the boreholes drilled and proposed to be drilled showing allotted block boundary and required lease area	✓
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Plates- XXI (A-C)	Progressive mine closure plan/ stage plans (1st , 3rd & Final Stage)	✓
Plates- XXII	Reclamation plan	✓

Chapter 1

Project Information

1.1 Introduction

The Dhirauli Coal Block in Singrauli Coalfield, in the State of Madhya Pradesh has been allocated to M/s Stratatech Mineral Resource Private Limited (SMRPL) vide Letter No. NA-104/7/2020-NA dated 03.03.2021 by MoC, GoI (Annex – I).

1.1.1 Name of Coal Block

Dhirauli Coal Block.

1.1.2 Name of the Coalfield

Singrauli Coalfield, Madhya Pradesh.

1.1.3 Base date of Mine Plan / Mine Closure Plan

March 2021.

1.1.4 Linked End use Plants

The Block is auctioned under commercial coal block. There shall be no restriction to carry on mining operations for own consumption, sale or for any other purpose.

1.1.5 Distance of end use Plant

Not Applicable.

1.1.6 Mode of Coal Transport

It is proposed by Railway / truck /conveyor based on consumer location.

1.2 Location, Topography and Communication

1.2.1 Location of Coal Deposit

The Singrauli Coalfield which forms the northern most part of Son-Mahanadi Master basin occupies a prominent position on power map of India due to its vast Quarriable coal resources. Singrauli Coalfield covering an area of about 2200 sq km is located mainly in Singrauli district of Madhya Pradesh with a small portion falling in Sonbhadra District of Uttar Pradesh. Singrauli coalfield is structurally composed of two techno-sedimentary domain viz. the Moher sub basin in north east

and the Main Basin in the west. The large part of the coalfield known as Main Basin covering nearly 1900 sq km has been partly explored while the Moher sub basin having an area of around 300 sq km has been extensively explored in detail. These two basins of Singrauli Coalfield are separated by a concealed basement high. The Dhirauli Coal block spread over a total 26.72 sq.km area is located at about 70 km south-west of Singrauli township, whereas, it is around 50 km south-west of Waidhan township, the District Headquarter of Singrauli District. This area is a part of Survey of India Topo sheet No.64 I/5 (on R.F.1:50000).

1.2.2 Communication

Waidhan-Sidhi State Highway via Bargawan traverses 20 km north of the block. A metalled road from Parsona to Mara is located further east of the block. An un-metaled road branching out of this at Rajmelan culminates at Sarai. From this road to the west of River Mahan, a north-south running road leads to Langadda via Bhalyatola, Suliyari & Jhalri. The block is also accessible by an all weather metalled road from Singrauli as well as from Waidhan. The distance of Sarai-Gram, the nearest major railway station on Chopan-Singrauli-Katni line of central railway is about 18 km from the block. The nearest Airport is Varanasi which is at a distance of about 250 km from Waidhan. Shakti Nagar is an important industrial town in the vicinity of Singrauli and Waidhan townships. The other very important industrial township & railway station Renukoot is at a distance of 70 km from Waidhan on Chopan-Garwah Road section of eastern railway.

Block is traversed by number of fair weathered and forest roads. The important villages in and around the block are Suliyari & Dhirauli villages located within the block, while village Jhalri & Majhalipath are located outside, west of the block.

1.2.3 Availability of Power supply & water

The power requirement shall be fulfilled from the nearby 132/33kV substation at Dongri village. 33kV line shall be taken up to the CHP area and further power distribution for CHP equipment, mine pit water pumping and illumination shall be carried out as per requirement at 6.6kV and 415 V through overhead line and cables as suitable.

1.2.4 Prominent physiographic features, drainage pattern , natural water courses, rainfall data, highest flood level

Western part of Dhirauli block is characterized by almost plain topography, while, north-eastern and south-central part are highly undulating and have rugged topography as evident from the topographical plan. The north-eastern and south central part of the block have forest cover and is occupied by hillocks of elevation up to a maximum of 638 m above MSL. In general elevation of ground varies from 459.23m as observed near borehole MSD-102 to 603.45 m near borehole MDP-19 located in the south-western and south-eastern corner of the block respectively.

Drainage of the block is mainly controlled by westerly flowing Hardul Nala which traverses the block and passes almost through central part of the block. Many small seasonal nallas originating from elevated topography of north eastern and south central part of the block drain its water into Hardul Nala. The minor nallas and tributaries present in the block shows dendritic to sub-dendritic drainage pattern.

Climate of the area is characterized by hot dry summer as well distributed rainfall in the monsoon season. The summer season begins from March and extends up to May with maximum temperature rising up to 48°C during the peak period. The monsoon period extends from June to September with an average rainfall of 1132.7 mm. The winter season commences in early November up to February with the mean daily temperature of 8.1°C.

1.2.5 Important surface feature within the project area and major diversion or shifting involved

Human habitation: Eight villages (Aamdand, Amraikhoh, Basi-Berdah, Phatani, Belwar, Dhirauli, Jahalari, Sirswah,) are located in / immediate periphery of the block.

Road: There are 4 roads passing from block having total length of approx. ~18 km which needs to be diverted along southern, western and northern boundary of the block.

1.	Khanua-Dongri-Phatpani Road
2.	Suliyari- Baheritola Road
3.	Pondi-Gurwani Road
4.	Jhalari-Basiberdha Road

Ponds: Few Small ponds and dug wells in the area. These are utilized for irrigation and drinking water purpose.

Nala/River: The ground is deeply incised by a prominent Hardul nala and its tributaries flowing from almost East to west in the central part part. Few small nala is also following out from Northern and southern side of block.

Transmission line - Total 5 transmission line (132kv- one line to 765 kv – 4 lines) is passing from the block which is proposed to divert from outside of Dhirauli coal block.

1.3 Details of Allotment Agreement

1.3.1 Name of Allottee

Allottee of Dhirauli coal block is Stratatech Mineral Resources Private Limited (SMRPL), a Private company wholly owned by the Adani Enterprises Limited (AEL).

1.3.2 Details of Allotment / vesting order

The Dhirauli Coal Block in Singrauli Coalfield, in the State of Madhya Pradesh has been allocated to M/s Stratatech Mineral Resources Private Limited (SMRPL) vide Letter No. NA-104/7/2020-NA dated 03.03.2021 by MoC, GoI (Annex– I).

1.3.3 Name and address of the applicant

The registered office and address for communication of M/s SMRPL is given below:

"STRATATECH MINERAL RESOURCES PRIVATE LIMITED" (SMRPL)

Adani Corporate House, Shantigram, Nr. Vaishnodevi, S G Highway.
Khodiyar, Ahmedabad-382421, Gujarat".

Telephone : +91 124 255 5555
Fax : +91 79 2555 5500
Email : Info@adani.com
Web site : www.adanienterprises.com

1.3.4 Name of previous allottee of the Block

Not applicable

1.3.5 Starting date of the Mine as per CMDPA

April 2025

1.3.6 Rated Capacity as per CMPDA

3 Mtpa

1.3.7 Production Schedule as per opening permission (meeting provisions of CMDPA if any)

April 2025

1.3.8 End Use of Coal as per allotment order if any.

The Block is auctioned under commercial coal block. There shall be no restriction to carry on mining operations for own consumption, sale or for any other purpose.

1.3.9 Cardinal Points co-ordinates of the block boundary

The Dhirauli coal block boundary coordinates in WGS84 datum as per CMDPA is as follows:

List of Cardinal Points

POINTS	NORTHING	EASTING
1	23^{0}56'07"	82^{0}19'04"
2	23^{0}56'07"	82^{0}24'21"
3	23^{0}03'04"	82^{0}24'21"
4	23^{0}03'04"	82^{0}19'04"

1.4 Details of the Previous Approval of Mining Plan

There is no earlier approved Mining Plan for Dhirauli Coal Block.

1.5 Parameters of Approved Mining Plan Vis-À-Vis Proposed Mining Plan

Mining plan for Dhirauli Coal Block has been submitted to Ministry of coal for approval afresh. Details of proposed parameter has been summarized below:

Sl No	Description	Approved Mining Plan	Proposed Mining Plan
1.5.1	Block Area in "Ha"	Not Applicable, No Mining Plan Prepared and Approved earlier	2672
1.5.2	Block Area Projectised "Ha"		2672
1.5.3	Lease Area "Ha"		2672
1.5.4	Project Area "Ha"		2672
1.5.5	Life of the Project Area "Yrs"		40 OCP / 87 including UG
1.5.6	Minimum and Maximum Depth of working "m"		35 / 280 Opencast mine
1.5.7	Net Geological Block "Ha"		2672
1.5.8	Production Target "Mt"		5MTPA from Opencast mining & 1.5MTPA from UG)
1.5.9	Seams Available "as per GR'		21
1.5.10	Seams not considered for Mining with Reasons		12 (<1m thickness and inconsistent in nature)
1.5.11	Gross Geological Reserve		620.013
1.5.12	Net Geological "Mt"		558.011 Mte (OCP-260.263 Mte, UG-297.748Mte)
1.5.13	Blocked Reserve "Mt"		244.22 Mte (OCP-64.52 Mte, UG-179.70 Mte)
1.5.14	Mineable Reserve "Mt"		313.79 Mte (OCP- 195.74 Mte, UG- 118.05 Mte)
1.5.15	Extractable Reserve "Mt"		298.12 Mte (OCP- 186.06 Mte, UG- 112.07 Mte)
1.5.16	% of Extraction / Recovery		Overall 53.43% (OCP -71.49% , UG – 37.64%)
1.5.17	Reserve Depleted (till the base date) Reserve "Mt"		Nil
1.5.18	Balance Extractable Reserve "Mt"		298.12 Mte (OCP- 186.06 Mte, UG- 112.07 Mte)
1.5.19	Average Grade		G8
1.5.20	OB in MM^3		1963.55 MBCM
1.5.21	SR MM^3 /te		10.55

1.5.22	Mining Technology		For OB: Shovel – 3-4.5 cum Hyd shovel + 35 T dumper & 10-12 cum Hyd shovel +100T Dumper For Coal: OCP- surface miner – FEL – Dumper UG- Continuous Miner
1.5.23	Coal Beneficiation envisaged		Not Applicable
1.5.24	Handling of Rejects		Not Applicable
1.5.25	**Land use pattern "Ha"**		
1	Excavation Area		2096.59
2	Top Soil Dump		35.34(Upto 5th Year)
3	External Dump		387.55
4	Safety Zone		19.73
5	Other Use		19.17
6	Infrastructure Area		30.05
7	Green Belt		46.80
8	Undisturbed area		72.11
	Total		**2672.00**
1.5.26	Reason for revision		Not Applicable

CHAPTER – 2

EXPLORATION, GEOLOGY, SEAM SEQUENCE, COAL QUALITY & RESERVES

2.1 Details of the Block

2.1.1 Particulars of adjacent blocks

The Dhirauli Coal block spread over ~ 26.72 sq km area is located in Singrauli Coal field. The block boundary has been defined below:

North: Northern boundary is defined by eastern boundary of Gurwani passing north of borehole MDP-4, MDP-6, MSD-81 & MSD-89 and west of borehole MDP-5 & MSD-76 of Dhirauli block.

South: Southern boundary of the block is defined by an imaginary line commencing 400m south of borehole MDP-17 & 100 m south of borehole MSD-105 running almost parallel to E-W grid line and passing south of borehole MDP-18, MSD-100 & MDP-24 of Dhirauli block.

East: Eastern boundary is demarcated by western boundary of Mara II Mahan block explored earlier by MECL.

West: Dhirauli block is delimited on the west by eastern boundary of Suliyari- Belwar Coal block in the southern & part in the region of borehole no. MSD-105, MDP-17, MSD-60, 102, 45, 107, 46, 32, 29, 34 & 75 while in the region of borehole no. MSD-65, MDP-1, MSD-13, MDP-8, MSD-85 & MDP-4, it is delimited partly by eastern boundary of Dongri-Tal block.

2.1.2 Location of the Block

The block is located at about 70 km south-west of Singrauli township, whereas, it is around 50 km south-west of Waidhan township, the District Headquarter of Singrauli District. This area is a part of Survey of India Toposheet No.64 I/5 (on R.F.1:50000).

2.1.3 Area of the Block

2672 Ha.

2.1.4 Area of the Geological Block projectised "in Ha".

2672 Ha.

2.1.5 Balance area yet to be projectised "Ha".

Nil

2.1.6 Likely Reserve in the area yet to be projectised.

Nil

2.1.7 Cardinal point Co-ordinates of non-coal bearing area / existing mining lease outside the allotted Geological Coal Block

Not applicable - Project area is confined within the allotted block boundary.

2.1.8 Certificate of Qualified person / Accredited Mining Plan preparing agency (MPPA)

Project area is confined within area, certified map from Qualified person is attached as annexure II

Table of Cardinal Points

POINT ID	LATITUDE	LONGITUDE	POINT ID	LATITUDE	LONGITUDE
P-1	23° 56' 8.050" N	82° 20' 41.828" E	P-50	23° 58' 56.172" N	82° 21' 27.555" E
P-2	23° 56' 39.089" N	82° 20' 50.850" E	P-51	23° 58' 54.681" N	82° 21' 29.063" E
P-3	23° 57' 5.526" N	82° 20' 41.671" E	P-52	23° 58' 54.605" N	82° 21' 29.140" E
P-4	23° 57' 20.472" N	82° 20' 36.481" E	P-53	23° 58' 48.805" N	82° 21' 35.008" E
P-5	23° 58' 16.288" N	82° 19' 42.885" E	P-54	23° 58' 44.204" N	82° 21' 40.180" E
P-6	23° 58' 16.849" N	82° 19' 23.052" E	P-55	23° 58' 34.898" N	82° 21' 50.640" E
P-7	23° 58' 40.299" N	82° 19' 33.286" E	P-56	23° 58' 34.895" N	82° 21' 50.642" E
P-8	23° 59' 1.261" N	82° 19' 16.590" E	P-57	23° 58' 25.695" N	82° 22' 0.983" E
P-9	23° 59' 1.400" N	82° 19' 16.479" E	P-58	23° 58' 18.698" N	82° 22' 9.112" E
P-10	23° 59' 16.431" N	82° 19' 4.505" E	P-59	23° 58' 18.660" N	82° 22' 9.156" E
P-11	23° 59' 16.438" N	82° 19' 4.645" E	P-60	23° 58' 14.515" N	82° 22' 13.972" E
P-12	23° 59' 16.769" N	82° 19' 4.382" E	P-61	23° 58' 14.145" N	82° 22' 14.402" E
P-13	23° 59' 16.880" N	82° 19' 10.421" E	P-62	23° 58' 14.140" N	82° 22' 14.408" E
P-14	23° 59' 16.984" N	82° 19' 17.296" E	P-63	23° 58' 14.045" N	82° 22' 14.517" E
P-15	23° 59' 17.215" N	82° 19' 32.702" E	P-64	23° 58' 11.809" N	82° 22' 16.490" E
P-16	23° 59' 17.746" N	82° 20' 4.348" E	P-65	23° 58' 7.869" N	82° 22' 19.964" E
P-17	23° 59' 17.831" N	82° 20' 13.490" E	P-66	23° 58' 0.929" N	82° 22' 26.687" E
P-18	23° 59' 19.414" N	82° 20' 13.672" E	P-67	23° 58' 0.876" N	82° 22' 26.739" E
P-19	23° 59' 26.521" N	82° 20' 14.490" E	P-68	23° 57' 55.843" N	82° 22' 31.614" E
P-20	23° 59' 35.671" N	82° 20' 15.530" E	P-69	23° 57' 42.880" N	82° 22' 43.585" E
P-21	23° 59' 42.269" N	82° 20' 16.060" E	P-70	23° 57' 42.593" N	82° 22' 43.889" E
P-22	24° 0' 0.375" N	82° 20' 17.753" E	P-71	23° 57' 42.573" N	82° 22' 43.910" E
P-23	24° 0' 0.405" N	82° 20' 17.755" E	P-72	23° 57' 33.698" N	82° 22' 53.282" E
P-24	24° 0' 2.782" N	82° 20' 17.978" E	P-73	23° 57' 26.902" N	82° 23' 0.343" E

POINT ID	LATITUDE	LONGITUDE	POINT ID	LATITUDE	LONGITUDE
P-25	24° 0' 2.765" N	82° 20' 17.994" E	P-74	23° 57' 26.890" N	82° 23' 0.355" E
P-26	24° 0' 2.755" N	82° 20' 18.005" E	P-75	23° 57' 18.132" N	82° 23' 9.453" E
P-27	23° 59' 59.910" N	82° 20' 20.825" E	P-76	23° 57' 18.090" N	82° 23' 9.497" E
P-28	23° 59' 59.888" N	82° 20' 20.846" E	P-77	23° 57' 16.700" N	82° 23' 10.940" E
P-29	23° 59' 59.316" N	82° 20' 21.414" E	P-78	23° 57' 11.105" N	82° 23' 16.947" E
P-30	23° 59' 59.308" N	82° 20' 21.421" E	P-79	23° 57' 6.215" N	82° 23' 22.196" E
P-31	23° 59' 59.034" N	82° 20' 21.693" E	P-80	23° 57' 5.430" N	82° 23' 22.913" E
P-32	23° 59' 58.300" N	82° 20' 22.421" E	P-81	23° 57' 5.426" N	82° 23' 22.916" E
P-33	23° 59' 47.987" N	82° 20' 33.434" E	P-82	23° 57' 3.475" N	82° 23' 24.696" E
P-34	23° 59' 46.887" N	82° 20' 34.609" E	P-83	23° 57' 2.234" N	82° 23' 25.828" E
P-35	23° 59' 46.862" N	82° 20' 34.636" E	P-84	23° 56' 56.930" N	82° 23' 30.667" E
P-36	23° 59' 40.729" N	82° 20' 41.185" E	P-85	23° 56' 50.675" N	82° 23' 37.034" E
P-37	23° 59' 40.723" N	82° 20' 41.192" E	P-86	23° 56' 50.661" N	82° 23' 37.048" E
P-38	23° 59' 37.000" N	82° 20' 45.167" E	P-87	23° 56' 44.937" N	82° 23' 42.874" E
P-39	23° 59' 36.967" N	82° 20' 45.202" E	P-88	23° 56' 37.480" N	82° 23' 51.058" E
P-40	23° 59' 28.481" N	82° 20' 54.264" E	P-89	23° 56' 36.759" N	82° 23' 51.994" E
P-41	23° 59' 28.447" N	82° 20' 54.300" E	P-90	23° 56' 36.599" N	82° 23' 52.154" E
P-42	23° 59' 25.291" N	82° 20' 57.670" E	P-91	23° 56' 8.603" N	82° 24' 20.086" E
P-43	23° 59' 17.337" N	82° 21' 6.039" E	P-92	23° 56' 8.247" N	82° 22' 30.929" E
P-44	23° 59' 17.320" N	82° 21' 6.058" E	P-93	23° 56' 8.247" N	82° 22' 30.831" E
P-45	23° 59' 10.337" N	82° 21' 13.404" E	P-94	23° 56' 8.160" N	82° 22' 5.257" E
P-46	23° 59' 7.735" N	82° 21' 15.987" E	P-95	23° 56' 7.869" N	82° 20' 41.822" E
P-47	23° 59' 7.733" N	82° 21' 15.989" E	P-96	23° 56' 8.050" N	82° 20' 41.875" E
P-48	23° 59' 3.193" N	82° 21' 20.497" E	P-97	23° 56' 8.050" N	82° 20' 41.828" E
P-49	23° 58' 59.036" N	82° 21' 24.675" E			

2.1.9 KML file of the Proposed lease and geological block

KML file of the proposed lease and Geological block boundary has been attached as plate III

2.1.10 Whether the project area is confined within allotted boundary.

Yes, Project area is confined within allotted boundary.

2.1.11 If the project area extends outside the allotted block boundary

The project area does not extend outside block boundary.

2.1.12 Type of the project (Operating / under Implementation) and year of starting

Block is under Implementation for operation and will be operational in 2025.

2.2 EXPLORATION, GEOLOGY AND ASSESSMENT OF RESERVE

2.2.1 Regional geological setup of the area, local geology, Structure, Stratigraphy sequence

- **REGIONAL GEOLOGY**

Singrauli coalfield forms the northern extremity of Son-Mahanadi master Gondwana basin, at the junction region of east-west trending Damodar-Koel-Tatapani graben and the NW-SE trending Son-Mahanadi rift zone; thus reflecting the lithological and structural characteristics of both Damodar and Son valley Gondwana basins. The northern limit of the Singrauli coalfield is defined by a major east west trending northern boundary fault, which is parallel to the Narmada-Son lineament. High standing Mahadeva hills are defining the southern boundary. Talchir beds rest un-conformably over Precambrian rocks and the Precambrian themselves, are forming the eastern boundary whereas the western boundary is formed by the contact of Precambrian and Supra Barakar sediments. The generalized stratigraphic succession (after Laskar, et.al 1977 and Raja Rao 1983) is given in below table.

- **Stratigraphy**

Thus based on both the surface and subsurface data available, the following stratigraphic succession has been proposed as below.

Stratigraphic Succession of Singrauli Coalfield

Age	Group	Formation	Lithology
Cretaceous		Intrusives	Dolerite dykes & Sills
Upper Triassic (?)	Upper Gondwana	Mahadeva	Coarse grains, ferruginous sandstone with bands of shale, clay and conglomerates.
Lower Triassic	Lower Gondwana	Panchet (?)	White, greenish white and pink micaceous, medium to coarse grained sandstone with red beds, greenish brown silty shales and conglomerates.
Upper Permian		Raniganj (215-403 m)	Fine grained sandstones and shales with coal seams including 134 m thick Jhingurdah seam
Middle Permian		Barren Measures (125-300 m)	Very coarse grained, ferruginous, sandstones, green clays & shales.

Lower Permian		Barakar (325-600 m)	Medium to coarse grained, sandstones, shales, clays and coal seams.
Upper Carboniferous to Lower Permian		Talchir (75-130 m)	Tillite, sandstones, siltstones, needle shales etc.
---------- Unconformity ----------			
Precambrian		Precambrian	Phyllites, quartzites, schists and gneisses.

2.2.2 Local Geology

- **GEOLOGICAL STRUCTURE**

The Dhirauli block is traversed by 11 normal gravity faults designated as F1-F1 to F11-F11. There are two sets of faults – one trending NW-SE and the other trending NE-SW. The magnitude of these faults varies from 5 m to 85 m within the block. The faults have been deciphered based on the floor level difference observed on either side of the fault planes and on the basis of borehole intersections. It is pertinent to mention here that, the numbers of minor slips are also observed in boreholes causing insignificant reduction of parting and seam thickness. It is seen that, out of 11 faults interpreted 10 faults are of low magnitude having throw between 5 m to 35 m, except fault F9-F9 which is having a maximum 85 m of throw.

- **Strike and Dip**

In general, the strike varies from NE-SW in the entire area of the block to almost E-W in the southern part of the block with gentle dip of 2º to 4º north-easterly to north and south-westerly to south at places.

- **Seam Correlation**

Range of occurrence of seam with actual as well as thickness and parting is given below table.

Table: Sequence of Coal Seam- Dhirauli Block

Seam	Floor Depth Range	Thickness Range	Eff. Thickness Range	Parting	Inter-section
L-1					
MIN	22.39(MSD-32)	0.07(MDP-15)	0.07(MDP-15)	0.33 (MSD-18)	8
MAX	172.89(MDP-7)	0.93(MSD-63)	0.93(MSD-63)	1.02 (MSD-63)	
VIII-T					
MIN	24.31(MSD-32)	0.55(MSD-63)	0.55(MSD-63)	0.25 (MSD-63)	24
MAX	218.37(MSD-68)	3.16(MSD-25)	2.82(MSD-25)	0.90 (MSD-106)	
VIII-B					

Seam	Floor Depth Range	Thickness Range	Eff. Thickness Range	Parting	Inter-section
MIN	25.12(MSD-32)	0.18(MSD-25)	0.18(MSD-25)	26.10 (MSD-34)	24
MAX	219.56(MSD-68)	0.60(MSD-35)	0.60(MSD-35)	27.96 (MSD-6)	
VIII-COMB					
MIN	21.73(MSD-86)	1.37(MSD-65)	1.37(MSD-65)	23.27 (MDP-22)	82
MAX	258.99(MSD-103)	4.47(MDP-22)	4.00(MDP-22)	32.39 (MSD-69)	
L-2					
MIN	51.86(MSD-32)	0.16(MSD-29)	0.16(MSD-29)	0.56 (MDP-22)	13
MAX	272.75(MDP-5)	1.44(MDP-7)	1.44(MDP-7)	1.64 (MSD-69)	
VII-TOP					
MIN	68.68(MSD-101)	0.83(MDP-7)	0.83(MDP-7)	0.63 (MSD-94)	36
MAX	296.78(MSD-103)	8.48(MSD-58)	7.92(MSD-58)	5.35 (MSD-88)	
VII-BOTT					
MIN	69.84(MSD-101)	0.18(MSD-58)	0.18(MSD-58)	11.69 (MSD-94)	36
MAX	299.00(MSD-103)	1.52(MSD-88)	1.52(MSD-88)	27.83 (MDP-22)	
VII-COMB					
MIN	43.08(MSD-43)	1.27(MDP-24)	1.27(MDP-24)	12.52 (MSD-100)	71
MAX	242.61(MSD-4)	9.08(MDP-23)	8.32(MDP-23)	38.88 (MSD-75)	
VI					
MIN	83.00(MSD-86)	0.05(MSD-29)	0.05(MSD-29)	4.30 (MDP-3)	91
MAX	318.45(MSD-103)	2.47(MSD-13)	2.47(MSD-13)	26.84 (MSD-7)	
L-3					
MIN	55.59(MSD-46)	0.02(MSD-46)	0.02(MSD-46)	7.18 (MSD-7)	44
MAX	329.00(MSD-103)	2.13(MDP-3)	2.03(MDP-3)	42.53 (MSD-18)	
L-4					
MIN	82.96(MSD-46)	0.02(MSD-1)	0.02(MSD-46)	20.27 (MSD-88)	50
MAX	362.00(MSD-72)	1.02(MSD-91)	1.02(MSD-91)	61.45 (MSD-89)	
V-T					
MIN	64.17(MSD-107)	0.04(MSD-36)	0.04(MSD-91)	2.54 (MDP-21)	39
MAX	392.81(MSD-103)	0.93(MDP-12)	0.93(MDP-12)	11.89 (MSD-91)	
V-B					
MIN	43.27(MSD-50)	0.11(MSD-73)	0.11(MSD-73)	0.52 (MSD-57)	81
MAX	398.24(MSD-103)	1.25(MSD-3)	1.25(MSD-3)	9.91 (MSD-87)	
L-5					
MIN	47.40(MSD-62)	0.03(MSD-26)	0.03(MSD-26)	0.60 (MSD-94)	46
MAX	388.50(MSD-67)	0.48(MSD-94)	0.48(MSD-94)	3.37 (MSD-48)	
IV					
MIN	51.08(MSD-62)	1.11(MSD-107)	1.11(MSD-107)	2.85 (MSD-65)	126
MAX	407.80(MSD-103)	3.90(MDP-3)	3.90(MDP-3)	13.23 (MSD-101)	
III-T					
MIN	27.11(MDP-17)	1.60(MSD-105)	1.60(MSD-105)	0.38 (MDP-17)	130
MAX	422.12(MSD-103)	7.60(MSD-2)	6.98(MSD-2)	6.94 (MSD-10)	
III-B					
MIN	29.20(MDP-17)	0.18(MSD-16)	0.18(MSD-16)	1.57 (MSD-30)	125
MAX	426.91(MSD-103)	2.44(MSD-90)	2.44(MSD-90)	17.80 (MSD-5)	
L-6					
MIN	36.07(MSD-105)	0.03(MSD-39)	0.03(MSD-39)	1.40 (MDP-5)	56
MAX	425.00(MSD-72)	0.95(MSD-69)	0.95(MSD-69)	8.58 (MSD-44)	

Seam	Floor Depth Range	Thickness Range	Eff. Thickness Range	Parting	Inter-section
L-7					
MIN	199.96(MDP-15)	0.02(MDP-18)	0.02(MDP-18)	0.90 (MSD-103)	31
MAX	436.10(MSD-103)	0.79(MSD-76)	0.79(MSD-76)	18.61 (MDP-12)	
II					
MIN	60.02(MDP-17)	0.05(MDP-16)	0.05(MDP-16)	20.23 (MDP-21)	119
MAX	440.00(MSD-103)	4.55(MSD-96)	4.35(MSD-96)	48.37 (MDP-16)	
I					
MIN	94.64(MDP-17)	0.25(MDP-13)	0.25(MDP-13)	-	10
MAX	445.16(MDP-21)	1.30(MDP-19)	1.30(MDP-19)	-	
BAND					
MIN	107.95(MSD-24)	0.51(MSD-24)	0.51(MSD-24)	-	1
MAX	107.95(MSD-24)	0.51(MSD-24)	0.51(MSD-24)	-	

NOTE: Band is uncorrelatable hence parting range have not been given.

2.2.3 Geology Block Area "Ha"

2672 Ha.

2.2.4 Status of Exploration of the block

Fully Explored

2.2.5 Area covered by 'detailed' exploration within the block

Entire area of 26.72 Sq. Km.

2.2.6 Whether entire lease area has been covered by detailed exploration.

Yes, entire area has been covered by detailed exploration

2.2.7 No. of boreholes drilled within the block

Number of boreholes drilled by different agency has been presented in table below:

Phase I - Old boreholes (Drilled earlier by MECL)	
i) No. of boreholes drilled	24 BHS (MDP-1 to MDP-24)
ii) Total Meterage drilled	7614 m
Phase II Explored by MECL	
i) No. of boreholes drilled	107 boreholes (MSD-1 to 107)
ii) Total Meterage drilled	29182.00 m
Year 2014-15	9365 m (35 BHS)
Year 2015-16	16158 m (59 BHS)
Year 2016-17	3659 m (13 BHS)
Total Meterage	**29182 m (107 BHS)**
Grand Total	**36796 m (131 BHS)**

2.2.8 Future Exploration Requirement

4500 meterage drilling is proposed in indicated reserve area which shall be completed within 2 years of commencement of Mining operation.

2.2.9 Year wise future programme of exploration

Year	Proposed Borehole (No)	Total Meterage
1	10	2000
2	10	2500
Total	**20**	**4500**

2.2.10 Overall borehole density within the block

The borehole density is 5 boreholes per sq.km in the entire block. Block auctioned under fully explored block in commercial coal block auction.

2.2.11 No of Seams available as per GR (Geological Report)

A total of 21 coal seams are present in Dhirauli block including 7 local seams viz. Seam-L-1, Seam-VIII Top, VIII Bottom, VIII-Combined, L-2, VII Top, VII Bottom, VII Combined, VI, L-3, L-4, V-Top, V-Bottom, L-5, IV, III Top, III Bottom, L-6, L-7, II & Seam-I.

2.2.12 Seam not considered for mining with reason

The seams viz. L-1 to L-7, VIII Bottom, V Top, V Bottom, III Bottom & Seam-I are not considered for mining as it has not developed workable thickness and are uneconomical.

2.2.13 Dip of Seam

Gentle dip of 2º to 4º north-easterly to north and south-westerly to south at places.

2.2.14 Geological Reserve

The seam-wise, thickness-wise, depth-wise reserves, volume of overburden are furnished in below Table.

Table Break-up of Net Geological Reserve

Seam	Thickness Range	Depth Range (m)	Net Geo. Res. (Mt)	Blocked Reserve (Mt)					Mineable Reserves (Mt)		Mining losses (Mt)
				Highwall/ Batter	Nala/River/Road	Barrier	Uneconomical	Total Blocked	UG	OC	
VIII-Top	0.55-3.16	24.31-218.37	6.96	1.08	0.02	0.10		1.20	0.00	5.76	0.69
VIII-Comb.	1.37-4.47	21.73-258.99	83.55	13.98	0.32	3.31		17.61	0.00	65.94	4.27
VII-Top	0.83-8.48	68.68-296.78	31.13	6.89	0.14	1.24		8.27	0.00	22.86	0.87
VII-Bott.	0.32-1.52	69.84-299.00	4.11	0.91	0.02	0.45		1.37	0.00	2.73	0.11
VII-Comb.	1.27-9.08	43.08-242.61	134.52	29.79	0.59	5.69		36.06	0.00	98.46	3.75
Total OC	-	-	**260.26**	**52.66**	**1.08**	**10.78**	**0.00**	**64.52**	**0.00**	**195.74**	**9.69**
VI	0.58-2.47	83-318.45	25.15	0.00	0.00	18.23		18.23	6.92	0.00	0.36
V-Bott.	0.33-1.25	43.27-398.24	3.54	0.00	0.00	0.00	3.54	3.54	0.00	0.00	0.00
IV	0.55-3.9	51.08-407.80	83.07	0.00	0.00	46.12		46.12	36.95	0.00	1.87
III-Top	1.6-7.6	27.11-422.12	149.75	0.00	0.00	82.43		82.43	67.31	0.00	3.39
III-Bott.	0.22-2.44	29.20-426.91	8.11	0.00	0.00	6.94	1.18	8.11		0.00	0.00
II	0.4-4.55	60.02-440.00	28.13	0.00	0.00	21.27		21.27	6.87	0.00	0.36
Total UG			**297.75**	**0.00**	**0.00**	**174.99**	**4.72**	**179.70**	**118.05**	**0.00**	**5.98**
Grand Total	-	-	**558.01**	**52.66**	**1.08**	**185.77**	**4.72**	**244.22**	**118.05**	**195.74**	**15.66**

Table -Seam Wise Extractable Reserve

Seam	Extractable Reserves (MT)			As on base date							Reason not considered for mining
				Depletion of Reserve (MT)			Balance Reserve (MT)				
	UG	OC	High-wall	UG	OC	High-wall	UG	OC	High wall	Total	
VIII-Top	-	4.76	-	-	-	-	-	4.76	-	4.76	considered
VIII-Comb.	-	63.46	-	-	-	-	-	63.46	-	63.46	considered
VII-Top	-	21.72	-	-	-	-	-	21.72	-	21.72	considered
VII-Bott.	-	2.58	-	-	-	-	-	2.58	-	2.58	considered
VII-Comb.	-	93.53	-	-	-	-	-	93.53	-	93.53	considered
VI	6.56	-	-	-	-	-	6.56	-	-	6.56	considered
V-Bott.	-	-	-	-	-	-	-	-	-	-	Thickness <1.5 m
IV	35.08	-	-	-	-	-	35.08	-	-	35.08	considered
III-Top	63.92	-	-	-	-	-	63.92	-	-	63.92	considered
III-Bott.	0.00	-	-	-	-	-	-	-	-	-	Thickness <1.5 m
II	6.51	-	-	-	-	-	6.51	-	-	6.51	considered
Total	**112.07**	**186.06**	**-**	**-**	**-**	**-**	**112.07**	**186.06**	**-**	**298.12**	

2.2.15 Methodology of Reserve Estimation

Topography , Base of weathering, Seam folio plans, seam in-crop, isochore and iso-grade, parting, density grid are generated using Minex 6.5.1 version for the estimation of reserves.

An overall deduction of 10% is applied to the gross tonnage from each seam to arrive at the net in-situ reserve of coal to account for data gaps, wash out zones, abrupt change in seam thickness.

- **Computation of Coal Reserves**

The reserves of coal seams are computed considering thickness, in-seam dirt bands, GCV bands with corresponding density and 0.9m thickness seam limit from MINEX 6.5.1. A deduction of 10% from 'Gross' reserves has been made to arrive at 'Net' reserves in order to account for unforeseen geological factors like abrupt change in seam thickness, structural disturbance etc.

- **Computation of Coal Quality**

Core samples have been analyzed in MECL lab, for following parameters -

a. Band by band analysis
b. Proximate Analysis on equilibrated basis for all seams where it is not analyzed , determined value is used –
    1. Moisture %
    2. ASH%
    3. Volatile Matter %
    4. Fixed Carbon %
    5. Gross Calorific Value (GCV – KCL/KG)
c. Ultimate Analysis is done in 28 boreholes for below radicals -
    1. Carbon %
    2. Hydrogen %
    3. Nitrogen %
    4. Total Sulfur %
    5. Oxygen %
d. Density
    Specific gravity for each grade has been calculated using the following formula by taking average ash% for each grade:
    Sp. Gr. = 1.29 + 0.01 x Ash.

Quality grid is prepared for proximate analysis and Density values to determine the weighted average value of each parameter.

- **Overburden**

The overburden consists of soil, weathered mantle, and argillaceous as well as arenaceous rocks. The parting between the two seams consists of argillaceous and arenaceous rocks with thin coal / carbonaceous bands. Overburden and parting up to Seam-VII is considered us OB. Below seam VII underground mining in proposed.

- **In-Seam Burden**

The in-seam dirt bands of combustible and / or non-combustible nature of more than 1 meter in thickness have been identified and volume of such in-seam burden have been added to the volume of parting lying above the seam and accounted under overburden.

- **Methodology of Overburden Estimation**

Methodology of overburden/parting volume estimate is similar to that of reserve estimation except it is restricted up to volume and not for tonnage. These assessments have been made using Minex 6.5.1 software.

- **Depth of Excavation**

The floor of Seam-VII has been considered as the floor of the opencast mine. The maximum floor depth of this seams from surface is around 280 m in the block. The depth of excavation of seams considered for Open cast mine is given in Plate XIII. Below seam VII underground mining in proposed.

2.2.16 Average GCV

4960 Kcal/kg (G8)

2.2.17 Gross Geological Reserve of the block "Mte"

620.013 Million Tonnes

2.2.18 Net Geological Reserve of the block "Mte"

558.011 Mte (OCP-260.263 Mte, UG-297.748Mte)

2.2.19 Minable Reserve of the block "Mte"

313.79 Mte (OCP- 195.74 Mte, UG- 118.05 Mte)

2.2.20 Blocked Reserve "Mte"

244.22 Mte (OCP-64.52 Mte, UG-179.70 Mte)

2.2.21 Corresponding extractable reserve of the block "Mte"

298.12 Mte (OCP- 186.06 Mte, UG- 112.07 Mte)

2.2.22 Percentage of Extraction

Overall 53.43% (OCP -71.49%, UG – 37.64%)

2.2.23 Reserve already depleted (based date of Mine Plan)

Nil

2.2.24 Balance Reserve (as on Base Date)

298.12 Mte (OCP- 186.06 Mte, UG- 112.07 Mte)

CHAPTER 3

Mining

3.1 Mining Method

3.1.1 Existing Method of mining

Not Applicable, Dhirauli is virgin coal block.

3.1.2 Proposed Method of mining

Considering the geo-mining characteristics of the block and for conservation of resource, it is proposed to extract the coal reserves within the block using combination of open cast mining (upto seam VII) and underground mining (below Seam VII to Seam II) method.

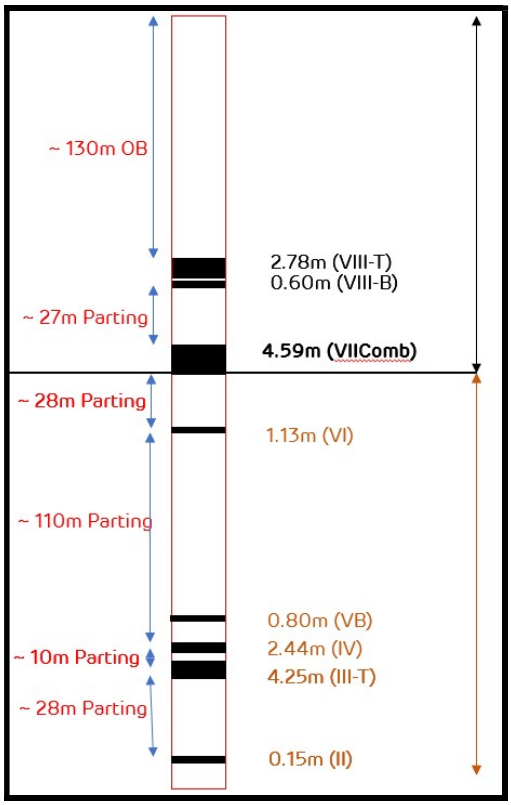


Figure 1: Generalized coal and parting thickness

Opencast limit is planned upto seam VII floor due to thick parting and thin coal seams below seam VII.

3.1.2.1 Opencast mining

i. Mine Boundaries

It is proposed to mine maximum area of block boundary considering safety zone, road diversion , garland drain and road diversion and safety distance from road and nala to pit surface limit as per statutory requirement. The diversion of road is proposed along the Southern, Eastern and Northern boundary of block. Nala diversion is proposed in North East corner of block.

The mine boundaries of the Opencast mine are as follows :-

- **North:** The surface limit of the mine has been drawn leaving a surface barrier of 45 m safety distance from proposed nala diversion and safety zone as per CMR 2017 (Reg.-119).

- **East:** The surface limit of the mine has been drawn leaving a surface barrier of 45 m safety distance from proposed diverted drain. Road diversion and Safety Zone is proposed after diverted drain to maintain the 45 meter safety distance between pit surface and diverted drain as per CMR 2017 (Reg.-119). Two Shaft is also proposed for ventilation (outlet) of UG mining in eastern boundary.

- **South:** The surface limit of the mine has been drawn leaving a surface barrier of 45 m safety distance from proposed diverted drain. Road diversion and Safety Zone is proposed after diverted drain to maintain the 45 meter safety distance between pit surface and diverted drain as per CMR 2017 (Reg.-119).

- **West:** The surface limit of the mine has been drawn leaving a surface barrier of 45 m safety distance from proposed Road diversion. Garland drain and Safety Zone is proposed after diverted road to maintain the 45 meter safety distance between pit surface and diverted road as per CMR 2017 (Reg.-119).

Where the incrop is more than 45 meter from the block boundary incrop is followed for mine surface limit.

ii. Opening location

Mine opening is planned from southwest corner of block (in-crop of seam VII) and further development is planned along strike of the seam.

A patch of 387.55 Ha in the south west corner is non coal bearing (considering seams for Opencast mining only) beyond in-crop of seam-VII where it is proposed to have the external dump.

Non coal bearing area (beyond in crop of VII seam) of approx. 21 Ha shall be utilized for mine facilities, additionally another patch of ~9 ha is proposed for underground infrastructure for second set of incline planned at north-west side of block. (Plate XI).

External dumping shall be merged with internal back filling dump in future when mine advances towards further north side.

iii. Mine Design

- **Rated Capacity**

Mining Plan for Dhirauli Coal Block has been prepared for a rated capacity of 5.0 Mty of power grade ROM Coal from Opencast mine and 1.5 Mty from underground mines. This output is considered technically feasible because of following conditions-

- Gradient of 2^0-4^0 of the coal seams.
- Multiple coal seams (9 No. of Coal Horizons 5 for OCP and 4 for UG))
- strike length.
- Thin coal seams (due to splitting).
- Variable thickness of OB/partings (high strip ratio)
- 11 number of Normal faults (Dip-side)

With this rated capacity of 5.0 Mty of the mine, the annual rate of advance of the mine would be about 150-160 m along the dip on the mine floor for opencast mine.

➢ **Design Criteria**

The design criteria adopted in this Mining plan is as follows: -

- Number of annual working days --- 330
- Number of daily shifts /day --- 3
- Duration of each shift (hours) --- 8

The opencast mine would be worked on the 3-shift/day and seven days/week round the year for coal extraction and overburden removal.

iv. Mining Scheme

Based on the above geo-mining condition, Mining system has been worked out for achievement of rated capacity in shorter period i.e. low gestation period as well as reduction of Inter-mixing of Coal with stone bands and starting of internal dumping as soon as sufficient de-coaled area is created. The top OB benches above mining mass would be worked in horizontal slicing method.

Coal Winning & OB Removal

Coal will be mined using Combination of surface miner – FEL – Dumper method. The surface miner shall essentially be used in coal seams for quality improvement. The OBR would be removed using conventional shovel dumper method with drilling & blasting. Drilling & blasting shall be conducted in scientific way using environment friendly technology. Some major system parameters for both coal winning & OB removal are given below:-

Bench Height

For OBR (12 m^3 Hyd. Shovel)	10-12 m
Top Soil/ Intervening Parting (3-4.5 m^3 excavator)	3-6 m
Coal	as per thickness

Proposed Bench Width

1. Working Bench Width for 12 m^3 Hyd. Shovel	20-30m
2. Non-Working Bench Width for 12 m^3 Hyd. Shovel	12-20m
4. Width of the temporary transport ramp	20m
5. Usual height of the Top soil / parting dump bench	12-15m
6. Usual height of the Hard Rock dump bench	30m

7. Bench Slope

a) OB Bench	70^0
b) Coal Bench	70^0
c) Dump bench	37^0
8. Overall (Ultimate) pit slope	37^0

v. Sequence of Mining

Dhirauli Coal mine is planned from south-west corner of block (seam VII incrop). Due to high strip ratio and limited space of OB dumping coal evacuation is planned from advancing face and no permanent haulage road is planned for the block. The box cut is developed in such a manner so as to facilitate the proper drainage of water towards the sump. This would also facilitate extension of coal and OB bench for full development of mine. The mine will advance towards dip direction exposing the floor of Seam-VII. After creation of sufficient de-coaled area of about 100m, internal backfilling of OB will be started in the 3rd year of mining operation. The coal production will start from the 1st year of mine operation and the target coal production of 5.00 MTY will be achieved in the 3rd year of mine operation.

The alignment of the face has been so planned as to facilitate the drainage of water. Entire quarry has been planned for OB dumping by leaving lag distance of 100 meter from advancing benches (northern side)

A surface retrieving conveyor will be installed along the center of block from 2nd year. Coal shall be transported from mine face to dump station by truck . Moveable Dump station is planned which will be shifted at 5 year interval timeframe. 1st year, 3rd year, 5th year, and final year stage planes are given in **Plate no. XVIA to XVI D.**

vi. Overburden Removal and OB Dumps

The opencast mine is planned upto 280 m depth on the floor of seam-VII with overall average stripping ratio of 10.55 m^3/te.

The total volume of OB has been estimated as 1963.55 Mcum. The OB removed during initial years will be placed beyond the incrop of the seam VII as external dump. The total volume of external dump has been

estimated as 259.01 Mm^3. Rest of the OB will be placed as internal dumps. The total volume of internal OB, i.e. the volume which will be accommodated internally by backfilling has been estimated as 1704.54 Mm^3.

The internal dumping will start when about 100 m internal space is available on quarry floor. By adopting the proposed sequence of mining, as the quarry advances, the amount of internal dump will increase as more space for the internal dumping is created.

It is proposed to start internal dumping from 3rd year of mine operation along with external dumping to optimize lead. As the gradient of the seam is flat, during working of the quarry substantial amount of OB can be accommodated as internal dump. After 18th year of mine operation, no external dumping will be required. Hence, OB will be accommodated as internal dump for rest of the mine life.

During 1st year, height of external dump will be kept at only 60 m above the ground level. During 3rd year, height of eastern external dump and eastern in-pit dump will be merged by maintaining 90m height above the ground level (RL of 600). At the end of 5th year height of internal dump will be 90m above ground level. At the end of mine life, internal dump will be at 60 above the ground level for some part.

Table - Dhirauli Coal Block Solid Waste Management

Year	External Dump		Internal Dump		Total OB	
	Progressive (Mcum)	Cumulative (Mcum)	Progressive (Mcum)	Cumulative (Mcum)	Progressive (Mcum)	Cumulative (Mcum)
Yr-1	16.35	16.35	-	-	16.35	16.35
Yr-2	28.12	44.47	-	-	28.12	44.47
Yr-3	19.36	63.83	13.94	13.94	33.30	77.77
Yr-4	12.39	76.22	20.76	34.70	33.15	110.92
Yr-5	11.64	87.86	21.53	56.23	33.17	144.09
Yr-6	10.5	98.36	24.30	80.53	34.80	178.89
Yr-7	11.34	109.70	24.66	105.19	36.00	214.89
Yr-8	11.55	121.25	25.70	130.89	37.25	252.14
Yr-9	11.97	133.22	26.33	157.22	38.30	290.44
Yr-10	12.11	145.33	26.49	183.71	38.60	329.04
Yr-11	12.81	158.14	27.49	211.20	40.30	369.34
Yr-12	13.02	171.16	28.73	239.93	41.75	411.09

Year	External Dump		Internal Dump		Total OB	
	Progressive (Mcum)	Cumulative (Mcum)	Progressive (Mcum)	Cumulative (Mcum)	Progressive (Mcum)	Cumulative (Mcum)
Yr-13	13.58	184.74	30.32	270.25	43.90	454.99
Yr-14	13.79	198.53	32.11	302.36	45.90	500.89
Yr-15	14.42	212.95	32.88	335.24	47.30	548.19
Yr-16	14.91	227.86	34.09	369.33	49.00	597.19
Yr-17	15.33	243.19	34.72	404.05	50.05	647.24
Yr-18	15.82	259.01	35.03	439.08	50.85	698.09
Yr-19	-	259.01	51.40	490.48	51.40	749.49
Yr-20	-	259.01	52.25	542.73	52.25	801.74
Yr-21	-	259.01	53.30	596.03	53.30	855.04
Yr-22	-	259.01	54.25	650.28	54.25	909.29
Yr-23	-	259.01	55.75	706.03	55.75	965.04
Yr-24	-	259.01	58.25	764.28	58.25	1023.29
Yr-25	-	259.01	60.75	825.03	60.75	1084.04
Yr-26	-	259.01	62.75	887.78	62.75	1146.79
Yr-27	-	259.01	64.00	951.78	64.00	1210.79
Yr-28	-	259.01	64.50	1016.28	64.50	1275.29
Yr-29	-	259.01	65.50	1081.78	65.50	1340.79
Yr-30	-	259.01	65.75	1147.53	65.75	1406.54
Yr-31	-	259.01	66.50	1214.03	66.50	1473.04
Yr-32	-	259.01	67.25	1281.28	67.25	1540.29
Yr-33	-	259.01	67.25	1348.53	67.25	1607.54
Yr-34	-	259.01	67.75	1416.28	67.75	1675.29
Yr-35	-	259.01	68.50	1484.78	68.50	1743.79
Yr-36	-	259.01	68.50	1553.28	68.50	1812.29
Yr-37	-	259.01	69.25	1622.53	69.25	1881.54
Yr-38	-	259.01	53.50	1676.03	53.50	1935.04
Yr-39	-	259.01	21.50	1697.53	21.50	1956.54
Yr-40	-	259.01	7.01	1704.54	7.01	1963.55
Total	**259.01**	**259.01**	**1704.54**	**1704.54**	**1963.55**	**1963.55**
	259.01		**1704.54**		**1963.55**	

vii. Top Soil Management

Topsoil is proposed to be removed separately and dumped outside the quarry in a manner so as not to loose its fertility. The top soil would be spread over the reclaimed land, afterward.

Topsoil will be removed and dumped on the area shown on surface plan. Topsoil will be stored for initial four years and during subsequent years it will be directly spread over the reclaimed area.

Topsoil details:

1. Height of Topsoil dump : 3 meters.
2. Year of reclamation : after 5th year of mine operation.

Year	Top soil (Mcum.)
1	0.80
2	0.90
3	0.50
4	0.40
5	0.30

3.1.2.2 Underground mining

i. Mine Boundary

Limit of underground mining is defined by half of the pillar width (24m), all along the block boundary and workable thickness (1.5 m) of underground seams.

ii. Location of Mine Opening

There will be four accesses to the seams in each sector – two shaft and two inclines. One incline will be for coal evacuation by a belt conveyor and will also be used as air intake for each sector. Second incline will be used for man and material transport and also as air intake for ventilation purpose each sector. Two shaft will be used as return air shaft equipped with main mechanical ventilator in each sector.

The main parameters of the sector wise openings are proposed in below table-

Sl. No.	Name	Purpose	Length / Depth (m)	Size of Entry	Type of Support
Sector I					
1	Incline 1	Evacuating of coal by Belt conveyor, Intake	406	5.5m x 3.3m	Roof bolting. Wire mesh & W-straps and yielding access where necessary. Girders in interconnection
2	Incline 2	Haulage for material & traveling of Man, Intake	410	5.5m x 3.3m	Roof bolting. Wire mesh, W-straps & yielding access where necessary. Girders in interconnection
3	Air Shaft 1	Return Air	85	6.0m diameter	RCC/MCC lined through out
4	Air Shaft 2	Return Air	224	6.0m diameter	RCC/MCC lined through out
Sector II					
1	Incline 3	Evacuating of coal by Belt conveyor, Intake	1168	5.5m x 3.3m	Roof bolting. Wire mesh & W-straps and yielding access where necessary. Girders in interconnection
2	Incline 4	Haulage for material & traveling of Man, Intake	1174	5.5m x 3.3m	Roof bolting. Wire mesh, W-straps & yielding access where necessary. Girders in interconnection
3	Air Shaft 3	Return Air	215	6.0m diameter	RCC/MCC lined through out
4	Air Shaft 4	Return Air	367	6.0m diameter	RCC/MCC lined through out

iii. Mine Design

Rate Capacity – Dhirauli Coal Block has been planned for a rated capacity of 1.50 Mty underground mining. This output is considered technically feasible because of seam thickness, seam occurrence (mostly patchy), geological disturbance (11 faults dip side), parallel opencast mining operation, limited strike length which is further divided in to small sub sectors due to dip side faults.

The distance between the centers of any two adjacent pillars left as per CMR 2017 reproduced in Table below for longer stability and fast development of all the seams as depillaring is proposed after completion of development in the respective seams. This will be beneficial for caving pattern also.

TABLE
PILLARS SIZES IN RESPECT OF SURFACE COVER (SQUIRE IN SHAPE)

Depth of seam from surface	Where the width of the galleries does not exceed 3.0m	Where the width o f the galleries does not exceed 3.6m	Where the width of the galleries does not exceed 4.2m	Where the width of the galleries does not exceed 4.8m
	The distance between centers of adjacent pillars shall not be less than			
1	2	3	4	5
	Meters	Meters	Meters	Meters
Not exceeding 60m	12.0	15.0	18.0	19.5
Exceeding 60 but not exceeding 90m	13.5	16.5	19.5	21.0
Exceeding 90 but not exceeding 150m	16.5	19.5	22.5	25.5
Exceeding 150 but not exceeding 240m	22.5	25.5	30.5	34.5
Exceeding 240 but not exceeding 360m	28.5	34.5	39.0	45.0
Exceeding 360m	39.0	42.	45.	48.0

The mechanized panels shall be laid down on apparent gradient for self draining. The five heading dip drives will be developed with Continuous Miner for faster progress. A fully mechanized panel developed with Continuous Miner will also give annual production @ 0.50MTPA/CM.

iv. Mining Scheme

The general orientation of the block is North-South (~9.9 x 2.7 km) and coal extraction by underground mining is proposed by two set of inclines seeing the dip rise length (9.9 km) of block. First set incline is planned to cover first half of the block named as Sector-I (~ 4.9 km length) and second set of incline for remaining half named as Sector II of the property (5 km length). Inclines are proposed at western side of block boundary and Vertical ventilation shaft of 6m diameter will be driven separately for exhaust of return air, proposed at eastern side of block.

The underground mining will be first start with one pair of inclines from surface named as Incline No.1 and No.2. These Inclines will be driven with height of 3.3 meters and width of 5.5 meters having gradient of 1 in 5. The mouths of inclines are located on borehole No. MSD-107 at Surface RL 460m and are aligned towards borehole No. MSD-59. The Incline will reach the floor of seam III at 380 m FRL and will have a length of ~410m crossing Seam VI to IIITop and partings. Seam II is not developed in first half of the property (Sector I) therefore first set of incline is not planned upto seam II.

Second set of Inclines named as incline no. 3 and 4 is proposed to access remaining half of the property (Sector-II). Second set of Inclines will be driven with height of 3.3 meters and width of 5.5 meters having gradient of 1 in 5. The mouths of inclines are located on borehole No. MSD-65 at Surface RL 490m and are aligned towards borehole No. MSD-15. The Incline will reach the floor of seam II at 230 m FRL and will have a length of ~1174m crossing Seam VI to IIITop and partings.

v. Support system

A. During Development:

1. All development galleries in coal are proposed to be supported by five non-retractable resin grouted roof bolts of 1.8m length for VI, IV, II and combined III Top Seams, in one row for Sector-I & II . The bolts will be made of 22mm diameter high tensile strength Tor Steel.
2. The distance between the rows of roof bolts as well as between two bolts in the same row shall be 1.2m. The roof bolts nearest to the pillar shall be kept 0.60m away from the edge of the pillars.

3. In geologically disturbed areas and in junctions the galleries should be additionally supported by roof bolts of 1.8m / 2.4m length (flexi bolts or hydra bolts) with w-straps.
4. In extreme bad condition additional supporting with steel girders shall be provided.
5. Support system shall follow the DGMS approved Systematic Support Plan.

B. During Depillaring Stage:

1. During the extraction of pillars, additional supporting will be required at the goaf edges in the form of breaker line support in order to facilitate caving. The breaker line support roof bolts will be of 2.4m length with 0.8m grid pattern which will be placed during development of split galleries only. The first bolt in a row shall be 0.20m away from the edge of the pillar.
2. If need be, sides of the pillars are to be supported by two Fiber-glass/reinforced plastic (GPR) based rib bolts of 1.8m length. This support may be required where the height of extraction is more than 3m or areas where spalling of coal pillar is observed.

vi. Extractable reserve

Extractable reserve estimated is 112.07 Mt.

vii. Blasting

Extraction of coal is planned by Continuous Miner therefore blasting is not required however if required during the development face suitable explosive shall be used.

viii. Ventilation system

The calculation of requirement of air for the ventilation system in the mine is as follows-

a) Requirement of air on production basis (i.e, daily production of coal) is given by :

= 2.5 m^3 / minute x 5000 te of coal/ day
= 12500 m^3 / minute.

b) Requirement of air on manpower basis i.e. manpower working in general shift are:

= 6 m^3 / minute x 350 persons in largest shift
= 2100 m^3 / minute

c) Requirement of air on Gas basis (i.e, daily gas emission by production of per tonne of coal for degree I Mine max. up to 1 m^3 per tonne of coal raised) is given as under :

Max. allowable concentration of methane in return air = 0.75%

i) Requirement of air for the Mine

Avg. daily coal production (@ 1.50 MTPA)	=	5000 te/day
Daily gas emission	=	5000 x 1
	=	5000 m^3/day
Air required to bring this 100% concentration to 0.75%	=	5000 x 100/0.75
	=	0.67 mil. cum / day
	=	463 cum/min

ii) Requirement of air for the Sector I District in the Mine

There are two fully mechanized districts in the mine deployed with Continuous miner with capacity of 0.50 MTPA/Continuous Miner.

Sector A will be worked with one Continuous Miner with capacity 0.5MTPA

Max. allowable concentration of methane in return air	=	0.75%
Avg. daily coal production (@0.50 MTPA)	=	1667 te/day
Daily gas emission	=	1667 x 1
	=	1667 m^3/day
Air required to bring this 100% concentration to 0.75	=	1667 X 100/0.75
	=	0.22 mil. cum/day
	=	154 /min

Requirement of air, based on speed limit basis i.e. max. 4.0 m/sec vide DGMS circular No. 8674-94 dated 29.5.74 for CM district near working face and min. 0.50m/sec. The min. quantity of air required in highest

capacity CM district for a daily production of 1667 tonne is 154 cum per min for 5.5m wide and 3.3m height.

Thus, the velocity of air current = 154/ (5.5x3.3) = 154/18.15 = 8.48 m/min.

= 0.14m/sec.

This is 3.5 % of max. permissible limit i.e, 4 m/sec.

Thus Max allowable quantity of air in the district = 154/0.035 = 4400

iii) Requirement of air for the Sector II District in the Mine

Sector B will be worked with 2 Continuous Miner with capacity of 0.5MTPA each and total production will be 1.00 MTPA for the district.

Max. allowable concentration of methane in return air	=	0.75%
Avg. daily coal production (@ 1.00 MTPA)	=	3333 te/day
Daily gas emission	=	3333 x 1
	=	3333 m^3/day
Air required to bring this 100% concentration to 0.75	=	3333 x 100/0.75
	=	0.44 mil. cum/day
	=	308 cum/min

Requirement of air, based on speed limit basis i.e. max. 4.0 m/sec vide DGMS circular No. 8674-94 dated 29.5.74 for CM district near working face and min. 0.50m/sec. The min. quantity of air required in highest capacity CM district for a daily production of 3333 tonne is 308 cum per min for 5.5 m wide and 3.3m height.

Thus, the velocity of air current = 308/ (5.5x3.3) = 308/18.15 = 16.96m/min.

= 0.28m/sec.

This is 7% of max. permissible limit i.e, 4 m/sec.

Thus Max allowable quantity of air in the district = 308/0.07 = 4400

Hence, considering all the options from a) to c), the option "a" is selected. After considering 50% leakage during circulation and requirement of panels individually, total air requirement works out to 19000 m^3/min. To meet this requirement, it is proposed to install 4 Mechanical Ventilators of total capacity of 19000 m^3/min. This fan (exhaust) will be installed at ventilation

air shaft on surface through evacuee. During the drivage of inclines and reaching the stage of connection between Inclines and shafts, one of the inclines will be kept as intake and the other will be used as return and these will be inter connected at 200m interval. The exhaust fan will have the provision of variable pitch of blades to improve the quantity of air required in future.

TWO MECHANICAL VENTILATOR

Two mechanical ventilator are proposed to be placed at ventilation air shafts located nearly in the Eastern and Western part of the block.

SIZE AND CAPACITY OF MAIN FAN

Therefore four numbers of mechanical ventilators of following specification will be installed at incline through evacuee.

Type	-	Axial flow fan
KW	-	270
RPM	-	750
Air flow	-	6 m/Sec
W.g.	-	75-110 mm.

Evacuee of suitable design will be constructed for improving the efficiency of the main mechanical ventilator.

3.1.3 Coal Production capacity proposed "Mtpa"

5 Mtpa by OCP and 1.5 Mtpa by UG

3.1.4 Justification for optimization of coal capacity

Mining Plan for Dhirauli Coal Block has been prepared for a rated capacity of 5.0 Mty of power grade ROM Coal from Opencast mine and 1.5 Mty from underground mines. This output is considered technically feasible because of following conditions-

- Gradient of 2^0-4^0 of the coal seams.
- Multiple coal seams (9 No. of Coal Horizons 5 for OCP and 4 for UG))
- Strike length.
- Thin coal seams (due to splitting).

- Variable thickness of OB/partings (high strip ratio)
- 11 number of Normal faults (Dip-side)

With this rated capacity of 5.0 Mty of the mine, the annual rate of advance of the mine would be about 150-160 m along the dip on the mine floor for opencast mine.

3.1.5 Calendar year from which the production will start

2025-2026

3.1.6 Year of Achieving rated capacity

3rd year

3.1.7 Tentative Coal Production Plan

Calendar Plan of Coal Production and OB Removal has been presented below:

Table 2.2-1 Calendar Plan of Coal Production and OB Removal

years		Coal Production			OB	SR	
		OC	UG	Total	Running	Running	cumulative
		(Mt)	(Mt)	(Mt)	(MCum)	(Cum/t)	(Cum/t)
1	2025-26	2.00	0.00	2.00	16.35	8.18	8.18
2	2026-27	4.00	0.00	4.00	28.12	7.03	7.41
3	2027-28	5.00	0.00	5.00	33.30	6.66	7.07
4	2028-29	5.00	0.00	5.00	33.15	6.63	6.93
5	2029-30	5.00	0.00	5.00	33.17	6.63	6.86
6	2030-31	5.00	0.00	5.00	34.80	6.96	6.88
7	2031-32	5.00	0.00	5.00	36.00	7.20	6.93
8	2032-33	5.00	0.00	5.00	37.25	7.45	7.00
9	2033-34	5.00	0.00	5.00	38.30	7.66	7.08
10	2034-35	5.00	0.00	5.00	38.60	7.72	7.15
11	2035-36	5.00	0.50	5.50	40.30	8.06	7.24
12	2036-37	5.00	1.00	6.00	41.75	8.35	7.34
13	2037-38	5.00	1.50	6.50	43.90	8.78	7.46
14	2038-39	5.00	1.50	6.50	45.90	9.18	7.59
15	2039-40	5.00	1.50	6.50	47.30	9.46	7.72
16	2040-41	5.00	1.50	6.50	49.00	9.80	7.86
17	2041-42	5.00	1.50	6.50	50.05	10.01	7.99
18	2042-43	5.00	1.50	6.50	50.85	10.17	8.12
19	2043-44	5.00	1.50	6.50	51.40	10.28	8.24
20	2044-45	5.00	1.50	6.50	52.25	10.45	8.35

years		Coal Production			OB	SR	
		OC	UG	Total	Running	Running	cumulative
		(Mt)	(Mt)	(Mt)	(MCum)	(Cum/t)	(Cum/t)
21	2045-46	5.00	1.50	6.50	53.30	10.66	8.47
22	2046-47	5.00	1.50	6.50	54.25	10.85	8.58
23	2047-48	5.00	1.50	6.50	55.75	11.15	8.69
24	2048-49	5.00	1.50	6.50	58.25	11.65	8.82
25	2049-50	5.00	1.50	6.50	60.75	12.15	8.96
26	2050-51	5.00	1.50	6.50	62.75	12.55	9.10
27	2051-52	5.00	1.50	6.50	64.00	12.80	9.24
28	2052-53	5.00	1.50	6.50	64.50	12.90	9.38
29	2053-54	5.00	1.50	6.50	65.50	13.10	9.51
30	2054-55	5.00	1.50	6.50	65.75	13.15	9.63
31	2055-56	5.00	1.50	6.50	66.50	13.30	9.76
32	2056-57	5.00	1.50	6.50	67.25	13.45	9.87
33	2057-58	5.00	1.50	6.50	67.25	13.45	9.98
34	2058-59	5.00	1.50	6.50	67.75	13.55	10.09
35	2059-60	5.00	1.50	6.50	68.50	13.70	10.20
36	2060-61	5.00	1.50	6.50	68.50	13.70	10.30
37	2061-62	5.00	1.50	6.50	69.25	13.85	10.40
38	2062-63	3.00	1.50	4.50	53.50	17.83	10.52
39	2063-64	1.50	1.50	3.00	21.50	14.33	10.55
40	2064-65	0.56	1.50	2.56	7.01	12.52	10.55
41-87	2065-2113	-	68.57	68.57			
Total		**186.06**	**112.07**	**298.13**	**1963.55**	**-**	**10.55**

10 year lag is proposed between Opencast and Underground mining operation for safety reason.

3.1.8 Rated Capacity "Mtpa"

By OC - 5 Mtpa Rated Capacity
By UG- 1.5 Mtpa Rated Capacity
Overall- 6.5 Mtpa Rated Capacity

3.1.9 Life of the Mine

Considering underground 87 years, life of Opencast mine is 40 years (excluding 2 years of construction period).

3.1.10 Whether the proposed external OB dump site is coal bearing

No, the proposed external OB dump is planned outside of incrop of Seam VII (Opencast pit limit).

3.1.11 Whether negative proving for coal in the proposed site for OB dump/ infrastructure has been done.

Yes, negative proving has been done. It is plan on non coal bearing area are for opencast seams.

3.1.12 Results of any investigation carried out for scientific mining, conservation of minerals and protection of environment; future proposals.

It is proposed to undertake following studies/investigation:

1. Rock Mechanics study.
2. Gassiness Study of Seam
3. Study for installing surface retrieving conveying system
4. Slope stability study.
5. Geo-technical study.
6. Use of Technology for Environment, sustainability & Governance in Mining operation.

3.1.13 Type of Equipment / HEMM proposed

The mine is envisaged to be worked with by combination of opencast and underground mining method. Opencast mining is proposed by Surface miners (SM) -FEL-Truck for coal and drill blast for OB. Underground mining is proposed by Continuous miner (CM).

- **Overburden**

3-4.5 Cum Hydraulic Shovel in combination of 35 T Dump truck and 10-12 cum Hyd. Shovel in combination of 100 T Rear Dumper will be used for removal of overburden. In initial year, 3-4.5 Cum Hydraulic Shovel in combination of 35 T Dump truck will be deployed because of highly undulating topography and parting near around in-crop zone.

- **Coal**

Selective mining is required to control coal quality. It is, therefore, suggested to use surface miner methods of coal extraction for this mine.

Surface Miner, 5-6 M^3 pay loaders & 35T Rear Dumpers have been proposed for coal extraction. The list of HEMM and other equipment along with their population at peak production stage is provided below-

Table List of HEMM & Other Equipment

Sl no	Particulars	Capacity	No of equipment
HEMM			
Overburden:			
1	Hydraulic shovel	3-4.5 cu.m.	20
2	Rear Dumper	35 T	98
3	Dozer	410 HP	2
4	Ripper Attachment		2
5	Hydraulic shovel	10-12 cu.m.	7
6	Rear Dumper	100 T	49
7	Dozer	410 HP	8
8	Blast Hole Drill	160 mm	15
Coal (OCP) :			
1	Surface Miner	2200/3800	2
2	Hyd. Shovel	5-6 m^3	2
3	Front End Loader	5-6 m^3	3
4	Rear Dumper	35	22
5	Wheel Dozer	410 HP	6
6	Ripper attachment		2
7	Blast Hole Drill	160 mm	2
Coal (UG) :			
1	Continuous Miner (CM)		3
2	Shuttle Cars		6
3	Twin Roof Bolting Machines		6
4	Feeder Breaker with suitable power pack		3
5	Belt Conveyors		
6	LHD		3
7	Material Haulage		
8	Main & Auxiliary Fan		4
Common :			
1	Hyd. Exc.(Backhoe)	1.2-2.5m^3	2
2	Motor Grader	280 HP	2
3	Vibratory Compactor	30 T	1
4	Explosive Van	10T	2
5	Wheel Dozer	410HP	1
6	Mobile R.T. Crane	75T	1
7	R.T. Crane	30T	1
8	R.T. Crane	8T	2
9	Front End Loader	5-6M^3	1
10	Water Sprinkler	28 Kl	4

Sl no	Particulars	Capacity	No of equipment
11	Wagon Drill	100-120mm	2
12	Diesel Bowser	10KL	2
13	Tyre Handler		2
14	Fire Tender		1
15	Tipping Trucks	10T	2
16	Maintenance Van		2
17	Ambulance		1

Chapter 4

Safety Management

4.1 Important Safety aspects

To ensure safety in operating the mine, all provisions of Coal Mine Regulations 2017 along with Circulars issued by Director-General of Mines Safety from time to time shall be adhered to. In addition, related statues viz. Mines Act 1952, Mines Rules 1955 and others shall also will be complied with. Some of the important statutory provisions relating to mechanized open cast mine which recently have been incorporated in Regulation are reiterated in the following paragraphs.

4.1.1 Statutory Aspects for Safety of Mechanised Opencast Mine

Safety Management Plan :

For complying with **Reg. 104** of CMR 2017, exercise shall be done to identify, assess and record the hazards of health and safety of the persons employed in the mine after consulting the Safety Committee and Internal Safety Organisation (ISO). Based on the above, Safety Management Plan (SMP) shall be formulated for overall management for developing and implementing the safety policy of the company. SMP shall contain, *inter alia*, plan to implement the policy, principal hazard management, standard operating procedure (SOP), monitor, evaluate and review the plan.

Mechanized opencast working :

For complying with **Reg. 106 (2)**, before starting mining operation, it will be ensured that the mine including its method of working, ultimate pit slope, dump slope and monitoring of slope stability has been planned, designed and worked as determined by a scientific study, and a copy of the report of such study, shall be kept available in the office of the mine .

Mine Geometry :

(i) This property has thick cover of soil, running sand, clay, sand sludge etc. To comply with **Reg. 106 (4),** top 3 benches shall be worked in height of 3m and width of 15 m. Subsequently, where the thickness of this type of ground is thicker (30m or more) 4 benches, 5 m high and

20 m wide will be formed. For that purpose exemption shall be sought from Chief Inspector as provided in **Reg. 106 (6).**

(ii) Bench height in OB and coal shall not exceed the digging height of excavator and width of the bench not less than 3 times the width of dumper. In this plan bench height in hard rock has been planned as 10 m and width 30-50 m which complies with **Reg. 106 (5).**

Spoil banks and Dumps :

(i) **Reg108 (2)** stipulates that slope of spoil bank shall be determined by the natural angle of repose of the material being deposited , but in any case, shall not exceed 37 degrees from horizontal. In this plan, external dump for soil will have slope of 37 deg. As regards slope of the back-fill in Quarry, it is planned at 34 degree.

(ii) Any spoil bank exceeding 30 m in height shall be benched so that no bench exceeds 30 m in height and the overall slope shall not exceed 1 vertical to 1.5 horizontal.

(iii) The toe of a spoil-bank shall not be extended to any point within 100m of a mine opening,

Deployment of HEMM /Machinery :

(i) Transport Rules will be framed as per **Reg.109** and enforced amongst officials , supervisors and workmen for compliance.
(ii) Code of Practice shall be framed and enforced for all types machinery.
(iii) Conditions laid down in DGMS Circular No. 36 of 1972, relating to deep hole blasting shall be complied with.

In addition to the above, systematic maintenance of equipment, as laid down by OEM, shall be followed. All the machineries to be deployed shall be checked by competent authority before deployment in the mine. Proper record of repairs and maintenance (Log-book) along with inspections done by competent engineers shall be maintained.

Rear Dumpers deployed shall be provided with Audio Visual Alarms and proper lights. Suitable type of fire extinguishers shall be provided in every

machine. Modern dumpers are presently equipped with automatic fire alarm and sprinkler systems.

4.1.2 Precautions against danger of inundation from surface water

(i) Hardul Nala flows from east to west, from the center of block which will be diverted for opencast mine . Since there is no major river near by the block and diversion of existing nala is proposed for opencast mining there is no issue of flood. All required precaution against inundation would be taken care of.

(ii) A careful assessment shall be made against the danger from surface water before the onset of rainy season. Garland drains shall be provided to drain away the surface rain water from the mine excavated area. Adequate capacity of pumping will be installed. All pumps in designated sumps , will be mounted on floats to prevent drowning in case of unwarranted heavy rainfall. Inspection for any accumulation of water, obstruction in normal drainage and weakening of embankment shall be carried out regularly.

(iii) Standing order for withdrawal of persons in case of apprehended danger shall be framed and implemented.

4.2 A commitment from the Company Board

Attached as Annexure III

Chapter 5

Infrastructure Facilities

5.1 Mine infrastructure required

Infrastructure is planned in non coal bearing area for opencast mining (beyond in crop of VII seam). Non coal bearing area (beyond in crop of VII seam) of approx. 21 Ha shall be utilized for mine facilities, additionally another patch of ~9 ha is proposed for underground infrastructure for second set of incline planned at north-west side of block.

i. Mine Facilities

It is proposed to develop various infrastructural facilities to support, organize and improve the overall performance of the mine. Mine facilities, proposed, will be as follows:

Table Mine Facilities

Sl No.	Mine Facilities
1.	Project Office complex Including Manager's Office
2.	Parking : Cars + Scooters /Cycles
3.	Sub-Station for receiving power
4.	Rescue Room
5.	Vocational Training Centre
6.	MTK / Pit Office
7.	CHP & CPP and Weigh Bridges
8.	Stores & pavement
9.	Base Workshop shed & pavement
10.	Canteen
11.	Pit top bath room
12.	Cap lamp
13.	Pit top Office& MTK room
14.	Parking area for Rear Dumpers
15.	Rest Shelter
16.	Lavatory / Urinal
17.	First Aid Room
18.	Arterial road to Quarry including 4m lane for LMV with divider
19.	Haul road
20.	Other internal service roads
21.	ETP & STP
22.	Water works
23.	Sedimentation Ponds / Setting Ponds

ii. **Roads and Culverts**

Haul roads suitable for plying 100T & 35T class rear dumpers with side drains and dozer path would be provided within the mining area.

Heavy Duty Road will also be maintained as dumpers deployed in the benches will also go to the workshop for maintenance as well as dump for dumping. Hence a provision for heavy duty road has been made. The type of road suitable for 100T & 35T class rear dumpers would be provided connecting, workshop, dumps etc. Approach roads have been proposed to the project, township and magazine.

iii. <u>Base Workshop</u>

The Base Workshop will have two modules:

(i) Excavation Workshop

This unit will deal with repair and maintenance of HEMM and related equipment. It will have facilities for the following:

- Washing, lubrication, routine inspection and scheduled preventive maintenance, reconditioning of worn out components of HEMM.
- Separate shops for dumpers, dozers, drills, and small size loaders and excavators will be provided, with support of machine shop, tyre-handler, EOT cranes, welding etc.
- The workshop will be able to provide medium scale repair and replacement of assemblies and sub-assemblies.
- This workshop will also give support to mobile repair and maintenance of excavators and other HEMM at site, in the field.

(ii) E&M Workshop

This unit will be equipped with

- Washing station, as well as, repairs and replacement of components / assemblies of for Light Motor Vehicles (LMV) .
- Medium scale repair and replacement of components, assemblies and subassemblies of Coal Handling Plant, pumps and other electrical and mechanical equipment, viz. switchgear, motors etc.
- This will have support of machine shop, welding, smithy, battery charging etc.

5.2 Power supply & illumination

5.2.1 POWER SUPPLY

The power requirement shall be fulfilled from the nearby 132/33kV substation at Dongri village. 33kV line shall be taken up to the CHP area and further power distribution for CHP equipment, mine pit water pumping and illumination shall be carried out as per requirement at 6.6kV and 415 V through overhead line and cables as suitable.

5.3 Drainage and Pumping

Western part of Dhirauli block is characterized by almost plain topography, while, north-eastern and south-central part are highly undulating and have rugged topography as evident from the topographical plan. The north-eastern and south central part of the block have forest cover and is occupied by hillocks of elevation up to a maximum of 638 m above MSL. In general elevation of ground varies from 459.23m as observed near borehole MSD-102 to 603.45 m near borehole MDP-19 located in the south-western and south-eastern corner of the block respectively.

Drainage of the block is mainly controlled by westerly flowing Hardul Nala which traverses the block and passes almost through central part of the block. Many small seasonal nallas originating from elevated topography of north eastern and south central part of the block drain its water into Hardul Nala. The minor nallas and tributaries present in the block shows dendritic to sub-dendritic drainage pattern (Plate VII).

5.3.1 Estimation of volume of water to be pumped

a. Opencast Mine

The monsoon period extends from June to September with an average rainfall of 1132.7 mm. An attempt has been made to estimate volume of water to be pumped out of the OC mine, on the basis of surface precipitation, Volume of rain water entering the mine and accumulating in the quarry (make of water) may be assessed on the basis of the following formula :

$\mathbf{Q = A \times H \times \eta}$ m^3 /day

where, A = Catchment area in m^2

H = Maximum daily precipitation in m

η = Run-off co-efficient

Run-off co-efficient (η) has been adopted as below:

i. For mined out area : 0.60
ii. For internal dump area : 0.15
iii. For area beyond excavation : 0.10

The value of maximum daily percolation is determined from probability curve plotted based on data received from meteorological station for some period of, say 15 or 20 years. Assessment is made for maximum daily precipitation at probabilities of 10% and 5% which corresponds to repetition once in every 10 years and 20 years. In the instant case no such data is available. As a result, make of water will be calculated from assumed maximum rainfall in the coalfield.

Water ingress in the mine during rainy season is estimated, considering the stage of the mine when maximum void has been created.

- **Quarry Excavation**

Water ingress**(A)** = 0.15 m x [(max void area ha x 0.60) + (back-filled area ha x 0.15)] x 10^4

= 0.15 X [160 X 0.60 +1987 X 0.15] X 10^4 m^3 / day
= 591075m3 / day
= 591075 m3/day/ 5 days/ 18 hours
= 6567.5 m3/hr

b. Underground mine

Estimation of make of water & Pumping Capacity – Sector-I

Let, V_1 = Percolation of rain water into ground in m^3 in a day

A = Area of mine in Km^2 = 13.45 KM^2

B = Max. Rainfall in a day = 50 mm

Percolation of rain water at the rate 10% of total rainfall in a day

Then V_1 = 0.1 x (A x B) M^3 in a day

= 0.1 x (13.45 x 10^6 X 50/1000)

= 67250 M^3 in a day = 747.22 M^3/ hr. [Considering the water to be pumped out in next 5 days at the rate of pumping 18 hrs per day.]

Addition of Seepage water, V_2, is assumed as 20% of V1 = 149.44 M^3/ hr.

Addition of Ground water, V_3, is assumed as 10% of (V1 + V_2) = 89.66 M^3/ hr.

Annual inflow of water becomes V = (V_1 + V_2 + V_3)

= 986.33 M^3/ hr

Pumping capacity with 30% reserve factor and 1.1 as Service factor = 219.56 x 1.3 x 1.1 = 1410.45 M^3/ hr. say 1415 M^3/ hr.= 393 lps

Similar pumping capacity shall be applicable for sector II aa the area is almost same.

5.3.2 Selection of Pumps

a. Opencast

Excavation operation of a quarry is a dynamic process. Gradually the depth of working increases. The duty of the pumps particularly the static head increases as the quarry goes deeper and deeper.

Details of pumps are tabulated below

Table 5-4.21 Details of Pumps

Quarry (Peak pumping duty ; stage pumping load assumed 50 % of max. pumping duty)	KW	Nos.
Slurry Pumps (Face) Pumps : 50 lps x 50 m	60	3
Main Pumps 80 lps x 200 m 6.6 KV electrical	250	6
160 lps x 200 m 6.6 KV electrical	450	5
200 lps x 200 m 6.6 KV electrical	600	4
80 lps x 150 m 6.6 KV electrical	200	3
160 lps x 150 m 6.6 KV electrical	360	3
200 lps x 150 m 6.6 KV electrical	500	2
Diesel Pumps 76 lps x 150 m	112	2

b. Underground

Suitable pumps shall be installed in phase wise manner based on stage plans.

5.4 Coal Handling Arrangement

The total coal production from this mine has been proposed as 5 MTPA from OCP and 1.5 MTPA from UG mine. Independent CHP- dump station/ train loading stations have been proposed to handle the entire production of ROM coal from this mine. No crushing and screening is considered,

since the mining method for extracting coal is surface miner from OCP and Continuous Miner from UG mine.

The coal handling plant shall have facilities for receiving coal from rear discharge dumpers via dump station, conveyor and loading into wagons by wagon loading system. Enough ROM storage provision has been provided in the coal handling system to meet the eventualities of disrupted coal production in the mine or dispatch irregularities. The plant will be operated in synchronization with the production of the mine. The coal handling plant shall also be provided with suitable repair, communication and other auxiliary facilities to meet the day-to-day requirement in the plant operation.

The CHP has been planned keeping in view the rugged terrain. The following factors have been considered in finalizing the location of CHP:

a) Mine Lease Boundary
b) Location of quarries
c) Entry of Each quarry
d) Topography
e) Availability of free space
f) External dumps of the mine
g) Proposed Evacuation system

System Description

The handling capacity of the CHP has been decided to match with the production capacity of the mine. The system capacity has been considered based on mine's production and to meet any fluctuations of coal output from the mine or due to irregularities of dispatch / transport system and seasonal fluctuations. The coal handling plant shall be designed to match the mine production rate of 5 million tons per year (MTPY) from Dhirauli coal block, in planned mine production hours. The scheme for coal handling plant facility has been described below, which meets the functional requirement of the coal handling facility.

The facilities have been designed to consider regulation on environmental aspects so that the coal handling is possible in an environmentally acceptable manner. Safety devices have been provided to allow safe operation of all the facilities i.e. conveyors alarms, trip switches, interlocks, emergency trip system reclamation purposes.

As per mine plan total mine production is 6.5 MTPA (including UG production). Accordingly CHP is planned with the system capacity as 850 TPH rated and 935 TPH design, keeping the peak production capacity in mind.

Dump trucks will discharge ROM coal to Coal receiving station which has adequate receiving and conveying equipment's to handle and deliver the coal into wagons for further transport.

In the initial year surface conveyor will planned from south side of the mine to north side of mine without any inpit conveying system. As mine progress from south side to north side the Dump station will be relocated to new pit location.

Accordingly to suit the new dump station location as per mine plan requirement Conveyor will be retrieved in different years of operations. In retrieving the conveyor system (5 MTPA -OCP), certain length of conveyor will be dismantled to suit the mine pit boundary location.

For underground production separate fixed conveyor unit is planned.

As dispatch will be done in northern side of mine and small stockpile of adequate capacity will be made near norther side of mine and coal from stockpile will be load into rapid loading silo to load the rake in about 1 hour time.

No coal washing is envisaged for Dhirauli coal block.

Chapter 6

6.1 Land Requirement

6.1.1 Total Land Requirement for the mine in "Ha"

Pre-Mining Land use has been presented in table below:

Table 4.2-1 Pre-Mining Land Use Plan

Ownership	Type of Land	Area(Ha)
Tenancy Land	Agricultural	530.841
	Township	
	Grazing	
	Barren	
	Water bodies	6.000
	Road	12.000
	Community	
Sub Total		**548.841**
Govt Non Forest Land	Agricultural	684.431
	Township	
	Grazing	
	Barren (Road)	
	Other	
Sub Total		**684.431**
Forest Land	Protected Forest land	1337.144
	Rev Forest (CJBJ)	101.585
Free hold		
Sub Total		**1438.729**
Grand Total		**2672.00**

6.1.2 During Mining Land use -to be changed

Table 6.2 During and Post Mining Land Use

Mining Activity	Proposed Land Use Area (Ha)	Land Use (End of Life) Area	Post Mining Land Use (Ha)						
			Agriculture Land	Plantation	Water Body	Public Use	Forest land (Returned)	Undisturbed	Total
Excavation Area	2,096.59	2,096.59	-	1,843.03		-	1,843.03	-	1,843.03
Backfilled Area (in Excavation Area)	1,796.23	1,796.23	-	1,843.03	-	-	1,843.03	-	1,843.03
Excavated Void (in Excavation Area)	300.36	300.36	-	-	253.56	-	-	-	253.56
Top Soil Dump *	35.34 (Upto 5th Year)	35.34 (Upto 5th Year)	-	-	-	-	-	-	0.00
External Dump	387.55	387.55	-	387.55	-	-	387.55	-	387.55
Safety Zone	19.73	19.73	-	19.73	-	-	19.73		19.73
Haul Road between quarries	-	-	-	-	-	-	-	-	0.00
Road diversion	4.13	4.13	-	-	-	4.13	-	-	4.13
Settling pond	2.20	2.20	-	-	2.20	-	-	-	2.20
Road & Infrastructure area	20.80	20.80	-	20.80	-	-	20.80	-	20.80
CHP & Washery	8.10	8.10	-	8.10	-	-	8.10	-	8.10
Coal Evacuation Route & Approach Road	1.15	1.15	-	1.15	-	-	1.15	-	1.15
Garland drains	5.34	5.34	-	5.34	-	-	5.34	-	5.34
Embankment	7.50	7.50	-	7.50	-	-	7.50	-	7.50
Green Belt	46.80	46.80	-	46.80			46.80		46.80
Water Reservoir	-	-	-	-	-	-	-	-	0.00
Rationalization area	72.11	72.11	-	72.11	-	-	72.11	-	72.11
Total (exclude back filled void & topsoil area)	**2,672.00**	**2,672.00**	-	**2,412.11**	**255.76**	**4.13**	**2,412.11**	**-**	**2,672.00**

6.1.3 Surface feature over the block area

Human habitation: Eight villages (Aamdand, Amraikhoh, Basi-Berdah, Phatani, Belwar, Dhirauli, Jahalari, Sirswah,) are located in / immediate periphery of the block.

Road: there are 4 roads passing from block having total length of approx. ~18 km which needs to be diverted along southern , western and northern boundary of the block.

1.	Khanua-Dongri-Phatpani Road
2.	Suliyari- Baheritola Road
3.	Pondi-Gurwani Road
4.	Jhalari-Basiberdha Road

Ponds: Few Small ponds and dug wells in the area. These are utilized for irrigation and drinking water purpose.

Nala/River: The ground is deeply incised by a prominent Hardul nala and its tributaries flowing from almost East to west in the central part part. Few small nala is also following out from Northern and southern side of block.

Transmission line - Total 5 transmission line (132kv- one line to 765 kv – 4 lines) is passing from the block which is proposed to divert from outside of Dhirauli coal block.

6.1.4 No. of Villages/ Houses to be shifted

Eight villages (Aamdand, Amraikhoh, Basi-Berdah, Phatani, Belwar, Dhirauli, Jahalari, Sirswah,) are located in / immediate periphery of the block. Number of houses to be shifted will be estimated after SES.

6.1.5 Population to be affected by the project

Project Affected Families (PAF) is 1000. Figure will be updated after socio-economic survey.

6.1.6 Proposed Rehabilitation programme

Rehabilitation will be done as per prevailing Policies.

6.2 Details of lease

6.2.1 Status of Lease

Land acquisition applied under CBA act.

6.2.2 Existing Lease Area "Ha"

Nil

6.2.3 Period for which Mining Lease has been granted/is to be renewed/ is to be applied for.

Lease shall be proposed for 50 years (including 2 years of construction)

6.2.4 Date of expiry of earlier Mining Lease, if any

Not applicable.

6.2.5 Whether the lease boundary/ required boundary is same as mentioned in the allotment order

Yes, lease boundary / required boundary is same as mentioned in the allotment order and certified by Qualified person is annexed as II.

6.2.6 Lease Area (applied/ required) as per the Mining Plan under consideration (Ha)

2672 Ha

6.2.7 Whether the applied lease area falls within the allotted block

Yes.

6.2.8 Area (Ha) of lease which falls outside the delineated block/sub-block

NIL

6.2.9 Details of outside area

Not applicable.

6.2.10 Whether some part(s) of the allotted block has not been applied for mining lease.

No, complete 2672 ha has been applied for mining lease.

Chapter 7

Environment Management

The Company will comply Environment and Forest Condition stipulated in the respective clearances has been annexed in **Annexure IIIA**

Chapter 8

Progressive & Final Mine Closure Plan

8.1 Land Degradation and restoration schedule

8.1.1 Land Degradation and Technical Reclamation (Commutative Area "Ha")

Year wise land degradation and Technical Reclamation has been given below:

Table 8-1 Land Degradation and Technical Reclamation

Year	Land Degraded				Technically Reclaimed Area			
	Excav area	Dump (Ext + top soil)	Infra / Others	Total	Backfill	Dump (Extn +Top Soil)	Other	Total
Y-01	57.21	163.34	141.06	361.61	-	-	8.20	8.20
Y-03	173.92	355.54	141.06	670.53	-	-	11.26	11.26
Y-05	323.79	548.15	141.06	1013.00	-	-	53.70	53.70
Y-10	536.33	274.34	141.06	951.73	343.12	200.45	78.74	622.31
Y-15	764.83	330.94	141.06	1236.84	519.75	250.76	78.74	849.25
Y-20	993.34	387.55	141.06	1521.95	664.33	330.94	78.74	1074.01
Y-25	1251.42	387.55	141.06	1780.03	771.97	387.55	78.74	1238.26
Y-30	1509.50	387.55	141.06	2038.10	931.35	387.55	78.74	1397.64
Y-35	1826.42	387.55	141.06	2355.03	1135.27	387.55	78.74	1601.56
Y-40	2096.59	387.55	187.86	2672.00	1596.23	387.55	115.24	2099.02
Y-45	2096.59	387.55	187.86	2672.00	1843.03	387.55	181.53	2412.11

8.1.2 Biological Reclamation (Cumulative in "Ha")

Table 4.2-2 Biological Reclamation

Year	Biological Reclaimed Area (Ha)							
	Agri	Plantation	Water Body	Public / Company Use	Total	Forest Land (Return)	Undisturbed / to be left for Public / com use	Total
Y-01	-	-	2.2	-	2.2	-	-	-
Y-03	-	-	2.2	4.13	6.33	-	4.13	4.13
Y-05	-	-	2.2	4.13	6.33	-	4.13	4.13
Y-10	-	543.57	2.2	4.13	549.9	543.57	4.13	547.7
Y-15	-	770.51	2.2	4.13	776.84	770.51	4.13	774.64
Y-20	-	995.28	2.2	4.13	1,001.61	995.28	4.13	999.41
Y-25	-	1,159.52	2.2	4.13	1,165.85	1,159.52	4.13	1,163.65
Y-30	-	1,318.90	2.2	4.13	1,325.23	1,318.90	4.13	1,323.03
Y-35	-	1,522.81	2.2	4.13	1,529.14	1,522.81	4.13	1,526.94
Y-40	-	1,729.35	2.2	4.13	1,735.69	1,729.35	4.13	1,733.49
Y-45	-	2,412.11	255.76	4.13	2,672.00	2,412.11	4.13	2,416.24

8.2 Post Closure Water Quality Management

8.2.1 Water Quality Management

(i) Waste water generation and control of pollution

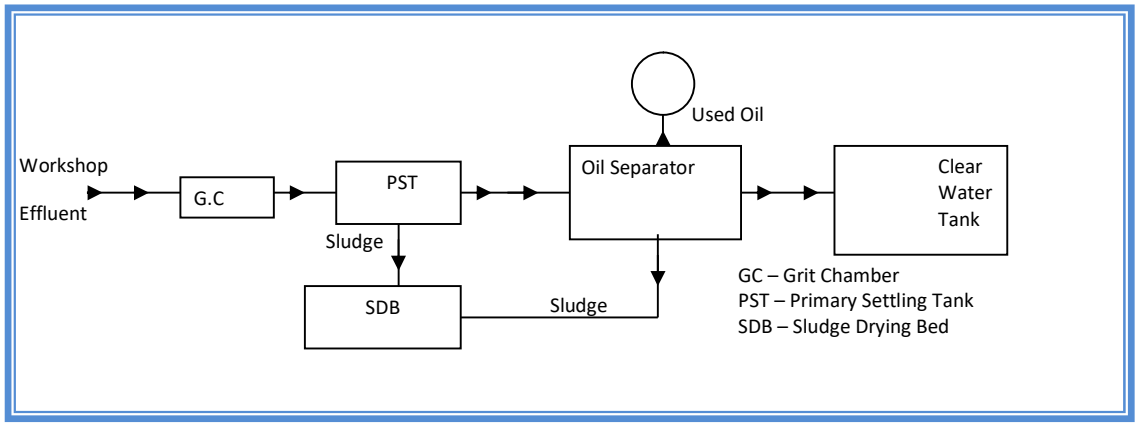
Use of water at various mining operation, run-off water after precipitation on OB dumps, coal stockyard, over mined out areas and pumping discharge of percolated ground water in mine excavation, generate wastes of various quality and quantity, which need to be addressed to prevent pollution of surface water and contamination of groundwater system. The various source of waste water and the pollution control measures are elaborated in the following paragraphs

(ii) Waste water from service facilities

Water used at various service facilities viz. office, canteen, etc is likely to generate waste water with high suspended solids, BOD, etc. Estimated quantity of waste water from this source will be 10 Kl/d. The waste generated from these units will be collected and treated in a Package Sewage Treatment Plant and the effluent will be chlorinated and used for plant greeneries and dust suppression.

(iii) Waste from HEMM washing and Workshops

Waste water / industrial effluent coming out of the HEMM washing in Base Workshop and other repair and maintenance shops will be estimated 45 Kl/d. This effluent contains suspended solids, TSP, oil and grease and the same will be sent to a grease trap. After removal of grease, the effluent from the Grease Trap will be fed to a settling tank with oil skimming arrangement in the Effluent Treatment Plant (ETP). The effluent of the settling tank will be utilized in haul road dust suppression / forestation / green belt.



iv) Waste from dust suppression at CHP and coal stock pile

Waste water from CHP system which will contain fine coal dust as suspended solid has been estimated as 30 Kl/d . This will be routed through a settling tank to the Sedimentation Pond for treatment.

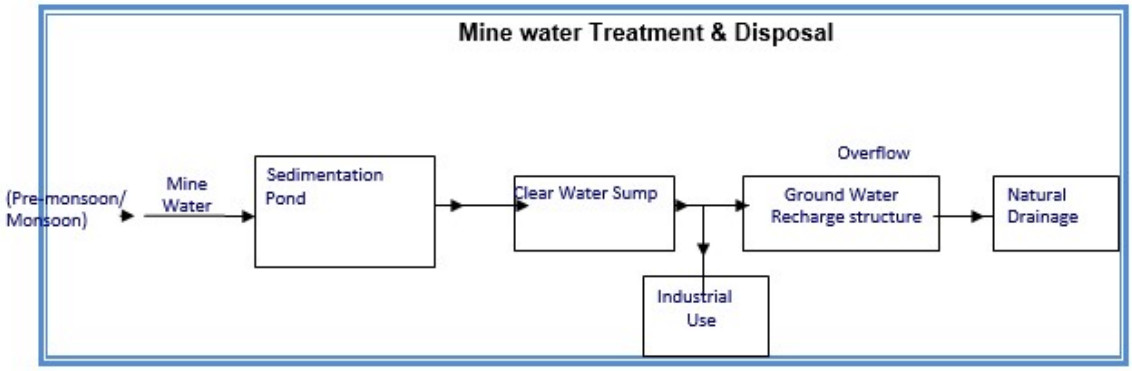
Pyritic impurities in coal is a source of acid drainage. From the petrographic studies of the coal stated in the GR, Pyrite is there in the samples . It is proposed that during the operation of the mine, effluent quality of CHP is to be sampled frequently to determine the pH and corrective action taken.

(v) Pumped out water from the quarry

Water accumulates in course of mining and has to be constantly pumped out for safety of men and machines Mine water is generated from two sources (a) ground water: as the quarry goes deeper, more and more aquifers are intercepted and volume of water increases, (b) rain water: direct precipitation over the excavated area and surface run-off flowing into the mine during rains. For reducing the run-off , garland drains will be constructed around the excavated area and the top of back-filled

area will be given a grade, so that rain water flows outwards. However, a portion of the rain water will always find way in the quarry.

The pumped out water of the quarry generally contains high TSP and in some cases dissolved minerals making the water acidic. Though a substantial portion of this water is used within the mine for industrial use viz. HEMM washing / workshop use / CHP and for dust suppression and forestation, it is not advisable to discharge the surplus water to the general drainage system without treatment, lest the surrounding will be contaminated. To mitigate this, it has been proposed to conduct the water to a Sedimentation Pond of 10,000 cu.m. from where the water will collect in clear water sump. During actual mining, it will be decided whether raw water treatment will be needed to avoid high turbid water supply. After treatment, the water is distributed by pumping to consuming points. And the surplus water allowed to flow out. Regular sampling of surplus water shall also be conducted.



(vi) Surface run-off from External dump

This topic has already been dealt in detail for external dump of OB. Broadly, the external dump will have garland drain all around. To arrest the sediments and prevent silting of the water courses by the run-off during rains, toe-walls / retaining walls with weep-holes at strategic stretches will be constructed. The gullies will have check-dams to prevent erosion. Garland drain will convey the water to decantation ponds and after settling allowed to flow in diversion channels. If turbidity is still high, the water is to be conducted to Sedimentation Pond, (as shown in the Water Balance Chart in Closure Plan).

8.2.2 Post-Project Phase

From nearby wells located at appropriate locations ground level will be monitored 4 times in a year (i.e. May, August, November and January).

Monitoring of quality of drinking water and effluent will be done as per the statute.

8.2.3 Water Demand & Water Balance

The demand of water for the project has been estimated as per industrial norms. The requirement of water for various purposes has been furnished below:

Water Demand at Dhirauli Coal Mine

Sl No.	Industrial water	m^3 /day
1	Water requirement for sprinkling at mine haul roads	340
2	Service water requirement for CHP & dust suppression system	500
3	Water requirement for Base Work Shop & other miscellaneous purposes	100
4	Water requirement for green belt development and biological reclamation	750
5	Evaporation loss	20
6	Potable Water (Drinking and sanitation water requirement in Mine)	50
Total		1400
Add 10 % design allowance		140
Net water demand		**1540**
considering 18 hrs/day of operation		**85.56 m^3/ Hr**

- **Source of water**

It is envisaged that to meet the requirement of water for construction, drinking and sanitation as well as mine operation , at the initial stage of 2-3 years , will be met from ground water . After that mine quarry will collect sufficient water which will meet the industrial demand. However, the potable water demand at mine , mine facilities will be met through ground water by bore wells .

8.3 Post Closure Air Quality management

8.3.1 Air and Dust Pollution Control Measures

The $PM_{2.5}$& PM_{10}, CO, SO_2 and NOx concentrations are within limits as already discussed earlier. The mining operations and related activities are anticipated to increase the levels of $PM_{2.5}$& PM_{10} and gaseous pollutants to a limited extent. The control measures to be adopted are mentioned in the following paragraphs:

i. Controlling fugitive dust

Dust particles, which are normally generated during various mining and transportation deteriorate the ambient air quality. Adequate control measures are, therefore, proposed to be taken during mining operations, transportation and crushing/loading operations. These control measures are discussed as follows:

i. Drilling operation in OB:

Drills will have dust extractors. Presently Blast- hole Drill manufacturers have provided for wet drilling arrangement, which will be used.

ii. Blasting in O.B:

It is proposed to do blasting only once in a week for each excavator and only once in a day between shifts .. Use of Raydet /Nolen and similar delay detonators and proper design of blast and using muffle, throwing up of blasted rock and consequent production of dust can be dramatically reduced.

iii. Loading of O.B. and coal to Dumpers:

Since this operation takes place in a bench protected by highwall and since excavator bucket delivers material close to the bucket of the dumper, there is comparatively less generation of dust.

iv. Transport of OB and Coal:

Water sprinklers (28 Kl) will be deployed to sprinkle water on haul roads, both for coal and OB to suppress dust from this source. In dry seasons, it is proposed to sprinkle the haul roads at least twice in a shift. To make water sprinkling effective, Graders will follow water sprinklers in each run, so that the settled dust due to sprinkling, does not lie on the haul road but gathered to on the flanks of the roads, lest the same dust will be raised by the passage of successive dumpers. Suitable arrangement has been kept for water required for this purpose. For dust production on haul roads, one saving clause is that with advance of quarry, the activities will take place below the ground level. In that case the high walls of quarry will reduce the dispersal of dust generated beyond the quarry area.

Haul Roads on the surface of the mine will be black-topped. In addition to the above measures, plantation along both sides of haul roads on the surface of the mine, around CHP and the green belts formed around mining excavation will largely trap the airborne dust which escapes sprinkling operation.

v. Control of Dust in CHP

(a) Receiving Hopper, Apron Feeder and Feeder Breaker is proposed to be enclosed in covered structure. A dust extraction, collection and disposal system would be installed.

(b) At all transfer points in CHP, precision anti-clog nozzles shall be installed at suitable locations for suppressing dust by spraying water. Chutes provided to reduce the height of fall, thus reduce dust generation will be covered.

(c) Belt conveyor reclaiming coal from Apron feeder to Surge Bunker will be covered.

ii. Measures to mitigate CO levels

It has already been discussed that the concentration of CO in the ambient air is negligible and is far below the prescribed limit of CPCB and is not anticipated to exceed it in future. Still all heavy and light vehicles shall be tested for pollutants concentration in their exhausts regularly and well maintained. Strict vigil will be kept in and around the operational area for any fire which shall be immediately controlled.

iii. Measures to mitigate NOx levels

The mine ambient air quality will be regularly tested to detect the presence of any pollutants above prescribed limits and appropriate measures will be adopted.

8.3.2 Noise Level

To assess the ambient noise level, measurements have been carried out at different sites of adjacent mine. Noise level was measured at several locations near the human dwellings located in the adjacent mine. Mipoy integrated sound level meter meeting IEC-197A was used to measure the noise level. Average day and night Leq values have been assessed at each location for four hours duration both during day and night time with the interval of 30 minutes.

Central Pollution Control Board has stipulated some specific standard for ambient noise-level in industrial, commercial, residential and silence zones for both day and night time. The standards stipulated are given below.

Standard of Noise limits as Stipulated by Central Pollution Control Board

S. No.	Location	Noise Level [Leq in dB(A)]	
		Day Time	Night Time
1.	Industrial Area	75	70
2.	Commercial Area	65	55
3.	Residential Area	55	45

Noise Control Measures

The following control measures will be adopted to keep the ambient noise levels below permissible limits 75 dB (A).

i. Provision and maintenance of thick tree belts
ii. Avenue plantation within the project area
iii. Proper maintenance of noise generating machinery including the transport vehicles

To protect the workers from exposures to higher noise levels, the following measures will be adopted:

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

8.4 Waste Management (Figures in MM3) (Tentative)

Table – 8-3 Waste Management

Year	Waste Management (Figures in $Mm^{3)}$						
	Cumulative OB Removal			External Dump(Cumulative)		Internal dump/Backfilling (Cumulative)	
	Topsoil	OB	Total	Top soil	OB	Top soil	OB
Y-01	0.80	15.55	16.35	-	16.35	-	0.00
Y-03	2.20	75.57	77.77	-	53.83	-	23.94
Y-05	2.90	141.19	144.09	-	73.27	-	70.82
Y-10	5.36	323.68	329.04	0.54	130.20	4.83	193.48
Y-15	7.65	540.55	548.19	0.76	197.60	6.88	342.95
Y-20	9.93	791.81	801.74	0.99	258.02	8.94	533.79
Y-25	12.51	1071.53	1084.04	1.81	257.20	10.71	814.33
Y-30	15.09	1391.45	1406.54	1.81	257.20	13.29	1134.25
Y-35	18.26	1725.53	1743.79	1.81	257.20	16.46	1468.33
Y-40	21.43	1942.12	1963.55	1.81	257.20	19.63	1684.91
Y-45	-	-	-	1.81	257.20	19.63	1684.91

8.5 Top Soil Management — (Including Action plan for Top Soil management)

(Tentative)(All Figures are cumulative and in MM^3).

Table – 8-4 Top Soil Management

Year	Top soil Removal Plan	Top Soil Used				
		Spreading over Embankment	Spreading over Backfilling area	Spreading over External Dump area	used in Green Belt area	Total Utilised
Y-01	0.80	-	-	-	-	-
Y-03	2.20	-	-	-	-	-
Y-05	2.90	-	-	-	-	-
Y-10	5.36	-	4.83	0.54	-	5.36
Y-15	7.65	-	6.88	0.76	-	7.65
Y-20	9.93	-	8.94	0.99	-	9.93
Y-25	12.51	-	10.71	1.81	-	12.51
Y-30	15.09	-	13.29	1.81	-	15.09
Y-35	18.26	-	16.46	1.81	-	18.26
Y-40	21.43	-	19.63	1.81	-	21.43

8.6 Management of Coal Rejects.

Washery not required, therefore not applicable.

8.7 Restoration of Land used for Infrastructure

i. Infrastructure to be retained area

a. Water pipe lines,

b. Water tanks

c. Overhead Electrical Transmission Lines established for supply of power to these facilities

d. Roads constructed to serve these facilities.

The above facilities shall be handed over to the concerned State Authority on closure of the mine for the best possible use by the local community. As the Company shall be handing over these facilities to the State Government the maintenance shall also be done by the State Government.

ii. Infrastructure to be decommissioned

1. All power lines, telephone lines, trestles, poles, cables and conductors, including Sub-Station, transformers, switchgears etc. not required for public use.
2. All buildings and their sewer system, other than those required for

public use.

3. All structural sheds except workshop, store.
4. All surface haul roads and other roads except the roads to be used for society.

8.8 Disposal of Mining Machinery

Disposal of scrap and such machineries which are not in use in O / C mines will be disposed off towards the end of the mine operation. The equipment including HEMM deployed by company will be taken back to other projects. Therefore. no equipment will left in the mine premises at the time of mine closure/after final mine closure. The disposal of the owner equipment will be completed within 5 year after mines life. No mining machinery will be permitted to remain in the lease area after completing the closure activities.

8.9 Safety & Security

To ensure safety in operating the mine, all provisions of Coal Mine Regulations 2017 along with Circulars issued by Director-General of Mines Safety from time to time shall be adhered to. In addition, related statues viz. Mines Act 1952, Mines Rules 1955 and others shall also will be complied with. Some of the important statutory provisions relating to mechanized open cast mine which recently have been incorporated in Regulation are reiterated in the following paragraphs.

Statutory Aspects for Safety of Mechanized Opencast Mine:

Safety Management Plan:

For complying with **Reg. 104** of CMR 2017**, exercise** shall be done to identify, assess and record the hazards of health and safety of the persons employed in the mine after consulting the Safety Committee and Internal Safety Organisation (ISO). Based on the above, Safety Management Plan (SMP) shall be formulated for overall management for developing and implementing the safety policy of the company. SMP shall contain, *inter alia*, plan to implement the policy, principal hazard management, standard operating procedure (SOP), monitor, evaluate and review the plan.

Mechanized opencast working:

For complying with **Reg. 106 (2)**, before starting mining operation, it will be ensured that the mine including its method of working, ultimate pit slope, dump slope and monitoring of slope stability has been planned, designed and worked as determined by a scientific study, and a copy of the report of such study, shall be kept available in the office of the mine.

Precautions against danger of inundation from surface water:

There is no major river near around the block. Most of nalla are being originated within block except few 2nd order streams which is planned to control by garland drain along the block boundary. Only Nala covering bigger catchment outside of block is planned nalla diversion which along with bund to protect against inundation from surface water.

8.10 Abandonment Cost and Financial Assurance

8.10.1 Abandonment Cost:

The fund for environmental monitoring has been provided in the cost estimate. The mine owner will prepare survey and disposal report for rehabilitation of mine pits.

Details of expenditure on Progressive and Post Mine Closure activities are given in Table below. A Bar Chart showing time scheduling of for abandonment activities is given in annexure V

Sl. No.	Head	Description	Unit	Quantity	Rate Rs / Unit	Amount "Rs. Crs"
Progressive closure						
1	Progressive closure	Water quality management	LS	40	500000	2.00
2		Air quality management	LS	40	500000	2.00
3		Waste Management	Ha	2143.39	10000	2.14
4		Barbed wire fencing around dump	m	4500	500	0.23
5		Barbed wire fencing around the Pit	m	21433.90	500	1.07
		Filling of Void - Rehandling of Crown Dump	MM^3			
6		Top Soil management	MM^3	3.00	20000000	6.00
7		Technical & Biological reclamation of Mines out land & OB dump plantation	Ha	2143.39	300000	64.30
9		Plantation over virgin area including green belt	Ha	64.4	250000	1.61
10		Manpower Cost and supervision	month	480	50000	2.40
11		Toe Wall around the dump	m	4500	1500	0.68
12		Garland drain	m	21433.90	200	0.43

Sl. No.	Head	Description	Unit	Quantity	Rate Rs / Unit	Amount "Rs. Crs"
13		Garland drain around the dump	m	4500	200	0.09
14		Any other activity (Protective wall for embankment)	m	200	20000	0.40
Sub Total						**83.35**
FINAL MINE CLOSURE						
1	Dismantling of Infrastructure & Disposal / rehabilitation of Mining machinery	Dismantling of workshop	LS			0.30
2		Rehabilitation of the dismantled facilities	LS			0.20
3		Dismantling of pumps and Pipes / other facilitates	LS	750	450	0.03
4		Dismantling of stowing bunkers, provisions for bore well pumping arrangement	LS	30000	500	1.50
5		Dismantling of UG equipment	LS			0.80
6		Rearranging water pipelines to dump top park / Agricultural land	LS			0.15
7		Dismantling of Power lines	LS			0.00
8	Safety and security	Barbed wire fencing around dump	m	Already Covered		-
9		Barbed wire fencing around pit	m	Already Covered		
10		Barbed wire fencing with masonry pillar	m	199801	130	2.60
11		Concrete wall with masonry pillar around the pit	m			0.00
12		Securing air shaft and installation of bore well pumps	LS	4.00	1000000	0.40
13		Securing of inclines	LS	2.00	1000000	0.20
14		Concrete wall fencing around the water body	m	8000	750	0.60
15		Boundary wall around the water body	m	8000	1200	0.96
16		Stabilisation (viz benching, pitching etc) of side walls of the water body	LS			-
17		Toe Wall around the dump	LS			-
18		Garland drain	LS	Already Covered		
19		Garland Drain around the dump	LS			-
20		Drainage Channel from main OB dump	LS			-
21	Technical & Biological Reclamation of Mined out area and OB Dump	Filling of Void	MM^3	198.00	44000000	871.20
22		Top Soil management	MM^3	3.00	20000000	6.00
23		OB rehandling for back filling	MM^3			-
24		Terracing, Blanketing with soil and vegetation for Ext. OB dump	Ha	387.55	250000	9.69
25		Peripheral road, gates, view point, cemented steps on	LS			0.15

Sl. No.	Head	Description	Unit	Quantity	Rate Rs / Unit	Amount "Rs. Crs"
		bank				
26		Expenditure on development of Agriculture land	LS			-
27		Landscaping and Plantation	LS			0.20
28	Post Closure management and supervision	Power cost	LS			0.00
29		Post Mining Water quality management	LS	6.00	500000	0.30
30		Post Mining Air quality management	LS	6.00	500000	0.30
31		Subsidence monitoring for 5 years	LS	5.00	500000	0.25
32		Waste Management	LS			-
33		Manpower Cost and supervision	LS			-
34	Others activities	Entrepreneurships development, vocational / skill development training for sustainable income of affected people	LS			0.10
35		Golden Handshake / Retrenchment benefits to employees of OC	LS			-
36		Golden Handshake / Retrenchment benefits to employees of UG	LS			-
37		One time financial grant to Society / Institutions / Organisations which is dependent upon the project	LS			-
38		Provide jobs in other mines of the company	LS			-
39		Continuation of other services like running of schools etc.	LS			-
40		Corpus Fund for CSR and R&R Colony	LS			-
		Sub-total				**895.93**
		Grand Total				**979.28**
Grand total of estimated expenditure of Progressive & Final Closure activities						**979.28**

The perusal of above table shows that the total expenditure on closure activities for OC mine will be 979.28 Crs.

The financial impact for the PMCP has been prepared in accordance with the guidelines circulated by MOC, Govt. of India.

8.10.2 Financial Assurance: Amount to be deposited in Escrow account as a security against the mine activities to be carried out for the closure of the mine.

WPI as on April 2019		121.700
WPI as on Dec 2020		124.500
Escalation Rate of Closure cost		1.03
	UG	OC
Base Rate of Closure Cost "RS/Crs/Ha)"	0.015	0.090
Closure Cost "Rs/Crs/Ha)"	0.015	0.093
Project Area	2672.00	2672.00
Amount to be deposited in ESCROW account "Rs in Crs"	41.30	247.79

Amount already deposited into ESCROW account "Rs in Crs"	0.00	0.00
Net Amount to be deposited into ESCROW account "Rs in Crs"	41.30	247.79

Rate of compounding of Annual Closure Cost		0.05
Balance life of the project "in Yrs"	87	40
Annual Closure cost	0.475	6.195

Amount to be deposited in ESCROW account after compounding @ of 5% "Rs in Crs"	**396.97**	**748.33**

Table 8-5 Escrow account calculation

Amount to be deposited into ESCROW Account" in Crs)					
Year	**OC**	**UG**	**Total**	**Already Deposited**	**Balance to be deposited**
1	6.19	0.00	6.19	0.00	6.19
2	6.50	0.00	6.50	0.00	6.50
3	6.83	0.00	6.83	0.00	6.83
4	7.17	0.00	7.17	0.00	7.17
5	7.53	0.00	7.53	0.00	7.53
6	7.91	0.00	7.91	0.00	7.91
7	8.30	0.00	8.30	0.00	8.30
8	8.72	0.00	8.72	0.00	8.72
9	9.15	0.00	9.15	0.00	9.15
10	9.61	0.00	9.61	0.00	9.61
11	10.09	0.47	10.57	0.00	10.57
12	10.60	0.50	11.09	0.00	11.09
13	11.12	0.52	11.65	0.00	11.65
14	11.68	0.55	12.23	0.00	12.23
15	12.27	0.58	12.84	0.00	12.84
16	12.88	0.61	13.48	0.00	13.48
17	13.52	0.64	14.16	0.00	14.16
18	14.20	0.67	14.87	0.00	14.87
19	14.91	0.70	15.61	0.00	15.61
20	15.65	0.74	16.39	0.00	16.39
21	16.44	0.77	17.21	0.00	17.21
22	17.26	0.81	18.07	0.00	18.07
23	18.12	0.85	18.97	0.00	18.97
24	19.03	0.90	19.92	0.00	19.92
25	19.98	0.94	20.92	0.00	20.92
26	20.98	0.99	21.96	0.00	21.96
27	22.03	1.04	23.06	0.00	23.06
28	23.13	1.09	24.22	0.00	24.22
29	24.28	1.14	25.43	0.00	25.43
30	25.50	1.20	26.70	0.00	26.70
31	26.77	1.26	28.03	0.00	28.03
32	28.11	1.32	29.43	0.00	29.43
33	29.52	1.39	30.91	0.00	30.91
34	30.99	1.46	32.45	0.00	32.45
35	32.54	1.53	34.07	0.00	34.07
36	34.17	1.61	35.78	0.00	35.78
37	35.88	1.69	37.57	0.00	37.57
38	37.67	1.77	39.45	0.00	39.45
39	39.56	1.86	41.42	0.00	41.42
40	41.53	1.95	43.49	0.00	43.49
41-87	0.00	365.43	365.43	0.00	365.43
Total	**748.33**	**396.97**	**1145.30**	**0.00**	**1145.30**