BHARAT COKING COAL LIMITED
(A SUBSIDIARY OF COAL INDIA LIMITED)
OFFICE OF THE GENERAL MANAGER
LODNA AREA

Ref. No: - BCCL/LA/GM/21/ 214

Dated:- 26/05/21

To,
The Director,
Ministry of Environment, Forest & Climate Change, Govt. Of India.
Regional Office (ECZ), Bunglow No. A-2,
Shyamli Colony,
Ranchi-834002

Sub: - Six monthly compliance report on implementation of Environmental Measures for the period from 1st October 2020 to 31st March 2021 in respect of Cluster – IX Group of Mines, Lodna Area of BCCL.

Ref. No. 1: EC Order No.-J-11015/307/2010-IA.II (M), dated – 21st May, 2013.
Ref. No. 2: EC Order No. -J-11015/307/2010-IA.II (M), dated – 1st March, 2018.

Dear Sir,
Please find enclosed herewith the Six Monthly Compliance report on implementation of Environmental Measures for the period from 1st October 2020 to 31st March 2021 in respect of Cluster – IX Group of Mines, Lodna Area of BCCL.

Hope you will find the same in order.

Enclosure: as above.

Yours faithfully,

25/5/21
General Manager
Lodna Area

Cc to (Through Email):-

1. Director 1A monitoring cell, Paryavaran Bhawan CGO Complex, New Delhi-110003
2. General Manager (Env) BCCL, Koyla Bhawan, Dhanbad.
3. File

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ENVIRONMENTAL CLEARANCE COMPLIANCE OF CLUSTER – IX.
(GRANTED VIDE – J-11015/307/2010-IA.II (M), dated – 21st May, 2013and amendment on dated- 1st March 2018)
(From Oct. 2020 to March 2021)

Sl. No.	A.) Specific conditions by MOEF	Compliance
i	The Maximum production shall not exceed beyond that for which environmental clearance has been granted.	The production from the cluster is within the limit for which environment clearance has been granted. Details are attached as **Annexure I**
ii	Action should be taken to segregate and isolate the fire areas eg. Trench cutting for isolation of fire. Area-wise Action Taken report for extinguishing the fire should be provided.	It is being complied. Thereafter the coal is excavated and fire is doused by water. The doused coal is then loaded into trucks for transportation.
iii	"Mission Mode Programme' for extinguishing fire is required wherein scientists and other experts be involved. Any international agency may also be contacted for their expertise in extinguishing the fire in such big area.	Global Expression of Interesthad been opened for the international experts/firms/consultants/agencies to deal with coal mine fire in Jharia Coalfield with vision of reclamation, further minimization of spread of fire & subsidence control for which no bidder has qualified to take up the work. Enclosed as **Annexure II.**
iv	The recommendations of Indira Gandhi Centre of Atomic Research, Kalpakam should followed dealing with fire in coal mine in Jharia coalfield.	A mail was sent and requested for providing recommendation in this regard. IGCAR replied that there is no any recommendation from their end. Copy is attached as **Annexure III.**
v	Transportation Plan should be submitted to the MOEF.	Action has been taken for formulating adequate transportation plan for conveyor-cum-rail system of dispatch. CMPDIL has been requested to prepare the plan. Transportation is being done by covering vehicle with tarpaulin cover and it is made mandatory in Transportation contracts. Transportation plan is enclosed as **annexure-IV.**
vi	The finalized Mine Closure Plan of Cluster – IX should be submitted to MOEF. The void should be in 30 ha. Area with 30 mt. depth.	Mine closure plan as per the guideline of Ministry of coal and on the basis of cluster concept has been prepared and submitted by CMPDIL and progressive mine closure plan is being followed. Progressive Mine Closure plan has been attached as **Annexure V.** As on date no such voids are available.

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vii	The road transportation of coal during phase – I should be by mechanically covered trucks. The road used for coal transportation should be developed with avenue plantation on both sides.	Transportation of coal is being done by tarpaulin covered trucks at present as mechanically covered truck OEM not available in market. Avenue plantation is being done along the transportation route. 300 nos. of plants have been planted from South Tisra W/S to Thakur More (Jharia –Baliapur road), 400 nos. of plants from Indira Chowk to Patherdih, 25 nos. of plants in bararee More, 25 nos. of plants in chatkari jore, 25 nos. of plants in Magazine etc.1200 nos. of Bamboo gabion avenue plantation will be done by DFO, Dhanbad along transportation road. Photographs are attached.
viii	The company must give priority to capacity building both within the company and to the local youth, who are motivated to carry out the work in future.	It is being done. Training and skill development programs are being conducted by VTCs and HRD of BCCL on regular basis. There are 02 Handloom Training Centres in Lodna area at Alakdiha and Mukunda, Dhanbad. Presently, 40 numbers of women are engaged with these training centres belonging to nearby villages like Alakdiha, Mukunda, Surunga and Rakshakali Dham, belonging to underprivileged class of the society.
ix	Details of transportation, CSR, R&R and implementation of environmental action plan for each of the 17 clusters should be brought out in a booklet form.	It is being complied. Details of transportation, CSR, R&R and implementation of environmental action plan is enclosed here as **Annexure VI.**
x	A study should be initiated to analyze extent of reduction in pollution load every year by reducing road transport.	It is being complied. More than 60%of coal is transported through railway which is environmentally better option than the road transportation. The study has been completed by the CMPDIL to analyze the extent of reduction in pollution load every year by reducing road transport. **Enclosed as Annexure VII.**

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xi	The expertise available internationally should be utilized for control of fire in Jharia coalfields and for their reclamation and to further minimize time for fire and subsidence control.	**It is under process.** Global Expression of Interest had been opened for the international experts/firms/consultants/agencies to deal with coal Mine fire in Jharia Coalfield with vision of reclamation, further minimization of spread of fire & subsidence control for which no bidder has qualified to take up the work. The proven technology of Fiery coal excavation is practiced for liquidation of fire. Presently Master Plan Approved by Govt. of India is under implementation for this purpose Enclosed as **Annexure II.**
xii	The abandoned pits and voids should be backfilled with OB and reclaimed with plantation and or may be used for pisciculture.	At present no abandoned pit is present. Backfilling process in abandoned pits and voids are continuously carried out along with the mining operation. Ecological restoration and Plantation is being carried out at the stable OB dumps. Reclamation of old dump has been taken up. About 35,000 Nos. of plants have been planted at Gokul Park in NT-ST till March 2021. 16 Ha of OB dump has been bio-reclaimed DFO, Dhanbad for the FY 2020-21. Details are attached as **Annexure I.** Abandoned Pits will be utilized for Pisciculture in Post Mining Phase.
xiii	BCCL may consider setting up a separate management structure for implementing environment policy and socio-economic issues and the capacity building required in this regard.	Environmental Engineer provided at mine and Area level. A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable, qualified multidisciplinary team of executives has been established. The activities are monitored on regular basis at Area and at Headquarters levels. GM (Environment) at Head quarter level, Co-ordinates with all the Areas and reports to the Director (Technical) and in turn he reports to the CMD of the company. The team is multidisciplinary and very much motivated under the guidance of company's Director (Technical) and CMD. Further capacity building at both corporate and operating level is being done.

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xiv	The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board.	Complied.The location of monitoring stations in Jharia Coal Field has been identified with the consultant advisory of CMPDIL and also finalized with the permission of Jharkhand State Pollution Control Board. The location of monitoring stations are: (i) Jeenagora (A13) (ii) Kusmatand Village (A12) (iii) Bhowrah North (A14) (iv) Hurriladih UGP (A28) **Enclosed as Annexure VIII.**
xv	The smoke / dust emission vary from source to source (fuel wood, coal, fly ash from TPPs, silica from natural dust, etc.) and a source Apportionment study should get carried out for the entire Jharia Coalfields.	Work order had already been issued to NEERI Nagpur on 12.05.2018 and Field data collection of first phase and second phase has been done in summer and winter of 2019 respectively. Progressive report has been **enclosed as Annexure IX.**
xvi	Mineralogical composition study should be undertaken on the composition of the suspended particulate matter (PM10 and PM2.5) in Jharia Coalfields and also quantified. These studies would help ascertain source and extent of air pollution, based on which appropriate mitigative measures could be taken.	Work order had already been issued to NEERI Nagpur on 12.05.2018 and Field data collection of first phase and second phase has been done in summer and winter of 2019 respectively. Progressive report has been **enclosed as Annexure IX.**
xvii	The proponent shall prepare time-series maps of the Jharia Coalfields through NRSA to monitor and prevent fire problems in the Jharia Coalfields by isothermal mapping / imaging and monitoring temperatures of the coal seams (whether they are close to spontaneous ignition temperatures) and based on which, areas with potential fire problems shall be identified.	NRSA is periodically conducting work of "Delineation of Surface Coal Fire and associated land Subsidence in Jharia Coal field, Jharkhand using satellite based remote –sensing techniques", latest report is received in 2018. As per report observed in 2017 the fire area in north tisra was 0.1802 Sq. km., in south tisra 0.1015 Sq. km. & in Jeenagora 0.0470 sq. km. **Enclosed as annexure-X.**
xviii	Measures to prevent ingress of air (Ventilation) in such areas, to prevent restart fresh / spread fires in other areas including in mines of cluster IX shall be undertaken.	Action is being taken as per Jharia Master Plan Approved by GOI and State Govt. of Jharkhand. Excavation/ Open Cast mining is being done in the Fire/subsidence affected mines to dig out combustible materials to save the coal from burning and to prevent further spread of the fire. Once the fiery coal is dugout/ excavated there will be no chance of further restarting/ spreading of fresh fire into other areas.
xix	Underground mining should be taken up after completion of reclamation of Opencast mine area after 15 Years.	It shall be complied. Underground Mining will be done after extraction of upper seams and beneath Backfilled and reclaimed area.

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xx	No mining shall be undertaken where underground fires continue. Measure shall be taken to prevent / check such fire including in old OB dump areas where the fire could start due to presence of coal / shale with sufficient carbon content.	Action is being taken to control mine fires including old OB dump & areas as specified in Jharia Master Plan and the open cast mining is being done in fire affected areas.
xxi	The rejects of washeries in Cluster – IX should be sent to FBC based plant.	Coal washery does not exist in this cluster at present.
xxii	There shall be no external OB dumps. At the end of the mining there shall be no void and the entire mined out area shall be re-vegetated. Areas where opencast mining was carried out and completed shall be reclaimed immediately thereafter.	Action is being taken as specified in EMP. Backfilling of OB is going on with mining. Gokul park has been developed after backfilling of OB. 16 Ha of OB dump also has been bio-reclaimed through DFO. Dhanbad in the year 2020-21. At the end of Mining there shall be no void and area will be re-vegetated and reclaimed.
xxiii	A detailed calendar plan of production with plan for OB dumping and backfilling (for OC Mines) and reclamation and final mine closure plan for each mine of cluster – IX shall be drawn up and implemented.	Mining operation is being done as per approved Calendar Plan. Calendar Plan has been prepared. Details are attached as **Annexure I.** Mine closure plan as per the guidelines of Ministry of Coal has been prepared by Central Mine Planning and Design Institute (CMPDI). Progressive mine closure plan is being implemented. Activities under mine closure plan are: (i) Subsidence Management (ii) Reclamation of abandoned Quarry (iii) OB dump Reclamation (iv) Plantation (v) Entrepreneurship Development (vi) Miscellaneous activities
xxiv	The void shall be converted into a water reservoir of a maximum depth of 15-20 m and shall be gently sloped and the upper benches of the reservoir shall be stabilized with plantation and the periphery of the reservoir fenced. The abandoned pits and voids should be backfilled with OB and biologically reclaimed with plantation and or may be used for pisciculture.	It shall be complied. A part of the void will be converted into the water body as specified in EMP. Abandoned pits are regularly filled with over burden. Abandoned Pits/Voids will be utilized for Pisciculture in Post Mining Phase. Backfilling process in abandoned pits and voids are continuously carried out along with the mining operation. Ecological restoration and Plantation is being carried out at the stable OB dumps. Abandoned Pits will be utilized for Pisciculture in Post Mining Phase.

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<table>
<tr><td>xxv</td><td>Mining shall be carried out as per statuette from the streams / Nalas flowing within the lease and maintaining a safe distance from the Nalas flowing along the lease boundary. A safety barrier of a minimum 60 m width shall be maintained along Nalas / water bodies. The small water bodies in OC shall be protected to the extent feasible and the embankment proposed along water body shall be strengthened with stone pitching.</td><td>Mining is being carried out as per Statute from the streams/Nalas flowing within the lease and maintaining a safe distance (>60 m) from the nalas flowing along the lease boundary.</td></tr>
<tr><td>xxvi</td><td>Active OB dumps near water bodies and rivers should be rehandled for backfilling abandoned mines voids. However, those which have been biologically reclaimed need not be disturbed.</td><td>No active dumps near water bodies exist. The OB dumps created earlier are stabilized and converted into Eco-restoration park.</td></tr>
<tr><td>xxvii</td><td>Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. During post mining stage, a total of 937.84 ha. Area would be reclaimed. The total additional area under plantation would be 367.95 ha. (189.95) ha.abandoned quarry area, 178 ha. active quarry area, 104.34 OB dump outside quarry area, 36.49 ha.service building / Mine infrastructure area / coal dump etc., 165.88 ha. Green belt around OCP, 263.22 ha. barren area), by panting 2344700 plants at a total cost Rs. 10830.45 lakhs.</td><td>Year wise plantation is being done as per following details:
<table><tr><th>Year</th><th>Cluster/Mine /Area</th><th>Area of greenbelt (Ha.)</th></tr><tr><td>2014-15</td><td>Lodna</td><td>05</td></tr><tr><td>2015-16</td><td>Lodna</td><td>07</td></tr><tr><td>2016-17</td><td>Lodna</td><td>07</td></tr><tr><td>2017-18</td><td>Lodna</td><td>07</td></tr><tr><td>2018-19</td><td>Lodna</td><td>3.8</td></tr><tr><td>2019-20</td><td>Lodna</td><td>0.3</td></tr><tr><td>2020-21</td><td>Lodna</td><td>16</td></tr></table></td></tr>
<tr><td>xxviii</td><td>The road should be provided with avenue plantation on both side as trees act as sink of carbon and other pollutant.</td><td>Avenue plantation is being developed in phased manner.

300 nos. of plants have been planted from South Tisra W/S to Thakur More (Jharia –Baliapur road), 400 nos. of plants from Indira Chowk to Patherdih, 25 nos. of plants in bararee More, 25 nos. of plants in chatkari jore, 25 nos. of plants in Magazine etc.1200 nos. of bamboo gabion avenue plantation has been awarded to DFO, Dhanbad and will be planted at the earliest.

Photographs are attached.</td></tr>
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xxix	Specific mitigative measures identified for the Jharia Coalfields in the Environmental Action plan prepared for Dhanbad as a critically polluted area and relevant for Cluster IX shall be implemented.	It shall be compiled. Dhanbad Action Plan is being implemented. The salient actions of this cluster. 1. Covered transportation of coal. 2. Water sprinkling: 1no. Of mobile tankers of capacity 28KL AND 5 nos. of mobile tankers of capacity 18KL, 4-5 trips/day covering 8-9 km of distance. 3. Plantation. 4. Toe wall constructed along OB dump. 5. Installation of fixed sprinkler at railway siding. Photographs are attached.
xxx	The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board. The committee stated that smoke / dust emission very from source to source (fuel wood, coal, fly ash from TPPs silica from natural dust, etc) and a source Apportionment Study should be got carried out the entire Jharia Coalfields. Mineralogical composition study should be undertaken on the composition for suspended particulate matter (PM 10 and PM 2.5) in Jharia coalfields and also qualified. These studies would help ascertain source and extent of the air pollution, based on which appropriate mitigative measures could be taken.	The locations of monitoring stations have been finalized with the Jharkhand State Pollution Control Board. The location of monitoring stations are: (i) Jeenagora (A13) (ii) Kusmatand Village (A12) (iii) Bhowrah North (A14) (iv) Hurriladih UGP (A28) Work order had already been issued to NEERI Nagpur on 12.05.2018 and Field data collection of first phase and second phase has been done in summer and winter of 2019 respectively. Progressive report has been enclosed as **Annexure IX.** CMPDIL is now on work since 2015.
xxxi	No ground water shall be used for the mining activities. Additional water required, if any, shall be met from mine water or by recycling / reuse of the water from the existing activities and from rainwater harvesting measures.	No ground water is being used for mining activities. Mine water is being used for the industrial purpose. Pressure filters are installed for converting the mine water to portable water. Few lagoons are developed as ground water recharge structure. Mine water is also supplied to colonies and community after filtration through pressure filters. Pressure filters have been installed at South Tisra workshop (0.08mgd capacity), Noonidih (02 nos. of capacity 0.32mgd) for utilization of Mine Water. 2. Rain water Harvesting.

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xxxii	Regular monitoring of groundwater level and quality of the study area shall be carried out by establishing a network of existing wells and construction of new peizometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for quality including Arsenic and Fluoride during the month of May. Data thus collected shall be submitted to the Ministry of Environment & Forest and to the Central Pollution Control Board / SPCB quarterly within one month of monitoring. Rainwater harvesting measures shall be undertaken in case monitoring of water table indicates a declining trend.	It is being complied. CMPDI RI-II is regularly Conducting study of groundwater level and quality of areas within Cluster IX. As per report ground water has not been declined. Groundwater monitoring data has been enclosed as **Annexure XI.** The estimate for drilling establishment of 23 nos. of Piezometric well has been prepared by Geological Department, BCCL, HQ, which has been approved by the Committee members. Tender was processed by civil department BCCL, HQ. Open e-tender was floated by Civil Department on dated 10.03.2021. Technical Bid opened on 30.03.2021. **Annexure XII.**
xxxiii	Mine discharge water shall be treated to meet standards prescribed standards before discharge into natural water coursed / agriculture. The quality of the water discharged shall be monitored at the outlet points and proper records maintained thereof and uploaded regularly on the company website.	It is being complied. Mine discharge water is being allowed to settle down in the mine sumps before filtration through Pressure Filter. The monitoring of water quality parameters is regularly carried out by CMPDIL. The report of mine water discharge is uploaded on BCCL official website which is also given in the six-monthly EC compliance report. Mine water quality data has-been enclosed as **Annexure XIII.**
xxxiv	ETP shall also be provided for workshop, and CHP, if any. Effluents shall be treated to confirm to prescribe standards in case discharge into the natural water course.	Oil and grease trap is installed at South Tisra workshop and is functional. Water and oil is separated by the help of Oil and grease trap and stored in separate reservoir. **Photographs attached.**
xxxv	Regular monitoring of subsidence movement on the surface over and around the working area and impact on natural drainage pattern, water bodies, vegetation, structure, roads, and surroundings shall be continued till movement ceases completely. In case of observation of any high rate of subsidence movement, appropriate effective corrective measures shall be taken to avoid loss of life and material. Cracks shall be effectively plugged with ballast and clayey soil / suitable material.	No UG working, only OC operation in the mine. However some cracks are developed naturally which are filled by incombustible materials regularly and Some buildings and structures are being dismantled also for the purpose of shifting of fires and subsidence affected people to a safe place.
xxxvi	Sufficient coal pillars shall be left un-extracted around the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.	No UG working, only OC operation in the mine.

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xxxvii	High root density tree species shall be selected and planted over areas likely to be affected by subsidence.	No UG working, only OC operation in the mine. Planation is regularly done in leasehold area of Cluster IX. High root density plants are regularly planted as per the roadmap prepared by Forest Research Institute, Dehradun.
xxxviii	Depression due to subsidence resulting in water accumulating within the low-lying areas shall be filled up or drained out by cutting drains.	It is being complied. Time to time depression has been filled by the locally available material and over burden.
xxxix	Solid barriers shall be left below the roads falling within the blocks to avoid any damage to the roads.	No UG working, only OC operation in the mine.
xL	No depillaring operation shall be carried out below the township / colony.	At present no depillaring operation is going on.
xLi	The transportation plan for conveyor-cum-rail for Cluster-IX should be dovetailed with Jharia Action plan. Road transportation of coal during Phase – I should be by mechanically covered trucks, which should be introduced at the earliest. The plan for conveyor-cum-rail for Cluster – IX should be dovetailed with Jharia Action Pan. The road transportation of coal during Phase – I should be done by mechanically covered trucks.	It shall be complied. Action has been taken for formulating adequate transportation plan for conveyor-cum-rail system of dispatch. CMPDIL has been requested to prepare the plan. Detail is attached as **Annexure XIV.** Transportation is being done by covering vehicle with tarpaulin cover and it is made mandatory in Transportation contracts.
xLii	A study should be initiated to analyze extent of reduction in pollution load every year by reducing road transport.	It is being complied. More than 60%of coal is transported through railway which is environmentally better option than the road transportation. The study has been completed by the CMPDIL to analyze the extent of reduction in pollution load every year by reducing road transport. **Enclosed as Annexure VII.**

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xLiii	R&R of 12246 Nos. of PAF's involved. They should be rehabilitated at cost of Rs. 126092.027 Lakhs as per the approved Jharia Action Plan.	Implementation is being done as per the Master Plan. As per the approved Master Plan prepared for dealing with fire subsidence and rehabilitation in the leasehold of BCCL for Jharia Coal Field, the master plan has identified 595 unstable sites in the entire Jharia Coal Field. Out of these, 98 sites covering an area of 224.56 Ha consisting of 12246 no. of houses/families fall in Cluster-IX mines. The cost for rehabilitation for the families is estimated to be Rs. 126092.03 lakhs. In the NT-ST-Jeenagora mining block, 1716 houses have to be rehabilitated. The cost for rehabilitation is estimated to be Rs. 6989.88 lakhs with an affected area of 22.74 ha. 236 Nos. of Quarters have been allotted for shifting of PAFs by JRDA at Belgaria Township.42 nos. of PAFs have been given allotment letter out of which 40nos. of PAFs have shifted to this site. The shifted PAFs belongs to the fire affected areas of DB road and Bengal Jharia section of NT-ST OCP.
xLiv	A detailed CSR Action plan shall be prepared for Cluster IX group of mines. Specific activities shall be identified for CSR the budget of RS. 142.55 Lakhs per year @ Rs. 5/T of coal as recurring expenditure. The 391.28 ha. of area within Cluster IX Ml existing as waste land and not being acquired shall be put to productive use under CSR and developed with fruit bearing and other useful species for the local communities. In addition to afforesting 1942.12 ha. of area at the post-mining stage, the waste land / barren land within Cluster IX ML. shall be rehabilitated / reclaimed as forest / agricultural land under CSR Plan in consultation with local communities. Third party evaluation shall be got carried out regularly for the proper implementation of activities undertaken in the project area under CSR. Issue raised in the public Hearing shall also be integrated with activities being taken up under CSR. The details of CSR undertaken along with budgetary provisions for the village-wise various activities and expenditure thereon shall be uploaded on the company website every year. The company must give priority to capacity building both within the company and to the company and to the local youth, who are motivated to carry out the work in future.	It shall be complied. BCCL is implementing CSR activities. A separate CSR committee has been formed for this purpose. TISS has conducted the survey for effective and need based CSR activities implementation. Recommendations of TISS shall be followed. A handloom weaving project (JHARCRAFT) has been started in the area which provides employment to local womenfolk. Details are attached as **Annexure VI.** Under the CSR activities in the purview of NTST-Jeenagora OC, the handloom making projects (Jharkraft) at Mukunda at an expenditure of about Rs.10.38 lakhs during the year 2015-17 and at Alakdiha at an expenditure of about Rs.10.72 lakhs during the year 2016-18 have been established. At these centres, local women are getting training for making of clothes through the handloom.

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xLv	For monitoring land use pattern and for post mining land use, a time series of land use maps, based on satellite imagery (on a scale of 1:5000) of the core zone and buffer zone, from the start of the project until end of mine life shall be prepared once in 3years (for any one particular season which is consistent in the time series), and the report submitted to MOEF and its Regional office at Bhubaneswar.	It is being complied. Land Use Map of Cluster IX has been prepared by CMPDIL using remote sensing data for monitoring of land use pattern and for post mining land use. **Enclosed as Annexure XV.**
xLvi	A final Mines Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment & Forest Restoration Plan of the mine area shall be carried out using a mix of native species found in the original ecosystem, which were conserved in-situ and ex-situ in an identified area during mine reclamation and at the post mining stage for habitat restoration.	Progressive Mine closure plan as per approved MCP is under implementation. Final closure plan will be submitted at appropriate time. Ecological Restoration a mix of native species are being used in mine reclamation. Native species of flora and fauna can be seen on these site. Approval of Mine Closure Plan is attached as **Annexure XVI.**
xLvii	A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company for implementing environment policy and socio-economic issues and the capacity building required in this regard.	Separate multidisciplinary environmental management cell at Area Level has already been established. Office Order of the same has been enclosed as **Annexure XVII**. Environmental Engineer provided at Mine and Area level. A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable qualified multidisciplinary team of Executives has been established. Rainwater harvesting methods etc. Capacity building at both corporate and operating level is being done.
xLviii	Implementation of final mine closure plan for Cluster IX, subject to obtaining prior approval of the DGMS in regard to mine safety issues.	Final Mine Closure Plan, will be prepared at appropriate time. Mine closure plan as per the guidelines of Ministry of Coal has been prepared by Central Mine Planning and Design Institute (CMPDIL) and progressive mine closure plan is being implemented.

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xLix	**Corporate Environment Responsibility** :- The company shall have a well laid down Environment Policy approved by the Board of Directors. The environment Policy shall prescribe for standard operating process / procedures to bring into focus any infringements / deviation / violation of the environmental or forest norms / conditions. The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished. To have proper checks and balances, the company shall 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.	A well-defined Corporate Environment Policy has already been laid down and approved by the Board of Directors. This is also posted on BCCL website. http://www.bcclweb.in/environment/CEP_280220.pdf Complied. A hierarchical system of the company to deal with environmental issue from corporate level to mine level already exists. Flow chart is attached as **Annexure XVIII.** Being complied.
Sl. No.	**B.) General Conditions**	**Compliance**
i	No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.	No change in mining technology and scope of working has been undertaken.
ii	No change in the calendar plan of production for quantum of mineral coal shall be made.	The approved peak production of coal for Cluster IX is 8.512 MTPA. The production of coal for the cluster is well within the limit. Calendar plan has been enclosed as **Annexure I.**

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iii	Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for PM 10, PM 2.5, SO_2 and NO_X monitoring. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the state Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc carried out at least once in six months.	The optimum location of monitoring stations in Jharia Coal Field has been identified with the consultant advisory of CMPDIL and finalized with the approval of Jharkhand State Pollution Control Board. The location of monitoring stations are: (i) Jeenagora (A13) (ii) Kusmatand Village (A12) (iii) Bhowrah North (A14) (iv) Hurriladih UGP (A28) **Enclosed as Annexure VIII.** The work of monitoring of ambient environment (Air quality monitoring and water quality monitoring including monitoring of Heavy metals) had been started by Central Institute of Mining & Fuel Research (CIMFR), Dhanbad which is having CSIR Laboratory recognized under the EP Rules. Currently CMPDIL is carrying out the work of monitoring. To maintain the air quality as per applicable standard following precaution measures is being taken:- 1. Sprinkling on Transportation road. 2. Covered truck transportation 3. Plantation 4. Dust controlled blasting and drilling. 5. Regular maintenance of machineries involved in mining. 6. Fixed water sprinkling at railway siding. Air quality Monitoring and Water quality monitoring report has been enclosed as **Annexure XIX.**
iv	Data on ambient air quality (PM 10, PM 2.5, SO_2 and NO_X) and heavy metals such as HG, As, Ni, Cd, Cr and other monitoring data shall be regularly submitted to the Ministry including its Regional Office at Bhubaneswar and to the State Pollution Control Board and the Central Pollution Control Board once in six months. Random verification of samples through analysis from independent laboratories recognized under the EPA rules, 1986 shall be furnished as part of compliance report.	It is being complied. Data is regularly submitted to ministry along with compliance report. Air quality Monitoring and Water quality monitoring report is also submitted with six monthly compliance report. Attached as **Annexure XIX.**
v	Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with ear plugs / muffs.	Being complied. Personnel operating HEMMs, drilling machine and other machines comply with safety regulation and are equipped with Personal Protective Equipment. The noise and vibration during blasting operations are controlled by using Electronic Detonators. Noise monitoring data has been enclosed as **Annexure XX.**

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vi	Industrial wastewater (workshop and wastewater from the Mine) shall be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19th May, 1993 and 31st December 1993 or as amended from time to time before discharge. Oil and grease trap shall be installed before discharge of workshop effluents.	Industrial wastewater (workshop and wastewater from the Mine) is not discharged to any water body. Effluents discharge standards are regularly monitored by CMPDIL for cluster IX group of mines. Mine water is being treated using filter Plants (Pressure, Sand filters etc.) for its further use in industrial purpose and supply to the community. Mine water monitoring report has been enclosed as **Annexure XIII.** Oil and grease trap is installed at South Tisra workshop and is functional. Water and oil is separated by the help of Oil and grease trap and stored in separate reservoir.
vii	Vehicular emission shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.	It is being complied. Vehicle no. & PUC Certificate no. are as follows: **Vehicle no.** — **PUC Certificate** JH10AQ7491 — JH01002910000405 JH10AW1047 — JH01002090000041 JH10AY7329 — JH01000090002137 JH10AT6328 — JH01002910000427 JH10BBB4903 — JH01000530000262 JH10BR6069 — JH01001940000023 JH10BS2944 — JH01000740000127 JH10BF4903 — JH01000740000007 PUC Certificate is enclosed as **Annexure XXI.**
viii	Monitoring of environment quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board and data got analyzed through a laboratory recognized under EPA Rules, 1986.	It is complied. Ambient environmental monitoring is being done by CMPDIL. Monitoring data have been enclosed as **Annexure XIX.**

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ix	Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects.	Dust is suppressed at source by water sprinkling. Dust masks are provided to persons working in dusty areas. The details are given as follows: FY / Dust Mask 2015-16: 1000 2016-17: 940 2017-18: 1000 2018-19: 1000 2019-20: 350 2020-21: 1500 Vocational training Centers under separate Human Resource Development Dept. is conducting regular training programme on these issues. Details of training programme are as: Year / Total 2013-14: 1348 2014-15: 1353 2015-16: 2715 2016-17: 1004 2017-18: 2145 2018-19: 1013 2019-20: 794 2020-21: 664
x	Occupational health surveillance programme of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective measure, if needed and records maintained thereof. The quality of environment due to outsourcing and the health and safety issues of the outsourced manpower should be addressed by the company while outsourcing.	Initial Medical Examination (IME) of contracted personnel and periodical Medical Examination (PME) of all the personnel are carried out as per the Statutes and Director General of Mines Safety (DGMS) guidelines. Details of PME/IME: Year / IME / PME 2014: 09 / 1710 2015: 333 / 1564 2016: 257 / 1335 2017: 245 / 1134 2018: Nil / 1400 2019: 380 / 1058 2020: 133 / 495

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xi	A separate environment management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the Company.	Separate multidisciplinary environmental management cell at Area Level has already been established. Office Order of the same has been enclosed as **Annexure XVII.** Environmental Engineer provided at mine and Area level. The activities are monitored on regular basis at Area and at Head Quarters levels. GM (Environment) at Head Quarter level Co-ordinates with all the Areas and reports to the Director (Technical) and in turn he reports to the CMD of the company. The team is multidisciplinary and very much motivated under the guidance of company's Director (Technical) and CMD. Further capacity building at both corporate and operating level is being done.
xii	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its Regional Office at Bhubaneswar.	It is being complied. The funds are available at Area and HQ level for implementation of activities in the capital & revenue budget. The booking is being done as per operations by concerned department. Enclosed as **Annexure XXII.**
xiii	The project authorities shall advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and may also be seen at the website of the ministry of Environment & Forests at http://envfor.nic.in.	It has been complied and published timely. **Enclosed as Annexure XXIII.**
xiv	A copy of the environmental clearance letter shall be marked to concern Panchayat/ZilaParished, Municipal Corporation or Urban local body and local NGO, if any, from whom any suggestion / representation has been received while processing the proposal. A copy of the clearance letter shall also be displayed on company's website.	It has been Complied. Environmental Clearance letter received by Panchayat/ ZilaParishad is **Enclosed as Annexure XXIV.**
xv	A copy of the environmental clearance letter shall be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at the Regional Office District Industry Sector and Collector's Office/Tehsildar's Office for 30 days.	It has been complied.

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xvi	The clearance letter shall be uploaded on the company's Website. The compliance status of the stipulated environmental clearance conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain. The monitoring data environmental quality parameter (air, water, noise and soil) and critical pollutant such as PM_{10}, $PM_{2.5}$, SO_2 and NO_x (ambient) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.	The EC, its compliance along with monitoring data is being uploaded regularly on BCCL official website. The photo of the display of critical sectoral parameters at the entrance of mine office is attached as **Annexure XXV.** http://www.bcclweb.in/?page_id=20425
xvii	The project proponent shall submit six monthly compliance reports on status of compliance of the stipulated environmental clearance conditions (both in hard copy and in e-mail) to the respective Regional Office of the Ministry, respective Zonal Offices of CPCB and the SPCB.	Six monthly reports of cluster –IX is regularly submitted to (twice in a year) the Regional Office of MoEFCC, Ranchi along with required data and information in soft copy.
xviii	The Regional Office of this Ministry located at Bhubaneswar shall monitor compliance of the stipulated conditions. The Project authorities shall extend full cooperation to the Office(s) of the Regional Office by furnishing the requisite data / information / monitoring reports.	Project will extend its all possible support and cooperation to the Regional Office in any kind of monitoring/visit/data collection etc.
xix	The Environment Statement for each financial year ending 31 March in for-V is mandated to be submitted by the project proponent for the concerned State Pollution Control Board as prescribed under the Environment (protection) Rules, 1996, as amended subsequently, shall also be uploaded on the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MOEF by E-mail.	Complied regularly on time. Attached as **annexure XXVI.**
Sl. No.	**C.) Other Conditions by MOEF :**	**Compliance**
i	The Ministry or any other Competent Authority may stipulate any further condition(s) for environmental protection.	Complied. Following additional measure as informed by MoEF and JSPCB from time to time
ii	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment (Protection) Act, 1986.	Agree.

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iii	The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act 1991 along with their amendments and Rules, the proponent shall ensure to undertake and provide for the costs incurred for taking up remedial measures in case of soil contamination, contamination of groundwater and surface water, and occupational and other diseases due to the mining operations.	The storage of materials does not attract PLA, 1991.
iv	The Environmental clearance is subject to the outcome of the Writ Petition filed by M/s Bharat Coking Coal Limited (BCCL) in response to the closure orders issued by the Jharkhand State Pollution Control Board which is pending in the Jharkhand High Court.	Agree.

25/5/21

Area Manager (env.)
Lodna Area

25/05/21

Project Officer
Amal. Joyrampur Colliery

21.05.2021

Project Officer
NT-ST (Exp.) OCP

26/5/21

General Manager
Lodna Area

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Annexure I

Calendar Plan

LODNA AREA

2021-22 (AAP Tgt.)

COAL

UNIT	PATCH	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Amal.NTST-JG Colliery	Patch-B	100.000	95.000	95.000	95.000	85.000	85.000	90.000	105.000	110.000	130.000	110.000	135.000	1235.000
	Patch-F	130.000	130.000	125.000	115.000	115.000	120.000	140.000	145.000	155.000	165.000	155.000	175.000	1670.000
	Hired Total	230.000	225.000	220.000	210.000	200.000	205.000	230.000	250.000	265.000	295.000	265.000	310.000	2905.000
	Dept.	50.000	50.000	50.000	40.000	40.000	41.000	50.000	60.000	70.000	85.000	74.000	90.000	700.000
	Total	280.000	275.000	270.000	250.000	240.000	246.000	280.000	310.000	335.000	380.000	339.000	400.000	3605.000
Kujama Colliery	Patch-G	30.000	40.000	50.000	45.000	45.000	45.000	50.000	50.000	55.000	60.000	60.000	65.000	595.000
Grand Total		310.000	315.000	320.000	295.000	285.000	291.000	330.000	360.000	390.000	440.000	399.000	465.000	4200.000
Asking Rate (TPD)		10333	10161	10667	9194	9194	9700	10645	12000	12581	11739	14194	14250	11507

O B R

UNIT	PATCH	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Amal.NTST-JG Colliery	Patch-B	542.000	592.000	591.000	542.000	542.000	541.000	592.000	592.000	641.000	642.000	556.000	641.000	7014.000
	Patch-F	314.000	364.000	363.000	314.000	314.000	313.000	364.000	364.000	363.000	383.000	362.000	382.000	4200.000
	Hired Total	856.000	956.000	954.000	856.000	856.000	854.000	956.000	956.000	1004.000	1025.000	918.000	1023.000	11214.000
	Dept.	211.000	211.000	212.000	201.000	201.000	202.000	221.000	221.000	222.000	232.000	223.000	243.000	2600.000
	Total	1067.000	1167.000	1166.000	1057.000	1057.000	1056.000	1177.000	1177.000	1226.000	1257.000	1141.000	1266.000	13814.000
Kujama Colliery	Patch-G	190.000	190.000	290.000	300.000	300.000	300.000	390.000	490.000	490.000	500.000	440.000	500.000	4380.000
Grand Total		1257.000	1357.000	1456.000	1357.000	1357.000	1356.000	1567.000	1667.000	1716.000	1757.000	1581.000	1766.000	18194.000
Asking Rate (Cum/Day)		41900	43774	48533	43774	43774	45200	50548	57200	55355	56677	54517	56968	49847

DESPATCH / OFFTAKE (Fig. in te)

UNIT	MODE	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	TOTAL
LODNA AREA	RAIL	220000	226000	220000	218000	218000	218000	228000	229000	240000	240000	230000	256000	2743000
	ROAD	150000	150000	150000	148000	148000	148000	150000	149000	169000	158000	150000	159000	1829000
	TOTAL	370000	376000	370000	366000	366000	366000	378000	169000	409000	398000	380000	415000	4572000
Asking Rate (TPD)		12333	12129	12333	11806	11806	12200	12194	12600	13194	12663	12839	13571	12526

Reported Production Coal & OB, up to 31.03.2021

COAL

	Tgt. MARCH	Daily Asking Rate	Coal on date	Last year on date	Current Prog. Month	Last Year Prog. Month	Up to Mar-21	Up to Mar-20	Prog. Year 19-20	Prog. Year 20-21	Growth %
Deptt.	83000	2677	3134	0	85064	20086	381358	358858	378944	466422	123.08
Hired		0			0	0			0	0	
Patch- B	98000	3161	5670	4986	95184	113526	363044	827374	940900	458228	48.70
Patch- F	122000	3935	3906	9900	135846	261972	1203876	952944	1214916	1339722	110.27
Patch- D										0	
Total Hired	220000	7097	9576	14886	231030	375498	1566920	1780318	2155816	1797950	83.40
Total	303000	9774	12710	14886	316094	395584	1948278	2139176	2534760	2264372	89.33

OB

	Tgt. MARCH	Daily Asking Rate	OB on date	Last year on date	Current Prog. Month	Last Year Prog. Month	Up to Mar-21	Up to Mar-20	Prog. Year 19-20	Prog. Year 20-21	Growth %
Deptt.	239000	7710	4080	6916	146252	176240	1276343	1087646	1263886	1422595	112.56
Hired		0			0	0			0	0	
Patch- B	594000	19161	10368	14844	446016	393744	7110330	4922050	5315794	7556346	142.15
Patch- F	267000	8613	8736	10152	255720	249552	2655514	2946052	3195604	2911234	91.10
Patch- D											
Total Hired	861000	27774	19104	24996	701736	643296	9765844	7868102	8511398	10467580	122.98
Total	1100000	35484	23184	31912	847988	819536	11042187	8955748	9775284	11890175	121.64

Despatch

	Tgt. MARCH	Daily Asking Rate	Desp. on date	Last year on date	Current Prog. Month	Last Year Prog. Month	Up to Mar-21	Up to Mar-20	Prog. Year 19-20	Prog. Year 20-21	Growth %
Rail	194000	6258	23609	4060	166842	275202	839633	1586054	1861256	1006475	54.08
Road	160000	5161	1710	25	40553	31986	913536	667086	699072	954089	136.48
Total	354000	11800	25319	4085	207395	307188	1753169	2253140	2560328	1960564	76.57

Year	Quantity of coal produced (Tonn.)	OB excavated (Cum.)	Top soil generated (cum)	Backfilling area (Ha.)	Reclaimed Area (Ha.)
2013-14	**3359851**	**12595276**	414332	3.60	Nil
2014-15	**3530017**	**16334190**	420456	4.38	5
2015-16	**3826689**	**18987993**	479584	5.00	7
2016-17	**3839054**	**23204981**	66049	1.60	7
2017-18	**3192316**	**17999510**	492342	4.75	7
2018-19	**2484642**	**10362176**	187598	-	3.8
2019-20	**2534760**	**11027419**	12552	-	0.3
2020-21	**2264372**	**11890175**	5000	-	16

Global Expression of Interest (EoI)

For

Dealing with coal mine fires in lease hold of BCCL in Jharia Coalfield, Dhanbad, Jharkhand, India. Detailed scope of work as given in the document.

LAST DATE OF SUBMISSION : 28.04.2014

1. BHARAT COKING COAL LIMITED: A PROFILE

Bharat Coking Coal Limited incorporated in January, 1972 as a fully owned subsidiary of Coal India Limited a 'Maharatna' Public Sector Undertaking under the Ministry of Coal, Government of India. Being the sole repository of prime coking coal in the country, BCCL, at present operates 68 coal mines spread over in Jharia Coalfield and part of Raniganj Coalfield apart from 6 coking coal washeries & 2 non-coking coal washeries. The mines are grouped under 12 areas for administrative convenience. BCCL has some unique inherent and perennial characteristics which are adversely affect the normal operation of the Company. Difficult geo-mining conditions involving large number of coal/dying coal seams, preponderance of old workings, high degree of gassiness, coal fires affecting working seams, water logged upper seams above current places of working, etc. restricts coal production and productivity. Besides, high density of population in the coal bearing areas limits the equipment size of opencast operations apart from being an impediment to acquisition of land for uninterrupted operations. In the year 2012-13, the company achieved a coal production of 31.21 million tons and offtake of 32.99 million tons thereby registering the highest ever the Turnover and Profitability (PAT) of Rs 9817662 Cr. and Rs 1709.06 respectively. A brief description of the organizational structure and the detailed activities of Bharat Coking Coal Limited can be viewed in the website http://www.bccl.gov.in.

The mission is to produce planned quantity of coal efficiently and economically in an Environmentally manner with due regard to Safety, Conservation & Quality. The company strives to meet the growing demand of thermal as well as metallurgical coal in the country in a environmentally and socially sustainable manner.

SE-10

2.2. Bidder's Credential Requirement:

i) The bidder(s) must have successfully dealt with mine fire in at least two coal mines, one open cast and one underground mine. The annual capacity of opencast and underground mines should be at least 2 Mt and 0.5 Mt respectively during last seven years of the financial year. The documentary proof of successful dealing with fire shall be submitted along with the bid.

ii) The bidder in their name must have achieved a minimum average annual financial turnover of INR One Hundred Million or equivalent USD during last 3 years ending 31st March of previous financial year. The documentary evidence to this effect would be copies of audited Balance Sheet and Profit & Loss A/c duly countersigned by the authorized representative of bidding company and a declaration to the above effect duly signed by the authorized representative of bidding company & countersigned by a Chartered Accountant or equivalent.

iii) The bidder must provide "key personnel" (minimum number) of the following categories with requisite qualification and experience :-

Sl. No	Skill of key personnel	Requisite Qualification	Minimum Experience	Minimum Nos. for eligibility
1.	Technical Expert (Mining/ Fire dealing/ Mine Rescue)	B.E./B.Tech (Mining) or equivalent	10 years	10
2.	Technical Expert (Geology/Remote Sensing)	M.Sc (Geology) or equivalent	10 years	2
3.	Technical expert (Environment)	B.Tech/B.E/M.Sc (Envt) or equivalent	10 years	1
4.	Technical Expert (Infrastructure)	B.E./B.Tech (Civil/Mechanical / Electrical / civil) or equivalent	10 years	3
5.	IT Expert	B.E/B.Tech/ M.Sc (Computer) or equivalent	10 years	1
6.	Financial Expert	MBA(Finance)/Chartered Accountant/ICWA or equivalent	10 years	1

Note :- The bidder shall designate one of the team members as the team leader.

The documentary evidence to it - effect would be self-attested CVs including necessary competency certificate for work in Indian mines duly countersigned by the authorized representative of bidding company.

iv) Copy of PAN (Permanent Account Number) with Income Tax Authority in India for bidder(s) from India.

v) Copy of PAN Based Service Tax Registration Number in India for bidder(s) from India.

3.0 Availability of details for EOI

Details for EOI including Terms and Conditions of EOI can be collected from the following place during the period as stated below:

Date: From 27.01.2014 to 26.02.2014

Time: **10.00 AM to 1.00 PM** (on all working days)

Office of the GM (CMC)
Contract Management Cell, BCCL
Level-V, Koyla Bhawan,
Dhanbad - 826005

Details for EOI including Terms and Conditions of EOI can also be downloaded directly from the BCCL web-site http://www.bccl.gov.in and NIC Portal, website http://www.tenderwizard.in during the period as mentioned above.

4.0 Pre - EOI submission meeting :

Pre - EOI submission meeting will be held on 14.02.2014 at 11:00AM in the office of GM (CMC), BCCL, Level-V, Koyla Bhawan, Dhanbad for clarifications and discussion.

5.0 GENERAL INSTRUCTIONS FOR SUBMISSION OF EOI :

Expression of Interest (EOI) shall be submitted by the Consultants / agencies / firms / organizations in a sealed envelope superscribed with "**EOI for Dealing with coal mine fires in lease hold of BCCL in Jharia Coalfield, Dhanbad, Jharkhand, India. Detailed scope of work as given in the document.**" giving EOI reference no. with due and full postal address & telephone nos. on the envelope.

6.0 RECEIPT OF EOI

EOI will be received in sealed envelopes up to **28.04.2014** at the following address only:

Office of the GM (CMC)
Contract Management Cell, BCCL
Level-V, Koyla Bhawan,
Dhanbad - 826005

The offers may be submitted through post also. BCCL takes no responsibility for delay, loss or non receipt of the offers sent by post. Fax offers or offers sent through e-mail shall not be accepted.

SCT-10

7.0 OPENING OF THE EOI :

EOI will be opened on 29.04.2014 at 04.00 PM in the office of the GM (CMC), BCCL, Level-V, Koyla Bhawan, Dhanbad-826005.

Bidders are requested to go through the details of EOI document & confirm all the required documents along with the proposal. Each page of the proposal shall be signed with seal.

8.0 Prospective parties may note that mere submission of EOI and / or submission of additional information do not automatically entitle them to claim for pre-qualification. BCCL reserves the right to seek for any other information during the process of evaluation, if required.

10.0 BCCL reserves the right to reject any / all the applications to EOI without assigning any reason(s) whatsoever thereof.

Sd/-
General Manager
(Contract Management Cell)

Distribution :

1. PRO :- With a request to publish the abridged EOI as enclosed in local as well as National dailies as per norms of the Category and also arrange to send the paper cutting of publication to the Contract Management Cell.
2. DT(CP) / DT(F&P) / DT(P) / DT(T) / CVO.
3. GM(Co-ordn.) / GM(S&M) / GM(FA&C) / GM(M&M) / GM(C&M) / GM(Envt) / GM(P&P) / GM(IE) / GM(System) / Dy. GM (Estt.), BCCL.
4. Sr.ES to CMD - for kind information of CMD.
5. HOD (Admn) with a request to display this EOI in Koyla Bhawan Notice Boards.
6. All CGMs/GMs of the Areas including Washery Zones for wide circulation through display in the Notice Boards.
7. Inspector, CISF - with a request to deploy security personnel at the office of GM (CMC), Level-V, Koyla Bhawan on 28.04.2014 from 9.30A.M to 4.00P.M and on 29.04.2014 from 3.30 PM till completion of the meeting.
8. Dept. In-Charge, BCCL, M.M Division, 4th floor, 6, Lyons Range, Kolkata.
9. CGM / GM (Contract Management Cell), WCL/SECL/NCL/MCL/ECL/CCL & CIL.
10. Sri R.R. Choubey, Sr. DEO / Sri B.N Banerjee, DEO, CMC Deptt. - to upload this EOI in BCCL Website and forward soft copy of NIC format to GM (System) for uploading the same at NIC portal website (soft copy of the same is enclosed for ready).

Sd/-
General Manager
(Contract Management Cell)

Annexure III

Gmail

Environment Lodna Area <envlodna@gmail.com>

Fw: Recommendation of Indira Gandhi Centre of atomic Research, Kalpakkam for dealing the fire in coal mine in Jharia coalfield.

O.T.G.Nair <diradmn@igcar.gov.in> 24 February 2020 at 13:47
To: envlodna@gmail.com
Cc: "Venkatraman B.[Dir SQRMG]" <bvenkat@igcar.gov.in>, borah@igcar.gov.in

Sir,

It appears that the reference to IGCAR in the MoEF letter dated 21-5-2013 is erroneous. You may like to check-up with MoEF. .

Regards,

Director (P&A)

From: Environment Lodna Area
Sent: Saturday, February 15, 2020 12:35 AM
To: O.T.G.Nair ; borah@igcar.gov.in
Subject: Re: Fw: Recommendation of Indira Gandhi Centre of atomic Research, Kalpakkam for dealing the fire in coal mine in Jharia coalfield.

Dear Sir,

As per **EC no: J-11015/307/2010-IA-II (M) dated: 21st May 2013, Specific condition no. iv** (copy attached) of Cluster IX, it is mentioned that the recommendation of Indira Gandhi Centre for Atomic Research, Kalpakkam should be followed. Cluster IX of mines situated in Lodna Area of Jharial Coal field is highly affected by fire.

We request you provide us the recommendation made by your institution for dealing the fire in the following address.
Enclosure: EC (Cluster IX)

warm regards
General manager

On Thu, 9 Jan 2020 at 22:32, O.T.G.Nair <diradmn@igcar.gov.in> wrote:

> Dear Dr. Borah,
>
> The previous papers were sent to you for a response to the firm. Please look into this.
>
> Regards,
>
> OTG Nair
>
> **From:** Environment Lodna Area
> **Sent:** Saturday, January 11, 2020 12:59 AM
> **To:** O.T.G.Nair
> **Subject:** Re: Fw: Recommendation of Indira Gandhi Centre of atomic Research, Kalpakkam for dealing the fire in coal mine in Jharia coalfield.
>
> Dear Sir,
> Please give your recommendation. We need to comply this condition as per EC given by MoEF&CC and we have to submit the report to MoEF&CC.
> So You are kindly requested to do the needful at the earliest.
>
> warm regards
> General manager

Annexure IV


KUJAMA COLLIERY
JEALGORA COLLIERY
BADULIA COLLIERY
JOYRAMPUR COLLIERY
PATCH-B
PATCH-A
PATCH-II
XIV SM
O.B. DUMP
COAL DUMP No.26
DISHARGARH
DISHERGARH
DISWADIH COLLIERY
BARAREE COLLIERY
C.F.R.I
DENOBIL SCHOOL
BATHROOM WASHERY
M (W/B)
N (WATER)

CHAPTER – I
INTRODUCTION

1.0 Introduction

NT-ST-Jeenagora group of mines consist of three existing mines of Lodna Area of BCCL, namely, NTST OCP (256.15 Ha), Jeenagora OC (276.05 Ha) and North Tisra UG (246.24 Ha). These mines came into operation before nationalisation. In addition, the group also includes a very small part of Joyrampur UG. At present these mines are operating in NTST-Jeenagora Group of Mines.

The above Group of Mines are covered in Cluster IX for EMP. As per the approved Terms of Reference (TOR) in the proposed scenario (from April 2012 tentatively) for preparation of the Environment Management Plan of Cluster IX of BCCL, NT/ST (Exp) OCP is proposed to be worked by carving 755.15 Ha of land from the property of above four existing mines and additional 675.98 Ha land from outside coal bearing area for OB dumping and infrastructure. Hence the area of proposed NTST Expansion OCP is 1431.00 Ha which comprises 755.15 Ha land for mining and 675.85 Ha land from non-coal bearing area for OB dumping.

Within the proposed quarry area, there are three sanctioned opencast Mines viz. North Tisra OCP, South Tisra OCP and Sulunga- Jeenagora OCP (within Jeena Gora Colliery Boundary). All these projects are operating mines and are in the category of "Completed Projects of BCCL". In addition to these OCP's , there is one Underground production units in North Tisra Colliery boundary, namely 6 Incline .The underground production units along the three above mentioned opencast mine will be closed before merging into the proposed opencast project.

The present production from the different operational units is given in Table 1.1.

Table 1.1 Present Production Units – NT-ST-Jeenagora Group of mines

Sl. No.	Working Unit	Method of work with seam	Production ('12-'13) (MTY)	Remarks
1	NT/ST OCP	OCP (IV to I seam)	0.872	Shovel Dumper Combination by Deep Hole Blasting Method
2	Jeenagora OCP	OCP (IV Top to III seam)	1.057	Shovel Dumper Combination by Deep Hole Blasting Method
3	North Tisra UG	UG (IV BOTTOM)	0.095*	Bord & Pillar method with SDLs.

***** Likely to be closed soon due to OCP operation

This mine closure plan has been prepared on the basis of Project Report on NTST Expansion OCP & approved TOR/Form–I(Proposed Scenario) and data furnished by the officials of Lodna Area/ BCCL.

1.1 Name of mine owner / company

Project: North Tisra/ South Tisra (Expn.) OCP
Area: Lodna Area
Company: BCCL
Mine Owner: Director (Technical) (Operation), BCCL (Nominated)

1.2 Address for Communication with PIN and Phone nos.

PO : Khas Jeenagora
District : Dhanbad
State : Jharkhand
PIN : 828 115
Mob(Agent) : +91-9470596903

1.3 Location of mine:

Latitude :	$23^0$41'50'' to $23^0$43'48'' North
Longitude :	$86^0$26'14'' to $86^0$27'33'' East
Area :	Lodna Area
Coalfield :	Jharia Coalfield

1.4 Capacity of the mine

Mine started:	Proposed
Date of start of production:	Proposed
The capacity of the mines	6.0 MTY (PEAK – 7.8MTY)

1.5 Method of Mining including equipments deployment of in the area

There are three active units working in the lease hold area of NT/ST (Expn.) OCP as depicted in the Table 1.1. The NT/ST OCP is being worked in IVT, IVB, III, IIT, II B & I by opencast method using shovel & dumper combination, departmentally. Total O.B. of the running quarry is being dumped in decoaled area of the existing quarry on the floor of I seam. Deep hole blasting is being adopted for the quarrying. Blasted coal and overburden is further loaded by shovels on to the dumpers deployed for it. In Jeengora OCP, mechanised open cast mine is being worked in geologically IV Top, IV Bottom, & III seams. On an average IV Top seam & IV Bottom seams are 4.8m & 6.1m thick respectively while III seam is about 12m thick. IV Bottom has been developed in one section and SOP.

At North Tisra UG IV Bottom seam is being worked which has been extensively developed on B&P method of mining through 6 incline. The gradient of seams is suitable for the deployment of SDLs, wherever thickness permits. The average gradient of seam is around 1 in 5. It is, therefore will follow the B&P method of mining with SDL loading onto tubs. Apart from these three units, there is some part of Joyrampur UG mine considered in the proposed NTST Expansion OCP where VIII and IV Top seams are being worked at present. The seam IV (T) is being developed by Bord & Pillar with

SDL while the VIII seam is being depillared with stowing which will be replaced by V/VI Seam.

Seam IX/X, VIIIA, VIII, V/VI/VII, VII, V/VI, IVT, IVB, III, IIT, IIB & I have been considered for exploitation within the leasehold of the proposed NT/ST (Exp) OCP. The base of the quarry will be floor of I seam.

1.6 Coal Processing/ Beneficiation Operation

At present coal production from North Tisra UG is mostly linked by rail to steel sector and power plant through JGB No. 9 siding which is 2-3 km from the mine. Coal from pit head stock to siding is transported by road contractually. A part of its production is linked to various private cokeries through road. Coal from NT/ST OC is being dispatched through JGB No. 9 and 6 sidings for different thermal power stations. Road linkage for public sale is being carried through E-Auction. The production from Jeenagora OC is being sent to power house by rail. Some coal is being transported through road sale.

In proposed NT/ST (Expn.) OCP, the non-coking coal from the project will be linked to thermal power station. NLW coal will also be linked to TPS till it is unacceptable to SAIL/Washery. Coking coal (S-II to W-IV) will be linked to SAIL/Washeries. Jhama will be linked to cement companies, refractories etc.
No beneficiation is envisaged for the current output of the group of mines.

1.7 Total Lease/Project Area involved:-

Existing	:	755.15Ha
Proposed	:	1431.00Ha(including existing)
Total	**:**	**1431.00Ha**

1.8 Type of Lease /Project Area (Ha):-

Table 1.2 Type of Lease Area

Sl. No.	Particulars	Mining Area(Ha)	Outside mining area (Ha)	Total * (Ha)
1	BCCL land	568	65	633
2	Forest land	Nil	17	17
3	Govt. land	22	65	87
4	Tenancy land	60	616	676
5	Others (Rly. Land)	18.0	Nil	18.0
	Total	668.0	763.0	1431.0

*Includes 675.98 Ha of land outside of Cluster IX, proposed to be used for external dumping.

1.9 Communication and Physiography

The proposed NT/ST (Exp) OCP is well connected by rail and road. It is about 15Km south of Dhanbad town. The Jharia – Baliapur District Board road passes parallel to northern boundary and Patherdih-Pradhankhanta Rly. Line passes adjacent to southern boundary of the project.

The area has an undulating topography with a gentle slope towards west. The mining activity which is going on in the area since long time has severely obliterated the general topography. The maximum ground elevation of 202m has been observed in the north-eastern part while the minimum elevation is 163m in south-western part at BH No. ST-2. The drainage of the area is controlled by southerly flowing Tisra jore on the west side of the property.

1.10 Type of Present and Proposed Land Use of mining area (Ha)

Table 1.3 Land Use of Mining Area(Based on Mine data)

Sl. No.	TYPE OF LAND USE		Present mining land use (in Ha)	Post mining land use (in Ha)
1	Running quarry	Backfilled	47.11	0.00
		Not back filled	63.77	0.00
2	Abandoned quarry	Back filled	115.40	0.00
		Not back filled	35.85	0.00
3	External OB dump		45.93	0.00
4	Service Building/ Mine Infrastructure		36.61	25.00
5	Coal dump		5.42	5.00
6	Road & Rail		27.04	18.00
7	CHP/Siding			45.00
8	Homestead land		680.21	0.00
9	Agriculture land		6.00	0.00
10	Forest land		17.00	17.00
11	Plantation		20.80	886.93
12	Water body		9.62	164.46
13	Barren Land		320.24	269.61
	TOTAL		**1431.00**	**1431.00**

1.11 Statutory Approvals

Table 1.4 Statutory Approval Status

Sl. No	Particulars	Status
A	Mine plan / F.R / P.R	Formulated
B	Forestry clearance	Under process
C	Env clearance	Under process
D	Consent to operate	Existing Mines
E	Any other approval from Central / State regulatory authorities for operating mine with special reference to mine closure.	Mine closure plan to be approved by BCCL Board of Directors.

1.12 Reasons for Closure

The proposed NTST Expansion OCP has been planned after merging the properties of existing NTST –Jeenagora group of mines for a nominal capacity of 6.0MTY having an extractable reserves of 145.08MT. With this rate of production, the life of the project will be 30 years. This includes 2 years of pre-construction period, 2 years of construction periods and 26 years of production periods. There may be a scope of expansion of the mine further dip-side after reaching the proposed boundary as per the PR. In such situation, it is proposed that a new Mine Closure Plan should be prepared in the changed scenario.

A Report titled "***Draft scheme for dealing with fire by excavation method below Dhanbad-Patherdih Railway Line at Lodna Area (XI/XII Seam Base)***" was prepared and the Report is likely to be implemented in future to deal with the seams on fire. If the proposal is implemented, it is proposed that a Revised Mine Closure Plan should be prepared, taking into account the new emerging scenario.

Any mines in this group may be closed in future on account of exhaustion of economically recoverable coal reserves in the lease hold area before the start of the expansion project. It may also be closed on account of other unforeseen reasons i.e. Force Majeure or directives from statutory organizations or court etc. for which information and notices shall be served to concerned Government authorities and departments. Under such conditions, a revised Mine Closure Plan should be prepared. As per guidelines of Ministry of Coal, Govt. of India, mine closure plan has to be submitted along with the mine plan for getting competent approval within one or two years of date of approval of mine plan.

1.12.1 Need of Mine Closure Planning

Mining is a hazardous operation as it offsets the equilibrium of natural depositional environment viz. it alters or tries to alter the in-situ field stress, ground water, surface drainage system as well as the socio-economic

condition. Although mining activities are usually short term phenomena, they are liable to leave long lasting impacts on landscape, ecology and on the mind set of local inhabitants. Thus, it is imperative that any mining venture should have adequate closure plan addressing issues like reclamation, environmental protection and rehabilitation of disturbed area which should be acceptable to local community as well as the regulatory authority. Community acceptable implementation of mine closure plan bound to incur some extra cost. Neglecting this aspect will lead to future problems of attending compensation or may creep up expensive socio-economic problems.

Mine closure encompasses the restoration process designed to restore physical, chemical and biological quality disturbed by the mining activities. Mine closure is not just something that happens at the end of a mine's life, rather mine closure is an ongoing series of decisions and activities beginning in the pre-mining stage of mine and ending with a creation of self sustainable site that can be returned to the community.

Thus, a mine closure plan needs to define the liabilities, responsibilities and authorities of the different agencies like the mine management, other regulatory bodies, Central and State Governments after mine closure.

Various objectives of the advance mine closure planning are as given below.

a. To allow productive and sustainable after-use of the site, which is acceptable to the mine owner and the regulatory authority
b. To protect public health and safety
c. To eliminate environmental damage and thereby encourage environmental sustainability
d. To minimize adverse socio-economic impacts of mining activities
e. To protect the flora and fauna of the area affected by the mining
f. Effective use of the assets created during the course of mining

Primarily, the mine closure activities are planned in two stages. The initial plan identifies the activities required to be executed in line with the mining activities in progress, after the inception of the project, i.e., progressive mine closure activities. These activities may undergo subtle changes depending upon the actual site condition during implementation. Finally, a detailed closure plan is to be prepared 4-5 years before the actual closure time of the mine depending upon the existing parameters at that point of time, i.e., final mine closure activities.

1.12.2 Mine closure planning strategy in respect of NT-ST-Jeenagora Group of mines based on existing set of parameters

As the balance life of the mine is 30 years from now for the seams proposed to be worked , following activities are envisaged towards mine closure programme in respect of NT-ST-Jeenagora Group of mines.

a. Progressive mine closure activities will continue as envisaged in the project report and as enumerated in the various approvals, permits, consents etc. The progressive Closure activities are funded by levying a charge of ₹ 5.50/Te of coal for opencast mines.

   The recent guidelines issued in this regard by MoC, GoI will also be followed.

b. Although, it is very difficult to foresee the likely impacts due to closure of the mining activities in the leasehold area of the project, but in the present report, the same has been estimated and some mitigating measures have been suggested accordingly. These suggested measures along with certain other measures, as deemed fit, at the time of closure of mining activity in the seams being worked at present shall be taken up.

c. The final closure plan carrying the finer details would be prepared at the time of preparing the mine plan for last mineable patch of coal seam in the leasehold area of the group.

1.13 Approval of Company Board of Directors or any other competent authority

The closure plan will be placed to Board of Directors of BCCL for approval.

CHAPTER – II

MINE DESCRIPTION

2.1 Geology of the group

Geology of the block has been established by surface and sub surface data. The leasehold area of the NT-ST-Jeenagora Group of mines is entirely covered by Barakar formation. The coal bearing rocks of Barakar formation of Permian age occur in the NT-ST-Jeenagora Group of mines is located on the eastern edge of Jharia Coalfield, where rocks of Talchir, Barakar & Barren Measures are exposed in patches. However NT-ST-Jeenagora Group of mines is generally covered by soil which is underlain by the coal bearing rocks of the Barakar Measures.

A total of 44 boreholes have been drilled in time phases in the entire project. In addition, data of adjoining 10 boreholes have also been considered for the evaluation of geological features. The borehole density in the area is approximate 8/Sq. Km.

2.1.1 Geological Structure of the area

Dip & Strike

The general strike of the formation is North-South. In the small strip, strike of the formation swings to NNE-SSW, in the southern/south-western corner of the assessment area. The amount of dip varies from 8^0 to 11^0 westerly. The dip is however, steep towards southern part, adjacent to Fault F6-F6, because of the proximity of the area to the major fault.

Faults

A total of 7 faults having throw ranging from 2m to 20m have been deciphered in the area.

Pyrolitisation

The area is free from pyrolitisation, however seam II (Bottom) and I seam have been affected due to pyrolitisation in small part of the area, and the seam is partially/fully burnt in small part of the area.

2.1.2 General Description of coal seams

In NT-ST-Jeenagora Group of Mines, detailed drilling has proved existence of number of workable coal seams of over 0.50m thickness from XI/X to I seam.

2.1.3 Seam sequence

The generalised sequence of coal seams and the intervening partings in proposed NT/ST (Exp) OCP are given in Table 2.1.

Table 2.1 Generalised Seam Sequence and Parting

Seam/Parting	Thickness (m)	
	Minimum	Maximum
IX/X	8.17	12.06
P	14	38
VIIIA	1.00	5.47
P	4	30
VIII	1.45	3.93
P	2	3
V/VI/VII	15.10	17.74
P (VIII to VII)	3	22
VII	5.02	9.57
P	2	20
V/VI	4.32	8.44
P	20	33
IV TOP	1.52	6.95
P	13	19
L-5	0.76	2.60
P (L-5 to IVB)	2	6
P(IVT-IVB)	12	29
IVB	1.98	7.02
P	18	33
III	8.60	19.81
P	1	16
II TOP	0.90	5.75
P	1	13
II BOT	1.22	7.46
P (III to II Comb)	3	6
II (Comb)	5.80	7.6
P (IIB to I)	2	18
P (II Comb to I)	4	13
I	1.82	8.28

2.1.4 Reserves, Types and Quality

Balance mineable reserves have been given in the Table 2.2.

Table-2.2 Seam wise Grade & Reserve(as per PR)

Seam	Grade	Bal. Min. Res. (MT)
IX/X	W-IV	1.08
VIIIA	W-IV	2.27
VIII	W-III	2.69
V/VI/VII	W-IV	3.16
VII	W-IV	4.99
V/VI	W-IV	9.19
IVT	F	9.42
L-5	D	1.21
IVB	F	11.52
III	E	52.42
II Comb	E	5.32
IIT	D	7.42
IIB	E	12.37
I/I & IIB	W-IV	22.02
		145.08

Note: The reserve data estimated is based on the actual situation prevailing in the area. This reserve includes jhama also.

2.2 Mining Details

2.2.1 Boundary Details of NT-ST-Jeenagora Group of mines

North: - Colliery boundary between N. Tisra & Goluckdih/Kujama Collieries.

South:- Incrop of I seam in Bhulan Bararee thrust zone

East:- Intcrop of I seam and Metamorphics.

West:- 200m margin from incrop of XI/XII seam

2.2.2 Present Working Seams

North Tisra/South Tisra Opencast Mine: This opencast mine is operating within the sanctioned area and exploiting IV to I seams. Present production level is 0.872MTY.

Jeenagora Opencast (Patch): Production from III, IVB & IVT seams are being done in the name of Jeenagora (Patch) OC. OB Dumping in being done internally over the coal bearing area. Present production level is 1.057MTY.

Thus, total production from l these two opencast mines is 1.929MTY.

North Tisra UG: Total production from the underground unit from within the proposed quarry area is 0.095MTY. The winning of coal is being carried out from IVB seam.

2.3 Mining Methods

The proposed NTST Expansion OCP opencast is an expansion of the existing opencast mines. In the existing opencast mines, though infrastructure has been created but they are suitable for small level of production. The proposed opencast is a large mine with higher level of mechanisation. Therefore, all necessary infrastrcture need to be created for the larger project.

In the first two years of implementation of the proposed project (1st & 2nd) land will be acquired and shifting / rehabilitation of houses will be done to make the site available for working. During 3rd & 4th year of the project necessary infrastructure will be created like Workshop / Store, Power Supply arrangement, Feeder Breaker, Railway Siding etc. During these four years of construction (1st to 4th) of the expansion project, existing opencast mines will continue to produce coal & excavate OB. In fact the operation of the existing mines will be tailored to prepare the mine for larger level of mechanisation for the proposed 6.0 mty Opencast.

OB excavation and coal production from the proposed opencast will start by 5th year of operation and target will be achieved by 6th year. By this year all major construction activities will be completed for sustaining the production level for the entire project life.

2.3.1 The status of working and fire in different seams:

The status of exploitation of various coal seams and the area under fire considered in this report is based on the mine working plan supplied by the colliery authorities. The status of working and the fire limit of different seams are given below:

IX/X Seam: This seam has been extensively worked by UG method. The seam has been goaved in major part of the area and is under fire. This seam has also been quarried out in outcrop region.

VIIIA Seam: This seam has been quarried out in patches along the incrop region and extensively worked by underground method in major part of the area. The seam has been goaved also in major part, particularly in northern side of the area. The seam is under fire in northern part.

VIII Seam: The seam has been extensively worked by UG method. It has been quarried out along the incrop region. The seam has been goaved also in major part. The seam is under fire in northern half of the area.

V/VI/VII Seam: This combined seam is restricted to northern part of the area. The seam have been developed in two sections and quarried also towards incrop side. The seam is goaved at places. Seam is on fire in the northern part of the area.

VII Seam: This seam is quarried out in major part of incrop region. The seam has been worked through inclines in major part. It is developed in one section in major part and two sections working in small area in Jeenagora colliery only. The seam has been goaved also in patches. The part area of the seam is on fire also.

V/VI Seam: This seam is also extensively developed in the entire area and quarried out in incrop region. The seam has been goaved also in central part of the area. The seam has been developed in one section by underground method. The seam is under fire also in part area.

IV Top Seam: The seam is quarried in incrop region only and the seam is virgin in major part of the area. It has developed also through underground working in Jeenagora Colliery only.

IV Bot. Seam: The seam has been worked by underground method and it is quarried also. In small part, the seam is goaved and depillared.

III Seam: The seam has been quarried out in incrop region and it is extensively developed also. Two section of workings have been done in major part of the area.

II Top Seam: This seam has been mainly worked by opencast method. Underground development is restricted to South Tisra colliery only.

II Bot Seam: This seam is developed by UG method in major part of the area and quarried also in incrop region. The seam is virgin in dip side.

I Seam: This seam is developed only by underground method. In the northern side, the seam is goaved in incrop side. The seam is quarried also in small part.

2.3.1 OB dumps and their status

Table 2.3 OB Dump Status

	External OB Dump	Internal OB Dump
Nos.	Nil	4 (D1, D2, D3,D4)
Area (Ha)	Nil	(D1=31.9, D2=65.4, D3=7.15,D4=11) Total=115.45
Volume (capacity)	Nil	35 million Cum
Height (m)	----	D1=50, D2=70, D3=40,D4=50
Status	----	Active- D1, D2, D4 Dormant-D3

2.3.2 Depth of Workings & Mine Entries

At present all working seams occur at depth of 102 m in the quarry. All the underground mine entries except for the Incline of NT UG in the leasehold area are sealed or dozed off.

The details of existing outlets of North Tisra UG are as follows :

Name of the Outlet	Sunk in	X-sec. (mXm)	Purpose	winder/ Fan
1/6 Incline	IV Bot.	3.5X2	Intake, production	Haulage – 115 KW
3/6 Incline	IV Bot.	3.0X2	Intake, travelling	
Fan drift Adjacent to 3/6 Inc.	IV Bot.	4.25X2	Return	Fan- PV-160

2.3.3 Major Equipments

Table 2.4A List of major opencast equipment at NT ST OC

SL. No.	Existing Equipment	Annual Productivity/ Eqpt (MM^3)	No. Of Equip ment	Total annual Capacity (MM^3)
A	EXCAVATION CAPACITY			
1	5.0 m^3 Elect Rope Shovel with RD – 35 T	0.86	07	6.02
2	2.7 m^3 Elect. Hyd Shovel with RD – 35 T	0.65	02	1.3
3	1.3 m^3 Diesel Backhoe with RD – 35 T	0.40	01	0.40
4	1.2 m^3 Diesel Backhoe with RD – 35 T	0.30	01	0.30
5	Dragline 6/45	1.00		1.00
B	TRANSPORTATION CAPACITY (Avg. Lead - 1.00KM)			
1	Rear Dumper 35 Te with 5 m^3 Electric Rope Shovel		28	
2	Rear Dumper 35 Te with 2.7 m^3 Electric Hyd Shovel		06	
3	Rear Dumper 35 Te with 1.3 m^3 Diesel Backhoe		03	
4	Rear Dumper 35 Te with 1.2 m^3 Diesel Backhoe		03	
C	MINE CAPACITY (MM^3/Year)			

Table 2.4B List of major opencast equipment at Jeenagora OC

Sl No	Existing equipment	Bucket capacity (m^3)	No of equipment	Annual capacity Mm^3.
1	EKG - 399	5	1	0.86
2	EKG - 266	4.6	1	0.79
3	EKG - 519	5	1	0.86
4	H-55 (HYD)	3.3	1	0.68
5	TATA Hitachi (HYD)	2.8	1	0.54
	TOTAL	**--**	**5**	**3.73**
DUMPER				
1	35 Te Rear Dumper	--	21	(0.18 x 21)= 3.78
2	Water tanker	--	1	--
	TOTAL		**22**	**3.78**
DRILL				
1	IDM – 30 (160 mm)	--	1	N/A
2	IDM – 70 (250 mm)	--	1	N/A
3	R (Colla) (150 mm)	--	1	N/A
4	ICM – 260 (100 mm)	--	1	N/A
	TOTAL	--	4	N/A
DOZER				
1	155 D	320 HP	3	--
Crain	9 (T)	--	1	--
Motor Grader	Middle Blade	135 HP	1	--

Table 2.4C List of major UG equipment at North Tisra UG

Sl No	Existing equipment	No of equipment
I	**SURFACE**	
1	Haulage 150 HP	1No
2	Ventilation Fan PV -160	1No
II	UNDERGROUND	
1	SDL	3 nos.
2	Endless Haulage 50 H P	1 no.
3	Direct Haulage 75 H P	2 nos.
4	Main Pump 150 H P	2 nos.
5	Pump 70 H P	2 nos.
6	Air Compressor 60 H P	3 nos.
7	T S U (315 KVA)	4 nos.
8	Main Pump 1000 GPM	1 no.

Table 2.4D List of major opencast equipment proposed at NT-ST-Jeenagora Group of Mines(NTST EXPN. OCP)

Sl.No.	Particulars	Peak Population
A.	**HEMM for OB**	
1	10 m^3 Electric Rope Shovel	8
2	5 m^3 Electric Rope Shovel	2
3	250 mm (Elec.) Drill	8
4	160 mm (Elec.) Drill	2
5	410 HP Dozer	8
6	320 HP Dozer	2
7	85 t RD	96
8	35 t RD	26
B	**HEMM for Coal**	
1	3.8-4.2 m^3 Elec. Hyd. Shovel	4
2	2.8 m^3 Elec. Hyd. Backhoe	1
3	160 mm (Elec.) Drill	5
4	320 HP Dozer	6
5	35 t RD	47
C	**Common for HEMM**	
1	280 HP Motor Grader	2
2	50 t Rough Terrain Crane	1
3	10 t Vibratory Roller for Haul Road	2
4	Jack Hammer Drill	10
5	3.96 m^3 / min Compressor	4
D	**HEMM for Misc. Activities &for Ecology & Environment**	
1	1.5 m^3 Diesel Hyd. Backhoe	2
2	8.5 m^3 / 10 t Tipper	8
3	28 KL Water Sprinkler	3
4	Mobile Env. Lab. Van	1
5	410 HP Dozer (for Reclamation)*	4

Infrastructure Facilities:

Existing

A) Magazine – Location, capacity and Licence no.

NT-ST OC has surrendered its license. At present required explosive is procured from the Magazine located in the leasehold area of the Barari Colliery. The specification of the Magazine is given below:

Location – west side of 6 Pit.

Capacity:

E- 25 (6) 962/ BI-1143	E-25 (6) 964/ BI-1145
Explosive class – 3. 1950 Kg.	Explosive Class – 3. 1950 Kg.
Class 6, Div- 1, 10,000 mts.	Class-6, Div I , 5000 mtrs.
Class 6, Div 3 5000 Nos.	Class 6, Div 2 5000 mtrs.
Class 6, Div 44000 Nos.	Class 6 Div 3 44, 000 Nos.
As any one time shall not exceed	At any one time shall not be exceed.
Not more than 10 times shall be in a month.	Not more than 5 times shall be in a month
Area - 6300 m^2	

B) Workshop

Existing:

NT-ST OC

Two workshops (one for NT OCP and other for STOCP) with independent store have been functioning with all required facilities including required manpowers.

Jeenagora OC

The repair and maintenance of excavation equipment are being done at the Jeenagora OCP Excavation Workshop. This workshop has the following facilities:

1. Washing of dumpers.
2. Welding.
3. Charging of batteries.
4. Auto repair shed.

5. Dumper shed.
6. Diesel fuelling shed.

North Tisra UG

There is a Pit Head Workshop. Help is taken for major works from Area Central Workshop. The colliery store is available. We are collecting materials from Lodna Regional Store and preserving the materials at Collieary Store from where the Mine is served.

Proposed:

A workshop has been proposed to render services to routine maintenance, minor as well as capital repair of the equipment envisaged for N.Tisra / S.Tisra (Expansion) OCP. Both Excavation Workshop and E & M Workshop will be for maintenance of departmental equipment. Storage facilities will be provided for storing spares and consumables required for the Project. Mobile crane and fork lift truck have been provided for material handling and transportation

C) Fuelling station:

Existing:

There is a Diesel fuelling shed is available at Jeenagora OC.

Proposed

For fuelling the vehicles, fuelling stations fully equipped with required facilities has been provided. Racking System for stores has been provided for proper placement of consumables.

D) Pumping and Drainage

Existing: The seams encountered in this project are IX/X, VIIIA, VIII, VII, V/VI/VII, V/VI, IV T, IV B, III, II T, II B & I. Most of the seams are developed to varying extent. Presently the quarry operates up to II seam for which 3 nos. of submersible pumps are deployed for dewatering the needs of the quarry. Boreholes for these pumps extend up to 112 M depth in I seam. These three boreholes are located on the dip most side of the present quarry boundary.

North Tisra UG

Underground water from faces and developed area is collected in underground main sump. Coal particles and other solid tiny particles are settled in the main Sump. The fresh water is discharged by main pumps to surface in tank through boreholes.

Details of the pumps are given as follows:

Seam	Pump No.	Details of Pumps			Location Dip/ Level	Delivery through pit/inc./ BH	Discharge at settling tank/Nala/ River
		GPM	Head	KW			
IV Bot.	1	1000	200 m	110	-2 Dip, 35L	BH	Tank
	2	600	150 m	110	M/D, 36L	BH	Tank
	3	600	150 m	110	1Dip, 36L	BH	Tank

- Pumping Hours/day : 16 hrs
- Make of Water in Monsoon : 2000 GPM
- Make of Water in Lean Period : 1400 GPM
- Installed Capacity of main Pumps : 2200 GPM
- Quantity of Water Discharged on Surface :

Jeenagora OC

Present pumping arrangement

Presently 3 Bore holes submersible pumps are in operation with capacity of 500 GPM.

Total 500 x 3 = 1500 GPM.

Period	Installed capacity in GPM	Total Discharge (KLD)	Quantity wise use (KLD)				
			Domestic	Industrial	Other	Sulungajore	Total
Lean	500	1600	70	200	15	1315	1600
Monsoon	1500	4800	70	100	15	4615	4800

NTST OC

- Installed capacity of main pumps discharging water to surface – 1600 GPM.
- Quantity of water being discharged to surface – 1000 GPM.
- Point of discharged of water – Surface
- Use of discharged water.

  Industrial use – 252 KLD.
  Domestic – 200 KLD.

Proposed: Considering the project area, ultimate depth and life of the mine, the pumping capacity has been proposed to cover the entire mining activities under single stage of pumping operation. With the basic considerations as above, make of water has been estimated as 446512 Cum. (98.26 million gallon.) and the pumping requirement for the mine works out as to 21.55 Cum (It includes 30% reserve pumping capacity) up to the end of the project.

Water settling tank / pond (cemented floor) of 0.6 million gallon capacity has been envisaged for this project. This tank will be suitably located between the outside edge of quarry and Tisra river. The pumped out quarry water will be discharged into the proposed settling tank. Dust / contamination will be settled in the pond. Overflow water will be discharged into theTisra Jore.

In a separate fire dealing report titled “Scheme for Dealing with Fire at Lodna Area below DP Rly. Line (XI/XII Seam Base)” a surface water reservoir will be provided near Bararee Colliery site. This water reservoir will act as a reservoir for this project too.

The proposed reservoir receives water from pumping discharge of various collieries of Lodna Area (viz. Joyrampur, Bararee, Bagdigi, Lodna & Jealgora). The water from respective collieries will be guided into the reservoir from where water will be pumped to fire dealing site / faces of the proposed opencast.

E) Proposed Surface Coal Handling

Feeder Breaker

Six (6) nos. of feeder breakers having each of 300 to 350 tph capacity have been proposed for sizing of ROM coal down to (-) 100 mm to handle proposed production. The proposed feeder breaker will be installed near the Railway siding which will be located at SW corner of the proposed opencast mine.

Belt Conveyor

The crushed coal will be carried out by an elevating belt conveyor for a distance of about 100 m.

Loading & Transport arrangements

Loading of coal at surface stock yard into tippers as well as at Railway siding into wagon will also be arranged by BCCL with leased out equipment. This is as per present practices prevailing in BCCL mines. The tippers for transportation of coal from surface coal dump to the site of feeder breaker and to transport sized coal from hopper of the feeder breaker to spread all along the length of the proposed Railway siding will be arranged and organised by BCCL management with leased out equipment.

Railway Siding

There will be two nos. of conventional Railway siding of full length for accommodating two nos. of full rake capacity (each of 58 box wagons) proposed for this OCP. The loop take up arrangement for this siding will be such that there will be single entry at one end and single exist point at other end drawn from Patherdih Rakhitpur main line.

F) Power Supply Arrangement

Existing:

At present North Tisra , South Tisra and Jeenagora colliery receive power at 11 kV from Goluckdih 33 kV sub-station of BCCL. For power supply to these three collieries , three Nos. of 11 kV feeders viz. North Tisra , South Tisra and Jeenagora feeders emanate from one 7.5 MVA 33 / 11 kV transformer installed at Goluckdih sub-station .

The existing electrical load on these three feeders is as follows

a) North Tisra Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
Chhat Talab	2500 kVA 11/3.3 kV	North Tisra u/g (6 Incl.)
No.6 sub-stn.	2 MVA 11/3.3 kV 500 kVA 11/.55 kV 500 kVA 11/.44 kV	North Tisra OCP
Borehole sub-stn.	500 kVA 11/.55 kV	Submersible pumps
LUJ sub-stn.	500 kVA 11/.55 kV	LUJ pit colliery
No.6 Feeder Breaker	2 x 500 kVA 11/.55 kV	No.6 Feeder Breakers

b) South Tisra Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
G.J sub-stn.	3150 kVA 11/6.6 kV 630 kVA 6.6/.44 kV	South Tisra OCP - Dragline - Drill
South Tisra sub-stn.	2 MVA 11/3.3 kV 500 kVA 11/.55 kV 250 kVA .55/.44 kV	South Tisra OCP

c) Jeenagora Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
B.J. sub-stn.	250 kVA 11/.44 kV 300 kVA 11/.55 kV	Light Submersible pump
No.9 Feeder Breaker	1000 kVA 11/.55 kV	No.9 Feeder Breakers
K.T. sub-stn.	1000 kVA 11/3.3 kV 500 kVA 11/.55 kV 250 kVA 11/.44 kV	Jeenagora OCP Submersible pumps Light
E.B. sub-stn.	1000 kVA 11/.55 kV 300 kVA .55/.44 kV	Submersible pumps Light

Existing NTST OCP receives power at 3.3 kV by two Nos. of overhead lines which run along the periphery of the quarry to feed quarry bed power consuming units. From the Golden Jeenagora sub-station two Nos. of 6.6 kV overhead lines run to the quarry bed to feed power to one Dragline and one Drill at 6.6 kV.

Jeenagora OCP receives power at 3.3 kV by two Nos. of overhead lines coming from K.T. sub-station and running along the periphery of the quarry.

No. 6 Incline and LUJ pit colliery receive power at 11 kV from North Tisra Feede

In the proposed scheme Existing North Tisra, South Tisra and Jeenagora Opencast mines will continue to work for about four years. Thereafter, they will be merged and expanded to one single project viz. North Tisra / South Tisra (Expansion) OCP. Existing underground mines viz. N.Tisra 6 Incline will also be closed in due course. LUJ Pit of N.Tisra is already closed. Till then the existing power supply system of these mines will continue.

The following existing substations being used for No.6 Incline , LUJ pit colliery, and North Tisra , South Tisra and Jeenagora Opencast mines are proposed to continue till the new expanded Opencast project comes :

Sub-station	Being used for
No.6 sub-station	North Tisra OCP & No.6 Incline
LUJ pit sub-station	LUJ pit underground colliery
South Tisra sub-station	South Tisra OCP
Golden Jeenagora sub-station	South Tisra OCP
K.T. sub-station	Jeenagora OCP

After merger of the two OCPs, these sub-stations will be removed along with their overhead line feeders.

At present one No. 7.5 MVA 33 / 11 kV transformer installed at Goluckdih 33 kV sub-station feeds power to different collieries of North Tisra , South Tisra and Jeenagora area . In the proposed scheme , to meet the increased power demand of the Noirth Tisra / South Tisra (Expansion) OCP (Approximately 3 MVA over existing load) , the installed transformer capacity of Goluckdih 33 kV sub-station is required to be strengthened. One more 7.5MVA 33 / 11 kV transformer is proposed to be installed at Goluckdih 33 kV sub-station for this purpose . Thus , two Nos. of 7.5 MVA 33 / 11 kV transformers installed at Goluckdih 33 / 11 kV sub-station shall be used to meet the power demand of the new North Tisra / South Tisra (Expansion) OCP. From each of these two transformers three Nos. of 11 kV feeders will emerge for North Tisra / South Tisra (Expansion) OCP. Other existing power consuming units connected to the existing 7.5 MVA transformer shall continue to receive power from this transformer in addition.

Proposed:

Following sub-stations are proposed to be installed for North Tisra / South Tisra (Expansion) OCP for its various power consuming units :

Quarry sub-station – I : For HEMMs and pumps in the quarry
Quarry sub-station – II : For HEMMs and pumps in the quarry
Feeder Breaker sub-station – I : For 3 Nos. of Feeder Breakers
Feeder Breaker sub-station – II : For 3 Nos. of Feeder Breakers
Workshop sub-station : For HEMM and E&M workshop
Office building sub-station : For office building and other infrastructures

Two Nos. of 11 kV sub-stations viz. Quarry Sub-station-I and Quarry Sub-station-II will be installed near two nos. of entries of the quarry. These two sub-stations shall receive power at 11 kV by two nos. of separate Overhead Line feeders from Goluckdih sub-station. All the quarry power consuming units shall be fed power from these two substations.

Two more 11 kV Feeders will emanate from Goluckdih sub-station and shall run along the quarry periphery to the proposed location of Feeder breakers and workshop. They will feed power to the Feeder Breaker Sub-station-I, Feeder Breaker Sub-station-II and Workshop at 11 kV.

ii) Quarry Power Supply :

Installed transformer capacity of Quarry Sub-station-I and Quarry Sub-station-II will be as follows :

2 MVA 11 / 6.6 kV Transformer - 2 Nos.
2 MVA 11 / 3.3 kV Transformer - 1 No.
250 kVA 11 / 0.415 kV Transformer - 1 No.

a) Power Supply to HEMMs :

From the proposed Quarry sub-station I and II, 6.6 kV and 3.3 kV overhead lines will run along the periphery of the quarry for power supply to HEMMs and other quarry power consuming units in the quarry bed.

G) Telecommunication

EPABX system with 200 lines is proposed to be installed for the project with telephone sets in the office building, other infrastructural building and at all other strategic points. RAX sets of BCCL network shall also be provided at all strategic points.

H) Existing Infrastructural facilities available (Road, water supply etc.) :

NT-ST OC

Non metal Road is available from the mine area to nearest DB Road (Lodna and Jharia) leading to Dhanbad - Sindri. The water supply to residential areas is only through borehole pumps. Mine water is used for industrial purposes like sprinkling in the road as well as for washing of HEMM.

Jeenagora OC

Pucca Road has been provided from mine area to the nearest Bhaga – Jeenagora D.B. Road, which connects office & work shop to area office and dispensary.

North Tisra UG

D.B.Road - Jharia-Lodna DB road passes through the middle of the property**.**

Company's Road. – Network of kuchcha/pucca colliery roads exist in the leasehold of the Mine.

Water supply – Drinking water is supplied from MADA (200 KLD) through pipe network. For other miscellaneous domestic work mine water is supplied (350 KLD).

I) Existing effluent treatment plant & sewage treatment plant (Mine & Colony) with quantity per month:

There is no such plant available in the Mine. However, domestic effluent is disposed off in soak pit and solid waste is dumped off in abandoned quarry.

J) Location of Hospital, School, habitation and their distance from the mine:

NT-ST OC

Location	Distance from OCP
Hospital Near Colliery OCP workshop	1.0 KM
School Near project office	1.0 KM
Habitation within lease hold area	1.2 to 3.0KM

Jeenagora OC

1. One Dispensary with duly qualified Doctor, Paramedical staff and other staff has been functioning inside the mine for the treatment of employees.
2. Well equipped Regional Hospital is available for the whole Lodna Area.
3. Primary Schools situated within half kilometres and High School with in 5 KM. Sulunga Basti is situated within 1 KM.

North Tisra UG

Sl. No.	Name of Feature	Location	Distance (Km.)
1.	Middle School	Madhuban, Lodna Section	2
2.	Colliery Hospital	MOCP Colony	1
3.	Regional Hospital,	Lodna	7
4.	Central Hospital	Dhanbad	16
5	Residential Buildings along DB Road, Tilabani Basti, Madhuban Lodna Area, Depo Dhowra.	Within leasehold area of the Mine.	

2.5. Details of coal beneficiation plant and its use after closure of mine

There are no coal beneficiation arrangements in the leasehold area.

CHAPTER – III

CLOSURE PLAN AND RELATED ACTIVITIES

3.1 Closure Planning details of mine

The progressive mine closure activities will continue as envisaged in the project report and as enumerated in the various approvals, permits, consents etc. It is very difficult to predict the various parameters which would be prevalent at the time of final mine closure and also to foresee the likely impacts due to closure of the mining activities (when the entire reserve in the block would get exhausted). However, broad mine closure activities need to be identified under the various heads.

The mines falling in the NTST-Jeenagora Group are covered in Cluster IX for the purpose of EMP.

3.1.1 Mined out land & proposed final land use

After completion of mining activities, the quarried area shall be reclaimed by developing ponds, water bodies and plantation, which will not only improve the aesthetic value of the area but also be used for some productive purpose like pisciculture and water supply to the local communities. Formation of water bodies which develops aquatic life and with the plantation around it will lead to restoration of ecology of the area.

At present opencast mine is being worked in IVT, IVB, III, IIT, IIB and I seams, which along with other seams(upto X Seam) have balance extractable reserve of about 145.08 MT.

The proposed conceptual post-mining land use plan vis-à-vis present land use is provided in Para 1.10.

a. Total Mined out area (Ha) – Present + Proposed----568.38 Ha
b. Backfilled area (Ha)---------- 403.93 Ha.

c. Balance left mined out area (Ha) which will not be backfilled--164.59 Ha.
d. The balanced left mined out area will be developed into ponds which will be used for Pisciculture & water supply to the local villagers.

As regards, the underground void, if any, which will remain at the time of closure of the mine, the same will get gradually filled with water. The necessary precautions for the safety of the neighboring mine would be taken care of before deciding the voids to get water filled. Further, the water filled in UG voids will help in maintaining the water level in the nearby area. The Pit/Shaft will be covered with RCC structure with suitable opening for future inspection by competent person.

3.2 Water quality management

3.2.1 Drainage pattern of the area (pre and post closure)

3.2.1.1 Existing drainage pattern

The area has an undulating topography with a gentle slope towards west. The maximum elevation of 202m has been observed in the North-eastern part while the minimum elevation is 163m in the south-western part. The drainage of the area is control by the southerly flowing Tisra Jore on the west.

3.2.1.2 Post closure drainage pattern

Major area of the mine will be quarried out. Kuccha garland drain will be made around the periphery of the quarry. This garland drain will be connected to Tisra Jore which is not likely to be disturbed by mining operation. Thus, this garland drain will drain off the rain water away from the mine. Various measures to prevent water pollution will be taken.

3.2.2 Water Quality Status of Surface and Ground Water

3.2.2.1 Present Practice

The samples were analyzed for relevant physical, chemical and bacteriological parameters for drawing up the base line data.

All the basic precautions and care were taken during the sampling to avoid contamination. Analysis of the samples was carried out as per established standard method and a procedure prescribed by the relevant IS codes and standard methods (AAPHA).

Standards followed

Standard for mine water - GSR-742(E):2000
Standard for surface water - IS 2296:1982
Standard for drinking water - IS 10500:1991

3.2.2.2 Present status of water quality

The monitoring of water quality under Baseline Environment Data Generation for Cluster IX has been conducted by CIMFR, Dhanbad by collecting water samples from ground water, surface water and mine water discharge / workshop discharge (if any) for the proposed project. The various purposes of the water environment monitoring are as follows:

- To assess the water quality characteristics for critical parameters;
- To evaluate the impacts on agricultural productivity, habitat conditions, creational resources and aesthetics in the vicinity ; and
- To facilitate predication of impact on water quality by project activities

The results as per CIMFR, Dhanbad Report are given subsequently.

To assess the quality of lotic system (surface water), water samples were collected from the following locations (Refer to CIMFR, Dhanbad Report):

Table 3.1: Sampling Locations for Water Quality Monitoring in Cluster –-IX

S.N.	Sample	Sample Code	Description	Sampling Site	Remark
1.	Surface Water	SW-1	Kashi Jore	Bararee	Core Zone
2.		SW-2	Kari Jore	Burragarh	Buffer Zone
3.		SW-3	Pond water	Hurriladih	Buffer Zone
4.	Drinking Water	GW-1	Groundwater	Lodna	Core Zone
5.		GW-2	Groundwater	Joyrampur	Core Zone
6.		GW-3	Groundwater	Sudamdih	Buffer Zone
7.	Effluent water	EW-1	Mine water	Jeenagora	Core Zone
8.		EW-2	Mine water	Hurriladih	Buffer Zone

The physico-chemical characteristics of surface water samples collected from three different locations in Cluster IX have been presented in Table 3.2.

Table 3.2: Physico-chemical characteristics of surface water in Cluster-IX Mining Area

S.N.	Parameter and Unit	SW-1	SW-2	SW-3	IS:2296
1.	Odour	Unobjectionable	Unobjectionable	Unobjectionable	--
2.	Colour (True) (Hazen unit)	5.43	4.13	7.43	300
3.	pH (max) (min : 6.5)	7.9	7.5	7.4	8.5
4.	Conductivity (25^{o}C) µS/cm	1275	1262	623	--
5.	DO (mg/L) (minimum)	4.7	5.2	6.3	4
6.	BOD (3d, 27oC) (mg/L)	8.65	9.69	8.45	3
7.	Total Coliforms (MPN/100 mL)	312	232	423	5000
8.	Total Dissolved Solids (mg/L)	992	926	446	1500
9.	Oil and Grease (mg/L)	0.064	0.050	0.032	0.1
10.	Mineral oil (mg/L)	-	-	-	--
11.	Total Hardness (mg/L as $CaCO_3$)	562	368	156	--
12.	Chlorides (mg/L as Cl)	58.7	113.8	47.7	600
13.	Sulfates (mg/L as SO_4)	304.5	152.1	55.6	400

S.N.	Parameter and Unit	SW-1	SW-2	SW-3	IS:2296
14.	Nitrates (mg/L as NO_3)	29.3	19.2	2.52	50
15.	Free CO_2 (mg/L)	1.23	1.18	1.34	--
16.	Free NH_3 (mg/L as N)	0.14	0.45	1.12	--
17.	Fluorides (mg/L as F)	1.05	1.14	1.32	1.5
18.	Calcium (mg/L)	87.8	68.54	23.05	--
19.	Magnesium (mg/L)	83.3	47.85	23.82	--
20.	Copper (mg/L)	0.040	0.035	0.022	1.5
21.	Iron (mg/L)	0.167	0.134	0.054	50
22.	Manganese (mg/L)	0.045	0.054	0.026	--
23.	Zinc (mg/L)	0.076	0.078	0.067	15
24.	Boron (mg/L as B)	0.098	0.115	0.075	--
25.	Barium (mg/L)	0.086	0.096	0.074	--
26.	Silver (mg/L)	BDL	BDL	BDL	--
27.	Arsenic Total (mg/L)	0.016	0.012	BDL	0.2
28.	Mercury (mg/L)	BDL	BDL	BDL	--
29.	Lead (mg/L)	0.017	0.021	0.023	0.1
30.	Cadmium (mg/L)	BDL	BDL	0.006	0.01
31.	Chromium (VI) (mg/L)	0.036	0.043	0.033	0.05
32.	Selenium (mg/L)	BDL	BDL	BDL	0.05
33.	Cyanide (mg/L)	0.020	0.015	0.012	0.05
34.	Phenols (mg/L)	BDL	BDL	BDL	0.005
35.	Anionic detergents (mg/L as MBAS)	ND	ND	ND	1
36.	PAH (mg/L)	ND	ND	ND	--
37.	Pesticides (ug/L)	Absent	Absent	Absent	--
38.	Percent Sodium (%)	22.4%	43.7%	51.2%	--
39.	Sodium Absorption Ratio (SAR)	1.08	2.34	2.25	--

ND=Not Detected, BDL: Below detection limit

The analytical results of physico-chemical analysis of surface water samples collected from Kashi and Kari jores (stream) near Bararee and Burragar and ponds water near Hurriladih has been given in **Table 3.2**. To assess the quality of the surface water resource the results has been compared with the prescribed surface water standards IS-2296 for Class 'C' water (tolerance limit for stream water used drinking water sources with conventional treatment followed by disinfection). It can be seen that pH of the water is slightly alkaline in nature and found well within the prescribed limit of 8.5. In general the total dissolved solids and other analysed

parameters are found well within the threshold values. Concentration of sulphate varies between 55.6 and 304.5 mg L^{-1} and is below the prescribed value of 400 mg L^{-1} (IS-2296). The concentrations of the analysed heavy metals in the surface water resource are also found within the prescribed limits. It shows that the surface water of the area is fit for its designated use as a drinking water source with conventional treatment followed by disinfection.

The physico-chemical characteristics of ground water samples collected from three different locations in Cluster IX have been presented in Table 3.3.

Table 3.3: Physico-chemical characteristics of groundwater in Cluster-IX Mining Area

S.N.	*Parameters*	Station Code			IS: 10500
		W-1 (Lodna)	W-2 (JoyRampur)	W-3 (Sudamdih)	
1.	Colour, Hazen units	Colorless	Colorless	Colorless	Un-objectionable
2.	Odour	Un-objectionable	Un-objectionable	Un-objectionable	Un-objectionable
3.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
4.	Turbidity NTU Max	0.76	1.23	2.13	10
5.	Dissolved Solids mg/l, Max	1186	828	399	500
6.	pH Value	7.6	8.1	7.48	6. 5 to 8. 5
7.	Total hardness (as $CaCO_3$) mg/l, Max	749	553	213	300
8.	Calcium (as Ca) mg/l, Max	112.9	95.5	66.2	75
9.	Magnesium (as Mg) mg/l, Max	113.6	76.4	11.5	75
10.	Copper (as Cu) mg/l, Max	0.030	0.031	0.015	0.05
11.	Iron (as Fe) mg/l, Max	0.112	0.106	0.065	0.3
12.	Manganese (as Mn) mg/l, Max	0.054	0.038	0.164	0.1
13.	Chlorides (as Cl) mg/l, Max	63.1	17.7	84.5	250
14.	Sulphate (as SO_4) mg/l, Max	414	365	16.2	150
15.	Nitrate (as NO_3)	16.7	5.3	23.61	45
16.	Fluoride (as F) mg/l)	1.32	0.96	0.30	0.6 to 1. 2
17.	Phenolic Compounds (as C_6H_5OH) mg/l, Max	BDL	BDL	BDL	0.001
18.	Mercury (as Hg) mg/l, Max	BDL	BDL	BDL	0.001
19.	Cadmium (as Cd) mg/l, Max	0.010	0.013	0.009	0.01
20.	Selenium(as Se mg/l, Max	BDL	BDL	BDL	0.01
21.	Arsenic (as As) mg/l, Max	0.012	0.019	0.008	0.05

S.N.	*Parameters*	Station Code			IS: 10500
		W-1 (Lodna)	W-2 (JoyRampur)	W-3 (Sudamdih)	
22.	Cyanide (as Cn) mg/l, Max	BDL	BDL	BDL	0.05
23.	Lead (As Pb) mg/l, Max	0.039	0.028	0.015	0.1
24.	Zinc (as Zn) mg/l, Max	0.065	0.059	0.063	5
25.	Arionic detergents (as MBAS), mg/l, Max	0.064	0.055	0.037	0.2
26.	Chromium (as Cr^{6++}) mg/l, Max	0.040	0.038	0.044	0.05
27.	Polynuclear aromatic hydrocarbon (PAH) mg/l, Max	ND	ND	ND	
28.	Mineral Oil mg/l, Max	BDL	BDL	BDL	0.01
29.	Residual, free chlorine, mg/l, Min	0.14	0.12	0.016	0.2
30.	Pesticides	Absent	Absent	Absent	Absent
31.	Radioactive materials a) Alpha emitters uc/ml, Max b) Beta emitters uc/ml, Max	ND	ND	ND	10^{-8} 10^{-7}

ND=Not Detected, BDL: Below detection limit

To assess the status of drinking water quality of IX area, three ground water samples were collected from hand pump at Lodna, Joyrampur and Sudamdih in May 2011 and analysed for parameters as per the drinking water standards (BSI 1993). The hydro-chemical parameters of the groundwater of the study area were compared with the prescribed limit of Indian Standard for drinking water (BIS 1991) to asses the suitability for drinking and public health purposes (**Table 3.3**). The analytical results show that most of the analysed parameters are well within desirable limits and water is potable for drinking uses. pH of the analysed groundwater are found well within the safe limit of 6.5 - 8.5, prescribed for drinking water by BIS (1991). The turbidity is one of the important physical parameters for water quality defining the presence of suspended solids in water which causes the muddy or turbid appearance of water body. The consumption of high turbid water may cause a health risk as excessive turbidity can protect pathogenic microorganisms from effects of disinfectants and also stimulate the growth of bacteria during storage. In the study area the turbidity in the groundwater are found below the recommended value of 5 NTU. The total dissolved solid (TDS) and Total Hardness (TH) exceed the desirable limit of 500 mg L^{-1} and 300 mg L^{-1} in the groundwater samples of Lodna and Joyrampur but below the desirable limit in the groundwater samples of Sudamdih. However, TDS is well within

the maximum permissible limit of 1000 mg L^{-1} in Joyrampur groundwater. Concentration of Ca, Mg, SO_4 and F are also slightly exceeding the desirable limit in the groundwater of Lodna area though it is below the maximum permissible limit of IS-10500. The other analysed parameters like Cl, NO_3, Na etc. were found below the desirable level.

Heavy metal analysis in the groundwater samples indicated that all the analyzed heavy metals like As, Cd, Cr, Pb, Zn, Mn and Fe are found either below the detection limit or less than the desirable limit for drinking water.

The physico-chemical characteristics of effluent water samples collected from three different locations in Cluster IX have been presented in Table 3.4.

Table 3.4: Physico-chemical characteristics of effluent (mine water) in Cluster-IX Mining Area

S.N.	Parameter	EW-1 (Jeenagora)	EW-2 (Hurriladih)	Inland Surface water IS:2490
1.	Colour and odour	Colorless	Colorless	Of Annexure-1
2.	Suspended solids mg/l, max.	39.8	54.8	100
3.	pH value	7.7	8.3	5.5 to 9.0
4.	Temperature (^{0}C)	26.4	25.8	Shall not exceed 5ºC above the receiving water temperature
5.	Total Dissolved Solids mg/l	502	711	2100
6.	Oil and grease, mg/l max.	2.87	2.65	10
7.	Total residual chlorine, mg/l max.	0.28	0.19	1.0
8.	Ammonical nitrogen (as N), mg/l max.	6.76	5.87	50
9.	Total nitrogen (as N), mg/l max.	8.56	9.24	100
10.	Free ammonia (as NH_3), mg/l max.	4.23	5.34	5.0
11.	Biochemical oxygen demand, BOD (3 days at 27ºC), mg/l max.	5.67	5.54	30
12.	Chemical oxygen demand, mg/l max.	67.8	75.3	250
13.	Arsenic (as As), mg/l max.	0.012	0.027	0.2
14.	Mercury (as Hg), mg/l max.	0.008	0.012	0.01
15.	Lead (as Pb), mg/l max.	0.034	0.043	0.1
16.	Cadmium (as Cd), mg/l max.	0.012	0.015	2.0
17.	Hexavalent chromium (as Cr^{+6}), mg/l max.	0.037	0.030	0.1
18.	Total Chromium (as Cr), mg/l max.	0.065	0.068	2.0
19.	Copper (as Cu), mg/l max.	0.032	0.029	3.0
20.	Zinc (as Zn), mg/l max.	0.098	0.088	5.0
21.	Selenium (as Se), mg/l max.	0.009	0.012	0.05

S.N.	Parameter	EW-1 (Jeenagora)	EW-2 (Hurriladih)	Inland Surface water IS:2490
22.	Nickel (as Ni), mg/l max.	0.025	0.031	3.0
23.	Cyanide (as CN), mg/l max.	0.009	0.012	0.2
24.	Fluoride (as F), mg/l max.	1.67	0.97	2.0
25.	Dissolved phosphates (as P), mg/l max.	0.67	0.54	5.0
26.	Sulphide (as S), mg/l max.	0.95	0.76	2.0
27.	Phenolic compounds (as C_6H_5OH), mg/l max.	0.072	0.054	1.0
28.	Radioactive materials a. α emitters micro cure, mg/l max. b. β emitters micro cure, mg/l max.	ND	ND	 10^{-7} 10^{-6}
29.	Manganese (as Mn)	0.097	0.070	2 mg/l
30.	Iron (as Fe)	0.314	0.348	3 mg/l
31.	Vanadium (as V)	0.116	0.122	0.2 mg/l
32.	Nitrate Nitrogen	93.05	39.78	10 mg/l

ND=Not Detected, BDL: Below detection limit

Mine water samples discharged from Jeenagora and Hurladih underground mine were collected to assess the effluent water quality. The analytical results were compared with the inland surface water quality standard as per the IS-2490 and presented in **Table 3.4**. The mine water of the area is found to be alkaline in nature and measured pH was well within the prescribed limit of 5.5 to 9.0 as per IS:2490. Total Dissolved Solid Concentration in the discharged mine water were also found much below the recommended limit of 2100 mg L^{-1} for inland surface water as per IS:2490. The suspended sediment are found 39.8 and 54.8 mg L^{-1} respectively in the mine water of Jeenagora and Hurriladih which is less than the permissible limit of 100 mg L^{-1}. Concentration of heavy metals in the mine water of the area are also to be found within the permissible limit as per IS:2490.

3.2.2.3 Practice after the closure

The above practice of monitoring of quality of water would be continued for a period of 3 years after cessation of mining activities in the area. If required, corrective action/steps would be taken to mitigate any adverse effect on local water regime. The responsibility of maintaining the quality of drinking water will be entrusted on the State Authorities after 3 years of mine closure.

3.2.3 Measures for Control of Pollution (Details for Pollution Control Arrangement)

3.2.3.1 Impact due to Water Pollution and its Management

The mine discharge water may contain high-suspended solids and other pollutants. The treatment scheme thus needs to focus on the removal of suspended solids from the water. Mine water must be treated to meet the prescribed standards before being discharged into water bodies. When the water is used for agricultural or domestic work, it shall undergo further treatment, as established by Scientific Studies conducted in this regard. The important factors to be considered in selecting the appropriate method for treatment are as follows:

(a) Settling tank will be provided to collect the mine discharged water for settling the suspended solids.

(b) The flow and the quality of mine water vary seasonally. Therefore settling tank should be so constructed that it will be able to absorb these fluctuations.

(c) The mine water must be neutral in nature before discharge and therefore necessary neutraliser may be provided to maintain the pH of the settling pond water.

(d) In order to reduce the dependence on fresh water sources for meeting the demands of water in the mining related operations, the entire mining water will be utilised. The effluent free mine water will be utilised in water spraying for dust suppression, hydraulic stowing, equipment washing and other industrial requirements.

(e) Mine water discharge and drainage in the core zone has been planned to be regulated in a manner so that impact on surface and other water bodies of the area is not affected. No major diversion of surface drainage channel is required. Expected increase of solids particles due to surface handling of coal shall be controlled by:

i. Construction of garland drains around the OB dump & coal stock area

ii. Construction of settling tanks of adequate size for removal of particulate matters

iii. De-silting of settling ponds and drains at regular intervals

iv. Effluents from washing areas, garage and workshop will be collected in garlands and routed through a settling ponds and oil and grease trap. The solid wastes generated shall be treated as per the provisions of Hazardous Waste Management Act. The water shall be recirculated for washing.

3.2.4 Water Balance of the area

Hydrogeology and Aquifer characteristics of the area

Groundwater occurrence and storage in study area are mainly controlled by the geological setup of the area. The ability of geological formation to store and transmit water is dependent on its formation parameters, such as porosity and hydraulic conductivity. Based on these two parameters, the rock formation of the area may be classified as hard and soft rocks. Hard rocks (mainly crystalline and consolidated sedimentary rocks) are characterized by very little porosity. Ground water in such rocks circulated to a limited extent through the secondary openings represented by joints, cracks, fissures and such other planes of discontinuity. Soft rocks represented by sandstone, pebbles and loose sand, posses higher degree of primary porosity and as such characterized by higher water storage capacity. As greater part of the study area is underlain by Precambrian crystalline rocks, the weathered residual of the hard rocks as well as the fractures, joints, fissures, faults and other zones of discontinuity are the principle repositories of ground water in the area. The weathered zone is usually of limited thickness, fractures and joints generally close up with depth. The thickness of weathered mantle in the hard rock zone of area is about 10-20 meter in the topographic lows. Ground water in the weathered and fracture zones of hard rocks occur under unconfined condition. Ground water circulating through fracture zone is sometimes held under pressure. Depth of the water table in the hard rock of the area generally ranges from 3.0m to 15.0m below ground level.

The Gondwana sediments form the semi-consolidated formations and are better water potential zone. The splintery shales of Talchir and basal pebbles bed, the variegated Barren Measure shales and the sandstones are the major litho units of the Gondwana Formations. Gondwana sandstones in general, are known to constitute good aquifers at many places. Ground water occurs under unconfined condition in the weathered mantles varying depths from 4.23 – 12.34m as observed in the dugwells and semi-confined condition in the deeper aquifers. Depth of water level for pre-monsoon period varies from 5–12m below ground level and it stretches to a deeper depth of 7-12m in some places. The pre-monsoon water level rises due to recharge and becomes 2 - 8 m below ground level around the area during post-monsoon period.

Rainfall is the principal recharge source to groundwater. The area experiences an average annual rainfall of about 1200-1400 mm. Besides rainfall, the mine water discharge from the local mining areas and existing water bodies including water logged in abundant mine quarries are also contributed to the ground water recharge as return flow. In the study area, ground water is withdrawn usually by means of open dug wells and small diameter hand operated tube wells for domestic and irrigation purposes. The tube wells are most often deeper (25m – 58m) than the dug wells and tap the aquifer below the weathered mantle. As the area is being located in the hot-tropical belt, the temperature regime is very high; the daily maximum reaches to over 45^0C in summer. Due to excessive heat, the loss of moisture through evaporation is considerably high (60-65%). During the wet monsoon seasons, the net evaporation is less than the precipitation, resulting in surplus water which loss through either surface runoff or being part of the subsurface storage. The surface run-off and sub-surface storage of water depends upon various factors including the amount of rainfall, topography of the area, land use pattern, soil type, slope, physiographic, drainage pattern and hydro-geomorphology of the catchment/ sub-catchment. The study area is having gentle slope towards south and south east. Water received on the slopes, gets collected in low-lying area and is thus ultimately absorbed in the top soil cover and become part of the ground water flow according to the slope to form seasonal streams/nallas.

In the mining area, the water levels are bound to be affected and disturbed. The mining area of JCF area is highly disturbed and the permeability of individual geological units is spatially variable and depends on lithology, fracturing and attenuation with depth. The porous and more open-jointed sandstone members tend to form aquifers, the shaly members are aquitards, which may be leaky but are poorly permeable & form poor permeable barriers to the vertical groundwater movement.

Water quality monitoring will be done for three years after closure. The sampling stations shall be one number mine water with quarterly frequency and two numbers ground water samples in core and buffer zone with quarterly frequency.

3.2.5 Acid Mine Drainage Source

Not Applicable

3.2.6 Water Management

3.2.6.1 Existing mine water discharge details

a. Mine water is pumped out in a settling tank. Clean water coming out from the settling tank is used for dust suppression, stowing and other Industrial uses.
b. Excess pumped out mine water is allowed to flow into the surface water bodies.
c. Drains are provided around the coal stock to collect run-off for diverting into settling pond before discharge into the natural water courses.

Present pumping arrangement in opencast mine:

- Make of water:
  Monsoon: 8M Gallons/day
  Lean period: 1 M Gallons/ day.
- Installed capacity of main pumps discharging water to surface.: 1600 GPM
- Pumping hours/day : 18 hrs.

Pumps Installed for Dewatering and Domestic supply:

Type of Pumps	Total Nos.	Capacity (GPM)
Submersible Pump	1	1000
Pontoon Pump	2	300

3.2.7. Post closure Mine water discharge

Once the reserve is exhausted, the entries into the mine would be securely sealed for safety purposes. However, if for the safety of the future mine or any neighboring mine, pumping is required from the worked seams, then the arrangements for pumping will be kept intact and the water shall be discharged into the surface water bodies after passing the same through settling tank on the surface. The accumulated water in underground workings may be utilized to meet water shortage in nearby areas.

3.3 Air quality management

3.3.1 Present practice

a. At present air borne dust is suppressed by:

- Sprinkling water on the various roads of the mine where the vehicles ply.
- Water sprinkling at the various points where coal is handled.
- Proper loading of trucks to avoid any spillage of coal.
- Proper maintenance of I.C. engines.

The monitoring of air quality under Baseline Environment Data Generation for Cluster IX has been conducted CIMFR, Dhanbad and test results of air samples are furnished in Table 3.6A and 3.6B.

Table 3.5: Details of Sampling Locations

Stn. Code	Location	Source of Air Pollution
CORE ZONE		
CA_1	North Tisra	Mining and transportation of coal, domestic works and poor condition of road, heavy vehicular movement.
CA_2	Jeenagora	Domestic, background pollutants due to agricultural, domestic works and mining and transportation activities in buffer zone.
CA_3	Barari	Mining and transportation of coal, domestic works and poor condition of road, vehicular movement
CA_4	Lodna	Household Coal burning and poor condition of road and heavy vehicular movement, etc.

Stn. Code	Location	Source of Air Pollution
BUFFER ZONE		
BA_1	Golakdih	Mining and transportation of coal, coal burning and poor condition of road, heavy vehicular movement.
BA_2	Simlabahal	Mining and transportation of coal, domestic works and poor condition of road, heavy vehicular movement
BA_3	Patherdih	Mining and transportation of coal, domestic works and poor condition of road.
BA_4	Bhaga Mining Institute	Mining and transportation of coal, domestic works and poor condition of road, vehicular movement.

Table 3.6A: Ambient Air Quality in Cluster-IX Mine Area

Core Zone – North Tisra (CA_1)

(Pre-monsoon Season: April 2011 to June 2011)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_x**
2011-April	*1st Week*	6/4/2011	57.9	111.4	30.3	55.7
		8/4/2011	58.4	106.2	31.9	55.4
	2nd Week	11/4/2011	51.8	89.3	30.9	52.9
		13/04/2011	61.2	111.3	23.9	50.6
	3rd Week	21/04/2011	47.2	81.4	33.8	47.9
		23/04/2011	52.4	90.3	29.8	58.7
	4th Week	28/04/2011	49.2	84.9	31.4	49
		30/04/2011	53.0	91.4	25.2	44.8
2011-May	*1st Week*	4/5/2011	61.7	110.2	32.3	49.7
		6/5/2011	57.0	103.7	27	50.7
	2nd Week	12/5/2011	61.3	105.7	31.9	56.7
		14/05/2011	61.4	113.7	23.9	58.3
	3rd Week	18/05/2011	58.6	104.7	29.2	57.1
		20/05/2011	56.4	100.7	21	47.2
	4th Week	25/05/2011	56.5	97.4	27.1	50.2
		27/05/2011	60.8	112.6	26.6	54.4
2011-June	*1st Week*	5/06/2011	61.4	105.8	28.8	53.6
		7/06/2011	60.9	110.8	28.1	55.3
	2nd Week	11/06/2011	65.8	117.5	30.6	57.2
		13/06/2011	56.6	97.5	26.1	54.4
	3rd Week	19/06/2011	48.5	83.7	21.5	43.1
		22/06/2011	49.7	85.7	21.7	38.4
	4th Week	27/06/2011	50.2	86.5	27.4	38.8
		29/06/2011	52.0	89.6	19.3	42.6

Minimum	**47.2**	**81.4**	**19.3**	**38.4**
Maximum	**65.8**	**117.5**	**33.8**	**58.7**
Average	**56.3**	**99.7**	**27.4**	**50.8**
Std. Deviation	**5.5**	**11.7**	**4.3**	**6.3**
98th Percentile	**63.9**	**115.8**	**33.1**	**58.5**

Table 3.6B: Ambient Air Quality in Cluster-IX Mine Area

Core Zone – Jeenagora (CA_2)

(Pre-monsoon Season: April 2011 to June 2011)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_x**
2011-April	*1st Week*	6/4/2011	60.8	110.6	28.2	52.1
		8/4/2011	60.6	104.4	27.6	56.3
	2nd Week	11/4/2011	50.8	92.4	26.2	49.2
		13/04/2011	51.5	92	23.6	48.5
	3rd Week	21/04/2011	57.1	98.4	25.9	48.1
		23/04/2011	49.5	85.4	32.4	50.5
	4th Week	28/04/2011	51.3	88.4	36.3	45.3
		30/04/2011	48.9	84.3	28.9	48.3
2011-May	*1st Week*	4/5/2011	53.7	92.5	28.2	47.2
		6/5/2011	55.3	95.4	28.4	47
	2nd Week	11/5/2011	54.5	93.9	29.2	47.5
		13/05/2011	53.9	93	26.3	46.3
	3rd Week	18/05/2011	61.0	105.1	29.1	52.2
		20/05/2011	52.1	89.9	27.2	47.5
	4th Week	25/05/2011	57.6	99.3	32.4	45.3
		27/05/2011	69.1	130.3	35	50.4
2011-June	*1st Week*	6/6/2011	60.8	104.9	36.1	49.6
		8/06/2011	59.5	114.5	35.9	53.1
	2nd Week	11/6/2011	39.7	68.4	27.6	41.7
		13/06/2011	48.3	83.3	30.2	51.5
	3rd Week	20/06/2011	40.8	70.4	22.3	40.1
		22/06/2011	43.3	74.7	25.3	38.2
	4th Week	27/06/2011	50.1	86.3	24.2	32.9
		29/06/2011	48.3	83.3	25.7	37.7
Minimum			**39.7**	**68.4**	**22.3**	**32.9**
Maximum			**69.1**	**130.3**	**36.3**	**56.3**
Average			**53.4**	**93.8**	**28.9**	**46.8**
Std. Deviation			**7.7**	**15.8**	**4.2**	**6.1**
98th Percentile			**65.3**	**123.0**	**36.2**	**54.8**

Table 3.7: National Ambient Air Quality Standards
(As per MoEF Notification on* 16th November, 2009*)

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	Sulpher Dioxide (SO_2), $\mu g/m^3$	Annual* 24 hours**	50 80	20 80	- Improved West and Gaeke - Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter (Size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM - Beta attenuation
4	Particulate Matter (Size less than 2.5 µm) or PM_2 $\mu g/m^3$	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM - Beta attenuation
5	Ozone (O_3) $\mu g/m^3$	8 hours* 1 hour**	100 180	100 180	-UV photometric - Chemiluminescence -Chemical Method
6	Lead (Pb) $\mu g/m^3$	Annual* 24 hours**	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
7	Carbon Monoxide(CO) mg/m^3	8 hours* 1 hour**	02 04	02 04	-Non Dispersive Infra Red (NDIR)Spectroscopy)
8	Ammonia(NH_3) $\mu g/m^3$	Annual*	100	100	- Chemiluminescence

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
		24 hours**	400	400	- Indophenol blue method
9	Benzene(C_6H_6) µg/m^3	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo(o) Pyrine (BaP)-Particulate phase only, ng/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic(As), ng/m^3	Annual*	06	06	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	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 compiled with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note – Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limit specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation

3.3.2 Practice after the closure of the mine

a. As the sources of dust and fume generation would no longer be present, the present practice of arresting the air pollution, as enumerated above may be discontinued. However, water sprinkling would be done on the roads, which remain in use after the mine closure.

b. Quality of air would be monitored for a period of 3 years after cessation of mining activity. 3 samples at fortnight frequency for 3 years, one sample in core zone and one sample each in upwind and downwind direction will be collected and analyzed.

3.4 Dump Reclamation

External dump

The external OB dumps shall be formed in suitable lifts of appropriate height keeping an overall slope not exceeding 36^0 from the horizontal. In course of mining and after the completion of the final lift, the external OB dump shall be biologically reclaimed. The dumps shall be afforested by selecting proper plant species in consultation with State Forest Department.

As per new Guidelines for Preparation of Mine Closure Plan GOI (Ministry for Coal) Dated 7th January, 2013 all efforts should be made and reflected (in the Project Report/Mining Plan) to keep land requirement bare minimum for external OB dumping to minimise land degradation. This may necessitate increase of dump height to the maximum extent keeping in view the safety requirement with special emphasis on stability analysis. After back filling of quarry voids, the left out void may be allowed to be filled with water. This will help to recharge and stabilize the water table in the neighbourhood and the local populace will benefit from it.

Internal Dumps

The residual voids, if any, will serve as a lagoon and may be utilised as water reservoir for the locality. The entire area shall be suitably fenced. Most of the back filled area shall be afforested by selecting proper plant species in consultation with State Forest Department. A part of the back filled area would also be developed for agricultural purpose with the help of the concerned State Authority.

The underground unit is not likely to generate any solid waste during the mining operation.

3.5 Details of Surface Structures proposed for dismantling

3.5.1 Infrastructure details

As far as possible, industrial structures will be utilized by the adjacent mines. However, if these structures are not found fit at the end of mine life, the same will be dismantled and salvaged. The equipments will be removed and used somewhere else. Every effort will be made to restore the area to economic utilization value in line with mine closure plan.

A. SERVICE BUILDINGS: The service buildings/ structures, viz. workshop, stores, office building, cap-lamp room, Pit top office, winding rooms, etc. are to be demolished after collecting all re-useable items, or be used for some other projects and the land covered by them restored for productive use. However, it has to be ensured that as and when a service building is vacated/ abandoned, the same should be demolished to prevent any unauthorized occupation.

B.OTHER INFRASTRUCTURES: All other infrastructures like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. will be utilized for the neighbouring projects.

However, possibility shall be explored for handing over the buildings and other infrastructures including the reclaimed land to the State Government for the benefit of local villagers and strengthening the area infrastructures.

The end use of these facilities shall be decided by the State Government with the help of District Authorities and Village Panchayat. The peripheral village community facilities developed by the Mine Authorities will be left to the Local Body/ State Government for their management and public use.

Prior to surface demolition/ restoration, a surface audit will be undertaken on all surface structures, spoil heaps etc. to assess whether there is any hazardous material that could cause problem, i.e. explosive, asbestos, chemical, oil, etc.

A list of surface and UG assets (Plant & Machinery) will be prepared and made available to potential purchasers or transferred to other new/ working mines of the company. This will ensure that the assets perform during their economic life.

3.5.2 Post closure disposal/Re-use of the Buildings, Plants & Machineries

a. Disposal or reuse of existing HEMM, CHP, workshop and railway siding for OC

   Since the opencast is proposed to be operated through outsourced HEMM, disposal will not be required.

b. Disposal or reuse of haulage, ventilation, workshop and railway siding for UG.

   At the time of closure of the mine, it is expected that most of the equipments would complete its rated life and would be surveyed off as per the Company's guidelines. The surveyed off equipments would be auctioned as per prevalent norms.

   However, if some of the equipments would not have covered their rated life, they would be diverted to the neighbouring projects for gainful utilisation.

   There is no railway siding in the leasehold.

c. Disposal or reuse of transmission lines and sub-station

As per the electricity demand of the existing neighbouring projects, an analysis would be made as to whether the existing sub-station and transmission lines could be gainfully used or not. If the scope of gainful utilization is not found, they will be dismantled and the usable items/spares/conductors etc. would be dispatched to needy Areas/Projects.

d. Disposal or reuse of residential and non-residential buildings

At the time of final closure, a list of surface buildings would be prepared in detail. Thereafter following steps would be taken in chorological order in respect of the available buildings:

- An assessment would be made to find that whether the available buildings can be used by the existing neighboring projects or any new project that might have come up in the vicinity.
- In case, the listed assets cannot be utilized by the nearby project, efforts would be made to sale these assets after making the list available to potential purchasers and asking the interested purchasers to submit sealed bids.
- Thereafter, the state agencies/local agencies may be asked to take possession of the buildings, if they required few of them.
- When there would be no takers, the buildings would be demolished and usable items would be recovered for future use.

Table 3.8 Proposals for Infrastructure Facilities

Sl. No.	Particulars	Action Suggested
A	CHP	This will be dismantled and land will be covered with plantation
B	Workshop	-Do-
C	Railway Sidings	There is a proposal of Rly. Siding in the project.
D	Colony	These will be handed over to the State Government if fit for use or will be dismantled.
E	Details of non-residential buildings	-Do-

F	Other facilities (ETP /STP)	-Do-

3.6 Safety and Security Arrangement

3.6.1 Mine entry

After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any unauthorized entry into the area. Flags/Boards with warning signals shall be posted at vulnerable places to avoid chances of accidents. However, the guidelines / instructions from DGMS, if any, will be followed.

Sealing details and dimensions shall also be prepared for the purpose. The minimum thickness of mine sealing will be 100cm RCC (M20) with nominal reinforcement. For incline entry, the mine entry path of 5 m will be filled with debris and clay before sealing the mine.

Details of fencing around abandoned quarry, indicating the length of the fencing

As explained earlier the proposed OCP patches will not be backfilled and the void will act as water reservoir. It is proposed to develop a water lagoon in the area. The water lagoon may be handed over to State Authorities for conversion into a picnic spot.

The void of the quarry would be properly fenced to avoid any inadvertent entry of animals or human beings. Sufficient Boards and danger signs shall be placed all around.

Later on, the responsibility of keeping the fencing secured would be entrusted on the State Authorities.

The entry into the mine is the haul road. This haul road will remain for entry into the picnic spot. Both side of this haul road will be afforested.

3.6.2 Slope stability arrangement for high wall and back filled dumps

During operation of the mine, overall slope will be maintained at an angle not exceeding 22^0- 28^0. Vegetation cover will also be provided along the slopes to arrest any failure.

As regards stability of back-filled dumps, the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will serve as a lagoon which may be utilised as water reservoir for the locality.

During operation, the external and internal OB dump will be developed with 40 m berm width and maximum height of 60m in case of external OB dump and the overall dump slope shall not exceed **22^0- 28^0**. The waste dumps will be provided with toe wall and garland drains. The dump will be technically reclaimed and vegetation will be grown after spreading the top soil. The above measures will prevent slope failure and improve the aesthetic value.

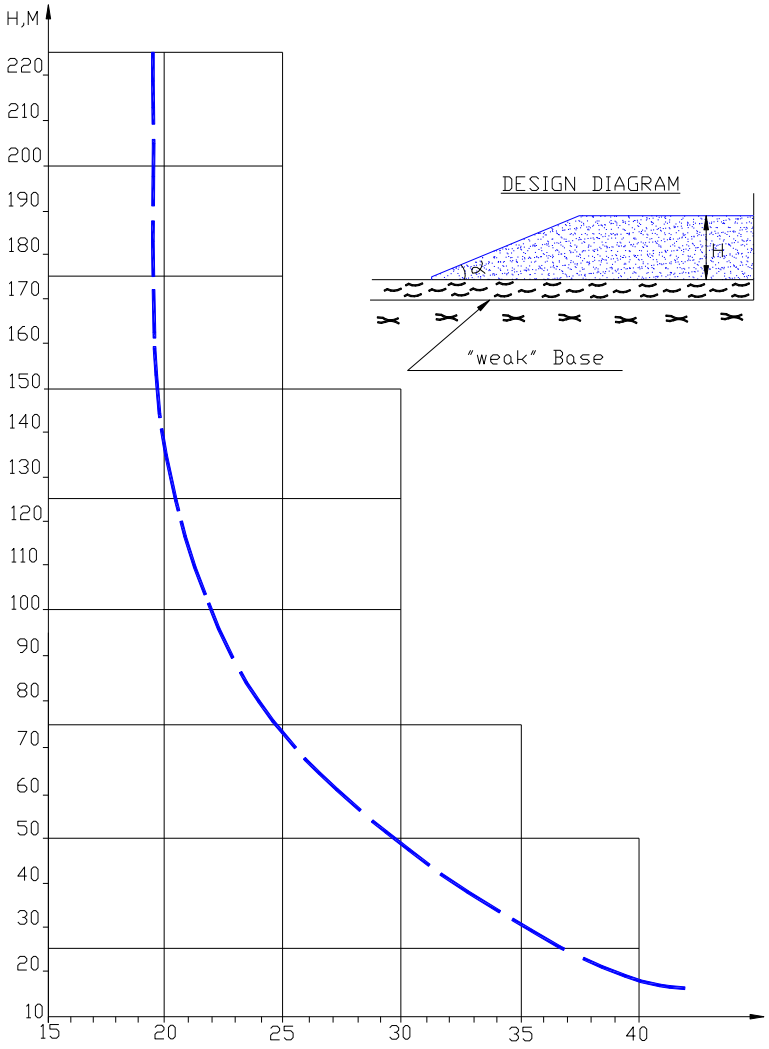


Fig. 5.5.4. Graph illustrating dependence of stable slope angle (α) on height (H) of ex-site dumps formed on "weak" Base

3.6.3 Providing one time lighting arrangement

Sufficient lighting as per standard is provided at all the required places, i.e., pit office, haulage room, fan house, cap lamp room, mine entry, workshop, sub-station haul road in quarry etc.

After closure of the mine, the lighting arrangements will be kept maintained at all locations which are not required to be demolished or dismantled like sub-stations, transformers, community services, pump-houses, water-

treatment/ filtration plants, waterlines, power lines, roads etc. to be utilised for the neighbouring projects and local communities.

3.6.4 Survey records of workings

All the mine workings including subsidence areas, roads, ponds, tanks etc. shall be resurveyed and records shall be updated. Copy of such records shall also be submitted to the appropriate competent authorities, such as DGMS and State Authorities.

Maintenance of records pertaining to Progressive Mine Closure

The Mine management shall maintain following Progressive mine closure plans for every 5 year period:

A Progressive mine closure plan for surface activities

This plan shall be maintained at a scale of 1: 4000 showing the entire progressive mine closure activities (surface) carried out on yearly basis. The plan shall be updated on annual basis and shall be signed by appropriate authorities from the Project and the Area. After every annual renewal, the plan shall be placed before HOD (Env.) of the Company for scrutiny and approval.

The UG unit is likely to be closed soon and entire Group is considered as an OC Unit for the purpose of Closure. However, if , for any reasons , whatsoever, UG Operation is continued, a progressive mine closure plan showing the UG activities shall be maintained. This plan shall also be updated on annual basis and signed by all the above mentioned officials.

Besides the above plan, a progressive mine closure register shall also be maintained by the mine management. This register shall carry details of the progressive mine closure activities carried out on yearly basis. The details to be maintained in the said register shall cover inter alia the name of activity, place, period of execution, executing agency, expenditure incurred, proof of expenditure incurred, final status of the area where activity was executed, plan on which such activity has been shown etc.

The entries into the said register shall be signed by the appropriate authorities from the Project and the Area. At the end of the year the said register (along with two plans) shall be placed before HOD (Env.) of the Company for scrutiny and approval.

3.6.5 Disposal management of hazardous material

At the time of closure, assessment would be made as to find whether there is any hazardous material that could cause problem. Such hazardous material e.g. explosives, chemicals, oil etc. shall be appropriately disposed off.

3.7 Entrepreneurship development Program

As the mine progresses, more and more local people gets indirectly dependent on the mine for their sustainable income. After closure of mine there would be no source of income for these people. In order to ensure that these people do not suffer in the post closure period, the Project authorities in consultation with BCCL (HQ) shall make efforts to develop entrepreneurial skills in the local people by imparting skill development/vocational training programs. It is expected that after developing adequate entrepreneurial skills, the local people would be able to run their own business in the post closure period and maintain a sustainable income for their livelihood.

3.8 Miscellaneous activities

In future, the prevalent geo-mining/environmental conditions in and around the project area may require execution of some other progressive mine closure activities not covered in the preceding paragraphs. Such activities may be carried out by the mine after observing the needful formalities and obtaining approval of HOD (Env.) of the Company.

3.9 Execution of progressive mine closure activities and 5 yearly monitoring

After observing the necessary administrative/financial formalities, the mine authorities shall execute the identified progressive mine closure activities,

whenever and wherever required. The executed activities shall be shown on the above said plans and recorded in the said registers.

The executed progressive mine closure activities shall be monitored on 5-yearly basis by 3rd party (ISM, CMPDI, NEERI etc.).

The 5 yearly return from escrow fund would be equal to expenditure incurred on progressive mine closure activities during last 5 years or 80 % of total deposited amount in the escrow account (including interest) whichever is less. The said return would be subject to above said monitoring of progressive MCP by a third party (ISM/CMPDI/NEERI etc.).

As the 5 yearly return from escrow fund is linked with the expenditure incurred on progressive mine closure activities during last 5 years, it is very important that progressive mine closure records, plans, expenditure details along with proof are properly maintained.

At this juncture it is important to note that some of the progressive mine closure activities, enumerated in the preceding paragraphs, are legal obligations specified in Project reports, EMP, permissions obtained from statutory bodies such as CPCB, SPCB, DGMS etc. The Project authorities are bound to comply with these obligations.

3.10 Re-deployment of work force

The current manpower of the project is 1752. And at present, it is very difficult to assess the manpower of the project, which will remain at the time of closure of mining activities in the presently worked seams. As some of the seams of the block is still virgin and is most likely to be mined in future, the remaining manpower will be gainfully utilized in continuing mining activity.

3.11 Emancipation from the community facilities and the facilities to the PAPs

3.11.1 The Project affected Persons (PAPs) and also the local communities are being provided many civic facilities, such as educational facilities, health

facilities, and drinking water. As some of the seams of the block are still virgin and are most likely to be mined in future, these facilities, in all probability, will be kept maintained.

3.11.2 However, at the time of final closure after exhaustion of entire mineable reserve these facilities will be entrusted upon the local bodies/Trust of PAPs/State bodies after consultation with local people and state authorities so that same could continue even after the mine closure. If needed, a lump sum reasonable amount would also be paid to the local bodies/Trust of PAPs/State bodies after proper approval for proper upkeep and maintenance of various community facilities.

3.11.3 To ensure that no financial loss due to the closure of mining activity in the presently worked seam occur to the local community engaged indirectly to the existing mine, following steps would be taken:

- It has been seen in past that in the event of closure of a mine, the local people indirectly dependent on the mine switch over their economic/professional activities in the existing/new or expansion mines located in the nearby area. Local management, if needed, extends some basic helps to them in such type of switching over. Hence, it is expected that in this project also the transition of the local people from one area to the other area for their sustenance would not be any problem.

- It is proposed that reclaimed and afforested land will be handed over to State Forest Dept. for the benefit of local ecosystem. The forest wealth can also be utilised by local people or tribal in the form of fruits and fodders.

- The proposed picnic spot would be handed over to a society of local people for commercial use of the picnic spot by them.

CHAPTER – IV

ECONOMIC REPURCUSSION

4.0 Economic Repercussions of closure of mine

4.1 Manpower of the project

The total proposed manpower strength of NT-ST-Jeenagora Group of Mines is 1752 (as per UCE of Proposed NTST Expansion OCP, October, 2011).

Table 4.1Present Manpower

Manpower	Strength (Nos.)
EXECUTIVE	87
NON EXECUTIVE	1665
TOTAL	1752

Post Closure Manpower

It has been proposed to monitor and implement the post-closure activities departmentally. Departmental manpower will be needed after closure of the mine for monitoring and implementation of the post closure activities. Manpower required for the same is given in Table- 4.2.

Table 4.2: Manpower required for monitoring and implementation of Mine Closure Activities

Sl. No.	Category of Manpower	Requisite heads
1	Officer-in-charge/ Manager (Mining)	2
2	Overman-in-charge	3
3	Foreman/Overseer-in-charge	3
TOTAL		**8**

4.2 Assessment of income scenario of local people

As NT-ST-Jeenagora Group of Mines is basically an opencast mining project in the long run, a lot of surface excavation will be undertaken. Moreover, the basic mining infrastructures have been made on the company acquired land. So there will be displacement of some local people from this project. Sufficient fund has been provided in the Jharia Action Plan to rehabilitate and resettlement of the project affected people of this project.

After the closure of the mine, the manpower deployed in the mine will be further redeployed in other mines of BCCL to make no loss of sustenance income of the eligible employee.

4.2.1 At present, it is very difficult to assess the manpower of the project, which will remain at the time of closure of mining activities in the existing project.

4.2.2 The local communities are being provided many civic facilities, such as educational facilities, health facilities, and drinking water. At the time of final closure after exhaustion of entire mineable reserve these facilities will be entrusted upon the local bodies/Trust of PAPs/State bodies after consultation with local people and state authorities so that same could continue even after the mine closure. If needed, a lump sum reasonable amount would also be paid to the local bodies/Trust of PAPs/State bodies after proper approval for proper upkeep and maintenance of various community facilities.

4.2.3 To ensure that no financial loss due to the closure of mining activity in the presently worked seam occur to the local community engaged indirectly to the existing mine, following steps would be taken:

- It has been seen in past that in the event of closure of a mine, the local people indirectly dependent on the mine switch over their economic/professional activities in the existing/new or expansion mines located in the nearby area. Local management, if needed, extends some basic helps to them in such type of switching over. Hence, it is

expected that in this project also the transition of the local people from one area to the other area for their sustenance would not be any problem.

- It is proposed that reclaimed and afforested land, if any, will be handed over to State Forest Dept for the benefit of local ecosystem. The forest wealth can also be utilised by local people in the form of fruits and fodders.

CHAPTER – V

TIME SCHEDULE FOR POST-CLOSURE ACTIVITIES

5.1 It is very difficult to predict the various parameters which would be prevalent at the time of final mine closure (when the entire block reserve would get exhausted) and therefore a mine closure activity schedule cannot be rigidly prepared at this point of time.

5.2 The closure of mine involving technical aspects, environmental aspects, socio-political aspects and financial assurances as implementing post-closure activities will run for three years. The time schedule envisaged for completion of all closure activities is presented in the following table in the form of bar chart.

Table 5.1 Implementation Schedule for post-closure activities for NT-ST-Jeenagora Group of mines.

Sl. No.	Major Activities	Time Period	Year-wise Phasing			
			Y1	Y2	Y3	Y4
1	Technical aspects	2 years				
2	Environmental aspects	2 years				
3	Post closure environment monitoring	3 years				
4	Socio-political aspects	3 years				

5.2.1 Technical Aspects:

i) **Safety & security**: In the mine closure plan, action will be taken to cover all the safety aspects including management of fire & subsidence and mine inundation.

i) **Management of pit slopes and waste dump**:

The same has been addressed in detail in the Para No. 3.4 and in Para. 3.6.2.

ii) **Management of hydrology and hydro-geology**: After closure of mining activities, the workings will be waterlogged which will help in maintaining the water table in the surrounding areas and may become a source of water supply to the neighbouring areas.

iii) **Closure of Mine Entries**: After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any unauthorized entry into the area. However, the guidelines / instructions from DGMS, if any, will be followed.

iv) **Disposal of mining machinery**: All the opencast machineries, which will have residual life, will be shifted to the other collieries of the area/company. The salvaging and shifting operation of mining machinery and other equipment will be done considering the ground realities during the period 1 (one) year advance of final mine closure.

v) **Details of surface structure proposed to be dismantled**:

As far as possible, industrial structures will be utilised by the adjacent mine. However, if these structures are not found fit at the end of mine life, the same will be dismantled and salvaged. The equipments will be removed and used somewhere else. Every effort will be made to restore the area to economic utilization value in line with mine closure plan.

A. **Service Buildings**: The service buildings/ structures, viz. workshop, stores, office building, Site office, rooms, etc. are to be demolished after collecting all re-useable items, or be used for some other projects and the land covered by them restored for productive use. However, it has to be ensured that as and when a service building is vacated/ abandoned, the same should be demolished to prevent any unauthorized occupation.

B. **Other Infrastructures**: All other infrastructures like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. will be utilized for the neighbouring projects.

However, possibility shall be explored for handing over the buildings and other infrastructures including the reclaimed land to the State Government for the benefit of local villagers and strengthening the area infrastructures. The end use of these facilities shall be decided by the State Government with the help of District Authorities and Village Panchayat. The peripheral village community facilities developed by the Mine Authorities will be left to the Local Body/ State Government for their management and public use.

Prior to surface demolition/ restoration, a surface audit will be undertaken on all surface structures, spoil heaps etc. to assess whether there is any hazardous material that could cause problem, i.e. explosive, asbestos, chemical, oil, etc.

A list of surface and OCP assets (Plant & Machinery) will be prepared and made available to potential purchasers or transferred to other new/ working mines of the company. This will ensure that the assets perform during their economic life.

5.2.2 Environment Aspects

i) **Mined-out land and proposed final land use:** At NT-ST-Jeenagora Group of mines it is proposed to extract coal by opencast method. The existing infrastructures, if not usable, will be dismantled and the land will be graded & will be handed over to the local authorities for community use.

ii) **Air & Water quality management:** Appropriate air and water pollution control measures will be taken to contain the air and water pollution for maintaining the ambient air and water quality within the stipulated standards besides making the mining operation eco-friendly in the project. These measures (both preventive and suppressive) are enumerated in Para 3.2.3 of the present report.

iii) **Management of waste:** The solid wastes generated by the mine during the coal production are non-hazardous and non-toxic in nature. The above solid wastes will be disposed off by backfilling the mined out area and then re-vegetating without causing any siltation problem on surface water bodies.

However, scientific studies shall be undertaken regarding applicability of solid wastes for various uses. Toxic solid wastes like used oil, used batteries, oily sludge, besides filters and filter materials containing oil during maintenance of vehicles, will be generated by the mining project. Used oil will be stored in drums safely for disposal through auction to the authorized re-processors. Similarly, used batteries will be stored safely for auction to the authorized re-processors. The oily sludge, besides filter and filter materials, will be disposed off in impervious layer lined pits without causing environmental hazards.

iv) **Management of final voids**: It will be dealt as per the directive provided in the EMP.

v) **Land reclamation and rehabilitation:** If any cracks or void is created due to mining activities, it will be restored to original profile by filling up cracks/ voids. It is proposed that the site restoration should be kept progressive so that the restoration is more or less similar to the rate of mining.

vi) **Reclamation of forest/ vegetation and plantation:** 17 Ha of forest land is required for the project. Moreover, regular plantation will be taken up during the life of the mine to create green barrier. The plant species will be selected in consultation with the state forest department.

The objective of restoration of post mining area will be determined through consultation with local community and the Government authority, so that the potential/ required end use of the mined out land is determined in advance. Such usage may be agriculture, forestry, amenity development or nature reserve.

5.2.3 Post Closure Environment Monitoring

After cessation of mining and its related activities, there will be no effect on ambient air and water quality due to this mine as proper mitigation measures for air and water pollution control are to be taken by the authorities of the mine. However, the air and water quality parameters in the mined out area will be monitored by some external agency for next three years after closure of the mine.

Air and water samples will be taken from the specified sampling stations at regular frequency for 3 consecutive years after the closure of the mining project. 1 sample of mine water will be collected and analyzed with fortnightly frequency and 2 samples of ground water from core & buffer zones with monthly frequency. Similarly, 1 air sample will be taken at core zone, and 1 air sample each in upwind and downwind directions of the project at fortnightly frequency.

5.2.4 Socio-Political Aspects

i) **Re-deployment of work force**: Due to closure of mining operations, the persons directly employed in the mine will be surplus. Suitable manpower re-deployment plan may be formulated by the mining company sufficiently before closure of mine for re-deployment of the work force in other units of the company. Alternatively, they would be given option of voluntary retirement.

ii) **Civic facilities**: It is proposed that the civic facilities developed during the mining phase will be transferred to the local government/ municipality so that the region transforms smoothly into post mining phase. A one-time payment should be made by the mine for obtaining its release from providing these facilities, which will there from be taken care of by the local and state bodies.

iii) **Channelisation of available water**: If the mine has sufficient water, this can be used for domestic and agriculture purpose by the local community. The water from this area shall be discharged after treatment for domestic and agricultural usages.

iv) **Emancipation for project affected population**: The village/ basti which are to be rehabilitated at North Tisra, Jeenagora OCP and South Tisra as per Master Plan of JCF (March'08) are given in Table No. 5.2A, 5.2B and 5.2C:

Table 5.2A Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
BCCL Colony No. 1/O1	142	47	47	5	241
SG Section Basti /O3	41	0	0	0	41
Tilaboni Basti/O2	15	122	122	6	265
Tilaboni Basti/O2	0	153	0	0	153
Total(Phase-I)	**198**	**322**	**169**	**11**	**700**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**198**	**322**	**169**	**11**	**700**

Table 5.2B Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
Central Sulunga Colony No.1/ O9	90	1	5	1	97
E.B. Section colony no. 1/O1	19	9	0	0	28
E.B. Section colony no. 1/O1	0	0	10	0	10
EB Sec. Colony No. 2/O2	58	0	0	1	59
Khas Jeenagora Colony No.1/O3	88	0	0	0	88
Khas Jeenagora & Kalisthan /O5	40	0	0	1	41
Khas Jeenagora Colony No. 2/ O4	107	0	0	5	112
Khas Jeenagora Colony no. 3/ O6	64	43	10	1	118
Khas Jeenagora Colony no. 4/O7	13	0	0	1	14
Total(Phase-I)	**479**	**53**	**25**	**10**	**567**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**479**	**53**	**25**	**10**	**567**

Table 5.2C Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
B.J. & S.T. Section/ O3	110	85	42	3	240
Huchuktand Basti/O1	29	95	24	2	150
No.1 Pit S.T. Section /O2	38	21	0	0	59
Total(Phase-I)	**177**	**201**	**66**	**5**	**449**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**177**	**201**	**66**	**5**	**449**

5.3 Although, it is very difficult to conclusively predict the likely impacts due to closure of the mining activities in the in the leasehold area of the Instant Project and the likely activities that would be taken up at that point of time, but a broad mine closure activity schedule may be prepared as per guidelines of Ministry of Coal. The post closure implementing activities will run for three years. The activities given overleaf as per the given bar chart are most likely to be implemented.

IMPLEMENTATION SCHEDULE FOR MINE CLOSURE IN NT- ST JEENAGORA GROUP OF MINES(OC)

(LIFE OF THE MINE: 30 YEARS)

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
A	**Dismantling of Structures**										
	Service Buildings	2 years									
	Residential Buildings	2 & ½ years									
	Industrial structures like CHP, Workshop, field sub-station, etc.	2 & ½ years									
B	**Permanent Fencing of mine void and other dangerous area**										
	Random rubble masonry of height 1.2 metre including leveling up in cement concrete 1:6:12 in mud mortar	2 years									
C	**Grading of highwall slopes**										
	Levelling and grading of highwall slopes	2 years									
D	**OB Dump Reclamation**										
	*Handling/Dozing of OB Dump and backfilling	Throughout the life of the mine including 3 years after cessation of mining operation									

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
	*Technical and Bio-reclamation including plantation and post care	Throughout the life of the mine including 3 years after cessation of mining operation									
E	**Landscaping**										
	Landscaping of the open space in the leasehold area for improving its esthetics and eco value	Throughout the life of the mine including 3 years after cessation of mining operation									
F	**Plantation**										
	Plantation over cleared area obtained after dismantling	2 years									
	*Plantation around the quarry area and in safety zone	Throughout the life of the mine including 3 years after cessation of mining operation									
	*Plantation over the external OB Dump	Throughout the life of the mine									
G	**Post Closure Env Monitoring / testing of parameters for three years**										
	Air Quality	3 years									
	Water Quality	3 years									

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
H	***Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people**	Throughout the life of the mine									
I	***Miscellaneous and other mitigative measures**	Throughout the life of the mine including 3 years after cessation of mining operation									
J	**Post Closure Manpower cost for supervision**	3 years									

NOTE: *: To be covered under Progressive Mine Closure activities also**.**

NOTE: The progressive mine closure will be done as per the provisions made out in the Project report and as per the situation/requirement that may arise in course of execution of the Project Report.

CHAPTER – VI

MINE CLOSURE COST

6.0 Mine Closure activities would be a constant exercise for the mine which would begin with the commencement of mining operations and continue till post closure. The mine closure activities would naturally entail certain expenditures, which will have to be borne by the mine operator. There would be two types of expenditures on account of mine closure activities in respect of NT-ST-Jeenagora Group of mines:

6.1 Revenue expenditures

This would cover the activities which are being executed along with normal mining operation and would continue to be executed in course of execution of the project. The cost of progressive mine closure activities is already part of the project cost.

6.2.1 Expenditures to be incurred just prior to actual mine closure and in the post closure period

6.2.2 As per MOC guidelines, a corpus escrow account @ ₹ 1.0 lakhs (August, 2009 Price Level) per Ha (for UG) and @ ₹ 6.0 lakhs (for OC) of the project area shall be opened with the coal controller organization to meet the expenses of final mine closure. The current Guidelines read as:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the project area and it would be Rs. 1.00 lakh per Hectare for underground mine project area at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time".

In NT-ST-Jeenagora Group of Mines, the proposed project area is about 1431.0Ha. Therefore, the entire 1431.0Ha of project area (existing and

proposed) has been considered for the calculation of closure cost of the area based on OC norms.

The money deposited in the Escrow Account has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure

6.2.2 As per the above guidelines these rates will stand modified based on Whole Price Index as notified by Government of India from time to time. Thus the total expenditure on this front may be calculated in following manner:

- The total amount for mine closure activity in respect of the proposed NT-ST-Jeenagora Group of Mines = 1431.0 Ha X ₹6.00 lakhs X 1.35416 =₹11626.875 lakhs

*** The amount has been escalated based on WPI of July, 2013(175.5) vis-à-vis WPI of August '09(129.6).**

6.2.3 It is difficult to conclusively predict the mining parameters on a long term basis owing to rapidly changing mining technology, developments in the field of clean coal technologies and R&D activities in development of alternative energy sources.

As per the latest Guidelines issued by the MoC, GoI(dt. 07.01.2013) the *"annual closure cost is to be computed considering the total project area at the above mentioned rates and dividing the same by the entire life of the mine in years for new projects and balance life of mine in years for operating/existing mines."*

Jharia Coalfield is characterized by occurrence of a number of working coal horizons, giving a leverage of extended working life of the mines. Some more seams can come in the lap of workable horizons due to improvement in mining

technology in times to come. The underground mines in leasehold of JCF are generally small capacity mines, giving a false impression of very long lives due to small level of current production level. There may be a strategy in future to amalgamate the mines for higher production level to attain the economics of scale. The existing OC Mines working at shallow depth may be worked at a greater depth, In such a situation, the life of the mine arrived at with current level of production for the balance reserve may not be workable in the long run.

In view of the above, for the purpose of mine closure cost calculations, the life of the mine has been taken from formulated project report of NT-ST-Jeenagora Group of Mines as mentioned in the approved TOR/Form-I. Since the proposed life of the NT-ST-Jeenagora Group of Mines was calculated as 30 years, the life of NT-ST-Jeenagora group will be also 30 years.

To arrive, at the annual cost, to be deposited in each year in an escrow account, the mine closure cost has been divided by 30, as shown below:

- Amount to deposited in 1st year will be--------₹ 387.563 lakhs
- Amount to be deposited in 2nd year will be—₹ 387.563 (1 + 5%)^1 lakhs
- Amount to be deposited in 3rd year will be—₹ 387.563 (1 + 5%)^2 lakhs

6.2.4 In the above fashion, an amount will be deposited every year up to the last year of mine life by applying the following formula:

- Amount to be deposited in Nth year will be --- ₹ 387.563 (1 + 5%) ^(n-1) lakhs

6.2.5 The amount calculated by the above formula shall be deposited every year by BCCL in the Escrow Account opened with the Coal Controller organisation in a scheduled Bank. An agreement, outlining detailed terms and conditions of operating the said Escrow Account shall be executed amongst BCCL, the Coal Controller and the commercial Bank.

6.2.6 Thus, total amount that shall be deposited for final mine closure activities **NT-ST-Jeenagora Group of Mines** during the considered period of 30 years stands out to be ₹ 25749.206 lakhs as per the present status of the mine. The Break-Up cost of Mine Closure of NT-ST-Jeenagora Group of Mines Yearwise is given in Table No. 6.1.

Table No. 6.1 Yearwise Break-Up Mine Closure Cost

Year	Amount to be deposited per year ₹ in Lakhs
1	387.563
2	406.941
3	427.288
4	448.652
5	471.085
6	494.639
7	519.371
8	545.339
9	572.606
10	601.237
11	631.298
12	662.863
13	696.007
14	730.807
15	767.347
16	805.715
17	846.000
18	888.300
19	932.715
20	979.351
21	1028.319
22	1079.735
23	1133.721
24	1190.407
25	1249.928
26	1312.424
27	1378.045

Year	Amount to be deposited per year ₹ in Lakhs
28	1446.948
29	1519.295
30	1595.260
Total	25749.206

6.2.7 Based on the existing mine closure planning norms, the above calculated cost at WPI of July 2013 on mine closure may be tentatively grouped under different heads as given in Table No. 6.2 as per the guidelines of CMPDI(HQ).

Table 6.2 Break up Costs of Mine Closure Activities

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	51.498
	Residential Buildings	687.504
	Industrial Structures like CHP, Workshop, field sub-station, etc.	77.248
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	386.238
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	455.761
D	**OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	22829.246
	Bio-Reclamation including soil spreading, plantation and maintenance	102.997
E	**LANDSCAPING**	
	Landscaping of the cleared land for improving its aesthetics	77.248
F	**Plantation**	
	Plantation over area obtained after dismantling	128.746
	Plantation around fencing	51.498
	Plantation over the cleared external OB Dump	5.150

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
G	**Monitoring/Testing of parameters for three years**	
	Air Quality	56.648
	Water Quality	51.498
H	**Entrepreneurship Development(Vocational/skill development training for sustainable income of affected people**	66.948
I	**Miscellaneous and other mitigative measures**	514.984
J	**Manpower Cost for Supervision**	205.994
	TOTAL	**25749.206**

6.2.8 Thus, total amount that shall be deposited for final mine closure activities of **NT-ST-Jeenagora Group of Mines** mine during the period of 30 years has been estimated as **₹ 25749.206 lakhs** based on UG norms at WPI of July 2013.

6.2.9 *Mining is to be carried out in a phased manner initiating afforestation/reclamation 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. 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 shall be released to mine owner/leaseholder at the end of the final Mine Closure on compliance of all provisions of Closure Plan. This compliance report should be duly signed by the lessee and certify that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court etc. and certified by the Coal Controller.*

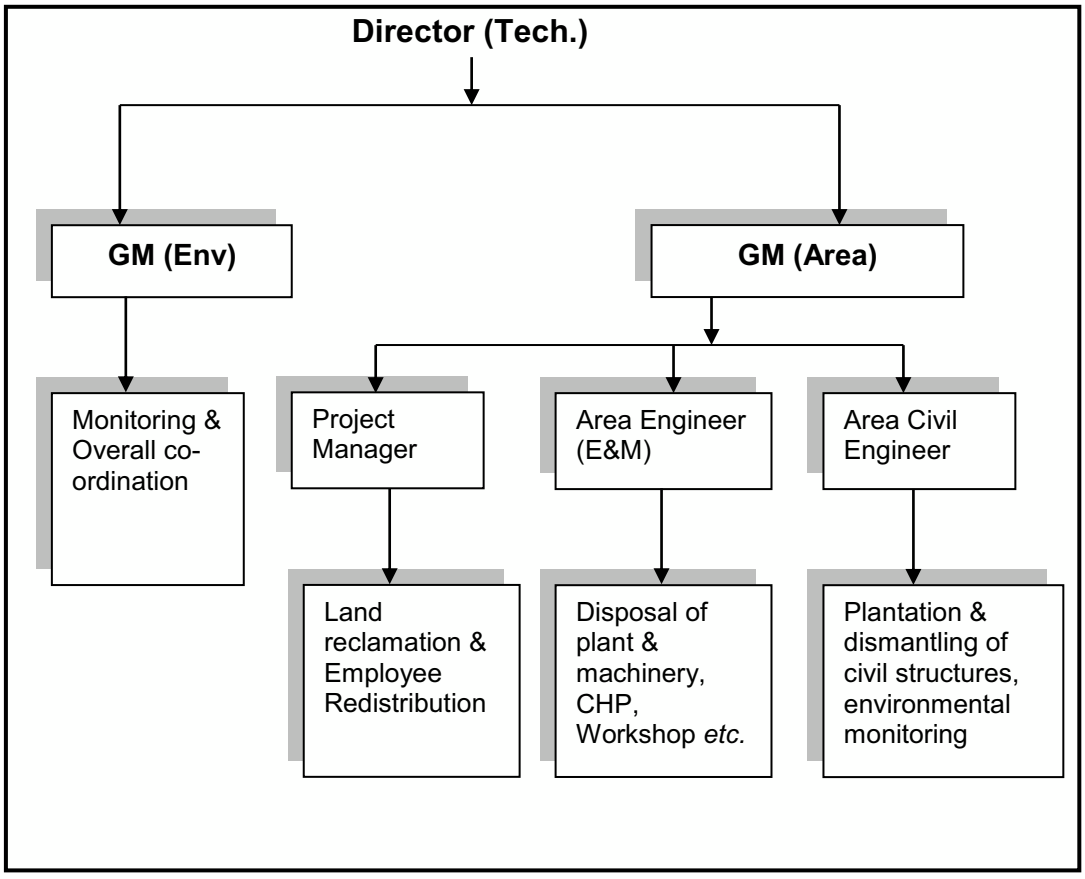
6.2.10 However, the additional amount beyond the escrow account, if any estimated later on, will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guideline)**.**

CHAPTER-VII

IMPLEMENTATION PROTOCOL

7.1 As the mine closure activities would continue even after cessation of mining activities, an organization consisting of different discipline would be formed to undertake the implementation of mine closure activities as well as monitoring of the same**.** Such activity shall continue for a period of three years after the closure of mining activity in the mine. Once the closed mine becomes stabilized in respect of safety, environmental and social aspects, the monitoring team would be withdrawn.

7.2 For implementing the mine closure activities and monitoring thereof, the following organisational structure at Corporate level has been proposed:



7.3 Environmental monitoring for three years after closure of mine will be carried out to evaluate the environmental quality of the area. If need be, proper mitigation measures will be taken up after evaluating the environmental quality. Before closure of the mine, Area GM will prepare survey and disposal report and the same will be submitted to DGMS for acceptance.

7.4 When the mine closure activities would take final shape and the entire are under influence is brought to an acceptable shape, BCCL would 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 for surrendering the reclaimed land to the State Government concerned.

CHAPTER – VIII

PLANS ENCLOSED

The following underground and surface plans have been enclosed along with this mine closure report plan:

a. Location Plan of Cluster IX
b. Surface cum Topographical plan of Cluster IX showing surface features, contours, roads, depot/siding, OB dumps, quarries (working/old/discontinued), subsidence, plantations, habitations, vacant land, surface water bodies, natural drainage and mine discharge water channels
c. Geological Plan of Cluster IX
d. Working plan of IV B Seam- North Tisra UG
e. Surface Plan of existing NTST OC.
f. Final Stage Dump Plan of NTST Expansion OCP

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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.

BHARAT COKING COAL LIMITED

MINING PLAN

AND

MINE CLOSURE PLAN

FOR

AMALGAMATED JOYRAMPUR COLLIERY (OC)

(LODNA AREA)

November – 2017

CENTRAL MINE PLANNING & DESIGN INSTITUTE LTD.
REGIONAL INSTITUTE NO.-II
DHANBAD

MINING PLAN AND MINE CLOSURE PLAN

FOR

AMALGAMATED JOYRAMPUR COLLIERY(OC)

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MINING PLAN AND MINE CLOSURE PLAN

FOR

AMALGAMATED JOYRAMPUR COLLIERY(OC)

LIST OF ANNEXURE

Sl. No.	Particulars	Annexure No.	Page No.
1	Copy of noting sheet from GM(P&P), BCCL & GM, Lodna Area, BCCL for preparation of Mining Plan	IA & IB	A.1 & A.2
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MINING PLAN AND MINE CLOSURE PLAN

FOR

AMALGAMATED JOYRAMPUR COLLIERY(OC)

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1	G-I	Location plan
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Floor Contour Plan of Seams		
5	G-V-A	XV-A
6	G-V-B	XV
7	G-V-C	XIV-A
8	G-V-D	XIV
9	G-V-E	XIII-B
10	G-V-F	XIII-A
11	G-V-G	XIII
12	G-V-H	XI/XII & XI/XII/XIII (Combined)
13	G-V-I	IX/X
Seam Folio Plan of Seams		
14	G-VI-A	XV-A
15	G-VI-B	XV
16	G-VI-C	XIV-A
17	G-VI-D	XIV
18	G-VI-E	XIII-B
19	G-VI-F	XIII-A
20	G-VI-G	XIII
21	G-VI-H	XI/XII & XI/XII/XIII (Combined)
22	G-VI-I	IX/X
23	MIN-I	Surface Plan
24	MIN-II	Plan Showing Initial Stage Mining Operation
25	MIN-III	Plan Showing Intermediate Stage Mining Operation
26	MIN-IV	Final Stage Dump Plan
27	MIN-V	Surface Plan showing the location of proposed external OB dump
28	ENV-I	Plan showing Proposed Plantation Sites

List of Abbreviations used in the Report

BCCL - Bharat Coking Coal Limited
RF - Representative Factor
MECL - Mineral Exploration Corporation Limited
UVM - Unit Volatile Matter
UHV - Useful Heat Value
GCV - Gross Calorific Value
BH - Bore Hole
B&P - Bord and Pillar
SDL - Side Discharge Loader
DB - District Board
SOP - Standing on Pillar
OC - Open Cast
OB - Over Burden
HEMM - Heavy Earth Moving Machinery
CMR - Coal Mines Regulations
DGMS - Directorate General of Mines Safety
UG - Underground/Ungraded
GPM - Gallon Per Minute
HT/LT - High/Low Tension
HP - Horse Power
DVC - Damodar Valley Corporation
BOD - Biological Oxygen Demand
MCP - Mine Closure Plan
WM - Weathered Mantle

GENERAL INFORMATION

1. Name of the Coal Block area (Acre/Hectare/Sq. Km.)
   Amalgamated Joyrampur Colliery(OC) (Part of Mukunda), 1186.97 Ha as per the plan supplied by the colliery authority.

2. Name of the Coalfield and its location i.e. District and State
   Jharia Coalfield, Dhanbad distt. , Jharkhand

3. Name & Address of the Applicant : Kalyanji Prasad
   General Manager,
   Lodna Area, Bharat Coking Coal Limited,
   Dhanbad.

4 Indication, if it is a Revised Mining Plan and if so, the Revision no. i.e. First Revision, Second Revision etc.

   Not Applicable

5. Targetted capacity: 2.512 MTY + 30%

6. Date of preparation of Mining Plan- November.2017

7. Indication, if the Mining Plan is re-submitted after incorporation the suggestions of Standing Committee

   Not Applicable

C. SUMMARISED DATA	
1. General	
a) Name and Addresses of the applicant company	BCCL(A Central Public Sector Undertaking) owned by Govt. of India
b) Name and address of the Block allottee	Not Applicable
c) Relationship between the applicant allottee company	Not Applicable
d) Status of the applicant company: Central / Public Sector Undertaking / state Government Undertaking / IV Company / Pvt. Company / Public Co. / Others (Specify).	Central PSU
e) Name of the coal block together with name of coalfield & state where located	Part of Mukunda Block, JCF, JHARKHAND
f) Date of allotment	By Nationalisation
g) End use of coal as per approval by the competent authority	Power Houses & Steel Plant
h) ROM quantity proposed to be produced as per mining plan	0.40 Mill.Te in 1st year, 0.70 Mill.Te. in 2nd year, 1.00 Mill.Te per annum in 3 rd year, 1.40 in 4th year, 1.90 Mill. Te. In 5th year, 2.512 Mill.Te. from 6 th year to 22nd year, 1.80 Mill.Te in 23rd year, 1.30 Mill. Te. In 24 th year, 0.825 Mill. Te in 25th year.
i) Norms adopted for calculating ROM quantity requirement is case is differs from the quantity indicated in the allotment order.	Not Applicable
j) Beneficiation required – Yes/No	No
k) Requirement of beneficiated coal & expected availability thereof.	Not Applicable
l) Period for which mining lease is to be renewed	NA
m) Date of Expiry of earlier mining lease, if any	30.04.2002
n) RQP who has prepared the mining plan*	

*Based on authenticated data, information and plans furnished by Amalgamated Joyrampur Colliery (OC), Lodna Area, BCCL, this mining plan is prepared at CMPDI, RI-II.

D. Information regarding earlier approved Mining Plans, if any	
a) Approval letter no and date	**NOT APPLICABLE**
b) Lease Area	
c) Date of grant of lease	
d) Date of Expiry of lease	
e) Targeted Production	
f) Proposed year of start of production	
g) Propose year of achieving the targeted production level	
h) Envisaged life of the mine (in years)	
i) Date of actual commencement of mining operations, if operations already started	
j) Likely date of Mining Operations, if operations not yet started & reasons for non-commencement of operations	
k) Planned production and actual levels achieved in last 3 years.	
l) Coal – U/G	
O/Cast	
OB	
m) Reasons for difference between the planned and actual production levels.	
n) Reason for revision of the Mining Plan	
o) Details of changes in the new mining plan compared to earlier approval	
(i) Lease Area	
(ii) Block boundary	
(iii) Production level	
(iv) Reserves	
E. Location	
a) Location of the Block Taluka / Village / Khasra / Plot / Block Range/ Etc.	Lodna, Padhyadih, Madhuban, Bhulan Bararee, Brahman Bararee, Radhachowk, Bhati, Jealgora, Bagdigi, Joyrampur and Nunudih mouza
b) Name of the Coalfield / Coal belt	JHARIA Coalfield
c) Particulars of adjacent blocks North – South, East, West	.
d) Area of the allotted block (hectares) i. Geological block area ii. Mining block area	Part of Mukunda Block, Total leasehold area -1186.97 Ha.

e) Reference no. of plan of block boundary issued by CMPDI/SCCL / NLCL (a copy of the plan also to be annexed)	Not Applicable
f) Whether the lease boundary / required boundary is same as demarcated by CMPDI/SCCL / NLCL for delineating block / sub-block.	Not Applicable
g) Existing Mining Lease Area in case of existing mines, (hectares)	1186.97 Ha
h) Applied / Required Lease Area as per the mining plan under consideration (hectares)	1186.97Ha
i) Whether the applied lease area falls within the allotted block	Yes
j) Area (hectares) of lease which falls outside the block/ sub-block delineated by CMPDI/SCCL/NLC.	Not Applicable
k) Details of outside area: - Whether forms part of any other coal block - Whether it contains any coal/ lignite reserves - Purpose for which it is required, e.g. roads/ OB dumps/service buildings/ colony safety zone / others (specify)	Not Applicable
l) Whether some part(s) of the allotted block has not been applied for mining lease. - Total area in Ha. Of such part(s) - Total reserves in such part(s) - Brief reasoning for leaving such part(s)	Not Applicable
m) Type of land involved in Hectares - Forest land - Non Forest land o Tenancy land o Govt. land o BCCL Land o Others	 Nil 49.91 Ha 23.61 Ha 1002.94 Ha 110.51 Ha
n) Proximity of public road / railway line/ major water body if any and approximate distance.	The Amalgamated Joyrampur Colliery is located in the South-eastern part of the Jharia coalfield. It is situated at a distance of 11 Km from Dhanbad Railway station and situated in the eastern side of Jharia Patherdih – Sindri main road.
o) Topo sheet no. with latitude and longitude	The project area lies between Latitude 23º44'03" to 23º40'57" (N) and Longitude 86º24'43" to 86º26'46" (E). The area falls in Survey of India Topo sheet

	No. 77, 78, 79, 85, 86 & 87 (all partly) of Jharia coalfield (RF 1:4000).
F. GEOLOGY AND EXPLORATION	
a) Name of the Geological Block and area in hectares	Amalgamated Joyrampur Coliery (OC), Part of Mukunda Block. Area of the Leasehold Boundary of the mine : 1186.97 hectares
b) Name of the Geological Report (GR) with year of preparation	Geological Report on Exploration for Coal in Mukunda Open Cast Block, Jharia Coalfield, Dhanbad (July, 1981, prepared by CMPDI)
c) Name of the agency which conducted exploration and prepared GR	CMPDI, MECL & GSI
d) Period of conducting exploration	Till mid of June, 1981
e) Details of drilling (by all agencies)	Table Enclosed **(Table-3.1)**
f) No. of boreholes drilled within the leasehold boundary	68
g) Overall borehole density within the block (no./sq.km)	6 BHs/Km^2
h) Area covered by ' detailed' exploration within the leasehold boundary (hectares) i) Area covered by ' detailed' exploration outside the block(hectares) - No. of boreholes drilled outside the block - Borehole density for outside area (no./sq.km)	1186.97 hectares 1013.03 hectares 63 6 BHs/Km^2
j) Whether entire lease area has been covered by 'detailed' exploration.	Yes
k) Whether any further exploration is required or suggested and timeframe in which it is to be completed	No
l) Number of coal/lignite seams/horizons - Thickness range of coal seams - Mean Thickness of total coal horizon - Standard Deviation of thickness - Minimum & maximum depth of coal seams	Table Enclosed **(Table-4.2)**
m) Gross Calorific Value (GCV in K Cal/kg) and useful Heat Value (UHV in K. Cal/Kg). of cal as per GR : Range Mean	All coal seams are coking

n) Quality(Grade) of coal as per GR: Range Mean	Given in seam wise description
o) Total geological reserves in the block	Net Geological Reserves considered is 121.09 M.Te within the leasehold boundary
p) Depletion of reserves(in case of running mine)	NA
q) Additional reserves established (if any for running mine) r) Geological reserves considered for mining: by opencast by underground	NA Net Geological Reserves considered for Opencast Mining is 57.81 M.Te within delineated quarry..
s) Corresponding Extractable reserves: by opencast by Underground	Extractable/Mineable Reserves considered for Opencast Mining is 52.029 M.Te . within delineated quarry.
t) Percentage of recovery w.r.t. geological reserves by opencast by Underground *Seam wise details of items (f) to (t) to be included in the relevant chapter.	Mineable/Extractable Reserve is 90% of Net Geological Reserves of the Seams considered within delineated quarry.

G. Mining	
a) Existing and proposed method of mining (opencast for OB & coal separately with dragline/ shovel / surface miners / manual / etc.) (underground by long wall/ bord & pillar / continuous miners/ LHD/ SDL/manual/etc..)	Opencast with Shovel - dumper
b) The peak capacity as well in addition to targeted capacity in mtpa when the mine is fully developed and the year which proposed to be achieved by underground: by opencast : Total:	0.40 Mill.Te in 1st year, 0.70 Mill.Te. in 2nd year, 1.00 Mill.Te per annum in 3 rd year, 1.40 in 4th year, 1.90 Mill. Te. In 5th year, 2.512 Mill.Te. from 6 th year to 22nd year, 1.80 Mill.Te in 23rd year, 1.30 Mill. Te. In 24 th year, 0.825 Mill. Te in 25th year.
c) Life of the mine underground workings: opencast workings: Total:	- 25 Years 25 Years

d) Indicate quantum of production and expected grade as in table below:

Year	UG production Mt	Opencast			ROM coal (Mt)	Saleable coal (Mt)	Washery rejects (Mt)
		Production Mt	OB (Mcum)	Stripping ratio (cum/t)			
Year wise till targeted production is reached	-	The detailed calendar programme given in Chapter V					
Total for full lease period	-						

e) Whether the proposed external OB dump site is coal/ lignite bearing: - If so, whether coal/lignite below waste disposal area is extricable.	NA
f) Whether negative proving for coal / lignite in the proposed site for OB dump / infrastructure has been done.	NA
g) Proposed configuration of HEMM for OC (Coal & OB) & Major Equipment for UG.	Shovel-dumper
h) Mode of entry for underground mines	-
i) Operations that are proposed to be outsourced	Excavation and transportation of OB and coal including drilling operation.
j) Propose coal evacuation facilities Face to surface Surface to railway siding.	 By Dumpers/Tippers By tippers

H. END USE OF COAL	NOT APPLICABLE
a) Capacity of the approved end use plants	
b) Coal/ lignite requirement for end use plant with grade / quality	
c) % age of end use requirement to be met from this mine	
d) If washing / beneficiation of the coal / lignite is planned to be conducted on site or adjacent to the extraction area, briefly describe the nature of the beneficiation and recovery rate with consumption of water etc.	
e) Proposed Use of Rejects/Middlings	

I. ENVIRONMENTAL MANAGEMENT	
a) Existing land use pattern	Given in Chapter-IX
b) Land area indicating the area likely to be degraded due to mining, dumping, roads, workshop, washery, township etc.	Nil
c) Surface features over the block area	Villages, Infrastructure, etc.
d) No. of villages/ houses to be shifted	Rehabilitation is required for total 9439 houses*
e) Population to be affected by	
f) Year wise proposal for reclamation of land affected by mining activities	Given in Chapter X
g) Monitoring schedules for different environmental components after the commencement of mining and other related activities.	Air and Water quality monitored on regular basis by CMPDI,RI-2

J. PROGRESSIVE AND FINAL MINE CLOSURE PLAN (Details given in Mine Closure Chapter)	
a) Estimated total expenditure for mine closure activities (Rs. in lakhs)	26996.897
b) Major closure activities with proposed expenditure (Rs. in lakhs)	
i. Dismantling of Structures	925.4888
ii. Permanent Sealing of mine entries (incline mouth and air shaft)	420.3945
iii. Subsidence Management	19.2003
iv. LANDSCAPING	115.349
v. Plantation	244.0154
vi. Monitoring/Testing of parameters for three years	164.9246
vii. Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people	100.0635
viii. Miscellaneous and other mitigative measures	590.8691
ix. Manpower Cost for Supervision	262.46

*R&R required for external OB dump is not included as it is yet to be estimated.

K. OTHERS	
a) Base date of mining plan	Novenber,2017
b) Calendar year from which the production will start	2017-18
c) Results of any investigation carried out for scientific mining conservation of minerals and protection of environment, future proposals.	NA
d) Signature of RQP Date Place	

CHAPTER - I

INTRODUCTION

1.0 INTRODUCTION

Bharat Coking Coal Limited, a subsidiary of Coal India Limited, is a Central Public Sector undertaking, owned by the Govt. of India, engaged for extraction of Coal in Jharkhand and West Bengal. Lodna Area of BCCL is located in the South-eastern part of the Jharia coalfield. It is situated at a distance of 11 Km from Dhanbad Railway station and situated in the eastern side of Jharia Patherdih – Sindri main road. Prior to nationalization all the mines were being operated by large nos. of private colliery owners. Amalgamated Joyrampur Colliery is under the administrative control of Lodna area of BCCL.

Amalgamated Joyrampur Colliery is formed by Amalgamation of 05(five) Underground Mines (i.e. Lodna Colliery, Bagdigi Colliery, Bararee Colliery, Jealgora Colliery & Joyrampur Colliery) vide letter no. R-2/0100190/ P-12-15/1517-27 dated 28.8.2015 issued by Director of Mines safety, Region-2,DGMS, Dhanbad . Brief history of each individual mines are given below. All the Underground Mines were earlier worked by different small Mine owners and seams were developed , depillared in patches and at present all the upper seams upto XI/XII seam are under fire. It is proposed to extract the fire affected seams by Opencast method upto IX/X seam to make the underlying seams workable.

The demarcated boundary of Amalgamated Joyrampur Colliery covers a leasehold area of 1186.97 Ha. and it involves part of Mukunda Geological Blocks. Seams from I to XVI Seam exist within the mine and all the upper seams upto XI/XII seam are under fire within boundary of Amalgamated Joyrampur Colliery .

At present all the underground units of Amalgamated Joyrampur Colliery are closed. Now it has been decided by BCCL management to extract the fiery

seams by Opencast method upto IX/X seam to unlock the underlying seams that have been rendered unworkable due to existence of fire in overlying seams.

At present opencast mining operation is going on by deployment of hired HEMM(Patch-D) in the leasehold of Amalgamated Joyrampur Colliery.

BRIEF HISTORY OF MINES :

Lodna Colliery :

This mine is a Large U/G mine situated in the eastern side of the Jharia Patherdih main line. This Mine was opened in the Year 1920 by Turner Morrison Company. At the beginning Bagdigi colliery and Lodna colliery were operated as one mine. Later on Bagdigi Colliery was separated from Lodna Colliery. Prior nationalization a few no of small mines like North Burakar Company , N.S. Lodna, Standard Baniyahir, New Suratand , Lelori Pathra, Kalithan Suratand ,Suratand etc in the periphery of Lodna colliery were also amalgamated to Lodna Colliery.

Total lease hold area of Lodna U/G Mine was 391.64 Ha. In the past there was a washery, Coke plant situated at this Mine and this mine was one of the premier mine of BCCL till a long period after nationalization. In Lodna colliery there are total 17 seams available starting from XVA to IIB/I seam with a minimum thickness of 1.48 m (IIT seam) to maximum thickness of 18.11 m (III seam).

Presently there is no coal production from the mine and only pumping is going on.

Bagdigi Colliery:

With a lease hold area of 61 Ha this mine is presently closed due to fire in the shaft. Production of coal stopped from 22.09.2011 due to water logging and later on shafts were filled up due to fire. This mine was part of Lodna colliery started by Turner Morrison Company in 1920. In the year 1935 there was a water gas explosion in the mine. The Mine got inundated in the year 2001 ,due to which the Mine remained closed for a long time and re-started after

dewatering. In the Year 2013 due to increase in temperature of the in-set stoppings of both 9 & 12 Pit and jumping up of fire from the sealed off areas to the pits both the Pits (9 &12 Pit) were filled up and all the Mining activities in the Mine are stopped. At the time of stoppage of work at Bagdigi colliery development was going on in VII seam.

Presently the entries in the Mine is filled up completely.

Joyrampur Colliery:

Joyrampur colliery with a lease hold area of 98.04 Ha was working but due to water problem production is stopped and only pumping is being done at the present moment. Before nationalization the mine was worked by small mine owners and developed in four sections from north to south namely , East Lodna section, Khas Joyrampur section, Lower Joyrampur section and Pure Joyrampur section.

Presently there is no coal production from underground unit and only pumping is going on. At present opencast mining operation is going on by deployment of hired HEMM(Patch-D) in the leasehold of Amalgamated Joyrampur Colliery.

Bararee Colliery:

This Mine was started by East India Company in the year 1905. Total lease hold area of the mine 475 Ha. Previously it was part of Bhowra area and in the year 1997 this mine was annexed/merged to Lodna Area. Bhulan Bararee thrust zone lies here ,where all the seams abruptly changes its dip from 1in 10 to 1in1.

Presently there is no coal production from underground unit and only pumping is going on.

Jealgora Colliery:

This Mine was started by East India Company in the year 1905. Total lease hold area of the mine 138 Ha. Previously it was part of Bhowra area and in the

year 1997 this mine was annexed/merged to Lodna Area. Production stopped from this mine 2007 due to water logging.

Presently there is no coal production from underground unit and only pumping is going on.

The coal production from 2012-13 to 2016-17 for erstwhile different mines within the leasehold of Amalgamated Joyrampur Colliery is given below:

Sl No.	Name of colliery	Production stopped since	Coal Production in Te.				
			2012-13	2013-14	2014-15	2015-16	2016-17
1	Joyrampur Colliery	25.09.14	67506	22098	3813	0	0
2	Bagdigi Colliery	23.09.11	0	0	0	0	0
3	Lodna Colliery	27.07.13	83434	20460	0	0	0
4	Bararee Colliery	14.02.17	95482	66500	55917	60450	56363
5	Jealgora Colliery	2007	0	0	0	0	0
6	Amalgamated Joyrampur Colliery						67676

1.1 MINING PLAN

The Draft Mining Plan was prepared as per the reference received from BCCL (Vide noting No. 1779 dated 25/10/2017, copy enclosed as Annexure-IA & letter no. BCCL/GM(LA) : Secy :2017/284 dated 14.10.2017 issued by GM, Lodna Area, copy enclosed as Annexure-IB) and circulated to BCCL. Comments regarding Draft Mining Plan has been received from GM(P&P), BCCL(HQ) vide letter no BCCL/GM(P&P)/F-76/456 dated 18.11.2017 and Lodna Area, BCCL vide letter no. BCCL/LA/2017/844 dated 18.11.2017 After compliance of the above comments this report has been finalized and submitted .

Scope of the Mining Plan :

1. Exploitation of the seams by opencast method of mining is considered.

2. Seams from IX/X seam and all above occurring seams (upto XVA seam) within the proposed quarry limit has been considered for exploitation.

3. The Surface limit of west side of proposed quarry has been finalized keeping 60 m distance from proposed diverted route of Chatkari Jore.

Limitation of the Mining Plan

1. Seams below IX/X seam have not been considered for exploitation.
2. Most of the seam has been affected by fire. The extents of fire are tentative and demarcated by colliery authority. The coal resource within the fire area is assumed as "zero" and the coal resource beyond the fire limit as demarcated on the individual seam working plan are tentative and the same may not be available also as impact of fire on individual seams in not known.
3. Grade of coal within the fire affected area cannot be assessed or confirmed, however the grade of coal within the fire area will be given as per available data in Geological Report of Mukunda OCP (1981), which may be deteriorated later due to burning effect of fire and cannot be confirmed.
4. This Mining Plan has been prepared based on the data / plans and other information submitted by Project / BCCL.

This Mining Plan has been prepared based on Feasibility Report prepared earlier by BCCL for obtaining environmental clearance and the data furnished by BCCL/Area/Collieries at current scenario

1.2 SURFACE REORGANIZATION

1.2.1 LAND ACQUISITION:

The Status of land within the Amalgamated Joyrampur Colliery leasehold is given in table below:

Sl. No.	Particulars	Total (Ha)
1	BCCL land	1002.94
2	Forest land	Nil
3	Govt. land	23.61
4	Tenancy land	49.91
5	Others	110.51
	Total	1186.97

The land other than BCCL holding has to be transferred to BCCL / to be acquired by BCCL.

Apart from the above, land for external OB dump of around 424.93 M.Cum. will be required in non-coal bearing area or in the de-coaled area of adjacent mine. The mine management has identified area for external dump that is shown in Plate no.-MIN-V.

1.2.2 REHABILITATION / SHIFTING OF HOUSES

The location of the proposed quarry is highly crowded with population and built up areas. Therefore, huge numbers of BCCL, private and encroacher houses need to be shifted for the operation of the mining plan. As per the data furnished by Colliery authority that all rehabilitation required for excavation is covered under Jharia master Plan.

1.2.3. SURFACE CONSTRAINTS

The Chutkari jore is flowing from north to south through the middle of proposed quarry. This jore needs to be diverted for the operation of the quarry. The diversion of the Chatkari jore will be done through the dipside of the quarry considering topography and existing drainage pattern of the area. Feasibility of diversion of the Chatkari jore along the proposed route needs to be examined in detail. Surface limit of proposed quarry has been fixed keeping minimum 60 m distance from the proposed diverted route of Chatkari Jore. Other mine infrastructures situated over the proposed quarry area required to be shifted in other suitable places.

CHAPTER-II

DETAILS OF EARLIER APPROVAL OF MINING PLAN

2.0 No approved mining plan exists for the mines.

CHAPRER - III

PROJECT SITE INFORMATION

3.0 INTRODUCTION

The area under consideration falls within the Mukunda exploration block in the eastern part of Jharia coalfield, District: Dhanbad, Jharkhand. The Report is based on the data available in the “Geological Report on exploration for coal in Mukunda Open Cast Block” Jharia coalfield, Dhanbad (July, 1981, prepared by CMPDI, RI-2, Dhanbad).

3.1 GENERAL

The Jharia coalfield is located in the Dhanbad and Bokaro districts of Jharkhand. After nationalization and formation of Bharat Coking Coal Ltd. (BCCL), a feasibility report for reconstruction and development of the collieries (FR ’78) of this coalfield was prepared in collaboration with the Polish consultants, wherein amalgamation of the erstwhile collieries including virgin area was envisaged. In this FR, 9 large opencast blocks and 21 large underground blocks were envisaged. However, this could not be implemented in full due to various constraints.

The present report is confined to the assessment of the part area (northern part) of original block of Mukunda OCP (GR, 1981), it includes part area of Lodna Colliery, Bagidigi, Colliery, Joryampur Colliery, Jealgora Colliery and Bararee Colliery which are constitute the Amalgamated Joyrampur Colliery.

3.2 LOCATION

The area under consideration is located in western halves of Mukunda exploration block of Jharia coalfield and constitutes of leasehold boundary of Amalgamated Joyrampur Colliery of Lodna Area, BCCL. The project area lies between Latitude 23º44'03" to 23º40'57" (N) and Longitude 86º24'43" to 86º26'46" (E). The area falls in Survey of India Topo sheet No. 77, 78, 79, 85, 86 & 87 (all partly) of Jharia coalfield (RF 1:4000).

3.3 AREA

The leasehold boundary of Amalgamated Joyrampur is 1186.97 Ha The surface area of the proposed quarry under consideration has a total surface area of about 749 Ha.

3.4 ACCESSIBILITY

The proposed project area is about 5 Km west of Jharia town and can be approached easily by Dhanbad-Jharia-Sindri road. The location of the project site is shown in Plate-G-I.

3.5 CLIMATE AND RAINFALL DATA

The area under consideration falls in the sub-humid region of the state of Jharkhand. The maximum temperature rises as high as 48°C during summer (April to middle of June) and falls down to minimum of 6°C during winter (December to January). The area receives fair to moderate rainfall, the average annual precipitation being 140 cm, most of which is received between June to September.

3.6 TOPOGRAPHY AND DRAINAGE

The area has a general undulating topography with a gentle southward slope. The mining activity which is going on in the area over 100 of years severely obliterated the general topography. Several small quarries, subsided goaf, OB dump, fire etc. have been shattered the original topography of the area. The highest elevation (199.17 m) has been observed near borehole no. NGK-17 in the north-eastern part, whereas, the lowest ground elevation (161.44 m) has been observed in the southern corner of the block around borehole No GL-5.

The drainage of the block is mainly controlled by southerly flowing Chatkari Jore which is a tributary of Damodar River. The another small nala, Tisra Jore is flowing from north to south and meet with the Chatkari Jore near bore hole GL-9.

3.7 PROPOSED QUARRY BOUNDARY

The quarry limits of the Amalgamated Joyrampur Colliery on the surface is delineated within the leasehold boundary as under:

North : Minimum of about 25 m from the leasehold boundary.

South : Limit of Metamorphics/Minimum of about 25 m from the leasehold boundary.

East : Leasehold boundary of Amalgamated Joyrampur Colliery.

West : Minimum Distance of about 60 m from the proposed diverted route of Chatkari jore.

3.8 STATUS OF EXPLORATION

A total of 35 boreholes have been drilled involving a total meter age of 10325.65 meters within the proposed quarry area.

Table- 3.1A

Status of Exploration

Serial No	Series	Drilling Agency	No. of BH	Meterage drilled
1	GL	CMPDI	8	2504.03
2	JBJ	GSI	1	470.15
3	LJ	GSI	1	412.95
4	MJ	MECL	9	3423.85
5	MSR	CMPDI	8	728.96
6	NGK	CMPDI	1	511.65
7	ST	CMPDI	7	2274.06
Total			35	10325.65

The density of boreholes comes to 5 BHs/Km^2 within the proposed delineated quarry limit.

A total of 68 boreholes have been drilled involving a total meterage of 19709.65 meters within whole leasehold area of Amalgamated Joyrampur Colliery.

Table- 3.1B

Status of Exploration

Serial No	Series	Drilling Agency	No. of BH	Meterage drilled
1	GL	CMPDI	10	3314.43
2	JBJ	GSI	3	1558.65
3	LJ	GSI	4	1838.79
4	MJ	MECL	14	5473.05
5	MSR		11	858.11
6	NGK	CMPDI	14	3128.88
7	ST	CMPDI	12	3537.74
Total			68	19709.65

The density of boreholes comes to 6 BHs/Km^2 within the whole leasehold area of Amalgamated Joyrampur Colliery Boundary.

3.9 SCOPE AND LIMITATIONS

1. The scope of the present assessment is to assess the potentiality of seams (seam XV-A seam to seam IX/X seam) occurring within the project area for their extraction by opencast mining method.

2. Only the standard geological nomenclature of seams has been used in this report.

3. The report is based on the data available in the “Geological report on Exploration for coal in Mukunda Open Cast Block” Jharia coalfield, Dhanbad (July, 1981, prepared by CMPDI, RI-2, Dhanbad). In addition to that, there are some infilling bore holes (MSR Series) which were drilled after preparation of the above GR, have been incorporated in the present report.

4. The updated mine plan / data generated and supplied by colliery authorities have also been considered for preparing this report. The

surface plan of this report is mainly based on colliery plan and topo sheet of Survey of India.

5. The coordinates of the boreholes have been converted into the Jharia grid as supplied by the colliery authority.

6. An element of approximation exists in location and extent of mine workings when matched with borehole location plan. Surface features like quarries, Incline, roads etc. shown on the plan supplied by colliery do not well match with Survey of India Topo sheet available on 1:4000 RF.

7. Areas having thickness less than 0.5 m have not been considered for geological reserve estimation.

8. In some bore holes (GL & MSR series) only band-by-band quality data are available, hence weighted average have been calculated for those data.

9. In seam descriptions, the special test data (CI, CT, SI etc.) and ultimate analysis data are taken form “Geological report on Exploration for coal in Mukunda Open Cast Block” Jharia coalfield, Dhanbad (July, 1981, prepared by CMPDI, RI-2, Dhanbad).

10. Most of the seam has been affected by fire. The extents of fire as demarcated colliery authority are tentative. The coal resource within the fire area is assumed as “zero” and the coal resource beyond the fire limit as demarcated on the individual seam working plan are quiet uncertain and the same may not be available (since impact of fire in these areas on the individual seams cannot be confirmed due to very old workings which are unapproachable) .

11. Grade of coal within the fire affected area cannot be assessed or confirmed, however the grade of coal within the fire area will be given as per available data in Geological Report of Mukunda OCP (1981), which may be deteriorated later due to burning effect of fire and cannot be confirmed.

CHAPTER – IV

GEOLOGY & DEPOSIT APPRAISAL

4.0 GEOLOGY

4.1. REGIONAL GEOLOGY OF JHARIA COALFIELD

The Jharia coalfield (453 Km^2) is sickle shaped on plan and occurs in the form of syncline with its axis trending broadly in E-W direction and plunging towards west. The southern flank of this coalfield is truncated by boundary fault having maximum throw about 2.5 Km at Mohuda Basin. The non-coal bearing Talchir formation is mainly exposed along the northern and western portion of the coalfield. The Barakar formation covering an area of 218 Km^2 which is exposed in the northern, eastern and south-eastern part of the coalfield area contains over 40 coal horizons including local and persistent seams, some of which are exclusively store house of metallurgical coal in India. The Barakar formation is successively overlain by Barren Measure formation which is devoid of work able coal seams. This is mainly exposed in the central part of the coalfield. The Barren Measure is overlain by the coal bearing Raniganj formation (54 Km^2). These are exposed within a sub elliptical basin the south-western part of the coalfield.

4.2. STRATIGRAPHY

The Regional stratigraphic succession of Jharia coalfield is given in table no. 4.1

Archeans: The Archeans, consisting of gneisses and mica schists are exposed all along the periphery of Jharia Coalfield. A tongue or protrusion of metamorphic, thrusting into the Gondwanas, is observed near Patherdih in the south-eastern part of the coalfield. Besides, a small inlier of metamorphic has been noticed near Khenudih in the north-western part of the coal field. Metamorphic high has been interpreted in the south-eastern part of the

coalfield in Sitanala area, resulting the omission of older seams. The metamorphics are profusely intruded by quartz veins.

Talchir: In an Archean basement, the lower Gondwana sediments are deposited with a pronounced unconformity. The lowermost Gondwana sediments of Talchir formation are represented by variegated shale and greenish sandstones which at times show laths of unaltered feldspars. They are exposed all along the northern fringe of the coal field. They are, however not exposed along the southern fringe due to boundary fault. Near Lutipahar in the north-western part of the coal field, Talchir formation is comparatively well developed in a large area and boulder bed shows exposures of spheroidal weathering.

Barakar: In the eastern, northern and north-eastern parts of the block, the Barakar are extensively developed. All along the southern boundary they are extending under the thick over of Barren Measures. The Barakar formation comprises pebbly sandstones, conglomerate, grit, coarse to fine grained sandstones, shales, carbonaceous shales and coal seams. Verma *et. al*. (1989) have observed a gradual decrease in thickness of Barakar from east to west. A maximum thickness more than 1250 m has been observed in the south-eastern part of the coalfield in Tasra region, while minimum thickness of around 600m is noticed in Damuda area. Barakar is the most important geological formation as it contains more than 40 coal horizons having thickness more than 50 cm.In general seam X (Ten) and younger seams are better quality coal (prime coking) than older seams which changes with depth to non-coking coal.

Barren Measure: The Barren Measure formation lying conformably over the Barakar formation consists of massive multistoried sandstone alternating with carbonaceous shale, grey shale and sandstone/ shale intercalations with occasionally very thin impersistent, non-workable coal horizons in the lower part of the formation. The Barren Measures shows a widespread development extend ending from the central part of the coalfield up to the southern margin.

The maximum thickness of the Barren Measure has been estimated to be around 625m in the central part of the basin. It gradually decrease westward and eastward and reduces to a minimum of 375m in the south-eastern part.

Raniganj: Raniganj formation is deposited in sub elliptical basin that is called Mohuda basin the south-western part of the coalfield. The formation represented by sandstone, shale, carbonaceous shale and coal seams. There are 24 coal seam have been reported from this formation. These seam comprise high volatile, high moisture, medium coking coal. The maximum thickness around 725m of Raniganj formation has been observed.

Igneous Intrusive: Mica peridotite and dolerite are the two most common Post Gondwana intrusives. The mica peridotite occur as dyke and sill throughout the entire coal field and has caused widespread devolatisation of the coal seams. The dolerite dyke is mostly confined in the western part of the coal field and has limited effect on coal seams. A number of dykes and their offshoots have been established in the coalfield, but the most surprising phenomenon of a 250m zone characterized by pyrolitization and devolatisation has been observed in the north-western part of the coalfield at Daumda Block where presence of any igneous intrusives has not been noticed. The mica periodotite sills have devolatised the extensive reserve of good quality coal in the coalfield and have limited or practically no effect on inferior quality coal.

As mentioned earlier most of the area is covered by sandy soil and alluvium. The thickness of soil varies from 1.0 m to 9.0 meter.

Table-4.1

Geological Succession of Jharia coalfield

Stratigraphic Division	Age	Formation	Lithological characters
	Recent	Alluvium/Soil/Sand	
	Cretaceous to Jurassic	Mica Peridotite/Dolerite Dyke	
---------- Unconformity ----------			
Lower Gondwana	Upper Permian	Raniganj Formation	Mainly fine to medium grained grey current bedded sandstone with shale and coal seam
	Middle Permian	Barren Measures	Black carbonaceous micaceous shale with clay, ironstone and sandstone.
	Lower Permian	Barakar Formation	Coarse grained to conglomeratic white sandstone with shale and coal seams
	Lower Permian	Talchir Formation	Coarse grained sandstone, white or slightly variegated at Top, green shale with undecomposed feldspar, boulder bed etc.
---------- Unconformity ----------			
Archeans			Granites, gneisses and schists.

4.3. GEOLOGY OF AMALGAMATED JOYRAMPUR COLLIERY

The area under consideration is located in the eastern flank of the Jharia coalfield, and it is primarily covered by the Barakar formation which is overlain by thin layers of sandy soil and clay. The thickness of soil is ranges between 1.5 m. (GL-6) to 14.2 m. (MJ-11). Talchir formation also outcropping on the south-eastern boundary of the project area. The southern limit of the coal bearing formation is delineated by a major fault (F7-F7) having a maximum throw of 90 m. toward north direction. The up thrown side of this fault is occupied by metamorphic rock of Archean age. The rocks of Barakar formation consist of pebbly sandstone, grits, fine to coarse grained sandstone, intercalation of sandstone and shale, sandy shale, grey shale, carbonaceous shale, fire clays and number of coal seams. Coal seams XVI to IX/X occur

within the project area and under the purview of this Geological Report (Plate No. G-III). The maximum thickness of Barakar formation as encountered in the borehole no. LJ-2 has been found to be 600 m.

Good rock exposures are rather few excepts in old quarries and it has not been possible to precisely delineate the incrop position of the seams because of the extensive goaf, fire and subsided ground which have severely affected the original topography. The incrop position of the coal seams have been extrapolated on the basis of geological data viz. geological cross section, floor contour and quarry/incline positions and are interpretative. Geology and correlation of the seams have been established mainly on the basis of sub-surface data obtained from borehole and mine workings.

Igneous Intrusion:

The following dykes are reported to occur in the colliery workings within the project area.

1. A 10 m. thick dyke (dyke-1) running approximately north-south all along the west central portion of the project area.

2. A NW-SE trending 5 m. thick dyke (dyke-2) located in the SW quadrant of the project area. This dyke appears to meet the above mentioned 10m thick dyke east of borehole JBJ-3.

The position of the dykes is shown in plate no: G-III as well as in geological cross sections. These positions have been projected from the locations shown in some of the working plans of the seams. In addition to the dykes mentioned above, a number of coal seams are partly or wholly pyrolitised converting them to jhama at palces in the area indicating the presence of several sills of mica peridotites.

4.4 SEQUENCE OF COAL SEAMS (within the proposed quarry Limit)

Table-4.2

Seam/Parting	True Seam Thickness (m)		Average Seam/Parting Thickness (meter)	No. of BH intersection	Depth Range (approx.) (m)
	Minimum	Maximum			
XVI	2.16 (GL-10)	3.25 (MJ-6, 12)	2.95		
P	64.73 (GL-10)	75.81 (NGK-31)	72		
XV-A	**0.6 (MJ-1)**	**1.60 (NGK-33)**	**1.15**	**6**	Incrop to 65
P	28.31(GL-2)	38.85 (MJ-2)	34		
XV	**7.50 (NGK-33)**	**11.25 (JBJ-1)**	**7.95**	**9**	Incrop to 110
P	2.08 (JBJ-1)	6.70 (GL-2)	4		
XIV-A	**1.42 (MJ-2)**	**3.75 (GL-2)**	**2.00**	**9**	Incrop to 115
P	14.50 (JBJ-1)	25.40 (GL-3)	20		
XIV	**4.14 (LJ-3)**	**9.68 (MJ-11)**	**8.20**	**10**	Incrop to 140
P	15.91 (GL-2)	22.96 (NGK-33)	18		
XIII-B	**0.67 (GL-2)**	**4.30 (MJ-4)**	**2.70**	**12**	Incrop to 160
P	1.39(MJ-2)	28.3 (MJ-4)	10		
XIII-A	**1.2 (MJ-9)**	**4.6 (MJ-1)**	**3.80**	**13**	Incrop to 170
P (XIII-A to XIII)	4.75 (GL-5)	11.6 (MJ-11)	11		
P (XIII-A to XI/XII/XIII)	5.75(MJ-9)	26.56 (NGK-33)	24		
XIII	**2.3 (GL-4)**	**6.10 (MJ-4)**	**4.00**	**12**	Incrop to 180
XI/XII/XIII	**11.75 (MJ-10)**	**19.80 (MJ-8)**	**14.00**	**9**	Incrop to 200
P (XIII to XI/XII)	3.85 (MJ-4)	34.00 (GL-2)	24		
XI/XII	**6.02 (MJ-1)**	**10.0 (MJ-4)**	**7.90**	**19**	Incrop to 205
P	10.32 (GL-1)	39.17 (MJ-4)	23		
X-A	**0.25 (LJ-3)**	**5.65 (MJ-8)**	**2.25**	**29**	Incrop to 220
P (X-A to IX/X)	13.95 (GL-2)	63.10 (LJ-3)	41		
IX/X	**3.48 (JBJ-1)**	**15.88 (GL-7)**	**9.2**	**31**	50-270

4.5 NOMENCLATURE OF COAL SEAMS VIS-À-VIS COLLIERY NOMENCLATURE

Table – 4.3

Standard Nomenclature (Geological)	Colliery Nomenclature (Amalgamated Joyrampur Colliery)
XVI	XVI
XV-A	XV-A
XV	XV
XIV-A	XIV-A
XIV	XIV
XIII-B	XIII-B
XIII-A	XIII-A
XIII	XIII
XI/XII	XI/XII
X-A	X-A
IX/X	IX/X

4.6 GEOLOGICAL STRUCTURE OF THE BLOCK

4.6.1 STRIKE & DIP

The geological structure of the area is relatively simple. The general strike of the strata is normally NNW-SSE swinging to N-S covering the major part of the area and finally E-W in the southern extremity of the area. The beds dip 4° to 12° due WSW, west and north respectively. In the small strip (in the southern part) where the strike of the formation swings to NNE-SSW and E-W, the gradient of the seam is steeper (40°) because of the proximity of the area to the major fault (throw 90 m towards north). The relevant details of strike and dip can be seen from the geological cross section and floor contour plans.

4.6.2. FAULTS

Based on boreholes/colliery data 7 nos. of faults have been interpreted within the colliery leased hold area. Throw of these faults varies from 10 m to 90 m. The details of fault are given in Table No–4.4.

Description of faults

Table- 4.4

Sl. No.	Fault No.	Extent & Location	Trend/Dip	Max Throw / Direction	Nature & Evidence
1.	**F1-F1**	Strike fault located at the western limit of the block .It originates near the boundary at about 440 m NE of LJ-1 and continuous in the SE direction	NW-SE	15 m./NE	Encountered in the colliery workings of XV, XIV-A and XIV seams
2.	**F2-F2**	Located in the NW corner of the block. It originates at a point about 400 m SW of NGK-12 and dies out at about 190 m south of NGK-3.	NW-SE/ 60^0	10m./SW	Encountered in the colliery workings of XA, IX/X, VIII-A and VIII seams
3.	**F3–F3**	Located in the NW corner of the block It originates at about 90 m NW of NGK-3 and at a point 400 m SE of NGK – 11. It runs in the SE direction and dies out about 50 m south of NGK-3.	NW-SE/ 60^0	10 m./NE	• Encountered in the colliery workings of X-A, IX/X, VIII-A and V/VI/VII/VIII seams. • Roof of V/VI/VII/VIII seam is faulted in NGK-3
4.	**F4–F4**	Located in the central part of the project area. It originates from midway between NGK-5 and GL-7 and continuous south-easterly upto the eastern limit of the block.	NW-SE/ 60^0	15 m./NE	• Encountered in the colliery workings of IX/X, VIII-A, VIII, VII, V/VI/VII, V/VI, IV Bot, III and I seams. • Shifting of the coal seam outcrops across the fault.
5.	**F5–F5**	Located in the central part of the project area. It originates from midway between NGK-5 and GL-7 and runs parallel to F4-F4. It dies out near NGK-6.	NW-SE/ 60^0	10 m./NE	Encountered in the colliery workings of IX/X, VIII-A, VIII and V/VI/VII seams
6.	**F6–F6**	Located in the south-eastern part of the project area. It originates at about 320 m. south west of NGK-1 and continuous towards SSW. It passes east of boreholes ST-7 , ST-12 and dies out at a point about 120 m west of ST-13	NNE-SSW swinging to NE-SW/60^0	10 m./WNW or NW	• Encountered in the colliery workings of IX/X, VIII-A, VIII, VII and V/VI seams. • Reduction of parting between V/VI and VII seams in ST-7. • Reduction of parting between IX/X and VIII-A and slicken-sided cores at 45 m. depth in ST-12.
7.	**F7–F7**	This faults form the southern boundary of the Mukunda OC block. It passes south of MJ-5, MJ-14 and MJ-8 and gradually dies out about 390 m. south of ST-19.	ESE-WNW to ENE-WSW (curvilinear)/ 60^0	90 m./N	• Reduction of parting between X-A and IX/X seams in MJ-5. • Floor faulted of I/II Bot seam in MJ-8. • High core dip at 440 m. depth in MJ-8.

4.7. METHODOLOGY FOR ASSESSMENT OF COAL SEAMS

4.7.1. THICKNESS & SPATIAL VARIATION OF SEAMS

The description and the assessment of the quality of coal seam are primarily based on the seam folio plans which depict the iso-chores, iso-ash, iso-UVM and iso-UHV lines besides the outer extent of the underground and opencast developments.

4.7.2. ISO- CHORES

Only the vertical thickness (In-band) of the coal seams, as encountered in the boreholes, has been considered for drawing iso-chores. Since 50 cm thickness has been considered as the minimum limit for reserve estimation, the iso-chores of 50 cm have been drawn followed by iso-chores of 0.9, 1.2, 2, 4, 6, 8, 10, 12, and 15 m.

4.7.3. ISO-ASH

The ash content forms the basis for grading of coking coals as per notification by Gov. of India, Ministry of Energy, Dept. of Coal, dated 13.02.1981. Coal having ash > 50% (in case of coking coal) have not been assessed.

4.7.4. FLOOR CONTOUR PLANS

Floor contour plans of all persistent coal seams have been drawn. Spot levels of various seam workings have been considered during preparation floor contour plans. However in some cases, like seam IX/X and seam XI/XII, there are a little variation exists between the floor value and the spot level data of the respective seams. In this circumstance, we have confirmed the floor value with the FRL values of the respective seams available in various pit sections of different collieries. It may be noted that the spot levels are not necessarily on the floor of the respective seams as most of the seams are thick and two sections UG development are present (e.g. seam IX/X and XI/XII). Necessary corrections have been made while using the data.

4.7.5. BASIS FOR THICKNESS AND QUALITY DETERMINATION

Analytical results of coal cores supplied by the C.F.R.I and private analytical agencies have been utilized to assess the thickness and quality of the coal seams.

While determining the quality of the seams following norms have been followed.

i. Coal Sections containing ash upto 35.0%.
ii. Shaly coal Section containing ash form 35.01% to 50.0%.
iii. Dirt bands Sections with ash from 50.01% to 75%.

To arrive at the in-band thickness of the coal seams as per opencast norms, all dirt bands (combustible) up to 1.00 m thickness occurring within the seam have been included. Dirt bands having thickness more than 1.00 m occurring within the seam have been excluded.

If the non-combustible bands that are developed within the seam persistently in a considerable area, the seam have been considered as split and line of split or merger has been drawn in relevant floor contour and seam folio plans.

The analytical data / overall analysis of various coal cores for including bands (In-band) as well as excluding bands (Ex-bands) were provided by the analytical laboratories. The in-band ash of the seams, wherever not available, have been calculated on weighted average basis and in case where weight is not given it has been calculated on length average basis.

The volatile matter on unit coal basis (UVM) has been calculated by the following empirical formula –

$$UVM\% = 100-(100xFC)/100-(1.1A+M) \quad \text{(i)}$$

Where:

FC = Fixed carbon

A = Ash%

M = Moisture %

Carbonate correction, wherever required have been carried out.

Seam wise average quality parameters are given in Table No.-4.5.

4.8. SEAM-WISE DESCRIPTION

Seam XV-A

This seam occurs below XVI seam with a parting varies from 64.73 m (GL-10) to 75.81m (NGK-31).The full coal thickness has been intersected into 15 boreholes within the project limit. The In-band thickness of seam varies from 0.60 m (MJ-1) to 1.60 m (NGK-33). The seam has been considered as prime coking coal within the project area. In general, the ash content shows an increasing trend from south to north. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
19.0-28.30	31.9.-34.5	W-I – W-IV	25* 17-24	G2-G3* F-G1	6.5*	0.26-0.84
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Roof & Floor

Roof and floor both generally composed of carbonaceous shale.

Exploitation

The seam is extensively quarried, goved and it is almost exhausted within the project area, as well it is fallen within the active fire zone hence resource has not been assessed.

Seam XV

Seam XV occurs below XV-A seam with a parting varies from 28.31m (GL-2) to 38.85 m. (MJ-2). The full coal thickness have been intersected in 4 boreholes. The In-band thickness of the seam varies from 5.50m (NGK-33) to

8.22m (MJ-10). In one borehole the seam is partly jhama and in 5 boreholes only part thickness has been encountered due to underground working.

The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
9.90-14.90	30.0-32.8	S-I	24-26* 18-30	G2-G4* E-G3	6.5-7.0*	1.14-1.60
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Roof & Floor

The roof is generally of carbonaceous shale while the floor is generally made up with shale and sandstone.

Exploitation

The seam is extensively quarried, goved and it is almost exhausted within the project area, as well as it is fallen within the active fire zone hence resource has not been assessed.

Seam XIV-A

This is underlying below the seam XV with a parting of 2.08m (JBJ-1) to 6.70m (GL-2) and has been intersected fully in 7 boreholes within the proposed project limit. In-band thickness of the seam varies from 1.42 m (MJ-2) to 3.75 m. (GL-2). In 2 boreholes only part thickness has been encountered due to underground working.

The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
10.20-19.20	28.6-35.1	S-I – W-I	24* 19-22	G2-G3* E-F	6.5*	0.41-1.80
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Roof & Floor

The roof is generally of sandstones and floor is generally made up with carbonaceous shale.

Exploitation

The seam is extensively quarried, goved and it is almost exhausted within the project area, as well as it is fallen within the active fire zone hence resource has not been assessed.

Seam XIV

This seam is separated from the overlying seam XIV-A by a parting of thickness varying from 14.50 (JBJ-1) to 25.40 (GL-3) and it has been intersected fully in 7 boreholes within the proposed project limit. In-band thickness of the seam varies from 7.24 m (NGK-33) to 9.68m (MJ-11). In 3 boreholes, only part thickness has been encountered due to underground working.

The seam has been considered as prime coking coal within the project area. The ash content, in general, increases from east to west. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
14.00-20.10	27.7-32.9	S-I – W-I	23-26* 18-28	G1-G4* F-G5	7.0-7.5*	0.34-2.70
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Net Geological Resource (Mt.)

Coal	Coal in C+JH Zone	Total
0.55	–	0.55

Roof & Floor

The roof is generally of sandstones and floor is generally made up of grey shale and carbonaceous shale.

Exploitation

The seam has been extensively worked and goaved in the project area. Except for a small virgin area in the north western part of the area, the other small areas, which are virgin, are restricted to the barriers between the leaseholds of erstwhile collieries. The seam is extensively on fire in the north-western, west-central and in small patches in the southern fringes of the project area.

Seam XIII-B

XIII-B seam occurs 15.91 m. (GL-2) to 22.96 m. (NGK-33) below the overlying XIV seam and has been intersected fully in 10 boreholes within the project limit. The In-band thickness varies from 0.67 m. (GL-2) to 4.30 m. (MJ-4). In one borehole the seam is partly jhama and in 2 boreholes only part thickness has been encountered due to underground working.

The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
21.8-38.0	28.8-32.0	W-II – UG	17-23* 18-21	G2-G3* F-G1	6.5-7.5*	0.08-1.50
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Net Geological Resource (Mt.)

Coal	Coal in C+JH Zone	Total
1.79	0.03	1.82

Jhama: 0.06 Mt.

Roof & Floor

The roof generally made up with fine to medium grained sandstone& floor is made of shale.

Exploitation

The seam has been extensively worked and goaved in the project area, except for the north western part of that area. The other small areas, which are virgin, are restricted to the barriers between the leaseholds of erstwhile collieries. The seam is extensively on fire in the north-western and in small patches in the south-eastern portion of the project area.

Seam XIII-A

This seam is underlying below the seam XIII-B with a parting between 1.39 m. (MJ-2) to 28.3 m. (MJ-4) and has been intersected fully in 8 boreholes within the proposed project limit. In one borehole the seam is completely jhama and

in 4 boreholes part jhama thickness has been encountered. In one borehole the seam is faulted (MJ-3). In-band thickness of the seam varies from 1.20 m (MJ-9) to 4.30 m (NGK-33).

The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
17.90-31.00	29.1-32.3	S-II – W-IV	24-25* 18-29	G2-G4* F-G2	7-8*	0.47-0.98
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Net Geological Resource (Mt.)

Coal	Coal in C+JH Zone	Total
1.02	1.72	2.74

Jhama: 6.36 Mt.

Roof & Floor

The roof is generally of sandstone while the floor is generally carbonaceous shale.

Exploitation

The seam has been extensively worked and goaved in the project area, except dip side of that area. The other small virgin patches are available at the barriers between the leaseholds of erstwhile collieries. The seam is extensively on fire in the north-western and west-central portion as well as in small patches in the south-eastern portion of the project area.

Seam XIII

XIII seam occurs 4.75 m. (GL-5) to 11.60 m. (MJ-11) below the overlying XIII-A seam and the full coal thickness of the seam has been intersected in 11 boreholes within the project limit. The In-band thickness varies from 2.30 m. (GL-4) to 4.45 m. (MJ-4). In one borehole the seam is partly jhama. The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
13.10-24.2	27.30-29.80	S-I – W-IV	21* 15-26	G5* E-G3	-	0.01-1.50
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Net Geological Resource (Mt.)

Coal	Coal in C+JH Zone	Total
5.30	0.03	5.33

Jhama: 0.07 Mt.

Roof & Floor

The roof is generally of carbonaceous shale while the floor isfine grained sandstone and dark shale.

Exploitation

The seam has been extensively worked and goaved in the project area, except dip side of that area. As far as the composite seam is concerned, the seam has been extensively developed in 1 section and goaved at places. The seam is virgin in small areas in the SW and NW sides of the block. The seam is extensively on fire in the north-western and west-central portion as well as in two small patches in the south-eastern portion of the project area.

Seam XI/XII/XIII

The seam has been occurring in south-central side within the project limit. It is underlying below the seam XIII-A with a parting between 5.75 m. (MJ-9) to 26.56 m. (NGK-33) and the full coal thickness has been intersected in 6 boreholes within the proposed project limit. In 2 boreholes only part thickness has been encountered due to underground working.

In-band thickness of the seam varies from 11.75 m (MJ-10) to 14.00 m (MJ-13).

The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
20.60-27.00	26.9-30.5	W-I – W-III	22-26* 12-32	G-G3*	5.5-7.5*	0.29-1.59
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Net Geological Resource (Mt.)

Coal	Coal in C+JH Zone	Total
4.81	–	4.81

Roof & Floor

The roof is generally of sandstone while the floor is generally carbonaceous shale.

Exploitation

The seam has been extensively worked and goaved in one or 2 section and very small patches are remaining as virgin within the project area.

Seam XI/XII

This seam is underlying below the seam XIII with a parting between 3.85 (MJ-4) to 34.00 m. (GL-2) and the full coal thickness has been intersected in 14 boreholes within the proposed project limit. In 4 boreholes only part thickness has been encountered due to underground working.

In-band thickness of the seam varies from 6.02 m (MJ-1) to 10.00 m (MJ-4).

The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	CO_2%
17.00-30.00	27.2-30.2	S-II – W-IV	13-19* 15-25	F-G3* E-G7	0.19-1.20
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.					

Net Geological Resource (Mt.)

Coal	Coal in C+JH Zone	Total
4.58	–	4.58

Roof & Floor

The roof is generally of sandstone while the floor is generally carbonaceous shale.

Exploitation

The seam has been extensively worked in one or two sections and is goaved in the eastern half. Several sand stowed developed zones also occur within the area. The seam is extensively on fire in the north-western and central portion of the project area.

Seam X-A

This seam is underlying below the seam XI/XII with a parting between 10.32(GL-1) to 39.17 m. (MJ-4) and the full coal thickness has been intersected in 20 boreholes within the proposed project limit. In 5 boreholes only part jhama thickness has been encountered and in one borehole full jhama with MP has been encountered. In one borehole (GL-1) the seam is occurs as carbonaceous shale.

In-band thickness of the seam varies from 0.25 m (LJ-3) to 3.12 m (MJ-9). The seam is very thin and most of the area it is non workable.

The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.	CO_2%
22.0-47.32	25.7-31.7	S-II - UG	19- 23* 17-22	G-G5* F	5.5*	0.51-0.62
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.						

Net Geological Resource (Mt.)

Seam XA is very thin (average thickness below 1 meter), impersistable hence its resource can not to be considered for mine planning purpose.

Roof & Floor

The roof is generally of sandstone while the floor is generally carbonaceous shale.

Seam IX/X

This seam is either underlying below the seam X-A with a parting between 13.95 (GL-2) to 63.10 m. (LJ-3) and the full coal thickness has been intersected in 23 boreholes within the proposed project limit. In 7 boreholes only part thickness has been encountered due to underground working.

In-band thickness of the seam varies from 4.51 m (ST-15) to 9.84 m (GL-9).

The seam has been considered as prime coking coal within the project area. Detailed quality parameters and net geological resource is given below in table.

Quality Parameters

Proximate Analysis (On air-dried basis)

Ash%	UVM%	Grade	C.I.	G.K.L.T	S.I.
25.00-45.50	23.80-29.30	W-III - UG	15-25* 13-28	E - G6* E - G5	2-7*
* Result of coking properties based on float fraction at 1.50 Sp. Gr. cut (3mm size). Without asterics (*) are on raw coal only.					

Ultimate Analysis (Unit Coal basis)

CO_2%	C %	H%	P%	S%
0.15-1.60	88.70-90.32	4.68-4.85	0.112-0.117	0.51-0.60

Net Geological Resource (Mt.)

Coal	Coal in C+JH Zone	Total
31.49	–	31.49

Roof & Floor

The roof is generally of sandstone while the floor is generally carbonaceous shale.

Exploitation

The seam has been extensively worked and goaved in the project area, except western and south-western portions where it is virgin. In most of the area the seam has been worked in two sections but at places it has it has also been developed in three sections. It has been extensively goaved in the eastern part of the area and in patches only elsewhere. There are some stooks areas which have been filled with sand. In the incrop region small old quarries are found. The seam is extensively on fire in several patches towards the eastern portion and also in a small patch in the north central portion of the area. (Ref: GR, Mukunda OC Block, July, 1981).

4.9 INSITU COAL QUALITY

The quality of coal seams in this Revised Geological Report is based on “Geological Report, Mukunda Open Cast ” Jharia coalfield, Dhanbad (July, 1981, prepared by CMPDI, RI-2, Dhanbad).The non-combustible bands like sandy shale, sand stone, siderite,grey shale (Ash > 75 %) etc. irrespective of their thickness and carb shale(Ash > 50 %) of 1 meter and above in thickness occurring within the seam, have been excluded from the total thickness of the seam for computing the effective thickness (**I**100) of coal seams for the purpose of quality consideration. Rest of the dirt bands has been included as a part of the coal seams.

Faulted, partly faulted, worked seam/part worked seam thickness encountered in the boreholes have not been considered for the purpose of quality assessment.

4.10.1 RESOURCE ESTIMATION CRITERIA

A. The seam wise status of developed, depillared and goaved areas in addition to virgin patches has been identified on the basis of seam working plan. These have been clearly marked on the seam folio plans and floor contour plans of all the seams proposed for quarrying in the area.

B. **Goaf & Quarries**: These areas have been considered as devoid of coal, however in case of goaf the devoid zone is considered according to the height of the goaf.

C. **Developed Areas:** In developed areas, where reserves are standing on pillars, seam wise dimension of extraction (height & width) have been decided on the basis of seam working plan made available by area/collieries authorities and after detailed discussion with them. And only after that percentage of extraction factor for each seam has been arrived which ranges from 30 % to 50 %. For standing on pillars an average of 30% and for stooks 90% extraction of coal has been considered and accordingly Net Geological Resource has been calculated.

D. **Thickness:** Only the In-band (I100) thickness of the seam has been considered for reserve estimation. Areas having thickness less than 0.5 m have not been considered for reserve estimation.

E. **Jhama Zone:** The jhama and coal+ jhama zone have been drawn on the basis of following assumption :

- In case full jhama being encountered in one borehole and full coal in adjoining boreholes, the total distance between two boreholes, has been divided into three equal parts to represent full jhama zone, coal+jhama zone and full coal zone

- In case of part of jhama and part of coal being encountered in one bore hole and full coal in the adjoining borehole, the total distance

between two boreholes have been divvied into two equal parts to represent coal + jhama zone and full coal zone.

The demarcated zones are indicative of possible occurrence of coal and jhama zone. However, in view of erratic behavior of the burning pattern, these zones are interpretative.

- Keeping in view, the erratic behavior of pyrolitsation, thickness, ash, UVM etc. quality lines have not been drawn within coal + jhama zone. As stated earlier , seam XIII, XIII-A, XIII-B, XIV and XV has undergone pyrolitisation in part area, the resource of coal in coal + jhama zone have been assessed separately on the basis of total thickness of coal encountered in the boreholes within the pyrolitised zone.

- The resources of jhama in pyrolilitisation zone have been assessed separately by considering the specific gravity of jhama is 1.7 and effective thickness of jhama in these zones excludes the thickness of the MP bands.

- Not developed areas have been demarcated and these areas have been excluded from resource estimation.

F. Resource under fire affected area:

- It is very difficult to know the extent underground fire and its quantitative and qualitative affect upon the seam under consideration. However, quantitative assessment of coal has been derived based on data as provided by the colliery authority regarding the extent of fire and percentage of coal damage due to fire.
- Most of the seams have been affected by fire. The extents of fire are purely tentative and demarcated by the colliery authority. The coal resources within the fire area are tentative and the same may not be available also as impact of fire on individual seams in not known.

- Since the effect of fire upon each seam are not uniform, hence we considered the data of seam wise percentage of damage coal due to fire as provided by colliery authority .

- Grade of coal within the fire affected area cannot be assessed or confirmed, however the grade of coal within the fire area has been considered as per available data in Geological Report of Mukunda OCP (1981), which may be deteriorated later due to burning effect of fire and cannot be confirmed.

- Quantity of coal in seams XV-A, XV, XIV-A within the proposed quarry limit have not been assessed in line of deliberations made with the colliery authority in view extensive mining activity as well as severe burning effect of coal.

G. Seam extent (floor limit) of different seams within the periphery of proposed quarry limit has been decided on the basis of slope study during the preparation of Mukunda PR.

Coal resource estimation of individual seam within the proposed quarry limit has been assessed by taking the area of each seam extent marked in individual floor contour plan/seam folio plan and considering all the assumptions as discussed above.

4.10.2 METHODOLOGY OF RESERVES CALCULATION

The reserve has been estimated through “MINEX” software.

1. The resource has been calculated using “Detailed Resource Reporting” menu of **MINEX 6.5.1** software along with separate template for each individual seam.

2. A deduction of 10% from the ‘gross resources’ of coal has been made to account for unidentified geological uncertainties like structural

disturbances, washout zones etc. to arrive at the 'net geological resources'.

3. The seam wise status of developed, depillared, stook, fire areas in addition to virgin patches has been identified on the basis of seam working plan supplied by the concerned area/colliery officials. These have been clearly marked on the seam folio plans and floor contour plans of all the seams.

4. **Heave Zone**: The areas falling within the heave zone of a fault has been excluded for the purpose of resource estimation.

5. Coal resource estimation of individual seam within the proposed quarry limit of Amalgamated Joyrampur Colliery has been assessed by taking the area of each seam extent marked in individual floor contour plan/seam folio plan.

4.11 EXPLORATORY WASHABILITY TESTS

Exploratory washability test result of coal cores of BH No. GL-10 given in Annexure-I (A).

4.12 BAND IN COAL SEAM

All the seams contain several number of bands. The thickness of the band varies from 2 centimeters to 2 meter. The bands generally composed of carbonaceous shale, dark shale, fine grained sandstone, MP etc.

4.13 CONCLUSION

The integrated geological assessment of the surface and subsurface data available from the earlier geological reports have clearly established 51.32 million tonnes of coal out of which 49.54 million tonnes is available in full coal zone and 1.78 million tonnes coal available within coal+jhama zone. Out of 51.32 million tonnes of total proved resource of coking coal, about 31.49 million tonnes (61.0 %) coal available in seam IX/X only. Beside coal, 6.49 million tonnes jhama also vailable within the proposed project limit.

Net Geological Resource of Coal & Jhama

(Within the Proposed Quarry Limit)

Table No: 4.5

Seam wise/grade wise proved resource of coking coal (Million Tonnes)

Proved								
Coking (Full Coal Zone)								
Seam	**S-I**	**S-II**	**W-I**	**W-II**	**W-III**	**W-IV**	**UG**	**Sub Total**
XV-A	Almost Exhausted (Extensively quarried, goved, dipillered and fallen within active fire zone. Resource cannot be assessed)							
XV	Almost Exhausted (Extensively quarried, goved, dipillered and fallen within active fire zone. Resource cannot be assessed)							
XIV-A	Almost Exhausted (Extensively quarried, goved, dipillered and fallen within active fire zone. Resource cannot be assessed)							
XIV	0.02	0.41	0.12					**0.55**
XIII-B				0.21	0.37	1.20	0.01	**1.79**
XIII-A			0.10	0.18	0.31	0.43		**1.02**
XIII	0.02	1.42	2.82	0.80	0.24			**5.30**
XI/XII/XIII			0.08	3.30	1.43			**4.81**
XI/XII		0.1	0.95	2.63	0.52	0.38		**4.58**
IX/X					2.69	26.40	2.40	**31.49**
Total	0.04	1.93	4.07	7.12	5.56	28.41	2.41	**49.54**

Table No: 4.6

Seam wise/grade wise proved resource of coking coal (Million Tonnes)

Proved							
Coking (Coal in Coal+Jhama Zone)							
Seam	**S-II**	**W-I**	**W-II**	**W-III**	**W-IV**	**UG**	**Sub Total**
XIII-B					0.02	0.01	**0.03**
XIII-A	0.04	0.04	1.26	0.36	0.02		**1.72**
XIII	0.02	0.01					**0.03**
Total	0.06	0.05	1.26	0.36	0.04	0.01	**1.78**

Table No: 4.7

Seam wise/ proved resource of Jhama (Million Tonnes)

Jhama Resource (Mt.)	
Proved	
Seam	
XIII-B	0.06
XIII-A	6.36
XIII	0.07
Total	**6.49**

Table No: 4.8

Coal Resource Summary Table (Million Tonnes) Within Proposed Quarry Limit

Coal Resource Summary (Mt.)					
Seam	Coal	Coal in C+Jh Zone	Sub Total	Jhama	Total
XIV	0.55		0.55		0.55
XIII-B	1.79	0.03	1.82	0.06	1.88
XIII-A	1.02	1.72	2.74	6.36	9.1
XIII	5.3	0.03	5.33	0.07	5.4
XI/XII/XIII	4.81		4.81		4.81
XI/XII	4.58		4.58		4.58
IX/X	31.49		31.49		31.49
Total	**49.54**	**1.78**	**51.32**	**6.49**	**57.81**

Table No: 4.9

Coal Resource Summary Table (Million Tonnes) Within Leasehold Boundary

Coal Resource Summary (Mt.)					
Seam	Coal	Coal in C+Jh Zone	Sub Total	Jhama	Total
XIV	2.03		2.03		2.03
XIII-B	3.03	0.61	3.64		3.64
XIII-A	1.37	2.91	4.28	12.38	16.66
XIII	2.03	1.60	3.63	2.40	6.03
XI/XII/XIII	9.12	3.27	12.39		12.39
XI/XII	8.25		8.25		8.25
IX/X	72.09		72.09		72.09
Total	97.92	8.39	106.31	14.78	121.09

ANNEXURE-I (A)

Exploratory Washability Test Result

Borehole No.GL-10

(Sample crushed to 13 mm size)

Seam No.	Ash % of the raw coal	Cleans at 1.50		Middlings at 1.50 to 1.80		Rejects at 1.80	
		Wt %	Ash%	Wt %	Ash %	Wt %	Ash %
IX	31.8	41.6	20.9	50.6	36.6	7.8	
1					**Clean**	**Middlings**	**Rejects**
1.0	**Proximate analysis (Air dried basis)**						
1.1	Moisture %				1.0	0.8	
1.2	Ash %				20.9	36.6	58.9
1.3	V.M. %				20.6	18.2	
2.0	**Calorific value (K.Cal/kg)**						
2.1	Gross					5150	
2.2	Net					4960	
3.0	**Phosphorus**				0.049		
4.0	**Coking properties**						
4.1	Caking Index				21		
4.2	Coke Type (GKLT)				G1		
4.3	Swelling Index				5		
5.0	**Ultimate Analysis (Unit Coal Basis)**						
5.1	Carbon				89.63	89.52	
5.2	Hydrogen				4.87	4.89	
5.3	Nitrogen				2.04	1.81	
5.4	Sulphur				0.73	0.69	
5.5	Oxygen (By difference)				2.73	3.09	
6.0	**H.G.I.**					49	
7.0	**Ash fusion temperature range in ^{0}C (In Mild reducing temperature)**						
7.1	Initial Deformation					1210	
7.2	Hemispherical Point					1370	
7.3	Flow Point					1400(over)	
8.0	**Carbonate CO_2 %**				0.47	0.88	
9.0	**Ash Analysis**						
9.1	SiO_2					57.39	
9.2	Al_2O_3					23.48	
9.3	Fe_2O_3					7.95	
9.4	TiO_2					1.43	
9.5	P_2O_5					1.52	
9.6	CaO					3.51	
9.7	MgO					2.10	
9.8	SO_4 (Sulphate)					1.03	
9.9	Alkalies (By difference)					1.79	
10	**Ash Viscosity**						

ANNEXURE-I (A)

Exploratory Washability Test Result

Borehole No.GL-10

(Sample crushed to 13 mm size)

Seam No.	Ash % of the raw coal	Cleans at 1.50		Middlings at 1.50 to 1.80		Rejects at 1.80	
		Wt %	Ash%	Wt %	Ash %	Wt %	Ash %
XI/XII	21.4	75.1	15.8	16.4	33.3	8.5	
1					Clean	Middlings	Rejects
1.0	Proximate analysis (Air dried basis)						
1.1	Moisture %				1.1	1.0	
1.2	Ash %				15.8	33.3	47.5
1.3	V.M. %				24.0	21.0	
2.0	Calorific value (K.Cal/kg)						
2.1	Gross					5370	
2.2	Net					5170	
3.0	Phosphorus				0.061		
4.0	Coking properties						
4.1	Caking Index				23		
4.2	Coke Type (GKLT)				G		
4.3	Swelling Index				$5^{1/2}$		
5.0	Ultimate Analysis (Unit Coal Basis)						
5.1	Carbon				88.96	88.51	
5.2	Hydrogen				5.03	5.08	
5.3	Nitrogen				1.71	1.59	
5.4	Sulphur				0.69	0.74	
5.5	Oxygen (By difference)				3.61	4.08	
6.0	H.G.I.					59	
7.0	Ash fusion temperature range in ^{0}C (In Mild reducing temperature)						
7.1	Initial Deformation					1180	
7.2	Hemispherical Point					1350	
7.3	Flow Point					1400(over)	
8.0	Carbonate CO_2 %				0.51	1.03	
9.0	Ash Analysis						
9.1	SiO_2					60.31	
9.2	Al_2O_3					23.73	
9.3	Fe_2O_3					8.43	
9.4	TiO_2					1.41	
9.5	P_2O_5					0.81	
9.6	CaO					2.31	
9.7	MgO					1.04	
9.8	SO_4 (Sulphate)					0.89	
9.9	Alkalies (By difference)					1.07	
10	Ash Viscosity						

ANNEXURE-I (A)

Exploratory Washability Test Result

Borehole No.GL-10

(Sample crushed to 13 mm size)

Seam No.	Ash % of the raw coal	Cleans at 1.50		Middlings at 1.50 to 1.80		Rejects at 1.80	
		Wt %	Ash%	Wt %	Ash %	Wt %	Ash %
XIII-B	27.4	66.1	15.6	11.2	37.8	22.7	
1					**Clean**	**Middlings**	**Rejects**
1.0	**Proximate analysis (Air dried basis)**						
1.1	Moisture %				1.0	1.1	
1.2	Ash %				15.6	37.8	58.2
1.3	V.M. %				25.0	21.0	
2.0	**Calorific value (K.Cal/kg)**						
2.1	Gross					4910	
2.2	Net					4710	
3.0	**Phosphorus**				0.055		
4.0	**Coking properties**						
4.1	Caking Index				20		
4.2	Coke Type (GKLT)				G/ G1		
4.3	Swelling Index				$6^{1/2}$		
5.0	**Ultimate Analysis (Unit Coal Basis)**						
5.1	Carbon				88.54	88.34	
5.2	Hydrogen				5.12	5.16	
5.3	Nitrogen				1.83	1.71	
5.4	Sulphur				0.69	0.73	
5.5	Oxygen (By difference)				3.82	4.06	
6.0	**H.G.I.**					49	
7.0	**Ash fusion temperature range in ^{0}C (In Mild reducing temperature)**						
7.1	Initial Deformation					1190	
7.2	Hemispherical Point					1390	
7.3	Flow Point					1400(over)	
8.0	**Carbonate CO_2 %**				0.31	0.78	
9.0	**Ash Analysis**						
9.1	SiO_2					58.15	
9.2	Al_2O_3					22.16	
9.3	Fe_2O_3					9.01	
9.4	TiO_2					1.93	
9.5	P_2O_5					1.25	
9.6	CaO					2.68	
9.7	MgO					1.71	
9.8	SO_4 (Sulphate)					1.03	
9.9	Alkalies (By difference)					2.10	
10	**Ash Viscosity**						

ANNEXURE-I (A)

Exploratory Washability Test Result

Borehole No.GL-10

(Sample crushed to 13 mm size)

Seam No.	Ash % of the raw coal	Cleans at 1.50		Middlings at 1.50 to 1.80		Rejects at 1.80	
		Wt %	Ash%	Wt %	Ash %	Wt %	Ash %
XIV	22.2	72.0	16.1	24.7	36.1	3.3	
1					**Clean**	**Middlings**	**Rejects**
1.0	**Proximate analysis (Air dried basis)**						
1.1	Moisture %				1.2	0.9	
1.2	Ash %				16.1	36.1	51.8
1.3	V.M. %				24.9	21.1	
2.0	**Calorific value (K.Cal/kg)**						
2.1	Gross					5170	
2.2	Net					4960	
3.0	**Phosphorus**				0.029		
4.0	**Coking properties**						
4.1	Caking Index				24		
4.2	Coke Type (GKLT)				G/ G1		
4.3	Swelling Index				$6^{1/2}$		
5.0	**Ultimate Analysis (Unit Coal Basis)**						
5.1	Carbon				88.36	88.15	
5.2	Hydrogen				5.11	5.15	
5.3	Nitrogen				1.97	2.01	
5.4	Sulphur				0.71	0.81	
5.5	Oxygen (By difference)				3.85	3.88	
6.0	**H.G.I.**					49	
7.0	**Ash fusion temperature range in ^{0}C (In Mild reducing temperature)**						
7.1	Initial Deformation					1160	
7.2	Hemispherical Point					1380	
7.3	Flow Point					1400(over)	
8.0	**Carbonate CO_2 %**				0.37	1.02	
9.0	**Ash Analysis**						
9.1	SiO_2					56.19	
9.2	Al_2O_3					25.11	
9.3	Fe_2O_3					11.21	
9.4	TiO_2					1.75	
9.5	P_2O_5					0.97	
9.6	CaO					2.01	
9.7	MgO					0.98	
9.8	SO_4 (Sulphate)					0.71	
9.9	Alkalies (By difference)					1.07	
10	**Ash Viscosity**						

ANNEXURE-I (A)

Exploratory Washability Test Result

Borehole No.GL-10

(Sample crushed to 13 mm size)

Seam No.	Ash % of the raw coal	Cleans at 1.50		Middlings at 1.50 to 1.80		Rejects at 1.80	
		Wt %	Ash%	Wt %	Ash %	Wt %	Ash %
XIV-A	13.4	95.4	12.2	3.8	26.4	0.8	
1					**Clean**	**Middlings**	**Rejects**
1.0	**Proximate analysis (Air dried basis)**						
1.1	Moisture %				1.5	1.3	
1.2	Ash %				12.2	26.4	72.3
1.3	V.M. %				27.0	22.7	
2.0	**Calorific value (K.Cal/kg)**						
2.1	Gross					6090	
2.2	Net					5880	
3.0	**Phosphorus**				0.051		
4.0	**Coking properties**						
4.1	Caking Index				22		
4.2	Coke Type (GKLT)				G1/ G2		
4.3	Swelling Index				$5^{1/2}$		
5.0	**Ultimate Analysis (Unit Coal Basis)**						
5.1	Carbon				87.06	88.08	
5.2	Hydrogen				5.17	5.10	
5.3	Nitrogen				2.02	1.97	
5.4	Sulphur				0.71	0.75	
5.5	Oxygen (By difference)				4.24	4.10	
6.0	**H.G.I.**					64	
7.0	**Ash fusion temperature range in ^{0}C (In Mild reducing temperature)**						
7.1	Initial Deformation					1190	
7.2	Hemispherical Point					1390	
7.3	Flow Point					1400(over)	
8.0	**Carbonate CO_2 %**				0.27	0.81	
9.0	**Ash Analysis**						
9.1	SiO_2					51.45	
9.2	Al_2O_3					27.37	
9.3	Fe_2O_3					10.51	
9.4	TiO_2					1.71	
9.5	P_2O_5					0.98	
9.6	CaO					2.31	
9.7	MgO					1.91	
9.8	SO_4 (Sulphate)					0.91	
9.9	Alkalies (By difference)					2.85	
10	**Ash Viscosity**						

ANNEXURE-I (A)

Exploratory Washability Test Result

Borehole No.GL-10

(Sample crushed to 13 mm size)

Seam No.	Ash % of the raw coal	Cleans at 1.50		Middlings at 1.50 to 1.80		Rejects at 1.80	
		Wt %	Ash%	Wt %	Ash %	Wt %	Ash %
XV-A	25.1	68.6	16.7	20.7	34.7	10.7	
1					**Clean**	**Middlings**	**Rejects**
1.0	**Proximate analysis (Air dried basis)**						
1.1	Moisture %				1.3	1.4	
1.2	Ash %				16.7	34.7	60.0
1.3	V.M. %				26.0	20.9	
2.0	**Calorific value (K.Cal/kg)**						
2.1	Gross					5260	
2.2	Net					5260	
3.0	**Phosphorus**				0.037		
4.0	**Coking properties**						
4.1	Caking Index				20		
4.2	Coke Type (GKLT)				G/ G1		
4.3	Swelling Index				6		
5.0	**Ultimate Analysis (Unit Coal Basis)**						
5.1	Carbon				87.85	87.82	
5.2	Hydrogen				5.19	5.06	
5.3	Nitrogen				1.99	2.01	
5.4	Sulphur				0.69	0.75	
5.5	Oxygen (By difference)				4.28	4.36	
6.0	**H.G.I.**					55	
7.0	**Ash fusion temperature range in ^{0}C (In Mild reducing temperature)**						
7.1	Initial Deformation					1170	
7.2	Hemispherical Point					1350	
7.3	Flow Point					1400(over)	
8.0	**Carbonate CO_2 %**				0.39	0.51	
9.0	**Ash Analysis**						
9.1	SiO_2					60.15	
9.2	Al_2O_3					22.11	
9.3	Fe_2O_3					9.15	
9.4	TiO_2					1.39	
9.5	P_2O_5					1.11	
9.6	CaO					2.43	
9.7	MgO					1.13	
9.8	SO_4 (Sulphate)					0.78	
9.9	Alkalies (By difference)					1.75	
10	**Ash Viscosity**						

ANNEXURE-I (A)

Exploratory Washability Test Result

Borehole No.GL-10

(Sample crushed to 13 mm size)

Seam No.	Ash % of the raw coal	Cleans at 1.50		Middlings at 1.50 to 1.80		Rejects at 1.80	
		Wt %	Ash%	Wt %	Ash %	Wt %	Ash %
XVI	26.4	60.9	16.2	26.0	33.5	13.1	
1					**Clean**	**Middlings**	**Rejects**
1.0	**Proximate analysis (Air dried basis)**						
1.1	Moisture %				1.7	1.0	
1.2	Ash %				16.2	33.5	59.5
1.3	V.M. %				29.4	23.3	
2.0	**Calorific value (K.Cal/kg)**						
2.1	Gross					5380	
2.2	Net					5180	
3.0	**Phosphorus**				0.041		
4.0	**Coking properties**						
4.1	Caking Index				20		
4.2	Coke Type (GKLT)				G1/ G2		
4.3	Swelling Index				6		
5.0	**Ultimate Analysis (Unit Coal Basis)**						
5.1	Carbon				86.92	86.94	
5.2	Hydrogen				5.39	5.27	
5.3	Nitrogen				2.01	1.98	
5.4	Sulphur				0.71	0.75	
5.5	Oxygen (By difference)				4.97	5.06	
6.0	**H.G.I.**					59	
7.0	**Ash fusion temperature range in ^{0}C (In Mild reducing temperature)**						
7.1	Initial Deformation					1180	
7.2	Hemispherical Point					1380	
7.3	Flow Point					1400(over)	
8.0	**Carbonate CO_2 %**				0.61	1.03	
9.0	**Ash Analysis**						
9.1	SiO_2					56.10	
9.2	Al_2O_3					24.58	
9.3	Fe_2O_3					10.31	
9.4	TiO_2					1.71	
9.5	P_2O_5					0.81	
9.6	CaO					2.64	
9.7	MgO					1.32	
9.8	SO_4 (Sulphate)					0.75	
9.9	Alkalies (By difference)					1.78	
10	**Ash Viscosity**						

CHAPTER - V

MINING

5.0 PRESENT STATUS

Amalgamated Joyrampur Colliery is under the administrative control of Lodna area of BCCL. Amalgamated Joyrampur Colliery is formed by Amalgamation of 05(five) Underground Mines (i.e. Lodna Colliery, Bagdigi Colliery, Bararee Colliery, Jealgora Colliery & Joyrampur Colliery) vide letter no. R-2/0100190/P-12-15/1517-27 dated 28.8.2015 issued by Director of Mines safety, Region-2, DGMS, Dhanbad. The demarcated boundary of Amalgamated Joyrampur Colliery covers a leasehold area of 1186.97 Ha. as per data/plan supplied by colliery authority and it involves part of Mukunda Geological Block. All the Underground Mines were earlier worked by different small Mine owners and developed , depillared in patches. Seams from I to XVI Seam exist within the mine and all the upper seams upto XI/XII seam are under fire within boundary of Amalgamated Joyrampur Colliery At present all the underground units of Amalgamated Joyrampur Colliery are closed. It is proposed to extract the fire affected seams by Opencast method upto IX/X seam to make the underlying seams workable.

At present opencast mining operation is going on by deployment of hired HEMM(Patch-D) in the leasehold of Amalgamated Joyrampur Colliery.

Opencast:

As stated earlier it has been decided by BCCL management to discontinue underground mining operation within Amalgamated Joyrampur Colliery. In this mining plan, it is proposed to extract the IX/X & all above occurring seam within proposed quarry (upto XVA seam) through opencast operation .The details of the quarry are given in relevant Para . Opencast operation is proposed to be worked by Shovel-Dumper system of mining.

Nomenclature:

Nomenclature of coal seams Vis-À-Vis Colliery Nomenclature

Standard Nomenclature (Geological)	Colliery Nomenclature (Amalgamated Joyrampur Colliery)
XVI	XVI
XV-A	XV-A
XV	XV
XIV-A	XIV-A
XIV	XIV
XIII-B	XIII-B
XIII-A	XIII-A
XIII	XIII
XI/XII	XI/XII
X-A	X-A
IX/X	IX/X

Present Status of Seams:

Status of the seams of different erstwhile individual mines are given below.

Seamwise status of Working

1. **Lodna Colliery:**

Seam	Status
XIV	Exhausted and on Fire
XIII B	Exhausted and on Fire
XIIIA	Exhausted and on Fire
XIII	Exhausted and on Fire
XI/XII	50% area depillared with caving/stowing, 50% area standing on pillars. Dip side area is waterlogged.
IX/X	Partly depillared Partly Standing on Pillar.
VIIIA	In 70 % area the seam has been thinned out and in 30% area the seam is developed and standing on Pillar.
VIII	In 60 % area the seam is developed and in 40% area the seam is virgin. Dipside developed working is waterlogged.
VII	In 40 % area the seam is developed and in 60% area the seam is virgin.
V/VI	In 10 % area the seam is developed and in 90% area the seam is virgin. The developed workings are fully waterlogged.
All seams below V/VI seam are virgin.	

BAGDIGI COLLIERY

Seams	Status
XV	Exhausted and under fire.
XIVA	Exhausted and under fire.
XIV	Exhausted and under fire.
XIIIB	Exhausted and under fire.
XIII A	Exhausted and under fire.
XIII	Exhausted and under fire.
XI/XII	Exhausted and under fire.
X(A)	Not worked due to thinness
IX/X	Exhausted.
VIIIA	Not worked due to thinness
VIII	50% area developed and 50% area virgin. seam.
VII(T)	50% area developed and 50% area virgin. .
All seams below VIIT are virgin.	

JOYRAMPUR COLLIERY

Seam	Status of Working
XIII B	Exhausted & under Fire.
XIII A	Exhausted & under Fire.
XIII	Exhausted & under Fire.
XI/XII	Mostly depillared with caving and partly standing on pillars. The seam is on fire.
IX/X	Mostly depillared (90%) with caving and partly standing on pillars. The seam is on fire.
VIIIA	Mostly depillared (90%) with caving and partly standing on pillars.
VIII	50% depillared with caving/stowing and 50% area developed and standing on pillars.
VII	65% depillared with caving/stowing and 35% area developed and standing on pillars. At present seam is being depillared with stowing (Manual)
V/VI	Fully developed and standing on pillars. The dipside area waterlogged (30 MG).
IV T	35% area developed and 65 % area virgin. .
All the seams below IVT seam are Virgin	

BARAREE COLLIERY

Sl. No.	Seam	Status
1	XV	Fully developed on B&P method Partly caved and rest SOP., Under fire and dipside water logged. Being excavated in the outcrop zone. Unapproachable.
2	XIV A	Fully developed on B&P method Partly caved and rest SOP., Under fire and dipside water logged. Being excavated in the outcrop zone. Unapproachable.
3	XIV	Fully developed on B&P method Partly caved and rest SOP., Under fire and dipside water logged. Being excavated in the outcrop zone. Unapproachable.
4	XIIIB	Fully developed on B&P method Partly caved, partly split and stowed and rest SOP., Under fire and dipside water logged. Outcrop zone quarried. Unapproachable.
5	XIIIA	Fully developed on B&P method Partly caved, partly split and stowed and rest SOP., Under fire and dipside water logged. Unapproachable.
6	XIII	Fully developed on B&P method Partly caved, partly split and stowed and rest SOP., Under fire and dipside water logged. Unapproachable.
7	XI/XII	Fully developed on B&P method Partly caved, partly split and stowed and rest SOP., Under fire and dipside water logged. Unapproachable.
8	X(Top)	Under development by B&P Method.
9	X (Bottom)	Under development by B&P Method Drowned below 14th level .standing on pillar.
10	IX	Almost Drowned . standing on pillar
11	VIII	Almost Drowned standing on pillar
12	VII(T)	Almost Drowned standing on pillar
13	VII(B)	Developed in small portion and drowned at present.
14	V/VI & below	Virgin

JEALGORA COLLIERY

Sl. No.	Seam	Status
1	XV	Fully developed on B&P method Partly caved and rest SOP.,Under fire and dipside water logged. Being excavated in the outcrop zone. Unapproachable.
2	XIV A	Fully developed on B&P method Partly caved and rest SOP.,Under fire and dipside water logged. Being excavated in the outcrop zone. Unapproachable.
3	XIV	Fully developed on B&P method Partly caved and rest SOP.,Under fire and dipside water logged. Being excavated in the outcrop zone. Unapproachable.
4	XIIIB	Fully developed on B&P method Partly caved, partly split and stowed and rest SOP.,Under fire and dipside water logged. Outcrop zone quarried. Unapproachable.
5	XIIIA	Fully developed on B&P method Partly caved, partly split and stowed and rest SOP.,Under fire and dipside water logged. Unapproachable.
6	XIII	Fully developed on B&P method Partly caved, partly split and stowed and rest SOP.,Under fire and dipside water logged. Unapproachable.
7	XI/XII	Fully developed on B&P method Partly caved, partly split and stowed and rest SOP.,Under fire and dipside water logged. Unapproachable.
8	IX/X and below	Virgin

5.1 CHOICE OF MINING METHOD

Considering the dip of beds which varies from 4^0 to 12^0 and mining of multiple seam separated by multi partings, the shovel dumper combination is proposed for mining. The opencast is proposed to be operated with Shovel-Dumper System of mining.

5.1.1 JUSTIFICATION FOR OPTIMIZATION OF TARGETED CAPACITY

As per the current mining parameters of the mine, the normative production of the mine is 2.512 MTPA. The peak production from the mine will be 30% higher than the normal production (2.512 MTPA + 30%) which can be achieved by better utilization of resources and favorable geo-mining conditions.

5.1.2 ASSUMPTIONS MADE, IF ANY

It is assumed opencast method with Shovel-Dumper System of mining will be used in the mine. It is also assumed that required excavation & transport capacity will be available for opencast mining operation.

5.2 RESERVES

5.2.1 GEOLOGICAL AND MINEABLE RESERVES

The net geological reserves within leasehold boundary as well as within delineated quarry, blocked reserves within barrier & batter, mineable reserve within the delineated quarry & parting wise OB within the delineated quarry area given in the following tables:

SEAMS	Net Geological Reserve (mt.)			Mineable Reserve (mt.) within delineated quarry
	Within leasehold boundary	Blocked Reserves in Barriar & Batter	Within delineated Quarry	
XIV	2.03	1.48	0.55	0.495
XIII-B	3.64	1.76	1.88	1.692
XII-A	16.66	7.56	9.10	8.190
XIII	6.03	0.63	5.40	4.860
XI/XII/XIII	12.39	7.58	4.81	4.329
XI/XII	8.25	3.67	4.58	4.122
IX/X	72.09	40.60	31.49	28.341
Total	121.09	63.28	57.81	52.029

- XIVA, XV and XVA seams are exhausted/burnt within the delineated quarry area

PARTING WISE OB TO BE REMOVED

Partings	Volume in M.Cum
Top OB	300.98
Parting Between XIV & XIIIB	45.69
Parting Between XIIIB & XIIIA	37.43
Parting Between XIIIA & XIII	37.02
Parting Between XIII & XI/XII &XI/XII/XIII	70.78
Parting Between XI/XII & XI/XII/XIII & IX/X	377.78
Total	869.68

5.4 GEO-MINING PARAMETERS

5.4.1 SEAMS TO BE WORKED

In this mining plan, it is proposed to extract the IX/X & all above occurring seams (upto XVA seam) in the proposed quarry limit through opencast operation.

Thus, IX/X to XVA seam are to be worked by opencast method of mining.

The seams below IX/X seam will be considered while preparing the expansion Project Report of NT-ST including the area of Amalgamated Joyrampur Colliery with I seam as base seam.

5.5 MINING ELEMENTS

5.5.1 BRIEF DESCRIPTION OF OPENCAST OPERATIONS

At present all the underground units of Amalgamated Joyrampur Colliery is closed. It has been proposed in this mining plan to extract coal from IX/X to XVA seam through opencast operation. The base seam of the mine will be IX/X seam floor. The mine boundary of the quarry is given below.

Mine Boundaries Delineation

The quarry limits of the Amalgamated Joyrampur Colliery on the surface is delineated within the leasehold boundary as under:

North : Minimum of about 25 m from the leasehold boundary.

South : Limit of Metamorphics/Minimum of about 25 m from the leasehold boundary.

East : Leasehold boundary of Amalgamated Joyrampur Colliery

West : Minimum Distance of about 60 m from the proposed diverted route of Chatkari jore

Basic Dimensions of the Quarry

Basic dimensions of the quarry is tabulated below:

Sl. No.	Description	Unit	Value
1	Area of Excavation	Ha	749
2	Strike Length	km	4.330
3	Dip rise width	m	1.950
4	Min and Maximum depth	m	70-240
5	Base of quarry		Floor of IX/X seam

Opening of the Mine

Amalgamated Joyrampur Colliery is proposed to be developed through access trench and box cut which is further fully developed into benches along the strike length above IX/X seam floor. Surface Plan is shown in Plate no. MIN-I. It is suggested that the mines should work as per stage plan given herewith, so that equipment deployment of the proposed opencast can be facilitated better in the later stage. Plan showing initial stage mining operation is shown in Plate no. MIN-II. Plan showing intermediate stage mining operation is shown in Plate no. MIN-III.

OC Operations

It has been decided by BCCL management to mine out IX/X & all occurring seams within quarry limit (upto XVA seam) by opencast mining in the Amalgamated Joyrampur Colliery. The proposed Amalgamated Joyrampur Opencast has a life of about twenty five years considering the seams & area as stated above. The broad parameters of proposed Amalgamated Joyrampur Opencast Mine are given here:

Mineable/Extractable Coal	:	52.029 M.Tes
Overburden including Loose OB	:	869.68 M. Cum
Av. Stripping Ratio	:	16.72 M^3/Te

Base of the Quarry

Floor of IX/X seam is the base of the quarry .

Haul Road Layout

It is proposed to lay 20 m haul road at 1 in 16 gradient in the floor of the IX/X seam in proposed area to reach the maximum quarry depth, Haul road alignment is shown in Plate no. MIN-IV (Final Stage Dump Plan).

Excavation

All the seams considered for exploitation will be mined in separate single benche where ever possible.

Variation in thickness of OB will make it difficult to maintain uniform bench height in OB horizons. However, it is proposed to have a ceiling on OB bench height from safety reasons. The height of the bench generally shall not exceed the boom height of shovel. The height of the bench is proposed as 10 m.

Out of total 869.68 M.Cum of OB, 444.75 Mcum of OB will be dumped internally in the decoaled area of the quarry on quarry floor and the rest around 424.93 Mcum will have to be dumped externally. The lead for internal OB dumping will be from 1.00 Km to 4.00Km. Final Stage dump Plan is shown in Plate no. MIN-IV. The mine management has identified area for external dump that is shown in Plate no.-MIN-V.

For initial years OB will be dumped in external dump. After creation of void in the decoaled area at IX/X seam floor of Amalgamated Joyrampur Colliery , OB will be dumped internally from 3rd year onwards.

For convenience of operation it is proposed to keep a minimum working width of coal and OB bench as 10 to 20 m. The working benches of OB and coal will be kept at a slope angle of 70^{o} and 80^{0} respectively during operation.

The final pit slope of the quarry has been planned at 37^{o} for the final depth of the quarry (240 m)

Year wise dump schedule given below.

YEAR	INTERNAL DUMP (M.Cum.)	EXTERNAL DUMP (M.Cum.)	TOTAL (M.Cum.)	AREA FOR RECLAMATION (Ha)
1		15.00	15.00	
2		22.00	22.00	
3	3.00	27.00	30.00	
4	4.10	34.90	39.00	
5	8.10	35.90	44.00	
6	10.00	34.00	44.00	
7	15.00	29.00	44.00	
8	22.96	21.04	44.00	
9	25.42	17.08	42.50	
10	25.42	17.08	42.50	
11	25.42	17.08	42.50	
12	25.42	17.08	42.50	
13	25.42	17.08	42.50	
14	25.42	17.08	42.50	20.82
15	25.42	17.08	42.50	20.85
16	25.42	17.08	42.50	41.64
17	25.42	17.08	42.50	41.64
18	25.42	17.08	42.50	41.64
19	25.42	17.08	42.50	41.64
20	29.90	11.10	41.00	41.64
21	21.89	7.11	29.00	41.64
22	21.00		21.00	41.64
23	16.00		16.00	41.64
24	8.00		8.00	41.64
25	5.18		5.18	41.64
PC-1				41.64
TOTAL	444.75	424.93	869.68	499.71

OB Dump Benches

Bench height for OB dumps will be 30 m and slope of individual dump benches will be 37^0. Width of berm between two adjacent benches will be about 40 m. Dumping will be done by End-Tipping method.

Drilling and Blasting

O.B. will be excavated in benches after proper drilling & blasting. Drilling in OB benches will be done by 250mm/160mm drills. The blasted OB will be dozed, heaped and loaded on to dumpers for transportation to OB dumps.

Drilling in coal benches will be done by 100 mm/ 160mm drills and after proper drilling & blasting, the blasted coal will be loaded by Shovels on to dumpers for transportation up to the surface stock yard.

The standard practice involving the electric detonators for the initiation of detonating cord, detonating relays to achieve hole-to-hole delays, use of Heavy ANFO, slurry or emulsion explosives as the column charge will be used for blasting.

The pattern of drilling and blasting will be decided during actual operation of the quarry. However, specific consumption of explosives has been envisaged as 0.3 kg/cum for OB and 0.2 kg/cum for Coal.

Transportation

There exist two Railway Sidings named as no. 6 and no. 9 siding in Lodna Area. The ROM coal from the OC will be transported by the tipping trucks from the pithead stock up to the siding directly and spread them all along the wharf. Contractual pay loaders will be engaged to load the coal into the railway wagons.

5.5.3 LIFE OF MINE

The life of mine for opencast project is 25 years at projected level of production.

5.5.4 SEQUENCE OF MINING

The mining shall be carried out in descending order.

5.6 MACHINERY TO BE DEPLOYED

Shovel Dumper System of Excavation with Drilling & Blasting will be supported with suitable population of Dozers, Motor Grader, Water Sprinkler and other

Auxiliary / Support equipments for excavation in the hot ROM material conditions.

5.7 PRODUCTION SCHEDULING

OPENCAST

The normative target production of the mine will be 2.512 MTY. However the peak production capacity of 2.512 MTY + 30% which may be achieved occasionally by better utilization of resources & favorable geo mining condition.

The calendar programme of mining operation has been formulated based on the adopted sequence of mine development and optimum condition of mining operation for the entire life of opencast project.

The year wise production from the Amalgamated Joyrampur Colliery is given below:

Year	CoalProduction (M.Tes)	O.B.Removal (M.Cum)	Av. Stripping ratio (Cum/T)
1	0.40	15.00	37.50
2	0.70	22.00	31.43
3	1.00	30.00	30.00
4	1.40	39.00	27.86
5	1.90	44.00	23.16
6	2.512	44.00	17.52
7	2.512	44.00	17.52
8	2.512	44.00	17.52
9	2.512	42.50	16.92
10	2.512	42.50	16.92
11	2.512	42.50	16.92
12	2.512	42.50	16.92
13	2.512	42.50	16.92
14	2.512	42.50	16.92
15	2.512	42.50	16.92
16	2.512	42.50	16.92
17	2.512	42.50	16.92
18	2.512	42.50	16.92
19	2.512	42.50	16.92

Year	CoalProduction (M.Tes)	O.B.Removal (M.Cum)	Av. Stripping ratio (Cum/T)
20	2.512	41.00	16.32
21	2.512	29.00	11.54
22	2.512	21.00	8.36
23	1.80	16.00	8.89
24	1.30	8.00	6.15
25	0.825	5.18	6.28
TOTAL	52.029	869.68	16.72

5.8 FIRE DEALING MEASURES

The proposed excavation area is a part of large fire of Lodna Area. Practically all the fires of the Lodna Area west of the erstwhile Rly. line e.g. Bagdigi fire, Lodna fire and Bararee colliery fire have merged into a single mega fire. Even the fire has crossed east of erstwhile Rly. property at places and active fire is visible on the east side . Presently, the fire is under control by surface sealing, trenching etc. So, any excavation in any part of fire area will increase breathing and there is all likelihood of aggravation of fire. Therefore, for excavating the proposed area top most priority has been accorded to seal off air supply to the exposed faces. The techniques are as follows :

5.8.1. APPLICATION OF THERMOSEAL

To isolate the operation area, every exposed mouths of development gallery along box-cut need to be closed with non-combustible material (OB rock & mutti), compacted properly and sprayed with Thermoseal (a mica based sealant). The sealant will close all the pores of breathing and thus chances of aggravation of fire will be minimised. For spraying ‘Thermoseal’ a ‘Sealant Spraying Machine’ will be used.

The ‘Thermoseal’ will also be sprayed over the coal face exposed along the box-cut. These exposed coal face might have either burnt out or are already on fire or are succeptible to spontaneous combustion due to heating and long history of fire in the area. Spraying of Thermoseal over the exposed coal face will cut-off air supply and thus prevent further aggravation of fire. If the faces are very

hot, immediate cooling should be done by spraying 'Water-Chemical (DAP&Urea) mixture or Water-Pyrocool mixture and then 'Thermoseal' should be applied. At final pit limit the sealant should be sprayed after covering the exposed faces with mutti & compacting them properly.

5.8.2. APPLICATION OF WATER-CHEMICAL MIXTURE

Even if the above mentioned measures are taken, possibility of occurrence of blazing fire on the exposed excavation / coal faces cannot be ruled out. To cool down such blazing fire during excavation, it is proposed that a water-chemical mixture containing Urea & DAP (on 1:1 ratio) be sprayed at high-pressure through nozzles of the Fire Tenderers into the fire site. For the purpose 50 Kg each of Urea & DAP has to be mixed with water in a fire tenderer of 18 Kl for spraying. After quenching the fire immediate measure is required to be taken to seal off the area so that fire do not re-erupt there again.

Alternatively, a 0.50% mixture of Pyrocool with water may also be used for spraying thro' high-pressure nozzles. However, since the chemical (Pyrocool) is very costly, it should be used judiciously only in case of uncontrollable and emergency fire conditions.

5.8.3. MODIFICATION IN UNIT OPERATIONS FOR EXCAVATION OVER FIRE AREA

For excavation of the area, standard unit operations of opencast mining e.g. drilling, blasting, excavation, transportation and dumping will be followed. But due to presence of fire, the unit operation will be modified slightly which are as follows:

Cooling of faces: Over the benches under excavation, application of fire fighting chemicals / additives like Di-ammomnum Phosphate (DAP) with Urea, mixed with water has to be carried out for suppressing the fire, extracting the heat and reducing the flame rapidly followed by profuse water jetting by high pressure nozzles for safe deployment of man & machines.

Cooling of Blast-hole & Insertion of Fire Resistant & Thermal Insulation Casing in the Blast Hole

Over the benches under excavation, drilling of blast-hole will be followed by cooling of the hole by use water and / or water-chemical mixture to bring down the temperature below 70^{o}C (if temp is very high). Finally fire resistant and thermal insulator casing will be inserted inside the hole before charging the explosive into it.

Blasting of the Excavation Bench

The size of each blast will be small with fewer number of blast holes established on the basis of rate of increase in temperature within the blast-hole, so that temp inside the hole before blasting is kept under detonation limit.

Quenching of Blasted Bench with Flushing of Water

After blasting the bench, the excavation area will be quenched by profuse use of water. For this, pipe range has been proposed to be laid round the quarry and high pressure nozzles has been proposed to be connected at regular interval with T-joint so that water can be sprayed over hot/fire excavation benches. Adequate pumping capacity has been provided from a Water Reservoir proposed to be excavated for the purpose. Water into the reservoir will be filled from pumps located in different collieries. From this surface Water Reservoir, water will be pumped out at faces for quenching purpose.

Excavation of the blasted & quenched material shall be done by use of Electric Rope Shovels and loaded into Rear Dumpers.

Transportation & Dumping

OB will be transported to external or internal OB dumps for dumping. After dumping, the OB will be again sprayed with water to quench the fire, if any, completely, so that chances of re-appearance of fire at OB

dumps is eliminated. Adequate pumps have been provided for the purpose.

Coal, if recovered, will be transported to Surface Coal Stock Pit filled up with water where hot ROM coal will be quenched completely and then transported to the Washeries or the Railway sidings, as the case may be.

Sealing Off At Pit Limit

At the end of the mine life, end pit slope within the seam and every exposed mouths of development gallery along the length of the bench / box-cut should be closed with non-combustible material (OB rock &mutti), compacted properly and sprayed with Thermoseal (a mica based sealant). The exposed gallaries will be filled up first followed by sealing of exposed coal on the highwalls of the quarry.

5.8.4. FIELD TRIALS OF THE FIRE DEALING MEASURES

Before starting the operation of actual excavation within the fire area, field trials need to be conducted for all the fire-dealing-measures suggested in the foregoing para. Field-trials are necessary to standardize and indigenize the technique by the colliery. Field Trials should be conducted in consultation with CIMFR & DGMS.

CHAPTER - VI

MANPOWER, SAFETY AND SUPERVISON

6.0 MANPOWER

The total manpower strength of Amalgamated Joyrampur Colliery is 2040 as on 01.11.2017.

	Number
EXECUTIVE	15
NON EXECUTIVE	2025
TOTAL	2040

The manpower engaged in outsourcing is 181.

6.1 SAFETY

Safety of men and machine deployed in the mining area should be properly taken care of irrespective of whether the mining activities are performed by departmental or by outsourcing option.

All the regulations & schedules of Coal Mines Regulations 1957 relating to opencast mining and other circulars issued time to time have to be adhered to and implemented in order to maintain day to day safety precautions as per stature. The following precautions should be taken during opencast mining operations.

SURFACE FEATURES :

i) Before starting any quarrying operation all structures / dwellings if any located with 100 m distance from the proposed area shall be vacated and rendered uninhabitable and no blasting shall be done within 100 m of both sides of any High tension line and its trestle, passing through the proposed area, if any.

ii) The management shall indemnify any person who may be affected and owner of any surface structure in case of damage or loss to any life or property arising out of aforesaid mining operation.

iii) Hot overburden excavated during mining operation or any hot material or ash shall not be deposited on any outcrop of coal or in opencast workings or in any ground broken by extraction of coal.

iv) Water pool shall be constructed above entire fire affected area after filling it with mutti/inflammable material and shall be maintained effectively.

v) After completion of operations, excavated area shall be filled with incombustible material and restored to the original ground level within the period not exceeding three months voids formed due to excavation in the quarry shall be back-filled simultaneously with coal extraction.

vi) An embankment 3.0 m above the HFL and 3.0 m wide at top with sides sloping at an angle of 45 degree pitched with slope shall be built along the river and Jore at places where the R.L. of the ground containing the edges of the quarry 3.0 m less than the HFL at the River or Jore.

OPEN CAST WORKINGS :

i) The height of the benches shall not be more than the height of the boom of the machine used for digging, excavation or removal.

ii) The width of any bench shall not be less than :-

(a) three times of the widest Machine plying on the bench plus five meters, or

(b) if dumpers ply on the bench-three times of the width of the dumper or

(c) the height of the bench whichever is more.

iii) The quarry shall be completely worked by deployment of Machineries no manual working shall be permitted within 10.0 m of the working face.

iv) Adequate precautions shall be taken to ensure dressing of the side. Special care shall be taken, when any slip or other plane of weakness or other geological disturbance exists, so as to prevent danger to the work-persons.

v) No person shall be engaged to work or allowed to travel close to high sides / benches from which he is likely to fall more than 1.8 m vertically down, unless he is provided with and uses a safety belt or rope.

FENCING AROUND OPENCAST WORKINGS :

i) The top edge of the opencast working shall be kept fenced with wire rope strands or barbed wire, supported by posts of timber, iron or concrete (movable). The gap between the adjacent rope strand or wires shall not be more than 0.30 m and bottom most rope, strand or wire shall not be more than 0.25 m and the topmost rope, strand or wire shall not be less than 1.0 m from ground level.

ii) At the finishing stage, opencast working shall be fenced with a masonry wall using lime mortar not less than 0.40 m thick and not less than 1.2 m high, with a parapet top.

SPOIL BANKS :

(i) The slope of a spoil-bank face shall be determined by the natural angle of repose of the material being deposited, but shall in no case exceed 37½ degree from the horizontal. The spoil-bank face shall not be retained by artificial means at an angle in excess of its natural angle of repose.

(ii) Any spoil-bank exceeding 30.0 m in height shall be benched so that no bench exceeds 30.0 m in height and the general slope does not exceed vertical to 1.5 m horizontal.

(iii) The toe of a spoil-bank face shall not be permitted to approach a railway or other public works, public road or building or other permanent structure

not belonging to the Owner of the mine, closer than a distance equal to the vertical height of its face.

(iv) No person shall, or shall be permitted to approach the toe of an active spoil-bank where he may be endangered from material rolling down the face.

HAUL ROADS :

i) No road shall be of width less than three times the width of the largest vehicle plying on road plus 5.0 m.

ii) All corners and bends in roads shall be made in such a way that the operators of the vehicle shall have a clear view for a distance of not less than 3.0 times the breaking distance of largest vehicle playing at speed of 40.0 Km/Hour.

iii) Wherever it is not possible to ensure clear visibility of the operator for a distance as specified in Clause (b), there shall be provided two roads of width not less than 2 times the width of the largest vehicle plus 3.0 m with a strong road divider in between having adequate lighting and reflector along the divider.

iv) Where any road is existing above the level of surrounding area, it shall be provided with strong parapet walls / embankment of the following dimensions:

(i) Width at top-not less that 1.0 m.
(ii) Width at Bottom-not less than 2.5 m.
(iii) The height not less than the diameter of tyre of largest vehicle playing on road.
(iv) It may be noted that just dumping of mud or overburden shall not treated a strong parapet wall.

v) No road shall have a gradient steeper than 1 in 16.

vi) Ramps with 1 in 10 gradients shall not be more than 10.0 m at one stretch and in case of machine having largest turning radius, the length of the span at a stretch one the ramp shall be designed compatibly with a written permission from the Regional Inspector of Mines.

6.2 SAFETY ASPECTS FOR OF HEMM / EQUIPMENT

Special precaution should be taken while deploying workers in the mine. Before employing any labour to the mine proper vocational training should be imparted and recommendations of VIII Safety Conference should be strictly followed. Some of the major aspects are as follows:-

A) For persons:

i) No persons shall be deployed unless he is trained at VTC.
Records in Form-B Form-D shall be maintained.

ii) Records of Vocational training Certificate and driving license of operators shall be kept by competent authority and shall be made readily available for inspection by management.

iii) No person shall be employed unless person holds VTC. A record of it shall be maintained.

iv) Adequate supervision shall be maintained by qualified competent persons only.

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

i) All the machineries to be deployed in mines should be checked before deployment by competent authority.

ii) A proper record of repair and maintenance along with inspection done by competent authority and defect pointed out shall be maintained and signed by authorized person.

iii) All the equipment shall be provided with audio-visual alarms, proper light for use at night and period.

iv) When natural light is not sufficient an audio-visual alarms for reversing on trucks shall be provided.

v) Machine manufacturers should be asked to give risk analysis details in respective machines deployed

vi) Suitable type of the fire extinguishers shall be provided in every machine.

C) General:

i) No person/vehicle shall be deployed at any place other than authorized place.

ii) All workers should obey lawful instruction of mine management.

iii) Risk Management Plan of tipper/pay loader shall be made and implemented.

iv) All drivers shall obey systematic traffics rules prepared by management.

v) Before deploying workers they must be trained and briefed about safety aspects in opencast mine. However during course of execution of the work, if any accident occurs whether major or minor, the matter shall have to be immediately informed to mine management, i.e. Colliery Manager/Agent/GM of Area so that Notices of accidents in a accordance of (Reg.9 of CMR 1957) and Section 23 of The Mines Act 1952 may be given and other necessary steps may be taken in accordance with the Mines Act 1952.

vii) Mine authority shall operate transport system in such a way so as to minimize pollution in the mine.

6.3 STABILITY OF BENCHES, QUARRY HIGHWALLS AND SPOIL DUMPS:

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

i) Shearing effect on rocks

ii) Ground water pressure

Shearing effect occurs due to gravity loading, shock & seismic vibration. Shock & seismic vibration can be minimized by adopting control blasting techniques.

Gravity loading can be minimized by controlling the kinetic load of dumpers by preventing over speeding while running on the benches.

Since the seams are developed, problem of ground water pressure is not likely to be faced in developed part of the project. Adequate pumping provision has been made which will reduce the ground water pressure.

Bench parameters shall be adopted as mentioned in the report. However, during actual mining operation, the condition of benches & dumps should be closely observed at regular intervals and the dimension is to be modified as and when required. Working benches and spoil dumps shall be kept under constant vigil to mark any development of crack.

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

During actual mining operation, systematic observations of the condition of benches, high wall slopes and spoil dumps should be carried out and the dimensions be modified if necessary to suit the local conditions.

6.4 MEASURES TO BE TAKEN FOR FIRE FIGHTING AND FIRE PREVENTION:

The excavation of fire area will be required during quarry operation. Therefore, method of work as discussed in fire dealing measures and other statutory provisions in this respect must be adhered to while working in the fire zone. However, the method may be improved / upgraded after suitable scientific field trials.

During implementation of the fire dealing measures and excavation & dumping of hot materials, monitoring of status of fire, its movement, temperature condition and efficiency of fire dealing measures, is to be done regularly. Even

on dump sites, such a monitoring is required so that quenching can be done in time to avoid dump fire.

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

1) Organisation of special cell for systematic observations to examine and prevent fire.
2) Removal of spillage of coal on benches and cleaning of coal horizons to prevent cases of coal heating.
3) Storage of lubricants and cotton waste in enclosed fireproof containers in working places.
   Provision of fire extinguishers

6.5 PRECAUTIONS AGAINST DANGER OF INUNDATION FROM SURFACE WATER.

1) A careful assessment is to be made against the danger from surface water before the onset of rainy season. The necessary precautions should be clearly laid down and implemented. A garland drain needs to be provided to drain away the surface rainwater from coming into the mine.

2) Inspections for any accumulation of rainwater, obstruction in normal drainage and weakening in embankment.

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

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

5) Nallah or water inlets may be diverted or isolated by embankments if so required.

6.6 PROTECTION OF EQUIPMENT DEPLOYED AT BOTTOM HORIZONS FROM FLOODING:

During the heavy monsoon period, the mining operation in the lower-most bench may have to be stopped. Therefore, it is proposed to drown the lower-most bench, which would work as a sump. The water will be pumped out and discharged into the nearby Kari jore.

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

1) Drivage of initial trenches if any and coal cutting on bottom benches should be done during the dry period of the year.

2) Ramps should be made for quick shifting of equipment from bottom horizons, liable to be flooded during monsoon period, to the top horizons.

6.7 PREVENTION OF ELECTRIC SHOCKS:

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

1) For protection from electric shocks to persons, all electrical equipment with voltage up to 1000V should be provided with Earth Leakage Relay, which will automatically disconnect electrical circuits.

2) Closed mobile substations and switchgears should be mechanically interlocked which exclude the possibility of opening the door when oil switch and air circuit breakers are in operation.
3) All metal parts of electrical equipment should be properly earthed to avoid failure of insulation.
4) All H.T lines and cables located within the blasting zones should be disconnected during charging & blasting operations.

6.8 DUST SUPPRESSION & DILUTION OF EXHAUST FUMES :

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

1) Spraying with water on all working faces & haul roads, by special spraying machines or water-sprinkler.
2) While drilling holes, it is necessary to use dust extraction devices.
3) Installation of local dust suppression and air conditioning devices in cabins of excavators and drilling rigs may be considered.
4) Leveling of spoil dump surface.
5) Separate dust suppression arrangement should be provided for CHP.

To prevent collection of harmful mixtures in the atmosphere, from the different sections of quarry workings, it is recommended:-

To spread out the sources of dust formation and omission of harmful gases throughout the working area of the quarry.

1) Drilling & blasting operations should be timed for periods of maximum wind activity during the day.
2) Dumpers may be provided with purifiers for exhaust gases.

6.9 MEASURES TO BE TAKEN WHILE DRILLING BLASTING:

PRECAUTIONS WHILE DRILLING :

1. The holes shall be drilled in the pattern proposed by the Manager on beginning of that day, in such a way that length of the face shall be more than three times the width of the face having three rows of holes, with spacing and burden as recommended for specific diameter of hole.

2. i) No drilling shall be commenced in an area where shots have been fired, until the shot fire has made a thorough examination at all

places, including remaining butts of old deep holes, for unexploded charges that the drill may strike.

(ii) The position of every deep hole to be drilled shall be distinctly marked by the blasting Overman so as to be readily seen by the drillers.

(iii) No drill or bore rod or pick shall be inserted in butts of old deep holes even if an examination under Clause (i) has failed to reveal presence of explosives.

3. (i) Drilling operations shall not be carried out simultaneously on two benches at places directly one above the other.

(ii) Drilling and charging of deep holes shall not be carried out in the same area at the same time.

PRECAUTIONS WHILE TRANSPORT OF EXPLOSIVES :

i) Where explosives are transported in bulk for deep hole blasting the precautions laid down under Regulation 164A (of C.M.R. Amendment Regulation 1971 vide Notification No. G.S.R. 568 dated 17/04/71) shall be strictly complied with.

(ii) All conditions specified by the Chief Inspector of Mines in the documents, if any granting permission to carry a larger quantity of explosives in a single case or canister or for the use at one time in one place of more than one such case or canister, in relaxation of Regulation 163 of the Coal Mines Regulations, 1957, shall be strictly complied with.

(iii) Not withstanding anything contained in the Coal Mines Regulations, 1957, the transportation of explosives, preparation of charges and the charging and stemming of holes shall be carried out under the personal supervision of a competent person who shall himself fire the shots in deep holes.

PRECAUTIONS WHILE CHARGING OF HOLES :

i) Where there is any doubt and particularly where there are cracks and crevices reported in the hole at the time of drilling the bottom 2.0 m length of the hole shall be filled with sand / water ampoule. In crushed / broken ground charging of the hole shall not be done.

ii) Explosives shall be delivered first to the hole farthest from the 'Priming Station' so as to avoid persons walking among piles of explosives.

iii) Not more than one hole shall be in the process of being charged at any one face at any one time.

iv) All charging, stemming and connecting up shall be done while standing on the solid, that is to say, on the side of holes remote from the quarry face.

v) The safe explosives charge for a limiting peak particle velocity shall not exceed the limits recommended at Para 7.2 of D.G.M.S. Circular No. 7 of 1997. The P.P.V. shall be measured once in every quarter and the records of the same shall be maintained in a bound paged book and a copy of the same shall be submitted to this Directorate.

vi) The cartridges of explosive shall be lowered carefully to avoid sticking in the hole so as not to cause air / space. After inserting cartridges the length of the remaining hole shall be measured to ascertain that the cartridges are in close contact and there is no air space.

PRECAUTIONS WHILE FIRING OF THESHOTS :

i) A safe code of blasting practice shall be framed by the manager and shall be circulated to all concerned for its strict compliance.

(ii) The Manager shall fix the blasting time and shall circulate it to all concerned and display it on the Notice Board.

(iii) Clear and distinct warning shall be given before commencing charging of hole as well as before firing the shots. Subsequent to blast, after 15.0 minutes all clear signal shall be given. Presently hooters shall be installed for this purpose.

(iv) Adequate number of guards shall be posted to prevent inadvertent entry of any persons in the danger zone during firing of the shots.

(v) Shots shall not be fired except during the hours of day light or until adequate artificial light is provided. All holes charged on any one day shall be fired on the same day. Sleeping of holes shall not be permitted till the time specific permission in this regard is obtained.

(vi) Shots if fired beyond day light hours should be muffled so that, flying fragments from blasting can not project beyond a distance of 10.0 m from the place of firing in this connection, attention is drawn to D.G.(Tech.) Circular No. 8 of 1976 for compliance.

(vii) As far as practicable the shot firing shall be carried out either between shifts or during the rest interval or at the end of work for the day.

(ix) Precautions with regards to taking shelter, etc., as laid down in Regulation 170 of the Coal Mines Regulations, 1957 (Third Amendment) Regulation 1974 (vide Notification No. G.S.R. 1092 dated 20/09/74) shall be complied with.

(x) Notwithstanding what is contained under Regulation 170 of the Coal Mines Regulations, 1957, no person other than blasting in-charge and his assistants, if any, shall be permitted to remain within a radius of 20.0m or within 60.0 m on the same bench where charging of holes with explosives is being carried out.

(xi) A proper record of every blast showing the patter of shot-holes and particulars of charge and observation regarding fly rock and ground vibration shall be maintained by the blasting in-charge (First class

Assistant Manager) and shall be countersigned by the Manager on every entry.

(xii) All works relate to drilling, charging and firing of deep holes shall be carried out under supervision of Blasting – Officer / blasting in-charge, who shall having First Class Mine Manager's Certificate of Competency. He shall be assisted by an Overman for all works.

PRECAUTIONS WHEN PROVISION UNDER REGULATION 170 (1A) & (1B) ARE ATTRACTED

(i) No deep hole blasting shall be done within a distance of 100.0 m from any public road, land acquired for railway, any structure not belonging to the owner and those inhabited by any person unless vacated and demolished.

(ii) For carrying out blasting in the quarry when the permanent structures or buildings are located beyond 100 m but within 300 m of the site of blasting, safe charge of explosive that will cause ground vibrations less than the stipulated norms, as suggested by Proj No. Cons/2012/12-13 dated January 2013 studied by the Indian School of Mines, shall be used.

(iii) Not more than three rows shall be fired in a round of blast. The blasting patch shall be such that the length of the face is more than three times the width of the face.

(iv) Face of the blasting patch shall not be oriented in the strike direction. The initiation of a round shall start from the village end.

(v) For day-to day blast, burden and spacing shall not be less than 2.5 m and 3.0 m respectively.

(vi) To reduce noise and air over-pressure levels, the surface detonating cord shall be covered with at least 15 cm thick sand.

(vii) Before conducting deep hole blasting in the OCP, persons employed in the belowground workings lying within 180 m of the point of blasting measured in any direction, in the same mine or in any adjoining mine,

shall be withdrawn and no work-person shall be readmitted into the said underground workings until the same have been inspected by a competent person duly authorized for the purpose and found safe and free from loose roof and sides, any noxious gases and signs of fire etc.

(viii) A system of obtaining written confirmation from the Manager or authorized person of Colliery in a register, the respect to withdrawal of persons from underground shall be recorded and shall be countersigned by Manager of the mine. A code of practice in this regard, duly signed by the Manager of the colliery shall be adopted and submitted to this Directorate.

(ix) Danger zone shall be kept marked in the field as well as on the plan maintained under Regulation 59(1)(a) of the Coal Mines Regulations, 1957.

(x) Competent persons i.e. explosive carrier trained in controlled blasting techniques and duly authorized by manager shall be permitted for charging & firing the shots.

(xi) Blasting shall be conducted in such a way that the underground galleries are completely filled up, failing which no heavy machinery should be brought over those galleries.

(xii) Further dozing/filling shall be done in these galleries before bringing heavy machineries over these galleries:

(a) Where there is any doubt and particularly where there are cracks and crevices the bottom 2 m length of the hole shall be filled with sand.

(b) No person including shot firer shall take shelter within 100 m of the site of blasting in the quarry unless such shelter shall be of approved design.

(xiii) The provisions of Regulation 170 of Coal Mines Regulations, 1957 shall be strictly complied with subject to the conditions as stipulated in the permission letter.

6.10 PRECAUTIONS WHILE EXTRACTING THE DEVELOPED PILLARS

(i) No heavy machinery or vehicle except drilling machinery shall be deployed when the thickness of overburden above the underground galleries as proved by advance bore hole or other suitable means is reduced to 6.0 meters unless the underground galleries are completely filled in after blasting.

(ii) Where the workings are accessible the same shall be surveyed and cleaned of all the coal dust and thickly stone dusted before commencement of extraction of pillar.

(iii) The spacing of the holes in overburden bench lying immediately above the coal seam shall be so adjusted that the holes do not lie immediately above the galleries as for as possible in under to ensure that the holes do not directly fire into the underground workings.

(iv) Blasting shall be done in such manner so that the underground galleries are completely filled up. Otherwise mutti / overburden shall be dozed to fill up the galleries completely.

(v) No person shall be allowed at any place in opencast workings where thickness of overburden and / or coal over any gallery has been reduced to 1.5 m or less.

(vi) Each coal pillar shall be exposed completely by removing the overburden overlying the pillar and the adjoining galleries on all side.

(vii) The quarrying operations shall be done from rise to the dip.

(viii) Entrances to the wide underground galleries in an opencast shall be kept effectively fenced off.

(ix) D.G.M.S.(Tech.) Circular No. 3 and Circular No. 4 of 1980 regarding precautions against the danger of coal dust explosion while extracting pillars by opencast method shall be complied with.

6.11 CONSERVATION

For conservation of precious coal resource during mining operation, following measures are suggested :

i) OB dump should be so planned so that no extractable coal is buried below OB dumps which may result in sterilisation of coal reserves.

ii) No OB dumping should be done within the coal bearing area.

iii) Adequate precaution should be taken to eliminate loss of coal while mining the developed coal seams.

iv) Coal in "Coal+Jhama Zone" should be identified and mined selectively and separably from Jhama.

vi) While working in zone affected by fire, measures as suggested in ‘Fire Dealing Measures’ should be adhered to religiously to maximise recovery of coal in fire zone.

vii) Practice of selective mining of dirt bands must be adhered to by sub-benching whenever bench > 1.0 m thickness is encountered.

viii) Extractable local seams (> 0.50 m thickness) whenever encountered must be exploited by sub-benching.

6.12 DISASTER MANAGEMENT PLAN

Mining is a hazardous industry. There is risk to life and property associated with various mining and allied activities of the project. The project report has been drawn in conformity with the prevailing statutory provisions as per Mines Act, 1952 & CMR 1957 applicable for safety in mines. A detailed study has been

carried out covering identification and assessment of risk, and recommendation of measures to prevent damage to life and property against such risks.

Safety Audit is an integrated component of Risk Assessment and Safety Management, which is required to be undertaken on regular basis by System Study and Safety Audit(SYSSA). Such System Study and Safety Audit (SYSSA) should be conducted at least once in every year, after every major accident or disaster or dangerous occurrence, before implementation of any new technology or use of any new system or machinery in the mine. Such Study may be subject wise as well as an integrated report of the mine incorporating all subjects such as mining, mechanical, , electrical, personal, occupational Health & Hygiene, and any other subject applicable to the mine and the system prevailing or to be used therein.

Risk Reduction Programme (RRP) is an ongoing process to achieve Zero Harm Status of Safety in any mine and should be incorporated in the Disaster Management Programme.

6.13 Recommendations of 11th conference on Safety in Mines held on 4th & 5th July, 2013 at New Delhi regarding Contractor work vis-à-vis safety

Para 2.0 :Contractor work vis-à-vis safety

2.1 Employer's responsibilities

2.1(a) Suitable clauses (in consistence with risk of the work allotted) shall be included in tender document (including NITs) stating how the risk arising to men and material from the mining operation/operations to be done by the contractors shall be managed.

2.1(b) Ensure that contractors are familiar with the relevant parts of the statutes, health and safety management system and are provided with copies of such documents prior to commencing work.

2.1(c) Ensure that contractor's arrangements for health and safety management are consistent with those for the mine owner. All the rules, regulations and bye-laws as applicable to the mine owner are also applicable to the contractor. Details of the contractor's workmen should be maintained in the owners Form-B register. Whereas as C, D & E registers for contractor men may be maintained independently by the owner and shall be kept in the mine office of the manager.

2.1(d) Ensure that contracts should preferably of longer period (3 years), so that there is adequate scope of management of safety by the contractor.

2.1(e) Ensure that contractors provide the machinery, operator and other staff with written safe work procedures for the work to be carried out, stating clearly the risk involved and how it is to be managed.

2.1(f) Monitor all activities of the contractors to ensure that contractors are complying with all the requirements of statute and the system related to safety. If found non-compliance of safety laws directing the contractors to take action to comply with the requirements and for non-compliance, the contractor may be suitably penalized. Clause to this affect may be a part of the agreement between the employer and the contractor.

2.1(g) Where a risk to health or safety of a person arises because of a noncompliance directing the contractor to cease work until the non- compliance is corrected.

2.2 Contractor's responsibilities:

2.2(a) Prepare written Safe Operating Procedure (SOP) for the work to be carried out, including an assessment of risk, wherever possible and safe methods to deal with it/them.

2.2(b) Provide copy of the SOP to the person designated by the mine owner who shall be supervising the contractor's work.

2.2(c) Keep an up to date SOP and provide a copy of changes to a person designated by the mine owner.

2.2(d) Ensure that all work is carried out in accordance with the Statue and SOP and for the purpose he may deploy adequate qualified and competent personnel for the purpose of carrying out the job in a safe manner.

2.2(e) For work of a specify scope/nature, develop and provide to the mine owner a site specific Code of Practice (COP).

2.2(f) Ensure that all sub-contractors hired by him comply with the same requirement as the contractor himself and shall be liable for ensuring the compliance all safety laws by the sub or sub-sub contractors.

2.2(g) All persons deployed by the contractor for working in mine must undergo vocational training, initial medical examination, PME. They should be issued cards stating the name of the contractor and the work and its validity period, indicating status of VT & IME.

2.2(h) Every person deployed by the contractor in a mine must wear safety gadgets to be provided by the contractor. If contractor is unable to provide, owner, agent and manager of the mine shall provide the same.

2.2(i) The contractor shall submit to DGMS returns indicating -Name of his firm, Registration number, Name and address of person heading the firm, Nature of work, type of deployment of work persons, Number of work persons deployed, how many work persons hold VT Certificate, how many work persons undergone IME and type of medical coverage given to the work persons. The return shall be submitted quarterly (by 10th of April, July, October and January) for contracts of more than one year. However, for contracts of less than one year, returns shall be submitted monthly.

2.3 Employees Responsibilities

2.3(a) An employee must, while at work, take reasonable care for the health and safety of people who are at the employee's place of work and who may be affected by the employee's act or omissions at work.

2.3 (b) An employee must, while at work, co-operate with his or her employer or other persons so far as is necessary to enable compliance with any requirement under the act or the regulations that is imposed in the interest of health, safety and welfare of the employee or any other person.

CHAPTER - VII

COAL HANDLING, WASHING &MODE OF DISPATCH

7.1 COAL DISPATCH ARRANGEMENT

Presently produced coal from Lodna area is dispatched to crockeries through local sale and to power plants through 6 no. and 9 no. siding. Further coal produced from Amalgamated Joyrampur Colliery will be dispatched by road and rail (through 6 and 9 no. siding) until the proposed siding at Patherdih-Rakhitpur railway comes up.

90 % coal will be dispatched to Patherdih coal washery through rail and proposed conveyor belts.

10 % coal will be provided to crockeries and consumers through roads.

CHAPTER - VIII

INFRASTRUCTURE FACILITIES PROPOSED AND THEIR LOCATION

8.0 GENERAL

Amalgamated Joyrampur Colliery is under the administrative control of Lodna area of BCCL. Amalgamated Joyrampur Colliery is formed with Amalgamation of 05(five) Underground Mines (i.e. Lodna Colliery, Bagdigi Colliery, Bararee Colliery, Jealgora Colliery & Joyrampur Colliery) vide letter no. R-2/0100190/ P-12-15/1517-27 dated 28.8.2015 issued by Director of Mines safety, Region-2, DGMS, Dhanbad.

8.1 PRESENT LINKAGE OF COAL

Coal produced from Amalgamated Joyrampur Colliery will be dispatched by road and rail (through 6 and 9 no. siding) until the proposed siding at Patherdih-Rakhitpur railway comes up.

90 % coal will be dispatched to patherdih coal washery through rail and proposed conveyor belts.

10 % coal will be provided to crockeries and consumers through roads.

8.2 PRESENT PUMPING ARRANGEMENT

List of installed pumps are given in table below.

Sl. No.	Pump Type	Detail	Location
1	Submersible Pump	Head - 210 Mtr, GPM-600, RPM-2900	1 Pit, Lodna Colliery
2	Submersible Pump	Head - 210 Mtr, GPM-600, RPM-2900	2 Pit, Lodna Colliery
3	Submersible Pump	Head - 180 Mtr, GPM-600, RPM-2900	5 Pit, Joyrampur Colliery
4	Submersible Pump	Head - 160 Mtr, GPM-600, RPM-2900	Seth Kothi, Joyrampur Colliery
5	Submersible Pump	Head - 180 Mtr, GPM-600, RPM-2900	7 Pit, Jealgora Colliery
6	Submersible Pump	Head - 180 Mtr, GPM-600, RPM-2900	7 Pit, Jealgora Colliery
7	Submersible Pump	Head - 180 Mtr, GPM-600, RPM-2900	7 Pit, Jealgora Colliery
8	Submersible Pump	Head - 180 Mtr, GPM-600, RPM-2900	2 Pit, Jealgora Colliery
9	Submersible Pump	Head - 180 Mtr, GPM-600, RPM-2900	2 Pit, Jealgora Colliery
10	Submersible Pump	Head - 200 Mtr, GPM-600, RPM-1450	2 Pit, Jealgora Colliery
11	Horizontal Pump	GPM - 600	2 Pit, Jealgora Colliery
12	Horizontal Pump	GPM - 600	2 Pit, Jealgora Colliery
13	Submersible Pump	GPM - 600	Huchunktand, Jeenagora Colliery
14	Submersible Pump	GPM - 600	KT, Jeenagora Colliery
15	Submersible Pump	GPM - 600	Bhatta Par, Jeenagora Colliery
16	Submersible Pump	GPM - 600	East Golakdih (Sai Shree), Jeenagora Colliery
17	Submersible Pump	GPM - 600	Near Jeenagora Weigh Bridge, Jeenagora Colliery
18	Horizontal Pump	PL - III, 5 Stage, 1000 GPM	F - Patch, Amalgamated NT-ST-JGR Colliery
19	Horizontal Pump	PL - III, 5 Stage, 1000 GPM	F - Patch, Amalgamated NT-ST-JGR Colliery
20	Horizontal Pump	GPM - 2000	F - Patch, Amalgamated NT-ST-JGR Colliery

21	Horizontal Pump	PL - II, 4 Stage, GPM - 1000*	NT coal face, Amalgamated NT-ST-JGR Colliery
22	Horizontal Pump	GPM - 1000	NT coal face, Amalgamated NT-ST-JGR Colliery

8.3 PRESENT POWER SUPPLY

The Amalgamated Joyrampur Colliery of Lodna area are receiving power at 11 kV from Jeolgora main D.G. sub-station of BCCL. The main D.G. sub-station of BCCL is receiving power at 33 kV from DVC and is stepped down to 11 kV for supplying power to different collieries of Lodna Area.

The colliery sub-station wise installed main transformers are as under;

Sl.no.	Capacity in MVA	Nos.	Voltage ratio in kV	Supplying power to
a. JEOLGORA MAIN D.G. SUB-STATION OF BCCL				
1	10	3	33/11	Joyrampur, Bagdigi, Bararee, lodna, Jeolgora, Bhowrah collieries and Patherdih coal washery
b. BARAREE X SEAM SUB-STATION				
1	7.5	1	11/3.3	Surface and underground load
2	0.5	1	3.3/.550	
c. BAGDIGI SUB-STATION				
1	1	1	11/3.3	Surface and underground load
2	1	1	11/0.55	
3	0.250	1	3.3/.44	
4	0.250	1	0.55/0.44	
d. LODNA P.H.SUB-STATION				
1	3.15	2	11/3.3	Surface and underground load
2	1.5	1	11/3.3	
3	1	2	11/3.3	
4	1	1	11/0.44	
e. JEOLGORA 2-PIT SUB-STATION				
1	1.5	1	11/0.55	Surface and underground load
2	1	1	11/0.55	
3	0.75	2	11/0.55	
4	0.50	1	11/0.44	
5	2	2	11/2.2	
6	0.60	1	11/2.2	
7	0.250	1	2.2/0.55	
8	0.30	1	2.2/0.55	
f. JOYRAMPUR 3 & 5-PIT SUB-STATION				
1	1	2	11/3.3	Surface and underground load
2	1	3	11/0.55	
3	0.5	3	11/0.44	

8.4 WORKSHOP & STORE

There is no departmental workshop. An E & M workshop is proposed to the day-to-day repair and maintenance of pumps, motors, CHP assemblies etc. is being done. The excavation workshop will be maintained by outsourcing agency.

Existing store will cater the future requirements.

8.5 MAGAZINE – LOCATION AND CAPACITY & AREA

There are three magazines in the premises of Bhulan Bararee Magazine. Old licence numbers are as under:-

E/EC/JH/22/854(E50524)
1144/EX- surrendered
E/EC/JH/22/393(E12946)

Add. General Manager, Lodna Area is the licence holder of both the magazines.

Licence for the 3rd Magazine has been applied but not been granted yet.

Only two(02) nos. of magazines are in operation. These are situated in one premise at Bhulan Bararee Magazine. Bhulan Bararee Magazine is being used as a central magazine since 08.10.2010. Two nos. explosive van (one departmental and one hired) are used for transportation of explosives.

Explosives and accessories are distributed by an explosive van under the control of Explosive Issue Clerk to all the UG collieries and OCP of Lodna Area. Quarterly return (online) is submitted on regular basis.

8.6 INFRASTRUCTURE FACILITIES AVAILABLE

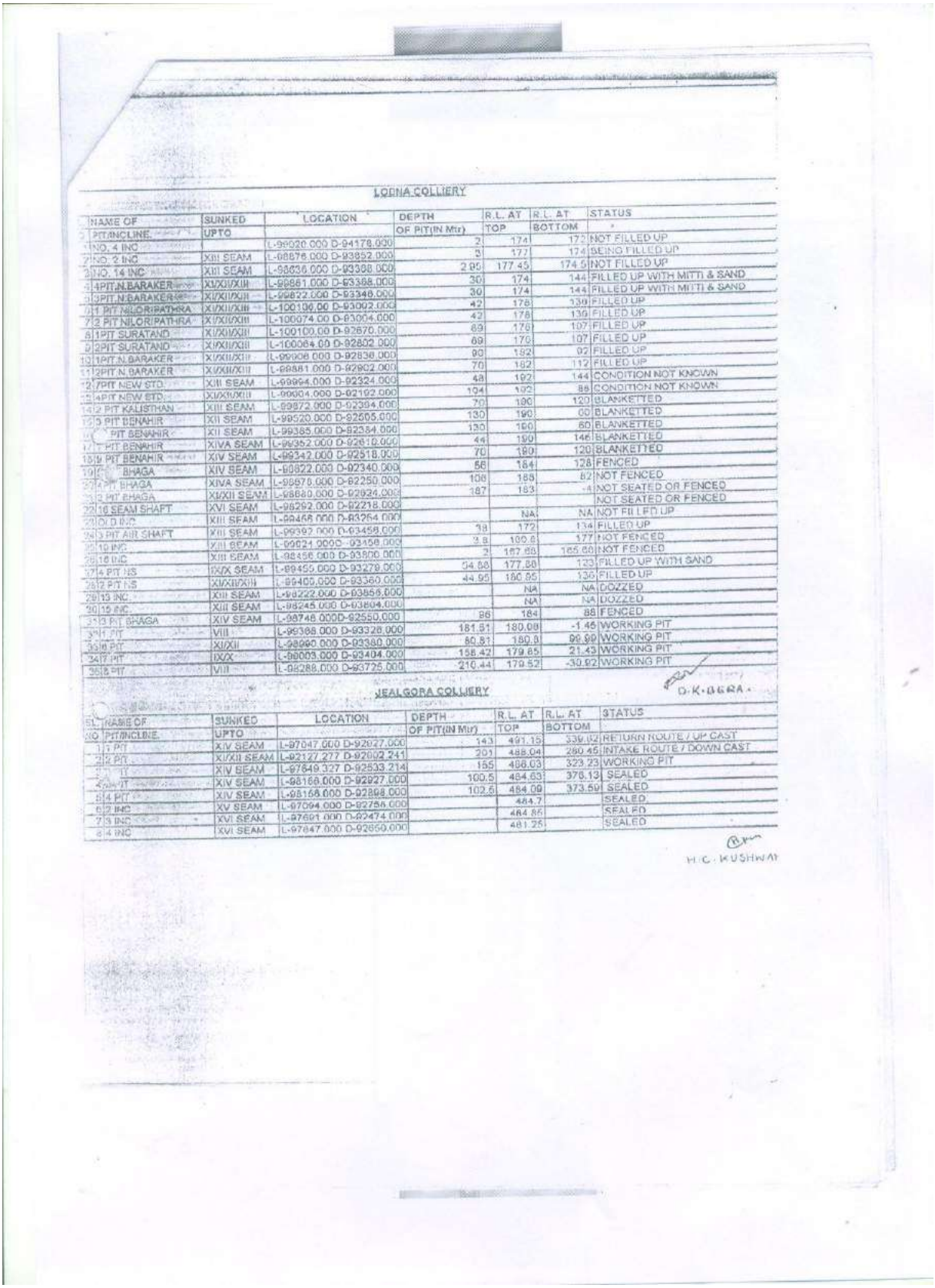
The detail infrastructures are as under:

Sl.	Name of establishment	Nos.	Remarks
1	Alakdiha Out post	01	
2	Post Office	01	
3	Bank Of India	01	
4	CISF Camp	01	
5	Joyrampur Colliery Dispensary	01	
6	School	05	
7	Temple	06	
8	Community Hall	01	
9	Anganwadi Kendra	02	
10	Lodna Area Office	01	
11	Joyrampur Colliery Office including workshop, substation, Area Auto garage		
12	Pit Head gear structures with winding engines	05	Joyrampur-02 Bagdigi-02 Lodna-01
13	BCCL quarters	1291	
14	Unauthorised	1077	
15	Bagdigi Colliery Office with workshop, sub-station		

The infrastructures situated within proposed quarry limit required to be shifted in other suitable places.

Pit/Incline in the Leasehold Area:

Present status of Pit/Incline exist within the mines of Lodna Area is given in following pages:



LODNA COLLIERY

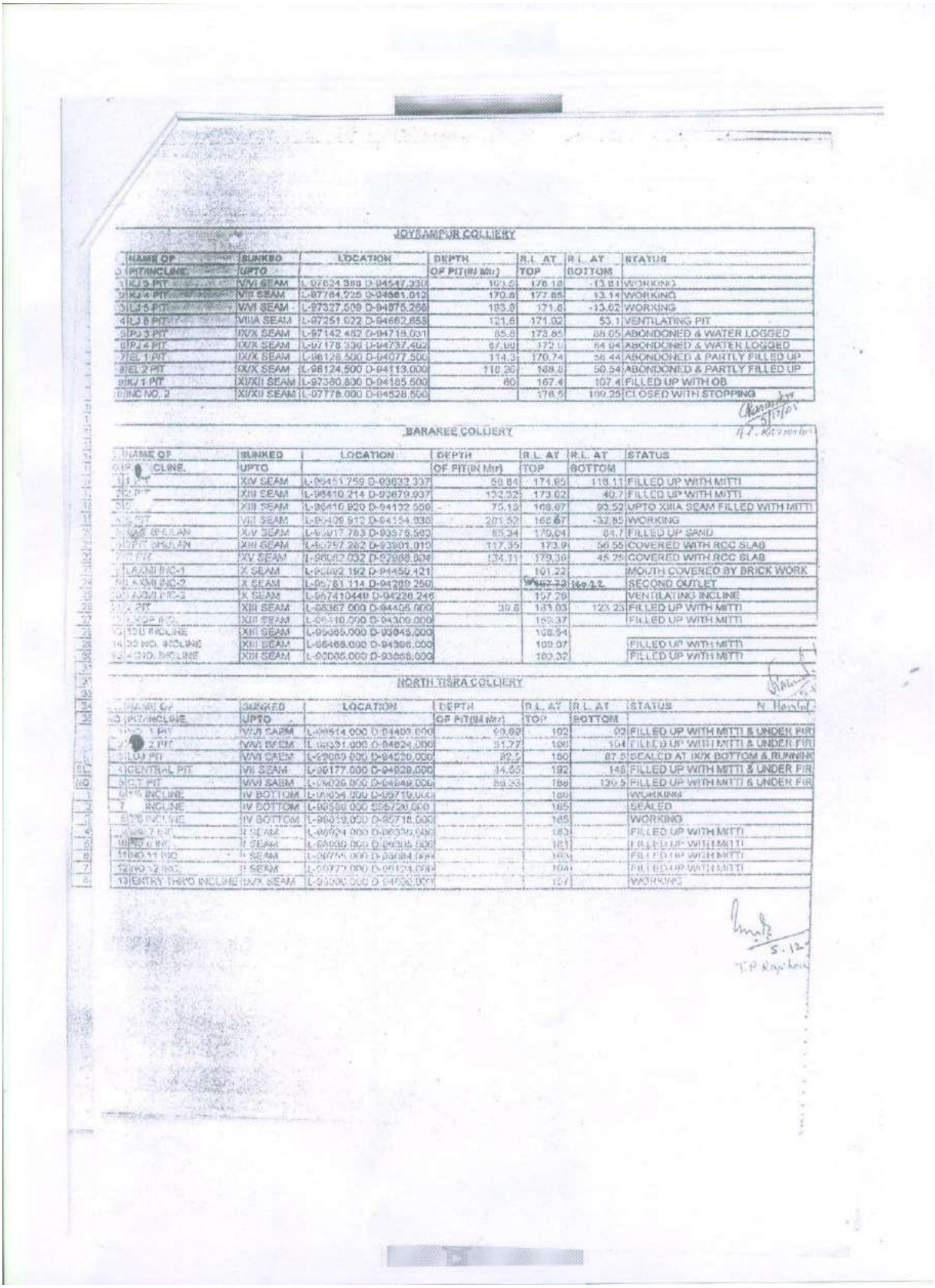
SL NO	NAME OF PIT/INCLINE	SUNKED UPTO	LOCATION	DEPTH OF PIT(IN Mtr)	R.L. AT TOP	R.L. AT BOTTOM	STATUS
1	NO. 4 INC		L-99020.000 D-94178.000	2	174	172	NOT FILLED UP
2	NO. 2 INC	XIII SEAM	L-98876.000 D-93892.000	3	177	174	BEING FILLED UP
3	NO. 14 INC	XIII SEAM	L-98636.000 D-93388.000	2.95	177.45	174.5	NOT FILLED UP
4	4PIT N.BARAKER	XI/XII/XIII	L-99861.000 D-93388.000	30	174	144	FILLED UP WITH MITTI & SAND
5	3PIT N.BARAKER	XI/XII/XIII	L-99822.000 D-93348.000	30	174	144	FILLED UP WITH MITTI & SAND
6	1 PIT NILORIPATHRA	X/XI/XII/XIII	L-100196.00 D-93092.000	42	178	136	FILLED UP
7	2 PIT NILORIPATHRA	X/XI/XII/XIII	L-100074.00 D-93004.000	42	178	136	FILLED UP
8	1PIT SURATAND	X/XI/XII/XIII	L-100100.00 D-92670.000	69	176	107	FILLED UP
9	2PIT SURATAND	X/XI/XII/XIII	L-100064.00 D-92802.000	69	176	107	FILLED UP
10	1PIT N.BARAKER	X/XI/XII/XIII	L-99906.000 D-92836.000	90	182	92	FILLED UP
11	2PIT N.BARAKER	X/XI/XII/XIII	L-99881.000 D-92902.000	70	182	112	FILLED UP
12	7PIT NEW STD	XIII SEAM	L-99994.000 D-92324.000	48	192	144	CONDITION NOT KNOWN
13	4PIT NEW STD	XI/XII/XIII	L-99904.000 D-92192.000	104	192	88	CONDITION NOT KNOWN
14	2 PIT KALISTHAN	XIII SEAM	L-99872.000 D-92384.000	70	190	120	BLANKETTED
15	5 PIT BENAHIR	XII SEAM	L-99520.000 D-92605.000	130	190	60	BLANKETTED
16	PIT BENAHIR	XII SEAM	L-99385.000 D-92384.000	130	190	60	BLANKETTED
17	PIT BENAHIR	XIVA SEAM	L-99352.000 D-92610.000	44	190	146	BLANKETTED
18	9 PIT BENAHIR	XIV SEAM	L-99342.000 D-92518.000	70	190	120	BLANKETTED
19	BHAGA	XIV SEAM	L-99822.000 D-92340.000	56	184	128	FENCED
20	4 PIT BHAGA	XIVA SEAM	L-99878.000 D-92250.000	108	189	82	NOT FENCED
21	3 PIT BHAGA	XI/XII SEAM	L-99880.000 D-92934.000	187	183	-4	NOT SEATED OR FENCED
22	16 SEAM SHAFT	XVI SEAM	L-98292.000 D-92218.000				NOT SEATED OR FENCED
23	OLD INC	XIII SEAM	L-99466.000 D-93264.000		NA	NA	NOT FILLED UP
24	3 PIT AIR SHAFT	XIII SEAM	L-99392.000 D-93458.000	38	172	134	FILLED UP
25	10 INC	XIII SEAM	L-99021.000 D-93458.000	2.8	180.8	177	NOT FENCED
26	16 INC	XIII SEAM	L-98456.000 D-93800.000	2	187.88	185.88	NOT FENCED
27	4 PIT NS	IX/X SEAM	L-99455.000 D-93278.000	54.88	177.88	123	FILLED UP WITH SAND
28	2 PIT NS	XI/XII/XIII	L-99405.000 D-93360.000	44.95	180.85	136	FILLED UP
29	13 INC	XIII SEAM	L-98222.000 D-93856.000		NA	NA	DOZZED
30	15 INC	XIII SEAM	L-98245.000 D-93804.000		NA	NA	DOZZED
31	3 PIT BHAGA	XIV SEAM	L-98748.000D-92550.000	96	184	88	FENCED
32	1 PIT	VIII	L-99388.000 D-93328.000	181.91	180.08	-1.45	WORKING PIT
33	6 PIT	XI/XII	L-98990.000 D-93340.000	80.81	180.8	99.99	WORKING PIT
34	7 PIT	IX/X	L-99003.000 D-93404.000	158.42	179.85	21.43	WORKING PIT
35	8 PIT	VIII	L-98288.000 D-93725.000	210.44	179.52	-30.92	WORKING PIT

D.K.DEBRA

JEALGORA COLLIERY

SL NO	NAME OF PIT/INCLINE	SUNKED UPTO	LOCATION	DEPTH OF PIT(IN Mtr)	R.L. AT TOP	R.L. AT BOTTOM	STATUS
1	1 PIT	XIV SEAM	L-97047.000 D-92027.000	143	491.15	339.02	RETURN ROUTE / UP CAST
2	2 PIT	XI/XII SEAM	L-92127.277 D-92092.241	201	488.04	280.45	INTAKE ROUTE / DOWN CAST
3	PIT	XIV SEAM	L-97849.327 D-92533.214	155	486.03	323.23	WORKING PIT
4	PIT	XIV SEAM	L-98168.000 D-92927.000	100.5	484.63	376.13	SEALED
5	4 PIT	XIV SEAM	L-98168.000 D-92898.000	102.6	484.09	373.59	SEALED
6	2 INC	XV SEAM	L-97094.000 D-92756.000		484.7		SEALED
7	3 INC	XVI SEAM	L-97691.000 D-92474.000		484.86		SEALED
8	4 INC	XVI SEAM	L-97847.000 D-92650.000		481.25		SEALED

H.C. KUSHWAH



JOYSANGUR COLLIERY

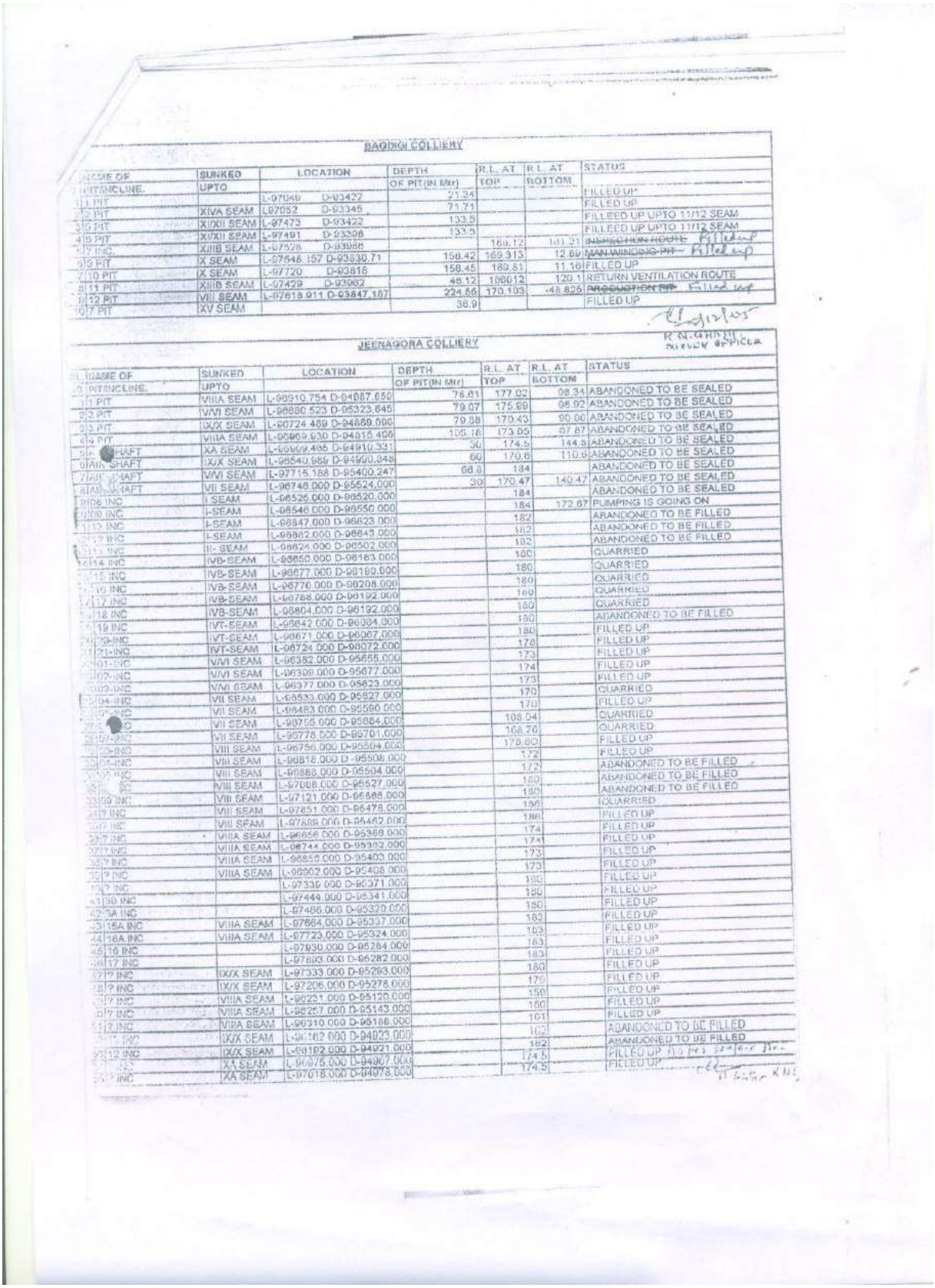
NAME OF PIT/INCLINE	SUNKED UPTO	LOCATION	DEPTH OF PIT(IN Mtr)	R.L. AT TOP	R.L. AT BOTTOM	STATUS
1 RJ 3 PIT	V/VI SEAM	L-97634.389 D-94547.939	191.5	178.18	-13.81	WORKING
2 RJ 4 PIT	VIII SEAM	L-97764.226 D-94661.012	170.8	177.85	13.14	WORKING
3 RJ 5 PIT	V/VI SEAM	L-97327.509 D-94875.268	183.8	171.6	-13.62	WORKING
4 RJ 8 PIT	VIIIA SEAM	L-97251.022 D-94662.855	121.6	171.02	53.1	VENTILATING PIT
5 PJ 3 PIT	IX/X SEAM	L-97142.482 D-94719.031	85.8	173.85	88.05	ABONDONED & WATER LOGGED
6 PJ 4 PIT	IX/X SEAM	L-97178.330 D-94737.402	87.00	172.0	84.94	ABONDONED & WATER LOGGED
7 EL 1 PIT	IX/X SEAM	L-96128.500 D-94077.500	174.3	170.74	56.44	ABONDONED & PARTLY FILLED UP
8 EL 2 PIT	IX/X SEAM	L-96124.500 D-94113.000	116.26	169.8	50.54	ABONDONED & PARTLY FILLED UP
9 KJ 1 PIT	XI/XII SEAM	L-97360.800 D-94185.600	60	167.4	107.4	FILLED UP WITH OB
10 INC NO. 2	XI/XII SEAM	L-97778.000 D-94528.500		178.5	109.25	CLOSED WITH STOPPING

BARAKEE COLLIERY

NAME OF CLINE.	SUNKED UPTO	LOCATION	DEPTH OF PIT(IN Mtr)	R.L. AT TOP	R.L. AT BOTTOM	STATUS
11	XIV SEAM	L-96451.759 D-93632.337	58.81	174.85	116.11	FILLED UP WITH MITTI
12 PIT	XIII SEAM	L-96410.214 D-93679.937	132.32	173.02	40.7	FILLED UP WITH MITTI
13	XIII SEAM	L-96416.820 D-94132.598	73.13	166.07	93.52	UPTO XIIIA SEAM FILLED WITH MITTI
14 PIT	VII SEAM	L-96409.912 D-94154.930	201.52	168.67	-32.85	WORKING
15 AIR SHAFT	XIV SEAM	L-96417.783 D-93578.563	85.34	170.64	84.7	FILLED UP SAND
16 PIT SHAFT	XIII SEAM	L-96757.282 D-93901.015	117.35	173.9	56.55	COVERED WITH RCC SLAB
17 PIT	XV SEAM	L-96087.032 D-92988.504	134.11	179.36	45.25	COVERED WITH RCC SLAB
18 VENTI INC-1	X SEAM	L-96192.192 D-94450.421		191.22		MOUTH COVERED BY BRICK WORK
19 VENTI INC-2	X SEAM	L-95781.114 D-94289.250		167.73	169.22	SECOND OUTLET
20 VENTI INC-3	X SEAM	L-96741040 D-94236.246		197.29		VENTILATING INCLINE
21 PIT	XIII SEAM	L-96367.000 D-94405.000	36.8	183.03	123.23	FILLED UP WITH MITTI
22 TOP INC.	XIII SEAM	L-96310.000 D-94309.000		160.37		FILLED UP WITH MITTI
23 100 INCLINE	XIII SEAM	L-96085.000 D-93845.000		168.54		
24 92 NO. INCLINE	XIII SEAM	L-96469.000 D-94306.000		169.07		FILLED UP WITH MITTI
25 END INCLINE	XIII SEAM	L-96066.000 D-93868.000		160.32		FILLED UP WITH MITTI

NORTH TISRA COLLIERY

NAME OF PIT/INCLINE	SUNKED UPTO	LOCATION	DEPTH OF PIT(IN Mtr)	R.L. AT TOP	R.L. AT BOTTOM	STATUS
1 PIT	V/VI SEAM	L-96514.000 D-94409.000	90.89	193	02	FILLED UP WITH MITTI & UNDER FIR
2 PIT	V/VI SEAM	L-96531.000 D-94624.000	91.27	196	104	FILLED UP WITH MITTI & UNDER FIR
3 LOJ PIT	V/VI SEAM	L-97089.000 D-94520.000	92.5	180	87.5	SEALED AT IX/X BOTTOM & RUNNING
4 CENTRAL PIT	VII SEAM	L-96177.000 D-94828.000	14.55	192	146	FILLED UP WITH MITTI & UNDER FIR
5 DIP PIT	V/VI SEAM	L-96426.000 D-94849.000	59.55	188	130.5	FILLED UP WITH MITTI & UNDER FIR
6 100 INCLINE	IV BOTTOM	L-96354.000 D-95719.000		190		WORKING
7 INCLINE	IV BOTTOM	L-96589.000 D-96720.000		185		SEALED
8 92 INCLINE	IV BOTTOM	L-96619.000 D-95716.000		185		WORKING
9 INC 7 NO.	II SEAM	L-96924.000 D-96330.000		183		FILLED UP WITH MITTI
10 INC 6 NO.	II SEAM	L-96930.000 D-96305.000		183		FILLED UP WITH MITTI
11 INC 11 NO.	II SEAM	L-96775.000 D-96084.000		180		FILLED UP WITH MITTI
12 INC 2 NO.	II SEAM	L-96770.000 D-96123.000		184		FILLED UP WITH MITTI
13 ENTRY THRO INCLINE	IX/X SEAM	L-97000.000 D-94700.000		197		WORKING



BAGDIGI COLLIERY

NAME OF PITINCLINE.	SUNKED UPTO	LOCATION	DEPTH OF PIT(IN Mtr)	R.L. AT TOP	R.L. AT BOTTOM	STATUS
		L-97040 D-93422	71.34			FILLED UP
1 PIT			71.71			FILLED UP
2 PIT	XIVA SEAM	L97052 D-93345	133.5			FILLEED UP UPTO 11/12 SEAM
3 PIT	XI/XII SEAM	L-97473 D-93422	133.5			FILLEED UP UPTO 11/12 SEAM
4 PIT	XI/XII SEAM	L-97491 D-93398		169.12	161.21	INSPECTION ROUTE Filled up
5 INC.	XIIIB SEAM	L-97528 D-93986	156.42	169.313	12.89	MAN WINDING PIT Filled up
6 PIT	X SEAM	L-97648.157 D-93830.71	158.45	169.61	11.16	FILLED UP
7 10 PIT	X SEAM	L-97720 D-93816	48.12	168012	120.1	RETURN VENTILATION ROUTE
8 11 PIT	XIIIB SEAM	L-97429 D-93982	224.66	170.103	-48.825	PRODUCTION RP Filled up
9 12 PIT	VIII SEAM	L-97618.911 D-93847.187	38.9			FILLED UP
10 7 PIT	XV SEAM					

JEENAGORA COLLIERY

NAME OF PITINCLINE.	SUNKED UPTO	LOCATION	DEPTH OF PIT(IN Mtr)	R.L. AT TOP	R.L. AT BOTTOM	STATUS
1 PIT	VIIIA SEAM	L-96910.754 D-94087.650	78.81	177.02	98.34	ABANDONED TO BE SEALED
2 PIT	VIVI SEAM	L-96880.523 D-95323.645	79.07	175.89	96.92	ABANDONED TO BE SEALED
3 PIT	IX/X SEAM	L-96724.489 D-94869.000	79.88	170.43	90.66	ABANDONED TO BE SEALED
4 PIT	VIIIA SEAM	L-96869.930 D-94810.400	105.18	173.05	67.87	ABANDONED TO BE SEALED
5 SHAFT	XA SEAM	L-96999.465 D-94910.331	30	174.5	144.5	ABANDONED TO BE SEALED
6 FAN SHAFT	IX/X SEAM	L-96540.869 D-94900.348	60	170.6	110.6	ABANDONED TO BE SEALED
7 FAN SHAFT	VIVI SEAM	L-97715.188 D-95400.247	68.8	184		ABANDONED TO BE SEALED
8 FAN SHAFT	VII SEAM	L-96748.000 D-95524.000	30	170.47	140.47	ABANDONED TO BE SEALED
9 DIP INC	I SEAM	L-96526.000 D-96520.000		184		ABANDONED TO BE SEALED
10 DIP INC	I-SEAM	L-96546.000 D-96550.000		184	172.67	PUMPING IS GOING ON
11 INC	I-SEAM	L-96847.000 D-96823.000		182		ABANDONED TO BE FILLED
12 INC	I-SEAM	L-96882.000 D-96843.000		182		ABANDONED TO BE FILLED
13 INC	II- SEAM	L-96624.000 D-96502.000		182		ABANDONED TO BE FILLED
14 INC	IVB-SEAM	L-96650.000 D-96163.000		180		QUARRIED
15 INC	IVB-SEAM	L-96677.000 D-96180.000		180		QUARRIED
16 INC	IVB-SEAM	L-96770.000 D-96208.000		180		QUARRIED
17 INC	IVB-SEAM	L-96788.000 D-96192.000		180		QUARRIED
18 INC	IVB-SEAM	L-96804.000 D-96192.000		180		QUARRIED
19 INC	IVT-SEAM	L-96642.000 D-96004.000		180		ABANDONED TO BE FILLED
20 INC	IVT-SEAM	L-96671.000 D-96067.000		178		FILLED UP
21 INC	IVT-SEAM	L-96724.000 D-96072.000		173		FILLED UP
101 INC	VIVI SEAM	L-96382.000 D-95655.000		174		FILLED UP
102 INC	VIVI SEAM	L-96309.000 D-95677.000		173		FILLED UP
103 INC	VIVI SEAM	L-96377.000 D-95623.000		170		QUARRIED
104 INC	VII SEAM	L-96533.000 D-95927.000		170		FILLED UP
105 INC	VII SEAM	L-96483.000 D-95590.000		168.04		QUARRIED
106 INC	VII SEAM	L-96755.000 D-95884.000		168.76		QUARRIED
107 INC	VII SEAM	L-96778.000 D-95701.000		175.80		FILLED UP
108 INC	VIII SEAM	L-96756.000 D-95504.000		172		FILLED UP
109 INC	VIII SEAM	L-96818.000 D-95508.000		172		ABANDONED TO BE FILLED
110 INC	VIII SEAM	L-96868.000 D-95504.000		180		ABANDONED TO BE FILLED
111 INC	VIII SEAM	L-97068.000 D-95527.000		180		ABANDONED TO BE FILLED
112 INC	VIII SEAM	L-97121.000 D-95568.000		180		QUARRIED
113 INC	VIII SEAM	L-97851.000 D-95478.000		180		FILLED UP
114 INC	VIII SEAM	L-97888.000 D-95462.000		174		FILLED UP
115 INC	VIIIA SEAM	L-96656.000 D-95369.000		174		FILLED UP
116 INC	VIIIA SEAM	L-96744.000 D-95382.000		173		FILLED UP
117 INC	VIIIA SEAM	L-96855.000 D-95403.000		173		FILLED UP
118 INC	VIIIA SEAM	L-96902.000 D-95408.000		180		FILLED UP
119 INC		L-97339.000 D-96371.000		180		FILLED UP
120 INC		L-97444.000 D-95341.000		180		FILLED UP
15A INC		L-97486.000 D-95320.000		182		FILLED UP
15A INC	VIIIA SEAM	L-97664.000 D-95337.000		183		FILLED UP
16A INC	VIIIA SEAM	L-97723.000 D-95324.000		183		FILLED UP
16 INC		L-97930.000 D-95284.000		183		FILLED UP
17 INC		L-97869.000 D-95282.000		180		FILLED UP
7 INC	IX/X SEAM	L-97333.000 D-95283.000		178		FILLED UP
7 INC	IX/X SEAM	L-97206.000 D-95278.000		158		FILLED UP
7 INC	VIIIA SEAM	L-96251.000 D-95135.000		186		FILLED UP
7 INC	VIIIA SEAM	L-96257.000 D-95143.000		161		FILLED UP
7 INC	VIIIA SEAM	L-96310.000 D-95186.000		162		ABANDONED TO BE FILLED
7 INC	IX/X SEAM	L-96162.000 D-94923.000		182		ABANDONED TO BE FILLED
12 INC	IX/X SEAM	L-96192.000 D-94921.000		174.5		FILLED UP
7 INC	XA SEAM	L-96075.000 D-94907.000		174.5		FILLED UP
7 INC	XA SEAM	L-97018.000 D-94078.000				

CHAPTER - IX

LAND REQUIREMENT

9.0 LAND ACQUISITION:

The Status of land within the Amalgamated Joyrampur Colliery leasehold is given in table below:

Sl. No.	Particulars	Total (Ha)
1	BCCL land	1002.94
2	Forest land	Nil
3	Govt. land	23.61
4	Tenancy land	49.91
5	Others	110.51
	Total	1186.97

9.1 LAND USE

Type of Present land use (Ha)

Sl No.	Type of Land Use		Area (Ha)
1	Running Quarry	Backfilled	0
		Not Backfilled	0
2	Abandoned Quarries	Backfilled	19.53
		Not Backfilled	41.29
3	O.B Dump*		61.82
4	Service building/ Mine Infrastructure		12.81
5	Coal Dump		2.81
6	Rail and Road		55.83
7	Homestead Land		125.12
			74.74
8	Agricultural Land		0
9	Forest Land		0
10	Plantation		34.67
11	Water Body		15.76
12	Barren Land		742.59
TOTAL			**1186.97**

*In proposed stage, apart from the above, land for external OB dump of around 424.93 M.Cum. will be required in non-coal bearing area or in the de-coaled area of adjacent mine. Therefore, in proposed stage, the mine management has identified about 900 Ha land for external dump in non coal bearing area that is shown in Plate no.-MIN-V.

CHAPTER - X

ENVIRONMENT MANAGEMENT

10.0 ENVIRONMENTAL IMPACT ASSESSMENT

10.1 INTRODUCTION

The impacts (both beneficial and adverse) of mining and its allied activities of the project have been assessed and presented in respect of biophysical & socio-economic environment.

Environmental Impact assessment has been carried out by studying the likely impacts on existing ambient air, water and noise conditions etc. of the area due to mining activities at the site under consideration. For this, the latest data generated from the mine / adjacent existing mine has been taken into consideration as this will give a practical status of the impact of existing mining activities in the area.

10.2 AIR POLLUTION IMPACT ASSESSMENT

The impact assessment has been carried out dealing with the following points:

(a) Phase-wise inventory of air pollution emission sources

(b) Impact assessment

a. Phase-wise inventory of air pollution emission sources

The pollution sources are obvious and to assess the impact, the project life is divided into following time frames:

Operational 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:

Operational 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 & Blasting	:	Dust confined to OC Workings only
(ii)	Handling of coal	:	Noise, Dust and noxious gases
(iii)	Movement of vehicles	:	Noise, Dust and noxious fumes

Post-operational stage

During this stage of the project, the activities related to the closure of mine are to be carried out. Preparation of 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 subsided area, if any
- Salvaging and shifting operation of UG Machineries 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 dozers for physical reclamation of subsided area	:	Noise, Dust and obnoxious fumes
(ii)	Movement of vehicles for shifting and salvaging operation of UG Machineries and other equipment	:	Noise, Dust and obnoxious fumes
(iii)	Movement of vehicles for clearing of coal and other materials	:	Noise, Dust and obnoxious gases

b. Impact assessment

The mining and its related activities create ambient air pollution. The impact of mining on ambient air quality is highlighted in the following paragraphs:

The ambient air quality is influenced due to the presence of RPM, SPM, SO_2, NOx, etc., which are generated due to various activities like drilling, blasting and coal & material handling related to the project. Further, the ambient air quality is affected to a varying degree due to the mining activities of other nearby opencast and underground coalmines of the same coalfield. The concentration of pollutants may vary depending upon the various micro-meteorological parameters and the seasons of a year.

In order to assess the ambient air quality in the area surrounding the site where mining activities are continuing since beginning of the 20th century vis a vis the present scenario monitoring has been carried out at nearby villages based on the wind pattern and topography. The results of the monitoring completed by CMPDI RI-II, Dhanbad in 2016 (Refer Chapter XI) shows that, in spite of mining activities continuing in the area the Environmental quality w.r.t. ambient air has not been affected to any significant extent as the recorded data are all within the permissible limits.

The present assessment as validated through monitoring data as explained above, also proves that, mining activities in the area have not affected the ambient air to any significant extent which has become possible because of various Pollution Control Measures which are continuously being taken and augmented whenever necessary.

Moreover, fortnightly monitoring of ambient air quality at all the operating mines helps in identifying any source generating the pollution for which appropriate control measures are then planned for implementation, which can be validated in the subsequent monitoring.

The above paragraphs clearly bring out the fact that, impact of mining activities on ambient air is insignificant and the mine under consideration will be no exception.

10.3 IMPACT ASSESSMENT ON WATER

I. Identification of the sources of water pollution

Likely sources of water pollution from this project along with the type of pollutants are as follows:

(i) Sanitary (domestic) wastewater : Suspended solids and BOD.

(ii) Water pumped out from mine : Suspended solids of coal, clay and oil.

(iii) Surface run-off passing through coal stockpiles : Suspended solids.

(iv) Storm water from leasehold area and built-up area : Suspended solids.

II. Impact Assessment

Mining and its related activities may create water quality problems. The impact of mining at the project on both surface and ground water sources are given subsequently.

(a) Surface water sources

Deterioration of water quality and pollution of water bodies due to discharge of mine effluent, if not treated. Change in relief pattern due to mining may cause flooding, siltation, choking and pollution. Mitigation measures would involve provision of the following depending on the site condition and actual requirement statutory or otherwise.

(i) Garland drains on periphery of mine entries for managing flood,

(ii) Sedimentation ponds for reducing the pollution of surface water bodies.

As per the quarterly water quality monitoring data generated by CMPDI RI-II for Cluster Group of Mines in which Amalgamted Joyrampur falls, the physico-chemical characteristics of surface water samples have been found to be

within the permissible limit. The details are given in Chapter XI of the Mining Plan.

However, due care will be taken to treat the mine water discharge by sedimentation if need arise for the mine under consideration.

III. Impact on noise level

In order to assess the existing ambient noise level in the surrounding of the mine site corresponding to existing scenario, ambient noise level data has been generated at different villages and it is seen that existing quality of ambient noise is quite satisfactory.

In case of UG mines the basic coal winning operations are restricted below ground, as such the effect on ambient noise at surface is negligible.

ACCEPTABLE INDUSTRIAL NOISE LEVEL

As per Env. (Protection) Amendment Rules, 2000 the ambient air quality standards in respect of noise in industrial, commercial, residential and silence zones area as follows:

Table No.10.1 Noise Level Limit Category-wise

Sl. No.	Category of area	Limits [dB (A)]	
		Day time (6.00 AM to 10.00 PM)	Night time (10.00 PM to 6.00 AM)
1.	Industrial	75	70
2.	Commercial	65	55
3.	Residential	55	45
4.	Silence zone	50	40

Assessment of the degree of noise, to which a workplace noise is harmful, is done by comparing the values measured at workplace to the permissible TLV adopted by statutory bodies like DGMS.

The Director General of Mines Safety vide their circular no. DG (Tech.)/18 of 1975 has prescribed the TLV for noise level as 90 dB (A), for the workers engaged in mining occupation likely to be exposed to in an 8 hour shift period

with unprotected ear. Whereas, the following table shows the maximum permissible noise exposure levels, as per American Standards, for the industrial workers.

Table No.10.2 Noise Level Limit as per Exposure Time

Exposure time (Hrs./day)	Noise level [dB (A)]
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	108
0.25 or less	115
Exposure to Pulse or Impact Noise Should Not Exceed 140 Db (A)	

Now to assess the likely contribution from mining activities, the ambient noise level of an operating mine of the same area has been taken into consideration. It is observed that noise level recorded in mine activity area is well within the permissible limit.

The present assessment as validated through monitoring data as explained above, also proves that, mining activities in the area have not affected the ambient noise to any significant extent which has become possible because of various Pollution Control Measures are continuously being taken and augmented whenever necessary.

Moreover, fortnightly monitoring of ambient noise quality at all the operating mines helps in identifying any source generating the pollution for which appropriate control measures are then planned for implementation which can be validated in the subsequent monitoring.

The above paragraphs, clearly bring out the fact that, impact of mining activities on ambient noise is insignificant and the mine under consideration will be no exception.

IV. Socio- economic Impact

The socio –economic impacts of the project is given below.

A) Population Growth and Migration

Mining activities in this coalfield is continuing since beginning of 20th century. The development of the area is totally indebted to coal mining as well as the entire economy of the area is sustaining due to coal mines. In addition to creating adequate direct employment in the coalmine large opportunities of indirect employment have also been created. Numbers of people from out side the state have migrated in this region, which has resulted in through mixing of different culture and customs as per the tradition of our country “Unity in diversity”.

B) Resettlement & Rehabilitation.

Due to acquisition of tenancy land for mining activity number of landowners would be affected. All the land losers have been suitably compensated as per Company's norms.

5 collieries of Lodna area, BCCL namely Joyrampur Colliery, Bagdigi Colliery, Lodna Colliery, Bararee Colliery and Bagdigi Colliery have been amalgamated into a single mine namely Amalgamated Joyrampur Colliery.

There are eighty sites in leasehold of Amalgamated Joyrampur Colliery which are proposed to be rehabilitated as per Master Plan of JCF (March’08). The Sites are as follows:

Table No.10.3 Rehabilitation proposed under Amalgamated Joyrampur Colliery

Colliery	Village/Site	BCCL	Pvt.	Enchr	Other	Total
	PHASE-I					
Bagdigi	Bagdigi Basti /O1	0	715	0	0	715
Bagdigi	Bagdigi Colony / O2	105	0	57	0	162
Bagdigi	Bagdigi Colony / O2	0	0	43	0	43
	Sub total	**105**	**715**	**100**	**0**	**920**
Bararee	Along Jore Side Colony/11	35	30	0	0	65
Bararee	Along Jore Side Colony/11	0	0	13	0	13

Colliery	Village/Site	BCCL	Pvt.	Enchr	Other	Total
Bararee	Bazaar Dhowrah/12	0	0	14	0	14
Bararee	Brahman Basti / O2	0	21	0	0	21
Bararee	Chhata Dhowra & Durga Mandir /O5	52	0	0	0	52
Bararee	Chiraiyatand Colony /O1	130	0	0	0	130
	Colony near 1 pit /O4	65	0	43	0	108
Bararee	Colony near Bararee School / Bagan Dhowra /O3	41	0	29	0	70
Bararee	Digwadih New Colony / O8	129	0	0	0	129
Bararee	Dom Dhowra /O6	55	0	0	0	55
Bararee	East side of DB Road /O9	0	136	0	0	136
Bararee	Mudivita Village/10	0	82	0	3	85
Bararee	Mudivita Village/10	0	6	0	0	6
Bararee	Naya Dhowra Colony/ O7	46	7	0	0	53
	Sub total	**553**	**282**	**99**	**3**	**937**
Jealgora	1&2 Pit Area/11	152	0	36	0	188
Jealgora	Bagdigi Basti / 12	6	180	0	20	206
Jealgora	Bucharkhana Area O1	54	43	29	0	126
Jealgora	Buriband /14	62	0	0	0	62
Jealgora	Check Post area /O6	44	0	0	0	44
Jealgora	North Jealgora 3&4 Pit/ O2	152	0	0	0	152
Jealgora	Stadium Area colony/O8	18	0	0	0	18
Jealgora	Sweeper Dhowra /O9	70	0	50	0	120
	Sub total	**558**	**223**	**115**	**20**	**916**
Joyrampur	6 pit Dhowra & Atta Chaki /O1	23	0	0	0	23
Joyrampur(S)	6 pit Dhowra & Atta Chaki /O1	0	0	96	0	96
Joyrampur	Around Area Office/WS & No. 2 Basti/O3	137	0	0	0	137
Joyrampur	Beer Company Locality/O5	87	0	0	2	89
Joyrampur	Durga Mandir Area /O4	105	0	0	2	107
Joyrampur	Hazaribagh Colony near Hosptal /O2	73	0	0	0	73
Joyrampur(S)	Hazaribagh Colony near Hosptal /O2	0	0	47	0	47
	Sub total	**425**	**0**	**143**	**4**	**572**
Lodna	2 pit Bhaga Colony/ 28	44	36	0	0	80
Lodna	16 no incline Jore side Colony / 22	16	17	0	0	33
Lodna	2 No. Incline Colony / 23	13	0	0	0	13
Lodna(S)	2 No. Incline Colony / 23	0	0	310	0	310
Lodna	3 pit basti /O9	0	71	0	0	71
Lodna(S)	3 pit basti /O9	0	0	6	0	6
Lodna	4 pit Colony / 24	213	0	0	0	213
Lodna	5 No. Colony/ (C-17)	112	0	0	0	112
Lodna	8 pit area colony / 19	59	0	0	0	59
Lodna(S)	8 pit area colony / 19	0	0	74	0	74

Colliery	Village/Site	BCCL	Pvt.	Enchr	Other	Total
Lodna	Balugada Colony / 26	41	0	0	0	41
Lodna(S)	Balugada Colony / 26	0	0	3	0	3
Lodna	Chalchalia Labour Colony /25	59	0	0	0	59
Lodna	Chalchalia Labour Colony/ (C-13)	60	0	71	4	135
Lodna	Firkuband Colony / 30	23	37	0	0	60
Lodna	Hanumangari Basti/14	0	71	0	0	71
Lodna	Indira Chowk Road side Basti /O7	0	7	0	0	7
Lodna(S)	Indira Chowk Road side Basti /O7	0	19	0	0	19
Lodna	Jealgora Barrier Colony / 18	100	0	0	0	100
Lodna	Jeenagora Branch site / 20	12	0	0	0	12
Lodna(S)	Jeenagora Branch site / 20	0	0	30	0	30
Lodna	Jharia Club & road side Basti /O8	50	93	0	0	143
Lodna	Joyrampur / Badigi Barrier / 21	23	0	0	0	23
Lodna	Kalidham Colony / 27	18	0	0	0	18
Lodna	Kujama Village /O2	0	64	0	0	64
Lodna(S)	Kujama Village /O2	0	51	21	0	72
Lodna	Lodna Village /O1	537	314	1626	16	2493
Lodna(S)	Lodna Village /O1	0	24	26	0	50
Lodna	Nadiapar Kujama Basti /O4	33	91	0	0	124
Lodna	New Bhaga Bast / 11	233	0	0	0	233
Lodna	New Colony Baniahir /13	205	0	0	0	205
Lodna	Niluri Patra Bastee /O5	23	86	0	0	109
Lodna	Office Compelx Area / 31	129	57	0	10	196
Lodna(S)	Office Compelx Area / 31	0	0	21	0	21
Lodna	Suratand Basti /O6	0	79	0	0	79
Lodna(S)	Suratand Basti /O6	0	49	80	0	129
Lodna	Tar Plant Area / 12	12	0	0	0	12
Lodna(S)	Tar Plant Area / 12	0	10	9	0	19
	Sub total	**2015**	**1176**	**2277**	**30**	**5498**
	Total(Phase-I)	**3656**	**2396**	**2734**	**57**	**8843**
	PHASE-II					
Lodna	5 No. Colony/29	94	57	0	0	151
Lodna	GM Bunglow & Road Side Bastee/15	58	0	0	0	58
Lodna	Phus Bungla Road side Bastee/10	15	120	0	0	135
Lodna	Phus Bungla Road side colony/16	0	58	0	0	58
Lodna	Puranadih Village/O3	0	143	0	0	143
Lodna	Shalimar Colony/17	47	0	0	0	47
Lodna	5 No. Colony/29	94	57	0	0	151
Lodna	GM Bunglow & Road Side Bastee/15	58	0	0	0	58

Colliery	Village/Site	BCCL	Pvt.	Enchr	Other	Total
Lodna	Phus Bungla Road side Bastee/10	15	120	0	0	135
Lodna	Phus Bungla Road side colony/16	0	58	0	0	58
	Sub total	**214**	**378**	**0**	**0**	**592**
	Total(Phase-II)	**214**	**378**	**0**	**0**	**592**
	Total(Phase I+II)	**3870**	**2396**	**2734**	**57**	**9435**

C) **Transport and Communication**

The present network of metalled approach road to the place of work and other places of public interests like shopping, education, medical services etc. is going to improve with continuation of mining operation.

D) **Health**

The facilities created in the area are extended for neighboring population also.

E) **Literacy**

With continuation of mining activities in the area, educational facilities developed in the area will continue to improve the literacy of the rural areas also.

F) **Economic Impacts**

With the continuation of mining activities the occupational structure of the area is going to improve further and many people are likely to be involved in the job of mining and allied activities. Hence, income level of these people is likely to improve to significant level.

Employment opportunities both direct & indirect in this project are likely to cause migration from outside. Amenities like medical educational, recreational etc. are available to local people and their quality of life has definitely improved.

V. Land Use Pattern during Mining

Land in case of coal mining activity, gets degraded by way of actual excavation for coal winning operation and dumping of waste material on the surface especially in the open cast mining.

Year wise backfilling programme and area of reclamation is given below:

YEAR	BACKFILLING QUANTITY (M.Cum.)	AREA FOR RECLAMATION (Ha)
1		
2		
3	3.00	
4	4.10	
5	8.10	
6	10.00	
7	15.00	
8	22.96	
9	25.42	
10	25.42	
11	25.42	
12	25.42	
13	25.42	
14	25.42	20.82
15	25.42	20.85
16	25.42	41.64
17	25.42	41.64
18	25.42	41.64
19	25.42	41.64
20	29.90	41.64
21	21.89	41.64
22	21.00	41.64
23	16.00	41.64
24	8.00	41.64
25	5.18	41.64
PC-1		41.64
TOTAL	444.75	499.71

VI. Rehabilitation & Resettlement:

The land losers have been suitably rehabilitated as per company norms. In addition, various socio-economic developmental activities have already been taken up after survey of the felt needs of the community around the project throughout the revenue life of the mine and the same will be continued during balance life of the project.

VII. Impact on flora & fauna:

There is no endangered and endemic species in core and buffer zone. By developing plantation of native species efforts are being made to improve the green cover in and around the immediate vicinity of the mine area. BCCL in association with local people will make all efforts to conserve the flora & fauna in the immediate surroundings of the mine area.

10.4 ENVIRONMENTAL MANAGEMENT PLAN

I. Environmental Pollution Control Measures:

i) Air, Noise Pollution Control Measures:

a) To reduce air pollution due to dust produced during various mining and allied activities, adequate water spraying would be done at strategic points so that dust do not get air-borne. Suitable chemical re-agents to coagulate the dust particles would also be tried while water spraying.

b) Proper blasting techniques by designing a suitable blasting pattern after actual field observation would be followed to minimize adverse effects of ground vibration and noise if required.

c) Black topping of roads.

d) Biological reclamation of subsided areas, development of green belt around infrastructure, colony, along roads and in vacant land against villages would be undertaken for arresting dust and noise propagation.

e) Fixed sprinklers will be provided along haul road in lease area outside the quarry.

f) Proper maintenance of all Machines etc. will be undertaken so as to reduce harmful exhaust and noise.

g) Regular cleaning of transportation roads will be carried out.

h) Coal are being transported using covered trucks. No overloading of trucks are being allowed.

i) Personal protective gears are given to workmen exposed to dusty and noise work environment.

Plantation/green carpeting/ green belt as a mitigative measures against environmental pollution:

Plantation/green carpeting is an important tool to combat air pollution, noise pollution and soil erosion. In addition to these it gives an aesthetic look to the area.
For plantation purpose following areas can be considered:

Area where ornamental trees viz. gulmohar, Eucalyptus and fruit trees like Mango, Guava, Jamun and medicinal plant like Neem etc. can be provided like colony area, schools, dispensary, community buildings, playground etc. Grass carpeting can be provided in dip side batter,

Areas where different rows of trees including tall and fast growing varieties along with ornamental shady trees shall be planted e.g. around colony, along roads, haul roads, and around industrial buildings, etc.

Plantation of these trees will also take off some pressure on the nearby forests as far as firewood is concerned.

Plantation Programme / Green Belt:

As being practiced presently, the plantation/green carpeting would be taken up with the help of State Forest Deptt. With three years maintenance contract after plantation of saplings. Thereafter, this process would continue concurrently with the mining activities.

Width of green belt:

a) Along the roads 1000 saplings per road km; two rows on both sides of the road; width – 3 m.

b) Around colony & infrastructure – 2500 saplings per ha; width – 5 m; 3 rows of plantation all around.

c) Vacant land – 2500 saplings per ha.

Density of plantation will be as mentioned earlier.

Plantation activity will be carried out throughout the life of the mine around the quarry and in safety zone. In post closure period plantation will be carried over OB dumps to biologically reclaim it. Phase wise Plantation activities to be carried out are as mentioned under:

Proposed Plantation Amalgamated Joyrampur Colliery (OC)												
	Year	Pandeybera		Jealgora		OB Dump		Batter & Safety Zone		Total Plantation	Total Area Under Additional Plantation (Ha)	Total Plantation cost @ Rs.55101/Ha (in Rs.Lakhs)
		Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings			
During active mining	1							1.5	3750	3750	1.5	0.83
	2							1.5	3750	3750	1.5	0.83
	3							1.5	3750	3750	1.5	0.83
	4	7.778	19445							19445	7.778	4.29
	5	7.778	19445							19445	7.778	4.29
	6	7.788	19470							19470	7.788	4.29
	7	7.788	19470							19470	7.788	4.29
	8	7.788	19470							19470	7.788	4.29
	9	7.798	19495							19495	7.798	4.30
	10			9.3775	23444					23444	9.3775	5.17
	11			9.3775	23444					23444	9.3775	5.17
	12			9.3775	23444					23444	9.3775	5.17
	13			9.3775	23444					23444	9.3775	5.17
	14					20.82	52050			52050	20.82	11.47
	15					20.85	52125			52125	20.85	11.49
	16					41.64	104100			104100	41.64	22.94
	17					41.64	104100			104100	41.64	22.94
	18					41.64	104100			104100	41.64	22.94
	19					41.64	104100			104100	41.64	22.94
	20					41.64	104100			104100	41.64	22.94

	Year	Pandeybera		Jealgora		OB Dump		Batter & Safety Zone		Total Plantation	Total Area Under Additional Plantation (Ha)	Total Plantation cost @ Rs.55101/Ha (in Rs.Lakhs)
		Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings			
	21					41.64	104100			104100	41.64	22.94
	22					41.64	104100			104100	41.64	22.94
	23					41.64	104100			104100	41.64	22.94
	24					41.64	104100			104100	41.64	22.94
	25					41.64	104100			104100	41.64	22.94
Post mining	26					41.64	104100	45.49	113729	217829	87.13	48.01
	27							45.49	113729	113729	45.49	25.07
	28							45.49	113729	113729	45.49	25.07
	29							46.99	117479	117479	46.99	25.89
	Total	**46.72**	**116795**	**37.51**	**93775**	**499.71**	**1249275**	**187.97**	**469915**	**1929760**	**771.91**	**425.33**

Plantation Site Details

Plantation Site No.	Location	Area (Ha.)
1	Pandeybera	46.72
2	Jealgora	37.51
3	OB Dump	499.71
4	Batter & Safety Zone	187.97
	Total	771.91

ii) Water Pollution Control Measures:

a) Domestic Effluent:

Residential quarters are provided with conventional soak pit system.

b) Mine Discharge:

Water collected in the workings will be first allowed to settle in sumps. Sufficiently large sumps has been provided to eliminate the discharge of undissolved suspended solids to the surface along with mine water. The quality of mine pumped out water as being monitored in all the operating mines also establishes the fact that, the untreated mine pumped out water does not contain any significant pollution load.

c) The final treated discharge then be utilized for various purposes e.g. water spraying, watering of plants, etc. Balance quantity if any, will be supplied for irrigation, if required otherwise discharged in natural watercourses. Moreover, analysis of water pumped out from existing mines around the mine under consideration shows that even untreated water meets the acceptable limits; as such quality of water pumped out from the mine is not likely to have any significant pollution load even in untreated condition. However, it is proposed to carry out the monitoring of quality of mine discharge and if any undesirable element is found in the sample it will be treated properly before it is re-used.

iii) Remedial measures to control ground water depletion

The following methodology and remedial measures will be taken to minimize the mine-induced impact on ground water levels and also adverse effects in the area.

a) Utilization of treated mine water discharge by both industry and local people in the mine influence area. The excess mine water can be used to recharge groundwater system through connecting pipeline to abandoned dug wells & surface water ponds. Utilization of mine water for local irrigation use may also enhance the ground water recharge potential through artificial recharge in the area.

b) Runoff conservation structures like check dams, nala bunds may be constructed over the stream / nala bed which would help in recharging

of the groundwater levels as the increased contact period of stored rainwater with the underlying formation will lead to more percolation of the water to underlying strata. They should be constructed across small streams with gentle slope and there is no submergence beyond stream course. The site selection should be based on having sufficient thickness of permeable bed / weathered formation to facilitate recharge within short span of time.

c) Roof-top rainwater harvesting (RWH) may be taken up by the mine authority in the project area using the administrative/ residential buildings.

d) After cessation of mining operation, with plenty rainfall and abundant ground water 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 (UG) behave as water pool and improve the groundwater resources availability in the coalfield area.

e) Increase in vegetative cover by plantation in the mine area as suggested in the proposed mining plan under land amelioration measures, this in turn will contain the surface run-off and increase the groundwater recharge in the mining area.

f) Creation of awareness among workers and local peoples about Rain water harvesting and artificial recharge will be given priority by the mine management. This aspect is usually covered during the Environmental Week celebrated every year (5 to 12 June).

g) Monitoring of water quality of mine water discharge, local River/nala and domestic water source (dug well/hand pump wells) will be continued under routine monitoring (Quarterly).

h) The water shortage in the villages, if any, in the influence area can be supplemented by supply of water from outside source or from the mine water after treatment

Regular well water monitoring in nearby villages will be carried out quarterly as per MOEF's guidelines.

iv) Rehabilitation:

There is no village in the core zone. Hence no house oustees is involved in this project. However, land losers have been suitably compensated as per Company's norms.

v) Occupational Health:

The coal mining activity is carried out as per statute. Initial & periodical medical examination of the workmen is done as per statute. At area level there is a full-fledged hospital.

II. Disaster Management Plan

Mining is a hazardous industry. There is risk to life and property associated with various mining and allied activities of the project. The project report has been drawn in conformity with the prevailing statutory provisions as per Mines Act, 1952 & CMR 1957 applicable for safety in mines. A detailed study has been carried out covering identification and assessment of risk, and recommendation of measures to prevent damage to life and property against such risks. They are discussed subsequently.

i) Innundation

Provisions stipulated in the statute should be strictly complied with.

ii) Ventilation

Adequate ventilation, as stipulated in the statute, shall be provided at the mine.

iii) Precaution Against Fire

(1) Wild or herbaceous plants shall be removed from the mine.

(2) No person shall deposit heated material or ashes on surface near any opencast working. Also no person shall light a fire or permit a fire to be lighted in any UG working except by the permission in writing of the Manager and only for a special purpose specified therein.

(3) Panels should be sealed off immediately after extraction.

iv) DUST SUPPERSSION

Suppression of mine dust may be done by water spraying as per Statute. Fixed sprinklers at continuous intervals should be provided on roads outside the quarry in leasehold area on which coal hauling operations are undertaken. Total length of such road is 3.87 km and considering a throw of approx. 20 m for each fixed sprinkler, 97 sprinklers should be installed at 40 m interval each on one side of the road.

v) MISCELLANEOUS PRECAUTIONS

i. Machinery to be deployed in the project shall be equipped with suitable inbuilt safety devices like audio-visual alarm, fire extinguishers etc.
ii. Emergency Response Plan shall be prepared by Manager as per statute.
iii. Monsoon preparation shall be done in project in advance every year.
iv. All provisions regarding storage, transport & use of explosive as per statute shall be strictly followed.
v. All the regulations & schedules of Coal Mines Regulations 1957 relating to underground mining have to be adhered to and implemented in order to maintain day to day safety precautions as per statute.

III. MONITORING & MANAGEMENT ORGANISATION

Close monitoring of the environment and implementation of various protective measures discussed in the report forms an important part of EMP. In the earlier paragraphs the causes of various pollutions along with the preventive and mitigative measures have been discussed. In this paragraph, monitoring organization is being discussed.

Monitoring Organization

To have a close watch on the environmental condition and implementation of the various measures suggested, a multi-disciplinary approach is essential.

a) BCCL (HQ) acts as an apex body, which monitors the activities relating to environment at project level through the General Manager.

b) General Manager of the area co-ordinates the activities of various disciplines in the area to render all necessary assistance at the implementing level i.e. the Project. Nodal Officer (Environment) of the area monitors all aspects of environment on behalf of the General Manager. He also takes suitable steps for generation of environmental data for its analysis and interpretations. Plantation is being done on a large area. At present it is implemented through State Forest Deptt. The horticulturist along with the Supervisor shall only monitor and guide the agency for selection of site, treatment of soil and selection of species.

c) Project Officer is primarily responsible for reclamation of the mined out area. He shall also be responsible for biological reclamation with the assistance of GM's office.

ORGANISATION CHART

Sl. No.	Measures/Actions		Agency
1.	Environmental Control	1	General Manager, Lodna Area
		2	Nodal Officer, (Environment), Lodna Area
		3	Project Officer, Amalgamated Joyrampur Colliery
		4	Area Manager (Civil), Lodna Area
		5	Environmental Cell (BCCL H.Q.)
2.	Environmental Monitoring	1	General Manager, Lodna Area
		2	Staff Officer (Civil), Lodna Area
		3	Nodal Officer, (Environment), Lodna Area
		4	Project Officer, Amalgamated Joyrampur Colliery
		5	Environment Cell of BCCL Headquarters
		6	Environmental Laboratory of CMPDI RI-II, Dhanbad.
3.	Reclamation	1	Project Officer, Amalgamated Joyrampur Colliery
		2	Nodal Officer (Environment), Lodna Area

CHAPTER - XI

ENVIRONMENTAL MONITORING REPORT

11.1 AIR AND WATER QUALITY

The mine falls in Cluster IX for the purpose of Environmental Monitoring Data Generation. The quarterly monitoring of water quality under Quarterly Environmental Monitoring report for Cluster-IX is being conducted by CMPDI RI-II, Dhanbad by collecting water samples from ground water, surface water and mine water discharge / workshop discharge (if any) for the proposed project. The various purposes of the water environment monitoring are as follows:

- To assess the water quality characteristics for critical parameters;
- To evaluate the impacts on agricultural productivity, habitat conditions, creational resources and aesthetics in the vicinity ; and
- To facilitate predication of impact on water quality by project activities

The results as per CMPDI RI –II, Dhanbad Report are given subsequently.

To assess the quality of lotic system (surface water), water samples were collected from the following locations (Refer to CMPDI RI-II Report):

TABLE – 11.1

Sampling locations for water quality monitoring in Cluster-IX

S. No	Components	Locations (Station Code)	Frequency	Number of Parameters Covered
1	Mine Water:	Jeenagora (MW9)	Each Fortnight	Four (pH, TDS, TSS, O&G)
2	Mine Water	Jeenagora (MW9)	Half Yearly	Twenty Seven parameters
4	Surface Water	i) Surface Water quality at **U/S of Kashi Jore (SW19).** ii) Surface quality at **D/S of Kashi Jore (SW20).**	Quarterly	Seventeen Parameters
5	Drinking Water	Lodna (GW9)	Quarterly	Twenty Five parameters

Table 11.2: Physico-chemical characteristics of surface water in Cluster-IX Mining Area

(A) Period: Quarter Ending September 2016

1. Upstream in Kashi Jore SW-19
2. Downstream in Kashi Jore SW-20

Sl. No	Parameter	Sampling Stations		Detection Limit
		SW-19	SW-20	
1	Arsenic (as As), mg/l, Max	<0.002	<0.002	0.002
2	BOD (3 days 27°C), mg/l, Max	2.4	2.6	2.00
3	Colour (Hazen Unit)	colourless	colourless	Qualitative
4	Chlorides (as Cl), mg/l, Max	254	44	2.00
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	0.03
6	Disolved Oxygen, min.	4.9	4.5	0.10
7	Fluoride (as F) mg/l, Max	0.56	0.74	0.02
8	Hexavalent Chromium, mg/l, Max	<0.01	0.01	0.01
9	Iron (as Fe), mg/l, Max	<0.06	<0.06	0.06
10	Lead (as Pb), mg/l, Max	<0.005	<0.005	0.005
11	Nitrate (as NO_3), mg/l, Max	41.2	13.4	0.50
12	pH value	8.42	8.55	2.5
13	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.002	<0.002	0.002
14	Selenium (as Se), mg/l, Max	<0.002	<0.002	0.002
15	Sulphate (as SO_4) mg/l, Max	135	232	2.00
16	Total Dissolved Solids, mg/l, Max	780	600	25.00
17	Zinc (as Zn), mg/l, Max	<0.01	< 0.01	0.01

The pH value is slightly alkaline in nature and found well within the prescribed limit. All the parameters were found within the prescribed limits of the applicable standards. The concentrations of the analysed heavy metals in the surface water resource are also found within the prescribed limits.

The physico-chemical characteristics of ground water samples collected from Jeenagora in Cluster IX have been presented in Table-11.3.

Name of the Company: Bharat Coking Coal Limited	Year : 2016-17
Name of the Cluster : Cluster - IX	Period: Q. E. Sept, 2016.

Area :`LODNA	**Jeenagora Stations:** Ground Water from Lodna GW-9	**Project: Jeenagora**	**Date of Sampling:** 06/09/2016

Table-11.3 : Physico-chemical characteristics of ground water samples

Sl. No	Parameter	Sampling Stations GW-9	Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
1	Boron (as B), mg/l, Max	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	4	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	185.6	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	110	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.63	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	0.09	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	<0.06	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	0.005	0.01	APHA, 22nd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	0.65	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	4.43	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.24	2.5	6.5 to 8.5	IS-3025/11:1983, R-1996, Electrometric
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	0.001	0.001	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	11	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Qualitative	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	252	4.00	200	IS-3025/23:1986, Titration
19	Total Arsenic (as As), mg/l, Max	<0.002	0.002	0.01	IS 3025/ 37:1988 R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	890	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	688	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	9	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	0.84	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel (as Ni), mg/l Max	<0.20	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*All values are expressed in mg/lit unless specified.

The physico-chemical characteristics of Mine water samples collected from Cluster IX have been presented in Table-11.4.

Table 11.4: Physico-chemical characteristics of effluent (mine water) in Cluster-IX Mining Area

Location: Jeenagora MW-9

Date of sampling: 23/06/2017 (Quarter Ending June 2017)

Sl.No.	Parameter	Sampling Stations	Detection Limit	MOEF -SCH-VI STANDARDS Class 'A'
		MW-9		
1	Ammonical Nitrogen, mg/l, Max	0.05	0.02	50.0
2	Arsenic (as As), mg/l, *Max*	<0.002	0.002	0.2
3	B.O.D (3 days 27°C), mg/l, Max	<2.00	2.00	30.0
4	COD, mg/l, Max	20	4.00	250.0
5	Colour	colourless	Qualitative	Qualitative
6	Copper (as Cu), mg/l, *Max*	<0.03	0.03	3.0
7	Dissolved Phosphate, mg/l, Max	<0.30	0.30	5.0
8	Fluoride (as F) mg/l, *Max*	0.76	0.02	2.0
9	Free Ammonia, mg/l, Max	<0.01	0.01	5.0
10	Hexavalent Chromium, mg/l, Max	<0.01	0.01	0.1
11	Iron (as Fe), mg/l, *Max*	<0.06	0.06	3.0
12	Lead (as Pb), mg/l, *Max*	<0.005	0.005	0.1
13	Manganese(as Mn), mg/l, Max	<0.02	0.02	2.0
14	Nickel (as Ni), mg/l, *Max*	<0.10	0.10	3.0
15	Nitrate Nitrogen, mg/l, *Max*	3.79	0.50	10.0
16	Oil & Grease, mg/l, Max	<2.00	2.00	10.0
17	Odour	Agreeable	Agreeable	Qualitative
18	pH value	8.33	2.5	5.5 to 9.0
19	Phenolic compounds (as C_6H_5OH),mg/l, *Max*	<0.002	0.002	1.0
20	Selenium (as Se), mg/l, *Max*	<0.002	0.002	0.05
21	Sulphide (as SO_3), mg/l, Max	<0.005	0.005	2.0
22	Temperature (^oC)	21.7	Shall not exceed 5^0 C above the receiving temp.	
23	Total Chromium (as Cr), mg/l, *Max*	<0.04	0.04	2.0
24	Total Kjeldahl Nitrogen, mg/l, Max	4.2	1.00	100.0
25	Total Residual Chlorine, mg/l, Max	<0.02	0.02	1.0
26	Total Suspended Solids, mg/l, Max	26	10.00	100.0
27	Zinc (as Zn), mg/l, *Max*	0.02	0.01	5.0

Note: Desirable / * Permissible limit in the absence of alternate source.

TABLE –11.5
GENERAL STANDARDS FOR DISCHARGE OF EFFLUENTS

[The Gazette of India – Extraordinary {Part II- Sec. 3(i)} Ministry of Environment and Forests Notification New Delhi, 19th May, 1993]

SI. No.	Parameters	Standards			
		Inland Surface Water	Public Sewers	Land for irrigation	Marine coastal areas
		(a)	(b)	(c)	(d)
1	Colour and odour	Note-1	Note-1	Note-1	Note-1
2	Suspended Solids, mg/l max.	100	600	200	Note-2
3	Particle size of Suspended Solids.	Note-3	-	-	Note-4
4	Dissolved solids (inorganic) mg/l max.	2100	-	2100	-
5	pH value	5.5-9.0	5.5-9.0	5.5-9.0	5.5-9.0
6	Temperature, ^{O}C	Note-5	-	-	Note-5
7	Oil & grease, mg/l max.	10	20	10	20
8	Total residual chlorine, mg/l max.	1.0	-	-	1.0
9	Ammonical Nitrogen (as N), mg/l. max.	50	50	-	50
10	Total Kjeldahl nitrogen (as NH_3), mg/l max.	100	-	-	100
11	Free ammonia (as N), mg/l max.	5	-	-	5
12	Biochemical Oxygen Demand (3 days at $27^{o}C$), max.	30	350	100	100
13	Chemical Oxygen Demand, mg/l max.	250	-	-	250
14	Arsenic (as As), mg/l max.	0.2	0.2	0.2	0.2
15	Mercury (as Hg), mg/l max.	0.01	0.01	-	0.01
16	Lead (as Pb), mg/l max.	0.1	1.0	-	2.0
17	Cadmium (as Cd), mg/l max.	2.0	1.0	-	2.0
18	Hexavalent Chromium (as Cr^{+6}), mg/l. max.	0.1	2.0	-	1.0
19	Total Chromium (as Cr), mg/l max.	2.0	2.0	-	2.0
20	Copper (as Cu), mg/l max.	3.0	3.0	-	3.0
21	Zinc (as Zn), mg/l max.	5.0	15	-	15
22	Selenium (as Se), mg/l max.	0.05	0.05	-	0.05
23	Nickel (as Ni), mg/l max.	3.0	3.0	-	5.0
24	Boron (as B), mg/l max.	2.0	2.0	2.0	2.0
25	Percent Sodium, max.	-	-	60	-
26	Residual sodium carbonate, mg/l max.	-	-	5.0	-
27	Cyanide (as CN) mg/l max.	0.2	2.0	0.2	0.2
28	Chloride (as Cl) mg/l max.	1000	1000	600	-
29	Fluoride (as F) mg/l max.	2.0	15	-	15
30	Dissolved Phosphate (as P), mg/l max.	5.0	-	-	-
31	Sulphate (SO_4) mg/l max.	1000	1000	1000	-

SI. No.	Parameters	Standards			
		Inland Surface Water	Public Sewers	Land for irrigation	Marine coastal areas
		(a)	(b)	(c)	(d)
32	Sulphide (as S), mg/l max.	2.0	-	-	5.0
33	Phenolic Compound (C_6 H_5 OH), mg/l max.	1.0	5.0	-	5.0
34	Radioactive materials: (a) Alpha emitters, µc/ml max. (b) Beta emitters, µc/ml max.	 10^{-7} 10^{-6}	 10^{-7} 10^{-7}	 10^{-7} 10^{-6}	 10^{-7} 10^{-7}
35	Bio-assay test	Note-6	Note-6	Note-6	Note-6
36	Manganese (as Mn) mg/l max.	2.0	2.0	-	2.0
37	Iron (as Fe) mg/l max.	2	3	-	3
38	Vanadium (as V), mg/l max.	0.2	0.2	-	0.2
39	Nitrate Nitrogen, mg/l max.	10	-	-	20
40	Pesticides, µg/l max.				
	(i) Benzene Hexachloride				
	(ii) Carbaryl	10	-	10	10
	(iii) DDT	10	-	10	10
	(iv) Endosulfan	10	-	450	450
	(v) Dimethoate	10	-	10	10
	(vi) Fenitrothion	10	-	10	10
	(vii) Malathion	10	-	10	10
	(viii) Phorate	10	-	10	10
	(ix) Methyl Parathion	10	-	10	10
	(x) Phenthoate	10	-	10	10
	(xi) Pyrethrums	10	-	10	10
	(xii) Copper oxychloride	9600	-	9600	9600
	(xiii) Copper sulphate	50	-	50	50
	(xiv) Ziram	1000	-	1000	1000
	(xv) Sulphur	30	-	30	30
	(III) Paraquat	2300	-	2300	2300
	(IIIi) Propanil	7300	-	7300	7300
	(IIIii) Nitrofen	780	-	780	780

Note-1: All efforts should be made to remove colour and unpleasant odour as far as practicable.

Note-2: (a) For process water – 100,
(b) For cooling water effluent, 10% above total suspended matter in influent.

Note-3: Shall pass 850 micron IS sieve.

Note-4: (a) Floatable solids-max. 3 mm.
(b) Settleable solids-max. 850microns.

Note-5: Shall not exceed 5^0C above the receiving water temperature.

Note-6: 90% survivals of fish after 96 hours in 100% effluent.

From the results shown above, it may be safely concluded that the physico-chemical characteristics of the discharge water samples collected from the four locations for one season had variations with respect to almost all the parameters but were well within the limits of General Standards for Discharge of Effluents. As regards heavy metals, like Iron were also within prescribed limits.

Air Quality monitoring

The monitoring of air quality under Quarterly Environment Monitoring Programme for Cluster IX is being conducted CMPDI RI-II, Dhanbad and test results of air samples are furnished subsequently.

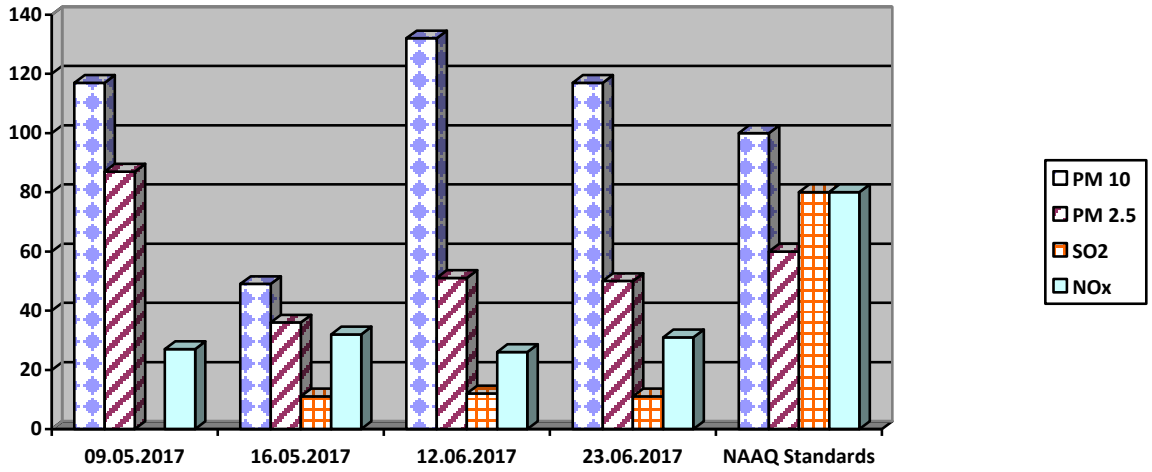
Table 11.6: Location of Air Sampling Stations

S. No	Components	Locations (Station Code)	Frequency	Number of Parameters Covered
1	Air Quality	**(Core Zone)** Jeenagora (A13)	Each Fortnight	Four (PM10, PM2.5, SO_x, NO_x)
		(Buffer Zone) Bhowrah North (A14) Hurriladih UGP (A28) & Kusmatand Village (A12)	Each Fortnight	Four (PM10, PM2.5, SO_x, NO_x)
2	Noise Levels	Jeenagora (N13) Bhowrah North (N14) Hurriladih UGP (N28) & Kusmatand Village (N12)	Each Fortnight	-NA-

Table 11.6A: Ambient Air Quality in Cluster-IX Mine Area for Core and Buffer zone

(A) **Station Code/Name: A13 – Jeenagora, Category: Industrial, Zone: Core Zone**

Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	09.05.2017	117	87	<10	27
2	16.05.2017	49	36	11	32
3	12.06.2017	132	51	12	26
4	23.06.2017	117	50	11	31
	NAAQ Standards	100	60	80	80

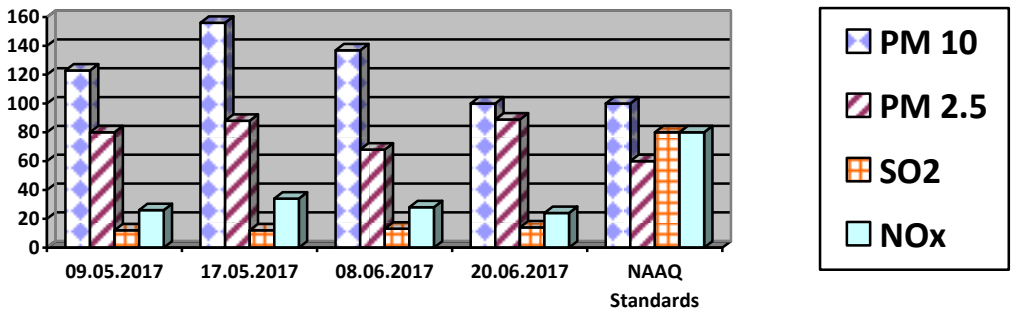


Trace Metal analysis report of Ambient Air Quality

Parameters	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Nickel (Ni)	Led (Pb)
Concentration($\mu g/m^3$)	<0.005	<0.001	<0.01	<0.001	<0.1	<0.005

(B). Station Code/Name: A14 Bhowrah North, Category: Industrial. , Zone: Buffer Zone

Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	09.05.2017	123	80	12	26
2	17.05.2017	156	88	12	34
3	08.06.2017	137	68	13	28
4	20.06.2017	100	89	14	24
	NAAQ Standards	100	60	80	80



Trace Metal analysis report of Ambient Air Quality

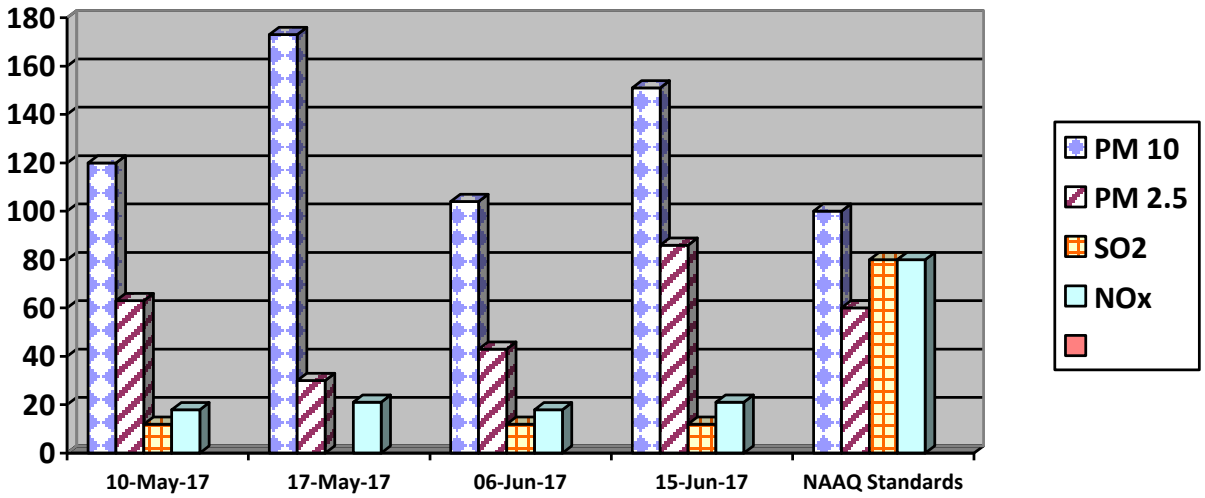
Parameters	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Nickel (Ni)	Led (Pb)
Concentration($\mu g/m^3$)	<0.005	<0.001	<0.01	<0.001	<0.1	<0.005

(C).Station Code/Name: A28 Hurriladih UGP Category: Industrial.

Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	10- May - 17	120	63	12	18
2	17- May - 17	173	30	<10	21
3	06- June - 17	104	43	12	18
4	15- June - 17	151	86	12	21
	NAAQ Standards	100	60	80	80

Trace Metal analysis report of Ambient Air Qualit

Parameters	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Nickel (Ni)	Led (Pb)
Concentration($\mu g/m^3$)	<0.005	<0.001	<0.01	<0.001	<0.1	<0.005



Trace Metal analysis report of Ambient Air Qualit

Parameters	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Nickel (Ni)	Led (Pb)
Concentration($\mu g/m^3$)	<0.005	<0.001	<0.01	<0.001	<0.1	<0.005

(D).Station Code/Name: A12 Kusmatand Village Category: Buffer.

Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	16- May - 17	192	50	11	30
2	05- June - 17	174	52	<10	21
3	28- June - 17	58	22	13	19
	NAAQ Standards	100	60	80	80

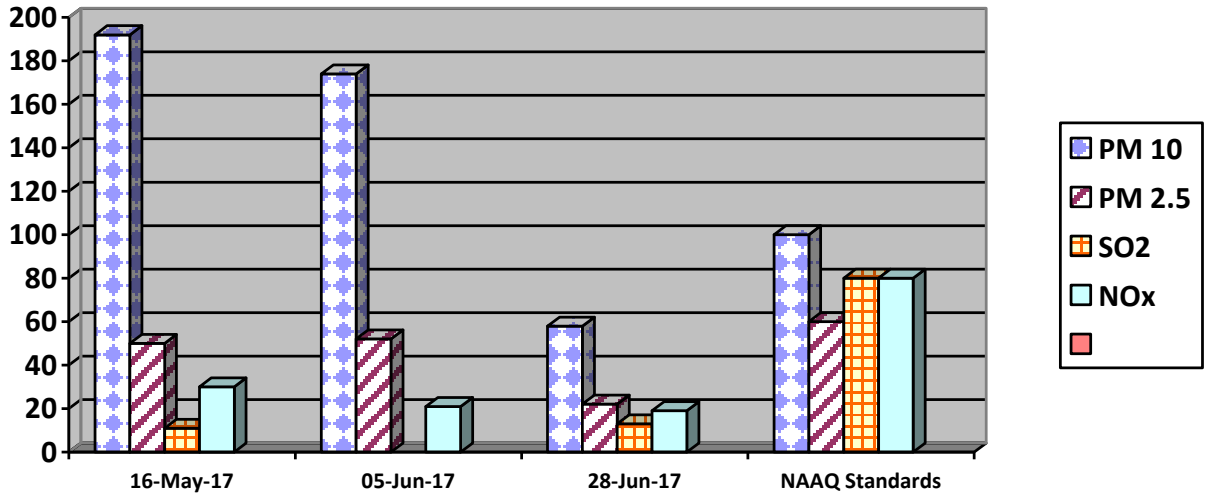


Table 11.6B: National Ambient Air Quality Standards
(As per MoEF Notification on* 16th November, 2009*)

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	Sulpher Dioxide (SO_2), µg/m^3	Annual* 24 hours**	50 80	20 80	- Improved West and Gaeke - Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), µg/m^3	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochheiser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter (Size less than 10 µm) or PM_{10} µg/m^3	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM - Beta attenuation
4	Particulate Matter (Size less than 2.5 µm) or PM_2 µg/m^3	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM - Beta attenuation
5	Ozone (O_3) µg/m^3	8 hours* 1 hour**	100 180	100 180	-UV photometric -Chemiluminescence -Chemical Method
6	Lead (Pb)	Annual*	0.50	0.50	-AAS/ICP method

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
	$\mu g/m^3$	24 hours**	1.0	1.0	after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
7	Carbon Monoxide(CO) mg/m^3	8 hours* 1 hour**	02 04	02 04	-Non Dispersive Infra Red (NDIR)Spectroscopy)
8	Ammonia(NH_3) $\mu g/m^3$	Annual* 24 hours**	100 400	100 400	- Chemiluminescence - Indophenol blue method
9	Benzene(C_6H_6) $\mu g/m^3$	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo(o) Pyrine (BaP)-Particulate phase only, ng/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic(As), ng/m^3	Annual*	06	06	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	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 compiled with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note – Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limit specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

NOISE LEVEL DATA

Name of the Company: **Bharat Coking Coal Limited** Year : **2017-18.**

Name of the Cluster : **Cluster -IX** Month: **May, 2017.**

Name of the Stations & Code :

1. **Dobari UGP (N11)**
2. **Jeenagora (N13)**
3. **Hurriladih UGP (N28)**
4. **Kusmatand Village (N12)**

(a) First Fortnight

Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	**Permissible Limit of Noise level in dB(A)*
1	**Jeenagora (N13)**	**Industrial area**	09.05.17	59.1	*75*
2	**Bhowrah North (N14)**	**Industrial area**	09.05.17	59.8	*75*
3	**Hurriladih UGP (N28)**	**Industrial area**	10.05.17	63.1	*75*

(b) Second Fortnight

Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	**Permissible Limit of Noise level in dB(A)*
1	**Jeenagora (N13)**	**Industrial area**	16.05.17	60.8	*75*
2	**Bhowrah North (N14)**	**Industrial area**	17.05.17	61.3	*75*
3	**Hurriladih UGP (N28)**	**Industrial area**	17.05.17	61.2	*75*
4	**Kusmatand Village (N12)**	**Residential Area**	16.05.17	53.8	*55*

Name of the Company: **Bharat Coking Coal Limited** Year : **2017-18.**

Name of the Cluster : **Cluster -IX** Month: **June , 2017.**

Name of the Stations & Code :

1. **Dobari UGP (N11)**
2. **Jeenagora (N13)**
3. **Hurriladih UGP (N28)**
4. **Kusmatand Village (N12)**

(a) First Fortnight

Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	**Permissible Limit of Noise level in dB(A)*
1	**Jeenagora (N13)**	**Industrial area**	12.06.17	60.1	*75*
2	**Bhowrah North (N14)**	**Industrial area**	08.06.17	58.2	*75*
3	**Hurriladih UGP (N28)**	**Industrial area**	06.06.17	62.2	*75*
4	**Kusmatand Village (N12)**	**Residential Area**	05.06.17	50.7	*55*

(b) Second Fortnight

Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	**Permissible Limit of Noise level in dB(A)*
1	**Jeenagora (N13)**	**Industrial area**	23.06.17	62.3	*75*
2	**Bhowrah North (N14)**	**Industrial area**	20.06.17	59.5	*75*
3	**Hurriladih UGP (N28)**	**Industrial area**	15.06.17	60.7	*75*
4	**Kusmatand Village (N12)**	**Residential Area**	28.06.17	51.6	*55*

CHAPTER - XII

PROGRESSIVE AND FINAL MINE CLOSURE PLAN

12.0 MINE CLOSURE PLANNING

12.1 OBJECTIVES OF CLOSURE PLANNING

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 and environmental challenges. Various other objectives are as follows:

- To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority;
- To protect public health and safety;
- To alleviate or eliminate environmental damage and thereby encourage environmental sustainability;
- To minimize adverse socio-economic impacts.

12.2 DIFFERENT ASPECTS OF MINE CLOSURE PLANNING

The mine closure planning broadly involves the following aspects:

(a) <u>Technical aspects:</u>

The following technical aspects would be reviewed in the final mine closure planning.

- **Safety hazards including management of fire and subsidence**:
  In the mine closure plan, action will be taken to cover all the safety aspects including management of fire & subsidence and mine inundation.

- **Management of Pit Slopes:**
  During operation of the mine, overall slope will be maintained at an angle not exceeding 22^0-28^0. Vegetation cover will also be provided along the slopes to arrest any failure.

As regards stability of back-filled dumps, the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will serve as a lagoon which may be utilised as water reservoir for the locality.

During operation, the external and internal OB dump will be developed with 40m berm width and maximum height of 90m in case of external OB dump and the overall dump slope shall not exceed 22 to 28 degrees. The waste dumps will be provided with toe wall and garland drains. The dump will be technically reclaimed and vegetation will be grown after spreading the top soil. The above measures will prevent slope failure and improve the aesthetic value.

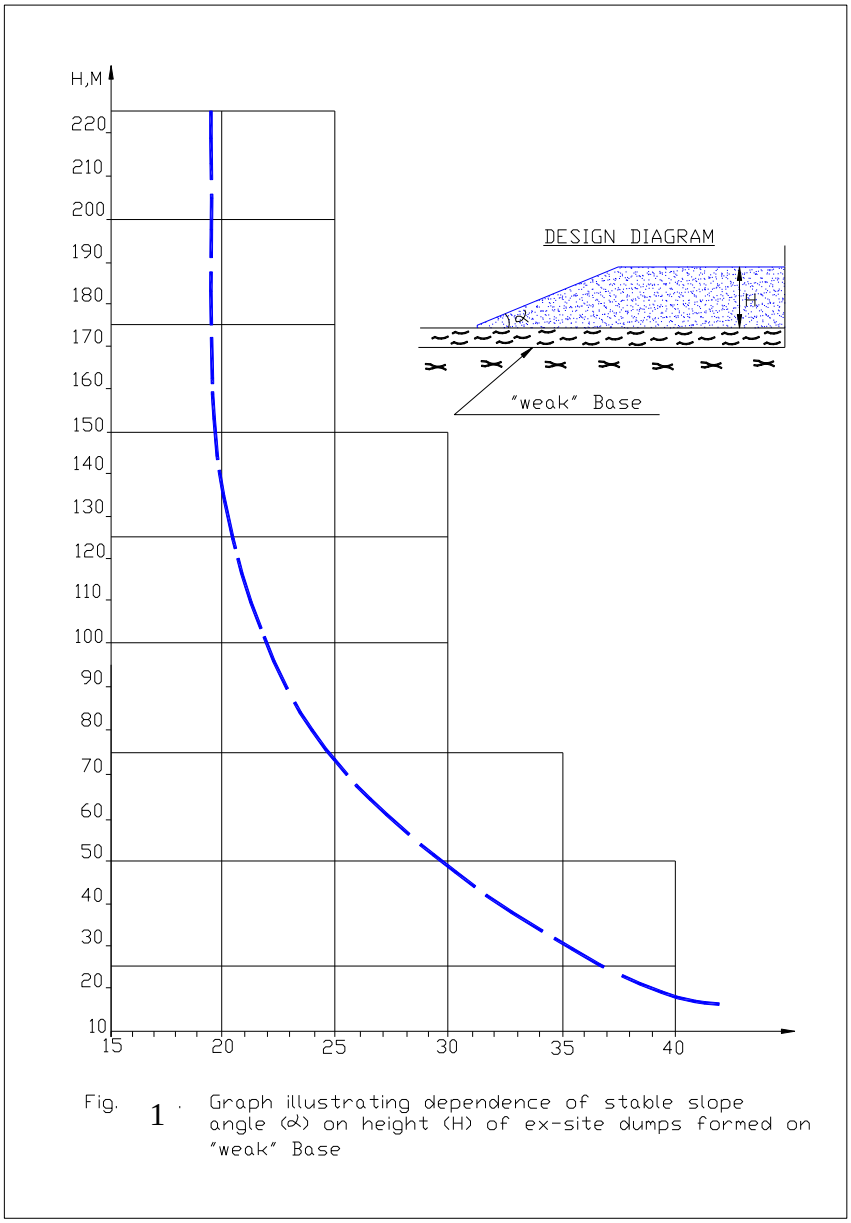


Fig. 1 . Graph illustrating dependence of stable slope angle (α) on height (H) of ex-site dumps formed on "weak" Base

The final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will also serve as a lagoon which may be utilised as water reservoir for the locality. Most of the back filled area shall be afforested by selecting proper plant species in consultation with State Forest Department. A part of the back filled area would also be developed for agricultural purpose with the help of the concerned State Authority.

- **Management of hydrology and hydro-geology**:

  In the mine closure plan, the surface flow pattern of precipitation and mine water would be clearly developed and water channel suitably laid down so that it does not disturb the general hydrology of the area.

  Mining operation may reduce the water table of the area. To recharge the water table, it is proposed that the mine water during operation will be discharged into surface water settling tank over flow of settled water from the tank will be used for water sprinkling, plantation, domestic purpose, etc. Therefore, the excess over flow water will be discharged into the nearby river. After closure of the mine vegetation will be grown on the entire vacant area.

- **Details of decommissioning of the infrastructures:**

  The decommissioning of the various infrastructures developed for the mine like office complex, roads, pipelines and transmission line etc. shall be planned in details so that the land occupied by these infrastructures are released. However, before such decommissioning, the possibility of re-use of these infrastructures for the neighbouring mines shall be explored.

- **Closure of entry to the open-cast mine:**

  At the end of the mine life, end pit slope within the seam and every exposed mouths of development gallery along the length of the bench / box-cut should be closed with non-combustible material (OB rock & mutti), compacted properly and sprayed with Thermoseal (a mica based sealant).

(b) <u>Environmental aspects</u>

This would include the following:

- **Management of final voids**:

  In the 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.

- **Reclamation of forests/vegetation:**

  It is to be ensured that in the final land use plan, all vacant land acquired for the project is afforested.

- **Channelisation of available water:**

  If the mine is having sufficient water and if on closure, the mine water flows into the surface water courses, channelising this water for surrounding community for their irrigational/domestic uses may be taken up. This can be planned by providing structures involving one time costing.

- **Management of Recharge Areas**:

  The pre-mining and post mining scenario on the hydrogeological recharge system would be included in the closure plan.

- **Acceptable Surface and Ground Water Flows**:

  In the final closure plan of the mine, wherever the mine water is likely to flow out to surface and meet the surface water sources; the quality of water from such mines would be assessed and flow pattern designed in the final plan.

(c) Social aspects

The social aspects of land use planning relating to mine closure would include the following:

- **Re-deployment of Workforce:**

  The company employees will be gainfully engaged in the neighboring projects after cessation of mining activities.

- **Management of Community Facilities:**

  In view of the short life of the project no new community facility will be created. However, the existing facilities of adjoining areas will be strengthened.

(d) Financial aspects:

There are two types of Closure, namely, Progressive Mine Closure (Concurrent) and Final Mine Closure. The cost of Progressive Closure activities is realized by the established norms and calculation made in that regard is explained below in Para 12.8, Chapter XII.

The Final Mine closure cost has to deal with the following:

Cost of closure activities.

- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure.

12.3 MINE CLOSURE OBLIGATIONS

There is need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, Central and State Governments after mine closure. Some obligations relating to the Mine Management Companies are as follows:

(a) **Health & Safety :** Regulation Nos. 6, 61, 106, 112 of Coal Mines Regulations, 1957 and its related DGMS Circulars;

(b) **Environment :** Water (Prevention & Control of Pollution) Act, 1974; Air (Prevention & Control of Pollution) Act, 1981; Environmental (Protection) Act, 1986 and Environmental Protection (Amendment) Rule, 2000; DGMS Directives on Noise & Ground Vibration;

(c) **Forest :** Forest (Conservation) Act, 1980.

(d) **Rehabilitation :** CIL's policy, however, applicable for land oustees only.

(e) **Decommissioning/asset disposal, etc.**

12.4 IMPACT ASSESSMENT REMEDIAL MEASURES

Environmental Impact on Landscape, Water Source, air and noise pollution during mine life has been discussed earlier. It is imperative that the environmental monitoring may be continued for 3 years after closure of OC in order to assess corrective measures to be implemented to sustain pre-mining ecosystem and environment in the core and buffer zone (to the extent possible).

12.5 STAKEHOLDERS INVOLVEMENT

Various stakeholders effected due to mine closure need to be identified and they may be as follows :

The Company	:	Employees, Management & Stakeholders
The Community	:	Local business and service providers, landholders, neighbours and nearby residents, local Government and NGOs and Community Groups.
The State	:	The State Government. The Central Government and concerned Government Agencies.

There is need of regular consultations between the stakeholders to evolve the needs of the stakeholders and their involvement in the process.

12.6 CLOSURE ACTION PLAN

Closure planning is a whole-of-life exercise that begins at the start of a mine and continues till post-closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, and new technology and remain flexible enough to cope with unexpected events.

The following steps have to be undertaken in relation to Mine Closure Planning:

- Prior to the surface demolition/restoration a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems; viz. explosives, chemicals, etc. A list of surface assets should be prepared and made available to potential purchasers, prospective purchasers could be invited and asked to submit sealed bids, this could ensure that the sale of assets give better financial gain.
- In order to identify potential impact, necessary hydro-geological studies into post-mining ground water recharge have to be done.
- Work force on roll of BCCL may be re-deployed for gainful utilization in the same or other mines of BCCL.
- As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of the mine. Once established, it may be updated annually.

12.7 PROTECTIVE MEASURES TO BE TAKEN

Protective measures must include the following :

- The protection of mine Entries , building and other structure on the project site against access by unauthorized persons;
- The maintenance of all mechanical, hydraulic and waste management system;
- The continuation of all monitoring programmes;
- The control of all contaminated effluents;
- The securing of all petroleum products, chemicals and waste;
- The rendering of all tailings, dams and piles of earth, rock and waste resulting from work done on the project site in a stable and safe condition.

12.8 CLOSURE COSTS

As per MOC guidelines, a corpus escrow account @ Rs 1.0 lakhs (August, 2009 Price Level) per Ha (for UG) and @ Rs 6.0 lakhs (for OC) of the project area shall be opened with the coal controller organization to meet the expenses of final mine closure. The current Guidelines read as:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the project area and it would be Rs. 1.00 lakh per Hectare for underground mine project area at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time".

It is difficult to conclusively predict the mining parameters on a long term basis owing to rapidly changing mining technology, developments in the field of clean coal technologies and R&D activities in development of alternative energy sources.

As per the latest Guidelines issued by the MoC, GoI (dt. 07.01.2013) the *"annual closure cost is to be computed considering the total project area at the above mentioned rates and dividing the same by the entire life of the mine in years for new projects and balance life of mine in years for operating/existing mines."*

As stated earlier that the 5 collieries of Lodna area, BCCL namely Joyrampur Colliery, Jealgora Colliery, Lodna Colliery, Bararee Colliery and Bagdigi Colliery have been amalgamated into a single mine namely Amalgamated Joyrampur Colliery vide letter no R-2/0100190/P-12-15/1517-27 dated 28.8.2015 issued by DGMS. Before amalgamation all the above 5 collieries of Lodna area were operating as single individual mine. Before amalgamation mine closure plan for 3 mines namely Joyrampur UG, Bararee UG and Lodna UG were prepared and approved by BCCL Board. As per the approved Mine Closure Plan the deposited amount till 31.3.2017 alongwith escrow account no. for above 3 mines are given in table below.

Name of mines	Escrow account no. & bank name	Amount deposited till 31.3.2017 (Rs. in Lakhs)
Joyrampur UG Mine	00150100009049 at bank of Baroda, Dhanbad Branch	40.15
Bararee UG Mine	00150100008940 at bank of Baroda. Dhanbad Branch	242.52
Lodna Colliery	00150100008942 at bank of Baroda, Dhanbad Branch	117.75
Total		400.42

The earlier mine closure plans were prepared considering Joyrampur UG, Bararee UG and Lodna UG as underground individual mine. However now 5 collieries of Lodna area, BCCL namely Joyrampur Colliery, Bagdigi Colliery, Lodna Colliery, Bararee Colliery and Jealgora Colliery have been amalgamated into a single mine namely Amalgamated Joyrampur Colliery.

At present all the underground units of Amalgamated Joyrampur Colliery are closed. In the present scenario, it has been decided by BCCL management to extract the fire affected seams in all the five mines by Opencast method upto IX/X seam.

In view of the above, a Mining Plan with revised Mine Closure Plan for Amalgamated Joyrampur Colliery is being prepared incorporating all the major current and proposed changes in the mining activities.

As per the data/plan furnished by mine officials, the total leasehold area of Amalgamated Joyrampur Colliery is 1186.97 Ha. Out of 1186.97 Ha area 1086.89 Ha area has been considered for computation of Mine closure cost. The 1086.89 Ha area comprises of 792.25 Ha of opencast and remaining 294.64 Ha project of underground. In addition to the above, 900 Ha has been considered for external dump. Thus the total project area for computation of mine closure cost comes to about 1986.89 Ha. Out of 1986.89 Ha, mine closure cost for 1692.25 Ha area has been considered as per Opencast norms and mine closure cost for the remaining 294.64 Ha area has been considered as per Underground norms.

Based on the above consideration, the mine closure cost for Amalgamated Joyrampur Colliery has been calculated.

The money deposited in the Escrow Account has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure

It is difficult to conclusively predict the mining parameters on a long term basis owing to rapidly changing mining technology, developments in the field of clean coal technologies and R&D activities in development of alternative energy sources.

As per the latest Guidelines issued by the MoC, GoI(dt. 07.01.2013) the *"annual closure cost is to be computed considering the total project area at the above mentioned rates and dividing the same by the entire life of the mine in years for new projects and balance life of mine in years for operating/existing mines."*

Jharia Coalfield is characterized by occurrence of a number of working coal horizons, giving a leverage of extended working life of the mines. Some more seams can come in the lap of workable horizons due to improvement in mining technology in times to come. The underground mines in leasehold of JCF are generally small capacity mines, giving a false impression of very long lives due to small level of current production level. There may be a strategy in future to amalgamate the mines for higher production level to attain the economics of scale. In such a situation, the life of the mine arrived at with current level of production for the balance reserve may not be workable in the long run.

In this mining plan, it is proposed to extract the IX/X & all above occurring seams in the proposed quarry limit through opencast operation using Shovel-Dumper system of mining. Amalgamated Joyrampur Colliery has mineable/extractable reserve of 52.029 MTs with avg. stripping ratio of 16.72 M^3/Te.

As discussed in Chapter-V, the life of the Amalgamated Joyrampur Colliery(OC) is estimated to be about 25 years, under given circumstances.

As per Mine Closure guidelines, the total expenditure to be incurred at the notified rate of the year (August 2009) has been calculated in following manner:

	UG Section	OC Section	Remarks
Area in Ha.	294.64	1692.25	Area X Notified Rate
Notified Rate (Rs. Lakhs/Ha)	1	6	
Total Amount (in base year) (Rs. Lakhs)	294.64	10153.5	

As per the guidelines *"these rates will stand modified based on Whole Price Index as notified by Government of India from time to time".*

Thus, an escalation factor has been calculated based on WPI of July. 2017 (177.79) ** vis-à-vis WPI of August '09(129.6) which comes out to be 1.37189737654321.

	UG Section	OC Section	Remarks
Total Amount (in base year) (Rs. Lakhs)	294.64	10153.5	Total Amount (in base year) X Escalation Factor
Escalation Factor	1.37189737654321	1.37189737654321	
Escalated Amount(Rs. Lakhs)	404.216	13929.56	

** As per the directives from Office of the Economic adviser, WPI series has been revised. In the revised series, base year has been changed to 2011-12 from 2004 -05. To account for the aforesaid change WPI Linking Factor has been taken as 1.561.

As stated earlier before amalgamation mine closure plan for 3 mines namely Joyrampur UG, Bararee UG and Lodna UG were prepared and approved by BCCL Board. As per the approved Mine Closure Plan the total deposited amount in all three Escrow Accounts till 31.3.2017 was Rs. 400.42 Lakhs. Thus after amalgamation either these three escrow accounts will be merged into a single escrow account in the name of Amalgamated Joyrampur Colliery or a new escrow account have to be opened in the name of Amalgamated Joyrampur Colliery. The amount already accrued in all 3 accounts shall be adjusted against the new closure cost calculated.

To account for the deposited amount, the total amount is deducted from the escalated amount to arrive at the balance escalated amount.

	UG Section	OC Section	Remarks
Escalated Amount (Rs. Lakhs)	404.216	13929.56	
Amount already deposited in escrow account(Rs. Lakhs)	400.42	0	
Balance Escalated Amount(Rs. Lakhs)	3.796	13929.56	

To arrive at the annual cost to be deposited in each year in an escrow account, the escalated amount shall be divided by the life of the section.

	Amount (in Rs. lakhs)		Remarks
	UG Section	OC Section	
Balance Amount	3.796	13929.56	Balance Amount / Life
Life	01	25	
Amount per year	3.796	557.182	

Since, Amalgamated Joyrampur Colliery is an opencast mine, balance amount for the underground section will be deposited in the 1st year along with the 1st instalment of OC section, detailed subsequently.

As per the guidelines, the arrived annual cost has to be escalated by 5% every year for the remaining life of the mine. The amount to be deposited every year after 5% escalation is given below:

Table No. 12.1 Break-Up cost of Mine Closure of Amalgamated Joyrampur Colliery

(Rs. Lakhs)

Year	UG Section	OC Section	Total
1	3.796	557.182	560.978
2		585.041	585.041
3		614.293	614.293
4		645.008	645.008
5		677.258	677.258
6		711.121	711.121
7		746.677	746.677
8		784.011	784.011
9		823.212	823.212
10		864.372	864.372
11		907.591	907.591
12		952.970	952.970
13		1000.619	1000.619
14		1050.650	1050.650
15		1103.182	1103.182
16		1158.341	1158.341
17		1216.258	1216.258
18		1277.071	1277.071
19		1340.925	1340.925
20		1407.971	1407.971
21		1478.370	1478.370
22		1552.288	1552.288
23		1629.903	1629.903
24		1711.398	1711.398
25		1796.968	1796.968
	3.796	26592.681	26596.477

The amount calculated above shall be deposited every year by BCCL in the Escrow Account in the name of Amalgamated Joyrampur Colliery.

Thus, total amount that shall be further deposited for final mine closure activities of Amalgamated Joyrampur Colliery in case of underground workings stands out to be Rs. 3.796 lakhs and in case of opencast workings during the considered period of 25 years stands out to be Rs. 26592.681 lakhs as per the present status of the mine.

The amount already deposited in the escrow account will also be available for mine closure activities and should be included to arrive at the total funds available for Mine Closure Activities.

	Amount (in Rs. lakhs)		
	UG Section	OC Section	Total
Amount Already Deposited in Escrow Account	400.42	0	400.42
Amount to be Deposited in the Escrow Account in the Future	3.796	26592.681	26596.477
Total Amount available for Mine Closure Activities	404.216	26592.681	26996.897

Based on the existing mine closure planning norms, the above calculated cost at Final WPI of July 2017 on mine closure may be tentatively grouped under different heads as given in Table No. 6.2 A and 6.2 B for underground and opencast respectively, as per guidelines of CMPDI(HQ).

Table 12.2 (A) Break up costs of Mine Closure Activities for Amalgamated Joyrampur Colliery (Underground)

Sl. No.	Activity	Mine Closure Cost (Rs. in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	14.1476
	Residential Buildings	42.7661
	Industrial Structures like CHP, Workshop, field sub-station, cap lamp room, haulage, fan installation etc.	25.5869
B	**Permanent Sealing of mine entries(incline mouth and air shaft)**	
	Sealing of incline mouths and air shafts	21.5043
C	***Subsidence Management**	19.2003

Sl. No.	Activity	Mine Closure Cost (Rs. in Lakhs)
D	**LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	35.571
E	***Plantation**	
	Plantation over the cleared area obtained after dismantling and on other barren spaces	52.5481
F	**Monitoring/Testing of parameters for three years**	
	Air Quality	27.608
	Water Quality	25.6273
G	***Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	30.9225
H	***Miscellaneous and other mitigative measures**	59.0155
I	**Manpower Cost for Supervision**	49.7186
	TOTAL	**404.216**

Note: * : To be covered under Progressive Mine Closure activities also

Table 12.2 (B) Break up costs of Mine Closure Activities for Amalgamated Joyrampur Colliery (Opencast)

Sl. No.	Activity	Mine Closure Cost (Rs. in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	53.185362
	Residential Buildings	710.0245827
	Industrial Structures like CHP, Workshop, field sub-station, etc.	79.778043
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	398.890215
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	470.6904537
D	***OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	23577.07097
	Bio-Reclamation including soil spreading, plantation and maintenance	106.370724

Sl. No.	Activity	Mine Closure Cost (Rs. in Lakhs)
E	**LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	79.778043
F	***Plantation**	
	Plantation over area obtained after dismantling	132.963405
	Plantation around fencing	53.185362
	Plantation over the cleared external OB Dump	5.3185362
G	**Monitoring/Testing of parameters for three years**	
	Air Quality	58.5038982
	Water Quality	53.185362
H	***Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	69.1409706
I	***Miscellaneous and other mitigative measures**	531.85362
J	**Manpower Cost for Supervision**	212.741448
	TOTAL	**26592.681**

Note: * : To be covered under Progressive Mine Closure activities also

Thus, total amount that shall be available for final mine closure activities of Amalgamated Joyrampur Colliery has been estimated as Rs. 26996.897 lakhs, out of which Rs. 26592.681 lakhs is for opencast based on OC norms at WPI of July 2017 and Rs. 404.216 lakhs is for underground based on UG norms at WPI of July 2017.

Mining is to be carried out in a phased manner initiating afforestation/reclamation 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. 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 shall be released to mine owner/leaseholder at the end of the final Mine Closure on compliance of all provisions of Closure Plan. This

compliance report should be duly signed by the lessee and certify that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court etc. and certified by the Coal Controller.

However, the additional amount beyond the escrow account, if any, estimated later on, will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guideline**.**

IMPLEMENTATION SCHEDULE FOR MINE CLOSURE IN AMALGAMATED JOYRAMPUR COLLIERY (UG & OC)
(LIFE OF THE MINE : 25 YEARS)

S.N	Activity	Time Frame	Year							
			1st Phase	2nd Phase	3rd Phase	4th Phase	Final	Post Closure Phase		
			1-5	6-10	11-15	16-20	21-25	PC1	PC2	PC3
A	**Dismantling of Structures**									
	Service Buildings	2 years								
	Residential Buildings	2 & ½ years								
	Industrial structures like CHP, Workshop, field sub-station, etc.	2 & ½ years								
	Dismantling of Service Bulding, Residential Building and Industrial Services for Underground section	10 years								
B	**Permanent Fencing of mine void and other dangerous area and underground mine opening**									
	Random rubble masonry of height 1.2 metre including leveling up in cement concrete 1:6:12 in mud mortar	2 years								
	Sealing of incline mouths and air shafts of underground section	10 years								
C	**Subsidence Management and Grading of highwall slopes**									

IMPLEMENTATION SCHEDULE FOR MINE CLOSURE IN AMALGAMATED JOYRAMPUR COLLIERY (UG & OC)
(LIFE OF THE MINE : 25 YEARS)

S.N	Activity	Time Frame	Year							
			1st Phase	2nd Phase	3rd Phase	4th Phase	Final	Post Closure Phase		
			1-5	6-10	11-15	16-20	21-25	PC1	PC2	PC3
	Subsidence Management	Throughout the life of the mine, if required including 3 years after cessation of mining operation								
	Levelling and grading of highwall slopes	2 years								
D	**OB Dump Reclamation**									
	*Handling/Dozing of OB Dump and backfilling	Throughout the life of the mine including 3 years after cessation of mining operation								
	*Technical and Bio-reclamation including plantation and post care	Throughout the life of the mine including 3 years after cessation of mining operation								
E	**Landscaping**									
	*Landscaping of the open space in the leasehold area for improving its esthetics and eco value	Throughout the life of the mine including 3 years after cessation of mining operation								
F	**Plantation**									
	Plantation over cleared area obtained after dismantling	2 years								

IMPLEMENTATION SCHEDULE FOR MINE CLOSURE IN AMALGAMATED JOYRAMPUR COLLIERY (UG & OC)
(LIFE OF THE MINE : 25 YEARS)

S.N	Activity	Time Frame	Year							
			1st Phase	2nd Phase	3rd Phase	4th Phase	Final	Post Closure Phase		
			1-5	6-10	11-15	16-20	21-25	PC1	PC2	PC3
	*Plantation around the quarry area and in safety zone	Throughout the life of the mine including 3 years after cessation of mining operation								
	*Plantation over the external OB Dump	Throughout the life of the mine								
G	**Post Closure Env Monitoring / testing of parameters for three years**									
	Air Quality	3 years								
	Water Quality	3 years								
H	***Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people**	Throughout the life of the mine								
I	***Miscellaneous and other mitigative measures**	Throughout the life of the mine including 3 years after cessation of mining operation								
J	***Post Closure Manpower cost for supervision**	3 years								

NOTE: *: To be covered under Progressive Mine Closure activities also**.**

ANNEXURE- IA

Bharat Coking Coal Limited
(A Subsidiary of coal India Limited)

टिप्पणी पत्र

विभाग: योजना एवं परियोजना पत्रांक 87

अधिकारी का नाम: आर के साहा, वरीय प्रबंधक(खनन) दिनांक: 23/10

विषय: **Requirement of Mining Plan and FSR in respect of Amalgamated Joyrampur Colliery of Lodna Area.**

Enclosed herewith a letter from GM(Lodna Area) regarding the above cited subject vide no. BCCL:GM(LA):Secy.:2017:284 dated 14/10/17 seeking Mining opening permission from CCO for which consent to operate was submitted to JSPCB with present EC of Cluster IX. However, as pointed out that a modification in the EC is required since the Area is marked to be worked by underground method which is not possible now. As such Mining Plan and Feasibility Report of Amalgamated Joyrampur Colliery is required to be submitted afresh for seeking Mining Opening permission from CCO and consent to operate from JSPCB.

The Competent Authority is requested to accord approval to get this job done from CMPDI as required in the enclosed letter from GM, Lodna Area.

Sr. Manager(Mining)P&P

GM(P&P)

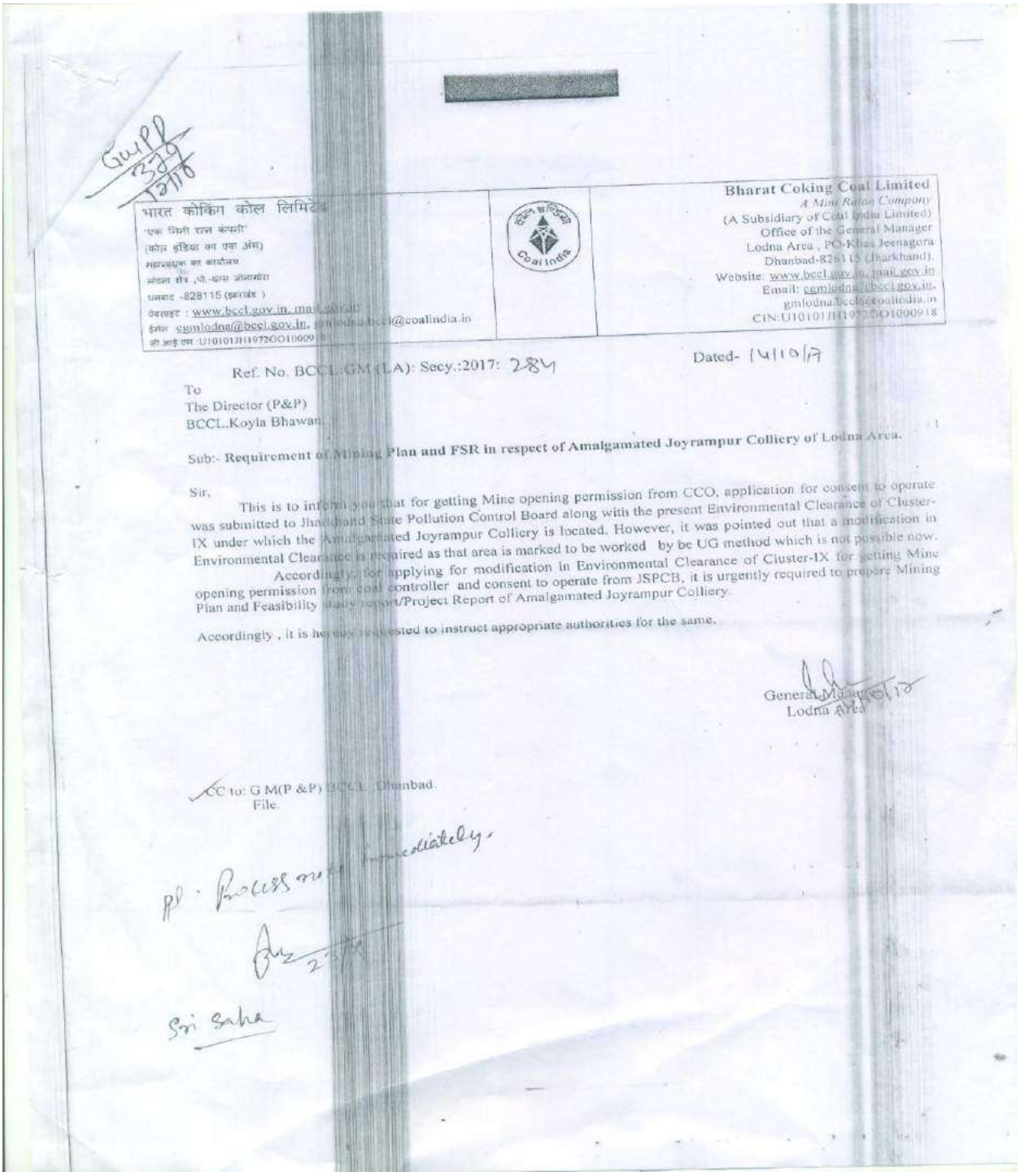
D(T)P&P

May be approved as Mining Plan and Feasibility Report is examined

RD RJ II

D(T)(P&PD)

ANNEXURE- IB



भारत कोकिंग कोल लिमिटेड
'एक मिनी रत्न कंपनी'
(कोल इंडिया का एक अंग)
महाप्रबंधक का कार्यालय
लोदना क्षेत्र ,पो.-खास जीनागोरा
धनबाद -828115 (झारखंड)
वेबसाइट : www.bccl.gov.in, mail.gov.in
ईमेल: gmlodna@bccl.gov.in, gmlodna.bccl@coalindia.in
सी आई एन :U10101JH1972GOI000918

Bharat Coking Coal Limited
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
Office of the General Manager
Lodna Area ; PO-Khas Jeenagora
Dhanbad-828115 (Jharkhand).
Website: www.bccl.gov.in, mail.gov.in
Email: gmlodna@bccl.gov.in,
gmlodna.bccl@coalindia.in
CIN:U10101JH1972GOI000918

Ref. No. BCCL:GM (LA): Secy.:2017: 284 Dated- 14/10/17

To
The Director (P&P)
BCCL,Koyla Bhawan

Sub:- **Requirement of Mining Plan and FSR in respect of Amalgamated Joyrampur Colliery of Lodna Area.**

Sir,

This is to inform you that for getting Mine opening permission from CCO, application for consent to operate was submitted to Jharkhand State Pollution Control Board along with the present Environmental Clearance of Cluster-IX under which the Amalgamated Joyrampur Colliery is located. However, it was pointed out that a modification in Environmental Clearance is required as that area is marked to be worked by be UG method which is not possible now.

Accordingly, for applying for modification in Environmental Clearance of Cluster-IX for getting Mine opening permission from coal controller and consent to operate from JSPCB, it is urgently required to prepare Mining Plan and Feasibility Study report/Project Report of Amalgamated Joyrampur Colliery.

Accordingly , it is hereby requested to instruct appropriate authorities for the same.

General Manager
Lodna Area

CC to: G M(P &P) BCCL, Dhanbad.
File.

Pl. Process immediately.

Sri Saha

Annexure VI

CSR, R&R AND TRANSPORTATION PLAN OF CLUSTER IX

As per EC Condition (Specific Condition No. IX)

Details of transportation, CSR, R&R and implementation of environmental action plan for each of the 17 clusters should be brought out in a booklet form

Bharat Coking Coal Limited
(A Mini Ratna Company)
Lodna Area
Dhanbad

CIL'S POLICY FOR CORPORATE SOCIAL RESPONSIBILITY (CSR)

Introduction:

Bharat Coking Coal Limited is a subsidiary of Coal India Limited, a Maharatna Company. The company is currently operating in 12 administrative areas in Jharia Coalfields encompassing around 226 peripheral villages mainly in the District of Dhanbad, Jharkhand and in some part of West Bengal. Coal India was aware of its Corporate Social Responsibility and was fulfilling the aspiration of the Society through well-defined "Community Development Policy" within the periphery of 8 Km of the Project sites. This has resulted into a harmonious relationship between Coal India and the peripheral Communities. The Strategic CSR of BCCL states that the company's main objective is to improve the quality of life of people living in and around its command areas. The key areas of CSR invention are rural development, livelihood generation and skill development. It has a long history of philanthropic activities which were converged to align with the Corporate Social Responsibility mandate of the Companies Act 2013. Rural development, livelihood generation and skill development are thrust areas of the BCCL‟s CSR interventions.

SCOPE

As per Schedule VII of New Companies Act 2013 the following should be the Scope of Activities under Corporate Social Activities:

1. Eradicating hunger, poverty and malnutrition, promoting healthcare including preventive health care and sanitation and making available safe drinking water.
2. Promoting education, including special education and employment enhancing vocation skills especially among children, women, elderly, and differently abled and livelihood enhancement projects;
3. Promoting gender equality, empowering women, setting up homes and hostels for women and orphans, setting up old age homes, day care centers and such other facilities for senior citizens and measures for reducing inequalities faced by socially and economically backward groups;
4. Ensuring environmental sustainability, ecological balance, protection of Flora and Fauna, animal welfare, agroforestry, conservation of natural resources and maintaining quality of soil, air and water;
5. Protection of national heritage, art and culture including restoration of buildings and sites of historical importance and works of art; setting up public libraries, promotion and development of traditional arts and handicrafts.
6. Measures for the benefit of armed forces veterans, war widows and their dependents
7. Training to promote rural sports, nationally recognized sports, Paralympics sports and Olympic sports;
8. Contribution to the Prime Minister's National Relief Fund or any other fund set up by the Central Government for Socio-economic development and relief and welfare of the Scheduled Castes, the Scheduled Tribes, other backward classes, minorities and women;
9. Contributions or funds provided to technology incubators located within academic institutions which are approved by the Central Government;
10. Rural development projects

Policy on CSR

CIL has well defined CSR policy framed on DPE's guidelines and on the Companies Act, 2013. The policy has CIL Board's approval. The Budget on CSR is allocated based on 2% on the average net profit of the company during the three immediate preceding financial years or R. 2.00 per tonne of coal produced in the previous year whichever is higher.

CSR Activities at Lodna Area: An Overview

- Healthcare
- Medical Camp
- Clinics at project level
- Health Awareness Programme
- Education
- Infrastructure Development
- Sanitation
- Environment protection
- Prime Minister's National relief fund (Contribution)
- Water Supply
- Electrical Supply

1. Healthcare :

Various health camps have been organized by Lodna Area for free health checkup and awareness of people in nearby villages. Some of the localities benefited from such camps include Belgaria, Golden Pahari, Bararee, Lodna etc.

Details of various free health checkup camps organized along with beneficiaries is given below:

Sl. No.	Date	Beneficiaries
1.	11.09.2017	50
2.	13.09.2017	69
3.	15.09.217	22
4.	18.09.2017	42
5.	20.09.2017	67
6.	22.09.2017	42
7.	27.09.2017	19
8.	11.10.2017	38
9.	13.10.2017	42
10.	18.10.2017	14
11.	20.10.2017	21
12.	23.10.2017	22
13.	25.10.2017	35
14.	27.10.2017	18
15.	02.10.2019	111
16.	11.11.2019	55
17.	28.02.2020	65

2. Education (School Grants):

For empowering the children of nearby villagers/ Project affected persons, Lodna Area management provide school grants to nearby schools annually, details of which are as follows:

Sl. No.	Name of School	Financial Year	Amount (Rs)
1.	**L P School, Golden Jeenagora**	2017-18	93,000
		2018-19	2,79,000
		2019-20	93,000
2.	**Middle School, North Tisra**	2017-18	2,49,000
		2018-19	7,47,000
		2019-20	2,19,000
3.	**Jealgora School of Learning, Jealgora**	2017-18	2,37,000
		2018-19	7,11,000
		2019-20	2,37,000

3. Infrastructure development Work (Welfare and CSR) done in Lodna Area, BCCL

Financial Year 2017-18			
Sl. No.	**Name of work**	**Amount (Rs.) in Thousand**	**Head**
1.	CHANGING OF WINDOW AND DOOR AND FLOOR OF HANDLOOM JHARCRAPT AT OLD WORKSHOPNTC UNDER LODNA AREA.	34.463	Welfare Building
2.	REPARING AND MAINTENANCE OF COMMUNITY CENTER SHIV MANDIR HANUMAN MANDIR ,ATTACHAKKI,ALAKDIHA TOP AND KATTAGHAR JEENAGORA UNDER LODNA AREA.	86.098	Welfare Building
3.	W/WASH, C/WASH, PAINTING OF COMMUNITY CENTER PANCHDEO MANDIR AT NOONUDIH UNDER LODNA AREA	72.971	Welfare Building
4.	W/WASH, C/WASH, PAINTING AND OTHER CIVIL WORK AT CHHAT TALAB JOYRAMPUR UNDER LODNA AREA	21.205	Welfare Building
5.	W/WASH, C/WASH, PAINTING OF MANAS MANDIR NEAR JEENAGORA STADIUM UNDER LODNA AREA.	99.005	Welfare Building
6.	C/WAS, PAINTING OF COMMUNITY CENTRE, SHIV MANDIR AT BAGDIGI 5 NO. UNDER LODNA AREA.	27.794	Welfare Building
7.	REPARING AND MAINTENANCE OF COMMUNITY CENTER BURAH BABA SHIV MANDIR AT JOYRAMPUR UNDER LODNA AREA.	69.300	Welfare Building
8.	W/WASH C/WASH,PANTING AND MISC CIVIL WORK AT SHIV MANDIR PIRKUBANDH SANTOSHI AND HANUMAN MANDIR AT BHAGA NO-4 UNDER LODNA AREA.	42.834	Welfare Building
9.	W/WASH C/WASH,PANTING ROOF REPARING AND RENOVATION OF CHABUTRA AT DURGA MANDIR AT P.G.PAHARI NT OCP UNDER LODNA AREA.	97.344	Welfare Building
10.	W/WASH C/WASH, PANTING ETC AT COMMUNITY CENTER SHIV MANDIR NHS QRT, DENOBLI MORE UNDER LODNA AREA.	36.130	Welfare Building
11.	W/WASH C/WASH, PANTING etc. AT COMMUNITY CENTER D/M AT BHAGA UNDER LODNA AREA	31.745	Welfare Building

12.	REPAIRING OF SHIV MANDIR AND YUTH CLUB AT BAGDIGI COLLIERY UNDER LODNA AREA.	69.305	Welfare Building
13.	C/WASH PAINTINGUNDER MISC CIV WORK AT (SEWING AND COMPUTER SEC)AT KHUTTA DHOWRA BARAREE UNDER LA	45.647	Welfare Building
14.	W/WASH C/WASH,PAINTING AND MISC CIVIL WORK AT RAKSHA KALI DHAM N.S LODNA UNDER LODNA AREA.	244.613	Welfare Building
15.	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK LODNA AT LODNA MASJID, LODNA COLLIERY LODNA UNDER LODNA AREA	351.865	Welfare Building
16.	W/WASH, C/WASH, PAINTING OF COMMUNITY CENTER (D/M) AT LODNA AND BHAGA UNDER LODNA AREA	77.225	Welfare Building
17.	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT COMMUNITY CENTER (D/M) SECTOR-1,11 AND PG PAHARI NTG/ST OCP UNDER LODNA AREA.	98.381	Welfare Building
18.	W/WASH, C/WASH, PANTING AT COMMUNITY CENTER (D/M) JEENAGORA AND JOYRAMPUR UNDER LODNA AREA.	37.862	Welfare Building
19.	W/WASH, C/WASH, PANTING AT BAGDIGI AND CHHATTA DHOWRAH BARAREE AT LODNA AREA.	59.695	Welfare Building
20.	REP OF SEPTIC TANK, B/WALL AND MISC CIVIL WORK AT COMMUNITY CENTER (D/M) LODNA UNDER LODNA AREA.	86.34	Welfare Building
21.	MAINTENANCE OF COMMUNITY CENTER BURA BABA SHIV MANDIR AT JOYRAMPUR UNDER LODNA AREA. (G.S.T)	83.394	Welfare Building
22.	REST PERMANENENT ROOF AND REPAIRING OF DAMAGED CHABUTRA AT JAMUNA SAHAY SMIRTI LODNA UNDER LODNA AREA.	199.275	Welfare Building
23.	REP/MAINTANANCE OF COMMUNITY CENTER (LNH-417) AT BHAGA UNDER LODNA AREA	69.20	Welfare Building
24.	REPARING/MAINTANANCE OF SHIV MANDIR NEAR BANIAHIR DAV SCHOOL AND SHIV SHAKTI NAGAR NEW COLONY UNDER LODNA AREA.	135.279	Welfare Building
25.	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT SHIV MANDIR PIRKU BANDH.	2.908	Welfare Building
26.	W/WASH,C/WASH, PAINTING ETC AT COMMUNITY CENTER SHIV MANDIR NHS QRT DENOBILI MORE	4.376	Welfare Building
27.	ROOF REPARING BY CGI SHEET ,OTHERS CIVILWORK AT KHAPRA DHOWRAH LODNA COLLIERY	35.537	Welfare Building
28.	W/WASH,PAINTING,OF COMMUNITY CENTER SHIV MANDIR A BAGDIGI 05NO UNDER LODNA AREA	3.367	Welfare Building
29.	DISTEMPARING,W/WASH, C/WASH,PAINTING AT COMMUNITY CENTER(shivmandir)BAGAN DHOWRAH BARAREE UNDER LODNA AREA	55.651	Welfare Building
30.	W/WASH,C/WASH,PAINTING,ROOF REPARING AND RENOVATION OF CHABUTRA AT DURGA MANDIR AT P.G.PAHARI NT OCP	11.792	Welfare Building
31.	W/WASH, C/WASH, PAINTING OF COMMUNITY OF COMMUNITY CENTER D/M AT BHAGA UNDER LODNA AREA.	3.845	Welfare Building
32.	W/WASH,C/WASH,PAINTING AND MISC CIVIL WORK AT BY QRT COMMUNITY CENTER (SHIV MANDIR)AT LODNA COLLIERY UNDER LODNA AREA.	31.125	Welfare Building
33.	W/WASH, C/WASH, PAINTING OF COMMUNITY CENTER (D/M) AT BHAGA UNDER LODNA AREA.	3.845	Welfare Building

34.	W/WASH, C/WASH, PAINTING AND RENOVATION OF NOORANI MASJID UNDER LODNA AREA.	184.104	Welfare Building
35.	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK at panchdeo mandir noonudih under Lodna Area.	39.539	Welfare Building
36.	REPARING AND MAINTANCE OF COMMUNITY CENTER SHIV MANDIR HANUMAN MANDIR ATTACHAKI, ALAKDIHA.	1.630	Welfare Building
37.	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT SANTOSHI MANDIR AND SHIV MANDIR 04NO BHAGA PIRKUBANDH UNDER LODNA AREA.	37.857	Welfare Building
38.	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT 3S CLUB BHAGA UNDER LODNA AREA.	20.716	Welfare Building
39.	WORK OF W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK WITH WIRING AT COMMUNITY CENTER BURHA BABA MANDIR AT JOYRAMPUR COLLY.	177.656	Welfare Building

Sl. No.	**Name of work**	**Amount (Rs.) in Thousand**	**Head**
1	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT 3S CLUB BHAGA UNDER LODNA AREA.	10.973+0	Other welfare works
2	WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT BARAREE MASJID UNDER LODNA AREA.	234.736	Other welfare works
3	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK WITH WIRING AT COMMUNITY CENTER(BURA BABA MANDIR)AT JOYRAMPUR COLLIERY UNDER LODNA AREA.	69.974	Other welfare works
4	W/EASH, C/WASH, PAINTING AND MISC CIVIL WORK AT SHAHID SAMARAK BAGDIGIH UNDER LODNA AREA.	35.612	Other welfare works
5	Work of W/Wash C/Wash painting and misc. Civil work at Panchdeo Mandir noonudih under Lodna Area.	74.649	Other welfare works
6	Community Centre Shiv Mandir Bararee / Denobili More Under Lodna Area.	3.243	Other welfare works

Financial Year 2018-19

Sl. No.	**Name of work**	**Amount (Rs.) in Thousand**	**Head**
1	C/WASH,PAINTING AND MISC. CIVIL WORK AT COMMUNITY CENTER (SHIV MANDIR AND HANUMAN MANDIR) AT DUMARITAND NEWCOLONY UNDER LODNA AREA.	92.8	welfare Building
2	REVALIDATION OF W/WASH, C/WASH, PAINTING AND MISCE CIVIL WORK AT SONTOSHI MANDIR AND SHIV MANDIR 04NO AT PIRKUBANDH BHAGA UNDER LODNA AREA.	63.431	welfare Building
3	W/WASH, C/WASH, PAINTING REPAIRING AND MISC WORK AT COMMUNITY CENTER(S/M) AT MOCP COLONY SECTOR-1 UNDER LODNA AREA.	203.453	welfare Building
4	W/WASH,PAINTING AND MISCE CIVIL WORK AT COMMUNITY CENTER (SHIV MANDIR)AT SOUTH TISRA NEAR OLD VTC JEENAGORA UNDER LODNA AREA.	18.96	welfare Building

5	W/WASH,PAINTING AND MISCE CIVIL WORK AT COMMUNITY CENTER (SHIV MANDIR) AND HANUMAN MANDIR ATTACHAKKI,MORE ALAKDIHA TOP,WEIGH BRIDGE LODNA AREA.	246.628	welfare Building
6	W/WASH, PAINTING ETC OF COMMUNITY CENTER (SHIV MANDIR) BAGDIGI NO-5 UNDER LODNA AREA.	27.939	welfare Building
7	REPAIRING/MAINTANCE OF MAZDOOR SMRITI MACE AT NOONUDIH PLAY GROUND UNDER LODNA AREA.	82.569	welfare Building
8	REPAIRING AND MAINTENANCE OF JAMUNA SAHAY SIMIRITI COMMUNITY CENTER LODNA COLLIERY UNDER LODNA AREA	253.425	welfare Building
9	PROVIDING OF COVERING OF NTC MIDDLE SCHOOL BY BRICK WALL GRILL AND GATE AT PG PAHARI UNDER LODNA AREA.	178.979	welfare Building
10	W/WASH C/WASH,PAINTING AND MISCE CIVIL WORK AT COMMUNITY CENTER (SHIV MANDIR) ATBYE QRT LODNA AND EST BARAREE JEENAGORA UNDER LOPDNA AREA.	56.366	welfare Building
11	W/WASH C/WASH,PAINTING AND MISCE CIVIL WORK AT COMMUNITY CENTER (SHIV MANDIR) NEAR DURGA MANDIR BAGDIGI COLLIERY UNDER LODNA AREA.	24.306	welfare Building
12	W/WASH C/WASH,PAINTING AND MISCE CIVIL WORK AT RAKSHA KALI MANDIR N.S LODNA UNDER LODNA AREA.	268.562	welfare Building
13	W/WASH C/WASH, PAINTING AND MISCE CIVIL WORK AT NOORANI MASZID BENIAHIR NEW COLONY UNDER LODNA AREA.	138.821	welfare Building
14	Grading front side pcc with chequred tile snowsenand painting and etc wrok at mocp sector-111 community center (d/m)under lodna area.	140.488	welfare Building
15	REPARING MAINTENANCE OF MANDIR OF PG PAHARI Buildings SHIFTING OF STC SHIV MANDIR AT PG PAHARI UNDER LDNA AREA.	177.364	welfare Building
16	REPAIRING/MAINTENANCE (WHITE WASH)OF CENTRAL WORK SHOP JEALGORA UNDER LODNA AREA	36.742	welfare Building
17	REPAIRING OF COMMUNITY CENTER NEAR D TYPE BLOCK AT MOCP UNDER LODNA AREA	152.109	welfare Building
18	REPAIRING SHIV MANDIR SULUNGA JEENAGORA UNDER LODNA AREA	156.611	welfare Building
19	DISTEMPERING, W/WASHING, PAINTING AND MISC CIVIL WORK OF COMMUNITY CENTER (D/M) OF MOCO SCETOR-1, SCETOR-11 AND PG PAHARI UNDER LODNA AREA.	44.28	welfare Building
20	REPAIRING DRAIN AND GARBAGE CLEANING NEAR JEALGORA 07 PIT DURGA MANDIR UNDER LODNA AREA.	116.91	welfare Building
21	REPARING/ MAINTENANCE INCLUDING ROOF REP AT JEENAGORA KALI THAN CLUB UNDER LODNA AREA.	62.561	welfare Building
22	W/WASH, C/WASH, PAINTING AT COMMUNITY CENTER (DURGA MANDIR) AT JOYRAMPUR UNDER LODNA AREA.	27.715	welfare Building
23	W/WASH, C/WASH, PAINTING AT COMMUNITY CENTER (DURGAMANDIR) AT JEENAGORA UNDER LODNA AREA.	19.238	welfare Building

24	W/WASH, C/WASH, PAINTING AT MISC CIVIL WORK AT MANAS MANDIR JEALGORA UNDER LODNA AREA.	134.789	welfare Building
25	W/WASH,C/WASH,PAINTING AT COMMUNITY CENTER (durga mandir)AT BHAGA UNDER LODNA AREA.	18.580	welfare Building
26	Revised Estimate of Shree Raksha Kali Dham NS LODNA	18.340	welfare Building
27	PIPE LINE HADI PATTI TO LALAH HIGH SCHOOL LODNA UNDER LODNAAREA	57.251	welfare Building
28	W/WASH,C/WASH,PAINTING AND MISC CIVIL WORK WITH ROOFGRADING AT COMMUNITY CENTER BURHA BABA MANDIR AT JOYRAMPUR COLLIERY UNDER LODNA AREA.	182.718	welfare Building
29	CLEANING AND REPAIRING OF DRAIN AT LODNA MORE SHANTOSHI MANDIR UNDER LODNA AREA.	263.932	welfare Building
30	RREVISED ESTIMATE OF COMMUNITY CENTER D TYPE BLOCK AT MOCP UNDER LODNA AREA.	12.859	welfare Building
31	W/WASH,C/WASH,PAINTING AT COMMUNITY CENTER DURGA MANDIRAND KALI MANDIR AT BAGDIGI COLLIERY UNDER LODNA AREA.	10.778	welfare Building
32	REPARING OF DAMAGED CHHAT GHAT AND STEP AT JOYRAMPUR COLLIERY UNDER LODNA AREA	44.036	welfare Building

Sl. No.	Name of work	Amount (Rs.) in Thousand	Head
1.	SPECIAI REPARING AND MAINTENANCE OF J.L.N STADIUM JEALGORA INCLUDING MAINTENANCE OF VARANDAH, MODLE ROOMAND V.I.P ROOM AT GUEST HOUSE.	354.20	Other Welfare Work
2.	BCCL KE LAL LADLI CENTRE OF LA TO BE INCURRED DURING MONTH FROM MARCH 2018 TO JULY 2018.	7.700	Other Welfare Work
3.	GRANT OF RS-15000/=TO MEET THE EXPAND OF SHRI SHRI DURGA PUJA AT BARAREE COLLY THE 2018.	5.00	Other Welfare Work
4.	W/WASH,C/WASH,PAINTING OF COMMUNITY CENTER (DURGA MANDIR AND KALI MANDIE) ATCHHATA DHOWRAH BARAREE AND NOONUDIH UNDER LODNA AREA.	25.215	Other Welfare Work
5.	W/WASH,C/WASH,PAINTING OF COMMUNITY CENTER (DURGA MANDIR AND KALI MANDIR)AT BAGDIGI COLLERY UNDER LODNA AREA.	46.607	Other Welfare Work
6.	Payment of rs- 20000/= Lodna Colly puja committee.	10.00	Other Welfare Work
7.	W/W C/W PAINTING OF N S LODNA WORK SHOP KALIMANDIR AND COMPOUND WALL AT LA.	19.567	Other Welfare Work
8.	W/WASH, C/WASH, PAINTING NG AND MISC CIVIL WORK AT GOKUL PARK NTC UNDER LODNA AREA.	29.670	Other Welfare Work
9.	REPAIRING OF DAMAGED CHHAT AND STEP AT JOYRAMPUR COLLIERY UNDER LODNA AREA.	53.120	Other Welfare Work
10.	CLEANING AND REPARING OF WALL AT ALINDI TOLLA SULUNGA JEENAGORA UNDER LODNA AREA.	33.500	Other Welfare Work
11.	W/W C/W PAINTING OF COMMUNITY CENTER KALIMANDIR KT SECTION JEEN AND OLD WORK SHOP UNDER LA.	23.716	Other Welfare Work
12.	ADMN APPR EST OF CHHAT TALAB STEP AT MALLAH PATTI UNDER LODNA AREA.	109.248	Other Welfare Work
Financial Year 2019-20			

Sl. No.	Name of work	Amount (Rs.) in Thousand	Head
1.	REVISED ESTIMATE OF REPAIRING AND MAINTANANCE OF JAMUNA SAHAY SMRITI COMMUNITY CENTER LODNA COLLIERY UNDER LODNA AREA.	20.819	Welfare Building
2.	REPAIRING AND MAINTENANCE OF CHHAT TALAB STEP AT MALLAH PATTI UNDER LODNA AREA.	83.094	Welfare Building
3.	CLEANING AND REPARING OF DRAIN AT LODNA MORE TO SANTOSHI MANDIR UNDER LODNA AREA.	482.731	Welfare Building
4.	COMMUNITY CENTER (SHIV MANDIR)AT BAGAN DHOWRAH BARAREE,BARAREE OFFICE AND DENOBOLI MORE DIGWADIH NEAR BHULI TYPE QRT UNDER LODNA AREA	215.664	Welfare Building
5.	CLEANING AND REPAIRING OF WALL AT KALINDI TOLLA SULUNGA JEENAGORA UNDER LODNA AREA	63.248	Welfare Building
6.	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT GOKUL PARK NTC UNDER LODNA AREA.	58.817	Welfare Building
7.	W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT NOORANI MASZID BANIAHIR NEW COLONY UNDER LODNA AREA.	13.258	Welfare Building
8.	REPARING AND MAINTANANCE OF J.L.N STADIUM JEALGORA.	34.425	Welfare Building
9.	W/WASH, C/WASH, PAINTING AT COMMUNITY CENTER (DURGA MANDIR) AT BHAGA UNDER LODNA AREA.	35.517	Welfare Building
10.	REVALIDATION OF DISTEMPRING, W/WASH, PAINTING AND MISC CIVIL WORK OF COMMUNITY CENTER D/M OF MOCO SECTOR-1, SECTOR-11 AND P.G PAHARI LODNA AREA.	68.281	Welfare Building
11.	REPARING AND MAINTENANCE OF RAKSHA KALIDHAM AT N.S.LODNA UNDER LODNA AREA	391.236	Welfare Building
12.	C/WASH, PAINTING, AND OTHERS MISC CIVIL WORK OF COMMUNITY CENTER ATBARAREE MASJID UNDER LODNA AREA.	375.834	Welfare Building
13.	W/WASHING, C/WASHING, PAINTING AND OTHER CIVIL MISC WORK OF COMMUNITY CENTER(S/M) AT MOCP SECTOR-1 NTC UNDER LODNA AREA.	82.663	Welfare Building
14.	REPAIRING OF WELL WATER TANK AND PROVIDING OF PIPE LINE FROM MAIN MINE PIT WATER PIPE TO WATER TANK AT NEARSOUTH TISRA RAILWAYGATE LODNA AREA.	133.718	Welfare Building
15.	REVISED ESTIMATE OF CLEANING AND REPAIRING OF DRAIN AT LODNA MORE TO SONTOSHI MANDIR UNDER LODNA AREA.	47.611	Welfare Building
16.	W/WASH,C/WASH,PAINTING AND MISC CIVIL WORK AT MANAS MANDIR JEALGORA UNDER LODNA AREA	335.451	Welfare Building
17.	ROOF AND CCEQUREWD TILES WORK OF COMMUNITYCENTER (D/M$K/M) AT MOCP SECTOR-1 UNDERLODNA AREA.	356.493	Welfare Building
18.	REPARING/MAINTENANCE OF COMMUNITY CENTENR NEAR 7 PIT JEALGORA UNDER LODNA AREA.	127.10	Welfare Building
19.	W/WASHING,C/WASHING,PAINTING AT COMMUNITY CENTER(DURGA MANDIR AND KALI MANDIR)AT CHHOTTO DHOWRAH BARAREE AND	30.738	Welfare Building

	NOONUDIH UNDER LODNA AREA.		
20.	W/WASH,C/WASH,PAINTING AND MISC CIVIL WORK OF COMMUNITY CENTER(SHIV MANDIR)BAGDIGI 05NO UNDER LODNA AREA	41.202	Welfare Building
Sl. No.	**Name of work**	**Amount (Rs.) in Thousand**	**Head**
1.	Repairing and maintenance of chhat talab step at Mallah patti under LA.	199.815	Other Welfare Work
2.	C/W PAINTING AND MISC CIVIL WORK AT COMMNIITY SHAD AT LODNA COLLY AND COMMINITY CHABUTRA BHAGA.	17.327	Other Welfare Work
3.	SNOWCEM DISTEMPER PAINTING ETC IN MAHABIR MANDIR AT JOYRAMPUR COLLY UNDER LA.	12.11	Other Welfare Work
4.	W/WASH,C/WASH,PAINTING AND MISCE CIVIL WORK OF SHAHID SMARAK (LAL MAIDAN) BARAREE UNDER LODNA AREA.	90.491	Other Welfare Work
5.	REPAIRING AND MAINTENANCE OF COMMUNITY CENTER (KALI MANDIR) JOYRAMPUR B.R COMPANY UNDER LODNA AREA.	58.39	Other Welfare Work
6.	REPAIRING AND MAINTENANCE OF SHIV MANDIR AT BHAGA NO-5 MAHABIR STHAN UNDER LODNA AREA.	28.889	Other Welfare Work
7.	REPAIRING AND MAINTENANCE OF COMMUNITY CENTER AT PIRKU BANDH BANIAHIR UNDER LODNA AREA.	35.581	Other Welfare Work
8.	PROVIDING OF COMPOUND WALL AND HOORING WORK OF COMMUNITY CENTER (D/M) AT STC UNDER LODNA AREA.	143.099	Other Welfare Work
9.	BCCL KE LAL AND BCCL KI LADLI CENTER OF LA TO BE FROM MAY 2019 TO AUG 2019.	11.132	Other Welfare Work
10.	PCC ROAD APPROACH OF KALI MANDIR AT GOKUL PAEK,NT-ST UNDER LODNA AREA.	232.851	Other Welfare Work
11.	W/WASHING,C/WASHING,PAINTING,AND MISCE CIVIL WORK ATCOMMUNITY CNTER (SHIV MANDIR) ATTA CHAKKI MORE AND ALEKDIHA O.P JOYRAMPUR UNDER LODNA AREA.	73.313	Other Welfare Work
12.	PROVIDING OF PAVER BLOCK IN THE FRONT SIDE OF KALI MANDIR AT GOKUL PARK NTC UNDER LODNA AREA.	223.400	Other Welfare Work
13.	REVISED ESTIMATE PROVIDING OF COMPOUND WALL AND FLOORING WORK OF COMMUNITY CENTER D/MAT STC UNDER LODNA AREA.	11.468	Other Welfare Work

Financial Year 2020-21

Sl. No.	**Name of work**	**Amount (Rs.) in Thousand**	**Head**
1.	RENOVATION OF KALI MANDIR SHIFTED FROM DB ROAD AT GOKUL DHAM NEAR NTC OLD WORKSHOP UNDER LODNA AREA	183.871	Welfare Building
2.	For W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK OF COMMUNITY CENTER SHIV MANDIR BAGDIGI 05 NO UNDER LODNA AREA.	69.524	Welfare Building
3.	For W/WASH, C/WASH, PAINTING AND MISC CIVIL WORK AT SHIV MANDIR AND HANUMAN MANDIR AT DUMARIYATAND NEW COLONY UNDER LODNA AREA.	73.564	Welfare Building
4.	FOR REPAIRING AND MAINTENANCE OF SHIV MANDIR AT BHAGA NO-5 MAHABIR STHAN UNDER	46.021	Welfare Building

	LODNA AREA.		
5.	FOR W/WASH, C/WASH PAINTING ETC AT MANAS MANDIR JEALGORA UNDER LODNA AREA.	141.836	Welfare Building
6.	FOR W/WASH, C/WASH PAINTING AND MISC CIVIL WORK AT COMMUNITY CENTER (SHIV MANDIR) AT SHIV SHAKTI NAGAR BANIAHIR DAV UNDER LODNA AREA.	241.599	Welfare Building
7.	FOR W/WASH, C/WASH PAINTING AND MISC CIVIL WORK OF PANCHANAN TEMPLE AT GOKUL DHAM.	55.914	Welfare Building
8.	FOR REPAIRING AND MAINTENANCE INCLUDING WHITE WASH,COLOUR WASH,AND PAINTING ERC AT COMMUNITY CENTER(SHIVMANDIR AND KALI MANDIR)AT SAIT KOTHI JEENAGORA.	101.80	Welfare Building
9.	FOR W/WASH, C/WASH PAINTING AND MISC CIVIL WORK AT COMMUNITY CENTER SHIV MANDIR ATTACHAKKI MORE AND ALAKDIHA OP JOYRAMPUR UNDER LODNA AREA.	73.313	Welfare Building
10.	FOR REPAIRING AND MAINTENANCE RAKSHA KALIDHAM AT N.S LODNA UNDER LODNA AREA.	164.704	Welfare Building
11.	FOR W/WASH,C/WASH, PAINTNG AT COMMUNITY CENTER DURGA MANDIR AND KALIMANDIR AT CHHATA DHOWRA BARAREE AND NOONUDIH UNDER LODNA AREA.	61.660	Welfare Building
12.	FOR REPAIRING AND MAINTENANCE OF COMMUNITY CENTER PIRKUBANDH BANIHIR UNDER LODNA AREA.	65.488	Welfare Building
13.	FOR REPAIRING AND MAINTENANCE OF COMMUNITY CENTER NEAR 07 PIT JEALGORA UNDER LODNA AREA.	172.628	Welfare Building
14.	FOR W/WASH, C/WASH, PAINTNG AND MISC CIVIL AT COMMUNITY CENTER DURGA MANDIR LODNA COLLIERY UNDER LODNA AREA.	55.820	Welfare Building
15.	FOR W/WASH, C/WASH, PAINTNG OF COMMUNITY CENTER SHIV MANDIR AT LODNA BAZAR, 40NO DHOWRAH, KHAPRA DHOWRA AT LODNA COLLIERY UNDER LODNA AREA.	140.672	Welfare Building
16.	FOR REPAIRING DAMAGED WALL FOR ASH PIT AND Buildings GARBAGE CLEANING NEAR GUEST HOUSE JEALGORA UNDER LODNA AREA.	49.089	Welfare Building
17.	FOR REPAIRING AND MAINTENANCE OF KALI MANDIR JEENAGORA RAILWAY CROSSING PAHALWAN DHOWRAH UNDER LODNA AREA.	45.413	Welfare Building
18.	FOR W/WASH,C/WASH,PAINTING ETC WORK AT COMMUNITY CENTER HANUMAN MANDIR AT EAST BARAREE JEENAGORA COLLIERY UNDER LODNA AREA.	25.106	Welfare Building
19.	FOR/WASH,C/WASH,PAINTING AND MISC CIVIL WORKS AT SHAHID SMARAK BAGDIGIH UNDER LODNA AREA.	40.536	Welfare Building
20.	FOR /WASH,C/WASH,PAINTING OF COMMUNITY CENTER DURGA MANDIR AND KALI MANDIR AT BAGDIGI COLLIERY UNDER LODNA AREA.	57.009	Welfare Building
21.	FOR COLOUR WASHING, PAINTING, WALL TILES AT 1ST FLOOR INCLUDING PARTIAL PORTION WIRING AT NOORANI MASZID NEW COLONY BANIAHIR UNDER LODNA AREA.	164.780	Welfare Building
22.	FOR CLEANING AND REPAIRING OF DRAIN AT BYE QRT NEAR SHIV MANDIR LODNA UNDER LODNA AREA.	148.513	Welfare Building
23.	FOR /WASH,C/WASH,PAINTING AND MISC CIVIL	33.230	Welfare Building

	WORK AT COMMUNITY CENTER(SHIVMANDIR) BYE QRT LODNA COLLIERY UNDER LODNA AREA.		
24.	FOR W/WASH, C/WASH, PAINTING AND OTHER MISC CIVIL WORK OF SHIV MANDIR AT MOCPSECTOR-1 NTC UNDER LODNA AREA.	13.317	Welfare Building
25.	FOR PROVIDING OF B/WALL AND SHED AT HANDLOOM CENTER AT JHARCRAFT NTC UNDER LODNA AREA.	230.938	Welfare Building
26.	FOR W/WASH, C/WASH, PAINTING AND OTHER MISC CIVIL WORK AT JEENAGORA PEHADIGORA MANDAL DHOWRA (shiv mandir) UNDER LODNA AREA.	24.532	Welfare Building
27.	FOR REPAIRING/MAINTENANCE OF COMMUNITY CENTER NEAR 07 PIT JEALGORA UNDER LODNA AREA.	13.316	Welfare Building
28.	FOR RENOVATION OF KALI MANDIR (SHIFTED FROM DB ROAD) AT GOKULDHAM NEAR NTC OLD WORKSHOP UNDER LODNA AREA.	194.00	Welfare Building
29.	FOR REVALIDATION OF PROVIDING OF PAVER BLOCK IN THE FRONT SIDE OF KALI MANDIR AT GOKUL PARK NTC UNDER LODNA AREA.	326.878	Welfare Building
30.	FOR W/WASH, C/WASH, PAINTING OF SHIV MANDIR AT PIRKUBANDH NEAR LODNA MORE UNDER LODNA AREA.	10.027	Welfare Building
31.	FOR PROVIDING OF PAVER BLOCK IN THE FRONT FACE OF TOILET AT GOKUL PARK UNDER LODNA AREA.	26.659	Welfare Building
32.	FOR C/WASH, PAINTING, AND OTHERS MISC CIVIL WORK OF COMMUNITY CENTER (H/M) AT MOCP SECTOR-11 UNDER LODNA AREA.	23.407	Welfare Building
33.	FOR REPAIRING AND MAINTENANCE OF J.L.N STADIUM JEALGORA FOR THE URGENT FUNCTION SCHEDULE TO BE HELD IN THE STADIUM UNDER LODNA AREA.	243.496	Welfare Building
34.	FOR W/WASH,C/WASH,PAINTING ETC OF SHIV MANDIR BHAGA NO-2 UNDER LODNA AREA.	12.017	Welfare Building
35.	FOR DISTEMPARING, PAINTING ETC OF TEMPLE SITUATED NEAR COLLIERY OFFICE BAGDIGI UNDER LODNA AREA.	15.919	Welfare Building
Sl. No.	**Name of work**	**Amount (Rs.) in Thousand**	**Head**
1.	Payment for fooding and lodging arrangement of Work migrate labour returning to Jharkhand from other States as directed by State and district admn.	220.150	Welfare Work
2.	Payment for fooding and lodging arrangement of Work migrate labour returning to jharhand from other states as directed by State & district administration authorities.	250.613	Welfare Work
3.	FOR W/WASH,C/WASH,PAINTING OF SHIV MANDIR AT LODNA BARAREE 40NO DHOWRAH KHAPRA DHOWRAH AT LODNA COLLIERY UNDER LODNA AREA.	29.350+5.283	Welfare Work
4.	FOR W/WASH,C/WASH,AND PAINRING AT COMMUNITY CENTER DURGA MANDIR LODNA COLLIERY UNDER LODNA AREA.	34.633	Welfare Work
5.	Repairing and Maintenance of Raksha Kali Dham at NS Lodna Area.	194.350	Welfare Work
6.	FOR W/WASH, C/WASH, PAINTING AND OTHER MISC CIVIL WORK OF KALI MANDIR AT SOUTH TISRA KT OF JEENAGORA RAILWAY PHATAK UNDER LODNA AREA.	15.632	Welfare Work

7.	FOR W/WASHING, C/WASHING AND PAINTING OF SHIV MANDIR AT PG PAHARI UNDER LODNA AREA.	25.226	Welfare Work
8.	TCR for the work rep of damaged dran at PG pahari NT ST Work under lodna.	58.045	Welfare Work
9.	FOR C/WASH, PAINTING AND OTHER CIVIL WORK OF COMMUNTY CENTER (H/M) AT MOCP SECTOR-11 UNDER LODNA AREA.	9.100	Welfare Work

4. Water Supply:

Treated mine water is being supplied through water pipelines and water tankers to the nearby villagers, from the different collieries of Lodna Area under Cluster IX.

Apart from this collieries have their own water treatment plants as well to supply the water to nearby villagers. Details of villages, where water is being supplied and corresponding nos. of beneficiaries (Family) are given below:

Sl. No.	Colliery name	Water supplied to nearby villages (Cum./day)	Name of beneficiary villages
1.	Amal. Joyrampur Colliery	10839	Parga, Mukunda, Surunga, Nunudih Basti, Bazar Dhowra, Lodna Bazar



Mine water being used by nearby public for domestic purposes Chatt Talab

CSR Expenditure:

CSR expenditure was not made at cluster level. However expenditure was allotted and made at corporate level i.e. M/s BCCL level and cluster-IX is contributor for the same.

Details of CSR expenditure of whole BCCL for last three years is given below:

FY 2018-19: 6.01 Cr
FY 2018-19: 1.43 Cr
FY 2017-18: 2.74 Cr
FY 2016-17: 11.45 Cr

REHABILITATION AND RESETTLEMENT PLAN

The cluster of mines will be dovetailed with the approved Jharia A**ction Plan for** dealing with fire, subsidence and rehabilitation of people. **Master Plan** for dealing with fire, subsidence and rehabilitation within the leasehold area of BCCL has already been approved by Government of Jharkhand & Government of India.

As per EC granted to Cluster IX, R&R of 12246 nos. of PAFs are involved. They should be rehabilitated to safe areas at the cost of Rs 126092.027 Lakhs as per the approved Jharia Action Plan.

Following will be the R&R package that will be given to affected families as Per approved Master Plan

A very attractive R&R package, for the affected people who are to be shifted from endangered areas, has been proposed in the Master plan and has been approved both by Govt. of Jharkhand and Govt. of India. **But no employment will be offered for any rehabilitation under this Master Plan.**

It may be noted that this R&R package is offered for safety of the people living in endangered areas and not for project implementation and mining of coal and thereby gaining any type of profit.

R&R package for non-BCCL authorized families:

a) Land Compensation:

Head of every displaced house shall be given compensation for his land at the market rate.

b) House Compensation:

Every head of displaced house will get replacement value for his house and other structures over the homestead land, the value of which shall be estimated on the basis of PWD civil rates. (Pucca house: Rs. 4.8 lakhs/unit and for Kutcha house: Rs. 1.37 lakhs/unit).

c) Other Benefits:

Head of each house will be provided a plot of 100 sq.m land at the proposed township. In case his requirement of land is more than 100 sq.m, additional land may be provided, on payment basis as per market rate if land is available. If this offer is not acceptable, head of each house shall be provided a constructed flat of around 40 m2 as super built up area in a triple storied building. A house owner not opting for a plot will be offered equivalent cash compensation in lieu of free plot.

d) Basic amenities:

Each township will be provided with all basic amenities and infrastructural facilities like Primary school, High school, Bank, Post office, Community centre, Shopping centre, Hospital, Playground, Children Park, Water supply, Sewage disposal & sanitation, Road, Culverts & Drains, and Power Supply etc.

e) Income generation benefit:

Head of each house shall be paid 250 days/year wage as per State Govt.'s minimum wage rate for a period of 2 years.

f) Shifting Allowance:

The head of every house is proposed to be paid 0.10 lakhs as shifting allowance from their present living places to the resettlement sites.

R&R package for non-BCCL unauthorized families (encroachers):

a) No compensation will be paid to the house owner having no home stead land (Unauthorized). Instead the following benefits will be provided to them.

b) Head of each house will be provided a constructed house on 27 sq.m land as super built up area in triple storey building in resettlement site with all basic amenities like Primary school, High school, Bank , Post office, Community centre, Shopping centre, Hospital, Play ground & children park, Water Supply, Sewage disposal & sanitation, Road, Culverts & Drains, Power Supply etc.

c) **Income generation benefit**: Head of each house shall be paid 250 days/year wage as per State Govt.'s minimum wage rate for a period of 2 years.

d) **Shifting Allowance:** The head of every house is proposed to be paid 0.10 lakhs as shifting allowance from their present living places to the resettlement sites.

R&R package for BCCL families:

a) BCCL families from the endangered areas to be rehabilitated in satellite townships in non-coal bearing areas outside JCF with all basic infrastructural facilities.

b) For each BCCL house 160 sq.m (including for all amenities) resettlement land has been proposed.

Coal Transportation Plan

Coal produced in the coal face in the different mines of Lodna Area is first dumped in the different coal dumps of the concerned colliery at the surface. From the individual coal dump, coal is then shifted to either railway siding of Amal. NT-ST-JG Colliery for rail dispatch or directly sent via road sell to power plants/steel plants.

- Rly. Siding (GOL 6 & 9)

Distance from coal dumps of NT-ST-JG Colliery to Railway Siding: **1-2 km**

Production Capacity (in ton.)											
S. No	**Name of Mine**	**Normative (MTY)**	**Peak (MTY)**	**Leasehold Area (Ha.)**	**2014-15 (Tonn.)**	**2015-16 (Tonn.)**	**2016-17 (Tonn.)**	**2017-18 (Tonn.)**	**2018-19 (Tonn.)**	**2019-20 (Tonn.)**	**2020-21 (Tonn.)**
1.	Amal. NT-ST-JG Colliery	6.0	7.8	755.15	**3530017**	**3826689**	**3839054**	**3192316**	**2484642**	**2534760**	**2264372**

Coal Transportation in Cluster-IX

Coal Dispatched by Rail & Road in FY 2016-17

Colliery Name	**Dispatch by Rail (Te)**	**Dispatch by Road (Te)**	**Total Dispatch (Rail + Road) (Te)**
Amal. NT-ST-JG Colliery	0	2965	2965

Coal Dispatched by Rail & Road in FY 2017-18

Colliery Name	**Dispatch by Rail (Te)**	**Dispatch by Road (Te)**	**Total Dispatch (Rail + Road) (Te)**
Amal. NT-ST-JG Colliery	6311	12806	19117

Coal Dispatched by Rail & Road in FY 2018-19

Colliery Name	**Dispatch by Rail (Te)**	**Dispatch by Road (Te)**	**Total Dispatch (Rail + Road) (Te)**
Amal. NT-ST-JG Colliery	**1776382**	**1068535**	2844917

Coal Dispatched by Rail & Road in FY 2019-20

Colliery Name	**Dispatch by Rail (Te)**	**Dispatch by Road (Te)**	**Total Dispatch (Rail + Road) (Te)**

Amal. NT-ST-JG Colliery	**1885804**	**699044**	2584848

Coal Dispatched by Rail & Road in FY 2020-21

Colliery Name	**Dispatch by Rail (Te)**	**Dispatch by Road (Te)**	**Total Dispatch (Rail + Road) (Te)**
Amal. NT-ST-JG Colliery	**1006475**	**954089**	1960564

Linkage: Coal produced in Lodna Area is dispatched to different organization like- power plants, steel plants etc.

Details of some of the Power/Steel/Fertilizer Plant which are supplied coal from Railway Siding and by road sale are as follows:

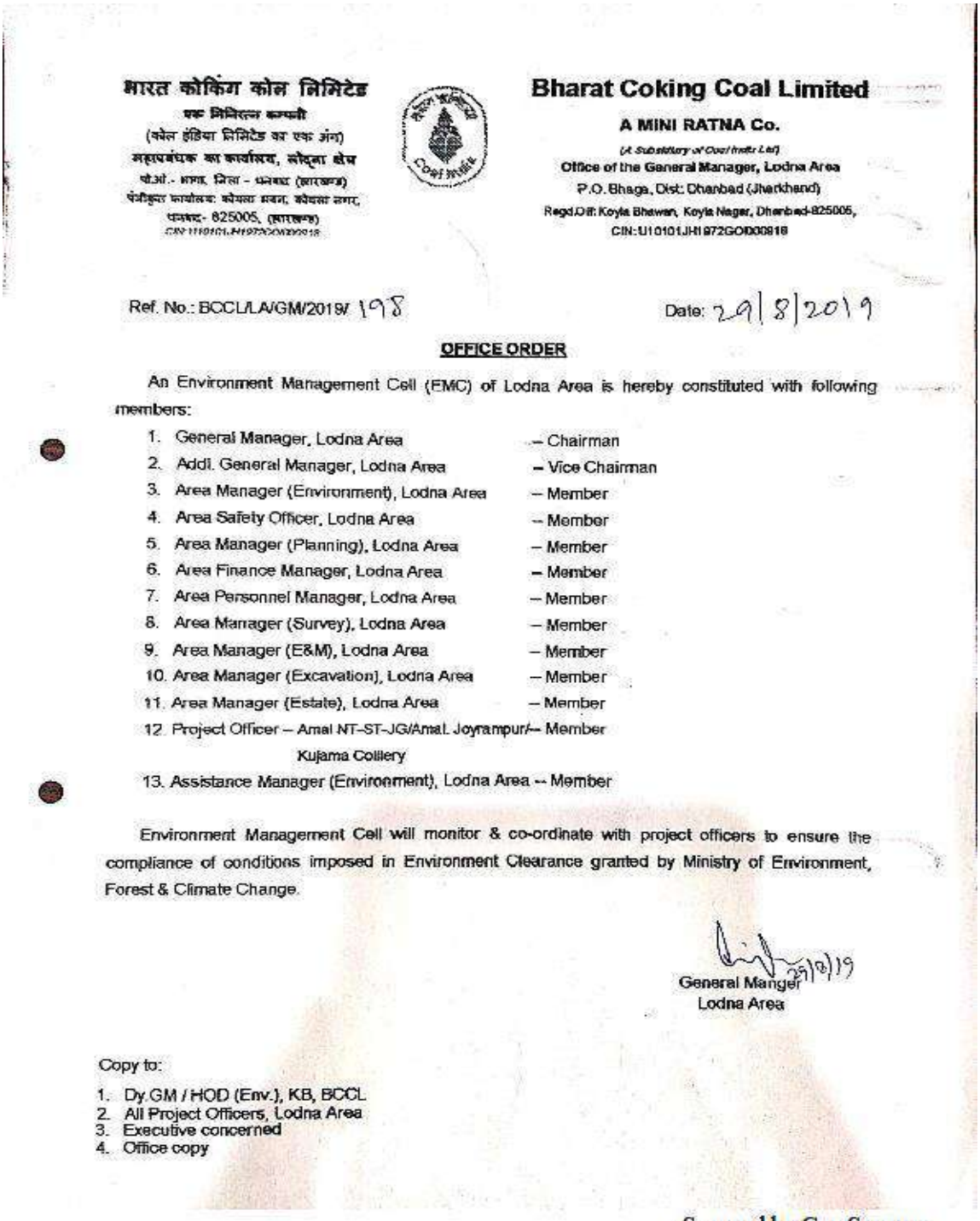
- Maithon Power Limited
- Patherdih Washery
- Steel Plant
- DVC
- Fertilizers
- RTPS
- Haldia
- APNL
- Others

Transportation Plan:



Environment Action Plan:

Sustainable coal production is the main objective of Lodna Area, BCCL i.e. meeting the energy demand of the nation while protecting and preserving the environment and ecology as well. For taking care of environment; cluster-IX has given full efforts to comply the conditions of Environmental clearance granted with cluster-IX group of mines. An Environment Management Cell has been formed under the chairmanship of General Manager, Lodna Area for ensuring the compliance of the conditions laid down in EC.



भारत कोकिंग कोल लिमिटेड
एक मिनिरत्न कम्पनी
(कोल इंडिया लिमिटेड का एक अंग)
महाप्रबंधक का कार्यालय, लोदना क्षेत्र
पी.ओ.- भागा, जिला - धनबाद (झारखण्ड)
पंजीकृत कार्यालय: कोयला भवन, कोयला नगर,
धनबाद- 825005, (झारखण्ड)

Bharat Coking Coal Limited
A MINI RATNA Co.
(A Subsidiary of Coal India Ltd)
Office of the General Manager, Lodna Area
P.O. Bhaga, Dist: Dhanbad (Jharkhand)
Regd.Off: Koyla Bhawan, Koyla Nagar, Dhanbad-826005,
CIN:U10101JH1972GOI000918

Ref. No.: BCCL/LA/GM/2019/ 198 Date: 29/8/2019

OFFICE ORDER

An Environment Management Cell (EMC) of Lodna Area is hereby constituted with following members:

1. General Manager, Lodna Area – Chairman
2. Addl. General Manager, Lodna Area – Vice Chairman
3. Area Manager (Environment), Lodna Area – Member
4. Area Safety Officer, Lodna Area – Member
5. Area Manager (Planning), Lodna Area – Member
6. Area Finance Manager, Lodna Area – Member
7. Area Personnel Manager, Lodna Area – Member
8. Area Manager (Survey), Lodna Area – Member
9. Area Manager (E&M), Lodna Area – Member
10. Area Manager (Excavation), Lodna Area – Member
11. Area Manager (Estate), Lodna Area – Member
12. Project Officer – Amal NT-ST-JG/Amal Joyrampur/ Kujama Colliery – Member
13. Assistance Manager (Environment), Lodna Area – Member

Environment Management Cell will monitor & co-ordinate with project officers to ensure the compliance of conditions imposed in Environment Clearance granted by Ministry of Environment, Forest & Climate Change.

29/8/19
General Manager
Lodna Area

Copy to:

1. Dy.GM / HOD (Env.), KB, BCCL
2. All Project Officers, Lodna Area
3. Executive concerned
4. Office copy

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Apart from the above Environment Management Cell, dedicated workforce is being engaged in various environment protection work such as biological reclamation of stabilized OB dumps, Block plantation, Avenue plantation along the roads, development of Herbal garden and Sneha Smriti Upavan etc.
Details of officials in Environment Department, Lodna Area is as follows:
Executive: 02
Non-Executives: 15

Eco restoration work in Lodna Area:

Lodna Area is committed to enhance the bio diversity/green cover in Area by regularly taking up eco restoration work on stabilized OB dumps, Avenue plantation, and block plantation etc.

In LODNA Area, In order to restore degraded mined out area, different activities has been started like uprooting of weeds, roots and its disposal, pit digging, spreading of top soil and cow dung, grass seed balls, etc. Under this activity, 10 Ha. Of Land at NT-ST OCP dump of Lodna area has been ecologically developed using three tier plantation as "GOKUL PARK". The park has been developed in collaboration with the FRI, Dehradun.

This noble initiative of BCCL has been well accepted and praised by the local inhabitants in and around. Everyday about 300-400 people visit the park. Another 5 Ha. Of degraded mined out area is earmarked around GOKUL PARK for plantation purpose during the year 2016-17. Again 7 Ha. Of degraded area developed in 3rd stage. Total 22 Ha. Area has been ecologically re-stored at Gokul Park.


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Shot on realme XT





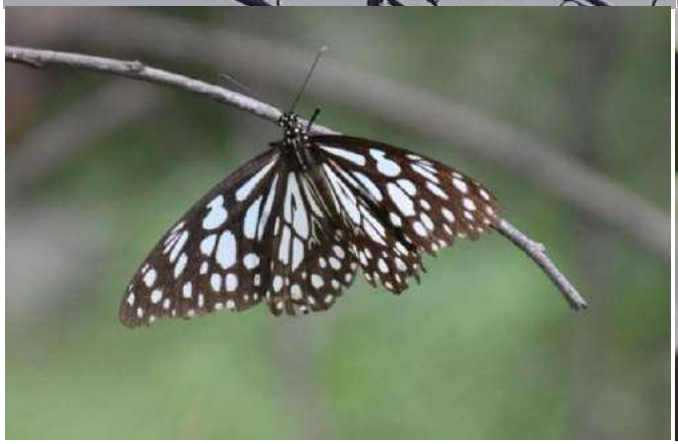

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Sneha Smriti Upavan: A garden of fruit bearing plants is being developed as Sneha Smriti Upavan in the memory of ancestors at NT-ST-JG Colliery.

It was inaugurated by General Manager, Lodna Area, BCCL.









Pictures of Sneha smriti upavan

Jharkraft in Lodna Area:

REELING AND SPINNING TRAINING PROJECT: This is a skill Development cum employment generation project under "*Swaavlambee* Project" of BCCL targeting groups of unemployed and willing to work women from *Mukunda, Alakdiha, Gareia , Panchmohali* and *Nootangram* villages belonging to Dhanbad District. These villages were chosen because they are located in the command area of BCCL, a project was estimated to generate employment for a group of thirty women from a village. For this purpose, BCCL and JHARCRAFT entered into an agreement for implementation of the project.

Objectives of the project

1. Skill enhancement through Training and shortening the learning curve of skilled and semi-skilled women.

2. Self-Employment generation and enhancing employability of women groups in the villages.

As per the agreement with CIL, TISS was entrusted the responsibility to undertake the work of generating data through a baseline survey in the peripheral villages of BCCL. Accordingly TISS conducted a sample survey in 42 villages in and around BCCL in the year 2013 to assess community needs that could be addressed through CSR initiatives.

Based on the results of the baseline survey, a skilled development and employment generation project was envisioned for unemployed women of these villages. In order to facilitate the identified groups of women of these villages with employment opportunities, initiatives have been taken to take the help of JHARCRAFT, a Government of Jharkhand undertaking. Five groups of women each group comprising of thirty (30) women were identified at Mukunda, Alakdiha, Gareria, Panchmohali and Nootangram village.

Mukunda Training Centre

The centre was inaugurated in the month of January, 2016 and training started from the month of March, 2016. The facility was provided in the adjoining centre of Mukunda Hospital operated by BCCL. The centre is spacious to facilitate trainings and store needful logistics like raw material, equipment & finished products.

Twenty-five women have been trained and are participating in the process of manufacturing at the Mukunda Centre. They reside in the radius of five kilometers from the centre and are between twenty-five to thirty-five years old. Most are either illiterate or barely educated, only one was reported to be a graduate. The women largely belong to Other Backward Classes, Scheduled Caste and Scheduled Tribe and monthly average income ranges from Rs. 15000 to Rs. 30000 per month. According to the beneficiaries, they are currently not employed anywhere else other than the training centre. None of them have started a self-employment venture as a result of the reeling and spinning training because according to the beneficiaries, the handlooms are unaffordable for them.

The beneficiaries explained that they were uninitiated to the workings of the handloom craft and thus were hesitant to join the training and commit two years for the same. Since the beneficiaries had not contributed to the household income prior to this initiative, their family members were uncertain about the viability of the project as well. It was only after the detailed information dissemination by the „*mukhiya*" and the BCCL personnel that the women decided to join the training. The beneficiaries were also assured an increase in income as a consequence of the training program. The beneficiaries noted that their main motivation for engaging with this program was to gain a unique skill which could be used for income generation at any time in the future.

The training was conducted in a facility adjoining the Mukunda hospital operated by BCCL. The centre was found to be spacious enough to facilitate trainings and store resources. The facility houses 20 large handlooms along with a storage room for raw materials such as thread, needles, parts of the handlooms and also the finished materials. The women spent approximately five to six hours a day at the facility weaving fabrics. Even though the agreement between BCCL and Government of Jharkhand states that JHARCRAFT will be solely responsible for the purchase of the finished products and will also bring business for the beneficiaries evidence from secondary research conducted and perspectives from KIIs on the field, indicate that JHARCRAFT has been unable to uphold this aspect of the agreement in its totality. Nevertheless, JHARCRAFT has been instrumental in providing training to the beneficiaries and the trainer is still involved with the production of fabric so that he can provide assistance to the beneficiaries when required.

According to secondary research, JHARCRAFT is, however, not able to provide the optimum market for the produce of the centre. Handloom is learnt over many years whereas these women had spent only two years practicing the craft. Consequently the quality of the product was not at par with market standards On the other hand, the women expected get gainful employment after the completion of the project. Resulting in uncertainty due to the lack of it. This is also breach of contract as they agreed to sale the output of the centre. The beneficiaries unanimously noted that the trainer was a highly skilled professional trainer who had been integral in the growth of their artisan skills. They were well aware of the procedures of the agreement and the roles of JHARCRAFT and BCCL officials. In addition, they were found to have successfully grasped intricate concepts from their syllabus. They also mentioned that post the initial training period, they practiced the nuances of handloom reeling and spinning and are still in the process of honing their craft. They express their gratitude to the involved parties to help them work on the handloom machines post the training.

Apart from facilitation in acquiring a new skill, the reeling and spinning training project has also helped in self-esteem boost, development of entrepreneurship andenhancement in quality of life. The beneficiaries shared that they had never gone out of their house without a male companion but now are able to access the banking services without any assistance post the training program. They also shared instances of realizing the importance of quality education after exposure to myriad of delegates and officials from the well renowned organisations such as BCCL and their partners. The beneficiaries have now tried to chart out a plan to provide quality education to their children and hope this training program will aid them in contributing to the increase in their household income.

As regards to achievement of stated milestones, disappointment was expressed by beneficiaries, as there have been no financial gains to the women in spite of working for more than five hours a day for twenty days in the month. They earn a bare minimum income of INR 350- INR 600 per month which is less than minimum wages and far less than the benefit promised to them. Conclusively, there is a marginal increase in the household incomes as reported by the beneficiaries. Corrective measures for the same are yet to be taken from the all the stakeholders.











Pictures of jharcraft, Lodna Area

List of Environmental measure works which is being done at cluster-IX regularly

1. Air, Water and Noise monitoring by CMPDIL regularly and taking proper measures for controlling Air, Water and Noise pollution.
2. Coal Production based on calendar plan.
3. Regular Water Sprinkling for dust suppression within mine and on the main transportation road.
4. Developing green belt by avenue plantation as well as block plantation.
5. 3 tier Ecological restoration.
6. Rain water harvesting.
7. Making of embankment and toe wall.
8. Analysis of Pollution load reduction by CMPDI.
9. Tarpaulin Covered coal transportation.
10. Fire delineation study by IIT (ISM) Dhanbad and CMPDI.
11. Subsidence management.
12. Implementation of Mine closure Plan prepared by CMPDI.
13. Conducting PME/IME of workers engaged in mining activities regularly.
14. Source Apportionment Study by NEERI Nagpur.

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Study to Analyze the Extent of Reduction of Pollution Load Every Year by reducing Coal Transportation by Road

CLUSTER IX GROUP OF MINES

(NT/ST Expan. OCP, Amalgamated Joyrampur OC)

Peak Production : 8.512 MTPA
Lease Hold Area : 1942.12 Ha

Bharat Coking Coal Limited

(March, 2019)

Prepared by

Environment Division
Central Mine Planning & Design Institute Limited
CMPDI (HQ)
Gondwana Place
Kanke Road, Ranchi-834008

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Chapter – I

Introduction

1.1 Genesis:

MOEF provided Environmental Clearance to the various mines of the Cluster EC granted vide.J-11015/307 / 2010 -IA.II(M) ; dated 21st May 2013, Amended vide J-11015/307 / 2010 -IA.II(M) dated 01.03.2018 .

As per the Environmental Clearance Conditions given by the Ministry of Environment & Forest "A study should be initiated to analyse extent of reduction in pollution load every year by reducing road transport of coal". Therefore the present study has been carried out to quantify the pollution load due to coal transportation.

1.2 Methodology:

In order to find out the pollution load due to coal transportation a Questionnaire was developed by the Environment Division of CMPDI Headquarter and Regional Institute –II, Dhanbad. The Questionnaire was circulated to the various mines of BCCL for collection of the requisite inputs for this study. The quantification of pollution load for PM-10 has been carried out on the basis of the field visit, data provided by BCCL officials and interaction with them.

1.3 General Information about the Cluster:

1.3.1 Brief Description:

Cluster-IX group of mines of BCCL is a group of nine mines consisting of opencast and underground mines. BCCL is the proponent of the cluster and it is under the administrative control of Coal India Limited. Coal India Limited is a Public Sector Undertaking of Government of India and functioning under the Ministry of Coal, Govt. of India.

The history of coal mining in Jharia Coalfield was started since eighteenth century. The only energy source during those years, the mining was carried out through manual and semi-manual methods resulting into large scale degradation of land, forests and environment. The unscientific mining resulted into large scale mine fires, subsidence and land degradation. The mines of Jharia Coalfield were taken

over mines by BCCL from the erstwhile private mine owners. Most of the mines had their history from pre-nationalization period.

During the takeover of the mines in 1972 in BCCL from private mine owners, the data like leasehold area, underground mine planning, production capacity were unknown. However, most of the mines were further reorganized.

BCCL is the proponent of the cluster and it is under the administrative control of Coal India Limited.

1.3.2 Nature and Size of the Cluster:

The details of the mines showing normative/ peak productions, lease hold areas and life are given in Table no. 1.1.

Table 1.1: Details of the Mines of Cluster – IX

Sl No	Name of Mine	Production Capacity (MTY)		Lease Hold Area (Ha)
		Normative	Peak	
1	Amalgamated Joyrampur Colliery (OC)	2.512	3.25	1186.97
2	NT-ST Expansion OCP	6.0	7.8	755.15
	Total		8.512*	1942.12

*Peak of the cluster will remain same, as peak of individual will be achieved in different year.

1.3.3 Impact of Fire Control on Ambient Air Quality:

Due to unscientific mining prior to nationalization there are unstable sites identified in the BCCL. Out of 595 unstable sites identified in the Master Plan, 98 sites affected area of 2.246 Km2 consisting of 12246 no. of houses/families are affected. The affected families will be rehabilited in adjacent non coal bearing area at a cost of Rs. 126092.027 lakhs.

1.3.4 Impact of Resettlement on Ambient Air Quality:

As per Jharia Action Plan (JAP) household will be shifted for implementation of master plan. The reduction in number of households within the leasehold area of Cluster will lead to reduction in generation of air pollutants due to reduction in movement of man & materials apart from decrease in consumption of coal as a domestic fuel. As per Jharia Action Plan (JAP) household will be shifted as per for implementation.

1.4 Meteorological Data

A meteorological data generated during 1st January 16 to 31st March 2016 has been presented in this report .The micro meteorological set up was established at the roof of BCCL Dugda Guest house and parameters like temperature, relative humidity, wind speed and directions, cloud cover and rainfall were recorded. The data were collected on hourly basis during the entire study period.

Generally, moderate winds prevailed throughout the study period. The wind velocity ranged between ≤ 0.5 m/s to 13.2 m/s. The seasonal average wind speed was observed to be 0.69 m/s. Wind-roses were made by using latest WRPLOT View of Lakes Environmental Software.

The analysis of wind pattern during the season showed that the predominant wind directions were from North-West & West followed by North-East having frequencies 15.71%, 11.45% & 4.67% respectively. The receptors located in the Downwind directions i.e. SE and East from the dust generating sources are likely to be affected. The dispersion of air borne dust during calm period (45% of time) will be very poor and buildup of pollutant concentration during this period will occur.

The maximum temperature recorded was 39.3^{0}C and the minimum was 6.2^{0}C. The daily average relative humidity values were in the range of 32.2 to 65.0%. The sky was mostly clear during the study period. The average atmospheric pressure value has been found to be around 732.3 mm Hg. Total 94.5mm rainfall was recorded

during the study period. The average rainfall during the season was found to be 1.04 mm.

Table 1.2: SEASONAL WIND DISTRIBUTION

Period: 01st JAN.'2016 – 31stMAR.'2016

Wind Direction	Wind Velocity (m/s) & Duration (%)				
	< 0.5	0.6 -1.5	1.6 -3.5	>3.5	Total
N		1.61	0.78	0.00	2.38
NNE		0.83	0.37	0.00	1.19
NE		3.17	1.47	0.05	4.67
ENE		0.41	0.14	0.00	0.55
E		1.10	0.69	0.00	1.79
ESE		0.50	0.37	0.00	0.87
SE		1.28	0.41	0.05	1.74
SSE		0.64	0.18	0.00	0.82
S		0.41	0.09	0.00	0.50
SSW		0.28	0.05	0.00	0.32
SW		2.29	0.60	0.00	2.88
WSW		1.06	0.41	0.00	1.47
W		8.99	2.48	0.00	11.45
WNW		1.24	1.01	0.00	2.24
NW		11.47	4.22	0.05	15.71
NNW		2.11	3.59	0.00	5.7
CALM	44.97	-	-	-	44.97
Total	44.97	37.32	17.56	0.15	100

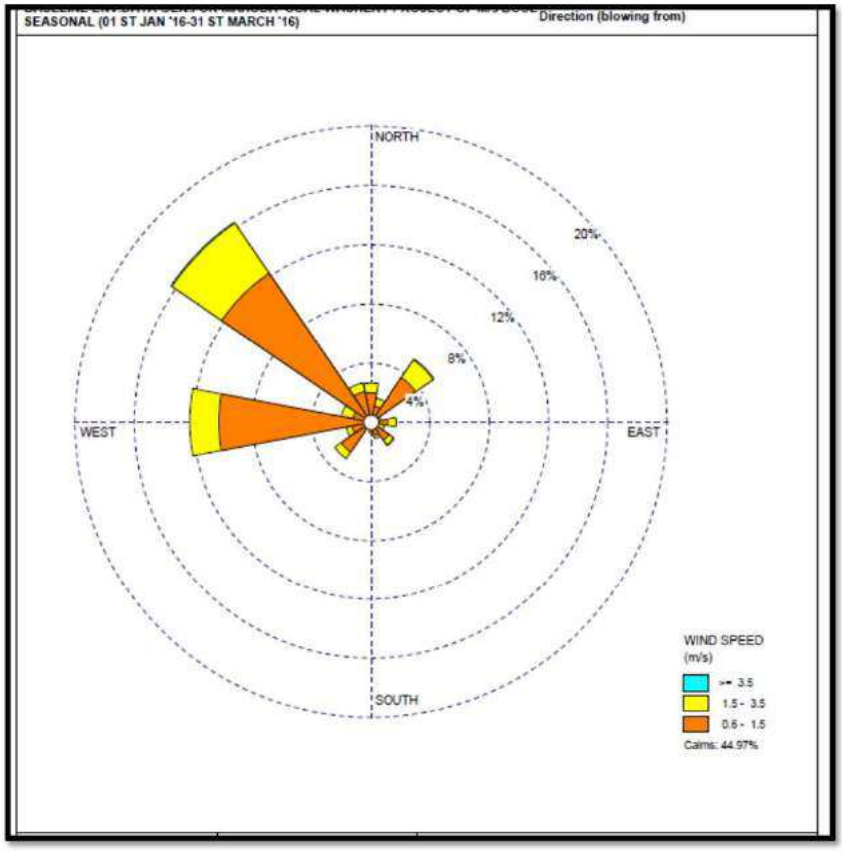


Figure No.-1.1 Wind Rose diagram for the period 1St Jan to 31St March 2016

Chapter – II

Fugitive Dust Generation Due To Movement of Coal

2.1 Introduction

The coal produced moves to the consumers via Road & Rail. Coal from the mine face is brought to the surface dumps and bulk of it goes to the nearby railway sidingsfor further movement to the consumer- end through rail. The journey from the mine face to the railway siding is covered by road. A portion of the coal produced by the mine directly goes to the consumers via road. Transportation of coal by rail is an environmentally better option than the road transportation. Road Transportation results in generation of fugitive dust from road surface apart from other pollutants released due to consumption of Diesel.

The fugitive dust generated due to coal transportation through road depend upon the following factors:

1. Speed and Weight of the moving vehicles.
2. Silt Content of the Road Dust (Particles less than 200 mesh size is considered as silt)
3. Silt loading of the road dust (Kg/m^2).
4. Moisture Content of the dust lying on the road surface.
5. Ambient Temperature, Humidity & wind velocity.

The dust generation will be lower if the quantity of dust (silt loading) lying on the road surface is minimum and the moisture content of the loose material lying on the road surface is high.

2.2 Movement of Coal

Distance travelled by coal and subsequent release of fugitive dust during its journey towards the consumer end has been described and dust load has been worked out.

2.2.1 Dust Generation :

Table: 2.1 Dust Generation (Kg/day)

						Dust generated per day (Kg/Day)					
Sl No.	Name of the Mine	Year	Location	Distance from Face to Siding (Km)	Coal Transferred (Te)	Daily Coal Production (Te/Day)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 (kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)	Dust generated Kg/per tonne
1	Amal. Joyrampur Colliery	16-17	9 no. siding	4.5	56363.00	185.41	10.00	166.87	0.53	88.441	
			Total for 16-17			**185.41**				**88.441**	0.48
2	Amal. NT-ST-JG Colliery	16-17	6/9 no. siding	3.47	3074877.00	9315.87	10.00	6465.21	0.53	3426.563	
			Total for 16-17			**9315.87**				**3426.563**	0.37
		17-18	6/9 no. siding	3.47	3324372.00	8300.45	10.00	5760.51	0.53	3053.072	
			Total for 17-18			**8300.45**				**3053.072**	0.37

* In terms of PM 10 expressed as kg/day, ** Average distance has been considered, *** Capacities of Dumpers used in transportation of coal from face to siding taken as 30Te. to Washery 20Te. and Outside Transport 15 Te. ..## Emission rate for PM_{10} has been taken from the S&T work (funded by MoC) carried out by CMPDI during 2002-2007.

2.3 Optimum Coal Transportation scheme in the Present Scenario:

Phase – I (for 10 + 05 Years)

As suggested by the Environmental Appraisal Committee, it is proposed to continue the existing Road–Rail transport network system in view of the implementation of the Jharia Action Plan (JAP) for 10 years and another 05 years gestation period after the completion of the JAP for consolidation of the backfilled dug out fire areas and unstable areas is required. Thus the period of 15 years, make the Phase – I. All mitigation measures like covered trucks, green belting on either side of the road, enhanced water sprinkling, proper maintenance of roads, removal of spilled materials etc shall be adopted for 15 years with the existing road – rails transport system.

2.4 Conceptual Plan of Proposed Integrated Coal Transportation Network for the Cluster:

Phase – II (after 15 Years):

As suggested by the EAC Members, BCCL shall implement conveyor –cum-rail transport to avoid movement of trucks within the cluster for coal transportation in Phase –II. Loading of coal by pay–loaders shall be discontinued.

During 2016-17, the combined daily coal production of the Cluster was 9501 tones resulting in 3535 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.37 kg/te.

As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 9544 kg/day for daily coal production of 25797 tonnes (0.234 MTY) during Phase –II.

Table 2.2: Proposed Infrastructure for Coal Transportation (phase – II)

Cluster	Mines in Operation in Phase - II	Production Capacity (MTY)	Proposed Transport Infrastructure in Phase – II
IX	Amalgamated Joyrampur Colliery (OC)	3.25	**Coal transport by Conveyor to Railway Siding**
	NT-ST Expansion OCP	7.8	
		8.512*	

*Peak of the cluster will remain same, as peak of individual will be achieved in different year.

2.5 Conclusion:

On the basis of the study undertaken to assess the impact of coal transportation on pollution load, the followings may be concluded:

Phase – I :(2016-17 to 2028 -29):

1. During Phase – I, business as usual (BAU) scenario will prevail and the existing road cum rail transport network system will be used for coal dispatch to the consumers. During 2016-17, the combined daily coal production of the Cluster was 9501 tones resulting in 3515 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.37 kg/te.
2. The generation of fugitive dust due to transportation of coal by road can be further reduced by enforcing covering of loaded trucks, periodical removal of loose materials lying on the road surface and black topping of coal transportation roads.
3. Avenue plantation, effective wetting of the road surface and proper maintenance of roads will further result in mitigation of the impact of road generated dust on ambient air quality.
4. Better road condition, by the use of Mechanical Sweeper or vacuum cleaner dust generation may be minimized.

Phase – II :(From 2029-30 Onwards):

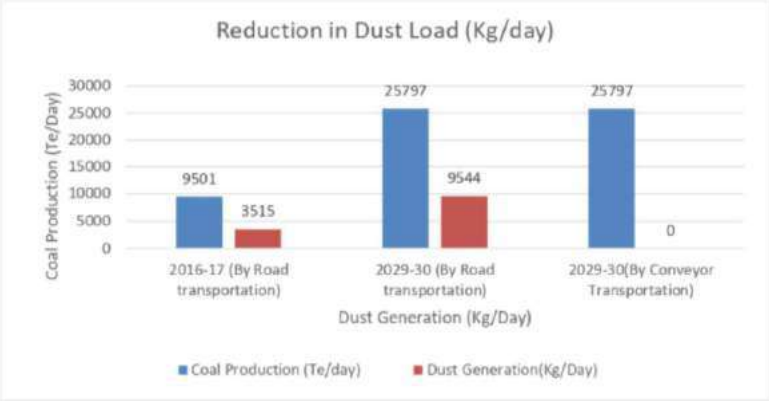
1. As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 9544 kg/day for daily coal production of 25797 tonnes (0.234 MTY) during Phase –II.
2. During Phase –II, dust load will further reduce due to quenching of mine fire and domestic coal consumption after resettlement of general population dwelling within the command area of cluster, as a result of implementation of Jharia Action Plan. It will result in significant improvement in ambient air quality.

3. **Coal Production Vs. Dust Generation due to Road Transportation is presented below:**

Table2.3: Coal Production Vs. Dust Generation due to Road Transportation

Year	Coal Production (Te/day)	Dust Generation(Kg/Day)
2016-17 (By Road transportation)	9501	3515
2029-30 (By Road transportation)	25797	9544
2029-30(By Conveyor Transportation)	25797	0

Figure 2.1: Presentation of reduction in dust generation due to replacement of Road transportation by Conveyor system.


Reduction in Dust Load (Kg/day)
Coal Production (Te/Day)
30000
25000
20000
15000
10000
5000
0
9501
3515
25797
9544
25797
0
2016-17 (By Road transportation)
2029-30 (By Road transportation)
2029-30(By Conveyor Transportation)
Dust Generation (Kg/Day)
Coal Production (Te/day)
Dust Generation(Kg/Day)

(7)

Ph: 0326-2204933

झारखण्ड राज्य प्रदूषण नियंत्रण पर्षद्

Jharkhand State Pollution Control Board

HIG-1, Housing Colony, Dhanbad-826001

Letter No.....2650 Dated .....6/7/13.....

From,

Regional Officer,
Dhanbad

To,

HOD (Envt.),
M/s. B.C.C.L.,
Koyla Bhawan, Koyla Nagar,
Dhanbad.

Sub: **Fixing up monitoring station/Sampling location of Air, Water & Noise.**

Sir,

With reference to you letter no. GM(Env.)/F-JSPCB/2013/783, dt. 06.07.2013 We have approved Air, Water & Noise monitoring Station/Sampling location after verification and return a copy of the map.

Encl-A/a.

Your's faithfully,

6/7/13

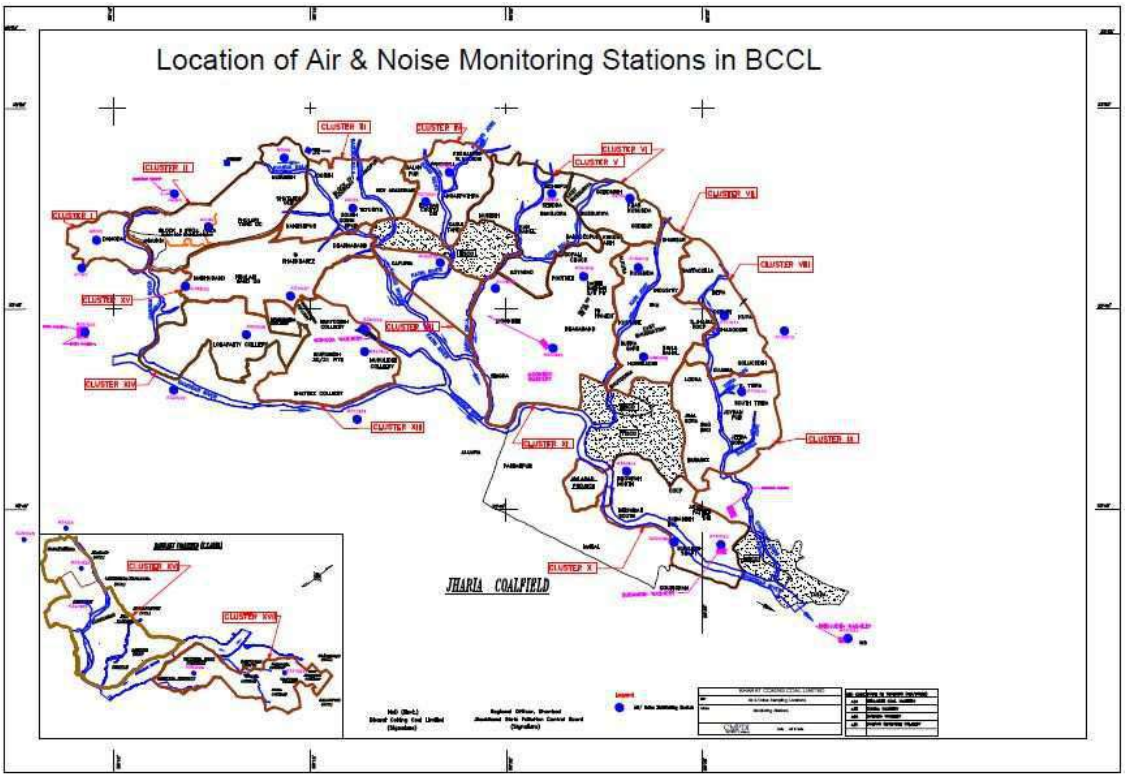
(Dinesh Prasad Singh)
Regional Officer.

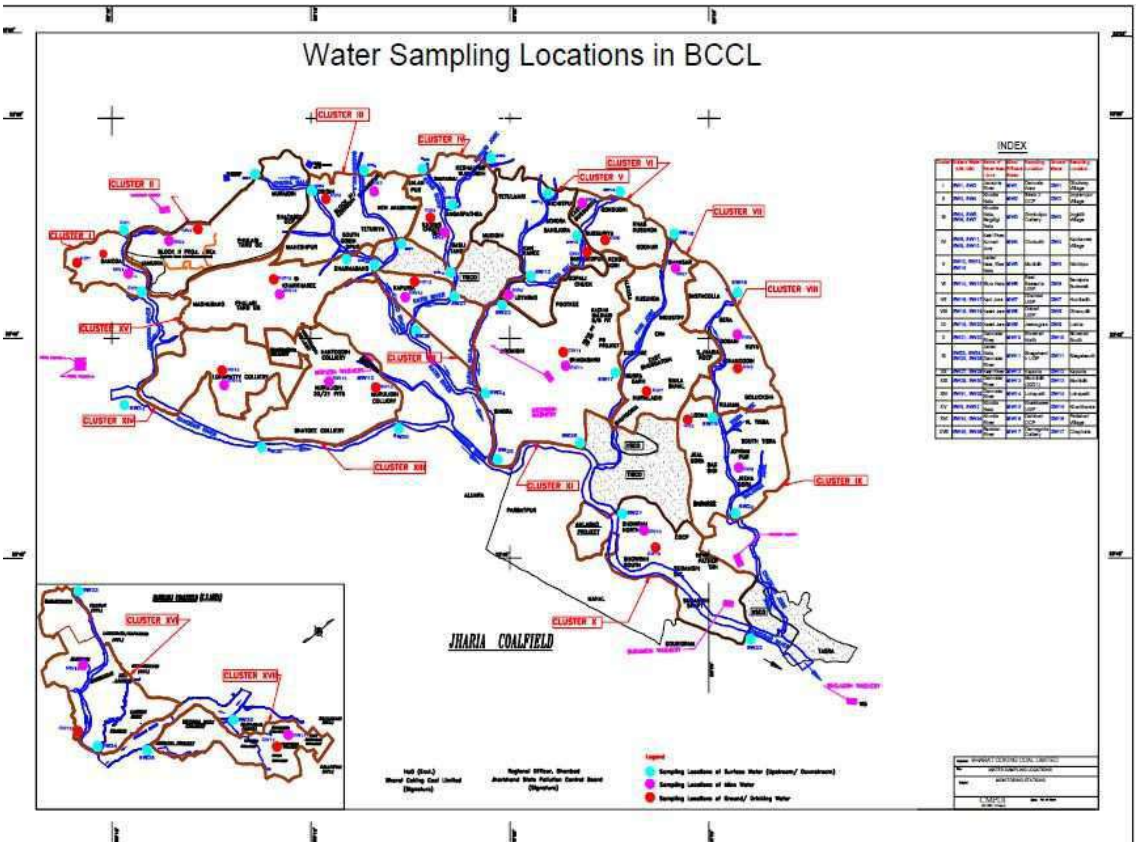
Memo..... Dhanbad, dated.....

Copy to: The Member Secretary, Jharkhand State Pollution Control Board for information & enclose a copy of the map for necessary action.

Encl-A/a.

(Dinesh Pd. Singh)
Regional Officer.


Location of Air & Noise Monitoring Stations in BCCL
JHARIA COALFIELD


Water Sampling Locations in BCCL
INDEX
JHARIA COALFIELD

Progress Report

1st Phase Air Monitoring report for

"Source apportionment of ambient air particulate matter in Jharia coalfields region, Jharkhand"

Sponsor

Bharat Coking Coal Limited (BCCL)

CSIR-National Environmental Engineering Research Institute, Nagpur

2019

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1. Introduction

1.1 Project Background

Bharat Coking Coal Limited, a subsidiary of Coal India Limited, has been operating the majority of the coal mines in the Jharia coal field regions since its inception in 1972. Jharia coal mines are special for its low ash content and high calorific value coals. Therefore, they are often used directly in iron and steel plants for metal oxide reduction after washing. Although these coal mines are highly priced for their high quality coal, they are notorious for their mine fires, which causes lot of fugitive gaseous and PM emissions. Hence, Jharia region has been under scrutiny by various public authorities and common public with a vision to improve the ambient air quality.

Various sources contribute to high particular matter concentration in the Jharia region: vehicles, mining activities, re-suspended dusts, fugitive emissions, fuel oils, household LPGs, etc. The percentage contribution of these factors in the ambient depends exclusively on the economic activities of that particular region. In order to improve the existing ambient air quality, the major sources of PM emissions first need to be identified. Hence, the environmental clearance committee of MoEF has directed BCCL to conduct a source apportionment study for particulate matter. In this context, BCCL has approached CSIR-NEERI to conduct a source apportionment study of ambient air particulate matter in Jharia coalfields region in order to quantify the various sources PM emissions and suggest an effective environmental management plan.

1.2 Project objectives

The major objective of the study is to assess the current ambient air quality, sources of air pollution and propose the priorities for the actions for improvement of air quality. The study to include the entire Jharia Coalfield along with area up to 10 Km from the periphery / boundary of BCCL mines.

The detailed objectives are as following:

i. Ambient Air Monitoring

- ✓ Monitoring of ambient air quality at selected receptor locations for pollutants including PM10, PM 2.5(limited), SO2, NOx, PAHs to establish the status of the air quality in Jharia Coalfields along with area up to 10 K.M from the periphery/boundary of BCCL mines. Also, review of the available air quality monitoring data from Central Pollution Control Board (CPCB) /Jharkhand State Pollution Control Board (JSPCB).

- ✓ To calibrate dispersion modelling predictions using measured air quality parameters.

- ✓ To draw supportive data through specific site related monitoring regarding impact causing sources such as kerbside monitoring.
- ✓ To establish the impact of meteorological conditions on a few select indicator pollutants in different micro meteorological conditions of the Jharia Coalfields.

ii. Emission Inventory related of Jharia Coalfields along with area up to 10 Km from the periphery / boundary of BCCL mines.

- ✓ To identify the pollution load grid wise for point, line and area source
- ✓ To establish possibilities of receptor level concentrations of air pollutants by matching dispersion modelling and air quality-monitoring data.

iii. Source apportionment related

- ✓ To identify and apportion the pollution load at receptor level to various sources in the Jharia Coalfields along with area up to 10 Km from the periphery / boundary of BCCL mines.
- ✓ To carry out the source apportionment using molecular markers for a limited number of samples through a time resolved sample collection at various period of the day and day-of-the-week.

iv. Any other item in consensus between both BCCL/CIL & NEERI evolved during the study.

2. Field visit

In connection with the above objectives, the NEERI's team and BCCL's team visited BCCL's Jharia coal filed for 3 days from 23 September to 27 September 2018. The team covered the entire Jharia coalfield, which spans roughly 30km in length and 22 km wide in three days with the following purpose.

To identified the location for air monitoring station in entire Jharia Coal Field region.

2.1 Jharia coalfield maps:

BCCL environmental department provided the map of the Jharia region. The site visit was carried out with assistance from BCCL's team. The 15 Jharia mines coal fields were segregated into three parts and details of the visit along with mine cluster names are given in Table 2.1.

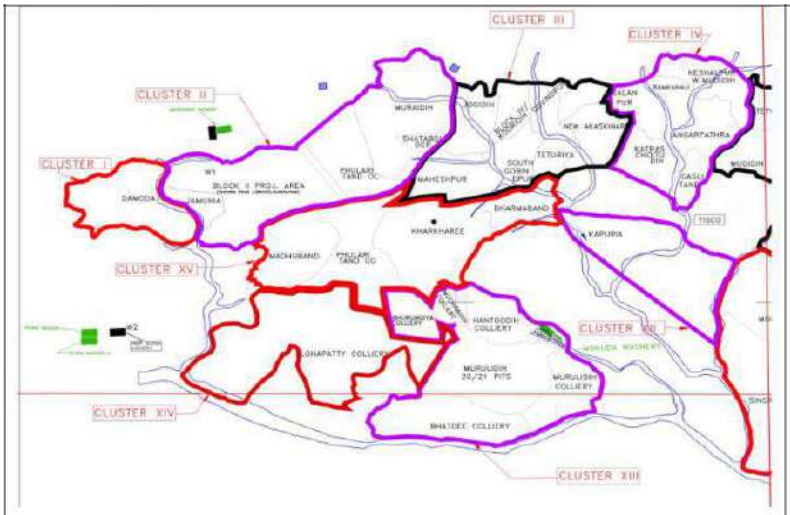
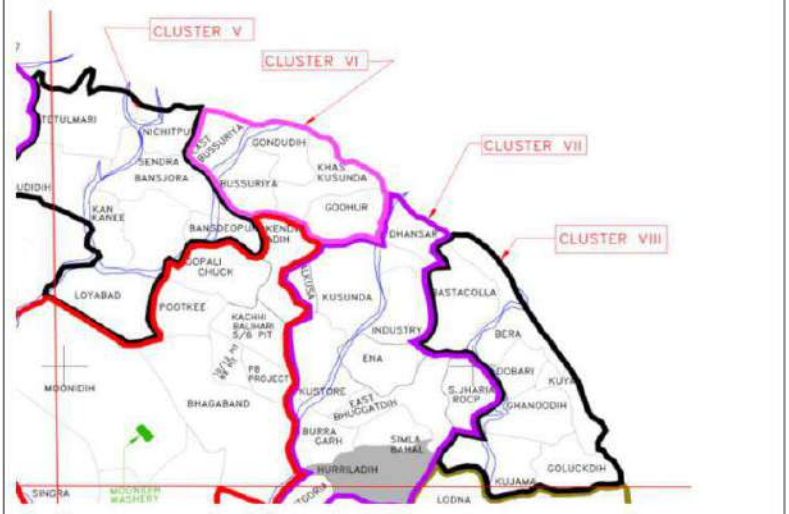
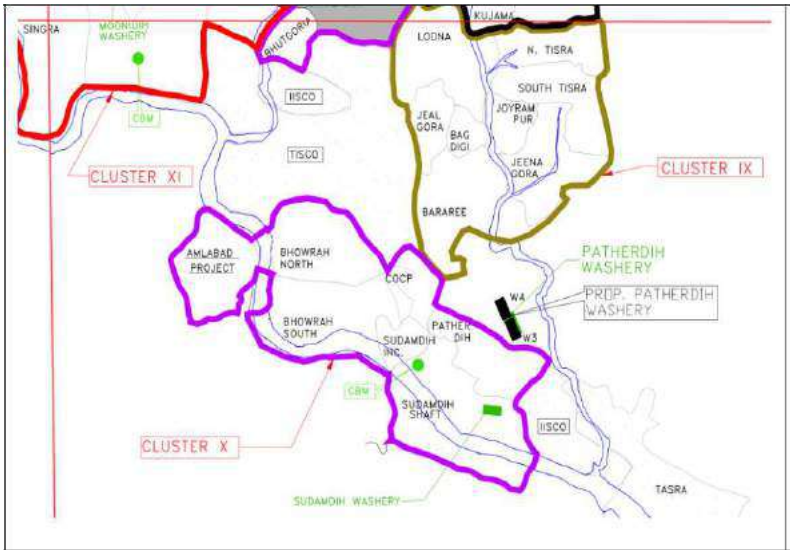
 	**Part 1:** Cluster VI, VII, VIII, and X **Part 2:** I, II,III, IV, V, XI, XII, XIII, and XV
	**Part 3:** Cluster IX

Table 2.1 Jharia coalfields Site visit on cluster-base

Based on the objectives and outcomes envisaged, the various mine areas were visited to identify sources of emissions such dumpsite emissions, fugitive emissions, blasting emissions. Furthermore, the already existing PM monitoring sites of BCCL were also visited to explore of possibility of installing NEERI's PM monitoring stations.

2.2 Site Identification:

The Entire Jharia Coal Field (JCF) is divided into 16 clusters. Both opencast and underground mines are operational in JCF. Standard mining operations like drilling, blasting, hauling, accumulation, and transfer are the major sources of emissions and air pollution. Apart from that, a typical emission source, mine fire, is prevailing at JCF. Besides, JCF encompasses large non-mining regions, which have their own emission sources like vehicular emission in congested traffics, road dust, Power Plant emission, other industrial emissions (coke oven plants, brick kilns, stone crushers, etc.), crematoria, domestic burning, open burning etc.

Based on the preliminary field visit by CSIR-NEERI Scientists along with BCCL staffs, the following locations are selected for the establishment of Air Quality Monitoring Stations for source apportionment study;

Core Zone

1. Cluster XIV (Lohapatty) – nearby sources: Chandrapura Thermal Power Plant
2. Cluster VII (Mine rescue station)- nearby sources: Coal Mine, Industry
3. Cluster IV or Cluster V – Banssuriya or Katras
4. Cluster IX (Lodhna)
5. Cluster XI (Moonidih)
6. Cluster X (Patherdih): nearby sources: Coal Mine, Steel Industry
7. Cluster VIII (Bastacola)

Buffer Zone

8. Bank More
9. Harina
10. Bhuli
11. Sindri
12. Parbatpur Electrosteel/ Bhaga

13. Background site (Upwind & away from sources) and also secondary Data from DVC, CCL mines Sail Bokaro and Jharkhand pollution Control Board will be obtained.

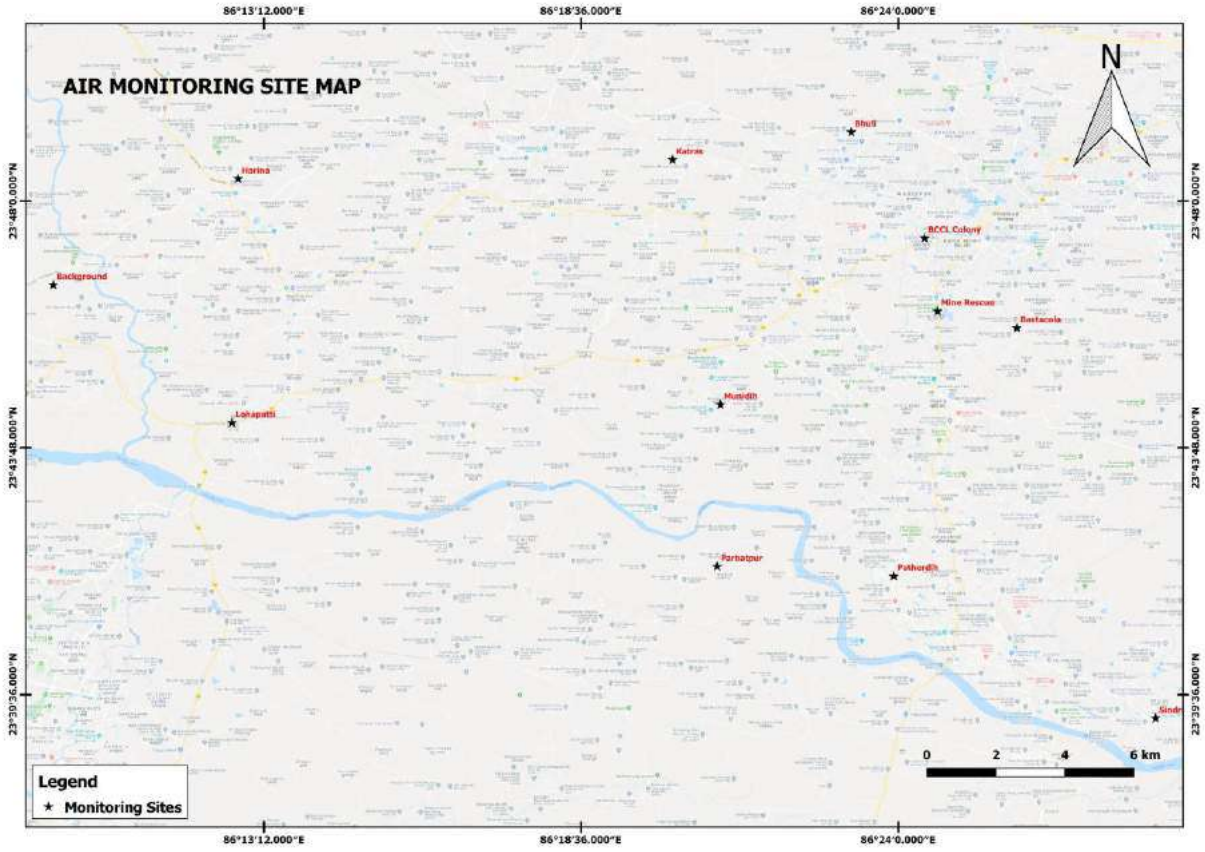


Figure2.1 Identified air monitoring station in Jharia Coalfield

3. Sampler Selection and Procurement

Standard equipment were catered for the parameter required towards ambient air particulate characterization and gaseous sampling in the initial phase of the project.

Table 3.1 Samplers Procured for Monitoring

Sampler	**Brief Description of operating conditions**
Fine Dust Sampler	Sampling Inlets- $PM_{2.5}$, PM_{10} and TSP Flow rate-16.7LPM
FRM Sampler	Versatile inlet configurations for $PM_{2.5}$, PM_{10}, or TSP sampling FRM quality 24-hour sampling at 16.7 LPM
Gaseous Sampler	Sampling Rate-0.5-1.0 LPM Operation time-8 hours

4. Monitoring parameters

Parameters of monitoring were decided based on the objectives of air pollution and source apportionment study. The source apportionment analysis required air monitoring for particulate matter ($PM_{2.5}$ and PM_{10}) and its chemical speciation to develop signature profiles of pollution sources that can be used in chemical mass balance models. The analysis data could also be used to interpret the overall loading of different chemicals contributed varied sources. Monitoring included air quality attributes such as Particulate matter, Sulphur Dioxide (SO_2) and Oxides of Nitrogen as NO_2, to understand not only the regulatory compliance but also their inter-correlations with other species such as Heavy metals, EC, OC etc. Since the objective of source apportionment study is to determine the contributions from various sources such as industries, vehicular and other area sources additional parameters were also monitored such as Polycyclic Aromatic Hydrocarbons (PAHs). List of all parameters, sampling flow rate and analytical methods are provided in Table 4.1

Table 4.1 Ambient Air Quality Sampling/Analysis Methodology for Target Pollutants

Particulars	Parameters			
	PM_{10}	$PM_{2.5}$	NO_2	SO_2
Sampling Instrument	Fine Dust Sampler & FRM Sampler	Fine Dust Sampler & FRM Sampler	APM sampler	APM sampler
Sampling Principle	Cyclonic Flow Technique	Cyclonic Flow Technique/ WINS Impactor	Chemical absorption in suitable media	Chemical absorption in suitable media
Flow rate	16.7 LPM	16.7 LPM	0.5 LPM	0.5 LPM
Sampling Period	24 hourly	24 hourly	8 hourly	8 hourly
Sampling Frequency	10 days continuous, Teflon and quartz on alternate days	10 days continuous, Teflon and quartz on alternate days	10 days continuous	10 days continuous

Analytical Instrument	Electronic Micro Balance	Electronic Micro Balance	Spectrophoto-meter	Spectrophoto-meter
Analytical Method	Gravimetric	Gravimetric	Colorimetric Improved West & Gaeke Method	Colorimetric Improved West & Gaeke Method
Minimum reportable value	5 $\mu g/m^3$	5 $\mu g/m^3$	9 $\mu g/m^3$	4 $\mu g/m^3$

4.1 Monitoring Frequency

All pollutants exhibit diurnal and seasonal variations, which have been taken into account while determining the frequency of the sampling. In order to assess the impact of the diurnal variations in source contributions for a given meteorology of the day, 24 hourly monitoring plan was envisaged (8 hourly sampling for gaseous pollutants and 24 hourly sampling for particulate matter). The field study was planned for a period of 10 days at each monitoring site for the season to represent variation in air quality. The sampling frequency details are presented in Table 4.1.

Table 4.1.1 Frequency of Air pollutants sampling in Jharia Coalfield

Parameter	Number of Days	Change of Filter/ absorbing media	Reporting
PM_{10}	10	24 hourly, Teflon: 05 days Quartz: 05 days	24 hourly
$PM_{2.5}$	10	24 hourly Teflon: 05 days Quartz: 05 days	24 hourly
NO_2	10	8 hourly	8 hourly
SO_2	10	8 hourly	8 hourly

The glimpses of air monitoring of some locations are shown in Figure 4.1.



Kataras



Lodhana



Moonidih



Patherdiha



Bastacola



Sindri

Figure 4.1 Glimpses of air monitoring of some locations

4.2 Filter handling and Weighing:

Teflon-membrane and quartz-fibre filter are most commonly used for chemical analysis. Each filter was individually examined prior to labelling for discoloration, pinholes, creases, separation of ring, chaff or flashing, loose material, or other defects.

Gravimetry measured the net mass on a filter by weighing the filter before and after sampling with balance in temperature and relative humidity controlled environment. To minimize particle volatilization and aerosol liquid water bias, $PM_{2.5}$ Filters were equilibrated for 24 hours at a constant (within ±5%) relative humidity between 30% and 40% at a constant (within ±2°C) temperature between 20°C and 23°C. PM_{10} filters were equilibrated at 20% to 45% relative humidity (±5%) and 15°C to 30°C temperature (±3°C).

Methods of Chemical characterization:

Sulphur dioxide (SO_2)	: Modified West and Gaeke method
Nitrogen dioxide (NO_2)	: Sodium Arsenite method
Suspended Particulate Matter (SPM)	: High Volume method (Gravimetric method)
Respirable suspended Particulate Matter (RSPM)	: Gravimetrically with GFA/EPM 2000 filter paper using respirable dust sampler (Cyclonic Flow Technique)

5. Ambient Air Quality Monitoring

Core Zone

Site 1: Cluster XIV (Lohapatty)

The samplers were installed on the roof of area office of Lohapatty (Latitude 23.737066 and Longitude 86.210894). It was located near residential colony. Coal mine was 1 km away from the sampling site. Coal has been transported through railway line which is 1.5 km away on a daily basis and also through trucks. NH-32 construction was going on 500 m away from the site. The major fuel used for cooking is coal in the study area.

Site 2: Cluster VII Mine rescue Station

Monitoring station was positioned in Mine rescue station, Dhansar on the roof of office building (Latitude 23.768746 and Longitude 86.411141). Mine rescue station is next to

the state highway 12 where continuous movement of heavy vehicles takes place. Mining activities were also observed nearby the location.

Site 3: Cluster V Katras

In Katras, samplers were installed at Expert hostel (Latitude 23.811692 and Longitude 86.335910). There was a settlement residential area nearby. Mining activities was in progress within 500m area. Railway track was nearly at 150m distance from the site. Coal was used for cooking. Many other activities were observed during sampling in the nearby area which may contribute. 'Mela' and continuous 'Hawan' were going on within 100m area. Also road construction was in progress near 7km.

Site 4: Cluster IX (Lodhana)

Samplers were installed at office in Lodhna (Latitude 23.721713 and Longitude 86.410260). Near Lodhna, colliery was 2 km away from the site. Nearest Railway track was 1.5 km away. Coal was mostly used for cooling.

Site 5: Cluster XI (Moonidih)

Moonidih mine is one of the underground mine of BCCL. Sampler was stationed in Area office of Moonidih mine (Latitude 23.742228 and Longitude 86.349494). Since monitoring location was 250-300m from the mine, movement of heavy vehicles was continuous. There is washery also at distance of 500m where trucks and conveyor were used for transportation of coal. So the mining activities nearby contributes to particulate matter emission.

Site 6: Cluster X (Patherdih)

Samplers were stationed in guest house of BCCL in Patherdih area (Latitude 23.693577 and Longitude 86.398728). It is situated beside highway where continuous movement of heavy vehicles observed. TATA steel coal mine is situated 1km away from the location where continuous mining activities takes place. Transportation of coal through railway wagons in same area also contributes to particulate matter emission.

Site 7: Cluster VIII (Bastacola)

The samplers were positioned in area office of Bastacola mine (Latitude 23.763966 and Longitude 86.433635). Here also, coal was used as a cooking media. Railway track was

at Jodaphata which was 3-4 km away from the site. Residential area was nearly 0.5-1km. Mine was situated 3km from the site but no Mining activity was observed during monitoring.

Buffer zone

Site 8: Bank More (BCCL Colony)

Sampling station was installed in BCCL colony, Jawahar Nagar on the roof of a resident (Latitude 23.789463 and Longitude 86.407448). No mining activities were observed but the colony was beside the NH 18 highway so it may contribute to particulate matter emission.

Site 9: Harina

At Harina, the site chosen for air sampling was BCCL colony (Latitude 23.806308 and Longitude 86.212641). Since it was BCCL residential area, fuel used for cooking purpose was LPG. Settlement residential area was observed nearby where coal was used as a media for cooking. Colliery and Railway track were 3km and 2 km away from the site respectively. Highway was 1km away from the site and Coal washery at distance of 4.5km.

Site 10: Bhuli

The samplers were installed on the roof of Saraswati Vidya Mandir, Bhuli (Latitude 23.819554 and Longitude 86.386647). The location was in residential area. Mining activity was going at a distance of 8-10km. A closed Brick factory was located in the nearby area. Fuel used for cooking was mostly coal. Railway track used for coal transportation was 4km from the site. Construction of highway was also going on within 1.5km area during the monitoring.

Site 11: Sindri

Air samplers were installed at BIT Sindri college campus (Latitude 23.653214 and Longitude 86.473022). Transportation of coal was done by railway wagons at distance of 2km from monitoring site. LPG was mostly used for cooking rather than coal. A construction activity was going on nearby. The site was near the highway at a distance of <100m.

Site 12: Parbatpur

The sampling station was installed on roof of a house (Latitude 23.696296 and Longitude 86.348609). Mining activity was no longer going nearby. Coal was primarily used for cooking.

Site 13: Background

The air monitoring samplers were installed on roof of resident's house which was near to the highway at a distance of less than 1 km (Latitude 23.776180 Longitude 86.160177). Construction activities were going on nearby the location. Heavy rainfall also occurred during monitoring period. Mine activities were also observed in radius of 2-3km. Settlement resident's uses coal for cooking purposes.

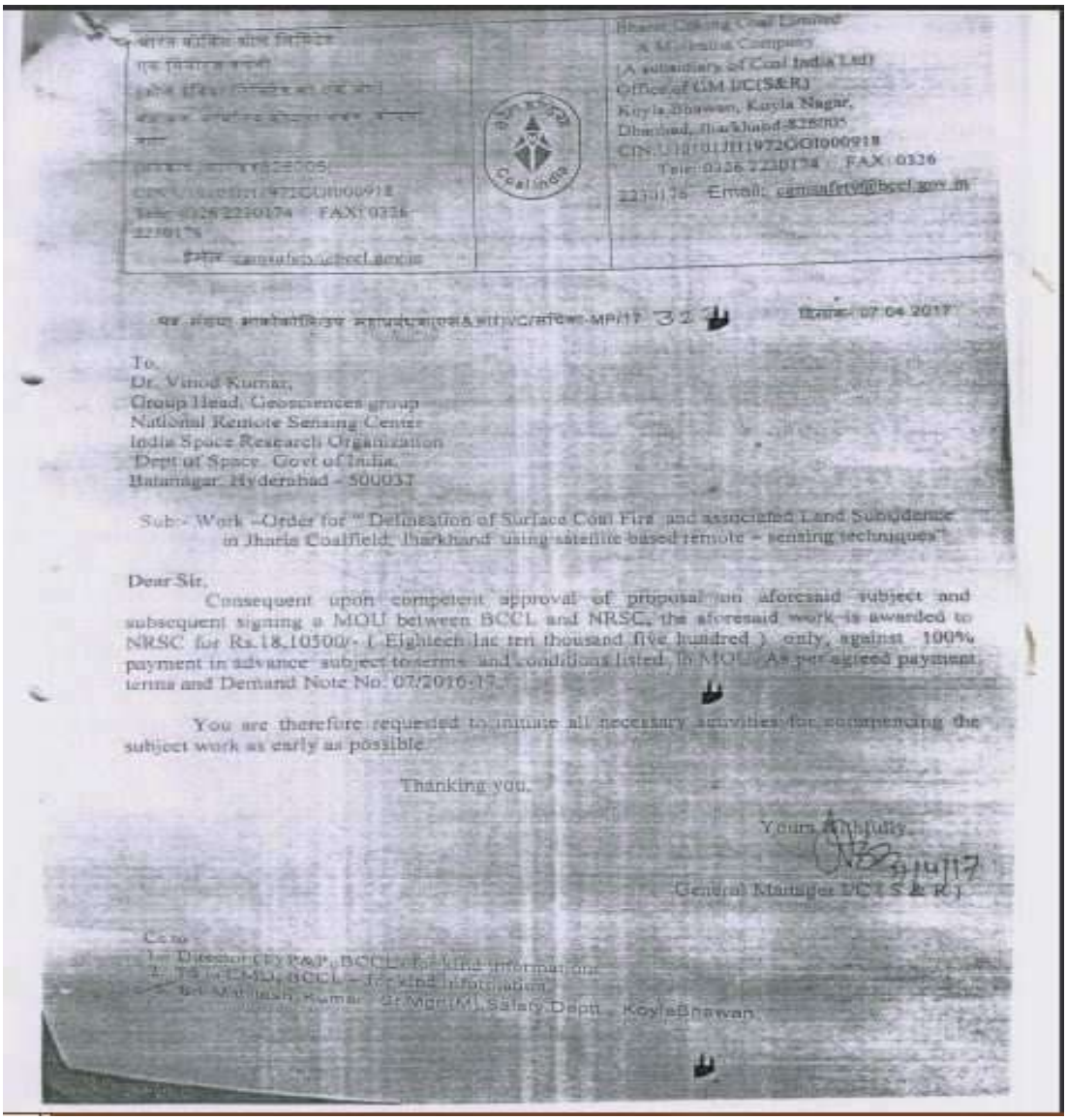
Sample collection Transportation and Preservation

Ambient $PM_{2.5}$ and PM_{10} samples were collected using suitable sampler at a desired flow rate. Filters were wrapped carefully with aluminium foil and stored in re-sealable plastic bags. At sampling site, the filter that collected the particle sample on the previous day was taken out of the filter holder and immediately wrapped with aluminium foil and sealed. The sample filers were transported back to the laboratory in an isolated cooler container with ice and then frozen at -10°C until analysis.

Table 5. 1 Physical and Chemical components for characterization of Particulate matter

Components	**Filter Matrix**	**Analytical Methods**
PM10/ PM2.5	Teflon/Quartz filter paper	Gravimetric
Elements (Na, Mg, Al, Si, P, S, Cl, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Br, Rb, Sr, Y, Zr, Mo, Pd, Ag, Cr, Cd, In, Sn, Sb, Ba, La, Hg, Ti, and Pb)	Teflon/Quartz filter paper	ICP-OES
Ions ($NO2^-$, $NO3^-$, SO_4^{-2}, K+, NH^{4+}, Na^+)	Teflon/Quartz filter paper	Ion chromatography with conductivity detector
Carbon Analysis (OC, EC)	Quartz filter paper	TOR/TOT method
PAHs	Teflon/Quartz filter paper	Extraction followed by GC-MS analysis with and without derivatization

Annexure X



Bharat Coking Coal Limited
A Miniratna Company
(A subsidiary of Coal India Ltd)
Office of GM DC(S&R)
Koyla Bhawan, Koyla Nagar,
Dhanbad, Jharkhand-826005
CIN: U10101JH1972GOI000918
Tele: 0326 2230174 FAX: 0326
2230174 Email: cgmsafety@bccl.gov.in

Dhanbad, 07.04.2017

To,
Dr. Vinod Kumar,
Group Head, Geosciences group
National Remote Sensing Center
Indian Space Research Organization
Dept of Space, Govt of India,
Balanagar, Hyderabad - 500037

Sub:- Work –Order for " Delineation of Surface Coal Fire and associated Land Subsidence in Jharia Coalfield, Jharkhand using satellite based remote – sensing techniques".

Dear Sir,

Consequent upon competent approval of proposal on aforesaid subject and subsequent signing a MOU between BCCL and NRSC, the aforesaid work is awarded to NRSC for Rs.18,10500/- (Eighteen lac ten thousand five hundred) only, against 100% payment in advance subject to terms and conditions listed in MOU. As per agreed payment terms and Demand Note No: 07/2016-17.

You are therefore requested to initiate all necessary activities for commencing the subject work as early as possible.

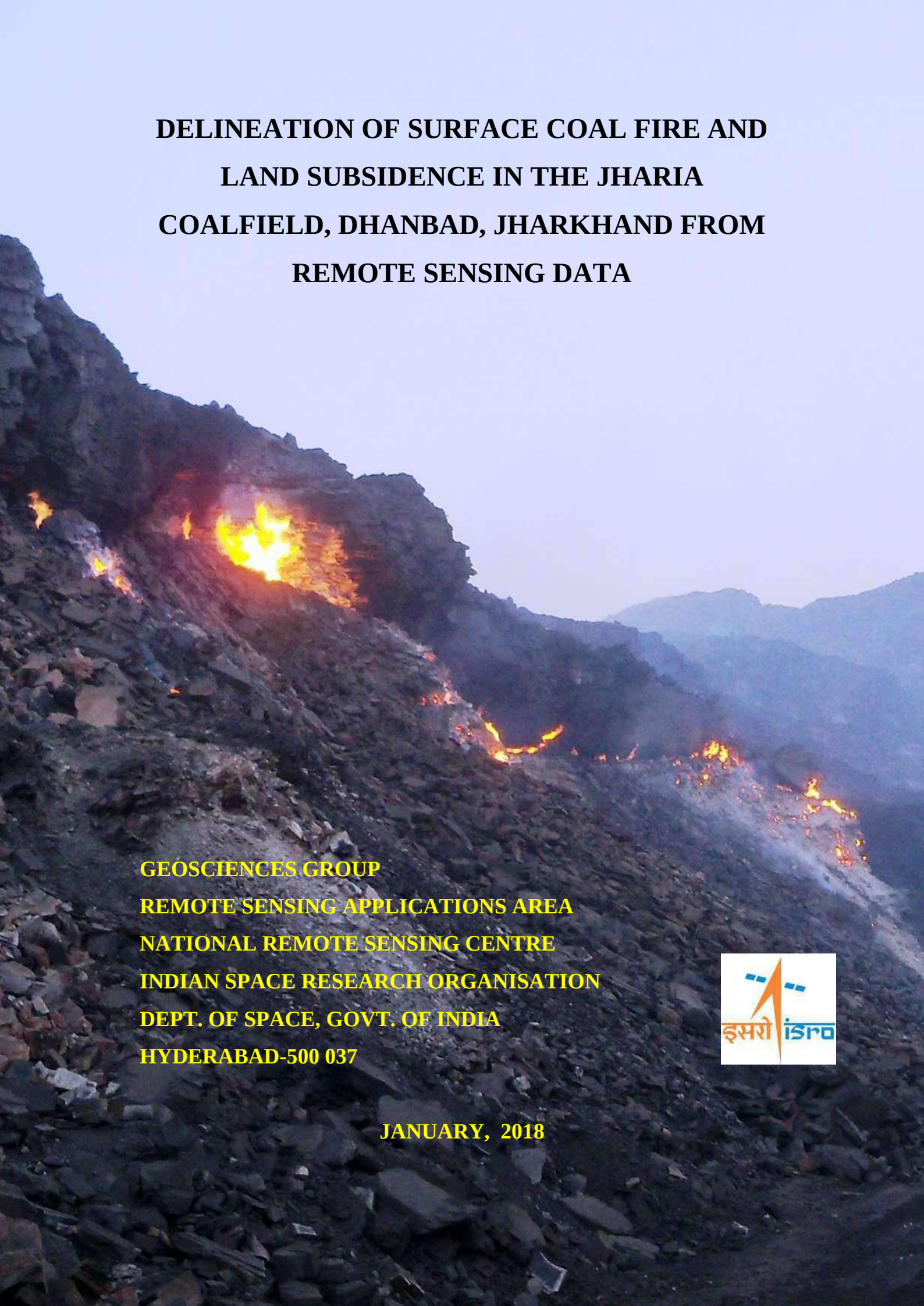
Thanking you,

Yours faithfully,

General Manager DC (S & R)

Copy to :
1. Director (T) R&P, BCCL – for kind information.
2. PA to CMD, BCCL – for kind information.
3. Sri Mahesh Kumar, Sr Mgr (M), Safety Dept., KoyleBhawan.

DELINEATION OF SURFACE COAL FIRE AND LAND SUBSIDENCE IN THE JHARIA COALFIELD, DHANBAD, JHARKHAND FROM REMOTE SENSING DATA



GEOSCIENCES GROUP

REMOTE SENSING APPLICATIONS AREA

NATIONAL REMOTE SENSING CENTRE

INDIAN SPACE RESEARCH ORGANISATION

DEPT. OF SPACE, GOVT. OF INDIA

HYDERABAD-500 037

JANUARY, 2018

DELINEATION OF SURFACE COAL FIRE **AND** LAND SUBSIDENCE IN THE JHARIA COALFIELD, DHANBAD, JHARKHAND FROM REMOTE SENSING DATA

Report for

BHARAT COKING COAL LIMITED (BCCL)

(A SUBSIDIARY OF COAL INDIA LTD.)

ENVIRONMENT DEPARTMENT, KOYLA BHAWAN

KOYLA NAGAR, DHANBAD – 826 005, JHARKHAND

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HYDERABAD-500 037

JANUARY, 2018

PROJECT TEAM

1. **Dr. K VINOD KUMAR**, Group Head, Geosciences Group
   Project formulation and coordination
2. **Dr. Tapas R. Martha**, Scientist 'SF'
   Field survey and report preparation
3. **Shri Priyom Roy,** Scientist 'SD'
   Image processing, interpretation, field survey, maps and report preparation

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ACKNOWLEDGEMENTS

The project team is grateful to Dr. Y.V.N. Krishnamurthy, Director, NRSC, for his support at various stages during execution of this project. We are extremely grateful to Dr. P.V.N. Rao, Deputy Director (RSAA), NRSC for his overall guidance and encouragement. We thank Shri D. Gangopadhyay (Director, P&P). BCCL, for this project initiative and for providing Geosciences group, NRSC, the opportunity to carry out the task. We are thankful to Shri A. K. Singh (GM, I/C), BCCL for taking keen interest in the project work and for the support during our fieldwork. We also thank Shri Dipankar Maity, Surveyor (Mining) and Shri Mithilesh Kumar, Sr. Manager (Mining) for their support and fruitful discussion during the fieldwork. The support of all the BCCL officials in the various collieries visited during the course of the ground truth verification is duly acknowledged.

EXECUTIVE SUMMARY

Coal fire is a serious problem in Jharia coal field, where high ranking coals are gradually burnt due to these fires. The combined effect of surface and sub-surface fires and mining related subsidence has endangered the environmental stability of Jharia coal field. Coupled with the ecological changes instigated by open cast mining, the landscape in and around Jharia have changed drastically over the years. In the present study, delineation of coal fire and mining related land subsidence have been addressed. Thermal band of Landsat-8 (100m resolution) have been used to demarcate the coal mine fire areas from non fire areas. For this study, Landsat-8 data of May, 2017 have been used. The band 10 (10.60-11.19 μm) of Landsat-8 data is used to derive the relative radiant temperature. Further ALOS-PALSAR 2, L band microwave data has been used to delineate zone of probable land subsidence (using differential interferometry) due to mining. The study reflects that, compared to 2012, the eastern flanks (Lodna and Tisra) show a larger fire area. The western flank (Nadkhurkee and Shatabdi) and the northern flank (Katras and Gaslitand) show isolated fire pockets in active mines as well as OB dumps. Among all the colliery areas, Kusunda and Lodna area is most affected by coal mine fire. The current fire area mapped is 3.28 sq.km. Apart from this, five distinctive areas of land subsidence have been identified using interferometric method. These are primarily caused by older or active underground mining. The Moonidih Project is most affected by subsidence. The coal mine fire and subsidence areas are further verified on the ground. The final coal mine fire and subsidence map of Jharia coal field is prepared by using remote sensing data analysis with field validation.

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CHAPTER I

INTRODUCTION

Coal fire is a perennial problem in Jharia coal field (JCF) covering 447 sq. km. area in the Dhanbad district of Jharkhand state. Subsurface and surface coal fires are a serious problem in many coal-producing countries. The severity and extent of mine fires in some of the Indian coalfields, particularly Jharia and Raniganj coalfields, are quite alarming. Combustion can occur either within coal or in coal dumps on the surface. Considerable economic loss and environmental problem arises due to the coal fire. Coal fire burns valuable coal and also creates difficulties in mining by increasing the cost of production or making existing operations difficult. Noxious gases like sulphur dioxide, nitrogen oxide, carbon monoxide, carbon dioxides, which are the result of coal burning processes, often affect the immediate surroundings of an active coal fire area (Gangopadhyay, 2003). These greenhouse gases not only affect local atmosphere but also play a crucial role in the damages, found associated with coal fire such as land surface subsidence and surface cracking. Coal fires are caused by oxidation of coal but the reaction involved in oxidation of coal is not understood till date. Broadly, the potential for spontaneous combustion lies in its ability to react with oxygen at ambient temperature. This occurs through the reaction of oxygen at the surface of the coal resulting in an exothermic reaction. As a consequence, the temperature of coal rises and if temperature reaches the threshold temperature, ranging between 80^0 to 120^0C, a steady reaction starts, which produces carbon dioxide. Temperature keeps on increasing once CO_2 started to form and at 2300°C, the exothermic reaction becomes rapid. It is known that high grade coals (high carbon content) are more fire prone, though the reason behind this is not well understood. Another important parameter, which controls fire, is the size of the particles. Larger the effective area of coal (fire particles), more rapidly the reaction proceeds. Cracks, fissures play a role like positive catalysts to coal oxidation by slowly supplying oxygen / air through their conduits.

Coal mining in Jharia Coal Field (JCF) started way back in 1895. History of fire in Jharia Coal Field date back to 1916 when the first incidence of fire was reported from XIV seam of Bhowrah colliery. JCF was nationalised in 1972 and over the decades, the fire has spread or been contained but never extinguished. The combination of underground fire and subsidence have affected vast areas of JCF.

1.1 Background

Remote sensing technique in thermal band offers a cost-effective and time-saving technology for mapping various geoenvironmental / hazardous features such as coal fires, forest fires, oil well fires, volcanic eruptions etc. NRSC has carried out coal fire mapping projects in the past; conducting an airborne campaign in 1989 and using Landsat-5 TM data in 1995 (Bhattacharya *et. al.*, 1995), over Jharia coalfield, Jharkhand and using Landsat-5 TM data for 2001 over Raniganj coalfield, West Bengal. Further, projects were executed in 2006 and 2012 in which coal fires of the JCF were mapped using Landsat-7 ETM+ and ASTER data, respectively. Additionally, a R&D study was taken up in 2013 to delineate subsidence areas using differential interferomteric (DInSAR) technique. In view of the past experiences, based on the letter (Ref. no. NRSC/16/76) from Director (Tech.), Operations, BCCL addressed to Director, NRSC on 01 February 2016. a project was formulated to take up Coal fire and Land Subsidence study of the Jharia Coal Field using space-borne remote sensing technique. The formal Memorandum of Understanding between BCCL and NRSC was signed on 23rd of Dec, 2016.

1.2 Objectives

The following objectives are formulated on the basis of the above mentioned background:

I. To map Coal fire in the study area based on pixel integrated relative radiant temperature derived from latest available Landsat-8 data of 2016-17 time period.

II. To compare the change in the coal fire distribution in the Jharia coalfield within the period of 2012 and 2016-17.

III. To delineate probable subsidence areas in the region using differential interferometry method.

1.3 Study Area

Jharia Coalfield is located in the Dhanbad district of Jharkhand state (Figure 1) and it is named after the main coal mining town of Jharia. It is situated in the Damodar River valley and is about 250 km NW of Kolkata. The coalfield is contained roughly within latitudes 23º 42’ N and 23º 50’N and longitudes 86º 09’E and 86º 30’E.

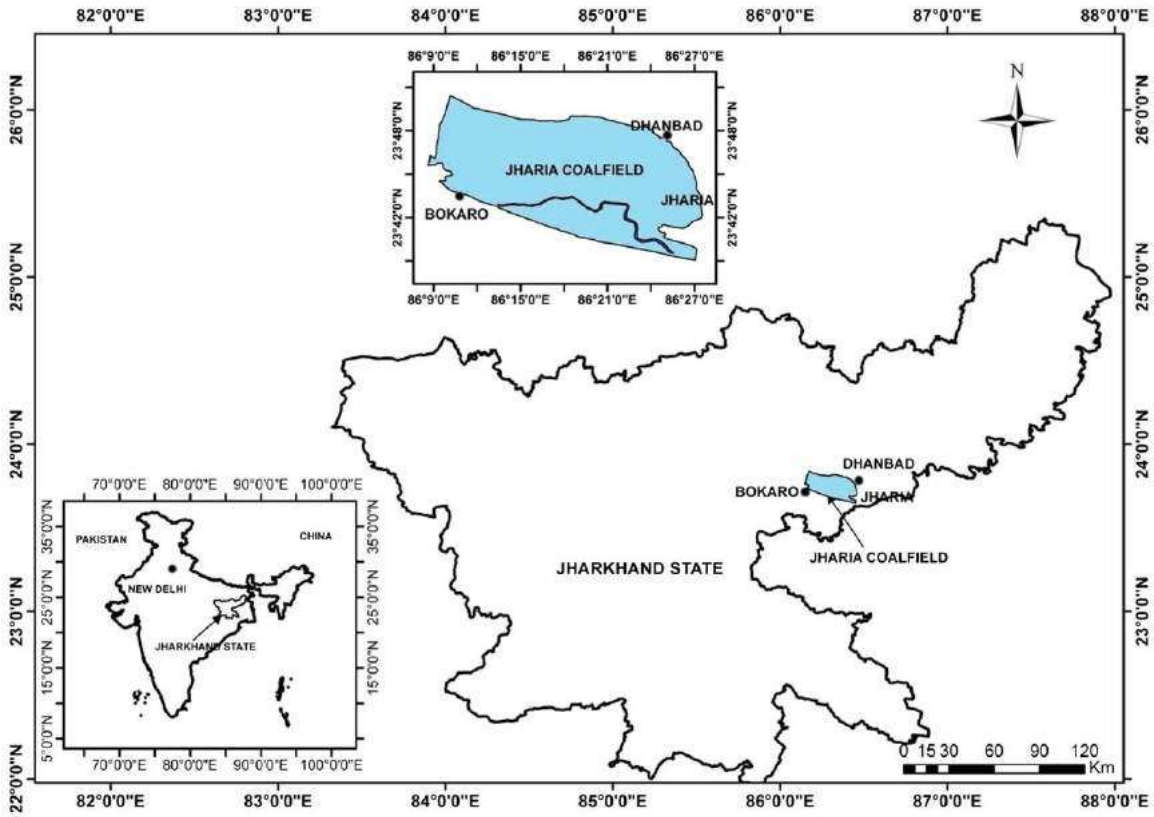


Figure 1: Study area map of Jharia Coalfied, Jharkhand

CHAPTER II

GENERAL DESCRIPTION OF THE STUDY AREA

2.1 Location and Accessibility

Jharia is an old mining town in the Dhanbad district of Jharkhand. This town is famous for its surrounding mines producing high grade coal and supplying mainly to the neighbouring industrial areas. Jharia is approximately 6 km in south western direction from Dhanbad town and connected by metal road. Dhanbad is well connected to Kolkata by road and rail.

2.2 Physiography, Drainage and Climate

Jharia coalfield is characterised by undulatory topography with very low rolling slope towards the eastern part of the area. The average height of the area is around 200 meters above the mean sea level. Damodar is the major river in the study area. The other tributaries to the Damodar River in this area are Jamuniya Nadi, Khudia Nadi, Khatri Nadi, Jarian Nala, Kari Jora and Domohani Nadi. Damodar River flows from west to east in this area. The minimum temperature is <10º C in the month of December – January and maximum temperature is >50º C in the month of May – June.

2.3 General Geology

Gondwana Super Groups of rocks of Up. Carboniferous to Lr. Cretaceous age (i.e. from 320 MY to 98 MY) are exposed here. Gondwana Super Group rocks unconformably overlie Archaean rocks. In Gondwana Rocks, Raniganj and Barakar Formations of Permian age have more potential as far as the coal production is concerned. Barakar Formation is exposed in north and north eastern part of the basin (Figure 2). Most of the coal mines are confined to the Barakar Formation in JCF. Barakars consists of coarse, medium grey and white sandstones, shales and coal seams. Raniganj consists of grey and greenish soft feldspathic sandstones, shales and coal seams. Faults are prevalent in this portion of basins (Figure 2). NW trending faults are conspicuous north to Jharia. Many lamprophyre and dolerite dykes are also exposed in this area in a criss-cross manner. The Raniganj Formation though coal bearing, has suffered much deformation due to faulting, thus causing difficulty for

mining in the area. The generalised stratigraphy of JCF is mentioned below (after Saraf, et al., 1995).

FORMATION	LITHOLOGY	MAXIMUM THICKNESS
Supra Panchet	Red and Grey sandstones and shales	300m
Panchet	Micaceous Yellow and Grey sandstones, Red and Greenish shales	600m
Raniganj	Grey and Greenish soft feldspathic sandstones, shales and coal seams	1050m
Ironstone Shales	Dark carbonaceous shales with ironstone bands	360m
Barakar	Coarse and medium Grey and white sandstones, shales and coal seams	630m
Talchir Boulder Bed	Coarse sandstones above and Greenish shales below	300m

Table 1: Generalised stratigraphy of JCF.

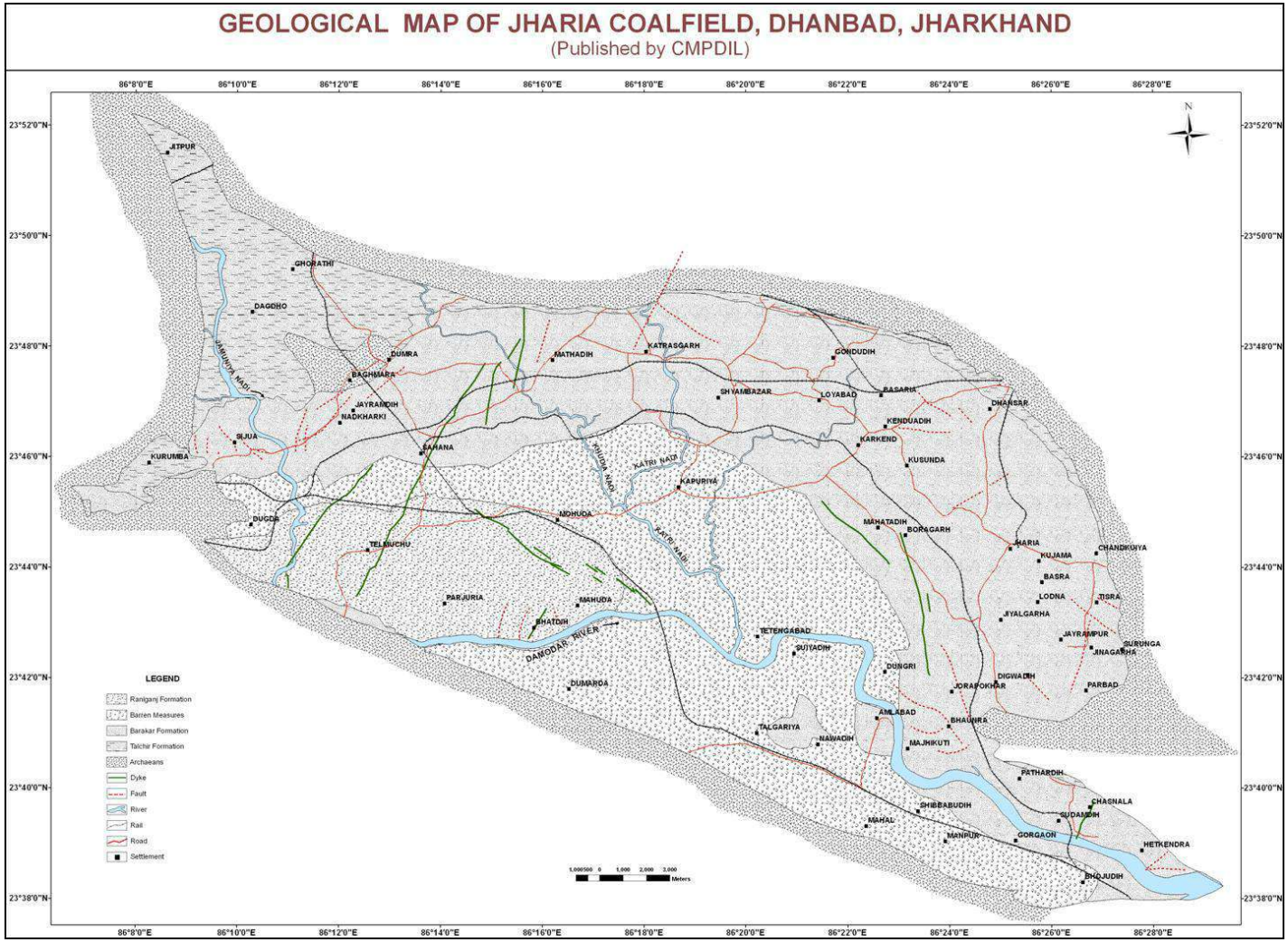


Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (published by CMPIDL)

CHAPTER III

DATA REQUIREMENTS

3.1 Remote Sensing Data

The most recent available thermal satellite data was used in conjunction with the fieldwork for mapping coal fire in JCF. A coal fire map generated from the same, would serve as a reference for the fieldwork, as the observations can be verified in the field. For this purpose, a coal fire map was created from LANDSAT 8 TIRS data of 14-May 2017 .

Further, the coal fire map of 2012 prepared by NRSC (NRSC, 2012) from ASTER data was used as a reference to identify the changes that has occurred in the extent and disposition of the fires from 2012 to 2017.

For the land subsidence study, L-band microwave data from ALOS-PALSAR satellite (JAXA) were used. Five scenes of "Fine mode" SLC data were taken from PALSAR-2 archives over a period from October, 2014 to February, 2017. This was done to identify long term terrain changes and differentiate the same from short term changes due to mining excavations and overburden dumping.

Table 2: List of satellite data used in the present study.

Sl. No	Satellite	Sensor	Time	Date	Data source
1	LANDSAT-8	TIRS	Daytime	14 May 2017	USGS, USA
2	ALOS-PALSAR-2 (Fine mode)	PALSAR-2	-	4 October. 2014	JAXA, Japan
3				3 October, 2015	
4				20 February. 2016	
5				01 October, 2016	
6				18 February. 2017	

3.2 Ancillary data

1. Geological map of Jharia coal field.
2. Mine surface plans as provided by BCCL.

CHAPTER IV

REMOTE SENSING DATA ANALYSIS

4.1 Methodology

4.1.1 Processing of Landsat 8 Data

With the launch of the LANDSAT-8 mission in February, 2013; thermal space borne data is available from its thermal infrared sensor (TIRS). This has enabled monitoring of the earth with a spatial resolution of 100 m in the thermal domain with a repeat cycle of 16 days. The LANDSAT-8 has two channels (Band 10 and Band 11) in the thermal infrared region (Table 1) which ranges from 10.4 micrometer to 12.5 micrometer. In present study, band 10 of TIRS sensor (acquired on 14 May, 2017) has been used coal fire mapping (Gangopadhyay et al. 2012). The spectral domain of the band is known for its maximum transmittance (Chatterjee et al. 2007; Martha et al. 2010). The data are freely accessible through USGS portal (Landsat 8 download source: http://landsatlook.usgs.gov).

Landsat-8 data are available in GeoTiff format and the data are converted to top of the atmosphere spectral radiance using the radiance rescaling factors provided in the metadata file, using equation 1.

$$L_\lambda = M_L Q_{cal} + A_L \text{ …….. (1)}$$

Where:

L_λ = Spectral radiance (Watts/ (m2 * srad * μm)).

M_L = Band-specific multiplicative rescaling factor from the metadata.

A_L = Band-specific additive rescaling factor from the metadata.

Q_{cal} = Quantized and calibrated standard product pixel values (DN).

Once the spectral radiance (Lλ) for ASTER Band 13 and Landsat-8 band 10 data is generated, it is possible to calculate radiant (brightness) temperature directly using equation 2. Planck's radiation function (Planck, 1914) forms the basis of radiant temperature derivation from spectral radiances and the theory is discussed in detail in existing literatures (Gupta, 2003).

$$T_R = K_2 / \ln ((K_1 / L_\lambda) + 1) \text{…….. (2)}$$

T_R = Radiant (brightness) temperature,

K_1 = Calibration constant (1260.56 K),

K_2 = Calibration constant (666.09 watts/ (m2 *ster*μm)),

L_λ = Spectral radiance

4.1.2 Thresholding of radiant temperature image

Once the Landsat-8 data are converted to radiant temperature image, the next step was to segregate fire pixels from the background, which requires the estimation of the cut-off temperature (Roy et al. 2015). This has been attempted by the statistical analysis of sensor derived radiant temperature to delineate clusters (in the scatter-plot) indicative for fire and non-fire pixels. Mean and maximum radiant temperatures are derived from randomly sampled uniform sized pixel blocks distributed in entire spatial extent of Barakar formation (Figure 3) known for fire bearing coal seams. The pixel block sizes are chosen to adequately represent the overall areal extent of the coalfield and homogeneously encompass all the mining blocks (27x27 pixels for Landsat-8, Figure 3). The maximum temperature value recorded in each representative area, derived from each of the datasets, is plotted against the mean temperature. The maximum temperature represents that of fire (wherever present), whereas the mean temperature represents the average background temperature, for normalization. The fire and background populations show considerable variance, separating coal fire and background radiant temperatures. The cut-off temperature derived is the maximum temperature of the background cluster, above which all temperatures represent coal fires. In the case of the Landsat-8 data used in this study, the cut-off temperature was determined around 39°C (Figure 4). Based on this cut-offs, regional coal fire map was prepared (Figure 5).

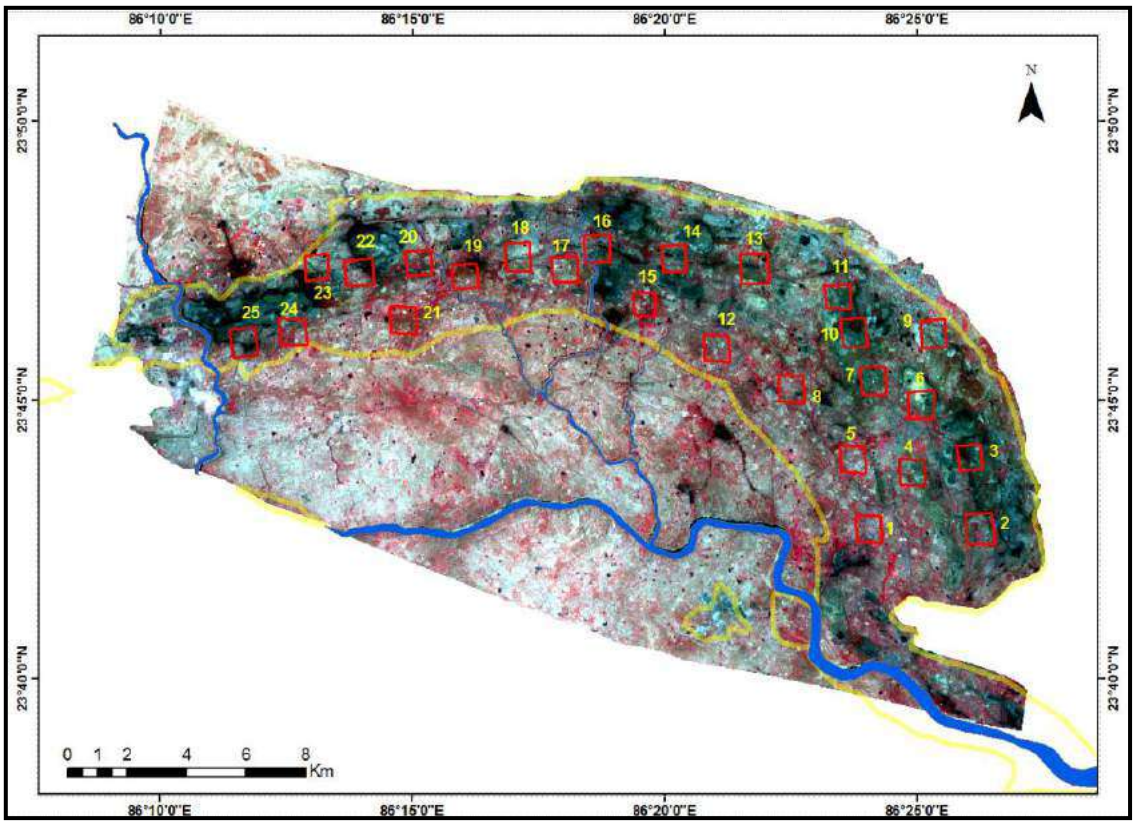


Figure 3. False colour composite image of Jharia Coalfield, with subset blocks (in red boxes) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.

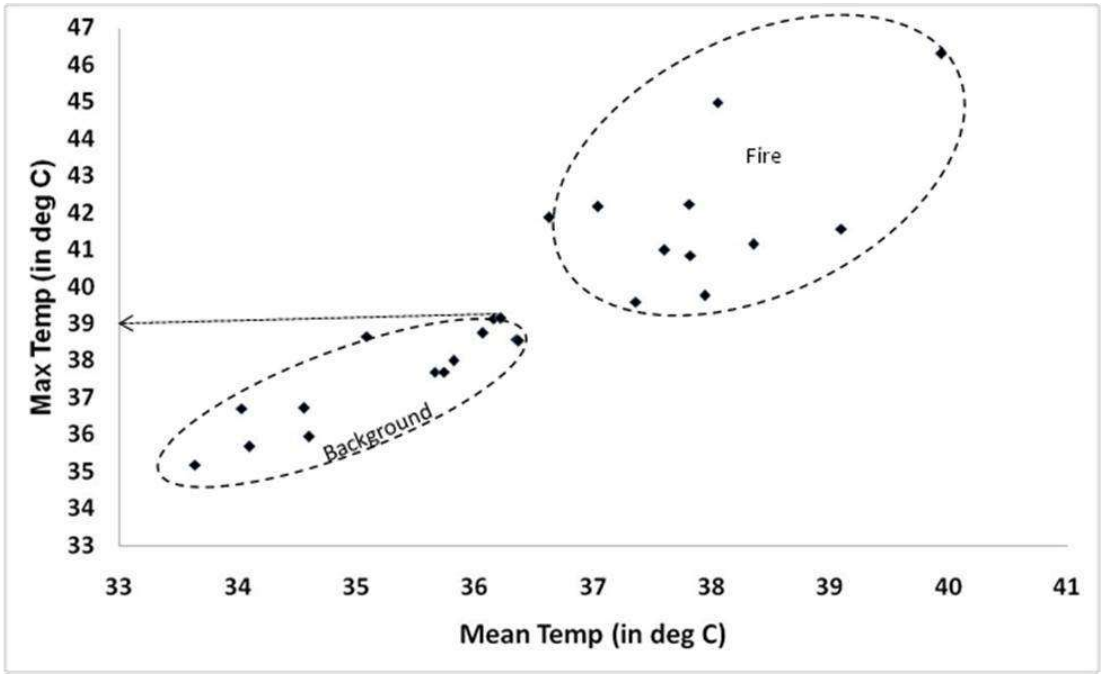


Figure 4. Maximum temperature plotted against mean temperature for various locations; cluster separation observed around 39 °C (marked with arrow)

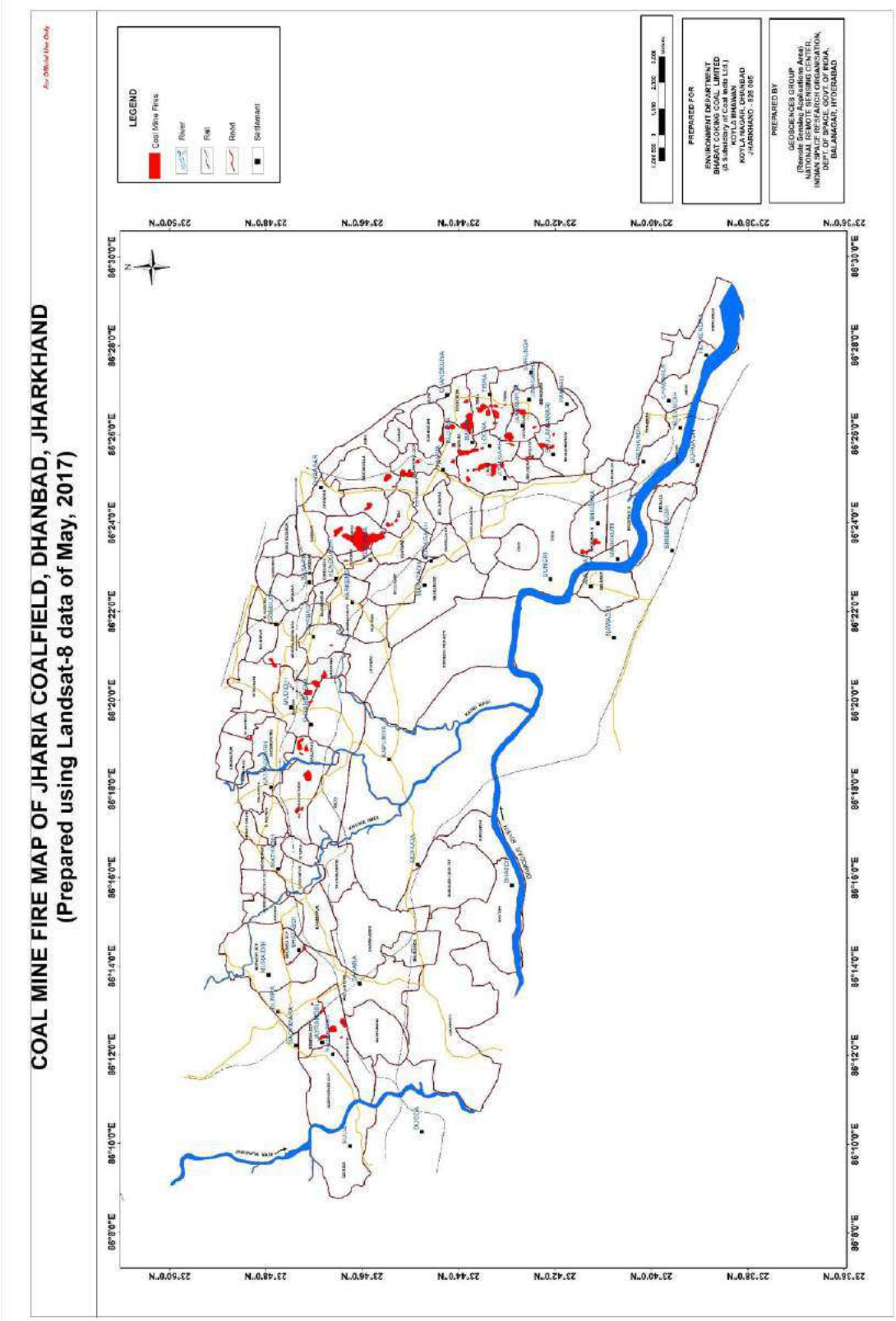


Figure 5: Coal mine fire map (May, 2017) of Jharia coal field, Dhanbad. The fire areas shown in this map have been verified in the field as per field points in figure 13.

4.2 Methodology For Subsidence Detection

4.2.1 Processing of ALOS-PALSAR 2 Data

Differential Interferometric SAR (DInSAR) techniques consist of combination of two SAR images of the same area acquired from slightly different positions (Figure 6).

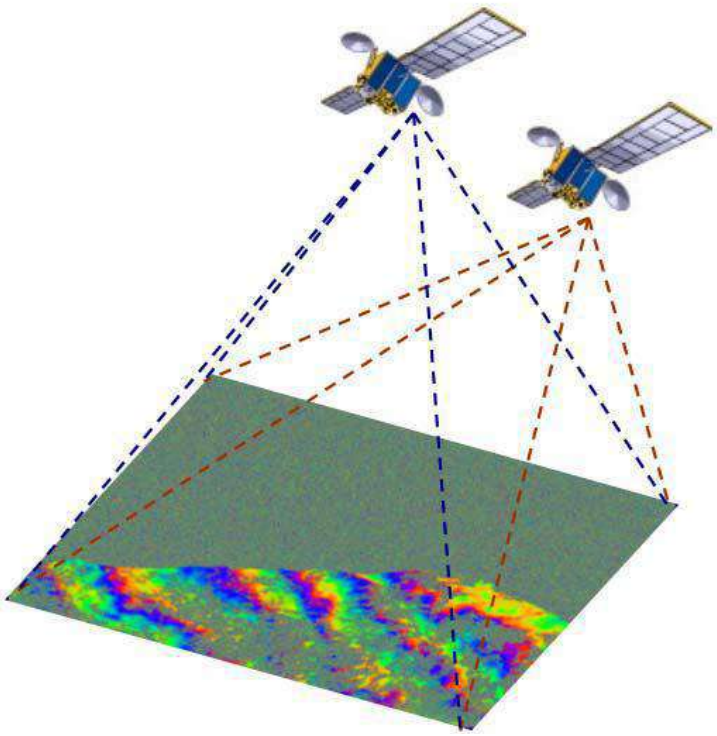


Figure 6. DInSAR acquisition scheme.

The result of this combination provides a new image, known as 'interferogram', whose phase component is formed by the following term:

$$\Delta\Phi Int = \Phi Topo + \Phi Mov + \Phi Atm + \Phi Noise \quad (3)$$

where, ΦTopo denotes the topographic component, ΦMov denotes the terrain deformation/ displacement component, ΦAtm is the noise component and ΦNoise is the thermal noise.

Topography, atmospheric effects and thermal noise needs to be removed or optimized to obtain precise measurements of terrain movement. When working with classical DInSAR interferograms (combination of two SAR images) the main problem is the presence of atmospheric artefacts, since there is no way to cancel them without a priori information. On the other hand, the term related with topography can be cancelled out using and external Digital Elevation Model (DEM) and the orbital ephemeris from the SAR acquisitions, considering no height errors on the DEM.

$$\Delta\Phi dif = \Phi ErrorTopo + \Phi Mov + \Phi Atm + \Phi Noise \qquad (ii)$$

Since the coal mine area is very dynamic in terms of its surfacial changes (open cast mine, abandoned mine, fire affected waste/reclaimed land, over burden dumps) over time, it is proposed to utilize an advanced DInSAR technique. It is a recent remarkable improvements in SAR differential interferometry that has led to an innovative approach based on the use of a large dataset of SAR images over the same area to overcome the intrinsic limitations of conventional DInSAR in terms of temporal and geometrical decorrelation as well as atmospheric disturbances (Ferretti et al 2001; Hooper et al 2004; Kampes, 2006; Lanari et al 2004; Mora et al 2003;Werner et al 2003).

Broad work flow diagram for generating land subsidence map using satellite based DInSAR technique is shown in Figure 7.

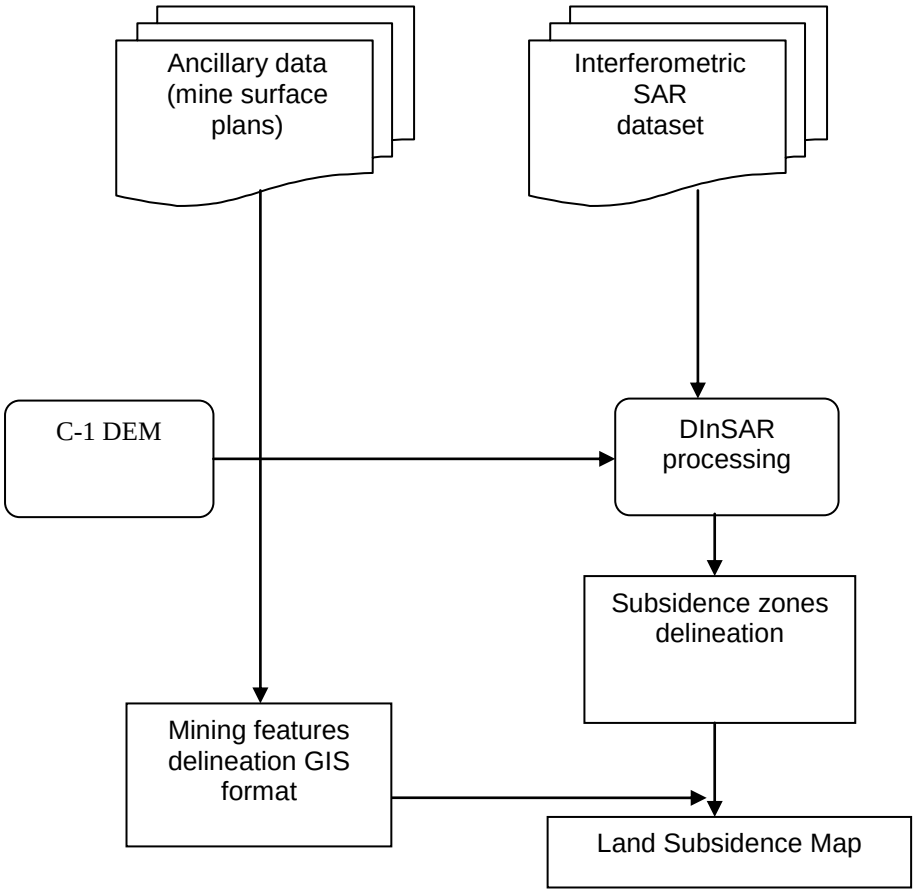


Figure 7. Work flow diagram for generating land subsidence map using DInSAR technique.

In the present study, 5 sets of ALOS-PALSAR L-band microwave data (as mentioned in table 1) were procured. The datasets were paired into master-slave pairs as per short and long temporal baselines. The short temporal baseslines include master slave pairs of time difference of six months or less, whereas long temporal baselines include data pairs of time difference of one year or more. This has been illustrated in figure 8.

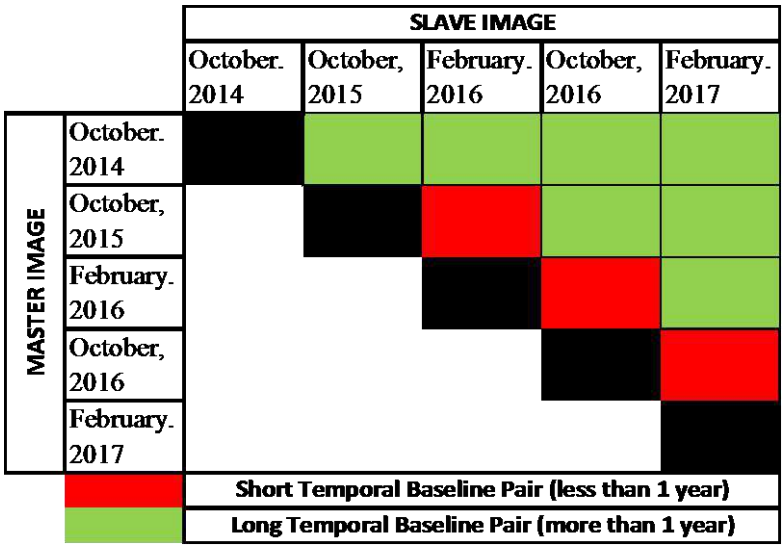


Figure 8. ALOS-PALSAR - 2 Master-Slave pairs for short and long temporal base line processing

The interferometric fringes generating from short baseline pairs will generally indicate terrain changes due to mining activity happening over a short period of time. This will include mining excavations and creation of new OB dumps adjacent to the mining area. Any incidences of slow land subsidence will not be demarcated in the results (figure 9).

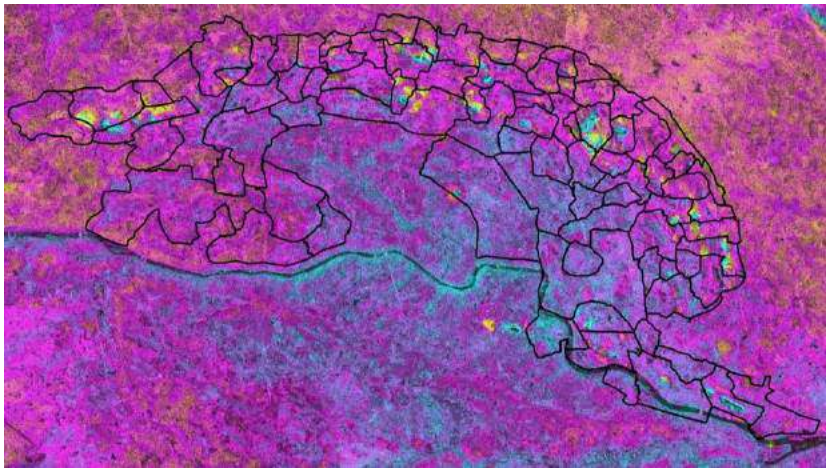


Figure 9. Fringe patterns generated from short baseline processing (e.g. Master: Oct, 16, Slave: Feb, 17).

On the other hand, master-slave pairs of long temporal baseline (one year or more, as shown in figure 8) will incorporate terrain changes due to mining activities as well, as long term ground subsidence from underground mining where ever present (figure 10).

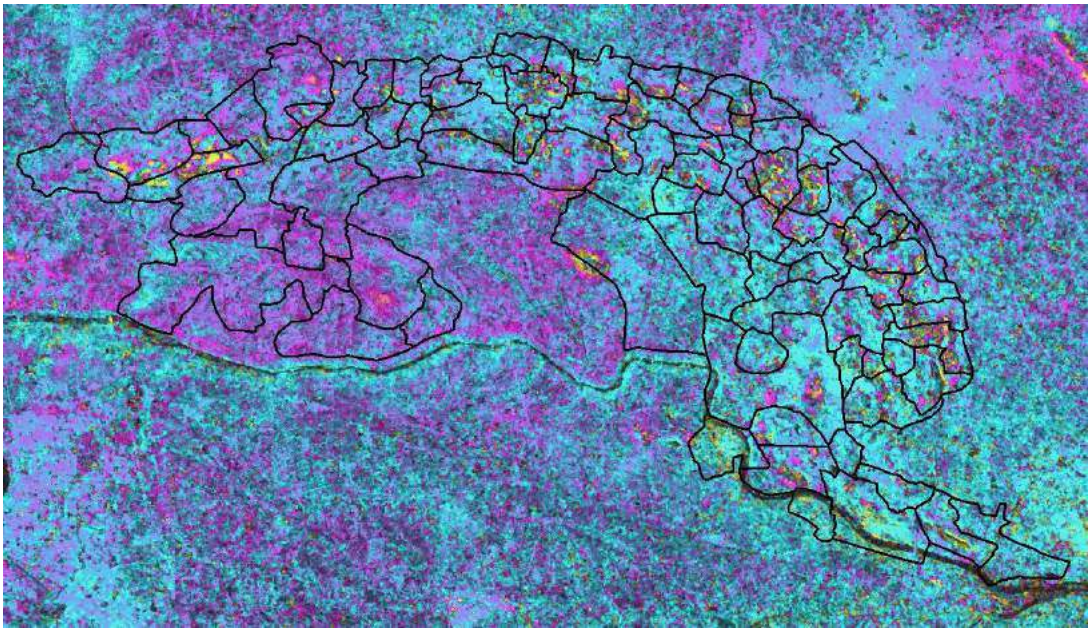


Figure 10. Fringe patterns generated from long baseline processing (e.g. Master: Oct, 15, Slave: Feb, 17).

The results from the long and short baseline processing can be compared and zone where fringes have been developed due to terrain changes due to mining excavation and dumping, can be systematically identified and demarcated. The remaining fringes from the long temporal baseline processing will then indicated towards zones where subsidence has taken place due to underground mining. Using this, a terrain change

map of the Jharia Coalfield was generated demarcating terrain changes due to mining activities and subsidence areas (Figure 11).

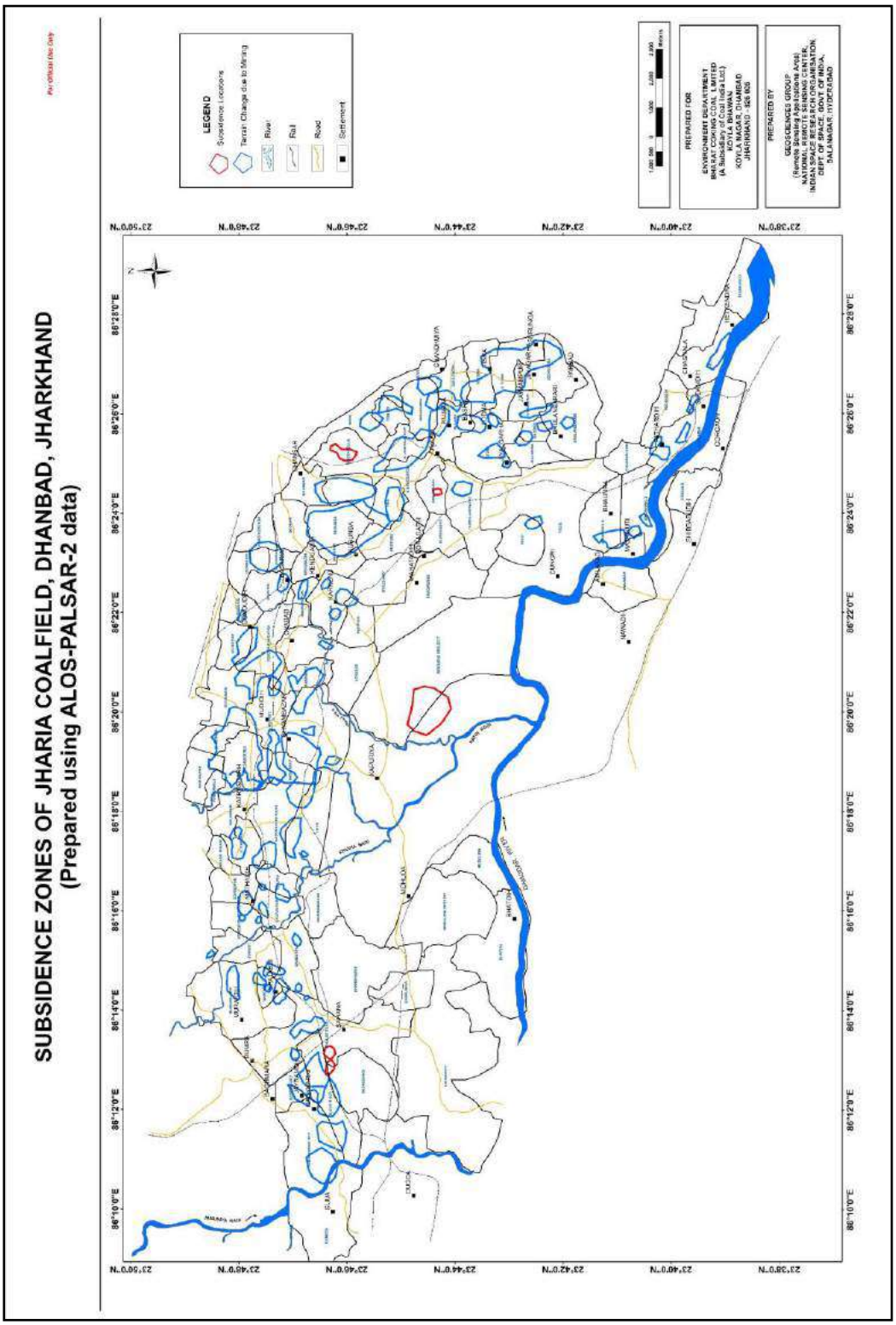


Figure 11: Subsidence map of Jharia coal field, Dhanbad.

CHAPTER V

FIELD WORK

A field work for verification of the coal fire locations and the subsidence zones as identified by the satellite data were taken up in December, 2017. A total of 53 coal fire points and 37 land subsidence locations were identified from the satellite data analysis. The locations of these points along with geographic coordinates were given to BCCL prior to the December, 2017 field work for their feedback on the status of these points. Out of the 53 coal fire locations identified, 52 points were confirmed to be fire bearing as per the present masterplan of the Jharia coalfield created by BCCL Both the coal fire and the subsidence locations were further independently verified by NRSC during the fieldwork in December, 2017. The locations and the observations are coal fire and subsidence are provided in annexure 1 and annexure 2 of this report respectively.

The salient overview of the field observations are as follows:

Coal-fire observations:

1. The coal fires as observed identified by the Landsat-8 data are mostly accurately delineated. Fires have been identified in the western, northern and eastern flank of the coalfield with considerable accuracy in the spatial locations.
2. In the eastern flank, the main fire affected mines are Kusunda, Lodna and Tisra. Active fires area present in the mines and fumes can be seen from the OB dumps. The Bhowra and Bhulanbarari mines also show presence of fire, however, the extent of the fire area appears to be underestimated in the data. Similarly, the extent of fires in Lodna and Tisra appears to have been overestimated in the data. The largest extent of fire in the single mine block is that in Kusunda.
3. In the northern flank, the main fire bearing mines are Katras, Gaslitand and Mudidih, However, it is seen that in these areas, the fires appears in pockets and are not pervasively present. The spatial extent of the fires on the ground and as estimated in the data can be correlated.

4. In the western flank, the Block II OCP is the primary fire affected region. However, it is seen that the Shatabdi OCP also bears fire pockets along semi-vertical mine walls, This is not identified in the data.

Subsidence location observations:

1. Subsidence locations as identified by the data area difficult to verify in the field, unless there are tell-tale signatures like large cracks or fissures on the ground or damage to anthropogenic constructions like vertical cracks on building cracks etc.
2. Out of the 37 identified subsidence locations from the microwave data, it is seen that 32 are due to terrain changes resulting from mining activities like ongoing excavations or formation of new mining dump. These decrease or increase in elevations has resulted in forming of interferometric fringes in the data thus creating false positives.
3. Five areas were firmly established as subsidence zones. Out of these, the main area where subsidence is occurring in a pervasive scale, is that in the Moonidih Underground Project. The Moonidih Project is an underground long wall mine where excavations are going on for over decades. This may have resulted in pervasive subsidence in the region. The signatures of subsidence such as ground cracks are observed in the area.
4. Two adjacent locations are observed south of the Block II OCP and in Phularitand mining block. This may be resulted due to older underground mining in the area. Signatures such as sagging of ground is seen.
5. Another minor subsidence region was identified around the Simlabahal underground mining project. This is again due to active underground mining in the area. A similar region was also observed in the northern part of the Bastacolla mines where active underground mining is ongoing.

In lieu of the observations in field on the fire and subsidence locations, few post field work correction in the coal fire and subsidence maps was necessitated and has been discussed in the next chapter.

CHAPTER VI

POST FIELDWORK ANALYSIS

As observed in the fieldwork, there were certain mine areas where the presence of fire was not detected by the satellite data. For example in Shatabdi and Bhulanbarari mine areas, the fire appears in small pockets on mine faces and was possibly not detected by the threshold temperature calculated for the entire mine area. On the other hand, in the Bhowra, Lodna and Tisra mine areas, the spatial extent of fire appears to have been overestimated by the regional threshold temperature use to separate the fire and the background areas.

Therefore, mine specific threshold temperature analysis was carried out for Shatabdi, Bhulanbarari, Bhowra, Lodna and Tisra mine areas to correctly depict the fire areas on the ground. The threshold temperature selected from each of these mine areas are given in Table 3.

Table 3: Threshold temperature for fire area estimation of individual mines.

Name of the Mine Block	Threshold Temperature (in °C)
Bhowra	38.5
Tisra (north and south)	North : 41; South : 40.5
Lodna	41
Bhulanbarari	38.5
Shatabdi	38

Using the threshold temperatures as mentioned in the table 3, the previously undetected fire areas in the Shatabdi and Bhulanbarari mines were detected. Further the spatial extent of the fire areas in Bhowra, Lodna and Tisra mines were changed to adequately represent the actual extent of the fire on the ground. These were incorporated in the coalfire map shown in figure 5.

CHAPTER VII

DISCUSSIONS AND CONCLUSIONS

7.1 Discussions

7.1.1 Coal fire analysis

The present study is aimed to provide the status of coal fire in the Jharia coal field for the period of 2017. Landsat-8 data of May, 2012 was used to prepare the coal mine fire map (Figure 5) for the year 2017. The data have 100 m spatial resolution in the thermal bands and is as on study date, the best thermal satellite data available. The Coal fire maps of 2017 when compared to map of 2012 (NRSC, 2014) depicts the dynamics of coal fire. Coal fire is difficult to mitigate because of its dynamic nature. But the understanding the trend in the shift of coal fire zones and over all distribution of coal fire will help in environmental and risk management related to coal mining activities.

The coal mine fire map for the year 2017 (Figure 5 illustrates the overall fire distribution in the area). The maps reveal that the coal fires are distributed across the Jharia coal field in pockets associated with major open cast mining activities. All most all the coal mine fires are restricted to the Barakar Formation where coal seams are exposed. In the eastern flank of the arcuate shaped mining extent, the collieries in Lodna and Tisra (North and South) is the highest fire affected mining blocks and Bhowra, Bhulanbarari, Kujama and Jharia are also affected by multiple smaller fire pockets. The fire in the areas is mostly manifested by high temperature fume cracks with occasional presence of active flames especially the the Lodna-Tisra area. Further, towards the north east, in Ena and Kusunda active fires are more prevalent and the area is extensively affected. The highest radiant temperatures (in order of ~50°C) are recorded by the satellite sensors in these areas. In the north, a large number of moderate to small fire pockets are seen in the areas around Shyambazar (Figure 5 & 6). These are related to the mining areas of Katras, Gaslitand, Mudidih and Kankanee. Mining activity, over the last few of years has exposed new, isolated and discontinuous fires in these regions.

In the western flank, three distinguishable fire affected zones are seen. Toward the western end of the mining area, the Benedih and Block II OCP are affected by smaller fires from isolated coal seams. These again are surfacialy manifested in the

form of fume cracks with smoke emanating from them. The Shatabdi OCP are also affected but fire is manifested in the along vertical mining wall sections.

Comparison of the 2017 coal fire map with that of 2012 (NRSC, 2014) indicated the dynamism in the spatial extent and distribution of the coal fires. The changes are highlighted as follows:

i. In reference to the map generated in 2012, the 2017 map shows that the emergence/re-emergence of fires in the eastern flank, namely Kujama, Tisra, Lodna and Jharia etc. The entire zone has been affected by multiple fire occurrences. The spatial disposition of fires in Bastacolla, Jharia and Bhulanbarari appear to have a minor increase.
ii. The areal extent of major fire zone around Kusunda/Kenduadih and Ena appears to remain the same, though here again the spatial location of the anomalies has changed. This is probably due to the mitigation and active mining in this region.
iii. The fire zones in Benedih/Block II OCP and Shatabdi OCP have also changed/diminished in areal extent with presence of isolated smaller anomalies. There has been a considerable reduction in fire areas in and around the Shatabdi OCP.
iv. The spatial disposition of fire areas around Katras, Gaslitand and Mudidih show minor change. In 2012, a number of small fire pockets were seen, however presently those fire pockets have given away to a few fire zones of moderate disposition.
v. It needs to be noted that the 2012 study was carried out using ASTER data whereas the present study is carried out using Landsat-8 data. Therefore, the difference of sensor sensitivities will have a influence on the way the fires are sensed on the ground. Difference of sensor sensitivities will influence the number of fires identified as well as the areal extent of the fires in the data.

In summary, there is a change in the areal disposition of the fires from 2012 to 2017. Observations suggest the emergence/re-emergence of new areas in the eastern flanks in areas around Lodna and Tisra. Concurrently, there is a decrease in extent of fire areas Shatabdi, Nadkhurkee area in the western flank from 2012 to 2017. A quantitative comparison of the 2012 and 2017 data was carried out. As compared

2012, when the total fire affected extent of about 2.18 km^2; in 2017 total fire affected extent is about 3.28 km^2. The colliery wise break-up of change in fire area from 2012 to 2017 is given in Annexure III.

7.1.2 Subsidence analysis

An attempt to identify subsidence zones in the Jharia Coalfield was also carried out using ALOS-PALSAR-2 L band microwave data using differential interferometric technique. 5 scenes of PALSAR-2 data spanning over a period of 2014 to 2017 were used to delineate the subsidence if any in the region and separately identify them from the terrain changes due to mining. Verification of the subsidence zones as seen from data is difficult as it requires visible signatures of subsidence in the form of cracks on the ground and damage to anthropogenic structures. In this study, data analysis and consequent field verification resulted in identification is 5 prominent subsidence areas. Of these, the major area where considerable ground subsidence is occurring is the Moonidih UG project. Long term underground mining has resulted in continuous subsidence in the area. Apart from this, the other four areas are south of Block II OCP, Simlabahal and Bastacolla. No quantitative estimates of the subsidence has been carried out in the study.

7.2 Conclusions

The following conclusions can be made:

1. As of the date of study in the year 2017 and in comparison with the previous study done in 2012, there has been a change in areal extent and disposition of the fire affected areas.
2. Compared to 2012, the eastern flanks (Lodna, Tisra areas) show considerable increase in fire disposition and the western flank (Shatabdi and Block II area) show diminished fire presence.
3. The major new fire areas are observed in the northern flank in the areas around Lodna and Tisra etc. These areas were not mapped as fire in the 2012 study.
4. The mines in Kenduadih and Lodna remain to be the worst affected with maximum presence of active fires.
5. There is a increase in areal extent of the fire (Figure 12) from 2012 to 2017.

Note: *Estimations of fire extent (in terms of sq.km.) both in 2012 and in the present 2017 study are pixel based. They do not represent the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.*

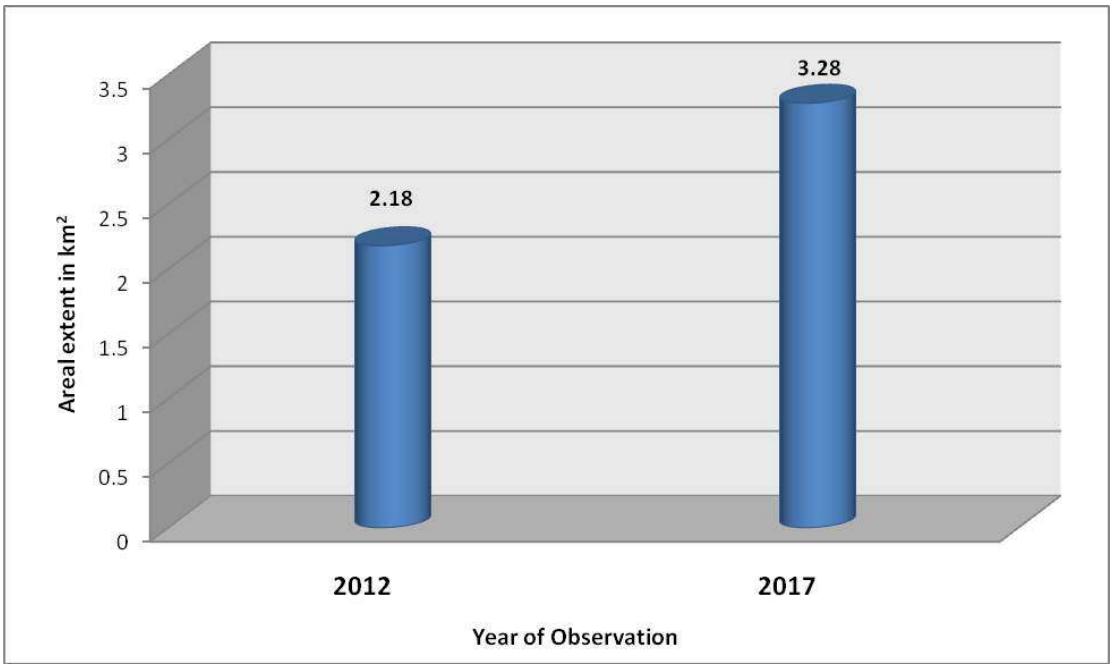


Figure 12: Total fire area statistics

CHAPTER VIII

LIMITATIONS

Delineation and mapping of coal fire from thermal data of remote sensing platforms carries with it some inherent limitations which needs to be understood in order to decipher the results obtained from it. This will assist is deducing the correct information and remove any ambiguity associated with the results. The key limitations of the data and the results obtained are as follows:

1) An anomalous pixel from LANDSAT data represents an area of 30m x 30m (resampled from spatial resolution of 100m) on the ground whose temperature is considerably higher than its surroundings. This can be attributed to two circumstances, namely the area has a very high intensity fire located within a smaller pocket or there are a number of low intensity fires spread across it. In both the mentioned cases the actual areal extent of the fire on the surface differs, but appears as a single anomalous pixel in the data. Hence, representation of fire affected ground area by means of pixel area is ambiguous and hence should be considered with caution.

2) There are locations as observed during the fieldwork, where coal seams are affected by active fires along vertical/semi-vertical sections of open cast mines (see cover page). In such cases, the actual areal expression of the fire affected area as seen by the sensor changes considerably and the representation from the same is not accurate.

3) As discussed in section 4.2.1, thresholding the data to separate the fires from the non fire areas, is a statistical technique. However, this method is dependent on how the temperature of non-fire background area is distinctive from the fire temperature.

4) The background temperatures vary with the time of the day when the data is collected, topography, and season of the year when the data is acquired. Night-time data has lower background temperature as compared to day-time. Similarly a data collected in October-November will have a considerably lower background temperature than that collected in May-June due to seasonal temperature variations. Hence, identification of the background temperature range becomes essential in

estimation of threshold temperature and the same varies depending upon the discussed controlling factors.

5) Generally, a constant threshold temperature is estimated over the entire study area, and the same is applied to delineate the fire areas from those of non-fire. However, it is seen that the application of such global thresholding may mask fires which are in turn seen in the field and that the threshold temperature value may vary locally. In the current scenario, it is seen that the fire locations as verified in the fieldwork at Bhulanbarari and Shatabdi were not identified in the data on application of a global threshold of 39°C. However, a subset of the data within the Bulanbarari area only, is analyzed with a lower threshold of 38.5°C, the fire pixels are manifested in the data. Hence, the appropriateness of a singular thresholding temperature value may need to be relooked upon. Future studies can be carried out using colliery wise statistical local thresholding to create a composite coal fire map.

6) Due to the mitigation measures taking place in various mines, it is seen that in a number of places the fire affected seam is excavated and dumped as overburden. However, these overburden dumps retains the excavated burning coals and thus are seen to have active fires occasionally. There lies a possibility that the same will be identified as anomalous pixels and hence, although the fire is not a part of any active coal seam, it will be included as a fire affected area in the final map.

7) Verification of the subsidence zones as detected from the interferometric technique is sometimes difficult due to lack in observable signatures of subsidence such as cracks on the ground and damage to anthropogenic structures.

Therefore, in quantitative estimation of fire affected areas and areas denoted as subsidence, the above mentioned limitations needs to be taken into account diligently, as it is inevitable that the area estimate will not define the actual fire/subsidence affected area on the ground. However, the areal extent estimated from the data can be "like to like" compared to earlier estimates of similar studies to understand the change and dynamism of the fire in terms of area affected and spatial disposition.

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Annexure –I

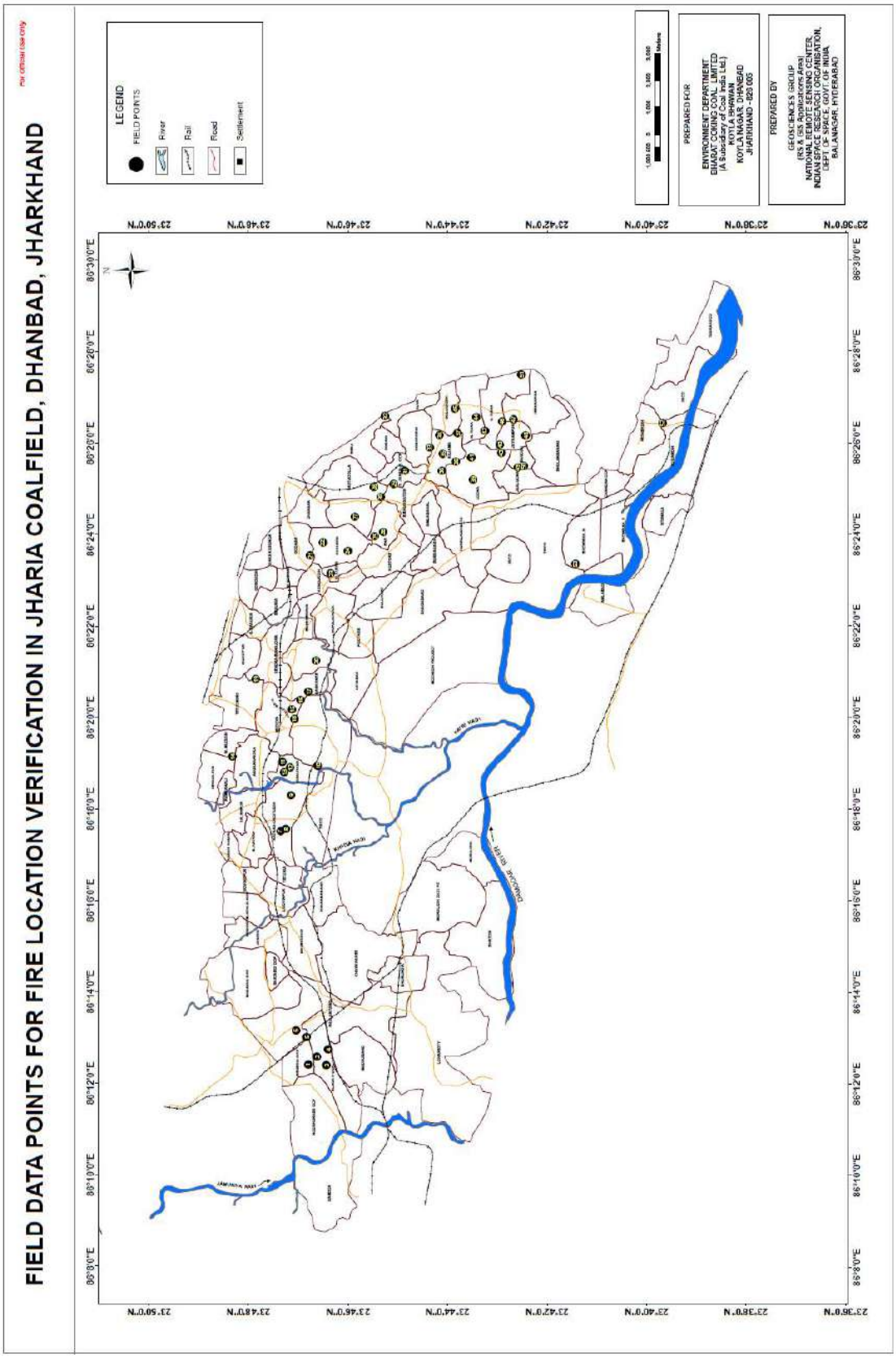


Figure 13. Field data points for coal fire verification

Table – 4: Coal Fire observations during fieldwork (see figure 13 for reference)

SL. No.	Point of Observations		Comments		
	Latitude	Longitude	Type of Mining Activity	Presence of Coal Fire	Mine name and Any other Comments
1	23.7801	86.2068	OB Dump	Fire	ABOCP
2	23.7771	86.2097	Active Mine	Fire	ABOCP
3	23.7739	86.2066	Active Mine	Fire	ABOCP
4	23.7733	86.2124	OB Dump	Fire	ABOCP
5	23.7806	86.2168	No Working	Fire	ABOCP
6	23.7841	86.2192	No Working	Fire	Phularitand
7	23.7893	86.2919	No Working	Fire	Katras Chatudih
8	23.7875	86.2926	No Working	Fire	Katras Chatudih
9	23.7857	86.3049	Working	Fire	Gaslitand
10	23.7768	86.3157	Outside Jharia Mines		Tata
11	23.7887	86.3170	OB Dump	Fire	Gaslitand
12	23.7862	86.3151	OB Dump	Fire	Gaslitand
13	23.7880	86.3133	OB Dump	Fire	Gaslitand
14	23.8054	86.3191	Working	Fire	AKWMC
15	23.7855	86.3363	OB Dump	Fire	Mudidh
16	23.7826	86.3397	Working	Fire	Kankanee
17	23.7800	86.3427	Working	Fire	Kankanee
18	23.7848	86.3327	OB Dump	Fire	Mudidih
19	23.7977	86.3473	OB Dump	Fire	Sendra Bansjora
20	23.7775	86.3540	OB Dump	Fire	Loyabad
21	23.7793	86.3924	No Working	No fire	Kusunda (Domestic coal burning)
22	23.7753	86.3970	Working	Fire	Kusunda
23	23.7724	86.3858	Working	Fire	Kusunda
24	23.7669	86.3940	OB Dump	Fire	Kusunda
25	23.7578	86.3993	OB Dump	Fire	Ena
26	23.7550	86.4009	OB Dump	Fire	Ena
27	23.7645	86.4065	Working	Fire	ADIC
28	23.7580	86.4172	Old Quarry	Fire	ROCP
29	23.7515	86.4184	OB Dump	Fire	ROCP
30	23.7559	86.4137	OB Dump	Fire	ROCP
31	23.7476	86.4232	Working	Fire	ROCP
32	23.7543	86.4431	Outside Jharia Mines		Unknown site (Out side of Kuya)
33	23.7394	86.4317	Active Mine	Fire	Ghanoodih
34	23.7360	86.4362	OB dump	Fire	Goluckdih
35	23.7349	86.4293	OB Dump	Fire	Kujama
36	23.7354	86.4232	No Working	Fire	Kujama
37	23.7301	86.4369	Working	Fire	NT-ST
38	23.7305	86.4265	OB dump	Fire	Kujama
39	23.7249	86.4200	No Working	Fire	Lodna
40	23.7159	86.4327	Working	Fire	Joyrampur
41	23.7254	86.4280	No Working	No fire	Lodna
42	23.7209	86.4376	Working	Fire	NT-ST
43	23.7154	86.4296	Working	Fire	Lodna
44	23.7238	86.4427	Working	Fire	NT-ST
45	23.7309	86.4457	OB dump	Fire	NT-ST
46	23.7151	86.4412	Active Mine	Yes	NT-ST
47	23.7114	86.4419	OB Dump	Fire	NT-ST
48	23.7073	86.4360	Active Mine	Fire	Joyrampur
49	23.7097	86.4243	Working	Fire	Bagdigi/Joyrampur
50	23.7079	86.4249	Active Mine	Fire	Bagdigi/Joyrampur
51	23.7086	86.4582	Outside Jharia Mines		Unknown site (Out side of NT-ST)
52	23.6614	86.4404	Outside Jharia Mines		Chasnala
53	23.6906	86.3892	OB dump	Fire	Bhowrah (North)

Annexure –II

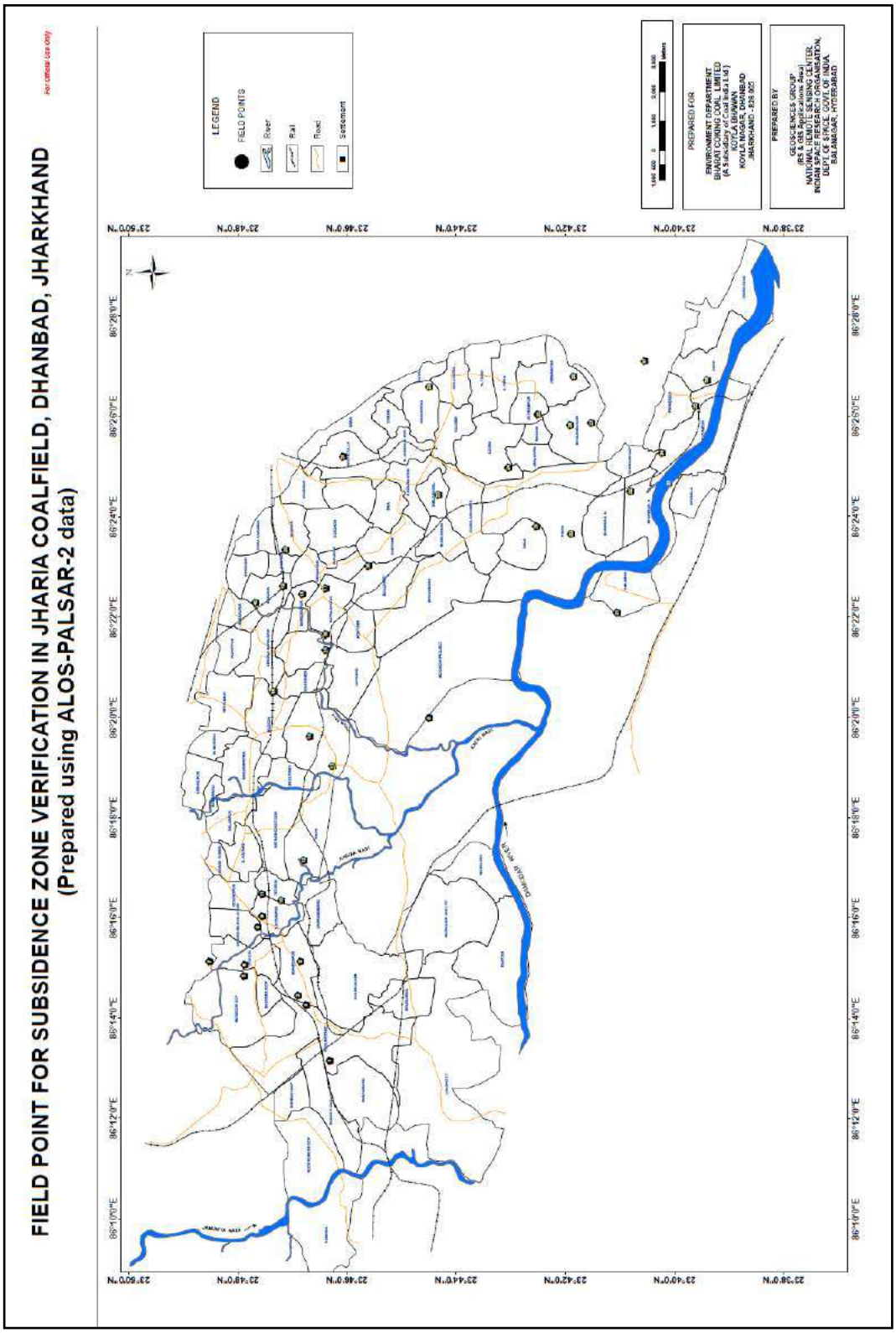


Figure 14. Field data points for subsidence verification

Table – 5: Coal Fire observations during fieldwork (see figure 14 for reference)

	Point of Observations		Comments	
Sr. no.	Latitude	Longitude	Mine name and Any other Comments	Signs of Subsidence (crack on building/ground crack etc.)
0	**23.7416**	**86.3338**	Moonidih UG Project	Sagged area, Building damage
1	**23.7722**	**86.2192**	South of Block II (2 areas)	Cracks on the ground
2	**23.7817**	**86.2409**	Terrain Change due to mining	
3	**23.7811**	**86.2521**	Terrain Change due to mining	
4	**23.7792**	**86.2376**	Terrain Change due to mining	
5	**23.7983**	**86.2473**	Terrain Change due to mining	
6	**23.7981**	**86.2510**	Terrain Change due to mining	
7	**23.8088**	**86.2521**	Terrain Change due to mining	
8	**23.7941**	**86.2636**	Terrain Change due to mining	
9	**23.7926**	**86.2671**	Terrain Change due to mining	
10	**23.7868**	**86.2724**	Terrain Change due to mining	
11	**23.7928**	**86.2746**	Terrain Change due to mining	
12	**23.7800**	**86.2857**	Terrain Change due to mining	
13	**23.7713**	**86.3171**	Terrain Change due to mining	
14	**23.7783**	**86.3270**	Terrain Change due to mining	
15	**23.7893**	**86.3419**	Terrain Change due to mining	
16	**23.7734**	**86.3556**	Terrain Change due to mining	
17	**23.7734**	**86.3762**	Terrain Change due to mining	
18	**23.7804**	**86.3742**	Terrain Change due to mining	
19	**23.7865**	**86.3769**	Terrain Change due to mining	
20	**23.7855**	**86.3890**	Terrain Change due to mining	
21	**23.7679**	**86.4199**	Bastacolla	Sagged areas
22	**23.7390**	**86.4071**	Simlabahal UG	Sagged areas
23	**23.7417**	**86.4431**	Terrain Change due to mining	
24	**23.7176**	**86.4163**	Terrain Change due to mining	
25	**23.7085**	**86.4339**	Terrain Change due to mining	
26	**23.6986**	**86.4304**	Terrain Change due to mining	
27	**23.6923**	**86.4312**	Terrain Change due to mining	
28	**23.6977**	**86.4466**	Terrain Change due to mining	
29	**23.7092**	**86.3967**	Terrain Change due to mining	
30	**23.6985**	**86.3942**	Terrain Change due to mining	
31	**23.6845**	**86.3681**	Terrain Change due to mining	
32	**23.6804**	**86.4083**	Terrain Change due to mining	
33	**23.6685**	**86.4110**	Terrain Change due to mining	
34	**23.6706**	**86.4211**	Terrain Change due to mining	
35	**23.6603**	**86.4366**	Terrain Change due to mining	
36	**23.6568**	**86.4454**	Terrain Change due to mining	
37	**23.6760**	**86.4516**	Terrain Change due to mining	
38	**23.7603**	**86.3836**	Terrain Change due to mining	
39	**23.7734**	**86.3609**	Terrain Change due to mining	
40	**23.7948**	**86.3715**	Terrain Change due to mining	

Annexure –III

SL. NO.	COLLIERY AREA NAME	FIRE AREA 2012 (SQ. KM.)	FIRE AREA 2017 (SQ. KM.)	AREA CHANGE (SQ. KM.)	Increase/Decrease
1	DAMODA	0.0000	0.0000	0.000	**NO FIRE**
2	TISCO (west)	0.0000	0.0000	0.000	**NO FIRE**
3	IISCO	0.0000	0.0000	0.000	**NO FIRE**
4	TISCO (north)	0.0885	0.0153	-0.073	**DECREASE**
5	NUDKHURKEE OCP	0.0000	0.0000	0.000	**NO FIRE**
6	BENEDIH OCP	0.0530	0.0453	-0.008	**DECREASE**
7	BLOCK-II OCP	0.0530	0.1353	0.082	**INCREASE**
8	MURAIDIH OCP	0.1478	0.0022	-0.146	**DECREASE**
9	SHATABDI OCP	0.0378	0.0361	-0.002	**DECREASE**
10	TETURIA	0.0000	0.0000	0.000	**NO FIRE**
11	S.GOVINDPUR	0.0000	0.0000	0.000	**NO FIRE**
12	KORIDIH BLOCK-IV OCP	0.0000	0.0000	0.000	**NO FIRE**
13	JOGIDIH	0.0000	0.0000	0.000	**NO FIRE**
14	DHARAMABAND	0.0000	0.0000	0.000	**NO FIRE**
15	MAHESHPUR	0.0000	0.0000	0.000	**NO FIRE**
16	PHULARITAND	0.0133	0.0205	0.007	**INCREASE**
17	MADHUBAND	0.0000	0.0000	0.000	**NO FIRE**
18	AKASH KINARI	0.0000	0.0000	0.000	**NO FIRE**
19	GOVINDPUR	0.0000	0.0000	0.000	**NO FIRE**
20	E. KATRAS	0.0133	0.0000	-0.013	**DECREASE**
21	KATRAS-CHOITUDIH	0.1021	0.1368	0.035	**INCREASE**
22	KESHALPUR	0.0000	0.0013	0.001	**INCREASE**
23	RAMKANALI	0.0000	0.0000	0.000	**NO FIRE**
24	NICHITPUR	0.0000	0.0000	0.000	**NO FIRE**
25	E. BASURIA	0.0000	0.0000	0.000	**NO FIRE**
26	KHAS KUSUNDA	0.0000	0.0000	0.000	**NO FIRE**
27	GONDUDIH	0.0000	0.0000	0.000	**NO FIRE**
28	W. GODHAR	0.0012	0.0000	-0.001	**DECREASE**
29	BASURIA	0.0000	0.0000	0.000	**NO FIRE**
30	TETULMARI	0.0223	0.0220	0.000	**DECREASE**
31	DHANSAR	0.0000	0.0000	0.000	**NO FIRE**
32	GODHAR	0.1073	0.0000	-0.107	**DECREASE**
33	INDUSTRY	0.0119	0.0513	0.039	**INCREASE**
34	KUSUNDA	0.4243	0.7398	0.315	**INCREASE**
35	SENDRA-BANSJORA	0.0796	0.0275	-0.052	**DECREASE**
36	BASTACOLLA	0.0663	0.0810	0.015	**INCREASE**
37	BERA	0.0000	0.0000	0.000	**NO FIRE**
38	KUYA	0.0000	0.0000	0.000	**NO FIRE**
39	GOLUCKDIH	0.0301	0.1122	0.082	**INCREASE**
40	KUJAMA	0.0398	0.2404	0.201	**INCREASE**

41	S. JHARIA-R. OCP	0.0244	0.1118	0.087	INCREASE
42	DOBARI	0.0000	0.0000	0.000	NO FIRE
43	GONHOODIH	0.0398	0.0322	-0.008	DECREASE
44	SIMLABAHAL	0.0000	0.0000	0.000	NO FIRE
45	HURRILADIH&STD	0.0000	0.0000	0.000	NO FIRE
46	ENA	0.0918	0.0432	-0.049	DECREASE
47	BURRAGARH	0.0000	0.0000	0.000	NO FIRE
48	N. TISRA	0.0098	0.1802	0.170	INCREASE
49	LODNA	0.0000	0.3527	0.353	INCREASE
50	S. TISRA	0.0000	0.1015	0.102	INCREASE
51	BARAREE	0.1037	0.1074	0.004	INCREASE
52	AMLABAD	0.0000	0.0000	0.000	NO FIRE
53	PATHERDIH	0.0000	0.0000	0.000	NO FIRE
54	SUDAMDIH	0.0000	0.0000	0.000	NO FIRE
55	SITANALA	0.0000	0.0000	0.000	NO FIRE
56	MURULIDIH 20/21 PIT	0.0000	0.0000	0.000	NO FIRE
57	MURULIDIH	0.0000	0.0000	0.000	NO FIRE
58	BHATDIH	0.0000	0.0000	0.000	NO FIRE
59	LOHAPATTY	0.0000	0.0000	0.000	NO FIRE
60	IISCO	0.0000	0.0000	0.000	NO FIRE
61	TASRA-IISCO	0.0000	0.0000	0.000	NO FIRE
62	KENDUADIH	0.0610	0.0000	-0.061	DECREASE
63	BULLIHARY	0.0000	0.0000	0.000	NO FIRE
64	GOPALICHUCK	0.0000	0.0000	0.000	NO FIRE
65	POOTKEE	0.0000	0.0000	0.000	NO FIRE
66	BHURUNGIA	0.0000	0.0000	0.000	NO FIRE
67	KHARKHAREE	0.0000	0.0000	0.000	NO FIRE
68	GASLITAND	0.1194	0.1215	0.002	INCREASE
69	KANKANEE	0.0530	0.0525	-0.001	DECREASE
70	MUDIDIH	0.1141	0.1104	-0.004	DECREASE
71	W. MUDIDIH	0.0171	0.0000	-0.017	DECREASE
72	LOYABAD	0.0133	0.0063	-0.007	DECREASE
73	BHAGABAND	0.0000	0.0000	0.000	NO FIRE
74	MOONIDIH PROJECT	0.0000	0.0000	0.000	NO FIRE
75	E.BHUGGATDIH	0.0022	0.0214	0.019	INCREASE
76	ALKUSHA	0.0326	0.0294	-0.003	DECREASE
77	KUSTORE	0.0524	0.0463	-0.006	DECREASE
78	ANGARAPATRA	0.1331	0.0149	-0.118	DECREASE
79	SALANPUR	0.0000	0.0000	0.000	NO FIRE
80	BHOWRAH. N	0.0133	0.0980	0.085	INCREASE
81	BHOWRAH. S	0.0000	0.0000	0.000	NO FIRE
82	BAGDIGI	0.0000	0.0209	0.021	INCREASE
83	JEALGORA	0.0000	0.0067	0.007	INCREASE
84	JEENAGORA	0.0000	0.0470	0.047	NO FIRE

85	JOYRAMPUR	0.0099	0.1042	0.094	**INCREASE**
86	CHANDAN OCP	0.0000	0.0000	0.000	**NO FIRE**
87	BANSDEOPUR	0.0000	0.0000	0.000	**NO FIRE**
	TOTAL AREA	**2.18**	**3.28**	**1.10**	**INCREASE**

Table 6: Colliery wise break-up of change in fire area from 2012 to 2017

Note:
1) "**NO FIRE**" implicates that the fire has not been identified satellite data *(either absent or below sensor resolution)*
2) "**INCREASE**" implies, increase in fire area OR emergence of fire areas not identified in 2012 study.
3) "**DECREASE**" implies, decrease in fire area OR fire areas of 2012, which are not identified in present study *(either absent or below sensor resolution).*
4) Estimations of fire extent (in terms of sq.km.) both 2012 and in present 2017 study are pixel based. They do not represent the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.

Annexure –IV



Figure 15: Fume cracks in Lodna-Tisra Area. (point 39 in figure 13 and table 4)



Figure 16: Burnt area near OB dump in Lodna area (point 41 in figure 13 and table 4)



Figure 17: Coalfries in active seams in Kusunda (point 23 in figure 13 and table 4)



Figure 18: Sagged area due to subsidence, south of Block II OCP. (point 1 in figure 14 and table 5)



Figure 19: Fire in OB dumps in Kusunda area. (point 24 in figure 13 and table 4)



Figure 20: Fume cracks in the Bhulanbarari area.

Annexure XI

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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.

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2020-21)

[CLUSTER – I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV & XVI of Mines, BCCL]

JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)

For

(BHARAT COKING COAL LIMITED)

(A Subsidiary of Coal India Limited)

KOYLA BHAWAN (DHANBAD)

Prepared by

Hydrogeology Department

Exploration Division

CMPDI (HQ), Ranchi

MARCH – 2021

Job no - 200419012

GROUNDWATER LEVEL & QUALITY REPORT

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CMPDIL

CENTRAL MINE PLANING & DESIGN INSTITUTE

HYDROGEOLOGY SECTION, EXPLORATION DEPARTMENT

GONDWANA PLACE, KANKE ROAD, RANCHI, JHARKHAND– 834031

(Accredited Groundwater Professional Institutions by CGWB/CGWA)

(Accredited by NABL, valid upto: 2022)

(Accredited as a FAE in (HG) by QCI-NABET, valid upto: Aug'2021)

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Annexure – I

DETAILS OF THE REPORT

Sl No.	ITEMS	INFORMATIONS
1	Geographical Area	Jharia Coalfield (JCF): 453 sq. km. Raniganj Coalfield (RCF part): 19.64 sq. km. (Cluster-XVI area only)
2	Major Physiographic Units	Dissected Pediplain with surface Reduced Level (RL) varies from 160 m to 220 m above mean sea level (AMSL) in JCF and 100 m to 140 m AMSL in RCF.
3	Drainage System	Damodar River is the master drainage flowing along western boundary of the JCF. Jamunia River, Khudia River, Katri River, Jarian Nala, Ekra Jore, Kari Jore, Kashi Jore, Chatkari Jore and their tributaries are flowing through the JCF area. Damodar River, Barakar River is the master drainage of the part of RCF area (CV Area).
4	Annual Rainfall	Dhanbad Dist: Bokari Dist:
5	Geological Formations	Gondwana Formation (Talchir Formation, Barakar Formation, Barren Measure Formation & Raniganj Formation)
6	Aquifer System	Unconfined/Phreatic Aquifer – thickness 25 m (Avg.) Semi-confined to confined Aquifer – thickness from 25 m upto 650 m
7	Hydrogeological properties	Unconfined Aquifer (Damoda BJ Section & Block-III): Hydraulic Conductivity – upto 0.50 m/day Transmissivity – 10 - 42 m^2/day
		Semi-confined to confined Aquifer (Sitanala & Kumari Block): Hydraulic Conductivity – 0.0006-1.44 & 0.05-0.0027 m/day Transmissivity – 0.06 – 0.573 m^2/day
8	Groundwater Level Monitoring Network	Out of total 252 nos. of monitoring stations 64 nos located within core mining area and rest comes within Buffers zone. 60 Nos. of Groundwater monitoring well (Dug Wells) network established by CMPDI to record groundwater level data in and around the Core Zone of JCF and 4 Nos. of Groundwater monitoring well (Dug Wells) in RCF (CV Area).
9	Groundwater Levels Below Ground Level (bgl)	JCF area: Pre-monsoon – 0.80 to 16.25 m (Avg. 4.95 m bgl) in '2020 Post-monsoon – 0.75 to 10.10 m (Avg. 3.26 m bgl) in '2020 RCF area (part): Pre-monsoon – 2.30 to 9.70 m (Avg. 4.30 m bgl) in '2020 Post-monsoon – 1.75 to 5.50 m (Avg. 2.70 m bgl) in '2020
10	Groundwater Quality	Potable (Annexure- VII)
11	Proposed Piezometers	Proposed piezometers (23 nos.) to monitor impact of coal mining on groundwater regime within the coalfield area (JCF & part of RCF) for maximum depth upto 290 m.
12	Stage of Groundwater Development (CGWB)	Dhanbad District-76.30% (GWRE-2017)

GROUNDWATER LEVEL & QUALITY REPORT FOR CLUSTER OF MINES OF BCCL

1.0 INTRODUCTION

1.1 LOCATION DETAILS AND BRIEF ABOUT THE PROJECT

The 15 nos. Cluster of mines (Cluster-I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV and XVI) of BCCL is located in the Jharia coalfield in Bokaro district of and Dhanbad district of Jharkhand and part of Raniganj coalfield of Dhanbad district of Jharkhand.

The area of Jharia Coalfield (JCF) is 453 sq. km. and Raniganj Coalfield (RCF part) is 19.64 sq. km. (Cluster-XVI area only). Located about 3.0 km south-west of Dhanbad town and 10.0 km north-east of Bokaro town. The coalfield bounded by Jamunia River in the west, Damodar river in the south, and metamorphics (hard rock) in the north and east side. **(Plate-I)**.

1.2 OBJECTIVE OF THE STUDY:

The objective of the report is to conducting hydrogeological study by quarterly monitoring of groundwater level and quality of the Jharia coalfield and Raniganj coalfield (part) within BCCL command area for 15 nos. Cluster of mines of BCCL. The data collected shall submitted to the MoEF&CC, CPCB & SPCB within stipulated timeframe. The work being done yearly and require d to be continued as per the specific condition mentioned invariably in Environmental Condition (EC) for all of the Clusters of BCCL.

1.3 SCOPE OF THE STUDY:

The following scope has taken into account for hydro-geological investigation of the study area.

i) The monitoring of the groundwater levels done four times/year during (May, August, Nov and Jan).
ii) The monitoring of the groundwater quality done during May including Arsenic and Fluride.
iii) To evaluate the status of ground water level condition in the area.
iv) To study the ground water flow direction in the mining areas.
v) To study the depth to ground water level condition in the mining areas.
vi) To study the ground water quality data and interpretation in the mining areas.

File No. 08HBDD/JRRI/BCCL/ENV/0003/2018-BD Divn.-CMPDI (Computer No. 68378)
Receipt No : 188686/2018/O/e HEAD OF BUSINESS DEVELOPMENT, CMPDI HQ

भारत कोकिंग कोल लिमिटेड
एक मिनी रत्न कंपनी
(कोल इंडिया लिमिटेड का एक अंग)
कोयलाभवन, कोयलानगर,धनबाद –826005

Bharat Coking Coal Limited
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
Regd.Off: Koyla Bhawan, Koyla Nagar
CIN: U10101JH1972GOI000918
Environment Department

पत्र संख्या भाकोकोलि/उप महाप्रबंधक(पर्या0)/संचिका-/18/1086-1088/H) दिनांक : 14.06.2018

सेवा में,
महाप्रबंधक
व्यापार विकास
सीएमपीडीआई - कांके रोड रांची ८३४०३१-

Sub: For work of Ground water level and quality monitoring

महोदय,

This is with reference to earlier letter ref no. BCCL/HOD(Env)/F-Env/13/161 dated 11.02.2014 regarding conducting hydrological study by quarterly monitoring of groundwater level and quality of the study to be carried out by establishing a network of existing wells. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) season and for quality including Arsenic and Fluoride during month of May. Data thus collected shall be submitted to the Ministry of Environment & Forest and to Central Pollution Control Board/SPCB quarterly within one month of monitoring.

The above work is being done yearly and required to be continued as per the specific condition mentioned invariably in Environment Clearance order of all clusters of BCCL.

This is for your kind information and further necessary action

भवदीय

14/6/18

उप-महाप्रबंधक (पर्यावरण)

Copy To:
१ महाप्रबंधक (गवेषण), कांके रोड रांची ८३४०३१-

1.4 TOPOGRAPHY AND DRAINAGE

Northern part of the JCF area covered with hills and thin forest. In general, the altitude varies from 220 m AMSL in Barora area (Cluster-I) to 160 m above mean sea level (AMSL) in Sudamdih area (Cluster-X). Pediplains developed over sedimentary rocks or Gondwana formation consisting of Sandstone, Shale, coal, etc. Dissected pediplains developed over Gondwana formations found in Jharia, Baghmara, Katras areas etc. However, in RCF (part) areas the altitude varies from 100 m to 140 m AMSL (Cluster-XVI). The general slope of the topography is towards south, i.e. Damodar River.

The drainage pattern of the area is dendritic in nature. The drainage system of the area is the part of Damodar sub-basin. All the rivers that originate or flow through the coalfield area have an easterly or southeast course and ultimately joins Damodar River, the master drainage. The drainage of the JCF is mainly controlled by Jamuniya River (5th order), Khudia nala (3rd order), Katri River (4th) and Chatkari nala (3rd order) flowing from north to south and joins Damodar River. Whereas, Barakar River and Khudia River are controlling the drainage pattern of RCF (part) and joins Damodar River in the south. Damodar River is the main drainage channel and flows from west to east along the southern boundary of JCF and RCF.

The drainage map of the JCF and part of RCF has been prepared on topographic map of scale 1:50,000 (***Plate-II***). The watershed of all tributary rivers (Jamuniya River to Barakar River) falls within the north-western part of Damodar sub-basin which comes under Lower Ganga Basin.

Besides, a large number of ponds/tanks distributed in and around JCF, out of which one prominent lake is located at Topchanchi in the north-west part. Two reservoirs, Maithon dam in Barakar River and Panchet dam in Damodar River near to Chanch Victoria Area of BCCL (part of RCF) are the main source of water supply to the nearby area. Jharia Water Board, Damodar Water Supply Scheme and Mineral Area Development Authority (MADA) are supplying water.

1.5 DETAILS REGARDING WETLANDS

A **wetland** is a distinct ecosystem that flooded by water, either permanently or seasonally. The primary factor that distinguishes **wetlands** from other landform or water bodies is the characteristic vegetation of aquatic plants. Wetland are protective ecosystem as per new guidelines of CGWA & MoEF&CC. There are no Wetlands in and around the area (Jharia coalfield and Raniganj coalfield) as per the list given on official website of MoEF&CC, Govt. of India. The list enclosed as **Annexure-III.**

1.6 CLIMATE & RAINFALL

The Jharia Coalfield (JCF) and part of Raniganj Coalfield (RCF) area in Dhanbad District belongs to sub-humid tropical climatic region. The maximum temperature during summer shoots upto 45^{o} C and falls between 10^{o} C to 5^{o} C in winter. The maximum rainfall occurs during the period between June and September. Rainfall data of IMD Dhanbad and Mine Rescue Station Dhanbad given in ***Annexure-IV***.

In Jharkhand state, Daily Rainfall data from 1989 to 2018 considered for analysis of trend variability and mean rainfall patterns. From the daily rainfall data, monthly rainfall series of each stations computed and then monthly district rainfall series has constructed by considering arithmetic average of all the station rainfall values within the district. The monthly rainfall series of the state has computed by using area weighted rainfall values of all the districts within the state. The objective of the analysis is to:

1. Identify the spatial pattern of the mean rainfall
2. Understand district wise observed rainfall trend and variability in annual and SW monsoon season (June, July, august and September).

Daily station rainfall data utilized for identification of the mean spatial patterns and rainfall intensity trends. From mean and standard deviation (SD), the coefficient of variation (CV) calculated as follows: Coefficient of variation (CV) = [Standard Deviation / Mean] × 100

The analysis has done in two parts. For identification of the spatial pattern mean rainfall and variability and observed trends we have used district rainfall series and results have been brought out for four southwest monsoon months viz. June, July, August, September, for the southwest monsoon season and also for annual.

Table shows the mean rainfall (mm) and coefficient of variation of the state for the monsoon months, southwest monsoon season and annual during the period 1989-2018. It can see that the state gets highest rainfall (31%) of southwest monsoon rainfall in July month while the August month get 28% of the southwest monsoon rainfall. June and September receive 19% and 22% of southwest monsoon rainfall. Also more than 84% of annual rainfall receives during the southwest monsoon season only. The variability of monsoon or annual rainfall is also very less.

Jharkhand State

	June	July	August	September	Sub-total	Annual
Mean	190.3	313.9	289.2	225.7	1019.1	1211.4
CV	44.4	29.0	24.8	37.0	18.7	16.9

Dhanbad District

	June	July	August	September	Sub-total	Annual
Mean	203.9	327.7	302.5	271.5	1105.6	1332.2
CV	41.0	35.0	33.5	48.7	20.8	19.4

Fig. 1 and 2 show the time series of rainfall in mm for the months of June, July, August, September and southwest monsoon season, annual respectively. The trend lines displayed for each of the series. Neither monthly rainfall nor seasonal rainfall shows any significant increasing/decreasing trend while annual rainfall shows significant decreasing trend. In the monthly rainfall June, July, August, September and seasonal rainfall shows decreasing trend. During the last 30 years highest rainfall of 390.3 mm received in June in the year 1994, 492.1 mm received in June in the year 2017, 431.5 mm received in August in the year 1997, while highest rainfall of 395.2 in September received in the year 1995. Highest annual rainfall of 1587.9 mm received in the year 1999 and highest southwest monsoon rainfall of 1364.6 mm received in the year 1994 (Climate Research and Services, IMD, Ministry of Earth Sciences, Pune, Jan'2020).

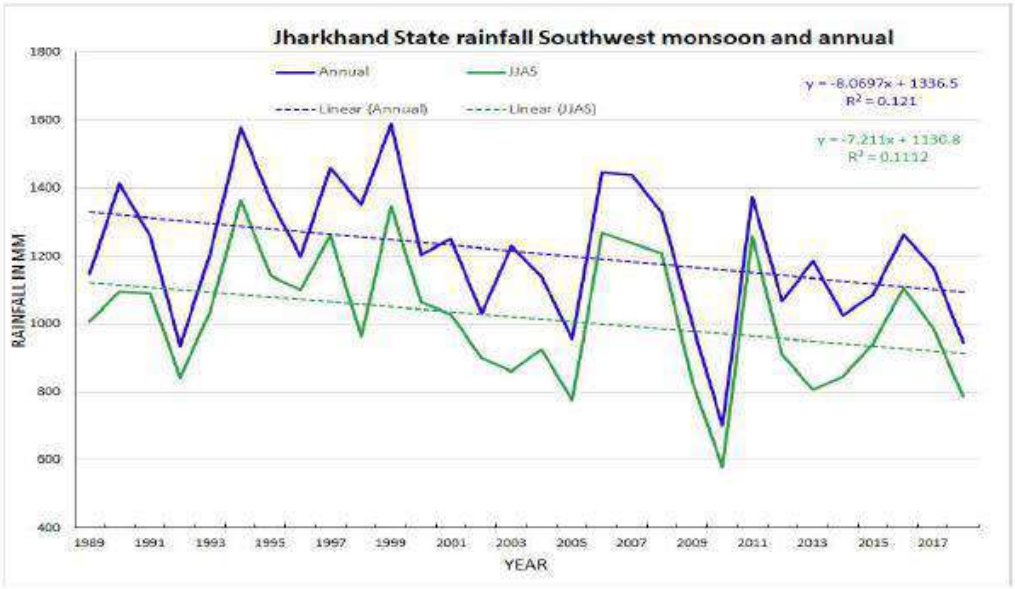


Fig-1.

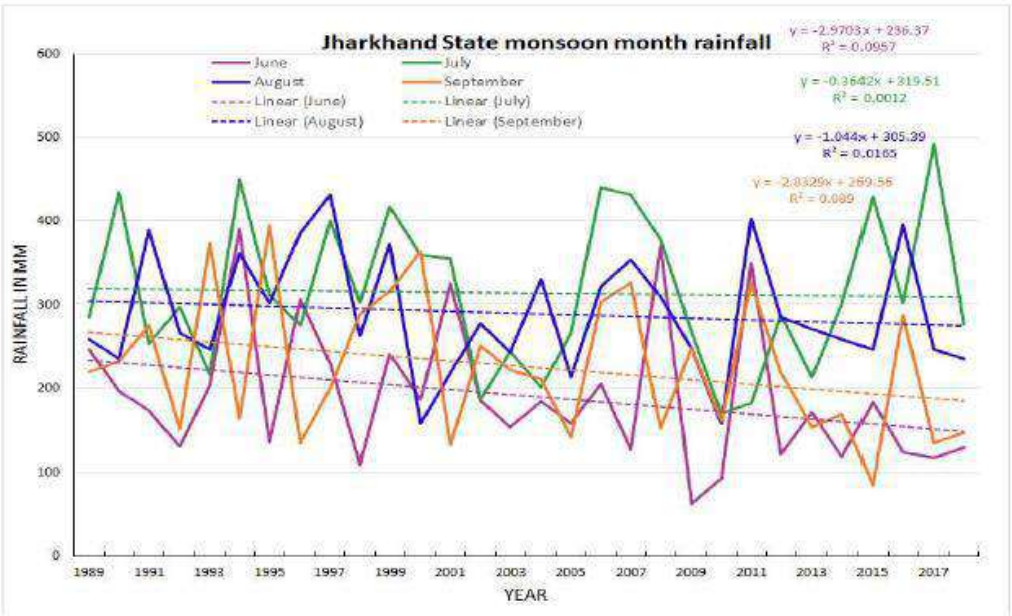


Fig-2.

2.0 GEOLOGY AND HYDROGEOLOGICAL SETUP OF THE AREA

2.1 REGIONAL GEOLOGY

The Jharia Coalfield covers an area of 453 sq. km. located in Dhanbad District, Jharkhand. The non-coal bearing Talchir Formation exposed in patches along the northern fringe of the Coalfield. The Barakar FormatioN overlies the Talchir is covering the most part of the Jharia Coalfield and having an area of 218 sq. km. This successively overlain by the non-coal bearing Barren Formation mainly exposed in the central part of the Coalfield. This, in turn, overlain by the Raniganj formation (Coal Bearing horizon) in the south-west part of the Coalfield and covers an area of 54 sq. km.

Chanch-Victoria Area is located in the western part of Raniganj Coalfield. The Raniganj coalfield represents the eastern most coal basin in the Damodar Valley Region, located in the border of Dhanbad District of Jharkhand and Bardhaman District of West Bengal. The Coalfield is almost elliptical in shape and covers an area of about 1530 sq. km. out of which only 35 sq. km. comes under leasehold area of BCCL out of which 19.64 sq. km is the study area (Cluster-XVI only). The coal bearing formations of the area belongs to Barakar Formation of the Lower Gondwana in **Table-1**.

Table – 1: Regional Geological Succession of Jharia Coalfield in the area

Geological Formations		Age
Quaternary/Recent	Soil cover/Weathered mantle	Recent
Post-Gondwana	Dolerite	Upper Cretaceous
	Lamprophyres	Jurassic
Damoda Group	Raniganj Formation	Upper Permian
	Barren Measures Formation	Middle Permian
	Barakar Formation	Lower Permian
	Karharbari	
	Talchir Formaton	Upper Carboniferous
----------Unconformity----------		
Metamorphics		Proterozoic

2.2 HYDROGEOLOGICAL SET- UP

The permeable formations mainly composed of sandstone behave as aquifer units. The coal seam and shales developed in the area act as impermeable beds i.e. aquiclude. The aquifer materials of Gondwana Formation constituted of fine to coarse grain sandstone having primary porosity of intergranular void space. The secondary porosity formed due to presence of faults, fracture, joints, etc. Sandstone of Gondwana formations in JCF and RCF are very hard, compact and cemented sandstone and forming less potential aquifer, particularly the deeper aquifer system. The secondary porosity along with primary porosity forms a conduit system making these formations good aquifers for movement and storage of ground water.

2.3 AQUIFERS DESCRIPTION

The aquifer system for shallow and deeper aquifer has established through hydrogeological studies, exploration, surface and subsurface geophysical studies in the JCF and RCF (part) covering all geological formations. The aquifer can be divided into two zones – Un-confined/Phreatic (shallow) and Semi-confined to confined (deeper) aquifer.

PHREATIC/UN-CONFINED AQUIFER

The top aquifer occurred above the top most coal seam/shale bed called un-confined or water table aquifer and it consists of relatively permeable formation such as weathered sandstone and loose soil. The thickness of the un-confined aquifer is varying from few meters to 50 m. This un-confined aquifer is potential than semi-confined to confined aquifer.

SEMI-CONFINED TO CONFINED AQUIFER

The semi-confined to confined aquifer consisting of sandstone bed is sandwiched with coal seams/shale beds and multiple aquifer system developed due to presence of multiple numbers of coal seams/shale beds. With the presence of intercalated shale and carbonaceous shale beds and reduction in permeability with depth, the lower aquifers are poor in potential.

Table –2 Generalized Hydrogeological Units developed in the study Area

Sl. No.	Type of Aquifer	Depth range (m)	Core zone (within 3 km)	Buffer zone (within 10 km)
1.	Unconfined	0 – 25 (Avg.)	Alluvium, weathered sandstone	Alluvium, weathered sandstone
2.	Semiconfined/ confined	Beyond 25 upto 650 m	Multiple Sandstone horizons in Barakar formation	Multiple Barakar, sandstone, Barren Measure, Raniganj sandstone and Talchir shale

2.4 GENERAL AQUIFER PARAMETERS

PHREATIC/UN-CONFINED AQUIFER

The wells tested by CMPDI for determination of aquifer parameters in Damuda (BJ Section) and Block-III area of JCF. The hydraulic conductivity of the un-confined aquifer is 0.50 m/day as computed from pumping tests on the wells. The transmissivity of the unconfined aquifer ranges from 10.68 m^2 /day to 41.48 m^2 /day.

SEMI-CONFINED TO CONFINED AQUIFER

The un-confined aquifer, the sandstone partings in-between impervious layers of shale and coal seams designated as semi-confined / confined aquifers. The sandstones in these aquifers are fine to coarse grained, hard and compact with very low porosity. Mostly groundwater occurs in the weak zones formed due to weathering, fracture, faults, which create the secondary porosity. The hydrogeological parameter has determined by CMPDI in Sitanala Block by conducting aquifer performance test (APT). The hydraulic conductivity (K) of semi-confined aquifer in Barakar Formation ranges from 0.0006 m/day to 1.44 m/day. The hydrogeological parameter has also been determined at Kumari OCP Block in the central JCF by conducting aquifer performance test. The hydraulic conductivity (K) of semi-confined aquifer in Barakar Formation in this area ranges from 0.0027 m/day to 0.05 m/day.

Table – 3: Aquifer parameters considered for the study Area

Hydraulic Parameter	Unconfined aquifer Site: Damuda (BJ Section) and Block-III area	Semi-confined aquifer Site: (1): Sitanala Block (2): Kumari Block
Transmissivity (m^2/d)	10.68 – 41.48	0.0621 – 0.573
Hydraulic conductivity (m/d)	0.5	0.05 – 0.0027
Specific yield	0.03 to 0.04 (as per GEC recommended values)	

3.0 GROUND WATER LEVEL MONITORING

To collect the representative groundwater levels in the study area, CMPDI has established a monitoring network of total 252 monitoring stations out of which 64 located within core zone and rest comes within Buffer zone. Total 60 nos. dug well within JCF and 04 nos. dug well within RCF (part) area (Details of the Hydrograph stations & water level given in **Annexure-V, VA** & **VB**) spread over the entire BCCL leasehold area, **Plate-II**. Water level monitoring in all hydrograph stations has been done in pre-monsoon as well as in post monsoon whereas in 64 stations monitoring done in quarterly (May'20, Aug'20, Nov'20 and Jan'21) basis.

Depth to water level of the water table depict the inequalities in the position of water table with respect to ground surface and is useful in delineating recharge / discharge areas, planning of artificial recharge structure and shows the overall status of the groundwater level in the area. Historical groundwater level (GWL) of entire JCF and part of RCF with fluctuation, GWL of Non-mining / Mining areas and GWL of the Cluster of Mines of BCCL are shown in this report to assess the effect of Coal mining activity in the groundwater regime in and around the Coalfield area.

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. The impact on shallow water regime due to mining activity can broadly viewed as under:

- Historical GWL with annual fluctuation over the years
- GWL scenario in Non-mining and Mining area (OC/UG mines)
- GWL scenario of Cluster of mines of BCCL

3.1 HISTORICAL GROUNDWATER LEVEL (GWL)

Historical GWL of JCF and part of RCF given from 2005 to 2020 of CMPDI monitoring stations (total 64 stations within Coalfield area). Pre-monsoon and Post-monsoon GWL with Fluctuation has been mentioned below in the table.

Table – 4: Historical Groundwater Level

Period		(Water level in metre below ground level)								
		Pre-Monsoon (April/May)			Post-Monsoon (Nov/Dec)			Fluctuation		
		From	To	Average	From	To	Average	From	To	Average
JCF	2005	0.07	19.08	6.29	0.84	12.13	3.20	0.12	12.45	3.21
	2007	0.40	19.27	5.66	0.35	8.21	2.87	0.02	16.15	2.96
	2008	0.45	18.35	5.42	0.35	14.20	3.62	0.03	9.22	2.45
	2010	0.85	14.47	5.24	0.10	15.88	4.48	0.02	5.55	1.54
	2012	1.27	18.68	5.58	0.15	7.80	2.72	0.08	13.45	2.96
	2013	0.70	19.20	5.65	0.45	8.35	2.77	0.29	15.88	3.17
	2014	0.70	16.28	4.92	0.75	14.98	3.27	0.25	10.15	2.17
	2015	1.38	17.20	6.00	0.45	14.58	3.92	0.28	7.62	2.15
	2016	0.78	16.73	5.64	0.30	12.43	3.19	0.23	6.35	2.88
	2017	0.67	16.28	5.61	0.15	6.97	2.41	0.10	12.10	3.25
	2018	1.20	14.58	5.55	0.40	7.17	2.83	0.20	9.45	2.68
	2019	0.95	15.88	5.46	0.45	5.95	2.34	0.20	13.40	3.05
	2020	0.80	16.25	4.95	0.75	10.10	3.26	0.25	11.05	2.15
RCF (part)	2008	5.02	10.50	7.59	2.85	4.90	3.71	1.82	6.60	3.87
	2010	2.20	8.85	4.74	2.78	9.58	4.63	0.68	1.10	0.89
	2011	3.57	8.02	4.98	2.50	6.21	3.75	0.55	1.90	1.23
	2012	3.10	7.34	4.59	1.55	7.00	3.66	0.05	2.78	0.94
	2013	1.70	9.87	6.54	2.90	8.85	4.71	1.02	5.54	2.84
	2014	3.27	6.48	4.57	2.13	3.03	2.63	0.54	3.45	1.94
	2015	3.38	9.52	5.33	2.68	8.20	5.11	1.06	1.32	1.81
	2016	3.61	10.65	6.24	0.90	6.50	3.18	1.63	4.40	3.06
	2017	1.93	5.80	3.25	1.63	3.78	2.47	1.63	3.78	0.78
	2018	2.34	8.70	4.35	1.75	5.70	2.75	0.41	2.55	1.59
	2019	1.60	9.35	5.29	0.80	3.88	2.10	0.80	5.47	3.20
	2020	2.30	9.70	4.30	1.75	5.50	2.70	0.40	2.75	1.60

3.2 GROUNDWATER LEVEL SCENARIO IN NON-MINING/MINING AREA

Depth to water level (DTW) range in different formations with respect of mining and non-mining areas summarized in the Table-5.

Table – 5: Depth to water table

Formation	*Area*		*DTW (bgl, m) [Year-2020]*		*Average GWL (m)*	
			Pre-monsoon (Apr/May)	*Post-monsoon (Nov/Dec)*	*Pre-monsoon*	*Post-monsoon*
Sedimentary (Gondwana)	Non-mining		1.40-11.35	0.75-4.60	5.45	2.55
	Mining	OC	0.90-12.50	0.55-5.85	5.15	2.24
		UG	1.20-16.25	0.55-4.75	5.85	2.75
Metamorphics (Hard rock)	Peripheral part of the Coalfield		0.45-15.10	0.45-9.50	7.25	3.85

The study revealed that water table is in shallow depth and there is no significant stress in the water table due to coal mining activity. Mining and Non-mining areas shows barely any difference in water table condition in the JCF and RCF (part) area. The average hydraulic gradient of the water table within mining and non-mining areas given in Table-6. There is no significant change in hydraulic gradient observed. Relatively steep gradient near active opencast mining areas w.r.t., Non-Mining, Underground mines and Metamorphics areas observed.

Table – 6: Average hydraulic gradient

Sl. No	*Formation*	*Area*		*Average hydraulic gradient*
1	Sedimentary (Gondwana)	Non-Mining		1.0×10^{-3} to 3.0×10^{-3}
		Mining	OC	3.0×10^{-2} to 6.0×10^{-3}
			UG	2.0×10^{-2} to 4.0×10^{-3}
2	Metamorphics (Hard rock)	Peripheral part of the Coalfield		1.0×10^{-3} to 3.0×10^{-3}

3.3 GROUND WATER LEVEL DATA OF THE CLUSTER OF MINES OF BCCL

A GROUND WATER LEVEL OF CLUSTER-I

Cluster-I (Damuda Group of Mines) consisting of (Cluster-I consisting of Damoda UG, Albion OCP, Proposed BJ Section OCP and Abandoned Gutway OCP) of Barora area, BCCL is located in the western most part of Jharia coalfield in Bokaro district of Jharkhand. The life of the project works out upto 15 years considering annual target production of 1.17 MTPA. It is located in the extreme western part of JCF in Bokaro district of Jharkhand (Toposheet no – 73 I/1).

The present leasehold area of Cluster-I is 575.0 Ha. The Damoda block area marked by more or less flat and gently undulating topography. The RL varies from 179 m to 208 m AMSL and the general slope of topography is towards east. Jamuniya River, Kari Jore, Podo Jore and its tributaries are controlling the drainage system of the area. The area comes under the watershed of Jamuniya River.

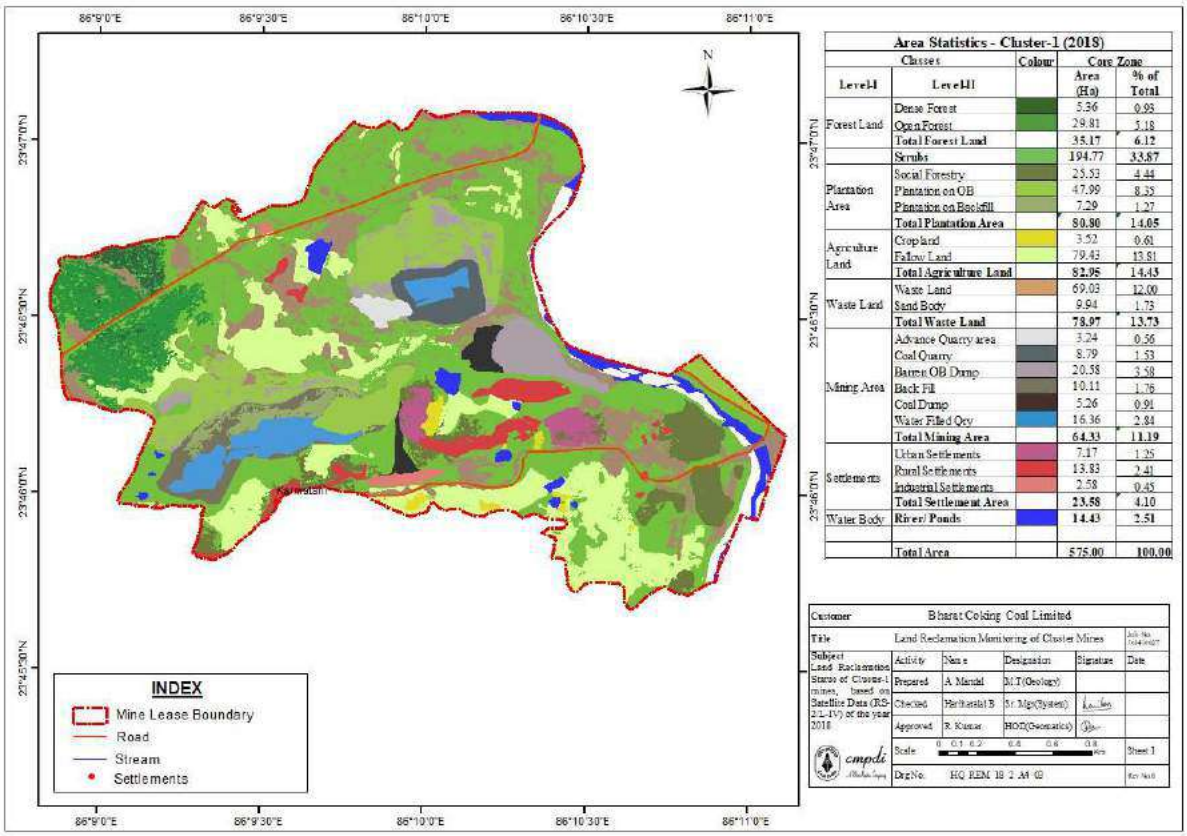
Monitoring stations (**B-15, B-21A, B51 and B-53**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	B-15	Bera Basti	3.70	0.15	1.47	1.70	1.90	0.45	1.65	2.65	1.56	1.85	0.75	0.85
2	B21A	Dugdha	10.00	4.15	5.80	6.70	9.45	1.90	-	-	6.73	9.65	3.45	2.65
3	B-51	Taranga	5.00	0.88	2.10	3.00	5.10	1.10	2.70	2.90	3.00	5.02	2.25	2.42
4	B-53	Karmatanr	3.12	1.07	1.40	1.92	3.22	0.97	1.42	2.12	2.52	3.92	1.62	1.42
Average WL (bgl)			5.46	1.56	2.69	3.33	4.92	1.11	1.92	2.56	3.45	5.11	2.02	1.84

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.85 m Max – 10.00 m
Post-monsoon GW Level (m): Min – 0.85 m Max – 5.80 m

LAND USE / LAND COVER MAP OF THE CLUSTER-I MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	393.69 x 10^4	393.69 x 10^4	393.69 x 10^4
2	Open Land	204.89 x 10^4	204.89 x 10^4	204.89 x 10^4
3	Road/ Paved Area	09.0 x 10^4	09.0 x 10^4	09.0 x 10^4
4	Rooftop area of building/ sheds	14.58 x 10^4	14.58 x 10^4	14.58 x 10^4
5	Total	575.00 x 10^4	575.00 x 10^4	575.00 x 10^4

B. GROUND WATER LEVEL OF CLUSTER-II

Cluster-II consists of seven mines namely; (Block II Mixed mines (OCP & UGP), Jamunia OCP, Shatabdi OCP, Muraidih Mixed mines (OCP & UGP), and Phularitand OCP of BCCL is located in the western most part of Jharia coalfield in Bokaro district and Dhanbad district of Jharkhand. The life of the project works out upto 30 years considering annual target production of 20.215 MTPA. It is located in the extreme western part of Jharia Coalfield in Dhanbad district of Jharkhand (Toposheet no- 73 I/1 and I/5).

The present leasehold area of Cluster-II is 2260.54 Ha. The Damoda block area marked by more or less flat and gently undulating topography. The RL varies from 176 m to 235 m AMSL. Jamuniya River, Khudia River and its tributaries are controlling the drainage system of the area. The area comes under the watershed of Jamuniya River and Khudia River.

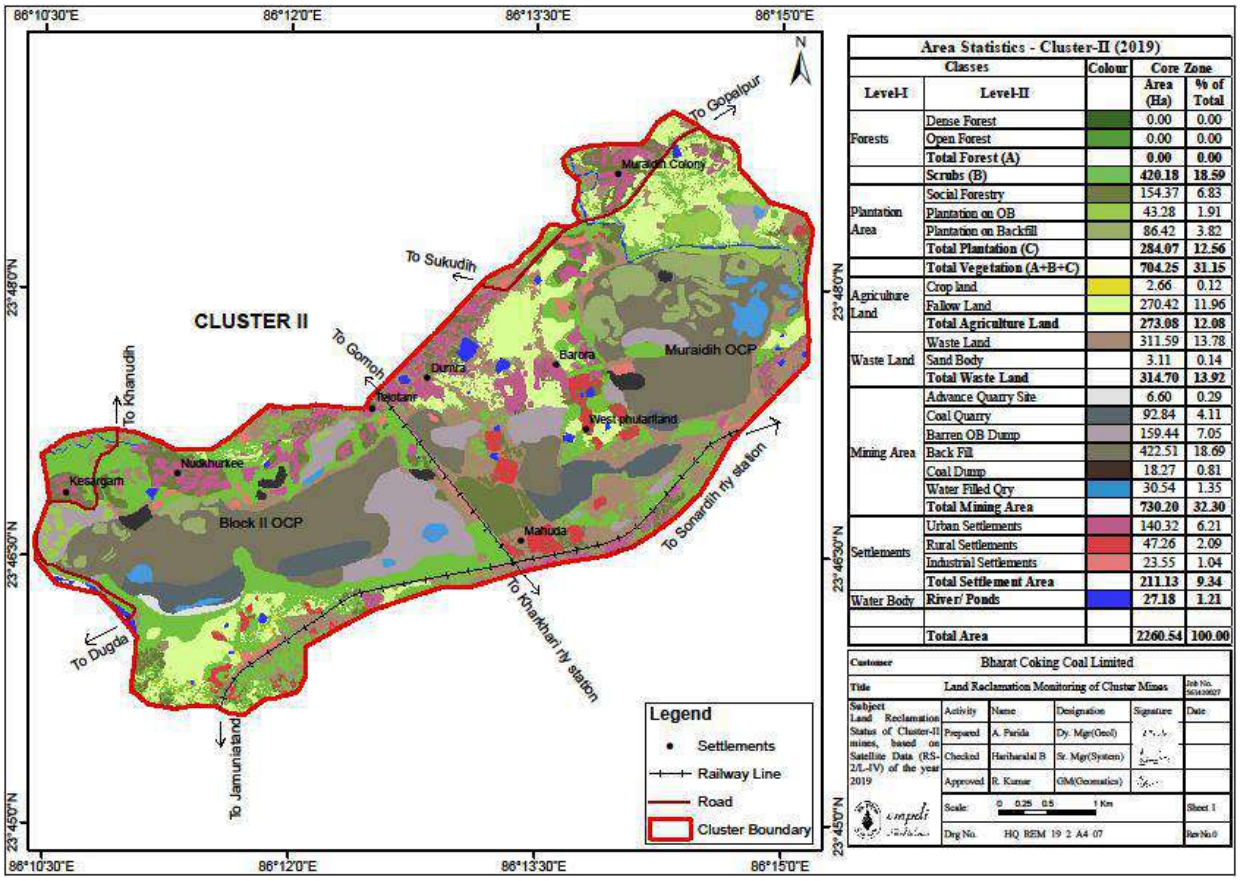
Monitoring stations (**B-1, B-59, B-60, B-61A and B-62A**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	B-1	Muraidih	3.28	0.73	1.63	1.73	3.18	1.33	1.73	1.98	1.68	2.88	1.48	2.08
2	B-59	Khodovaly	5.25	0.67	1.40	2.10	6.20	0.80	0.90	1.20	1.38	5.47	0.90	1.10
3	B-60	Bahiyardih	10.33	0.91	3.21	6.13	8.13	1.23	3.23	4.93	8.21	13.68	3.13	4.23
4	B61A	Kesargora	3.32	0.85	1.60	2.07	3.32	1.39	0.52	1.12	1.27	2.57	2.62	2.02
5	B62A	Sadiyardih	6.95	2.77	3.00	4.95	7.55	2.80	3.25	4.95	5.87	8.27	4.00	4.78
Average WL (bgl)			5.83	1.19	2.17	3.40	5.68	1.51	1.93	2.84	3.68	6.57	2.43	2.84

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.57 m Max – 13.68 m
Post-monsoon GW Level (m): Min – 0.52 m Max – 4.78 m

LAND USE / LAND COVER MAP OF THE CLUSTER-II MINES, BCCL



Area Statistics - Cluster-II (2019)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**420.18**	**18.59**
Plantation Area	Social Forestry		154.37	6.83
	Plantation on OB		43.28	1.91
	Plantation on Backfill		86.42	3.82
	Total Plantation (C)		**284.07**	**12.56**
	Total Vegetation (A+B+C)		**704.25**	**31.15**
Agriculture Land	Crop land		2.66	0.12
	Fallow Land		270.42	11.96
	Total Agriculture Land		**273.08**	**12.08**
Waste Land	Waste Land		311.59	13.78
	Sand Body		3.11	0.14
	Total Waste Land		**314.70**	**13.92**
Mining Area	Advance Quarry Site		6.60	0.29
	Coal Quarry		92.84	4.11
	Barren OB Dump		159.44	7.05
	Back Fill		422.51	18.69
	Coal Dump		18.27	0.81
	Water Filled Qry		30.54	1.35
	Total Mining Area		**730.20**	**32.30**
Settlements	Urban Settlements		140.32	6.21
	Rural Settlements		47.26	2.09
	Industrial Settlements		23.55	1.04
	Total Settlement Area		**211.13**	**9.34**
Water Body	**River/ Ponds**		**27.18**	**1.21**
	Total Area		**2260.54**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 200419027
Subject: Land Reclamation Status of Cluster-II mines, based on Satellite Data (RS-2/L-IV) of the year 2019	Activity	Name	Designation	Signature	Date
	Prepared	A. Parida	Dy. Mgr(Geol)		
	Checked	Hariharalal B	Sr. Mgr(System)		
	Approved	R. Kumar	GM(Geomatics)		
	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 19 2 A4 07				Rev No.0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	977.33×10^4	977.33×10^4	977.33×10^4
2	Open Land	1072.08×10^4	1072.08×10^4	1072.08×10^4
3	Road/ Paved Area	140.32×10^4	140.32×10^4	140.32×10^4
4	Rooftop area of building/ sheds	70.81×10^4	70.81×10^4	70.81×10^4
5	Total	2260.54×10^4	2260.54×10^4	2260.54×10^4

C. GROUND WATER LEVEL OF CLUSTER-III

Cluster-III consists of nine mines namely, Jogidih UG, Govindpur UG, Maheshpur UG, Kooridih/Block-IV Mixed Mine, New Akashkinaree Mixed Mine, South Govindpur UG (closed), and Teturiya UG (closed) mines. It is located in the western most part of Jharia coalfield in Dhanbad district of Jharkhand. The life of the project works out upto 60 years considering annual target production of 3.60 MTPA. This Cluster of mines is located in western part of Jharia Coalfield in Dhanbad district of Jharkhand (Toposheet no – 73 I/5).

The present leasehold area of Cluster-III is 1552.53 Ha. The area is plain with gentle undulation with RL varies from 160 m to 208.80 m AMSL. The general slope of the area is towards south. Khudia River, Baghdihi Jore, Katri River and its tributaries are controlling the drainage system of the area. The area comes under the watershed of Khudia River.

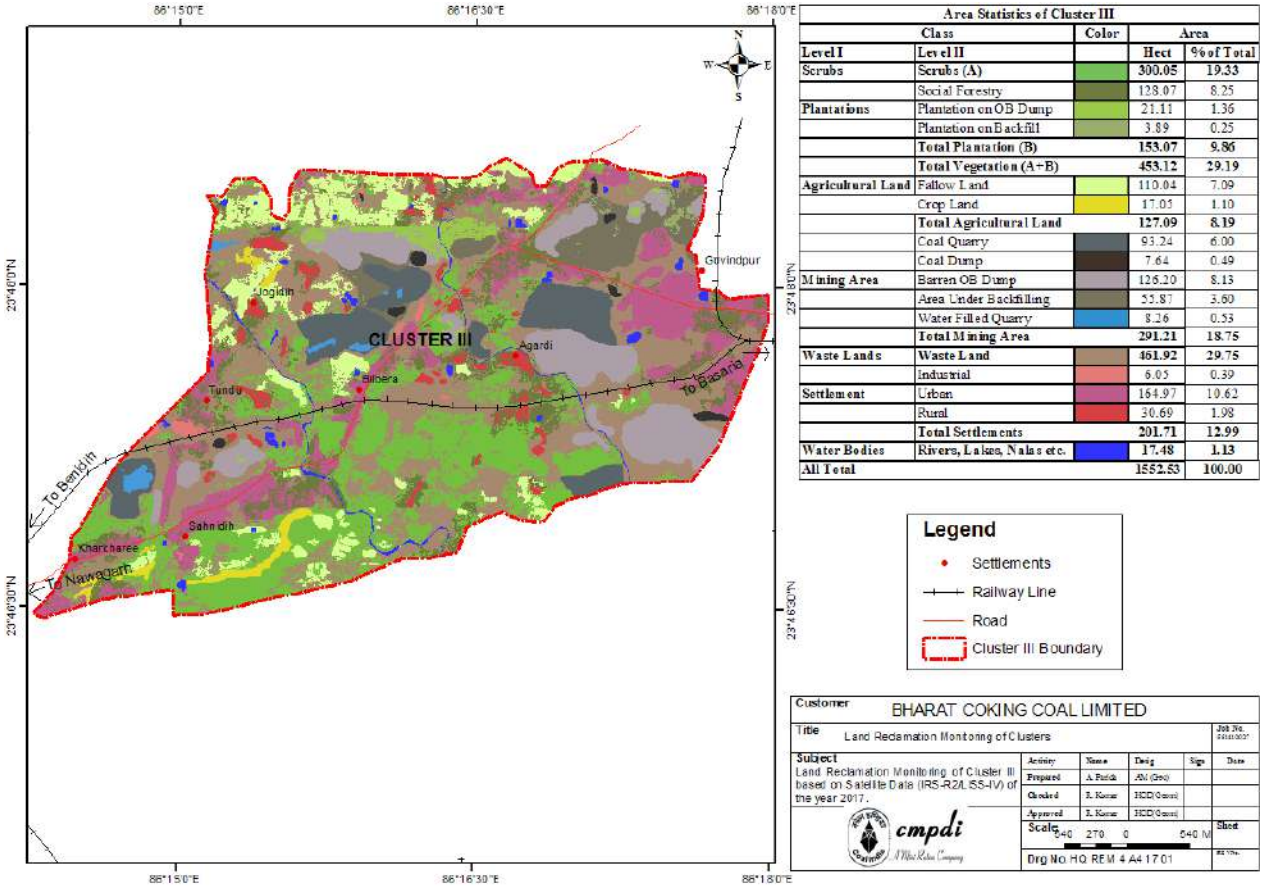
Monitoring stations (**A-12, A-25, A-29, B-14 and B-60**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A12	Jamua	2.60	0.32	0.50	1.20	2.10	0.29	0.45	0.75	1.20	2.80	0.40	1.0
2	A25	Sinidih	2.98	1.30	1.83	2.53	6.08	1.43	1.93	2.48	4.88	6.63	2.88	3.13
3	A29	Dharmaband	6.20	1.21	3.20	3.25	4.85	1.20	3.40	3.65	3.25	6.45	2.86	2.10
4	B14	Mathadih	2.44	0.32	1.04	1.69	2.24	0.54	0.94	2.04	1.69	3.64	1.22	2.84
5	B60	Sonardih	10.33	0.91	3.21	6.13	8.13	1.23	3.23	4.93	8.21	13.68	3.13	4.23
Average WL (bgl)			4.91	0.81	1.96	2.96	4.68	0.94	1.99	2.77	3.85	6.64	2.12	2.64

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.10 m Max – 13.68 m
Post-monsoon GW Level (m): Min – 0.45 m Max – 4.23 m

LAND USE / LAND COVER MAP OF THE CLUSTER-III MINES, BCCL



Area Statistics of Cluster III				
Class		Color	Area	
Level I	Level II		Hect	% of Total
Scrubs	Scrubs (A)		300.05	19.33
	Social Forestry		128.07	8.25
Plantations	Plantation on OB Dump		21.11	1.36
	Plantation on Backfill		3.89	0.25
	Total Plantation (B)		**153.07**	**9.86**
	Total Vegetation (A+B)		**453.12**	**29.19**
Agricultural Land	Fallow Land		110.04	7.09
	Crop Land		17.05	1.10
	Total Agricultural Land		**127.09**	**8.19**
	Coal Quarry		93.24	6.00
	Coal Dump		7.64	0.49
Mining Area	Barren OB Dump		126.20	8.13
	Area Under Backfilling		55.87	3.60
	Water Filled Quarry		8.26	0.53
	Total Mining Area		**291.21**	**18.75**
Waste Lands	**Waste Land**		**461.92**	**29.75**
	Industrial		6.05	0.39
Settlement	Urban		164.97	10.62
	Rural		30.69	1.98
	Total Settlements		**201.71**	**12.99**
Water Bodies	Rivers, Lakes, Nalas etc.		17.48	1.13
All Total			1552.53	100.00

Customer: BHARAT COKING COAL LIMITED

Title: Land Reclamation Monitoring of Clusters

Subject: Land Reclamation Monitoring of Cluster III based on Satellite Data (IRS-R2A LISS-IV) of the year 2017.

cmpdi

Scale: 540 270 0 540 M

Drg No: HQ REM 4 A4 1701

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	580.21×10^4	580.21×10^4	580.21×10^4
2	Open Land	770.61×10^4	770.61×10^4	770.61×10^4
3	Road/ Paved Area	164.97×10^4	164.97×10^4	164.97×10^4
4	Rooftop area of building/ sheds	36.74×10^4	36.74×10^4	36.74×10^4
5	Total	1552.53×10^4	1552.53×10^4	1552.53×10^4

D. GROUND WATER LEVEL OF CLUSTER-IV

Cluster-IV consists of six mines namely, Amalgamated Keshalpur & West Mudidih colliery, Amalgamated Angarpathra & Ramkanali colliery, Katras-Choitudih Colliery, Salanpur colliery and Gaslitand colliery of Katras area, BCCL. It is located in the north-central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out more than 30 years considering annual target production of 9.55 MTPA (Toposheet no – 73 I/5).

The present leasehold area of Cluster-IV is 1123.79 Ha. The area has a general undulating topography, with an overall gentle south-westerly slope. The RL varies from 182 m to 216 m AMSL. Katri River, Kumari Jore and its tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Katri River.

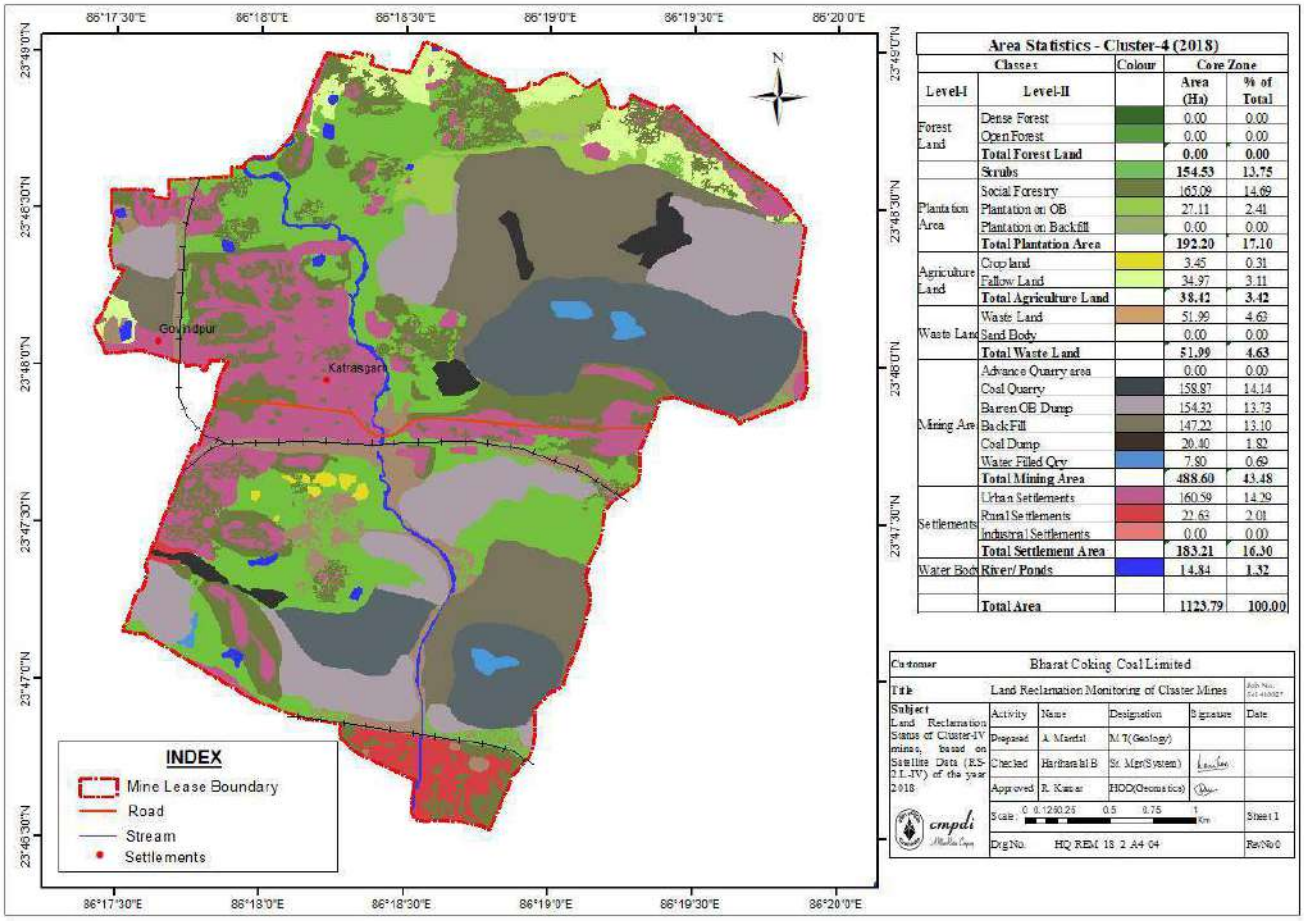
Monitoring stations (**A-26, A28A, B-64 and B-65A**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A-26	Malkhera	6.98	2.69	3.18	4.78	6.58	2.23	3.33	3.83	4.75	6.23	3.58	3.88
2	A28A	Lakarka	4.00	1.33	3.03	3.35	2.45	1.25	3.15	3.60	2.22	4.15	2.00	2.51
3	B-64	Keshalpur	1.85	0.93	0.50	1.37	0.95	0.30	0.45	1.20	1.42	2.15	0.55	1.85
4	B65A	Jhinjipahari	9.25	0.03	2.30	4.10	11.05	1.85	0.95	2.95	4.18	10.03	2.10	2.40
Average WL (bgl)			5.52	1.25	2.25	3.40	5.26	1.41	1.97	2.90	3.14	5.64	2.16	2.66

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 0.95 m Max – 11.05 m
Post-monsoon GW Level (m): Min – 0.45 m Max – 3.88 m

LAND USE / LAND COVER MAP OF THE CLUSTER-IV MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	385.15×10^4	385.15×10^4	385.15×10^4
2	Open Land	555.43×10^4	555.43×10^4	555.43×10^4
3	Road/ Paved Area	160.59×10^4	160.59×10^4	160.59×10^4
4	Rooftop area of building/ sheds	22.63×10^4	22.63×10^4	22.63×10^4
5	Total	1123.79×10^4	1123.79×10^4	1123.79×10^4

E. GROUND WATER LEVEL OF CLUSTER-V

Cluster-V consists of twelve mines namely; Tetulmari OC & UG mines, Mudidih OC & UG mines, Nichitpur OC mine, Sendra Bansjore OC & UG mines, Bansdeopur OCP (proposed) & UG Mines, Kankanee OC & UG mines and Loyabad UG mine (closed) of Sijua area, BCCL. This Cluster of mines is located in northern part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out more than 30 years considering annual target production of 6.311 MTPA (Toposheet no – 73 I/6).

The present leasehold area of Cluster-V is 1724.52 Ha. The area has a general undulating topography, with an overall gentle south westerly slope. The RL varies from 210 m to 170 m AMSL. Jarian Nala, Nagri Jore, Ekra Jore and its tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Jarian Nala and Ekra Jore.

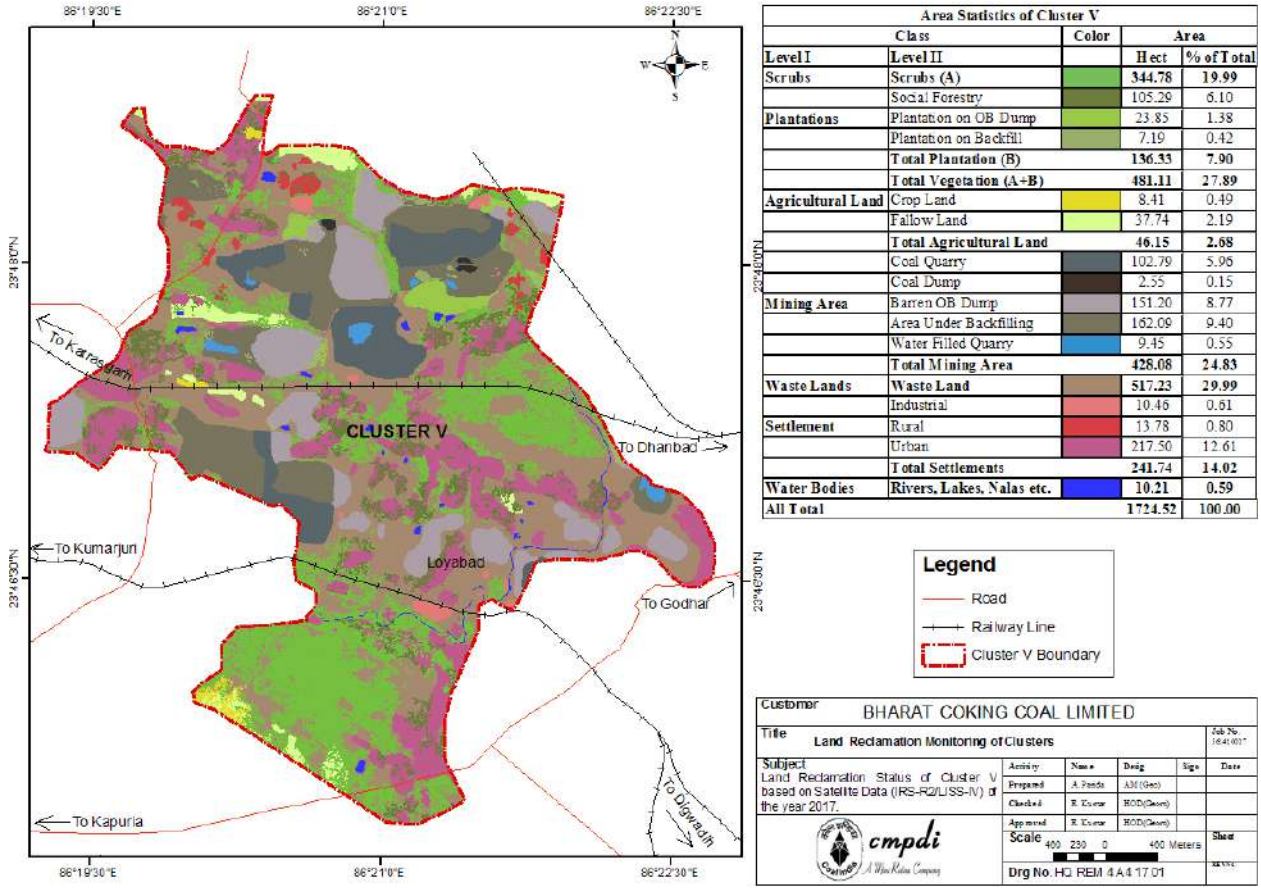
Monitoring stations (**A-3, A-16, A-27 and D-23**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A-3	Sijua	1.57	0.02	0.47	0.77	3.47	0.32	0.47	0.62	0.77	1.27	0.37	0.47
2	A-16	Ekra	7.15	1.34	1.75	3.20	5.45	1.65	1.95	4.55	2.60	4.30	2.05	3.65
3	A-27	Tetulmari	2.40	0.03	1.10	1.90	2.40	0.15	0.92	1.30	1.90	2.90	1.49	1.00
4	D-23	Jogta	5.60	1.69	3.35	3.70	4.70	1.65	1.40	1.50	2.70	4.40	2.60	3.40
Average WL (bgl)			4.18	0.77	1.67	2.39	4.01	0.94	1.19	1.99	1.99	3.22	1.63	2.13

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.27 m Max – 5.60 m
Post-monsoon GW Level (m): Min – 0.47 m Max – 3.65 m

LAND USE / LAND COVER MAP OF THE CLUSTER-V MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	527.26×10^4	527.26×10^4	527.26×10^4
2	Open Land	973.52×10^4	973.52×10^4	973.52×10^4
3	Road/ Paved Area	217.50×10^4	217.50×10^4	217.50×10^4
4	Rooftop area of building/ sheds	24.24×10^4	24.24×10^4	24.24×10^4
5	Total	1724.52×10^4	1724.52×10^4	1724.52×10^4

F. GROUND WATER LEVEL OF CLUSTER-VI

Cluster–VI consists of four coal mines; East Bassuriya opencast (OC), Bassuriya underground (UG), Gondudih Khas-Kusunda OC and Godhur Mixed Mines (OC and UG) of BCCL. This Cluster of mines is located in central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out more than 30 years considering annual target production of 7.631 MTPA (Toposheet no – 73 I/6).

The present leasehold area of Cluster-VI is 831.83 Ha. The area has a general undulating topography with general slope towards south. The RL varies from 180 m to 240 m AMSL. Ekra Jore, Kari Jore and their tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Ekra Jore and Kari Jore.

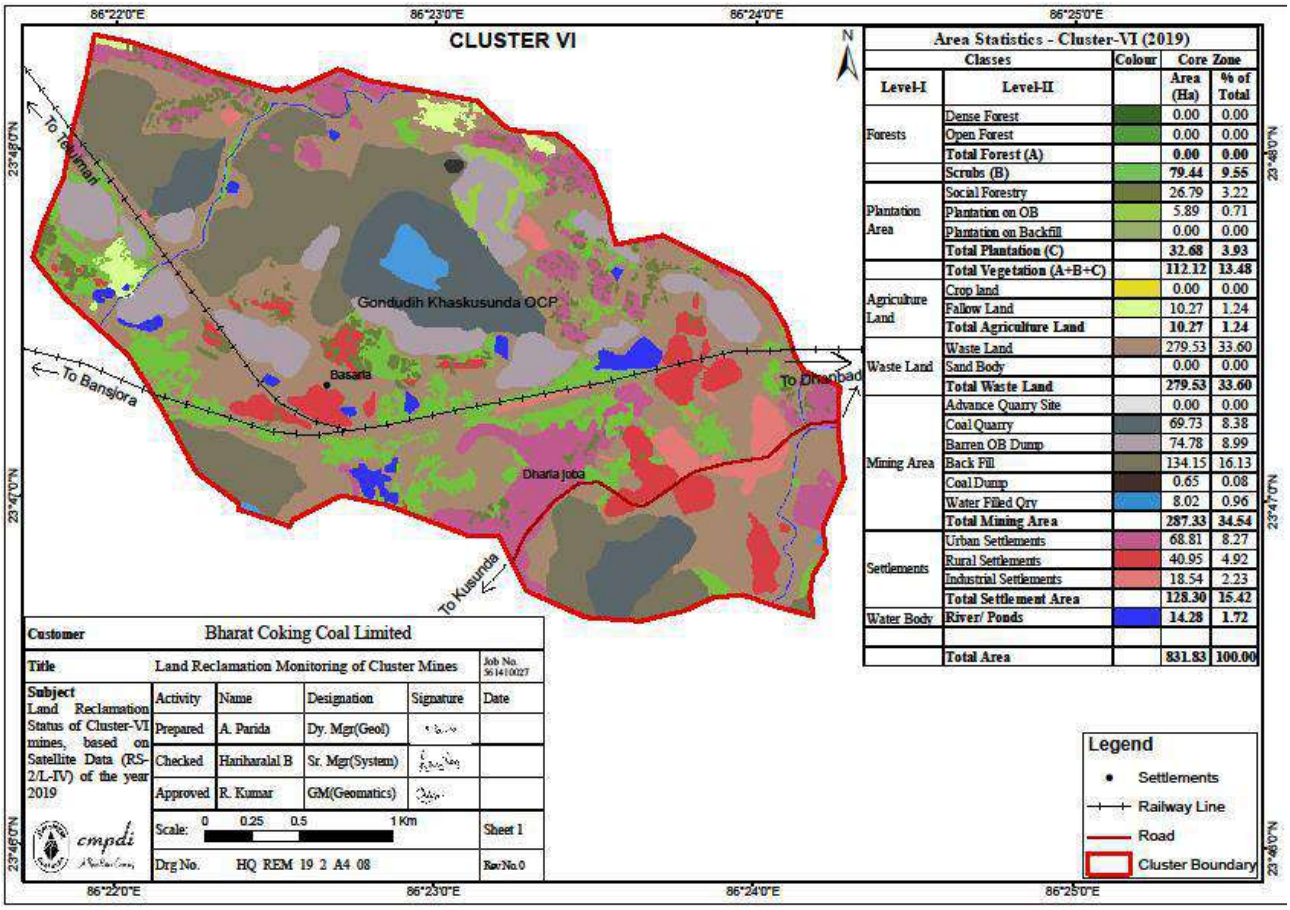
Monitoring stations (**D-25 and D-30**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	D25	Godhur	10.50	2.28	5.62	6.40	9.90	4.35	5.38	5.50	0.50	2.60	0.60	2.40
2	D30	Borkiboa	4.50	1.65	1.35	2.40	4.60	0.38	0.75	1.95	2.60	4.58	1.00	1.10
Average WL (bgl)			7.50	1.97	3.49	4.40	**7.25**	**2.37**	**3.07**	**3.73**	***1.55***	***3.59***	***0.80***	***1.75***

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.60 m Max – 10.50 m
Post-monsoon GW Level (m): Min – 0.75 m Max – 5.62 m

LAND USE / LAND COVER MAP OF THE CLUSTER-VI MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	122.39 X 10^4	122.39 X 10^4	122.39 X 10^4
2	Open Land	581.14 X 10^4	581.14 X 10^4	581.14 X 10^4
3	Road/ Paved Area	68.81 X 10^4	68.81 X 10^4	68.81 X 10^4
4	Rooftop area of building/ sheds	59.49 X 10^4	59.49 X 10^4	59.49 X 10^4
5	Total	831.83 X 10^4	831.83 X 10^4	831.83 X 10^4

G. GROUND WATER LEVEL OF CLUSTER-VII

Cluster-VII consists of fourteen mines namely; Kusunda Area, Bastacolla Area and PB Area B.C.C.L (Jharia Coalfield) is located in Dhanbad district of Jharkhand. Cluster–VII consists of coal mines; Dhansar UG, Dhansar OCP, Kusunda OCP and Viswakarma OCP (proposed) are under the administrative control of Kusunda Area and Industry UG (closed), Alkusa UG, Ena OCP, S.Jharia/Rajapur OCP, Burragarh UG, Simlabahal UG, Hurriladih UG, Bhutgoria UG (Re-opening), Kustore UG (closed) and E.Bhuggatdih UG (closed) are under Bastacolla and PB Area of BCCL. This Cluster of mines is located in east central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out more than 30 years considering annual target production of 8.226 MTPA (Toposheet no – 73 I/6).

The present leasehold area of Cluster-VII is 2127.70 Ha. The area has a general undulating topography with general slope towards south. The RL varies from 172 m to 221 m above M.S.L. Kari Jore, Chatkari Jore and its tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Kari Jore and Chatkari Jore.

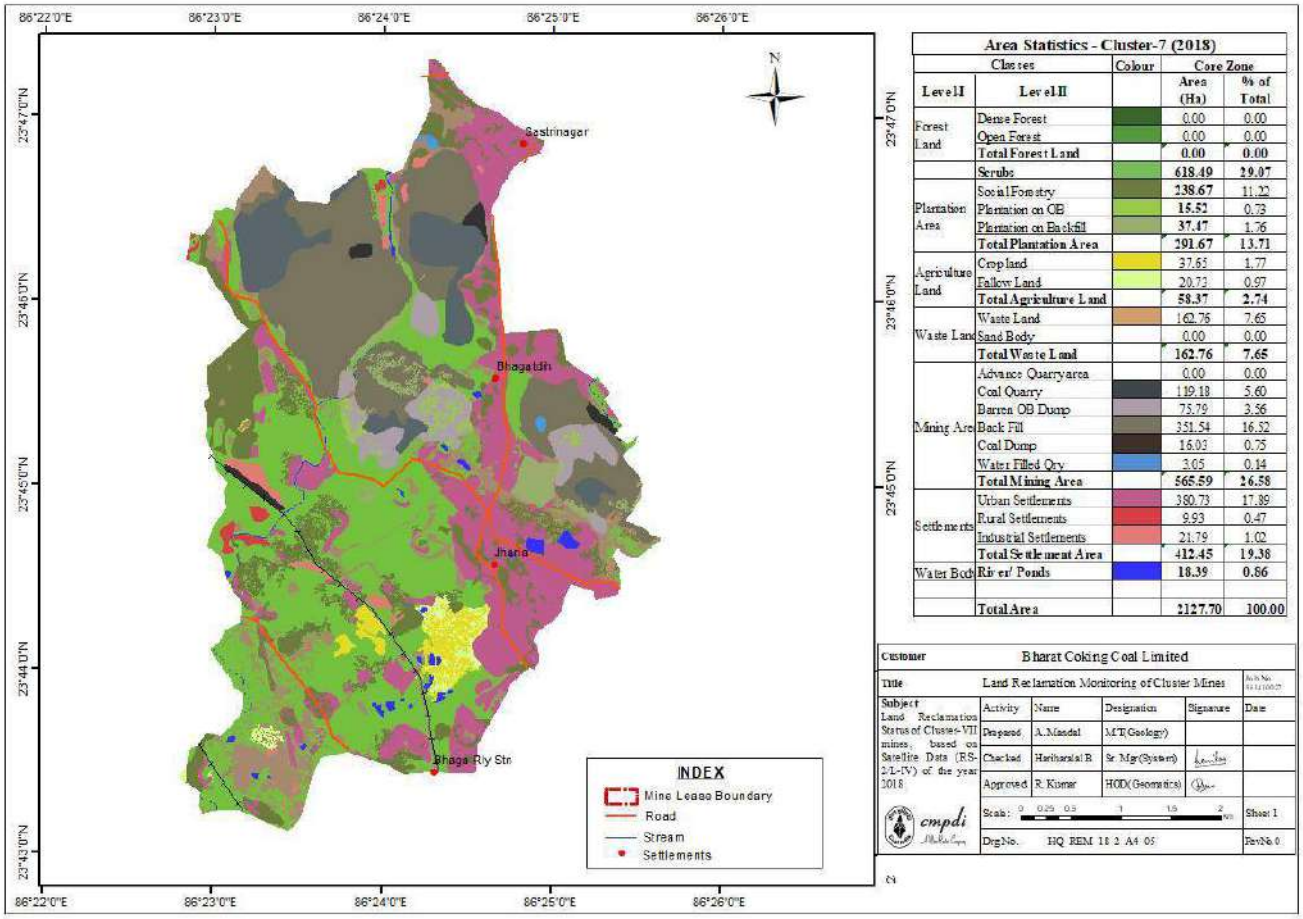
Monitoring stations (**D-3, D-4, D-33, D-34, D-47, D-55 and D-80**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	D-3	Dhansar	5.40	0.56	1.38	1.90	1.75	1.05	1.30	1.45	1.65	3.43	1.50	2.45
2	D-4	Jharia	3.41	0.51	1.41	2.26	2.81	1.16	1.71	2.16	1.21	1.91	0.91	1.56
3	D33	Kustore	3.65	0.48	1.45	1.80	2.35	0.25	1.65	2.35	0.55	2.85	0.55	0.95
4	D34	Kusunda	3.30	2.00	2.80	2.95	4.75	2.10	2.40	2.55	0.60	2.80	0.45	0.70
5	D47	Parastanr	9.45	3.41	5.45	5.83	4.55	1.90	4.35	4.20	3.55	5.33	2.55	3.65
6	D55	Hariladih	9.42	3.88	8.60	8.62	8.42	2.97	5.47	8.62	4.42	8.42	1.57	4.02
7	D80	Bastacolla	4.30	2.08	4.90	5.00	5.00	2.30	3.05	3.80	4.35	9.35	3.28	4.20
Average WL (bgl)			5.56	1.85	3.71	4.05	4.23	1.68	2.85	3.59	2.33	4.87	1.54	2.50

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.75 m Max – 9.45 m
Post-monsoon GW Level (m): Min – 0.70 m Max – 8.60 m

LAND USE / LAND COVER MAP OF THE CLUSTER-VII MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	968.53 x 10^4	968.53 x 10^4	968.53 x 10^4
2	Open Land	746.72 x 10^4	746.72 x 10^4	746.72 x 10^4
3	Road/ Paved Area	380.73 x 10^4	380.73 x 10^4	380.73 x 10^4
4	Rooftop area of building/ sheds	31.71 x 10^4	31.71 x 10^4	31.71 x 10^4
5	Total	2127.70 x 10^4	2127.70 x 10^4	2127.70 x 10^4

H. GROUND WATER LEVEL OF CLUSTER-VIII

Cluster - VIII of B.C.C.L mines under administrative control of Bastacolla Area of B.C.C.L (Jharia Coalfield) is located in Dhanbad district of Jharkhand. Cluster-VIII consists of ten mines namely; Bastacolla mixed mines (OC & UG), Bera mixed mines (OC&UG), Dobari UG, Kuya mixed mines (OC&UG), Proposed Goluckdih (NC) OC mine, Ghanoodih OC mine and Kujama OC mine are under Bastacolla Area of BCCL is located in the west part of Jharia Coalfield. All above the mines are contiguous in nature and the environmental impact is overlapping in ambient environment due to cumulative effect of the mining activities. The life of the project works out upto 25 years considering annual target production of 6.383 MTPA (toposheet no. 73 I/5 and I/6).

The present leasehold area of Cluster-VIII is 1331.95 Ha. The area has a general undulating topography with general slope towards south and south-west. The ground elevation in the area ranges from 175 m to 221 m AMSL. Chatkari Jore, Tisra Jore and its tributaries controlling the drainage pattern of the area. The area comes under the watershed of Chatkari Jore.

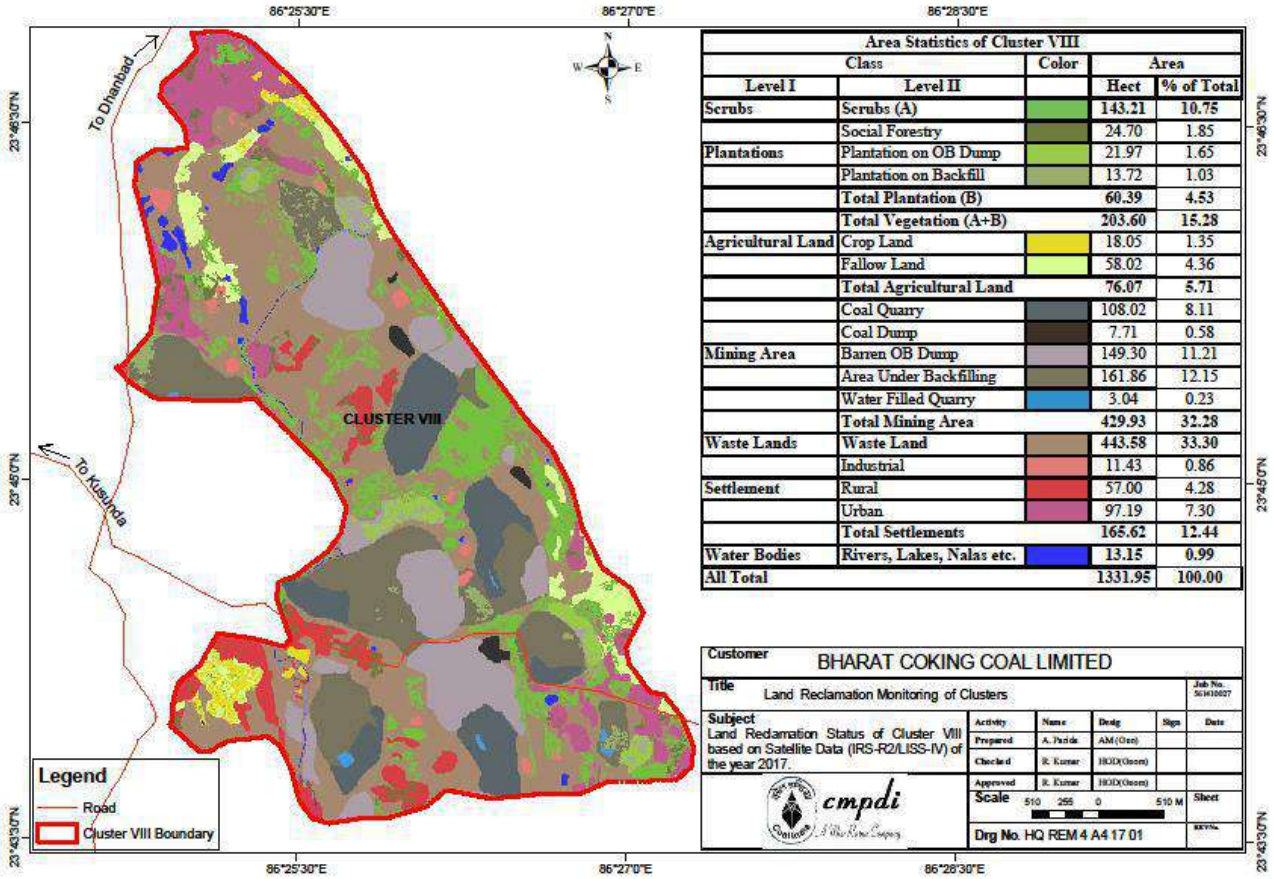
Monitoring stations (**D-8, D-43, D-49 and D-51**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	D-8	Alokdiha	5.83	1.70	2.75	3.20	4.80	1.95	2.85	4.25	3.20	5.65	1.65	1.85
2	D43	Alagdih	6.60	2.31	2.55	3.05	7.35	3.55	2.70	4.25	3.05	7.15	2.90	3.45
3	D49	Galucdih	3.25	1.41	1.65	1.98	1.75	0.60	1.50	1.25	1.98	3.45	1.45	2.45
4	D51	Chankuiya	8.45	6.03	5.70	7.35	9.95	8.05	5.75	7.75	8.26	10.93	4.80	7.10
Average WL (bgl)			6.03	2.86	3.16	3.90	5.96	3.54	3.20	4.38	4.12	6.80	2.70	3.71

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.75 m Max – 10.93 m
Post-monsoon GW Level (m): Min – 1.50 m Max – 5.75 m

LAND USE / LAND COVER MAP OF THE CLUSTER-VIII MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	279.69 x 10^4	279.69 x 10^4	279.69 x 10^4
2	Open Land	886.66 x 10^4	886.66 x 10^4	886.66 x 10^4
3	Road/ Paved Area	97.19 x 10^4	97.19 x 10^4	97.19 x 10^4
4	Rooftop area of building/ sheds	68.43 x 10^4	68.43 x 10^4	68.43 x 10^4
5	Total	1331.95 x 10^4	1331.95 x 10^4	1331.95 x 10^4

I. GROUND WATER LEVEL OF CLUSTER-IX

Cluster - IX of B.C.C.L mines under administrative control of Lodna Area of B.C.C.L (Jharia Coalfield) is located in Dhanbad district of Jharkhand. Cluster- IX consists of eight mines namely; North Tisra/South Tisra OCP, Jeenagora OCP, North Tisra UG, Lodna UG, Bagdigi UG, Bararee UG, Joyrampur UG and Jealgora UG (closed) are under the administrative control of Lodna Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). Among them N. Tisra/S. Tisra OCP, Jeenagora OCP and N. Tisra UG mine will be amalgamated and will formed North Tisra/South Tisra Expansion OCP. North Tisra/South Tisra Expansion OCP, Lodna UG, Bagdigi UG, Bararee UG and Joyrampur UG are under Lodna Area of BCCL is located in the west part of Jharia Coalfield. All above the mines are contiguous in nature and the environmental impact is overlapping in ambient environment due to cumulative effect of the mining activities. The life of the project works out upto 30 years considering annual target production of 8.513 MTPA (toposheet no. 73 I/6).

The present leasehold area of Cluster-IX is 1967.22 Ha. The topography of the area is undulating with gentle slope towards south. The RL varies from 221 m to 188.44 m AMSL. Chatkari Jore, Tisra Jore, Sulunga Jore and its tributaries controlling the drainage pattern of the area. The area comes under the watershed of Chatkari Jore.

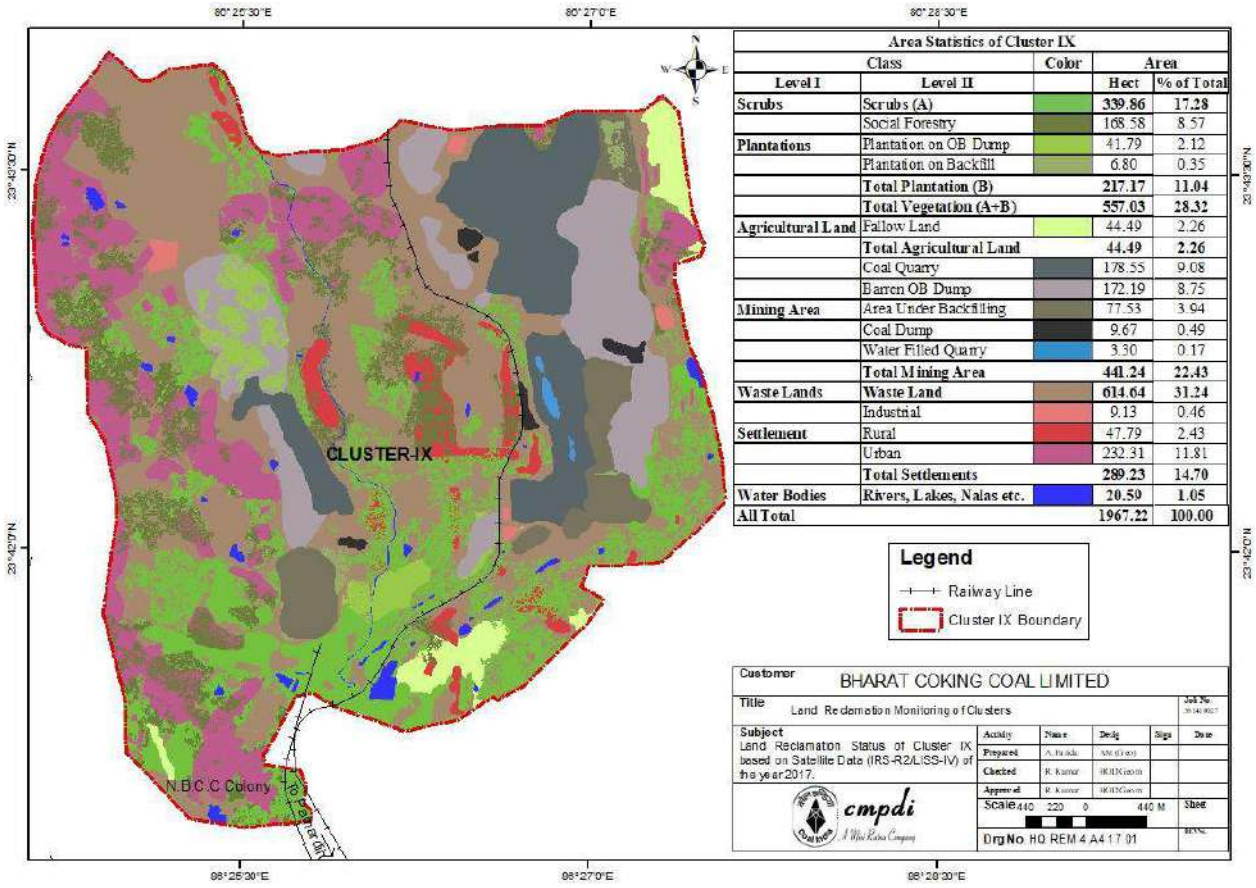
Monitoring stations (**D-5, D-7, D-39, D-40A, D-41 and D-74**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	D-5	Jiyalgora	8.60	3.20	7.70	7.90	8.25	2.90	4.85	8.20	5.80	7.80	4.39	5.30
2	D-7	Golden Pahari	7.33	2.56	5.13	5.35	8.23	1.88	3.28	4.86	5.15	7.53	2.23	2.83
3	D-39	Tilaboni	9.40	3.35	6.05	6.78	12.60	4.00	5.95	12.45	3.18	4.95	2.50	4.35
4	D40A	Khapa Dhawra	1.95	0.30	1.43	6.78	1.85	1.50	1.45	1.95	1.70	2.10	1.10	1.40
5	D-41	Joyrampur	3.30	1.43	1.45	1.60	2.30	0.70	1.25	1.40	1.30	1.59	1.08	1.32
6	D-74	Bhulan Bararee	4.30	2.58	3.93	4.00	5.80	2.35	3.57	4.95	5.80	8.60	3.40	4.80
Average WL (bgl)			5.81	2.24	4.28	4.54	6.51	2.22	3.39	5.64	3.82	5.43	2.45	3.33

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.59 m Max – 12.60 m
Post-monsoon GW Level (m): Min – 1.25 m Max – 7.70 m

LAND USE / LAND COVER MAP OF THE CLUSTER-IX MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	601.52×10^4	601.52×10^4	601.52×10^4
2	Open Land	1076.47×10^4	1076.47×10^4	1076.47×10^4
3	Road/ Paved Area	232.31×10^4	232.31×10^4	232.31×10^4
4	Rooftop area of building/ sheds	56.92×10^4	56.92×10^4	56.92×10^4
5	Total	1967.22×10^4	1967.22×10^4	1967.22×10^4

J. GROUND WATER LEVEL OF CLUSTER-X

Cluster-X consists of Bhowrah North OC & UG, Bhowrah South OC & UG, Amalgamated Sudamdih Patherdih, Sudamdih Shaft, Amlabad UG (Closed) and Sudamdih Coal Washery comes under the administrative control of Eastern Jharia Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). This cluster of mines is located in eastern part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out is more than 30 years considering annual target production of 2.289 MTY.

Cluster-X mine involves leasehold area of about 2057.47 Ha of land. It covered in Survey of India toposheet no. 73 I/6. The area of Bhowrah North OC & UG, Bhowrah South OC & UG, Amalgamated Sudamdih Patherdih, Sudamdih Shaft, Amlabad UG (Closed) are 280.83 Ha, 571.58 Ha, 498.61 Ha, 391.50 Ha and 386.95 Ha respectively.

The present leasehold area of Cluster-X is 2057.47 Ha. The area has an undulating topography with gentle slope towards south and south east. The RL varies from 185 m to 150.0 m AMSL. Gaurkuthi Nala and few seasonal streams are controlling the drainage pattern of the area. The area comes under the watershed of Damodar River.

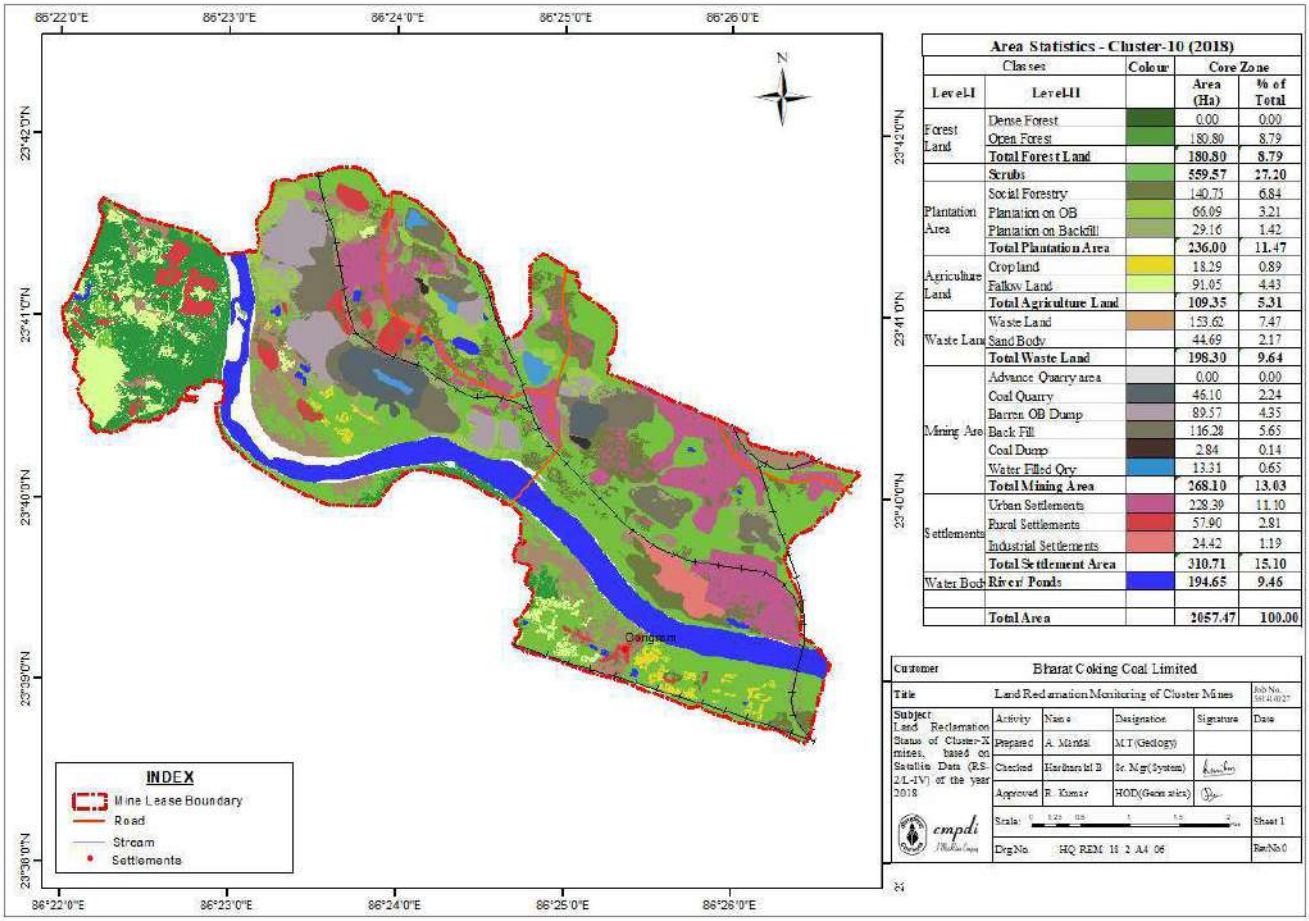
Monitoring stations (**A-19, D-35, D-36 and D-77**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A-19	Bhowrah	6.05	2.30	3.25	3.70	4.85	0.95	3.43	4.95	2.95	5.55	1.85	2.45
2	D-35	Patherdih	8.20	2.98	5.40	5.62	8.00	3.15	3.80	5.90	6.58	8.40	3.58	4.45
3	D-36	Sudamdih	2.10	0.06	1.00	1.15	1.20	0.10	0.55	0.65	1.00	1.20	0.45	0.60
4	D-77	Amlabad	6.40	5.90	3.50	4.25	6.40	2.80	3.20	4.50	3.63	6.30	4.00	5.20
Average WL (bgl)			5.69	2.81	3.29	3.68	5.11	1.75	2.75	4.00	3.54	5.36	2.47	3.18

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.20 m Max – 8.40 m
Post-monsoon GW Level (m): Min – 0.55 m Max – 5.40 m

LAND USE / LAND COVER MAP OF THE CLUSTER-X MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1085.72 x 10^4	1085.72 x 10^4	1085.72 x 10^4
2	Open Land	661.04 x 10^4	661.04 x 10^4	661.04 x 10^4
3	Road/ Paved Area	228.39 x 10^4	228.39 x 10^4	228.39 x 10^4
4	Rooftop area of building/ sheds	82.32 x 10^4	82.32 x 10^4	82.32 x 10^4
5	Total	2057.47 x 10^4	2057.47 x 10^4	2057.47 x 10^4

K. GROUND WATER LEVEL OF CLUSTER-XI

Cluster–XI consists of eight coal mines; Moonidih UG, Gopalichak UG Project, Kachi Balihari 10/12 Pit UG, Pootkee Balihari Project UG, Bhagaband UG, Kendwadih UG (closed), Pootkee UG (closed), Kachi Balihari 5/6 Pit UG (closed) are under the administrative control of Western Jharia Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). The Cluster- XI is located in central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out about upto 50 years considering annual target production of 6.604 MTPA (toposheet no. no. 73 I/5 7 73 I/6).

The present leasehold area of Cluster-XI is 3527.58 Ha. The area has an undulating topography with gentle slope towards south. The RL varies from 201 m to 166 m AMSL. Katri River, Jarian Nala, Ekra Jore and Kari Jore are controlling the drainage of the area. The area comes under the watershed of Katri River and Kari Jore.

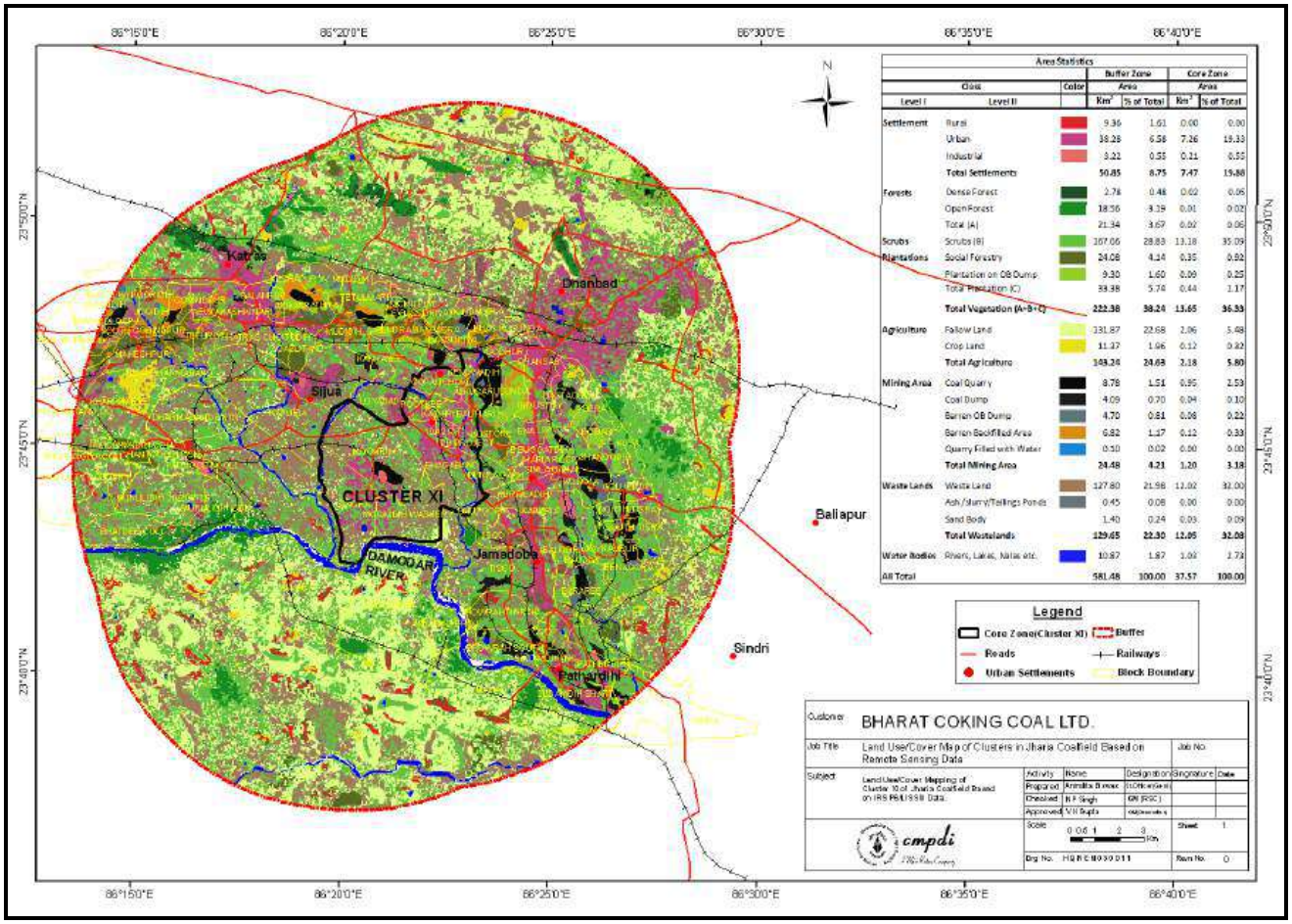
Monitoring stations (**A-17, A-18, A-20 and A-32**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A-17	Kachi Balihari	2.14	0.64	1.69	1.79	2.94	0.34	2.24	2.42	2.07	3.34	1.64	2.84
2	A-18	Baghaband	1.09	0.39	0.34	0.89	2.29	1.09	0.69	1.09	0.89	1.24	1.34	0.99
3	A-20	Gorbudih	8.47	1.44	3.87	4.42	4.57	3.32	1.82	4.02	3.59	4.57	1.92	2.57
4	A-32	Baludih	1.90	0.36	1.75	1.80	2.75	0.62	0.95	1.65	0.60	2.80	0.45	0.70
Average WL (bgl)			3.40	0.71	1.91	2.23	3.14	1.34	1.43	2.30	2.26	3.20	1.64	2.16

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 0.62 m Max – 8.47 m
Post-monsoon GW Level (m): Min – 0.34 m Max – 3.87 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XI MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1060.61×10^4	1293.46×10^4	1293.46×10^4
2	Open Land	1518.33×10^4	1509.06×10^4	1509.06×10^4
3	Road/ Paved Area	171.08×10^4	171.08×10^4	171.08×10^4
4	Rooftop area of building/ sheds	777.56×10^4	563.06×10^4	563.06×10^4
5	Total	3527.58×10^4	3527.58×10^4	3527.58×10^4

L. GROUND WATER LEVEL OF CLUSTER-XIII

Cluster-XIII, consists of one running mine (Murulidih 20/21 pit UG mine) and six abandoned mines i.e. Bhurungiya colliery, Muchraidih colliery, Hantoodih colliery, Padugora colliery, Murulidih colliery and Bhatdee colliery of Western Jharia area, BCCL is located in the south-western part of Jharia coal field in Dhanbad district of Jharkhand. The area is covered by Survey of India toposheet no. 73 I/6. The life of the project works out about 15 years considering annual target production of 0.234 MTPA.

The present leasehold area of Cluster-XIII is 1898.62 Ha. The area has an undulating topography with gentle slope towards south-east. The maximum RL is 224 m AMSL in the north-western part of the area whereas the minimum RL is 179 m AMSL at southern part. The area comes under the watershed area of Jamunia River and Katri River.

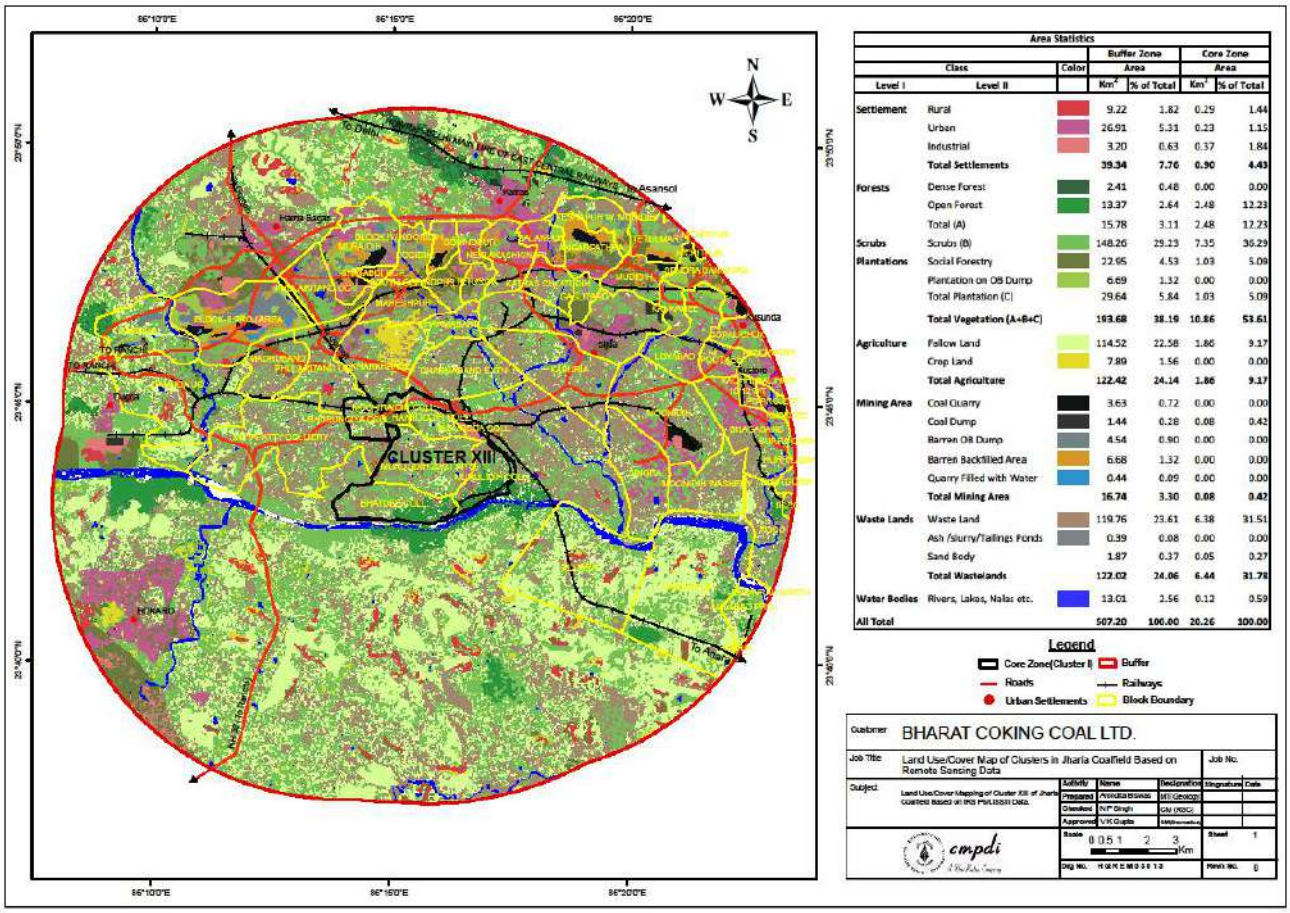
Monitoring stations (**A-22, A-23, A-33, A-34, B-25 and B-48**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A-22A	Nagdah Basti	2.90	0.20	1.98	2.00	2.60	1.75	2.00	2.85	1.70	3.35	1.10	1.30
2	A-23	Machhayara	8.92	1.12	5.62	7.12	11.97	5.37	3.77	6.57	8.92	11.15	6.46	7.17
3	A-33	Mahuda Washery	4.55	0.38	1.85	2.85	3.65	0.55	1.25	1.55	2.24	4.07	1.26	2.35
4	A-34	Mahuda Mosque	8.35	3.43	3.45	5.35	6.35	3.45	3.95	5.45	5.32	9.45	4.75	5.35
5	B-25	Mahuda More	7.90	3.02	2.55	3.45	4.80	1.38	1.40	3.50	3.68	5.90	2.90	3.70
6	B-48	Mahuda	8.20	3.37	3.85	4.51	7.05	2.85	4.35	5.45	3.55	7.33	2.95	3.97
Average WL (bgl)			6.80	1.92	3.22	4.21	6.07	2.56	2.79	4.23	4.24	6.88	3.24	3.97

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.60 m Max – 11.15 m
Post-monsoon GW Level (m): Min – 1.25 m Max – 5.62 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XIII MINES, BCCL



Area Statistics

Class		Color	Buffer Zone Area		Core Zone Area	
Level I	Level II		Km²	% of Total	Km²	% of Total
Settlement	Rural		9.22	1.82	0.29	1.44
	Urban		26.91	5.31	0.23	1.15
	Industrial		3.20	0.63	0.37	1.84
	Total Settlements		**39.34**	**7.76**	**0.90**	**4.43**
Forests	Dense Forest		2.41	0.48	0.00	0.00
	Open Forest		13.37	2.64	2.48	12.23
	Total (A)		15.78	3.11	2.48	12.23
Scrubs	Scrubs (B)		148.26	29.23	7.35	36.29
Plantations	Social Forestry		22.95	4.53	1.03	5.09
	Plantation on OB Dump		6.69	1.32	0.00	0.00
	Total Plantation (C)		29.64	5.84	1.03	5.09
	Total Vegetation (A+B+C)		**193.68**	**38.19**	**10.86**	**53.61**
Agriculture	Fallow Land		114.52	22.58	1.86	9.17
	Crop Land		7.89	1.56	0.00	0.00
	Total Agriculture		**122.42**	**24.14**	**1.86**	**9.17**
Mining Area	Coal Quarry		3.63	0.72	0.00	0.00
	Coal Dump		1.44	0.28	0.08	0.42
	Barren OB Dump		4.54	0.90	0.00	0.00
	Barren Backfilled Area		6.68	1.32	0.00	0.00
	Quarry Filled with Water		0.44	0.09	0.00	0.00
	Total Mining Area		**16.74**	**3.30**	**0.08**	**0.42**
Waste Lands	Waste Land		119.76	23.61	6.38	31.51
	Ash /slurry/Tailings Ponds		0.39	0.08	0.00	0.00
	Sand Body		1.87	0.37	0.05	0.27
	Total Wastelands		**122.02**	**24.06**	**6.44**	**31.78**
Water Bodies	Rivers, Lakes, Nalas etc.		13.01	2.56	0.12	0.59
All Total			507.20	100.00	20.26	100.00

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1484.41 x 10^4	1570.48 x 10^4	1570.48 x 10^4
2	Open Land	183.28 x 10^4	97.22 x 10^4	97.22 x 10^4
3	Road/ Paved Area	71.84 x 10^4	71.83 x 10^4	71.83 x 10^4
4	Rooftop area of building/ sheds	159.09 x 10^4	159.09 x 10^4	159.09 x 10^4
5	Total	1898.62 x 10^4	1898.62 x 10^4	1898.62 x 10^4

M. GROUND WATER LEVEL OF CLUSTER-XIV

Cluster-XIV of B.C.C.L mines under administrative control of Western Jharia Area of B.C.C.L (Jharia Coalfield) is located in Dhanbad district of Jharkhand. Lohapatty UG and Lohapatty OC patch (proposed) are under the administrative control of Western Jharia Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). The Cluster- XIV is located in western part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out upto 08 years considering annual target production of 0.526 MTPA. Cluster-XIV mine involves leasehold area of about 1418.25 Ha of land. It covered in Survey of India toposheet no. 73 I/2.

The present leasehold area of Cluster-XIV is 1418.25 Ha. The topography of the area is undulating with slope towards south west. The maximum RL is 224 m in the north-eastern part whereas the minimum RL is 170 m above mean sea level on the south-western part of the area. Jamunia River and its tributaries are controlling the drainage of the area. The area comes under the watershed area of Jamunia River.

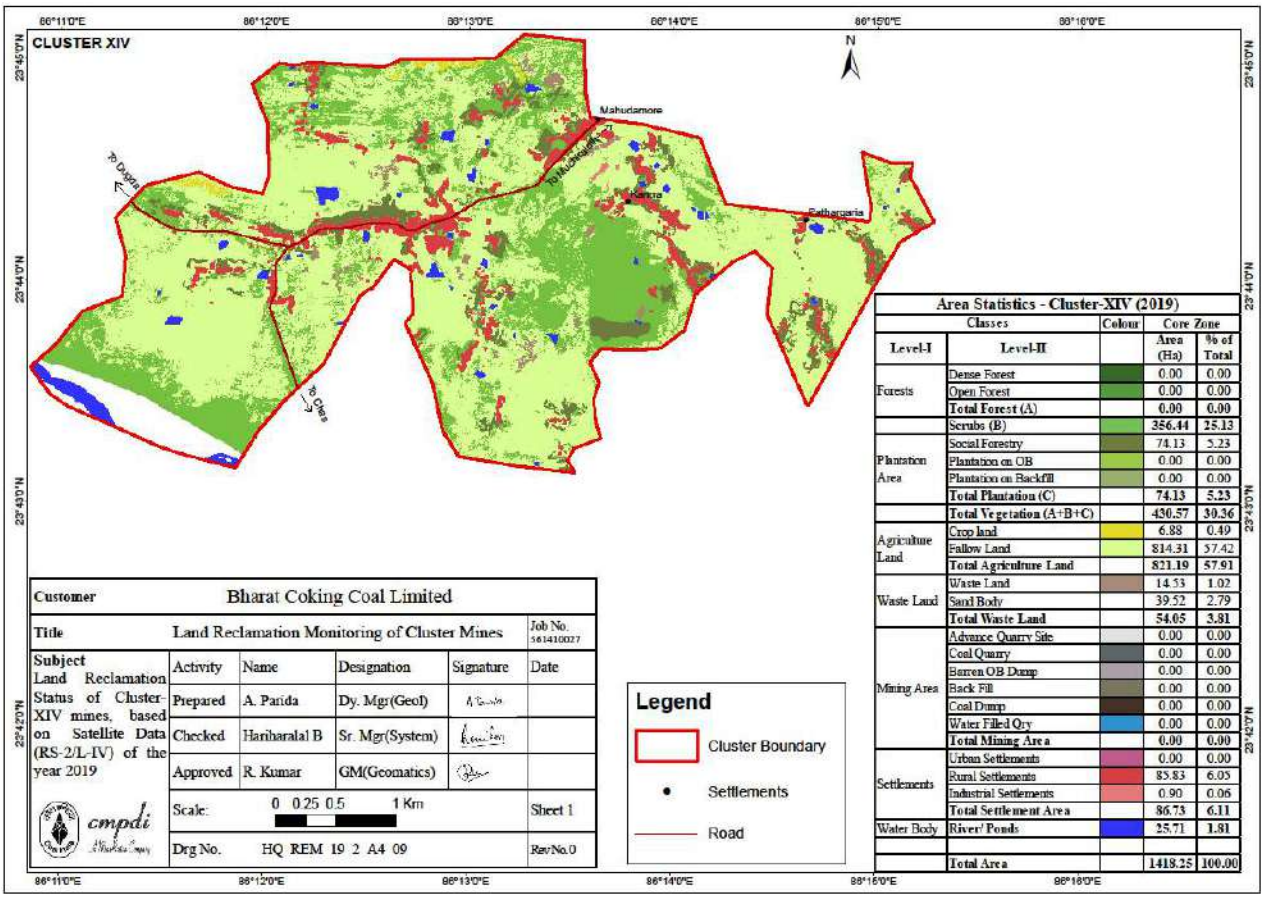
Monitoring stations (**B-23, B-24 and B-67**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	B-23	Lohapatti	3.24	0.77	1.76	2.69	2.84	1.12	1.34	2.24	3.04	6.64	1.74	2.14
2	B-24	Telmuchu	5.48	1.13	3.53	4.38	4.58	1.23	2.33	3.63	6.43	9.28	3.31	4.33
3	B-67	Simatanr	7.55	1.83	3.95	5.90	8.57	3.37	4.35	4.65	6.50	9.55	3.60	4.00
Average WL (bgl)			5.42	1.24	3.08	4.32	5.33	1.91	2.67	3.51	5.32	8.49	2.88	3.49

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.84 m Max – 9.55 m
Post-monsoon GW Level (m): Min – 1.34 m Max – 4.35 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XIV MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1251.76 x 10^4	1251.76 x 10^4	1251.76 x 10^4
2	Open Land	79.76 x 10^4	79.76 x 10^4	79.76 x 10^4
3	Road/ Paved Area	85.83 x 10^4	85.83 x 10^4	85.83 x 10^4
4	Rooftop area of building/ sheds	0.90 x 10^4	0.90 x 10^4	0.90 x 10^4
5	Total	1418.25 x 10^4	1418.25 x 10^4	1418.25 x 10^4

N. GROUND WATER LEVEL OF CLUSTER-XV

Cluster - XV of B.C.C.L mines under administrative control of Govindpur Area and barora Area of B.C.C.L (Jharia Coalfield) is located in Dhanbad district of Jharkhand. Cluster–XV consists of four coal mines; Kharkharee UG (underground mine) and Dharmaband UG are under the administrative control of Govindpur Area and Madhuband UG & Phularitand UG are under the administrative control of Barora Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). The Cluster-XV is located in western part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out upto 30 years considering annual target production of 0.423 MTPA. Cluster-XV mine involves leasehold area of about 1696.55 Ha of land. It covered in Survey of India toposheet no. 73 I/1 and 73 I/5.

The present leasehold area of Cluster-XV is 1696.55 Ha. The topography of the area is undulating with slope towards south-west. The maximum RL is 235 m in the Kharkharee mine area whereas the minimum RL is 165 m AMSL on the eastern & western part of the Cluster. Jamunia River and Khudia River are controlling the drainage of the area. The area comes under the watershed area of both Jamunia River and Khudia River.

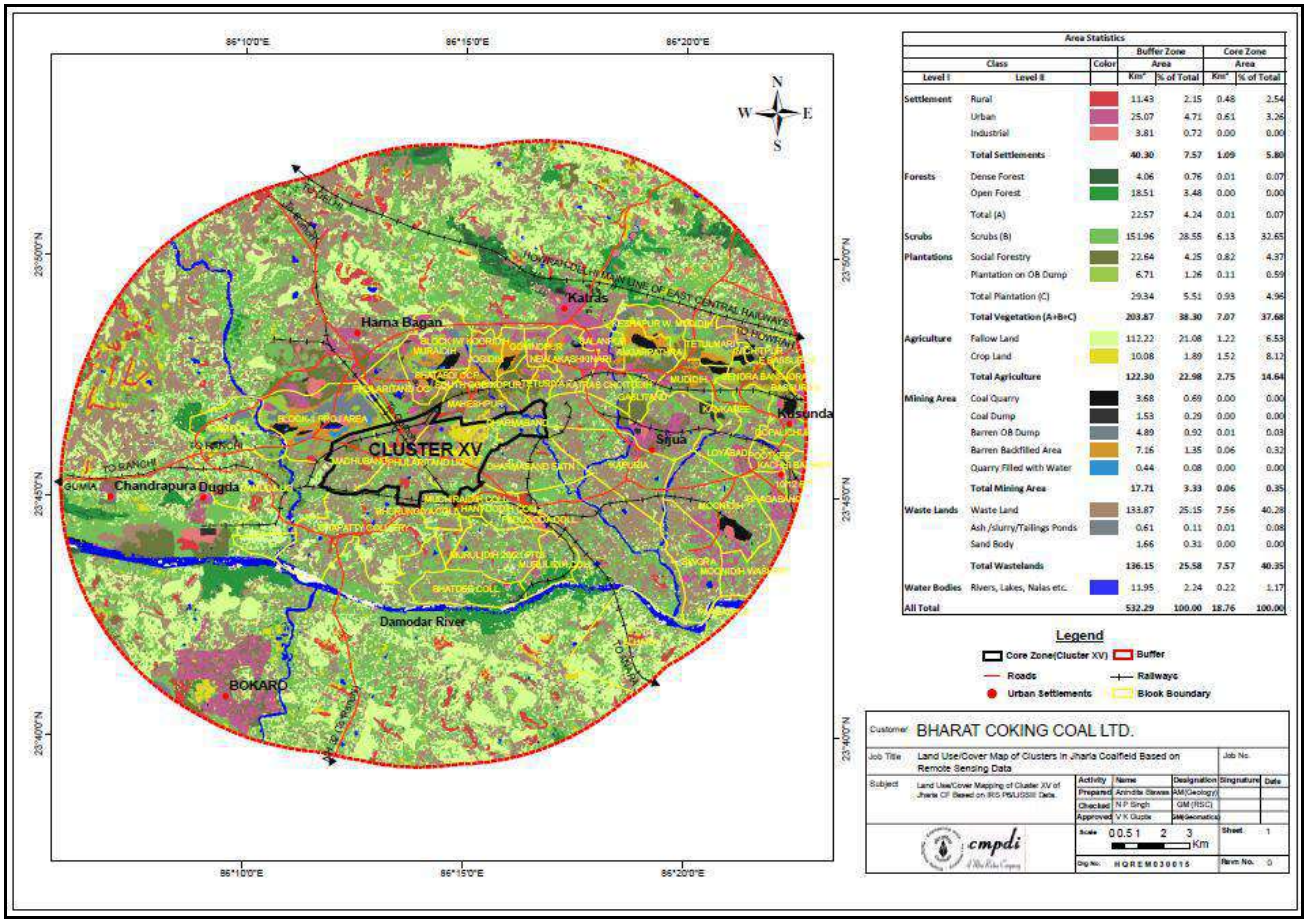
Monitoring stations (**A-24, B-32A and B-61A**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A24	Pipratanr	4.88	-	4.28	4.68	15.88	1.73	2.48	4.08	11.68	14.58	5.78	6.88
2	B32A	Madhuband	3.30	1.18	2.00	2.21	5.55	1.25	1.70	2.35	3.23	6.75	2.80	3.90
3	B61A	Kesargora	3.32	0.85	1.60	2.07	3.35	1.39	0.52	1.12	1.27	2.57	2.0	2.02
Average WL (bgl)			3.83	1.02	2.63	2.99	8.25	1.46	1.57	2.52	5.39	7.97	3.63	4.27

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.57 m Max – 15.88 m
Post-monsoon GW Level (m): Min – 0.52 m Max – 6.88 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XV MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	365.18×10^4	957.34×10^4	957.34×10^4
2	Open Land	1130.53×10^4	538.37×10^4	538.37×10^4
3	Road/ Paved Area	101.67×10^4	101.67×10^4	101.67×10^4
4	Rooftop area of building/ sheds	99.17×10^4	99.17×10^4	99.17×10^4
5	Total	1696.55×10^4	1696.55×10^4	1696.55×10^4

O. GROUN D WATER LEVEL OF CLUSTER-XVI

Cluster - XVI of B.C.C.L mines under administrative control of Chanch Victoria Area of B.C.C.L (Raniganj Coalfield) is located in Dhanbad district of Jharkhand. The Cluster-XVI (Dahibari-Basantimata Group of mines) is located on the western part of the Raniganj Coalfield and falls within Dhanbad district of Jharkhand. There are total five collieries within this Clusture- XVI (Dahibari-Basantimata OC, Basantimata UG, New Laikdih OC, Laikdih Deep UG and Chanch UG Colliery). All above the mines are contiguous in nature and the environmental impact is overlapping in ambient environment due to cumulative effect of the mining activities. The life of the project works out upto 24 years considering annual target production of 1.963 MTPA. Cluster-XVI mine involves leasehold area of about 2008.40 Ha of land. It covered in Survey of India toposheet no. 73 I/14.

The present leasehold area of Cluster-XVI is 2008.40 Ha. The topography of the area is undulating with slope towards south west. The area is plain with gently undulating with elevation varying from 100 m to 140 m AMSL. The general slope of the area is towards southeast. Barakar River and Khudia River are controlling the drainage of the area. The area comes under the watershed area of Barakar River.

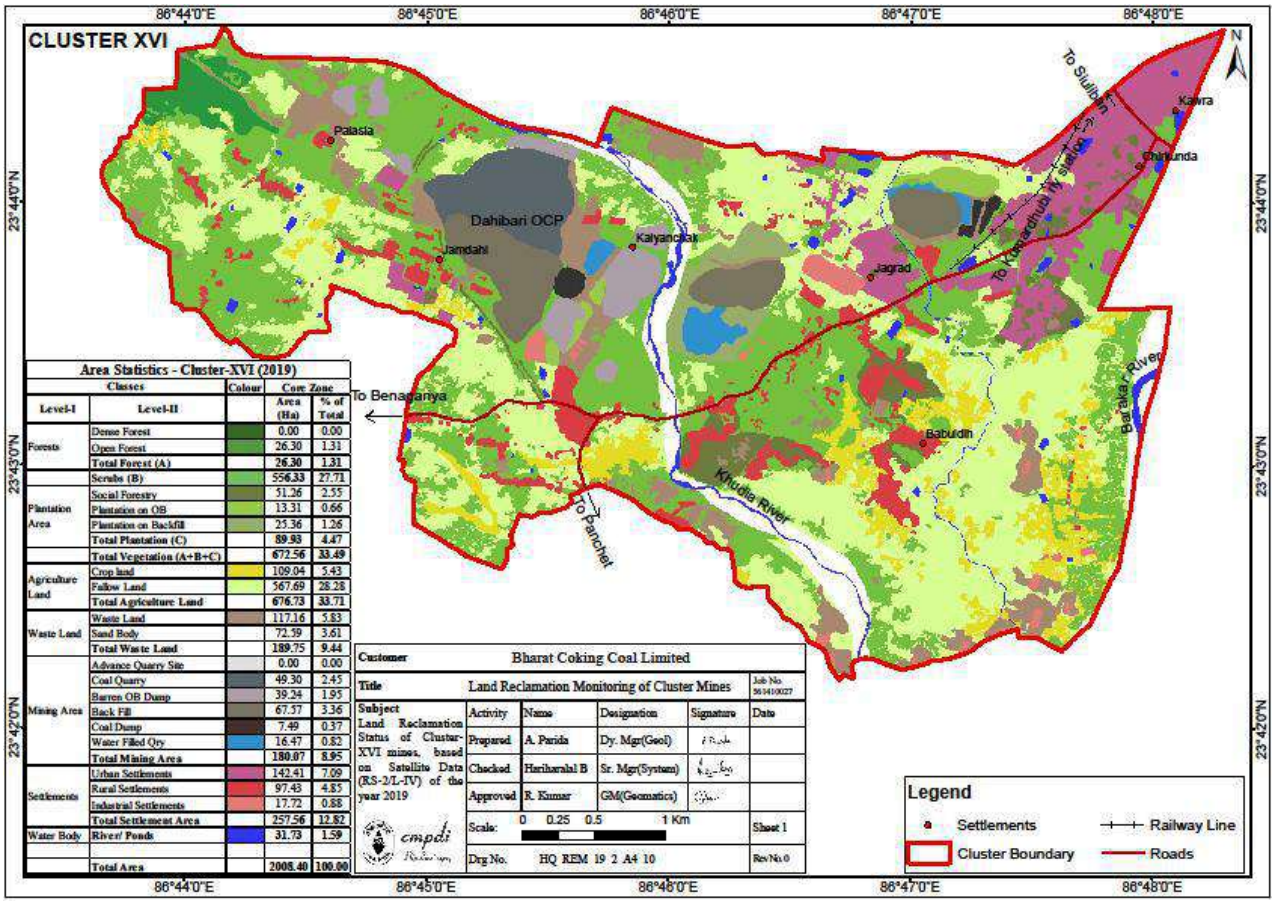
Monitoring stations (**DB-22, DB-23, DB-24 & DB-25**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	DB22	Dahibari, Niche Basti	2.63	1.30	2.25	2.38	4.93	1.38	1.63	1.73	1.98	2.34	1.35	1.93
2	DB23	Dahibari OC	2.50	0.70	1.95	2.17	1.60	0.88	0.80	1.00	2.00	2.85	1.20	1.75
3	DB24	Dahibari	3.60	1.57	5.70	5.90	9.35	3.20	3.88	4.80	8.70	8.25	4.43	5.70
4	DB25	Basantimata UG	3.98	1.19	2.63	2.68	-	-	-	-	3.23	3.93	1.41	1.63
Average WL (bgl)			3.18	1.19	3.13	3.28	4.53	1.82	2.10	2.51	3.98	4.34	2.10	2.75

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.60 m Max – 9.35 m
Post-monsoon GW Level (m): Min – 0.80 m Max – 5.70 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XVI MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1349.29 x 10^4	1349.29 x 10^4	1349.29 x 10^4
2	Open Land	401.55 x 10^4	401.55 x 10^4	401.55 x 10^4
3	Road/ Paved Area	142.41 x 10^4	142.41 x 10^4	142.41 x 10^4
4	Rooftop area of building/ sheds	115.15 x 10^4	115.15 x 10^4	115.15 x 10^4
5	Total	2008.40 x 10^4	2008.40 x 10^4	2008.40 x 10^4

4.0 GROUND WATER LEVEL SCENARIO

The summarized water level data of all clusters given in **Table – 7**.

Table –7: Groundwater level data Cluster-wise

Sl. No.	Cluster of BCCL	No. of Monitoring Wells	Water level fluctuation Below ground level (May, Aug, Nov'20 & Jan'21)	Avg. Fluctuation (in meters) during 2020-21	Geological Formation
1	I	4 nos.	0.15 to 10.00 m	2.76 m	Barakar
2	II	5 nos.	0.67 to 10.33 m	3.66 m	Barakar
3	III	5 nos.	0.32 to 10.33 m	2.95 m	Barakar
4	IV	4 nos.	0.03 to 9.25 m	3.27 m	Barakar
5	V	4 nos.	0.02 to 5.60 m	2.51 m	Barakar
6	VI	2 nos.	1.65 to 10.50 m	4.02 m	Barakar
7	VII	7 nos.	0.48 to 9.45 m	2.26 m	Barakar
8	VIII	4 nos.	1.41 to 8.45 m	2.87 m	Barakar
9	IX	6 nos.	0.30 to 9.40 m	1.53 m	Barakar
10	X	4 nos.	0.06 to 6.40 m	2.40 m	Barakar
11	XI	4 nos.	0.36 to 8.47 m	1.50 m	Barakar & Barren Measure
12	XIII	6 nos.	0.20 to 8.92 m	3.60 m	Raniganj
13	XIV	3 nos.	0.77 to 7.55 m	2.35 m	Raniganj
14	XV	3 nos.	0.85 to 4.88 m	1.20 m	Barakar & Barren Measure
15	XVI	3 nos.	0.70 to 5.90 m	0.75 m	Barakar

Depth to water level (in bgl) values described that water level goes down to maximum 10.50 m during pre-monsoon'2020 and maximum upto 8.60 m during post-monsoon'2020. Un-confined aquifer affected around 20 m to 30 m maximum close to active opencast mining areas, showing steep gradient towards mine void. Other than that, there is no mining effect in the water level within JCF area and RCF area (part). Historical water level data and hydrograph of permanent observation stations from CGWB shown in **Annexure–VII**. Water Table contour map and Depth to water level map shown in **Plate-IV & V**.

Monitoring groundwater (quantity & quality) to assess the present condition and resource has done regularly in the coalfield areas. Well hydrographs (**Annexure–VI and VII**) are prepared and studied to identify potentially adverse trends so that appropriate action can protect groundwater resource. Hydrograph trend analysis of CGWB monitoring wells and CMPDI observation wells, reveals decline

trends in both Pre and Post-monsoon GW level trends (max. upto 0.55 cm/year in Cluster-I, Cluster-V and Cluster-VII) but no significant decline trend (>1.0 m/year) of water level is noticed in any particular area for the last 10 years within the coalfield area. Regarding quality monitoring, the water sample location map (**Plate–II**) with collection points details (dug wells) given in **Annexure–V** and Quality is given in **Annexure–VII**.

5.0 GROUND WATER QUALITY

The ground water sample of the study area (15 nos. of Cluster of mines, BCCL) collected from dug wells and analyzed. Fifteen ground water samples (GW-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15 & 16) analyzed during the month of June'2020 at CMPDI, RI-II, Dhanbad. The water sampling details given in **Annexure–V** and Water sample locations shown in **Plate-II**. The water quality data enclosed in **Annexure–VII.**

The study of the variations in water quality parameters described below:

The pH of the groundwater samples varies between 7.81 (GW-6) to 8.21 (GW-3), the pH is within the IS 10500 limit of drinking water standard.

The mineral constituents dissolved in water constitute the dissolved solids. The total dissolve solids vary from 178 (GW-11) to 764 mg/l (GW-5), the TDS values are above the IS 10500 standards of drinking water.

The alkalinity of the water samples varies from 76 (GW-6) to 152 mg/l (GW-11) and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 32 (GW-11) to 180 mg/l (GW-15) and are ***slightly above*** the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 148 (GW-8) to 680 mg/l (GW-5) and the value of total hardness in water samples are ***above*** the permissible limit (200 mg/l). The sulphate ranges between 38 (GW-8) to 178 mg/l (GW-13) and the value of sulphate in water sample are within the permissible limit (200 mg/l). The Iron, Copper, Manganese, Lead, Zinc and Chromium concentration in the water samples found to be below the upper ISI limits for drinking water.

6.0 STAGE OF GROUNDWATER EXTRACTION

The groundwater mainly utilized for domestic needs and for irrigation purposes. The groundwater abstraction is mainly through dug wells and bore wells. The stage of groundwater development in Dhanbad District is 76.30% (as per 2017 GWRE). The highest stage of development is in Jharia Block (127.0%) & Dhanbad Block (107.50%) and lowest stage of development is in Baliapur Block (78.24%) as per GWRE-2013. The Gondwana sandstones in general, known to constitute good aquifers at many places. However, the yield potential of the area adjoining to active mines in the coal belt is poor. The active mines often act as groundwater "sinks". In contrast, the water logged abandoned mines and pits act as potential sources of groundwater. As per the assessment by Central Ground Water Board (CGWB), Patna in 2017, Block wise data of Dhanbad District given below:

Table–8A: Block wise Stage of Groundwater development

Sl No.	Administrative Unit		Stage of GW Development	Category (GWRE-2013)	Category (GWRE-2017)
	District	Block			
1	Bokaro	Bermo	156.30%	**Over- exploited**	**Over- exploited**
2	Dhanbad	Baghmara	91.74%	Critical	Critical
3	Dhanbad	Baliapur	78.24%	Semi- Critical	Semi- Critical
4	Dhanbad	Dhanbad	107.50%	**Over- exploited**	**Over- exploited**
5	Dhanbad	Jharia	127.0%	**Over- exploited**	**Over- exploited**
6	Dhanbad	Topchachi	98.45%	Critical	Critical

- **Dynamic Groundwater Resource Assessment, CGWB as per 2013 & 2017.**

Table–8B: Cluster wise Groundwater development scenario

Cluster/ Area	Adminis-trative Blocks/Stage Of GW Extraction	Total Water demand (cum/day)				Avg. GW level (bgl in m) 2020		GW level declining trend 2005-2020		Remarks
		Mine Discharge + BH pumping	Surface Water Source	Total Use (Domestic + Industrial)	Excess Or other use	Pre-monsoon	Post-monsoon	Pre-monsoon	Post-monsoon	
Cluster-I	Bermo (SOD: Over-exploited)	2173 (2065+108)	NIL	2112 (1698+414)	61	5.46	2.69	YES	YES	Recharge structure needed
Cluster-II	Baghmara (SOD: Critical)	8350	Jamunia river	6737 (2755+3982)	1613	5.83	2.17	NO	NO	Excess mine water needed to be utilized
Cluster-III		12760 (10960+1800)	NIL	8946 (7849+1097)	3814	4.91	1.96	NO	NO	
Cluster-IV		5900	MADA	5100 (3605+1495)	800	5.52	2.25	NO	NO	
Cluster-V		12690 (11025+1665)	MADA	11063 (5710+5353)	1897	4.18	1.67	YES	YES	
Cluster-VI	Dhanbad (SOD: Over-exploited)	4150	MADA	4150 (1664+2486)	0.0	7.50	3.49	YES	NO	--
Cluster-VII		21565	MADA	20826 (17596+3230)	739	5.56	3.71	YES	YES	Excess mine water needed to be utilized water
Cluster-VIII	Jharia (SOD: Over-exploited)	9320	MADA	5294 (3730+1564)	4026	6.03	3.16	NO	NO	
Cluster-IX		12980	MADA	9358 (4549+4809)	3622	5.81	4.28	NO	NO	
Cluster-X		11825	Damodar river	6201 (4255+1946)	5624	5.69	3.29	YES	NO	
Cluster-XI	Dhanbad (SOD: Over-exploited)	24960	MADA & DVC	19425 (14015+5410)	5535	3.40	1.91	NO	NO	
Cluster-XIII	Baghmara (SOD: Critical)	4815	Damodar river	4815 (4679+136)	0.0	6.80	3.22	NO	NO	--
Cluster-XIV		2600	NA	2550 (2412+138)	50	5.42	3.08	NO	NO	--
Cluster-XV		6200	NA	5941 (4600+1341)	259	3.83	2.63	NO	NO	--
Cluster-XVI	Nirsa (SOD:Safe)	1910	DVC (Barakar river)	1730 (1380+350)	180	3.18	3.13	NO	NO	--

MADA – Mineral Area Development Authority, Jharkhand, Dhanbad (payment basis).

DVC – Damodar Valley Corporation, Maithon/Panchet, Jharkhand (payment basis).

7.0 IMPACT OF MINING ON GROUND WATER REGIME

7.1 GENERAL CONSEQUENCES OF COAL MINES ON AMBIENT HYDROGEOLOGICAL REGIME

Mining of coal either by opencast or underground method is bound to incise one or more water bearing strata (aquifers) which in turn may result in depletion or draw down in water levels and a corresponding inflow of water into the mine workings. The potential effects of coal mining operations on the hydrogeological regime are as under:

- Creates disruption in formation/aquifer
- Dewatering of aquifers
- Change in hydraulic gradient
- Modification of recharge to aquifers
- Change in groundwater flow pattern

The general need in mine planning from the hydrogeological point of view is the estimation of make of water (ground water seepage) into the mine, its rate, the mine pumping capacity to meet the storm rainwater accumulation, extent of depression of water surface and management of mine effluent (mine water). It is also desirable that the consequences of mining operation on the groundwater regime be determined in advance. However, the mine pumping in most of the cases are passive dewatering for the safety of the mine pit, active mine dewatering is done in few cases for very high potential aquifers.

7.2 POTENTIAL CONSEQUENCES OF OPENCAST AND UNDERGROUND COAL MINES OF JHARIA COALFIELD ON HYDROGEOLOGICAL REGIME

Generally, in the opencast and underground mines of Jharia Coalfield, alluvium and overlying weathered mantle are the first to excavate followed by upper Barakar Formation / Aquifer. Since these formations vary in thickness, compaction and their constituents over the area, their aquifer properties also vary.

The porosity and the compactness in the sandstone controls the discharge from these aquifers. The alluvium and weathered Formation wherever loose and fragile possess more porosity and this has high groundwater potential. Due to the mine cut, the depression in the water table created. The initial discharges due to this depression is large in amount due to concentration of flow to that region. In the top zones, water table condition prevails and away from the opening in the stratified section, semi-confined conditions exist. With progress of mine operations, there is an increase in the depth of incision as a result; the semi-confined aquifers are also punctured.

During mining the hydraulic gradients generally, steeps down near mine i.e. within the mine influence area. In the up-dip region, only un-confined aquifer punctured through the mining process and thus only it

affected whereas in the down-dip region both un-confined and semi-confined aquifers may be affected. The confined aquifers of lower Barakar Formation in the mining area not punctured as it lies below the working coal seams and hence normally there is no noticeable effect in the aquifer related to this formation.

7.3 ESTIMATION OF RADIUS OF MINE INFLUENCE ZONE

Radius of Influence can defined as the radial distance from the center of the borehole to the point where there is no lowering of groundwater table/potentiometric surface.

The radius of influence (R) for Opencast and UG Mines within Jharia CF calculated by using Sichardt's formula based on present mining scenario.

$$R_0 = C*(H-h) * \sqrt{(K)}$$

Where, R_0- Radius of influence (m), C - Constant =3000,

(H-h)- Drawdown (m), K – Hydraulic conductivity (m/s).

Here, K has used for Barakar Formations i.e. 0.05 m/d or 5.7×10^{-7} m/sec.

It may be appropriate to mention here that the presence of prominent boundaries/water bodies, faults or interfringing of sandstone and shale beds may restrict propagation of the drawdown cone. With the presence of low permeable beds such as clay/shale and younger coal seams in the formation, laying above the working seams the water level in the phreatic aquifer not directly affected. During the working of board and pillar method, subsidence takes place during the extraction of total coal (depillaring), both the phreatic and semi-confined aquifers get affected. Surface vigilance and filling up subsided zone, if any, has to constantly in view. The effect on groundwater level for most of the coal mine in Jharia coalfield has been observed in the down-dip side, generally within a distance upto 500 m and becomes milder/ negligible thereafter.

8.0 CONSERVATION MEASURES & FUTURE STRATEGY

- BCCL has installed 25 Pressure Filter Plant of total capacity of 4.16 MGD to meet drinking water requirement nearby the area. At present 63 Water Treatment Plants are operational having capacity of 16.16 MGD within Jharia Coalfield area. Further installation of 28 more Pressure Filter Plants with the capacity of 5.84 MGD are in progress.

- BCCL participated in development of low cost technology for drinking water in a CSIR project along with CIMFR, Dhanbad and a pilot plant of 4000 Liters/hour is functional at PB Project site of BCCL. Similar plant has proposed at other sites of BCCL.
- A scheme entitled 'Scheme for multi-purpose utilization of surplus mine water of Barora Area, Block II and Govindpur Area of BCCL' was prepared with a view to harness the excess water discharge to take care of the persistence problem of water scarcity in the nearby villages. In the scheme, two water reservoirs of capacity 27 MG and 17 MG have been proposed in the non-coal bearing area for storage of 3250 GPM and 2000 GPM surplus mine water which will be fed through pipe line by mine discharge at mines of Barora, Block-II and Govindpur Area.
- Rooftop rainwater harvesting (RWH) will took up in the project area using the administrative buildings. 138 no. of quarters having roof-top area of about 14950 sq. m. is already prepared to harvest rainwater and around 13150 cum/annum of water is going to be recharged the nearby groundwater system through RWH structures. Proposal already made to facilitate this kind of RWH structure at suitable locations i.e. Lodna Area, Kusunda Area (Jawahar Nagar, Matkuria, Coal Board Colony), Sijua Area (Nichitpur and Tetulmari Colony) within Jharia Coalfield to augment groundwater recharge.
- After cessation of mining, with plenty rainfall and abundant ground water recharge, the water levels will recoup and attain normalcy. Thus, the impact of mining on groundwater system may considered as a temporary phenomenon. The abandoned mine workings (UG) behave as water pool and improves the resources availability in the coalfield area.
- Utilization of treated mine water discharge by both industry and local people in the mine influence area. The excess mine water can be used to recharge groundwater system through connecting pipeline to abandoned dug wells. Utilization of mine water for irrigation use will also enhance the ground water recharge potential through artificial recharge in the area.
- Increase vegetative cover by plantation in the mine area under land amelioration measures. This will contain the surface run-off and increase the groundwater recharge.
- Creation of awareness among workers and local peoples about Rainwater harvesting and artificial recharge will have priority. This aspect usually covered during the Environmental Week celebrated every year (5 to 12 June).
- 23 nos. of Piezometer proposed to install within JCF and RCF to monitor GW level (**Plate-III**).

Monitoring of water quality of mine water discharge, local River/nala and domestic water source (dug well/hand pump wells) will continued under routine monitoring (May, August, November & Jan).

9.0 EXISTING/PROPOSED RAINWATER HARVESTING STRUCTURES IN BCCL COAL MINES

Fig-3 to 4.



Proposed Rain Water Harvesting Site GVTC, Cluster-I, Barora Area



Proposed Rain Water Harvesting Site Nehru Balika Vidhalaya, Cluster-I, Barora Area

Fig-5 to 6.



Proposed Rain Water Harvesting Site Barora Area Guest House, Cluster-I, Barora Area



Proposed Rain Water Harvesting Site Regional Hospital Baghmara, Cluster-I, Barora Area

Fig-7 to 8.



Proposed Rain Water Harvesting Site – Barora Area Office, Cluster-I, Barora Area

RECHARGE POND / ABANDONDED IN THE JCF MINE AREA

Fig-9 to 10.



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA

Fig-11 to 12.



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA

Fig-13 to 14.



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA



FILTER PLANT IN THE MINE AREA

Fig-15.



Government of India
Ministry of Environment, Forest and Climate Change
Wetlands Division

List of Ramsar Sites in India

S. No	Name of Ramsar site	State	Area in hectares	Date of designation	Coordinates
1.	Ashtamudi Wetland	Kerala	6,140	19/08/2002	08°57'N 076°34'E
2.	Beas Conservation Reserve	Punjab	6,429	26/09/2019	31°23'N 075°11'E
3.	Bhitarkanika Mangroves	Odisha	65,000	19/08/2002	20°39'N 086°54'E
4.	Bhoj Wetland	Madhya Pradesh	3,201	19/08/2002	23°13'N 077°19'E
5.	Chandertal Wetland	Himachal Pradesh	49	08/11/2005	32°28'N 077°36'E
6.	Chilika Lake	Odisha	116,500	01/10/1981	19°42'N 085°21'E
7.	Deepor Beel	Assam	4,000	19/08/2002	26°07'N 091°39'E
8.	East Calcutta Wetlands	West Bengal	12,500	19/08/2002	22°27'N 088°27'E
9.	Harike Lake	Punjab	4,100	23/03/1990	31°13'N 075°12'E
10.	Hokera Wetland	Jammu & Kashmir	1,375	08/11/2005	34°04'N 074°42'E
11.	Kanjli	Punjab	183	22/01/2002	31°25'N 075°22'E
12.	Keoladeo National Park (MR)	Rajasthan	2,873	01/10/1981	27°13'N 077°31'E
13.	Keshopur-Miani Community Reserve	Punjab	344	26/09/2019	32°05'N 075°23'E
14.	Kolleru Lake	Andhra Pradesh	90,100	19/08/2002	16°37'N 081°12'E
15.	Loktak Lake (MR)	Manipur	26,600	23/03/1990	24°25'N 093°49'E
16.	Nalsarovar	Gujarat	12,000	24/09/2012	22°46'N 072°02'E
17.	Nandur Madhameshwar	Maharashtra	1,437	21/06/2019	20°01'N 074°06'E
18.	Nangal Wildlife Sanctuary	Punjab	116	26/09/2019	31°23'N 076°22'E
19.	Nawabganj Bird Sanctuary	Uttar Pradesh	225	19/09/2019	26°36'N 080°39'E
20.	Parvati Arga Bird Sanctuary	Uttar Pradesh	722	02/12/2019	26°56'N 082°09'E
21.	Point Calimere Wildlife and Bird Sanctuary	Tamil Nadu	38,500	19/08/2002	10°19'N 079°37'E
22.	Pong Dam Lake	Himachal Pradesh	15,662	19/08/2002	32°01'N 076°04'E
23.	Renuka Wetland	Himachal Pradesh	20	08/11/2005	31°37'N 077°27'E
24.	Ropar	Punjab	1,365	22/01/2002	31°01'N 076°30'E
25.	Rudrasagar Lake	Tripura	240	08/11/2005	23°28'N 091°16'E
26.	Saman Bird Sanctuary	Uttar Pradesh	526	02/12/2019	27°00'N 079°10'E
27.	Samaspur Bird Sanctuary	Uttar Pradesh	799	03/10/2019	25°59'N 081°23'E
28.	Sambhar Lake	Rajasthan	24,000	23/03/1990	27°00'N 075°00'E
29.	Sandi Bird Sanctuary	Uttar Pradesh	309	26/09/2019	27°18'N 079°58'E
30.	Sarsai Nawar Jheel	Uttar Pradesh	161	19/09/2019	26°58'N 079°15'E

Annexure – IV

Rainfall Data (in mm) At Dhanbad Observatory Station, IMD (Source: WRIS Website data)

Year	January	February	March	April	May	June	July	August	Sep	Oct	Nov	Dec	Annual
1994	26.5	20.0	3.3	23.5	4.5	289.5	245.5	240.0	134.0	40.5	0.0	0.0	1027.3
1995	15.0	18.3	20.0	0.0	34.5	122.0	140.1	257.0	446.0	0.0	34.0	5.5	1092.4
1996	12.5	12.5	5.2	0.0	0.0	210.5	138.5	400.0	214.0	24.0	0.0	0.0	1017.2
1997	10.5	17.5	2.8	63.5	41.5	231.5	599.3	621.1	196.8	16.5	34.0	16.0	1851.0
1998	20.5	21.0	160.0	18.0	40.0	80.0	347.0	409.0	123.0	120.5	11.0	0.0	1350.0
1999	0.0	0.0	0.0	0.0	64.0	150.0	511.0	336.0	510.5	124.0	0.0	0.0	1695.5
2000	2.0	15.0	0.0	20.0	68.0	452.5	270.5	89.0	234.5	-	0.0	0.0	1151.5
2001	0.0	0.0	34.0	13.0	104.0	448.7	552.5	121.0	107.0	126.5	0.0	0.0	1506.7
2002	12.0	10.0	26.0	0.0	32.5	185.0	150.0	125.5	310.0	64.0	0.0	0.0	915.0
2003	6.0	58.5	38.5	40.0	24.0	-	366.1	279.0	145.1	151.6	0.0	2.3	1111.1
2004	18.45	2.13	1.55	53.93	9.53	95.95	408.57	261.07	174.01	63.01	51.10	12.85	1152.15
2005	44.49	23.11	26.16	17.90	28.95	272.26	388.86	158.86	69.03	117.63	0.09	1.67	1149.01
2006	0.00	0.00	3.11	12.64	86.68	113.20	505.72	316.06	339.51	9.80	3.73	0.00	1390.45
2007	0.00	58.69	35.76	21.08	25.33	139.60	666.30	416.85	363.93	43.63	1.57	0.00	1772.74
2008	16.44	1.96	6.27	6.78	37.26	180.58	422.25	275.33	198.31	27.64	0.00	0.00	1172.82
2009	0.00	0.26	5.81	0.19	105.82	78.32	232.20	370.39	429.16	68.56	11.31	0.98	1303.00
2010	0.59	19.64	7.62	38.24	93.72	146.68	157.31	198.97	239.75	78.76	5.26	40.53	1027.07
2011	0.00	1.60	18.25	12.81	102.58	294.61	174.35	445.43	214.88	30.35	0.69	0.00	1295.55
2012	18.45	2.13	1.55	53.93	9.53	95.95	408.57	261.07	174.01	63.01	51.10	12.85	1152.15
2013	0.07	17.62	0.79	15.24	105.51	176.77	170.14	276.70	135.76	304.46	0.00	0.00	1203.06
2014	9.27	35.71	21.21	8.16	62.77	112.58	283.73	223.38	214.48	30.30	0.00	0.00	1001.59
2015	12.06	3.33	26.71	45.73	32.91	162.96	385.21	239.38	71.34	15.62	0.00	0.61	995.86
2016	6.16	17.59	1.73	1.33	73.90	197.34	248.86	395.33	424.81	30.45	0.00	0.00	1397.50
2017	5.12	0.00	34.96	59.89	81.01	141.66	502.58	168.84	111.95	274.18	0.64	4.12	1384.95
2018	0.00	0.06	2.90	159.52	31.22	202.84	344.59	211.91	153.63	16.31	0.04	20.99	1144.01
2019	0.00	25.18	7.24	46.99	109.43	109.11	292.02	234.65	327.95	199.63	0.10	5.13	1357.43
2020	21.14	5.94	74.96	27.94	71.32	218.12	187.01	258.74	196.87	52.23	1.23	0.00	1115.50

Rainfall Data (in mm) At Dhansar (Rescue station) Observatory Station
State Sec Deptt of Coord, BCCL

Year	January	February	March	April	May	June	July	August	Sep	Oct	Nov	Dec	Annual
2005	34.20	22.80	41.80	32.20	33.00	193.00	542.00	107.80	185.60	39.20	0.00	2.00	1233.60
2006	0.00	0.00	34.40	33.80	87.60	214.20	477.70	246.30	172.00	0.00	1.00	0.00	1267.00
2007	0.00	22.00	37.80	0.00	78.70	167.20	545.00	426.40	351.40	52.00	0.00	0.00	1680.50
2008	5.80	4.80	17.80	18.40	18.00	216.10	433.48	183.80	297.80	85.80	0.00	0.00	1281.78
2009	0.00	0.00	1.60	2.20	112.00	72.80	269.20	192.80	333.00	98.20	10.20	0.00	1092.00
2010	0.00	12.20	7.60	9.20	64.30	206.20	199.40	212.60	230.10	45.30	3.4	----	991.90
2011	7.60	0.00	18.0	11.40	121.60	344.20	163.40	452.0	374.0	41.80	0.00	0.00	1534.20
2012	17.6	13.4	1.0	9.0	6.60	52.0	328.20	315.10	367.70	11.60	61.60	18.0	1201.80
2013	0.0	32.0	3.0	33.90	190.40	244.20	192.80	364.40	304.70	233.60	0.0	0.0	1599.0
2014	12.40	36.80	21.80	2.60	79.80	217.60	305.30	315.60	178.0	6.40	0.0	0.0	1176.0
2015	23.80	0.0	6.20	76.20	35.80	122.10	407.60	244.40	145.20	25.60	0.0	6.20	1093.10
2016	3.0	20.60	5.50	0.0	99.40	181.60	248.80	456.70	443.60	50.40	0.0	0.0	1509.60
2017	8.80	0.0	3.80	17.90	33.20	120.0	533.40	284.70	247.40	207.70	3.40	0.0	1460.30
2018	0.0	0.0	0.0	102.90	76.30	270.60	382.30	338.80	159.50	38.90	2.40	37.90	1346.60
2019	0.0	49.60	10.20	54.20	132.0	188.0	319.10	343.60	403.10	156.40	3.20	10.80	1667.00
2020	22.0	7.60	77.80	76.80	86.20	214.10	296.80	351.40	214.0	92.0	0.0	0.0	1438.70

Annexure – V

Location of Hydrograph Stations (Dug Wells)

Well No	Latitude	Longitude	Well No	Latitude	Longitude
A-3	23^{0}47'53.35" N	86^{0}19'55.14" E	**B-63**	Abandoned due to OCP	
A-12	23^{0}48'20.31" N	86^{0}16'51.64" E	**B-64**	23^{0}48'43.14" N	86^{0}18'44.25" E
A-16	23^{0}46'57.00" N	86^{0}21'38.57" E	**B-65A**	23^{0}48'53.65" N	86^{0}18'11.82" E
A-17	23^{0}45'09.44" N	86^{0}22'16.35" E	**B-67**	23^{0}43'30.70" N	86^{0}14'01.45" E
A-18	23^{0}44'37.65" N	86^{0}22'58.90" E	**D-3**	23^{0}46'46.31" N	86^{0}24'49.30" E
A-19	23^{0}41'12.86" N	86^{0}23'55.27" E	**D-4**	23^{0}44'29.37" N	86^{0}24'42.88" E
A-20	23^{0}44'56.64" N	86^{0}19'55.35" E	**D-5**	23^{0}42'20.05" N	86^{0}24'86.06" E
A-22	23^{0}43'06.65" N	86^{0}14'48.53" E	**D-7**	23^{0}43'12.08" N	86^{0}27'11.89" E
A-23	23^{0}45'06.38" N	86^{0}15'12.69" E	**D-8**	23^{0}44'06.13" N	86^{0}27'20.72" E
A-24	23^{0}45'20.44" N	86^{0}13'45.12" E	**D-23**	23^{0}47'20.89" N	86^{0}20'09.96" E
A-25	23^{0}47'06.20" N	86^{0}15'27.79" E	**D-25**	23^{0}47'03.28" N	86^{0}23'29.56" E
A-26	23^{0}46'49.24" N	86^{0}18'12.12" E	**D-30**	23^{0}48'36.10" N	86^{0}21'50.07" E
A-27	23^{0}48'42.55" N	86^{0}20'21.80" E	**D-33**	23^{0}45'34.62" N	86^{0}23'18.50" E
A-28A	23^{0}47'34.74" N	86^{0}18'04.18" E	**D-34**	23^{0}45'36.50" N	86^{0}23'02.45" E
A-29	23^{0}47'08.02" N	86^{0}16'02.72" E	**D-35**	23^{0}40'46.54" N	86^{0}25'46.33" E
A-32	23^{0}44'15.56" N	86^{0}20'43.80" E	**D-36**	23^{0}40'19.26" N	86^{0}25'18.98" E
A-33	23^{0}44'32.58" N	86^{0}16'58.28" E	**D-39**	23^{0}43'28.50" N	86^{0}26'0.10" E
A-34	23^{0}42'58.63" N	86^{0}15'19.31" E	**D-40A**	23^{0}43'20.18" N	86^{0}25'45.70" E
B-1	23^{0}48'48.06" N	86^{0}14'16.87" E	**D-41**	23^{0}42'40.00" N	86^{0}26'17.20" E
B-14	23^{0}48'00.81" N	86^{0}16'25.88" E	**D-43***	NA	NA
B-15	23^{0}46'06.92" N	86^{0}08'59.30" E	**D-47**	23^{0}45'20.59" N	86^{0}24'34.86" E
B-21A	23^{0}45'10.50" N	86^{0}09'36.38" E	**D-49**	23^{0}44'08.96" N	86^{0}26'32.71" E
B-23	23^{0}44'13.05" N	86^{0}11'46.56" E	**D-51**	23^{0}44'20.86" N	86^{0}27'11.37" E
B-24	23^{0}44'26.80" N	86^{0}13'09.38" E	**D-55**	23^{0}43'58.37" N	86^{0}24'07.45" E
B-25	23^{0}44'44.98" N	86^{0}13'57.80" E	**D-74**	23^{0}41'33.66" N	86^{0}25'06.10" E
B-32A	23^{0}45'49.18" N	86^{0}13'03.64" E	**D-77**	23^{0}41'00.74" N	86^{0}22'25.55" E
B-48	23^{03}4'35.09" N	86^{0}16'38.30" E	**D-80**	23^{0}46'09.46" N	86^{0}24'33.08" E
B-51	23^{0}47'40.20" N	86^{0}09'11.90" E	**DB-22**	23^{0}43'38.81" N	86^{0}45'09.00" E
B-53	23^{0}45'55.25" N	86^{0}09'35.44" E	**DB-23**	23^{0}43'44.24" N	86^{0}45'06.39" E
B-53A	DO	DO	**DB-24**	23^{0}43'53.00" N	86^{0}45'03.88" E
B-59	23^{0}47'59.87" N	86^{0}13'37.97" E	**DB-25**	23^{0}44'10.75" N	86^{0}44'35.84" E
B-60	23^{0}48'7.87" N	86^{0}15'37.12" E			
B-61A	23^{0}45'59.85" N	86^{0}11'40.80" E			
B-62A	23^{0}45'44.15" N	86^{0}11'27.80" E			

Annexure – VA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	R.L. (G.L) (m)	Formation	Owner	Utility
A-3	Sijua	0.53	3.00	5.20	203	Barakar	Govt.	Domestic
A-12	Jamua	0.80	1.90	3.30	202	Barakar	Govt.	Domestic
A-16	Ekra, Kalali More	0.45	3.10	6.50	205	Barakar	Govt.	Domestic
A-17	Kachi Balihari	0.56	1.60	5.30	182	Barakar	Govt.	Domestic
A-18	Bhagabandh	0.61	1.45	3.37	182	Barakar	Govt.	Domestic
A-19	Bhaura	0.54	3.15	11.65	162	Barakar	Govt.	Domestic
A-20	Gorbhudih	0.43	3.30	8.30	181	BM	Govt.	Domestic
A-22	Nagdah, Niche	0.00	1.40	9.50	171	Raniganj	Govt	Irrigation
A-23	Machhyara	0.43	1.85	12.40	203	Raniganj	Govt	Domestic
A-24	Pipra Tanr	0.22	1.80	19.55	208	Raniganj	Govt	Domestic
A-25	Sinidih	0.22	2.00	11.30	203	Barakar	Govt	Domestic
A-26	Pasitanr	0.32	1.80	9.65	198	Barakar	Govt	Domestic
A-27	Chandor	0.60	2.50	5.50	221	Barakar	Govt	Domestic
A-28A	Lakarka 6 no.	0.65	1.30	5.25	199	Barakar	BCCL	Domestic
A-29	Aambagan	0.10	2.60	9.15	186	Barakar	Govt	Domestic
A-32	Baludih	0.55	2.30	6.85	182	BM	Govt	Domestic
A-33	Mahuda	0.75	2.00	10.80	195	BM	BCCL	Domestic
A-34	Bhatdih	0.55	3.50	24.50	162	Raniganj	BCCL	Domestic
B-1	Muraidih	0.47	1.80	5.35	212	Talchir	Govt	Domestic
B-14	Mathadih	0.76	2.15	3.75	201	Barakar	Govt	Domestic
B-15	Bera Basti	0.55	1.60	2.50	221	Talchir	Dhanu Roy	Domestic
B-21A	Dugdha	0.55	2.10	10.35	220	Metamorphics	Govt	Domestic
B-23	Lohapati	0.26	3.60	10.85	204	Raniganj	Govt	Domestic
B-24	Telmuchu	0.67	4.35	10.83	207	Raniganj	Govt	Domestic
B-25	Mahuda More	0.10	2.45	8.45	205	Raniganj	Govt	Domestic
B-32A	Madhuband	0.80	4.30	8.60	205	Barakar	BCCL	Domestic
B-48	Mahuda	0.65	2.10	11.50	181	Raniganj	Mosque	Domestic
B-51	Taranga	0.00	2.50	5.75	215	Metamorphics	Bisun	Irrigation
B-53	Karmatanr	0.58	2.70	13.25	195	Barakar	Govt	Domestic
B-53A	Damoda OCP							
B-59	Khodovaly	0.60	2.40	9.30	202	Barakar	BCCL	Domestic
B-60	Bahiyardih	0.77	3.00	15.60	196	Barakar	BCCL	Domestic
B-61A	Kesargora	0.48	2.00	11.20	201	Barakar	BCCL	Domestic
B-62A	Sadariyadih	0.15	3.10	9.50	188	Barakar	Govt	Domestic

Annexure – VA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	R.L. (G.L) (m)	Formation	Owner	Utility
B-63	West Mudidih	0.60	1.70	3.35	196	Barakar	BCCL	Domestic
B-64	Keshalpur	0.65	1.10	3.40	195	Barakar	BCCL	Domestic
B-65A	Jhinjipahari	0.95	2.20	12.40	196	Barakar	Shiv Temple	Domestic
B-67	Simatanr	0.55	2.20	11.80	198	Raniganj	Govt	Domestic
D-3	Dhansar	0.60	1.70	8.70	217	Barakar	Govt	Domestic
D-4	Jharia	0.59	1.90	5.73	218	Barakar	Govt	Domestic
D-5	Jiyalgora	0.70	2.80	10.55	183	Barakar	Govt	Domestic
D-7	Golden Pahari	0.67	2.85	10.05	201	Barakar	BCCL	Domestic
D-8	Alokdiha	0.35	1.75	7.57	201	Metamorphics	BCCL	Domestic
D-23	Jogta (Sindra)	0.40	3.10	7.25	205	Barakar	BCCL	Domestic
D-25	Godhar More	0.60	2.75	5.60	219	Barakar	Govt	Domestic
D-30	Borkiboa	0.70	2.00	5.60	221	Talchir	H.Kumbhakar	Domestic
D-33	Kustore-4	0.55	1.85	3.45	196	Barakar	BCCL	Domestic
D-34	Kusunda-7	0.60	1.50	3.45	201	Barakar	BCCL	Domestic
D-35	Patherdih	0.40	2.00	11.20	160	Barakar	BCCL	Domestic
D-36	Sudamdih	0.90	2.00	6.20	141	Barakar	BCCL	Domestic
D-39	Tilabani	0.85	2.00	5.90	178	Barakar	BCCL	Domestic
D-40A	Khapra Dhaora	0.55	1.95	3.70	180	Barakar	Panchayat	Domestic
D-41	Joyrampur	0.50	1.80	4.00	180	Barakar	BCCL	Domestic
D-43	Alagdih	0.45	2.20	8.90	200	Metamorphics	Govt	Domestic
D-47	Parastanr	0.45	3.20	23.80	206	Barakar	BCCL	Domestic
D-49	Goluckdih	0.55	1.80	6.15	192	Barakar	BCCL	Domestic
D-51	Chankuiya	0.55	3.70	11.90	197	Barakar	BCCL	Domestic
D-55	Hariladih	0.48	2.80	11.80	184	Barakar	Govt	Domestic
D-74	Bhulan Barari	0.10	1.60	12.80	173	Barakar	Govt	Domestic
D-77	Rohoniatanr	0.40	3.15	6.70	156	Barakar	Govt	Domestic
D-80	Bastacolla	0.70	2.50	24.95	219	Barakar	Govt	Domestic
DB-22	Nichebasti	0.67	2.40	10.65	121	Barakar	Govt	Domestic
DB-23	Dahibari OC	0.70	2.30	8.00	-	Barakar	BCCL	Domestic
DB-24	Dahibari	0.60	3.60	13.70	125	Barakar	BCCL	Domestic
DB-25	Palasya	0.37	1.55	5.25	127	Barakar	Govt	Domestic

MP: Measuring Point R.L.: Reduced Level W.L.: Water Level m: Meter
Abn.: Abandoned b.g.l.: Below Ground Level a.g.l.: Above Ground Level
G.L.: Ground Level bmp: Below Measuring Point BM: Barren Measure

Annexure – VB

Historical Water Level data of Hydrograph Stations

Well No	Water level below ground level (bgl) in meters													
	May 14	Nov 14	May 15	Nov 15	May 16	Nov 16	May 17	Nov 17	May 18	Nov 18	May 19	Nov 19	May 20	Nov 20
A-3	4.67	2.37	3.70	3.42	4.87	0.47	0.67	0.77	1.27	0.47	3.47	0.47	1.57	0.47
A-12	2.45	1.4	3.00	2.68	2.50	0.70	2.55	0.85	2.80	1.0	2.10	0.45	2.60	0.50
A-16	5.5	2.9	5.55	4.17	5.85	3.15	3.65	2.20	4.30	3.65	5.45	1.95	7.15	1.75
A-17	2.19	1.91	3.79	2.64	2.44	2.69	2.44	2.24	3.34	2.84	2.94	2.24	2.14	1.69
A-18	1.76	1.19	2.84	1.29	1.14	0.89	1.29	0.99	1.24	0.99	2.29	0.69	1.09	0.34
A-19	3.00	2.75	3.05	2.75	7.81	4.11	6.37	2.45	5.55	2.45	4.85	3.43	6.05	3.25
A-20	3.97	2.55	4.59	2.93	7.49	3.50	4.27	1.77	4.57	2.57	4.57	1.82	8.47	3.87
A22A	1.50	2.0	3.20	1.96	3.25	1.75	4.27	1.77	3.35	1.30	2.60	2.00	2.90	1.98
A-23	8.76	6.82	11.3	9.37	11.87	8.13	6.40	1.50	11.15	7.17	11.97	3.77	8.92	5.62
A-24	16.28	14.98	17.2	14.5	16.62	12.43	11.87	6.97	14.58	6.88	15.88	2.48	*4.88	4.28
A-25	7.03	5.28	7.78	5.85	7.43	4.58	6.38	2.88	6.63	3.13	6.08	1.93	2.98	1.83
A-26	7.71	4.58	7.73	3.18	8.93	4.48	5.28	2.53	6.23	3.88	6.58	3.33	6.98	3.18
A-27	1.63	1.55	4.40	3.95	4.85	1.80	2.90	1.25	2.90	1.0	2.40	0.92	2.40	1.10
A28A	3.29	1.91	4.35	3.60	3.35	1.47	4.30	1.55	4.15	2.51	2.45	3.15	4.00	3.03
A-29	3.3	2.35	4.55	4.60	5.92	6.96	4.40	1.30	6.45	2.10	4.85	3.40	6.20	3.20
A-32	3.15	2.45	4.41	2.13	4.75	2.10	3.15	1.55	2.80	0.70	2.75	0.95	1.90	1.75
A-33	4.08	1.57	4.91	1.97	5.75	2.60	6.45	1.55	4.07	2.35	3.65	1.25	4.55	1.85
A-34	4.45	4.45	8.40	4.81	4.75	4.45	12.45	4.45	5.90	3.70	6.35	3.95	8.35	3.45
B-1	2.43	1.81	3.28	2.75	3.58	1.93	2.33	0.85	2.88	2.08	3.18	1.73	3.28	1.63
B-14	3.24	4.44	2.94	2.29	2.44	0.47	2.94	1.84	3.64	2.84	2.24	0.94	2.44	1.04
B-15	0.95	1.45	1.50	0.45	1.85	0.55	4.85	0.15	1.85	0.85	1.90	1.65	3.70	1.47
B21A	9.54	3.7	7.37	4.65	5.55	4.50	8.85	5.65	9.65	2.65	9.45	-	10.00	5.80
B-23	6.57	2.74	7.86	4.29	6.81	2.41	7.74	2.14	6.64	2.14	2.84	1.34	3.24	1.76
B-24	9.40	2.21	10.0	5.78	10.63	4.28	10.03	4.03	9.28	4.33	4.58	2.33	5.48	3.53
B-25	5.82	5.15	6.88	-	7.05	1.70	6.70	1.40	5.90	3.70	4.80	1.40	7.90	2.55
B32A	8.33	2.05	7.55	3.32	6.95	3.07	6.95	2.80	6.75	3.90	5.55	1.70	3.30	2.00
B-48	6.38	4.35	7.90	5.42	9.35	4.60	7.70	4.15	7.33	3.97	7.05	4.35	8.20	3.85
B-51	2.09	1.98	4.65	3.40	4.90	3.18	4.98	2.55	5.02	2.42	5.10	2.70	5.00	2.10
B-53	3.39	-	5.58	2.82	4.70	1.45	4.02	1.92	3.92	1.42	3.22	1.42	3.12	1.40
B-59	2.65	1.0	4.12	1.60	4.40	0.50	5.40	0.60	5.47	1.10	6.20	0.90	5.25	1.40
B-60	9.82	4.59	9.21	5.28	10.33	5.03	13.23	3.18	13.68	4.23	8.13	3.23	10.33	3.21
B61A	6.93	3.57	6.15	4.52	6.58	3.87	2.57	0.82	2.57	2.02	3.32	0.52	3.32	1.60
B62A	8.83	5.85	9.10	5.21	9.30	4.95	8.15	4.35	8.27	4.78	7.55	3.25	6.95	3.00

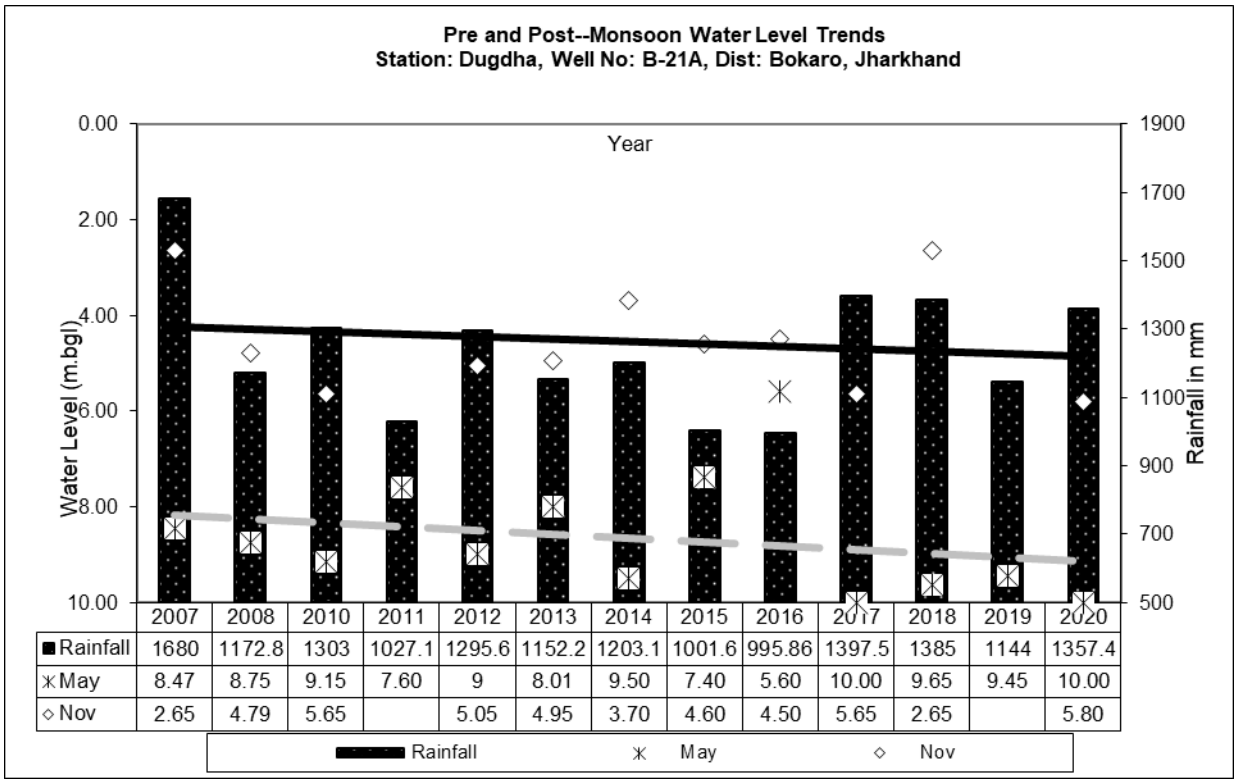
Annexure – VB

Historical Water Level data of Hydrograph Stations

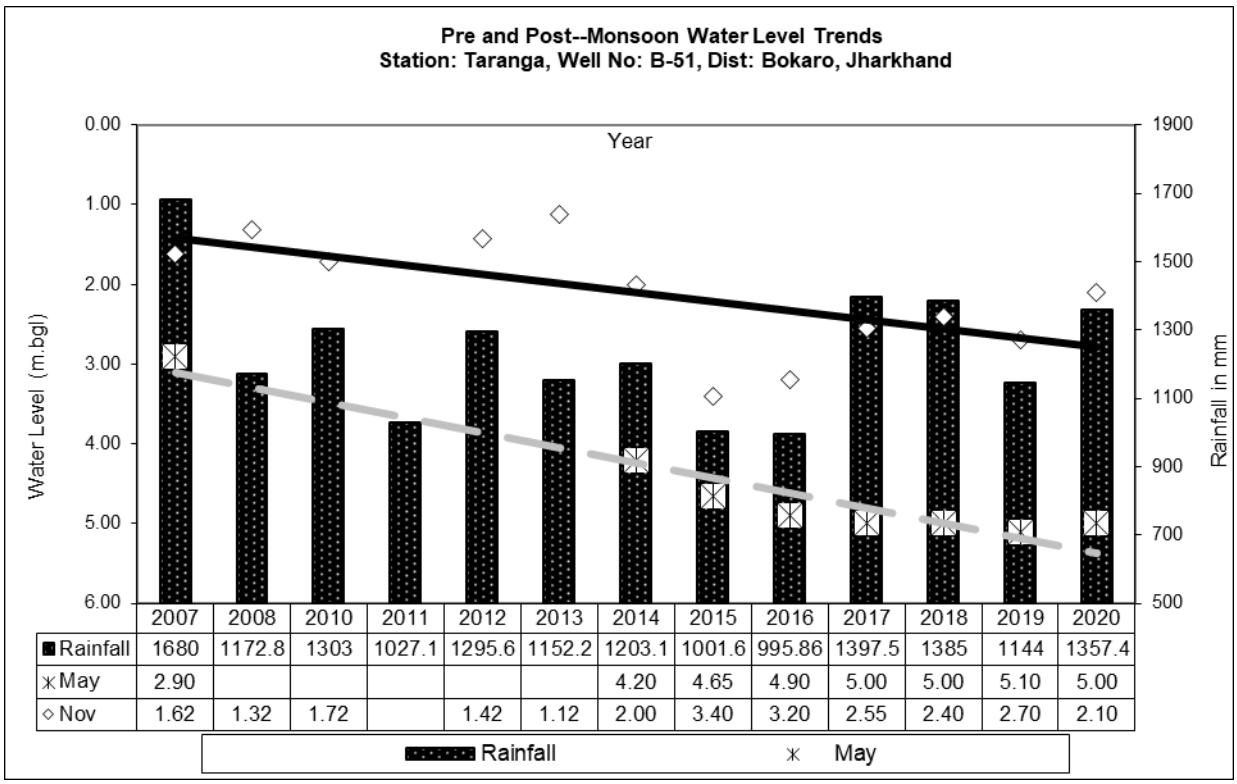
Well No	Water level below ground level (bgl) in meters													
	May 14	Nov 14	May 15	Nov 15	May 16	Nov 16	May 17	Nov 17	May 18	Nov 18	May 19	Nov 19	May 20	Nov 20
B-64	0.7	1.15	1.38	0.95	2.35	0.55	1.25	0.85	2.15	1.85	0.95	0.45	1.85	0.50
B65A	10.45	2.4	7.82	5.87	7.15	2.68	9.05	1.25	10.03	2.40	11.05	0.95	9.25	2.30
B-67	9.80	3.72	9.23	5.53	9.53	4.30	10.00	2.15	9.55	4.0	8.57	4.35	7.55	3.95
D-3	2.54	2.11	4.25	2.25	2.35	1.90	2.15	2.30	3.43	2.45	1.75	1.30	5.40	1.38
D-4	1.23	0.91	2.41	1.27	1.21	1.36	1.21	1.46	1.91	1.56	2.81	1.71	3.41	1.41
D-5	9.0	7.8	9.37	8.33	9.40	6.40	7.90	5.20	7.80	5.30	8.25	4.85	8.60	7.70
D-7	5.28	5.53	8.25	5.61	7.53	4.03	7.33	2.88	7.53	2.83	8.23	3.28	7.33	5.13
D-8	7.73	-	6.24	4.38	8.00	3.43	5.15	1.85	5.65	1.85	4.80	2.85	5.83	2.75
D-23	6.38	2.4	6.55	3.48	5.70	1.63	2.80	2.98	4.40	3.40	4.70	1.40	5.60	3.35
D-25	4.42	2.9	4.48	2.45	2.40	1.90	2.40	1.20	2.60	2.40	*9.90	*5.38	10.50	5.62
D-30	4.17	3.3	4.55	3.15	4.45	3.20	4.40	1.25	4.58	1.10	4.60	0.75	4.50	1.35
D-33	1.72	0.35	2.25	1.10	2.50	1.95	0.75	0.75	2.85	0.95	2.35	1.65	3.65	1.45
D-34	2.80	0.30	2.55	1.45	2.30	0.30	0.80	0.55	2.80	0.45	4.75	2.40	3.30	2.80
D-35	6.94	6.15	9.80	7.90	9.52	6.45	8.80	3.60	8.40	4.45	8.00	3.80	8.20	5.40
D-36	1.82	0.75	1.66	1.13	0.78	0.95	1.30	0.70	1.20	0.60	1.20	0.55	2.10	1.00
D-39	5.03	2.25	5.00	2.61	2.18	2.65	6.17	4.75	4.95	4.35	*12.60	*5.95	9.40	6.05
D40A	2.35	2.45	3.07	2.45	1.40	0.85	1.45	1.35	2.10	1.40	1.85	1.45	1.95	1.43
D-41	3.20	1.35	2.65	2.32	1.30	1.52	1.40	1.20	1.59	1.32	2.30	1.25	3.30	1.45
D-43	6.0	4.75	6.61	5.05	8.20	3.35	7.50	3.60	7.15	3.45	7.35	2.70	6.60	2.55
D-47	8.0	2.37	9.60	3.60	3.18	2.95	3.15	2.85	5.33	2.55	4.55	4.35	9.45	5.45
D-49	2.51	1.65	3.55	2.35	2.45	1.72	2.70	2.05	3.45	2.45	1.75	1.50	3.25	1.65
D-51	9.60	9.05	10.48	9.15	11.15	6.45	10.45	5.43	10.93	7.10	9.95	5.75	8.45	5.70
D-55	1.95	2.07	6.15	1.57	2.52	3.62	6.42	2.37	8.42	1.57	8.42	5.47	9.42	8.60
D-74	5.0	4.0	10.05	7.20	7.73	5.00	9.25	3.85	8.60	4.80	5.80	3.57	4.30	3.93
D-77	6.23	6.0	6.44	5.60	4.60	2.90	6.50	4.90	6.30	5.20	6.40	3.20	6.40	3.50
D-80	13.3	3.15	10.97	3.35	6.55	4.15	8.65	3.70	9.35	4.20	5.00	3.05	4.30	4.90
RCF (part)	May 14	Nov 14	May 15	Nov 15	May 16	Nov 16	May 17	Nov 17	May 18	Nov 18	May 19	Nov 19	May 20	Nov 20
DB22	6.48	3.03	4.59	3.53	5.38	3.33	1.93	1.63	2.34	1.93	4.93	1.63	2.63	2.25
DB23	3.95	2.13	3.38	6.04	5.30	0.90	2.05	1.90	2.85	1.75	1.60	0.80	2.50	1.95
DB24	-	8.45	9.52	8.20	10.65	6.50	5.80	3.78	8.25	5.70	9.35	3.88	5.70	3.60
DB25	3.27	2.73	3.83	2.68	3.61	1.98	3.23	2.58	3.93	1.63	-	-	3.98	2.63

***New well**

HYDROGRAPHS OF CLUSTER-I

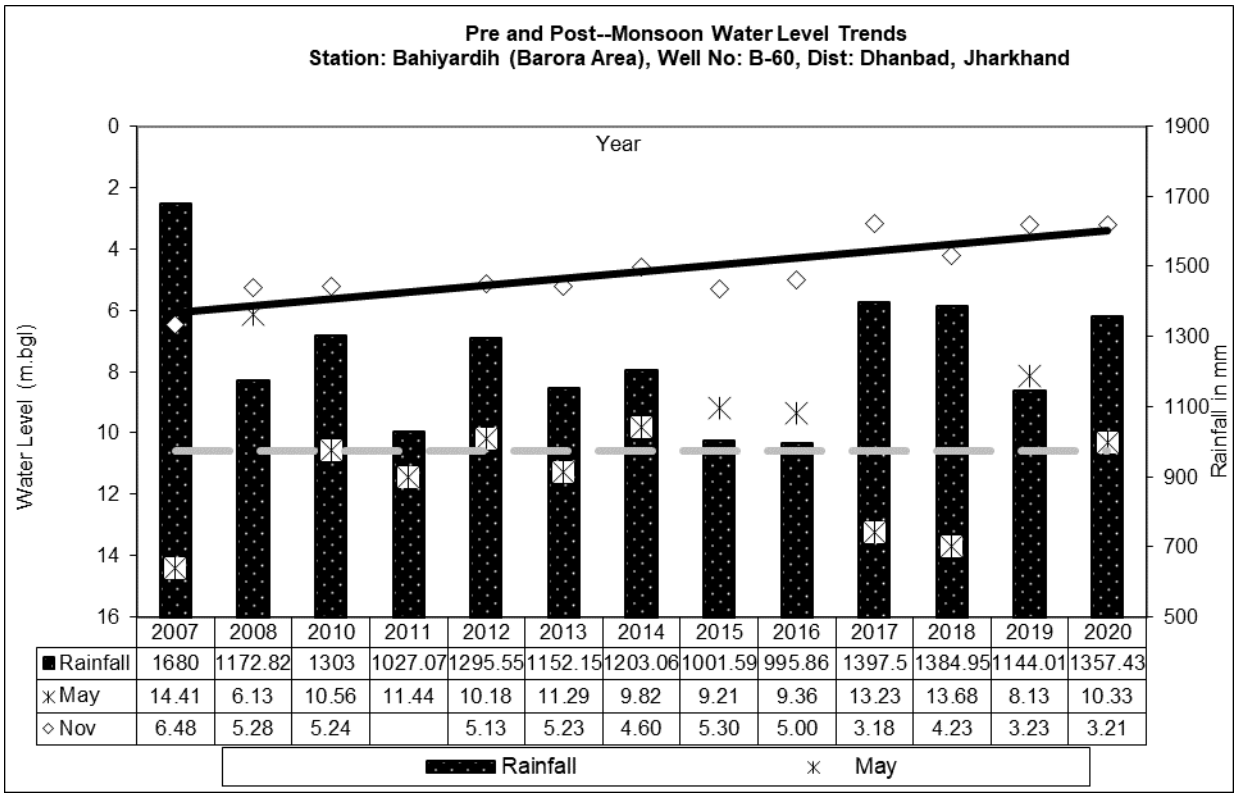


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	8.47	8.75	9.15	7.60	9	8.01	9.50	7.40	5.60	10.00	9.65	9.45	10.00
Nov	2.65	4.79	5.65		5.05	4.95	3.70	4.60	4.50	5.65	2.65		5.80

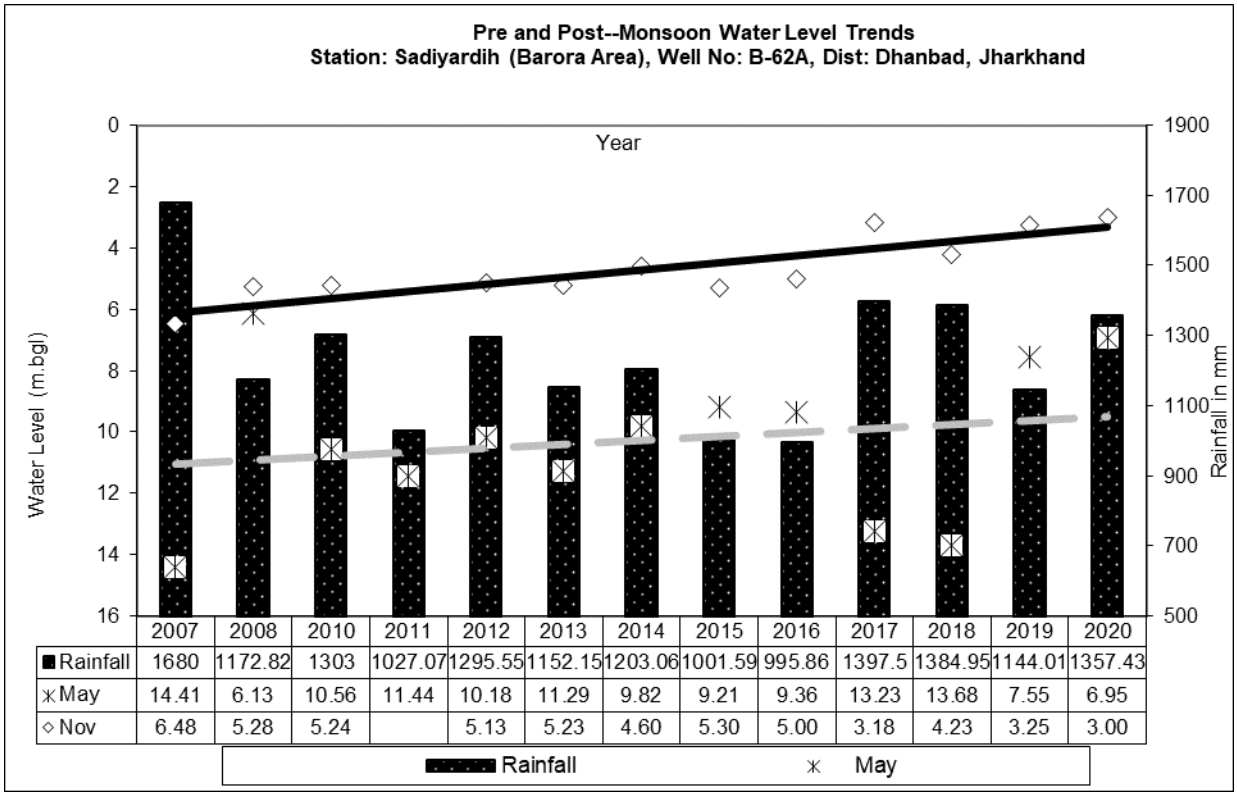


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	2.90						4.20	4.65	4.90	5.00	5.00	5.10	5.00
Nov	1.62	1.32	1.72		1.42	1.12	2.00	3.40	3.20	2.55	2.40	2.70	2.10

HYDROGRAPHS OF CLUSTER-II

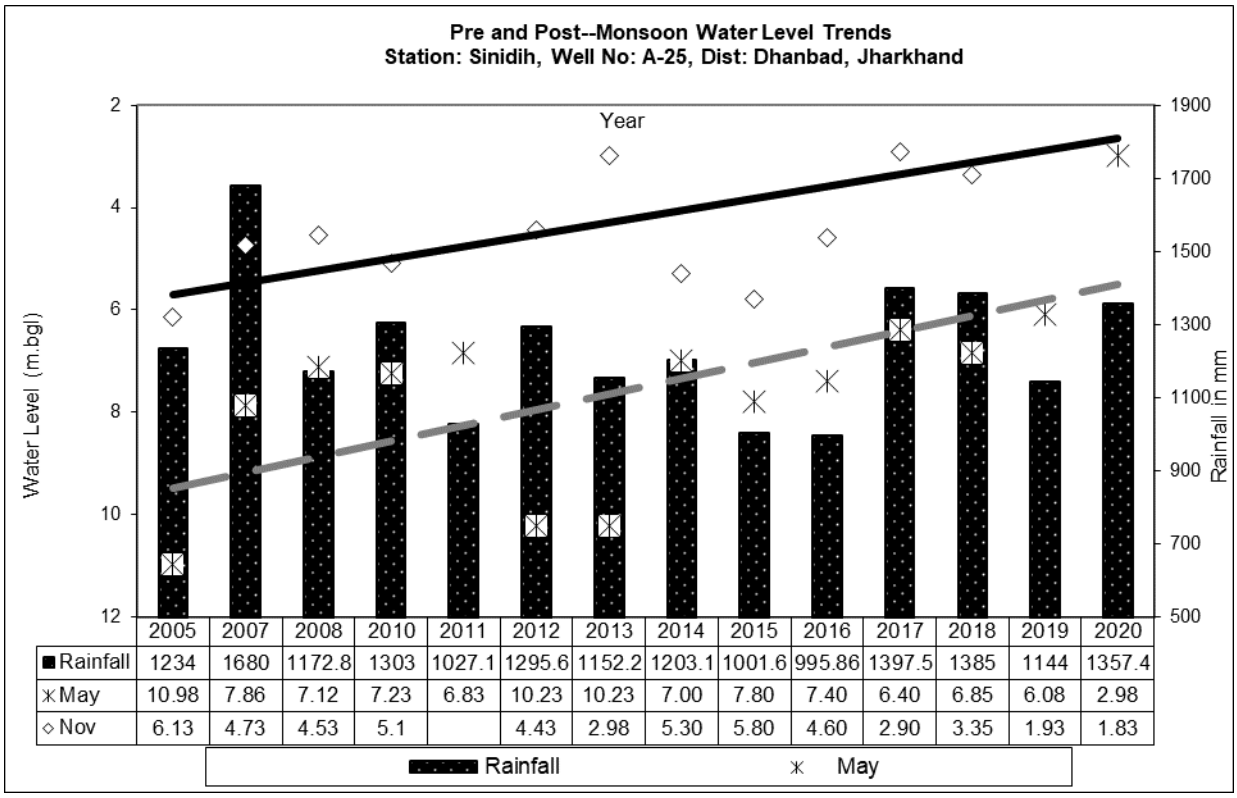


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	14.41	6.13	10.56	11.44	10.18	11.29	9.82	9.21	9.36	13.23	13.68	8.13	10.33
Nov	6.48	5.28	5.24		5.13	5.23	4.60	5.30	5.00	3.18	4.23	3.23	3.21

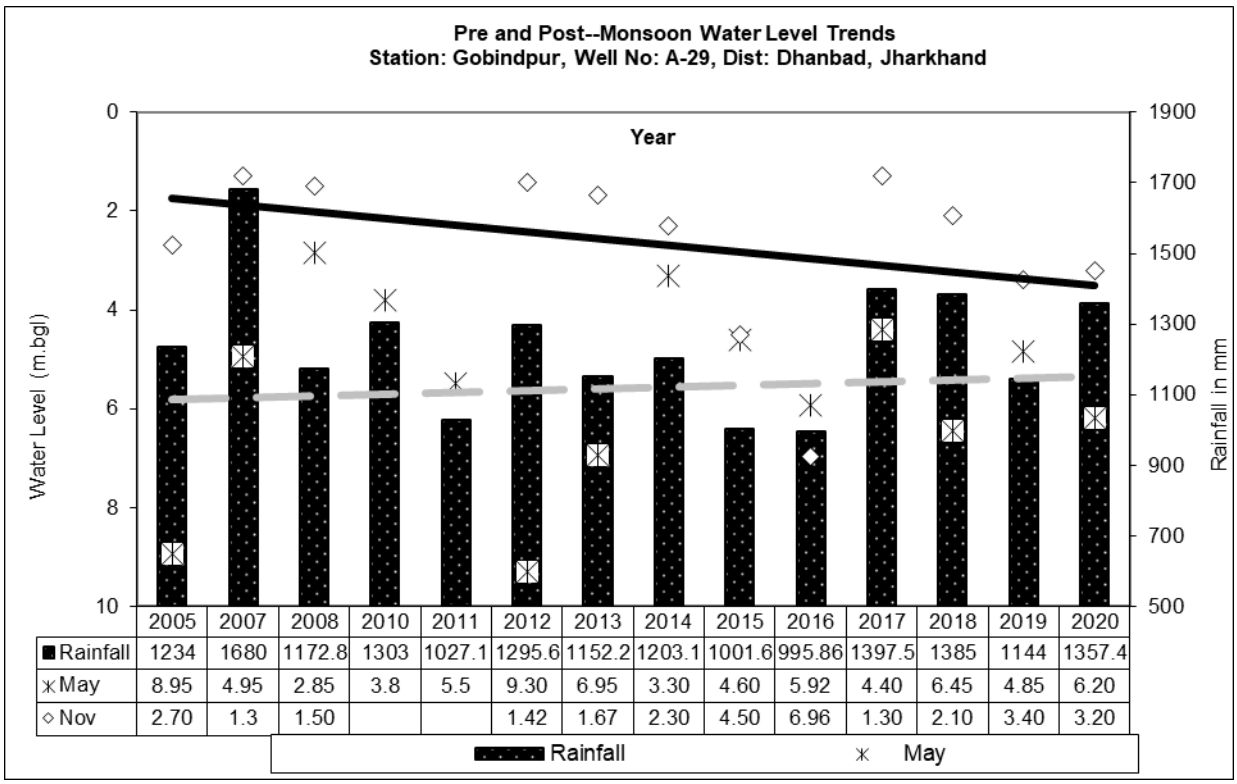


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	14.41	6.13	10.56	11.44	10.18	11.29	9.82	9.21	9.36	13.23	13.68	7.55	6.95
Nov	6.48	5.28	5.24		5.13	5.23	4.60	5.30	5.00	3.18	4.23	3.25	3.00

HYDROGRAPHS OF CLUSTER-III

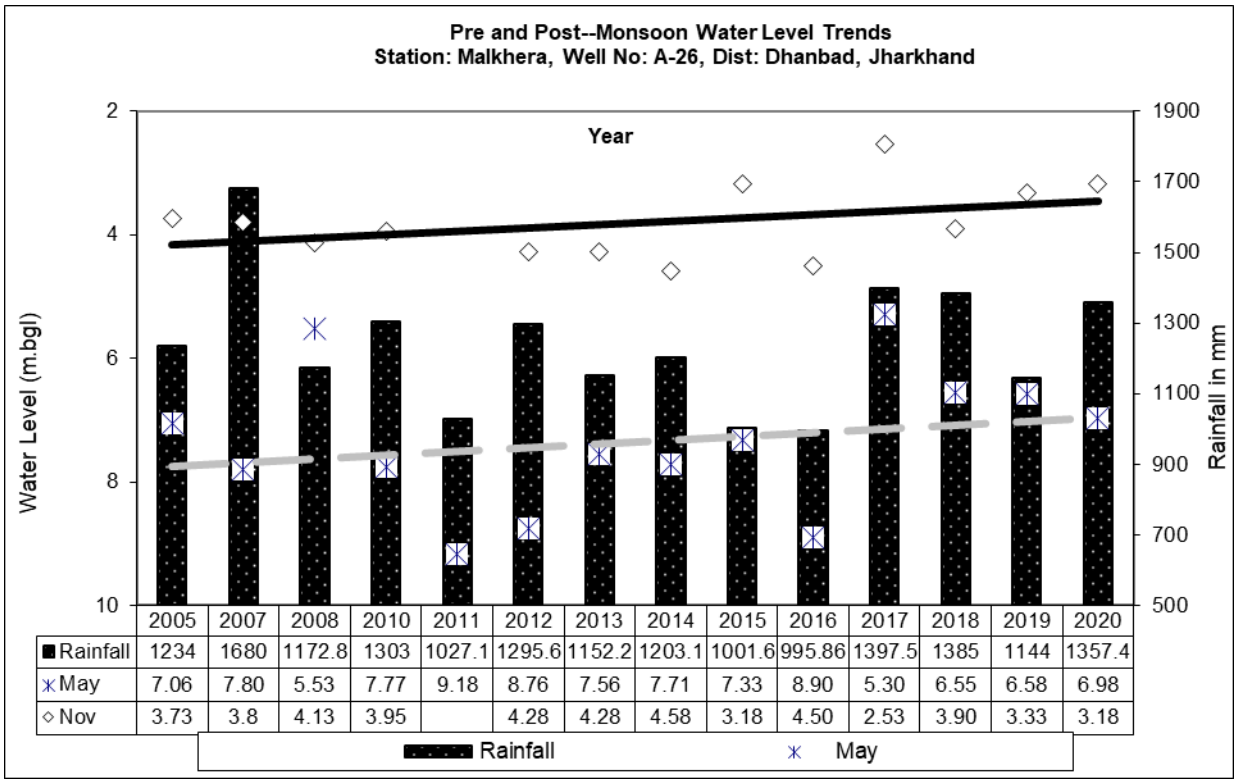


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	10.98	7.86	7.12	7.23	6.83	10.23	10.23	7.00	7.80	7.40	6.40	6.85	6.08	2.98
Nov	6.13	4.73	4.53	5.1		4.43	2.98	5.30	5.80	4.60	2.90	3.35	1.93	1.83

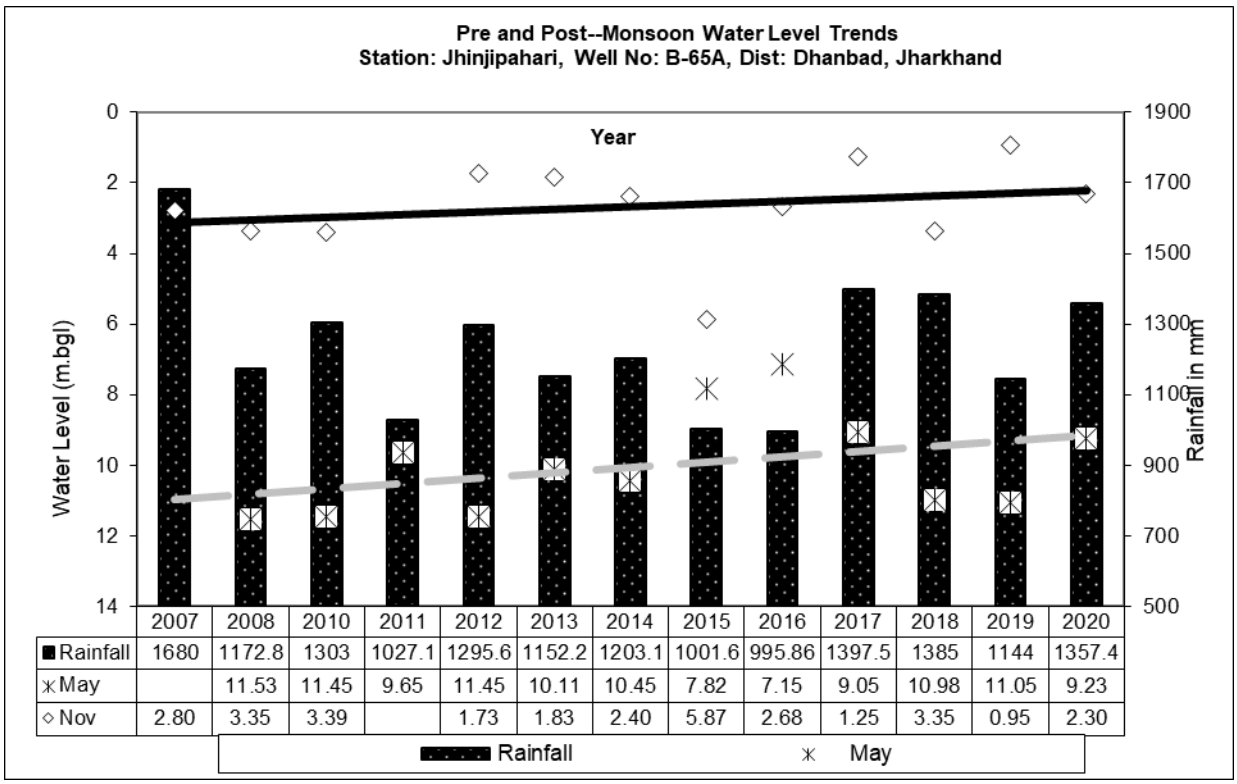


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	8.95	4.95	2.85	3.8	5.5	9.30	6.95	3.30	4.60	5.92	4.40	6.45	4.85	6.20
Nov	2.70	1.3	1.50			1.42	1.67	2.30	4.50	6.96	1.30	2.10	3.40	3.20

HYDROGRAPHS OF CLUSTER-IV

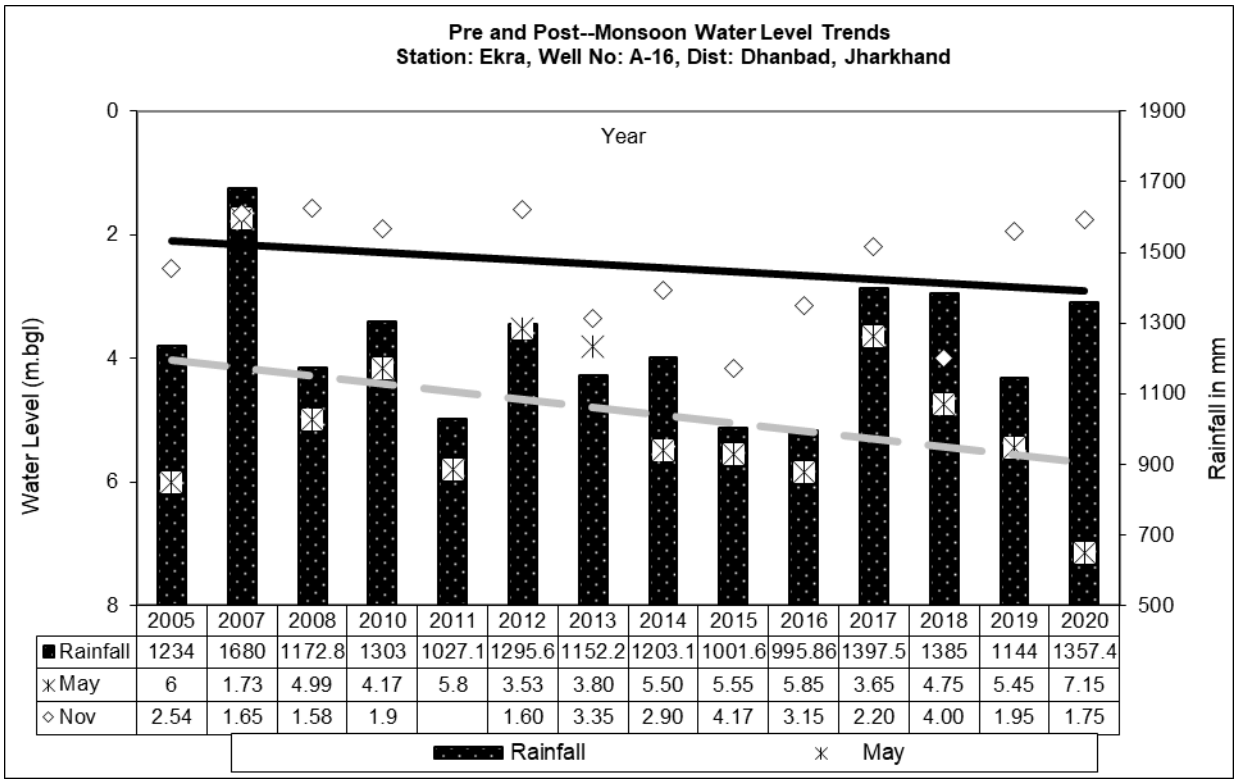


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	7.06	7.80	5.53	7.77	9.18	8.76	7.56	7.71	7.33	8.90	5.30	6.55	6.58	6.98
Nov	3.73	3.8	4.13	3.95		4.28	4.28	4.58	3.18	4.50	2.53	3.90	3.33	3.18

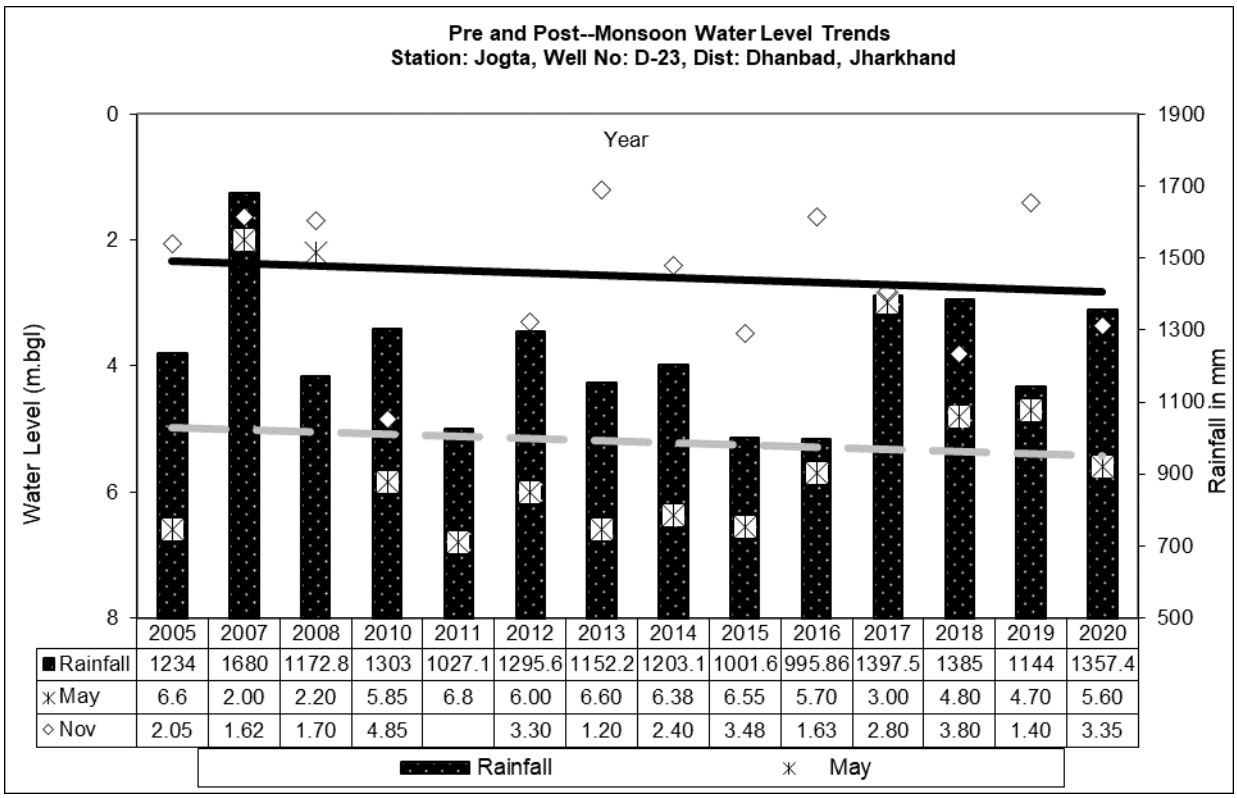


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May		11.53	11.45	9.65	11.45	10.11	10.45	7.82	7.15	9.05	10.98	11.05	9.23
Nov	2.80	3.35	3.39		1.73	1.83	2.40	5.87	2.68	1.25	3.35	0.95	2.30

HYDROGRAPHS OF CLUSTER-V

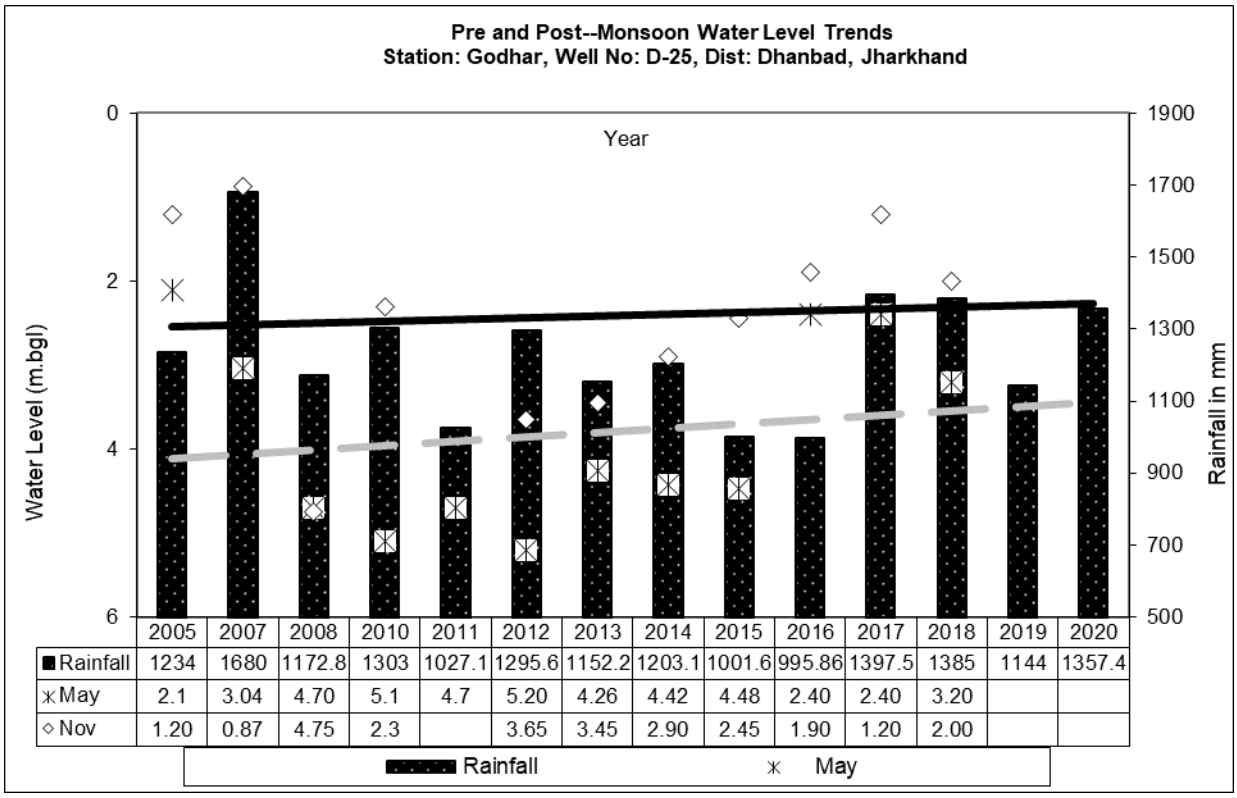


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	6	1.73	4.99	4.17	5.8	3.53	3.80	5.50	5.55	5.85	3.65	4.75	5.45	7.15
Nov	2.54	1.65	1.58	1.9		1.60	3.35	2.90	4.17	3.15	2.20	4.00	1.95	1.75

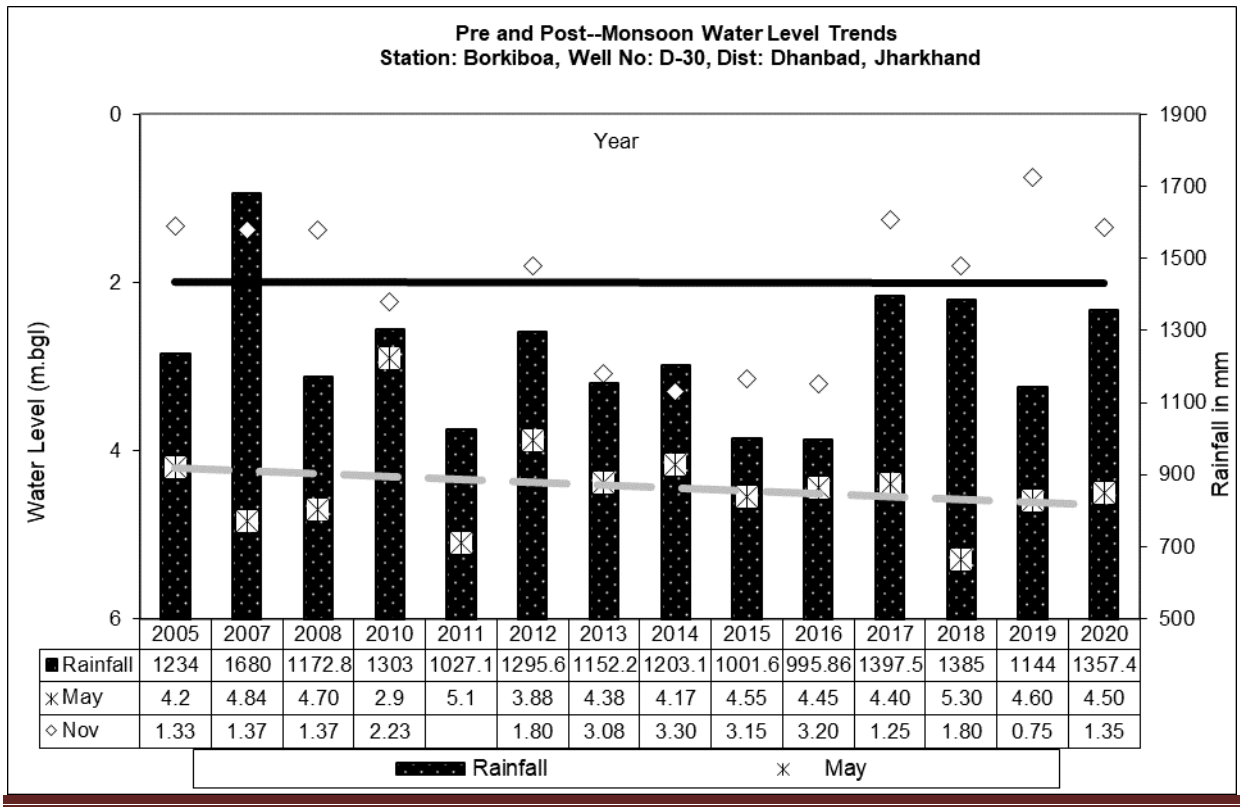


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	6.6	2.00	2.20	5.85	6.8	6.00	6.60	6.38	6.55	5.70	3.00	4.80	4.70	5.60
Nov	2.05	1.62	1.70	4.85		3.30	1.20	2.40	3.48	1.63	2.80	3.80	1.40	3.35

HYDROGRAPHS OF CLUSTER-VI

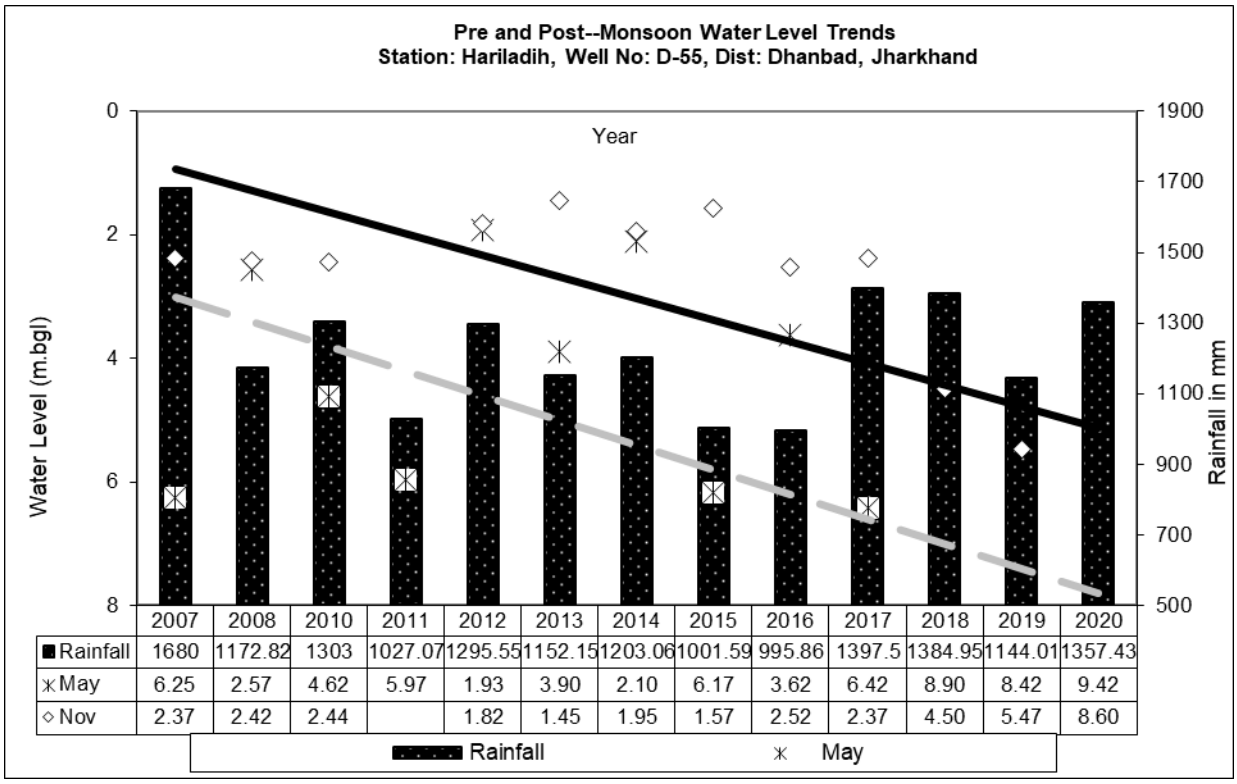


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	2.1	3.04	4.70	5.1	4.7	5.20	4.26	4.42	4.48	2.40	2.40	3.20		
Nov	1.20	0.87	4.75	2.3		3.65	3.45	2.90	2.45	1.90	1.20	2.00		

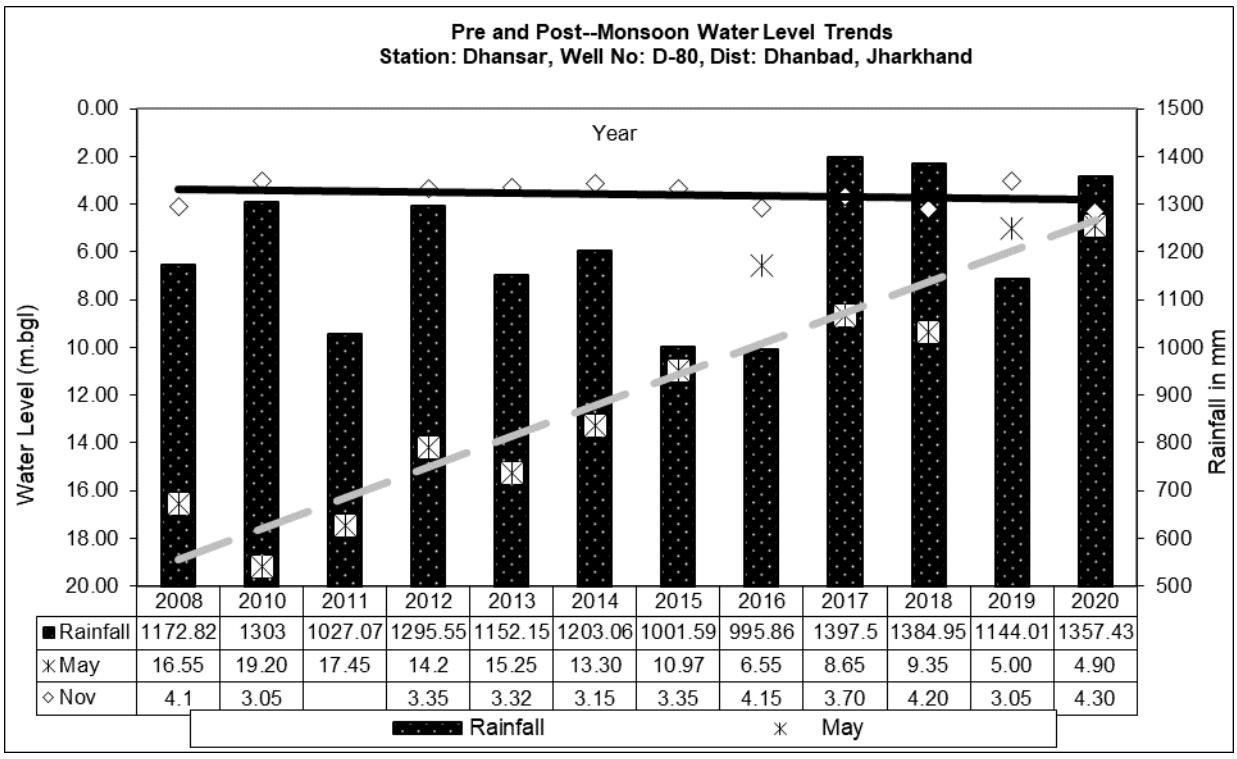


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	4.2	4.84	4.70	2.9	5.1	3.88	4.38	4.17	4.55	4.45	4.40	5.30	4.60	4.50
Nov	1.33	1.37	1.37	2.23		1.80	3.08	3.30	3.15	3.20	1.25	1.80	0.75	1.35

HYDROGRAPHS OF CLUSTER-VII

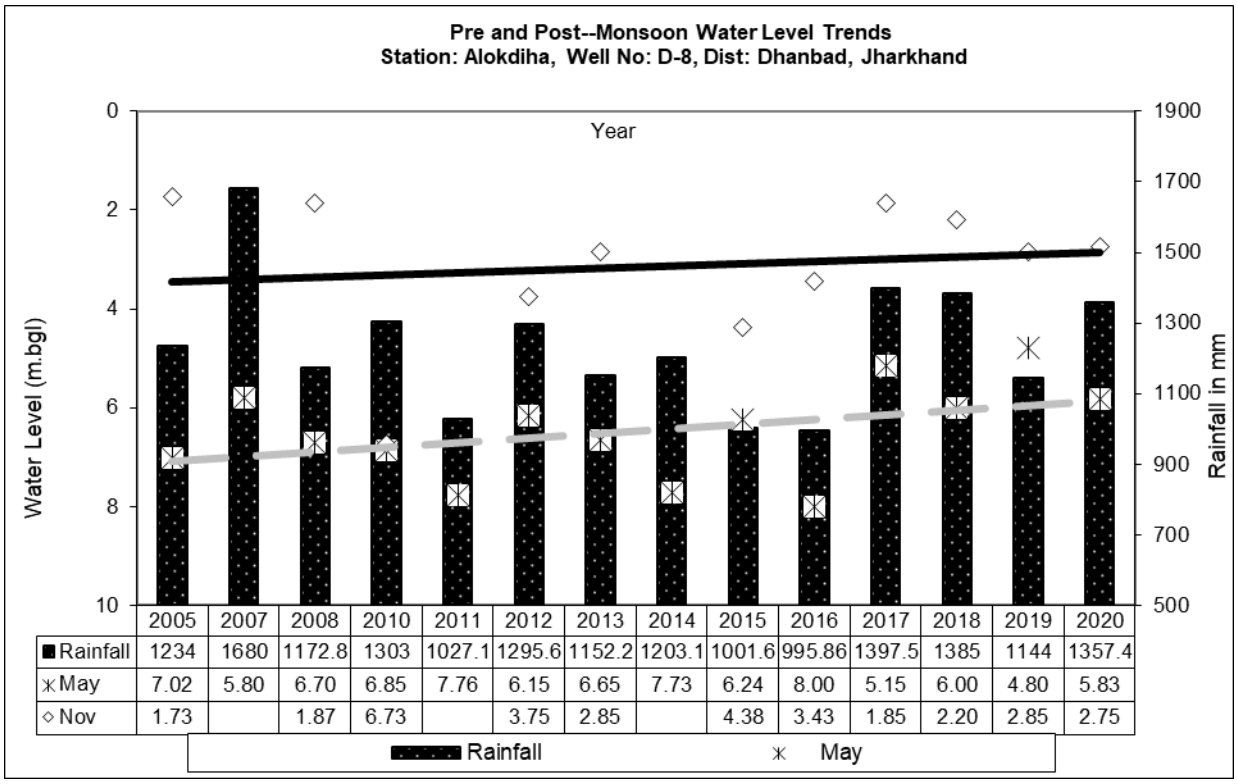


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	6.25	2.57	4.62	5.97	1.93	3.90	2.10	6.17	3.62	6.42	8.90	8.42	9.42
Nov	2.37	2.42	2.44		1.82	1.45	1.95	1.57	2.52	2.37	4.50	5.47	8.60

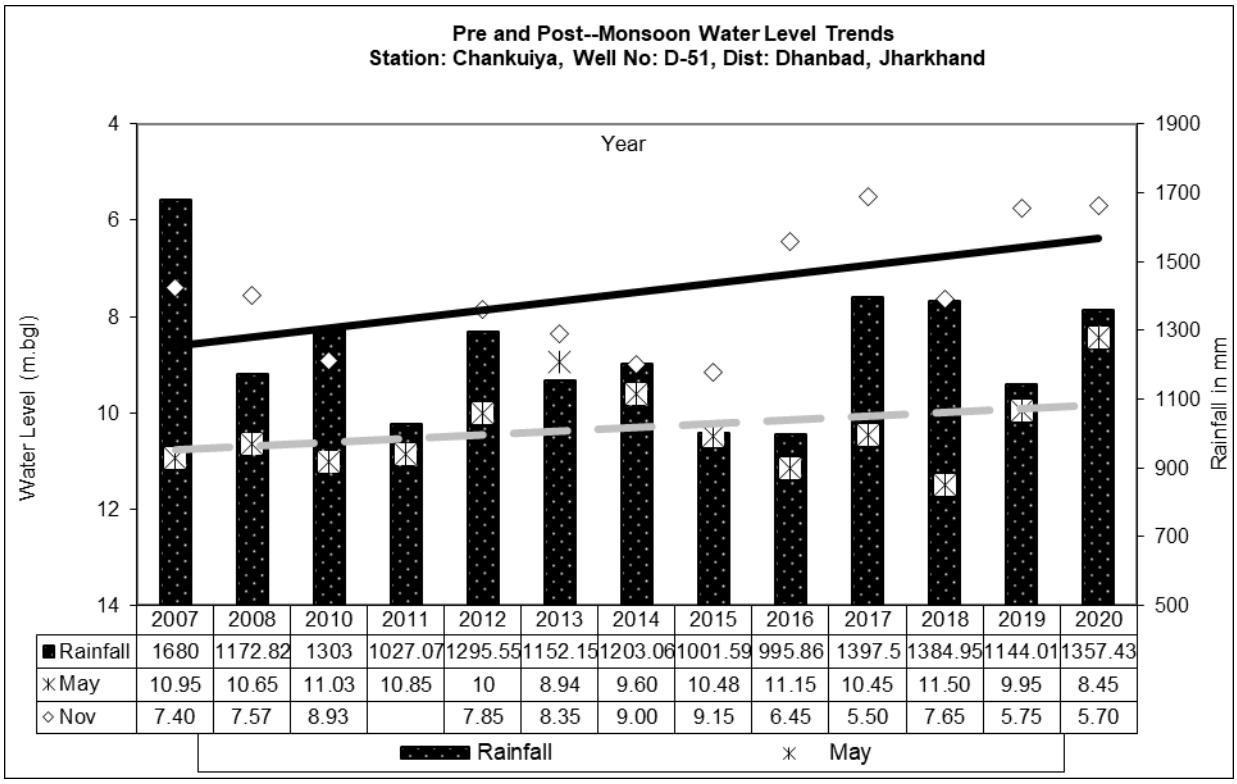


	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	16.55	19.20	17.45	14.2	15.25	13.30	10.97	6.55	8.65	9.35	5.00	4.90
Nov	4.1	3.05		3.35	3.32	3.15	3.35	4.15	3.70	4.20	3.05	4.30

HYDROGRAPHS OF CLUSTER-VIII

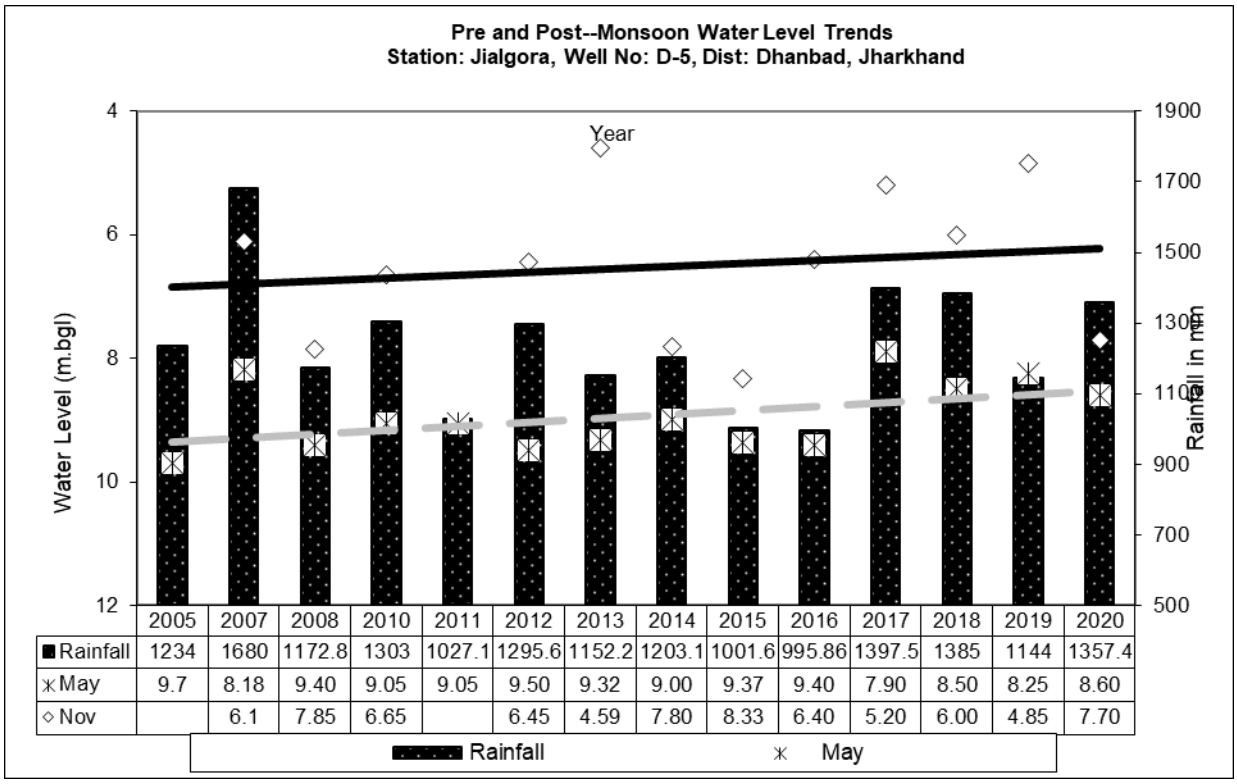


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	7.02	5.80	6.70	6.85	7.76	6.15	6.65	7.73	6.24	8.00	5.15	6.00	4.80	5.83
Nov	1.73		1.87	6.73		3.75	2.85		4.38	3.43	1.85	2.20	2.85	2.75

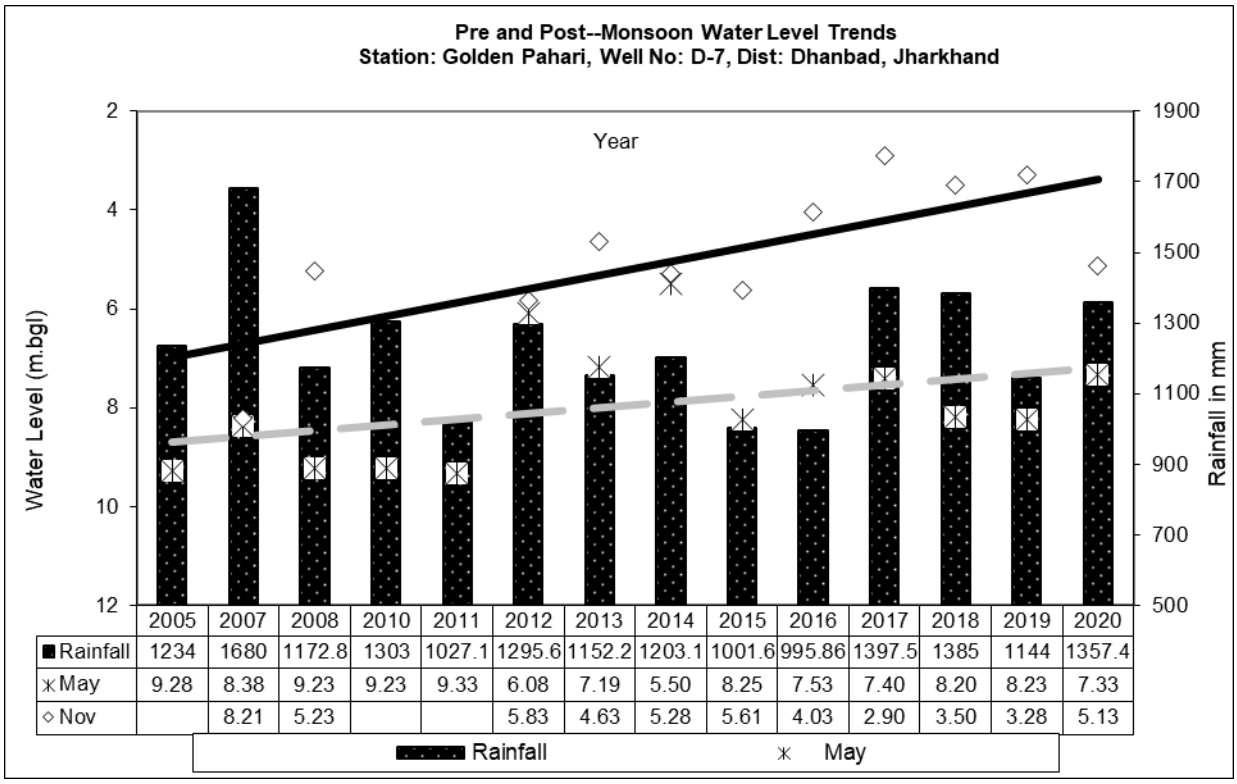


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	10.95	10.65	11.03	10.85	10	8.94	9.60	10.48	11.15	10.45	11.50	9.95	8.45
Nov	7.40	7.57	8.93		7.85	8.35	9.00	9.15	6.45	5.50	7.65	5.75	5.70

HYDROGRAPHS OF CLUSTER-IX

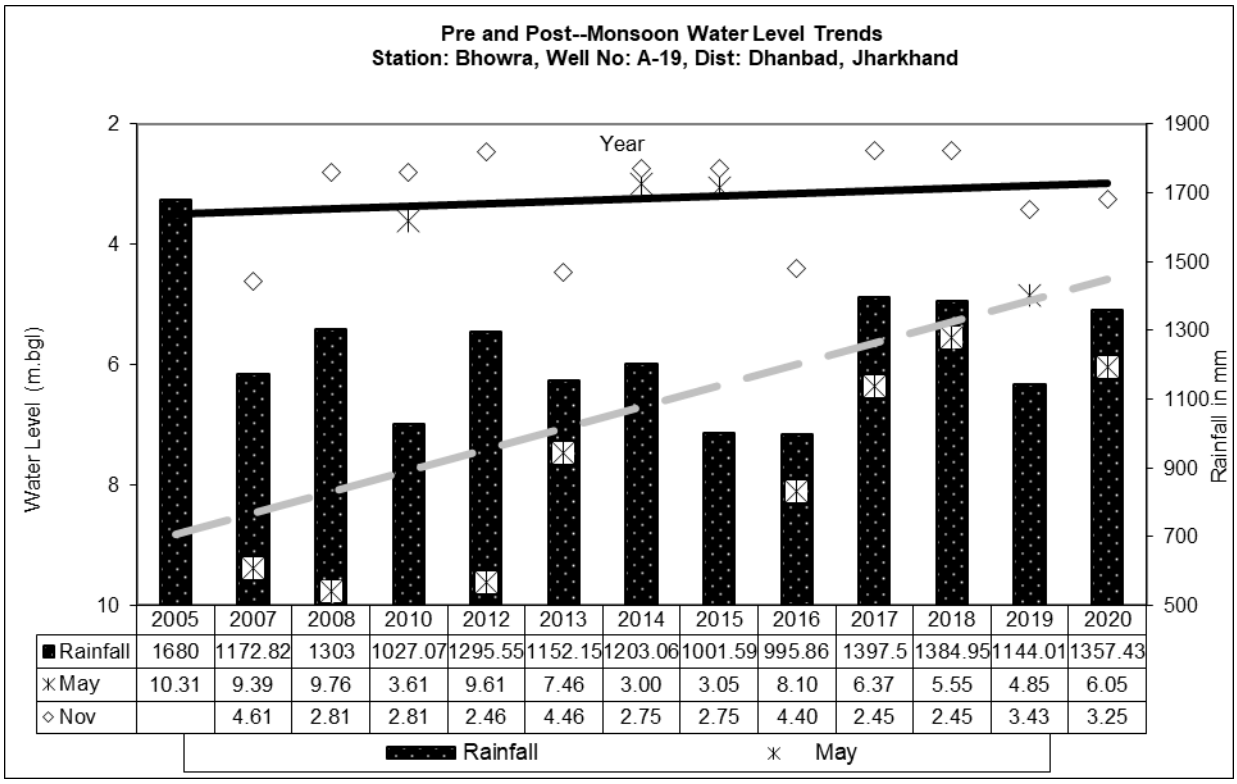


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	9.7	8.18	9.40	9.05	9.05	9.50	9.32	9.00	9.37	9.40	7.90	8.50	8.25	8.60
Nov		6.1	7.85	6.65		6.45	4.59	7.80	8.33	6.40	5.20	6.00	4.85	7.70

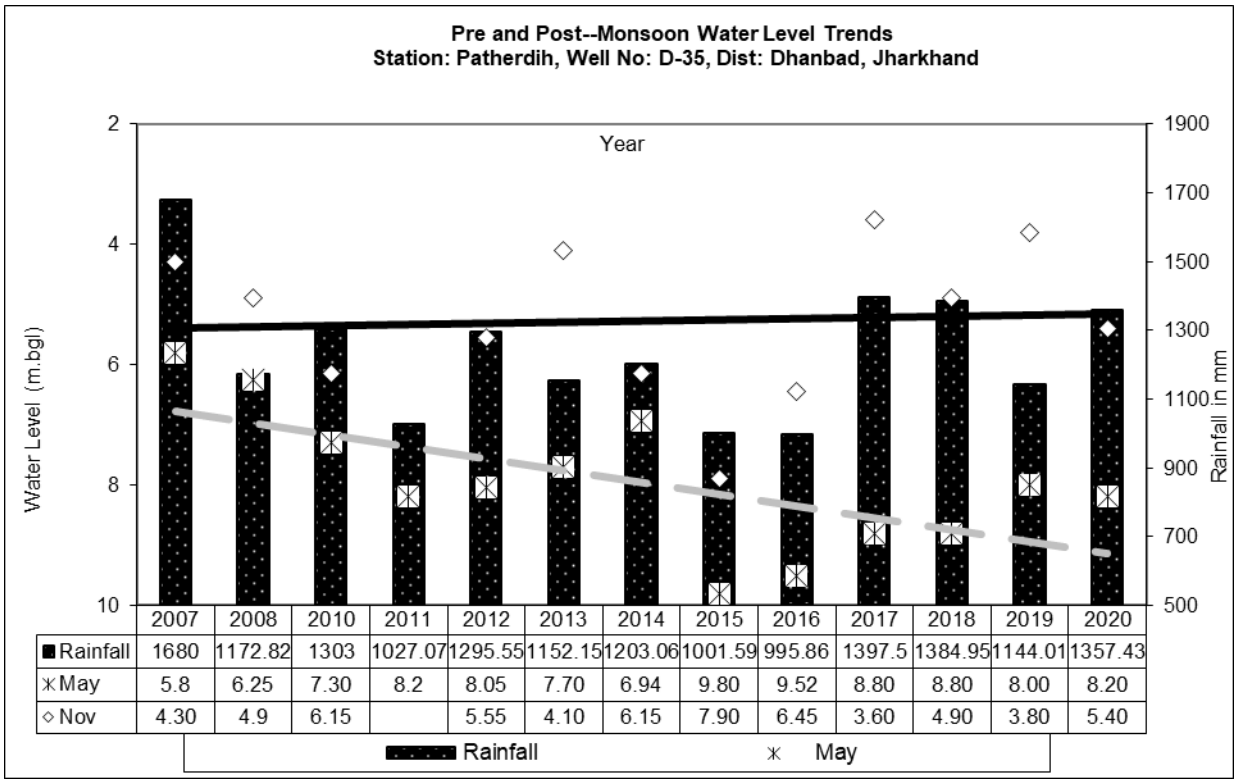


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	9.28	8.38	9.23	9.23	9.33	6.08	7.19	5.50	8.25	7.53	7.40	8.20	8.23	7.33
Nov		8.21	5.23			5.83	4.63	5.28	5.61	4.03	2.90	3.50	3.28	5.13

HYDROGRAPHS OF CLUSTER-X

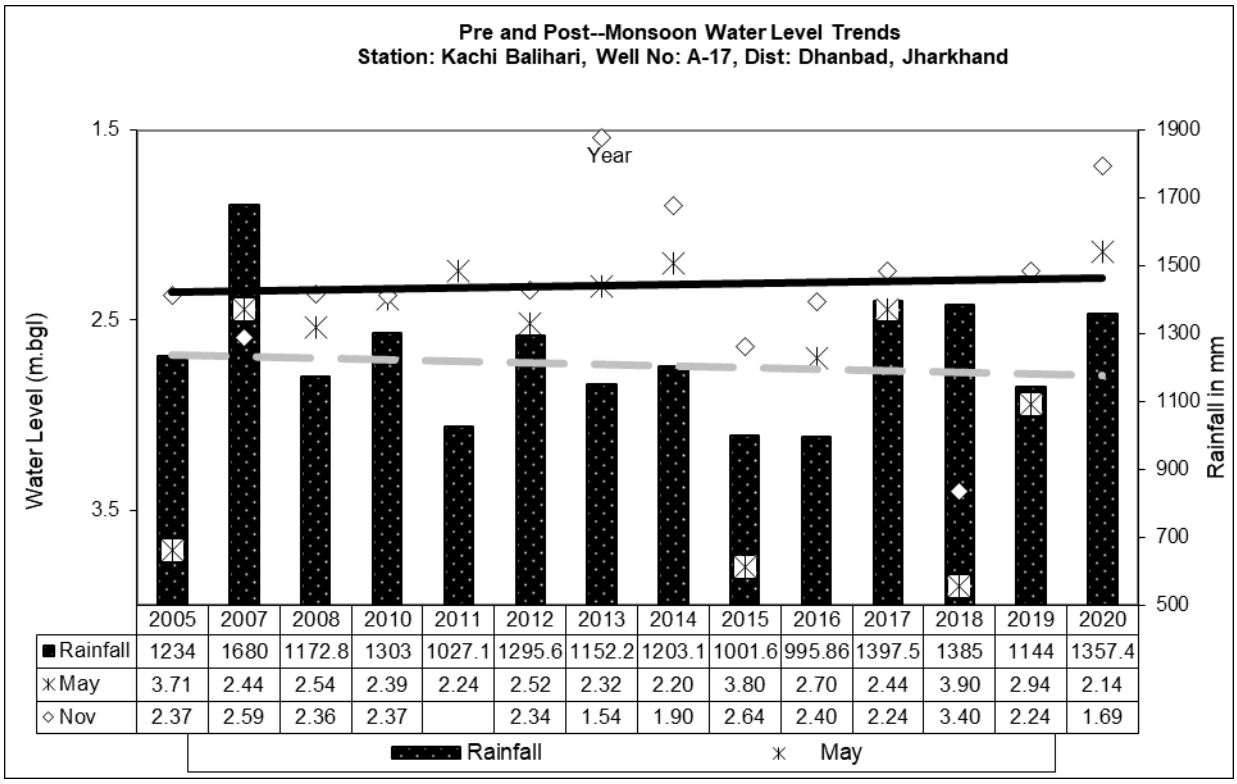


	2005	2007	2008	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	10.31	9.39	9.76	3.61	9.61	7.46	3.00	3.05	8.10	6.37	5.55	4.85	6.05
Nov		4.61	2.81	2.81	2.46	4.46	2.75	2.75	4.40	2.45	2.45	3.43	3.25

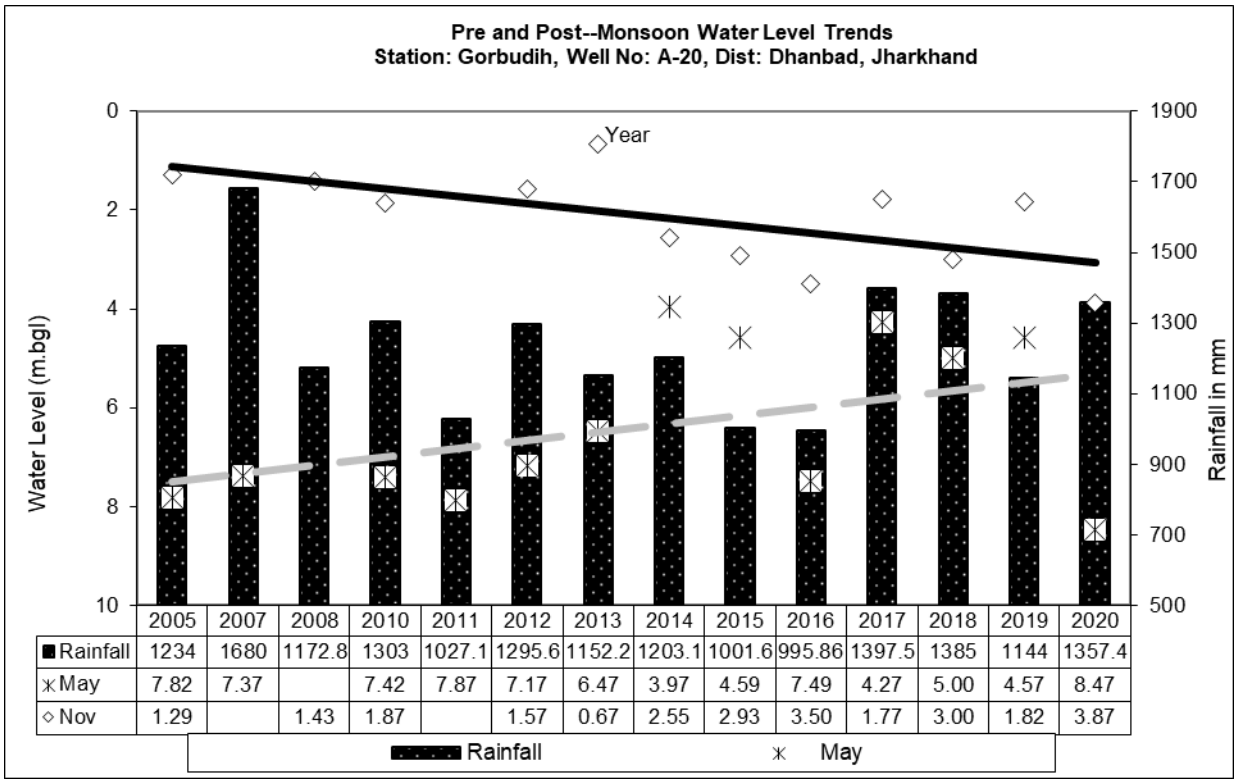


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	5.8	6.25	7.30	8.2	8.05	7.70	6.94	9.80	9.52	8.80	8.80	8.00	8.20
Nov	4.30	4.9	6.15		5.55	4.10	6.15	7.90	6.45	3.60	4.90	3.80	5.40

HYDROGRAPHS OF CLUSTER-XI

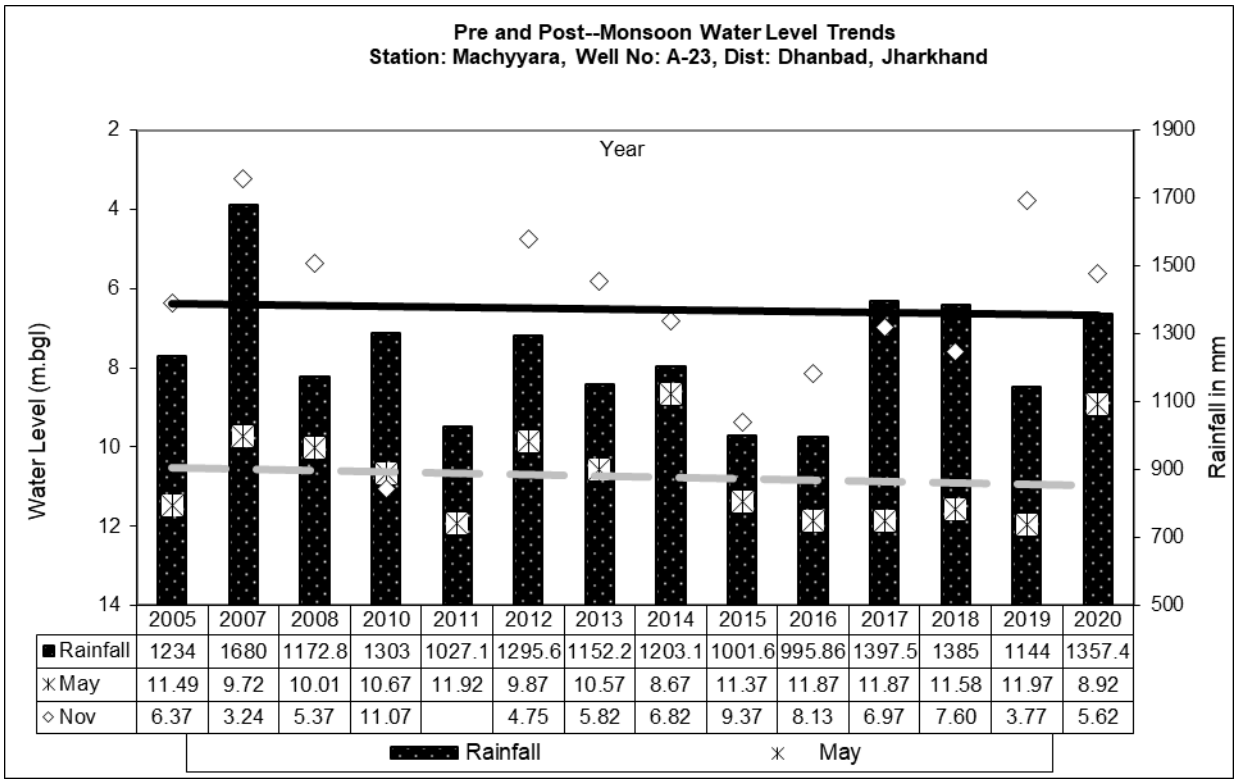


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	3.71	2.44	2.54	2.39	2.24	2.52	2.32	2.20	3.80	2.70	2.44	3.90	2.94	2.14
Nov	2.37	2.59	2.36	2.37		2.34	1.54	1.90	2.64	2.40	2.24	3.40	2.24	1.69

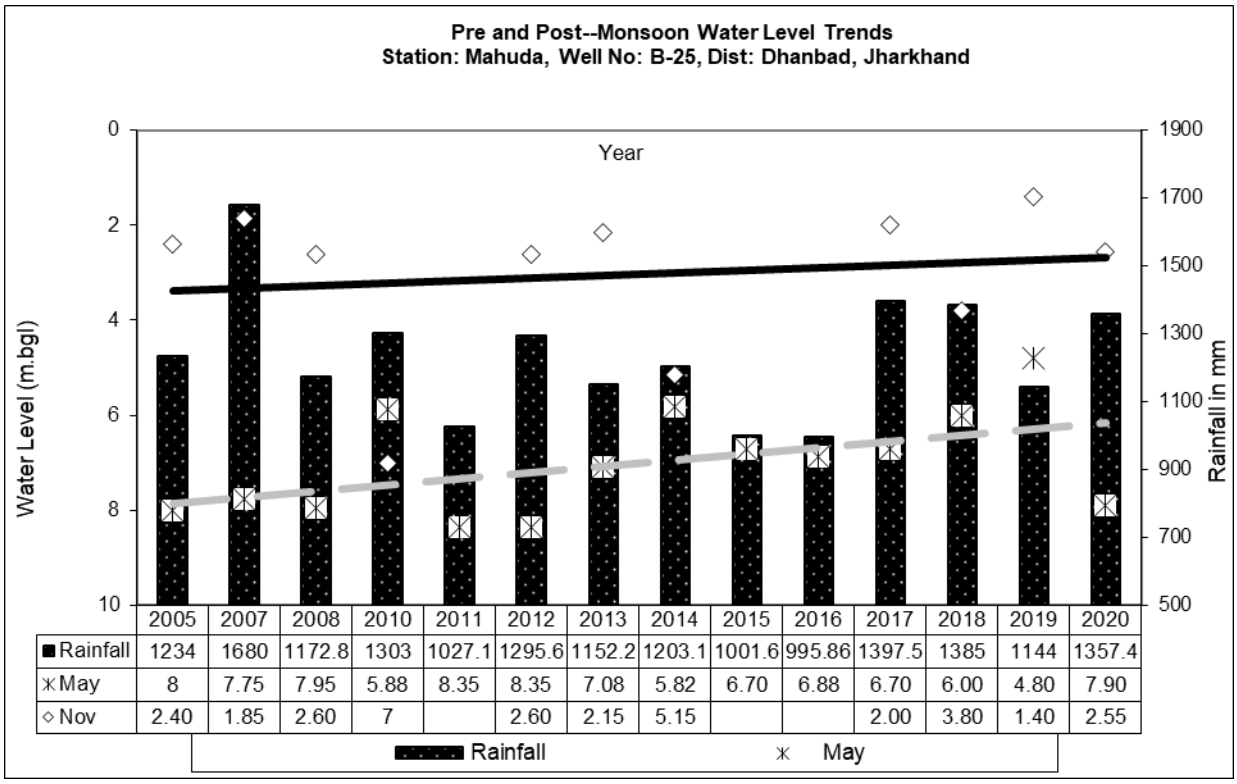


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	7.82	7.37		7.42	7.87	7.17	6.47	3.97	4.59	7.49	4.27	5.00	4.57	8.47
Nov	1.29		1.43	1.87		1.57	0.67	2.55	2.93	3.50	1.77	3.00	1.82	3.87

HYDROGRAPHS OF CLUSTER-XIII

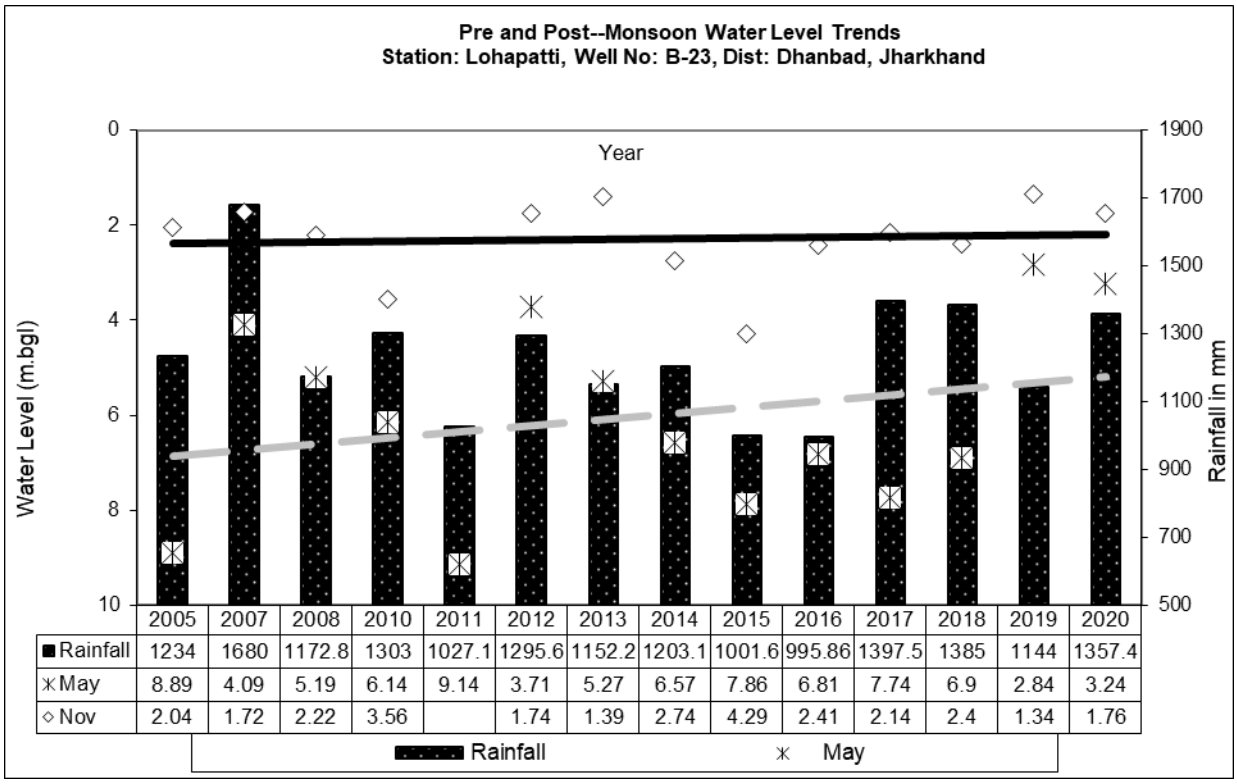


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	11.49	9.72	10.01	10.67	11.92	9.87	10.57	8.67	11.37	11.87	11.87	11.58	11.97	8.92
Nov	6.37	3.24	5.37	11.07		4.75	5.82	6.82	9.37	8.13	6.97	7.60	3.77	5.62

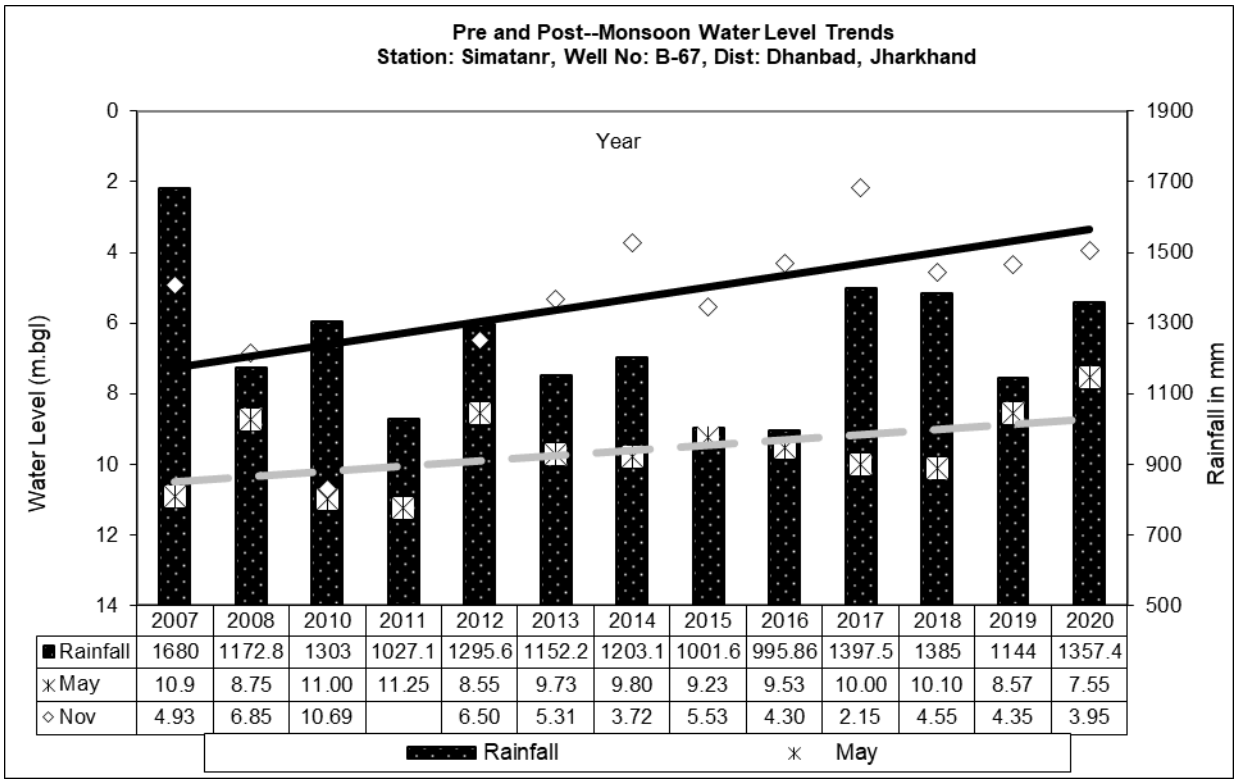


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	8	7.75	7.95	5.88	8.35	8.35	7.08	5.82	6.70	6.88	6.70	6.00	4.80	7.90
Nov	2.40	1.85	2.60	7		2.60	2.15	5.15			2.00	3.80	1.40	2.55

HYDROGRAPHS OF CLUSTER-XIV

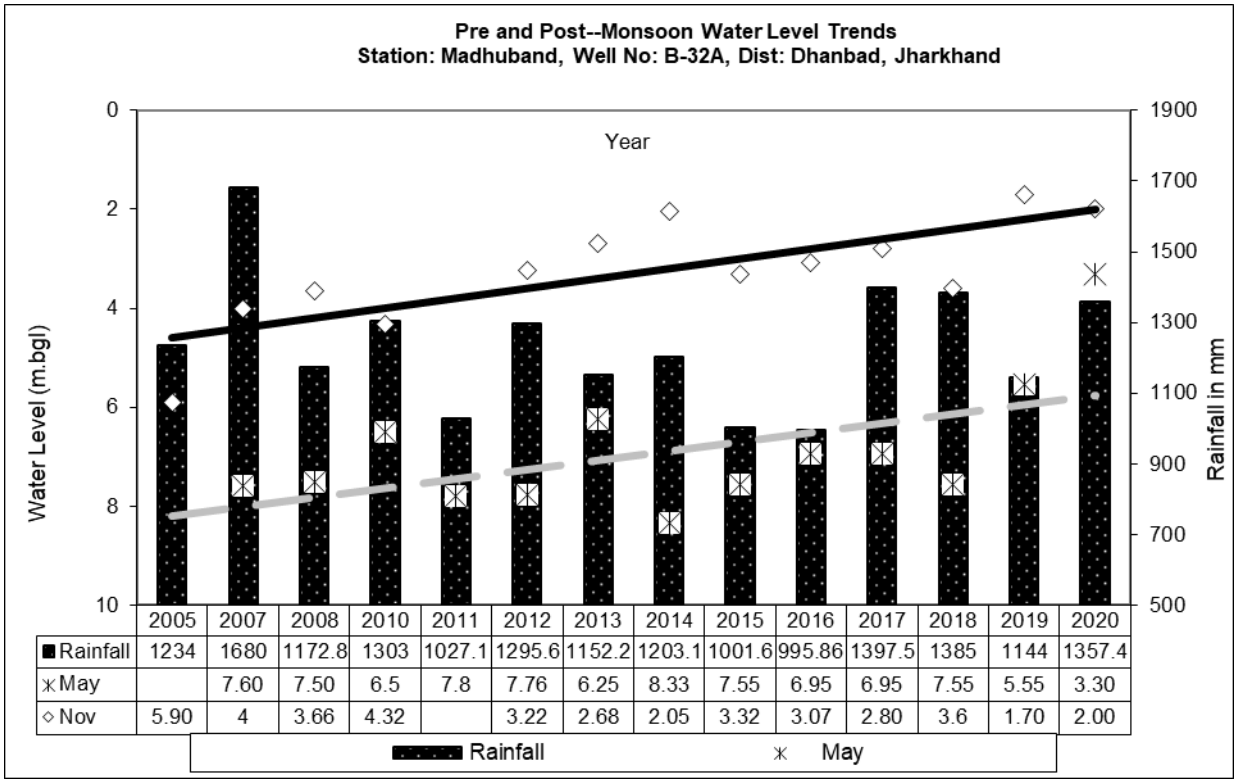


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	8.89	4.09	5.19	6.14	9.14	3.71	5.27	6.57	7.86	6.81	7.74	6.9	2.84	3.24
Nov	2.04	1.72	2.22	3.56		1.74	1.39	2.74	4.29	2.41	2.14	2.4	1.34	1.76

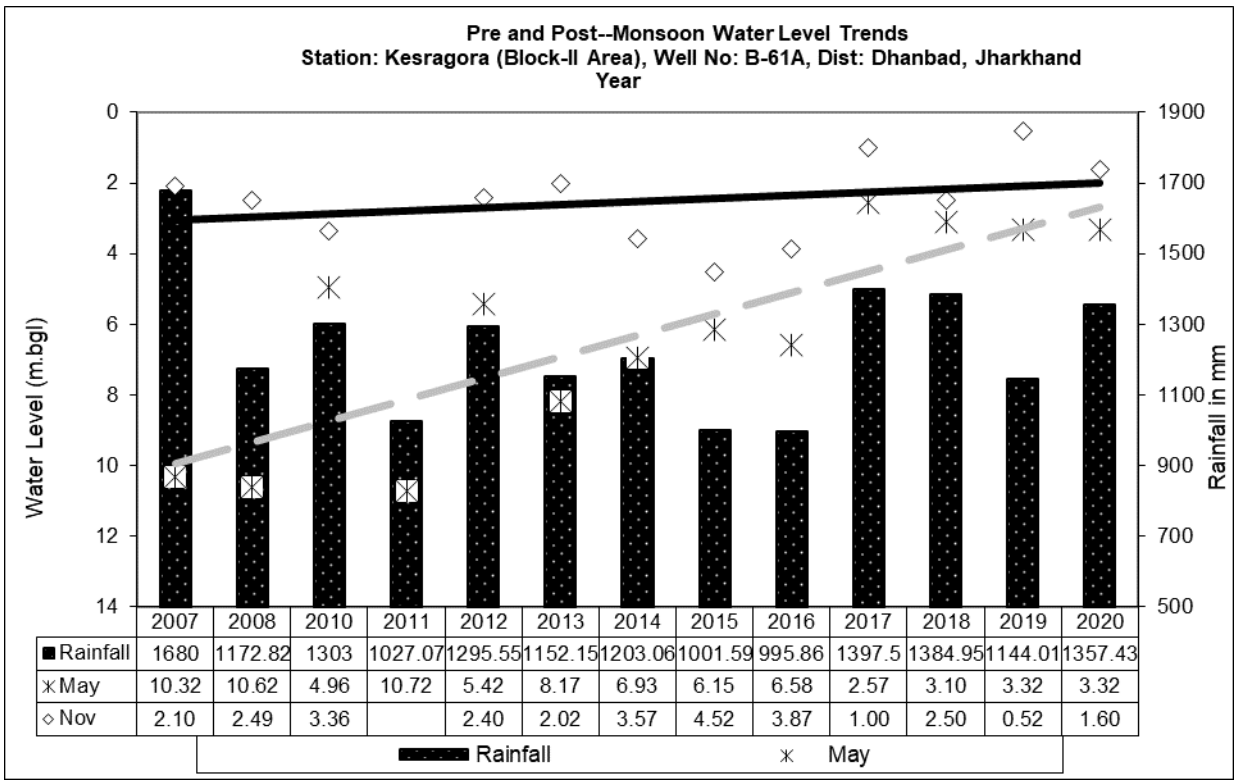


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	10.9	8.75	11.00	11.25	8.55	9.73	9.80	9.23	9.53	10.00	10.10	8.57	7.55
Nov	4.93	6.85	10.69		6.50	5.31	3.72	5.53	4.30	2.15	4.55	4.35	3.95

HYDROGRAPHS OF CLUSTER-XV

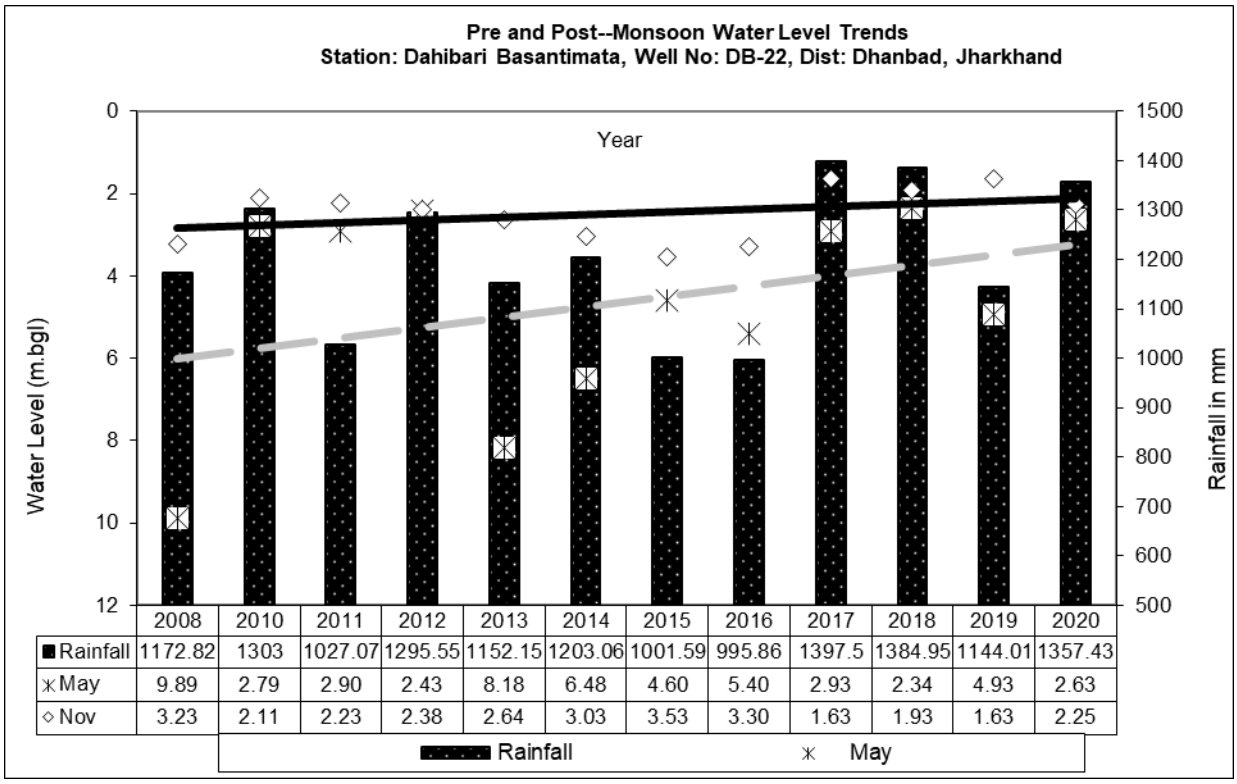


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May		7.60	7.50	6.5	7.8	7.76	6.25	8.33	7.55	6.95	6.95	7.55	5.55	3.30
Nov	5.90	4	3.66	4.32		3.22	2.68	2.05	3.32	3.07	2.80	3.6	1.70	2.00

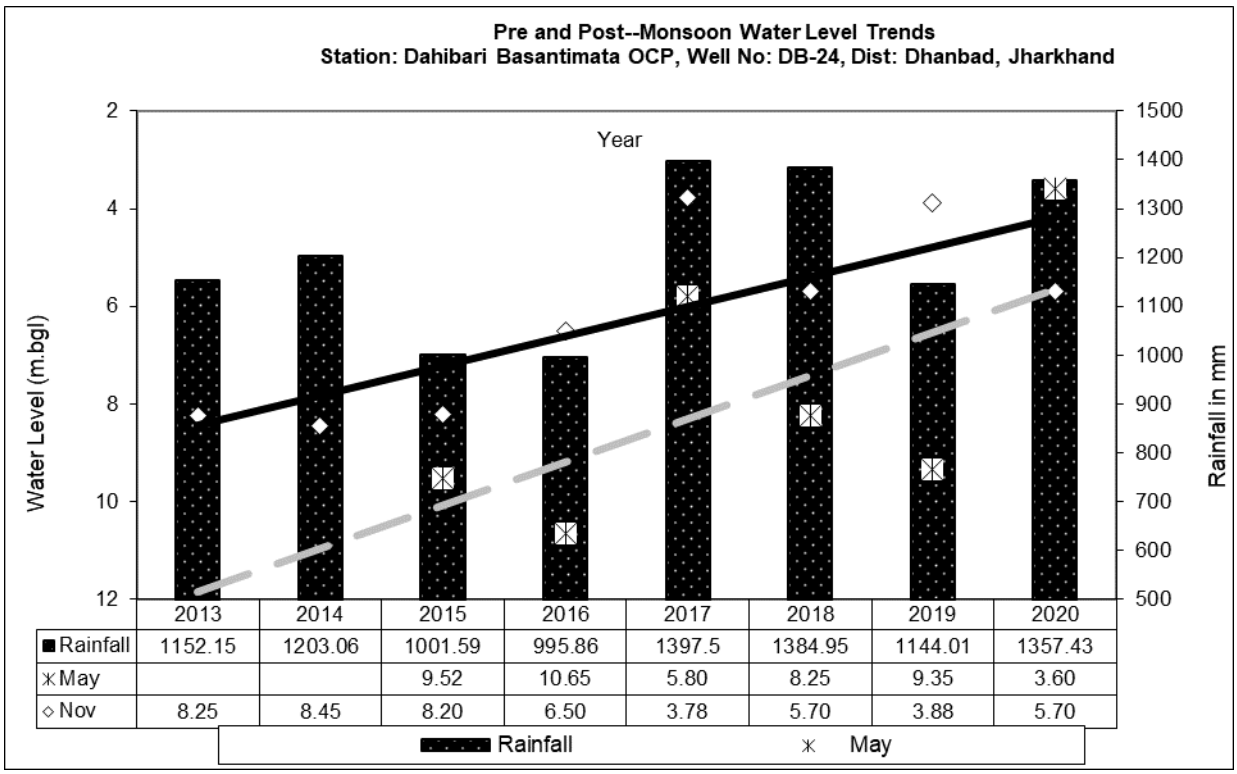


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1680	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	10.32	10.62	4.96	10.72	5.42	8.17	6.93	6.15	6.58	2.57	3.10	3.32	3.32
Nov	2.10	2.49	3.36		2.40	2.02	3.57	4.52	3.87	1.00	2.50	0.52	1.60

HYDROGRAPHS OF CLUSTER-XVI

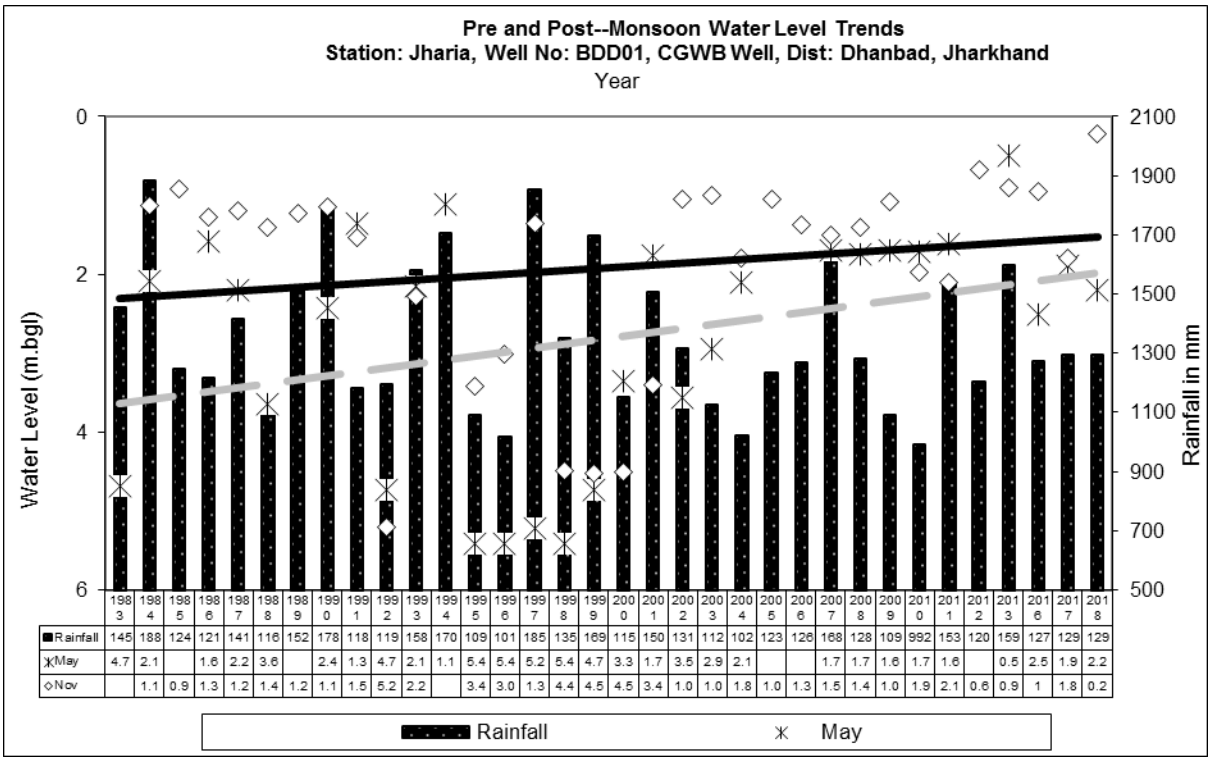


	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1172.82	1303	1027.07	1295.55	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May	9.89	2.79	2.90	2.43	8.18	6.48	4.60	5.40	2.93	2.34	4.93	2.63
Nov	3.23	2.11	2.23	2.38	2.64	3.03	3.53	3.30	1.63	1.93	1.63	2.25

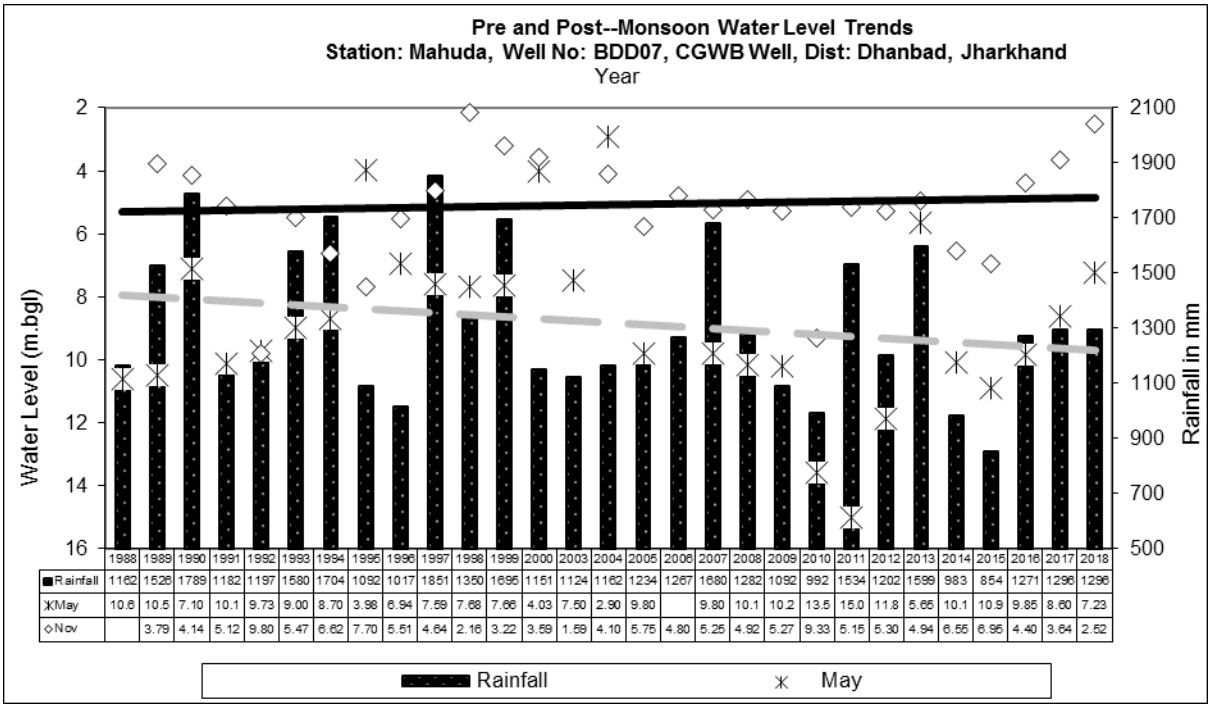


	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43
May			9.52	10.65	5.80	8.25	9.35	3.60
Nov	8.25	8.45	8.20	6.50	3.78	5.70	3.88	5.70

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS

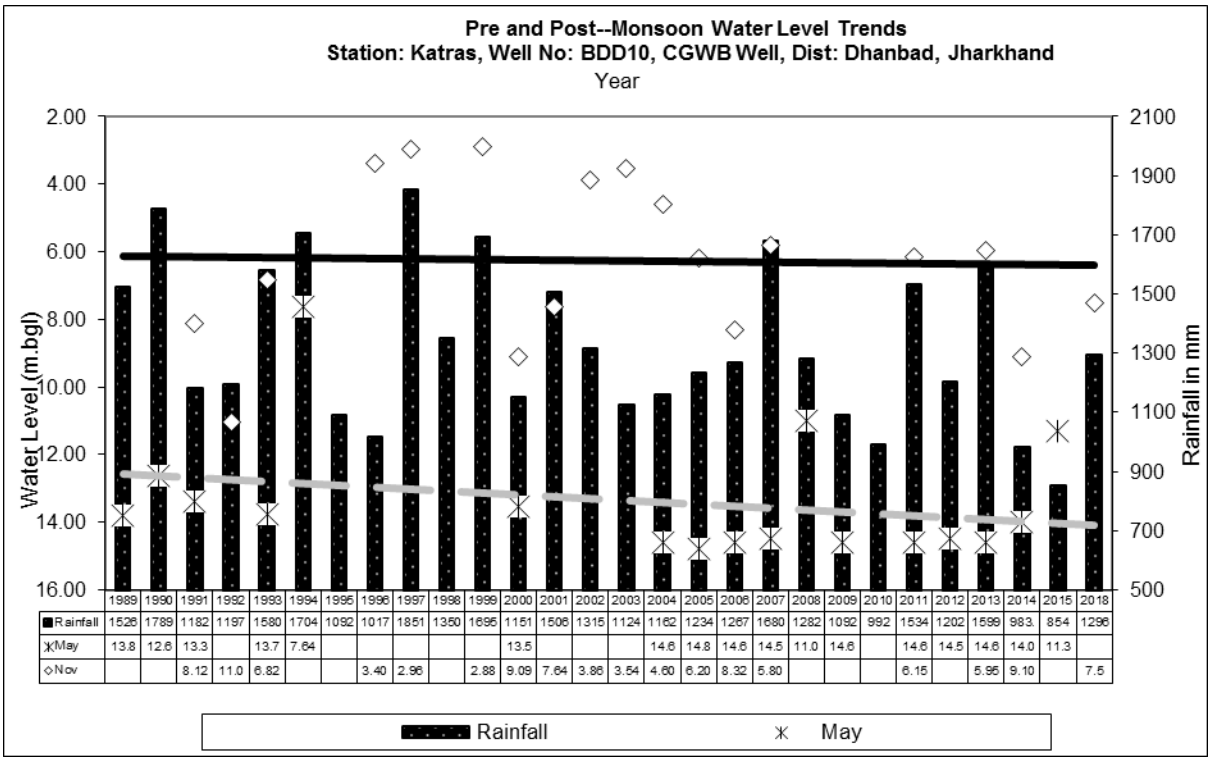


	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	145	188	124	121	141	116	152	178	118	119	158	170	109	101	185	135	169	115	150	131	112	102	123	126	168	128	109	992	153	120	159	127	129	129		
May	4.7	2.1		1.6	2.2	3.6		2.4	1.3	4.7	2.1	1.1	5.4	5.4	5.2	5.4	4.7	3.3	1.7	3.5	2.9	2.1			1.7	1.7	1.6	1.7	1.6		0.5	2.5	1.9	2.2		
Nov		1.1	0.9	1.3	1.2	1.4	1.2	1.1	1.5	5.2	2.2		3.4	3.0	1.3	4.4	4.5	4.5	3.4	1.0	1.0	1.8	1.0	1.3	1.5	1.4	1.0	1.9	2.1	0.6	0.9	1	1.8	0.2		

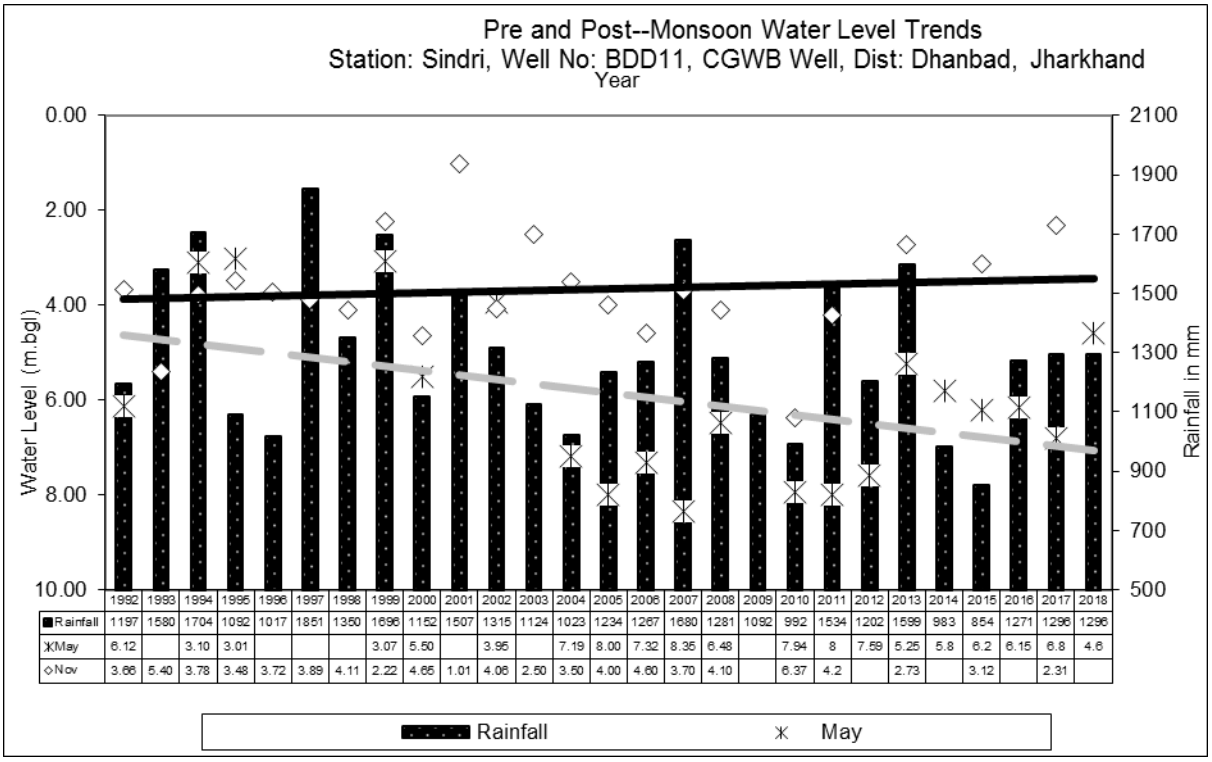


	1988	1989	1990	1991	1992	1993	1994	1996	1996	1997	1998	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1162	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	10.6	10.5	7.10	10.1	9.73	9.00	8.70	3.98	6.94	7.59	7.68	7.66	4.03	7.50	2.90	9.80		9.80	10.1	10.2	13.5	15.0	11.8	5.65	10.1	10.9	9.85	8.60	7.23
Nov		3.79	4.14	5.12	9.80	5.47	6.62	7.70	5.51	4.64	2.16	3.22	3.59	1.59	4.10	5.75	4.80	5.25	4.92	5.27	9.33	5.15	5.30	4.94	6.55	6.95	4.40	3.64	2.52

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS



	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2018
Rainfall	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1506	1315	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983.	854	1296
May	13.8	12.6	13.3		13.7	7.64						13.5				14.6	14.8	14.6	14.5	11.0	14.6		14.6	14.5	14.6	14.0	11.3	
Nov			8.12	11.0	6.82			3.40	2.96		2.88	9.09	7.64	3.86	3.54	4.60	6.20	8.32	5.80				6.15		5.95	9.10		7.5



	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1197	1580	1704	1092	1017	1851	1350	1696	1152	1507	1315	1124	1023	1234	1267	1680	1281	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	6.12		3.10	3.01				3.07	5.50		3.95		7.19	8.00	7.32	8.35	6.48		7.94	8	7.59	5.25	5.8	6.2	6.15	6.8	4.6
Nov	3.66	5.40	3.78	3.48	3.72	3.89	4.11	2.22	4.65	1.01	4.06	2.50	3.50	4.00	4.60	3.70	4.10		6.37	4.2		2.73		3.12		2.31	

Annexure – VIII

GROUNDWATER SAMPLE LOCATION DETAILS

Sampling month: June month of the assessment year of 2020-21

Sl No	Name of Cluster	Ground Water Sample	Dug well (CMPDI)	Location	Sampling Date
					June'2020
1	CLUSTER-I	GW-1	B-15	BERA VILLAGE	01.06.2020
2	CLUSTER-II	GW-2	B-59	KHODOVALY VILLAGE	01.06.2020
3	CLUSTER-III	GW-3	A-29	GOVINDPUR,AMBAGAN VILLAGE	01.06.2020
4	CLUSTER-IV	GW-4	B-63	KESHALPUR, BATIGHAR	01.06.2020
5	CLUSTER-V	GW-5	D-30	BORKIBOA VILLAGE	01.06.2020
6	CLUSTER-VI	GW-6	D-25	GODHUR MORE	01.06.2020
7	CLUSTER-VII	GW-7	D-80	DHANSAR MINE RESCUE STN.	02.06.2020
8	CLUSTER-VIII	GW-8	D-49	NEAR GHANOODIH OC	02.06.2020
9	CLUSTER-IX	GW-9	D-5	JEALGORA, NEAR P.O.	02.06.2020
10	CLUSTER-X	GW-10	D-35	PATHERDIH RLY. COLONY	02.06.2020
11	CLUSTER-XI	GW-11	A-32	MONNIDIH BAZAR	01.06.2020
12	CLUSTER-XIII	GW-13	A-23	MACHHAYARA	01.06.2020
13	CLUSTER-XIV	GW-14	B-23	LOHAPATTI VILLAGE	01.06.2020
14	CLUSTER-XV	GW-15	B-32A	MADHUBAND VILLAGE	01.06.2020
15	CLUSTER-XVI	GW-16	DB-22	DAHIBARI,NICHE BASTI	02.06.2020

WATER QUALITY

(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW-1 01.06.2020	**GW-2 01.06.2020**	**GW-3 01.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1	2	1	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	40	48	54	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	18	22	28	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.62	0.78	0.54	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	6.72	5.48	10.18	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	8.21	8.10	8.12	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	42	54	38	10	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	112	138	140	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	204	244	214	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	182	206	198	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2	2	2	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

WATER QUALITY

(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW-4 01.06.2020	**GW-5 01.06.2020**	**GW-6 01.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3	1	1	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	36	156	64	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	20	98	36	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.52	0.72	0.74	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	12.84	33.08	15.28	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.96	8.04	7.81	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	48	127	64	2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	144	96	112	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	208	764	236	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	182	680	204	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2	3	1	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

WATER QUALITY

(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW-7 02.06.2020	**GW-8 02.06.2020**	**GW-9 02.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1	1	1	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	64	52	144	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	36	24	68	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.46	0.76	0.58	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	16.28	8.92	28.42	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.88	8.12	8.15	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	62	38	174	2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	76	132	96	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	244	196	744	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_ac_{03}), mg/l, Max	172	148	636	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	1	1	2	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

WATER QUALITY

(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW-10 02.06.2020	**GW-11 01.06.2020**	**GW-13 01.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3	3	2	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	52	32	164	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	46	26	104	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.82	0.56	0.76	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	18.42	12.48	7.88	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	8.21	7.96	8.03	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	88	44	178	2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	98	152	88	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	248	178	756	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	192	164	680	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2	1	2	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

WATER QUALITY
(GROUND WATER- ALL PARAMETERS)

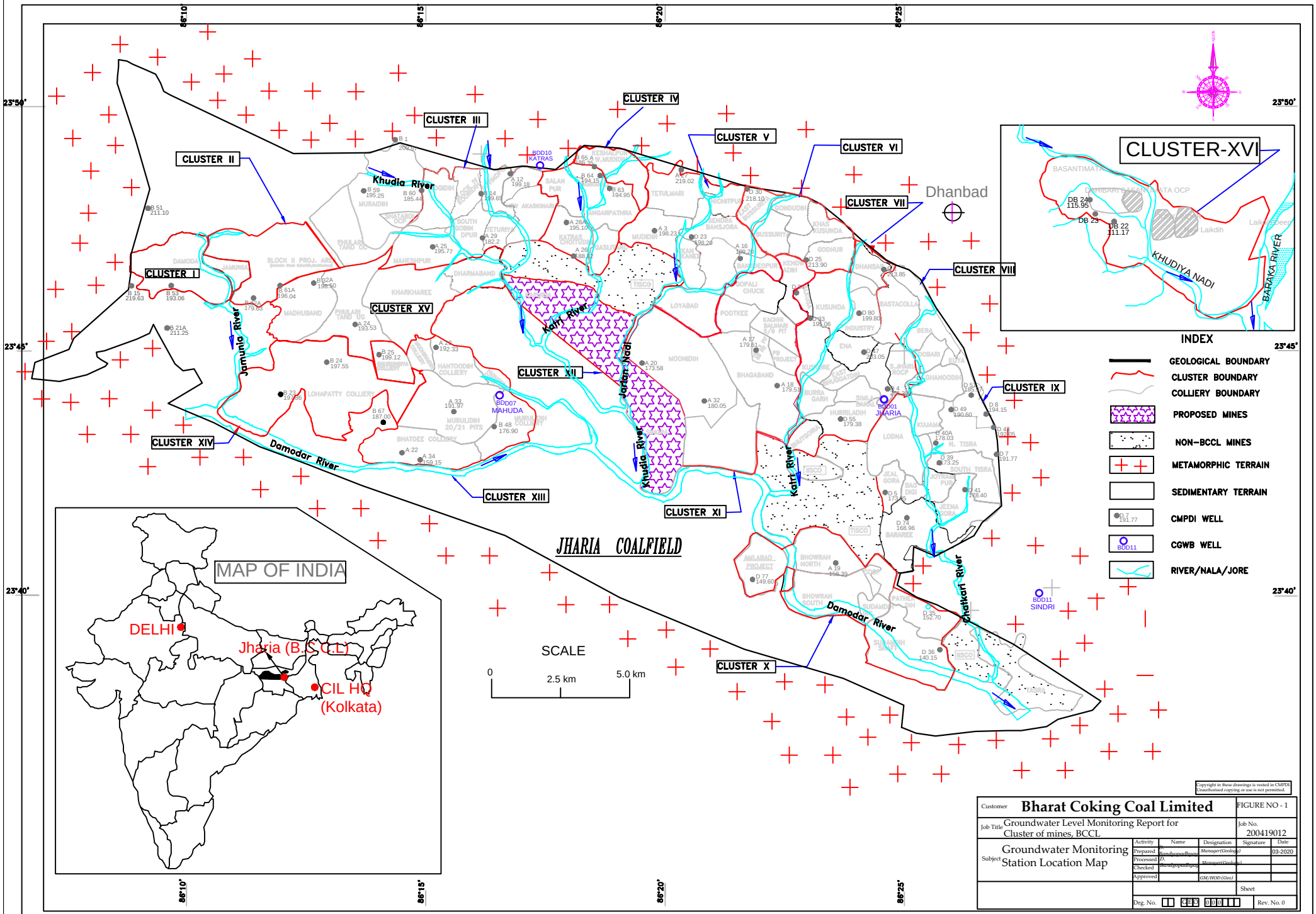
Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW 14 01.06.2020	**GW15 01.06.2020**	**GW16 02.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1	1	3	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	44	180	122	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	56	104	66	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.52	0.44	0.66	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	11.48	7.58	14.76	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	8.08	7.83	7.89	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	40	152	128	2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	110	98	116	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	204	756	512	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	194	666	472	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	1	1	1	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

Abbreviations

AMSL: Above mean sea level
Avg.: Average
APT: Aquifer Pumping Test
BCCL: Bharat Coking Coal Ltd.
bgl: Below Ground Level
Buffer zone: periphery of the 10 km radius from the project boundary
Core zone: Project / mine / colliery boundary (leasehold area)
CMPDI: Central Mine Plan & Design Institute
DVC: Damodar Valley Corporation
DTW: Depth to water level
GW: Groundwater
IMD: Indian Meteorological Division
JCF: Jharia Coalfield
RCF: Raniganj Coalfield
MADA: Mineral Area Development Authority
MCM: Million Cubic Meter
MGD: Million Gallon per day
NTU: Nephlometric Turbidity unit
OC / UG: Opencast / Underground
OCP / UGP: Opencast Project / Underground Project
RL: Reduced Level
RWH: Rainwater Harvesting
FF: Fire Fighting

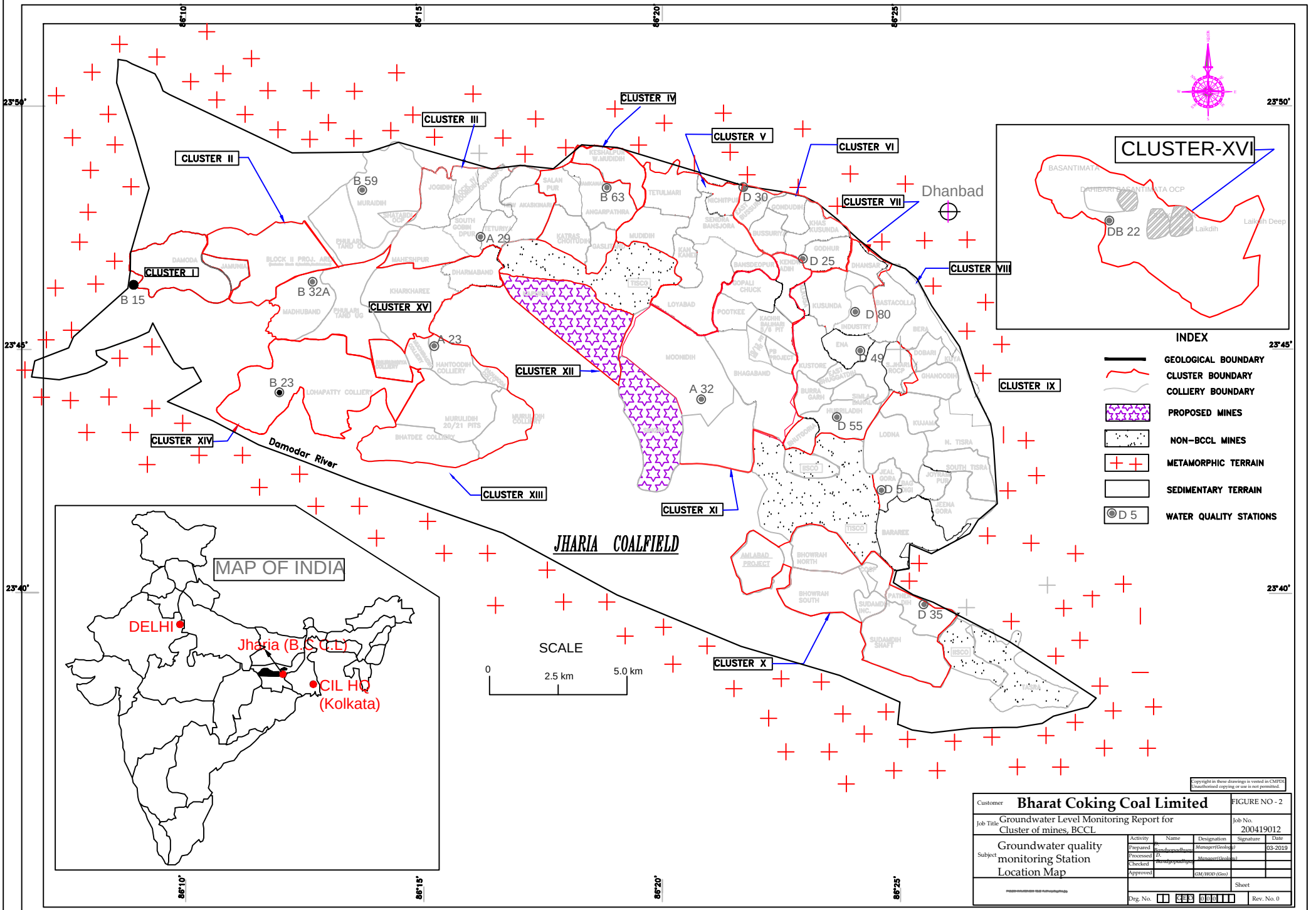
GROUNDWATER MONITORING STATION LOCATION MAP



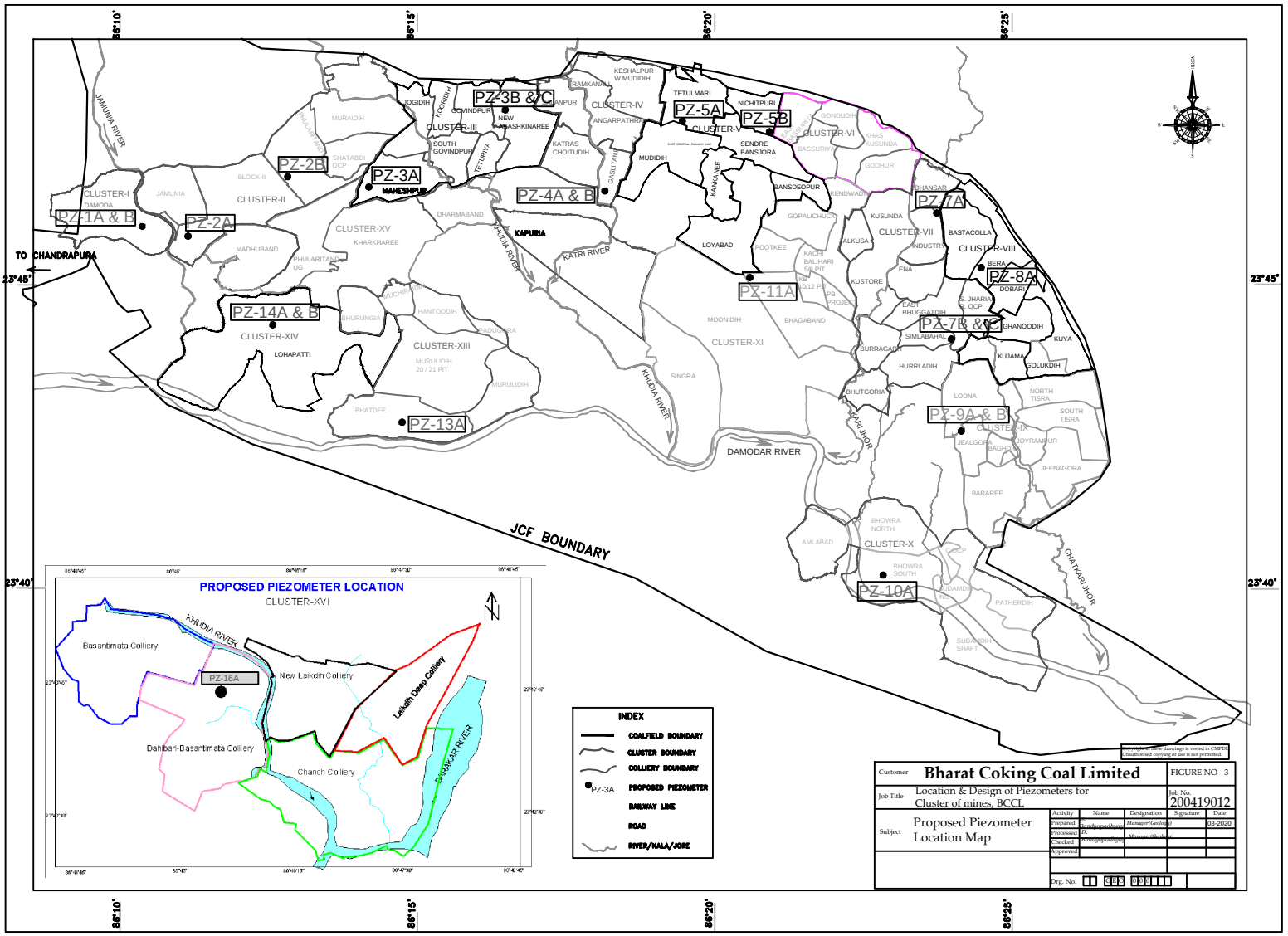
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Customer	**Bharat Coking Coal Limited**		FIGURE NO - 1
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL		Job No. 200419012
Subject	Groundwater Monitoring Station Location Map	Prepared: Ranchumadhwan, Manager(Geology)	03-2020
		Processed: D. Bandyopadhyay, Manager(Geology)	
		Checked	
		Approved: GM/HOD (Geo)	
		Sheet	
		Drg. No. CMPDI 000	Rev. No. 0

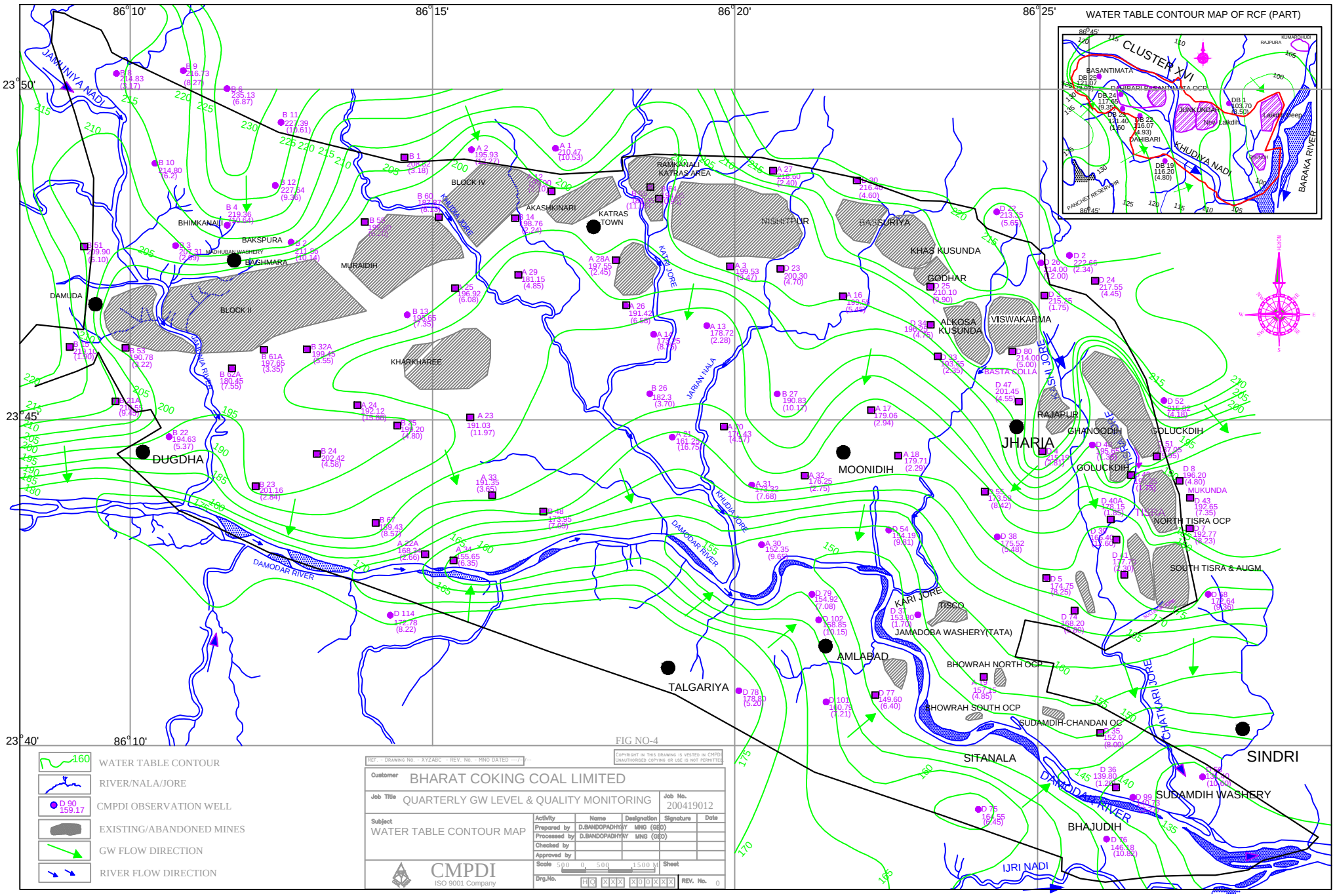
GROUNDWATER QUALITY MONITORING STATION LOCATION MAP



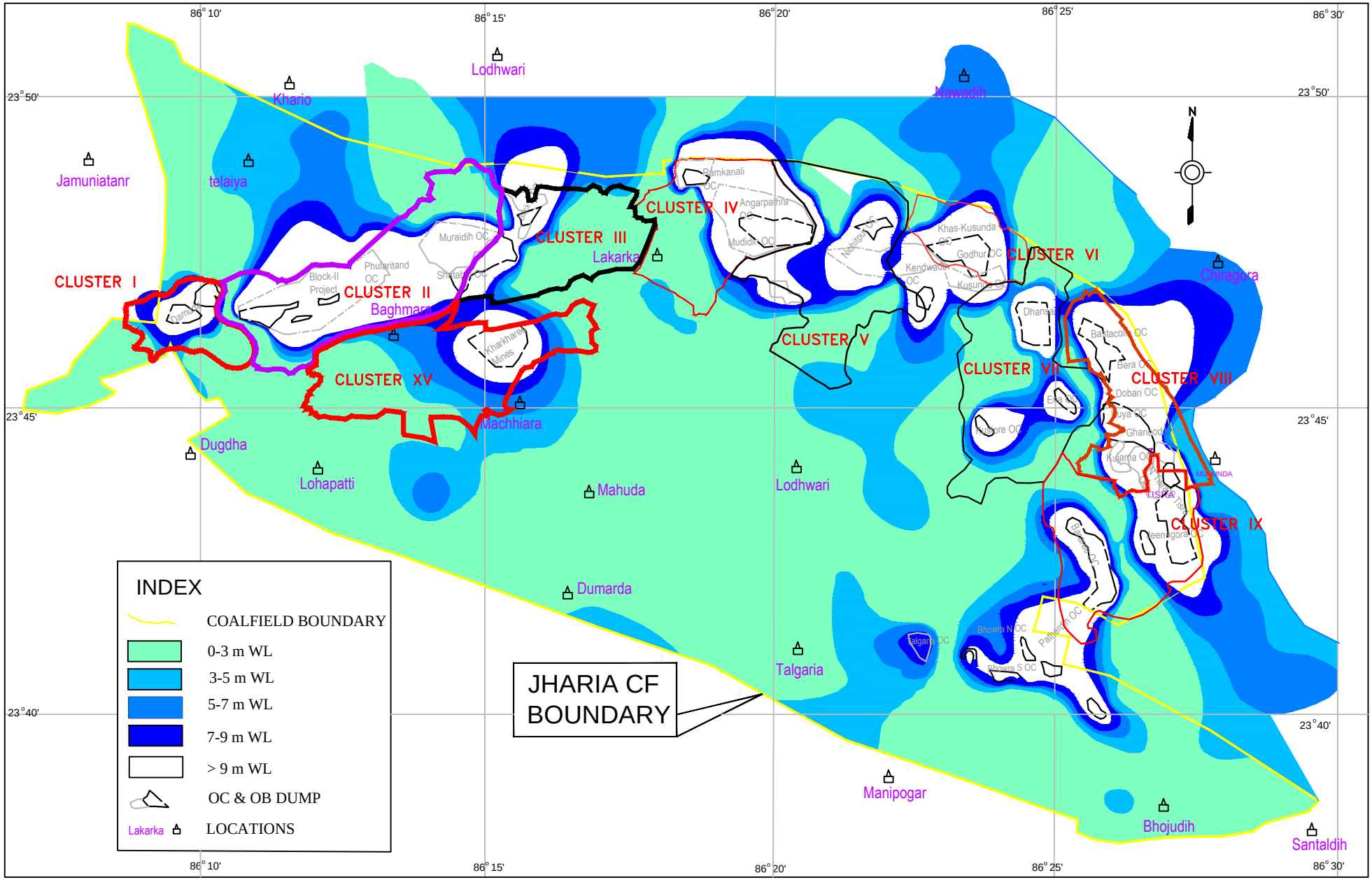
PROPOSED PIEZOMETER LOCATION MAP, JCF & RCF (part)



WATER TABLE CONTOUR MAP OF PRE-MONSOON 2020



DEPTH TO WATER LEVEL MAP OF JHARIA COALFIELD



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Ref. - Drawing No. - XYZ/ABC - REV. No. - HNO DATED ---/--

Customer: BHARAT COKING COAL LIMITED

Job No.

Job Title: HYDROGEOLOGICAL STUDIES FOR BCCL CLUSTERS

Subject: DEPTH TO WATER LEVEL MAP

	Name	Designation	Signature	Date
Activity				
Prepared by	D.BANDYOPADHYAY			
Processed by	D.BANDYOPADHYAY			
Checked by				
Approved by				

Scale: 5 0 5 10 15 KM

Sheet: XX

Drg.No.: HQ XXX XX0 XXX

REV. No. 0

CMPDI
ISO 9001 Company

Annexure XII

भारतकोकिंगकोललिमिटेड
(कोलइंडियालिमिटेडकाएकअंग)
BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Limited)

Civil Engineering Department, Koyla Nagar, Dhanbad – 826 005 (JH), India
, e-mail: gmcivil.bccl@coalindia.in

NIT Ref. No.: BCCL/CED/TC/eNIT-18/2020-21/968 **Date: 10.03.2021**

E – Tender Notice

Open E-Tender invited vide BCCL/CED/TC/eNIT-18/2020-21/968; Date: 10.03.2021 for the work of "**Drilling and installation of 23 nos of piezometric wells in the command area of BCCL**"

Estimated Value: Rs. 2,16,19,913.33 **Period of Work:175 days**

The tender documents can be downloaded from **11.03.2021to29.03.2021.** All prospective bidders are advised to visit website **https://coalindiatenders.nic.in** for further details and to participate against this tender. Full details of this tender are also available on website "**eprocure.gov.in**".

GM(Civil/Welfare), BCCL

Copy to:-

1) D (T) OP/D(P)/CVO, BCCL
2) GM (Civil/Ind.), BCCL.
3) GM All Area.
4) Chief Manager (Civil), CED HQ, BCCL.
5) GM (Geology)/HOD(Environment)/GM(P&P).
6) Area Manager (Civil), All Area
7) Assistant Manager (Civil), TC, CED.
8) TEMs.

..... for kind information

Annexure XIII

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WATER QUALITY REPORT
OF
BHARAT COKING COAL LIMITED,
CLUSTER – IX

(FOR THE Q.E. DECEMBER, 2020)

E. C. no. J-11015/307/2010-IA.II (M) dated 01.03.2018

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CLUSTER - IX

(FOR THE Q.E. DECEMBER, 2020)

CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.		EXECUTIVE SUMMARY
2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
4.	**Plates:** Plate. No. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

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FOR COMPANY USE ONLY RESTRICTED
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WATER QUALITY REPORT
OF
BHARAT COKING COAL LIMITED
CLUSTER – IX

(FOR THE Q.E. DECEMBER, 2020)

E. C. no. J-11015/307/2010-IA.II (M) dated 01.03.2018

CMPDI

ISO 9001 Company

Regional Institute-II

Dhanbad, Jharkhand

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the environment around us. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. One of these major attributes is water.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEFCC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Water sampling stations

The Water sampling stations were selected for mine effluent water, drinking water supply, well/ Hand pump water & also surface water samples.

2.2 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

3.0 Methodology of sampling and analysis

3.1 Water quality

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis & for 27 parameters on half yearly basis. The drinking and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI RI-II, Dhanbad

3.2 Heavy Metal in Ambient Air

Parameters chosen for assessment of Heavy metal in Ambient Air Quality were cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr), Nickel (Ni), and Lead (Pb). Respirable Dust Samplers (RDS) & fine particulates for PM 2.5 sampler were used for sampling PM 10 & PM 2.5 respectively. These heavy metals are analyzed regularly on half yearly basis. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad

4.0 Results and interpretations

4.1 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, IS.10500/2012 (Drinking water) and IS: 2296 (Surface water), are with in permissible limits.

4.2 Heavy Metal in Ambient Air

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

CHAPTER - I

INTRODUCTION

1.0 Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

Bharat Coking Coal Limited (BCCL), a subsidiary company of Coal India Limited (CIL) is operating UG Mines and Opencast Mines in Jharia Coalfield (JCF). The Jharia Coalfield (JCF) having an area of 450 Sq.KM.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster-IX is in the Eastern part of the Jharia coalfield. It includes a group of 6 Mines (viz. Lodna UG, Bagdigi UG, Joyrampur UG, Bararee UG, Jealgora UG,NT/ST Expan.OCP. The Cluster – IX is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – IX are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage pattern of the area is governed by Kashi Jore.

1.2 The Cluster-IX is designed to produce 6.548 MTPA (normative) and 8.512 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 6.548 MTPA (normative) and 8.512 MTPA (peak) capacity of coal production vide letter no. J-11015/307/2010-IA.II (M) dated 1st March, 2018.

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MoEF&CC & SPCB and other statutory authorities.

CHAPTER – II

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.2 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Jeenagora (A13) : Industrial Area

The location of the sampling station is 23^0 42' 31.00'' N & 86^0 25' 48.00'' E.

II. BUFFER ZONE Monitoring Location

i) Kusmatand Village (A12): Industrial Area

The location of the sampling station is $23^0$45' 4.65'' N & 86^0 26' 42.10'' E.

ii) Bhowrah North (A14): Industrial Area

The location of the sampling station is 23^o41' 37.00'' N & 86^o23' 54.00''E.

Iii) Hurriladih UGP (A28): Industrial Area

The location of the sampling station is $23^0$44' 4.18'' N & 86^0 24' 6.21'' E.

2.3 Results and interpretations

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

AMBIENT AIR QUALITY DATA

Name of the Company: **Bharat Coking Coal Limited** Year :2020-21

Name of the Cluster : **Cluster -IX** PERIOD: **Q. E. DEC- 2020.**

Heavy Metal Analysis report of Ambient Air Quality

SAMPLE	Cadmium(Cd) (µg/m3)	Mercury(Hg) (µg/m3)	Arsenic(As) (ng/m3)	Chromium(Cr) (µg/m3)	Nickel (Ni) (ng/m3)	Lead (Pb) (µg/m3)
Kusmatand Village (A12)	<0.001	<0.001	<0.005	<0.01	<0.1	0.006
Jeenagora (A13)	<0.001	<0.001	<0.005	<0.01	<0.1	0.005
Bhowrah North (A14)	<0.001	<0.001	<0.005	<0.01	<0.1	0.008
Hurriladih UGP (A28)	<0.001	<0.001	<0.005	<0.01	<0.1	0.018

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HOD(In-charge) Environment
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CHAPTER – II

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. - I**)

i) Drinking Water quality at **Lodna (DW9)**
ii) Surface Water quality at **U/S of Kashi Jore (SW19)**
iii) Surface quality at **D/S of Kashi Jore (SW20)**
iv) Mine Effluent at **Jeenagora (MW9)**

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis & for 27 parameters on half yearly basis. The drinking and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results show that most of the parmeters are within the permissible limits.

WATER QUALITY

WATER QUALITY

(SURFACE WATER- 17 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : 2020-21

Name of the Cluster: **Cluster - IX** Period: **Q. E. DEC, 2020.**

Cluster IX

Stations:

1. Upstream in Kashi Jore SW-19
2. Downstream in Kashi Jore SW-20

Date of Sampling:

28/12/2020

28/12/2020

Sl. No	Parameter	Sampling Stations				IS: 2296	Detection Limit	BIS Standard & Method
		SW19 28.12.2020	SW20 28.12.2020					
1	Arsenic (as As), mg/l, Max	<0.006	<0.006			0.2	0.006	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA
2	BOD (3 days 27°C), mg/l, Max	3.1	2.7			3.00	2.00	IS 3025 (Part 44) : 1993 Reaffirmed 2019 , 3 day incubation at 27°C
3	Colour	Colourless	Colourless			300	Qualitative	Physical/Qualitative
4	Chlorides (as Cl), mg/l, Max	74	84			600	2.00	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.2	<0.2			1.5	0.2	IS 3025/42 : 1992 R : 2019, AAS-Flame
6	Dissolved Oxygen, min.	3.7	4.2			4	0.10	IS 3025 (Part 38) : 1989, Reaffirmed 2019 Modified Winkler Azide Method
7	Fluoride (as F) mg/l, Max	0.87	0.85			1.5	0.02	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
8	Hexavalent Chromium, mg/l, Max	<0.01	<0.01			0.05	0.01	IS 3025 (Part 52) : 2003,Reaffirmed 2019
9	Iron (as Fe), mg/l, Max	<0.2	<0.2			50	0.2	IS 3025 /53 : 2003,R : 2019 , AAS-Flame Method
10	Lead (as Pb), mg/l, Max	<0.005	<0.005			0.1	0.005	APHA, 23rd Edition, AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	7.09	7.73			50	0.50	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	pH value	7.61	7.59			6.5-8.5	2.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
13	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.002	<0.002			0.005	0.002	APHA, 22nd Edition 4-Amino Antipyrine
14	Selenium, mg/l, Max	<0.007	<0.007			0.05	0.007	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA
15	Sulphate (as SO_4) mg/l, Max	247	159			400	2.00	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
16	Total Dissolved Solids, mg/l, Max	710	794			1500	25.00	IS 3025, Part 16: 1984 R 2017 Gravimetric method
17	Zinc (as Zn), mg/l, Max	<0.1	<0.1			15	0.1	IS 3025/ 49 : 1994, R : 2019, AAS-Flame

*All values are expressed in mg/lit unless specified.

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HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER QUALITY

(DRINKING WATER- 25 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : 2020-21**.**

Name of the Cluster: **Cluster - IX** Period: **Q.E.DEC, 2020.**

Stations: **Date of Sampling:**

1. Drinking Water from Lodna DW-9 23/11/2020

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		DW09 **23.11.20**					
1	Boron (as B), mg/l, Max	<0.2			0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3			1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	66			1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	91			2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03			0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	<0.2			0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04			0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2			0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005			0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	0.12			0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	16.94			0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable			Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.28			0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001			0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007			0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	122			10	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable			Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	188			4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006			0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04			0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	456			25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_ac_{03}), mg/l, Max	246			4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2			1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1			0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01			0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

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HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER QUALITY

(MINE WATER- 27 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : 2020-21

Name of the Cluster: **Cluster - IX** Period: **Q.E.DEC, 2020.**

Effluent water of BCCL Mines					**Date of Sampling:**
Sample Code : Mine Water Discharge Jeenagora MW-9					07.12.2020
Sl.No.	**Parameter**	**Results**	**Detection Limit**	**MOEF -SCH-VI STANDARDS Class 'A'**	**BIS Standard & Method**
1	Ammonical Nitrogen, mg/l, Max	0.06	0.02	50.0	IS 3025/34:1988, R : 2009, Nessler's
2	Arsenic (as As), mg/l, *Max*	<0.006	0.006	0.2	IS 3025, part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA
3	B.O.D (3 days 27°C), mg/l, Max	<2.0	2.00	30.0	IS 3025 /44:1993,R:2003 3 day incubation at 27°C
4	Colour	Colourless	Qualitative	Qualitative	Physical/Qualitative
5	COD, mg/l, Max	20	4.00	250.0	APHA 23rd Edition 5220 C Titrimetric Method
6	Copper (as Cu), mg/l, *Max*	<0.2	0.2	3.0	IS 3025(Part42): 1992 R : 2019, AAS-Flame
7	Dissolved Phosphate (as P), mg/l, Max	<0.3	0.30	5.0	IS 3025/ 31, 1988 R 2019
8	Fluoride (as F) mg/l, *Max*	0.94	0.2	2.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
9	Free Ammonia, mg/l, Max	<0.01	0.01	5.0	IS:3025/34:1988, Nesseler's
10	Hexavalent Chromium, mg/l, Max	<0.01	0.01	0.1	IS 3025 (Part 52) : 2003,Reaffirmed 2019
11	Iron (as Fe), mg/l, *Max*	<0.2	0.2	3.0	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame
12	Lead (as Pb), mg/l, *Max*	<0.005	0.005	0.1	APHA, 23rd Edition, AAS-GTA
13	Manganese(as Mn), mg/l, Max	<0.2	0.2	2.0	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame
14	Nickel (as Ni), mg/l, *Max*	<0.1	0.1	3.0	IS-3025(Part 54):2003, R:2019 AAS-Flame
15	Nitrate Nitrogen, mg/l, *Max*	1.48	0.50	10.0	APHA, 23 rd Edition,UV-Spectrphotometric
16	Oil & Grease, mg/l, Max	<2.0	2.00	10.0	IS 3025/39:1991, R : 2019, Partition Gravimetric
17	pH value	7.94	2.5	5.5 to 9.0	IS-3025/11:1983, R-2017, Electrometric
18	Phenolic compounds (as C_6H_5OH),mg/l, *Max*	<0.002	0.002	1.0	APHA, 23rd Edition 4-Amino Antipyrine
19	Selenium, mg/l, Max	<0.007	0.007	0.05	IS 3025, part 56:2003, R-2019/APHA 23rd Edition, AAS-VGA
20	Sulphide (as S^{2-}) mg/l Max.	<0.005	0.005	2.0	APHA 23rd Edition Methylene Blue Method
21	Temperature (°C)	26.3	Shall not exceed 5^0 C above the receiving temp.		IS-3025/09:1984, Thermometeric
22	Total Chromium (as Cr), mg/l, *Max*	<0.1	0.1	2.0	IS-3025(Part 52):2003, R:2019 AAS-Flame
23	Total Kjeldahl Nitrogen, mg/l, Max	1.4	1.00	100.0	IS:3025/34:1988, Nesseler's
24	Total Residual Chlorine, mg/l, Max	<0.04	0.04	1.0	APHA, 23rd Edition, , 4500-Cl B. (Iodometric Method-I)
25	Total Suspended Solids, mg/l, Max	23	10.00	100.0	IS 3025/17:1984, R :2017, Gravimetric
26	Zinc (as Zn), mg/l, *Max*	<0.1	0.1	5.0	IS 3025 /49 : 1994, R : 2019, AAS-Flame
27	Odour	Agreeable	Agreeable	Qualitative	APHA, 23rd Edition, , 2150-C

All values are expressed in mg/lit unless specified.*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Transportation Plan for Conveyor

सेंट्रल माईन प्लानिंग एण्ड डिज़ाइन इंस्टीच्यूट लिमिटेड
(कोल इंडिया लिमिटेड की अनुषंगी कम्पनी / भारत सरकार की एक लोक उपक्रम)
पंजीकृत कार्यालय : गोन्दवाना प्लेस , कांके रोड , राँची - 834031 (झारखण्ड) भारत
क्षेत्रीय संस्थान-2, पत्रा. बीसीसीएल टाउनशीप, कोयला नगर, धनबाद 826005 (झारखण्ड) भारत
Central Mine Planning & Design Institute Limited
(A Subsidiary of Coal India Limited / Govt. of India Public Sector Undertaking)
Registered Office : Gondwana Place, Kanke Road, Ranchi –834031(Jharkhand)
Regional Institute-II, P.O. BCCL Township, Koylanagar, Dhanbad 826005(Jharkhand) India
Corporate Identity No. U14292JH1975GOI001223

पत्रांकः आर.आई.-2/पर्यावरण/एम-30/1150 दिनांकः 20.06.2015

सेवा में,
उप महाप्रबंधक (पर्यावरण)
बी. सी. सी. एल.
कोयला भवन
धनबाद ।

विषयः Study of installation of Rail-cum-Conveyor System in BCCL for transportation of coal.

महोदय,

This has reference to your letter no. BCCL/GM(Env.)/F-EC/13/622, dated 25.05.2013 for conducting the study and preparation of plan for installation of Rail-cum-Conveyor System for coal transportation in BCCL as a part of compliance of environmental clearance (EC) conditions stipulated by MoEF & CC in EC orders of different clusters. In this regard, we would like to inform you the following:

a. As per EC clearance order transportation plan for Rail-cum-Conveyor system should dovetailed with Jharia Action Plan (Master Plan). The system of transportation is required to be installed in 2nd phase of EC implementation i.e. after completion of Master Plan (10 years) and 5 years of gestation period.

b. JRDA has issued direction to RITES for traffic survey and data collection to initiate feasibility study regarding Diversion of Railway lines from fire affected and subsidence prone areas

c. Coal transportation route / conveyor installation layout will be finalized after liquidation of coal mine fire, rehabilitation of 595 unstable sites, road and rail route alignment and location of Rly. Sidings of BCCL.

CMPDI will be able to submit the plan / study for installation of Rail-cum-Conveyor System in BCCL for transportation of coal only after diversions and re-alignments of roads and railway lines and relocation of railway sidings

This is for your kind information.

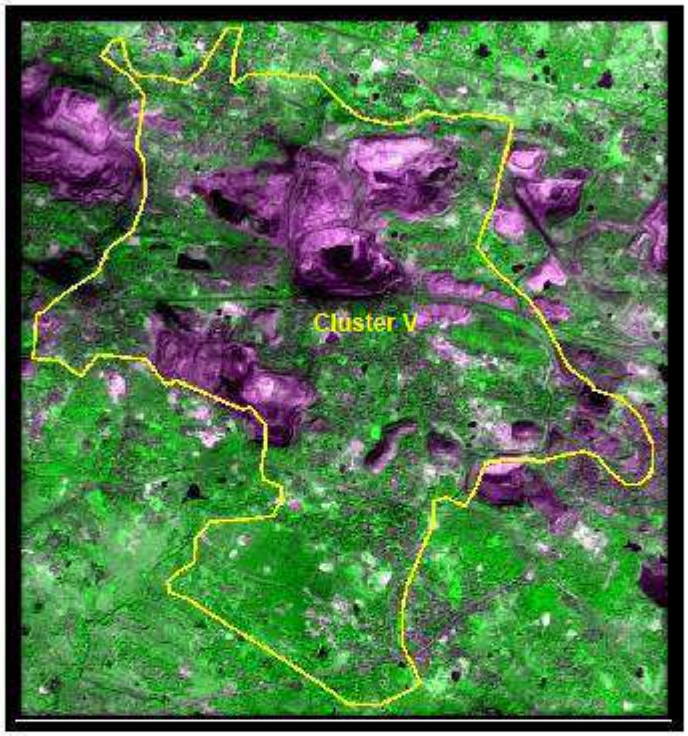
भवदीय

(वि. कु. सिंह)
क्षेत्रीय निदेशक

Sri Awadhesh Sir
For compliance purpose.
23/6/15

फोन : (+91) 0326-2230850 फैक्स / Fax : (+91) 0326-2230500
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Land Reclamation/ Restoration Monitoring of five Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data of the Year 2020



Submitted to

Bharat Coking Coal Limited

cmpdi

A Miri-Reina Company

Land Reclamation/ Restoration Monitoring of five Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data of the Year 2020

March-2021

Remote Sensing Cell
Geomatics Division
CMPDI, Ranchi

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Executive Summary

1. Project — Land reclamation/ restoration monitoring of five clusters of (Opencast + Underground) coal mines of Bharat Coking Coal Ltd. (BCCL), based on satellite data, on every three-year basis.

2. Objective — Objective of land reclamation/ restoration monitoring is to assess the area of backfilled, plantation, social forestry, active mining area, water bodies, and distribution of wasteland, agricultural land and forest in the leasehold area of the project. This will help in assessing the progressive status of mined land reclamation and to take up remedial measures, if any, required for environmental protection.

3. Salient Findings

- Out of 5 Clusters of mines viz. III, V, VIII, IX and XVII considered for land reclamation monitoring during the year 2020-21; XVII cluster of mines is added during the year 2020-21. These clusters consist of mainly opencast mines.

- Out of the total mine leasehold area of 7988.22 Ha. of the 05 clusters producing less than 5mcm (Coal+OB) annually considered for monitoring during the year 2020-21; total excavated area is 1300.74 Ha. out of which 27.81 Ha. area (2.14%) has been planted on backfill (Biological Reclamation) and 657.49 Ha. area (50.55%) is under backfilling (Technical Reclamation) and 615.44 Ha. area (47.31%) under active mining. Cluster wise details of land reclamation of the above Clusters is given in Table-1.

- Total area under plantation (green cover) covers an area of 645.75 Ha. which is 8.08% of total leasehold area.

- This report and the findings will be considered as basis for further monitoring and reclamation related activities.

Table 1

Land Reclamation Status in five Clusters (Underground + Opencast Mines) of BCCL based on Satellite Data of the Year 2020

Table - 1 Status of Land Reclamation in 5 clusters of BCCL based on Satellite Data of the Year 2020

(Area in Hectare)

Sl. No.	Cluster No.	Total Leasehold Area		Technical Reclamation		Plantation						Area under Active Mining		Total Excavated Area		Total Area under Plantation (% Green Cover Generated in Leasehold)		Total Area under Reclamation	
						Biological		Other Plantations											
				Area under Backfilling		Plantation on Excavated / Backfilled Area		Plantation on External OB Dumps		Social Forestry, Avanue Plantation Etc.									
1	*2*	*3*		*4*		*5*		*6*		*7*		*8*		*9 (=4+5+8)*		*10 (=5+6+7)*		*11(=4+5)*	
		2017	2020	2017	2020	2017	2020	2017	2020	2017	2020	2017	2020	2017	2020	2017	2020	2017	2020
1	Cluster III	1552.53	1552.53	55.87	60.37	3.89	3.89	21.11	21.11	128.07	162.33	101.50	104.79	161.26	169.05	153.07	187.33	59.76	64.26
				34.65%	35.71%	2.41%	2.30%					62.94%	61.99%			9.86%	12.07%	37.06%	38.01%
2	Cluster V	1724.52	1724.52	162.09	187.59	7.19	7.19	23.85	23.85	105.29	105.29	112.24	103.52	281.52	298.30	136.33	136.33	169.28	194.78
				57.58%	62.89%	2.55%	2.41%					39.87%	34.70%			7.91%	7.91%	60.13%	65.30%
3	Cluster VIII	1331.95	1331.95	161.86	206.91	13.72	9.93	21.97	21.97	24.70	24.70	111.06	124.49	286.64	341.33	60.39	56.60	175.58	216.84
				56.47%	60.62%	4.79%	2.91%					38.75%	36.47%			4.53%	4.25%	61.25%	63.53%
4	Cluster IX	1967.22	1967.22	77.53	77.53	6.80	6.80	41.79	41.79	168.58	168.58	181.85	217.24	266.18	301.57	217.17	217.17	84.33	84.33
				29.13%	25.71%	2.55%	2.25%					68.32%	72.04%			11.04%	11.04%	31.68%	27.96%
5	Cluster XVII	-	1412.00	-	125.09	-	0.00	-	5.00	-	43.33	-	65.40	-	190.49	-	48.32	-	125.09
					65.67%		0.00%						34.33%				3.42%		65.67%
	TOTAL	**6576.22**	**7988.22**	**457.35**	**657.49**	**31.60**	**27.81**	**108.72**	**113.72**	**426.64**	**504.23**	**506.65**	**615.44**	**995.60**	**1300.74**	**566.96**	**645.75**	**488.95**	**685.30**
				45.94%	**50.55%**	**3.17%**	**2.14%**					**50.89%**	**47.31%**			**8.62%**	**8.08%**	**49.11%**	**52.69%**

(% is calculated with respect to Excavated Area as applicable)

Note: In reference of the above Table, different parameters are classified as follows: (Cluster XVII started from current year)

1. Area under Biological Reclamation includes Areas under Plantation done on Backfilled Area Only.
2. Area under Technical Reclamation includes Area under Barren Backfilling only.
3. Area under Active Mining Includes Coal Quarry, Advance Quarry Site and Quarry filled with water etc., if any.
4. Social Forestry and Plantation on External OB Dumps are not included in Biological Reclamation and are put under separate categories as shown in the above Table.
5. (%) calculated in the above Table is in respect to Total Excavated Area except for “Total Area under Plantation” where % is in terms of “Leasehold Area”.

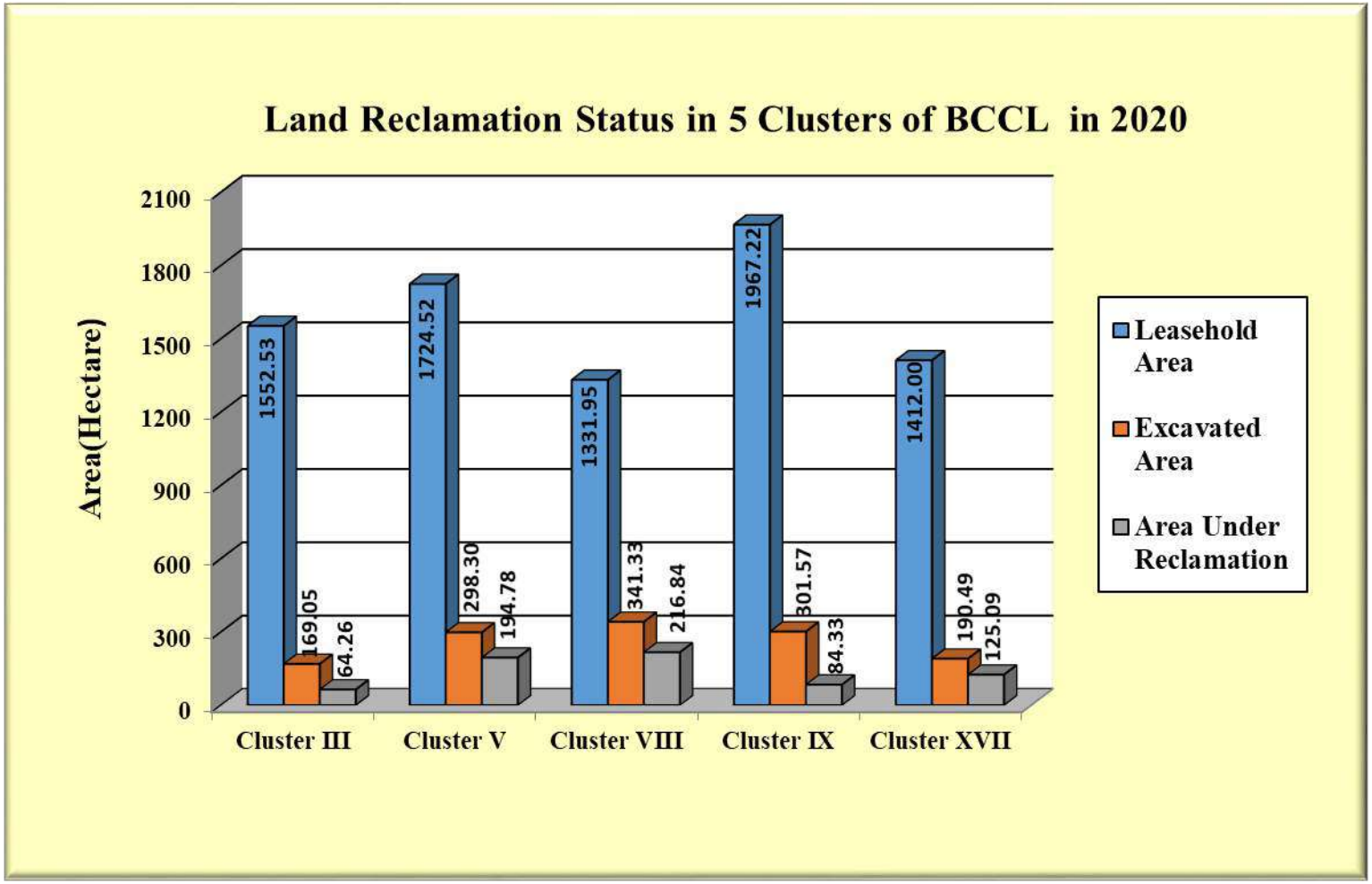


Fig. 1: Cluster wise Land Reclamation Status in five Clusters - 2020 (BCCL)

1. Background

1.1 Land is the most important natural resource which embodies soil, water, flora, fauna and total ecosystem. All human activities are based on the land which is the scarcest natural resource in our country. Mining is a site specific industry and it could not be shifted anywhere else from the location where mineral occurs. It is a fact that surface mining activities do affect the land environment due to ground breaking. Therefore, there is an urgent need to reclaim and restore the mined out land for its productive use for sustainable development of mining. This will not only mitigate environmental degradation, but would also help in creating a more congenial environment for land acquisition by coal companies in future.

1.2 Keeping above in view, Coal India Ltd. (CIL) issued a work order vide letter no. CIL/WBP/ENV/2017/DP/8391 dated 22.06.2017 to Central Mine Planning & Design Institute (CMPDI), Ranchi, for monitoring of clusters with coal mines (both underground and open cast projects) having less than 5 million m^3 per annum capacity (Coal +OB) at an interval of three years based on remote sensing satellite data for sustainable development of mining. Earlier, CMPDI used to carry out land reclamation monitoring for individual projects of less than 5 million capacity, but from 2017 the same was carried out cluster wise for mines of BCCL. For operational reasons and convenience, underground and opencast mines (often with multiple overlapping seams), have now been clustered together. The result of land reclamation status of all such mines are hosted on the website of CIL, (www.coalindia.in), CMPDI (www.cmpdi.co.in) and the concerned coal companies in public domain. Detailed report is submitted to Coal India and respective subsidiaries.

1.3 Land reclamation monitoring of all cluster coal mining projects would also comply the statutory requirements of Ministry of Environment, Forest & Climate Change (**MoEF&CC**). Such monitoring would not only facilitate in taking timely mitigation measures against environmental degradation, but would also enable coal companies to utilize the reclaimed land for larger socio-economic benefits in a planned way.

1.4 Present report is embodying the finding of the study based on satellite data of the year 2020 carried out for five clusters of mines comprising both underground and OC projects for Bharat Coking Coal Ltd.

2. Objective

Objective of the land reclamation/restoration monitoring is to assess the area of backfilled, plantation, OB dumps, social forestry, active mining area, settlements and water bodies, distribution of wasteland, agricultural land and forest land in the leasehold area of the project. This is an important step taken up for assessing the progressive status of mined land reclamation and for taking up remedial measures, if any, required for environmental protection.

3. Methodology

There are number of steps involved between raw satellite data procurement and preparation of final map. National Remote Sensing Centre (NRSC) Hyderabad, being the nodal agency for satellite data supply in India, provides only raw digital satellite data, which needs further digital image processing for extracting the information and map preparation before uploading the same in the website. Methodology for land reclamation monitoring is given in fig 2. Following steps are involved in land reclamation/ restoration monitoring:

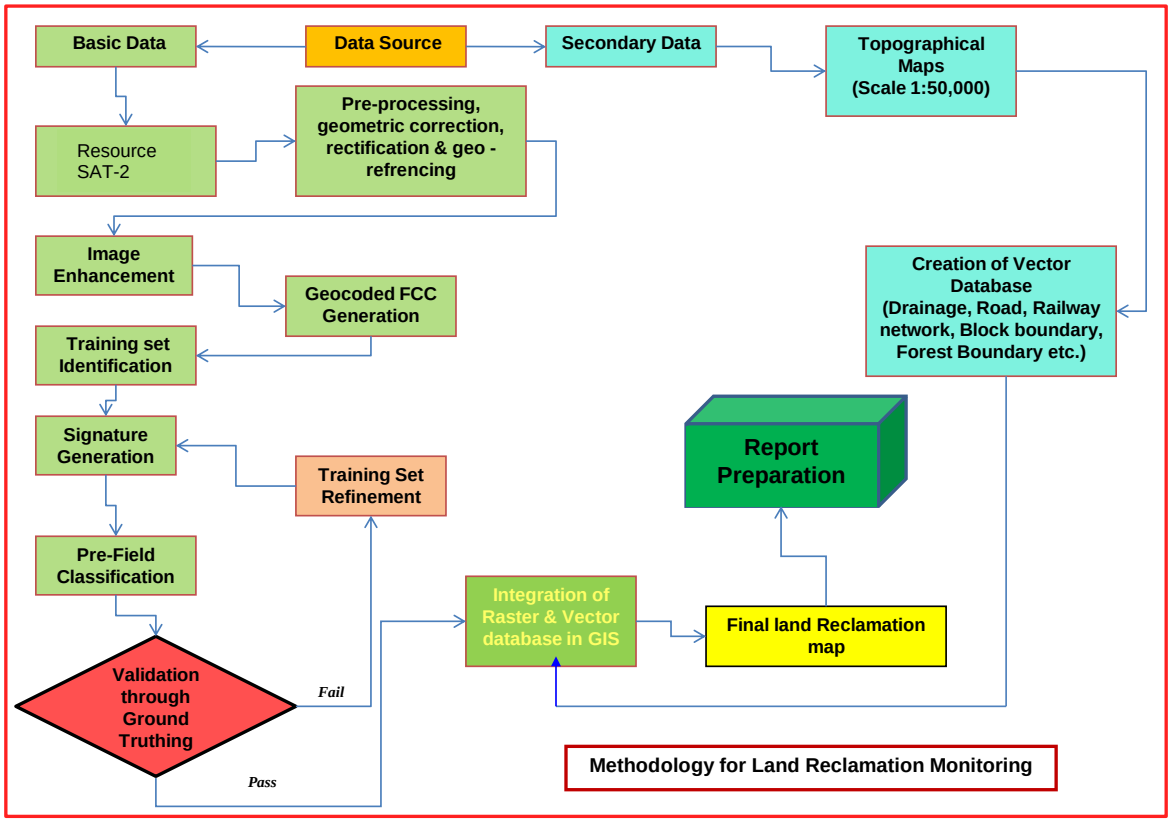


Fig. 2: Methodology of Land Reclamation Monitoring

3.1 **Data Procurement:** After browsing the data quality and date of pass on internet, supply order for data is placed to NRSC. Secondary data like leasehold boundary, toposheet are procured for creation of vector database.

3.2 **Satellite Data Processing:** Satellite data are processed using ERDAS IMAGINE digital image processing s/w. Methodology involves the following major steps:

- **Rectification & Geo-referencing:** Inaccuracies in digital imagery may occur due to 'systematic errors' attributed to earth curvature and rotation as well as 'non-systematic errors' attributed to satellite receiving station itself. Raw digital images may contain geometric distortions, which make

them unusable as maps. Therefore, geo-referencing is required for correction of image data using ground control points (GCP) to make it compatible with the new series WGS-84 compatible SoI toposheet.

- **Image enhancement:**

  To improve the interpretability of the raw data, image enhancement is necessary. Local operations modify the value of each pixel based on brightness value of neighbouring pixels using ERDAS IMAGINE 14.0 s/w. and enhance the image quality for interpretation.

- **Training set selection**

  Training set requires to be selected, so that software can classify the image data accurately. The image data are analysed based on the interpretation keys. These keys are evolved from certain fundamental image-elements such as tone/colour, size, shape, texture, pattern, location, association and shadow. Based on the image-elements and other geo-technical elements like land form, drainage pattern and physiography; training sets were selected/identified for each land use/cover class. Field survey was carried out by taking selective traverses in order to collect the ground information (or reference data) so that training sets are selected accurately in the image. This was intended to serve as an aid for classification.

- **Classification and Accuracy assessment**

  Image classification is carried out using the maximum likelihood algorithm. The classification proceeds through the following steps: (a) calculation of statistics [i.e. signature generation] for the identified training areas, and (b) the decision boundary of maximum probability based on the mean vector, variance, covariance and correlation matrix of the pixels. After evaluating the statistical parameters of the training sets, reliability test of training sets is conducted by measuring the statistical separation between

the classes that resulted from computing divergence matrix. The overall accuracy of the classification was finally assessed with reference to ground truth data.

- **Area calculation**

  The area of each land use class in the leasehold is determined using ERDAS IMAGINE v. 14.0 s/w.

- **Overlay of Vector data base**

  Vector data base is created based on secondary data. Vector layer like drainage, railway line, leasehold boundary, forest boundary etc. are superimposed on the image as vector layer in the Arc GIS database.

- **Pre-field map preparation**

  Pre-field map is prepared for validation of the classification result.

3.3 Ground Truthing:

Selective ground verification of the land use classes are carried out in the field and necessary corrections if required, are incorporated before map finalization.

3.4 Land reclamation database on GIS:

Land reclamation database is created on GIS platform to identify the temporal changes identified from satellite data of different cut - of dates. The database boundary shape files (.shp), kml files and the maps thus prepared confirm to the WGS-84 datum and UTM projected co-ordinate system.

4. Land Reclamation Status in Bharat Coking Coal Ltd.

4.1 Following 5 clusters of mines comprising both underground and opencast projects of Bharat Coking Coal Ltd. have been taken up for land reclamation monitoring during the year 2020-21:

- Cluster III
- Cluster V
- Cluster VIII
- Cluster IX
- Cluster XVII

4.2 Cluster wise Land Reclamation status of above mentioned clusters in BCCL is given in Table 1 and also shown graphically in Fig 1. Area statistics of different land use classes present in the mine leasehold of the above projects for the year 2020 are shown in Table 2. Land use maps derived from the satellite data are shown in Plate 1 - 5. Different land use classes based on satellite data are depicted in bar charts in Fig. 3 - 7.

4.3 Study reveals that out of total mine leasehold area of 7988.22 ha. of the 5 clusters of mines (Underground + Opencast) of BCCL mentioned above taken for this study in 2020-21, total excavated area is 1300.74 ha. out of which 27.81 ha. (2.14%) has been planted (*Biologically Reclaimed*), 657.49 ha. (50.55%) is under backfilling (*Technically Reclaimed*) and balance 615.44 ha. (47.31%) is under active mining.

4.4 Land reclamation monitoring for cluster XVII of BCCL is taken up for the first time in the year 2020-21. Hence comparison of this cluster in year 2020 has not been made with respect to year 2017. The data thus generated in the year 2020 will be considered as base data for comparison of land reclamation of this cluster of mines at the interval of every three year.

4.5 Study reveals that out of five clusters of mines of BCCL considered for reclamation monitoring in 2020, the area under total plantation (Green Cover) is maximum in Cluster IX i.e 217.17 ha., followed by Cluster III with 187.33 ha., Cluster V with 136.33 ha., Cluster VIII with 56.60 ha. and Cluster XVII with 48.32 ha.

4.6 Out of the 5 Clusters in BCCL considered for satellite data based land reclamation monitoring in 2020, Cluster XVII tops with 65.67% reclamation followed by Cluster V with 65.30%, Cluster VIII with 63.53%, Cluster III with 38.01% and Cluster IX with 27.96%.

4.7 In Cluster VIII, it is revealed that area under plantation on backfill (Biological Reclamation) has decreased from 13.72 ha. in the year 2017 to 9.93 ha. in the year 2020. This decrease of 3.79 ha. area in Biological reclamation is due to rehandling of backfill. Hence total area under plantation on backfill has decreased from 31.60 ha. (Yr 2017) to 27.81 ha. (Yr 2020).

4.8 On comparing the status of land reclamation for the year 2020 with respect to the year 2017 it is evident from the analysis that area under land reclamation has increased from 488.95 ha. (Yr 2017) to 685.30 ha. (Yr 2020). This increase of 196.35 ha. area under land reclamation is due to increase in reclamation activities in Cluster III, V & VIII as well as addition of Cluster XVII.

4.9 This study will again be carried out after an interval of three years to assess the progress and changes in land reclamation in the above clusters.

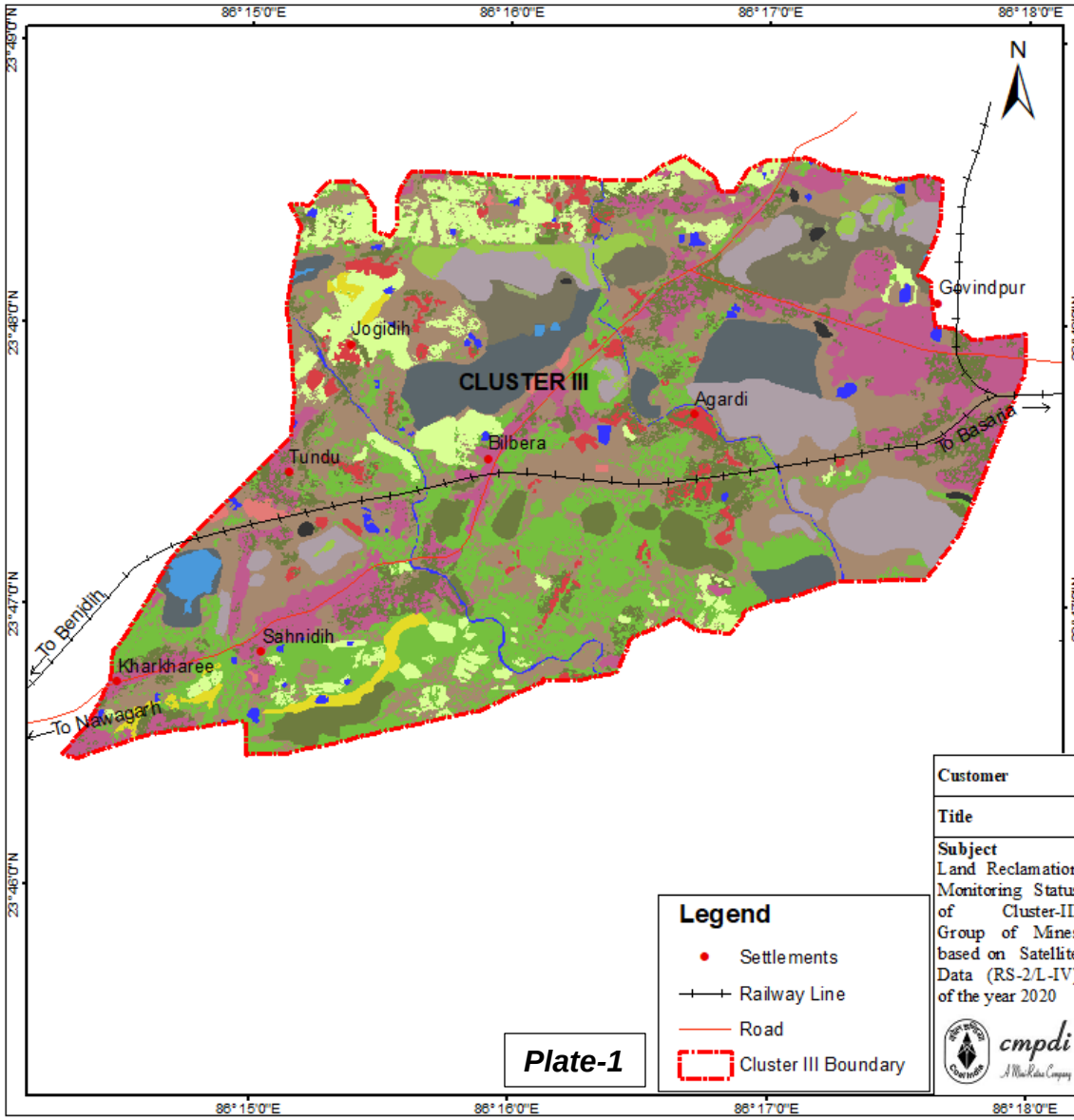
Table 2

Cluster wise Area Statistics of Land Use/ Cover classes in five Clusters of (OC+UG) mines of BCCL based on Satellite Data of the year 2020

Status of Land Reclamation in 5 Clusters of (UG+OC) mines of Bharat Coking Coal Ltd. based on Satellite data of the Year 2020

(Area in Hectare)

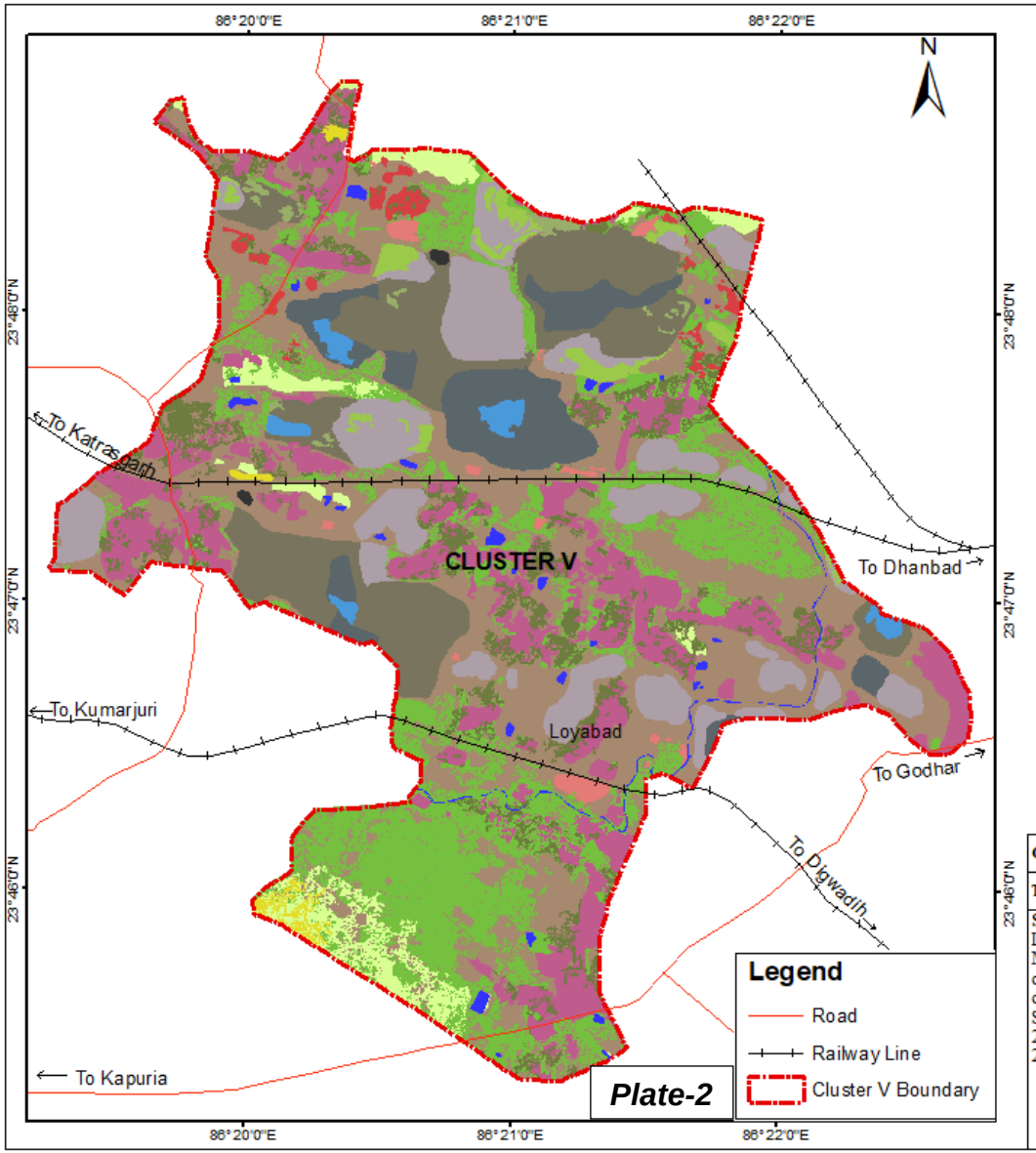
		CLUSTER III		CLUSTER V		CLUSTER VIII		CLUSTER IX		CLUSTER XVII		TOTAL	
		Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
FORESTS	Dense Forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Open Forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Forest (A)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCRUBS	**Scrubs (B)**	271.78	17.51	320.90	18.61	157.58	11.83	346.67	17.62	178.99	12.68	1275.92	15.97
PLANTATION	Social Forestry/Avenue Plantation	162.33	10.46	105.29	6.11	24.70	1.85	168.58	8.57	43.33	3.07	504.23	6.31
	Plantation on OB Dump	21.11	1.36	23.85	1.38	21.97	1.65	41.79	2.12	5.00	0.35	113.72	1.42
	Plantation on Backfill (Biological Reclamation)	3.89	0.25	7.19	0.42	9.93	0.75	6.80	0.35	0.00	0.00	27.81	0.35
	Total Plantation (C)	187.33	12.07	136.33	7.91	56.60	4.25	217.17	11.04	48.32	3.42	645.75	8.08
	Total Vegetation (A+B+C)	**459.11**	**29.57**	**457.23**	**26.51**	**214.18**	**16.08**	**563.84**	**28.66**	**227.31**	**16.10**	**1921.67**	**24.06**
	Coal Dump	3.58	0.23	1.70	0.10	3.72	0.28	4.89	0.25	0.00	0.00	13.89	0.17
ACTIVE MINING	Coal Quarry	94.89	6.11	87.72	5.09	101.43	7.62	191.65	9.74	56.82	4.02	532.51	6.67
	Advance Quarry Site	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Quarry Filled With Water	9.90	0.64	15.80	0.92	23.06	1.73	25.59	1.30	8.58	0.61	82.93	1.04
	Total Area under *Active Mining*	**104.79**	**6.75**	**103.52**	**6.00**	**124.49**	**9.35**	**217.24**	**11.04**	**65.40**	**4.63**	**615.44**	**7.70**
	Barren OB Dump	126.59	8.15	174.62	10.13	152.06	11.42	166.03	8.44	44.48	3.15	663.78	8.31
RECLAIMED	Area Under Backfilling (Technical Reclamation)	60.37	3.89	187.59	10.88	206.91	15.53	77.53	3.94	125.09	8.86	657.49	8.23
	Total Area under Mine Operation	**295.33**	**19.02**	**467.43**	**27.10**	**487.18**	**36.58**	**465.69**	**23.67**	**234.97**	**16.64**	**1950.60**	**24.42**
WASTELAND	Waste Lands	426.21	27.45	472.92	27.42	373.70	28.06	581.57	29.56	112.68	7.98	1967.08	24.62
	Fly Ash Pond / Sand Body	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.76	0.48	6.76	0.08
	Total Wasteland	**426.21**	**27.45**	**472.92**	**27.42**	**373.70**	**28.06**	**581.57**	**29.56**	**119.44**	**8.46**	**1973.84**	**24.71**
WATERBODIES	Reservoir, Nallah, Ponds	18.74	1.21	13.66	0.79	13.95	1.05	23.33	1.19	31.81	2.25	101.49	1.27
	Total Waterbodies	**18.74**	**1.21**	**13.66**	**0.79**	**13.95**	**1.05**	**23.33**	**1.19**	**31.81**	**2.25**	**101.49**	**1.27**
AGRICULTURE	Crop Lands	16.60	1.07	8.41	0.49	16.63	1.25	0.00	0.00	69.45	4.92	111.09	1.39
	Fallow Lands	122.68	7.90	58.64	3.40	58.63	4.40	43.56	2.21	472.71	33.48	756.22	9.47
	Total Agriculture	**139.28**	**8.97**	**67.05**	**3.89**	**75.26**	**5.65**	**43.56**	**2.21**	**542.16**	**38.40**	**867.31**	**10.86**
SETTLEMENTS	Urban Settlement	173.86	11.20	220.71	12.80	99.22	7.45	232.31	11.81	214.25	15.17	940.35	11.77
	Rural Settlement	33.95	2.19	13.97	0.81	60.71	4.56	47.79	2.43	31.36	2.22	187.78	2.35
	Industrial Settlement	6.05	0.39	11.55	0.67	7.75	0.58	9.13	0.46	10.69	0.76	45.17	0.57
	Total Settlements	**213.86**	**13.77**	**246.23**	**14.28**	**167.68**	**12.59**	**289.23**	**14.70**	**256.31**	**18.15**	**1173.31**	**14.69**
	Grand Total	**1552.53**	**100.00**	**1724.52**	**100.00**	**1331.95**	**100.00**	**1967.22**	**100.00**	**1412.00**	**100.00**	**7988.22**	**100.00**



Area Statistics - Cluster III (2020)

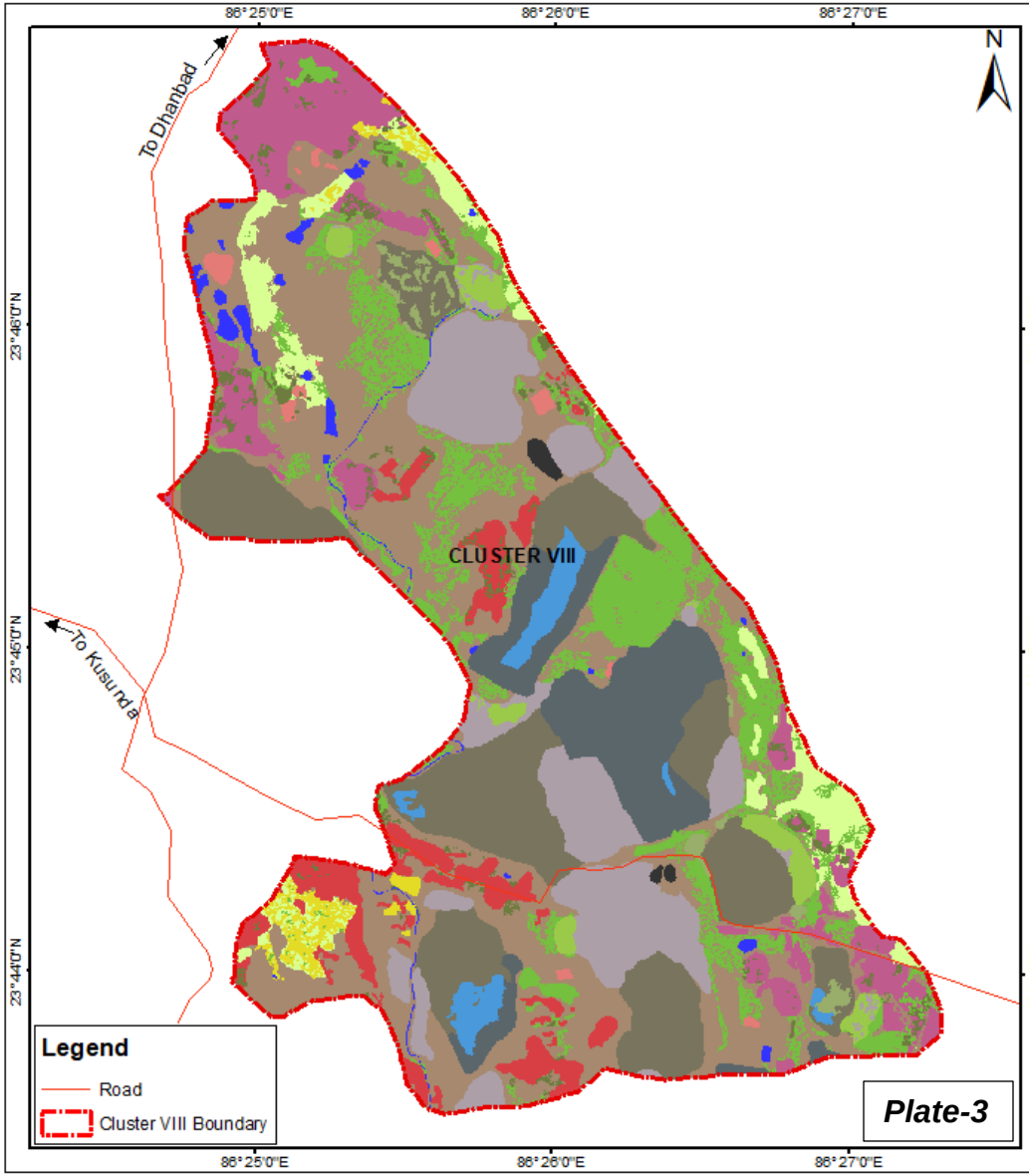
Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**271.78**	**17.51**
Plantation Area	Social Forestry		162.33	10.46
	Plantation on OB		21.11	1.36
	Plantation on Backfill		3.89	0.25
	Total Plantation Area (C)		**187.33**	**12.07**
	Total Vegetation (A+B+C)		**459.11**	**29.57**
Agriculture Land	Cropland		16.60	1.07
	Fallow Land		122.68	7.90
	Total Agriculture Land		**139.28**	**8.97**
Waste Land	Waste Land		426.21	27.45
	Sand Body		0.00	0.00
	Total Waste Land		**426.21**	**27.45**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		94.89	6.11
	Barren OB Dump		126.59	8.15
	Back Fill		60.37	3.89
	Coal Dump		3.58	0.23
	Water Filled Qry		9.90	0.64
	Total Mining Area		**295.33**	**19.02**
Settlements	Urban Settlements		173.86	11.20
	Rural Settlements		33.95	2.19
	Industrial Settlements		6.05	0.39
	Total Settlement Area		**213.86**	**13.77**
Water Body	**River/ Ponds**		**18.74**	**1.21**
	Total Area		**1552.53**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 561410027
Subject Land Reclamation Monitoring Status of Cluster-III Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Dy. Mgr(Geology)		
	Checked	B.K Choudhary	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
	Scale:	0 0.25 0.5 1 Km			Sheet 1
	Drg No.	HQREM20 R2 A4 CL-III			RevNo.0



Area Statistics - Cluster V (2020)				
Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	%of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**320.90**	**18.61**
Plantation Area	Social Forestry		105.29	6.11
	Plantation on OB		23.85	1.38
	Plantation on Backfill		7.19	0.42
	Total Plantation Area (C)		**136.33**	**7.91**
	Total Vegetation (A+B+C)		**457.23**	**26.51**
Agriculture Land	Crop land		8.41	0.49
	Fallow Land		58.64	3.40
	Total Agriculture Land		**67.05**	**3.89**
Waste Land	Waste Land		472.92	27.42
	Sand Body		0.00	0.00
	Total Waste Land		**472.92**	**27.42**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		87.72	5.09
	Barren OB Dump		174.62	10.13
	Back Fill		187.59	10.88
	Coal Dump		1.70	0.10
	Water Filled Qry		15.80	0.92
	Total Mining Area		**467.43**	**27.10**
Settlements	Urban Settlements		220.71	12.80
	Rural Settlements		13.97	0.81
	Industrial Settlements		11.55	0.67
	Total Settlement Area		**246.23**	**14.28**
Water Body	**River/ Ponds**		**13.66**	**0.79**
	Total Area		**1724.52**	**100.00**

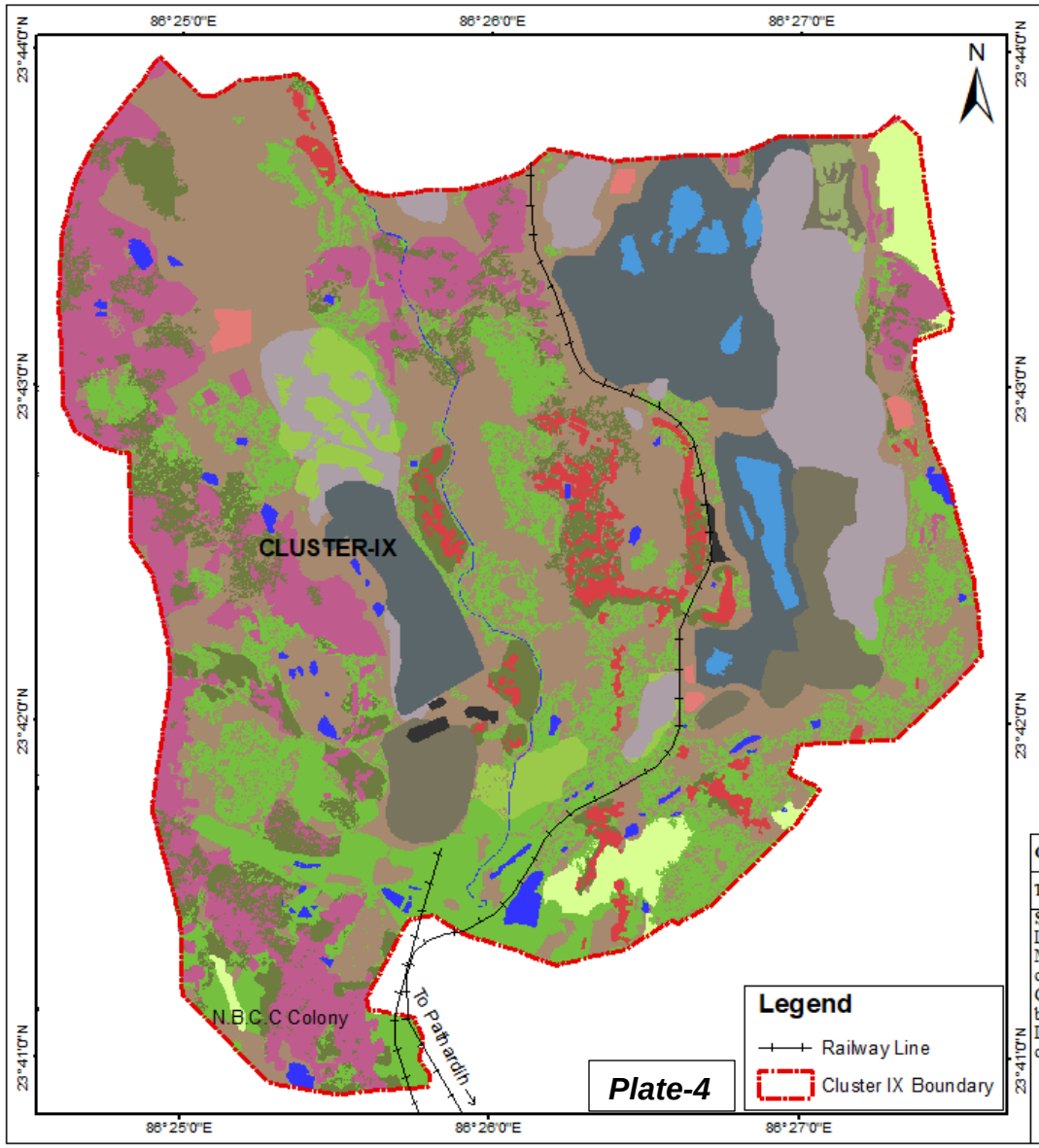
Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 561410027
Subject Land Reclamation Monitoring Status of Cluster-V Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Dy. Mgr(Geology)		
	Checked	B.K Choudhary	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale:	0 0.25 0.5 1 Km			Sheet 1
	Drg No.	HQ REM 20 R2 A4 CL-V			Rev No.0



Area Statistics - Cluster VIII (2020)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**157.58**	**11.83**
Plantation Area	Social Forestry		24.70	1.85
	Plantation on OB		21.97	1.65
	Plantation on Backfill		9.93	0.75
	Total Plantation Area (C)		**56.60**	**4.25**
	Total Vegetation (A+B+C)		**214.18**	**16.08**
Agriculture Land	Crop land		16.63	1.25
	Fallow Land		58.63	4.40
	Total Agriculture Land		**75.26**	**5.65**
Waste Land	Waste Land		373.70	28.06
	Sand Body		0.00	0.00
	Total Waste Land		**373.70**	**28.06**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		101.43	7.62
	Barren OB Dump		152.06	11.42
	Back Fill		206.91	15.53
	Coal Dump		3.72	0.28
	Water Filled Qry		23.06	1.73
	Total Mining Area		**487.18**	**36.58**
Settlements	Urban Settlements		99.22	7.45
	Rural Settlements		60.71	4.56
	Industrial Settlements		7.75	0.58
	Total Settlement Area		**167.68**	**12.59**
Water Body	**River/ Ponds**		**13.95**	**1.05**
	Total Area		**1331.95**	**100.00**

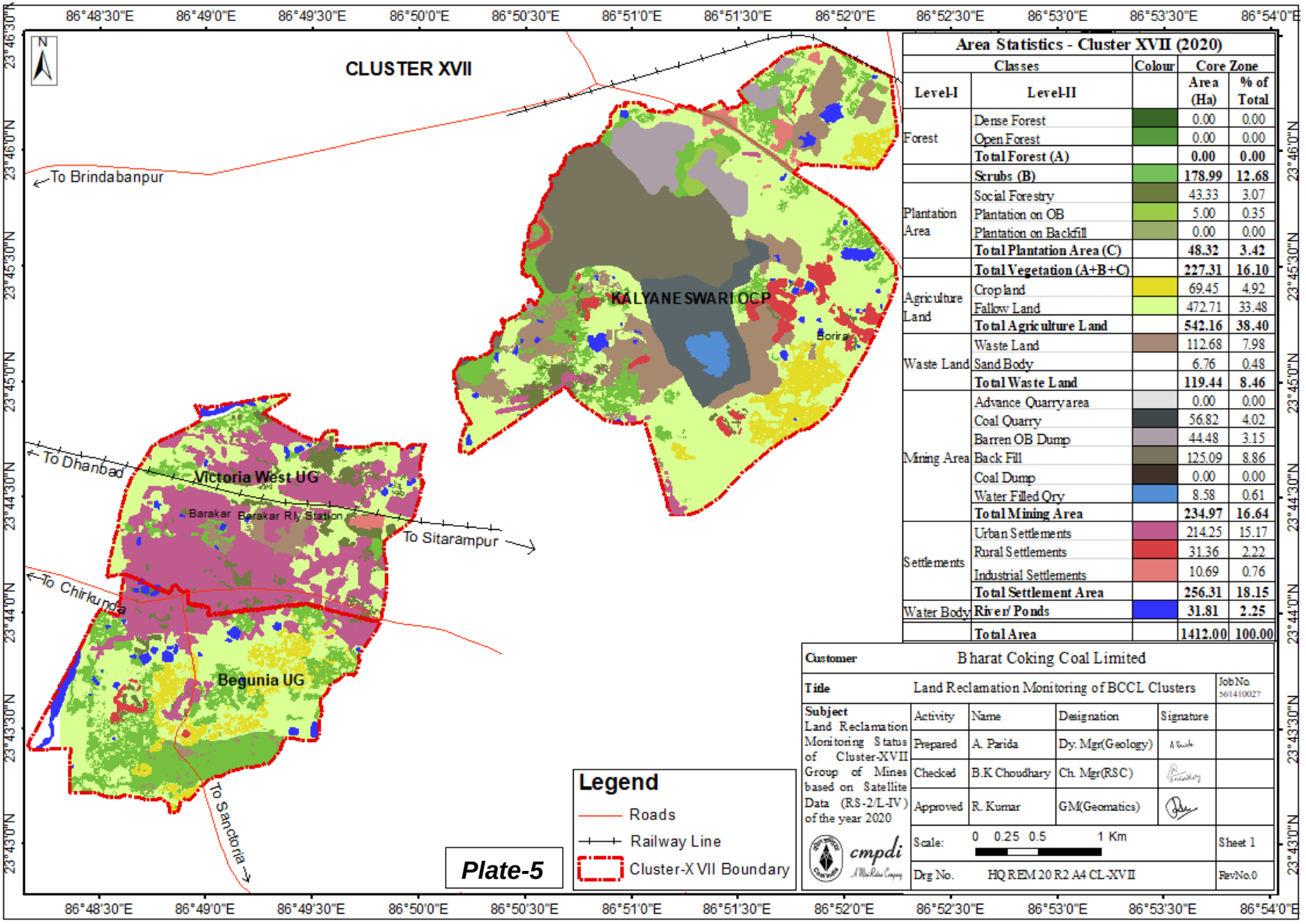
Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 561410027
Subject: Land Reclamation Monitoring Status of Cluster-VIII Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Dy. Mgr(Geology)		
	Checked	B.K Choudhary	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale:	0 0.25 0.5 1 Km			Sheet 1
	Drg No.	HQ REM 20 R2 A4 CL-VIII			RevNo 0



Area Statistics - Cluster IX (2020)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**346.67**	**17.62**
Plantation Area	Social Forestry		168.58	8.57
	Plantation on OB		41.79	2.12
	Plantation on Backfill		6.80	0.35
	Total Plantation Area (C)		**217.17**	**11.04**
	Total Vegetation (A+B+C)		**563.84**	**28.66**
Agriculture Land	Crop land		0.00	0.00
	Fallow Land		43.56	2.21
	Total Agriculture Land		**43.56**	**2.21**
Waste Land	Waste Land		581.57	29.56
	Sand Body		0.00	0.00
	Total Waste Land		**581.57**	**29.56**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		191.65	9.74
	Barren OB Dump		166.03	8.44
	Back Fill		77.53	3.94
	Coal Dump		4.89	0.25
	Water Filled Qry		25.59	1.30
	Total Mining Area		**465.69**	**23.67**
Settlements	Urban Settlements		232.31	11.81
	Rural Settlements		47.79	2.43
	Industrial Settlements		9.13	0.46
	Total Settlement Area		**289.23**	**14.70**
Water Body	**River/ Ponds**		**23.33**	**1.19**
	Total Area		**1967.22**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 561410027
Subject: Land Reclamation Monitoring Status of Cluster-IX Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Dy. Mgr(Geology)		
	Checked	B.K Choudhary	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
	Scale:	0 0.25 0.5 1 Km			Sheet 1
	Drg No.	HQ REM 20 R2 A4 CL-IX			RevNo.0



Area Statistics - Cluster XVII (2020)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**178.99**	**12.68**
Plantation Area	Social Forestry		43.33	3.07
	Plantation on OB		5.00	0.35
	Plantation on Backfill		0.00	0.00
	Total Plantation Area (C)		**48.32**	**3.42**
	Total Vegetation (A+B+C)		**227.31**	**16.10**
Agriculture Land	Crop land		69.45	4.92
	Fallow Land		472.71	33.48
	Total Agriculture Land		**542.16**	**38.40**
Waste Land	Waste Land		112.68	7.98
	Sand Body		6.76	0.48
	Total Waste Land		**119.44**	**8.46**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		56.82	4.02
	Barren OB Dump		44.48	3.15
	Back Fill		125.09	8.86
	Coal Dump		0.00	0.00
	Water Filled Qry		8.58	0.61
	Total Mining Area		**234.97**	**16.64**
Settlements	Urban Settlements		214.25	15.17
	Rural Settlements		31.36	2.22
	Industrial Settlements		10.69	0.76
	Total Settlement Area		**256.31**	**18.15**
Water Body	**River/ Ponds**		**31.81**	**2.25**
	Total Area		**1412.00**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No 561410027
Subject Land Reclamation Monitoring Status of Cluster-XVII Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Dy. Mgr(Geology)		
	Checked	B.K Choudhary	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
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	Drg No.	HQ REM 20 R2 A4 CL-XVII			RevNo.0

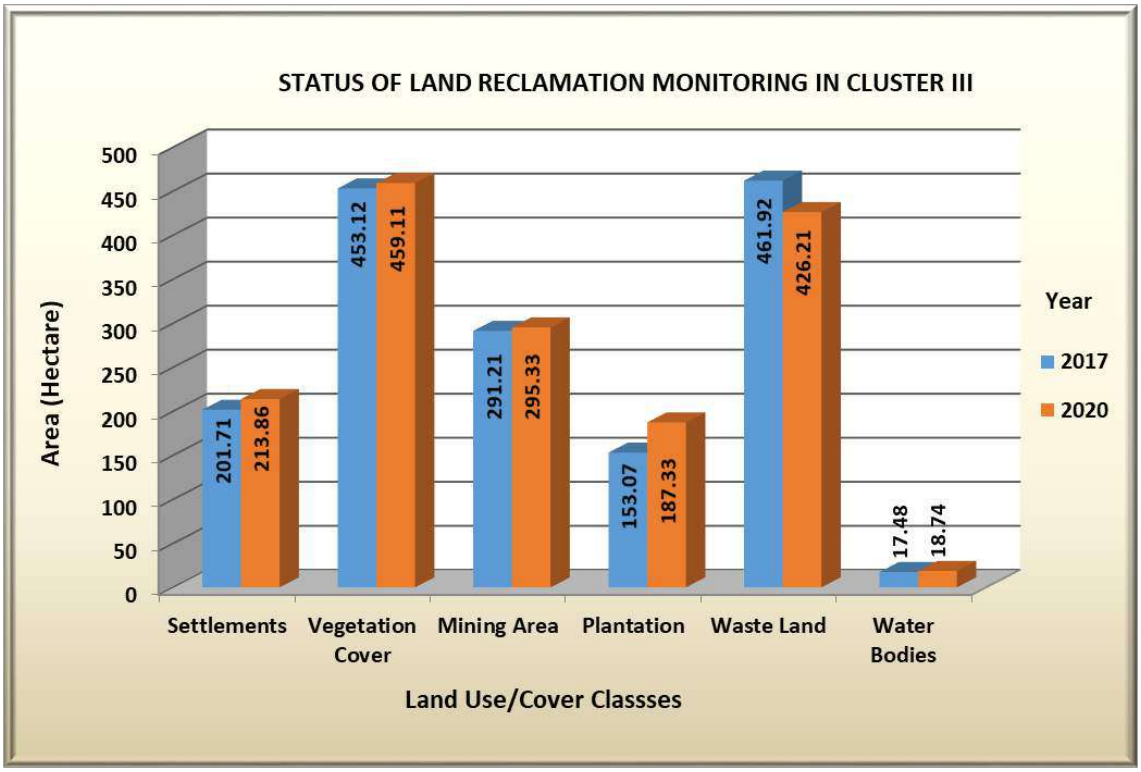


Fig. 3: Land Reclamation Status of Cluster III

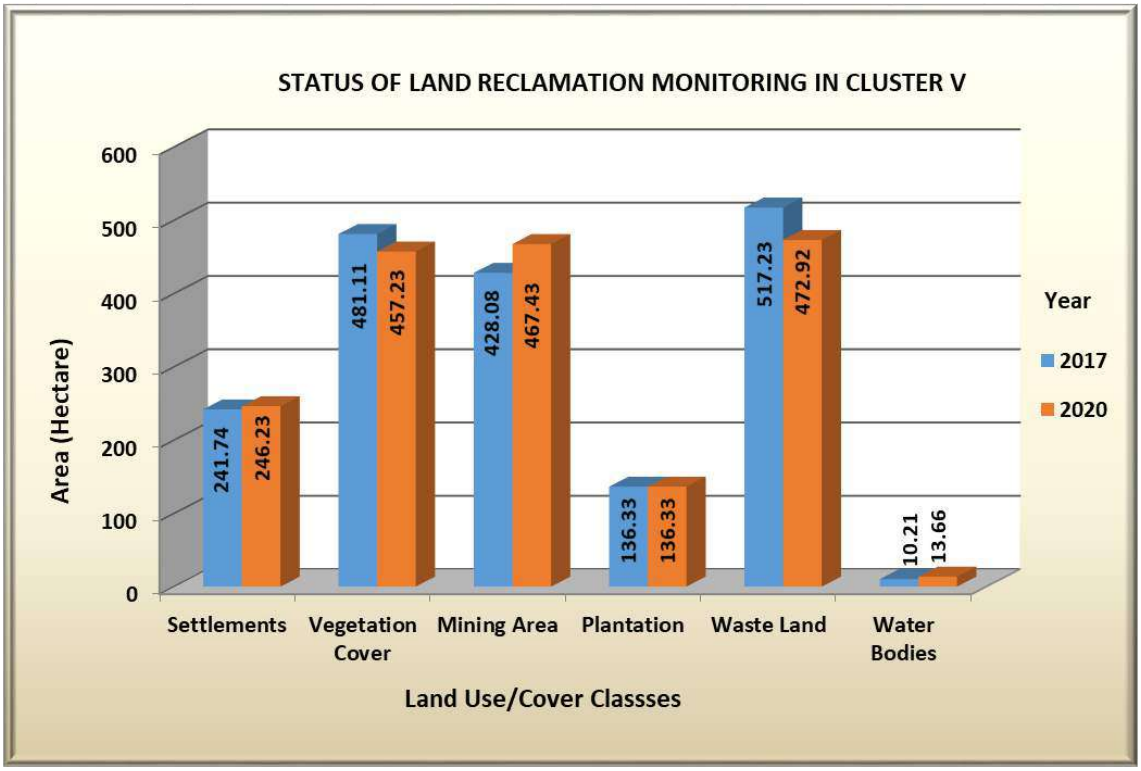


Fig. 4: Land Reclamation Status of Cluster V

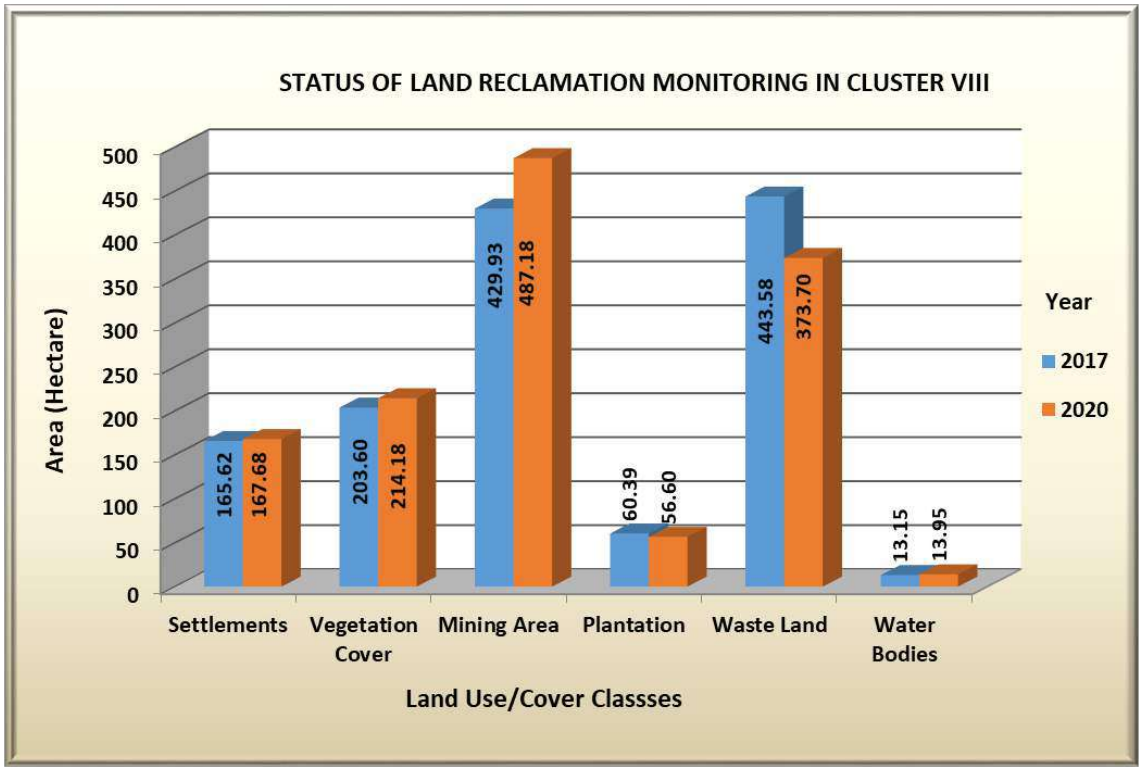


Fig. 5: Land Reclamation Status of Cluster VIII

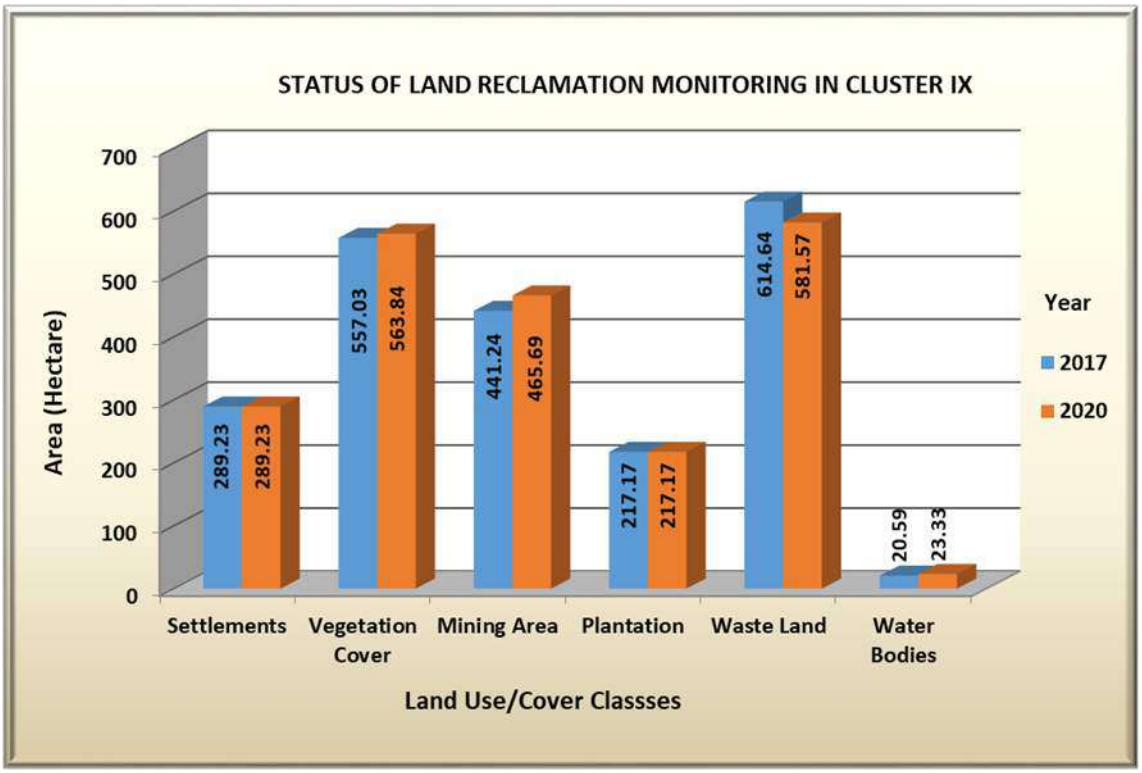


Fig. 6: Land Reclamation Status of Cluster IX

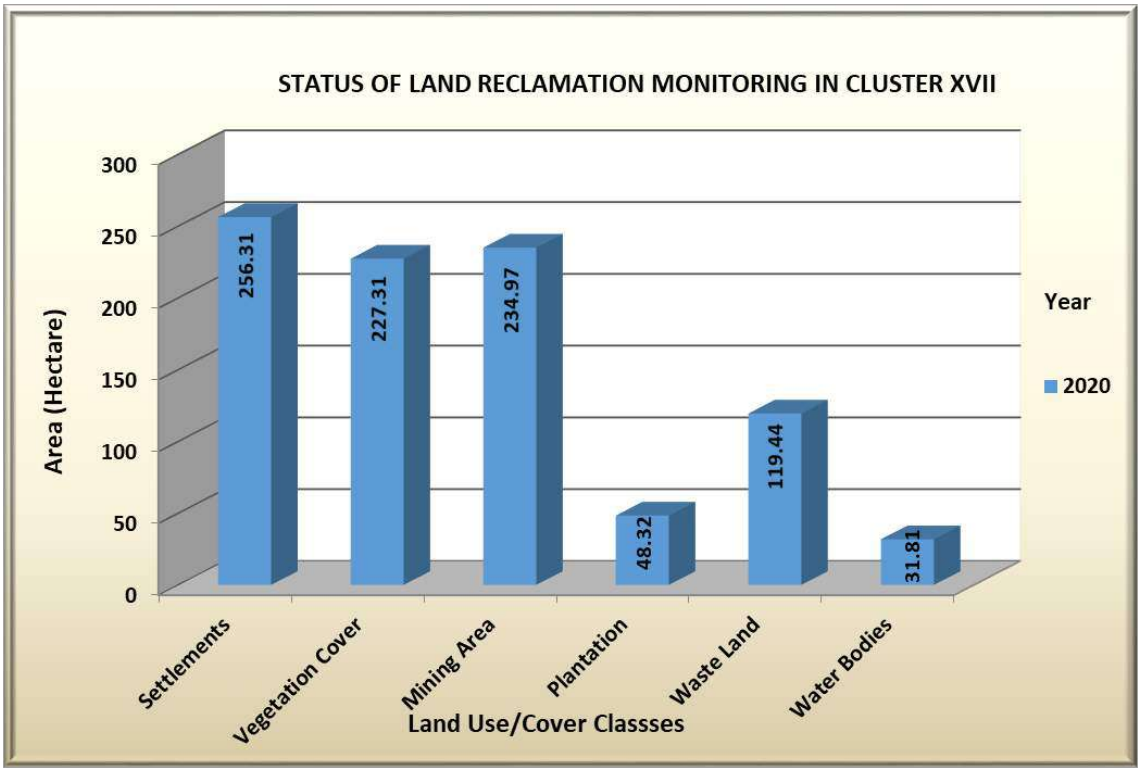


Fig. 7: Land Reclamation Status of Cluster XVII



Photo 1: Plantation on OB dump, Cluster III



Photo 2: Eco Restoration Site, Cluster V



Photo 3: Plantation on OB Dump, Cluster V



Photo 4: Plantation on OB Dump, Cluster VIII



Photo 5: Gokul Eco Cultural Park, Cluster IX



Photo 6: Plantation in Cluster XVII

Central Mine Planning & Design Institute Ltd.
(A Subsidiary of Coal India Ltd.)
Gondwana Place, Kanke Road, Ranchi 834031, Jharkhand
Phone : (+91) 651 2230001, 2230002, 2230483, FAX (+91) 651 2231447, 2231851
Wesite : www.cmpdi.co.in, Email : cmpdihq@cmpdi.co.in

Annexure XVI

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
योजना एवं परियोजना विभाग
कोयला भवन कोयला नगर
धनबाद- 826005
दूरभाष-0326-2230276
ईमेल: gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

Bharat Coking Coal Limited
(A Mini Ratna Company)
Planning & Project Division
Koyla Bhawan, Koyla Nagar
Dhanbad- 826 005
Telephone-0326-2230276
Email- gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

पत्रांक : बी.सी.सी.एल/महाप्रबंधक(P&P)/फ-76/17/494(H) **Dated**-20.12.2017

सेवा में
महाप्रबंधक ,
लोदना,
बी.सी.सी.एल., धनबाद

विषय: Approval of Mining Plan and Mine Closure Plan for Amalgamated Joyrampur Colliery(OC).

महोदय,

BCCL Board during its 336th meeting held on 09.12.2017 has approved the Mining Plan and Mine Closure Plan for Amalgamated Joyrampur Colliery(OC).

Board's resolution alongwith the above document is attached herewith. This is being sent to you for further necessary action.

भवदीय

20/12/17

(एन के मार्तण्ड)
महाप्रबंधक (योजना एवं परियोजना)

संलग्नक: यथोपरि

प्रतिलिपि:
क्षेत्रीय निदेशक, सी एम पी डी आई, क्षेत्रीय संस्थान-II, कोयला भवन परिसर , धनबाद
महाप्रबंधक (वित) प्रभारी, बी.सी.सी.एल., धनबाद
उप- महाप्रबंधक(पर्यावरण), पर्यावरण विभाग, बी.सी.सी.एल., धनबाद.

F-20A

भारत कोकिंग कोल लिमिटेड
(कोल इंडिया लिमिटेड का एक अंग)
कोयला भवन/ कोयला नगर,
धनबाद –826005
दूरभाष :0326-2230190/ **फ़ेक्स**-0326-2230050
ईमेल: cos@bccl.gov.in

Bharat Coking Coal Limited
(A Subsidiary of Coal India Limited)
Koyla Bhawan/ Koyla Nagar
Dhanbad-826005
Phone No. 0326-2230190/Fax-0326-2230050
email ID: cos@bccl.gov.in

बोर्ड सचिवालय /Board Secretariat

Ref. No. BCCL:CS:F-1(A): 154

Dated:21.02.2014
22

To
GM(P&P)
BCCL, Koyla Bhawan

Sub: Extracts of Minutes of 304th Meeting of the Board of Directors of BCCL held on 03.02.2014 at Dhanbad.

Dear Sir,

We send herewith extracts of Minutes of the **Item No. 304.5D** of the 304th Meeting of the Board of Directors of Bharat Coking Coal Limited held on 03.02.2014 at Dhanbad for taking necessary action at your end.

Action Taken Report (ATR) on the decision of the Board may please be submitted for appraisal of the Board.

Encl: As above

Yours faithfully

21/2/14
(B.K. Parui)
Company Secretary

cc to 1. Ad. GM (F) I/C
2. HOD (Budget)
3. Nalmapi Sahu P&P Deptt
4. Board file

22/2

304.5D **Approval of Mine Closure Plan.**

Board after deliberation passed the following resolution

Resolved that the proposal of Mine Closure Plan of the following 7(Seven) mines (as per the mine closure list given below) including the total closure cost of ₹61285.713 Lakhs (Rupees Six hundred twelve crores eighty five lakhs seventy one thousand and three hundred only) to be deposited in "Escrow Account" under Revenue head be and is hereby approved.

Further resolved that the said "Escrow Account' will be opened in accordance with the guidelines issued by D (F), CIL vide letter No.168/96 dated 26.06.2013 and 168/98 dated 28.06.2013 be and is hereby approved.

				Amount to be deposited to Escrow Account(₹Lakh)			
Sl. No	Name of Mine/Project	Project Area	Balance Life of Mine	1st Year	2nd Year	n^{th} Year	Total Mine Closure Cost
		(Ha)	(Years)			(End Year)	
1	Kalyaneswari Group of Mines	851.33	33	209.610	220.090	998.740	**16781.990**
2	Lohapatti Colliery	1535.31	16	267.695	281.080	264.047	**3293.157**
3	Block-II OCP Mines	707.00	26	207.396	217.766	702.315	**10600.717**
4	Pootkee Balihari Group of Mines	730.17	30	84.913	34.302	134.469	**2222.722**
5	NT-ST-Jeenagora Group of Mines	1431.00	30	387.563	406.941	1595.260	**25749.206**
6	Murulidih 20/21 Pits Colliery	394.32	17	31.410	32.981	68.567	**881.654**
7	Godhur Group of Mines	153.72	20	55.232	57.993	139.566	**1826.267**
TOTAL				**1243.819**	**1251.153**		**61285.713**

Certified to be True Copy

21/4/14

A.K. Paul
Company Secretary
Eastern Coalfields Limited
Kajora, Sitarampur
Dist.Burdwan-713325

भारत कोकिंग कोल लिमिटेड
एक मिनिरत्न कम्पनी
(कोल इंडिया लिमिटेड का एक अंग)
महाप्रबंधक का कार्यालय, लोदना क्षेत्र
पो.ओ.- भागा, जिला - धनबाद (झारखण्ड)
पंजीकृत कार्यालय: कोयला भवन, कोयला नगर,
धनबाद- 825005, (झारखण्ड)
CIN:U10101JH1972GOI000918

Bharat Coking Coal Limited
A MINI RATNA Co.
(A Subsidiary of Coal India Ltd)
Office of the General Manager, Lodna Area
P.O. Bhaga, Dist: Dhanbad (Jharkhand)
Regd.Off: Koyla Bhawan, Koyla Nagar, Dhanbad-825005,
CIN:U10101JH1972GOI000918

Ref. No.: BCCL/LA/GM/2019/ 198

Date: 29/8/2019

OFFICE ORDER

An Environment Management Cell (EMC) of Lodna Area is hereby constituted with following members:

1. General Manager, Lodna Area – Chairman
2. Addl. General Manager, Lodna Area – Vice Chairman
3. Area Manager (Environment), Lodna Area – Member
4. Area Safety Officer, Lodna Area – Member
5. Area Manager (Planning), Lodna Area – Member
6. Area Finance Manager, Lodna Area – Member
7. Area Personnel Manager, Lodna Area – Member
8. Area Manager (Survey), Lodna Area – Member
9. Area Manager (E&M), Lodna Area – Member
10. Area Manager (Excavation), Lodna Area – Member
11. Area Manager (Estate), Lodna Area – Member
12. Project Officer – Amal NT-ST-JG/Amal Joyrampur/Kujama Colliery – Member
13. Assistance Manager (Environment), Lodna Area – Member

Environment Management Cell will monitor & co-ordinate with project officers to ensure the compliance of conditions imposed in Environment Clearance granted by Ministry of Environment, Forest & Climate Change.

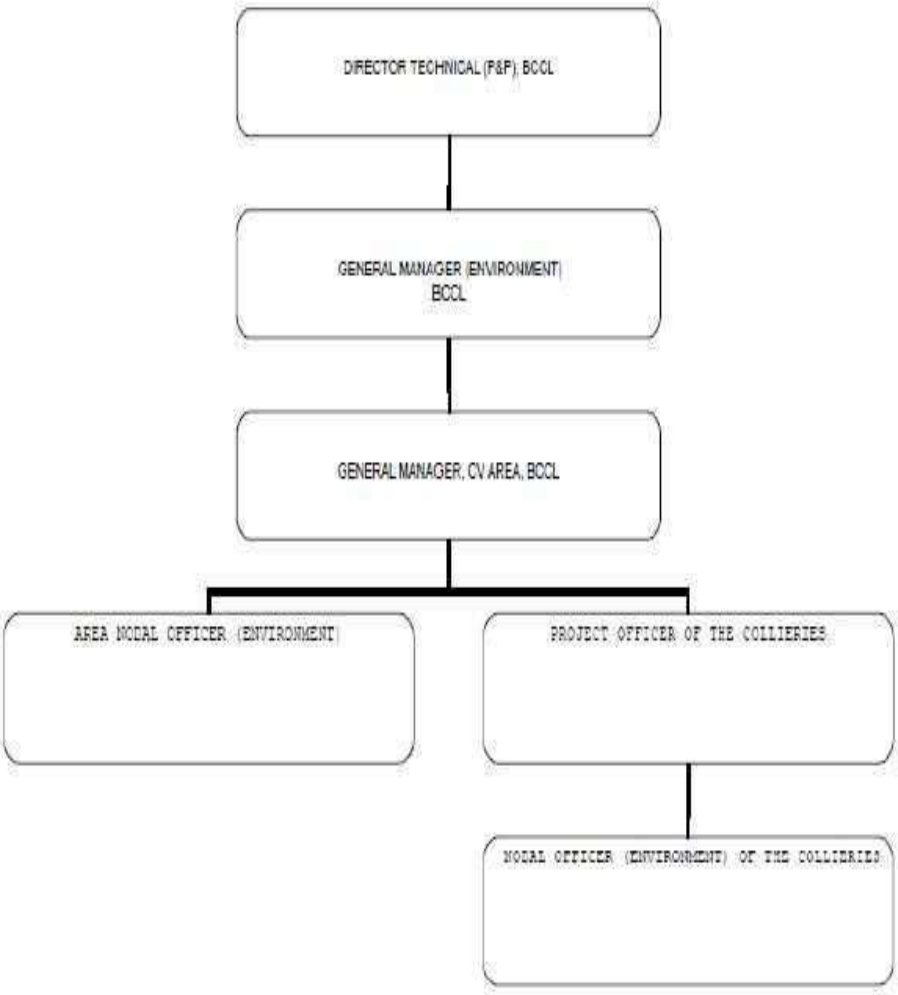
29/8/19
General Manager
Lodna Area

Copy to:

1. Dy.GM / HOD (Env.), KB, BCCL
2. All Project Officers, Lodna Area
3. Executive concerned
4. Office copy

Scanned by CamScanner

Fig 17 ORGANIZATION CHART



STRICTLY RESTRICTED
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.

ENVIRONMENTAL MONITORING REPORT OF BHARAT COKING COAL LIMITED, CLUSTER –IX

(FOR THE MONTH MARCH 2021)

E. C. no. J-11015/307/2010-IA.II (M) dated 01.03.2018

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

SL. NO.	CHAPTER	PARTICULARS	PAGE NO.
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	ANALYSIS & RESULTS	7-11
4.	CHAPTER-IV	STANDARDS & PLANS	12-15

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the fauna and flora. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM_{10}), Fine Particulate Matter ($PM_{2.5}$), Sulphur Di-oxide (SO_2) and Nitrogen Oxides (NO_X). Respirable Dust Samplers (RDS) and Fine Dust Sampler ($PM_{2.5}$

sampler) were used for sampling of $PM_{10,}$ SO_2, & NO_X and Fine Dust Sampler ($PM_{2.5}$ sampler) were used for sampling of $PM_{2.5}$ 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-II, Dhanbad.

3.2 Water quality

Water samples were collected as per standard practice. The Mine effluent samples were collected and analyzed for four parameters on fortnightly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory of CMPDI, RI- II, Dhanbad.

3.3 Noise level monitoring

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB(A).

4.0 Results and interpretations

4.1 Air quality

It has been seen from the analysis results that the 24 hours average concentration parameters like $PM_{10,}$ $PM_{2.5}$, SO_2 and NO_X are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM_{10}& $PM_{2.5}$ exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

The following preventive and suppressive mitigative measures can be undertaken to contain the pollution level within prescribed level:-

- Wet drilling and controlled blasting should be practice.
- Explosive used should be optimised to restrict the dust generation.
- Transportation roads should be permanently asphalted free of ruts, potholes etc.
- Water should be sprayed on coal transportation road, service road more frequently and at regular interval.
- Dust from roads should be removed physically or mechanically.
- Greenbelts around industrial sites, service building area besides Avenue plantation along roads should be created.
- Coal dust should be suppressed by using fixed sprinklers.
- Regular maintenance of plant and machinery should be undertaken.

4.2 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt.25.09.2000 Standards for Coal Mines were within permissible limits.

4.3 Noise Level

During the noise level survey it has been observed that the noise level in the sampling locations is within the permissible limits prescribed as per MoEF&CC Gazette Notification No. GSR 742(E) dt.25.09.2000 Standards for Coal Mines for Industrial Area and Noise pollution (Regulation and Control) Rules, 2000.

INTRODUCTION

1.0 Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

The very purpose of environmental monitoring is to assess the quality of various attributes which affects the environment. As per quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster-IX is in the Eastern part of the Jharia coalfield. It includes a group of 6 Mines (viz. Lodna UG, Bagdigi UG, Joyrampur UG, Bararee UG, Jealgora UG, NT/ST Expan. OCP. The Cluster – IX is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – IX are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage pattern of the area is governed by Kashi Jore.

1.2 The Cluster-IX is designed to produce 6.548 MTPA (normative) and 8.512 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 6.548 MTPA (normative) and 8.512 MTPA (peak) capacity of coal production vide letter no. J-11015/307/2010-IA.II (M) dated 1st March, 2018.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that " Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, SO_2, NOx monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets, other conditions regarding water / effluent and noise level monitoring in consultation with the State Pollution Control Board."

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MoEF&CC & JSPCB and other statutory authorities.

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Jeenagora (A13) : Industrial Area

The location of the sampling station is 23^0 42' 31.00'' N & 86^0 25' 48.00'' E. The sampler was placed at a height of 1.5 m from the ground level at the Safety Office.

II. BUFFER ZONE Monitoring Location

i) Kusmatand Village (A12): Industrial Area

The location of the sampling station is $23^0$45' 4.65'' N & 86^0 26' 42.10'' E. The sampler was placed at a height of 1.5 m from the ground level of the village.

ii) Bhowrah North (A14) : Industrial Area

The location of the sampling station is 23^o41' 37.00'' N & 86^o23' 54.00''E. The sampler was placed at 1.5 m above the ground level of Project Office.

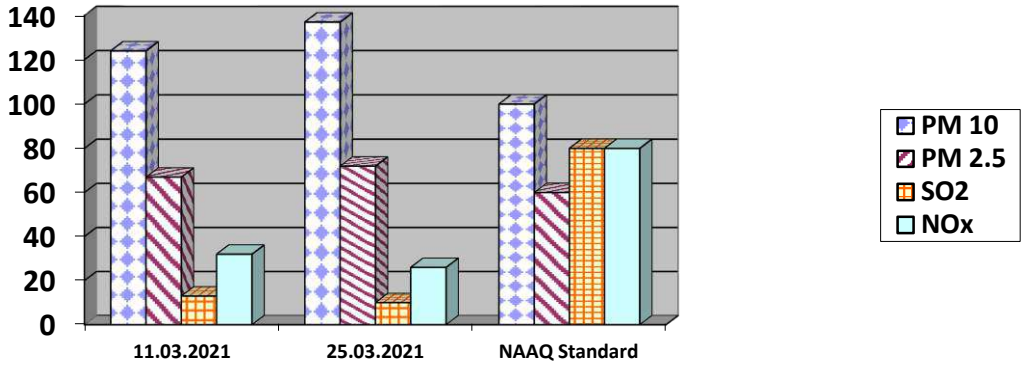
Iii) Hurriladih UGP (A28) : Industrial Area

The location of the sampling station is $23^0$44' 4.18'' N & 86^0 24' 6.21'' E. The sampler was placed at a height of 1.5 m from the ground level of the mine office.

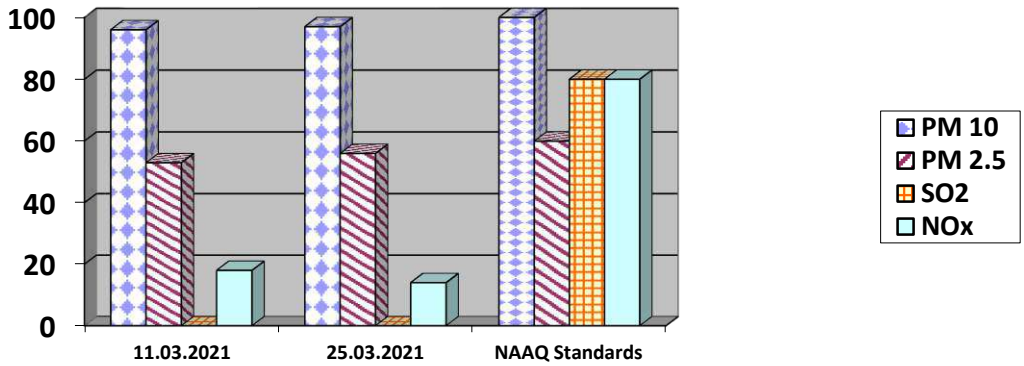
AMBIENT AIR QUALITY DATA

Cluster – IX, Bharat Coking Coal limited Month**: MAR,2021** Year: **2020-21.**

Station Name: A13 – Jeenagora		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	11.03.2021	124	67	13	32
2	25.03.2021	137	72	10	26
	NAAQ Standard	100	60	80	80



StationName:A12 Kusmatand Village		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	11.03.2021	96	53	<10	18
2	25.03.2021	97	56	<10	14
	NAAQ Standards	100	60	80	80

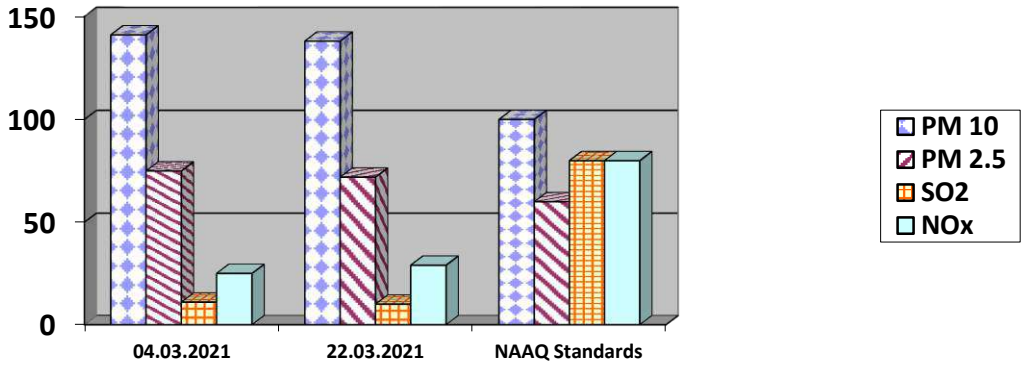


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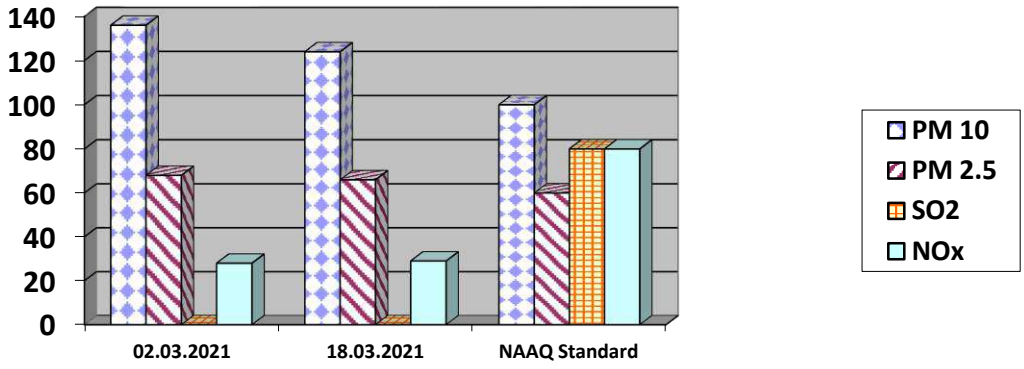
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RI-2, CMPDI, Dhanbad

Station Name: A14- Bhowrah North		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	04.03.2021	141	75	11	25
2	22.03.2021	138	72	10	29
	NAAQ Standards	100	60	80	80



Station Name: Hurriladih UGP (A28)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	02.03.2021	136	68	<10	28
2	18.03.2021	124	66	<10	29
	NAAQ Standard	100	60	80	80



- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

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JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Jeenagora (MW9)**

A sampling point is fixed to assess the effluent quality of Mine discharge.

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. The effluent samples were collected and analyzed for four parameters on fortnightly basis at the Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -IX**		Month: **MAR,2021**	Name of the Station: **Mine Discharge of Jeenagora**	
Sl. No.	**Parameters**	**MW9** First Fortnight	**MW9** Second Fortnight	**As per MOEF General Standards for schedule VI**
		15.03.2021	22.03.2021	
1	Total Suspended Solids	36	49	*100 (Max)*
2	pH	7.99	7.82	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	20	24	*250 (Max)*

All values are expressed in mg/lit except pH.

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NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. **Jeenagora (N13)**
2. **Kusmatand Village (N12)**
3. **Bhowrah North (N14)**
4. **Hurriladih UGP (N28)**

4.2 Methodology of sampling and analysis - Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L_{EQ} are presented**.** The observed values at all the monitoring locations are found to be within permissible limits.

NOISE LEVEL DATA

Name of the Project: **Cluster -IX**			Month**: MAR,2021**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	**Kusmatand Village (N12)**	**Residential area**	11.03.2021	54.2	*55*
2	**Kusmatand Village (N12)**	**Residential area**	25.03.2021	53.8	*55*
3	**Jeenagora (N13)**	**Industrial area**	11.03.2021	57.7	*75*
4	**Jeenagora (N13)**	**Industrial area**	25.03.2021	57.4	*75*
5	**Bhowrah North(N14)**	**Industrial area**	04.03.2021	55.2	*75*
6	**Bhowrah North(N14)**	**Industrial area**	22.03.2021	55.7	*75*
7	**Hurriladih UGP (N28)**	**Industrial area**	02.03.2021	56.2	*75*
8	**Hurriladih UGP (N28)**	**Industrial area**	18.03.2021	56.1	*75*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.
*** Day Time: 6.00 AM to 10.00 PM.**

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HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Ambient Air Quality Standards for Jharia Coal Field
As per the Environment (Protection) Amendment Rules, 2000 notified vide notification G.S.R. 742(E), dated 25.9.2000.

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
III Coal mines located in the coal fields of • Jharia • Raniganj • Bokaro	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 µg/m^3 700 µg/m^3	- High Volume Sampling (Average flow rate not less than 1.1 m^3
	Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average * 24 hours **	250 µg/m^3 300 µg/m^3	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide (SO_2)	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as NO_2	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemilumine-scence

Note:

* Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause2.

** 24hourly/8hourlyvaluesshallbemet92%ofthetimeinayear.However,8% of the time it may exceed but not on two consecutivedays.

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in supersession of the notification No(s).S.O.384(E), dated 11th April 1994 and S.O.935(E), dated 14th NOVober 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect.

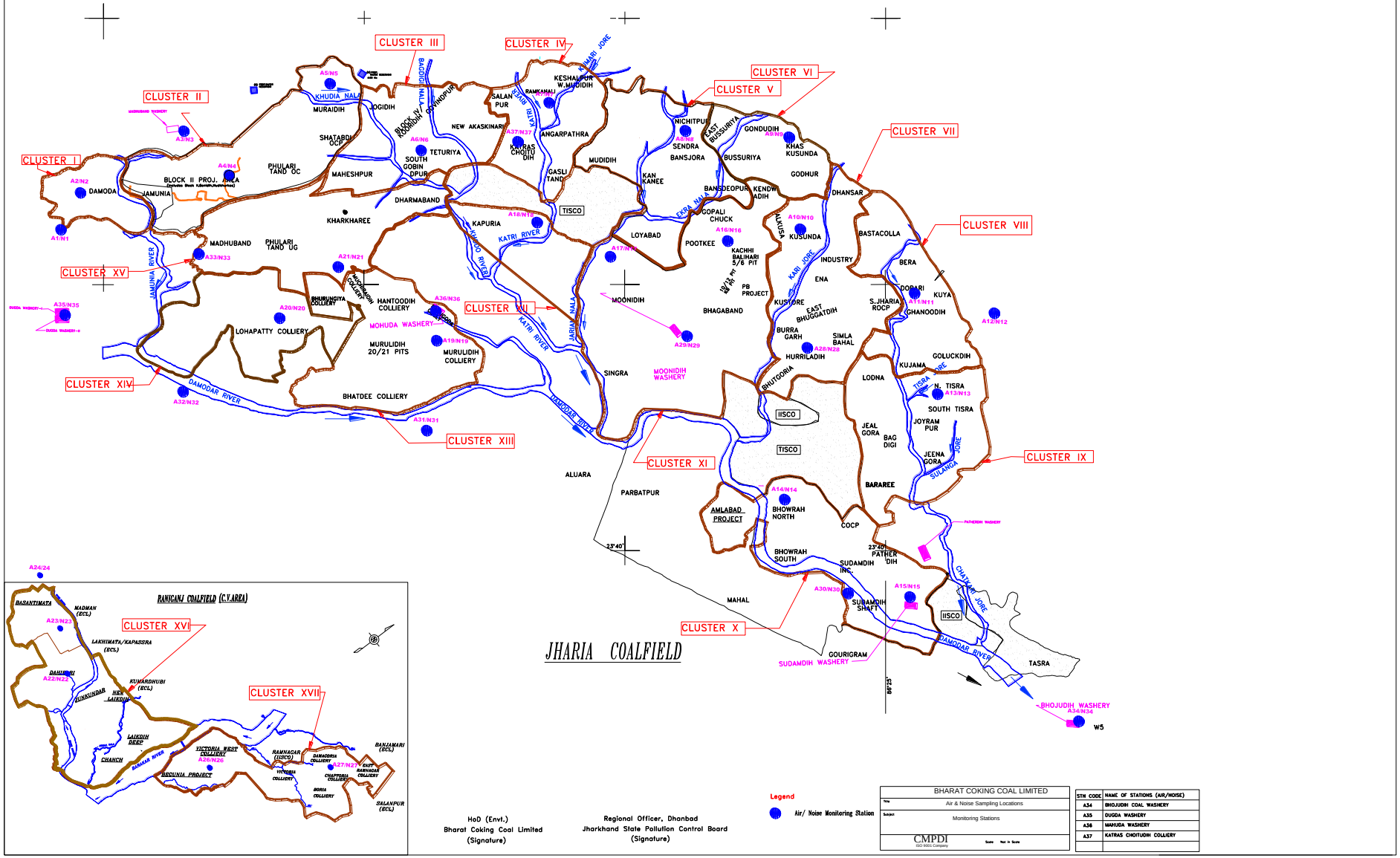
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
Nitrogendioxide (NO_2), µg/m³	Annual * 24 Hours **	40 80	30 80	-Jacob &Hochheiser modified ($NaOH$-$NaAsO_2$) Method -Gas Phase Chemiluminescence
Particulate Matter (Size less than 10µm) or PM_{10}, µg/m³	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
Particulate Matter (Size less than 2.5µm) or $PM_{2.5}$, µg/m³	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
Ozone (O_3) , µg/m³	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
Lead (Pb) , µg/m³	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
Carbon Monoxide (CO), mg/m³	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
Ammonia (NH_3), µg/m³	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
Benzene (C_6H_6), µg/m³	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
Benzo(a)Pyrene (BaP) Particulate phase only, ng/m³	Annual *	01	01	-Solvent extraction followed byHPLC/GC analysis
Arsenic (As), ng/m³	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni), ng/m³	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.

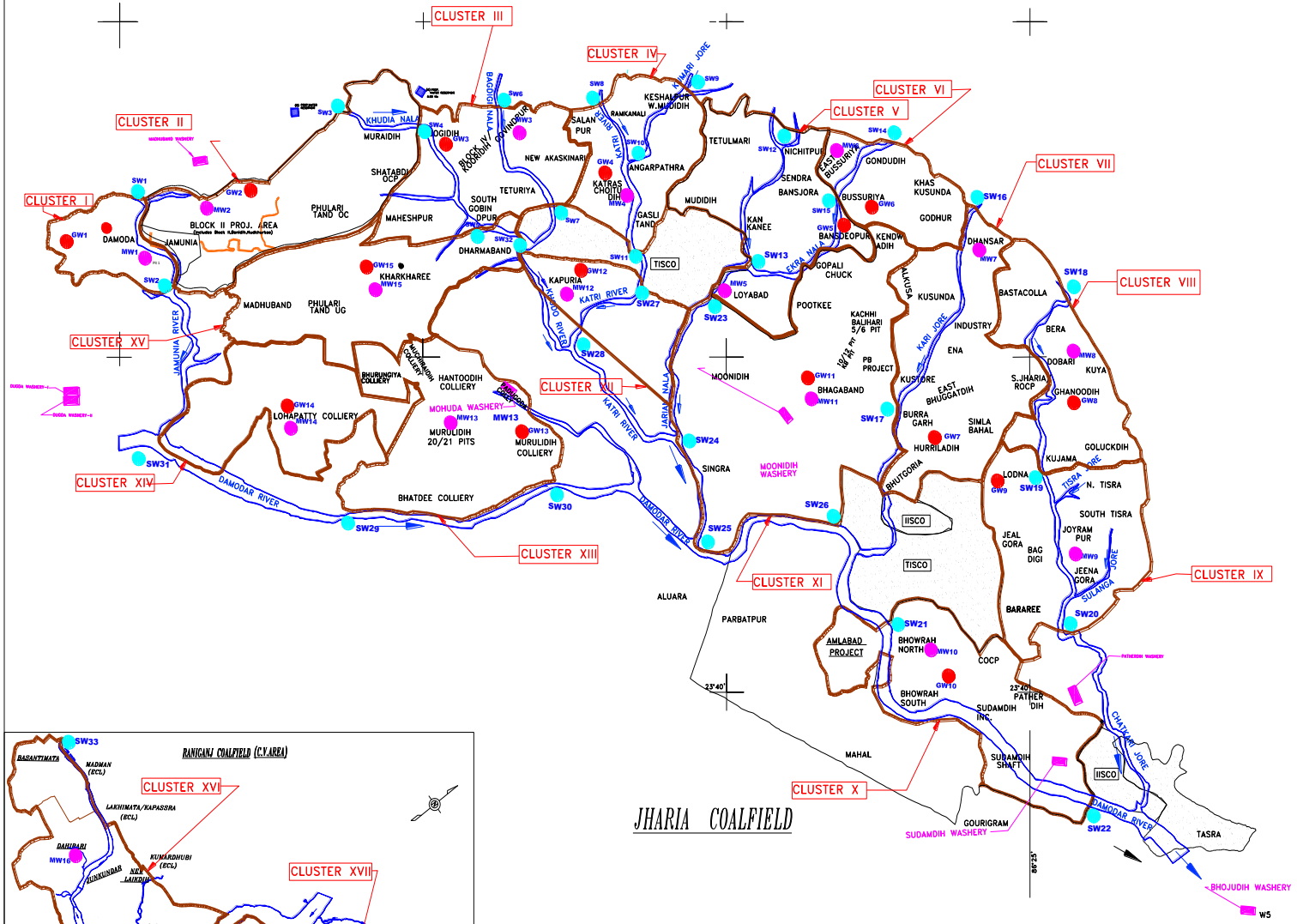
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

NOTE: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigations.

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ghutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogidih Village
IV	SW8, SW11, SW9, SW10	Katri River, Kumari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhansar UGP	GW7	Hurriladih
VIII	SW18, SW19	Kashi Jore	MW8	Dobari UGP	GW8	Ghanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband h UGP	GW11	Bhagabandh
XII	SW27, SW28	Katri River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Murulidih (20/21)	GW13	Murilidih
XIV	SW31, SW29	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudia Nala	MW15	Kharkharee UGP	GW15	Kharkharee
XVI	SW33, SW34	Khudia River	MW16	Dahibari OCP	GW16	Patlabari Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptoria

HoD (Envt.)
Bharat Coking Coal Limited
(Signature)

Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)

Legend
- Sampling Locations of Surface Water (Upstream/ Downstream)
- Sampling Locations of Mine Water
- Sampling Locations of Ground/ Drinking Water

Customer	BHARAT COKING COAL LIMITED
Title	WATER SAMPLING LOCATIONS
Subject	MONITORING STATIONS
CMPDI (ISO 9001 Company)	Scale: Not to Scale

CLUSTER - IX

(FOR THE Q.E. DECEMBER, 2020)

CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.		EXECUTIVE SUMMARY
2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
4.	**Plates:** Plate. No. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

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WATER QUALITY REPORT
OF
BHARAT COKING COAL LIMITED
CLUSTER – IX

(FOR THE Q.E. DECEMBER, 2020)

E. C. no. J-11015/307/2010-IA.II (M) dated 01.03.2018

CMPDI

ISO 9001 Company

Regional Institute-II

Dhanbad, Jharkhand

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the environment around us. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. One of these major attributes is water.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEFCC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Water sampling stations

The Water sampling stations were selected for mine effluent water, drinking water supply, well/ Hand pump water & also surface water samples.

2.2 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

3.0 Methodology of sampling and analysis

3.1 Water quality

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis & for 27 parameters on half yearly basis. The drinking and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI RI-II, Dhanbad

3.2 Heavy Metal in Ambient Air

Parameters chosen for assessment of Heavy metal in Ambient Air Quality were cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr), Nickel (Ni), and Lead (Pb). Respirable Dust Samplers (RDS) & fine particulates for PM 2.5 sampler were used for sampling PM 10 & PM 2.5 respectively. These heavy metals are analyzed regularly on half yearly basis. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad

4.0 Results and interpretations

4.1 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, IS.10500/2012 (Drinking water) and IS: 2296 (Surface water), are with in permissible limits.

4.2 Heavy Metal in Ambient Air

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

CHAPTER - I

INTRODUCTION

1.0 Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

Bharat Coking Coal Limited (BCCL), a subsidiary company of Coal India Limited (CIL) is operating UG Mines and Opencast Mines in Jharia Coalfield (JCF). The Jharia Coalfield (JCF) having an area of 450 Sq.KM.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster-IX is in the Eastern part of the Jharia coalfield. It includes a group of 6 Mines (viz. Lodna UG, Bagdigi UG, Joyrampur UG, Bararee UG, Jealgora UG,NT/ST Expan.OCP. The Cluster – IX is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – IX are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage pattern of the area is governed by Kashi Jore.

1.2 The Cluster-IX is designed to produce 6.548 MTPA (normative) and 8.512 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 6.548 MTPA (normative) and 8.512 MTPA (peak) capacity of coal production vide letter no. J-11015/307/2010-IA.II (M) dated 1st March, 2018.

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MoEF&CC & SPCB and other statutory authorities.

CHAPTER – II

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.2 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Jeenagora (A13) : Industrial Area

The location of the sampling station is 23^0 42' 31.00'' N & 86^0 25' 48.00'' E.

II. BUFFER ZONE Monitoring Location

i) Kusmatand Village (A12): Industrial Area

The location of the sampling station is $23^0$45' 4.65'' N & 86^0 26' 42.10'' E.

ii) Bhowrah North (A14): Industrial Area

The location of the sampling station is 23^o41' 37.00'' N & 86^o23' 54.00''E.

Iii) Hurriladih UGP (A28): Industrial Area

The location of the sampling station is $23^0$44' 4.18'' N & 86^0 24' 6.21'' E.

2.3 Results and interpretations

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

AMBIENT AIR QUALITY DATA

Name of the Company: **Bharat Coking Coal Limited** Year :2020-21

Name of the Cluster : **Cluster -IX** PERIOD: **Q. E. DEC- 2020.**

Heavy Metal Analysis report of Ambient Air Quality

SAMPLE	Cadmium(Cd) (µg/m3)	Mercury(Hg) (µg/m3)	Arsenic(As) (ng/m3)	Chromium(Cr) (µg/m3)	Nickel (Ni) (ng/m3)	Lead (Pb) (µg/m3)
Kusmatand Village (A12)	<0.001	<0.001	<0.005	<0.01	<0.1	0.006
Jeenagora (A13)	<0.001	<0.001	<0.005	<0.01	<0.1	0.005
Bhowrah North (A14)	<0.001	<0.001	<0.005	<0.01	<0.1	0.008
Hurriladih UGP (A28)	<0.001	<0.001	<0.005	<0.01	<0.1	0.018

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RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

CHAPTER – II

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. - I**)

i) Drinking Water quality at **Lodna (DW9)**
ii) Surface Water quality at **U/S of Kashi Jore (SW19)**
iii) Surface quality at **D/S of Kashi Jore (SW20)**
iv) Mine Effluent at **Jeenagora (MW9)**

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis & for 27 parameters on half yearly basis. The drinking and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results show that most of the parmeters are within the permissible limits.

WATER QUALITY

WATER QUALITY

(SURFACE WATER- 17 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : 2020-21

Name of the Cluster: **Cluster - IX** Period: **Q. E. DEC, 2020.**

Cluster IX

Stations:

1. Upstream in Kashi Jore SW-19
2. Downstream in Kashi Jore SW-20

Date of Sampling:

28/12/2020

28/12/2020

Sl. No	Parameter	Sampling Stations				IS: 2296	Detection Limit	BIS Standard & Method
		SW19 28.12.2020	SW20 28.12.2020					
1	Arsenic (as As), mg/l, Max	<0.006	<0.006			0.2	0.006	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA
2	BOD (3 days 27°C), mg/l, Max	3.1	2.7			3.00	2.00	IS 3025 (Part 44) : 1993 Reaffirmed 2019 , 3 day incubation at 27°C
3	Colour	Colourless	Colourless			300	Qualitative	Physical/Qualitative
4	Chlorides (as Cl), mg/l, Max	74	84			600	2.00	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.2	<0.2			1.5	0.2	IS 3025/42 : 1992 R : 2019, AAS-Flame
6	Dissolved Oxygen, min.	3.7	4.2			4	0.10	IS 3025 (Part 38) : 1989, Reaffirmed 2019 Modified Winkler Azide Method
7	Fluoride (as F) mg/l, Max	0.87	0.85			1.5	0.02	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
8	Hexavalent Chromium, mg/l, Max	<0.01	<0.01			0.05	0.01	IS 3025 (Part 52) : 2003,Reaffirmed 2019
9	Iron (as Fe), mg/l, Max	<0.2	<0.2			50	0.2	IS 3025 /53 : 2003,R : 2019 , AAS-Flame Method
10	Lead (as Pb), mg/l, Max	<0.005	<0.005			0.1	0.005	APHA, 23rd Edition, AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	7.09	7.73			50	0.50	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	pH value	7.61	7.59			6.5-8.5	2.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
13	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.002	<0.002			0.005	0.002	APHA, 22nd Edition 4-Amino Antipyrine
14	Selenium, mg/l, Max	<0.007	<0.007			0.05	0.007	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA
15	Sulphate (as SO_4) mg/l, Max	247	159			400	2.00	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
16	Total Dissolved Solids, mg/l, Max	710	794			1500	25.00	IS 3025, Part 16: 1984 R 2017 Gravimetric method
17	Zinc (as Zn), mg/l, Max	<0.1	<0.1			15	0.1	IS 3025/ 49 : 1994, R : 2019, AAS-Flame

*All values are expressed in mg/lit unless specified.

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JSA/SA/SSA

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RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER QUALITY

(DRINKING WATER- 25 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : 2020-21**.**

Name of the Cluster: **Cluster - IX** Period: **Q.E.DEC, 2020.**

Stations: **Date of Sampling:**

1. Drinking Water from Lodna DW-9 23/11/2020

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		DW09 **23.11.20**					
1	Boron (as B), mg/l, Max	<0.2			0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3			1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	66			1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	91			2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03			0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	<0.2			0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04			0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2			0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005			0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	0.12			0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	16.94			0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable			Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.28			0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001			0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007			0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	122			10	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable			Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	188			4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006			0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04			0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	456			25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_ac_{03}), mg/l, Max	246			4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2			1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1			0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01			0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER QUALITY

(MINE WATER- 27 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : 2020-21

Name of the Cluster: **Cluster - IX** Period: **Q.E.DEC, 2020.**

Effluent water of BCCL Mines					**Date of Sampling:**
Sample Code : Mine Water Discharge Jeenagora MW-9					07.12.2020
Sl.No.	**Parameter**	**Results**	**Detection Limit**	**MOEF -SCH-VI STANDARDS Class 'A'**	**BIS Standard & Method**
1	Ammonical Nitrogen, mg/l, Max	0.06	0.02	50.0	IS 3025/34:1988, R : 2009, Nessler's
2	Arsenic (as As), mg/l, *Max*	<0.006	0.006	0.2	IS 3025, part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA
3	B.O.D (3 days 27°C), mg/l, Max	<2.0	2.00	30.0	IS 3025 /44:1993,R:2003 3 day incubation at 27°C
4	Colour	Colourless	Qualitative	Qualitative	Physical/Qualitative
5	COD, mg/l, Max	20	4.00	250.0	APHA 23rd Edition 5220 C Titrimetric Method
6	Copper (as Cu), mg/l, *Max*	<0.2	0.2	3.0	IS 3025(Part42): 1992 R : 2019, AAS-Flame
7	Dissolved Phosphate (as P), mg/l, Max	<0.3	0.30	5.0	IS 3025/ 31, 1988 R 2019
8	Fluoride (as F) mg/l, *Max*	0.94	0.2	2.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
9	Free Ammonia, mg/l, Max	<0.01	0.01	5.0	IS:3025/34:1988, Nesseler's
10	Hexavalent Chromium, mg/l, Max	<0.01	0.01	0.1	IS 3025 (Part 52) : 2003,Reaffirmed 2019
11	Iron (as Fe), mg/l, *Max*	<0.2	0.2	3.0	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame
12	Lead (as Pb), mg/l, *Max*	<0.005	0.005	0.1	APHA, 23rd Edition, AAS-GTA
13	Manganese(as Mn), mg/l, Max	<0.2	0.2	2.0	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame
14	Nickel (as Ni), mg/l, *Max*	<0.1	0.1	3.0	IS-3025(Part 54):2003, R:2019 AAS-Flame
15	Nitrate Nitrogen, mg/l, *Max*	1.48	0.50	10.0	APHA, 23 rd Edition,UV-Spectrphotometric
16	Oil & Grease, mg/l, Max	<2.0	2.00	10.0	IS 3025/39:1991, R : 2019, Partition Gravimetric
17	pH value	7.94	2.5	5.5 to 9.0	IS-3025/11:1983, R-2017, Electrometric
18	Phenolic compounds (as C_6H_5OH),mg/l, *Max*	<0.002	0.002	1.0	APHA, 23rd Edition 4-Amino Antipyrine
19	Selenium, mg/l, Max	<0.007	0.007	0.05	IS 3025, part 56:2003, R-2019/APHA 23rd Edition, AAS-VGA
20	Sulphide (as S^{2-}) mg/l Max.	<0.005	0.005	2.0	APHA 23rd Edition Methylene Blue Method
21	Temperature (°C)	26.3	Shall not exceed 5^0 C above the receiving temp.		IS-3025/09:1984, Thermometeric
22	Total Chromium (as Cr), mg/l, *Max*	<0.1	0.1	2.0	IS-3025(Part 52):2003, R:2019 AAS-Flame
23	Total Kjeldahl Nitrogen, mg/l, Max	1.4	1.00	100.0	IS:3025/34:1988, Nesseler's
24	Total Residual Chlorine, mg/l, Max	<0.04	0.04	1.0	APHA, 23rd Edition, , 4500-Cl B. (Iodometric Method-I)
25	Total Suspended Solids, mg/l, Max	23	10.00	100.0	IS 3025/17:1984, R :2017, Gravimetric
26	Zinc (as Zn), mg/l, *Max*	<0.1	0.1	5.0	IS 3025 /49 : 1994, R : 2019, AAS-Flame
27	Odour	Agreeable	Agreeable	Qualitative	APHA, 23rd Edition, , 2150-C

All values are expressed in mg/lit unless specified.*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. **Jeenagora (N13)**
2. **Kusmatand Village (N12)**
3. **Bhowrah North (N14)**
4. **Hurriladih UGP (N28)**

4.2 Methodology of sampling and analysis - Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L_{EQ} are presented. The observed values at all the monitoring locations are found to be within permissible limits.

NOISE LEVEL DATA

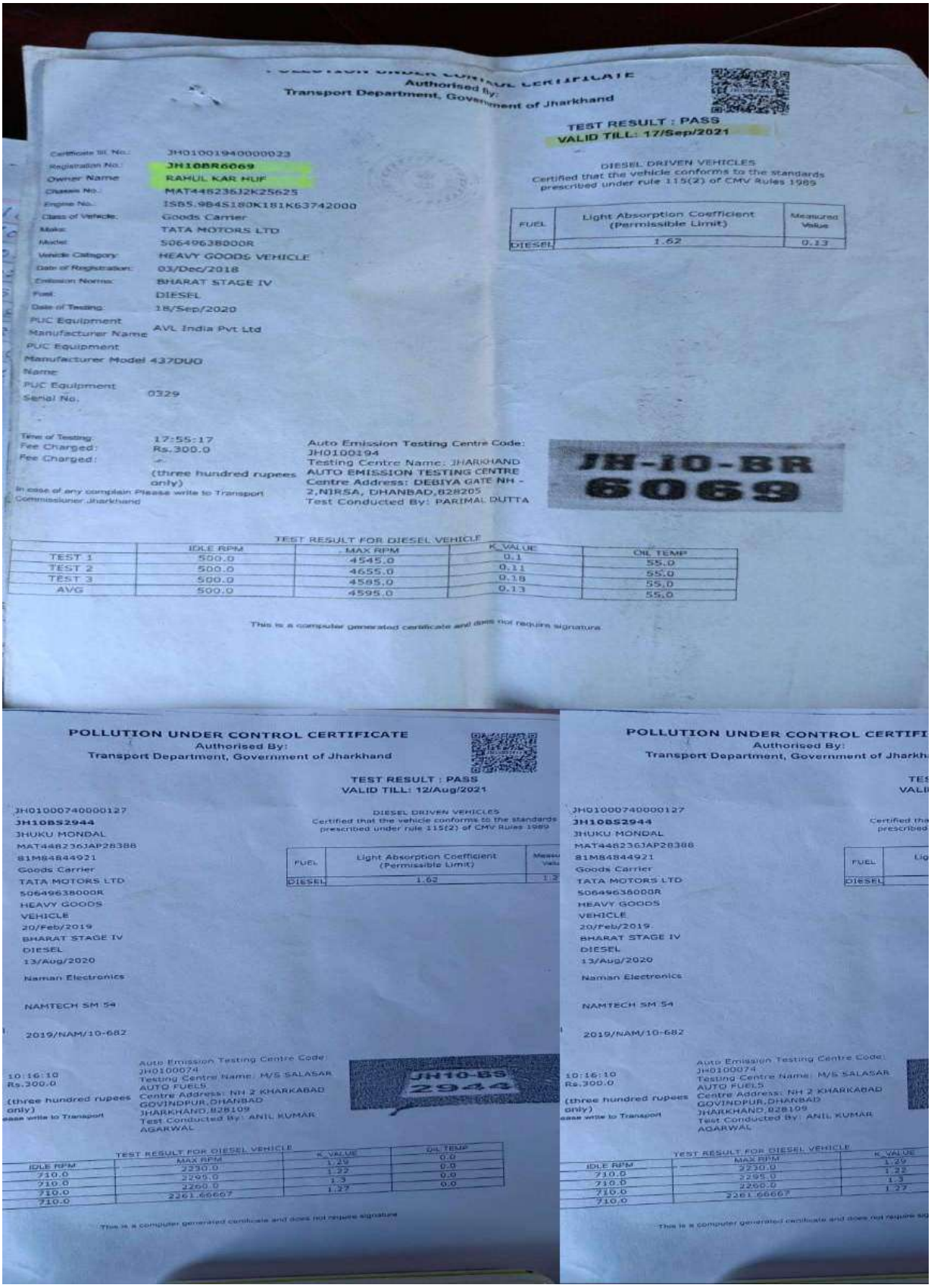
Name of the Project: **Cluster -IX**			Month: **MAR,2021**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	**Kusmatand Village (N12)**	**Residential area**	11.03.2021	54.2	*55*
2	**Kusmatand Village (N12)**	**Residential area**	25.03.2021	53.8	*55*
3	**Jeenagora (N13)**	**Industrial area**	11.03.2021	57.7	*75*
4	**Jeenagora (N13)**	**Industrial area**	25.03.2021	57.4	*75*
5	**Bhowrah North(N14)**	**Industrial area**	04.03.2021	55.2	*75*
6	**Bhowrah North(N14)**	**Industrial area**	22.03.2021	55.7	*75*
7	**Hurriladih UGP (N28)**	**Industrial area**	02.03.2021	56.2	*75*
8	**Hurriladih UGP (N28)**	**Industrial area**	18.03.2021	56.1	*75*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.
*** Day Time: 6.00 AM to 10.00 PM.**

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad



POLLUTION UNDER CONTROL CERTIFICATE
Authorised By:
Transport Department, Government of Jharkhand

TEST RESULT : PASS
VALID TILL: 17/Sep/2021

Certificate Sl. No.:	JH01001940000023
Registration No.:	JH10BR6069
Owner Name	RAHUL KAR HUF
Chassis No.:	MAT448236J2K25625
Engine No.:	ISB5.9B4S180K181K63742000
Class of Vehicle:	Goods Carrier
Make:	TATA MOTORS LTD
Model:	50649638000R
Vehicle Category:	HEAVY GOODS VEHICLE
Date of Registration:	03/Dec/2018
Emission Norms:	BHARAT STAGE IV
Fuel:	DIESEL
Date of Testing:	18/Sep/2020
PUC Equipment Manufacturer Name	AVL India Pvt Ltd
PUC Equipment Manufacturer Model Name	437DUO
PUC Equipment Serial No.	0329

DIESEL DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989

FUEL	Light Absorption Coefficient (Permissible Limit)	Measured Value
DIESEL	1.62	0.13

Time of Testing: 17:55:17
Fee Charged: Rs.300.0
Fee Charged: (three hundred rupees only)

In case of any complain Please write to Transport Commissioner Jharkhand

Auto Emission Testing Centre Code: JH0100194
Testing Centre Name: JHARKHAND AUTO EMISSION TESTING CENTRE
Centre Address: DEBIYA GATE NH - 2,NIRSA, DHANBAD,828205
Test Conducted By: PARIMAL DUTTA

JH-10-BR 6069

TEST RESULT FOR DIESEL VEHICLE

	IDLE RPM	MAX RPM	K VALUE	OIL TEMP
TEST 1	500.0	4545.0	0.1	55.0
TEST 2	500.0	4655.0	0.11	55.0
TEST 3	500.0	4595.0	0.18	55.0
AVG	500.0	4595.0	0.13	55.0

This is a computer generated certificate and does not require signature

POLLUTION UNDER CONTROL CERTIFICATE
Authorised By:
Transport Department, Government of Jharkhand

TEST RESULT : PASS
VALID TILL: 12/Aug/2021

JH01000740000127
JH10BS2944
JHUKU MONDAL
MAT448236JAP28388
81M84844921
Goods Carrier
TATA MOTORS LTD
50649638000R
HEAVY GOODS VEHICLE
20/Feb/2019
BHARAT STAGE IV
DIESEL
13/Aug/2020
Naman Electronics
NAMTECH SM 54
2019/NAM/10-682

DIESEL DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989

FUEL	Light Absorption Coefficient (Permissible Limit)	Measu Valu
DIESEL	1.62	1.2

10:16:10
Rs.300.0
(three hundred rupees only)
ease write to Transport

Auto Emission Testing Centre Code: JH0100074
Testing Centre Name: M/S SALASAR AUTO FUELS
Centre Address: NH 2 KHARKABAD GOVINDPUR,DHANBAD JHARKHAND,828109
Test Conducted By: ANIL KUMAR AGARWAL

JH10-BS 2944

TEST RESULT FOR DIESEL VEHICLE

IDLE RPM	MAX RPM	K VALUE	OIL TEMP
710.0	2230.0	1.29	0.0
710.0	2295.0	1.22	0.0
710.0	2260.0	1.3	0.0
710.0	2261.66667	1.27	0.0
710.0			

This is a computer generated certificate and does not require signature

POLLUTION UNDER CONTROL CERTIFI
Authorised By:
Transport Department, Government of Jharkh

TES
VALI

JH01000740000127
JH10BS2944
JHUKU MONDAL
MAT448236JAP28388
81M84844921
Goods Carrier
TATA MOTORS LTD
50649638000R
HEAVY GOODS VEHICLE
20/Feb/2019
BHARAT STAGE IV
DIESEL
13/Aug/2020
Naman Electronics
NAMTECH SM 54
2019/NAM/10-682

Certified tha prescribed

FUEL	Lig
DIESEL	

10:16:10
Rs.300.0
(three hundred rupees only)
ease write to Transport

Auto Emission Testing Centre Code: JH0100074
Testing Centre Name: M/S SALASAR AUTO FUELS
Centre Address: NH 2 KHARKABAD GOVINDPUR,DHANBAD JHARKHAND,828109
Test Conducted By: ANIL KUMAR AGARWAL

TEST RESULT FOR DIESEL VEHICLE

IDLE RPM	MAX RPM	K VALUE
710.0	2230.0	1.29
710.0	2295.0	1.3
710.0	2260.0	1.27
710.0	2261.66667	
710.0		

This is a computer generated certificate and does not require sig

POLLUTION UNDER CONTROL CERTIFICATE

Authorised By:
Transport Department, Government of Jharkhand

TEST RESULT : PASS
VALID TILL: 02/Jun/2021

Certificate Sl. No.:	JH01000740000007
Registration No.:	**JH10BF4903**
Owner Name:	KAMESHWAR OJHA
Chassis No.:	MAT448187H3D10285
Engine No.:	ISBE5.9180407ID63593146
Class of Vehicle:	Goods Carrier
Make:	TATA MOTORS LTD.
Model:	5007893830OR
Vehicle Category:	HEAVY GOODS VEHICLE
Date of Registration:	07/Jun/2017
Emission Norms:	BHARAT STAGE IV
Fuel:	DIESEL
Date of Testing:	03/Jun/2020
PUC Equipment Manufacturer Name:	Naman Electronics
PUC Equipment Manufacturer Model Name:	NAMTECH SM 54
PUC Equipment Serial No.:	2019/NAM/10-682

DIESEL DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989

FUEL	Light Absorption Coefficient (Permissible Limit)	Measured Value
DIESEL	1.62	0.78334

Time of Testing: 13:04:57
Fee Charged: Rs.300.0
Fee Charged: (Three hundred rupees only)

In case of any complain Please write to Transport Commissioner Jharkhand

Auto Emission Testing Centre Code: JH0100074
Testing Centre Name: M/S SALASAR AUTO FUELS
Centre Address: NH 2 KHARKABAD GOVINDPUR,DHANBAD JHARKHAND,828109
Test Conducted By: ANIL KUMAR AGARWAL



TEST RESULT FOR DIESEL VEHICLE

	IDLE RPM	MAX RPM	K_VALUE	OIL TEMP
TEST 1	640.0	2160.0	0.78	0.0
TEST 2	640.0	2195.0	0.81	0.0
TEST 3	650.0	2195.0	0.76	0.0
AVG	643.33334	2183.3333	0.78334	0.0

This is a computer generated certificate and does not require signature

POLLUTION UNDER CONTROL CERTIFICATE

Authorised By:
Transport Department, Government of Jharkhand

TEST RESULT : PASS
VALID TILL: 12/Apr/2021

Certificate Sl. No.:	JH01001740000129
Registration No.:	**JH10AE4041**
Owner Name:	PANKAJ KUMAR
Chassis No.:	MAT448099C3806827
Engine No.:	BS91803121B6323949
Class of Vehicle:	Goods Carrier
Make:	TATA MOTORS LTD
Model:	LPK2518
Vehicle Category:	HEAVY GOODS VEHICLE
Date of Registration:	18/May/2012
Emission Norms:	BHARAT STAGE III
Fuel:	DIESEL
Date of Testing:	13/Oct/2020
PUC Equipment Manufacturer Name:	135YS
PUC Equipment Manufacturer Model Name:	FCM1601
PUC Equipment Serial No.:	C0002

DIESEL DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989

FUEL	Light Absorption Coefficient (Permissible Limit)	Measu Valu
DIESEL	2.45	0.16

Time of Testing: 16:58:42
Fee Charged: Rs.300.0
Fee Charged: (three hundred rupees only)

In case of any complain please write to Transport Commissioner, Jharkhand

Auto Emission Testing Centre Code: JH0102174
Testing Centre Name: ADITYA MULTICOM PVT LTD
Centre Address: GT ROAD,NH 2,KHARKHARKHAND,826004
Test Conducted By: SATISH KUMAR SINGH

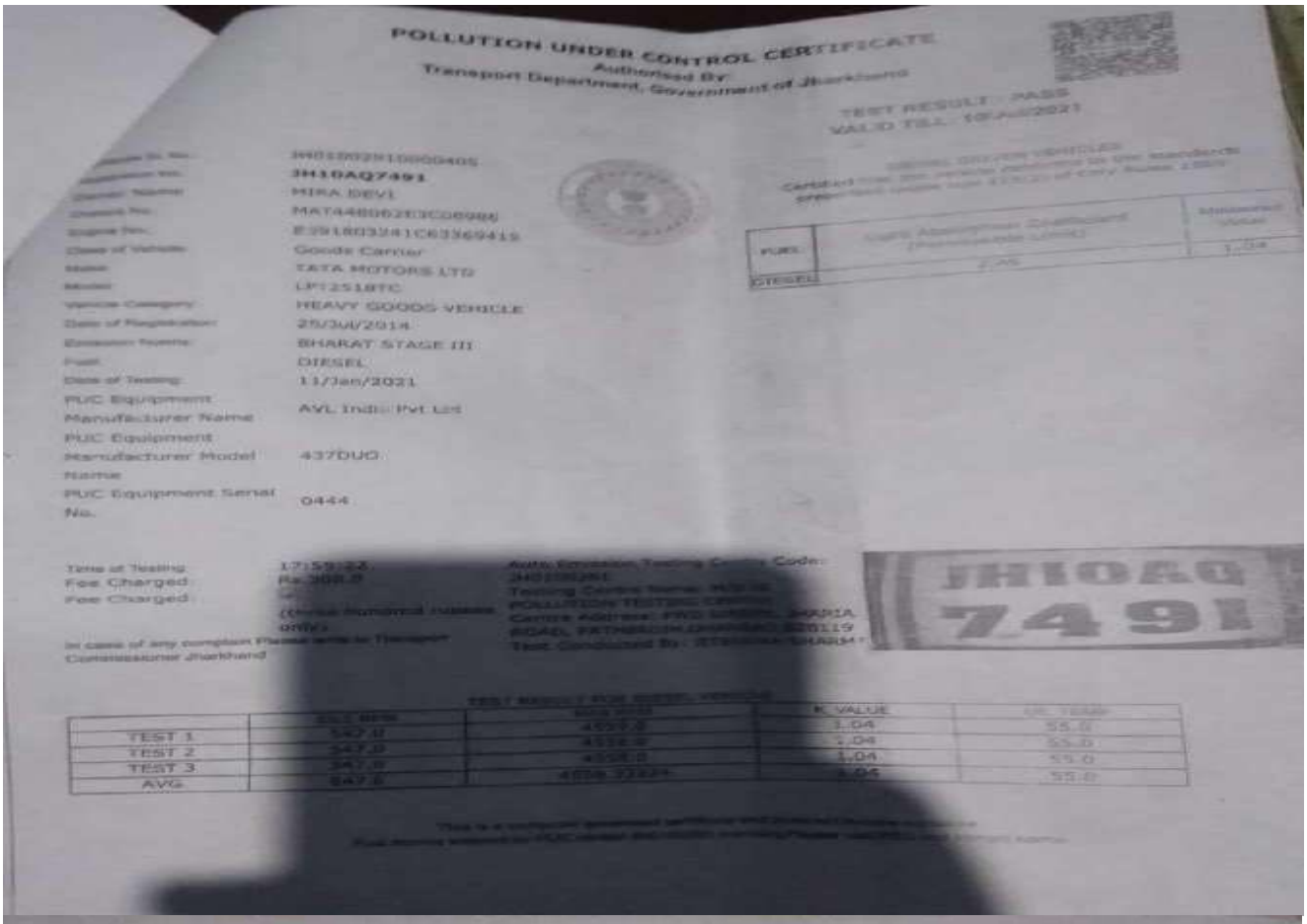


TEST RESULT FOR DIESEL VEHICLE

	IDLE RPM	MAX RPM	K_VALUE	OIL TEMP
TEST 1	624.0	2281.0	0.215	27.0
TEST 2	622.0	2281.0	0.089	27.0
TEST 3	631.0	2327.0	0.197	27.0
AVG	625.0	2263.0	0.168	27.0

This is a computer generated certificate and does not require signature

For Name Change by PUC centre Jharkhand, kindly change your RTO and correct name



POLLUTION UNDER CONTROL CERTIFICATE

Authorised By

Transport Department, Government of Jharkhand

TEST RESULT : PASS

VALID TILL : 12/Jul/2021

	JH10AQ7491
	HIRA DEVI
	MAT448062E3C06988
	E291B03241C63369415
Class of Vehicle	Goods Carrier
	TATA MOTORS LTD
	LPT2518TC
Vehicle Category	HEAVY GOODS VEHICLE
Date of Registration	25/Jul/2014
Emission Norms	BHARAT STAGE III
Fuel	DIESEL
Date of Testing	11/Jan/2021
PUC Equipment Manufacturer Name	AVL India Pvt Ltd
PUC Equipment Manufacturer Model Name	437DUO
PUC Equipment Serial No.	0444

FUEL	Light Absorption Coefficient (Permissible Limit)	Measured Value
DIESEL	2.45	1.04

			K VALUE	
TEST 1	547.0	4597.0	1.04	55.0
TEST 2	547.0	4516.0	1.04	55.0
TEST 3	547.0	4598.0	1.04	55.0
AVG	547.0	4570.7333	1.04	55.0

Time of Testing: 17:59:24

Fee Charged: Rs.300.0

Fee Charged: -

(Rupee Rupees only)

In case of any complain Please write to Transport Commissioner Jharkhand

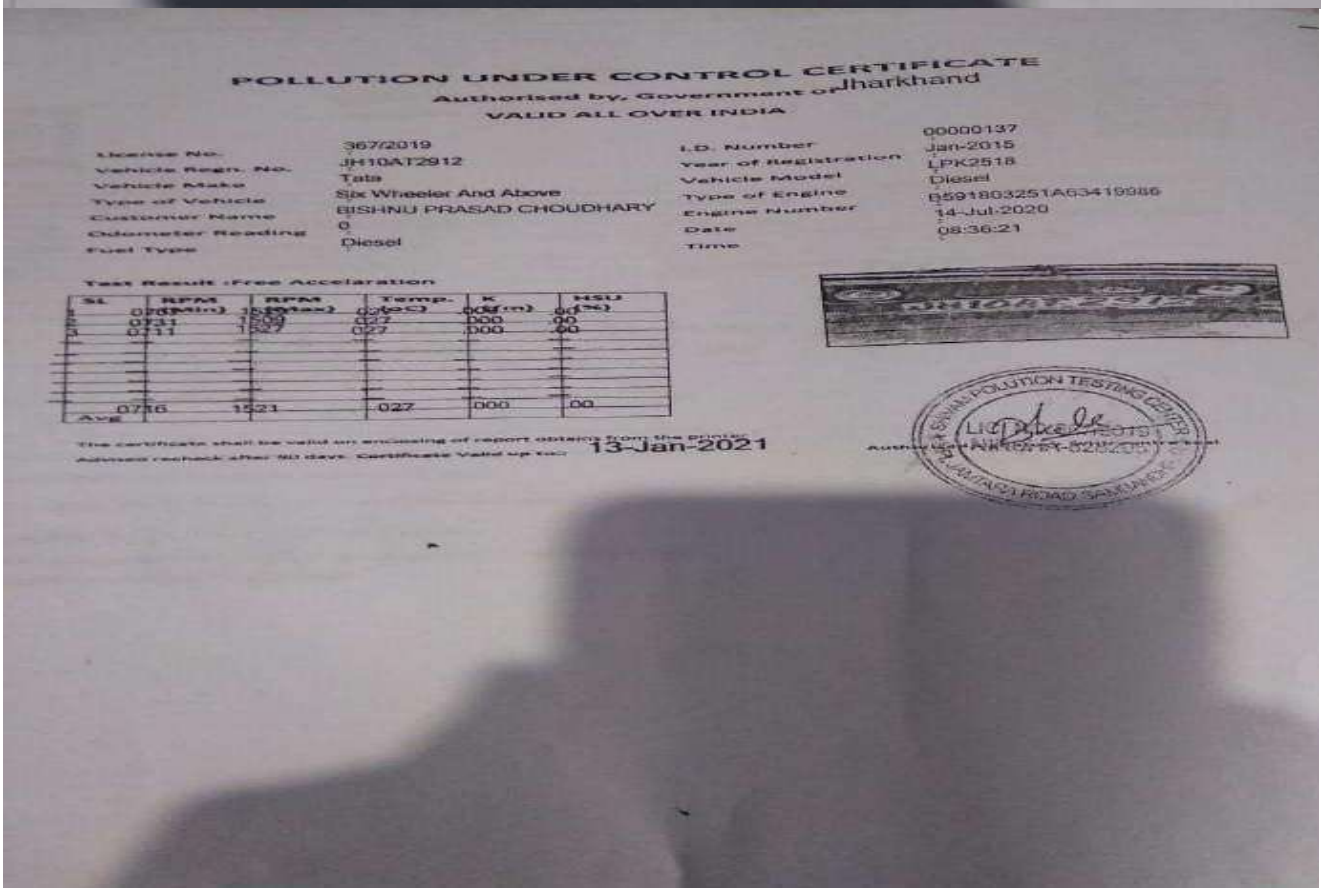
Auth. Emission Testing Centre Code: JH01SE061

Testing Centre Name: M/S SE POLLUTION TESTING CENTRE

Centre Address: PWD WORKS, JHARIA ROAD, PATHERDIH DHANBAD 828119

Test Conducted By : ATTENDANT SHARMA

JH10AQ 7491



POLLUTION UNDER CONTROL CERTIFICATE

Authorised by, Government of Jharkhand

VALID ALL OVER INDIA

License No.	367/2019	I.D. Number	00000137
Vehicle Regn. No.	JH10AT2912	Year of Registration	Jan-2015
Vehicle Make	Tata	Vehicle Model	LPK2518
Type of Vehicle	Six Wheeler And Above	Type of Engine	Diesel
Customer Name	BISHNU PRASAD CHOUDHARY	Engine Number	65918032S1A63419986
Odometer Reading	0	Date	14-Jul-2020
Fuel Type	Diesel	Time	08:36:21

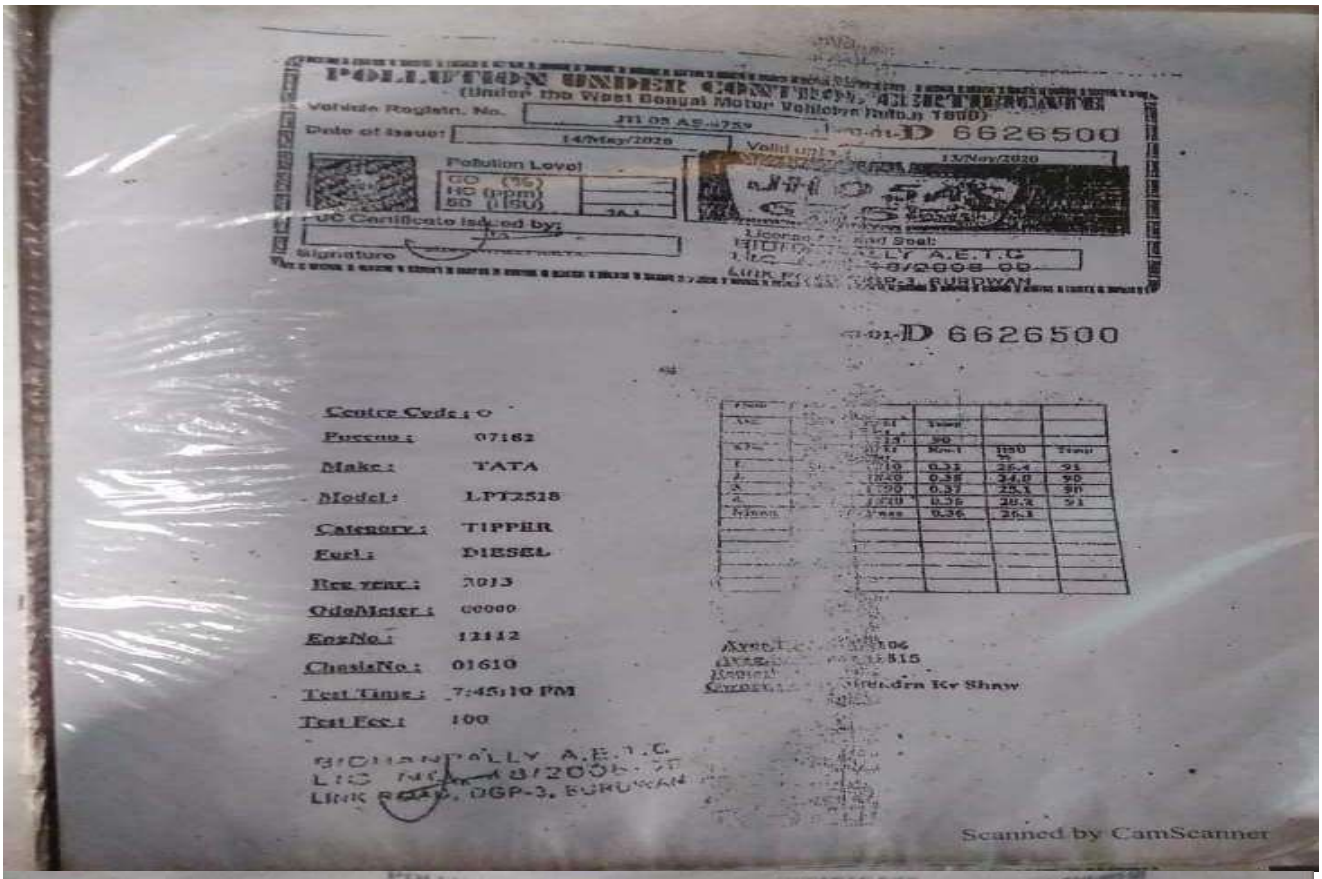
Test Result :Free Accelaration

SL	RPM (Min)	RPM (Max)	Temp. (Deg C)	K (/m)	HSU (%)
1	0731	1529	027	000	00
2	0731	1527	027	000	00
	0716	1521	027	000	00
Ave					

JH10AT2912

SHIVAM POLLUTION TESTING CENTER

The certificate shall be valid on enclosing of report obtains from the printer. Advised recheck after 90 days. Certificate Valid up to:- 13-Jan-2021



POLLUTION UNDER CONTROL CERTIFICATE
(Under the West Bengal Motor Vehicles Rules, 1989)

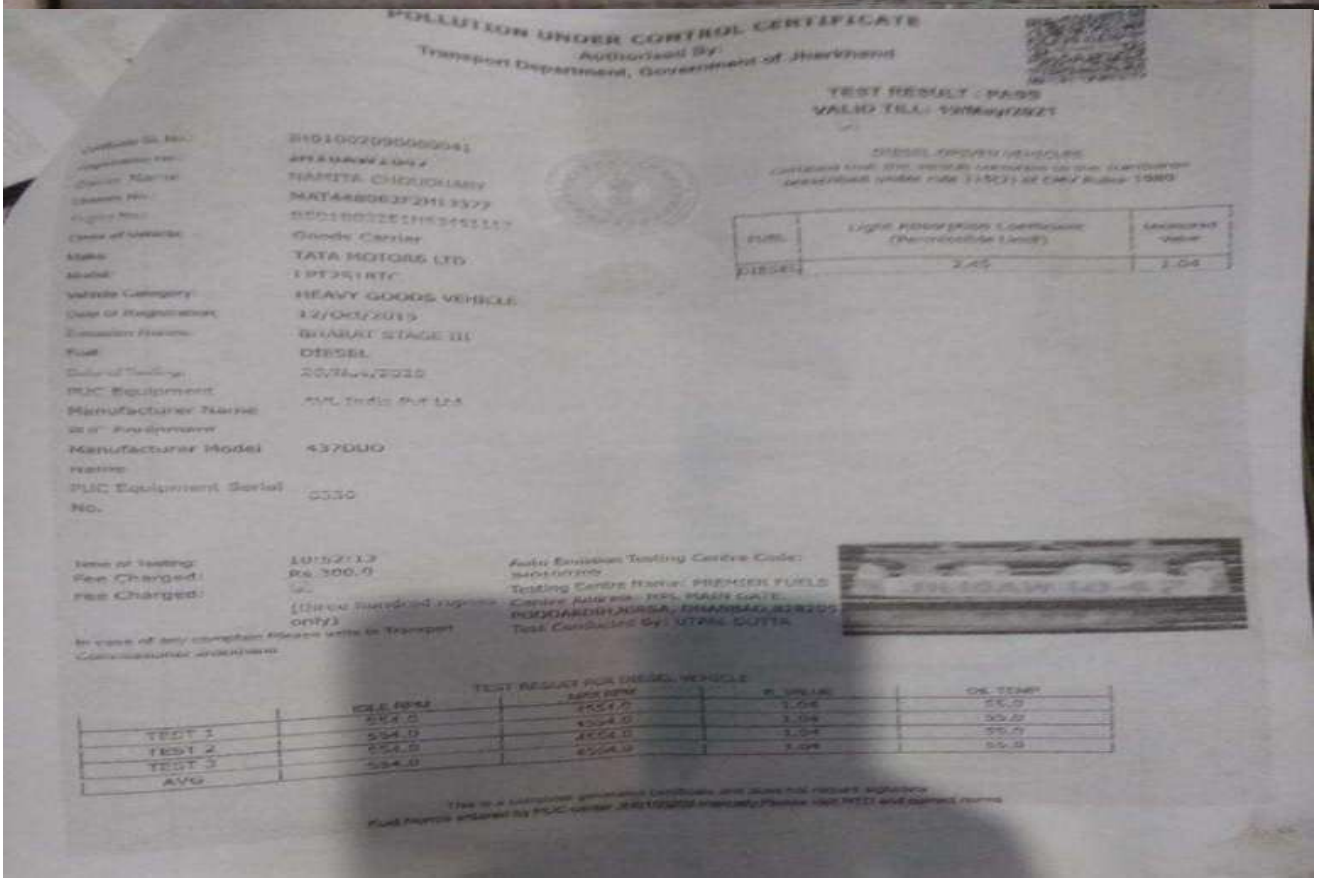
Vehicle Regisn. No. JH 05 AS-4759
Date of Issue: 14/May/2020
Valid upto: 13/Nov/2020
Pollution Level
CO (%)
HC (ppm)
SO (BSU)
PUC Certificate issued by:
Signature
Seal and Seal:

01-D 6626500

Centre Code : 0
Person : 07182
Make : TATA
Model : LPT2518
Category : TIPPER
Fuel : DIESEL
Reg year : 2013
OdoMeter : 00000
EngNo : 12112
ChasisNo : 01610
Test Time : 7:45:10 PM
Test Fee : 100

1	10	0.33	25.4	91
2	1420	0.35	24.0	90
3	1700	0.37	25.1	91
4	1410	0.35	26.3	91
Mean	Mean	0.35	25.1	

Scanned by CamScanner



POLLUTION UNDER CONTROL CERTIFICATE
Authorised By:
Transport Department, Government of Jharkhand

TEST RESULT : PASS
VALID TILL: 19/May/2021

Certificate Sl. No.	810022090000041
Registration No.	JH10AW1067
Owner Name	NAMITA CHOUDHARY
Chassis No.	MAT448083F2H13377
Engine No.	6SD1HO32E1HE31511317
Class of Vehicle	Goods Carrier
Make	TATA MOTORS LTD
Model	LPT2518TC
Vehicle Category	HEAVY GOODS VEHICLE
Date of Registration	12/Oct/2013
Emission Norms	BHARAT STAGE III
Fuel	DIESEL
Date of Testing	20/May/2020
PUC Equipment Manufacturer Name	AVL India Pvt Ltd
PUC Equipment Manufacturer Model Name	437000
PUC Equipment Serial No.	0330
Time of Testing	10:52:13
Fee Charged	Rs 300.0
Fee Charged (In words)	(Three hundred rupees only)
Auto Emission Testing Centre Code	JH010019
Testing Centre Name	PREMIER FUELS
Centre Address	RPL MAIN GATE, BOKAROBOKARO, JHARKHAND,827015
Test Conducted By	UTTAM DUTTA

In case of any complain please write to Transport Commissioner Jharkhand

FUEL	Light Absorption Coefficient (Permissible Limit)	Measured Value
DIESEL	2.45	1.04

TEST RESULT FOR DIESEL VEHICLE

	IDLE RPM	MAX RPM	K VALUE	OIL TEMP
TEST 1	554.0	4554.0	1.04	55.0
TEST 2	554.0	4554.0	1.04	55.0
TEST 3	554.0	4554.0	1.04	55.0
AVG				

This is a computer generated certificate and does not require signature
Fuel Name entered by PUC center JH010019 Harvest Petrol Pvt NTC and signed name

POLLUTION UNDER CONTROL CERTIFICATE

Authorised By:
Transport Department, Government of Jharkhand

TEST RESULT : PASS
VALID TILL: 07/Oct/2021

Certificate Sl. No.	JH01000090002137
Registration No.	JH10AY7329
Owner Name	ANUPAM MUKHERJEE
Chassis No.	MAT448059G2C*****
Engine No.	B591803261C635*****
Class of Vehicle	Goods Carrier
Make	TATA MOTORS LTD
Model	LPK2518
Vehicle Category	HEAVY GOODS VEHICLE
Date of Registration	07/Apr/2016
Emission Norms	BHARAT STAGE III
Fuel	DIESEL
Date of Testing	08/Apr/2021
PUC Equipment Manufacturer Name	Netel (India) Ltd
PUC Equipment Manufacturer Model Name	NPM-SM-111B
PUC Equipment Serial No.	1850

DIESEL DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989

FUEL	Light Absorption Coefficient (Permissible Limit)	Measured Value
DIESEL	2.45	1.16

Time of Testing	12:09:02
Govt Fees	100.0
Center Fees	200.0
Fee Charged:	Rs.300.0
Fee Charged:	(three hundred rupees only)

In case of any complain Please write to Transport Commissioner Jharkhand

Auto Emission Testing Centre Code: JH0100009
Testing Centre Name: SHRI RAM SERVICES
Centre Address: PATHURIA MORE SAHEBGANJ ROAD,GOVINDPUR DHANBAD,828109
Test Conducted By: SANDEEP KUMAR DAS



TEST RESULT FOR DIESEL VEHICLE

	IDLE RPM	MAX RPM	K VALUE	OIL TEMP
TEST 1	730.0	3173.0	1.13	0.0
TEST 2	735.0	3141.0	1.16	0.0
TEST 3	738.0	3184.0	1.19	0.0
AVG	734.33334	3166.0	1.16	0.0

This is a computer generated certificate and does not require signature
Fuel Norms entered by PUC center JH01100183 manually,Please visit RTO and correct norms

POLLUTION UNDER CONTROL CERTIFICATE

Authorised By:
Transport Department, Government of Jharkhand

TEST RESULT : PASS
VALID TILL: 18/Jul/2021

	JH01002910000427
	JH10AT6328
	M/S JAY MAA TARA ENTERPRISES
	MAT448062F2A01653
	B591803251A6D420356
	Goods Carrier
	TATA MOTORS LTD
	LPK2518
Vehicle Category	HEAVY GOODS VEHICLE
Date of Registration	11/Mar/2015
Emission Norms	BHARAT STAGE III
Fuel	DIESEL
Date of Testing	19/Jan/2021
PUC Equipment Manufacturer Name	AVL India Pvt Ltd
PUC Equipment Manufacturer Model Name	437DUO
PUC Equipment Serial No.	0444

DIESEL DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989

FUEL	Light Absorption Coefficient (Permissible Limit)	Measured Value
DIESEL	2.45	1.04

Time of Testing	10:19:04
Fee Charged:	Rs.300.0
Fee Charged:	(three hundred rupees only)

In case of any complain Please write to Transport Commissioner Jharkhand

Auto Emission Testing Centre Code: JH0100291
Testing Centre Name: M/S JA
POLLUTION TESTING CENTRE
Centre Address: PWD SINDRI, DHANBA
ROAD, PATHERDIH,DHANBAD,828122 (J
Test Conducted By: SIDDIKKA SHABAN



TEST RESULT FOR DIESEL VEHICLE

	IDLE RPM	MAX RPM	K VALUE	OIL TEMP
TEST 1	547.0	4357.0	1.04	55.0
TEST 2	546.0	4356.0	1.04	55.0
TEST 3	547.0	4356.0	1.04	55.0
AVG	546.66667	4356.3174	1.04	55.0

This is a computer generated certificate and does not require signature
Fuel Norms entered by PUC center JH01100183 manually,Please visit RTO and correct norms

POLLUTION UNDER CONTROL CERTIFICATE

Authorised By:

Transport Department, Government of Jharkhand

TEST RESULT : PASS

VALID TILL: 15/May/2021

Certificate SL No.:	JH01000530000262
Registration No.:	**JH10BB4903**
Owner Name	MIRA DEVI
Chassis No.:	MAT448059G2H19599
Engine No.:	B591803261H63541739
Class of Vehicle:	Goods Carrier
Make:	TATA MOTORS LTD
Model:	LPK2518
Vehicle Category:	HEAVY GOODS VEHICLE
Date of Registration:	05/Oct/2016
Emission Norms:	BHARAT STAGE III
Fuel:	DIESEL
Date of Testing:	16/Nov/2020
PUC Equipment Manufacturer Name	MARS Technologies Inc
PUC Equipment Manufacturer Model Name	SM05
PUC Equipment Serial No.	SM 744

DIESEL DRIVEN VEHICLES

Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989

FUEL	Light Absorption Coefficient (Permissible Limit)	Measured Value
DIESEL	2.45	0.65334

Time of Testing: 13:58:08

Fee Charged: Rs.300.0

Fee Charged: (three hundred rupees only)

In case of any complain Please write to Transport Commissioner Jharkhand

Auto Emission Testing Centre Code: JH0100053

Testing Centre Name: M/S COAL FIELD PETROL SERVICE STATION

Centre Address: M/S COAL FIELD PETROL SERVICE STATION,BHAGA,828301

Test Conducted By: SOUMITRO MUKHERJEE



TEST RESULT FOR DIESEL VEHICLE

	IDLE RPM	MAX RPM	K_VALUE	OIL TEMP
TEST 1	635.0	2050.0	0.64	0.0
TEST 2	630.0	2030.0	0.68	0.0
TEST 3	645.0	2070.0	0.64	0.0
AVG	636.66667	2050.0	0.65334	0.0

This is a computer generated certificate and does not require signature

Fuel Norms entered by PUC center JH0100053 manually,Please visit RTO and correct norms

1.

Statement Showing Escrow Accounts details				
Name of Subsidiary	Sl.No	Name of Block/Mine	Escrow A/c No.	Total amount in Escrow fund till 31st March 2021 (in Rs. lakhs)
BCCL	1.	NT-ST-JG GROUP OF MINES	**00150100009046**	**4607.35**
	2.	JOYRAMPUR UG MINES	**00150100009049**	**60.11**
	3.	BARAREE COLLIERY	**00150100008940**	**381.36**
	4.	LODNA COLLIERY	**00150100008942**	**180.12**
	5.	KUJAMA COLLIERY	**00150100008941**	**545.42**
	6.	Amal. Joyrampur OC	**00150100011026**	**2644.43**

2. Environmental Monitoring: **Rs.**10.76 Lakhs/year
3. Maintenance of Gokul park- **Rs.**1.2 lakh/year
4. CTE of NT-ST-JG GROUP OF MINES- **Rs.**8,33,280.00
5. CTO (upto March'23) of NT-ST-JG GROUP OF MINES- **Rs.**10,99,882.00
6. CTE of Amal. Joyrampur OC- **Rs.**75,000.00
7. CTO (upto June'22) of Amal. Joyrampur OC- **Rs.**3,37,500.00
8. Toe wall Construction- **Rs.2,30,000.00**
9. Separate Reservoir of Oil and water in O&G Trap- **Rs.70,000**
10. Procuring of Fixed type water Sprinkler- **Rs.**2,12,400.00
11. Plantation Cost (16 Ha. of OB dump reclaimed by DFO, Dhanbad)- for the FY 2020-21 **Rs.** 99,287.00
12. Avenue Plantation Cost FY 2020-21 (to be done by DFO, Dhanbad) **Rs.** 12,29,190.00

Expenditure made as per EMP for Cluster-IX

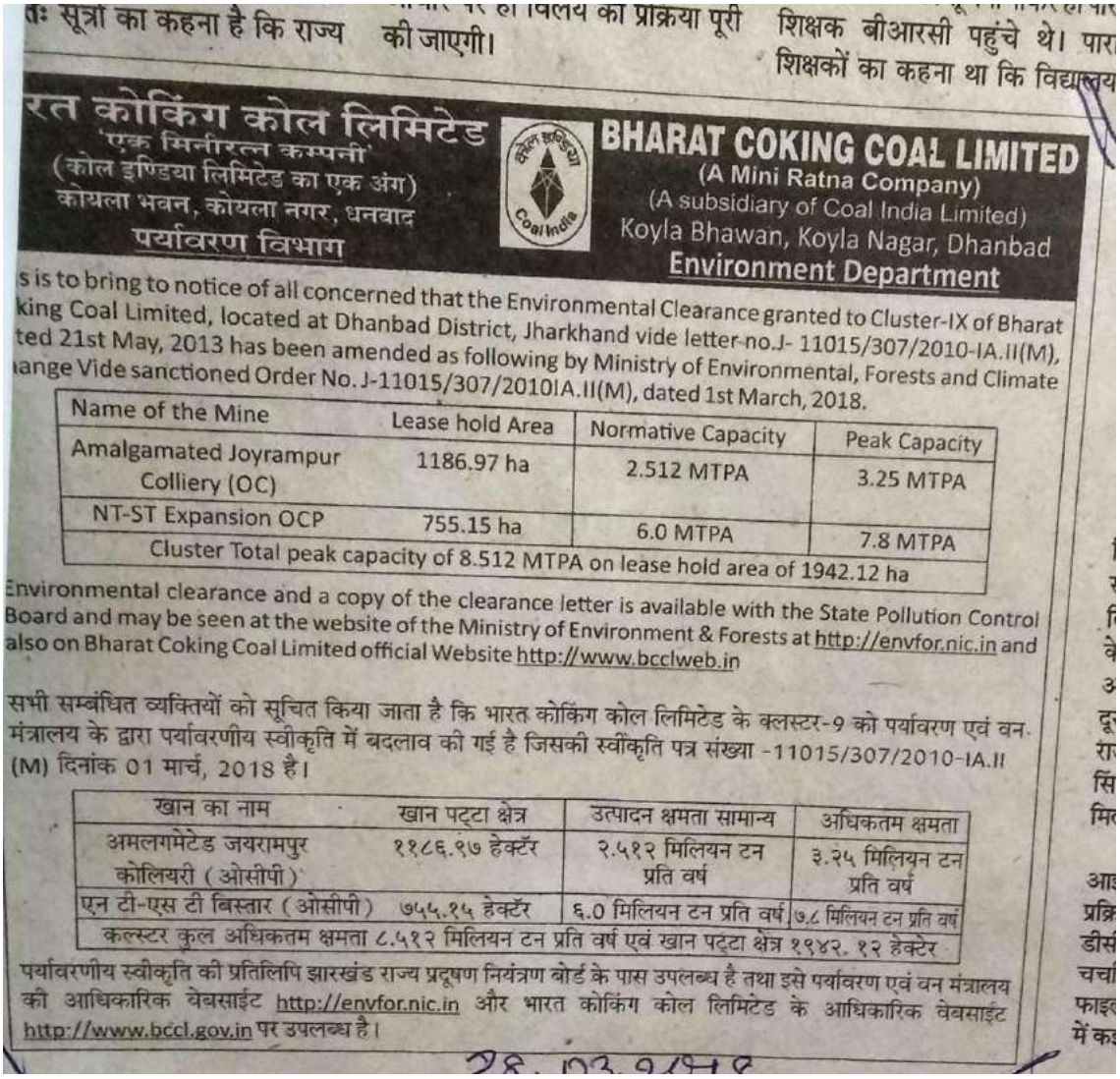
Capital Cost of Environment Management

Sl. No.	Item	Year	Cost (Lakhs)	Remarks
1.	2.70-3.5 m3 Diesel Hyd. Shovel (For reclamation and other Misc. jobs)	2013-14	217.00	-
2.	8 m3/te tipper	2013-14	264.00	-
3.	Dozer 355 dp	2016-17	613.00	-
4.	Water Sprinkler (10 KL & 28 KL)	2013-14	340.28	-
5.	**POLLUTION MONITORING**			-
	a) Respirable dust sampler	**CMPDIL has been hired for monitoring works and charges of monitoring paid to CMPDI is indicated in monitoring cost.**		
	b) Micro-meteorological station			
	c) Laboratory for testing			
	d) Acoustics for noise pollution control			
6.	Lab Equipment's for monitoring and analyzing air , dust , water , soil , noise , vibration & lighting standards			
7.	Domestic Effluent Treatment Plant (Septic tanks)	2017-18	5.00	-
8.	Industrial Effluent Treatment Plant	2012-13	2.00	-

Revenue Cost of Environment Management

Sl. No.	Item	Actual cost incurred (lakhs)			Remarks
		FY 2016-17	FY 2017-18	FY 2018-19	
1.	Air quality Monitoring Cost	Approx. 5.8428	Approx. 25.26503	Approx. 30.07068	As per information provided by Env department, HQ: Being done by CMPDIL RI-II Dhanbad
2.	Water quality Monitoring Cost				
3.	Noise Monitoring Cost				
4.	Green Belt Development	331.78572 (9292 nos. of Manpower with EMS @3570.66)	364.25468 (9944 nos. of Manpower with EMS @ 3663.06)	342.64941 (7434 nos. of Manpower with EMS @ 4609.22)	Manpower Cost incurred on Green Belt Development
5.	Ecological Restoration	33.31425	5.49459	43.00402	-
6.	Miscellaneous	6.32971	29.12577	33.88074	Protective measures taken for the prevention of dust generation from the waste material

- **EMP Preparation Cost:** 107.21 Lakhs (As per information provided by Env. Deptt. HQ, BCCL)



तः सूत्रों का कहना है कि राज्य की जाएगी। विलय की प्राक्रया पूरी शिक्षक बीआरसी पहुंचे थे। पार शिक्षकों का कहना था कि विद्यालय

रत कोकिंग कोल लिमिटेड
'एक मिनीरत्न कम्पनी'
(कोल इण्डिया लिमिटेड का एक अंग)
कोयला भवन, कोयला नगर, धनबाद
पर्यावरण विभाग

BHARAT COKING COAL LIMITED
(A Mini Ratna Company)
(A subsidiary of Coal India Limited)
Koyla Bhawan, Koyla Nagar, Dhanbad
Environment Department

s is to bring to notice of all concerned that the Environmental Clearance granted to Cluster-IX of Bharat king Coal Limited, located at Dhanbad District, Jharkhand vide letter-no.J- 11015/307/2010-IA.II(M), ted 21st May, 2013 has been amended as following by Ministry of Environmental, Forests and Climate ıange Vide sanctioned Order No. J-11015/307/2010IA.II(M), dated 1st March, 2018.

Name of the Mine	Lease hold Area	Normative Capacity	Peak Capacity
Amalgamated Joyrampur Colliery (OC)	1186.97 ha	2.512 MTPA	3.25 MTPA
NT-ST Expansion OCP	755.15 ha	6.0 MTPA	7.8 MTPA
Cluster Total peak capacity of 8.512 MTPA on lease hold area of 1942.12 ha			

Environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and may be seen at the website of the Ministry of Environment & Forests at http://envfor.nic.in and also on Bharat Coking Coal Limited official Website http://www.bcclweb.in

सभी सम्बंधित व्यक्तियों को सूचित किया जाता है कि भारत कोकिंग कोल लिमिटेड के क्लस्टर-9 को पर्यावरण एवं वन मंत्रालय के द्वारा पर्यावरणीय स्वीकृति में बदलाव की गई है जिसकी स्वीकृति पत्र संख्या -11015/307/2010-IA.II (M) दिनांक 01 मार्च, 2018 है।

खान का नाम	खान पट्टा क्षेत्र	उत्पादन क्षमता सामान्य	अधिकतम क्षमता
अमलगमेटेड जयरामपुर कोलियरी (ओसीपी)	११८६.९७ हेक्टेर	२.५१२ मिलियन टन प्रति वर्ष	३.२५ मिलियन टन प्रति वर्ष
एन टी-एस टी बिस्तार (ओसीपी)	७५५.१५ हेक्टेर	६.० मिलियन टन प्रति वर्ष	७.८ मिलियन टन प्रति वर्ष
कलस्टर कुल अधिकतम क्षमता ८.५१२ मिलियन टन प्रति वर्ष एवं खान पट्टा क्षेत्र १९४२. १२ हेक्टेर			

पर्यावरणीय स्वीकृति की प्रतिलिपि झारखंड राज्य प्रदूषण नियंत्रण बोर्ड के पास उपलब्ध है तथा इसे पर्यावरण एवं वन मंत्रालय की आधिकारिक वेबसाईट http://envfor.nic.in और भारत कोकिंग कोल लिमिटेड के आधिकारिक वेबसाईट http://www.bccl.gov.in पर उपलब्ध है।

28.03.2018

No.J-11015/307/2010-IA-II (M)
Government of India
Ministry of Environment, Forest and Climate Change
IA-II (Coal Mining) Division

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi-3
Dated: 1st March, 2018

To,

The General Manager (E&F)
M/s Bharat Coking Coal Ltd,
Koyala Bhawan,
District Dhanbad (Jharkhand)
Email: envbccl@gmail.com

Sub: Cluster IX Coal Mining Project (Group of 6 Mixed Mines) of total capacity 8.512 MTPA (peak) of M/s Bharat Coking Coal Limited located in Jharia Coal field, District Dhanbad (Jharkhand) - Amendment in EC - reg.

Sir,

This has reference to your letter No. BCCL/GM (Lodhna Area) /F-EC/318 dated 14.11.2017 along with online proposal No.IA/JH/CMIN/8452/2010, and subsequent letters dated 19.12.2018, 22.12.2018, 06.01.2018, 07.01.2018 and 11.01.2018 on the above mentioned subject.

2. The Ministry of Environment, Forest and Climate Change has considered the proposal for amendment in environmental clearance granted vide letter No.J-11015/307/2010-IA.II (M) dated 21st May, 2013 in favour of M/s Bharat Coking Coal Limited for the Cluster IX Coal Mining project (Group of 6 Mixed Mines) of total capacity of 8.512 MTPA in a total ML area of 1942.12 ha of located in Jharia Coal field District Dhanbad (Jharkhand), due to restructuring of individual mines of the cluster.

3. The proposal was considered by the Expert Appraisal Committee (EAC) in the Ministry for Thermal & Coal Mining Sector in its 24th meeting held on 11th January, 2018. During the meeting the project proponent informed about the proposed amendment in the above said Environmental clearance due to restructuring of individual mines of the cluster, with the total production capacity of 8.512 MTPA and the total mining lease area remaining same, with the details as under:-

As per existing EC							Modification sought					
S. No.	Mine	Status	Normative Capacity (MTPA)	Peak Capacity (MTPA)	Lease Hold Area (Ha)	Life (years)	Sl No	Name of the Mine	Production Capacity (MTPA)		Lease Hold Area (Ha)	Life (Yr)
									normative	peak		
1	Lodna UG	In operation	0.115	0.150	391.64	30	1	Amalgamated Joyrampur Colliery(OC)	2.512	3.25	1186.97	25
2	Bagdigi UG	In operation	0.110	0.143	61.0	30						
3	Joyrampur UG	In operation	0.153	0.199	89.04	30						
4	Bararee UG	In operation	0.170	0.221	475.0	30						
5	JealgoraUG		Nil	nil	138.0(wil	-						

	(closed for operation, mine not closed)				I be closed after fire dealing)							
6	NT/ST Expan. OCP	Proposed	6.0	7.8	755.15	30	2	NT-ST expansion OCP(in operation)	6.0	7.8	755.15	26
	total		6.548	8.512	1942.12*					8.512**	1942.12	

*Inclusive of 14.24 ha of North Tisra UG & 18.05 ha of Jeenagora OCP.**Peak of Cluster will remain same, as peak of individual will be achieved in different years.

The EAC was also informed that the Mining Plan after the proposed restructuring of individual mines was duly revised and approved by the Board of M/s BCCL on 9th December, 2017.

4. The EAC has recommended the amendments in the environmental clearance dated 21st May, 2013 due to restructuring of individual mines within the cluster, as proposed by the project proponent, on the above lines.

5. Based on recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords approval to the amendments in the environmental clearance dated 21st May, 2013 for **Cluster IX Coal Mining Project (Group of 6 Mixed Mines) of total capacity 8.512 MTPA** of M/s Bharat Coking Coal Limited in combined ML area of 1942.12 ha located in Jharia Coal field, District Dhanbad (Jharkhand), as proposed by the project proponent and mentioned in para 3 above, with the total production capacity of 8.512 MTPA and the total mine lease area of 1942.12 ha remaining the same.

6. All other terms and conditions stipulated in the said environmental clearance dated 21st May, 2013 shall remain unchanged.

1/3/2018

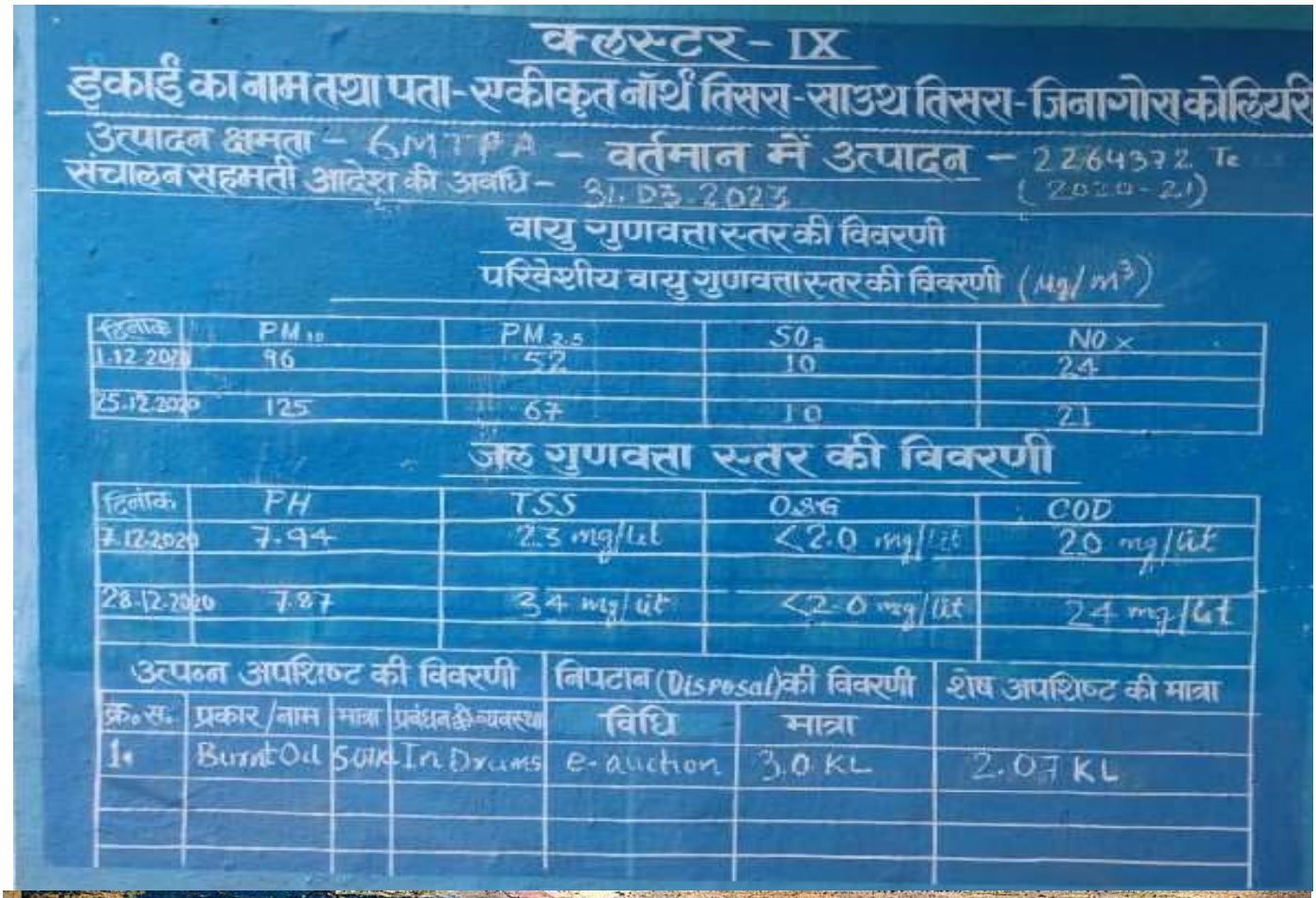
(S K Srivastava)
Scientist E

Copy to:

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi.
2. Secretary, Department of Environment & Forests, Govt. of Jharkhand, Secretariat, Ranchi
3. The APCCF, Ministry of Environment Forest and Climate Change, Regional Office (EZ), A-31, Chandrashekarpur, Bhubaneswar - 751023 (Odisha)
4. The Member Secretary, Jharkhand State Pollution Control Board, TA Building, HEC Complex, PO Dhurwa, Ranchi (Jharkhand)
5. The Member Secretary, CPCB, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 2
6. The Member-Secretary, Central Ground Water Authority, Ministry of Water Resources, Curzon Road Barracks, A-2, W-3 Kasturba Gandhi Marg, N Delhi
7. The District Collector, Dhanbad , Government of Jharkhand
8. Monitoring File 9. Guard File 10. Record File. 11. Notice Board

1/3/2018

(S K Srivastava)
Scientist E



क्लस्टर - IX

इकाई का नाम तथा पता - एकीकृत नॉर्थ तिसरा - साउथ तिसरा - जिनागोरा कोलियरी

उत्पादन क्षमता - 6MTPA - वर्तमान में उत्पादन - 2264372 Te (2020-21)

संचालन सहमती आदेश की अवधि - 31.03.2023

वायु गुणवत्ता स्तर की विवरणी

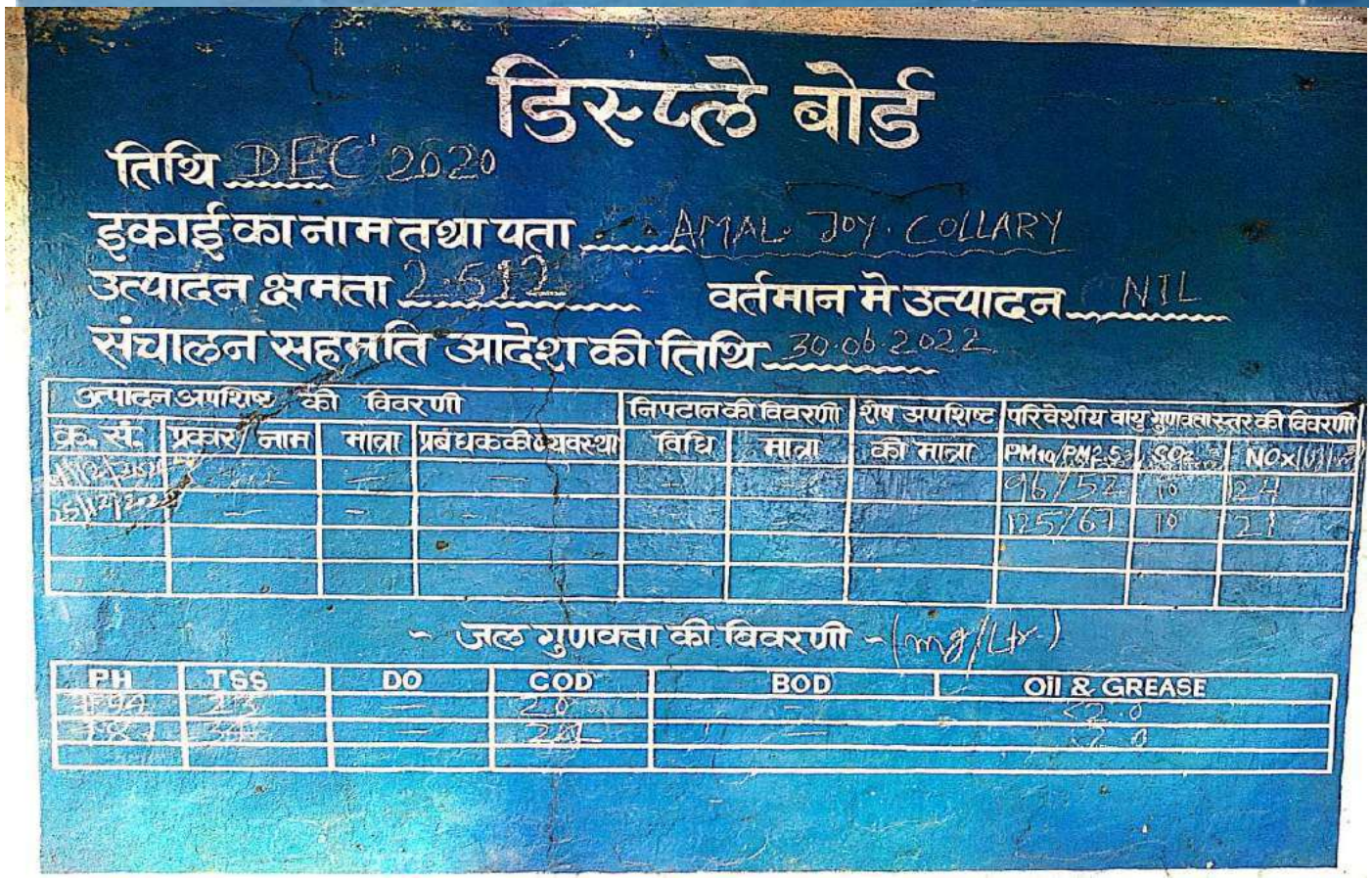
परिवेशीय वायु गुणवत्ता स्तर की विवरणी ($\mu g/m^3$)

दिनांक	PM_{10}	$PM_{2.5}$	SO_2	NO_x
1.12.2020	96	52	10	24
15.12.2020	125	67	10	21

जल गुणवत्ता स्तर की विवरणी

दिनांक	PH	TSS	O&G	COD
7.12.2020	7.94	23 mg/Lit	<2.0 mg/Lit	20 mg/Lit
28.12.2020	7.87	34 mg/Lit	<2.0 mg/Lit	24 mg/Lit

उत्पन्न अपशिष्ट की विवरणी				निपटान (Disposal) की विवरणी		शेष अपशिष्ट की मात्रा
क्र.स.	प्रकार/नाम	मात्रा	प्रबंधन की व्यवस्था	विधि	मात्रा	
1.	BurntOil	SOLD	In Drums	e-Auction	3.0 KL	2.07 KL



डिस्प्ले बोर्ड

तिथि DEC' 2020

इकाई का नाम तथा पता AMAL JOY COLLARY

उत्पादन क्षमता 2.512 वर्तमान मे उत्पादन NIL

संचालन सहमति आदेश की तिथि 30.06.2022

उत्पादन अपशिष्ट की विवरणी				निपटान की विवरणी		शेष अपशिष्ट की मात्रा	परिवेशीय वायु गुणवत्ता स्तर की विवरणी		
क्र. सं.	प्रकार/नाम	मात्रा	प्रबंधक की व्यवस्था	विधि	मात्रा		PM10/PM2.5	SO_2	NO_x
							96/52	10	24
							125/67	10	21

जल गुणवत्ता की विवरणी - (mg/Ltr)

PH	TSS	DO	COD	BOD	Oil & GREASE
			20		<2.0
			24		<2.0

[FORMV]

Environmental Statement for the financial year ending on 31st March 2020

PART A

(i) Name and address of the owner/occupier of the industry operation or process.

Shri. Pankaj Kumar,Projectofficer,NT-ST(Expansion) OCP, Post- Pargha Dist.- Dhanbad ,Jharkhand. PIN- 828201, PH. No. 6287696476.

(ii) Industry category Primary-(STC Code) Secondary-(STCCode).

Primary(Coal Mining)

(iii) Production capacity-

Peak EC Capacity- 7.8MTPA
(EC Order No.- J-11015/307/2010-IA-II (M) dated-1st March 2018)

(iv) Year of establishment-
Pre-nationalization (Pre-1973)

(v) Date of the last environmental statementsubmitted.- 07/09/2019

PART B

Water and Raw material consumption:

1. Water consumption-

Process- NIL

Cooling/spraying-Approx 19460.044Kl/Day

Domestic-Approx 7649.560Kl/Day

2. Raw material consumption

Name of raw material	Name of products	Consumption of raw material per unit of output	
		During the previous financial year (2018-2019)	During the current financial year (2019-2020)
1.Diesel	coal	1.43 ltr/Te	0.76 ltr/Te
2.Explosive	coal	2.94 kg/Te	2.96 kg/Te

*industry may use codes if disclosing details of raw material would violate contractual obligations,otherwise all industries have to name the raw material

PART-C

Pollution discharged to environment/unit of output(parameter as specified in the consent issued)

Pollution	Quantityof pollutants Discharged (mass/day)	Concentration of pollutants in discharges (mass/ volume)	Percentage of variationfrom prescribed standards with reasons
(a) Water	Analysis report enclosed	Analysis report enclosed for cluster-IX	The analysis report reveal that most of the parameters are below permissible limit.
(b) Air	Analysis report enclosed	Analysis report enclosed for cluster - IX	The analysis report reveal that most of the parameters are below permissible limit.

PART D

Hazardous Wastes
(as specified under Hazardous Wastes (Management and Handling) Rules, 1989)

Hazardous waste	Total Quantity(kg)	
	During the previous financial year (2018-2019)	During the current financial year (2019-2020)
From process	2.4KL Burnt oil	5.07KL Burnt oil
From pollution control facilities	Nil	Nil

PART E

Solid Wastes

Solid Wastes	Total quantity(Kg)	
	During the previous financial year(2018-2019)	During the current financial year (2019-2020)
From process (over burden)	10678570m^3	11027419m^3
From pollution control facilities	NA	NA
Quantity recycled or re-utilizes within the unit	NA(overburden used in backfilling)	NA(overburden used in backfilling)

PART -F

Please specify the characterization(in termsof composition and quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

1. Hazardous waste (Burnt oil) – Disposal is done by auction with due order from BCCLhead quarter.

2. Over Burden (overlying Rocks)-

   Utilized in backfilling of quarries

PART -G

Impact of the pollution abatemen measures taken on conservation of natural resources and on cost of production.

1. Protection of ambient environment-reduction in particulate matter concentration in ambient air,maintenance of surface and ground water qualitycontrol of noise pollutionrestoration of ecology etc.
2. No major impact on the cost of production

PART -H

Additional measures/investment proposal for environmental protection including abatement of pollution,prevention of pollution:

1.Plantation along transport road.

2.Installation of PM_{10} Analyzer to monitor the concentration of PM_{10} in ambient air.

PART-I

Any other particulars for improving the quality of the environment

1.Mobile water sprinkling in dust prone areas.
2.Plantation in mine area, schools and office complexes.
3.Distribution of plant saplings among locals.
4.Oil and grease trap-cum- settling trap to treat workshop effluents.
5.Ecological restoration of 38 Ha of Overburden dump.

14.9.20

Project officer
NT-ST(Expansion) OCP

Environmental Statement [FORM – V]
(See rule 14)

Environmental Statement for the financial year ending with 31st March 2020.

PART – A

(i) Name and address of the owner/occupier of the industry operation or process:
Name: Shri Monotosh Kundu
Designation: Project Officer
Address: Amal. Joyrampur Colliery
M/s BCCL,
P.O. – Khas Jeenagora
Dist. - Dhanbad
State- Jharkhand
Pin – 828115

(ii) Industry category: Primary (RED Category)

(iii) Production capacity- 3.25 MTY (Peak Production Capacity) and 2.512 MTY (Normative Production Capacity) as per EC granted by MOEF vide EC No. J-11015/307/2010-IA.II (M) dated 21.05.2013 (amendment in EC on dated: 01st March 2018).

(iv) Year of establishment- Prior to Nationalization of Coal Mines.

(v) Date of the last environmental statement submitted – 12.09.2019

PART – B

Water and Raw Material Consumption

I (A) Water consumption m3/d:

Name of products	Water consumption (m3/d) (2019-20)	
	Mining Operation	Domestic Supply
Coal	2616	32685

I (B) Process water consumption per unit of product output:

Name of Products	During the previous financial Year (2018-19) (m3/Te)	During the Current financial Year (2019-20) (m3/Te)
Coal	NIL	NIL

02/09/2020

II. Raw Material Consumption:

Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial year (2018-19)	During the current financial year (2019-20)
Explosive	Coal	NIL	NIL
	OB	NIL	NIL

PART - C

Pollution discharged to environment/unit of output
(Parameter as specified in the consent issued)

Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
a) Water	N/A	-	-
b) Air	N/A	-	-

PART – D

Hazardous Wastes

As specified under Hazardous Waste Management and Handling Rules, 1989

Hazardous Wastes	Total Quantity (Kg.)	
	During the previous Financial Year (2018-19)	During the current Financial year (2019-20)
1. From Process: (a) Oil Soaked Cotton (b) Burnt Oil (Used/Spent Oil)	----Kg. NIL	----Kg NIL
2. From Pollution Control Facilities	NIL	NIL

PART – E
Solid Wastes

Solid Wastes	Total quantity(Kg)	
	During the previous Financial Year (2018-19)	During the current Financial year (2019-20)
a. From process	NIL	N/A
b. Form pollution control facility	NIL	NIL
c. Quantity recycled or re-utilized within the unit	NIL	NIL

PART – F

Please specify the characterizations (in terms of composition of quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes. : - NIL

PART – G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

In order to carry out mining operation in eco-friendly manner the following pollution control measures have been adopted:

A. **Air Pollution Control Measures:**
- Regular water spraying is done with the help of mobile tankers wherever there is possibility of dust generation throughout the mine.
- Quarterly monitoring of ambient air quality parameters is being done by CMPDIL.

B. **Water Pollution Control Measures:**
- Most of the parameters of mine water conform to General Standard of MOEF for Class-A effluent as mentioned earlier.
- CMPDI RI-II is regularly conducting study of groundwater level and quality of areas within Cluster IX.

C. **Noise Pollution Control Measures:**
- Noise levels are in prescribed limit.
- Quarterly monitoring of Noise level parameters is being done by CMPDIL.

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution.

- Ambient Environmental Monitoring will be continued as per the guidelines of MoEF and Jharkhand State Pollution Control.
- Application for consent for emission/continuation of emission under section 21 of the Air (prevention and control of pollution) Act, 1981 and Application for consent for discharge Continuation of discharge under section 25/26 of Water (Prevention and Control of Pollution) Act, 1974 will be regularly done and Conditions laid down in Consent to Operate granted by JSPCB will be strictly followed.

PART – I
MISCELLANEOUS

Any other particulars in respect of environmental protection and abatement of pollution

After complete extraction of coal from coal bearing area, the small area will be backfilled and re-vegetated using technical/biological reclamation techniques.

08/09/2021

Project Officer
02/09/2021 mal. Joyrampur Colliery

SOME PHOTOGRAPHS, CLUSTER IX
















Sintex
Sintex
















Sintex
Sintex

Avenue Plantation and lagoon:
















64MP AI QUAD CAMERA
Shot by SAPAN M. DAS


64MP AI QUAD CAMERA
Shot by SAPAN M. DAS





Rain water Harvesting:













Water sprinkling by mobile water sprinklers in dust prone areas to prevent dust pollution.



Installation of fixed water sprinklers at railway siding under process







22 ha of OB dump has been biologically reclaimed with 3-tear plantation





Oil and grease trap cum-settling tank



Plantation along railway siding



Sampling for environmental monitoring by CMPDIL


WELCOME
GOKUL PARK


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SHOT ON REDMI NOTE5 PRO
MI DUAL CAMERA


SHOT ON REDMI NOTE5 PRO
MI DUAL CAMERA