नॉर्दर्न कोलफील्ड्स लिमिटेड
(मिनिरत्न कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)

Northern Coalfields Limited
(AMiniratna Company)
(A subsidiary of Coal India Limited)

Office of The General Manager, Jayant Project

CIN- U10102MP1985GOI003160
An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company
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No. Jnt/Env/MOEF /18/ 346 Date 15.06.2018

To,

Dr. S.K.Srivastava,
Addl. Director(IA-Coal mining),
Member Secretary, EAC
Ministry of Environment, Forest and Climate Change
3rd floor, Vayu Wing, Indira ParyawaranBhawan,
JorBagh, New Delhi- 110003

Sub: Additional details sought w.r.t Jayant Expansion OCP (25.0 MTPA) of Northern Coalfields Limited in the 30th EAC (Thermal and Coal ) held on 17-18th May'2018 at MOEF , Delhi.

Dear Sir,

With reference to the above, this is to submit that the proposal for consideration of grant of Environment Clearance with respect to expansion of Jayant open cast coal mine from 15.5 MTPA to 25.0 MTPA, in an area of 3177.171 Ha, of M/s Northern Coalfields Limited located in District Singrauli (M.P.) was put up in 30th EAC (Thermal & Coal mining Projects) meeting held on 17-18 May 2018 at New Delhi. The information sought by the committee and reflected in minutes of the EAC meeting, as referred above, with respect to expansion of Jayant open cast coalmine of M/s Northern Coalfields Limited District Singrauli (M.P.) is submitted as below:-

Clause No 30.1.4:-

1. Discrepancy in respect of total forest area involved under the project, whether 1180 Ha or 1180.17 ha. the same needs to be firmed up and the land use pattern / details to be revised accordingly.

   Reply:-

   (a) The total forest area involved for the Jayant expansion OCP (25 MTPA) is 1180.171 Ha, which was rounded off to 1180 Ha in the EMP submitted (at page no. 32 of chapter II) . However as per observations of the EAC , this is firmed up to the actual i.e. 1180.171 Ha, the details of which is deliberated as below:

| Sl. No. | Land description (Forest only) | Area | Remarks |
|---|---|---|---|
| I | Forest land area diverted before enactment of FC act 1980 | 943 Ha | The 927 Ha of forest land area was notified under CBA 1957 and another 16 ha was acquired through transfer in 1975 for Magazine. |
| II | Forest land area diverted after enactment of FC act 1980 | 219.171 Ha | Permission for acquisition of 219.171 Ha of land has been obtained in three phases as per following details: |

| Sl. No. | Land description (Forest only) | Area | Remarks |
|---|---|---|---|
| | | | • 100 Ha: Initially acquired in the year 1992 for lease period of 10 yrs and subsequently renewed.<br>• 68.290 Ha: Initially acquired in the year 1997 for lease period of 30 yrs.<br>• 50.881 Ha : Initially acquired in the year 2000 for lease period of 30 yrs. |
| III | Diversion of forest land area as per FC act 1980 | 18 Ha | The stage –II clearance of the referred 18 Ha of forest land has been obtained. |
| | Total | 1180.171 Ha | |

(b) The non-forest land required for the Jayant Expansion OCP 1997 Ha. As such the total land required for Jayant Expansion OCP is 3177.171 Ha, which is firmed up in the revised MCP and EMP.

(c) As far, land use pattern / details is concerned for total land of 3177.171Ha, the Mine Closure Plan and other details of Environment Management Plan has been revised accordingly. As per directive issued earlier, the MCP (revised) is to be approved by NCL board, so it would be put up to NCL Board meeting scheduled to be held on 21.06.2018 for approval.

(d) Calendar Plan or any other details of Production for 25.0 MTPA based on updated figures has been incorporated in the revised EMP.

(e) The copy of revised MCP and EMP both is enclosed (Annexure-1 and Annexure-2) hereby for kind consideration of the Member Secretary, EAC & other members of the Committee (Thermal and Coal Mining), So that the agenda item of Environmental clearance of Jayant Expansion OCP (25.0 MTPA) may be put up in the upcoming EAC Meeting.

2. More area to be acquired under the project involves additional forest land of 18 ha, carved out of Nigahi Opencast Coal mine project. As such parallel proposal for amendment in EC for Nigahi OCP also needs to be submitted.

Reply :-

(a) At present Nigahi project is having EC capacity of 18.75 MTPA for which total land involved is 2650.40 ha.Further the process of acquisition of additional forest land (386 Ha)for EC capacity of 18.75 MTPA only, is under consideration for which Stage-2 clearance has been obtained.

(b) Out of these 386 Ha for which FC stage 2 clearance has been obtained by Nigahi Project, 18 Ha shall be used by Jayant project. Accordingly changed mine plan of Nigahi Project is being put up to NCL Board which is scheduled to be held on 21/06/2018. Parallel proposal for amendments in the EC for Nigahi OCP is under preparation based on total land requirement of 3018.40 Ha ( 2650.40 + 386 -18 i.e. 3018.40Ha. ), which will be put up shortly for consideration in Expert Appraisal Committee. In this respect, a letter from GM, Nigahi is also enclosed (Annexure-3) for kind consideration of the same.

3. Coal productions during previous years, especially from the year 2000-01 up to 2007-08 has been consistently more than the reported sanctioned capacity of 9 MTPA, which clearly signifies the violations of the EIA Notification, 2006 and needs to be addressed at this stage vis-à-vis the orders of Hon'ble Supreme Court and / or extant statutory provisions.

Reply :

(a) EC capacity was not mentioned in the EC letter while the project sanctioned capacity against which EC was obtained was 10.0 MTPA. However, consent to operate (CTO) was granted by MPPCB for 9.0 MTPA based on earlier years production achieved.

Since sanctioned capacity was 10.0 MTPA and to meet the national demand of coal, the production was made accordingly.

(b) At present Jayant is having Environmental Clearance of 15.50 MTPA which was granted in the year Dec'2008 after which there was no violation of EC in respect of production capacity.

(c) As per the directives of MOEF&CC OM no F.No 3-50/2017-IA.III(pt.) dated 30.05.2018 the undertaking and commitment of the project proponent not to repeat any such violation in future, by way of affidavit for compliance of the all the statuary requirement & orders of Hon'ble Supreme Court dated 2nd Aug 2017, is enclosed hereby as Annexure- 4.

Therefore, you are requested to kindly consider the case for grant of Environment Clearance for Coal production of 25.0 MTPA by Jayant Expansion Opencast Project.

With regards.

Yours faithfully,

15/06/18

(Chanchal Goswami)
Area General Manager,
Jayant Project,NCL

Enclosures:

1. Revised MCP of Jayant Project.
2. Revised EMP of Jayant Project.
3. Declaration by Area General Manager, Nigahi.
4. Affidavit by Area General Manager , Jayant (Project Proponent)

Revised

# MINE CLOSURE PLAN
# of
# JAYANT OPENCAST PROJECT

**(Normative-20 Mtpa)**

**(Peak- 25Mtpa)**

## नार्दर्न कोलफील्ड्स लिमिटेड
## NORTHERN COALFIELDS LIMITED

**जून-२०१८**

**June - 2018**

*Prepared by*

***cmpdi***

**क्षेत्रीय संस्थान-६/Regional Institute-6**

**पो.आ.-जयंत/P.O. - Jayant**

**जिला-सिंगरौली (म.प्र.)/Distt. – Singrauli (M.P.)**

**Revised**

# MINE CLOSURE PLAN
# of
# JAYANT OPENCAST PROJECT

**(Normative-20 Mtpa)**

**(Peak- 25Mtpa)**

## NORTHERN COALFIELDS LIMITED

**June - 2018**

*Prepared by*

***cmpdi***

**Regional Institute-6**
**P.O. - Jayant**
**Distt. – Singrauli**

# Revised Mine Closure Plan of Jayant OCP

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# REVISED MINE CLOSURE PLAN

## 1.0.0 INTRODUCTION

Mine Closure Plan (MCP) of Jayant OCP is being revised taking into consideration the actual forest area of 1180.171 Ha. In the previously approved MCP of Jayant OCP the forest land had been rounded off to 1180 Ha. The EAC in its 30th meeting held on 17th May 2018 had pointed out that the discrepancy in respect of the total forest land needs to be firmed up. Hence this revised MCP has been prepared based on total land area of 3177.171 Ha for Jayant expansion OCP.

### 1.0.1 Name of Mine owner:

Administratively under the control of NCL headed by Director (Technical/Operations)

### 1.0.2 Location and Extent of Project/Lease Area

Jayant Opencast Project is located in Singrauli Coalfields which is situated in Singrauli district of Madhya Pradesh. It falls within latitude 24°6'26.08" & 24°11'40.86" North and longitude 82°38'2.01" & 82°40'55.64" East. (Survey of India topo sheet no 63 L/12 of GSI). Jayant OCP has a lease area of 3177.171 Ha. The location Map of Jayant OCP is enclosed as **Plate-I.**

### 1.0.3 Type of Project/Lease Area:

The lease area consists of Forest and Non Forest Land:

| Particulars | Total land Required (Ha) | Land possession details(Ha) | |
|---|---|---|---|
| | | Possessed | To be possessed |
| Forest land | 1180.171 | 1180.171 | nil |
| Non-Forest Land | 1997.0 | 1629.0 | 368.0 |
| Total | 3177.171 | 2809.171 | 368.0 |

### 1.0.4 Present Land use pattern

| Sl. No. | Land Details | Land (Ha) |
|---|---|---|
| 1 | Total quarry area | 1840.00 |
| 2 | External dump | 118.65 |
| 3 | Colony (Residential area) | 261.90 |
| 4 | Greenbelt in colony | 19.30 |
| 5 | Infrastructure | 82.00 |
| 6 | Road , Railway | 96.75 |

| | | |
|---|---|---|
| 7 | Green Belt on wasteland/ vacant land | 74.00 |
| 8 | Safety zone/ undisturbed area | 120.00 |
| 9 | Modwani Dam | 59.20 |
| 10 | Others (Wasteland, Vacant land, etc.) | 505.371 |
| | **Total** | **3177.171** |

### 1.0.5 METHOD OF MINING

Considering the geo-mining conditions prevalent in the lease area a combined system of opencast mining (dragline and shovel dumper combination) has been proposed.

### 1.0.6 COAL PROCESSING OPERATION

There is no proposal for Coal Beneficiation for this mine. Un-washed crushed coal from Coal Handling Plant / Silo is being dispatched to power stations and other customer through MGR and public railway system.

### 1.1.0 Reasons for closure

### 1.1.1 Exhaustion of Minerals

Depending on prevailing geo-mining & techno-economic conditions, it has been decided to mine coal up to exhaustion of reserve in the proposed block.

The Jayant mine has been designed for an annual capacity of 20.0 Mtpa. The geological reserve of coal of Jayant project is expected to be exhausted by March, 2034 and project need to be closed.

### 1.1.2 Lack of Demand

The Jayant mine is not to be closed due to lack of demand, but due to exhaustion of minerals.

### 1.1.3 Un-economic operations

The Jayant mine is not to be closed due to un-economic operations, but due to exhaustion of minerals.

### 1.1.4 Natural calamity

The Jayant mine is not being closed due to natural calamity, but due to exhaustion of minerals.

### 1.1.5 Direction/court cases

The Jayant mine is not being closed due to direction/court cases, but due to exhaustion of minerals.

The Mine Closure Plan has been prepared as per the Guidelines approved by the Ministry of coal, Govt. of India and notified vide communication No. 55011-01-2009-CPAM on dated 27th August, 2009, 8th September,2009, 11th January, 2012, 25th April, 2012 and & 7th January, 2013.

As per the notification all coal mine owners shall adopt a Mine Closure Plan for each of their mines comprising progressive Closure Plan and final Closure Plan duly approved by the Competent Authority.

In compliance of the notification this Mine Closure Plan for Jayant Opencast coal Mining Project has been prepared.

Mine closure encompasses rehabilitation process as an ongoing programme designed to restore physical and biological quality of environment disturbed by the mining to a level acceptable to all concerned. It must also aim to create a self-sustained ecosystem. Mine closure operation is a continuous series of activities starting from day one of the initiation of mining project.

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety risks and economic risks, social and environmental challenges. Some other objectives of Mine Closure Planning are as follows:

a. To allow a productive and sustainable after-use of the site which is acceptable to the mine owner, adjacent mine owners (since all the mines are owned by the same company therefore it is done in an integrated manner), the regulatory authority, the local community and the other stake-holders.

b. To protect public health and safety.

c. To alleviate or eliminate environmental damage and thereby encourage environmental sustainability.

d. To minimise adverse socio-economic impacts.

Mine closure planning covers the progressive mining and post-mining phase of the project. Several attribute of progressive mine closure planning have to be implemented and introduced during the period of mine operation.

Progressive mine closure process is undertaken concurrently with mine development/ production activities.

### 1.2.0 Statutory obligations

### 1.2.1 Special conditions imposed while execution of lease deed

Special conditions imposed while execution of existing lease deed (for 15.5 Mtpa) is being complied. Special conditions which would be imposed after acquiring the proposed expanded lease area of 368.00 Ha would be complied.

### 1.2.2 Approval of mining plan

The current EPR has been approved by NCL Board.

### 1.2.3 Directives/ conditions imposed by MoC/MoEF&CC/SPCB/CPCB

The directives /conditions imposed by the MoC/MoEF&CC/SPCB/ CPCB are being complied from time to time for the existing capacity of 15.5 Mtpa. Any new condition that would be put for compliance for the proposed expanded capacity of 20 Mtpa will be complied.

There is a need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, central and state governments after mine closure. Although no comprehensive legislation exists on mine closure, the following legislations are relevant to mine closure aspects of Coal Mines:

- The Mines Act, 1952.
- Coal Mines Regulations 1957: Regulations 6, 61, 106, 112,197 etc of Coal Mines Regulations, 1957 and its related DGMS Circulars.
- The Coal Mines (Conservation and Development) Act, 1974.
- Water (Prevention and Control of Pollution Act), 1974.
- Air (Prevention and Control of Pollution), Act 1981.
- Environment (Protection) Act, 1986 and Environment Protection (Amendment) Rule, 2000.

- The Hazardous Waste (Management, Handling and Transboundary Movement) Fourth Amendment Rules, 2010.
- Mines and Minerals (Development and Regulation) Act 1957, amended up to 20-12-2009.
- Mineral Concession Rules 1960, amended up to 18-01-2000.

In addition documents like EIA/EMP submitted to MoEF&CC and the commitments made therein also have legal status. The directives/conditions imposed by the SPCB are complied. The compliance status of EC conditions laid down by MoEFCC is enclosed as **Annexure-1.**

The specific conditions laid down for lease permissions of forest land awarded to Jayant Project and their compliance is enclosed as **Annexure-2.**

The compliance status of Air and Water consent conditions is enclosed as **Annexure-3.**

### 1.3.0 Closure Plan Preparation

### 1.3.1 Decision of mine closure

The Jayant mine has been designed to produce 20.0 Mtpa Coal. The geological reserve of coal of Jayant project is expected to be exhausted by 2034.Final decision of closure will be taken by the competent authority in appropriate time.

The layout map showing salient features of Jayant OCP is enclosed as **Plate-2.**

## 2.0 Mine Description

### 2.1.0 Geology

### 2.1.1 Topography

Jayant OCP falls within latitude 24˚6'26.08" & 24˚11'40.86" North and longitude 82˚38'2.01" & 82˚40'55.64" East. (Survey of India topo sheet no 63 L/12 of GSI). The surrounding area exhibits hilly rugged and undulating topography with general elevation variation from 375 to 424 m above MSL. Bijul Nalla, a tributary of sone river traverses, the north-eastern part of the

block. A numbers of seasonal nallas, flowing from north to south and south to north drain through this area and meet the master drain, the Rihand Dam (Govind Ballabh Pant Sagar)which is located south of this area and Sone river located North of this area. Bijul Nalla, Motwani Nalla, Balia Nalla, Amjhar Nalla and Tippa Jharia Nalla drain this area.

### 2.1.2 Rock Types

Entire block area is covered by the sediments of Barakar Formation with a thin cover of soil and alluvium at places.

**Stratigraphic sequence of rocks within Barakar Formation**

| Lithology | Thickness Range (m) | |
|---|---|---|
| | From | To |
| Soil | 0.00 | 12.20 |
| Sandstone with 2 to 3 clay bands and 1 to 2 thin impersistent carbonaceous horizon. | 16.40 | 204.90 |
| Coal Seam : Purewa Top (Full Seam) | 4.00 | 13.07 |
| Sandstone with thin shale bands | 2.80 | 33.04 |
| Coal Seam : Purewa Bottom | 8.69 | 18.54 |
| Sandstone with thin carb shale | 46.61 | 66.40 |
| Coal Seam : Turra | 13.90 | 23.61 |

Over a major part of the area, the thickness of soil is restricted to 3 m only. The Barakar sequence mainly consists of fine to coarse grained, light grey, feldspathic sandstone, shale, clay and coal seams. Kaolinised feldsper is usually the cementing material. Two to three clay beds occur within the upper horizon of the Barakars. The shale bands generally occur as inter banded with coal and constitutes most of the dirt bands within the seams. Presence of thin shale bands has also been observed within sandstone at places. The sandstones are feldspathic, at times kaolinised and rarely micaceous. The coal, shaly coal and carb shales constitute the coal horizon.

### 2.1.3 Toxic elements study

Toxic elements studies of coal samples from coal seams of NCL mines has been tested by IIT BHU & CIMFR, Dhanbad and Envirotech East Pvt. Ltd, Kolkata and is enclosed as **Annexure-4.**

### 2.1.4 Geological Structures

The beds show a gentle anticlinal flexure along NNE-SSW axis passing along the central part of the block. The beds have general NE-SW trend in the western part of the block, which gradually swing along anticline axis and assume NW-SE trend in the eastern part of the block.

Accordingly the direction of dip also changes from NW to NE. The amount of dip is generally about $2^o$ to $3^o$.

From the subsurface data, six faults have been deciphered in the Jayant Extension area. Most of the faults traverse through the eastern part while the western part is fairly undistributed.

### 2.2.0 RESERVE:

**Geological Reserves –** 305.50Mt (as on 31.03.2018)
**Mineable Reserve -** 282.71 Mt (as on 31.03.2018).

### 2.2.1 Study about category of Coal:

The grade of coal, based on Gross Calorific Value (GCV), for the three potential coal seams are as follows:

**Turra Seam-** G8 to G14

**Purewa Bottom-** G8 to G14

**Purewa Top-** G9 to G14

The average product mix grade of all the three seams is G10.

### 2.2.2 Balance quantity of coal/lignite reserve at time of mine closure

There will be no coal after mine closure as the mine is expected to be exhausted at the time of mine closure

### 2.3.0 Mining method

### 2.3.1 Mining Method

Jayant OCP has been working for last 40 years with combined system of mining viz. Dragline and shovel-dumper system. The existing system has been proposed to be continued with up-gradation of equipment size for achieving higher production level.

### 2.3.2 Mining Machinery Deployed

**For OB removal:**

In the sanctioned PR of Jayant OCP (10Mtpa), 3 Nos. of 24m3/88mR & 1 No. of 15m3/83mR draglines and 13 Nos. of 10m3 Elect. Rope Shovel in conjunction with 120/85/50 T rear dumpers had been envisaged for excavating overburden.

It is proposed to use the same set of draglines and 20m3 electric Rope shovels with combination of 190 T rear dumper. In the EPR (20 Mtpa), it is proposed to replace all the existing 10m3 electric rope shovels deployed in OBR with 5 Nos. of 20m3 electric rope shovels after their survey off.

Similarly, all the existing 50/85/120 T rear dumpers deployed in OBR are proposed to be replaced by equivalent numbers of 190 T rear dumpers after their survey off. The 15m3/83mR dragline has already been refurbished and the decision whether this dragline needs to be replaced should be taken after the minimum stipulated working hours of refurbished dragline. However, if & when 15m3/83mR dragline is to be replaced, it may be replaced by higher standard size e.g. 24m3/88mR dragline. 1 No. of 24m3/88mR Dragline has been surveyed off but working. This dragline will continue to work till replacement is made available.

**For Coal Winning:**

In the sanctioned PR of Jayant OCP (10 Mtpa), 10m3 Elect. Rope Shovel in conjunction with 85 T rear dumpers had been envisaged for coal production. It is proposed to use the 10m3 Elect. Rope Shovel and 10-12m3 Diesel Hyd. Shovel in conjunction with 100 T rear dumpers for winning the coal. Some of 85 T dumpers have already been upgraded to 100T and the balance existing 85T are proposed to be replaced by equivalent numbers of 100 T rear dumpers after their survey off.

### 2.3.3 Production Level:

The normative production will be 20.0 Mtpa with peak production of 25.0 Mtpa which will be achieved in the years where the geo-mining conditions are

favorable and by increasing efficiency and no. of working days to meet the overall demand of coal on NCL.

The proposed Coal and OB production schedule is given as **Annexure-5.**

### 2.3.4 General Scheme of operation:

The Jayant OCP expansion (20 Mtpa) is envisaged to be worked in two sections viz. Eastern and Western Sections with the application of 2 Nos. of Draglines in each Section. Coal from Turra seam will be extracted by 10m3 Elect. Rope shovel and transported through main Central Entry to receiving pit of proposed semi-mobile crusher as well as receiving pit of existing main CHP. Purewa Bottom & Purewa Top will be extracted by 10m3 Elect. Rope shovel and 10-12m3 Diesel Hyd. Shovel. The flank roads are proposed to be used for OB transportation to internal dumps and for coal transportation from Purewa Bottom and Purewa Top seams to receiving pits of proposed semi-mobile crusher.

## 2.4 Coal Beneficiation:

There is no proposal for coal beneficiation for this mine. Un-washed crushed coal from CHP/Silo will be dispatched to power stations and other customers through MGR and Public railway System.

# 3.0 Closure Plan

### 3.1.0 Mined out land

### 3.1.1 Proposal/Measures implemented for reclamation

The project report envisages concurrent land reclamation of mined out land. The reclamation is to be done in three phases.

**Phase-I**

**Physical / Technical Reclamation**

In phase-I, the mined out land area is backfilled with excavated OB material up to be pre-determined level and then leveled with dozer and grader. A layer of top soil will be spread with the help of grader on leveled surface of backfilled mined out land.

Equipment provided for land reclamation is as follows:

| Sl. No. | Particulars | Size | No. |
|---|---|---|---|
| 1 | Dozer | 410 HP | 5 |
| 2 | Grader | 280 HP | 2 |
| 3 | Diesel Hydraulic Shovel/ Backhoe | 3.2/3.8 $m^3$ | 1 |
| 4 | Tipping Truck | 8$m^3$ | 5 |
| 5 | Water sprinkler | 28 KL | 5 |
| 6 | Water sprinkler | 70 KL | 7 |
| 7 | Road Sweeping Machine | | 2 |

A fund of Rs. 5514.34 lakhs has been provided for above capital investment.

**Phase-II**

**Biological and Ecological Reclamation**

Biological reclamation is the Phase-II of reclamation process. Re-vegetation covers in terms of grass & trees of appropriate species are raised over the physically reclaimed land for three tier plantation. Proper steps will be taken for restoring the ecological integrity as envisaged in EMP.

The present and proposed Progressive Green Belt development & Biological reclamation plan is given as **Annexure-6.**

The present progressive land use pattern of Jayant OCP is given as **Plate-3.**

**Phase-III**

**Hydro Reclamation**

At the end of mine life a void with batter of 251.00 Ha will be left as void in the excavated zone. The ultimate depth of the void has been estimated 225 m. In the final mine closure plan, voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation where possible and for hydro reclamation where feasible.

### 3.1.2 Rehabilitation of mined out land

The reclamation of mined out land will be a concurrent with mining operations. The post mining land use at the end of mine life will be as follows:

| S.No. | Land use during Mining | Post mining Land Use (ha) | | | | |
|---|---|---|---|---|---|---|
| | | **Plantation** | **Water Body** | **Public Use** | **Others** | |
| **1** | External OB dump | 118.65 | - | - | - | 118.65 |
| **2** | Top soil dump | Top soil will be completely used in reclamation of dumps. | | | | |
| **3** | Excavation | 1589.00 | 251.00 | - | - | 1840.00 |
| **4** | Roads & railway | 96.75 | - | 0.00 | - | 96.75 |
| **5.** | Built-up area (Infrastructure & colony) | 82.00 | - | 261.90- | - | 343.90 |
| **6** | Greenbelt | 93.30 | - | - | - | 93.30 |
| **7** | Undisturbed area (Safety Zone, wasteland, vacant land and Mudwani dam) | 625.371 | 59.20 | - | - | 684.571 |
| **Total** | | **2605.071** | **310.20** | **261.90** | **-** | **3177.171** |

At post mining stage area of forest / green will increase from 1180.171 Ha to 2605.071

### 3.1.3 Actual site restoration for post mining land use

There will be significant increase in forest cover post-mining due to proposed reclamation activities and actual site restoration with improved green cover is targeted in the final mine closure plan. The proposed final dump plan is enclosed as **Plate-4** and reclaimed dump plan is enclosed as **Plate-5.**

### 3.1.4 Method of restoration/reclamation/Rehabilitation

Method of restoration/reclamation/rehabilitation has been described in the section 3.1.1.

### 3.1.5 Afforestation in the first phase mined out area while commencing the mining in second phase

Mining is being carried out in a phased manner initiating afforestation work in the mined out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mine.

3.1.6 **Progressive mine closure plan shall be prepared for a period of five years from beginning of mine operations**

Progressive mine closure plan has been prepared for a period of five years from the beginning of the mining operation.

3.1.7 **These plans would be examined periodically in every five years period and be subjected to third party monitoring by the agencies approved by the Central Government**

These plans would be examined periodically in every five years period and be subjected to third party monitoring by the agencies approved by the Central Government like the Central Mine Planning and Design Institute (CMPDIL), National Environmental Engineering Research Institute (NEERI), Indian School of Mines (ISM) etc. for the purpose.

3.2.0 **Steps for Water Quality protection**

Following water quality protection measures are taken:

**a) Control of erosion:** The possible sources of surface water erosion are the OB dumps. In order to prevent erosion from the OB surfaces massive plantation would be done on it (@3500 plants/ha).

For reclamation of OB dumps benching and leveling would be done by dozer, terracing would be done manually and then U.P. Forest Department and M.P.R.V.V.N will do the plantation.

In 2016-17, 50000 plants were planted by Jayant Project. Up to March-2017, more than 29.9548 Lakhs saplings have been planted in Jayant area.

The slopes of OB dumps are restricted to overall slope of 28°. Such a mild slope not only caters the stability requirement of dumps but also decelerates the surface runoff thereby minimizing the erosion.

The haul roads are properly paved and wherever possible black top roads are provided to minimize erosion.

**b) Sedimentation:** Siltation ponds have been properly designed and constructed to collect the runoff from the mine and allows its sedimentation. The water so collected is being utilized for watering the mine area, roads, green belt development etc.

**c) Diversion of water courses:** No water courses were encountered in the mine lease area so no such diversion was needed.

**d) Water Treatment:**

**Sanitary (domestic) wastewater:**

There is a STP of 4.00 MLD capacity in the project for treatment of domestic sewage from colonies. The treated water is reused for watering the plants in Rose Garden (Park), Jayant and nearby agricultural fields. The schematic diagram of the STP is enclosed as **Fig-1.**

**Mine water discharge:**

Mine water is treated in an ETP (32 MLD) and reused for watering the haul roads to control dust and various other activities. The schematic diagram of Mine ETP is enclosed as **Fig-2.**

**Workshop Discharge:**

For proper maintenance of HEMMS like dumpers, dozers, graders are washed frequently in workshop. In addition effluent from workshop includes water used after washing of floor and roads in workshop premises. These effluents contain suspended solid, grease and oil. Besides workshop there is effluent coming out of the CHP which contains mainly suspended solid (coal dust), oil and grease and dissolved solid.

For removal of oil and grease and suspended solids, ETP (8 MLD) has been provided with oil and grease trap and settling tanks etc. The clear water obtained is recirculated water use. The schematic diagram of mine ETP is given as **Fig-3.**

Most of the treated water except for rainy season would be reused for sprinkling on haul roads for dust suppression and in CHP.

**e) Control of siltation:** To arrest the silt brought by surface runoff Catch drains have been constructed around the OB dumps which have their out let in siltation ponds made to collect these surface runoffs and mine water.

At the toe of the dump Gabion wall is constructed to control siltation. A series of open drains have been provided on dump body to arrest surface run-off and prevent siltation.

**f) Hydrogeology Study in the area**:

The water table configuration in the unconfined aquifer is conforming to the local topography. A ground water divide is running across the centre of the area from west to east more or less following the high ground of coal mining projects. A flat water table with a gradient of 7.5 $x10^{-3}$ , slopping towards south / south east has been observed in the south of the area towards G.B.P. Sagar. On the northern side, the water table slopes towards the north east direction towards Bijul river. The aquifer units present above the working coal seams are the major sources for ground water inflow into the proposed mine workings. With the presence of shale and compaction, the seepage from mine floor may be considered as negligible. The various hydro-geological units developed in the Jayant (Expansion) OC Project is given in the table:

**Hydro-geological units developed in the Jayant Expansion OCP**

| Hydro-geological Unit | Formation | Thickness (m) |
|---|---|---|
| Phreatic aquifer (Top) | Soil, subsoil, weathered sandstone. | 0 – 3 |
| | Medium grained Sandstone with thin clay and shale | 20- 65 |
| Aquiclude | Coal seam – Purewa Top (Working seam) | 5 – 9 |
| Aquifer (middle) | Medium grained sandstone with thin shale. | 17 – 32 |
| Aquiclude | Coal seam – Purewa bottom (Working seam) | 9 – 12 |
| Aquifer (lower) | Medium to coarse grained sandstone with thin shale. | 52 – 60 |
| Aquiclude | Coal seam - Turra (Working seam) | 13 – 20 |

**Recharge Area:** Water table contour map prepared for May'2006 indicates that the recharge is from the elevated grounds covered with forest, located northwest of the Jayant Expansion OCP. The recharge is

mainly from rainfall to the phreatic aquifer. Deeper aquifer gets recharged from the outcrop region and leakage from phreatic aquifer.

**Discharge Area :**Water table contour map (May'2006) indicate that the discharge area is the low lying flat terrain, nadi and nala beds and G.B.P. Sagar located south and southeast of the mining projects. Open pit mines also act as manmade discharge zones.

As the local ground water levels may get affected by open cast mining, because of permeability of lower aquifer units, the impact of mining on local water regime will be marginal and the radius of influence will be limited to a small distance i.e. 612 m.

The net annual ground water recharge and draft in the study area was estimated as 35.00 $Mm^3$ and 27.79 $Mm^3$ respectively. Thus, the balance available annual ground water resource projected in the area is 7.21 $Mm^3$. The ground water recharge balance of study area is as follows :

Ground Water Recharge Balance in Study Area ( 10Km radius)

| | | |
|---|---|---|
| **A** | **Net Annual Ground water Recharge** | **: 35.00 $Mm^3$** |
| **B** | **Net Annual Ground water Draft** | **:** |
| | i) Irrigation Use | **:** 0.39 $Mm^3$ |
| | ii) Community Use | **:** 21.14 $Mm^3$ |
| | iii) Net Mine Discharge | **:** 6.26 $Mm^3$ |
| | **Net Annual Ground water Draft** | **: 27.79 $Mm^3$** |
| **C** | **Balance Annual Ground water Recharge (A-B)** | **: 7.21 $Mm^3$** |

To assess the impact of opencast mining on local water regime, a regular seasonal monitoring of ground water level and quality is being carried out by establishing a network of 34 nos. existing dug wells in the study area.

Analysis of ground water samples from monitoring wells around Jayant Project indicate that the water quality is generally suitable for domestic use. The pH ranges from 7.34 to 7.69 standard unit, concentration of dissolved solid,, sulphate, iron, manganese, nitrate, fluorite and other heavy metals

are found within limits of the drinking standard (IS-10500). In the study area ground water level variation is as follows:

| Sl. No. | Season | Water level (bgl) in m, Yr.-2017-18 (Study area- 10 Km radius) |
|---|---|---|
| 1 | Pre-monsoon | 1.31 to 20.85 |
| 2 | Post- monsoon | 1.16 to 21.55 |

Central Ground Water Board, N.C. Region, Bhopal MP had assessed and reported the total annual ground water recharge in the Waidhan Development Block (where 100% of Jayant (Expn.) OCP is located) as **181.45 $Mm^3$**. The net groundwater draft and resource availability was reported as **63.47 $Mm^3$** and **117.98 $Mm^3$** respectively and region falls within the category **"Safe"**.

The results of Ground water level & quality measured in 2017-18 is given as **Annexure-7.**

The result of Drinking and Surface water quality of Jayant OCP for 2017-18 is given as **Annexure-8** and that for effluent water as **Annexure-9.**

The location map for observation dugwells is enclosed as **Plate-6.**

### 3.3.0 AIR QUALITY MANAGEMENT PLAN

### 3.3.1 Existing Air Quality Status:

With progressive mine operation & closure, the Ambient air quality of Jayant OCP is being monitored regularly on fortnightly basis for all seasons by measuring the concentration of SPM,PM10,PM2.5, $SO_2$, $NO_X$. The existing ambient air quality of Jayant OCP is being monitored at eight locations/ stations in the core and buffer zone of the project, which are as follows.

| Sl. No. | Location | Location code | Category | Zone |
|---|---|---|---|---|
| 1 | Jayant C-ETP | JYA1 | Industrial | Core Zone |
| 2 | Jayant Coal Substation | JYA2 | Industrial | |
| 3 | Jayant Rose Garden | JYA3 | Residential | |
| 4 | CWS GM Office | CWSA1 | Residential | |

| | | | | |
|---|---|---|---|---|
| 5 | Madhauli Substation | JYA4 | Residential | Buffer Zone |
| 6 | Nigahi STP | NA3 | Residential | |
| 7 | Karwari Village | DA6 | Residential | |
| 8 | Suryakiran Bhawan | DA5 | Residential | |

The results of ambient air quality as measured in QE March 2018 is given as **Annexure-10.**

### 3.3.2 **Measures to control Air pollution:**

With existing control measures, the ambient air quality of the core & buffer zone is found to be well within the permissible limit and therefore no further control measures are required.

Following mitigation measures are in vogue:

- All drills are fitted with dust collection arrangements
- Approach roads to mine and service roads are provided with black topping to reduce dust generation.
- Water sprinklers are provided for dust control on haul roads
- Green belts provided along roads & plantation in vacant land in industrial & township areas for dust control
- In Coal Handling Plant (CHP), dust control system and automatic sprinklers are provided at coal receiving pits. Fixed sprinklers are provided for coal bunkers, transfer points and loading points.

For Jayant OCP monitoring of Ambient Air Quality and above Air Quality Control measures will continue for progressive mine operation & closure. After closure Ambient Air Quality will be monitored for a period of 3 years, if required further control measures will be taken.

## 3.4.0 **WASTE MANAGEMENT**

### 3.4.1 **Details of type, quality and quantity of OB**

Solid waste that would be generated in course of coal mining is overburden material consisting of fragments of sandstone of assorted size. They have not found to generate acid mine drainage or leach high quantity of heavy metals. Quantity of OB that will be generated is given in **Annexure -5.**

### 3.4.2 Year-wise progress of OB removal in terms of height of OB dump and no. of benches etc.

Proposed calendar programme of coal production & waste (O.B.) management is given in **Annexure-5.**

### 3.4.3 Their disposal practice

Main OB bench overlying Turra seam is proposed to be worked by dragline system and backfill the OB in de-coaled area of the previous cut. The advance benches above the dragline sitting level are to be developed by shovel-dumper system.

### 3.4.4 Stabilization of waste- Physical, biological year-wise progress to be achieved

The existing two no. of external dumps have been fully reclaimed. The present practice is to dump the OB produced as internal dumps in the decoaled areas and same is proposed in the future expansion. The year-wise biological reclamation has been enclosed as **Annexure-6.**

### 3.4.5 Measure for prevention of siltation, erosion and dust generation and their dispersal in the air, environment, leaching in the surface and ground water

Several mitigation measures are proposed for stabilization of the dump and preventing siltation and erosion:

- At the toe of the dumps retaining wall is to be provided.
- A series of inter connected open drains, with their outlet in siltation ponds, has to be provided on dump to arrest surface run-off and prevent siltation.
- Dumps has to be stabilized with geo textile material in initial stage and by plantation in maturation stage.
- Gabion walls has to be provided at the toe of the dumps and edge of the benches to prevent soil erosion.
- Proper mitigative measures are to be taken to prevent formation of gullies along the dump.
- It has also been proposed to re-grade the dump slope to $28^{o}$ whenever the dumps attains their final height.

The final stage dump plan is shown in **Plate-4** and the crossection of these dumps is shown in **Plate-7.**

### 3.4.6 Details of reclamation and afforestation with mining actvitiy

Details have already been given in 3.1.1 and **Annexure-6.**

### 3.4.7 Waste material re-handled or backfilled in the final voids for safety

As per EPR of Jayant OCP, major portion of quarry will be backfilled and reclaimed; only an area of 251 Ha would turn out to be void. In due course of time, dip side of the void will be filled with rain & ground water. This water reservoir may be developed for pisci-culture. At the time of final closure of mine, fencing with RCC post and barbed wire will be erected around the water body.

To maintain proper depth of water amicable for pisciculture the void will be back-filled with OB material to certain height. In the final mine closure plan, deign of voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation where possible and for hydro reclamation where feasible.

### 3.4.8 Efforts for minimum land requirement and degradation of land due to external dump

The dump plans of the project has been planned to accommodate total OB volume in internal dumps so land requirement for external dump is nil.

While designing the OB dumps, technical parameters such as width, slope of dump etc. have been taken into consideration for safe OB dumping, so that there is minimum impact on environment and land degradation.

### 3.4.9 Proposal to recharge and stabilize the water table in the surrounding areas

The project has already constructed water harvesting structures and water recharge structures in the nearby villages under CSR. This will help in recharging and stabilizing the groundwater table in the surrounding area, also at the end of the mining operation the void will converted into a huge water body which will also help in ground water recharge.

The project has already taken up the ground water table monitoring of dug wells and piezometers in and around the project area to watch any depletion in water table.

### 3.5.0 TOP SOIL MANAGEMENT

#### 3.5.1 Details of top soil available and its utilization

In Jayant OCP, top soil is available in patches. Top soil available in excavation area is stored in separate identified area. This top soil is preserved till it is used over the leveled, physically and technically reclaimed land. As such, availability of top soil is less, so proper and special care is taken to preserve this precious wealth.

#### 3.5.2 Quantity and details of preserving it

Top soil is collected at the earmarked place on monthly basis on the total area of 302280 sq. meters (30.22 Ha). Month wise top soil preservation details are given as follows:-

| Sl No. | Month | Quantity of top soil in $m^3$ |
|---|---|---|
| 1 | Dec.12 | 78 |
| 2 | Jan.13 | 221 |
| 3 | Feb.13 | 65 |
| 4 | Mar.13 | 78 |
| 5 | April.13 | 52 |
| 6 | May.13 | 65 |
| 7 | Jun.13 | 377 |

The details of preserving it are as follows:-

- Top soil removed will be stock piled only when it is impractical to promptly redistribute on required area.
- Stock piled top soil shall be selectively placed on pre designed area.
- A vegetative cover will be generated immediately on the stock pile to prevent erosion.

## 3.6 MANAGEMENT OF COAL REJECTS FROM WASHERY

There is no proposal for Coal Washery for this mine. Un-washed crushed coal from Coal Handling Plant / Silo is being dispatched to power stations and other customer through MGR and public railway system.

## 3.7.0 INFRASTRUCTURE

### 3.7.1 Details of existing infrastructural facilities

Several infrastructures have been provided that includes:

i. Workshop facilities
ii. Office complex
iii. Townships
iv. Coal Handling Plants
v. Railway siding for transportation of coal
vi. Power Network including sub-stations
vii. Industrial and municipal effluent treatment plants
viii. Community facilities

### 3.7.2 Decommissioning proposed and their dismantling and disposal proposal

At the end of mining operations, it is proposed to decommission the Industrial infrastructures. However, before such decommissioning other infrastructures like office complex, residential complex, roads, pipelines and transmission line and community facilities, the possibility of re-use of these infrastructures for the neighboring mines shall be explored.

Salvaged materials/equipment would be used for creating infrastructures facilities for coal mines that are likely to be developed in the coalfield in future. The unusable materials will be disposed off (including the hazardous materials, if found any, according to conditions imposed while granting authorization for handling hazardous materials). After decommissioning of industrial infrastructure facilities, the leasehold area will be leveled.

The community facilities developed during the mine life like educational facilities, health facilities etc. would be continued even after the mine closure. The final closure plan will envisage interaction of mining company with the State or local bodies for running these facilities.

## 3.8 DISPOSAL OF MINING MACHINERY

The machineries that can be used would be diverted to new/existing projects. Other machineries that have exhausted its life will be disposed off by auctioning and removed from the site.

## 3.9 SAFETY & SECURITY

While carrying out all kinds of mining and allied activities in the mine, the safety rules in force as per Rules& Regulations made under Mines Act, 1952 is being observed and required safety measures are taken. There will be various elements of safety & security at the time of mine closure, which will be dealt under above Rules & Regulations. The Safety & Security hazard include the followings.

**Safety hazards including management of fire:**

In the Final mine closure plan, action for control of likely fire areas of the mines will be discussed. Action will also be suggested to cover all the safety aspects.

**Management of Pit Slopes and Waste Dumps:**

The final quarry slopes has been so designed and then subsequently developed that after the closure of the mine, there is no likelihood of any slope failure. The final slope of the quarry has been designed with above consideration. However, strict compliance with the proposed final slope of quarry would be made as given in Quarry & Surface Layout Plan and subsequent slope stability studies.

**Waste Dumps:**

The external waste dump shall be developed as per the proposed design so that slope failures do not create any safety hazard to the local community. The external dump will be formed in number of decks, each deck will have 30 m (maximum) height & slope of $37^{o}$ (maximum) to avoid dump slope failure, overall dump slope shall be maintained within $28^{o}$. Waste dumps shall be provided with garland drains and vegetation cover on surface of these dumps.

**Fencing around mined out area:**

To prevent illegal mining and considering safety of human & fauna, mined out area shall be properly fenced and all the entries to the mine shall be effectively sealed.

**Management of final voids:**

As per mine plan of Jayant OCP, major portion of quarry will be back filled and reclaimed; only an area of 251.00 Ha void with batter would turn out to be void. In due course of time, dip side of void will be filled with rain & ground water. This water reservoir may be developed for pisci-culture.

At the time of final closure of mine, fencing with RCC post and barbed wire will be erected around the water body.

To maintain proper depth of water amicable for pisci-culture, the void will be back filled with OB dump material to certain height. In the final mine closure plan, design of voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation wherever possible and for hydro reclamation wherever feasible.

The final stage reclaimed dump plan is given in **Plate-5.**

## 3.10.0 ECONOMIC REPERCUSSIONS OF CLOSURE OF MINE

**Continued Engagement of Employees:** The total manpower of Jayant OCP will be 2690. Near the end of the mine life, manpower will reduce gradually. The reduction of manpower could be done as per the following options:

i) Natural retirement;

ii) Retraining and redeployment in other mine;

iii) Transfer to other projects.

**Compensation to Employees:** Since employees are to be redeployed on closure of mine, they will continue to enjoy the regular pay and other benefits. As such there is no need for additional compensation.

**Satellite Occupations:** Opportunity for economic activities has grown in secondary and tertiary sectors around the mine. Once the mine closes, some of these activities would be affected. But this effect would not be severe, as there are other mines and townships close to this mine.

**Management of Community Facilities:** The community facilities developed during the mine life like educational facilities, health facilities, water facilities, power facilities etc. would be continued even after the mine closure. A sum of Rs. 259.00 lakhs has been provided in EPR for community development.

The final closure plan will envisage interaction of mining company with the State or local bodies for running these facilities.

**Envisaged Expectation of the Society on Closure of Mine**: The mine extends several community development facilities to the population living in this vicinity. On closure of the mine, these facilities will be maintained.

**Emancipation of PAPs**: The project affected persons (PAPs) will be provided with basic civic facilities on the lines of the management of community facilities dealt above. The final closure plan will envisage interaction of mining company with the State or local bodies for running these facilities.

## 4.0 **Time scheduling for Abandonment**

Mine closure in terms of progressive internal and external dumping, technical &biological reclamation is concurrent with the mining process. With present rate of production life of Jayant mine is expected to operate up to the year 2033-34.

Detailed mine closure plan shall be prepared & submitted before actual closure. However, tentative closure activities at the time of mine closure are scheduled below:

| Sl. No. | Activities | Year after closure | | | | |
|---|---|---|---|---|---|---|
| | | 1st Yr. | 2nd Yr. | 3rd Yr. | 4th Yr. | 5th Yr. |
| 1. | Mine Pit & Dump Management | | | | | |
| 2. | Pit water body Management | | | | | |
| 3. | Plantation and its after care | | | | | |
| 4. | Disposal of Mining Machinery | | | | | |
| 5 | Infrastructure Dismantling | | | | | |
| 6 | Environmental Monitoring | | | | | |
| 7 | Fencing | | | | | |

## 5.0 **Abandonment Cost**

Calculation for amount to be submitted in Escrow account each year

Mine lease hold area of Jayant OCP = 3177.171 Ha

WPI for August 2009 = 129.6 (Base year 2004-05)

WPI for April 2018 = 116.8 (Base year 2011-12)

Linking Factor for the Base year 2004-05 = 1.561

WPI for April 2018 = 182.3 (Base year 2004-05)

Mine closure cost/ Ha according to WPI of 2009 = Rs. 6 lakhs

Mine closure cost/Ha according to WPI of April 2018 = Rs. 8.43982 lakhs

Mine closure cost according to April rate = Rs. 8.43982 /Ha X 3177.171 Ha = Rs. 26814.75135 lakhs……..(i)

Amount deposited up to 2017-18 Escrow account = Rs. 17757.88 lakhs……..(ii)

Balance mine closure cost = (i) – (ii)= Rs. 9056.87135

Amount to be deposited in first year i.e. 2018-19 = Balance mine closure cost/life of mine from 2018-19 = Rs. 9056.87135/16 =Rs. 566.05446 lakhs

The amount deposited in the following years with 5 % increment (as given in mine closure guidelines) is given in the following table:

**Annual Mine Closure Cost for Jayant OCP**

| SL. NO. | YEAR | Cost in Rs.Lakhs |
|---|---|---|
| 1 | March. 2019 | 566.05446 |
| 2 | March. 2020 | 594.35718 |
| 3 | March. 2021 | 624.07504 |
| 4 | March. 2022 | 655.27879 |
| 5 | March. 2023 | 688.04273 |
| 6 | March. 2024 | 722.44487 |
| 7 | March. 2025 | 758.56711 |
| 8 | March. 2026 | 796.49547 |
| 9 | March, 2027 | 836.32024 |
| 10 | March, 2028 | 878.13625 |
| 11 | March, 2029 | 922.04306 |
| 12 | March, 2030 | 968.14521 |
| 13 | March, 2031 | 1016.55247 |
| 14 | March, 2032 | 1067.38009 |
| 15 | March, 2033 | 1120.74909 |
| 16 | March, 2034 | 1176.78654 |
| **TOTAL :** | | **13391.42860** |

*****It has been estimated that typically closure cost for an open cast will come around six lakhs per hectare of the total project area at current price level (Aug 2009) and these rates will stand modified based on the whole sale price index as notified by Government of India from time to time.

**Table1: Progressive and Final Mine Closure Cost Distribution of Jayant OCP**

| Sl. No | Activity | Mine Closure Cost (% weightage) | Closure Cost (Rs. lacs) | Remarks |
|---|---|---|---|---|
| A | **Dismantling of Structure** | | | To be included in final mine closure plan |
| | Service Buildings | 0.2 | 26.78286 | |
| | Residential Buildings | 2.67 | 357.55114 | |
| | Industrial structures like CHP, Workshop, field sub-station etc. | 0.3 | 40.17429 | |
| B | **Permanent Fencing of mine void and other dangerous area** | | | To be included in final mine closure plan |
| | Random rubble masonry of height 1.2 m including leveling up in cement concrete 1:6:12 in mud mortar | 1.5 | 200.87142 | |
| C | **Grading of high wall slopes** | | | To be included in final mine closure plan |
| | Leveling and grading of highwall slopes | 1.77 | 237.02829 | |
| D | **OB Dump Reclamation** | | | 71% for progressive and 17.66% for final mine closure. |
| | Handling/Dozing of OB dump and backfilling | 88.66 | 11872.84060 | |
| | Technical and Bio-reclamation including plantation and post care | 0.4 | 53.56571 | Equal weightage throughout the life of the mine. |
| E | **Landscaping** | | | |
| | Landscaping of the open space in leasehold area for improving its aesthetics and eco value | 0.3 | 40.17429 | Equal weightage throughout the life of the mine. |
| F | **Plantation** | | | |
| | Plantation over cleared area obtained after dismantling | 0.5 | 66.95714 | To be included in final mine closure plan |
| | Plantation around the quarry area and in safety zone | 0.2 | 26.78286 | Equal weightage throughout the life of the mine. |
| | Plantation over the external OB dump | 0.02 | 2.67829 | Equal weightage throughout the life of the mine. |
| G | **Post Closure Environment Monitoring/testing of parameters for three years** | | | |
| | Air quality | 0.22 | 29.46114 | For three years after mine closure. |
| | Water quality | 0.2 | 26.78286 | |
| H | **Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people)** | 0.26 | 34.81771 | Equal weightage throughout the life of the mine. |
| I | **Miscellaneous and other mitigative measures** | 2.0 | 267.82857 | Equal weightage throughout the life of the mine. |
| J | **Manpower cost for supervision** | 0.8 | 107.13143 | To be included in final mine closure plan |
| | **TOTAL** | | **13391.42860** | |

The mine closure cost has been estimated as Rs. **13391.42860** lakhs. Other than Mine closure activities this cost also include all post environmental monitoring cost for 3 years, supervision charges for 3 years, power cost, protective and rehabilitation measures including their maintenance and monitoring, miscellaneous charges etc.

This cost has been estimated based on the guide line provided by Ministry of Coal i.e**.** Rs. 8.43982(April-2018) lakhs per Hectare of the mine lease hold area of 3177.171 ha. However, this is subject to modification based on wholesale price index as notified by Govt. of India from time to time.

The above fund will be generated annually over the remaining life of the mine i.e. 16 years from 2018-19.The annual closure cost is computed considering the total lease hold area at the above mentioned rate and dividing the same by the mine life.

An amount equal to the annual cost is to be deposited each year throughout the mine life compounded @5% annually.

## 6.0 Financial Assurance

For financial assurance, Northern Coal Field Ltd has opened an Escrow Account in Union Bank of India (A/c No. 391703800000527 & 391703800000926), with the Coal Controller Organization (on behalf of the Central Government) as exclusive beneficiary and has informed the same to Coal Controller, Kolkata. The above annual closure cost compounded @ 5% annually will be deposited annually for 16 years. Year wise deposition of closure cost is given in **section 5.0**. The amount being deposited will be reviewed with such periodicity as deemed fit by the Coal Controller.

Mining is to be carried out in a phased manner initiating afforestation/reclamation work in the mine out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mine. Up to 80% of the total deposited amount including interest accrued in the Escrow account may be released after every five years in line with the periodic examination of

the Closure Plan as per Clause 3.1 of the Annexure of the guidelines. The amount released should be equal to expenditure incurred on the Progressive Mine Closure in past five years or 80% whichever is less. The balance amount at the end of the Final Mine Closure shall be released to mine owner/leaseholder on compliance of all provisions of Closure Plan duly signed by the lessee to the effect that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, court etc. and duly certified by the Coal Controller.

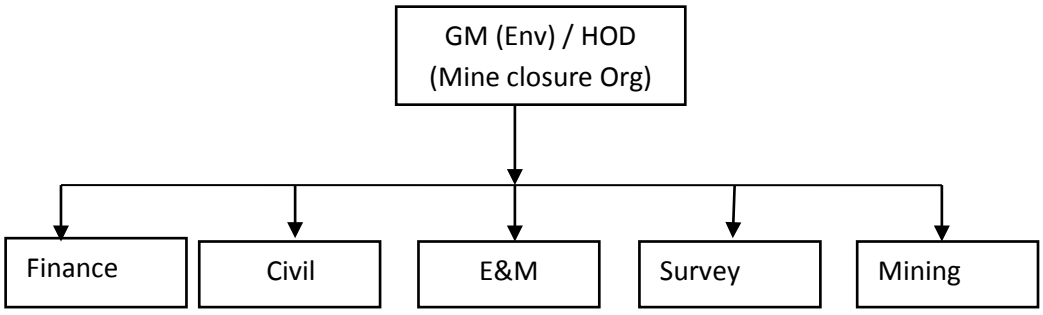
An agreement, outlining detailed terms and conditions of operating the Escrow Account, shall be executed amongst the mining company, the Coal Controller and the concerned bank in order to give effect this.

## 7.0 Responsibilities of Mine Closure

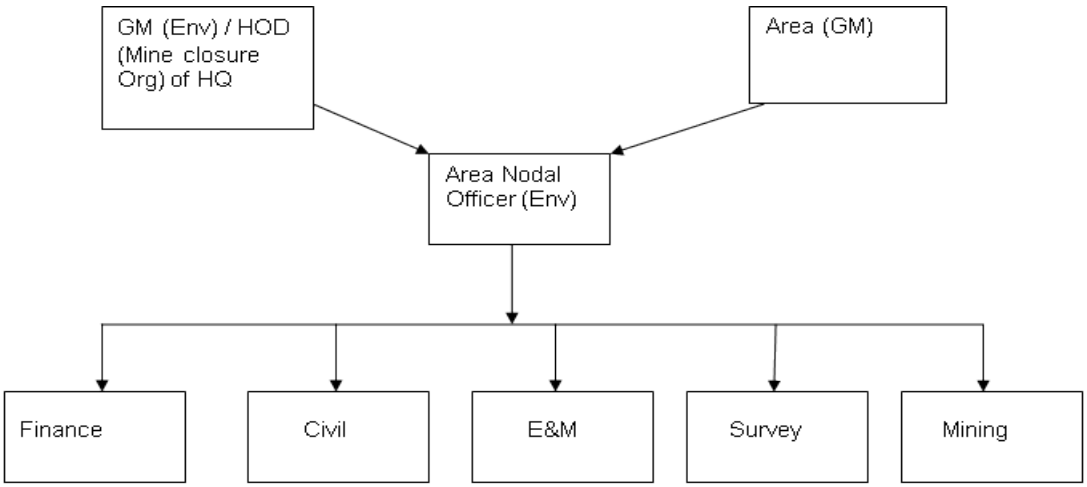
For the purpose of monitoring of mine closure activities, the unit as well as area and HQ levels of the production company should set standard system and form a mine closure cell. The team of monitoring at different level should consist of member each from Mining, Environment, E & M, Finance, Civil and Survey cadre etc.

Mine Closure Organization has to be created in all subsidiaries and all areas of the subsidiaries. This organization is to be headed by a nodal officer preferably GM (Environment)/ HOD (Mine Closure Org.) of the subsidiary at the Head Quarters. Below this Officer will be the Area Nodal Officer, preferably HOD (Env.) of the Area. The organization of the HQ and area will consist of executives from Finance, Civil, E&M, Mining and Survey. Organization chart is given below:

**Mine Closure Organization at HQ Level**




**Mine Closure Organization at Area Level:**




Team should keep the accounting of technical and financial impacts of different mine closure activities stated in Mine Closure Plan.

The company should also prepare accounting methodology by introducing separate code for each activity. All the expenditure should be booked under the said prefixed code as also suggested by Finance Division.

This will help CMPDIL or any other agency under Mine Closure Guidelines to monitor mine closure activities of any mine of Production Company. Company should have sufficient documentary evidences for reimbursement from the Escrow account (duly signed by the above MCP committee) after each progressive stage as well as after final stage of mine closure. Apart from above documentary evidences monitoring should also include the following:

(i) Satellite imagery of plantation.

(ii) Audio – Visual documentation of different mine closure activities.

As per final MCP, provision of additional fund to be added/assessed and included in final MCP. For abandoned and closed mines if there is no provision of escrow account the subsidiary has to provide fund as required.

## 8.0 Provision for Mine closure

The mine owner shall be required to obtain a mine closure certificate from Coal Controller to the effect that the protective, reclamation and rehabilitation works in accordance with the approved mine closure plan/final mine closure plan have been carried out by the mine owner for surrendering the reclaimed land to the State government concerned.

The balance amount at the end of the final Mine Closure shall be released to mine owner on compliance of all provisions of Closure Plan duly signed by the mine owner to the effect that said closure of mine complied with all statutory rules, regulations, orders made by the Central or State government, statutory organizations, court etc. and duly certified by the coal Controller. This should also indicate the estimated extractable coal reserves and coal actually mine out.

If the coal Controller has reasonable grounds for believing that the protective, reclamation and rehabilitation measures as envisaged in the approved mine closure plan in respect of which financial assurance was given has not been or will not be carried out in accordance with mine closure plan, either fully or partially, coal controller shall give the mine owner a written notice of his intention to issue the orders for forfeiting the sum assured at least thirty days prior to the date of the order to be issued after giving an opportunity to be heard.

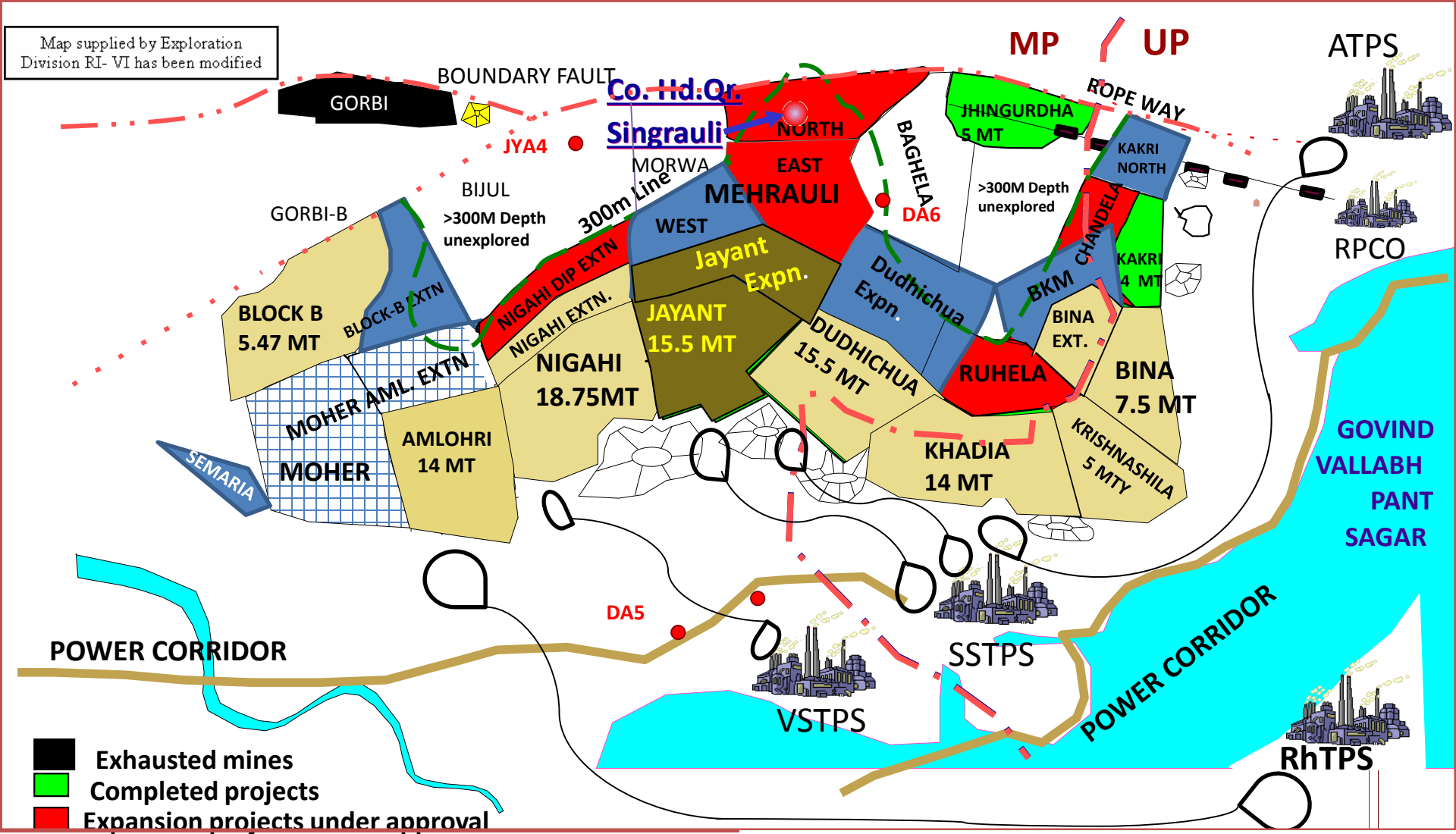



PLATE NO.-1



COSTOMER: NORTHERN COALFIELDS LTD.

MINE CLOSURE PLAN FOR JAYANT EXPN. OCP

JOB NO. 151606104

SUBJECT: PROJECT LOCATION PLAN OF JAYANT OCP

| Activity | Name | Designation |
|---|---|---|
| Modified | D.Sarkar | JSA |
| Checked | P.Chansoriya | Manager (Env.) |
| Approved | V.N.Dupattawala | HOD (Env.) |

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ISO 9001 Company

SCALE : NTS

Sheet. 1 of 1

R6 ENV 400029

REV. NO. 1

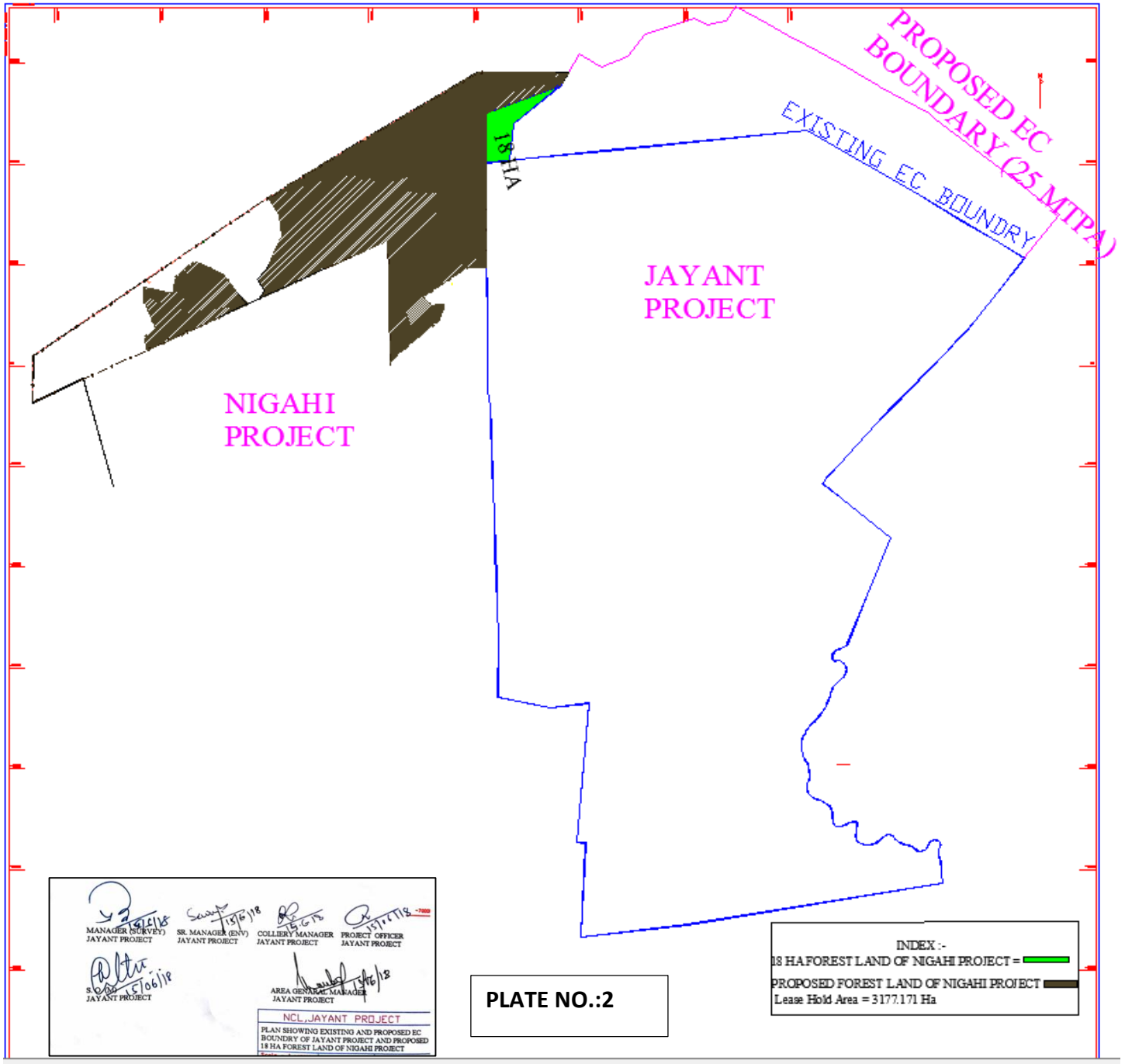
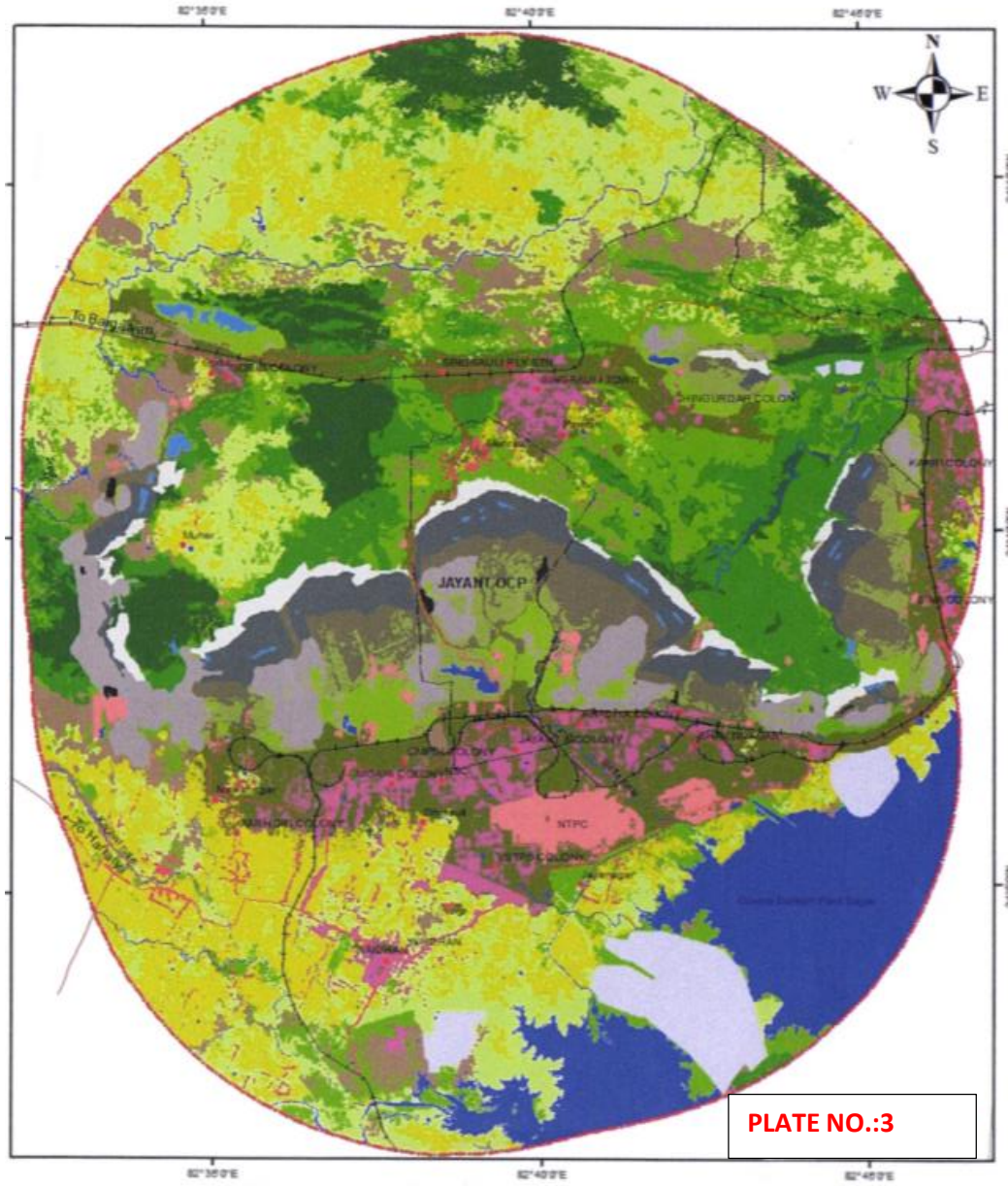

PROPOSED EC
BOUNDARY (25 MTPA)
EXISTING EC BOUNDRY
18 HA
JAYANT
PROJECT
NIGAHI
PROJECT
MANAGER (SURVEY)
JAYANT PROJECT
SR. MANAGER (ENV)
JAYANT PROJECT
COLLIERY MANAGER
JAYANT PROJECT
PROJECT OFFICER
JAYANT PROJECT
S.O.(S)
JAYANT PROJECT
AREA GENERAL MANAGER
JAYANT PROJECT
NCL,JAYANT PROJECT
PLAN SHOWING EXISTING AND PROPOSED EC BOUNDRY OF JAYANT PROJECT AND PROPOSED 18 HA FOREST LAND OF NIGAHI PROJECT
INDEX :-
18 HA FOREST LAND OF NIGAHI PROJECT =
PROPOSED FOREST LAND OF NIGAHI PROJECT
Lease Hold Area = 3177.171 Ha

**PLATE NO.:2**

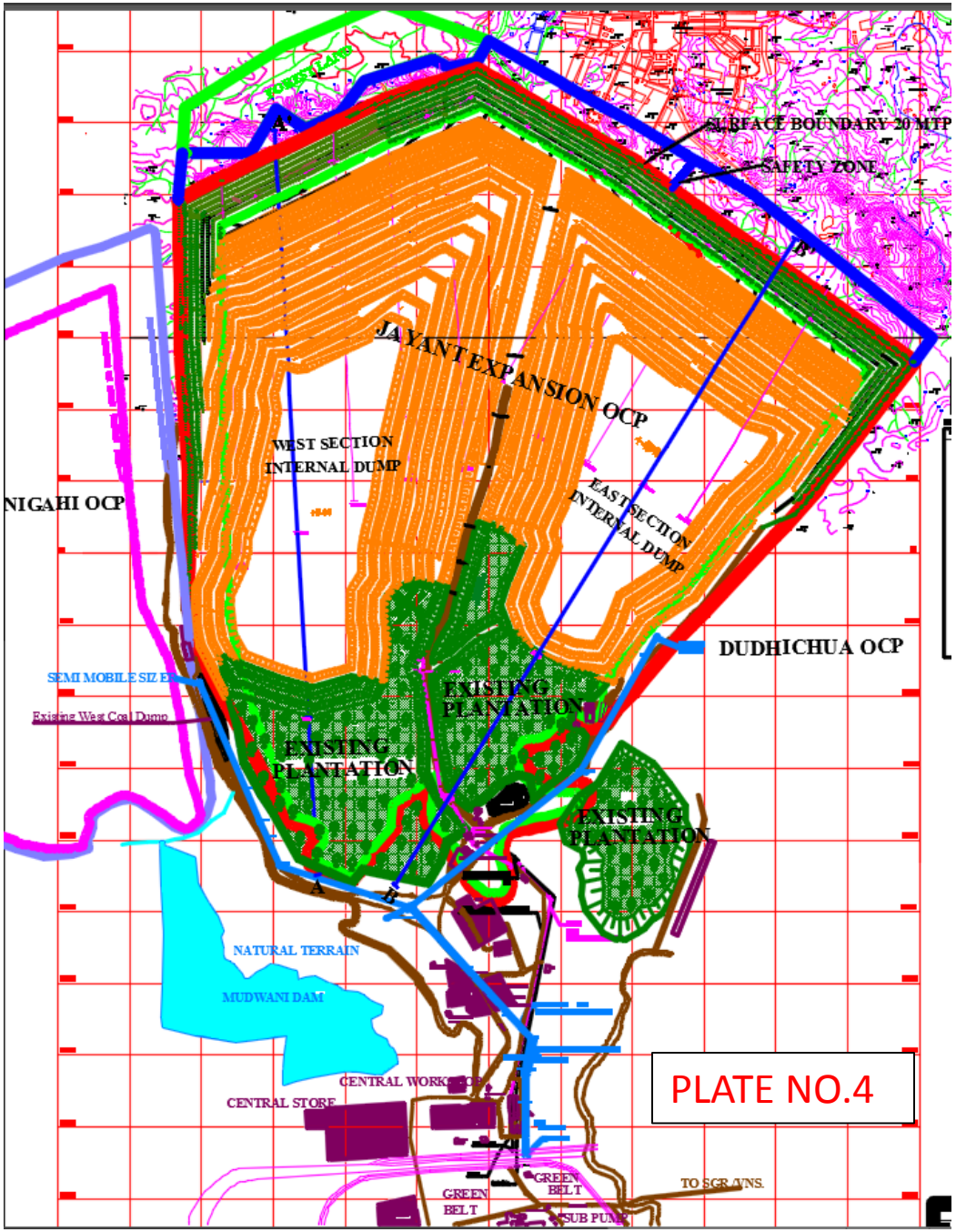


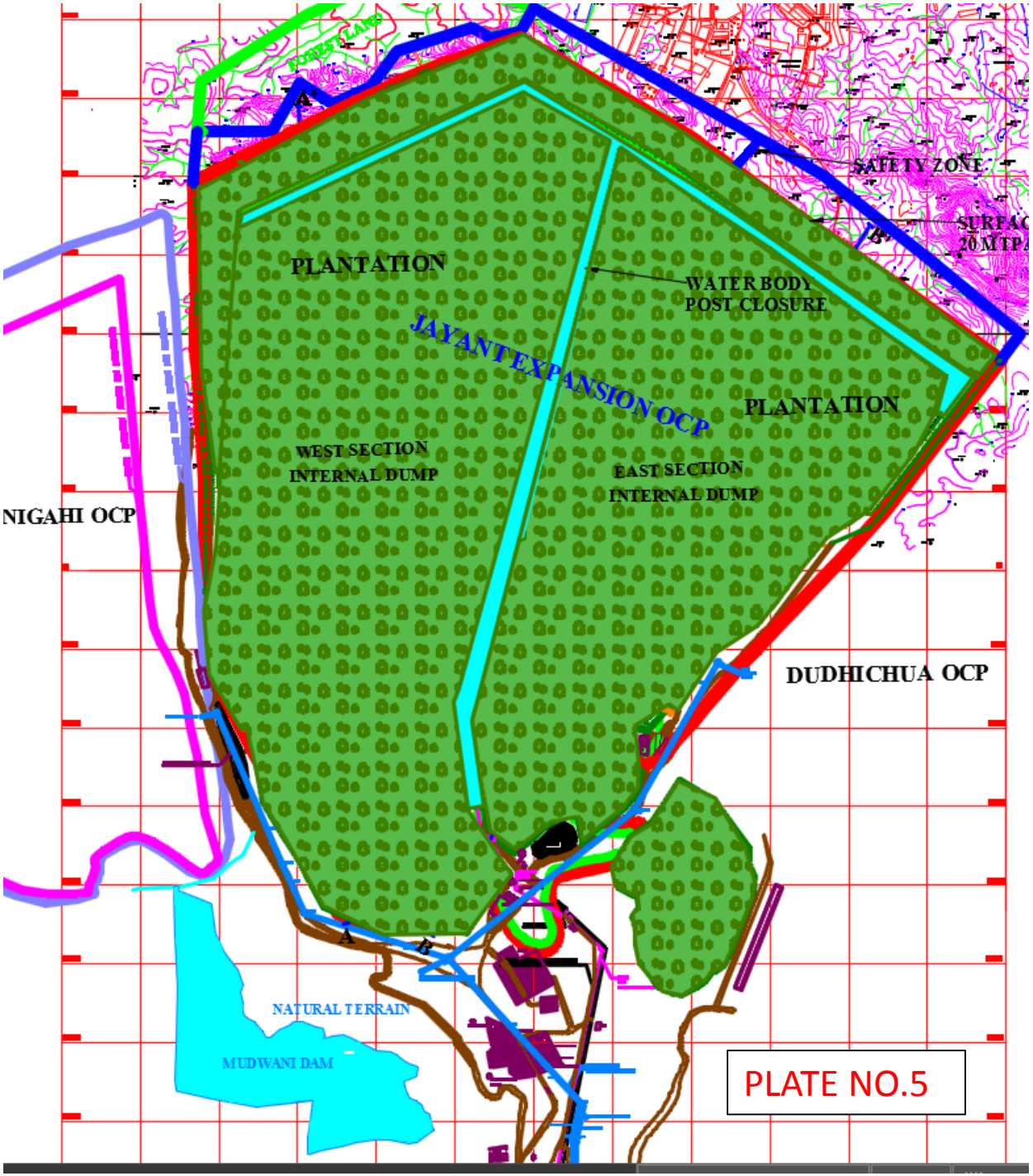

Area Statistics - Jayant OCP (2017)

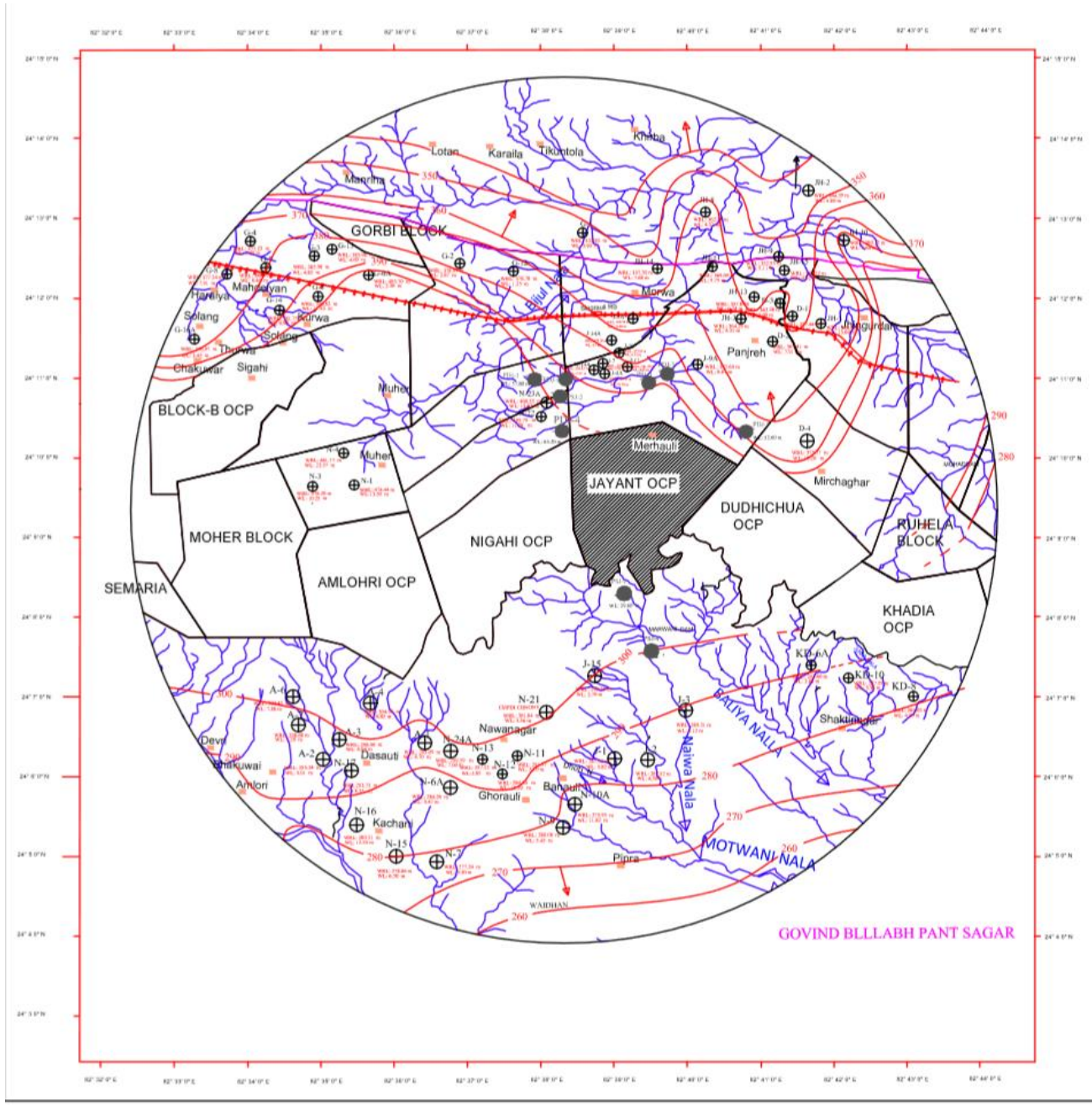
| Classes | | Colour | Core Zone | | Buffer Zone | |
|---|---|---|---|---|---|---|
| Level-I | Level-II | | Area ($Km^2$) | % of Total | Area ($Km^2$) | % of Total |
| | Dense Forest | | 0.00 | 0.00 | 30.00 | 5.39 |
| orest Land | Open Forest | | 0.38 | 1.31 | 48.80 | 8.76 |
| | **Total Forest Land** | | **0.38** | **1.31** | **78.80** | **14.15** |
| | **Scrubs** | | **3.63** | **12.54** | **61.62** | **11.06** |
| | Social Forestry | | 3.69 | 12.74 | 51.80 | 9.30 |
| antation | Plantation on OB | | 2.07 | 7.15 | 10.65 | 1.91 |
| ea | Plantation on Backfill | | 4.21 | 14.53 | 9.60 | 1.72 |
| | Orchard | | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Total Plantation Area** | | **9.97** | **34.42** | **72.05** | **12.93** |
| griculture | Crop land | | 0.65 | 2.24 | 62.83 | 11.28 |
| nd | Fallow Land | | 0.24 | 0.83 | 101.43 | 18.21 |
| | **Total Agriculture Land** | | **0.89** | **3.07** | **164.26** | **29.49** |
| | Waste Land | | 0.27 | 0.93 | 29.35 | 5.27 |
| Vaste Land | Sand Body | | 0.01 | 0.03 | 0.06 | 0.01 |
| | Fly Ash Pond | | 0.00 | 0.00 | 15.08 | 2.71 |
| | **Total Waste Land** | | **0.28** | **0.96** | **44.49** | **7.99** |
| | Coal Quarry | | 3.96 | 13.67 | 14.94 | 2.68 |
| | Barren OB Dump | | 2.47 | 8.53 | 20.64 | 3.71 |
| | Back Fill | | 3.51 | 12.12 | 16.65 | 2.99 |
| lining Area | Coal Dump | | 0.24 | 0.83 | 0.29 | 0.05 |
| | Water Filled Qry | | 0.06 | 0.21 | 1.57 | 0.28 |
| | Advance Quarry | | 1.02 | 3.52 | 7.25 | 1.30 |
| | **Total Mining Area** | | **11.26** | **38.88** | **61.34** | **11.01** |
| | Urban Settlements | | 1.34 | 4.63 | 18.44 | 3.31 |
| ettlements | Rural Settlements | | 0.45 | 1.55 | 2.24 | 0.40 |
| | Industrial Settlements | | 0.33 | 1.14 | 9.09 | 1.63 |
| | **Total Settlement Area** | | **2.12** | **7.32** | **29.77** | **5.34** |
| Vater Body | **River/ Ponds** | | **0.44** | **1.52** | **44.76** | **8.03** |
| | | | | | | |
| | **Total Area** | | **28.97** | **100.00** | **557.08** | **100.00** |

**Legend**

- Settlements
- stream
- Core zone
- Railway line
- Buffer zone-10 km
- Roads


SURFACE BOUNDARY 20 MTP
SAFETY ZONE
JAYANT EXPANSION OCP
WEST SECTION
INTERNAL DUMP
EAST SECTION
INTERNAL DUMP
NIGAHI OCP
DUDHICHUA OCP
SEMI MOBILE SIZER
Existing West Coal Dump
EXISTING
PLANTATION
EXISTING
PLANTATION
EXISTING
PLANTATION
NATURAL TERRAIN
MUDWANI DAM
CENTRAL STORE
GREEN
BELT
GREEN
BELT
TO SGR/VNS.
PLATE NO.4


FOREST LAND
SAFETY ZONE
PLANTATION
WATER BODY
POST CLOSURE
JAYANT EXPANSION OCP
PLANTATION
WEST SECTION
INTERNAL DUMP
EAST SECTION
INTERNAL DUMP
NIGAHI OCP
DUDHICHUA OCP
NATURAL TERRAIN
MUDWANI DAM
PLATE NO.5




PRE-MONSOON (May'17) WATER TABLE CONTOUR

MAP FOR JAYANT OCP, SINGRAULI COALFIELD

N

## INDEX

- Buffer Zone
- Dug well KD-8
- Piezometer PSJ-1
- Village
- River/Nadi
- Water table contour (In mamsl)
- Railway track

**Plate No: 6**



Customer: NORTHERN COALFIELDS LIMITED

Job Title: GROUNDWATER MONITORING REPORT FOR QUARTER ENDING JUNE'17 — Job No. 171806208

Subject: PRE-MONSOON (May'17) WATER TABLE CONTOUR MAP OF JAYANT OCP

| Activity | Name | Designation | Signature | Date |
|---|---|---|---|---|
| Prepared by | | | | |
| Processed by | | | | |
| Checked by | | | | |
| Approved by | | | | |

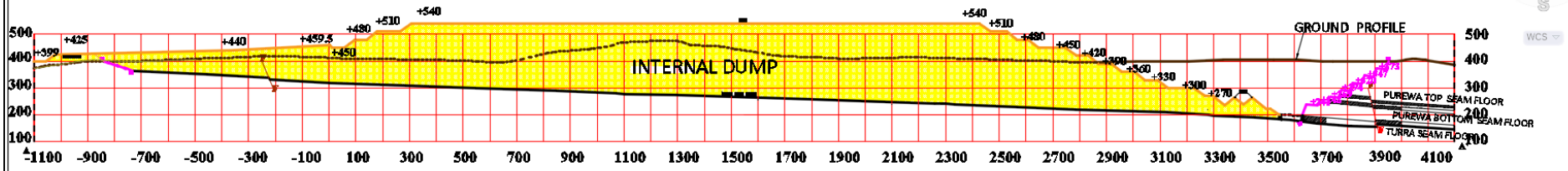
CMPDI ISO 9001 Company

Sheet

Drg.No. HC XXX X00XXX REV. No.

# SHOWING DUMP PROFILE AT THE END OF MINING OPERATION

**DUMP SECTION A - A'**




# SHOWING DUMP PROFILE AT THE END OF MINING OPERATION

**DUMP SECTION B - B'**

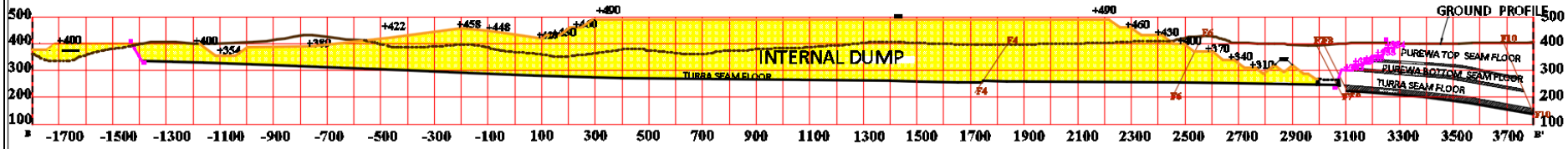
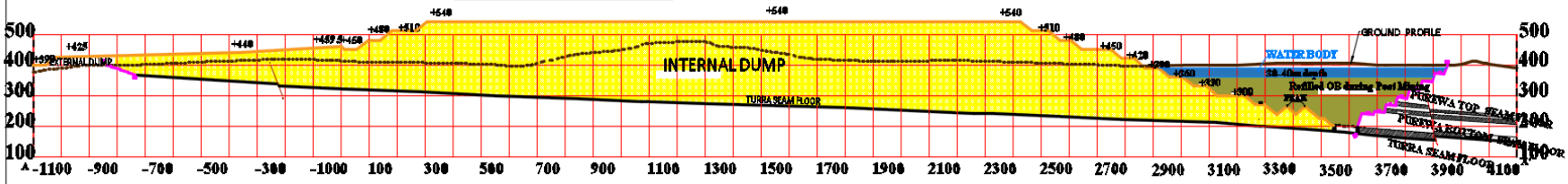



PLATE NO.7(a)

## SHOWING DUMP PROFILE AT THE END OF MINING OPERATION

### DUMP SECTION A - A'




## SHOWING DUMP PROFILE AT THE END OF MINING OPERATION

### DUMP SECTION B - B'

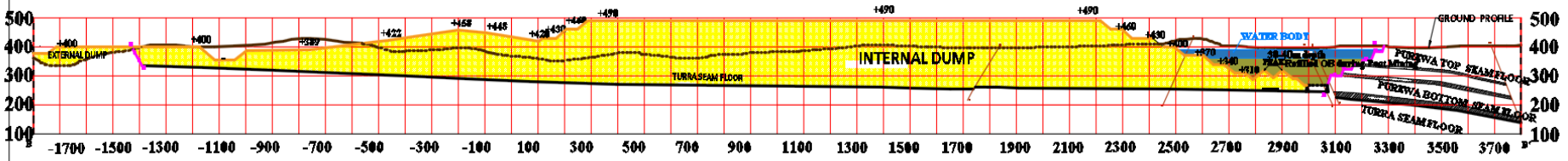



PLATE NO.7(b)

सीएमपीडीआई

cmpdi

*A Mini Ratna Company*

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**FOR COMPANY USE ONLY**
**RESTRICTED**

The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL / Government.

Revised

# ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENTAL MANAGEMENT PLAN

**(As per EIA Notification-2006)**

**FOR**

# JAYANT (EXPN.) OPENCAST PROJECT

**(Normative Capacity–20.00 Mtpa)**

**(Peak Capacity–25.00 Mtpa)**

## NORTHERN COALFIELDS LIMITED

**June - 2018**

*Prepared by*


**REGIONAL INSTITUTE – VI**
**P.O. : JAYANT COLLIERY**
**DISTT. :SINGRAULI (M.P.), 486 890**

# ENVIRONMENTAL IMPACT ASSESSMENT &

# ENVIRONMENTAL MANAGEMENT PLAN

## (As per EIA Notification-2006)

### FOR PEAK CAPACITY-25.00 MTPA of

# JAYANT (EXPN.) OPENCAST PROJECT

## (Normative Capacity–20.00 Mtpa )

## (Peak Capacity–25.00 Mtpa )

# NORTHERN COALFIELDS LIMITED

**June - 2018**

***Prepared by***

# CMPDI

**ISO 9001:2000 Company**

**REGIONAL INSTITUTE–VI**
**P.O. : JAYANT COLLIERY**
**DISTT. :SINGRAULI (M.P.), 486 890**

**ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENTAL MANAGEMENT PLAN FOR**

**Jayant Expansion OCP (Normative- 20 MTPA and Peak- 25 MTPA)**

**(As per EIA Notification - 2006)**

| ***PROJECT INFORMATION*** | |
|---|---|
| Name of the project | **Jayant Expansion OCP** |
| **Location :** | |
| - Village | Garda |
| - Tehsil | Waidhan |
| - Name of the Coalfield | Singrauli Coalfield |
| - District | Singrauli |
| - State | Madhya Pradesh |
| Name of the Company | Northern Coalfields Limited |
| Production Capacity (Mtpa)(in ROM) | 1. Existing approved production capacity : 15.50 Mtpa<br>2. Proposed increase in production capacity: Normative.- 20.00 Mtpa<br>Peak – 25.00 Mtpa<br>3. Total production capacity for which environmental clearance sought : - 25.00 Mtpa |
| Lease/Project Area (Ha) | 1. Existing mine lease area : 2704.171 Ha<br>2. Increase in mine lease area due to Expansion: 473.000 Ha<br>3. Total Mine lease area for which environmental clearance sought : 3177.171Ha. : |
| Prepared by QCI Accred. Consultant: | CMPDIL, Gondwana Place, Kanke Road, Ranchi – 834 031<br>(QCI Accreditation Letter No.QCI/NABET/ENV/ACO/16/05/0166 dated 24/05/2016) |

# NORTHERN COALFIELDS LIMITED

# नार्दर्न कोलफील्ड्स लिमिटेड

**(Job No. 1516606104, Revision-02)**

**June - 2018**

***Prepared by***

**CMPDI, REGIONAL INSTITUTE–VI**

**P.O.- Jayant, Distt.-Singrauli (MP), 486890**

# ENVIRONMENTAL IMPACT ASSESSMENT &

# ENVIRONMENTAL MANAGEMENT PLAN

**(FOR PEAK CAPACITY OF 25 MTPA)**

# JAYANT EXPN. OPENCAST PROJECT

**(Normative Capacity–20 Mtpa of Raw Coal)**

**(Peak Capacity–25 Mtpa of Raw Coal)**

## CONTENTS

# ENVIRONMENTAL IMPACT ASSESSMENT &

# ENVIRONMENTAL MANAGEMENT PLAN

**(FOR PEAK CAPACITY OF 25 MTPA)**

# JAYANT EXPN. OPENCAST PROJECT

**(Normative Capacity–20 Mtpa of Raw Coal)**

**(Peak Capacity–25 Mtpa of Raw Coal)**

## LIST OF PHOTOGRAPHS

# ENVIRONMENTAL IMPACT ASSESSMENT &

# ENVIRONMENTAL MANAGEMENT PLAN

**(FOR PEAK CAPACITY OF 25 MTPA)**

## JAYANT EXPN. OPENCAST PROJECT

**(Normative Capacity–20 Mtpa of Raw Coal)**

**(Peak Capacity–25 Mtpa of Raw Coal)**

## LIST OF ANNEXURES

# LIST OF ANNEXURES

# LIST OF ANNEXURES

# ENVIRONMENTAL IMPACT ASSESSMENT &

# ENVIRONMENTAL MANAGEMENT PLAN
# FOR PEAK CAPACITY OF 25 MTPA
# JAYANT EXPN. OPENCAST PROJECT

**(Normative Capacity–20 Mtpa of Raw Coal)**

**(Peak Capacity–25 Mtpa of Raw Coal)**

## LIST OF PLATES

# LIST OF PLATES

# CHAPTER-I

# INTRODUCTION

## 1.1 Purpose of the report

The Ministry of Coal has decided to increase the coal production from NCL coal mines due to increased demand of power grade coal by thermal power stations. Therefore NCL has planned to increase the coal production from its Jayant Opencast Project from existing capacity of 15.50 MTPA to 25.00 MTPA.

To meet the growing demand of coal, it is now proposed to increase the production capacity of Jayant OCP. To augment the production and for an optimum life of the project, it is necessary to encompass the additional coal reserves on the dip side from the Mehrauli East and West Geological Block.

Accordingly an Expansion Project Report (EPR) for Jayant OCP (Normative - 20MTPA and Peak – 25 MTPA) has been prepared. The EPR has been approved in the 202nd NCL Board meeting held on 1st March 2016 and by Coal India Board vide letter no. CIL:XI(D): 04112:2017:1760 dated 16th May' 2017 **(Refer Annexure No.-II).** The updated EPR with the base date of January, 2016 has been taken for preparation of this document.

The project has Environmental Clearance for 15.50 MTPA, vide MoEF letter no. J-11015/382/2008-IA-II (M) dated 10.12.2008 *and its corrigendum issued vide No. J-11015/382/2008-IA.II(M) dated 15th April 2009*.**(Refer Annexure No.-III)**

.

The Environmental Appraisal Committee (EAC on Thermal Power & Coal Mining of MoEF&CC) meeting held on 30-31 May 2017 has recommended the Project for grant of Terms of Reference. Based on the recommendations of the EAC, the Ministry of Environment, Forest and Climate Change issued TOR vide letter no. J-11015/12/2017-1A.II (M) dated 15th June, 2017 **(Refer Annexure No.-I).** As per TOR letter**,** this EIA/EMP Report based on the scope of work as defined in the standard TOR notified by MoEFCC for such projects/activities under the provisions of the Environment Impact assessment Notification, 2006, and other terms and conditions specified by EAC; has been prepared for EC.
The EAC in its 30th meeting held on 17-18 May 2018 had insisted for clarifications and inputs in respect of the following:

- *Discrepancy in respect of total forest area involved under the project, whether 1180Ha or 1180.171Ha. The same needs to be firmed up and the land use pattern/details to be revised accordingly*.

The total forest area involved in Jayant OCP is 1180.171 Ha. Previously it

had been rounded off to 1180Ha. The total leasehold area for the project is 3177.171Ha. The Mine Closure Plan has accordingly been revised. The land use pattern are accordingly revised in this report.

In accordance with this requirement, the EIA-EMP for Jayant Expansion (Normative 20.00 and peak 25.00 MTPA) opencast project has been prepared for granting the Environmental Clearance from MoEF&CC for peak production of 25.00 MTPA from Jayant Expn. OCP.

## 1.2 Identification of project & project proponent

Jayant Opencast mine is an operating opencast mines in Northern Coalfields Limited. Since 1976, Northern Coalfields Limited, a subsidiary of Coal India Limited is a prime producer of non-coking coal, mainly power grade, in the country. It operates coal mines in the states of M.P. and U.P. It is producing coal from different coal seams of Singrauli coalfields in the districts of Singrauli in M.P. and Sonebhadra in U.P. Mining operation is spread over one coalfields only i.e. Singrauli. Singrauli coalfield is the northern most member of the central Indian coalfields

Singrauli coalfield is located between latitudes 23°47' & 24°12'N and longitudes 81°40' & 82°52'E. The coalfield is about 102 km long from west to east and 45 km wide from north to south occupying a total area of 2202 sq.km

The coalfield is largely located in the Singrauli district of Madhya Pradesh and a small area of 80 sq.km in the extreme north-east lies in the district of Sonebhadra of Uttar Pradesh. Mining of coal at present is confined in the north eastern part of Singrauli coalfield.

The project under consideration is administratively under NCL headed by General Manager. The details are as given under:

| | | |
|---|---|---|
| Name of the proponent | : | Sri Chancal Goswami |
| Mailing Address | : | General Manager<br>Jayant OC Project, Northern Coalfields Ltd.<br>PO. Jayant Colliery.<br>Distt. - SINGRAULI, MADHYA PRADESH<br>PIN- 486 890 |
| Telephone | : | 07805-222228 |

## 1.3 Brief description of nature, size, location of the project and its importance to the country :

The Jayant Opencast Project of Northern Coalfields Limited (NCL) is located in Singrauli Coalfields, in Singrauli district of Madhya Pradesh. It falls within the latitudes $24^0$06’26.08” N to $24^o$11’40.86” N and Longitude $82^o$38’2.01” E to $82^o$40’55.64” E (Topo-Sheet No.63L/12 of the Survey of India on 1:50000

(1976)). The location of the project in the state and district is shown in **Plate No.-1 & Plate No.-2.**

Leasehold area of project in KML format and location on Topographical map in survey of India Topo-sheet has been shown in **Plate No. 1(A) and 1(B)** respectively.

The project is located in the south-central part of the Moher Sub-basin of Singrauli Coalfield and is bounded by Dudhichua and Nigahi Projects on the east and west respectively.

Jayant Project site is well connected by both road and rail. Nearest Railway Station Shaktinagar is about 5 km towards east and Singrauli Station is 12 km from the project office.

Jayant Project area exhibits hilly rugged and undulating topography with general elevation variation from 375m to 424m above MSL. Bijul Nalla, a tributary of Sone River traverses, the north-eastern part of the block.

A numbers of seasonal nallas, flowing from north to south and south to north drain through this area and meet the master drain, the Rihand Dam (Govind Ballabh Pant Sagar, GBP )which is located south of this area and Sone river located North of this area. Bijul Nalla, Motwani Nalla, Balia Nalla, Amjhar Nalla and Tippa Jharia Nalla drain this area.

The climate of this area is tropical with severe summer. The temperature in summer rises as high as 48$^{o}$C in May and June. In winter, temperature comes down to 4$^{o}$C and varies up to 21$^{o}$C.The rainy season is generally from July to September with average rainfall around 1132.70 mm. The Project falls in Seismic Zone-III. No earthquake has been reported in last 10 years.

The grade based on GCV for Turra seam and Purewa Bottom Seam varies mainly from G8 to G14 and that for Purewa Top seam from G9 to G14. The average product mix grade of all the three seams is G10.

The project is mainly linked to Singrauli Super Thermal Power Station (2000 MW) through their own MGR system. The present demand of SSTPS is 11.00 MTPA. There is also arrangement of the Public Railway to dispatch coal to other Thermal Power Stations and other consumers.

**Importance to the Country:**

Energy plays a vital role in the modern world for sustainable development and economic growth. This involves establishment of various up-stream and downstream industries, which result in enhanced energy consumption. In India, coal provides nearly 72.5 % of commercial energy, so the coal sector will remain the mainstay of commercial energy.

The proposed expansion of Jayant Expansion opencast project will help to bridge the gap of demand and supply of power grade coal especially for power sector in India as direct benefit to the nation.

The proposed expansion will also bring enhanced socio-economic benefits to the local population of the project area by way of direct and indirect employment, improvement in infrastructure and growth of ancillary facilities.

## 1.4 Scope of the study :

The Environmental Appraisal Committee (EAC on Thermal Power & Coal Mining of MoEF&CC) meeting held on 30-31 May 2017 has recommended the Project for grant of Terms of Reference. Based on the recommendations of the EAC, the Ministry of Environment, Forest and Climate Change issued TOR vide letter no. J-11015/12/2017-1A.II (M) dated 15th June, 2017 **(Refer Annexure No.-I).**

This final EIA/EMP report with public consultation has been prepared, subject to the scope of work as defined in the standard TOR notified by MOEFCC for such projects/activities under the provisions of the Environment Impact assessment Notification, 2006., and other terms and conditions specified as under :-

- Cumulative impact of all the existing industrial activities in the study area and also those in the pipeline/proposed, shall be studied to arrive at a comprehensive picture and planning of adequate environmental safeguards. (Chapter-VII (7.1))

- For baseline air quality assessment, additional monitoring stations (4-5 nos.) in the downwind areas need to be set up and included in the air quality modelling. (Chapter-IV (4.2.1.1) and Chapter-VII (7.1)).

- Ecological restoration and mine reclamation to be done with local/native species found in the area. (Chapter-IV (4.5.2.3) and Chapter-VII (7.1).

**Standard Terms of Reference (TOR) for Opencast Mines for EIA studies**

| Sl. No. | Terms of Reference for EIA studies | Compliance evidence in EIA-EMP |
|---|---|---|
| (i) | An EIA-EMP Report shall be prepared for **……** MTPA rated capacity in an ML/project area of …….ha based on the generic structure specified in Appendix III of the EIA Notification, 2006. | Chapter-I (1.5) |
| (ii) | An EIA-EMP Report would be prepared for ……. MTPA rated capacity to cover the impacts and environment management plan for the project specific activities on the environment of | Chapter-I (1.5) |

| Sl. No. | Terms of Reference for EIA studies | Compliance evidence in EIA-EMP |
|---|---|---|
| | the region, and the environmental quality encompassing air, water, land, biotic community, etc. through collection of data and information, generation of data on impacts including prediction modeling for **……..**MTPA of coal production based on approved project/Mining Plan for …….MTPA. Baseline data collection can be for any season (three months) except monsoon. | |
| (iii) | A topo-sheet specifying locations of the State, District and Project site should be provided. | Chapter- I (1.3) Plate No: 1, 1(A), 1(B) & 2 |
| (iv) | A Study area map of the core zone (project area) and 10 km area of the buffer zone (1: 50,000 scale) clearly delineating the major topographical features such as the land use, surface drainage pattern including rivers/streams/nallahs/canals, locations of human habitations, major constructions including railways, roads, pipelines, major industries/mines and other polluting sources. In case of ecologically sensitive areas such as Bio-sphere Reserves/national Parks/WL sanctuaries/ Elephant Reserves, forests (Reserved/Protected), Migratory corridors of fauna, and areas where endangered fauna and plants of medicinal and economic importance found in the 15 km study area should be given. | Plate No.-8 Chapter-III (3.1.6) |
| (v) | Land use map (1: 50,000 scale) based on a recent satellite imagery of the study area may also be provided with explanatory note on the land use. | Chapter-III (3.6 C ), plate no.-17 |
| (vi) | Map showing the core zone delineating the agricultural land (irrigated and unirrigated, uncultivable land as defined in the revenue records, forest areas (as per records), along with other physical features such as water bodies, etc. should be furnished. | Plate no.-3 |
| (vii) | A contour map showing the area drainage of the core zone and 25 km of the study area (where the water courses of the core zone ultimately join the major rivers/streams outside the lease/ project area) should also be clearly indicated in the separate map. | Plate No.-5 & 6 |
| (viii). | A detailed Site plan of the mine showing the proposed break-up of the land for mining operations such as the quarry area, OB dumps, green belt, safety zone, buildings, infrastructure, | Plate no.-4 & 21 |

<table>
<tr><th>Sl. No.</th><th>Terms of Reference for EIA studies</th><th>Compliance evidence in EIA-EMP</th></tr>
<tr><td></td><td>CHP, ETP, Stockyard, township/colony (within and adjacent to the ML), undisturbed area -if any, and landscape features such as existing roads, drains/natural water bodies to be left undisturbed along with any natural drainage adjoining the lease /project areas, and modification of thereof in terms of construction of embankments/bunds, proposed diversion/re-channeling of the water courses, etc., approach roads, major haul roads, etc. should be indicated.</td><td></td></tr>
<tr><td>(ix)</td><td>In case of any proposed diversion of nallah/canal/river, the proposed route of diversion /modification of drainage and their realignment, construction of embankment etc. should also be shown on the map as per the approval of irrigation and flood control department of the concerned state.</td><td>Chapter–II (2.7.8 F)</td></tr>
<tr><td>(x)</td><td>Similarly if the project involves diversion of any road/railway line passing through the ML/project area, the proposed route of diversion and its realignment should be shown in the map along with the status of the approval of competent authority.</td><td>Chapter–II (2.7.8 F)</td></tr>
<tr><td>(xi)</td><td>Break up of lease/project area as per different land uses and their stage of acquisition should be provided<br><br>LAND USE DETAILS FOR OPENCAST PROJECT should be given as per the following table:
<table>
<tr><th>S. N.</th><th>Land use</th><th>Within ML Area (ha)</th><th>Outside ML Area (ha)</th><th>TOTAL</th></tr>
<tr><td>1.</td><td>Agricultural land</td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Forest land</td><td></td><td></td><td></td></tr>
<tr><td>3.</td><td>Wasteland</td><td></td><td></td><td></td></tr>
<tr><td>4.</td><td>Grazing land</td><td></td><td></td><td></td></tr>
<tr><td>5.</td><td>Surface water bodies</td><td></td><td></td><td></td></tr>
<tr><td>6.</td><td>Settlements</td><td></td><td></td><td></td></tr>
<tr><td>7.</td><td>Others (specify)</td><td></td><td></td><td></td></tr>
<tr><td></td><td>TOTAL</td><td></td><td></td><td></td></tr>
</table></td><td>Chapter-II (2.7.4)</td></tr>
<tr><td>(xii)</td><td>Break-up of lease/project area as per mining plan should be provided.</td><td>Chapter-II (2.7.4)</td></tr>
</table>

| Sl. No. | Terms of Reference for EIA studies | Compliance evidence in EIA-EMP |
|---|---|---|
| (xiii) | Impact of changes in the land use due to the project if the land is predominantly agricultural land/forestland/grazing land, should be provided. | Chapter-IV (4.5.1) |
| (xiii)(a) | One-season (other than monsoon) primary baseline data on environmental quality – air ($PM_{10}$, $PM_{2.5}$, SOx, NOx and heavy metals such as Hg, Pb, Cr, As, etc), noise, water (surface and groundwater), soil - along with one-season met data coinciding with the same season for AAQ collection period should be provided. | Chapter-III (3.4) |
| (xiv) | Map (1: 50, 000 scale) of the study area (core and buffer zone) showing the location of various sampling stations superimposed with location of habitats, other industries/mines, polluting sources, should be provided. The number and location of the sampling stations in both core and buffer zones should be selected on the basis of size of lease/project area, the proposed impacts in the downwind (air)/downstream (surface water)/groundwater regime (based on flow). One station should be in the upwind/upstream/non-impact/non-polluting area as a control station.<br>The monitoring should be as per CPCB guidelines and parameters for water testing for both ground water and surface water as per ISI standards and CPCB classification wherever applicable. Observed values should be provided along with the specified standards. | Chapter-III (3.4) Plate No.- 9 to 15 |
| (xv) | Study on the existing flora and fauna in the study area (10km) should be carried out by an institution of relevant discipline. The list of flora and fauna duly authenticated separately for the core and study area and a statement clearly specifying whether the study area forms a part of the migratory corridor of any endangered fauna should be given. If the study area has endangered flora and fauna, or if the project falls within 15 km of any ecologically sensitive are, or used as a migratory corridor then a comprehensive conservation plan along with the appropriate budgetary provision should be prepared and submitted with EIA-EMP Report; and comments/observation form the CWLW of the State Govt. should also be obtained and furnished. | Chapter-III (3.4.6) Annexure 21 |
| (xvi) | Details of mineral reserves, geological status of the study area and the seams to be worked, ultimate working depth | Chapter-II (2.4 to 2.6), and |

| Sl. No. | Terms of Reference for EIA studies | Compliance evidence in EIA-EMP |
|---|---|---|
| | and progressive stage-wise working scheme until the end of mine life should be provided on the basis of the approved rated capacity and calendar plans of production from the approved Mining Plan. Geological maps and sections should be included. The Progressive mine development and Conceptual Final Mine Closure Plan should also be shown in figures. Details of mine plan and mine closure plan approval of Competent Authority should be furnished for green field and expansion projects. | Chapter–IV (4.8) |
| (xvii) | Details of mining methods, technology, equipment to be used, etc., rationale for selection of specified technology and equipment proposed to be used vis-à-vis the potential impacts should be provided. | Chapter-V (5.2) |
| (xviii) | Impact of mining on hydrology, modification of natural drainage, diversion and channeling of the existing rivers/water courses flowing though the ML and adjoining the lease/project and the impact on the existing users and impacts of mining operations thereon. | Chapter-IV (4.3.1.1) |
| (xix) | Detailed water balance should be provided. The break-up of water requirement for the various mine operations should be given separately. | Chapter-III (3.7), Annexure XIV |
| (xx) | Source of water for use in mine, sanction of the Competent Authority in the State Govt. and impacts vis-à-vis the competing users in the upstream and downstream of the project site, should be given. | Annexure No.-VII and XIV. |
| (xxi) | Impact of mining and water abstraction from the mine on the hydrogeology and groundwater regime within the core zone and 10 km buffer zone including long-term monitoring measures should be provided. Details of rainwater harvesting and measures for recharge of groundwater should be reflected in case there is a declining trend of groundwater availability and/or if the area falls within dark/grey zone. | Annexure No.-XIV. |

| Sl. No. | Terms of Reference for EIA studies | Compliance evidence in EIA-EMP |
|---|---|---|
| | | |
| (xxii) | Impact of blasting, noise and vibrations should be given. | Chapter-IV (4.4) |
| (xxiii) | Impacts of mining on the AAQ and predictions based on modeling using the ISCST-3 (Revised) or latest model should be provided. | Annexure No.-XXIII. |
| (xxiv) | Impacts of mineral transportation within the mining area and outside the lease/project along with flow-chart indicating the specific areas generating fugitive emissions should be provided. Impacts of transportation, handling, transfer of mineral and waste on air quality, generation of effluents from workshop etc, management plan for maintenance of HEMM and other machinery/equipment should be given. Details of various facilities such as rest areas and canteen for workers and effluents/pollution load emanating from these activities should also be provided. | Chapter-IV (4.2 ,4.3) |
| (xxiv)(a) | Effort be made to reduce/eliminate road transport of coal inside and outside mine and for mechanized loading of coal through CHP/ Silo into wagons and trucks/tippers. | Chapter-II (2.7.5) |
| (xxv) | Details of waste OB and topsoil generated as per the approved calendar programme, and their management shown in figures as well explanatory notes tables giving progressive development and mine closure plan, green belt development, backfilling programme and conceptual post mining land use should be given. OB dump heights and terracing based on slope stability studies with a max of $28^{o}$ angle as the ultimate slope should be given. Sections of final dumps (both longitudinal and cross section) with relation to the adjacent area should be shown. | Chapter - II (2.4.8, 2.5) Chapter-IV (4.5.2, 4.8), Plate 23,24 |
| (xxvi) | Efforts be made for maximising progressive internal dumping of O.B., sequential mining, external dump on coal bearing area and later re-handling into the mine void, to reduce land degradation. | Chapter-IV (4.5.1) |

<table>
<tr><th>Sl. No.</th><th>Terms of Reference for EIA studies</th><th>Compliance evidence in EIA-EMP</th></tr>
<tr><td>(xxvii).</td><td>Impact of change in land use due to mining operations and plan for restoration of the mined area to its original land use should be provided.</td><td>Chapter-IV (4.5.2)</td></tr>
<tr><td>(xxviii)</td><td>Progressive Green belt and ecological restoration /afforestation plan (both in text, figures and in the tabular form as per the format of MOEFCC given below) and selection of species (native) based on original survey/land-use should be given.<br>Table 1: Stage-wise Land use and Reclamation Area (ha)
<table>
<tr><th>S. N</th><th>Land use Category</th><th>Present (1st Year)</th><th>5th Year</th><th>10th Year</th><th>20th Year</th><th>24th Year to the end of Mine life</th></tr>
<tr><td>1.</td><td>Backfilled Area (Reclaimed with plantation)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Excavated Area (not reclaimed)/void</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3.</td><td>External OB dump Reclaimed with plantation)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4.</td><td>Reclaimed Top soil dump</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5.</td><td>Green Built Area</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.</td><td>Undisturbed area (brought under plantation)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7.</td><td>Roads (avenue plantation)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8.</td><td>Area around buildings and Infrastructure</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>TOTAL</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Table 2: Stage-wise Cumulative Plantation
<table>
<tr><th rowspan="2">Sl. No.</th><th rowspan="2">YEAR*</th><th colspan="2">Green Belt</th><th colspan="2">External Dump</th><th colspan="2">Backfilled Area</th><th colspan="2">Others (Undisturbed Area/etc)</th><th rowspan="2">TOTAL</th></tr>
<tr><th>Area (ha)</th><th>No. of trees</th><th>Area (ha)</th><th>No. of trees</th><th>Area (ha)</th><th>No. of trees</th><th>Area (ha)</th><th>No. of trees</th></tr>
<tr><td>1.</td><td>1st yr</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>3rd yr</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3.</td><td>5th yr.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4.</td><td>10th yr.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>Chapter-IV (4.5.2)</td></tr>
</table>

<table>
<tr><th>Sl. No.</th><th>Terms of Reference for EIA studies</th><th>Compliance evidence in EIA-EMP</th></tr>
<tr><td></td><td>
<table>
<tr><td>5.</td><td>15th yr.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.</td><td>20th yr.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7.</td><td>25th yr.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8.</td><td>30th yr.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>9.</td><td>34th yr. (end of mine life)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>10.</td><td>34-37th Yr. (Post-mining)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
*As a representative example</td><td></td></tr>
<tr><td>(xxix).</td><td>Conceptual Final Mine Closure Plan and post mining land use and restoration of land/habitat to the pre- mining status should be provided. A Plan for the ecological restoration of the mined out area and post mining land use should be prepared with detailed cost provisions. Impact and management of wastes and issues of re-handling (wherever applicable) and backfilling and progressive mine closure and reclamation should be furnished.<br>Table 3: Post-Mining Land use Pattern of ML/Project Area (ha)
<table>
<tr><th>S. No.</th><th>Land Use during Mining</th><th colspan="5">Land Use (ha)</th></tr>
<tr><td>1.</td><td>External OB Dump</td><td>Plantation</td><td>Water Body</td><td>Public Use</td><td>Undisturbed</td><td>TOTAL</td></tr>
<tr><td>2.</td><td>Top soil Dump</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3.</td><td>Excavation</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4.</td><td>Roads</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5.</td><td>Built up area</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.</td><td>Green Belt</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7.</td><td>Undisturbed Area</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>TOTAL</td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>Chapter-IV (4.8)</td></tr>
<tr><td>(xxx).</td><td>Flow chart of water balance should be provided. Treatment of effluents from workshop, township, domestic wastewater, mine water discharge, etc. should be provided. Details of STP in colony and ETP in mine should be given. Recycling of water to the maximum possible extent should be done.</td><td>Chapter-IV (4.3.2), Annex.-XIV.</td></tr>
<tr><td>(xxxi).</td><td>Occupational health issues. Baseline data on the health of the population in the impact zone and measures for occupational health and safety of the personnel and manpower in the mine should be given.</td><td>Chapter-III (3.3.1), Chapter-VII (7.4)</td></tr>
</table>

| Sl. No. | Terms of Reference for EIA studies | Compliance evidence in EIA-EMP |
|---|---|---|
| | | |
| (xxxii). | Risk Assessment and Disaster Preparedness and Management Plan should be provided. | Chapter-VII (7.2) |
| (xxxiii). | Integration of the Env. Management Plan with measures for minimizing use of natural resources - water, land, energy, etc. should be carried out. | Chapter-IV |
| (xxxiv). | Cost of EMP (capital and recurring) should be included in the project cost and for progressive and final mine closure plan. | Chapter-IX |
| (xxxv). | Details of R&R. Detailed project specific R&R Plan with data on the existing socio-economic status of the population (including tribals, SC/ST, BPL families) found in the study area and broad plan for resettlement of the displaced population, site for the resettlement colony, alternate livelihood concerns/employment for the displaced people, civic and housing amenities being offered, etc and costs along with the schedule of the implementation of the R&R Plan should be given. | Chapter- IV (4.1.4) , Chapter –III (3.3.1) |
| (xxxvi). | CSR Plan along with details of villages and specific budgetary provisions (capital and recurring) for specific activities over the life of the project should be given. | Chapter-VII (7.3) |
| (xxxvii). | Corporate Environment Responsibility:<br>a) The Company must have a well laid down Environment Policy approved by the Board of Directors.<br>b) The Environment Policy must prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.<br>c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions must be furnished.<br>d) To have proper checks and balances, the company should have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large. | Chapter –X (10.4.1) |
| (xxxviii). | Details on Public Hearing should cover the information relating to notices issued in the newspaper, | Chapter – VII (7.0) and |

<table>
<tr><th>Sl. No.</th><th>Terms of Reference for EIA studies</th><th>Compliance evidence in EIA-EMP</th></tr>
<tr><td></td><td>proceedings/minutes of Public Hearing, the points raised by the general public and commitments made by the proponent and the action proposed with budgets in suitable time frame. These details should be presented in a tabular form. If the Public Hearing is in the regional language, an authenticated English Translation of the same should be provided.</td><td>Annexure No.-XXVI.</td></tr>
<tr><td>(xxxix).</td><td>In built mechanism of self-monitoring of compliance of environmental regulations should be indicated.</td><td>Chapter-X (10.4.1)</td></tr>
<tr><td>(xl).</td><td>Status of any litigations/ court cases filed/pending on the project should be provided.</td><td>Chapter-I (1.7)</td></tr>
<tr><td>(xli).</td><td>Submission of sample test analysis of Characteristics of coal: This should include details on grade of coal and other characteristics such as ash content, S and heavy metals including levels of Hg, As, Pb, Cr etc.</td><td>Annexure No.-XIII.</td></tr>
<tr><td>(xlii).</td><td>Copy of clearances/approvals such as Forestry clearances, Mining Plan Approval, mine closer plan approval. NOC from Flood and Irrigation Dept. (if req.), etc. wherever applicable.<br>Details on the Forest Clearance should be given as per the format given:
<table>
<tr><th>TOTAL ML/PROJECT AREA (ha)</th><th>TOTAL FOREST LAND AREA (ha)</th><th>Date of FC</th><th>Extent of forestland</th><th>Balance area for which FC is yet to be obtained</th><th>Status of appl. for diversion of forestland</th></tr>
<tr><td></td><td></td><td>If more than one, provide details of each FC</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>Chapter –I (1.6), Chapter-II (2.7.4) Annexure no.-I to XII.</td></tr>
</table>

## 1.5 TOR compliance in EIA-EMP Report :

TOR compliance evidence has been given against each point of standard TOR given at 1.4 above. The EIA-EMP Report has been prepared for the incremental impacts of expansion of Jayant Opencast from 15.50 MTPA to 25.00 MTPA peak rated capacity in an ML area of 3177.171 ha based on the generic structure specified in Appendix III of the EIA Notification – 2006.

The EIA-EMP Report has been prepared for 25 MTPA rated capacity to cover the impacts and environment management plan for the project specific activities on the environment of the region, and the environmental quality encompassing air, water, land, biotic community, etc. through collection of data and information, generation of

data on impacts including prediction modeling for 25 MTPA of coal production based on approved Expansion Project Report (EPR) for normative 20 MTPA and peak 25 MTPA. The EIA-EMP Report has been prepared based on baseline data generated for Pre-monsoon season (March'2016 to June' 2016).

### 1.6 Status of approvals/ clearances obtained :

The following are the clearances /approvals obtained by the Project:

| Sl. No. | Particulars | Annexure No. |
|---|---|---|
| 1. | Copy of TOR for Jayant Expansion (from 15.50 MTPA to 25.00 MTPA) by MoEFCC vide letter no. J-11015/12/2017-IA.II (M) dated 15th June,2017. | I |
| 2. | Copy of Approval of Expansion Project Report (EPR) for Jayant Expansion OCP (Normative–20.00 MTPA and Peak- 25.00 MTPA) along with Mine closure Plan (incorporated in the EPR itself) by NCL Board Vide letter no. NCL/Board/08(202) /19 dated 09.04.2016 and by Coal India Board vide letter no. CIL:XI(D): 04112:2017:1760 dated 16th May' 2017 | II |
| 3. | Copy of Environment Clearance letter for Jayant by Ministry of Environment and Forest (MoEF) for a rated capacity of 15.50 MTPA of coal production vide letter no. J-11015/382/2008-IA. II (M) dated 10-12-2008 *and its corrigendum issued vide No. J-11015/382/2008-IA.II(M) dated 15th April 2009***.** | III |
| 4. | Copy of permission to establish from MPPCB vide letter No.8762/TS/Mine/MPPCB/2009 dated 23-02-2009. | IV |
| 5. | Copy of Consent to Operate by MPSPCB, Bhopal under Air Act, 1974, Water Act, 1981 and authorisation under Hazardous Waste amendment Rule, vide Letter no. 2008AWH-44929/MPPCB/SIN dated 17-11-2015. | V |
| 6. | **1. Forestland acquired before F.C. act. 1980 :**<br>The 943.00 ha forest land area was notified in phases under the Coal Bearing Area Act, 1957 prior to the enactment of the Forest (Conservation) Act, 1980.<br>(i) SO no 5136 dtd 15.11.1975<br>(ii) SO no 4413 dtd 04.11.1976<br>(iii) SO no 3456 dtd 15.11.1978<br>(iv) Forest area acquired through transfer: For magazine vide letter no DM/40961 dtd 31.12.75<br>**2. Forestland acquired after F.C. act. 1980 :**<br>(i)Stage –I FC for 100 Ha issued vide letter no. 8-158/90- FC dtd 20.03.1992 and no. T/624/2893/2002/10-3 dtd 25.11.2003.<br>(ii) Stage –I FC for 68.29 Ha issued vide letter no 8-158/90-FC dtd 16.01.1997.<br>(iii) Stage –I FC for 50.881 Ha issued vide letter no 8-93/99-FC dtd 25.01.2000.<br>(iv) Stage –I FC issued vide letter no. 8-26/2015-FC dtd 13.09.2017 for 424.517 ha for Nigahi OCP. | VI |
| 7. | Certificate of availability of water from IWSS (Letter No.GM(Civil)/NCL/SGR/GM(C)/17/2134 dated 11.09.2017) and sanction letter for withdrawal of water from Govind Ballav Pant Sagar by UP State Govt. | VII |

| | | |
|---|---|---|
| | (Letter No.649-CU-II/NTPC/79 dated 13.03.1979). | |
| 8. | Copy of NOC for withdrawal of ground water by CGWB for existing project vide Letter No.21-4(13)/NCR/CGWA/2007-626 dated 20.08.2007 and letter for application submission for NOC of Expn. Project. | VIII |
| 9. | Copy of Certificate of availability of Power Vide Letter No.NCL/ SGR/ F&M /132kv/July'2017/685 dated 21.07.2017 issued by GM (E&M), NCL, HQ, Singrauli. | IX |
| 10. | Copies of Explosive license for magazine of existing mine vide Letter No.E/ HQ / MP/22/245 (E35199) dated 26.05.2017. | X |
| 11 | Copy of Renewal of the license No.-P/CC/ MP/19/1028 (P360999) for Petroleum Class-B Outlet/ Service Station/ Consumer Pump at NCL Jayant Project vide Letter No. No.-P/CC/ MP/19/1028 (P360999) dated 28.10.2015. | XI |
| 12 | Copy of Approval of Mine Closure Plan for existing Jayant OCP by NCL Board Vide letter no. NCL/Board/8(166) /1222 dated 31.03.2012. | XII |

### 1.7 Status/details of any court case relating to the project or related activities :

A prosecution case alleging the violation of environmental laws for enhancing the production of Jayant project from 9.0 MT to 10.0 MT in the year 2003-04, 2004-05, 2005-06 was filed against the then CGM, Jayant, Director (T/Op), NCL and CMD, NCL. The case was particularly related to the grant of EC by MOEF for 10.0 MTPA production for the alleged period.

The trial court did not consider the evidences properly produced by the officials/ alleged accused and awarded punishment in its judgment dated 30.11.2015 and accordingly convicted the above officers with six months imprisonment and fine of Rs. 1000/- to each. Against the said Judgment dated 30.11.2015, an appeal has been filed before the district court, Singrauli which is pending for hearing. Meanwhile, the environment clearance of project was granted by MOEFCC for 15.50 MTPA vide letter no. J-11015/382/2008-IA.II(M) dated 10$^{th}$ Dec.'2008.

# CHAPTER–II

# PROJECT DESCRIPTION

## 2.1 Type of Project :

This is an expansion of existing Jayant opencast coal mine project of Northern Coalfields Limited. The proposed production capacity is Normative 20.00 Mtpa and Peak 25.00 Mtpa of coal. Also, there is increase in lease area from existing 2704.171 Ha to 3177.171 Ha.

## 2.2 Need of the Project :

Ensuring the projected demand of coal for Thermal Power Plants in the country, it is necessary to expand the capacity of the present Jayant Opencast project. The project is mainly linked to Singrauli Super Thermal Power Station (2000 MW) through their own MGR system**.** However, the present demand of SSTPS is 11.00 mtpa coal and it is proposed to supply the incremental coal production of 10 Mtpa to Proyagraj Power TPS, Bara ; Sangam Power TPS, Karchana ; Anpara-D, etc. coming in the vicinity of Singrauli Coalfield.

There is also arrangement of the Public Railway to dispatch coal to other consumers if required, from Singrauli / Shaktinagar Railway Station.

## 2.3 Location and communication:

Jayant Opencast Project is situated in Singrauli district of Madhya Pradesh and forms a part of Singrauli Coalfield of Northern Coalfields Limited (NCL). The project is located in the south-central part of the Moher Sub-basin of Singrauli Coalfield and is bounded by Dudhichua and Nigahi Projects on the east and west respectively.

Geographic co-ordinates are latitude 24$^0$06’26.08” North to 24$^o$11’40.86” North and Longitude 82$^o$38’2.01” East to 82$^o$40’55.64” East. Grid co-ordinates are latitude 5000 S to 4000 N and Departure 8000 W to 12500W. The area is covered in the Survey of India Topo-sheet No.63 L/12 (RF 1:50,000) and Sheet No. 6 to 9 (RF 1:10000) and shown in **Plate No.-1(B).** The total mine lease area of Jayant Expn. Project is 3177.171 Ha.

Jayant Project site is well connected by both road and rail. Nearest Railway Station Shaktinagar is about 5 km towards east and Singrauli Station is 12 km from the project office.

Ranchi-Rewa Highway passes E-W through the Southern part of Project. Project is also well connected to Singrauli Township on the north and Waidhan, HQ of Singrauli district on the south at 12km and 8km respectively. Road to Singrauli passes over the coal bearing area of the project between Nigahi and Jayant OCPs.

## 2.4 Size or magnitude of operation (Including associated activities required by or for the Project):

### 2.4.1 Mining Technology :

**(A)Description of the minefield :**

Expansion of the Jayant Opencast Mine from 10 Mtpa to 20 Mtpa has been envisaged with inclusion of the dip side of existing Jayant Block i.e. Mehrauli East and West Geological Block.

The property is located in the north-east part of the Singrauli Coalfield. In the east, Dudhichua Opencast Project and in west Nigahi Opencast Project are in operation. The terrain of the mine field represents the plain and hilly plateau. Top level of the escarpment is about 442m and lower one varies from 350m to 375m. The RL within working limit varies from 375 m to 424m. The drainage is controlled by many seasonal nallas and in the north a major Bijul Nalla flows northerly.

Three main coal seams in ascending order viz. Turra (13.90-23.61m), Purewa Bottom (8.69-18.54m) and Purewa Top (4.00-13.07m) are the main workable coal seams for opencast mining. The thickness of top overburden above Purewa Top Seam varies from 16.40 m to 204.90 m. The parting between Purewa Top and Purewa Bottom Seam varies from 2.80 m to 33.04 m and that between Turra and Purewa Bottom seam is 46.61-66.4 m. Quarry parameters are given below:

.

Source: EPR, Jayant Expn. OCP, Jan.-2016

| Sl. No. | Particulars | Unit | Western | Eastern | Total |
|---|---|---|---|---|---|
| 1 | Maximum strike length of quarry along Turra seam floor | Km | 2.20 | 2.35 | 4.55 |
| 2 | Maximum strike length of quarry along surface | Km | 2.50 | 2.60 | 5.10 |
| 3 | Dip-rise width of the quarry on Turra Seam floor from existing face | Km | 2.25 | 1.45 | 2.25 |
| 4 | Dip-rise width of the quarry on surface from existing face | Km | 2.55 | 1.65 | 2.55 |
| 5 | Maximum depth of the quarry from surface | m | 225 | 190 | 225 |
| 6 | Quarry Surface Area (Expansion) from existing face | Sq. Km | - | - | 10.41 |
| 7 | Total quarry Surface Area (Existing & Expansion) | Sq. Km | - | - | 18.40 |

**(B)Mine Boundaries :**

The mine boundaries of the opencast minefield (Refer **Plate No.-2**) have been fixed as follows:

The existing Jayant block boundaries have been extended by adding the part of Mehrauli East and West geological block for exploitation of coal in the proposed Jayant expansion OCP(20 Mtpa). The new boundaries of the opencast minefield have been delineated and fixed as follows:

(i) **Southern Boundary** (Rise Side)- Southern boundary of existing Jayant Opencast Mine (10 Mtpa) forms the southern boundary of Jayant Expn. OCP;

(ii) **Northern Boundary** (Dip side) – The northern boundary of the expansion project has been fixed considering the total mineable coal reserves of about 16 years and with minimum disturbance of Singrauli township and a proper dragline cut for facilitating drainage upto fault F-8.

(iii) **Eastern Boundary**- The existing floor boundary has been extended in the dip side and shares common boundary on the floor of Purewa Bottom seam with Dudhichua OCP.

(iv) **Western Boundary** – The western boundary for the sanctioned 10 Mtpa Jayant OCP was fixed after leaving about 100m surface barrier with Nigahi OCP. The same width of the surface barrier (100m) with Nigahi OCP has been maintained for fixation of the western boundary of Jayant Expansion Project.

### 2.4.2 Geological and Mineable reserves :

The total mineable coal reserve available as on 31.03.2018 is 282.71 Mt alongwith 836.69 $Mm^3$ of OBR with average stripping ratio of 2.96 $m^3/t$. The seam-wise break-up of geological reserve as on 31.03.2018, are given below:

Source: Mine Planning department

| Seam | Geological Reserve (Mt) |
|---|---|
| Purewa Top | 46.74 |
| Purewa Bottom | 86.53 |
| Turra | 172.23 |
| **Total** | **305.50** |

Seam-wise mineable reserves are given below:

Source: Mine Planning department

| Seam | Mineable Reserve (Mt) |
|---|---|
| Purewa Top | 42.06 |
| Purewa Bottom | 80.46 |
| Turra | 160.19 |
| **Total** | **282.71** |

### 2.4.3 Mining system :

Considering the mining and geological condition, the existing combined system of mining with the deployment of Draglines and Shovel-Dumper combination has been proposed to be continued with up-gradation of equipment size for achieving

higher production level. The Jayant minefield was proposed to be developed in two sections namely West and East sections through a central mine entry.

**General Scheme of Operations**

**OB Removal**

In the sanctioned PR of Jayant OCP (10Mtpa), 3 Nos. of 24$m^3$/88mR & 1 No. of 15$m^3$/83mR draglines and 13 Nos. of 10$m^3$ Elect. Rope Shovel in conjunction with 120/85/50 T rear dumpers had been envisaged for excavating overburden.

It is proposed to use the same set of draglines and 20$m^3$ electric Rope shovels with combination of 190 T rear dumper. In the EPR (20Mtpa), it is proposed to replace all the existing 10$m^3$ electric rope shovels deployed in OBR with 5 Nos. of 20$m^3$ electric rope shovels after their survey off. Similarly, all the existing 50/85/120 T rear dumpers deployed in OBR are proposed to be replaced by equivalent numbers of 190 T rear dumpers after their survey off.

The 15$m^3$/83mR dragline has already been refurbished and the decision whether this dragline needs to be replaced should be taken after the minimum stipulated working hours of refurbished dragline. However, if & when 15$m^3$/83mR dragline is to be replaced, it may be replaced by higher standard size i.e. 24$m^3$/88mR dragline. 1 No. of 24$m^3$/88mR dragline has been surveyed off but working. This dragline will continue to work till replacement is made available.

**Coal Winning**

In the sanctioned PR of Jayant OCP (10Mtpa), 10$m^3$ Elect. Rope Shovel in conjunction with 85 T rear dumpers had been envisaged for coal production.

It is proposed to use the 10$m^3$ Elect. Rope Shovel and 10-12$m^3$ Diesel Hyd. Shovel in conjunction with 100 T rear dumpers for winning the coal. Some of 85 T dumpers have already been upgraded to 100T and the balance existing 85T are proposed to be replaced by equivalent numbers of 100 T rear dumpers after their survey off.

### 2.4.4 Calender programme of excavation :

The calendar plan of mining operation has been formulated from normative production level based on the adopted sequence of opencast minefield development; optimum conditions of mining operations for the entire life of the opencast mine.

Peak production of 25 Mtpa shall be achieved in the year where the geo-mining conditions are favorable and by augmenting capacity through outsourcing and by increasing number of working days and efficiency to meet the overall demand of coal on NCL.

## Calendar Programme of Excavation

| Years | | Total (20 Mtpa) | | |
|---|---|---|---|---|
| | | Coal (Mt) | OBR ($Mm^3$) | SR ($m^3/t$) |
| Yr-1 | 18-19 | 18.00 | 60.54 | 3.36 |
| Yr-2 | 19-20 | 20.00 | 60.58 | 3.03 |
| Yr-3 | 20-21 | 20.00 | 60.58 | 3.03 |
| Yr-4 | 21-22 | 20.00 | 60.27 | 3.01 |
| Yr-5 | 22-23 | 20.00 | 60.24 | 3.01 |
| Yr-6 | 23-24 | 20.00 | 60.24 | 3.01 |
| Yr-7 | 24-25 | 20.00 | 60.28 | 3.01 |
| Yr-8 | 25-26 | 20.00 | 60.41 | 3.02 |
| Yr-9 | 26-27 | 20.00 | 60.46 | 3.02 |
| Yr-10 | 27-28 | 20.00 | 60.46 | 3.02 |
| Yr-11 | 28-29 | 20.00 | 57.29 | 2.86 |
| Yr-12 | 29-30 | 20.00 | 53.16 | 2.66 |
| Yr-13 | 30-31 | 17.00 | 45.35 | 2.67 |
| Yr-14 | 31-32 | 14.50 | 39.10 | 2.70 |
| Yr-15 | 32-33 | 8.00 | 22.73 | 2.84 |
| Yr-16 | 33-34 | 5.21 | 15.02 | 2.88 |
| **Total** | | 282.71 | 836.71 | |

*Peak production (25 Mtpa) shall be achieved in the years where the geo mining conditions are favorable and by increasing efficency and number of working days to meet the overall demand of coal on NCL.

### 2.4.5 Status of HEMM :

Number of shovels, dumpers, drills, dozers & other HEMM as per Sanctioned PR (10 Mtpa) have been considered for replacement and up-gradation to equivalent numbers of shovels, dumpers etc. after completion of their standard working hours/life. The status of HEMM has been shown in the Table below:

Status of HEMM (Existing & Incremental)

(Source : EPR, Jayant Expn. OCP, Jan.-2016)

| Sl. No. | HEMM | Size/ Cap | Sanctioned Provision (10 Mtpa) | Existing As on 31.03.15 (10 Mtpa) | Total Departmental | | |
|---|---|---|---|---|---|---|---|
| | | | | | Existing (10Mtpa) (Upgraded) | Incremental (10 Mtpa) | Total (20Mtpa) |
| **A** | **OB Removal** | | | | | | |
| 1 | Dragline | $24m^3$/88mR | 3 | 3(2+1*) | 3 | - | 3 |
| 2 | Dragline | $15m^3$/83mR | 1 | 1 | 1 | - | 1# |
| 3 | Elect. Rope Shovel | $20m^3$ | - | 2 | 5 | 7 | 12 |
| 4 | Elect. Rope Shovel | $10m^3$ | 13 | 5(2+3*) | - | - | - |
| 5 | Elect. Rope Shovel | $4.6m^3$ | 1 | - | - | - | - |
| 6 | RBH Drill | 311mm | 2 | 3 | 4 | - | 4 |
| 7 | RBH Drill | 250mm | 18 | 19(17+2*) | 14 | 10 | 24 |
| 8 | Rear Dumper | 190T | - | - | 37 | 51 | 88 |

| Sl. No. | HEMM | Size/ Cap | Sanctioned Provision (10 Mtpa) | Existing As on 31.03.15 (10 Mtpa) | Total Departmental | | |
|---|---|---|---|---|---|---|---|
| | | | | | Existing (10Mtpa) (Upgraded) | Incremental (10 Mtpa) | Total (20Mtpa) |
| 9 | Rear Dumper | 120T | 4 | 25(9+16*) | - | - | - |
| 10 | Rear Dumper | 85T | 85 | 35 | - | - | - |
| 11 | Rear Dumper | 50T | 14 | 4 | - | - | - |
| 12 | Dozer with Ripper | 770/850 HP | - | 4 | 6 | 6 | 12 |
| 13 | Dozer | 410 HP | 29 | 12 | 8 | - | 8 |
| **B** | **Coal Winning** | | | | | | |
| 1 | Elect. Rope Shovel | 10$m^3$ | - | 6 | 6 | - | 6 |
| 2 | Diesel Hyd. shovel | 10-12 $m^3$ | - | - | - | 2 | 2 |
| 3 | Elect. Rope Shovel | 6.3$m^3$ | 5 | - | - | - | - |
| 4 | RBH Drill | 160mm | 7 | 7(6+1*) | 7 | 5 | 12 |
| 5 | Drill | 100mm | - | 1 | 1 | - | 1 |
| 6 | Rear Dumper | 100T | - | 37 | 37 | 15 | 52 |
| 7 | Rear Dumper | 85T | 26 | - | - | - | - |
| 8 | BDCH | 60T | 4 | - | - | - | - |
| 9 | Dozer | 410 HP | 2 | 6 | 6 | 2 | 8 |
| 10 | Dozer | 250/320HP | 3 | - | - | - | - |
| **C** | **Common** | | | | | | |
| 1 | Motor Grader | 500 HP | - | - | - | 2 | 2 |
| 2 | Motor Grader | 280 HP | - | 5 | 4 | - | 4 |
| 3 | Motor Grader | 110/145 HP | 3 | - | - | - | - |
| 4 | Crane | 120 T | - | 1 | 1 | - | 1 |
| 5 | Crane | 75 T | 4 | 2 | 3 | - | 3 |
| 6 | Crane | 30 T | - | 1 | 1 | 1 | 2 |
| 7 | Crane | 20 T | - | - | - | 1 | 1 |
| 8 | Crane | 10T | - | 4 | 4 | - | 4 |
| 9 | Hyd. Shovel/ Back-hoe | 3.2/3.8$m^3$ | 1 | 1 | 1 | 2 | 3 |
| 10 | Hyd. Shovel/ Back-hoe | 1.2$m^3$ | - | 1 | 1 | - | 1 |
| 11 | FE Loader | 1.91$m^3$ | - | 1 | 1 | - | 1 |
| 12 | FE Loader | 3.5$m^3$ | 3 | - | - | - | - |
| 13 | FE Loader | 6.1$m^3$ | - | 1 | 1 | 1 | 2 |
| 14 | FE Loader | 10-12$m^3$ | - | - | - | 1 | 1 |
| 15 | Dozer | 410 HP | - | - | - | 2 | 2 |
| 16 | Wheel Dozer | 410/450HP | - | 2 | 2 | 1 | 3 |
| **D** | **Reclamation** | | | | | | |
| 1 | Dozer | 410 HP | - | 5 | 5 | - | 5 |
| 2 | Motor Grader | 280 HP | - | 2 | 2 | - | 2 |
| 3 | Hyd. Backhoe | 3.2/3.8$m^3$ | - | - | - | 1 | 1 |
| 4 | Tipping Truck | 8$m^3$ | 2 | - | 2 | 3 | 5 |
| 5 | Water Sprinkler | 28 KL | 6 | 7+9* | 5 | - | 5 |
| 6 | Water Sprinkler | 70KL | - | - | - | 7 | 7 |

| Sl. No. | HEMM | Size/ Cap | Sanctioned Provision (10 Mtpa) | Existing As on 31.03.15 (10 Mtpa) | Total Departmental | | |
|---|---|---|---|---|---|---|---|
| | | | | | Existing (10Mtpa) (Upgraded) | Incremental (10 Mtpa) | Total (20Mtpa) |
| 7 | Road Sweeping Machine | - | - | - | - | 2 | 2 |

# After minimum stipulated working hours of refurbished dragline, it may be replaced by standard size, 24 m3/88mR D/L
*Survey off but in use

### 2.4.6 Method of Mining:

At present, east and west sections are being developed simultaneously with the deployment of 2 draglines (2 Nos. 24 $m^3$/88mR in East Section & 1 No. 24$m^3$/88mR and 1 No. 15$m^3$/83mR in West Section) in each section with central sump located near the central entry. Both the sections are advancing from rise to dip simultaneously. The same sequence is proposed to be continued in the expansion stage also.

**(A) Mining details: (**Source: EPR, Jayant Expn. OCP, Jan.-2016)

(i) Stripping ratio (mineral in tonnes to over burden in $m^3$) - 2.99 $m^3$/t
(ii) Ultimate working depth - 225 m
(iii) Present working depth (As on 31.03.2017) - 180m
(iv) Thickness of overburden
Minimum - 2.80 m
Maximum - 204.90 m
Average - 103.85 m
(v) Mining Plan (System parameters)

| Sl. No. | Particulars | Unit | Overburden | | Coal |
|---|---|---|---|---|---|
| | | | D/L | Shovel | |
| 1 | Bench Height | m | 29-41 | 15-18 | 10-15 |
| 2 | Working Bench Width | m | 75 | 57-63 | 45 |
| 3 | Non-working Bench Width | m | 75 | 37-43 | 25 |
| 4 | Bench Slope | Deg. | 70 | 70 | 80 |
| 5 | Blast Hole Dia. | mm | 311 | 250 | 160 |
| 6 | Inclination of Boreholes | - | Inclined | Vertical | Vertical |
| 7 | Powder Factor | Kg/$m^3$ | 0.6 | 0.3 | 0.2 |

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

(vi) Type of blasting to be adopted –

Presently, large dia hole blasting with SME explosives using suitable delays is being practiced at the mine and same practice will continue in the expansion project.

**Production of Coal**

(a) Rated capacity of mine mineral-wise - Normative-20 Mtpa, peak- 25 Mtpa,

(b) Ultimate working depth - 225m

**(B) Mine life :** 16 years from 2018-19 for normative coal production capacity.

### 2.4.7 Drilling & blasting operations :

Drilling and blasting operations are necessary for loosening the OB and coal before excavation. Drills of 311 mm/250 mm dia RBH Electric drill and 160 mm RBH Electric drill have been provided. The blasting is required in all coal & OB benches for loosening the strata. The specific consumption of explosives has been adopted for estimating the annual requirement of explosives with the following :

Source : EPR, Jayant Expn. OCP, Jan.-2016

| Particulars | Sp. Explosive consumption |
|---|---|
| OB from Shovel benches | 0.3 Kg/ $m^3$ |
| OB from D/L benches | 0.6 Kg/ $m^3$ |
| Coal Seams | 0.2 Kg/ $m^3$ |

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

### 2.4.8 OB/Waste disposal techniques :

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

The total OB as on 01.04.2017 is 882.89 $Mm^3$ out of which 212.19 $Mm^3$ OB will be directly side cast by draglines in the de-coaled cut and balance 670.70 $Mm^3$ is proposed to be removed and dumped by shovel-dumper system in the internal dumps. Shovel-dumper spoil dumps will be formed in benches of 30m in height.

For the formation of dumps and levelling of dump area surface, 850 HP and 410 HP dozers have been envisaged. The annual productivity of dozers is estimated as 6.30 $Mm^3$ for 850 HP dozers and 2.10 $Mm^3$ for 410 HP dozers. A total number of 12 dozers of 850 HP, 23 Nos. of 410 HP dozers and 3 Nos. of 410/450 HP Wheel dozers have been provided for dumping purpose, face cleaning in OBR, coal, haul road and reclamation purposes.

There is no external dumping in the proposed expansion. The old External dumps of Jayant mines have already been fully reclaimed.

The final stage dump plan shows that total OB above dragline bench will be accommodated in the pit internally. Spoil dumps are proposed to be formed in

benches of 30m height. The recommended overall dump slope should not exceed $28^0$.

## 2.5 Proposed schedule for approval and implimentation :

The zero date of project implementation is the beginning year counted after the approval of PR by the Competent Authority. The EPR for Jayant OCP (20.00 Mtpa) has been approved by NCL Board on 1st March, 2016 and by Coal India Board vide letter no. CIL:XI(D): 04112:2017:1760 dated 16th May' 2017.
The target capacity of 20Mtpa of ROM coal (incremental 10Mtpa) is expected to be achieved in the 2nd year i.e. 2019-20.

The details of the major activities for project construction/implementation have been shown in the Harmon gram given below:

Source: EPR, Jayant Expn. OCP, Jan.-2016

**EPR FOR JAYANT OPENCAST PROJECT (20 Mtpa)**

**SCHEDULE OF MAJOR ACTIVITIES**

| S.No. | Particulars | Year of Quarry Operation | | | | |
|---|---|---|---|---|---|---|
| | | Actual | Yr-1 | Yr-2 | Yr-3 | Yr-4 |
| | | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
| 1 | Sanction of PR | | | | | |
| | - Preparation of PR | | | | | |
| | - NCL Board's Approval/Approval from Competent Body | | | | | |
| 2 | Environmental Clearance | | | | | |
| 3 | Acquisition of non-forest Land | | | | | |
| 4 | Rehabilitation | | | | | |
| 5 | Construction/Modification/Augmentation | | | | | |
| | a) CHP (Commissioning of Inpit Crusher) | | | | | |
| | b) Power Supply/Sub-station | | | | | |
| | c) Workshop Expansion/Modification | | | | | |
| | d) Service Buildings | | | | | |
| 6 | Mine Development | | | | | |
| 7 | HEMM Procurement & Commissioning as per requirement of Sanctioned Option | | | | | |
| 8 | **Coal Production (Mt)** | **14.40** | **15.00** | **16.00** | **18.00** | **20.00** |
| 9 | **OB Removal ($Mm^3$)** | **54.12** | **48.82** | **58.82** | **60.54** | **60.58** |

## 2.6 Technology and process description :

Considering the mining and geological condition and stripping ratio to handle large quantity of overburden, Jayant OCP has been working for last 40 years with combined system of mining viz. Dragline and shovel-dumper system. The existing system has been proposed to be continued with up-gradation of equipment size for achieving higher production level.

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

The Jayant minefield is being worked & continued to operate in two sections viz. East and West sections through a central mine entry. The OB removal is being done by dragline side casting and shovel-dumper combination. The blasted materials are transported to internal dumps through dumper transport.

The coal after blasting are loaded and hauled to CHP by dumpers from where after crushing the ROM coal, are being transported to silo point connected to MGR track through conveyor belts for loading into the wagon. There is no change in mining technology of the project for present Expansion.

## 2.7 Project Site description : Source : EPR, Jayant Expn. OCP, Jan.-2016

### 2.7.1 Geology :

**(A)Regional Geology:**

Singrauli coalfield is the northern most member of the central Indian coalfields. Despite locational advantage, it attracted very little attention because of poor accessibility and lack of infrastructure. It was during the second five-year plan period that the Coal Council included Singrauli Coalfield in the "List of priority" for geological survey of coal bearing areas and production of coal from this field.

Singrauli coalfield is located between latitudes 23°47' & 24°12'N and longitudes 81°40' & 82°52'E. The coalfield is about 102 km. long from west to east and 45 km. wide from north to south occupying a total area of 2202 sq.km. The coalfield is largely located in the Singrauli district of Madhya Pradesh and a small area of 80 sq.km in the extreme north-east lies in the district of Sonebhadra of Uttar Pradesh. Mining of coal at present is confined in the north eastern part of Singrauli coalfield.

**(B)Rock Formations:**

A total of 6 series of formations have been recognised on broad lithic characteristics within the Gondwana rocks of Singrauli coalfield (after G.S.I). In ascending order they are: Talchir, Barakar, Barren Measure, Raniganj, Panchet and Mahadeva. The Barakar & Raniganj are the main coal bearing formations of the area.

**(C)Stratigraphy:**

The generalised stratigraphic sequence of Singrauli coalfield (after G.S.I., 1977) is as given below:

**Generalised Stratigraphic Succession, Singrauli Coalfield**.

| Age | Group | Formation | Lithology | Thickness (m) |
|---|---|---|---|---|
| Cretaceous | | Intrusive | Dolerite dykes and sills | Not estimated |
| Upper Triassic | Upper Gondwana | Mahadeva | Coarse Grained, ferruginous sandstone with bands of shale, clay and conglomerate. | Not estimated |
| Lower Triassic | Lower Gondwana | Panchet | White, greenish white and pink micaceous, medium to coarse grained sandstone with red beds, greenish-brown silty shales and conglomerates. | Not estimated |

| Age | Group | Formation | Lithology | Thickness (m) |
|---|---|---|---|---|
| Upper Permian | | Raniganj | Fine-grained sandstone and shales with coal seams including 134m Jhingurdah seam. | 215 – 403 |
| Middle Permian | | Barren Measures | Very coarse grained to ferruginous sandstone, green clay and shales | 125-300 |
| Lower Permian | | Barakar | Medium to coarse grained sandstones, shale, clay and coal seams. | 325-600 |
| Upper Carboniferous | | Talchir | Tillites, sandstone, siltstones, needle shales | 75-130 |
| ----------Unconformity---------- | | | | |
| Precambrian | Phyllites, quartzites, schists and gneisses | | | |

The general strike of the beds of Moher sub-basin is more or less east-west except in Block-B in the west and Bina & Kakri blocks in the east where the strike is nearly north-south.

### 2.7.2 Regional Structure:

#### (A)Tectonic Set-up:

The Gondowana rocks in peninsular India are found mainly along well defined long narrow belts on pre-Cambrain platform and their extent roughly well-defined to the river valleys of Damodar, Sone, Mahanadi and Godavari. These alignments have been interpreted as pre-depositional zones of weakness where deposition of Gondwana sediments has been facilitated by its slow subsidence due to contemporaneous faulting. Another view holds Gondwana deposition to have taken place in alluvial valleys over a much wider area extending outside the present basin limits; it is only in the down faulted valleys where the rocks have been preserved from erosion. Each isolated individual occurrence of coal measures along these defined zones has been considered a separate coalfield by the workers on Gondwana geology.

Singrauli coalfield is one of such occurrences located at the northern extremity in the valley of Sone. Its northern boundary, defined by a prominent E-W trending boundary fault, is probably an offshoot of Sone-Narmada lineament.

#### (B)Basin Configuration:

The Singrauli coalfield is composed of two tectono-sedimentary domains, the Moher sub-basin in the north-east and main basin towards west. These two basins are separated by a NW-SE trending basement high, located roughly along Kachan River. The Moher-sub-basin shows a broad basin structure truncated against the east-west trending boundary fault in the north.

The bed exhibits a gentle upward in the central part of its southern stretch of occurrence. In conformity to above, the beds have a general NW-SE trend in the western part, which gently veers to nearly east west along Amlohri-Nigahi blocks. The stretch between Nigahi and Dudhiuchua exhibits a gentle anticlinal flexure. To the east of Dudhichua, the strike shows a gradual variation from NW-SE to NE-SW. The strike further swerves in the eastern part of Khadia and assumes an N-S trend in Bina and Kakri blocks. The beds have a corresponding centripetal dip. The amount of dip, in general, is about 2 to 3 degrees. However, high dips of about 8°-10° have been observed in Kakri and in area further north of it.

### 2.7.3 Geology of the block

Entire block area is covered by the sediments of Barakar Formation with a thin cover of soil and alluvium at places. The stratigraphic sequence of rocks within Barakar formation is as given below :

**Stratigraphic sequence of rocks within Barakar Formation**

Source: EPR, Jayant Expn. OCP, Jan.-2016

| Lithology | Thickness Range (m) | |
|---|---|---|
| | From | To |
| Soil | 0.00 | 12.20 |
| Sandstone with 2 to 3 clay bands and 1 to 2 thin impersistent carbonaceous horizon. | 16.40 | 204.90 |
| Coal Seam : Purewa Top (Full Seam) | 4.00 | 13.07 |
| Sandstone with thin shale bands | 2.80 | 33.04 |
| Coal Seam : Purewa Bottom | 8.69 | 18.54 |
| Sandstone with thin carb shale | 46.61 | 66.40 |
| Coal Seam : Turra | 13.90 | 23.61 |

Over a major part of the area, the thickness of soil is restricted to 3 m only. The Barakar sequence mainly consists of fine to coarse grained, light grey, feldspathic sandstone, shale, clay and coal seams. Kaolinised feldsper is usually the cementing material. Two to three clay beds occur within the upper horizon of the Barakars. The shale bands generally occur as inter banded with coal and constitutes most of the dirt bands within the seams. Presence of thin shale bands has also been observed within sandstone at places. The sandstones are feldspathic, at times kaolinised and rarely micaceous. The coal, shaly coal and carb shales constitute the coal horizon.

**Geological Structure :**

The beds show a gentle anticlinal flexure along NNE-SSW axis passing along the central part of the block. The beds have general NE-SW trend in the western part of the block, which gradually swing along anticline axis and assume NW-SE trend in the eastern part of the block. Accordingly the direction of dip also changes from NW to NE. The amount of dip is generally about $2^o$ to $3^o$.

From the subsurface data, six faults have been deciphered in the Jayant Extension area. Most of the faults traverse through the eastern part while the western part is fairly undistributed. Details of faults traversing the area are presented below :

Source: EPR, Jayant Expn. OCP, Jan.-2016

| Sl. | Fault No. (as per GR on Mehrauli East & West Block) | Trend | Throw | | Extent/Location |
|---|---|---|---|---|---|
| | | | Direction | Amount | |
| 1 | F | ENE-WSW | NNW | 50 m near CMMH080; likely to increase towards NE as no seam has been encountered in CMMH085 | In the NW corner of the area |
| 2 | $F_1$ | NE-SW to ENE-WSW | NW to NNW | 25 to30 m near CMMH055 | In the NW corner of the area |
| 3 | $F_3$ | NNW-SSE | West | 5 m near CMMH036 | Across the southern boundary near CMMH036 |
| 4 | $F_4$ | NNW-SSE | West | 25 m near SGR133 | Across northern and southern boundary in the central part |
| 5 | $F_6$ | NNW-SSE | West | 18 m near CMMH 219; reduces to 5 m near southern boundary | Across northern and southern boundary in the western part |
| 6 | $F_8$ | WNW-ESE | West | 30 m near CMMH214 | Along the northern boundary |

**(A) Exploration:**

The expansion area of the Jayant OCP (20 Mtpa), lies in between the surface limit of present Jayant OCP and proposed surface limit of floor of Turra seam. The expansion area from existing face (approx.10.41 sq.km) lies in the northern part of the existing Jayant Project and is covered within Mehrauli East & West Geological Block of area 12.80 sq.km. Detailed drilling within the block was carried out in phases by CMPDI for preparation of Geological Report. GSI and IBM have also drilled 3 and 46 boreholes respectively in the area. Average borehole density in expansion area is about 17 boreholes per sq.km.

**(B) Mining & Geological characteristics:**

There are three coal seams occurring in this block viz. Turra, Purewa Bottom and Purewa Top seam in ascending order. Three coal seams namely Turra (11.90-21.65m), Purewa Bottom (3.40-15.17 m), Purewa Top (4.00-13.07m) are

proposed to be mined. The beds have a corresponding centripetal dip. The amount of dip in general is about 2 to 3 degree. However, higher dip of about $8^{o}$-$10^{o}$ have been observed in the eastern part of the basin.

The thickness of top overburden above Purewa Top Seam varies from 16.40m to 204.90m. The thickness of parting between Purewa Bottom and Purewa Top seams varies from 2.80m to 33.04m and that between Turra and Purewa Bottom seams varies from 46.61m to 66.40m.

There are number of dirt bands in coal Seams, some of which are more than 1m in thickness. Detailed Borehole Lithology is given at Plate-4 of Annexure No.-XIV.

The overall ash percentage varies from 18.1 % to 49.6 %. Turra, Purewa Bottom and Purewa Top seams are proposed to be mined. The mining & geological characteristics of Jayant project is summarized below:

**GEOLOGICAL & MINING CHARACTERISTICS**

Source: EPR, Jayant Expn. OCP, Jan.-2016

| Sl. No. | Particulars | Unit | Value | |
|---|---|---|---|---|
| 1 | Thickness of Coal Seam (Full seam thickness zone) | | | |
| | Seam | | Stratigraphic Th. | Effective Th. |
| | a) Turra seam | m | 13.90-23.61 (19.17) | 11.90-21.65 (17.18) |
| | b) Purewa Bottom Seam | m | 8.69-18.54 (12.59) | 3.40-15.17 (11.19) |
| | c) Purewa Top Seam | m | 4.00-13.07 (7.87) | 4.00-13.07 (6.81) |
| 2 | Thickness of OB and Partings | | | |
| | a) OB above Purewa Top | m | 16.40-204.90 | |
| | b) Parting between Purewa Bottom & Purewa Top Seams | m | 2.80-33.04 | |
| | c) Parting between Turra & Purewa Bottom seams | m | 46.61-66.40 | |
| 3 | Seam Gradient | Deg. | 2-4 | |
| 4 | Volume weight of Coal | | | |
| | a) Turra Seam | t/cum | 1.52-1.54 | |
| | b) Purewa Bottom Seam | t/cum | 1.56-1.58 | |
| | c) Purewa Top Seam | t/cum | 1.60-1.64 | |
| 5 | Volume Weight of OB | t/cum | 2.20 | |
| 6 | Volume Weight of dirt bands | t/cum | 2.00 | |
| 7 | Excavation Category | | | |
| | a) Coal | | Cat-III - 90%<br>Cat-IV –10% | |
| | b) Overburden | | Cat-III - 90%<br>Cat-IV –10% | |

| Sl. No. | Particulars | Unit | Value |
|---|---|---|---|
| 8 | Total mineable reserves of EPR for Jayant OCP (20 Mtpa) as on 31.03.2018 | Mt | 282.71 |
| 9 | Total OB of EPR for Jayant OCP (20 Mtpa) as on 31.03.2018. | $Mm^3$ | 836.69 |
| 10 | Average Stripping Ratio | $m^3/t$ | 2.96 |

**(C) Coal quality:**

The grade based on GCV for Turra seam and Purewa Bottom Seam varies mainly from G8 to G14 and that for Purewa Top seam from G9 to G14. The average product mix grade of all the three seams is G10.

Details of sample test analysis of coal including ash and also heavy metal contents levels is given in **Annexure No.XIII.**

**(D) Hydro-geological characteristics :**

A Hydro-geological characteristics of steady area in details along with area drainage, water balance, impact of mining and water extraction on hydrogeology, breakup of water requirement etc. has been discussed in Comprehencive Hydro-geological Report given in **Annexure No.-XIV**.

### 2.7.4 Land requirements:

The total land requirement for EPR of Jayant OCP (20 Mtpa) has been broadly assessed as 3177.171 Ha for project expansion. The land requirement broadly includes the provision for mine area, external dumps, industrial areas, colony and other infra-structural facilities.

The break-up for the type of land is given below:

Source: EPR, Jayant Expn. OCP, Jan.-2016

| Type of Land | Existing Area (ha) | Additional area required for expansion(ha) | Total ML/Project area (ha) |
|---|---|---|---|
| Forest Land | 1162.171 | 18.00 | 1180.171 |
| Government land | 467.00 | 48.46 | 515.46 |
| Tenancy land | 1075.00 | 406.54 | 1481.54 |
| **Total** | **2704.171** | **473.00** | **3177.171** |

The break-up of lease/project area as per different land uses and their stages of acquisition are as given below :

| S.No. | Land use | Within ML area (ha) | Outside ML area (ha) | Total |
|---|---|---|---|---|
| 1. | Agricultural land | 1481.54 | NIL | 1481.54 |
| 2. | Forest land | 1180.171 | NIL | 1180.171 |
| 3. | Wasteland | - | NIL | - |
| 4. | Grazing land | - | NIL | - |
| 5. | Surface water bodies | - | NIL | - |
| 6. | Settlements | - | NIL | - |
| 7. | Others (Government land) (specify) | 515.46 | NIL | 515.46 |
| | **Total** | 3177.171 | NIL | 3177.171 |

The details of total forestland clearance of 1180.171ha and stages of acquisition is given in the prescribed format below:

| **TOTAL ML/ PROJECT AREA (ha)** | **TOTAL FORESTLAND (ha)** | **Date of FC** | **Extent of forest land** | **Balance area for which FC is yet to be obtained** | **Status of appl. for diversion of forestland** |
|---|---|---|---|---|---|
| 3177.171 | 1180.171 | **1. Forestland acquired before F.C. act. 1980 :**<br>The 943.00 ha forest land area was notified in phases under the Coal Bearing Area Act, 1957 prior to the enactment of the Forest (Conservation) Act, 1980.<br>(i) SO no 5136 dtd 15.11.1975<br>(ii) SO no 4413 dtd 04.11.1976<br>(iii) SO no 3456 dtd 15.11.1978<br>(iv) Forest area acquired through transfer: For magazine vide letter no DM/40961 dtd 31.12.75<br>Copy of above referred notification is enclosed as **Annexure No.-VI.** | **943.00**<br>445.00<br>339.00<br>143.00<br>16.00 | NIL | |
| | | **1. Forestland acquired after F.C. act. 1980 :**<br>(i)Stage –I FC issued vide | 100.00 | | Copy of letter is enclosed as |

| TOTAL ML/ PROJECT AREA (ha) | TOTAL FORESTLAND (ha) | Date of FC | Extent of forest land | Balance area for which FC is yet to be obtained | Status of appl. for diversion of forestland |
|---|---|---|---|---|---|
| | | letter no. 8-158/90- FC dtd 20.03.1992 and no. T/624/2893/2002/10-3 dt. 25.11.2003. | | | **Annexure No.-VI.** |
| | | (ii) Stage –I FC issued vide letter no. 8-158/90-FC dt. 16.01.1997. The lease period is valid for 30 Years. | 68.29 | | Copy of letter is enclosed as **Annexure No.-VI.** |
| | | (iii) Stage –I FC issued vide letter no. 8-93/99-FC dt. 25.01.2000. The lease period is valid for 30 years. | 50.881 | | Copy of letter is enclosed as **Annexure No.-VI.** |
| | | (iv) Stage –I FC issued vide letter no. 8-26/2015-FC dt. 13.09.2017 for 424.517 ha for Nigahi OCP. | 18.00 | | The referred land area of 18 Ha has been acquired by Nigahi Project. Copy of letter is enclosed as **Annexure No.-VI.** |

EAC observed that out of the total 1180.171 ha of forest land, 943 ha was notified in phases under the Coal Bearing Area Act, 1957 prior to the enactment of the Forest (Conservation) Act, 1980. Such a forest land already used/broken before the year 1980, would not attract the provisions of the Forest (Conservation) Act, 1980 and thus not requiring any clearance for its diversion for non-forestry purposes. Land acquisition plan of Jayant Expn. has been shown in **Plate No.-3**.

The break-up of total lease/project area as per EPR/mining plan are as given below:

Source: EPR, Jayant Expn. OCP, Jan.-2016

| Sl. No. | Particulars | Area (Ha) |
|---|---|---|
| 1 | Total Quarry Area | 1840.00 |
| 2 | External Dump | 118.65 |
| 3 | Colony (Residential area) | 261.90 |
| 4 | Green Belt in colony | 19.30 |

| Sl. No. | Particulars | Area (Ha) |
|---|---|---|
| 5 | Infrastructure (Office, drains etc.) | 64.00 |
| 6 | ETP, CHP, Mineral Storage | 18.00 |
| 7 | Road, Railway | 96.75 |
| 8 | Green Belt on Waste/Vacant land | 74.00 |
| 9 | Safety Zone/Undisturbed area | 120.00 |
| 10 | Modwani Dam | 59.20 |
| 11 | Others (waste land, vacant land etc.) | 505.371 |
| | **Total** | **3177.171** |

The master plan of Jayant expn. is shown in **Plate No.-4**.

### 2.7.5 Coal transportation outside the ML area:

The project is supplying 11.00 Mtpa coal to Singrauli Super Thermal Power Station (2000 MW) through their own MGR system**.** The EPR envisaged to supply the incremental coal production of 10 Mtpa to proposed TPS viz. Bara TPS, Karchana, Anpara-D, other consumers if required, etc. coming in the vicinity of Singrauli Coalfield through Public Railway. The total coal produced is proposed to transport through MGR and Public Railway.

Total handling capacity of the CHP including existing and proposed will be 25 Mtpa (10 Mtpa existing + 5 Mtpa as advance process+ 10 Mtpa additional proposed) which will cater the target peak load of 25 Mtpa.

### 2.7.6 Township:

The requirement of residential quarters has been assessed as per total manpower of the mine. However, there are already 2161 standard quarters available in the project township. The mine has been smoothly operating with existing manpower of 2186 (as on 01.04.2017) in different grades. The proposed manpower will be 3050.

Adequate existing quarters are available to meet the desired need of the proposed manpower of non-executives. However additional 22 Nos. of D type and 10 Nos. of C type quarters have been proposed for officer's accommodation as there is scarcity of proper housing at the nearby area. The actual overall satisfaction comes to 72 %.

**Water supply and sewage disposal arrangement**

The permanent water supply arrangement for Jayant Opencast Project is covered in Phase-I of IWSS for Singrauli Coalfield. Water requirement is to be fulfilled from existing supply of IWSS source, treated water from Mine ETP, CETP and STP for Re-use.

The normal requirement of water for domestic, industrial and firefighting purposes for Jayant Expn. OCP has been calculated as:

Source: EPR, Jayant Expn. OCP, Jan.-2016

| | | |
|---|---|---|
| a) | Potable water demand | 3428 $m^3$/d |
| b) | Industrial water demand | 8226 $m^3$/d |
| | Total | 11654 $m^3$/d |
| c) | Firefighting water demand | 1828 $m^3$/d |

The water requirement for fire fighting is for occasional use and would be kept stored in industrial reservoir and fire fighting sump located at high ground. The Certificate of water availability from IWSS for Jayant Expn. Project and permission letter for withdrawal of water from GBP Sagar for IWSS is given as **Annexure No.-VII.**

### 2.7.7 Manpower:

The existing total manpower in Jayant OCP as on 01.04.2017 is 2186. The existing manpower will be gainfully utilized in Jayant Expn. OCP. The estimated manpower for expansion of project is 3050.

The break-up of peak manpower is given below:

Source: EPR, Jayant Expn. OCP, Jan.-2016

| Sl. No. | Particulars | No. of Persons |
|---|---|---|
| 1 | OB | 723 |
| 2 | Coal | 767 |
| 3 | Common | 1505 |
| 4 | Land Reclamation | 55 |
| | Total | 3050 |

### 2.7.8 Infrastructure :

#### (A) Coal Handling Plant (CHP) :

Existing CHP of 10 Mtpa has already been constructed and is in operation. Existing CHP broadly has the facilities of three number of receiving and crushing complex, two number of bunkers for storage and reclamation, two silos with rapid loading system, one public railway loading system and associated conveyor system.

The coal production of Jayant OCP has reached 15 Mtpa. As the existing Coal Handling plant has been designed for dispatch of 10 Mtpa coal only an advance

action for the Coal handling Plant (Incremental Cap. - 5Mtpa, Total cap-15Mtpa) was prepared and submitted for approval. Board of Directors of CIL in its 279th meeting held on 12-13th March 2012 approved the proposal for taking up construction of CHP of 5 Mtpa capacity for Jayant project.

The EPR for Jayant OCP for a rated capacity of 20 Mtpa (Peak capacity 25 Mtpa) envisaged a separate new coal handling system of 10 Mtpa capacity which comprising of 2 Nos. of Semi-mobile crusher and sizer of product size of (-) 100 mm to be installed in east and west section each for Purewa Bottom and Purewa Top seams with associated conveying and dispatch system has been envisaged.

Total handling capacity of the CHP including existing and proposed will be 25 Mtpa (10 Mtpa existing + 5 Mtpa as advance process+ 10 Mtpa additional proposed) which will cater the target peak load of 25 Mtpa.

**(B) Workshop and Store :**

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

For expansion of the Project from 10 Mtpa to 20 Mtpa coal production, EPR has envisaged 52 Nos. 100T Dumper and 88 Nos. 190T Dumper. Existing 85T dumper and 120T dumper has been envisaged for replacement in equivalent numbers of 190 T dumpers.

The existing bays for 85T & 120T Dumpers both at Field workshop and Base workshop will be used to meet the repair & maintenance requirement of above two types of dumpers. In addition to this, 8 numbers of new bays for 190 T dumpers have been envisaged in Field workshop to cater the daily & schedule maintenance of entire fleet of dumpers.

Also, 11 numbers of bays for 190 T dumpers have also been provided in Base workshop for medium and minor repair of 190 T dumpers. A face equipment repair shop has been envisaged in Base workshop for repair and maintenance of face equipment of the project. Along with this, a machine shop, auto electric shop, welding & structural shop, engine and radiator repair shop have also been provided in the Base workshop. Sufficient dumper parking space and additional dumper washing facility have also been provided in the Field workshop and Base workshop.

An additional store shed of 72 m x 24 m has been provided in the existing store complex along with racking system to cater to the need of expansion of the project. Capital repair requirement will be met by the existing Central Workshop, Jayant.

**(C) Railway siding :**

The crushed coal (-100) from the West section & East section of Jayant OCP will be dispatched by PR/MGR. For the mine output of 10 Mtpa incremental (peak) 10 to 11 rakes of wagon will have to be loaded every day.

The loading has been envisaged round the clock in all the three shifts per day by one loading point with RLS @5500 TPH with 4000 te silo. The silo will be installed on the existing PR siding after necessary modification and one additional line will be envisaged under the proposed Silo. The proposed line will be connected with existing MGR/PR line.

The existing PR lines are taking off from Shaktinagar Railway Station. The proposed interconnection between existing lines and MGR rail lines shall be made at suitable location so that full length of PR rake empty receiving line and after loads line is available by extending the existing MGR loop line of NTPC.

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

**(D) Existing power supply arrangement :**

Jayant Project is getting power at 33 KV by Madhauli Sub-station of NCL. At present, there are three sub-stations in Jayant project viz. OB West sub-station, OB East sub-station and coal sub-station. The EPR envisaged the installation of additional transformers in the existing Sub-stations to cater the need of expansion project.

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

**(E) Service/ welfare buildings**:

Existing facilities of service buildings shall remain in use for the proposed EPR. However, Additional provision for expansion of GM office along with boundary wall has been made in the Office complex. Additional Provision of welfare buildings such as shopping center, Gymnasium, Cycle shed, Garage, with suitable boundary wall has been made in colony area. Provision for a new executive hostel has been made. Provision for extension of VTC has also been made.

**Magazine:** As the existing magazine at Jayant OCP is adequate and no additional provision shall be required. The project has a valid license for this magazine vide Letter Noose/ HQ / MP/22/245 (E35199) dated 26.05.2017 (Refer **Annexure No.-X**). Also, project has license for transport and storage of Petroleum products in bulk vide Letter No. No.-P/CC/ MP/19/1028 (P360999) dated 28.10.2015 (Refer **Annexure No.-XI**).

**(F) Diversion of nallah/ river / road/ railway etc.** :

The EPR envisaged no diversion of any nallah /river/road/railway etc., Therefore, no diversion of any nallah /river/road/railway etc in future for this expansion.

### 2.7.9 Mitigation measures for environmental management at project :

**Dust control :**
Dust Supression with watering including spraying and sprinkling at pollution source points. Green Belt through afforestation, creation of parks and avenues in the township. There are dust Extraction and dust suppression system in the existing as well as in proposed CHP. Also, all the drills are provided with dust extraction system ,except one 311 mm dia blast hole drill, which has wet drilling system.

**Preventive steps :**
Proper and Periodic maintenance of vehicles & HEMM as per Schedule.

**Water management :**
The mine water and waste water from CHP, workshop and township are being re-used after traeatment in Mine ETP, CETP & STP. There is Zero discharge arrangement in the project, except in rainy season. the treated water from ETP & STP respectively ,are within the acceptable limits.

Ongoing measures for control of water pollution will be continued in future also. Overall water quality will be assured through regular monitoring.

**Rehabilitation and Resettlement :**
About 4000 PAPs are being affected due to additional tenancy land requirement of Jayant Expansion OCP for 25 Mtpa capacity. For the compensation purpose, Rs.278.33 crores (as per UCE, Aug.-2016) has been provided in the Expansion Project report. These families will be shifted/rehabilitated as per R&R policy of CIL/Govt.

PAPs are to be given plots in rehabilitation complex and shifting grant per family.
Direct employment, payment of compensation for land and houses etc. is being given as per guidelines and directives. The R&R of existing project has already been completed.

**Mitigation measures for Noise :**
- Planting rows of trees with thick foliage along roads and other noise generating points
- Isolating/enclosing the noisy machines/sources by using resilient paddings and proper enclosures
- Provision of ear muffs/ear plugs for workers.
- All machine mounting have in their foundation anti-vibration pads/sheets for reducing the vibration and thereby noise.
- All transfer chutes and hoppers in CHP have wear resistant rubber or ultra high molecular weight plastic liners of various thicknes as per design requiement and their suitability.

**Medical facilities :**
Apart from dispensaries and primary health centre at the project, there is a well equipped Nehru Shatabdi Chikitsalaya within 1.0 km from the mine. Regular/Periodic Medical Examination(PME) is being done for all the workers.

**Land degradation and reclaimation :**
Land will be degraded due to opencast working. However, it would be reclaimed concurrently with the mining operation and brought to post mining land use by backfilling, grading and afforestation on the filled OB dumps. The external OB dumps are old and has already been reclaimed/ technically & biologically.

The land degradation in the Expn. Project has been kept at minimum. The additional land required for Expn. is only for quarry and safety zone. Also, the total OB generated will be backfilled in the de-coaled area as internal dump and reclaimed techanically and biologically. There is no external dumping envisaged in EPR. OB/waste disposal techniques shall be adopted as discussed in 2.4.8 above.

**Preventive measures :**
The mine is being planned to have a risk free working environment by proper designed & monitoring the OB & coal benches, haul roads and periodical inspection by the supervisors & executives. All the requirment of mine rules & regulations are strictly followed and honestly implemented.

The mine employees are provided with protective equipment (Gloves, helmets, muff, shoes etc.). DGMS, officials are visiting for inspection of the mine periodically for certifying the adoption of the safety requirements for this mines. For proper health care , PME is carried out for all the employees to detect and prevent curable diseases at an early stage.

**Mine Closure Plan :**
The details of mine closure plan including progressive and final mine closure plan has been given in **Chapter-IV**.

## 2.8 Assessment of new & untested technology for risk of technological Failure :

Considering the geo-mining conditions of the block, the combined system of mining with dragline and shovel-dumper combination is being used for exploitation of coal. This technology is a proven and tested technology for NCL mines.

The EPR for coal production from existing Jayant OCP does not envisage any new or untested technology for exploitation of coal. Though, Surface Miners have been introduced in NCL mines including Jayant OCP as a Pilot Project. After the success of the Pilot Project, application of Surface Miner may be considered in future for its implementation.

Hence, the technologies used for opencast mining at Jayant Expn. is very safe and suitable. Northern Coalfields Ltd. /Coal India Ltd. is very much relying on these technologies adoption at this project.

# CHAPTER-III

# DESCRIPTION OF THE ENVIRONMENT

## 3.1 Study Area Profile

### 3.1.1 Location & communication

The Jayant Expansion Opencast Project of Northern Coalfields Limited is situated in Singrauli district of Madhya Pradesh. The project lies between latitudes $24^0$06'26.08" N to $24^o$11'40.86" N and Longitude $82^o$38'2.01" E to $82^o$40'55.64" E. Location of the Singrauli Coalfield and location of Jayant Expansion project along with other infrastructure facilities and adjoining coal and power projects etc is shown in **Plate No.- 2**

Jayant Project site is well connected by both road and rail. Nearest Railway Station Shaktinagar is about 5 km towards east and Singrauli Station is 12 km from the project office.

Ranchi-Rewa Highway passes E-W through the Southern part of Project. Project is also well connected to Singrauli Township on the north and Waidhan, HQ of Singrauli district on the south at 12km and 8km respectively. Road to Singrauli passes over the coal bearing area of the project between Nigahi and Jayant OCPs.

### 3.1.2 Topography & drainage

**Topography**

Project is situated on plateau with elevations varying from 375 m. to 425 m. above Mean Sea Level (MSL).

**Surface drainage of Singrauli Coalfields**

The main mining activities in this coalfield were started in late seventies, hence so far no major changes have taken place in surface drainage system compared to pre-mining stage.

The Moher Basin can be morphologically divided into two distinct units, the northern and the southern sections separated by a crescent shape ridge from east to west in an accurate manner.
The ridges which contain coal reserves start from Kakri & pass to South and south-west through Bina, Marrak, Khadia, take a western swing through Dudhichua, Jayant, Nigahi, Amlohri, Moher and then take a north to north-east swing through Block - B.

**Northern side**

The northern drainage of the basin consist of several streamlets starting from the north side of the project area of Dudhichua, Jayant, Nigahi, Amlohri & west of Block 'B'. These ultimately join the Bijul Nalla which is perennial in nature. This nalla runs eastward in the area and ultimately joins the Sone river as one of its tributaries. The total area of northern region is about 132 Sq.Km.

The mining blocks which contribute to drainage of this area are Jhingurda, part of Dudhichua, part of Nigahi, part of Block 'B' and Gorbi. The drainage of Jhingurda and Gorbi Mine is controlled by Chatka and Upka nalla respectively, which ultimately joins Bijul. Drainage from northern part of Dudhichua and Nigahi flows into Chatka and Morwa/Mehrauli nalla respectively. Runoff from northern part of Block-B drains into Doraha nalla.

The northern draining streams which form the tributaries of Bijul nalla are:-

| | | | |
|---|---|---|---|
| i) | Morwa/Mehrauli (near Singrauli) | - | Perennial |
| ii) | Chatka (near Jhingurda) | \| | |
| iii) | Doraha (near Block-B) | \| | All are seasonal |
| iv) | Upka (near Gorbi Mine) | \| | in nature |

**Southern side**

The southern and eastern drainage region of the Moher Basin contains several stream-lets which start on the southern escarpments of sandstone formations and form streams, as detailed below. All these nallas drain into Govind Ballav Pant Sagar (Rihand Reservoir). The area of southern region is about 263 Sq.Km including Waidhan plains.

The mining block contributing to drainage of this area are Kakri, Bina, Marrak, Khadia, part of Dudhichua, Jayant, part of Nigahi, Amlohri and part of Block-B. Run-off from Kakri, Bina and Marrak flows through Kakria, Gorbandha and Jamtihua nalla respectively. The drainage of Khadia is controlled by Senduri and Hadwaria nalla which are tributaries of Ballia nalla.

The runoff from northern part of Jayant and southern part of Dudhichua flows into Ballia nalla. Southern part of Jayant and Nigahi contribute to main catchment of Motwani nalla. There is one dam formed by constructing an earthen embankment across the Motwani nalla near Jayant. The drainage of Amlohri and southern side of Block-B is controlled by Amjhar and Karahia nalla respectively which ultimately joins Kanchan river.

The southern draining streams are:-

| | | | |
|---|---|---|---|
| i) | Tippa Jharia (near Jhingurdah) | - | Perennial |
| ii) | Kakria (near Kakri) | \| | |
| iii) | Gorbandha (near Bina) | \| | |
| iv) | Jamtihua (near Bina Mine-II) | \| | |
| v) | Hadwaria, Senduri (Khadia) | \| | |
| vi) | Ballia (Dudhichua) | \| | Seasonal |
| vii) | Motwani (Jayant) | \| | |
| viii) | Amjhar (Amlohri) | \| | |
| ix) | Karahia nalla (Block - B) | \| | |
| x) | Kachani river | - | Perennial |

A contour map showing the area drainage of the core zone and 25 km of the study area (where the water courses of the core zone ultimately join the major rivers/streams outside the lease/ project area) is shown in drainage pattern of Singrauli Coalfields given as **Plate No.-5.**

**Drainage pattern of Project area**

Bijul Nalla, a tributary of Sone river traverses, the north-eastern part of the block. A numbers of seasonal nallas, flowing from north to south and south to north drain through this area and meet the master drain, the Rihand Dam (Govind Ballabh Pant Sagar) which is located south of this area and Sone river located North of this area. Bijul Nalla, Motwani Nalla, Balia Nalla, Amjhar Nalla and Tippa Jharia Nalla drain this area. The drainage pattern of Jayant project area is shown in **Plate No.-6.**

### 3.1.3 Climate

The region lies in south-eastern part of Uttar Pradesh and North- eastern part of Madhya Pradesh. This zone falls under the influence of South- west monsoon. The climate of the Singrauli area is tropical with three seasons- summer (March to June), monsoon (July to October), and Winter (November to February). The climate of this area is tropical with severe summer. The temperature in summer rises as high as 48$^{o}$C in May and June. In winter, temperature comes down to 4$^{o}$C and varies upto 21$^{o}$C.

The rainy season is generally from July to September with average rainfall around 1132.70 mm. The percentage of days is the highest for wind blowing in ESE direction and lowest in south direction. The average wind velocity is around 5 Km per hour.

### 3.1.4 Description of Core zone

The areas whose socio- economic attributes are directly affected by the operation of Coal Mining and allied activities are termed as the Core Zone. They are the most sensitive areas so far as environmental attributes are concerned.

The core zone of the project comprising of excavation zone, OB dump site, infrastructure area and safety zone for blasting covers partly and /or fully the land from 8 villages. In the Jayant Project area 8 villages are directly affected by mining operations namely Mudwani, Garda, Saraswah Rajatola, Saraswah Laltola, Jaitpur, Nigahi, Madhauli and Chandoli, which constitute the core zone. Out of these villages Garda & Chandoli villages are fully affected & balance six villages are partially affected by the existing project. The proposed expansion affects only Madhauli village partially.

Location of the eight affected Villages has been marked over the plan and shown in **Plate No.-7**

### 3.1.5 Description of Buffer zone

The area which are likely to be indirectly affected by the mining operations is termed as Buffer zone. The area within 10 KM radial distance from the leasehold boundary of the core zone of the project, excluding the core zone. Total 62 villages and 02 towns of Singrauli District of Madhya Pradesh state and 10 villages and 02 towns of Sonebhadra District of Uttar Pradesh, lie in the buffer zone. List of villages in study area is given in **Annexure No.-XV.** The whole of core zone and buffer zone combined, constitute the study area for EIA- EMP study.

These two zones with study area of Jayant Expansion Project has been marked over the plan and shown in **Plate No.–8.**

### 3.1.6 Features in the study area

The area is stated as the energy capital of the country, with number of coal mines and super thermal power plants operating in the area. The major features within the study area are given below:

| S. No. | Name of Feature | | Particulars of Feature |
|---|---|---|---|
| 1 | Mining Projects | (i)<br>(ii)<br>(iii)<br>(iv)<br>(v)<br>(vi)<br>(vii)<br>(viii)<br>(ix)<br>(x) | Amlohri OCP<br>Nigahi OCP<br>Dudhichua OCP<br>Khadia OCP<br>Jhingurdah OCP<br>Part of Krishnashila OCP<br>Part of Bina OCP<br>Part of Kakri OCP<br>Block-B OCP<br>Part of Moher OCP (Private SPL) |
| 2 | Thermal Power Stations | a)<br>b) | Vindhyachal STPS<br>Singrauli STPS |

| S. No. | Name of Feature | | Particulars of Feature |
|---|---|---|---|
| 3 | Dam | (i)<br>(ii) | Mudwani<br>Amjhar |
| 4 | Metalled Road | (i)<br>(ii)<br>(iii) | PWD metalled road connecting Singrauli and Waidhan via Jayant<br>PWD metalled road connecting Shaktinagar and Waidhan via Jayant<br>Ranchi-Rewa Highway passes E-W through the southern part of the project. |
| 5 | Railways | (i)<br>(ii) | Chopan Singrauli-Katni (Central Rly)<br>Singrauli-Obera (Eastern Rly) |
| 6 | Nallah | (i)<br>(ii)<br>(iii)<br>(iv)<br>(v) | Bijul Nalla<br>Ballia Nalla<br>Motwani Nalla<br>Sendhuri Nalla<br>Jogia Nalla |
| 7 | Forests | (i)<br>(ii)<br>(iii)<br>(iv)<br>(v)<br>(vi) | Gorbi Protected Forest<br>Parari Protected Forest<br>Moher Reserved Forest<br>Dudhichua Protected Forest<br>Mehrauli Protected Forest<br>Charki Reserved Forest |

As per the baseline survey study for Flora & Fauna, the study area is not an ecological sensitive area such as Bio-sphere Reserves/ National Parks / WL Sanctuaries / Elephant Reserves / migratory corridors of fauna and areas where endangered fauna and plants of medicinal and economic importance, exist in the study area. (**Refer Annexure No.-XXI** )

## 3.2 Environmental Baseline Study

The present environmental quality assessment, impacts and mitigation measures has been carried out by generating the baseline data of environmental quality parameters such as Ambient air, water, Noise levels, soil, Flora & Fauna study, socio-economic study, Land use survey by remote sensing, Hydro-geological study, water levels, etc.

Environmental Baseline study for the project has already been completed in March-June'2016 and the details of the studies conducted, period and agency entrusted, has been given below. The results of the study has been incorporated in the subsequent chapters for arriving at the impact assessment.

The studies conducted are tabulated as under:-

| Sl. No. | Nature of Study | Date and duration of study | Name of Agency which has conducted the study |
|---|---|---|---|
| 1 | Seasonal Ambient Air Quality, water/wastewater Quality, Soil Quality and Noise Levels Quality Study | March-June,2016 | M/s CEG Test House, Jaipur, Rajasthan |
| 3 | Socio- Economic and Occupational Health Survey | March- June, 2016 | M/s VRDS Consultants, Chennai, TN |
| 5 | Flora & Fauna study | Nov.,2016 | M/s. Eko Pro Engineers Pvt. Ltd., Gaziabad (UP) |
| 9 | Hydro-geological Study | Nov.-2016 | CMPDI |
| 10 | Land use Map by Remote sensing | IRS R2, LISS-IV data of the year 2015 and 2016 | Geometrics Division, CMPDI |
| 11 | Geology, Mining & economic parameter | EPR, Jan.'16 | Mine Planning Deptt, CMPDI |

CMPDI is also carrying out regular environmental monitoring of environmental parameters such as ambient air, water/effluent, noise and groundwater levels & quality for the existing Jayant OCP. The monitoring data have been taken in the assessment.

## 3.3 Existing Environmental scenario:

### 3.3.1 Socio-Economic Profile:

A study on Socio- Economic and Occupational Health Survey was conducted by M/s VRDS Consultants, Chennai, TN during March- June, 2016. Base line data on socio-economic aspects was collected for villages in core zone and buffer zone (area covering 10 km radial distance from the periphery of the Jayant Project) comprising 72 villages and 04 towns are in Singrauli district of Madhya Pradesh and in Sonebhadra District of Uttar Pradesh. The data was taken from the census report-2011 and also a sample survey was conducted in the study area for the same. The data from both the sources has been analysed and discussed in the study Report given as **Annexure No.-XV.**

The study reveals that, there are no places of religious historical and archaeological importance in the core and buffer zones except small village temples. Literacy level amongst female is less compared to male. Majority of village people are employed as workers. Primary schools are not available within most of the villages.

One dispensary with adequate medical facilities is present in Jayant colony. Another 150 bedded *Nehru Shatabdi Chikitsalaya* with all modern diagnostic and treatment facility has also been established.

The villagers don't have proper record of their medical history. Out of the surveyed villagers nobody has reported chronic disease. It is observed that Asthma, Hypertension, Cataract, Conductive Hearing Problem (CHB), and Dyslipidemia (Cholesterol) are common in people of old age group (> 40 years). Malaria, Jaundice, Dysentery/Diarrhea and Skin diseases are common in all age groups. Fibroid Uterus is common problems in ladies. No major diseases related to occupation have been observed in the study area.

There are 1438 land owners and 5860 house owners in this acquired land and about 1599 PAFs are eligible for rehabilitation /lump sum compensation as reported by Project.

The compensation of Rs. 617,41,86,624/- of land, trees, bandhas, houses, wells and bore wells etc. was sanctioned by The Ministry of Coal vide OM. 43020/10/2017-LA&IR dated 12.06.2017. These families will be shifted/rehabilitated as per R&R policy of CIL/Govt.

## 3.4. Primary baseline data on environmental quality

One-season (other than monsoon) primary baseline data on environmental quality – air ($PM_{10}$, $PM_{2.5}$, SOx, NOx and heavy metals such as Hg, Pb, Cr, As, etc.), noise, water (surface and groundwater), soil - along with one-season met data coinciding with the same season for AAQ collection, has been collected during March–June, 2016 (Pre-monsoon season) ; by M/S CEG Test House and Research Centre Pvt. Ltd., Jaipur, Rajasthan.

### 3.4.1 Micro-meteorology based on Site specific study

#### a) Location and rationale of sampling

Meteorological parameters are important factors in the study of Air pollution. The transport and diffusion of the pollutants in the atmosphere are governed by meteorological factors. Factors wind velocity, wind direction and atmospheric stability are known as primary/basic meteorological parameters since the dispersion and diffusion of pollutants depend mainly on these factors. Factors like ambient temperature, humidity, rainfall, atmospheric pressure, etc., are known as secondary meteorological parameters as these factors control the dispersion of the pollutants indirectly by affecting the primary factors. Thus, to assess the air pollution impact it becomes essential to collect the above-mentioned meteorological parameters in the project area.

Micrometeorological and microclimatic parameters are recorded by installing a meteorology station at Coal Sub-station of Jayant Project in Core zone as it represents the prevailing micrometeorological aspects of the study area.

During the study period, hourly readings of wind velocity, wind direction, temperature, relative humidity, cloud cover, atmospheric pressure and rainfall data are recorded and reported. Location of Metrological Station is shown in **Plate No.-9**. Abstract of these data along with Seasonal Wind rose diagram is given in **Annexure-XVI.**

**b) Methodology of sampling**

Auto weather monitoring station was installed at Coal Sub-station of Jayant mines and the station was hindrance free and opens from all the directions. Micro-meteorological data were collected for wind speed, wind direction, ambient temperature, relative humidity, barometric pressure, cloud cover, and sky appearance are recorded at hourly intervals along with rainfall data for 24 hours for the study period (Pre Monsoon.

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**c) Observations**

Meteorological data collected during the study reveal the following status:

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

**Wind Velocity**: Wind velocity are ranging from 0.0 kmph to 39.2 kmph.

**Temperature**: Temperature are ranging from 17.6 to 44.9°C.

**Relative Humidity**: The relative humidity are in the range of 8.0 to 91.2 %.

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

**Atmospheric Pressure**: The atmospheric pressure are ranging from 717.1 mm of Hg to 735.0 mm of Hg.

**Rainfall**: Generally no rainfall is recorded during the study period (pre monsoon season).

### 3.4.2 Ambient air quality Scenario

**a) Inventory of existing pollution sources**

Existing sources in the study area with respect to air pollution are existing coal mines i.e. Amlohri OCP, Nigahi OCP & Khadia OCP, Dhudhichua OCP, Thermal Power Stations i.e. Singrauli Super thermal Power Station, Vindhyachal Super thermal Power Station and vehicular activities only.

**b ) Scope & methodology**

To assess the ambient air quality status, monitoring stations are identified on the basis of meteorology in the upwind and downwind direction as well as to represent the cross sectional scenario of the project site. Kasar Village (JYAB5) was selected to represent upwind air quality conditions and the other stations of buffer zone and core zone were selected to represent downwind air quality status.

**c) Ambient Air Sampling**

The ambient air quality monitoring stations were set up at eight locations, four locations in core zone and four locations in buffer zone with due consideration to the above-mentioned points and as per the MoEFCC & CPCB guidelines.

Ambient air sampling was done at specified locations for 24 hours with a frequency of twice in a week at all the selected locations and the samples collected from various locations and analyze the prescribed parameters as per standard methods given in IS 5182 / CPCB guidelines. The following sampling sites as shown in the **Plate No.-10,** were selected for ambient air monitoring.

**Ambient Air Quality Monitoring Locations (Core Zone)**

| S. No. | Location Name | Coordinates of the Location | | Category | Station Code |
|---|---|---|---|---|---|
| | | Latitude | Longitude | | |
| 1 | Rose Garden | 24°06'30.6"N | 82°38'42.3"E | Residential | JYAB 1 |
| 2 | Base Work Shop | 24°07'35.3"N | 82°39'18.7"E | Industrial | JYAB 2 |
| 3 | CETP | 24°08'10.3"N | 82°39'45.4"E | Industrial | JYAB 3 |
| 4 | Baiga Basti | 24°08'12.5"N | 82°38'57.5"E | Residential | JYAB 4 |

**Ambient Air Quality Monitoring Locations (Buffer Zone)**

| S. No. | Location Name | Coordinates of the Location | | Category | Station Code |
|---|---|---|---|---|---|
| | | Latitude | Longitude | | |
| 5 | Kasar Village | 24°12'57.68"N | 82°33'57.71"E | Residential | JYAB 5 |
| 6 | Nigahi STP | 24° 6'1.49"N | 82°38'8.00"E | Residential | JYAB 6 |
| 7 | Near IWSS | 24°06'59.3"N | 82°42'24.1"E | Residential | JYAB 7 |
| 8 | Kohroul Village | 24° 7'9.36"N | 82°45'36.14"E | Residential | JYAB 8 |

**Air Quality Monitoring Parameters**

| S. No. | Parameter | Unit |
|---|---|---|
| **Particulate matter** | | |
| 1 | Suspended Particulate Matter as SPM | µg/m$^3$ |
| 2 | Particulate Matter as $PM_{10}$ (≤10µm) | µg/m$^3$ |
| 3 | Particulate Matter as $PM_{2.5}$ (≤2.5µm) | µg/m$^3$ |
| **Gaseous pollutants** | | |
| 4 | Oxides of Nitrogen as $NO_x$ | µg/m$^3$ |
| 5 | Sulphur Dioxide as $SO_2$ | µg/m$^3$ |
| **Trace/Heavy metals** | | |
| 6 | Mercury as Hg | µg/m$^3$ |
| 7 | Chromium as Cr | µg/m$^3$ |
| 8 | Cadmium as Cd | µg/m$^3$ |
| 9 | Lead as Pb | µg/m$^3$ |
| 10 | Arsenic as As | ng/m$^3$ |
| 11 | Nickel as Ni | ng/m$^3$ |
| 12 | Free Silica in $PM_{10}$ | % |

**Methodology of Sampling and Analysis**

The instruments used and method adopted for analysis for ambient air monitoring are given below:

| S. No. | Parameter | Equipment used for sampling | Method of analysis |
|---|---|---|---|
| | **Particulate matter** | | |
| 1 | Suspended Particulate Matter as SPM | Respirable Dust sampler (RDS) | IS: 5182 (P-4) |
| 2 | Particulate Matter as $PM_{10}$ (≤10µm) | Respirable Dust sampler (RDS) | IS: 5182 (P-23) |
| 3 | Particulate Matter as $PM_{2.5}$ (≤2.5µm) | Fine Particulate Sampler (FPS) | CPCB Guidelines (Gravimetric Method) |
| | **Gaseous pollutants** | | |
| 4 | Oxides of Nitrogen as $NO_x$ | RDS with Gaseous Sampling Attachment | IS: 5182 (P-6) |
| 5 | Sulphur Dioxide as $SO_2$ | RDS with Gaseous Sampling Attachment | IS: 5182 (P-2) |
| | **Trace/Heavy metals** | | |
| 6 | Mercury as Hg | Respirable Dust sampler (RDS) | CPCB Guidelines (ICP-MS) |
| 7 | Chromium as Cr | Respirable Dust sampler (RDS) | CPCB Guidelines (ICP-MS) |
| 8 | Cadmium as Cd | Respirable Dust sampler (RDS) | CPCB Guidelines (ICP-MS) |
| 9 | Lead as Pb | Respirable Dust sampler (RDS) | CPCB Guidelines (ICP-MS) |
| 10 | Arsenic as | Respirable Dust sampler (RDS) | CPCB Guidelines (ICP-MS) |
| 11 | Nickel as Ni | Respirable Dust sampler (RDS) | CPCB Guidelines (ICP-MS) |
| 12 | Free Silica in $PM_{10}$ | Respirable Dust sampler (RDS) | FTIR Method |

### 3.4.2.1Ambient Air Analysis

Instruments used for analysis of ambient air are given below:

| S. No. | Instrument Name | Make | Model/ Serial No. | Parameters |
|---|---|---|---|---|
| 1 | UV Spectrophotometer | Thermo Scientific, USA | EVO201 | $SO_2$, $NO_2$ |
| 2 | Electronic Balance | Matter Toledo | ME-204 | SPM, $PM_{10}$, |
| 3 | Micro Balance | Citizen | CX-165 | $PM_{2.5}$ |
| 4 | FTIR | Thermo Scientific, USA | AKX1200366 | Free Silica in $PM_{10}$ |
| 5 | ICP-MS | Thermo Scientific, USA | SN02200C | As, Ni, Pb, Hg, Cr, Cd |

### 3.4.2.2 Ambient Air Quality Standards and observations:

**Standards for coal mines:**

Ministry of Environment and Forest vide Notification no. GSR742 (E) dated 25/9/2000 has issued the standards for coal mines and the applicable standards for Singrauli Coalfields are as follows:

| Pollutant | Time Weighted Average | Concentration in Ambient Air ($\mu g/m^3$) | Method of Measures |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| Suspended Particulate Matter (SPM) | Annual* Average | 430 | High Volume Sampling (Average flow rate not less than 1.1 $m^3$/minute) |
| | 24 Hrs.** | 600 | |
| Respirable Particulate Matter (Size less than 10 µm) (RPM) | Annual Average* | 215 | Respirable Particulate Matter Sampling and analysis |
| | 24 Hrs** | 300 | |
| Sulphur dioxide ($SO_2$) | Annual Average* | 80 | 1. Improved West & Gaeke<br>2. Ultra fluorescene |
| | 24 Hrs.** | 120 | |
| Oxide of Nitrogen ($NO_2$) | Annual Average* | 80 | 1. Jacob & Hochheiser Modified (Na-Arsenic Method)<br>2. Gas Phase Chemiluminescence |
| | 24 Hrs** | 120 | |

**Note:**

* Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause 2 i.e. fortnightly.

** 24 hourly / 8 hourly values shall be met 92% of the time in a year. However, 8% of the time it may exceed but not on two consecutive days.

**National Ambient air quality Standards:**

The residential areas in the coal mining area are compared with the National Ambient Air Quality standards issued by CPCB vide Gazette Notification no. 217 on 18th Nov. 2009 as given below :

**National ambient air quality standards**

| Sl. No. | Pollutant | Time weighted average | Concentration in Ambient Air | | |
|---|---|---|---|---|---|
| | | | Industrial, Residential, Rural and Other Area | Ecologically Sensitive Area (notified by Central Government) | Methods of Measurement |
| (1) | (2) | (3) | (4) | (5) | (6) |
| 1. | Sulphur Dioxide (SO2), µg/ $m^3$ | Annual*<br>24 hours** | 50<br>80 | 20<br>80 | - Improved West and Gaeke<br>- Ultraviolet fluorescence |
| 2. | Nitrogen Oxide (NO2), µg/ $m^3$ | Annual*<br>24 hours** | 40<br>80 | 30<br>80 | - Modified Jacob & Hochheiser (Na-Arsenite)<br>- Chemiluminescence |
| 3. | Particulate Matter (Size less than 10 µm) or PM10 µg/ $m^3$ | Annual*<br>24 hours** | 60<br>100 | 60<br>100 | - Gravimetric<br>- TOEM<br>- Beta attenuation |
| 4. | Particulate Matter (Size less than 2.5 µm) or PM2.5 µg/ $m^3$ | Annual*<br>24 hours** | 40<br>60 | 40<br>60 | - Gravimetric<br>- TOEM<br>- Beta attenuation |
| 5. | Lead (Pb) µg/ $m^3$ | Annual*<br>24 hours** | 0.50<br>1.0 | 0.50<br>1.0 | - AAS/ICP method after sampling on EPM 2000 or equivalent filter paper<br>- ED-XRF using Teflon filter |
| 6. | Arsenic (As) ng/ $m^3$ | Annual* | 06 | 06 | - AAS/ICP method after sampling on EPM 2000 or equivalent filter paper |
| 7. | Nickel (Ni) ng/$m^3$ | Annual* | 20 | 20 | - AAS/ICP method after sampling on EPM 2000 or equivalent filter paper |

***** Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

****** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they exceed the limits but not on two consecutive days of monitoring.

**Observations of baseline data of AAQ**

The baseline data generated in Air for SPM, $PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_X$ and heavy metals such as Pb, As, Ni, Cr, Cd, Hg and free silica in $PM_{10}$ ; for Summer season is given in **Annexure-XVII**. Salient observations for five locations are summarised below:-

**Discussion of Ambient Air Quality**

**Rose Garden – (JYAB1):**

At this location, SPM concentrations are in the range of 227 - 279 µg/m$^3$. $PM_{10}$ and $PM_{2.5}$ concentration ranges between 73 - 88 µg/m$^3$ and 38 - 50 µg/m$^3$ respectively whereas NOx and $SO_2$ concentration ranges between 20.4 - 36.5 µg/m$^3$ and 14.2 - 21.5 µg/m$^3$ respectively. Hg concentrations are in the range of 0.001 – 0.002 µg/m$^3$. All Cr and Cd concentrations are found to be below detection limit of 0.001 µg/m$^3$ and 0.001 µg/m$^3$ respectively. Pb concentration are in the range of 0.001 – 0.029 µg/m$^3$. As and Ni concentration ranges between 1.02 – 1.27 and 1.32 – 1.43 ng/m$^3$. Free silica in $PM_{10}$ concentration ranges between 4.3 – 4.6 %. SPM, $PM_{10}$, $PM_{2.5}$, NOx, $SO_2$, Pb, As and Ni concentrations are found within the CPCB limit for residential area.

**Baiga Basti – (JYAB4):**

At this location, SPM concentrations are in the range of 228 - 273 µg/m$^3$. $PM_{10}$ and $PM_{2.5}$ concentration ranges between 75 – 90 µg/m$^3$ and 36 – 48 µg/m$^3$ respectively whereas NOx and $SO_2$ concentration ranges between 24.1 – 39.4 µg/m$^3$ and 12.6 – 28.5 µg/m$^3$ respectively. Hg concentration are in the range of 0.001 – 0.002 µg/m$^3$. All Cr and Cd concentrations are found to be below detection limit of 0.001 µg/m$^3$ and 0.001 µg/m$^3$ respectively. Pb concentrations are in the range of 0.083 – 0.180 µg/m$^3$. As and Ni concentration ranges between 1.00 – 1.09 and 1.00 – 1.24 ng/m$^3$. Free silica in $PM_{10}$ concentration ranges between 3.7 – 4.2 %. SPM, $PM_{10}$, $PM_{2.5}$, NOx, $SO_2$, Pb, As and Ni concentrations are found within the CPCB limit for residential area.

**Kasar Village – (JYAB5):**

At this location, SPM concentrations are in the range of 232 - 272 µg/m$^3$. $PM_{10}$ and $PM_{2.5}$ concentration ranges between 76 – 87 µg/m$^3$ and 35 – 51 µg/m$^3$ respectively whereas NOx and $SO_2$ concentration ranges between 27.5 – 37.1 µg/m$^3$ and 14.9 – 21.5 µg/m$^3$ respectively. Hg concentrations are found to be below detection limit of 0.001 µg/m$^3$. All Cr and Cd concentrations are found to be below detection limit of 0.001 µg/m$^3$ and 0.001 µg/m$^3$ respectively. Pb concentrations are in the range of 0.021 – 0.035 µg/m$^3$. As and Ni concentration ranges between 1.24 – 1.27 and 1.25 – 1.47 ng/m$^3$. Free silica in $PM_{10}$ concentration ranges between 4.1 – 4.5 %. SPM, $PM_{10}$, $PM_{2.5}$, NOx, $SO_2$, Pb, As and Ni concentrations are found within the CPCB limit for residential area.

**Nigahi STP – (JYAB6):**

At this location, SPM concentrations are in the range of 235 - 301 µg/m$^3$. $PM_{10}$ and $PM_{2.5}$ concentration ranges between 81 – 90 µg/m$^3$ and 36 – 57 µg/m$^3$ respectively whereas NOx and $SO_2$ concentration ranges between 25.2 – 43.2 µg/m$^3$ and 15.6 – 31.2 µg/m$^3$ respectively. Hg concentrations are in the range of 0.001 – 0.002 µg/m$^3$. All Cr and Cd concentrations are found to be below detection limit of 0.001 µg/m$^3$ and 0.001 µg/m$^3$ respectively. Pb concentrations are found to be below detection limit of 0.001 µg/m$^3$. As and Ni concentration ranges between 1.00 – 1.02 and 1.00 – 1.28 ng/m$^3$. Free silica in $PM_{10}$ concentration ranges between 4.4 – 4.8 %. SPM, $PM_{10}$, $PM_{2.5}$, NOx, $SO_2$, Pb, As and Ni concentrations are found within the CPCB limit for residential area.

**Near IWSS – (JYAB7):**

At this location, SPM concentrations are in the range of 253 - 290 µg/m$^3$. $PM_{10}$ and $PM_{2.5}$ concentration ranges between 82 – 92 µg/m$^3$ and 43 – 55 µg/m$^3$ respectively whereas NOx and $SO_2$ concentration ranges between 24.5 – 40.2 µg/m$^3$ and 13.4 – 31.4 µg/m$^3$ respectively Hg concentrations are found to be below detection limit of 0.001 µg/m$^3$. All Cr and Cd concentrations are found to be below detection limit of 0.001 µg/m$^3$ and 0.001 µg/m$^3$ respectively. Pb concentrations range between 0.160 µg/m$^3$ to 0.290 µg/m$^3$. As and Ni concentration ranges between 1.08 – 1.24 and 1.26 – 1.46 ng/m$^3$. Free silica in $PM_{10}$ concentration ranges between 4.1 – 4.4 %. SPM, $PM_{10}$, $PM_{2.5}$, NOx, $SO_2$, Pb, As and Ni concentrations are within the CPCB limit for residential area.

**Kohroul Village – (JYAB8):**

At this location, SPM concentrations are in the range of 256 - 298 µg/m$^3$. $PM_{10}$ and $PM_{2.5}$ concentration ranges between 83 – 90 µg/m$^3$ and 43 – 54 µg/m$^3$ respectively whereas NOx and $SO_2$ concentration ranges between 23.2 – 40.2 µg/m$^3$ and 14.5 – 31.4 µg/m$^3$ respectively. Hg concentrations are found to be below detection limit of 0.001 µg/m$^3$. All Cr and Cd concentrations are found to be below detection limit of 0.001 µg/m$^3$ and 0.001 µg/m$^3$ respectively. Pb concentrations are in the range of BDL – 0.026 µg/m$^3$. As and Ni concentration ranges between BDL – 1.15 and BDL – 1.37 ng/m$^3$. Free silica in $PM_{10}$ concentration ranges between 4.6 – 4.8 %. SPM, $PM_{10}$, $PM_{2.5}$, NOx, $SO_2$, Pb, As and Ni concentrations are found within the CPCB limit for residential area.

**Base Work Shop – (JYAB2):**

At this location, SPM concentrations are in the range of 396 - 446 µg/m$^3$. $PM_{10}$ and $PM_{2.5}$ concentration ranges between 147 – 178 µg/m$^3$ and 51 – 59 µg/m$^3$ respectively whereas NOx and $SO_2$ concentration ranges between 25.6 – 36.8 µg/m$^3$ and 12.5 – 25.4 µg/m$^3$ respectively. Hg concentrations are in the range of 0.002 – 0.003 µg/m$^3$. All Cr and Cd concentrations are found to be below detection limit of 0.001 µg/m$^3$ and 0.001 µg/m$^3$ respectively. Pb concentration are in the range of 0.019 – 0.023 µg/m$^3$. As and Ni concentration ranges between 1.00 – 1.31 and 1.23 – 1.34 ng/m$^3$. Free silica in $PM_{10}$ concentration

ranges between 4.1 – 4.6 %. SPM, $PM_{10}$, NOx and $SO_2$ concentrations are found within the CPCB coal mines limit for Industrial Area.

**CETP – (JYAB3):**

At this location, SPM concentrations are in the range of 408 - 441 µg/$m^3$. $PM_{10}$ and $PM_{2.5}$ concentration ranges between 158 – 179 µg/$m^3$ and 54 – 61 µg/$m^3$ respectively whereas NOx and $SO_2$ concentration ranges between 20.7 – 37.4 µg/$m^3$ and 12.9 - 21.5 µg/$m^3$ respectively. Hg concentrations are in the range of 0.001 – 0.003 µg/$m^3$. All Cr and Cd concentration are found to be below detection limit of 0.001 µg/$m^3$ and 0.001 µg/$m^3$ respectively. Pb concentrations are in the range of 0.25 – 0.29 µg/$m^3$. As and Ni concentration ranges between 1.34 – 2.01 and 1.39 – 1.65 ng/$m^3$. Free silica in $PM_{10}$ concentration ranges between 3.9 – 4.4 %. SPM, $PM_{10}$, NOx and $SO_2$ concentrations are found within the CPCB coal mines limit for Industrial Area.

### 3.4.3 Baseline Water Quality Scenario

**a) Inventory of Existing Pollution Sources**

Existing sources in the study area with respect to water pollution are mainly industrial effluent from coal mines, thermal power stations and domestic sewage.

**b) Objective of Water Quality Monitoring**

The objectives of water quality monitoring are as follows:

- Planning of pollution control strategies.
- To identify nature and magnitude of pollution control measures required.
- To evaluate effectiveness of pollution control efforts already in existence.
- Identification of state & trends in water quality both in terms of concentrations & effects.
- To identify the quality of water suggest the control measure to make suitable for drinking purpose.
- Testing of compliance with standards.
- Early warning and detection of pollution.

**c) Criteria for Site Selection**

Some general criteria for selecting appropriate sampling sites has been follows:

- Always have a reference station up-stream of all possible discharge points. The usual purpose of a monitoring exercise is to determine the degree of man induced pollution, and the damage that is caused to aquatic life.
- Sampling stations should be located upstream and downstream of significant pollution outfalls like STP and industrial effluent outfalls.

- Additional downstream stations are necessary to access the extent of the influence of an outfall, and locate the point of recovery.
- In case of groundwater sampling select only wells (tube wells, dug-well, hand pump), which are in use.
- Location of residential areas representing different activities/likely impact areas.

The details of water samples collected at locations are as follows:

**Drinking Water Quality Monitoring Locations**

| S. No. | Location Name | Coordinates of the Location | | Station Code |
|---|---|---|---|---|
| | | Latitude | Longitude | |
| 1 | Jayant Guest House (Tape Water) | 24°07'02.64"N | 82°39'44.44"E | JYDW 1 |
| 2 | Nandgaon Village (Hand pump) | 24°06'17.14"N | 82°35'14.18"E | JYDW 2 |
| 3 | Chilkatand Village (Hand pump) | 24°07'26.44"N | 82°42'11.10"E | JYDW 3 |
| 4 | Baiga Basti (Hand pump) | 24°08'12.01"N | 82°38'47.56"E | JYDW 4 |
| 5 | Meharuli Village (Dug well of Sheetalapad Prajapati) | 24°11'06.88"N | 82°38'54.63"E | JYDW 5 |
| 6 | Jaitpur Village (Dug well of Ram Kumar Sahu) | 24°06'16.21"N | 82°39'27.09"E | JYDW 6 |

**Surface Water Quality Monitoring Locations**

| S. No. | Location Name | Coordinates of the Location | | Station Code |
|---|---|---|---|---|
| | | Latitude | Longitude | |
| 1 | Madwani Dam (Overflow) | 24°07'58.13"N | 82°39'10.55"E | JYSW 1 |
| 2 | Ballia Nallah (Downstream near Shakti Nagar Road Crossing) | 24°07'08.34"N | 82°40'38.48"E | JYSW 2 |
| 3 | GBP Sagar (Near Fishing Location) | 24°06'42.31"N | 82°46'48.60"E | JYSW 3 |

**Effluent Water Quality Monitoring Locations**

| S. No. | Location Name | Coordinates of the Location | | Station Code |
|---|---|---|---|---|
| | | Latitude | Longitude | |
| 1 | ETP Outlet | 24°08'42.41"N | 82°39'22.88"E | JYEW 1 |
| 2 | CETP Outlet | 24°08'09.08"N | 82°39'44.77"E | JYEW 2 |
| 3 | STP Outlet | 24°06'21.81"N | 82°39'08.36"E | JYEW 3 |

The locations of drinking, surface and effluent water has been shown in **Plate No.-11, 12 and 13** respectively.

**d) Methodology for sampling**

Water samples were collected for physico-chemical and bacteriological parameters taking suitable precautions. Sterilized bottles were used to collect

samples for bacteriological analysis, stored in ice and transported to the Central Laboratory.

Temperature, pH, and dissolved oxygen were measured on spot during sampling. Physico-chemical and bacteriological parameters were determined in the laboratory as per standard methods. The selected parameters for water quality of ground water resources in and around project site have been studied for assessing the water environment and evaluate anticipated impact of the proposed project.

The general guidelines adopted for sampling are as follows:

- Rinse the sample container three times with sample before it is filled
- Leave a small air space in the bottle to allow mixing of sample at the time of analysis.
- Label the sample container properly, preferably by attaching an appropriately inscribed tag or label. The sample code and the sampling date should be clearly marked on sample container or the tag.
- Complete the sample identification form for each sample.
- Sample identification forms should be kept in a master file at the laboratory where the sample is analyzed.

**e) Methodology for sample analysis**

In order to assess the quality of water, samples collected at various locations were analyzed as per IS 3025, IS 1622 & APHA for the following parameters:

**Method adopted for analysis of drinking, surface and effluent water samples**

| Sl. No. | Parameters | Unit | Method of analysis | Drinking water | Surface water | Effluent water |
|---|---|---|---|---|---|---|
| | **Physical parameters** | | | | | |
| 1 | pH Value (at 25°C) | - | IS 3025 (Part 11) | + | + | + |
| 2 | Temperature | °C | IS 3025 (Part 9) | + | + | + |
| 3 | Odour | - | IS 3025 (Part 5) | + | + | + |
| 4 | Colour | Hazen | IS 3025 (Part 4) | + | + | + |
| 5 | Taste | - | IS 3025 (Part 7&8) | + | + | - |
| 6 | Turbidity | NTU | IS 3025 (Part 10) | + | - | + |
| 7 | Total Dissolved Solids | mg/l | IS 3025 (Part 16) | + | + | + |
| | **Chemical parameters** | | | | | |
| 8 | Total Alkalinity (as $CaCO_3$) | mg/l | IS 3025 (Part 23) | + | - | |
| 9 | Magnesium (as Mg) | mg/l | IS:3025 (P-46) | - | + | |
| 10 | Total Hardness (as $CaCO_3$) | mg/l | IS 3025 (Part 21) | + | + | + |

| Sl. No. | Parameters | Unit | Method of analysis | Drinking water | Surface water | Effluent water |
|---|---|---|---|---|---|---|
| 11 | Calcium (as Ca) | mg/l | IS 3025 (Part 40) | + | + | + |
| 12 | Chloride (as Cl) | mg/l | IS 3025 (Part 32) | + | + | + |
| 13 | Fluoride (as F) | mg/l | IS 3025 (Part 60) | + | + | + |
| 14 | Free Residual Chlorine | mg/l | IS 3025 (Part 26) | + | - | + |
| 15 | Nitrate (as $NO_3$) | mg/l | IS 3025 (Part 34) | + | + | + |
| 16 | Phenolic Compounds (as $C_6H_5OH$) | mg/l | IS 3025 (Part 43) | + | + | + |
| 17 | Sulphate (as $SO_4$) | mg/l | IS 3025 (Part 24) | + | + | + |
| 18 | Sulphide (as $H_2S$) | mg/l | IS:3025 (P-29) | - | - | + |
| 19 | Cyanide (as CN) | mg/l | IS:3025 (P-27) | - | - | + |
| 20 | Total Kjeldahl Nitrogen (TKN) | mg/l | IS:3025 (P-34) | - | - | + |
| 21 | Ammonical Nitrogen (as $NH_3$-N) | mg/l | IS:3025 (P-34) | - | - | + |
| 22 | Dissolved Phosphate (as P) | mg/l | IS:3025 (P-31) | - | - | + |
| 23 | Hexavalent Chromium (as $Cr^{+6}$) | mg/l | APHA 3125 | + | + | + |
| 24 | Oil & Grease | mg/l | IS:3025 (P-39) | - | + | + |
| 25 | Dissolved Oxygen | mg/l | IS:3025 (P-38) | - | + | - |
| 26 | Chemical Oxygen Demand | mg/l | IS:3025 (P-58) | - | - | + |
| 27 | Biochemical Oxygen Demand (3 days at 27°C) | mg/l | IS:3025 (P-44) | - | + | + |
| | **Trace/Heavy metals** | | | | | |
| 28 | Aluminium (as Al) | mg/l | APHA 3125 | + | - | + |
| 29 | Boron (as B) | mg/l | APHA 3125 | + | - | + |
| 30 | Copper (as Cu) | mg/l | APHA 3125 | + | + | + |
| 31 | Iron (as Fe) | mg/l | APHA 3111 | + | + | + |
| 32 | Manganese (as Mn) | mg/l | APHA 3125 | + | + | + |
| 27 | Selenium (as Se) | mg/l | APHA 3125 | + | + | + |
| 28 | Zinc (as Zn) | mg/l | APHA 3125 | + | + | + |
| 29 | Cadmium (as Cd) | mg/l | APHA 3125 | + | + | + |
| 30 | Lead (as Pb) | mg/l | APHA 3125 | + | + | + |
| 31 | Mercury (as Hg) | mg/l | APHA 3125 | + | + | + |
| 32 | Nickel (as Ni) | mg/l | APHA 3125 | - | - | + |
| 33 | Arsenic (as As) | mg/l | APHA 3125 | + | + | + |
| 34 | Total Chromium (as Cr) | mg/l | APHA 3125 | - | - | + |
| 35 | Vanadium (as V) | mg/l | APHA 3125 | - | - | + |
| | **Bacteriological parameter** | | | | | |
| 36 | Faecal Coliform | MPN/ 100ml | IS:1622:1981(RA 2009) | + | + | - |

+ parameter included in analysis, - parameter not included in analysis

**e) Observations**

The water quality analysis results along with prescribed standard are presented in **Annexure XVIII.** The water quality data thus collected have been critically examined to arrive at the existing water quality scenario in the study area.

**Drinking Water Quality Status:**

**Jayant Guest House, Tape Water – (JYDW 1):**

At this location, pH is found to be 7.7 while TDS is 395 mg/l. Total Hardness and Alkalinity values are found to be 271 mg/l and 212 mg/l respectively whereas Calcium, Chloride and Sulphate values are found to be 74.5 mg/l, 48.9 mg/l and 16 mg/l respectively. Fluoride and Nitrate values are found to be 1.2 mg/l and 2.4 mg/l respectively whereas Free Residual Chlorine, Phenolic Compounds and Hexavalent Chromium values found to be below detection limit. All heavy metal values are found to be below detection limit except Zinc value is found to be 0.06 mg/l. The Faecal Coliform value is found to be absent. From above discussion, it is evident that the drinking water quality is within the prescribed limits of IS: 10500 (2012).

**Nandgaon Village, Hand pump – (JYDW 2):**

At this location, pH is found to be 7.4 while TDS is 873 mg/l. Total Hardness and Alkalinity values are found to be 331 mg/l and 383 mg/l respectively whereas Calcium, Chloride and Sulphate values are found to be 113.3 mg/l, 167.6 mg/l and 34 mg/l respectively. Fluoride and Nitrate values are found to be 1.4 mg/l and 4.5 mg/l respectively whereas Free Residual Chlorine, Phenolic Compounds and Hexavalent Chromium values found to be below detection limit. All heavy metal values are found to be below detection limit except Aluminium, Copper, Manganese and Zinc. Aluminium, Copper, Manganese and Zinc values are found to be 0.01 mg/l 0.02 mg/l, 0.7 mg/l and 4.41 mg/l respectively. The Faecal Coliform value is found to be absent. From above discussion, it is evident that the drinking water quality is within the prescribed limits of IS: 10500 (2012) except Manganese.

**Chilkatand Village, Hand pump – (JYDW 3):**

At this location, pH is found to be 7.7 while TDS is 435 mg/l. Total Hardness and Alkalinity values are found to be 210 mg/l and 202 mg/l respectively whereas Calcium, Chloride and Sulphate values are found to be 68.0 mg/l, 52.4 mg/l and 15 mg/l respectively. Fluoride and Nitrate values are found to be 0.8 mg/l and 3.9 mg/l respectively whereas Free Residual Chlorine, Phenolic Compounds and Hexavalent Chromium values found to be below detection limit. All heavy metal values are found to be below detection limit except Aluminium, Iron, Manganese and Zinc. Aluminium, Iron, Manganese and Zinc values are found to be 0.01 mg/l 1.16 mg/l, 0.01 mg/l and 0.23 mg/l respectively. The Faecal Coliform value is found to be absent. From above discussion, it is evident that

the drinking water quality is within the prescribed limits of IS: 10500 (2012) except Iron.

**Baiga Basti, Hand pump – (JYDW 4):**

At this location, pH is found to be 7.5 while TDS is 1085 mg/l. Total Hardness and Alkalinity values are found to be 452 mg/l and 394 mg/l respectively whereas Calcium, Chloride and Sulphate values are found to be 74.5 mg/l, 157.2 mg/l and 99 mg/l respectively. Fluoride and Nitrate values are found to be 1.3 mg/l and 2.2 mg/l respectively whereas Free Residual Chlorine, Phenolic Compounds and Hexavalent Chromium values found to be below detection limit. All heavy metal values are found to be below detection limit except Zinc value is found to be 0.06 mg/l. The Faecal Coliform value is found to be absent. From above discussion, it is evident that the drinking water quality is within the prescribed limits of IS: 10500 (2012).

**Meharuli Village, Dug well of Sheetala pad Prajapati – (JYDW 5):**

At this location, pH is found to be 7.0 while TDS is 680 mg/l. Total Hardness and Alkalinity values are found to be 432 mg/l and 152 mg/l respectively whereas Calcium, Chloride and Sulphate values are found to be 103.6 mg/l, 94.3 mg/l and 33 mg/l respectively. Fluoride and Nitrate values are found to be 1.1 mg/l and 5.4 mg/l respectively whereas Free Residual Chlorine, Phenolic Compounds and Hexavalent Chromium values found to be below detection limit. All heavy metal values are found to be below detection limit except Zinc value is found to be 0.05 mg/l. The Fecal Coliform value is found to be absent. From above discussion, it is evident that the drinking water quality is within the prescribed limits of IS: 10500 (2012).

**Jaitpur Village, Dug well of Ram Kumar Sahu – (JYDW 6):**

At this location, pH is found to be 7.2 while TDS is 927 mg/l. Total Hardness and Alkalinity values are found to be 477 mg/l and 283 mg/l respectively whereas Calcium, Chloride and Sulphate values are found to be 126.3 mg/l, 227 mg/l and 60 mg/l respectively. Fluoride and Nitrate values are found to be 1.7 mg/l and 5.6 mg/l respectively whereas Free Residual Chlorine, Phenolic Compounds and Hexavalent Chromium values found to be below detection limit. All heavy metal values are found to be below detection limit except Zinc value is found to be 0.05 mg/l. The Fecal Coliform value is found to be absent. From above discussion, it is evident that the drinking water quality is within the prescribed limits of IS: 10500 (2012) except Fluoride.

**Surface Water Quality Status:**

**Madwani Dam, Overflow – (JYSW 1):**

At this location, pH value is found to be 8.2 while TSS and TDS values are found to be 15 mg/l and 465 mg/l respectively whereas Colour value is found to be 7 Hazen. Total Hardness, Calcium and Magnesium values are found to be 343.4 mg/l, 64.8 mg/l and 44.2 mg/l respectively whereas Chloride, Fluoride,

Sulphate and Nitrate nitrogen values are found to be 41.9 mg/l, 1.4 mg/l, 51.3 mg/l and 3.8 mg/l respectively. BOD and DO values are found to be 5.9 mg/l and 5.73 mg/l respectively whereas Phenolic compounds, Hexavalent chromium and Oil & grease are found to be below detection limit. All heavy metal values are found to be below detection limit except Copper, Manganese and Zinc. Copper, Manganese and Zinc values are found to be 0.02 mg/l, 0.01 mg/l and 0.02 mg/l respectively whereas Total Coliform value is found to be 46 MPN/100ml. From above discussion, it is evident that the surface water quality is within the prescribed limits of IS 2296: Class-'C' Standards except BOD.

**Ballia Nallah, Downstream near Shakti Nagar Road Crossing – (JYSW 2):**

At this location, pH value is found to be 7.1 while TSS and TDS values are found to be 962 mg/l and 405 mg/l respectively whereas Colour value is found to be 6 Hazen. Total Hardness, Calcium and Magnesium values are found to be 272.7 mg/l, 48.6 mg/l and 36.8 mg/l respectively whereas Chloride, Fluoride, Sulphate and Nitrate nitrogen values are found to be 31.4 mg/l, 0.9 mg/l, 24.4 mg/l and 5.6 mg/l respectively. BOD and DO values are found to be 6.3 mg/l and 5.63 mg/l respectively whereas Phenolic compounds, Hexavalent chromium and Oil & grease are found to be below detection limit. All heavy metal values are found to be below detection limit except Iron, Manganese and Zinc. Iron, Manganese and Zinc values are found to be 1.41 mg/l, 0.04 mg/l and 0.01 mg/l respectively whereas Total Coliform value is found to be 15 MPN/100ml. From above discussion, it is evident that the surface water quality is within the prescribed limits of IS 2296: Class-'C' Standards except BOD.

**GBP Sagar, Near Fishing Location – (JYSW 3):**

At this location, pH value is found to be 7.5 while TSS and TDS values are found to be 16 mg/l and 185 mg/l respectively whereas Colour value is found to be 8 Hazen. Total Hardness, Calcium and Magnesium values are found to be 121.2 mg/l, 28.3 mg/l and 12.3 mg/l respectively whereas Chloride, Fluoride, Sulphate and Nitrate nitrogen values are found to be 17.5 mg/l, 1.4 mg/l, 13.3 mg/l and 2.4 mg/l respectively. BOD and DO values are found to be 5.2 mg/l and 6.12 mg/l respectively whereas Phenolic compounds, Hexavalent chromium and Oil & grease are found to be below detection limit. All heavy metal values are found to be below detection limit except Copper, Iron, Manganese, Zinc and Lead. Copper, Iron, Manganese, Zinc and Lead values are found to be 0.02 mg/l, 0.32 mg/l, 0.24 mg/l, 0.05 mg/l and 0.13 mg/l respectively whereas Total Coliform value is found to be 21 MPN/100ml. From above discussion, it is evident that the surface water quality is within the prescribed limits of IS 2296: Class-'C' Standards except BOD and Lead.

**Effluent Water Quality Status:**

**ETP Outlet – (JYEW 1):**

At this location, pH value is found to be 7.4 and TSS value is found to be 15.3

mg/l. Total Hardness and Calcium values are found to be 323.2 mg/l and 80.96 mg/l respectively whereas Chloride, Fluoride and Sulphate values are found to be 27.94 mg/l, 1.5 mg/l and 23 mg/l respectively. Sulphide, Free Residual Chlorine, Phenolic Compounds, Hexavalent Chromium, Cyanide, Dissolved Phosphate and Oil & Grease are found to be below detection limit. Total Kjeldahl Nitrogen, Ammonical Nitrogen and Nitrate Nitrogen values are found to be 3.94 mg/l, 1.7 mg/l and 2.26 mg/l whereas BOD and COD values are found to be 12 mg/l and 35.6 mg/l respectively.

All heavy metals values are found to be below detection limit except Aluminium, Iron, Manganese and Nickel. Aluminium, Iron, Manganese and Nickel values are to be found 0.17 mg/l, 0.15 mg/l, 0.31 mg/l and 0.04 mg/l respectively. From above discussion, it is evident that the effluent water quality is within the prescribed limits of Environmental Protection Act. 1986 (Schedule VI) for Inland surface water.

**CETP Outlet – (JYEW 1):**

At this location, pH value is found to be 6.9 and TSS value is found to be below detection limit. Total Hardness and Calcium values are found to be 252.5 mg/l and 89.05 mg/l respectively whereas Chloride, Fluoride and Sulphate values are found to be 24.44 mg/l, 1.4 mg/l and 23 mg/l respectively. Sulphide, Free Residual Chlorine, Phenolic Compounds, Hexavalent Chromium, Cyanide, Dissolved Phosphate and Oil & Grease are found to be below detection limit. Total Kjeldahl Nitrogen, Ammonical Nitrogen and Nitrate Nitrogen values are found to be 3.93 mg/l, 2.26 mg/l and 1.69 mg/l. BOD value is found to be below detection limit and COD value is found to be 7.9 mg/l.

All heavy metals values are found to be below detection limit except Aluminium and Manganese. Aluminium and Manganese values are to be found 0.06 mg/l, and 0.01 mg/l respectively. From above discussion, it is evident that the effluent water quality is within the prescribed limits of Environmental Protection Act. 1986 (Schedule VI) for Inland surface water.

**STP Outlet – (JYEW 1):**

At this location, pH value is found to be 7.4 and TSS value is found to be below detection limit. Total Hardness and Calcium values are found to be 161.6 mg/l and 52.62 mg/l respectively whereas Chloride, Fluoride and Sulphate values are found to be 41.9 mg/l, 0.7 mg/l and 22 mg/l respectively. Sulphide, Free Residual Chlorine, Phenolic Compounds, Hexavalent Chromium, Cyanide, Dissolved Phosphate and Oil & Grease are found to be below detection limit. Total Kjeldahl Nitrogen, Ammonical Nitrogen and Nitrate Nitrogen values are found to be 3.94 mg/l, 2.83 mg/l and 1.13 mg/l whereas BOD and COD values are found to be 10.8 mg/l and 31.6 mg/l respectively.

All heavy metals values are found to be below detection limit except Aluminium, Iron and Manganese. Aluminum, Iron and Manganese values are to be found 0.01 mg/l, 0.12 mg/l, and 0.12 mg/l respectively. From above discussion, it is

evident that the effluent water quality is within the prescribed limits of Environmental Protection Act. 1986 (Schedule VI) for Inland surface water.

### 3.4.4 Baseline Noise Levels Monitoring

Noise often defined as unwanted sound, interferes with speech communication, causes annoyance, distracts from work, disturb sleep, thus deteriorating quality of human environment. The physical description of sound concerns its loudness as a function of frequency. In other way, noise may be defined as unwanted/un-desired sound, which is composed of many frequency components of various loudness distributed over the audible frequency range.

Noise survey has been conducted in the study area while covering three zones viz., residential, commercial and silence zones. Noise monitoring has been undertaken for 24 hours at each location. The main objective of noise monitoring in the study area is to establish the baseline noise levels and assess the impact of the total noise generated by the operation of the project activities around it.

**a) Inventory of existing pollution sources**

Various industrial activities, road transport and mining activities generate noise, whose level may be higher than safe level. Existing sources in the study area with respect to noise pollution are Coal mines and vehicular activities only.

**b) Rationale behind ambient noise quality monitoring**

A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the area. Noise monitoring locations have been identified based on the activities in the inhabited and mining areas.
The ambient noise quality monitoring stations were set up at eight locations, four locations in core zone and four locations in buffer zone area.

Details of the selected locations are as follows and shown in **Plate No.-14**:

**c) Noise Quality Monitoring Locations**

| S. No. | Location | Coordinates of the Location | | Classified Area | Category | Station Codes |
|---|---|---|---|---|---|---|
| | | Latitude | Longitude | | | |
| 1 | Field Workshop | 24°08'07.6"N | 82°39'25.5"E | Core Zone | Industrial Area | JYN 1 |
| 2 | Coal Substation | 24°08'07.3"N | 82°39'25.7"E | Core Zone | Industrial Area | JYN 2 |
| 3 | Jayant Colony | 24°06'57.6"N | 82°39'29.5"E | Core Zone | Residential Area | JYN 3 |
| 4 | Baiga Basti | 24°08'12.5"N | 82°38'57.5"E | Core Zone | Residential Area | JYN 4 |

| S. No. | Location | Coordinates of the Location | | Classified Area | Category | Station Codes |
|---|---|---|---|---|---|---|
| 5 | Singrauli Township | 24°12'13.0"N | 82°40'34.2"E | Buffer Zone | Residential Area | JYN 5 |
| 6 | Madhauli Substation | 24°10'50.3"N | 82°38'44.3"E | Buffer Zone | Residential Area | JYN 6 |
| 7 | Nigahi old Guest House | 24°06'58.9"N | 82°37'07.8"E | Buffer Zone | Residential Area | JYN 7 |
| 8 | NPCC/RR Colony (Jayant Mode) | 24°07'19.4"N | 82°39'03.3"E | Buffer Zone | Residential Area | JYN 8 |

**d) Noise Quality Monitoring Parameters**

Noise levels measured over a given period of time interval can be described by important features of noise using statistical quantities. This is calculated using the percent of the time certain noise levels are exceeding the time interval. The description of monitored parameters is as follows:

| S. No. | Parameter | Unit |
|---|---|---|
| 1 | $L_{day}$ (6.00 A.M to 10.00 P.M) | dB(A)Leq |
| 2 | $L_{night}$ (10.00 P.M to 6.00 A.M) | dB(A)Leq |

**e) Instrument Used for Ambient Noise Monitoring**

Ambient noise levels were measured using sound level meter manufactured by Extech Instruments (Model 407764 & Sl. No. 110104166) and Envirotech Instrumentsi (Model SLM -100 & Sl. No. 115 DTC 2011). The sound level meter measures the sound pressure level (SPL).

**f) Method of Ambient Noise Quality Monitoring**

Sound pressure level (SPL) measurements were measured by integrating noise meter at all locations. Noise level monitoring was carried continuously for 24 hours. The day noise levels have been monitored during 6.00 am to 10.00 pm and night levels during 10.00 pm to 6.00 am at all the locations.

**g) Standards for Noise Level** Noise Pollution (Regulation and Control), 2000, Schedule- III in respect of Ambient Noise given in the table below:

| S.No. | Category of Area | Limits in dB (A) | |
|---|---|---|---|
| | | Day Time (6AM - 9PM) | Night Time (9PM- 6AM) |
| 1 | Industrial Area | 75 | 70 |
| 2 | Commercial Area | 65 | 55 |
| 3 | Residential Area | 55 | 45 |
| 4 | Silence Zone | 50 | 40 |

Ministry of Environment and Forest vide Notification no. GSR 742 (E) dated 25/9/2000 has fixed the noise level standards for coal mines and the same are as below:

| **Time** | Day (6AM -10 PM) | Night (10PM-6AM) |
|---|---|---|
| **Noise Level (Leq)** | 75 dB(A) | 70 dB(A) |

**h) Results & Interpretations**

Ambient noise quality was monitored around Jayant Expn. Mines for 24 hourly intervals. Ambient noise levels were recorded during day and night time and the observed values were compared with standards prescribed by Environment Protection Act / MOEF. The noise level data for various locations are appended in **Annexure-XIX.**

**Field Workshop, Core Zone – (JYN1):**
The Leq noise levels recorded are ranging from 61.7 to 70.1 dB (A).

**Coal Substation, Core Zone – (JYN2):**
The Leq noise levels recorded are ranging from 62.7 to 72.2 dB (A).

**Jayant Colony, Core Zone – (JYN3):**
The Leq noise levels recorded are ranging from 44.6 to 54.9 dB (A).

**Baiga Basti, Core Zone – (JYN4):**
The Leq noise levels recorded are ranging from 44.5 to 54.3 dB (A).

**Singrauli Township, Buffer Zone – (JYN5):**
The Leq noise levels recorded are ranging from 44.7 to 54.1 dB (A).

**Madhauli Substation, Buffer Zone – (JYN6):**
The Leq noise levels recorded are ranging from 44.6 to 54.3 dB (A).

**Nigahi old Guest House, Buffer Zone – (JYN7):**
The Leq noise levels recorded are ranging from 44.5 to 54.3 dB (A).

**NPCC/RR Colony, Buffer Zone – (JYN8):**

The Leq noise levels recorded are ranging from 44.0 to 54.3 dB (A).

**Conclusion:**

The noise level in the industrial area of Jayant Expn.OCP is found to be within the permissible limit. Noise level in the village & colony area are within the permissible limit of residential area**.**

### 3.4.5 Baseline Soil quality status

Soil characteristics, erosion aspects, soil fertility etc. have direct bearing on the environment, knowledge of soil parameters is essential for the planning and implementation of afforestation. Further, major mining activities affect the soil regime of the surrounding areas directly or indirectly. Hence, it becomes important to study the soil characteristics.

a) **Location and rationale of sampling**

Soil characteristics, erosion aspects, soil fertility etc., have direct bearing on the environment. Knowledge of soil parameters is essential for the planning and implementation of afforestation. Further, major mining activities affect the soil regime of the surrounding areas directly or indirectly. Hence, it becomes important to study the soil characteristics.

By keeping the above aspects in view, three locations are selected. Locations are selected in such a way that different types of soil for supporting different species of vegetation are covered. Locations of soil sample collection has been shown in **Plate No.-15**.

**Soil Quality Monitoring Locations**

| S. No. | Location Name | Coordinates of the Location | | Location Code |
|---|---|---|---|---|
| | | Latitude | Longitude | |
| 1 | Madhauli Village (Agriculture land) | 24°11'06.12"N | 82°39'05.00"E | JYS 1 |
| 2 | Internal Dump | 24°09'27.48"N | 82°38'29.82"E | JYS 2 |
| 3 | Near Proposed CHP | 24°11'27.73"N | 82°38'56.31"E | JYS 3 |

**b) Methodology for Soil Sampling**

Soil samples were collected from three identified locations around the study area during study period to generate primary information on soil quality prevailing in the study area. These samples were collected once during the study period and preserved in polythene bags / Pet jar having lock facility. Soil samples were collected in disturbed and undisturbed condition in summer season and analysed in the laboratory.

The following parameters along with method adopted for analysis of soil samples:

| Sl. No. | Parameter | Unit | Method of analysis |
|---|---|---|---|
| 1 | pH | - | IS:2720 (Part 26) |
| 2 | Electrical Conductivity | µS/cm | IS: 14767:2000 |
| 3 | Water Holding Capacity | % | USDA Method |
| 4 | Field Capacity | $cm^3$ Water/$cm^3$ Soil | S.K. Maithi (Volume 2) |
| 5 | Wilting Coefficient | $cm^3$ Water/$cm^3$ Soil | S.K. Maithi (Volume 2) |
| 6 | Specific Gravity | - | IS:2720 (PART 3) |
| 7 | Available Nitrogen | kg/ha | TP/C/4.7 |
| 8 | Available Phosphorus | kg/ha | TP/C/4.5 |
| 9 | Available Potassium | kg/ha | TP/C/4.6 |
| 10 | Sodium Absorption Ratio (SAR) | - | S.K. Maithi (Volume 2) |
| 11 | Organic Carbon Available | % | IS:2720 (PART 22) |
| 12 | Cation Exchange Capacity | meq/100g | TP/C/4.14 |
| 13 | Texture | - | IS:2720 (PART 4) |
| | a) Sand | % | IS:2720 (PART 4) |
| | b) Silt | % | IS:2720 (PART 4) |
| | c) Clay | % | IS:2720 (PART 4) |

**(c) Results and observation of soil quality:**

The soil quality analysis results are given in **Annexure- XX.** The location wise observation of soil quality are given below:

**Madhauli Village, Agriculture land – (JYS1):**

At this location, pH value is found to be in the range of 6.34 – 6.70 whereas EC and Water holding capacity values ranges between 153 – 290 µS/cm and 36.0 – 43.7 % respectively. Nitrogen, Phosphorous and Potassium contents are found to be in the range of 122.4 – 273.3 kg/ha, 4.80 – 8.97 kg/ha and 352.3 – 365.3 kg/ha respectively. Organic carbon varies between 0.24 – 0.55 % whereas Cation exchange capacity 22.2 – 38.1 meq/100g. Texture class is found to be Sandy silt. The soil quality at this location supports vegetation.

**Internal Dump – (JYS2):**

At this location, pH value is found to be in the range of 7.14 – 7.70 whereas EC and Water holding capacity values ranges between 133 – 142 µS/cm and 23.3 – 27.3 % respectively. Nitrogen, Phosphorous and Potassium contents are found to be in the range of 82.5 – 85.2 kg/ha, 3.6 – 7.1 kg/ha and 174.5 – 177.2 kg/ha respectively. Organic carbon varies between 0.25 – 0.30 % whereas Cation exchange capacity 22.6 – 32.4 meq/100g. Texture class is found to be Sandy silt. The soil quality at this location supports vegetation.

**Near Proposed CHP – (JYS3):**

At this location, pH value is found to be in the range of 6.12 – 6.47 whereas EC and Water holding capacity values ranges between 156 – 200 µS/cm and 38.6 – 42.3 % respectively. Nitrogen, Phosphorous and Potassium contents are found to be in the range of 193.7 – 225.5 kg/ha, 1.60 – 5.39 kg/ha and 193.7 – 317.5 kg/ha respectively. Organic carbon varies between 0.20 – 0.27 % whereas Cation exchange capacity 36.8 – 49.4 meq/100g. Texture class is found to be Silty clay. The soil quality at this location supports vegetation.

### 3.4.6 Baseline Flora & Fauna survey and ecological study

CMPDI entrusted the Flora & Fauna study for Jayant Expn. Project to M/S Eko Pro Engineers Pvt. Ltd., Gaziabad (UP). The expert team has visited and observed 10 km around Jayant Expan.Project for study.

The objective of the study was to survey the core & buffer zone of the project for flora and fauna by adopting standard methods. In the study all type of flora from natural as well as artificial plantation and fauna have been surveyed. The copy of authenticated detail study report is placed as **Annexure- XXI**. Brief of Flora- Fauna study is as follows-

**Flora and Fauna Studies**

(1) The study area for Flora & Fauna covers 10 Km radius of the Core Zone.

(2) Baseline status of Flora & Fauna was evaluated through field sampling, reconnaissance surveys and from secondary sources. Important Flora & Fauna species of the eco system of the study area have been enumerated.

(3) The impact in the context of Flora & Fauna in the study area is not considered to be significant as the proposed project area does not contain any endangered and endemic Flora & Fauna.
(4) Stage-wise implementation of preservation and up-gradation of ecological environment shall be carried out, if it is required, on regular monitoring basis during operation of the proposed project.

**Objectives of Ecological Study**

- To generate baseline data from field observation;
- To compare the data so generated with authentic past record to understand changes;

- To characterize the environmental component of flora and fauna;
- To understand the present biodiversity;
- To identify susceptible sensitive and critical area (environmental hotspots);
- To understand impact of industrial activities on the flora and fauna;
- To predict changes as a result of impact in the composition and
- functioning of components of the ecosystem;

**Methodology for Primary Data Collection**

- Preparing a general checklist of all plants species encountered in the study area. This would indicate the biodiversity for wild and cultivated plants.
- Determining the bird population of migratory and local birds by taking 10 random readings at every location;
- Observing mammals, amphibians and reptiles, noting their calls, droppings, burrows, pugmarks and other signs;
- Effects on status and/or quality of growth on plants and any symptoms like defoliation, deformities, chlorosis, necrosis, warping, reduced vigour and infection by parasites and attacks by predator insects were noticed;
- Local inhabitants were interviewed for uses of plants and animals and to get ethnobiological data.

**Identification of Local Protected Species**

As per Botanical Survey of India records and available published literature pertaining to the study area and current detailed study of project site, no threatened, endangered and rare plant species were observed from the study area.

**Details of Forest Areas & Protected Areas**

There are six reserved / protected forests within the 10 km radius from the proposed mine lease boundary. In the study area Notable Forest Blocks are as follows:-

1) Gorbi PF 2) Dudhichua PF 3) Mehrauli PF 4) Parari PF 5) Muher RF 6) Charki RF.

Many pockets of the land have been kept fallow for long gestation of time; Mesquite is a good coppice even when felled, it shoots sprout green branches and for fuel wood sources – *Prosopis juliflora* is grown to provide fuel, and other agrarian uses. Common is “Mesquite or Vilayati babul .

**Protected Areas**

There is no presence of national parks, sanctuary, Biosphere reserves, Reserves, Conservation reserve, community reserves etc., in the study area within 15 km radial distance from the boundary of mining lease area, and its locations, clearly shown on 1:50,000 scale map. There are no “Tiger and Elephant Reserves/nor any community reserves in the study area”.

**Floristic Composition & distribution of forest in the study area:**

The Forest of the tract dealt which are well scattered. The forest of this division can be further grouped into various forest types as identified by ***Champion and Seth.*** The forest types chiefly found in Singrauli coal field are categorized under; Dry peninsular sal forest (5B/C1-c), Northern tropical dry deciduous forest (5B/C2), Boswellia forest (5B/E9) and Dry Bamboo brakes 5B/E9.

## 3.5. Routine environmental monitoring data on environmental quality

CMPDI is carrying out regular environmental monitoring of environmental parameters such as ambient air, water and noise of the existing Jayant Project. In order to assess the existing environmental quality of the project area in operational stage, the environmental monitoring data for Quarter ending June-2017 of the project are taken into consideration. The monitoring data on air, water and noise are given in **Annexure-XXII.**

### (A) Ambient Air Quality

### (a) Location of sampling station and their rationale

***( as per G.S.R. 742 (E) dt. 25th December,2000*)**

### I. Core zone monitoring location (Refer Plate No.-16)

i) **Jayant C-ETP (JYA1): Industrial Area**

The sampler was placed at C- ETP. This station was selected to assess the ambient air quality in the core zone where mining activities are in progress.

ii) **Jayant Coal Substation (JYA2) : Industrial Area**

The sampler was placed in premises of the Coal Substation of the Jayant mine. The station was selected to represent the impact of mining activities of Jayant OCP.

iii) **CWS GM Office (CWSA1): Industrial Area**

The sampler was placed at the roof top of administrative office (G.M. Office) in Central workshop. This station was selected to assess the ambient air quality in the core zone.

iv) **Jayant Rose Garden (JYA3): Residential Area**

The sampler was placed in the Rose Garden. This site was selected to assess the present ambient air quality status in residential area.

## II. Buffer zone monitoring locations (Refer Plate No.-2 )

i) **Madhauli Substation (JYA4)**: **Residential Area**

The Air sampler was placed at Roof top of Substation premises near Madhauli Village which is in the buffer zone of Jayant OCP. The station was selected to represent the impact of mining activities of Jayant project in buffer zone.

ii) **Nigahi STP (NA3)**: **Residential Area**.

The sampler was placed at STP. This site was selected to assess the present ambient air quality status in residential area of buffer zone of Jayant Project.

iii) **Karwari Village, Singrauli (DA6): Residential Area**

This location is selected to study the impact of ambient air quality of buffer zone of Jayant OCP.

iv) **Surya Kiran Bhawan (DA5)**: **Residential Area**

Surya Kiran Bhawan of sector B & C will represent a location in the residential area. This station is selected to assess the Air quality in residential area of buffer zone of Jayant Project.

### (b) Methodology of sampling and analysis

Parameters chosen for assessment of ambient air quality were Suspended Particulate Matter, Respirable Particulate Matter (PM 10), Fine Particulate Matter (PM 2.5), Sulphur Di-oxide ($SO_2$) and Nitrogen Oxides ($NO_X$). Respirable Dust Samplers (RDS) & Fine particulate samplers (FPS) were used for sampling “SPM, PM 10, SOx and $NO_2$ & “PM 2.5” respectively at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analysed in Environmental Laboratory of CMPDI, RI-VI, Jayant.

**(c) Results & Interpretations**

The results of Ambient Air Quality are presented in tabular form along with Bar chart for each monitoring station. The interpretations of different parameters are given below:

i) **Suspended particulate matter (SPM)**

In core zone under Industrial area varies from 177 to 376 µg/m$^3$.

iii) **Particulate matter ($PM_{10}$)**

In core zone under Industrial area varies from 136 to 293 µg/m$^3$ & in Residential area 89 to 103 µg/m$^3$. In buffer zone in Residential area varies from 69 to 100 µg/m$^3$.

iii) **Particulate matter ($PM_{2.5}$)**

In core zone under Industrial area varies from 41 to 81 µg/m$^3$ & in core zone under Residential area PM 2.5 varies from 18 to 32 µg/m$^3$. In buffer zone in Residential area varies from 17 to 45 µg/m$^3$.

**Sulphur Dioxide ($SO_2$)**

In core zone under Industrial area varies from 14 to 30 µg/m$^3$ & in Residential area 12 to 27 µg/m$^3$. In buffer zone in Residential area varies from 12 to 35 µg/m$^3$.

(iv) **Oxides of Nitrogen (NOx)**

In core zone under Industrial area varies from 11 to 26 µg/m$^3$ and in Residential area 12 to 31 µg/m$^3$. In buffer zone in Residential area varies from 11 to 33 µg/m$^3$.

(v) **Heavy metal (Hg, As,Ni,Pb,Cr,Cd) in $PM_{10}$**

All heavy metals are found Below Detection Limit (BDL). The detection limit are as below:

DL- Detection Limit (Hg = 0.001 µg/m$^3$, Cr = 0.001 µg/m$^3$, Cd = 0.001 µg/m$^3$, Pb = 0.001 µg/m$^3$, As = 1.0 ng/m$^3$ & Ni = 1.0 ng/m$^3$).

**(B) Water Quality status**

(a) **Location of sampling sites and their rationale** (Refer **Plate No.-16**)

i) **Inlet of Mine ETP (JYW1):**

The sampling site is selected to check the mine effluent quality before treatment in the mine ETP.

ii) **Outlet of Mine ETP (JYW2)**

Water is collected at the outlet point of the ETP constructed for treatment of mine effluent. The treated water is mainly used for industrial purposes. The sampling site is selected to check the water quality after treatment in the ETP.

iii) **Inlet of Combined ETP (JYW3)**

The sampling site is selected to check the CHP and Workshop combined effluent quality before treatment in the C- ETP.

iv) **Outlet from Combined ETP (JYW4)**

This location has been selected to monitor the treated water after treatment at C - ETP.

v) **Outlet of STP (JYW5)**

This site has been selected for assess the quality of treated domestic effluent through STP.

vi) **Overflow of Mudwani Dam (JYW6)**

The surface runoff from Nigahi and Jayant OCP flow to the dam. The overflow of dam needs to be monitored in order to assess the quality of water of mudwani dam.

vii) **D/S of Mudwani Nalla near Gole Market (JYW7)**

The downstream of Mudwani nalla is monitored to assess the quality of surface water (near Gole market) before discharge to GBP Sagar.

viii) **D/S of Ballia Nalla near Shakti Nagar road crossing (JYW8)**

Ballia Nalla carries the surface run-offs from Jayant & Dudhichua OCP's periphery to the GBP Sagar. For both the projects, this point will be a common monitoring station.

ix) **Main Reservoir of Jayant Colony (Water received from IWSS) (JYW9)**

This sampling site has been selected to keep a watch on the quality of drinking water supplied to the residents of Jayant Colony.

**(b) Methodology of sampling and analysis**

Water samples were collected as per standard practice. The effluent samples and Drinking water samples were collected and analyzed for four/five

parameters on fortnightly basis. The surface water sample and drinking water samples were collected and analyzed for all parameters on quarterly basis.
Parameters like pH, Temperature and Dissolved Oxygen were analyzed on-site while collecting the samples. Thereafter the samples were preserved and analyzed at the field laboratory located at RI-VI Office campus.

(c ) **Results & Interpretations**

The results are given in tabular form along with the applicable standards. Results are compared with as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Std. for Coal mines (For 4/5 parameters of effluent and drinking water), IS.10500/2012 (All parameters of Drinking water) & IS: 2296 for Inland Surface water (1982) Class 'C'. Results show that most of the parameters are within the permissible limits.

**(C) Noise levels status**

(a) **Location of sampling sites and their rationale (**Refer **Plate No.-16**)

i) **Time Office near Field Workshop (JYN1)**

Time office near field workshop will represent the effect of noise from crusher house/ receiving pit, field workshop, regional store, mining activities, dumper and dozer movement in haul roads and coal stock yards on the ambient environment of the area. To assess the ambient noise of a typical working area inside the core zone this site was selected.

ii) **VTC (JYN2)**

The noise levels were recorded in the mine area where all mining activities are in progress. The VTC area will represent the ambient noise environment inside the core zone affected by CHP operation, base-workshop, and CWS and loading stations nearby.

iii) **Jayant colony (JYN3)**

To assess the noise level in the residential area, noise levels were recorded during day as well as night time in the colony.

iv) **Nigahi Basti (JYN4)**

The location is selected to assess the noise level in Nigahi Basti which is near Nigahi Mine. The location is required to be monitored till it is rehabilitated by the Nigahi OCP.

**(b) Methodology of sampling and analysis**

Noise level measurements in form of 'LEQ' were taken using Integrated Averaging Sound Level Meter (CR: 812 C) during day and night time. Noise

levels were measured for about one hour time in day and night time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

**(c ) Results & Interpretations**

Ambient noise levels were recorded during day and night time and the observed values were compared with standards prescribed by MoEF&CC.

The results of Noise levels recorded during day and night time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of LEQ are presented**.**

The observed values at all the monitoring locations are found to be within permissible limits.

## 3.6 Land use pattern of study area

### (A) Land use pattern of Core zone at Pre-mining and Operational Stage:

Out of total 3177.171 ha land requirement, 1180.171 ha is forest land, 1481.54ha Tenancy land and 515.46 ha are Govt. land. The acquisition plan of Jayant Expn. for lease area is given in **Plate No.-3.**

### (B) Land use pattern of Core zone at Operational Stage:

The break-up of total lease/project area at operational stage as per EPR are as given below:

| Sl. No. | Particulars | Area (Ha) |
|---|---|---|
| 1 | Total Quarry Area | 1840.00 |
| 2 | External Dump | 118.65 |
| 3 | Colony (Residential area) | 261.90 |
| 4 | Green Belt in colony | 19.30 |
| 5 | Infrastructure (Office, drains etc.) | 64.00 |
| 6 | ETP, CHP, Mineral Storage | 18.00 |
| 7 | Road, Railway | 96.75 |
| 8 | Green Belt on Waste/Vacant land | 74.00 |
| 9 | Safety Zone/Undisturbed area | 120.00 |
| 10 | Modwani Dam | 59.20 |
| 11 | Others (waste land, vacant land etc.) | 505.371 |
| | **Total** | **3177.171** |

**(C) Land use pattern of study area as per satellite Imagery:**

A map showing Land use / cover mapping of study area of Jayant OCP based IRS R2, LISS-IV data of the year 2016 , was prepared using remote sensing technique by Geomatics Division (Remote Sensing Cell), CMPDIL, (HQ) Ranchi. The map is given as **Plate No.-17**. Based on this map, the following are the present land use pattern of study area of Jayant Expn.OCP.

| Class | | Core Zone | | Buffer Zone | |
|---|---|---|---|---|---|
| **Level-I** | **Level-II** | **Area ($Km^2$)** | **% of total** | **Area ($Km^2$)** | **% of total** |
| Forest Land | Dense Forest | 0.00 | 0.00 | 30.95 | 5.39 |
| | Open Forest | 0.38 | 1.31 | 48.80 | 8.76 |
| | **Total Forest Land** | **0.38** | **1.31** | **78.80** | **14.15** |
| | **Scrubs** | **3.63** | **12.54** | **61.62** | **11.06** |
| Plantation Area | Social Forestry | 3.69 | 12.74 | 51.80 | 9.30 |
| | Plantation on OB | 2.07 | 7.15 | 10.65 | 1.91 |
| | Plantation on Backfill | 4.21 | 14.53 | 9.60 | 1.72 |
| | **Total Plantation Area** | **9.97** | **34.42** | **72.05** | **12.93** |
| Agricultural Land | Crop Land | 0.65 | 2.24 | 62.83 | 11.28 |
| | Fallow Land | 0.24 | 0.83 | 101.43 | 18.21 |
| | **Total Agricultural Land** | **0.89** | **3.07** | **164.26** | **29.49** |
| Waste Land | Waste land | 0.27 | 0.93 | 29.35 | 5.27 |
| | Sand body | 0.01 | 0.03 | 0.06 | 0.01 |
| | Fly Ash Pond | 0.00 | 0.00 | 15.08 | 2.71 |
| | **Total Waste Land** | **0.28** | **0.96** | **44.49** | **7.99** |
| Mining Area | Coal quarry | 3.96 | 13.67 | 14.94 | 2.68 |
| | Barren O.B. Dump | 2.47 | 8.53 | 20.64 | 3.71 |
| | Back Fill | 3.51 | 12.12 | 16.65 | 2.99 |
| | Coal Dump | 0.24 | 0.83 | 0.29 | 0.05 |
| | Water Filled Quarry | 0.06 | 0.21 | 1.57 | 0.28 |
| | Advance quarry | 1.02 | 3.52 | 7.25 | 1.30 |
| | **Total Mining Area** | **11.36** | **38.88** | **61.34** | **11.01** |
| Settlements | Urban Settlements | 1.34 | 4.63 | 18.44 | 3.31 |
| | Rural Settlements | 0.45 | 1.55 | 2.24 | 0.40 |
| | Industrial Settlements | 0.33 | 1.14 | 9.09 | 1.63 |
| | Total Settlements Area | **2.12** | **7.32** | **29.77** | **5.34** |
| Water Body | **River/ Ponds** | **0.44** | **1.52** | **44.76** | **8.03** |
| | **Total Area** | **28.97** | **100.00** | **557.08** | **100.00** |

**Explanatory note on land use by Satellite Imagery:**

A Land Restoration / Reclamation monitoring of 50 OCPs of CIL base on the satellite data of the year 2016-17 has been done by Geomatics Division of CMPDI (HQ), Ranch. The study reveals that out of total excavated area of 116.97 $km^2$, 74.87% of area is under reclamation by NCL out of which 46.99 % area has been re-vegetated and 27.88% area is under backfilling. There is decrease of 0.98$Km^2$ for area under reclamation in NCL in the year 2016 with respect to the year 2015. This decrease is due to dumping of overburden over vegetated areas due to increased production and space constraints for dumping.

After analyzing the satellite data of year 2015 vs. 2016, it is evident that area under plantation has decreased from 57.52 km2 in 2015 to 54.96km2 in 2016 due to dumping of overburden over vegetated areas due to high overburden removal and no additional space available for dumping of overburden material.

The production capacities of most of the OC mine in NCL have been increased to cater to the power demand of the Nation Due to this the generation of overburden has also increased. Since the mine leasehold areas have no other space available for dumping these additional overburden generated are being dumped on vegetated dumps.

## 3.7 Hydro-geological assessment

A comprehensive hydro-geological assessment report has been prepared by CMPDI. The report is based on latest pre-monsoon and post-monsoon baseline data covering information on ground water situation, aquifer characteristics, water level conditions (Pre-Monsoon, Post Monsoon) estimate of ground water resources, predicted impact of the project on ground water regime and detailed remedial / conservation measures such as artificial recharge of ground water etc. The report is annexed as **Annexure No.-XIV.**

In the present study, to assess the water table configuration, a network consisting of 36 dug wells covering most of the villages falling within the core and buffer zone and 9 number of piezometers in Jayant expansion project was established in the study area and water levels were monitored. The selected wells are mostly used for domestic purposes.

**Ground water level Scenario:**

Ground water level by Permanent Observation Well (POW) of the area is continuously monitored by CMPDI. There is one shallow and one deep Piezometer of CGWB in the buffer zone of Jayant Expansion OCP. The details of water level of Piezometers monitored by CGWB is enclosed in Table 2c and

2d. The pre-monsoon and post-monsoon historical groundwater levels for the last 11 years (2006 to 2016) recorded by CMPDI at Jayant near Mudwani dam (Well No.: J-15) and near Bhuse Mode (JH-13) located in the core zone and the buffer zone, respectively.

The data shows that the pre-monsoon water levels vary from 3.46 m (2012 in J-15) to 8.21 m (2013 in JH-13) with an average of 5.87 m and the post-monsoon water levels vary from 1.50 m (2013 in J-15) to 7.36 m (2013 in JH-13) with an average of 4.68 m.

The water level fluctuation varies from 0.39 m (2010 in JH-13) to 1.95 m (2012 in JH-13) with an average fluctuation of 1.17 m in the area. The post-monsoon water level trend of J-15 and pre & post-monsoon water level trend of JH-13 hydrograph stations showing an increasing trend while pre-monsoon water level trend of J-15 hydrograph station showing normal trend. Overall groundwater utilisation with the increasing population and by mining has not affected the local groundwater regime.

Since project lies on water flow divide, hence general water table gradient would be different for northern and southern side of study area. The major drainage controlling the northern side of the study area is Bijul nala, while southern side is controlled by GBP Sagar. Studies reveal that the general water table gradient for the top aquifer in the north of study area is $8.01 \times 10^{-3}$ towards north-east. Whereas in the south of study area it is $5.05 \times 10^{-3}$ towards south-east.

**Recharge and Discharge Zone**

Water table contour map prepared for May'2016 indicates that the recharge is from the elevated grounds, located north and northwest of the Jayant Expansion OCP. The recharge is mainly from rainfall to the phreatic aquifer. Deeper aquifer get recharged from the outcrop region and leakage from phreatic aquifer.

Discharge zone is the low lying flat terrain, nadi, and nala beds and GBP Sagar located south and southeast of Jayant Expansion OCP. Open pit mines also act as man-made discharge zones.

**Groundwater Recharge Potential**

Rainfall is the major recharge source of groundwater. The area (Singrauli Distt.) experiences an average annual normal rainfall of 1132.70 mm (reported by CGWB, Northern Central Region, Bhopal). The irrigation water with 25% return flow augments the ground water recharge.

The groundwater recharge potential in the study area was estimated by Rainfall – infiltration method and Water Level Fluctuation method. The estimation of ground water resources balance in the area has been carried out as per the Ground Water Estimation Committee recommendations of 1997. The irrigation draft for the agricultural land (16,513 Ha) in the buffer zone and core zone was estimated as 4.97 M.cum.

The groundwater quality in the area is monitored regularly by CMPDI and the results indicate the groundwater in the area is potable and does not contain any toxic elements.

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# CHAPTER-IV

# Anticipated Environmental Impacts & Mitigation Measures

## 4.0 Introduction

The impacts (both beneficial and adverse) of mining and its allied activities of the project have been assessed and presented in respect of Ambient air, water, noise, blasting & vibration, socio-economic and Occupational health profile, flora & fauna, land resource, traffic movement and visual / aesthetic aspect in this chapter.

NCL has decided to carry out a Study by CMPDI, on Cumulative impact of all the existing industrial activities in the study area and also those in the pipeline/proposed to arrive at a comprehensive picture along with adequate environmental safeguards for Jayant Expansion OCP, in addition to those provisions made in this EIA/EMP. The study report is enclosed at Annexure XXXI.

The control measures to mitigate various environmental impacts are also highlighted in this chapter for carrying out mining operation in an environmentally compatible manner. Further, all provisions of Coal Mines Regulations and Directives are being followed in this project.

## 4.1 Socio-Economic Impact Assessment and Mitigation measures with R & R Action Plan

Due to project expansion there will be beneficial as well as adverse impact on socio-economic aspects. The direct & indirect employment generated due to mining operation has a great impact for balancing overall socio economical condition of the people around the area. The impact of mining activity in the area is positive on the socio-economic environment of the region. This project will improve socio-economic status of the joining areas and will help to meet the energy demand of the nation.

The expansion of the Jayant OCP will enhance the socio-economic activities, physical infrastructure in the adjoining areas. This will result in improvements in Physical Infrastructure, improvements in Social Infrastructure, and increase in Employment Potential contribution to the Post-mining enhancement of Green Cover.

The Socio-economic study reveals that, the project will have a positive impact on socio-economic profile of the area due to increase in economic activities, employment opportunities, trade and business, infra-structural development, better educational and health facilities, community Development, improved communication link etc. These impacts are as discussed below:

### 4.1.1 Beneficial Impact

- **Employment Opportunities**

The increased mining activities shall further accelerate the economic activities and urbanization in the region with the creation of new employment opportunities. The expansion of the project will generate employment opportunities in i) primary sector, ii) secondary sector and iii) tertiary sector.

The land oustees and other local people employed through employment exchange will fall under primary category. Local unskilled and semi-skilled persons may get employment through contractual agencies engaged in the various operational activities for the project. Such temporary employment may continue throughout the life of the Project and will fall under secondary employment sector.

The Project will further boost the various service facilities like supply of agricultural produce, milk and dairy product, fruits, vegetables etc. There will also be increase in requirement of vehicle repair and maintenance facilities, supply of spares, laundry, grocery shops, medicine shops, hotels, restaurants, tea stalls, snacks bars and several other facilities which will fall under tertiary employment sector and will be provided mainly by local people.

The Project has already provided compensation and rehabilitation of affected families for existing project. Thus due to expansion of the Project there will be further socio-economic upliftment of the local population.

- **Education**

Mining & other industrial activities has increased the awareness among the local people towards importance of education in the area. It is also observed that number of school going children is considerably improved in past few years. But to meet the requirement of the growing population, educational facility has already been provided by the Project which will take care of need arises due to proposed expansion.

- **Health care**

Opening of coal mining projects have improved the health care facilities in this region. The roads laid by NCL enable them to reach health centres in time. It has been noticed that there is considerable increase in rural people adopting immunization and family planning facilities, particularly after the development facilities established in this region.

NCL operating a Central Hospital in the area with almost all modern medical facilities. Also a Dispensary with all facilities has already in operation in Jayant Project. Persons from nearby villages has been also benefited with such facilities.

- **Others**

With the increase in female education & employment, social customs like child marriage and dowry have considerably decreased.

Improvement in economic status due to employment by NCL and compensation money paid towards land acquisition, if any.

- **Ecological awareness**

  Due to environment protection drive, people are becoming conscious to take environmental protection measures like tree plantation, use of other sources of domestic fuel, thus reducing tree felling etc.

  Considering the above impacts, it is quite clear that the expansion of project will have beneficial impact on socio-economic front.

### 4.1.2 Adverse impact

- Unplanned settlements of migrant population may create unhygienic conditions.
- Increase in pressure on the agriculture/ cultivable land for housing needs will reduce the crop yield. At the same time demand for food products will increase resulting in higher cost of living.
- Psychological effects of noise and ground vibration.

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- Dust deposition over the plants, houses and other house hold materials due to dust being carried away by wind from mine.

### 4.1.3 Socio-economic mitigation measures

- Direct employment to local inhabitants from affected villages. Indirect benefit to persons engaged during different construction activities.
- Benefit to local population through domestic and commercial services in projects like :

  a) Vehicle repair shop / maintenance garages
  b) Medical shop
  c) Transport agencies for supply of fruits, vegetable, cereals, milk, etc.
  d) Consumer goods
  e) Hotel, Restaurants, etc.

- Provision of residential annex with each shop in the shopping complex.

### 4.1.4 Rehabilitation & Resettlement action plan

The prime approach to the rehabilitation is that only minimum numbers of families are required to be shifted, mainly from the core activity areas of the project. A detail R & R plan is given in **Annexure No.XXVII**.

There are 1438 land owners and 5860 house owners in this acquired land and about 1599 PAFs are eligible for rehabilitation/lump sum compensation.

The compensation of Rs. 617,41,86,624/- of land, trees, bandhas, houses, wells and bore wells etc. was sanctioned by The Ministry of Coal vide OM. 43020/10/2017-LA&IR dated 12.06.2017. The payment of compensation for land and houses is under progress.

These families will be shifted/rehabilitated as per R&R policy of CIL/Govt. PAPs are to be given plots if desire, in rehabilitation complex of NCL and shifting grant per family.

Rehabilitation complex of NCL, is so planned that it constitutes part of the existing village environment, so that while enjoying all the civic facilities provided in the rehabilitation complex developed by NCL, the families continue to be in a rural matrix. Other amenities provided in the rehabilitation complex are Shopping Centre, Hand Pumps, Open Dug Wells, Primary School, Dispensary, Panchayat Bhawan, Flour Mill, etc.

In addition to above piped water supply system, WBM road, murrum road, chilren's park, playground, street lighting, plantation along road side and open space have also been provided. Some photographs of R&R site Nandgaon has been given in **P-17 and P-18.**

The following measures are adopted for proper Resettlement of PAFs:

**I. Compensation for the land and other property:**

The payment of compensation for the land and houses will be made as per R&R policy of CIL/Govt. The detail of the compensation package is given below:

(i) Apart from compensation for the land and other property, the affected persons are given financial assistance @ Rs. 3.0 lakhs per family for shifting of house hold effects to rehabilitation site.

ii) Special benefits for STs/SCs in providing jobs etc.

iii) Active association of the State Government, local Member of Parliament, MLAs and villagers' representatives is ensured and Rehabilitation Cells under the auspices of the District Magistrate have been formed.

**II. Employment in NCL:**

The requirement of the project for unskilled and semiskilled work force is met from the land losers. Special preference is given to the SCs & STs. Those persons, who are inducted in unskilled categories, are given the job training in 'Central Excavation Training Institute' for various skills depending on their aptitude. They are promoted to the post of Operators, Electricians, Fitters, etc. as per their skill acquisition. In most of

the cases they may doubly benefited, while remaining in the job he continues to do farming in the remaining land.

In the Jayant Expansion OCP, total around 353 new employments will be given against acquisition of 286 Ha of tenancy land. However, land oustees will have the option of availing monetary compensation of Rs. 5, 00,000/- for each acre of land on pro-rata basis in lieu of employment.

**III. Self-employment training schemes:**

This includes short term courses for carpentry, plumbing, carpet weaving, dairy and poultry farming, etc. The financial assistance for conducting such course is rendered by the project. NCL has provided training to persons from different villages namely Mudwani, Garda, Saraswah Rajatola, Saraswah Laltola, Jaitpur, Nigahi, Madhauli Khutar, Kusimahara, Kushwai, Dheki, and other villages in Driving, Tailoring, Elec/Electronics, Computer and Pisciculture trade.

As regards their means of earning livelihood, the families who have lost their homestead, land holdings only they will continue to do their existing vocation from the rehabilitation site. In their case the company has only asked them to shift from the present place of living to the new place which will not be far away from the existing residential locations. In fact, in rehabilitation complex, they will be provided with civic amenities which they may not have in their original village.

### 4.1.5 Welfare measures

This covers the following facilities provided to project employees:-

- **Residential complex**
  Residential complex with shopping centre, schools, bank, post office, children's park, open lungs, green belt, etc. provided to employees. Project also provides house to school teachers, bank employees, police personnel and other service organizations.

- **Health care**
  One dispensary with adequate medical facilities is provided in Jayant colony. Another 150 bedded Nehru Shatabdi Chikitsalya with all modern diagnostic and treatment facilities has already in Operation in the NCL, which is adjacent to Jayant project.

- **Education**
  Primary, Middle and secondary Schools. The project is providing financial help to these school.

- **Recreation**
  Recreation centre for officers & staff and playground for children have been provided. Also one stadium, swimming pool, Temple complex, a garden etc. have been provided in the colony.

## 4.2 Impact assessment & pollution control measures for ambient air quality

The impact assessment (both short-term and long-term) has been carried out dealing with the following points:

(i) Phase-wise inventory of air pollution emission sources

(ii) Impact assessment (short-term and long-term besides direct/indirect and residual)

Appropriate air pollution control measures will be taken to contain the air pollution for maintaining the ambient air quality within the stipulated standards besides making the mining operation eco-friendly in this project.

A project titled "Development of Methodology for Regional Air Quality Monitoring using satellite data and ground Observations." is going to start in near future by NRSC, Hyderabad with CMPDI. The Project will mainly be carried out at Singrauli Coalfield and validated later in Talcher Coalfield. This project will mainly be carried out by NRSC while CMPDI will provide the data.

### 4.2.1 Air pollution impact assessment

The pollution sources are obvious and to assess the impact, the project life is divided into following time frames:

- Operation phase
- Post-operational stage

The activities associated with these time frames and having impact on the ambient air quality along with the pollutants are enumerated in the following sections:

❁ **Operation phase:** During this phase, activities necessary for mining of coal, its handling and transport are taken up. Such activities having impact on ambient air quality are detailed below:

| | | | |
|---|---|---|---|
| (i) | Drilling | : | Dust |
| (ii) | Blasting of coal and overburden | : | Dust and noxious gases |
| (iii) | Handling of coal | : | Dust and noxious gases |
| (iv) | Overburden handling | : | Dust and noxious gases |
| (v) | Dump formation (internal /external) | : | Dust and exhaust fumes from dumpers and dust till the development of green cover |
| (vi) | Movement of HEMMs/vehicles | : | Dust and noxious fumes |

**Coal and OB Handling & Transportation:** In the mine lease area coal and OB are being handled by Shovel and Dragline and transported by Dumpers, which generate dust & Fumes. The predicted effect of Mineral Handling & Transportation on Ambient

Air quality is given **Annexure –XXIII.** Out side mine lease area coal is transported by MGR and Public Rail, which has minimum impact on environment.

The impacts (both direct and indirect) are long-term ones.

- **Post-operational stage:** During this stage of the project, the activities related to the closure of mine are to be carried out. Preparation of final mine closure plan shall be carried out during the period four to five years before the closure of the mine. Some of the activities for the closure are:

  - Modifications in physical and biological reclamation of backfilled area
  - Salvaging and shifting operation of HEMMs and other equipment
  - Clearing of coal and other materials, restoration of infrastructure area & colony area to the extent possible and necessary if not useful for other projects
  - Management of hydrology and hydrogeology.
  - Redeployment of workforce, etc.
  - Arrangement & implementation of post-operation monitoring mainly keeping watch, vigil, etc.

  The activities having impact on the ambient air quality are enumerated below:

  (i) Movement of HEMMs for physical reclamation of backfilled area : Dust and obnoxious fumes

  (ii) Movement of vehicles for shifting and salvaging operation of HEMMs and other equipment : Dust and obnoxious fumes

  (iii) Movement of vehicles for clearing of coal and other materials : Dust and obnoxious gases

  The impacts are both direct and indirect. The nature of adverse impacts is short-term. The mining and its related activities create ambient air pollution. The impact of mining on ambient air quality are highlighted in the following paragraphs:

  (a) The ambient air quality is influenced due to the presence of SPM, $PM_{10}$, $PM_{2.5}$, $SO_2$, NOx, etc., which are generated due to various activities like drilling, blasting and handling related to the project. The concentration of pollutants may vary depending upon the various micro-meteorological parameters and the seasons of a year.

  (b) The baseline ambient air quality data of the proposed expansion w.r.t. SPM, $PM_{10}$, $PM_{2.5}$, $SO_2$ and $NO_X$ are within the limits of the prescribed standard. So the ambient air quality will have no effect on human being, flora and fauna, soil quality, surface structures and aesthetic value of the surrounding environment as suitable mitigatory measures are taken and will be further strengthened to make the operation of expansion project eco-friendly.

  (c) As the project area (core zone) is small in comparison to the region, the mining activities of this project will not affect the climate, rainfall, and temperature.

#### 4.2.1.1 Ambient Air quality Impact Prediction by modeling

As suggested by EAC in other terms and conditions, that for baseline air quality assessment, additional monitoring stations (4-5 nos) in the downwind areas need to be set up and included in the air quality modelling.

The baseline ambient air quality monitoring was carried out for Jayant Expn. OCP and Dudhichua Expn. OCP, which is adjacent project to Jayant for the period pre-monsoon season (from 15th March to 15th June, 2016). Therefore, the monitoring stations of Duchichua Expn. OCP has been included in the AAQIP. The details of baseline Air monitoring for AQIP is given below and shown in **Plate No.-10**.

| Name of the station | Direction from Quarry Edge | Distance from Quarry Edge (KM) | Remarks |
|---|---|---|---|
| JYAB1 Rose Garden | SSW | 0.04 KM | Baseline Air monitoring stations for Jayant Expn. OCP |
| JYAB2, Base workshop | S | 0.90 KM | |
| JYAB3, CETP | SE | 0.40 KM | |
| JYAB5, Kasar Village | NW | 7.70 KM | |
| JYAB6, Nigahi STP | SSW | 1.20 KM | |
| JYAB7, IWSS | ESE | 5.60 KM | |
| JYAB8,Kohroul Village | ESE | 8.20 KM | |
| Amlohri Pump House | SW | 4.40 KM | As per TOR Additional 4 baseline air monitoring stations of Dudhichua has been taken for AQIP. |
| Dudhichua Colony A | SSE | 0.40 KM | |
| Dudhichua STP | SE | 0.20 KM | |
| Misira Village | ESE | 6.00 KM | |

The impact of mining activities on the air quality of the core zone and buffer zone, with respect to PM 10 & PM 2.5 at the eleven Ambient Air Quality Stations, chosen for the purpose of baseline AAQ data generation, has been assessed by using Fugitive Dust Model , FDM-90121, 1990.

The contribution from proposed mining activity (to achieve the peak production level of 25 MTPA) has been assessed for the worst scenario of operation (maximum OB generation) with existing control measures (dust suppressing chemicals as the only extra measure over business as usual) and with additional control measures.

The model was run to predict the incremental PM10 & PM 2.5 concentrations for the over and above the baseline concentrations found at the eleven Baseline AAQ stations.

The results of Air Quality Impact Prediction modeling by FDM on the selected receptor locations are tabulated as below:

**Predicted and Monitored 24 hourly average PM10 Concentration Levels at various Receptors**

| Receptor | Direction from the Quarry Edge and Distance | 24 hour average concentration in µg/m3 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Incremental Ground Level Concentration (GLC) with BAU | Incremental Ground Level Concentration (GLC) with additional control measures for haul road dust suppression | Maximum value of Background/ Baseline concentration | Predicted GLC (BAU Scenario) | Predicted GLC with Additional control measures | Permissible Limits |
| JYAB1 Rose Garden | SSW, 9.5 KM | 8.605 | 5.309 | 88 | 96.60 | 93.30 | 100** |
| JYAB2 Base workshop | S, 6.7 KM | 28.9 | 15.471 | 178 | 206.90 | 193.47 | 300* |
| JYAB3 CETP | SE,6.9 KM | 64.307 | 31.298 | 179 | 243.30 | 210.29 | 300 |
| JYAB5 Kasar Village | NW, 8.5 KM | 0 | 0 | 87 | 87.00 | 87.00 | 100 |
| JYAB6 Nigahi STP | SSW, 11 KM | 17.438 | 7.905 | 90 | 107.43 | 97.90 | 100 |
| JYAB7 IWSS | ESE, 13.5 KM | 1.550 | 0.768 | 92 | 93.55 | 92.76 | 100 |
| JYAB8 Kohroul Village | ESE, 15 KM | 6.879 | 3.585 | 90 | 96.87 | 93.58 | 100 |
| Amlohri Pump House | SW, 12 KM | 3.795 | 2.596 | 89 | 92.79 | 91.59 | 100 |
| Dudhichua Colony A | SSE, 9 KM | 24.910 | 10.421 | 86 | 110.91 | 96.42 | 100 |
| Dudhichua STP | SE, 9.3 KM | 17.502 | 8.741 | 86 | 103.50 | 94.74 | 100 |
| Misira Village | ESE, 13.6 KM | 1.937 | 0.966 | 81 | 82.93 | 81.96 | 100 |

* Standards for coal mines for monitoring stations at a distance of 500 meters from dust generating source.

** National Ambient Air Quality Standards

**Predicted and Monitored 24 hourly average PM-2.5 Concentration Levels at various Receptors**

| Receptor | Direction from the Quarry Edge and Distance | 24 hour average concentration in µg/m3 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Incremental Ground Level Concentration (GLC) with BAU | Incremental Ground Level Concentration (GLC) with additional control measures for haul road dust suppression | Maximum value of Background/ Baseline concentration | Predicted GLC (BAU Scenario) | Predicted GLC with Additional control measures | Permissible Limits |
| JYAB1 Rose Garden | SSW, 9.5 KM | 1.40 | 0.801 | 50 | 51.40 | 50.801 | 60* |
| JYAB2 Base workshop | S, 6.7 KM | 5.29 | 2.719 | 59 | 64.29 | 61.719 | N.A.** |
| JYAB3 CETP | SE,6.9 KM | 11.14 | 5.186 | 61 | 72.14 | 66.186 | N.A. |
| JYAB5 Kasar Village | NW, 8.5 KM | 0.00 | 0.000 | 51 | 51 | 51 | 60 |
| JYAB6 Nigahi STP | SSW, 11 KM | 3.17 | 1.391 | 57 | 60.17 | 58.391 | 60 |
| JYAB7 IWSS | ESE, 13.5 KM | 0.31 | 0.156 | 55 | 55.31 | 55.156 | 60 |
| JYAB8 Kohroul Village | ESE, 15 KM | 1.43 | 0.685 | 54 | 55.43 | 54.685 | 60 |
| Amlohri Pump House | SW, 12 KM | 0.73 | 0.460 | 57 | 57.73 | 57.46 | 60 |
| Dudhichua Colony A | SSE, 9 KM | 5.01 | 2.066 | 47 | 52.01 | 49.066 | 60 |
| Dudhichua STP | SE, 9.3 KM | 3.35 | 1.613 | 48 | 51.35 | 49.613 | 60 |
| Misira Village | ESE, 13.6 KM | 0.42 | 0.214 | 55 | 55.42 | 55.214 | 60 |

***** National Ambient Air Quality Standards

** Coal Mine Standards does not stipulate permissible limit for PM 2.5 in core zone.

The detail of AAQIP is given in **Annexure No.-XXIII**.

### 4.2.2 Air Pollution Control Measures

Appropriate mitigative measures shall have to be taken to contain the predicted level within prescribed level. These measures (both preventive and suppressive) are enumerated below:

❁ **Drilling operation**

The following steps are being taken to reduce dust generation:

- All the drills are equipped with well-designed dust extractor arrangement. Again, the thrust is given on their proper maintenance and handling.

❁ **Blasting operation**

The following practices are being maintained:

- Appropriate design of the geometry of blast holes.
- Use of proper amount of explosive taking into consideration the geo-mechanical conditions of the site.
- Controlled blasting is usually be done in daytime during the shift change over period.
- The operation is in conformity to the extant laws with closer control of blasting parameters including results of blasting like desired fragmentation, permitted vibration, etc.

❁ **Loading and transport**

The following measures are being taken at existing project and enhanced in the expansion project:

- Surfacing of all service roads/permanent roads by asphalt.
- The length of haul road is reduced to the minimum possible. The permanent haul roads are boulder pitched and maintained properly. .
- Regular maintenance of HEMM engines to limit emission of harmful exhaust fumes.
- Frequent and at regular intervals, water is sprayed on haul roads, service roads. There are 06 Mobile water sprinklers of 28 KL capacity are in operation.
- Proposal for procurement of two nos. of truck mounted mist spray system/ Mist gun amounting to Rs 9127023.00 (Rs Ninety one lakh twenty seven thousand twenty three only) for minimizing airborne dust in area of coal transportation road and Morwa siding, has been initiated and it is in the process of approval by competent authority at HQ level NCL Singrauli.
- Greenbelts around quarry, industrial sites, service building area and residential colony besides avenue plantation along roads.

- Application of Environmentally friendly dust suppression chemicals shall be provided during expansion stage.

**Additional Measures for Expansion Project**

- There are provision of additional 07 water sprinkler of 70 KL capacity and 02 road sweeping machines in the EPR to take care of Expansion need. Fixed water sprinklers along the haul road shall also be provided.
- Proposal for procurement of two nos. of truck mounted mist spray system/ Mist gun amounting to Rs 9127023.00 (Rs Ninety one lakh twenty seven thousand twenty three only) for minimizing airborne dust in area of coal transportation road and Morwa siding, has been initiated and it is in the process of approval by competent authority at HQ level NCL Singrauli.

❁ **Coal handling**

The following control measures are being adopted during coal handling at existing & enhanced production level:

- Suppression of coal dust during coal handling by fine nozzle mounted fixed sprinklers.
- Minimization of the height of coal-fall at transfer points to reduce the dust generation.
- Improved maintenance of plant and machinery.
- The Proposed CHP of 15 Mtpa capacity has equipped with Dust extraction sy

Dust Suppression system, noise control , Fire fighting and Fire detection system, Plant cleaning system and Plant maintenance system

- 

❁ **Fires at coalfaces, coal stockyards**

**(a) At coal faces**

To prevent and control such fires, the following measures are being taken at existing & enhanced production level:

- Exposures of coal benches for long time is avoided.
- Provision of adequate fire fighting arrangements including storage of sufficient quantity of water at all critical points.
- Careful removal of all loose coal from the abandoned coal faces.
- Regular supervision.

**(b) At coal stockyards**

- Limiting the amount of stock by giving close attention to dispatch of coal
- Attention to the following while stacking of coal:
  - Proper dimensions of stack (height to be limited to not more than 8m).
  - Dozing/compaction to make the stock semi-consolidated.

- Regular and strict supervision of stacks.
- Provision of fire fighting arrangement with supply of adequate quantity of water at sufficient pressure.

**(c) At OB dumps**

- Fire in coal recovered with OB to be dealt with water at the face itself immediately.
- Blanketing with OB material (non-coaly) to out off the oxygen supply.
- The ratio of OB to coal is maintained so high and dispersed in such a way that chances of fire taking place are minimal.
- The fire if any, is attended early by drenching with adoption of quick jet of water and covering with incombustible material.

❁ **At workshops and stores**

- Proper ventilation system in dumper and dozer repair shop and stores.

Some photographs showing Air pollution control measures has been given in **P-1 and P-2.**

## 4.3 Impact Assessment & Pollution Control Measures for Water

Likely sources of water pollution from this project along with the type of pollutants are as follows:

| | | | |
|---|---|---|---|
| (i) | Sanitary (domestic) waste water | : | Suspended solids and BOD. |
| (ii) | Industrial wastewater from workshop | : | Suspended solids, oil & grease; |
| (iii) | Waste water from mine | : | Suspended solids, and oil; |
| (iv) | Surface run-off passing through coal stockpiles | : | Suspended solids; |
| (v) | Storm water from leasehold area and built-up area | : | Suspended solids. |

➢ **Mine Water Discharge**

The pumping system of Jayant mine has been designed to dewater the inflow of water due to precipitation falling within the active pit limit during the monsoon season and the ground water discharged from aquifers to enable the mining activity to continue round the year and the working faces and haul roads remain dry. The lay out of the quarry provides suitable gradient along the quarry floors and the benches to facilitate self-drainage of water to the lowest level of the quarry.

The intake of rainwater to the opencast mine is non-uniform during the year. The maximum rainwater intake is during the period of about three months (July to September) in a year. During dry season, seepage from strata is moderate and the same is dealt by running a few number of pumps provided for monsoon pumping. During this period, repair & overhauling of the pumps is being done by rotation.

Capacity of sump has been decided to accommodate rainwater corresponding to maximum daily rainfall at 10% probability. The daily capacity of pumping has been kept as difference between, volume of water in the day for maximum rainfall and the holding capacity of sump. Mine water is treated in Mine ETP of 32000 $m^3$/d & water quality from ETP is within permissible limit. Schematic diagram of Mine ETP is given in **Plate No.-18.** The present mine water is 4321.95 $m^3$/d only and the estimated mine water pumping at max. depth of quarry for Expn. Project is 5184 $m^3$/d only. Therefore, mine ETP has sufficient capacity to cater the need of expansion project.

- **Workshop and CHP waste water**

For proper maintenance, HEMM's like dumpers, dozers, graders are washed frequently in workshop. In addition, effluent from Workshop constitute washing of floor and roads in workshop premises. These effluents contain suspended solid, grease and oil etc.
In Coal Handling Plant water is used for dust suppression at different points, in wet dust extractors and for washing purposes. Hence there is generation of waste water which is having mainly suspended solids (coal dust), oil & grease and dissolved solids.

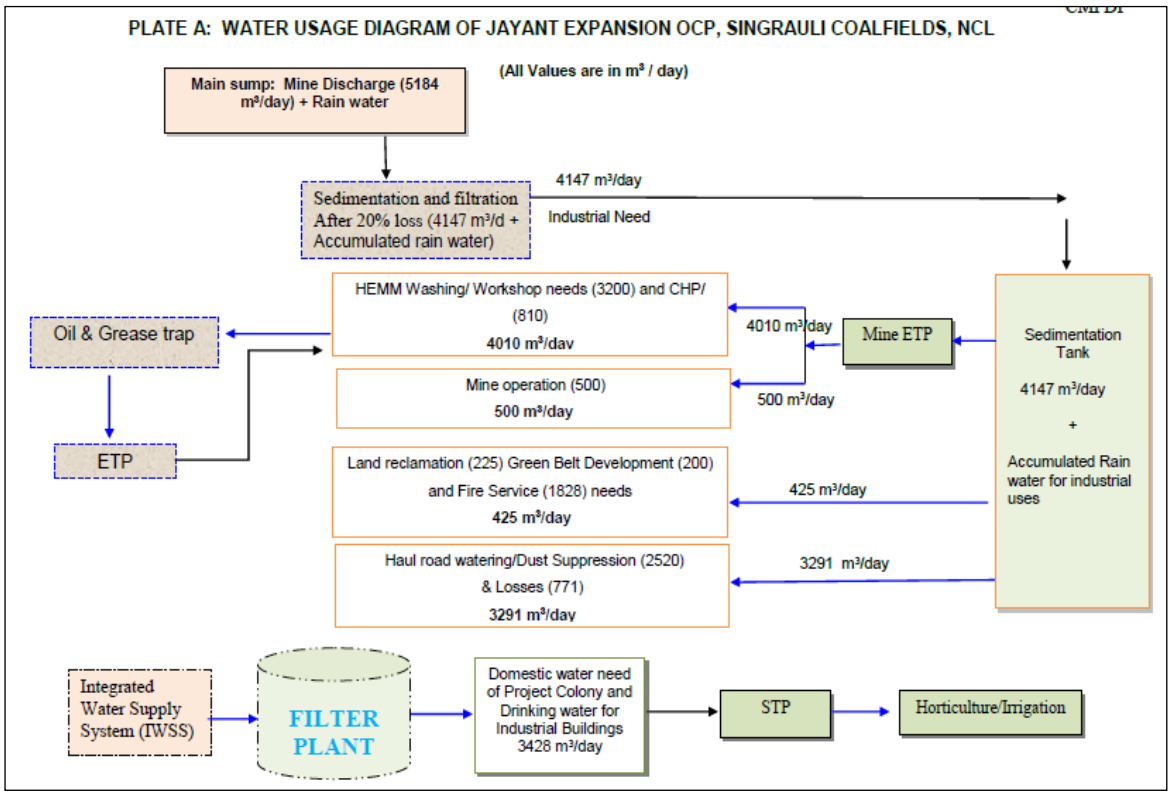
Waste water from Workshop & CHP is treated in existing CETP of 8000 $m^3$/d & treated water quality is within permissible limit. Schematic diagram of CETP is given in **Plate No.-19.** The total water requirement in workshop and CHP for Expn. Project has been estimated as 4010 $m^3$/d only. Therefore, Central ETP has sufficient capacity to cater the need of expansion project. The clear water obtained is re-circulated for Indusrtial use in Workshop and CHP and other .

- **Domestic effluent discharge**

Domestic waste water is generated in the project from residential area and service buildings. This wastewater contain mainly organic waste and suspended solids which is treated in existing STP of 4000 $m^3$/d capacty. Schematic diagram of Mine STP is given in **Plate No.-20.** The total water requirement for domestic use in township for Expn. Project has been estimated as 3428 $m^3$/d only. Therefore, STP has sufficient capacity to cater the need of expansion project.The treated water of STP are being used for horticulture purpose at Rose Garden in Jayant Township.

- **Surface Run-off from Devegetated Area**

The quantity of surface run-off from the devegetated area varies in different seasons. In the monsoon season the quantity is high, whereas, in the non-monsoon season the quantity is negligible. Total suspended solids is high in the surface run-off water. However, the content of toxic / heavy metal is within tolerable limits.
The Water usage Diagram of Jayant Expansion OCP for different uses and recycle/re-use has been given below :




### 4.3.1.1 Assessment of impact of mining on Hydrogeology and groundwater regime

Mining is a dynamic phenomenon. The mining activity creates dis-equilibrium in environmental scenario of the area and disturbs the groundwater conditions/regime in particular. A comprehensive hydro-geological assessment report has been prepared for Jayant Expn. OCP given at **Annexure No.-XIV.**

The report describes the aquifer description, groundwater level, groundwater resources potential, groundwater stage development, Mine drainage, impact of opencast mining on local ground water system including impact on aquifer system, impact on topography & drainage along with watershed description and radius of influence.

The Report also covers measures for augmentation of ground water recharge potential including water harvesting and artificial recharge, conservation measures along with future strategy. The summarised impacts are given below :
The impact on water regime due to mining activity can be broadly classified as under:

**I. Impact on topography and soil**
**II. Impact on Hydrology and surface water quality**
**III. Impact on groundwater and quality**

## I. Impact on Topography and Soil

A local change in ground topography is created at Jayant OCP due to mining operation such as open pit, embankment, dumps of overburden and coal, etc. As a result, there is marginal change in the drainage and surface run-off. During the mining process, soil is more susceptible for changes due to erosion, leaching phenomena/process, etc. Further the fine dust particles of coal and overburden may adversely affect the porosity of soils.

Within the core zone area, cracks and loosening of soils resulted due to mining and associated activities such as drilling, blasting, etc thereby physical / textural changes would occur in soil/formation. This mining process increases the rate of infiltration and recharge. The back-filled may be a good media for high groundwater recharge due to high permeability. Further, the void would store substantial quantity of rainwater, which is also for recharging the groundwater source. It may be appropriate to highlight the fact that temporary groundwater loss/deficit created during active mining stage would be compensated by these different means in the post mining stage so that the initial groundwater levels are regained to normalcy at the earliest for utility of the area.

## II. Impact on Hydrology and Surface Water Quality

No major nalla / river passes through mining property. Only 1st order / 2nd order streams flow in the mining area since it is located on a divide Drainage of the area on the south is controlled by various seasonal streams. On the western side these seasonal streams drain into Motwani nalla which is the main nalla. On the eastern side the seasonal streams drain into Ballia nalla. Both these nallas ultimately join Govind Ballav Pant (GBP) Sagar in south.

Towards north the drainage is through seasonal streams which discharge into Bijul nalla. The drainage pattern of Jayant area is shown in **Plate No.-6.** There will be no major changes in the Hydrology due to Project expansion.

Surface water quality is affected due to the opencast mining activities. During monsoon the input of loose silt from overburden into surface water drainage may change the water quality and accumulation of silt may change the course of surface water drainage. There are no discharge of quarry water, Industrial wastewater and domestic waste water except in monsoon season which do not affects the surface water quality. Following steps have been taken up by NCL to reduce this load:

1) Dense Plantation.
2) Construction of Siltation Pond.
3) Construction of Garland drainage
4) Construction Gabbion Wall
5) Construction of check dams

These activities will be further strengthened.

➢ **Mine sump water**

As the depth of excavation increases various aquifer beds are intercepted, which makes water pass through different type of rock formation and ultimately accumulates in the mine sump to meet the safety of the mine and create good working conditions. To collect the mine water, sumps are provided at deep-most part of the opencast mines. A garland drain of 0.83 km is built to arrest the rainwater into the mine. Rainwater of the catchments area of the mine will also be accumulated to the sump during rainy season. Some intermediate sumps are also proposed. These sumps also behave as primary settling tanks for the mine water. The rock formation do not have toxic chemicals and hence water is free from toxicity.

➢ **Runoff from mine area & OB dumps**

Runoff water from slopes of internal OB dumps, in-pit slopes, access road, if not channelised will find its way into the mine sump and other draining channels. This runoff water will have high suspended solids concentration. The Project has constructed a garland/catch drain (2.7 km long) towards northern side of the ML area to protect the mine pit from run-off water.

➢ **Seepage & leaching of chemical from OB dumps**

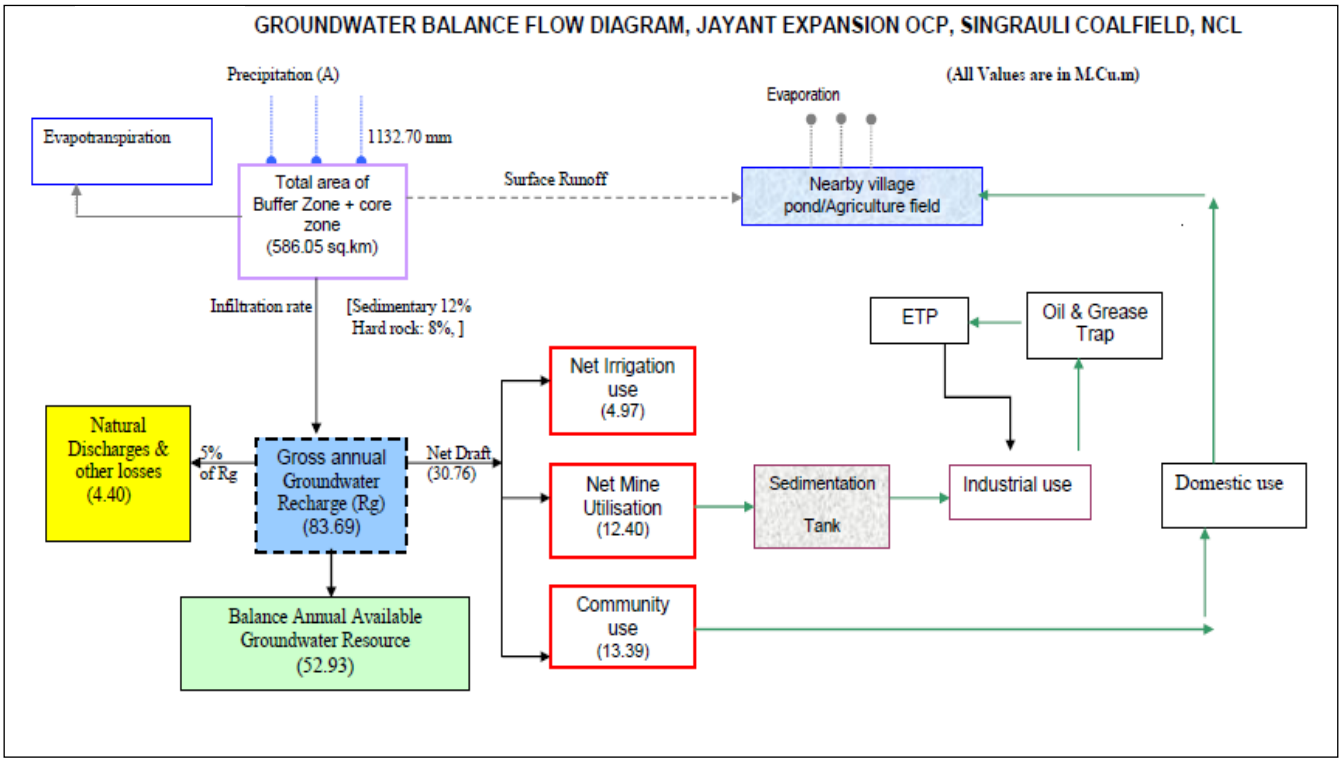
Part of rainwater infiltrates through OB dumps and finds its way in mine sump and other draining channels. This water will not have any toxic chemicals except dissolved solids and suspended solids.

Garland drains have also been constructed at the foot of the backfilled internal and external OB dumps, for arresting silts sediments and OB boulders. Also catch drains has been constructed along approach/haul roads. These arrangements will be further strengthened in expansion project.

Two siltation ponds are made all along the haul road by the Project in the ML area, one at the bottom of the internal OB dump and other on the western side near coal stack yard area.

**III. Impact on Groundwater and Quality due to Mining**

To minimize the impact of mining on ground water system, the project/mine authority has been adopting all possible measure to increase the ground water recharge potential. The projected radius of influence due to Jayant Expansion OCP on groundwater has been estimated at about 460 m from the mine periphery and there is no any village in this impact zone.




The stage of ground water development in the buffer zone (10 km from the periphery of the core zone) of Jayant Expansion OCP comes to about 36.75% (which falls in the **Safe** category). As per the data collected from the Central Ground Water Board, North central Region, Bhopal, the stage of ground water development in the Waidhan Block is 31.0%, in which Jayant Expansion OCP and its buffer zone located and the region falls within the "**Safe**" category. So, artificial recharge is not urgently required in the buffer zone of the Jayant Expansion OCP.

### 4.3.2 Water Pollution Control Measures

Effective water pollution control measures shall be taken as necessary keeping the following point.

- Sufficient safeguards have been taken to make the project eco-friendly from water pollution control point of view.
- Recycling of wastewater at CETP and mine ETP after appropriate treatment to the extent possible.
- Conforming to the limits of the Environment (Protection) Amendment Rules, 2000 ("Schedule-VI", General Standards for discharge of environmental pollutants, Part-A: Effluents) for the quality of the treated effluents.

The mitigation measures to be adopted in this project are given below in the following paragraphs:

- **Sanitary (domestic) wastewater**

Sanitary wastewater is treated in STP (4.0MLD Capacity). Domestic effluent treatment plant has been installed to take care of wastewater emanating from the residential colony of the project. Treated water are being utilized for horticulture purpose in Rose Garden at Jayant town ship. As there will be marginal increase in manpower for expansion of the project and present STP has sufficient capacity to take care of domestic effluent in project expansion. The Flow diagram of Sewage treatment Plant (STP) is given in **Plate No.-18**.

- **Industrial wastewater from Workshop & CHP**

Industrial wastewater is suitably treated in Central Effluent Treatment plant (CETP). The treated effluent from this plant is recycled for industrial use. The sludge collected from the sedimentation basins is disposed off as landfill in the de-coaled area. Oil and grease manually reclaimed from the trap is stored in drums safely for disposal through auction. Oily sludge will be disposed off in the impervious layer lined pit. Capacity (8 MLD) of existing CETP is sufficient to take care of the expansion project. The Flow diagram of CETP is given in **Plate No.-19.**

- **Wastewater from mine**

Mine discharge water is collected in a sump pit located in the mine floor from where it is pumped to Mine Effluent Treatment plant (Mine ETP). The treated clear water is used for dust suppression in haul road and CHP besides washing of dumpers and/or dozers in workshop. The sludge collected from the pond(s) is utilized as landfill in the de-coaled area. Capacity (32 MLD) of existing Mine ETP is sufficient to take care of the expansion project. The Flow diagram of Mine ETP is given in **Plate No.-20.**

- **Surface run-off**

(a) From OB/Coal dumps :
The surface run-off during monsoon from the dumps is collected in settling sumps/ ponds through garland drain of appropriate size provided at the foot, from where the overflow is discharge into natural drain. The surface water is monitored regularly. Same practice is being maintained for enhanced production.

- **Storm water**

To prevent inrush of precipitation run-off from the outside area to the quarry, storm water drains of suitable dimensions has been provided at appropriate locations with outlets to natural water courses. Settling tanks/ponds has been provided in the storm water drains at convenient locations to take care of suspended solids. Both storm

water drains and settling tanks/ponds are cleaned periodically to avoid choking of drains & malfunctioning of tanks/ponds. Same practice is being maintained for enhanced production.

Open masonry drains of appropriate dimensions with outlets to nearby natural water courses has been provided for handling the run-off from the built-up area. The above drains are cleaned periodically to avoid choking. Same practice is being maintained for expansion Project.

❁ **Conservative Measures**

The mine discharge has also been effectively utilized to meet the mine's needs, dust suppression and other industrial water needs. After the cessation of mining, with copious rainfall and abundant groundwater recharge, the water levels will recoup and attain normalcy. Thus, the impact of mining on groundwater system may be considered as a temporary phenomenon. The abandoned mine workings also behave as water pools and improve the resource availability in the area.

With no processing activity in coal mining, the mine water is free from any pollutants. However, with movement of HEMM and OB/Coal handling, the discharge will have high TSS. To reduce the TSS, the mine water is discharged after passing through siltation pond and the Mine E.T.P. Hence, the quality of groundwater in and around the mine will be protected/maintained as per the standards stipulated by the regulatory authorities.

- The deepening of irrigation tanks and ponds existing in the local villages will enhance the ground water recharge. After cessation of mining, part of quarry area will be reclaimed with highly permeable OB material. Thereby, in post-mining condition, the recharge and source potential in core zone will be much higher than the existing. The Mine Closure Plan envisaged that the open void (251Ha) which will be left inside the mine after backfilling of OB to keep 40m depth of water and act as a surface water storage. This water can be gainfully used for irrigation and also it will induce recharge to ground water. Proper safety measures will be taken by project authorities to provide proper slope, fence, and hedge plants to prevent animals falling into the water body. This water body may be used for pisci-culture in post mining stage.

- **Mitigation Measures:**
- To assess the impact in time and space, a close monitoring network around the mine area has been identified and quarterly water levels monitoring is in progress in 36 nos. of dug wells.
- For observing the impact on aquifer system, 04 shallow and 05 deeper piezometers has been constructed for monitoring the unconfined and

confined aquifers respectively. They has been constructed in a protected place and monitored quarterly. (Feb, May, Aug. and Nov.). Location & Design has been finalize by CMPDI in consultation with CGWB, Bhopal.

- Periodic cleaning and deepening of nallas.
- Periodic maintenance and repair of Mine ETP, CETP & STP.
- The water quality is monitored under routine monitoring.
- On analysing the field data, if any impact is noticed, suitable control measures will be adopted by the project authorities.
- Creation of awareness, among workers and local people, about rainwater harvesting.
- Effective utilisation of mine water both in the industrial use and firefighting.

Some photographs showing water pollution control measures has been given in **P-3, P-4 and P-7.**

## 4.4 Impact Assessment & Control Measures for Noise & Vibrations (Blasting)

In Jayant Open cast mine the sources of noise are:

- Drilling operation in coal and OB.
- Blasting for coal & overburden
- Operation of HEMMs like shovels, dumpers, dozers, graders, front-end loaders, etc
- Operation of equipment in CHP, workshop, etc.

The noise associated with mining activities may be classified into three types

- Continuous
- Intermittent
- Impulse

The workmen associated with the operation of HEMMs, etc. will experience a noise level above stipulated 90 dB (A) [DGMS Circular, No.18 (Tech.) of 1975] for more than 4-4.5 hours per shift. Unless suitable mitigatory measures are taken, high noise pollution will have impact on the workmen.

It is worthwhile to mention that intermittent and impulse noises are considered to be less dangerous than continuous noise due to the short exposure duration except under the situation when the level exceeds 115 dB (A).

### 4.4.1 Impact of Noise & Vibrations

#### 4.4.1.1 Impact of Noise

Noise is defined as undesirable sound. In Singrauli Coalfield, opencast mines located contiguous to each other and operating simultaneously and other associated activities may cause noise problem. The ambient noise level of existing project is being monitored regularly. Noise levels are within the limits of the prescribed standard.

The noise level in and around the project is not likely to increase in future due to expansion of Jayant Mine, as there is proposal for replacing the old equipment of lower capacity by higher capacity equipment with better noise protection measures. In case noise levels exceed the permissible limit it may have following adverse impacts:-

- **Auditory effects**

This is of more concern and should be given top priority because its ill effect extends beyond the period of exposure and may be irreversible. Noise-induced hearing-loss is influenced by a number of factors:

i) Frequency & Intensity of noise

ii) Duration of exposure during a single day

iii) No. of years of working day exposures

- **Non-auditory effects**

It affects mental & physical health. It causes many physiological effects such as increase in blood circulation, increase in breathing amplitude and heart beat, elevated blood cholesterol, changes in the excretion rate of saliva and gastric secretion, sleep interference, mental & physical fatigues etc. It also disturbs peace and tranquility.

- **Task interference**

Performance goes down, increase in error rate, time taken in performance of a task is increased and quality of the product suffers. Steady noise do not affect the performance unless it exceeds 90 dB (A). Irregular burst of noise are more disruptive even below 90 dB (A).

- **Masking**

Interference with communication is known as masking and it can create problems like interfering danger alarm signals. Interference with speech signal while issuing warning signal for blasting may create safety hazard.

### 4.4.1.2 Impact of Vibrations:

Blasting operation produces ground vibration & air shock wave. Ground vibrations produced from blasting operations are another cause of environmental concern. Apart from the effective utilisation of explosive energy in fragmenting and displacing rock mass, a lot of energy is wasted in the form of detrimental side effects like ground vibrations, air blast, fly rocks, etc. which create problems to miners as well as nearby inhabitants in many ways.

In opencast mining ground vibration is mainly caused by blasting in which less than 25% of the explosive energy is utilised in actual rock breaking process and rest is dissipated through air and ground. The explosive energy is utilised in the following ways:

a) For breaking & dislodging the rock mass

b) Air blast due to release of the pressure of explosion of gaseous product, creating burst of sound and raising dust cloud.

c) Air shock waves

d) Ground vibration

e) Causing over break & back break damaging pit slope

- **Causes of Ground vibration**

Factors affecting ground vibration due to blasting are as follows:

i) Uncontrollable factors such as rock properties, tectonics of rock medium i.e. presence of faults, natural planes of weakness.

ii) Controllable factors such as:
   a) Charge of blast holes
   b) Blast hole geometry
   c) Distribution pattern of explosives in blast hole
   d) Length of stemming column
   e) Availability of free face and
   f) Sequence of blasting, and use of delay sequence

- **Impact of ground vibration**

The main impacts due to ground vibration may be:

1. Development of cracks in the houses located in the neighboring areas.
2. During blasting rock fragments fly up to a distance of about 150m.

The other Impacts due to ground vibration are the following:

i) Physiological effect on human beings & other organism
ii) Damage to life/structures/buildings
iii) Lowering of water table due to excessive fracturing of strata
iv) Poor or no vegetation in the adjoining areas due to lowering of water table.
v) Wild animals & birds get scared and are driven away due to excessive growing vibration and noise.
vi) Peace and tranquility in the nearby areas are disturbed due to excessive vibration & noise.

**1. Impact on civil structures**

The **Table** below shows the nature of damage for different Peak .Particle .velocity range which can give a rough idea:

| S.N. | Velocity (v) mm/s | Nature of damage |
|---|---|---|
| 1 | 0 - 10 | No damage |
| 2 | 10 - 20 | Light damage, peeling of paint, hair line cracks in the plaster. |
| 3 | 20 - 60 | Light damage, cracks in the plaster & occasional peeling & failing of loosely connected portion. |
| 4 | 60 - 100 | Serious damage, cracks initiate in concrete structures through cracks in brick plaster which break in big peeling & failing of light weight roofing. |
| 5 | Exceeding 100 | Very serious damage, affect even reinforced cement concrete structures. |

➢ **Effect of air shock waves**

The air shock waves, which are generally produced by plaster shooting and also during heavy blasting may adversely affect the health of the people. Over pressure of 1 Kg/cm$^2$ above atmospheric pressure may cause serious fatal injury. The shock waves get converted in acoustic wave with an over pressure of 0.005 Kg/cm$^2$ and are intensively perceived & cause annoyance & fatigue.

### 4.4.2 Noise pollution control measures

The following measures are being taken:

- Proper designing of plant & machinery by providing in-built mechanisms like silencers, mufflers and enclosures for noise generating parts and shock absorbing pads at the foundation of vibrating equipment.

- Routine maintenance of equipment.
- Rational deployment of noise generating plant and machinery.
- Greenbelts around the quarry, infrastructure sites and service building area besides avenue plantation on both sides of the roads and railway siding to maintain noise level at night time within the limit for the inhabited localities situated at a very close proximity.
- HEMMs with sound proof cabins.
- Chute linings in CHP are provided.
- Personal protective devices to all the persons working in high noise areas.
- Regular monitoring of noise levels at various points.

The above practices are being / will be continued for existing and expansion project.

### 4.4.3 Blasting vibration control measures

❁ **Measures for safe blasting**

Due attention are given to the following factors:

(a) All provisions of Coal Mines Regulations are followed.

**(b) Quantity of explosive**
The quantity of explosive is decided as per condition imposed by DGMS.

**(c) Stemming material**
Stemming material to be used is sand. However, the drill cuttings and chips of triangular shape is used as an effective stemming material with proper packing.

**(d) Delay system**
Use of millisecond delay detonators that are initiated by shock tube initiation system, between rows and between holes in the same row.

**(e) Blasting time**
Blasting is done in day time during the shift change over period as per requirement.

**(f) Warning**
Before blasting is done, warning sound shall be given and placards/flags are displayed so that people can move to safe places.

❁ **Vibration control**

- Proper conformation to measures for safe blasting as mentioned above, to avoid damage to any structure or annoyance to the people in the colony area or neighboring villages.
- Proper design factor are being considered while constructing various structures for stability against vibration.

- A safe blasting zone has been kept around the periphery of the quarry. This zone is kept free from village habitation and community infrastructure and thus impact of vibration after blasting on the surface structures is avoided.
- Controlled blasting is being done near built-up areas and surface features, as and when required.

The above practices are being / will be continued for existing and expansion project.

## 4.5 Impact on Land Resource and Its Management

### 4.5.1. Impact on Land use

The total land required for the mining & infrastructures etc. of Jayant Expn. Project is 3177.171 ha. The major land degradation may be as a result of quarry excavation, overburden dumping, civil construction, approach roads etc. Land use pattern of Jayant OCP will be changed during mining operations. Internal back-filled dumps and external dumps formed temporarily during coal extraction. Depth of quarry will go up by 225m, which may also affect the adjoining land and water courses due to erosion of loose strata in dumps.

The land degradation in the Expn. Project has been kept at minimum. The additional land required for project expn. is only for quarry and safety zone. Also, the total OB generated will be backfilled in the de-coaled area as internal dump and reclaimed technically and biologically. There is no external dumping envisaged in EPR.

Opencast mining operations have beneficial as well as adverse impacts on land. These impacts are discussed below:-

➢ **Beneficial impact**

1) The non-forest land used for residential complex was mostly waste land with undulated terrain. Hence the construction of residential complex with green belt all around and garden & parks in colony have improve the aesthetic look as well as land use.

2) The total forest land, 1180.171 ha is involved in mining operations. In the post mining stage with the proposed massive afforestation, area of green land will be increased with vegetation cover. This will improve the diversity and density of species. After the mining operations a void would be left so that a water body would be created which augment the attraction of the wild life.

3) With the increase in vegetation cover, water retention capacity of soil will increase & its erosion will decrease.

4) During mining OB dumps & mined out area will be leveled and reclaimed. This leveled area after sometime will be developed for agro forestry or forest with leveled and suitably graded surface relief.

➢ **Adverse impact**

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

### 4.5.2 Progressive OB/land reclamation/green belt and ecological restoration Plan:

#### 4.5.2.1 Land Reclamation (Mitigation Measures)

**Objective:**

The overall objective of reclamation is to restore the mined out areas to an environmentally acceptable state as pre-mining stage if not better. This objective should be achieved without adversely affecting the surrounding environment. Forestry is the end objective adopted for final land use which has been subsequently deliberated.

**Post -Mining Land Use Planning**

In order to achieve objectives of reclamation it is necessary to decide the post mining land use with a view to form strategy of reclamation. The criteria adopted is based on pre-mining land use and socio- economic environment in surrounding areas. After the end of mining operations, the general ground relief of the quarry area will be a water body surrounded by OB dumps on the mine entry side and quarry batter on the dip side. The water body will have a surface area of 251 Ha with 40m depth. The OB dumps will be in the form of decks each of height 30m. The ultimate RL of OB dump will be about 540 m in the western section and about 490m in the eastern section rising from about 390m RL. Final OB dump plan is shown in **Plate No.-23.** Cross section of Dump Profile at the end of the mining operations have been shown in **Plate No.-24.**

The OB dumps, are being planted with indigenous as well as exotic species. The final land use has been planned as forestry.

Drainage in the post mining stage will follow the general ground relief. Run-off from the dip side beyond the quarry limit will flow through the garland drain to the existing nallas and finally into the GBP Sagar. Run-off from the mined out area and part of internal dumps will flow into the water body.

When the water level in the water body will increase above the mine entry level of 355m, it will overflow into the natural streams and finally into the GBP Sagar. Drainage system outside the mining area will remain undisturbed.

### 4.5.2.2Over Burden (OB)/ Waste Disposal and its Management:

**(A) Present status of OB Dumps and Top Soil :**

At present, there are two external OB dumps and two internal OB dumps exist in the project. An Independent Environmental Compliance Audit has been carried out by ICFRE, Dehradun and submitted report in April, 2017. Based on this report, the present status of OB dumps are as follows:

**External OB Dumps**: There are two external OB dumps spread in an area of 118.65 Ha located towards West and East sides of the lease area.

**West external OB Dump:** It is located towards western side of the ML and its height is ranging from 65m to 70 m and slope angle is about 45º. The dump has retaining wall and garland drain as well. The garland drain is to arrest the silt and sediments. The dump is biologically stabilized with both exotic and native plant species like, *Acacia auriculiformis, A. holosericea, Cassia siamea, Dalbergia sissoo, Eucalyptus* spp., *Peltophorum pterocarpum, Pennisetum* sp., *Pongamia pinnata, Saccharum munja,* etc.

**East external OB Dump:** It is located towards eastern side of the ML area and its height is varying from 55m to 60m and slope angle is ranging from 45 to 50º. The dump is biologically stabilized with both exotic and native plant species. However, the slopes are having several rills and deep gullies at few places, slopes facing towards CHP to sparse vegetation.

**Internal OB Dump:** There are two backfilled internal OB dumps, presently spread in an area of 650 Ha and it is divided by the central haul road and it is progressing towards northern side of the lease area.

**Eastern side backfilled internal OB Dump:** Its height is ranging from 70 m to 95 m and from original ground level and slope angle is about 50-55º. This dump has 5 terraces. Stabilization of dump slopes has to be undertaken by using Geo Textile Coir Mat followed by Hydro-seeding of local grasses and legume species to protect from erosion. Plantation has been made on the top bench of the eastern backfilled internal OB dump with both exotic and native plant species like *Acacia auriculiformis, A. holosericea, Albizia lebbeck, A. procera, Azadirachta indica, Cassia siamea, Dalbergia sissoo, endrocalamus strictus, Eucalyptus* spp., *Gmelina arborea, Peltophorum pterocarpum, Pennisetum* sp., *Pithecellobium dulce, Pongamia pinnata, Phyllanthus emblica, Ricinus communis, Saccharum munja, Tectona grandis,* etc.

**Western side backfilled internal OB Dump:**
Its height is ranging from 70 m to 95 m from the original ground level and slope angle is about 45-50º. At few places, observed deep rills and gullies on the dump slope and the OB materials rolled down all along the haul road in the ML area. A retaining/toe wall has been noticed at the bottom of the OB dump but it is completely filled with OB

materials. Vegetation of both exotic and native plant species like *Acacia auriculiformis, A. holosericea, Cassia siamea, Dalbergia sissoo, Eucalyptus* spp., *Leucaena leucocephala*, etc has been made at few places.

**Top soil storage:**
Top soil is stacked on the top of western side of backfilled internal OB dump and observed natural vegetation like *Saccharum munja, Hyptis suaveolans, Alternanthera* sp., *Calotropis gigantea, Acacia holosericea*. The Project has utilize this top soil by spreading on the OB dumps and other degraded areas. On first phase, it is recommended for biological stabilization of dumps by hydro-seeding especially native grasses and legume seeds which can thrive well and binds dump surface.

In the second phase, plantation has to be made with native shrubs and tree species. An area of 2.0 Ha each on Western and eastern part of mine has been selected for storage.

**(B) Proposed OB dumps :**

The opencast mining of Jayant Expn. OC Project involves removal of 882.89 million cubic meter of overburden from 01.04.2017. The total OB generated during expansion will be dumped into the de-coaled quarry as internal dump.

The Dump plan at present stage, target achieving stage, final dump plan and cross sections have been shown in **Plate No.-21, 22, 23 and 24** respectively.

### 4.5.2.3Schedule of Reclamation and Stage reclamation plan

The reclamation dumps will be started as soon as the dump formation completed. The reclamation plan at final stage mine operation along with cross sections have been shown in **Plates No.-25 and 26.**

Land/ OB Dump reclamation is divided in two stages, technical and biological. Methodology for technical and biological reclamation is given below.

- **Technical reclamation**

Technical reclamation is process of back-filling of excavated area with overburden in a systematic manner. It entirely depends on the depth and volume of overburden removed and equipment used for mining. Technical reclamation involves breaking and levelling the top of OB dumps, filling of gullies and terracing etc.

There is no external dump proposed in the EPR. The total OB will be backfilled in the decoaled area. For better stability of internal dumps, it is suggested to rip the mine floor in strips before back-filling. It is suggested to level the dumps and grade them outward properly to obviate water accumulation.

➢ **Biological Reclamation**

The physical, chemical and biological characteristic of the top surface of mine spoil is totally different than the original soil, which can be seen from the analysis results of natural forest soil and OB material.

Mine spoil is generally loose, having steep slopes hence susceptible to erosion, has high water infiltration rate and low moisture retention capacity.

These spoils are deficient in chemical, biological and organic nutrients. It is devoid of organic matter, soil fauna i.e. micro organism as well as soil flora. Hence natural process of soil development and enrichment is totally absent.

The general climate of the area is tropical arid. Rain is concentrated during 3-4 months of the year and remaining months are generally dry.

In such environmental conditions, natural process of re-vegetation and plant succession will be a slow process and will take many years to reach the levels of the natural eco-system prevailing in the pre-mining stage or more or less similar to that. The main objectives for re-vegetation of mine spoils would be as follows:

i) Stabilisation of loose spoil heaps by dump top levelling and re-grading of slope to minimise the soil erosion and reduce the infiltration rate.

ii) To initiate the process of enrichment of impoverished soil by natural process that is the plantation of grasses and legumes in the first instance with a view to have quick green cover to provide soil binding to check soil erosion, and to provide enrichment of soil by nitrogen fixation.

iii) Planting of indigenous plant species subsequent to grasses and shrubs to provide two tier plantation. This will enhance the microbial activities in the soil to provide for better growth of indigenous species. This will also improve the soil cover as well as increase the forest cover.

iv) To develop new eco-technology for enhanced soil enrichment, selection of suitable species which can grow in such environment.

Emphasis is being given on ecological restoration and mine reclamation by planting local/native species found in the area. Planting indigenous species which have better ecological synthesis with the natural environment at the same time this provides timber, fodder, fruits, other edible items, medicinal herbs as well as other plant produce of economic values.

NCL has started Ecological Restoration of mined out areas in Krishnashila and Nigahi Projects on 5.0 ha OB dump to convert degraded mined out areas into productive ecosystem as to enhance biodiversity with the technical guidance and assistance from FRI, Deharadun.

Also, NCL has plan to carry out Ecological Restoration study, to prepare comprehensive road map for ecological restoration works on OB dumps of NCL projects by ICFRE, Dehradun. The ICFRE expert team has already visited the project in March, 2018.

Therefore, In the Jayant Expansion the Eco-Restoration of OB dumps will be carried out as per the Road map developed based on recommendation of Eco-Restoration study and with the help of expert agency like FRI/ICFRE, Dehradun.

1180.171 ha. Forest land has already been acquired. Forest land affected by mining operations has already been compensated by compensatory afforestation. In addition, massive plantation is being done on reclaimed OB dumps.

The Plantation details on plain area as well as on OB dumps along with the reclaimed from inception of project are given in tables below:

**PLANTATION AROUND INFRASTRUCTURE, SAFETY ZONE AND AVENUE PLANTATION**

Data source: Project authorities

| SL. NO. | PLANTATION YEAR | PLANTATION AROUND INFRASTRUCTURE & SAFETY ZONE AND AVENUE PLANTATION | | | | TOTAL PLANTATION IN PLAIN AREA | TOTAL PLANTATION AREA (PLAIN) |
|---|---|---|---|---|---|---|---|
| | | COAL BEARING | CHP/WS | PLAIN/ COLONY | ROAD SIDE | | |
| 1 | 2 | 3 | 4 | 5 | 6 | (3+4+5+6) | 8 |
| 1 | 1985 | - | 2488 | 12695 | - | 15183 | 3.33 |
| 2 | 1986 | - | 29791 | 7500 | - | 37291 | 8.18 |
| 3 | 1987 | - | 14227 | 28873 | 810 | 43910 | 9.63 |
| 4 | 1988 | - | 21950 | 65630 | - | 87580 | 19.20 |
| 5 | 1989 | - | - | 3665 | - | 3665 | 0.80 |
| 6 | 1990 | - | - | 1500 | - | 1500 | 0.33 |
| 7 | 1991 | - | - | - | 3040 | 3040 | 0.67 |
| 8 | 1992 | 393500 | - | - | 7000 | 400500 | 87.81 |
| 9 | 1993 | - | - | - | 1000 | 1000 | 0.22 |
| 10 | 1994 | - | - | - | - | 0 | 0.00 |
| 11 | 1995 | 70000 | - | - | - | 70000 | 15.35 |
| 12 | 1996 | - | 500 | 2800 | - | 3300 | 0.72 |
| 13 | 1997 | 40000 | | - | - | 40000 | 8.77 |
| 14 | 1998 | - | 5000 | - | - | 5000 | 2.00 |
| 15 | 1999 | - | - | - | - | 0 | 0.00 |

| Sl. No. | Plantation Year | Plantation around infrastructure & safety zone and Avenue Plantation | | | | Total plantation in plain area | Total Plantation area (PLAIN) |
|---|---|---|---|---|---|---|---|
| | | Coal bearing | CHP/WS | Plain/ colony | Road side | | |
| 16 | 2000 | - | - | - | - | 0 | 0.00 |
| 17 | 2001 | - | - | 18000 | - | 18000 | 0.00 |
| 18 | 2002 | - | - | - | - | 0 | 0.00 |
| 19 | 2003 | - | - | - | - | 0 | 0.00 |
| 20 | 2004 | - | - | 15250 | 5000 | 20250 | 6.10 |
| 21 | 2005 | - | - | 6000 | - | 6000 | 2.60 |
| 22 | 2006 | - | - | 750 | 500 | 1250 | 0.30 |
| 23 | 2007 | - | - | - | 700 | 700 | 0.00 |
| 24 | 2008 | - | - | - | - | 0 | 0.00 |
| 25 | 2009 | - | - | - | - | 0 | 0.00 |
| 26 | 2010 | - | - | 37500 | - | 37500 | 15.00 |
| 27 | 2011 | - | - | 15000 | 500 | 15500 | 6.00 |
| 28 | 2012 | - | - | - | 72 | 72 | 0.00 |
| 29 | 2013 | - | - | - | 2500 | 2500 | 1.00 |
| 30 | 2014 | - | - | - | - | - | - |
| 31 | 2015 | - | - | - | - | - | |
| 32 | 2016 | - | - | 5000 | - | 5000 | 2.00 |
| Total | | 503500 | 73956 | 215163 | 21122 | 818741 | 190.0 |

**Status of Plantation and Reclamation of OB Dumps at Jayant project since inception**

Data source: Project authorities

| Sl. No. | Plantation Year | Plantation in OB dump (Nos.) | | | Reclamation area in Ha | | |
|---|---|---|---|---|---|---|---|
| | | Plantation in Ext. & Internal Dump | | Total Plantation in OB | Internal OB dump area | External OB dump area | Total OB dump area |
| | | Ext. OB | Int. OB | | | | |
| 1 | 1985 | - | - | 0 | 0.00 | 0.00 | 0.00 |
| 2 | 1986 | - | - | 0 | 0.00 | 0.00 | 0.00 |
| 3 | 1987 | - | 12320 | 12320 | 1.75 | 0.00 | 1.75 |
| 4 | 1988 | - | 10850 | 10850 | 1.54 | 0.00 | 1.54 |
| 5 | 1989 | - | 21010 | 21010 | 2.98 | 0.00 | 2.98 |
| 6 | 1990 | 65000 | 187500 | 252500 | 26.59 | 29.61 | 56.20 |
| 7 | 1991 | 153000 | 258960 | 411960 | 36.72 | 69.69 | 106.41 |
| 8 | 1992 | - | 121500 | 121500 | 17.23 | 0.00 | 17.23 |

| Sl. No. | Plantation Year | Plantation in OB dump (Nos.) | | | Reclamation area in Ha | | |
|---|---|---|---|---|---|---|---|
| | | Plantation in Ext. & Internal Dump | | Total Plantation in OB | Internal OB dump area | External OB dump area | Total OB dump area |
| | | Ext. OB | Int. OB | | | | |
| 9 | 1993 | - | 137000 | 137000 | 19.43 | 0.00 | 19.43 |
| 10 | 1994 | - | 150000 | 150000 | 21.27 | 0.00 | 21.27 |
| 11 | 1995 | - | 80000 | 80000 | 11.35 | 0.00 | 11.35 |
| 12 | 1996 | 17200 | 29500 | 46700 | 4.18 | 7.83 | 12.01 |
| 13 | 1997 | 2280 | 27720 | 30000 | 3.93 | 1.04 | 4.97 |
| 14 | 1998 | 20000 | 62500 | 82500 | 28.03 | 9.11 | 37.14 |
| 15 | 1999 | - | 85000 | 85000 | 23.00 | 0.00 | 23.00 |
| 16 | 2000 | 3000 | 97000 | 100000 | 15.00 | 1.37 | 16.37 |
| 17 | 2001 | - | 129500 | 129500 | 24.34 | 0.00 | 24.34 |
| 18 | 2002 | - | 86430 | 86430 | 20.89 | 0.00 | 20.89 |
| 19 | 2003 | - | 0 | 0 | 0.00 | 0.00 | 0.00 |
| 20 | 2004 | - | 23000 | 23000 | 4.58 | 0.00 | 4.58 |
| 21 | 2005 | - | 26250 | 26250 | 7.50 | 0.00 | 7.50 |
| 22 | 2006 | - | 110000 | 110000 | 30.00 | 0.00 | 30.00 |
| 23 | 2007 | - | 17500 | 17500 | 5.00 | 0.00 | 5.00 |
| 24 | 2008 | - | 17500 | 17500 | 5.00 | 0.00 | 5.00 |
| 25 | 2009 | 4625 | 49625 | 54250 | 14.17 | 0.00 | 14.17 |
| 26 | 2010 | - | 25000 | 25000 | 7.14 | 0.00 | 7.14 |
| 27 | 2011 | - | 33600 | 33600 | 9.60 | 0.00 | 9.60 |
| 28 | 2012 | - | 35000 | 35000 | 10.00 | 0.00 | 10.00 |
| 29 | 2013 | - | 45500 | 45500 | 13.00 | 0.00 | 13.00 |
| 30 | 2014 | - | 21000 | 21000 | 6.00 | 0.00 | 6.00 |
| 31 | 2015 | - | 10500 | 10500 | 3.00 | 0.00 | 3.00 |
| 32 | 2016 | - | 45000 | 45000 | 18.00 | 0.00 | 18.00 |
| Total | | 265105 | 1956265 | 2221370 | 391.22 | 118.65 | 509.87 |

## Progressive OB dump reclamation and land reclamation at Jayant Project

Data source: Project authorities

| Sl. No. | Plantation Year | Progressive OB Reclamation area in Ha. | | | Plantation area (plain) | | TOTAL AREA | Expenditure in Lakhs Rs. from 1987-88 |
|---|---|---|---|---|---|---|---|---|
| | | Internal OB dump area | External OB dump area | Total OB dump area | Plain area in Ha | Progressive plain area in Ha | Progressive OB dump area + plain area in Ha | |
| 1 | 1985 | 0.00 | 0.00 | 0.00 | 3.33 | 3.33 | 3.33 | - |
| 2 | 1986 | 0.00 | 0.00 | 0.00 | 8.18 | 11.51 | 11.51 | - |
| 3 | 1987 | 1.75 | 0.00 | 1.75 | 9.63 | 21.14 | 22.89 | 9.72 |

| Sl. No. | Plantation Year | Progressive OB Reclamation area in Ha. | | | Plantation area (PLAIN) | | TOTAL AREA | Expenditure in Lakhs Rs. from 1987-88 |
|---|---|---|---|---|---|---|---|---|
| | | Internal OB dump area | External OB dump area | Total OB dump area | Plain area in Ha | Progressive plain area in Ha | Progressive OB dump area + plain area in Ha | |
| 4 | 1988 | 3.29 | 0.00 | 3.29 | 19.20 | 40.34 | 43.63 | 3.82 |
| 5 | 1989 | 6.27 | 0.00 | 6.27 | 0.80 | 41.14 | 47.41 | 3.43 |
| 6 | 1990 | 32.86 | 29.61 | 62.47 | 0.33 | 41.47 | 103.94 | 27.60 |
| 7 | 1991 | 69.58 | 99.30 | 168.88 | 0.67 | 42.14 | 211.02 | 39.54 |
| 8 | 1992 | 86.81 | 99.30 | 186.11 | 87.81 | 129.95 | 316.06 | 80.64 |
| 9 | 1993 | 106.24 | 99.30 | 205.54 | 0.22 | 130.17 | 335.71 | 36.15 |
| 10 | 1994 | 127.51 | 99.30 | 226.81 | 0.00 | 130.17 | 356.98 | 31.88 |
| 11 | 1995 | 138.86 | 99.30 | 238.16 | 15.35 | 145.52 | 383.68 | 70.44 |
| 12 | 1996 | 143.04 | 107.13 | 250.17 | 0.72 | 146.24 | 396.41 | 17.21 |
| 13 | 1997 | 146.97 | 108.17 | 255.14 | 8.77 | 155.01 | 410.15 | 24.63 |
| 14 | 1998 | 175.00 | 117.28 | 292.28 | 2.00 | 157.01 | 449.29 | 14.39 |
| 15 | 1999 | 198.00 | 117.28 | 315.28 | 0.00 | 157.01 | 472.29 | 48.69 |
| 16 | 2000 | 213.00 | 118.65 | 331.65 | 0.00 | 157.01 | 488.66 | 45.74 |
| 17 | 2001 | 237.34 | 118.65 | 355.99 | 0.00 | 157.01 | 513.00 | 54.48 |
| 18 | 2002 | 258.23 | 118.65 | 376.88 | 0.00 | 157.01 | 533.89 | 68.28 |
| 19 | 2003 | 258.23 | 118.65 | 376.88 | 0.00 | 157.01 | 533.89 | 28.75 |
| 20 | 2004 | 262.81 | 118.65 | 381.46 | 6.10 | 163.11 | 544.57 | 20.10 |
| 21 | 2005 | 270.31 | 118.65 | 388.96 | 2.60 | 165.71 | 554.67 | 51.93 |
| 22 | 2006 | 300.31 | 118.65 | 418.96 | 0.30 | 166.01 | 584.97 | 57.85 |
| 23 | 2007 | 305.31 | 118.65 | 423.96 | 0.00 | 166.01 | 589.97 | 31.92 |
| 24 | 2008 | 310.31 | 118.65 | 428.96 | 0.00 | 166.01 | 594.97 | 38.54 |
| 25 | 2009 | 324.48 | 118.65 | 443.13 | 0.00 | 166.01 | 609.14 | 44.16 |
| 26 | 2010 | 331.62 | 118.65 | 450.27 | 15.00 | 181.01 | 631.28 | 42.27 |
| 27 | 2011 | 341.22 | 118.65 | 459.87 | 6.00 | 187.01 | 646.88 | 58.84 |
| 28 | 2012 | 351.22 | 118.65 | 469.87 | 0.00 | 187.01 | 656.88 | 45.35 |
| 29 | 2013 | 364.22 | 118.65 | 482.87 | 1.00 | 188.01 | 670.88 | 52.45 |
| 30 | 2014 | 370.22 | 118.65 | 488.87 | - | 188.01 | 676.88 | 38.70 |
| 31 | 2015 | 373.22 | 118.65 | 491.87 | - | 188.01 | 679.88 | 46.20 |
| 32 | 2016 | 391.22 | 118.65 | 509.87 | 2.00 | 190.01 | 699.88 | |
| Total | | | | | 190.0 | | | 1133.69 |

Details of Land use and reclamation area for Expn. Project in tabular form as per format of MoEFCC is given below:

**Stage-wise Land use and Reclamation Area (ha)**

| S.N. | Land use Category | Present (1st Year*) | 5th Year | 10th Year | End of life Year | Remarks |
|---|---|---|---|---|---|---|
| 1. | Backfilled Area (Reclaimed with plantation) | 25.00 | 160.00 | 370.00 | 808.00 | Post completion 390 Ha area will be reclaimed with plantation |
| 2. | Excavated Area (not reclaimed)/void | 55.94 | 132.33 | 193.44 | 75.66 | Void of 251 Ha with depth of 40 m remains as water body at post mining stage. |
| 3. | External OB dump Reclaimed with plantation) | - | - | - | - | The External OB dump has been reclaimed fully in yr.2000 and no external dumping in the Expn. |
| 4. | Reclaimed Top soil dump | 4.00 | 4.00 | 4.00 | 4.00 | |
| 5. | Green Built Area | 5.00 | 30.00 | 50.00 | 85.16 | |
| 6. | Undisturbed area (brought under plantation) | 20.00 | 60.00 | 150.00 | 303.9 | |
| 7. | Roads (avenue plantation) | 2.00 | 5.00 | 7.00 | 10.86 | |
| 8. | Area around buildings and Infrastructure | 2.00 | 5.00 | 30.00 | 47.93 | |
| | **TOTAL** | **113.94** | **396.33** | **804.44** | **1335.51** | |

*The beginning year counted after the approval of EPR by the competent Authority.

The biological reclamation of external OB dump (118.65 ha) has been completed. At present, the Project has already reclaimed and rehabilitated with both exotic and native plant species in an area of 391.22 Ha of backfilled area of OB dumps.

Out of total back filled area (i.e. internal dump) of 1589 Ha, biological reclamation in the area of 391.22 Ha has been completed & reclamation of balance area (1197.78 Ha) will be concurrent with the mining operation.

Hence during mining operations, disturbed forest land will be equally compensated which will ensure total green land area almost more at every stage of mining operation. Plantation done as compensation to forest as well as reclaimed land will take time to restore to original ecosystem.

➢ **Green belt development Plan**

Plants play very important role in combating environmental pollution in different ways as given below:

i) Prevents/reduces soil erosion by soil binding and canopy effect.
ii) Arrests dust particulate
iii) Provides cooling effect and helps in bringing rains.
iv) Provides peace and tranquility for mental relaxation.
v) Release oxygen and absorbs carbon dioxide.
vi) It acts as noise absorbing barrier.
vii) Improves aesthetic look.
viii) Provides timber, firewood, fodder, medicine, fiber, fruits, regins etc.
ix) Provides habitat for animal life
x) Serves as a genetic pool for bio-diversity.

Therefore, for controlling environmental pollution plantation as major thrust area has been adopted within the project as described below:-

1. Around CHP and workshop
2. Along railway line
3. Along approach roads.
4. In and around residential complex.
5. On Vacant land

The progressive green belt development has been concurrent with the mining operations as well as development of infrastructure. The density of sapling plantation will be kept @ 2500 per ha on plain area and on O.B. dumps. Stage-wise cumulative Plantation is given below:

**Stage-wise Cumulative Plantation**

| Sl. No. | YEAR* | Green Belt | | External Dump | | Backfilled Area | | Others (Undisturbed Area/etc) | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Area (ha) | No. of trees | Area (ha) | No. of trees | Area (ha) | No. of trees | Area (ha) | No. of trees | Area (ha) | No. of trees |
| 1. | 1st year* | 5.00 | 12500 | - | - | 25.00 | 62500 | 20.00 | 50000 | 50.00 | 125000 |
| **2.** | 3rd year | 15.00 | 37500 | - | - | 90.00 | 225000 | 30.00 | 75000 | 135.00 | 337500 |
| **3.** | 5th year | 30.00 | 75000 | - | - | 160.00 | 400000 | 60.00 | 150000 | 250.00 | 625000 |
| **4.** | 10th year | 50.00 | 125000 | - | - | 370.00 | 925000 | 80.00 | 200000 | 500.00 | 1250000 |
| **5.** | 15th year | 70.00 | 175000 | - | - | 675.00 | 1687500 | 100.00 | 250000 | 850.00 | 2125000 |
| **6.** | 16th year (end of mine life) | 85.16 | 212900 | - | - | 808.00 | 2020000 | 120.00 | 300000 | 1013.16 | 2532900 |
| **7.** | 17-20th Year (Post-mining) | 263.91 | 659775 | - | - | 1198.00 | 2995000 | - | - | 1461.91 | 3654775 |

*The beginning year counted after the approval of EPR by the competent Authority.

Up to 2016, total 30.40 Lakhs of plants have been planted in Jayant area.
Some photographs showing OB dump reclamation, Green belt and afforestation has been given in **P-6 and P-8 to P-19.**

## 4.5 Impact Prediction & Mitigation Measures: Biological Environment (Flora and Fauna)

The Flora & Fauna study for Jayant Expn. Project has been carried by M/S Eko Pro Engineers Pvt. Ltd., Gaziabad, UP. The expert team has visited and observed 10 km range of Jayant Project for study. The objective of the study was to survey the core & buffer zone of the project for flora and fauna by adopting standard methods. In the study all type of flora from natural as well as artificial plantation and fauna have been surveyed. The copy of authenticated detail study report is placed as **Annexure No.-XXI**.

Main objective of the environmental impact assessment (EIA) process is to predict the environmental consequences (positive or negative) impact on various component of entire project area and its surroundings; and to prepare an environmental management plan to ensure that the environmental quality of the area does not deteriorate due to the operation of the project. An EIA/EMP is a site specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with environmental legislation.

This part of the report provides a brief overview of the potential impacts on various environmental components especially flora and fauna due to the expansion of Jayant coal mining project by mechanized opencast mining method. The opencast mining operations involve development of benches, approach roads, haul roads, blasting, excavation and loading and unloading, crushing and transportation of materials. If adequate control measures are not taken to prevent/mitigate the adverse environmental impacts, these operations may cause ecological degradation and ultimately lead to irreversible damage to the ecosystem.

Coal mine of Jayant OC expansion project will take enough care in the mine to avoid adverse impacts on the surrounding environment. Although, different impacts on ecology, which are identified due to coal mining project, are discussed in the following sections:

### i. Impact on flora

- There is only 18 ha of forest land in the proposed expansion and vegetation patches developed on OB dump. On the other hand, both core and buffer zones are found to be free from ecologically sensitive and biologically rich areas/habitats, national parks, sanctuary, biosphere reserves, conservation reserve, community and are not present within an area of 10 km from the boundary of the mining lease.
- Dust deposition on leaf of the vegetation of the lease and its surroundings observed which may results in decline the rate of photosynthesis and retards the plant growth.

- There are four protected forests (Gorbi PF, Dudhichua PF, Mehrauli PF and Parari PF) and two reserved (Muher RF and Charki RF) within the 10 km radius from the proposed mine lease boundary. The forest clearances has been taken and NOC from the forest department has also been obtained for the concern area.
- Due to the mine water discharge and surface runoff during monsoon season, aquatic flora may be affected which may results in low rate of primary productivity and photosynthesis.
- The impact on terrestrial ecology, especially on flora will be due to emission of gaseous pollutant like NOx. The pollutant at a very low dose acts as an atmospheric fertilizer for the vegetation. However, at higher doses, they are injurious to both vegetation as well as animals.

❖ **Mitigation measures for minimizing impact on flora :**

**F**ollowing measures will be adopted to minimize the impact of mining on floral environment of the area:-

- Dust issues are mainly raised in the area due to unpaved road, cumulative fugitive dust emissions by various quarrying activities. To mitigate the impact regular water sprinkling/ fogging will be carried out within the mine lease area as well as approach road.
- Reclamation/stabilization OB dumps/soil shall be done by planting of local or native fast growing tree, shrubs and grass species to enhance the quality of ecosystem in the area.
- Replacement of saplings will be done after commencement of every monsoon in the core and buffer zone to maintain the green cover areas.
- There is provision for zero discharge of mine water, so aquatic flora will not be affected by the project activities. However, all care will be taken for conservation and protection of all kind of aquatic habitat (where aquatic flora & fauna exist) situated around the lease area.
- To reduce the dust pollution and sediment deposition on vegetation in the area measures like the biological reclamation of backfilled area, arboriculture / afforestation, compensatory afforestation, creation of greenbelt and avenue plantation will be done.

**ii. Impact on fauna**

- There is no National Park, Wildlife Sanctuary and Biosphere Reserve within 10 km radius of the project site (Lease area).
- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice scientific method of mining with proper Environmental Management Plan including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.
- Fencing around the mine lease area to restrict the entry of stray animals.
- Greenbelt development will be carried out which will help in minimizing adverse impact on the flora found in the area.

❖ **Mitigation measures for minimizing impact on fauna :**

The following measures are being and continue be adopted to minimize the impact of mining on faunal environment of the area:-

- Measures will be taken to curb pollution due to mining activities on air, water, land and noise environment. Plantation around mine area will help in creating habitats for small faunal species and to create better environment for various fauna in the adjoining areas.
- There is no any schedule-I fauna, endangered, endemic, rare and threatened species reported from the study area (core and buffer zone). Hence, no major impact has been observed due to project activities. On the other hand, others fauna found in the study area will be conserved while creating and developing awareness to the local people, labor and staff associated with the project about wildlife conservation.
- To enhance the quality of local ecosystem for others faunal species, plantation will be done in the area to ensure availability of food and suitable habitat for them. The project proponent is actively involved in the conservation of wildlife in the mine's surrounding area.
- The balance in the regional population will be maintained in natural course, owing to existing undisturbed forest areas in the vicinity of the project.
- The mine will be a "zero-discharge" one. If required, water is discharged only after suitable treatment. No adverse impact on the downstream aquatic life of surface water courses is expected.

**iii. Common mitigation measures for flora-fauna**

- Periodic maintenance of road used for mineral transport,
- Regular sprinkling of water through mobile tanker on mineral transport road,
- Transport of coal through covered trucks
- Development of thick plantation on OB dump and inside mine lease area,
- Regular monitoring of ambient air, water/ ground water and noise levels in core & buffer zone of the project area.

After the end of mining operations major mining area will be re-vegetated which will create suitable environment and habitat for different types of flora & fauna.

## 4.7 Impact on meteorology

The mining operation is a physical operation which involves excavation and material handling. No significant micro-meteorological condition will be affected by the increased mining activities due to expansion.

## 4.8 Mine Closure Plan

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social & environmental challenges. Various other objectives are as follows.

a) To allow a productive and sustainable after-use of the site this is acceptable to the mine owner and the regulatory authority.

b) To protect public health and safety.

c) To alleviate or eliminate environmental damage and thereby encourage environmental sustainability.

d) To minimize adverse socio-economic impacts.

### 4.8.1 Status of MCP for existing operations:

A Mine Closure Plan for existing Jayant OCP (15.50 Mtpa) has been prepared as per the MOC Guidelines ref. No. 55011–01–2009.CPAM Dt. 27.08.2009 and approved by NCL Board on 26.03.2012 . (Refer **Annexure No.–XII**).

The project has open an Escrow AC No. 391703800000527 in Union Bank of India, Morwa Branch, Singrauli (MP). The project has already deposited the Mine closure cost of Rs. 17757.88 lakhs upto 2017-18.

### 4.8.2 Mine Closure Plan for expansion Project

The Mine Closure Plan had been included in the Expansion Project Report for Jayant OCP and approved with EPR on 1st March'2016. Again the Mine Closure Plan has been revised incorporating the change in total leasehold are from 3177.00 ha to 3177.171 ha. The revised MCP will be put up to the NCL Board for approval. The Mine Closure Plan has been prepared as per the Guidelines approved by the Ministry of Coal, Govt. of India and notified vide communication No. 55011-01-2009-CPAM on 7th January, 2013.

Mine closure planning covers the progressive mining and post-mining phase of the project. Progressive mine closure process is undertaken concurrently with mine development/ production activities.

#### 4.8.2.1 Rehabilitation of mined out land

4.8.2.2 The reclamation of mined out land will be a concurrent with mining operations. The post mining land use at the end of mine life in the proposed expansion will be as follows:

**Post mining (conceptual) Land use of Mine Lease Area (Ha)**

| S.No. | Land use during Mining | Post mining Land Use (ha) | | | | |
|---|---|---|---|---|---|---|
| | | **Plantation** | **Water Body** | **Public Use** | **Others** | |
| **1** | External OB dump | 118.65 | - | - | - | 118.65 |
| **2** | Top soil dump | Top soil will be completely used in reclamation of dumps. | | | | |
| **3** | Excavation | 1589.00 | 251.00 | - | - | 1840.00 |
| **4** | Roads & railway | 96.75 | - | 0.00 | - | 96.75 |
| **5.** | Built-up area (Infrastructure & colony) | 82.00 | - | 261.90 - | - | 343.90 |
| **6** | Greenbelt | 93.30 | - | - | - | 93.30 |
| **7** | Undisturbed area (Safety Zone, wasteland, vacant land and Mudwani dam) | 625.371 | 59.20 | - | - | 684.571 |
| **Total** | | **2605.071** | **310.20** | **261.90** | **-** | **3177.171** |

At post mining stage area of forest / green cover will increase from 1180.171 Ha to 2605.071 Ha. There will be significant increase in green/forest cover at post-mining stage due to proposed reclamation activities and actual site restoration with improved green cover is targeted in the final mine closure plan. The final reclaimed dump plan and cross section is shown in **Plate No.-25 and 26** respectively.

### 4.8.2.2Financial Aspects

The mine closure cost has been estimated as Rs. 13391.42860 Lakhs. Other than Mine closure activities this cost also include all post environmental monitoring cost for 3 years, supervision charges for 3 years, power cost, protective and rehabilitation measures including their maintenance and monitoring, miscellaneous charges etc.

This cost has been estimated based on the guide line provided by Ministry of Coal i.e**.** Rs. 8.43982 (April-2018) lakhs per Hectare of the mine lease hold area of 3177.171ha. However, this is subject to modification based on wholesale price index as notified by Govt. of India from time to time.

The above fund will be generated annually over the remaining life of the mine i.e. 16 years from 2018-19. The annual closure cost is computed considering the total lease hold area at the above mentioned rate and dividing the same by the mine life. An

amount equal to the annual cost is to be deposited each year throughout the mine life compounded @5% annually.

Progressive and Final Mine Closure Cost Distribution of Jayant Expansion OC Mine

Source : Revised Mine Closure Plan 2018

| Sl. No | Activity | Mine Closure Cost (percentage weightage) | Closure Cost (Rs. lacs) | Remarks |
|---|---|---|---|---|
| A | **Dismantling of Structure** | | | To be included in final mine closure plan |
| | Service Buildings | 0.2 | 26.78286 | |
| | Residential Buildings | 2.67 | 357.55114 | |
| | Industrial structures like CHP, Workshop, field sub-station etc. | 0.3 | 40.17429 | |
| B | **Permanent Fencing of mine void and other dangerous area** | | | To be included in final mine closure plan |
| | Random rubble masonry of height 1.2 m including leveling up in cement concrete 1:6:12 in mud mortar | 1.5 | 200.87142 | |
| C | **Grading of high wall slopes** | | | To be included in final mine closure plan |
| | Leveling and grading of highwall slopes | 1.77 | 237.02829 | |
| D | **OB Dump Reclamation** | | | 71% for progressive and 17.66% for final mine closure. |
| | Handling/Dozing of OB dump and backfilling | 88.66 | 11872.84060 | |
| | Technical and Bio-reclamation including plantation and post care | 0.4 | 53.56571 | Equal weightage throughout the life of the mine. |
| E | **Landscaping** | | | |
| | Landscaping of the open space in leasehold area for improving its aesthetics and eco value | 0.3 | 40.17429 | Equal weightage throughout the life of the mine. |
| F | **Plantation** | | | |
| | Plantation over cleared area obtained after dismantling | 0.5 | 66.95714 | To be included in final mine closure plan |

| | | | | |
|---|---|---|---|---|
| | Plantation around the quarry area and in safety zone | 0.2 | 26.78286 | Equal weightage throughout the life of the mine. |
| | Plantation over the external OB dump | 0.02 | 2.67829 | Equal weightage throughout the life of the mine. |
| G | **Post Closure Environment Monitoring/testing of parameters for three years** | | | |
| | Air quality | 0.22 | 29.46114 | For three years after mine closure. |
| | Water quality | 0.2 | 26.78286 | |
| H | **Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people)** | 0.26 | 34.81771 | Equal weightage throughout the life of the mine. |
| I | **Miscellaneous and other mitigative measures** | 2.0 | 267.82857 | Equal weightage throughout the life of the mine. |
| J | **Manpower cost for supervision** | 0.8 | 107.13143 | To be included in final mine closure plan |
| | **TOTAL** | | **13391.42860** | |

### 4.8.1.3 Financial Assurance

For financial assurance, Northern Coal Field Ltd has an Escrow Account with Union bank of India, Morwa, with the Coal Controller Organization (on behalf of the Central Government) as exclusive beneficiary. The above annual closure cost compounded @ 5% annually will be deposited annually for 16 years. The amount being deposited will be reviewed with such periodicity as deemed fit by the Coal Controller.

Mining is to be carried out in a phased manner initiating afforestation/reclamation work in the mine out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mine. Up to 80% of the total deposited amount including interest accrued in the Escrow account may be released after every five years in line with the periodic examination of the Closure Plan as per the guidelines.

The amount released should be equal to expenditure incurred on the Progressive Mine Closure in past five years or 80% whichever is less. The balance amount at the end of the Final Mine Closure shall be released to mine owner/leaseholder on compliance of all provisions of Closure Plan duly signed by the lessee to the effect that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, court etc. and duly certified by the Coal Controller.

An agreement, outlining detailed terms and conditions of operating the Escrow Account, shall be executed amongst the mining company, the Coal Controller and the concerned bank in order to give effect this.

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# CHAPTER–V

## ANALYSIS OF ALTERNATIVES (TECHNOLOGY & SITE)

### 5.0 Review of mining methods

The project is site specific as coal occurrence is site specific. The proposal is for expansion of existing Jayant Opecast Project. The irreplenishable deposits of fossil fuel require proper methodology for successful exploitation with minimum loss. When safety and economy not a hindrance, nature of deposit is compatible, socio-economic impact on the people associated with the land and in the neighborhood is not profound or can be compensated, technology is available and has been proved under similar deposit conditions, adoption of opencast method is best of all known methods. The other criteria for choosing opencast method for Jayant Expn. Opencast project are as follows:

- Occurrence of moderately thick Turra seam (13.90m – 23.61m) in the shallow region and existence of another moderately thick seams namely Purewa Bottom seam (8.69-18.54m) and Purewa Top seam (4.00-13.07m);
- Overburden cover above Purewa Top seam varies from 16.40 m to 204.90m. This makes mining by opencast method a feasible option;
- Average stripping ratio of 2.99 $m^3$/t also attracts the feasibility of opencast method and
- Maximum haul depth is 225 m.

### 5.1 Technology alternatives

Considering the above geo-mining factors, mining economics and conservation of coal, opencast mining method has been adopted. The details of different technology alternatives of opencast mining are given below:

#### 5.1.1 Underground Mining Technology

Considering the above geo-mining factors as discussed above, mining economics and conservation of coal, the possibility of underground mining is ruled out.

#### 5.1.2 Continuous mining technology

Based on the available data on hardness of coal and OB, it can be said that most of the strata will need drilling and blasting prior to excavation. In view of this, application of continuous mining technology like bucket wheel excavators etc. may be ruled out.

#### 5.1.3 Crushing & Conveying technology

The size of the block is such that there is variation in the strike length and the topography of the block is rugged and undulating. The maximum volume of OB is accommodated in the internal voids with low transportation distance. Thus, the primary advantage of long distance hauling by conveyor is lost.

Also, considering the fact that conveyor technology requires comparatively much wider benches for operation and maintenance, the excavation at any point will be more for conveyor application then shovel-dumper system. In hilly terrain wide mining system results in adverse mine economics. As this is the non-practiced technology in NCL, the application of crushing and conveying technology has been ruled out under the prevalent geo-mining conditions.

### 5.1.4 Surface miner technology

The geo-mining conditions of Jayant Expn. OCP attracts the deployment of draglines, which will expose bottom most Turra seam. Use of surface miner in Turra seam will effect deployment of draglines. For upper thick Purewa Seams, the use of surface miner is restricted due to wider benches as mentioned above.

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

This technology has not got its applicability in NCL mines so far and therefore has not been considered for application in Jayant Expn. OCP.

## 5.2. Present mining technology

It has been proposed to mine the deposit of Jayant Expn. OCP by the existing technology as being the proven technology in NCL mines. Combined system of mining using shovel-dumper system with draglines has been proposed. The points in favour of draglines and shovel-dumper combination are:

a) General gradient of mining floor ($2^{o}$-$4^{o}$);
b) Mining of multiple seams i.e. Turra, Purewa Bottom & Purewa Top;
c) Parting between Turra and Purewa Bottom seam is 46.61– 66.40m and
d) Large scope of work including 25 Mt of coal and 75.45 $Mm^3$ of OB per annum (peak).

Shovel-dumper system for higher benches and draglines on the parting between Turra and Purewa Bottom seam has been proposed as this is the most suitable under the present geo-mining conditions.

Considering the geo-mining conditions of the Jayant OCP a combined system of mining deploying dragline for main bench over Turra seam and Shovel-dumper system for advance benches in OB has been proposed. Coal extraction is proposed by shovel-dumper system.

## 5.3 Summary of adverse impacts and their mitigation measures

The adverse impacts of selected mining technology have been discussed in Chapter-IV in detail. The mitigation measures to be adopted in the project in order to minimize the adverse impacts of the opencast mining technology have also been discussed in Chapter-IV in detail.

# CHAPTER-VI

## ENVIRONMENTAL MONITORING PROGRAMME

### 6.1 Introduction

Environmental monitoring including all aspects, has been already implemented by the project for existing production capacity. For expansion project, the existing time bound action plan for environmental management including all aspects will be further strengthened as per need by the project.

Samples for Ambient air, water/effluent and noise are collected and tested fortnightly/quarterly/ yearly at strategic places representing all the categories. The implementing authority is guided and advised as in accordance with feed back data obtained from these tests.

### 6.2 Parameters to be monitored

**Ambient Air Quality, Water/wastewater Quality and GroundWater Level & quality and Noise Levels quality**

Ambient air quality, water quality (treated water from Mine ETP, CETP, STP, ground water from dugwells & piezometers and drinking water samples), ground water level and noise level is being monitored for standard parameters. This is already being implemented through CMPDI in the existing project.

**Plantation**

Plant growth, its maintenance and survival rate will be monitored. This is already being implemented through M.P. Rajya Van Vikash Nigam in the running project.

**Land Reclamation and Plantation**

Overburden to be excavated, backfilled, the plantation schedules etc. will be monitored in the light of EIA-EMP and EC conditions.

**Health**

Health of the employees will be examined for identifying occupational diseases etc. to initiate remedial measures in time. Occupational health surveillance program has already been implemented by NCL in the Jayant project and Periodic Medical Examination (PME) as per DGMS guidelines after every 5 years for all the employees are being done at Nehru Hospital/ Project dispensary.

Status of PME:-

| S. No. | Year | No. of PME |
|---|---|---|
| 1. | 2012-13 | 687 |
| 2. | 2013-14 | 687 |
| 3. | 2014-15 | 919 |
| 4. | 2015-16 | 790 |
| 5. | 2016-17 | 720 |

The persons working at vulnerable places (highly pollution zone) is allowed to undergo the yearly health checkup or even earlier whenever needed.

**R & R Activities, specially Compensation to land losers**

R & R Activities, specially compensation to land losers is being monitored as per R&R Policy of CIL/Govt. through G.M.(Rev.) & Personnel Department NCL(HQ) in consultation with State Government.

## 6. 3 Monitoring Frequency

**Ambient Air, Water & Noise**

Following number of stations have been fixed for monitoring of environment for the present and proposed expansion project.

Ambient Air:- 08 (04 in core and 04 in Buffer Zone) Stations
Water/effluent :- 09 Locations
Noise:- 4 Stations
Groundwater : 36 dugwells, 09 piezometers

**Monitoring frequency for ambient air quality:** Ambient **a**ir quality monitoring at eight locations including industrial and residential areas are being done at a frequency of once in a fortnight as per G.S.R 742 (E)/CPCB guide line and National Ambient Air Quality Standards 2009 for the running mine and same practice shall be continued for expansion Project.

**Monitoring frequency for water/effluent quality:** Water samples from following stations are monitored regularlry as per required standard

| Sl. No. | Water Sample Type | No of stations | Frequency | Standard |
|---|---|---|---|---|
| 1 | Waste/Treated water | 5 | Fortnightly &Yearly (all parameters) | GSR 742 (E) dt. 25.09.2000 |
| 2 | Drinking Water | 1 | Fortnigtly & Quaterly | IS-10500 2012 |
| 3 | Surface Water | 3 | Quaterly | IS-2296 |
| 5 | Ground water | 45 | Yearly | IS-10500 2012 |

Same practice is being continued for expansion project.

**Monitoring frequency for ground water level & quality:** Regular monitoring of groundwater level and quality is being carried out by establishing a net work of 36 nos. dug wells and 09 nos. piezometers in the study area of Jayant Project. Ground water level monitoring is being done four times in a year i.e Pre-monsoon, Monsoon, Post Monsoon & Winter on a long term basis. Ground water quality monitoring is being done once in a year in May Month. The water samples is compared with IS: 10500-2012 standard. Same practice is being continued for expansion project.

**Monitoring frequency for noise level:** The noise level observations is being made as per G.S.R 742 (E)/CPCB guide line /Environment Protection Act GSR 1063(E) Schedule-III at the four noise monitoring stations. Out of four noise level monitoring stations , one is in buffer zone and balance three are at core zone. The noise level is being monitored fortnightly during day time (6 AM to 9 PM) and night time (9 PM to 6 AM).

**Plantation :** Plantation in Jayant Expn. project is being carried out by M.P. Rajya Van Vikas Nigam, and same is being maintained & monitored by them for continuous up to 3/5 years so that desired growth of plants and trees is attained.

**Land Reclamation and Plantation:** Land reclamation and plantation is being done as per schedule. Details of land reclamation and plantation in plain area and on OB Dumps is given in Chapter-IV.

**Health :** Periodic health examination of the employees is being done for identifying occupational diseases etc. and initiating remedial measures in case of detection. Same practice is being continued for expansion project.

## 6. 4 Measurement Methodologies

**Ambient Air Quality:** The Suspended Particulate Matter (SPM), Particulate Matter ($PM_{10}$), Particulate Matter ($PM_{2.5}$), Sulphur dioxide ($SO_2$) and Oxides of Nitrogen ($NO_X$) concentration and heavy metals such as Hg, Pb, Cr, Cd, As & Ni in $PM_{10}$ are being monitored in air monitoring stations (at a distance of 500 metres from the following dust generating sources) is measured in the manner indicated below:

| Sl. No | Parameter | Technique | Technical Protocol |
|---|---|---|---|
| 1 | Suspended Particulate Matter | RDS | IS:5182 (Part-IV) |
| 2 | Particulate Matter $PM_{10}$ and $PM_{2.5}$ | Respirable Dust Sampler and Fine particulate sampler (Gravimetric Method) | IS:5182 (Part-IV) |
| 3 | Sulphur Dioxide | Modified West & Gaeke | IS:5182 (Part-II) |
| 4 | Oxides of Nitrogen | Jacob & Hochheiser | IS:5182 (Part-VI) |
| 5 | Heavy metals in $PM_{10}$ (Hg, As, Cr, Pb, Cd, Ni ) | AAS | CPCB Guidelines |

**Water/Effluent Quality**: Three litres of representative water samples are collected in plastic container and transported to laboratory for physico-chemical analysis. For determination of BOD and bacteriological analysis, 250 ml pre-sterilized bottles is being used and care is taken to maintain cool temperature by keeping the bottles in ice boxes during transportation to the laboratory for analysis. Physico-chemical and bacteriological parameters for drinking water samples are compared with IS: 10500 standard and mine discharge water samples are compared with MoEF standard (GSR 742 E). The samples were analysed in the laboratory as per standard methods.

**Noise Level Measurement**: Spot levels are measured every minute for one hour in decibels under 'A' weighted average. Values are reported as equivalent day & equivalent night noise level.

## 6. 5 Emergency Procedures

The term 'major accident' means an unexpected and sudden occurrence of event from abnormal developments in course of one's industrial activity leading to a serious danger to public or environment, whether immediate or delayed, inside or outside the installation involving one or more hazardous substances.

Keeping in view the three basic principles i.e. prevention, preparedness( both pro-active and reactive) and mitigation of effect through rescue, recovery, relief and rehabilitation, a comprehensive blue print of Mines Emergency Response Plan /Disaster Management Plan(MERP/DMP) has been prepared & same is being followed.

The emergency procedures ( Disaster Management plan) have been discussed in Chapter-X.

## 6.6 Detailed buget & procurement schedule

The povision of Capital and revenue budget for the proposed environmental activities in the project are made every year in the annual budget of NCL. The environmental monitoring programme have been already implemented by NCL, CMPDI, RI-VI, Jayant; having suitable manpower ,well equiped laboratory and other infrastructure to carry out the job in a competent manner. The present capacity of NCL & CMPDI is sufficient to take care of enhanced activities in expansion of Jayant project.

*** * * ***

# CHAPTER-VII

## ADDITIONAL STUDIES

### 7.0 Public consultation

Public Consultation for Jayant Expn. Project (25.00 MTPA) was organized by M.P.Pollution Control Board on 13.12.2017 at Officer's Club, Jayant Project, Jayant, Singrauli, MP. Details of questions raised, reply given by project management and recommendation by members are enclosed as **Annexure-XXVI.**

### 7.1 Additional Studies suggested by EAC

The following are the status of additional conditions/studies as desired by EAC**:**

- Cumulative impact of all the existing industrial activities in the study area and also those in the pipeline/proposed, shall be studied to arrive at a comprehensive picture and planning of adequate environmental safeguards.

  **Status:**

  NCL has entrusted to carry out the study, on Cumulative impact of all the existing industrial activities in the study area and also those in the pipeline/proposed to arrive at a comprehensive picture along with adequate environmental safeguards for Jayant Expansion OCP to CMPDI. The study report is enclosed at Annexure XXXI.

- For baseline air quality assessment, additional monitoring stations (4-5 nos.) in the downwind areas need to be set up and included in the air quality modelling.

  **Status:**

  As suggested by EAC in other terms and conditions, that for baseline air quality assessment, additional monitoring stations (4-5 nos) in the downwind areas need to be set up and included in the air quality modelling.

  The baseline ambient air quality monitoring was carried out for Jayant Expn. OCP and Dudhichua Expn. OCP, which is adjacent project to Jayant for the period pre-monsoon season (from 15$^{th}$ March to 15$^{th}$ June, 2016). Therefore, the monitoring stations of Duchichua Expn. OCP has been included in the AAQIP. (AQIP is given in Annexure No-XXIII and discussed in Chapter-IV)

- Ecological restoration and mine reclamation to be done with local/native species found in the area.

  **Status:**

  Emphasis is being given on ecological restoration and mine reclamation by planting local/native species found in the area. Planting indigenous species which have better ecological synthesis with the natural environment at the same time this provides timber, fodder, fruits, other edible items, medicinal herbs as well as other plant produce of economic values.

  NCL has started Ecological Restoration of mined out areas in Krishnashila and Nigahi Projects on 5.0 ha OB dump to convert degraded mined out areas into productive ecosystem as to enhance biodiversity with the technical guidance and assistance from FRI, Deharadun.

  Also, NCL has plan to carry out Ecological Restoration study, to prepare comprehensive road map for ecological restoration works on OB dumps of NCL projects by ICFRE, Dehradun.

  Therefore, in the Jayant Expansion the Eco-Restoration plan of OB dumps is being prepared by FRI/ICFRE, Dehradun and will be submitted shortly. The ICFRE team has already visited site in March, 2018.

## 7.2 Risk assessment and management

Risk management is the process of analyzing the hazards or risks involved in operations and equipment, qualify them and work out preventive and corrective control measures to bring them to acceptable level.to reduce risk one has reduce either the probability of occurrences of an undesired event, its consequences(seriousness) or the duration of exposure.

The risk assessment and management is essential to guard against and mitigate the consequences of major accidents. The term, " major accident" means an unexpected and sudden occurrence of event from abnormal developments in course of one's industrial activity leading to a serious danger to public or environment, whether immediate or delayed, inside or outside the installation involving one or more hazardous substances. The risk assessment study is done by using Risk Rating Scale on Consequence, Exposure and Probability with weightage given on accident and the judgment of the work persons.

Keeping in view the three basic principles i.e. prevention, preparedness (both proactive and reactive) and mitigation of effect through rescue, recovery, relief and rehabilitation; a comprehensive blue print of Safety

Management Plan(SMP) has been prepared and in operation for Jayant OCP incorporating the following:

- Identification and assessment of risks
- Recommendation of measures to prevent damage to life and property against such risks.

The work Program is documented as Emergency Management Plan (EMP)

### 7.2.1 Slope failure in mine pit

The exposed ends of the coal seams and OB may fail due to slope failure and collapse of benches. A safe slope is being maintained for exposed ends of the coal seams and OB to avoid slope failure and collapse of benches. Similarly, at the end of mining operation safe terminal pit slope will be provided to avoid failure.
All the working benches are under the direct supervision of project level officials and all the necessary precautions are being taken to make the workings safe.

The following pit design parameters have been adopted.

**For coal seams**

| | |
|---|---|
| Bench height (max) | : 15m |
| Width | : 45m |
| Slope | : $80^{o}$ |

**For OB strata (Shovel Dumper)**

| | |
|---|---|
| Shovel bench height | : 10-12m |
| Working bench width | : 57-63m |
| Bench slope | : $70^{o}$ |

**For OB strata (Dragline)**

| | |
|---|---|
| Bench height | : 6-7 m |
| Working bench width | : 75m |
| Bench slope | : $70^{o}$ |

Each cycle of operation shall consist removal of overburden followed by extraction of the exposed coal. After extraction of coal no body shall be employed/no work to be done at any of the benches or bottom of quarry till benches in OB & coal are provided again from top downwards and coal is again exposed

### 7.2.2 Slope failure in OB Dump and management

During the process of OB removal by draglines, 10 m wide corridor was left and maintained at Turra seam top floor and at the same time a 15 m wide corridor was also being left at the sitting level of draglines on the dump side which facilitated uniform formation of profile of draglines cast dump. Maximum dump height of dragline cast dump was less than 60m

which was below the permission limit and also the slope of this dump did not exceed the angle of repose of the dump material (37 to 37 Degree). At present slope of the dump was 28 to 32 degree. Rib less mining method of extraction of Turra seam was being followed with a view to release hydrostatic pressure if built any time on the dumping side. After extracting Turra seam, about 10m wide strip from the toe of the Turra seam bench was being blasted off which facilitate draining out of accumulated water and at the same time it also helped in providing good bearing surface for dumping OB of the next cut. Present depth of the mine was about 200m from ground surface. Hugh volume of OB about 1.40 to 1.50 Lakh cum was being dumped/loaded continuously on the east side and west side dumps. Dumps were being monitored by Target less Total Station survey instrument targeting at fixed pegs kept on dump slope of dragline dump.

A continuous monitoring "dump & pit slope stability radar (SSR)" with integrated visual imaging system or any other such technology giving real-time displacement of strata and dumps and warn well in advance of any impending failure of pit slope or dump slope, to ensure safe and timely withdrawal of men and machinery from such prone areas, should be installed and put into operation in a time bound manner. A protocol for such monitoring shall be developed in consultation with DGMS and scientific agencies.

A geotechnical cell should be established at the mine level as well as company level to implement, maintain, monitor and control various geotechnical activities for safe and economic exploitation of coal from the mine, and at the same time this cell would look after the dump management and monitoring. Height of both the dumps should be scientifically justified by a scientific body.

**Slope stability study:** A detailed Dragline Dump slope stability study by BIT, Mesra, Ranchi has been carried out in Dec., 2010; with the help of a site specific computerized model. The recommendation are as below:

1. Factor of safety with consideration of seismic forces : 1.10
2. Factor of safety without consideration of seismic forces : 1.20
3. Slope of dump w.r.t. horizontal plan passing through Toe of dump : $36.5^0$
4. Height w.r.t. mine floor : 79 m
5. Height w.r.t. horizontal : 85 m

### 7.2.3 Blasting

Deep hole drilling and blasting are being conducted using SME, Safety Fuse, NONEL, Electric detonators, Electronic detonators and chord relay. Different dia holes are drilled as per availability of drill machines. In outsourced patch only 150mm dia holes are drilled whereas 260 mm to

311mm dia holes are drilled in departmental areas. 65 kg to 95 kg explosives are being charged depending on the bench condition, hole drilling pattern. In dragline bench of 27m high and hole of 300mm, 2 tonne explosive is being charged per hole. At a time 30 to 40 deep holes were blasted off. In outsourced patches, 240 to 300 holes were blasted at a time. One Blasting officer is appointed in the mine who is given the responsibility of conducting efficient blasting operation.

For proper blasting and minimising the adverse side effects due to blasting via noise, ground vibration, air blast, fly rocks etc., the following precautions are being taken to avoid dangerous situation :

- The optimal blast design parameters are maintained
- A safety zone for blasting has been provided around the quarry.
- Suitable drilling pattern.
- Before blasting is done, warning sound is given so that people can move to safe places.
- Controlled blasting with site mixed slurry.
- Optimisation of maximum quantity of explosive in a blast hole.
- Blasting will be done in daytime at a fixed time.
- Regular vibration monitoring is carried out and necessary precautions are taken while blasting
- Blasting is carried out in conformity of extant laws with closer control of blasting parameters including blasting results like desire fragmentation, permitted vibration, etc.

### 7.2.4 Explosive handling

The present day technology of blasting with Site Mixed Slurry (SMS) explosive shall be used with millisecond delay detonators that are initiated by shock tube initiation system. To avoid any accident, SMS is stored by the supplier as per GOI Notification. Further, transport and charging are also done by the supplier on the spot. Only priming will be done by the project authority the relevant statutory safety provisions as stipulated by DGMS, Chief Controller of Explosives and others are followed.

### 7.2.5 Mine inundation

The mine pit receives water from three sources namely, direct precipitation over excavated area, surface run-off from the surrounding areas and seepage from the strata. During heavy rainfall, there may be a situation when the mine may get flooded due to ingress of water from the higher ground through natural drainage. This may cause loss of human life, equipment etc. To guard against this eventuality, the following steps are taken:

- ✓ Calculation of sump capacity based on maximum rainfall in a day and pumping capacity for 18 hours.

- ✓ Installation and maintenance of pumps after calculating the anticipated quantity of inflow of water during a day of peak monsoon rain.
- ✓ Provision of garland drain around the mine to prevent ingress of precipitation, run off & keeping the same.
- ✓ Provision of sufficient number of pumps to pump out mine water during the critical rainfall period.
- ✓ Precaution against danger from local stream.
- ✓ Channelised rain water should not be allowed from dump top to enter into rain damaged area having undulating deep rain cut surface. Water should be coursed on toe side of dump top through kacha drain of 5m x 2m dimension.
- ✓ Berms of minimum1.5m height should be constructed 2-3 m away from crest part.
- ✓ In order to reduce the rate of silt generation and silt flow as a long term measure, technical reclamation(dozing, filling and proper benching) should be done followed by biological reclamation for growth of plants.

The pumping system mine has been designed to dewater the inflow of water due to precipitation falling within the active pit limit during the monsoon season and the ground water discharged from aquifers to enable the mining activity to continue round the year.

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

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

### 7.2.6 Fire

Accidental fires are causes of large scale loss of property and life. Keeping this in view, adequate fire fighting arrangement has been made. Adequate number of fire extinguisher has been provided for store and other service buildings. While calculating total water demand for the project, provision for firefighting has also been made.

As per the record as maintained, there were number of occurrences of fire in the mine. Fire occurred in dumpers, shovels, dozers, graders etc. many

times due to overheating and short circuiting. Thick seams are susceptible to spontaneous heating and as a result fire occurs in coal benches and also coal stock yards Limited exposure of coal benches with restriction on left over of loose blasted coals is one of the important control measures. The blasting for a limited quantity of coal which could be evacuated on the same day is also a precautionary measure against danger of fire.

Regular mock rehearsal for fire fighting in emergency situation is also practiced.

For fighting fire and to look after the firefighting organization, a Fire Officer is appointed at the mine. Under him three executives, three drivers and 4 to 6 general mazdoors are distributed in shifts. Two fire tenders and 2 water tankers are also available under the control of the Fire Office. Automatic Fire Fighting System has been provided in CHP.

- **Central Fire Fighting Station**

There is one Central Firefighting Station under CISF having mobile fire fighting equipment's and trained manpower to cater to the needs of all the projects of Singrauli Coalfields has been constructed and in operation at Jayant Project.

Adequate fire fighting arrangement has been provided. Adequate number of fire extinguishers has been provided for stores and other service buildings. While calculating total water demand for the project, provision for fire fighting has also been made.

### 7.2.7 Haul road maintenance

To avoid road accident further haul roads have been planned in such a way that the HEMM traffic remain away from the passenger traffic. Total length of haul roads in the mine is about more than 45 km. Haul road for rear dumpers are designed with double lane and shoulders on both sides for movement of dumpers and ancillary equipment. Sharp turnings have been avoided to reduce the chance of accidents. The haul road has been designed at a gradient of 1 in 16. Sufficient arrangements for illumination of roads including haul roads have also been made. Road crossings have been properly planned and designed to prevent vehicular accidents. The dumpers are fitted with sound warning while reversing. These measures are likely to prevent road accidents. A Senior Assistant Manager is appointed for the design, construction and maintenance of haul roads. He should also be given the responsibility for effective implementation of traffic rules and at the same time he should also ensure the conduct of air born dust survey and suppression of dust by water spraying on haul roads. For this purpose, a proper organization should be in place to support the team leader.

### 7.2.8 Illumination and communication

Sufficient lighting as per standards has been provided at all the required places, i.e. working faces, OB dump area, haul road, coal transfer points, loading points, CHP, workshop, etc., to avoid accidents and to create efficient working conditions. Tower Mast light fittings are to be installed at junctions for further improvement of lighting. Provisions for efficient communication systems (both internal and external) to allow communication link amongst various work centers to help avoid accidents and handle emergencies have been made.

### 7.2.9 Training

Coal industry has set up a number of training institutes for imparting training to its employees. In project level, Vocational Training Centre and at company level C.E.T.I cater the need of the training. These trainings are meant to raise awareness amongst workers for performing their duties properly with safety.

Further, the personnel directly responsible for handling emergencies are given training for making them better equipped for discharging the responsibilities. Mock drills for checking the risk management preparedness are being carried out regularly. Env. Awareness & need base training is given to all employees under IMS.

### 7.2.10 Medical preparedness

For guarding against accidental hazards the following measures are being taken:

1. Emergency ambulance service is kept ready on a 24 hour basis.
2. Doctor and paramedical staffs are made available during emergency.
3. First aid medical facilities exist at work place.

The mine hospital has already been provided with requisite facilities and qualified doctors to meet the medical emergencies arising out of accidents

For guarding against occupational and community health hazards, the following measures will be taken:

- Steps to control respirable dust improve workplace environment and reduce noise nuisance.
- Periodic Medical Examination (PME) of workers.
- Rehabilitation and treatment of workers affected and suffering from early stages of occupational diseases associated with coal mining.
- Availability of improved medical facilities.

### 7.2.11 Other miscellaneous measures

Following facilities exist:

- Provision of workshops for maintaining HEMMs and other equipment properly for avoiding their failures as well as the risk of accidents.

- Provision of store for spare parts for quick maintenance
- Fire alarm and firefighting system has been provided at the project site

The adoption of preventive measures as enumerated above ensures that the operation of this project remains safe as well as environment friendly.

Also, a Safety Management System development of safety management plan for Jayant Project by Pabsta Engineers India Ltd., Kolkata in year 2017. The Risk Assessment Plans for various Risks & hazards developed for Jayant mine is enclosed as **Annexure No.-XXVIII.**

### 7.2.12 Safety & conservation

- **Safety**

The rules & regulations made under Mine's Act, 1952 should be observed for all kinds of mining operations and rquired safety measures taken. Circulars issued from time to time regarding safety measures should be implemented. In order to ensure safety to the personnel and equipment of the mine and to improve the working conditions of the mine, the operational plan envisages following measures mainly :-

- Attempts are being made to remove/dress down the loose material/overhangs from highwall side to prevent any accidental falling of the same while advancing the key cut.
- Coal winning by shovels and drilling on the roof of the coal seam under dragline reach is prohibited.
- Coal is prone to spontaneous heating and catches fire. Steps are being taken to solve fire problems at the project.
- Sufficient width of haul road is provided/recommended.
- Atleast safety berm should be left on the benches.
- Stability of bench and dump slope is taken into consideration. If there is voilation in bench/dump slope then the precautions are given in the operational plan.
- Gradient of haul road is maintained be within permissible limit.
- Communication network inside the mine should be strengthened.
- There should be intensive training on safety so that the workers/operators become more conscious of this vital issue.
- Compulsory medical examination of workers, staff and executives is being carried out and a systematic record of medical examination should be maintained. This keep the persons in fit condition and enable them to discharge their duties efficiently.

- Measures are suggested for dust control and pollution control.

- After the risks are identified, appropriate risk control measures will be taken to prevent or minimize accidents.

➢ **Conservation**

- Rising coal demand profile coupled with limited coal reserves warrant immediate measures for conservation of coal.

  - The operational plan suggests following strategies to minimise coal losses and to improve conservation of coal.

  - There is an additional coal loss in coal rib left by dragline and at the end of the cut. Attempts shall be made to minimise such losses of coal and coal extraction should be upto the fixed floor boundary. Attempts should also be made to take all the exposed coal from mine floor.

- On the main dragline bench, drilling is not recommended below the roof of coal seam to avoid mixing of coal with OB due to blasting and to minimise coal loss.

  - Action shall be taken to solve fire problems so that coal loss due to firecan be minimised.

- Care should be taken in dumper loading so that there is no loss of coal during transportation. Attention should be given to minimise carpet losses of coal from coal yards.

- Due care should be taken for seam roof cleaning.

## 7.3. Corporate Social Responsibility (CSR)

### I. CSR Policy of Coal India :

Coal India was aware of its Corporate Social Responsibility much before the issue of Corporate Social Resposibility (CSR) became global concern, and was fulfilling the aspiration of the Society through well-defined “Community Development Policy” within the periphery of 8 Kms. of the Project sites. This has resulted into a harmonious relationship between Coal India and the peripheral Communities.

The primary beneficiaries of CSR should be land oustees, PAPs and those staying within the radius of 25 kms of the project. Poor and needy section of the society living in different parts of India should be second beneficiaries.
In the aforesaid backdrop, policy on CSR of CIL has been framed after incorporating the features of the companies Act 2013 and as per

notification issued by Ministry of Corporate Affairs, Govt. of India on 27.02.2014 as well as DPEs guidelines.

The policy covers Introduction, Objective, areas to be covered, Allocation of Fund, scope, Implementation, Institutional arrangement, Baseline survey & Documentation, Monitoring, Upkeep and maintenance of assets Created, Reflection of CSR activities and Conclusion. The CSR policy of CIL has been enclosed as **Annexure No.-XXIV.**

## II. Corporate Social Responsibility (CSR) at Jayant Project:

The CSR policy of CIL has been implemented at NCL and Jayant Project.

A Corporate Social Responsibility Committee (CSRC) has been constituted at the subsidiary (HQ) and Project level for identification and implementation of CSR activities. Also, for monitoring the CSR activities at NCL(HQ) and project level, a CSR Cell has been be constituted headed by an E-7 officer who has prepare the Annual Report on CSR Activities. Monthly Report on CSR has been sent by NCL to CIL highlighting the cumulative outlays and outcomes of the program in specific details.

### Source of fund

As per the CIL CSR policy of June-2014, the fund for the CSR should be allocated based on 2% of the average net profit of the company for the three immediate preceding financial years or Rs. 2/- per tonne of coal production of previous year whichever is higher. Out of above, 80% would be allocated for CSR activities to be carried out within the radius of 25 Km of the project site and the balance 20% would be allocated for carrying out CSR activities by company in the state to which it belongs.

Under the CSR activities the project arranges periodical health camps, immunization programme and family planning programmes in the nearby villages.

In addition, plantations have also been done in nearby villages to improve the environment and bring awareness to local inhabitants towards the preservation of the same. The following are the main thrust area in CSR:-

- **Health care**
  - i) Children's health immunization programmes are generally being taken up time to time in nearby villages.
  - ii) Eye relief camps are organized.
  - iii) Family planning camps are organized for vasectomy and tubectomy operations as well as to educate the villagers in family planning techniques
  - iv) Provision of medical service vans to villagers for outdoor medical facilities.

v) Cancer detection camps are also organized.
vi) Special camps by social workers for auditory problems and other disabilities.

- **Drinking water supply**

The Project has provision of open wells and hand pumps in nearby villages. Also, water in wells are treated by mixing bleaching powder etc. to make it fit for drinking purpose.

- **Self-employment scheme**

i) Provision of sewing machines and regular training to ladies for the use of these machines. These machines are kept in the villages under the custody of village panchayat.
ii) Training of unemployed youth in typing and stenography.
iii) Motor vehicle training for villagers so that they could be employed for driving vehicles.
iv) Development of ancillary activities opens scope of self-employment for the villagers.

- **Education**

i) Construction of primary school/nursery
ii) Provision of furniture & books to existing schools

A detailed list of work and expenditure for CSR Work for the last three years of Jayant Project are as follows.

| **Year** | **Activities** | **Total Cost Involved (Rs. Lakhs)** |
|---|---|---|
| 2013-14 | Construction of community hall in Deki village | 28.67 |
| | Construction of 200 m PCC road at Saraswah Raja tola | 12.28 |
| | Black topping of approach road | 69.28 |
| | Deepening and cleaning of ponds | 15.70 |
| | Total | 126.47 |
| 2014-15 | Construction of class room in government high school | 22.90 |
| | Installation of RO | 76.40 |
| | Portable water supply by tankers | 5.81 |
| | Construction of toilets | 20.0 |
| | Total | 125.11 |
| 2015-16 | Construction and Development of bus stand at Jayant more | 15.0 |

Some photographs showing CSR work in nearby villages has been given in **P-19 to P-21.**

## 7.4 Occupational Health study by NIOH Ahemdabad:

A Health study was conducted by NIOH Ahemdabad during Nov.-Dec.' 2014 for population in NCL area. The study includes Environmental monitoring and Health monitoring of NCL workers for all the 10 projects. The summarized finding are as follows:

### (A) Comparative analysis of miners and community of NCL :

The first phase of study included coal miners from 10 mines of Northern Coalfields Limited namely Kakri, Bina, Krishnashila, Gorby, Jhingurda, Nigahi, Amlohri, Dudhichua, Khadia and Jayant. Total 441 miners has been taken from all projects of NCL. The demographic characteristics of the mine workers and residents in the vicinity of mines has been observed that most of the mine workers belonged to the age group 45-54 years while in the residents group most of the subjects belonged to 25-34 years age group. Most of the subjects were married and attained middle school level of education in both the groups.
Most of the study miners were nonsmokers and did not have the alcohol drinking habits. Equal proportion of coal miners and residents had tobacco chewing habits.

The occupational characteristics of coal mine workers shows that most of the workers were working in the coal mines for more than 20 years and the mean duration of exposure was 23.2 ± 8.8 years. Maximum 77(17.5%) miners were dumper operator which was followed by 70(15.9%) fitters and 60(13.6%) miners working as helpers or general mazdoor. The others group included overman, lineman, crane operator, dragline operator, rigger, etc.

The symptoms reported are common respiratory complaints observed among coal miner was cough in 29(6.6%) workers of which only 17(3.9%) had productive cough. Breathlessness and hemoptysis was reported by only 11(2.5%) and 3(0.7%) coal miners respectively. Similarly in the resident groups only 7(2.5%) reported cough of which 4(1.4%) had productive cough. The other symptoms observed among coal miners were tiredness (3.4%), backache (6.6%) and difficulty in hearing (5.2%). Similarly among residents the other symptoms included tiredness (2.9%), backache (11%), digestive disturbances (2.2%), sciatica (1.8%) and difficulty in hearing (1.8%).

The clinical examination among the miners and residents shows, the mean height and weight of both the group were almost equal. The mean systolic blood pressure of miners was statistically significantly higher than that of resident group (t=20.72; df=1, p=0.000) and mean diastolic blood pressure of miners was statistically significantly higher than that of resident group

(t=29.02; df=1, p=0.000) thereby resulting in more number of hypertensive in miners group ($\chi^2$=15.79; df=1; p<0.001).

The pulmonary function impairments in the miners and residents when FVC and FVE1 were categorized shows that out of total 441 miners 8(1.8%) did not cooperate for the spirometry while 20(7.2%) out of 278 residents did not perform spirometry correctly. It can be observed that most of the miners in both the group had normal spirometry. However, significantly ($\chi^2$=10.78; df=1, p<0.001) more number of miners had restrictive type of pulmonary function impairment.

The mean values of Forced Vital Capacity (FVC) according to study parameters in the miner and resident groups was 3.21 ± 0.63 litres while that for residents was 3.52 ± 0.69 litres. The difference was statistically significant (t=37.61; df =1; p=0.000). When analyzed according to study variables, the mean FVC of residents was higher than that of miners for all study variables.

The mean values of Forced Expiratory volume first (FEV1) of the miners was 2.68 ± 0.60 litres while that for residents was 3.06 ± 2.82 litres. The difference was statistically significant (t=57.01; df =1; p=0.000). When analyzed according to study variables, the mean FEV1 of residents was higher than that of miners for all study variables.

The mean values of Peak expiratory Flow rate according to study parameters in the miner and resident groups. The mean FEV1 of the miners was 7.04 ± 1.84 litres/second while that for residents was 7.51 ± 1.86 litres/second. The difference was statistically significant (t=10.27; df =1; p=0.001). When analyzed according to study variables, the mean PEFR of residents was higher than that of miners for all study variables except for smokers.

**(B) Jayant Project Specific Observation on Health Study :**

The demographic characteristics of the Jayant mine workers Shows that most of the mine workers belonged to the age group 45-54 years. The mean age of the miners was 53.4 ± 5.2 years. Most of the subjects were married and attained middle school level of education.

The personal habits of Jayant mine workers shows that most of the study miners were non smokers and did not have the alcohol drinking habits. 49.4% of the coal miners were chewing tobacco mostly in the form of *Surti, guthka or pan*.

The occupational characteristics of Jayant mine workers shows that most of the workers were working in the coal mines for more than 20 years and the mean duration of exposure was 28.6 ± 5.9 years. Maximum 23(29.1%)

miners were fitters which were followed by 10 (12.7%) helpers and 9(11.4%) CHP operators. The others group included driver, pay load operator, tyre handler operator and rigger.

The symptoms reported by the study minears show tha the common respiratory complaints observed was cough in 5(6.3%) workers of which only 2(2.5%) had productive cough. Breathlessness and chest pain was reported respectively by 5(6.3%) and 2(2.5%) miners. The other symptoms observed among coal miners were backache (7.6%), difficulty in hearing (6.3%), skin rash, itching and soreness in mouth each in 3.8% subject.

The salient findings on clinical examination among the miners of Jayant mines shows that, the mean height and weight was 164.11 ± 19.87 cm and 67.44 ± 14.03 kg respectively. Nearly half of the miners were hypertensive.

The mean values of FVC, FEV1 and PEFR according to study variables are categorized, 3(3.8%) were found to have obstructive type, 5(6.3%) restrictive type and 2(2.5%) were having both obstructive as well as restrictive type of pulmonary function impairments while rest 83.5% had normal pulmonary functions. Three subjects did not cooperate for performing the spirometry.

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# CHAPTER-VIII

# PROJECT BENEFITS

## 8.1 Introduction

The project is supplying planned quantity of coal to Singrauli Super Thermal Power station (SSTPS) of NTPC through their own MGR system, other thermal power station of the nation and other consumers by Public Railway system, thus meeting the energy requirement of the country.

The expansion of the Jayant OCP will enhance the socio-economic activities in the adjoining areas. This will result in following benefits

- Improvements in Physical Infrastructure
- Improvements in Social Infrastructure
- Increase in Employment Potential
- Contribution to the Exchequer
- Post-mining Enhancement of Green Cover

## 8.2 Improvements in Physical Infrastructure & Community Development

The expansion of the Jayant OCP will improve the physical infrastructure of the adjoining areas. This would include the following:

- Improved road communication
- Strengthening of existing community facilities through the community development programme/CSR of NCL.
- Greater availability of good quality power grade coal will result in enhanced power generation to meet the energy demand of the Nation/society.
- Pumping of mine water may augment the water availability after due treatment
- Gainful post-mining land utilization of mine lease area
- Creation of community assets (infrastructure) like provision for drinking water, construction of school buildings, check dams, village roads / linked roads & culverts, dispensary & health centres, community centers, market place, etc.
- Skill development & capacity building like vocational training, income generation programs, and entrepreneurship development program.
- Literacy program, adult education, assist formation of Village Working Group (VWG), Mahila mandal etc.

- Awareness program and community activities, like health camps, medical aides, family welfare camps, AIDS awareness program, immunization camp, sports & cultural activities, plantation etc.

- NCL also developed 03 nos. R&R sites provided with minimum infrastructure such as a school building, a health centre, a pond and adequate tree plantation and other amenities.

The above list is illustrative and not exhaustive. The CSR activities are village specific depending on the need assessed for the people. As far as possible, efforts will be made to co-ordinate with similar developmental programmes that are taken up by the central or state Govt. in the areas of Coal India. All activities under the CD/CSR programme are environment friendly and socially acceptable to the local people.

## 8.3 Improvements in Social Infrastructure

There are some obvious changes in various environmental parameters due to mining activity, increased economic activities, creation of new employment opportunities, infra-structural development, better educational and health facilities. Following are the specific impacts.

### ➢ Socio-economic

Overall there will be positive impact in socio-economic area due to increased economic activities, creation of new employment opportunities, infra-structural development, better educational and health facilities. The impact in the core zone and buffer zone is due to the following-

### ➢ Population dynamics

Due to direct and indirect employment potential, there is scope of migration of people into project area and in the peripheral regions, from nearby areas Mining activities, acceleration of the economic activities and urbanisation along with creation of new employment opportunities and bussiness may change the population dynamics of the area.

### ➢ Standard of Living

The people come in contact with migrated people. This may encourage higher aspirations among the people of the area. Accelerated economic activities and urbanization may increase quality of life and standard of living

### ➢ Health Care facilities

Jayant project/NCL, undertake awareness program and community activities, like health camps, medical aides, family welfare camps, AIDS awareness program, immunization camp, etc.

## 8.4 Employment Potential

There will be creation of direct and indirect employment opportunities in primary, secondary and tertiary sector due to expansion of this mine. Overall, this will have positive impact on socio-economic profile of the area

NCL undertake skill development & capacity building programmes like vocational training, income generation and entrepreneurship development. Same will be continued for expansion project.

## 8.5 Other Tangible Benefits

Northern Coalfields Limited is facing increasing demand of power grade coal. Continuing and augmentation of coal production from the proposed expansion of Jayant mine of NCL will help to bridge the gap of demand and supply power grade coal in India. Present (2017-18) demand of coal from NCL is 109.25 Mt and supply is 90.00 Mt. To meet the growing demand of coal, especially in power sector, NCL has planned to increase its production capacity to 110.00Mt by the end of 2019-20 from the present production level under 1.0 Bt plan of CIL.

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# CHAPTER - IX

## ENVIRONMENTAL COST BENEFIT ANALYSIS

### 9.1 Environmental Cost:

In the Standard TOR environmental cost benefit analysis has not been recommended for Opencast mine. However a brief of environmental cost is as follows:

The total capital requirement for environmental control measures for Jayant OCP(Expansion) has been estimated as Rs.355.5691 crore (Base date : July, 2016 from UCE-August, 2016) which includes cost for technical reclamation, rehabilitation, pollution abatement cost for colony and industrial sewerage, water Sprinklers, dust suppression/ extraction in CHP, ventilation in Workshop, green belt development, and community development. The detail cost estimates are given in the following tables:-

**ESTIMATED CAPITAL EXPENDITURE ON ENVIRONMENTAL MANAGEMENT**

(As per EPR Updated Cost Estimates (UCE) of Jayant Expan. OCP (August, 2016). )

Base date : July, 2016 (Rs. in Lakhs)

| | | |
|---|---|---|
| **1.** | **Technical Reclamation** | 1937.67 |
| **2.** | **Pollution abatement cost (mine area)** | |
| a) | Water Sprinklers (28/70KL) | 3279.61 |
| b) | Dust suppression /extraction in CHP | 315.00 |
| c) | Ventilation in Workshop | 191.46 |
| **3.** | **Pollution abatement cost (residential area)** | |
| a) | Colony Sewerage | 708.40 |
| b) | Green Belt Development | 150.00 |
| **4.** | **Anti-pollution measures (industrial area)** | |
| a) | Industrial Sewerage | 891.37 |
| **Total capital for environmental control measures** | | **7473.51** |

**CAPITAL FUND PROVIDED FOR REHABLITATION AND COMMUNITY DEVELOPMENT/CSR**

(As per EPR Updated cost estimates of Jayant Expan. OCP (Aug., 2016).

Base date: July, 2016 (Rs. in Lakhs)

| | | |
|---|---|---|
| 1. | Rehabilitation | 27833.40 |
| 2. | Community Development | 250.00 |
| | **Total** | **28083.44** |

# CHAPTER-X

## ENVIRONMENT MANAGEMENT PLAN

### 10.1 Introduction

The success of environmental management in an organization not only depends on deep involvement of its personnel at all levels but also on the creation of an effective implementing organizational structure. The objectives are:

- To implement environmental control and protection measures.
- Subsequent environmental monitoring of the efficacy of various control measures.
- Plantation/green belt development.
- Land restoration.

Keeping this in view, an organizational structure responsible for the implementation of environmental control, compliance of environmental regulations and mitigatory measures as well as monitoring of such implementation has been discussed in this chapter.

### 10.2 Implementing Organisation

Northern Coalfields Limited, the owner of this project has already set-up an environment department headed by a general manager at its H.Q. The department provides necessary support that is required for environmental management of various projects and mines under the jurisdiction of the company. Further, to carry out rehabilitation & resettlement measures, an R&R department has been already set-up by NCL at its HQs.

The environmental cell at the project and environment department at corporate level looks after the following functions for implementation and monitoring of pollution control measures and for overall environmental management:

- Generation of environmental data bank.
- Evolving micro environmental management plan for the project in collaboration with other agencies and consultants.
- Monitoring project implementation along with environmental control measures.
- Co-ordinate with other project activities to ensure timely implementation of the project.
- Co-ordination with ministry of environment & forest, central /state pollution control board for prevention and control of pollution.

The responsibility for implementing environmental management plan rest with the chief general manager of the project, who gets proper assistance by a team of qualified and trained personnel.

### A) Corporate Level

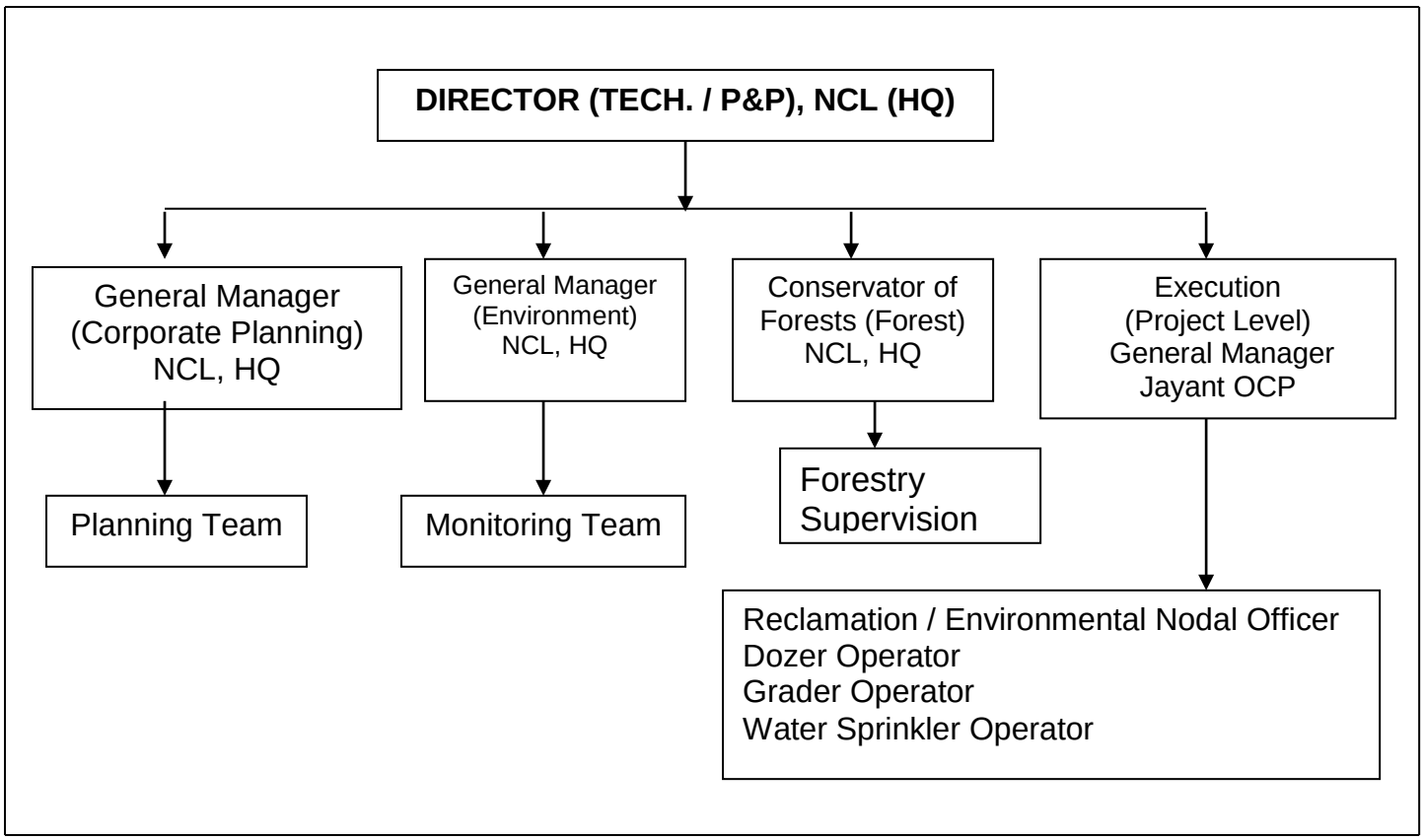
Northern Coalfields Limited, the owner of this project has already set-up an environment department headed by a general manager at its H.Q. The department provides necessary support that is required for environmental management of various projects and mines under the jurisdiction of the company. Further, to carry out rehabilitation & resettlement measures, an R&R department has been already set-up by NCL at its HQs. The above department is also headed by a general manager.

### B) Project Level

The environmental activities of the project are carried out by environmental cell at Project level headed by a chief manager, under the overall control of the General Manager of the project.

An organisation chart showing the hierarchical level at corporate and project level for environmental control is presented below:-

**ORGANISATION FOR MONITORING AND EXECUTION**




The objective of above Organization structure is:

1. To implement environmental control and protection measures.
2. Subsequent environmental monitoring of the efficacy of various control measures.

3. Plantation/green belt development.
4. Land restoration.

### 10.3. Activity wise Implementing Organization

- **Compensation to land loosers**

  - General Manager, Jayant Project.
  - Personnel Dept, Jayant Project.
  - Land Survey and Revenue Deptt. NCL(HQ)
  - Represenative from State Govt.

- **Pollution Control Measures**

  - General Manager, Jayant Project.
  - Environmental Cell, Jayant Project.
  - Environmental Cell, NCL HQ

- **Plantation/Green Belt Development**

  - Chief General Manager, Jayant Project.
  - Environmental Cell, Jayant Project..
  - Forest & Environment Dept, NCL HQ

- **Land Restoration**

  - Chief General Manager, Jayant Project..
  - General Manger (Mines), Jayant Project..
  - Forest & Environment Dept, NCL HQ
  - Environmental Cell, Jayant Project..

## 10.4 Environmental Monitoring and control

### 10.4.1 Corporate Environment Responsibility

CIL has adapted a Corporate Environmental policy. The policy and the objective are summarized below:-

**Policy Statement:** Coal India Ltd affirms its commitment for environmental friendly mining with right mitigation of pollution, reclamation of degraded land, preservation of biodiversity and proper disposal of waste following the best environmental practices including judicious use of the non-renewable energy of the path of continual improvement.

**Objectives:** Coal India Ltd shall endeavor to:

1. Conduct mining and associated operation in an environmental responsible manner to comply with applicable laws and other requirement related to environmental aspects. Design projects with due consideration to sustainable development.

2. Prevent pollution of surrounding habitation by continuous monitoring and adopting suitable measures for environmental projection.
3. Ensure compliance of all applicable EC conditions, FC conditions and other statutory condition issued by regulatory agencies.
4. Implement EMPs in all our mines effectively to mitigate pollution of air, water and noise, reclamation of degraded land and proper disposal of wastes.
5. Strive to conserve Bio-diversity.
6. Conserve natural resources through recycling of wastes on the principles of REDUCE, RECYCLE and REUSE. Put special trust on efficient energy utilization as a measure to reduce carbon foot-print.
7. Strive for continual improvement in our environmental performances by setting targets, measuring progress and taking corrective action.
8. Create environmental awareness among the employee and the local communities through pro-active communication and training.

In accordance with corporate environmental policy of CIL, NCL is committed to strive for environmental protection in all its mining operations through:

- Minimizing impacts of mining operation on land, water and air.
- Compliance with applicable environmental laws and regulations.
- Optimum resource utilization viz. energy and water.
- Continual improvement in environmental quality and prevention of pollution.
- Training of employees and creating general awareness, regarding Environment & prevention of pollution.
- Wide circulation of the policy.

**Self-monitoring of compliance of environmental regulations**

NCL has an Integrated Management System (IMS), consisting of ISO-14001, ISO-9001, and OHSAS-18001. Under IMS NCL/ Project adopted a “Corporate Management Policy” to implement a comprehensive system for simultaneous management of our economic, environmental, and social concerns as part of business agenda.

Functioning of the company in conformity with the policy is regularly monitored by the top management. Any deviation from the policy is reported to the higher Management under the system through Management Review Meetings.
Now on-wards any non-conformity in this regard will also be reported to the Board of Directors and will be displayed on company website and include in Annual Report.

The NCL/ Project has well defined organization which ensures effective implementation of the corporate environmental responsibility, monitoring and execution of the conditions laid down by MoEF and other statutory agencies.

### 10.4.2 Environmental Monitoring

For effective implementation and mid term corrective measures (if required) monitoring and control of programme implementation is essential. For this purpose a time bound action programme for environmental management has been prepared.

The scope of environmental management includes plantation, surface drainage, industrial complex water treatment plant, ambient air, water/effluent and noise pollution check etc.

For the purpose of land reclamation and afforestation, the project has interaction with different government departments like department of agriculture, MP state forest department, forest research institute. Guidelines and advice from ministry of environment and forest also result in systematic approach towards environmental management and control.

#### A) Air, water & Noise level Monitoring Schedule

To check the efficacy of ambient air, water/effluent and noise pollution control measures, environmental monitoring is carried out by CMPDI as per statutory guidelines at strategic locations. The monitoring report is submitted to the M.P. State Pollution Control Board & MoEFCC. Annual environmental statement report is also submitted to the MPPCB.

Following no. of stations have been fixed for monitoring of environment for the present and proposed increased production:

| | | |
|---|---|---|
| Ambient Air | : | 08 Stations (4 in core and 4 in Buffer zone) (Fortnightly) |
| Water/effluent | : | 09 Locations (Fortnightly, quarterly and annual) |
| Noise level | : | 04 Stations (Fortnightly) |

In case, it is found that the pollution levels exceed the tolerance limits as fixed by the state/central pollution control board or any other statutory body, the matter would be referred to CMPDI for suggestion of corrective measures.

#### B) Land reclamation and afforestation monitoring

At present the plantation work is being done by M.P. Rajya Van Vikas Nigam. A committee consisting of representative of NCL and M.P. Rajya Van Vikas Nigam (M.P.R.V.V.N.) at field level has continuously monitor the growth and survival/mortality rates of the plantations till the end of 3/5 years or so. Once trees attain desired growth, no further monitoring will be required.

#### C) Health monitoring

A regular monitoring of health of the workers and staff associated with the mining operations and other connected industrial activities is conducted for identifying occupational diseases etc. in time and initiating remedial measures. Mobile ambulance is also being used for such programmes to monitor the health of the population around the area.

# CHAPTER–XI
# SUMMARY & CONCLUSION

## 11.1 Introduction

Due to increase demand of power grade coal by thermal power stations, for the year 2017-18 there is a demand of 109.25 Mt from NCL, to cater the need of pit head thermal power plants and others in the country. So to increase the coal production from Jayant OC, it is proposed to increase the lease area and production from existing 15.50 Mtpa to peak 25.00 Mtpa in future. For obtaining Environmental Clearance from MOEFCC as per EIA Notification - 2006 for Jayant Expansion, this EIA-EMP Report has been prepared**,** as per TOR issued by MOEFCC vide letter no. J-11015/12/2017-1A.II (M) dated 15th June,

## 11.2 Project description

This is an expansion project for existing Jayant opencast coal mine of Northern Coalfields Limited. The proposed production capacity is to be enhanced to peak 25.00Mtpa Mtpa of coal with a corresponding peak OB removal of 75.45 $Mm^3$ per year. Ensuing the projected demand of coal for Thermal Power Plants in the country, it is necessary to expand the capacity of the present Jayant Opencast project. The present demand on coal from NCL for the year 2017-18 is 109.25 Mt which will increase to 116.50 Mt by the year 2019-20.

**Location:** The Jayant Opencast Project of Northern Coalfields Limited (NCL) is located in Singrauli Coalfields which is situated in Singrauli district of Madhya Pradesh. It falls within the latitudes $24^0$06'26.08" N to $24^o$11'40.86" N and Longitude $82^o$38'2.01" E to $82^o$40'55.64" E (Survey of India topo-sheet no 63 L/12 of GSI). The nearest railway station is Shaktinagar at a distance of about 5 km from project on Chopan-Katni (KBJ Line) railway line of East-Central Railway.

**Description of the Minefield:** Jayant Block having an area of 11.10 sq. km is located in the north-east part of Singrauli Coalfield. The terrain of the opencast minefield represents plain on hilly plateau. The top level of escarpment is about 442 m and lower one varies from 375-424m. The RL within working limits varying from 375-424m above MSL.

**Mineable reserves :** The Total mineable coal reserve as on 01.04.2018 is 282.71 Mt alongwith 836.69 $Mm^3$ of OBR with average stripping ratio of 2.99 $m^3/t$. There are Turra, Purewa Bottom and Purewa Top Seams. Jayant Opencast Project has produced 325.77 Mt. Of coal till 31st March, 2017.

**Geology of Jayant block :** The geological data given in this report are as per "Geological Report on Jayant Block prepared by CMPDI in 1975. There are three coal seams occurring in ascending order viz. Turra (11.90-21.65m), Purewa Bottom (8.69-18.54 m), Purewa Top (4.00-13.07m) are proposed to be mined. The beds have a corresponding centripetal dip. The amount of dip in general is about 2 to 3 degree. However, higher dip of about $8^o$-$10^o$ have been observed in the eastern part of the basin.

The grade based on GCV for Turra seam and Purewa Bottom Seam varies mainly from G8 to G14 and that for Purewa Top seam from G9 to G14. The average product mix grade of all the three seams is G10.

**Mining technology & process description:** Jayant OCP has been working for last 40 years with combined system of mining viz. Dragline and shovel-dumper system. The existing system has been proposed to be continued with up-gradation of equipment capacity/size for achieving higher production level. The OB removal will be done by dragline side-casting and shovel-dumper combination. The blasted material will be transported to internal dumps through dumper transport. The coal after blasting will be loaded and hauled to CHP by dumpers from where after crushing the ROM coal, it will be transported to silo point connected to MGR track through conveyor belts for loading into the wagon.

**Programme of excavation** : Jayant Expansion OCP has been planned to produce total 282.71 Mt coal & 836.69 $Mm^3$ O.B from 2018-19 to 2033-34. The calendar Plan of excavation is given in CH-II.

**Mining details :** Stripping ratio (mineral in tonnes to over burden in $m^3$)- 2.99 m3/t, Ultimate working depth - 225m, Present working depth existing mine-180m, Thickness of top soil is restricted to 3m only, over a major part of the area, Thickness of overburden varies 2.80m–204.90m.

**Mining plan & mine life:** Height and width of the bench in coal seam: 10-15m and 45m. Height and width of the O.B bench for Dragline varies from 29-41m and 75m and cut width will be 75m. In case of Shovel-Dumper O.B bench height is 15-18m and width is 57-63m. The slope of each bench is proposed as $70^0$ in OB and $80^0$ in coal. But overall running slope in working faces are is 16-$18^0$ and 35-$40^0$ at the time of closure of the mine. The estimated life of the project 16 years from 2018-19.

**Drilling & blasting operations:** The blasting is required in all coal & OB benches for loosening the strata. Drills of 311 mm (4 Nos.), 250 mm (24 Nos.) and 160 mm (12 Nos.) have been provided. The amount of secondary blasting is about as 4% of the total volume of explosives.

**OB/Waste disposal techniques :** The total volume of OB to be removed in expansion will be dumped internally and 60.00 $Mm^3$ has already been dumped in external dump and reclaimed technically and biologically.

**Proposed Schedule for Approval & Implementation :** The EPR has been approved in the 202nd NCL Board meeting held on 1st March 2016 and by Coal India Board vide letter no. CIL:XI(D): 04112:2017:1760 dated 16th May' 2017. The proposed expansion target of 20.00 Mtpa is likely to be achieved by 2019-20 and peak 25.00 Mtpa in 2021-22. The present proposal is for environmental clearance for a coal production from 15.50 Mtpa to 25.00 Mtpa.

**Infrastructure :**

**1) Coal Handling Plant (CHP):** Existing CHP of 10 Mtpa has already been constructed and is in operation. Existing CHP broadly has the facilities of three number of receiving and crushing complex, two number of bunkers for storage and reclamation, two silos with rapid loading system, one public railway loading system and associated conveyor system.

The EC sanction capacity of the Project is 15.50 Mtpa. Since, the coal production has reached to 15.00 Mtpa. Hence, an advance action for CHP for incremental capacity of 5.00 Mtpa has already been approved by NCL Board in March-2012. The tendering for construction of 5 Mtpa incremental CHP as advance action is under Process.

Total handling capacity of the CHP including existing and proposed will be 25.00 Mtpa (10.00 mtpa existing + 5.00 Mtpa as advance process+ 10.00 mtpa additional proposed) which will cater the target coal of 20.00 Mtpa up to peak load of 25.00 Mtpa.

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

For expansion of the Project from 10 Mtpa to 20Mtpa coal production, EPR has envisaged 52 Nos. 100TDumper and 88 Nos. 190T Dumper. Existing 85T dumper and 120T dumper has been envisaged for replacement in equivalent numbers of 190 T dumpers.

**3) Railway Siding:** Rapid Loading System silo is working on NTPC owned MGR track. A Public Railway system with two loading points is also working. The crushed coal from the West section & East section will be dispatched by PR/MGR. For the mine output of 10 Mtpa incremental (peak) 10 to 11 rakes of wagon will have to be loaded every day.

The EPR envisaged that a 4000 te silo will be installed on the existing PR siding after necessary modification and one additional line will be envisaged under the proposed Silo. The proposed line will be connected with existing MGR/PR line.

The existing PR lines are taking off from Shaktinagar Railway Station. The proposed interconnection between existing lines and MGR rail lines shall be made at suitable location so that full length of PR rake empty receiving line and after loads line is available by extending the existing MGR loop line of NTPC. Necessary provision for proposed interconnection and accommodation of full empty receiving and after load line has been made in EPR of Jayant OCP (20 Mtpa).

**4) Power supply arrangement:** Jayant Project is getting power at 33 KV by Madhauli Sub-station of NCL. At present, there are three sub-stations in Jayant project viz. OB West sub-station, OB East sub-station and coal sub-station. The EPR envisaged the installation of additional transformers in the existing Sub-stations to cater the need of expansion project.

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

**5) Other facilities:** Existing facilities of service buildings shall remain in use for the proposed EPR. However, Additional provision for expansion of GM office along with boundary wall has been made in the Office complex. Additional Provision of welfare buildings such as shopping center, Gymnasium, Cycle shed, Garage, with suitable boundary wall has been made in colony area. Provision for a new executive hostel has been made. Provision for extension of VTC has also been made.

**Risk of Technological Failure :** Considering the geo-mining conditions of the block, the combined system of mining with dragline and shovel-dumper combination is being used for exploitation of coal. This technology is a proven and tested technology. Hence, the present technology used for opencast mining at Jayant Expn. OCP is very safe and no risk of technological failure.

## 11.3 Description of the environment

### Topography, drainage & Climate:

Project is situated on plateau with elevations varying from 375 m. to 425 m. above Mean Sea Level (MSL) except one hill in the North West corner having an altitude of 500 m above MSL.

**Drainage;** Drainage of the area on the south is controlled by various seasonal streams. On the western side these seasonal streams drain into Motwani nalla which is the main nalla. On the eastern side the seasonal streams drain into Ballia nalla. Both these nallas ultimately join Govind Ballav Pant (GBP) Sagar in south. Towards north the drainage is through seasonal streams which discharge into Bijul nalla.

**Climate:** The area receives mostly south western monsoon and average annual rainfall is about 1105 mm. The lowest temperature recorded is $4^{o}$ C and the highest temperature $48^{o}$ C during last 15 years.

**Description of study area:**

**Core Zone:** The core zone of the project comprising of excavation zone, OB dump site, infrastructure area and safety zone for blasting covers partly and /or fully the land from 8 villages. There are 4000 PAPs form Madhauli (ward no.10) village will be affected directly by expansion project other 8 villages which already affected by mining operations namely Mudwani, Garda, Saraswah Rajatola, Saraswah Laltola, Jaitpur, Nigahi and Madhauli, which constitute the core zone.

**Buffer zone:** Total 62 villages and 02 towns of Singrauli District of Madhya Pradesh state and 10 villages and 02 towns of Sonebhadra District of Uttar Pradesh, lie in the buffer zone. Ten coal mines & two thermal power station lies in the Buffer Zone. The whole of core zone and buffer zone combined, constitute the study area for EIA- EMP study.

**Existing environmental scenario:**

**Environmental baseline Study :** The present environmental quality assessment, impacts, and mitigation measures has been carried out by generating the baseline data of environmental quality parameters such as ambient air & micro-meteorology, water, Noise levels, soil, flora & fauna, socio-economic & occupational Health, land use survey by remote sensing, hydro-geological data, water levels, etc. Environmental Baseline study for the project has already been completed in pre-monsoon (March-June, 2016)

**Socio-Economic & Occupational Health study:** NCL entrusted Socio-economic and Occupational Health study for Jayant Project to M/S VRDS Consultants, Chennai. The expert visited the site and collected data. The study report has been presented in **Annexure No.-XV.**

Baseline Data on ambient air with micro-meteorology, water, noise, and soil. The site specific data are recorded for three months period (From March-June'2016) by M/S CEG, Test House & research station Pvt. Ltd., Jaipur, Rajasthan. Details of Base line data on meteorology, air, water, noise and soil are given in **Annexure No.-XVII to XX**.

**Ambient air quality:** In order to assess ambient air quality of study area of Jayant Expn. Project, a meteorological station was installed in Core zone at Coal Section Office of Jayant Project which represents the prevailing micro meteorological aspects of the study area.
The base line ambient air quality data were recorded for three months period (From March to June'2016) by selecting four core zone & four Buffer zone stations. The Buffer Zone AAQ monitoring stations were selected in the village area considering upwind and downwind direction as well as to represent the cross sectional scenario of the project site Based on the production activities. The parameter chosen for assessment of ambient air quality are Suspended Particulate Matter (SPM), Particulate Matter ($PM_{10}$), Particulate Matter ($PM_{2.5}$), Sulphur di-oxide ($SO_2$), Oxides of Nitrogen (NOx) and Heavy metals such as Hg, Pb, Cr, Ni, As in $PM_{10}$.

**Water quality scenario:** In order to assess the water quality of study area of Jayant Project, the water sampling was done at different location in and around the area representing waste water/treated water, drinking/ground water and surface water sources. Locations of water samples are shown in the Plate No.-11, 12 and 13. Water sampling stations are selected to assess the effect of mining activities on the water quality in surrounding area as well as in the township. The water quality analysis results along with prescribed standard are presented in **Annexure XVIII.** The analysis results reveals that all the parameters were within the prescribed standards.

**Noise Levels:** In order to assess the Noise level in study area of Jayant Project, the Noise level recording was done at 08 different locations. These sampling locations are shown in the Plate No.-14. Ambient noise levels were recorded during day and night time and the observed values were compared with standards prescribed by MOEF. The results are found to be within permissible limits. The noise level data for various locations are appended in **Annexure-XIX.**

**Soil quality:** In order to assess the soil quality of study area of Jayant project, soil samples were collected in disturbed and undisturbed condition and analysed in the laboratory. To assess the baseline soil quality, samples are collected from identified locations using augers at depths 30, 60 and 100 cms. The samples are analysed for chemical parameters like pH, EC, N, P, K and engineering parameters like textural class, specific gravity, liquid limit, plastic limit, field capacity, wilting coefficient and available water holding capacity. Details of analysis is given in **Annexure No.-XX.**

**Flora & Fauna:** CMPDI entrusted the Flora & Fauna study for Jayant Expn.Project to M/S EkoPro Engineers Pvt. Ltd., Gaziabad (UP). The expert team has visited and observed 10 km around Jayant Expan. Project for study.
In the study all type of flora from natural as well as artificial plantation and fauna have been surveyed. The study report is placed as **Annexure No.-XXI**.

**Land use pattern:** Out of total 3177.171ha land requirement, 1180.171 ha is forest land, 1481.54 ha Tenancy land and 515.46 ha are Govt. land. The pre-mining and at operational stage land use pattern of total mine lease area is given in Chapter –III. The post mining land use is given in Chapter-IV.

**Hydrology & Hydro-geology:** A comprehensive hydro-geological assessment report has been prepared by CMPDI. The report is based on latest pre-monsoon and post-monsoon baseline data covering information on ground water situation, aquifer characteristics, water level, estimate of ground water resources, predicted impact of the project on ground water regime and detailed remedial / conservation measures such as artificial recharge of ground water etc. The detailed report is enclosed as **Annexure No.– XIV**.

## 11.4 Anticipated environmental impacts & mitigation measures

The impacts of mining and its control measures have been assessed and presented in respect of air, water, noise, blasting vibration, socio-economic profile, flora & fauna, land resource, traffic movement and visual / aesthetic aspect in the chapter-IV.

**Impact assessment & pollution control measures for ambient air:** The pollution sources are obvious and to assess the impact, the project life is divided into operational & post operational phase. Detail of impact assessment including Prediction of air quality due to expansion by modeling is given in Chapter IV. Appropriate mitigative measures to control the air pollution due to different activities like drilling, blasting, loading & transportation, coal handling etc. have been suggested in the above chapter

**Impact assessment & pollution control measures for water:** Sanitary (domestic) waste water, Industrial wastewater from workshop, Wastewater from mine, Surface run-off passing through coal stockpiles, Storm water from leasehold area and built-up area are likely sources of water pollution from this project. Impact of above sources on Hydrology & ground water have been assessed & appropriate mitigative measures have been suggested in the chapter –IV.

**Impact assessment & control measures for noise & blasting:** In Jayant Open cast mine the sources of noise are drilling & blasting operation in coal and OB, operation of HEMMs, operation of equipment in CHP, workshop, etc. Presently at existing production level Noise levels are within the limits of the prescribed standard. The noise level in and around the project is not likely to increase in future due to expansion of Jayant Mine, as the proposed equipment are less with higher capacity and with modern noise control mechanism. In case noise levels exceed the permissible limit , its adverse impacts impact have been assessed & appropriate mitigative measures have been suggested in the chapter –IV.

**Impact on Land Resource and Its Management:** The total land required for the mining & infrastructures etc. of Jayant Project is 3177.171 ha. The probable causes for land degradation are as a result of quarry excavation, overburden dumping, civil construction, approach roads etc. Land use pattern of Jayant OCP will be changed during mining operations. This changes has both beneficial & adverse impact. At post mining stage land will be reclaimed to an environmentally acceptable state as pre-mining stage if not better. Forestry is the end objective adopted for final land use. The details of Impact on Land Resource and Its Management is given in chapter IV.

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**Impact on flora and fauna:** The study report reveals that there is no endangered or endemic floral species in the core & buffer zone of study area. Also, there is no migratory corridor of any endangered fauna species in the core as well as in buffer zone of study area. Therefore no separate conservation plan is required. The impact on flora & fauna is not that serious.

**Impact on meteorology:** The mining operation is a physical operation which involves excavation and material handling. No significant micro-meteorological condition will be affected by the increased mining activities.

## 11.5 Analysis of alternatives (Technology)

When safety and economy not a hindrance, nature of deposit is compatible, socio-economic impact on the people associated with the land and in the neighborhood is not profound or can be compensated, technology is available and has been proved under similar deposit conditions, adoption of opencast method is best of all known methods. The other criteria for choosing opencast method for Jayant opencast project are as follows:

**Underground mining technology:** Considering the geo-mining factors as discussed in EPR, mining economics and conservation of coal, the possibility of underground mining is ruled out

**Continuous mining technology:** Based on the available data on hardness of coal and OB, it can be said that most of the strata will need drilling and blasting prior to excavation. In view of this, application of continuous mining technology like bucket wheel excavators etc. may be ruled out.

**Crushing & Conveying technology:** The size of the block is such that there is variation in the strike length and the topography of the block is rugged and undulating. The maximum volume of OB is accommodated in the internal voids with low transportation distance. Thus, the primary advantage of long distance hauling by conveyor is lost, so conveying technology has been ruled out under the prevalent geo-mining conditions.

**Surface Miner technology:** The geo-mining conditions of Jayant OCP attracts the deployment of draglines, which will expose bottom most Turra seam. Use of surface miner in Turra seam will effect deployment of draglines. This technology has not got its applicability in NCL mines

**Present mining technology**: It has been proposed to mine the deposit of Jayant Expn. OCP by the existing technology as being the proven technology in NCL mines. Combined system of mining using shovel-dumper system with draglines has been proposed. The points in favour of draglines and shovel-dumper combination are:

a) General gradient of mining floor ($2^{o}$-$4^{o}$);
b) Mining of multiple seams i.e. Turra, Purewa Bottom & Purewa Top;
c) Parting between Turra and Purewa Bottom seam is 46.61– 66.40m and
d) Large scope of work including 25 Mt of coal and 39.38 $Mm^3$ of OB per annum (peak).

Shovel-dumper system for higher benches and draglines on the parting between Turra and Purewa Bottom seam has been proposed as this is the most suitable under the present geo-mining conditions.

## 11.6 Environmental monitoring programme

Environmental Monitoring including all aspects has been already implemented by the project for existing production capacity. For expansion project, a time bound action plan for environmental management including all aspects has been prepared by the project .

**Parameters to be monitored :** Ambient air quality, water quality (mine discharge , ground water and drinking water samples), ground water level and noise level, will be monitored for standard parameters. Health of the employees , R & R Activities, Overburden to be excavated, backfilled, the plantation schedules etc. will be monitored

**Monitoring frequency :** Following number of stations have been identified for monitoring on Fortnightly basis

i. Ambient Air - 8 Stations ii. Water – 9 Stations iii. Noise - 4 Stations

Ambient air will monitored as per asper MoEF guide line G.S.R 742 (E). Water samples from following nine stations are monitored regularly as per required standard i.e. G.S.R 742 (E),for Effluent,. IS-10500 for drinking water, IS-2296 for Surface Water. The noise level observations is being made as per Environment Protection Act GSR 1063(E) Schedule III at the five Noise monitoring stations.

Plantation in Jayant project is being carried out by M.P. Rajya Van Vikas Nigam, and same are being maintained & monitored by them for continuous up to 5 years so that desired growth of plants and trees is attained. Land reclamation and plantation is being done as per schedule. Periodic health examination is of the employee is being done to for identifying occupational

diseases etc. and initiating remedial measures in case of detection. The details of PME for three years is given at **Annexure No.-XXX.**

**Emergency Procedures :** Keeping in view the three basic principles i.e. prevention, preparedness( both pro-active and reactive) and mitigation of effect through rescue, recovery, relief and rehabilitation, a comprehensive blue print of disaster management plan(DMP) in form of Mine Emergency Response Plan as per DGMS guidelines; has being prepared & same is being followed.

## 11.7 Additional studies

**Public Consultation:** Public Consultation for Jayant Expn. Project (25.00 MTPA) was organized by M.P.Pollution Control Board on 13.12.2017 at Officer's Club, Jayant Project, Jayant, Singrauli, MP. Details of questions raised, reply given by project management and recommendation by members are enclosed as **Annexure-XXVI.**

**Risk Assessment and Management:** The disaster management is essential to guard against and mitigate the consequences of major accidents. Keeping in view the three basic principles i.e. prevention, preparedness (both proactive and reactive) and mitigation of effect through rescue, recovery, relief and rehabilitation; a comprehensive blue print of disaster management plan (Chapter X) has been prepared for Jayant OCP incorporating the Identification and assessment of risks and Recommendation of measures to prevent damage to life and property against such risks.

**Socio- Economic Measures**: Direct employment to local inhabitants from affected villages. Indirect benefit to persons engaged during different construction activities. Benefit to local population through domestic and commercial services in projects like Vehicle repair shop / maintenance garages, Medical shop, Transport agencies i.e. supply of fruits, vegetable, cereals, milk, etc, Consumer goods , Hotel, Restaurants, etc . Provision of residential annex with each shop in the shopping complex.

**Rehabilitation & Resettlement:** There are 1438 land owners and 5860 house owners in this acquired land and about 1599 PAFs are eligible for rehabilitation/lump sum compensation.

The compensation of Rs. 617,41,86,624/- of land, trees, bandhas, houses, wells and bore wells etc. was sanctioned by The Ministry of Coal vide OM. 43020/10/2017-LA&IR dated 12.06.2017. The payment of compensation for land and houses is under progress. These families will be shifted/rehabilitated as per R&R policy of CIL/Govt. PAPs are to be given plots (if desire) in rehabilitation complex and shifting grant per family.

Employment in NCL**:** The requirement of the project for unskilled and semiskilled work force is met from the land losers. Special preference is given

to SCs & STs.

Self-employment training schemes**:** This includes short term courses for carpentry, plumbing, carpet weaving, diary and poultry farming, etc. The financial assistance for conducting such course is rendered by the project.

**Community Development:**

Under the community development programme the project arranges periodical health camps, immunisation programme and family planning programme in the nearby villages.

In addition, plantations have also been done in nearby villages to improve the environment and bring awareness to local inhabitants towards the preservation of the same. The main thrust area in Community Development programme is Health care, Drinking water supply, self employment scheme, education.

## 11.8 Project benefits

The expansion of the Jayant OCP will enhance the socio-economic activities in the adjoining areas. This will result in improvements in Physical Infrastructure, improvements in Social Infrastructure, increase in Employment Potential, contribution to the Exchequer, Post-mining Enhancement of Green Cover

The expansion of the Jayant OCP will improve the physical infrastructure of the adjoining areas. Overall there will be positive impact in socio-economic area due to increased economic activities, creation of new employment opportunities, infra-structural development, better educational and health facilities. There will be creation of direct and indirect employment opportunities due to expansion of this mine. Overall, this will have positive impact on socio-economic profile of the area. NCL undertake skill development & capacity building programme like vocational training, income generation and entrepreneurship development. Same will be continued for expansion Project.

**Other Tangible Benefits:** Northern Coalfields Limited is facing increasing demand of power grade coal. Continuing and augmentation of coal production from the mines of NCL will help to bridge the gap of demand and supply power grade coal in India.

## 11.9 Environment management plan

The success of environmental management in an organization not only depends on deep involvement of its personnel at all levels but also on the creation of an effective implementing organizational structure.

**Implementing Organisation:** Northern Coalfields Limited, the owner of this project has a well-established organization at Corporate as well as Project

level.

**Corporate Level:** Northern Coalfields Limited, the owner of this project has an Environmental Department headed by a General Manager at its H.Q. The department provides necessary support that is required for Environmental Management of various projects and mines under the jurisdiction of the company. Further, to carry out Rehabilitation & Resettlement measures, an R&R Department has been working at NCL HQs. The above cell is also headed by a General Manager.

**Project Level:** The environmental activities of the Project are carried out by Environmental Cell at Project level headed by a Sr. Manager (Mining/Env.), under the overall control of the General Manager of the project. The objective of this Organisation is:

1. To implement environmental control and protection measures.
2. Subsequent environmental monitoring of the efficacy of various control measures.
3. Plantation/green belt development.
4. Land restoration/ OB dump reclamation.

**Environmental Monitoring and Control:** For effective implementation and mid term corrective measures (if required) monitoring and control of programme implementation is essential. For this purpose a time bound action programme for environmental management has been prepared.

The scope of environmental management includes plantation, surface drainage, industrial complex, water treatment plant, Ambient air, water and noise level monitoring and implementation of control measures etc.

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# CHAPTER – XII

## DISCLOSURE OF CONSULTANTS ENGAGED

**12.0** The consultant engaged in preparation of EIA-EMP of Jayant Expan. Opencast Project (25.00 MTPA) is Central Mine Planning & Design Institute Limited (CMPDI), a subsidiary of Coal India Limited which is a Central Public sector undertaking, under Ministry of Coal, Government of India.

The other consultants engaged for Baseline Studies and as empanelled expert are as follows :

| Sl. No. | Nature of Study | Name of Agency which has conducted the study |
|---|---|---|
| 1. | Preparation of Expansion Project Report (EPR), EIA/EMP Report, and other data on Geology, Mining & economic parameter | CMPDIL |
| 2. | Hydro-geological Study | CMPDIL |
| 3. | Land use Map by Remote sensing | Geomatics Division, CMPDIL |
| 4. | Baseline data generation on Ambient Air including meteorological data , water/wastewater, Soil and Noise Levels Study | M/s CEG Test House and Research Centre Pvt. Ltd., Jaipur, Rajasthan |
| 5. | Flora & Fauna and soil conservation study | M/s. Eko Pro Engineers Pvt. Ltd., Gaziabad (UP) |
| 6. | Supervision of Flora & Fauna and soil conservation study with expert services for EIA/EMP | Prof. S.K. Maiti<br>Deptt. Of Environmental Science & Engineering<br>IIT (ISM), Dhanbad, Jharkhand |
| 7. | Socio- Economic and Occupational Health Survey | M/s VRDS Consultants, Chennai, TN |
| 8. | Supervision of Socio-economic and Occupational Health survey and expert services for EIA/EMP | Sri R.M. Bhute, socio-economic expert from M/s Sharda Development corporation, Ramgarh, Hazarbag distt, Jharkhand |

### 12.1 Brief resume of CMPDIL as consultant

CMPDIL has the accreditation of the EIA consultants with Quality Council of India (QCI), National Accreditation Board of Education and Training (NABET) vide letter No. QCI/NABET/ENV/ACO/16/05/0166 dated 24/05/2016).

CMPDIL (Central Mine Planning & Design Institute Limited), an ISO -9001 company, holds the pre-eminent position as the India's largest consultancy organization and the market leader in an expanding earth resource sector. A key factor in this success has been the offering of full-range of services in the sphere of resource exploration and development, coal preparation, utilization and management, coal/material handling arrangement, as well as engineering and environmental management.

CMPDI was established in the year 1975 as a subsidiary of Coal India Ltd. (A Govt. of India Enterprise) for rendering total consultancy services (i.e. from concept to commissioning) to Coal India Limited and its seven subsidiaries which contribute about 90% of the total coal production of the country.

Over the years, the initial experiences have effectively been extended to provide wide range of services right from coal exploration on its commercial application to different industries sectors. Currently CMPDI, besides Coal India Limited and its seven subsidiaries, extends consultancy services to host of clients in India and abroad.

The clients include Govt. and private entrepreneurs, United Nations agencies, international financial institutions, etc. Total focus on quality of services led to CMPDI being accredited ISO-9001:2008 Certificate by Certification International.

CMPDI operates through its headquarters at Ranchi (Jharkhand) and seven Regional Institutes located at Asansol, Dhanbad, Ranchi, Nagpur, Bilaspur, Singrauli and Bhubaneshwar, which are geographically spread in six states of the country.

CMPDI is registered consultant to

- World Bank,
- Asian Development Bank
- African Development Bank
- United Nations Development Programme

CMPDI has standing MoU with the following reputed International Consultant to work together in the area of earth resource sector worldwide.

- IMCL, UK
- Giproshakht,
- Montan Consulting GmbH, Germany
- Rheingraun, Germany
- DMT, Germany.

**Nature of consultancy rendered**

CMPDI renders services to CIL and subsidiaries, directly to MoC and also takes up specific jobs for companies other than CIL as consultancy services. The services rendered by CMPDI to different clients are listed below:

- Exploration including preparation of Geological Reports;
- Preparation of pre-feasibility reports, advance action proposal, feasibility/project reports, revised cost estimates for new and re-construction projects;
- Annual operational plans for large opencast mines;
- Preparation of project reports and working drawings for coal washeries, coal handling plants and various infrastructure facilities;
- Preparation of EMP and EIAs;
- Bid documents for CHPs, workshops, substations and other Infrastructure facilities;
- Annual assessment of mine capacity and HEMM/equipment performance of CIL.
- Technical services related to blasting, ventilation, support design Non-destructive testing etc;
- Laboratory testing services for coal characterization, washabiliy, Air/water quality, physical/mechanical property of rocks, etc. (Such activities are also undertaken by Central Fuel Research Institute (CFRI), Dhanbad – in fact much of lab testing in the coal sector is done by CFRI both commercial as well as for Scientific research)
- Management services for ISO certification;
- Energy Audit/Conservation Studies;
- Mining electronics and repair/testing of electronic component of Equipment;
- Third party inspection of quality checking of materials and random testing of explosives procured by subsidiaries;
- CMM related services;

- Special reports
- Nodal agency for CIL, R&D projects
- Promotional exploration and detailed drilling for non-CIL blocks;
- Nodal agency for other central sector scheme viz. research project under S&T schemes and EMSC projects.
- Identification and evaluation of captive mining blocks;
- Technical services including preparation of special reports;
- Preparation of inventory of coal reserves in collaboration with GSI, on annual basis. It has undertaken a project in 10$^{th}$ Plan regarding Integrated Coal Resource Information System for developing coal resources database as per UN International Framework Classification Guidelines.

## 12.2 Brief resume of CEG Test House And Research Centre Pvt. Ltd. (CEGTH)

CEG Test House And Research Centre Pvt. Ltd. (CEGTH) is a leading testing laboratory in India, providing laboratory services in the field of building material testing, food testing, agriculture testing, environmental testing and monitoring, geotechnical investigation, nondestructive testing etc. Proudly proclaimed as first of its own kind in the private sector in the state of Rajasthan, operational from the year 1984, this laboratory offers testing and advisory services across the country.

CEGTH, is a part of Consulting Engineers Group Ltd. (CEG), which is a well known Indian consulting organization working worldwide and supported by highly qualified and dedicated professionals including engineers, scientists, technicians, chemists and many more experts. CEGTH follows a well-structured quality assurance and quality management system to carry out various types of testing and analytical services.

Expert advisory services for pavement investigation, rehabilitation, design of foundations, ground improvement, pile integrity testing and all kind of soil testing works are also provided to clients.

CEGTH expanded its services in 2013 and added new test facilities for food, packaged drinking water and drug & pharmaceuticals. A wide range of chemical and microbiological testing services are provided for various food products like milk and dairy products, edible oil, spices and condiments, cereals, pulses products, canned and processed food, alcoholic drinks and beverages and nuts & peanuts. This NABL laboratory is accredited for more than 600 parameters for Food, Soil, Building Material, Environmental, Cement, Industrial Bitumen, Cement Concrete Tiles and Steel and other products.

**Our Services**

- Non Destructive Testing
- Environmental Monitoring
- Food, Agro & Water Testing
- Construction Material Testing
- Geotechnical Investigation
- Pavement Investigation and Design
- Textile and Apparel Testing

CEGTH has a state-of-art laboratory well equipped with environmental monitoring instruments and well qualified personnel to carry out environmental baseline and compliance monitoring in all walk of sectors like petrochemical, mining, cement, highways, housing and infrastructure for EIA studies. Sampling and Testing Facility Includes:

- Ambient Air.
- Water.
- Soil.
- Noise for Ambient and Stationary Sources.
- Stack Emissions.
- Solid and Hazardous Wastes.
- VOCs and Hydrocarbons.
- Fugitive Gas emissions.
- Indoor gas quality.
- Mercury.
- CO.

## 12.3 Brief resume of EKO PRO Engineers Pvt. Ltd.

EKO PRO Engineers Pvt. Ltd., established in 1998 as an analytical testing laboratory, is the leading Environmental Consultancy firm, backed by a state-of-the-art testing lab for Environment and Food testing in Central India region. We are a highly committed bunch of diligent-scientists turned savvy-environment-professionals working industriously towards achieving the overarching goal of environmentally sustainable development of our country.

They are recognized by the Ministry of Environment & Forests & Climate Change (MOEF & CC), New Delhi and are accredited to the Quality Council of India (QCI) for conducting Environmental Studies for various industries. EKO PRO is an ISO 9001:2008. The laboratory division of Anacon is accredited to the National Accreditation Board for Testing & Calibration Laboratories (NABL, Govt. Of India) for over 600 parameters in the areas of 'Chemical & Biological Testing' for Water, Food & Agricultural products, Cereals, Pulses, Snacks, Namkeen, Bakery products, Spices & Condiments, Milk & Dairy products, Tea, Coffee, Honey; as also for Chemical Testing of Ores & Minerals, Coal/Coke, Cosmetics, Oil, Petroleum & Petrochemicals and Mechanical Testing for thermoplastic road marking material. Anacon Laboratories is also recognised by the Bureau of Indian Standards for Chemical (including Bromate testing), Biological and Mechanical testing of Packaged Drinking water.

They are accredited from NABL for the Testing of the following commodities:

**Biological testing:** Animal Food & Feeds, Food and Agricultural Products, Water, Environment and Pollution, Cosmetics and Essential Oils

**Chemical testing :** Atmospheric Pollution, Pollution & Environment, Wastes, Soil & Waste Water, Water, Residues in Water, Food & Agricultural Products, Animal Food & Feeds, Marine/ Aqua Culture Food Products, Residues in Food Products, Ayush Products, Building Material, Metals & Alloys, Petroleum & Petroleum Products, Lubricants, Ores & Minerals, Solid Fuels, Fertilizers.

**Mechanical testing :** Building Materials, Soil & Rocks, Wood & Wood Products, Plastic & Polymers, Rubber & Rubber Products, Mechanical Properties of Metal.

## 12.4 Prof. S.K. Maiti, Department of Environmental science, IIT (ISM), Dhanbad

**Dr. Subodh Kumar Maiti**
Ph.D (Env Sc. & Engg., ISM), M.Tech (Envt Sc. & Engg, IIT Bombay), M.Sc. (Botany, Calcutta University), Mining & Env (Univ of Luleo, Sweden), EIA & Auditing (UK), SERI (Australia), FNEA, Mem IPS (USA); QCI experts on Ecology & Biodiversity (EB) and soil conservation (SC) for CMPDI, CIL

**Professor**
Centre of Mining Environment
Department of Environmental Science & Engineering
Indian Institute of Technology (ISM),
Dhanbad-826004, Jharkhand (India)

The Indian School of Mines was formally opened on 9th December 1926, by Lord Irwin, the then Viceroy of India to address the need for trained manpower related to mining activities in the country with disciplines of Mining and Applied Geology. In 1967 it was granted the status of a deemed to be university under Section 3 of UGC Act, 1956. Since its establishment, IIT(ISM) has undergone considerable expansion of its activities, and presently it can be considered as a total technology education institute.

In 1967 it was granted the status of a deemed to be university under Section 3 of UGC Act, 1956. Since its establishment, IIT(ISM) has undergone considerable expansion of its activities, and presently it can be considered as a total technology education institute. The departments of Petroleum Engineering and Applied Geophysics were established in 1957. The departments of Mechanical Engineering and Mining Machinery Engineering, Fuel and Mineral Engineering, Management Studies, and Electronics and Instrumentation Engineering were added in 1975-1977. The Centre of Mining Environment, the Computer Centre, the Centre of Long wall Mine Mechanization, and the departments of Applied Chemistry, Applied Physics, and Applied Mathematics were established between 1975 and 1977. The department of Computer Science and Engineering was added in 1997. The expansion of the institute into a total technology institute was further accelerated with the establishment of the Department of Electrical Engineering in the year 2005, the Department of Environmental Science and Engineering in 2006, and the Department of Chemical Engineering in 2010.

The Department of Environmental Engineering was created out of existing Centre of Mining Environment (established in 1987) at Institute in June 2007 with the commencement of a regular B.Tech. Degree in Environmental Engineering under IIT-JEE (first of its kind offered by any national institute). The graduates are well accepted by Industries and research organizations. This department is also accredited with ISO 9001 and OHSAS 18001 Certificate.

Apart from B.Tech. Environmental Engineering, the Department is also offering regular M.Tech. Program in Environmental Science and Engineering (since 1990) and Ph.D. programs in Environmental Science, as well as in Environmental Science and Engineering disciplines. The Department also offers course on Environmental Studies to Undergraduate Students of various other Departments of the Institute. The students are also well accepted by the Industry

## 12.5 Brief resume of VRDS, Consutants, Chennai, TN

This is a sole proprietorship having a registration with the Government of Tamil nadu. Directorate of Industries, District Industries Center as a small scale industry. VRDS are in the field of Environmental Engineering since last decade. VRDS have well qualified technical experts for undertaking environmental projects like, Environmental Impact Analysis study (EIA) / Environmental Management study (EMP), Environmental Baseline Data monitoring / generation, operation & maintenance of water / effluent treatment plants, Ecology & Bio-diversity study, Socio-economic and rehabilitation study etc:

The VRDS have successfully completed the Socio economic studies for the following:

| Sl. No. | Name of the organisation | Name of the work completed |
|---|---|---|
| 1. | Kutch Alumina Power Company Ltd.,Badodara | Socio economic study of Alumina and Power plant at Vaizag. |
| 2. | Central Mine Planning & Design Institute Ltd; Regional Institutes – I, II, III, IV, V and VI | Generation of One Season Baseline environmental Data for Socio Economic and census Data & Occupational study for different Opencast and underground coal mining projects. |

## 12.6 Brief resume of Sri R.M. Bhute, socio-economic expert from M/s Sharda Development corporation, Ramgarh, Hazarbag distt, Jharkhand :

**Social Action for Rural Development (SARDA), :**

**SARDA** is a multi-dimensional Non-Government Organization registered under Societies Registration Act, XXI of 1860 as well as under the Foreign Contribution Regulation Act of 1976. The organization, working significantly since ten years, is professionally managed and has under gone different phase from field implementation to planning simultaneously, sharing own experience with other like minded organizations as well different line departments.

The organization is expertise in the field of Agriculture, Forest Development/ Community based NRM/ Tribal Development, Livelihood Promotional Activities, Rural Livelihood Promotion and Micro credit, Environment and Sanitation, Women Empowerment and other development programs**.** SARDA have been established as specialized and professional NGO capable in implementing & managing the anti-poverty programs of Ministry of Rural Development (MoRD) and also to relate effectively these to the overall effort of poverty eradication.

SARDA aims at covering the whole of India with the developmental works targeted to enhance the living of the poorer sections of the Indian Society and contribute with 100% zeal and enthusiasm towards the process of development of rural India and to help make India a better place to live.

Presently it is working in 5 states (Jharkhand, Bihar, Maharashtra, MP and Chhattisgarh) where SARDA is providing its consultancy services throughout different locations of these 5 states and others too.

Social- Action for Rural Development, which is one of the reputed NGO in India, is a culmination of that conviction of the Managing Director cum Secretary Mr. N. P. Singh. Conceived and nourished by its architect the organization was established in 2001 and later on registered under Societies Registration Act, XXI of 1860 from Ranchi in 2003 as well as under the Foreign Contribution Regulation Act, 1976. SARDA has also been registered under the ISO 9001: 2008 for our Quality Management System.

नॉर्दर्न कोलफील्ड्स लिमिटेड
(मिनिरत्न कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)

Northern Coalfields Limited
(A Mini Ratna Company)
(A subsidiary of Coal India Limited)

कार्यालय महाप्रबंधक, निगाही क्षेत्र /Office of the General Manager, Nigahi Area

CIN- U10102MP1985GOI003160 (An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company)
पोस्ट- निगाही परियोजना जिला- सिंगरौली, म.प्र., पिन 486884/ Post- Nigahi Project, Distt- Singrauli, M.P. PIN-486884
Phone: 07805- 276040, (FAX) 276306 email: cgmngh@ncl.gov.in website : www.nclcil.in

Ref. No. NGH/GM/Env/EC/18/ 34 Date: 15.06.2018

To,
The General Manager (Envt),
Northern Coalfields Limited

Sub: Additional details sought w.r.t Jayant Expansion OCP (25.0 MTPA) of Northern Coalfields Limited in the 30th EAC (Thermal and Coal ) held on 17-18th May'2018 at MOEF,Delhi.

Dear Sir,

With reference to the meeting held on 14/06/2018, in the office of GM- Jayant, in presence of Director(Tech/P&P), NCL , GM Env, GM Jayant, RD, RI-VI, CMPRDI & undersigned, I presently working as GM, Nigahi , agree as follows:

1. Out of 386 Ha. of forest land diverted for Nigahi OCP(Stage-II obtained vide F no. 8-26/2015-FC dated 12.04.2018), 18 Ha. land will be carved out for Jayant OCP.
2. Accordingly a revised mine plan for 3018.40Ha. [2650.40+368 Ha. (386-18 Ha.)] will be put up to NCL Board, scheduled to be held on 21/06/2018, for approval.
3. Parallel proposal for amendment in EC (18.75 MTPA) of Nigahi OCP, for revised EC boundary of 3018.40 Ha. (2650.40+368 Ha.), will be put up to EAC shortly.

Submitted for necessary action please.

Yours faithfully

15/6/2018
Area General Manager
Nigahi Project

Copy for kind information to:-

1. Director (Tech/Oprn.)
2. Director(Tech./P&P), NCL

Copy to :

1. TS to CMD
2. GM, Jayant
3. RD, RI-VI, CMPDI, Jayant

Annexure-4

S.R. No. 12287/18
Dated 15/06/18
AT

भारतीय गैर न्यायिक

एक सौ रुपये Rs. 100

रु. 100 ONE HUNDRED RUPEES

सत्यमेव जयते

भारत INDIA

INDIA NON JUDICIAL

मध्य प्रदेश MADHYA PRADESH

AR 898341

NOTARY Manik Ram Verma Advocate Waidhan Distt. Singrauli M.P.-46/01/07/21-B (Two) 2015 GOVT. OF MADHYA PRADESH

## Affidavit

Area General Manager, Jayant Area, Presently , Chanchal Goswami, age 56 year's S/o Shri Basudeo Goswami, here by solemnise:

1. That, Coal production from jayant Opencast Coal Mine Shall never exceed the sanctioned EC capacity of the mine as given in Environmental clearance letter.
2. That, I will comply all the statutary requirement & judgements of Hon' ble supreme court dated 2nd Aug 2017 in Writ petition (Civil) No. 114 of 2014 in the matter of common cause versus Union of India and Others before grant of TOR/EC.
3. That, I will not repeat any such violation in future.
4. That, in case of any violation of statutary requirements or any conditions as given in the environment clearance letter, the TOR/environment clearance may be terminated forthwith.

भारत INDIA पाँच रुपये FIVE RUPEES NOTARIAL CANCELLED

भारत INDIA पाँच रुपये FIVE RUPEES NOTARIAL CANCELLED

Notarial Stamp Rs. 10.00 affixed

NOTARY Manik Ram Verma Advocate Waidhan Distt. Singrauli M.P.-46/01/07/21-B (Two) 2015 GOVT. OF MADHYA PRADESH

15/06/18

**Seal of Notary** **Signature of the Affiant**

Identified by

Manik Ram Verma Advocate NOTARY Waidhan Distt. Singrauli (M.P.) 15/06/18

Sig. of Deponent Executant
GENERAL MANAGER
Northern Coalfields Limited
Jayant Project, P.O. Jayant
Dist. Singrauli (M.P.)
PIN-486 890

भारतीय गैर न्यायिक

एक सौ रुपये

Rs. 100

रु. 100

ONE HUNDRED RUPEES

सत्यमेव जयते

भारत INDIA

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S. R. No. 12287/18

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NOTARY

GOVT. OF MADHYA PRADESH

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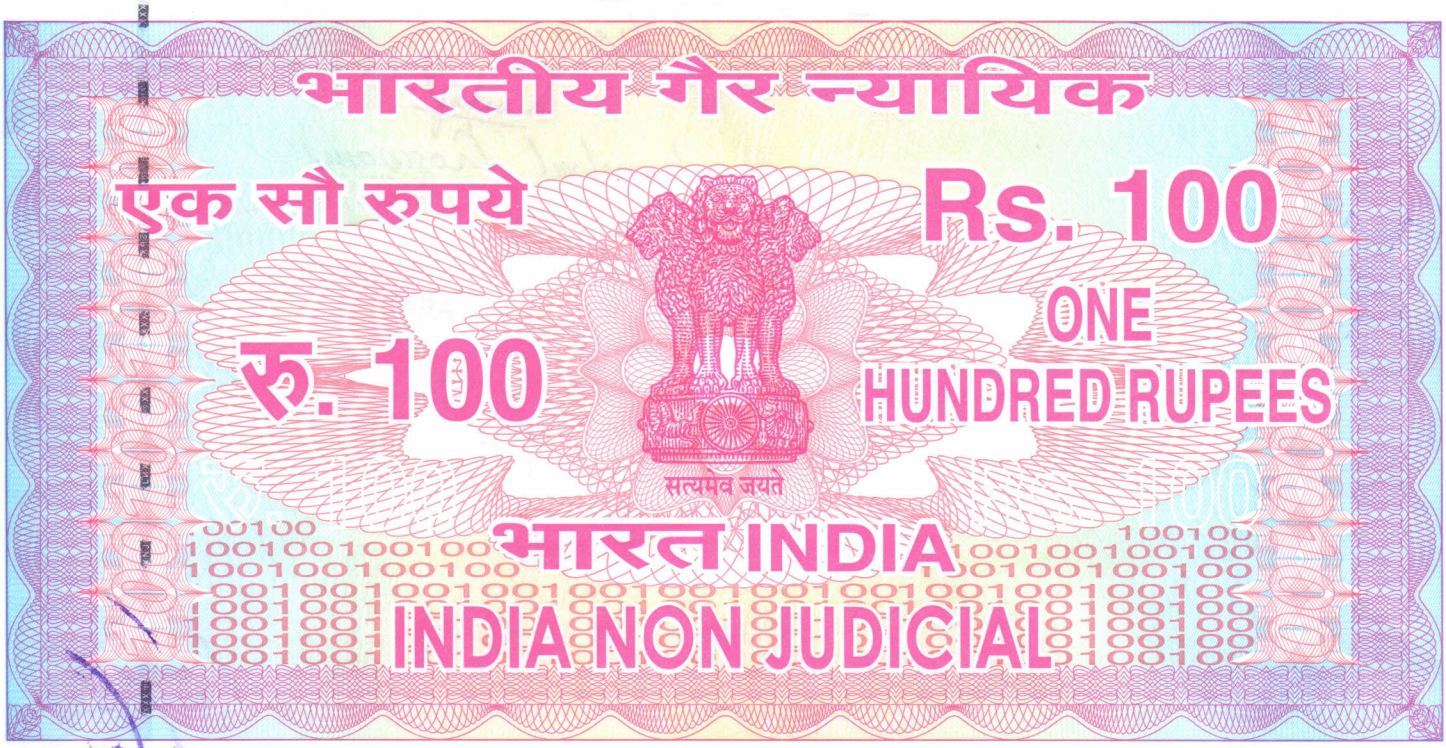
AR 898343

S. R. No. 12287/18

Dated 15/06/18

AT .....

NOTARY GOVT. MADHYA PRADESH

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Dated 15/06/18

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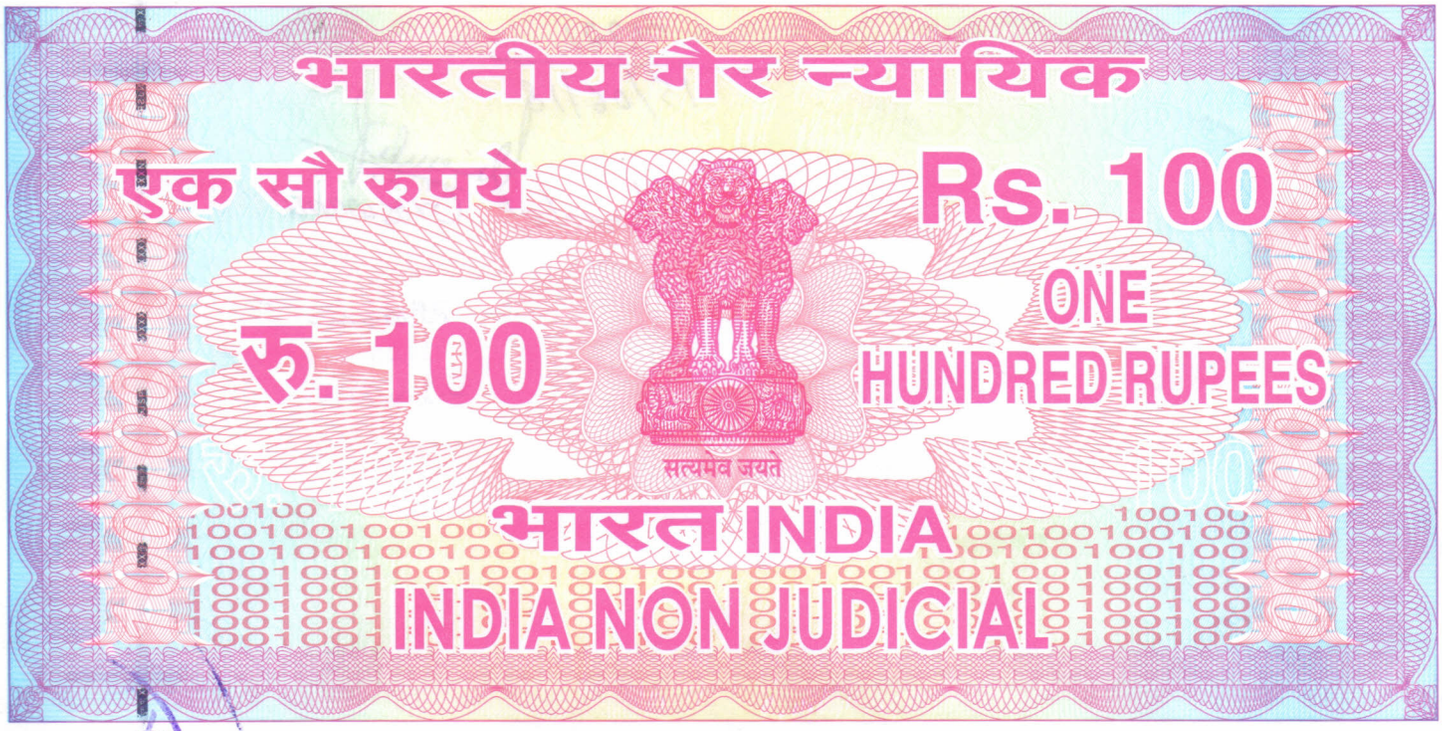


मध्य प्रदेश MADHYA PRADESH

AR 898345

S. R. No. 17287/18
Dated 15/06/18
AT

NOTARY
GOVT. OF MADHYA PRADESH