1/23

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

Ref. No: - BCCL/LA/GM/22/ 171

Dated:- 1/12/2022

To,
The Director,
Ministry of Environment, Forest & Climate Change, Govt. Of India.
2nd Floor, Headquarter- Jharkhand State Housing Board,
Harmu Chowk, Ranchi, Jharkhand – 834002

Sub: -Six monthly compliance report on implementation of Environmental Measures for the period from 1st April 2022 to 30th Sept. 2022 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 April 2022 to 30th Sept. 2022 in respect of Cluster – IX Group of Mines, Lodna Area of BCCL.

Enclosure: as above.

Yours faithfully,

General Manager
Lodna Area

Cc to (Through Email):-

1. Scientist & In-charge, Zonal Office, Central Pollution Control Board, 5th Floor 502, Hous & Conclave 1582, Rajdanga main Road, Kolkata-700107
2. Member Secretary, Jharkhand State Pollution Control Board, TA Division Building, H.E.C, Dhurwa, Ranchi-834004
3. Regional Office , Jharkhand State Pollution Control Board, Sardar Patel nagar, Dhanbad
4. HoD (Env) BCCL, Koyla Bhawan, Dhanbad.
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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 April 2022 to September 2022)

Sl. No.	A.) Specific conditions by MOEF	Compliance
i.	The Maximum production shall not exceed beyond that for which environmental clearance has been granted.	Complied. The production from the cluster is within the limit for which environment clearance has been granted. NT-ST (Expansion) OCP and Amalgamated Joyrampur Colliery are two mines that exist in Cluster IX in which Coal Production is being done only from NT-ST (Expansion) OCP. Mine wise production and waste excavation have been submitted 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.	Action taken report is enclosed as **Annexure II.** Action has been taken for extinguishing the fire are as follows: 1. In NT-ST (Expansion) OCP, Fiery Hotspot are being dealt by only proven excavation method. The work was awarded to deal the fire by excavation with ref no. BCCL/GM/SECY/LODNA/HIRING-HEMM-OS/2015/498 dated 30/06/2015 and BCCL/GM/SECY/LODNA/HIRING-HEMM-OS/2019/532 dated 28/03/2019. 2. To prevent the spread of fire some water pool has been created. (photographs are attached as Annexure-**II**) 3. Cracks and potholes being blanketed by sand and soil to cut oxygen supply to minimize the spontaneous heating. Photographs are also attached herewith.

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iii	'Mission Mode Program' 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 interest (EOI) was floated vide Ref no. BCCL/GM(CMC)/GLOBAL/EOI/FIRE/2014/870 dated 18.01.2014 by General Manager (Contract Management Cell) with the following description of work Dealing with coal mine fire in lease hold of BCCL in Jharia Coalfield, Dhanbad, Jharkhand , India. At Location of Leasheold of BCCL in Jharia coalfield Dhanbad, Jharkhand, India. Two firms participated in the said EOI Namely DMT GmbH & Co. KG Essen/Germany and Met-Chem Canada Inc. Both the Bidders were disqualified as they could not fulfill the requirements laid down in the EOI and failed to submit the required documents for evaluation by technical committee. Thus, BCCL by taking into consideration the earlier findings, suggestion of reputed Mining Institutes like ISM, Dhanbad and CIMFR, Dhanbad adopted the method of fire excavation for earliest fire dousing. Latest communication has been made to IIT(ISM),Dhanbad, BIT Sindri & CIMFR ,Dhanbad for providing their expertise/recommendation for control of fire and their reclamation. Copy attached as Annexure III
iv	The recommendation of Indira Gandhi Centre of Atomic Research, Kalpakam should be 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 IV.**
v	Transportation Plan should be submitted to the MOEF.	Transportation Plan prepared on proper scale has been attached as Annexure V. Transportation is being done by covering vehicle with tarpaulin cover.

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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.	Presently no mine in Cluster IX is under Final Mine Closure stage. Mine closure plan as per the guideline of Ministry of coal prepared by CMPDIL is under implementation and progressive mine closure plan is being followed. Progressive Mine Closure plan has been attached as **Annexure VI**. As on date no such voids are available.
vii	The road transportation of coal during phase – 1 should be by mechanically covered trucks. The road used for coal transportation should be developed with avenue plantation on both sides.	Request has been submitted to some of the vendors for making available details of mechanically covered trucks. Copy of the same is attached as Annexure VII. At present Transportation is being done by covering vehicle with tarpaulin cover. Avenue plantation is being done along the transportation route. 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 done by DFO, Dhanbad along transportation road and nearby areas also. 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 under active compliance. 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. Photographs of VTC and Handloom Training Center is attached.
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. The Details of transportation, CSR, R&R and implementation of environmental action plan in Booklet form that is attached as Annexure VIII.

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x	A study should be initiated to analyze extent of reduction in pollution load every year by reducing road transport.	More than 80% of coal is transported through railway which is environmentally better option than the road transportation. The study has been completed by the CMPDIL. The project proponent has submitted report of study to analyze the extent of reduction in pollution load every year by reducing road transport. **Enclosed as Annexure IX.**
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.	Global expression of interest (EOI) was floated vide Ref no. BCCL/GM(CMC)/GLOBAL/EOI/FIRE/2014/870 dated 18.01.2014 by General Manager (Contract Management Cell) with the following description of work Dealing with coal mine fire in lease hold of BCCL in Jharia Coalfield, Dhanbad, Jharkhand , India. At Location of Leasheold of BCCL in Jharia coalfield Dhanbad, Jharkhand, India. Two firms participated in the said EOI Namely DMT GmbH & Co. KG Essen/Germany and Met-Chem Canada Inc. Both the Bidders were disqualified as they could not fulfill the requirements laid down in the EOI and failed to submit the required documents for evaluation by technical committee. Thus, BCCL by taking into consideration the earlier findings, suggestion of reputed Mining Institutes like ISM, Dhanbad and CIMFR, Dhanbad adopted the method of fire excavation for earliest fire dousing. Latest communication has been made to IIT(ISM),Dhanbad, BIT Sindri & CIMFR ,Dhanbad for providing their expertise/recommendation for control of fire and their reclamation. Copy attached as Annexure III.

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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 36,000 Nos. of plants have been planted at Gokul Park in NT-ST till Sept. 2022. 16 Ha of OB dump has been bio-reclaimed by DFO, Dhanbad for the FY 2020-21. Plantation over 10 Ha. Of Area in Amal. Joyrampur Colliery has been taken up in FY 2022-23. 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.	Separate multidisciplinary environmental Management cell at Area Level has already been established. Office Order of the same has been enclosed as Annexure X. 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 Headquarters level, Coordinates 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 the company's Director (Technical) and CMD. Further capacity building at both corporate and operating levels is being done.
xiv	The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board.	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 is: (i) Jeenagora (A13) (ii) Kusmatand Village (A12) (iii) Bhowrah North (A14) (iv) Hurriladih UGP (A28) **Enclosed as Annexure XI.**

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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.	The said study of source apportionment was being conducted by NEERI, Nagpur. Workshop organized with NEERI, Nagpur on 04.10.2021. Comments/Clarification submitted to NEERI, Nagpur for its incorporation. Further, comments of JSPCB and BCCL also submitted to NEERI and final report submitted on 27.04.2022. A copy of final report is **enclosed as Annexure XII.**
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.	The said study of source apportionment was being conducted by NEERI, Nagpur. Workshop organized with NEERI, Nagpur on 04.10.2021. Comments/Clarification submitted to NEERI, Nagpur for its incorporation. Further, comments of JSPCB and BCCL also submitted to NEERI and final report submitted on 27.04.2022. A copy of final report is **enclosed as Annexure XII.**
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 2021. As per report observed in 2020 the fire area in north tisra is 0.031 Sq. km., in south tisra 0.021 Sq. km. & in Jeenagora 0.000 sq. km. **Enclosed as Annexure-XIII.**

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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. Cracks and potholes being blanketed by sand and soil to cut oxygen supply to minimize the spontaneous heating. A letter to CISF, requesting for help at the time of filling of cracks and potholes is attached as **Annexure XIV**. Photographs are also attached herewith. To prevent the spread of fire some water pool has been created. (Photographs are attached as **Annexure- XIV**).
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.
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. Soil has been spread to eliminate the spontaneous combustion. Photographs are attached as **Annexure XIV**.
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. No Dumping has been done in non-coal bearing area. Dumping has been done after excavation of Coal in de-coaled area. 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. Grassing is being done every year during the monsoon over the OB dumps. In the year 2021-22, 11 Ha of OB dump and in 2022-23 07 Ha of OB dump were grass seeded. At the end of Mining there shall be no void and area will be re-vegetated and reclaimed.

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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.
xxv	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.	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.
xxvi	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.	No active dumps near water bodies exist. The OB dumps created earlier are stabilized and converted into Eco-restoration park.

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<table>
<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>Grassing is being done every year during the monsoon over the OB dumps. In the year 2021-22, 11Ha of OB dump was being grass seeded, further 07 Ha of OB dump has been taken up for grass seeding in the year 2022-2023.Plantation will be done where de-coaled area is backfilled. 22 Ha. Of OB dump has been converted in Three Tier Plantation named as Gokul Park. 16 Ha of OB dump has been bio-reclaimed in 2020-21 through DFO,Dhanbad. 10 ha. Of area has been taken up for plantation in FY 2022-23 in Amal. Joyrampur Colliery.

1200 Nos of bamboo gabion plantation has been done from Joyrampur more to South Tisra workshop and other nearby areas including colonies.

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>
<tr><td>2022-23</td><td>Lodna</td><td>10</td></tr>
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<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>1200 nos. of bamboo gabion avenue plantation has been done by DFO, Dhanbad along roadside.

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. Photographs are attached. Sneh Smriti Upvan has been established in which fruit bearing plants have been planted.</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 is being complied. Specific mitigative measures have been taken for the Jharia Coalfields in the Environmental Action plan prepared for Dhanbad: 1. Covered transportation of coal. 2. Water sprinkling is being done by mobile water sprinklers and fog cannon along prominent dust generating roads. 3. Plantation. 4. Toe wall constructed along OB dump. 5. Avenue Plantation along the road 6. Water sprinkling through Truck Mounted Fog Cannon. 7. Construction of Pucca Roads from South Tisra workshop to North tisra Checkpost. 8. Grass seeding on dormant OB Dumps. 9. 2 Nos. of Online PM10 Analyzer has been installed in cluster-IX 10. Wetting of coal before loading 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) The said study of source apportionment was being conducted by NEERI, Nagpur. Workshop organized with NEERI, Nagpur on 04.10.2021. Comments/Clarification submitted to NEERI, Nagpur for its incorporation. Further, comments of JSPCB and BCCL also submitted to NEERI and final report submitted on 27.04.2022. Copy of Final report is enclosed as Annexure XII.
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. Rain water harvesting structure exists in Kaushal Vikash kendra, under lodna area,BCCL of Cluster - IX.

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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 XV.** Piezometer has been installed in Cluster IX. Photograph of piezometer is enclosed herewith. Ground water quality monitoring data has been sent to State Pollution Control Board/Central Pollution Control Board. Details are attached as Annexure **XVI.**
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.	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 XVII.**
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 with recycling arrangement 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. A copy of letter related to subsidence and subsidence record is attached as Annexure **XVIII.**
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.
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. Copy is enclosed as Annexure XIX.

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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. A document has been attached certifying that no depillaring operation has been done below the township/colony since 2013 as **Annexure XX**.
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 – 1 should be done by mechanically covered trucks.	Action has been taken for formulating adequate transportation plan for conveyor-cum-rail system of dispatch. CMPDIL has been requested to prepare the plan. However, CMPDIL had submitted that such transportation plan can be completed only after implementation of Master Plan and dousing of the fire. The copy of the reply submitted by CMPDI is attached as **Annexure XXI.** Request has been submitted to some of the vendors for making available details of mechanically covered trucks. Copy of the same is attached as Annexure VII. 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.	More than 80%of coal is transported through railway which is environmentally better option than the road transportation. The study has been completed by the CMPDIL. The Project Proponent has submitted the report of study to analyze the extent of reduction in pollution load every year by reducing road transport. **Enclosed as Annexure IX.**

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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. The responsibility of shifting Fire affected families/encroachers is with Jharia Rehabilitation and Devlopment Authourity (JRDA) formulated under the Chairmanship of DC, Dhanbad. 547 Nos. of Quarters have been allotted for shifting of PAFs by JRDA at Belgaria Township. The shifted PAFs belongs to the fire affected areas of DB road and Bengal Jharia section of NT-ST OCP, 271 Nos. of Fire affected Families/Encroachers have been shifted to Belgaria Township.

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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.	A detailed CSR Action Plan is attached as **Annexure VIII.** TISS has conducted the survey for effective and need based CSR activities implementation. Also Mid- term Evaluation of Project *Swablamban* - Reeling and Spinning Training Projecr under CSR has been conducted by TISS, Mumbai. Copy is attached as Annexure XXII. 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.
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.	The Project Proponent has submitted Land Use Map of Cluster IX which has been prepared by CMPDIL using remote sensing data for monitoring of land use pattern and for post mining land use. **Enclosed as Annexure XXIII.**
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 VI.**

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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. The Project Proponent has submitted Office Order of the same has been enclosed as **Annexure X**. 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 Headquarters level, Coordinates 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 the company's Director (Technical) and CMD. Further capacity building at both corporate and operating levels 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 been constituted at BCCL (https://www.bcclweb.in/environment/CEP_280220.pdf) and at CIL (https://www.coalindia.in/media/documents/CIL_Corporate_Environmental_Policy_2018.pdf) level to promote sustainable development by protecting the environment through integrated project planning & design, prevention/mitigation of pollution, conservation of natural resources, restoration of ecology & biodiversity, recycling/ proper disposal of wastes, addressing climate change and inclusive growth. 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 XXIV**. A letter with reference no.23/3/2015-ASO/BA, Government of India, Ministry of Coal, dated 26/04/2017 is attached herewith as Annexure- XV, regarding quarterly review of all environment compliances in board meeting. Board reviews all the environment compliance matters that creates a system of reporting infringements/ deviation/ violation of the environmental/forest/wildlife norms/conditions and/or **shareholders** /stake **holders.**
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. The production from the cluster is within the limit for which environment clearance has been granted. NT-ST (Expansion) OCP and Amalgamated Joyrampur Colliery are two mines that exist in Cluster IX in which Coal Production is being done only from NT-ST (Expansion) OCP.

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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.**
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 XI.** 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. Covered transportation of coal. 2. Water sprinkling is being done by mobile water sprinklers and fog cannon along prominent dust generating roads. 3. Plantation. 4. Toe wall constructed along OB dump. 5. Avenue Plantation along the road 6. Water sprinkling through Truck Mounted Fog Cannon. 7. Construction of Pucca Roads from South Tisra workshop to North tisra Checkpost. 8. Grass seeding on dormant OB Dumps. 9. 02 Nos. of PM 10 Analyser has been installled in Cluster-IX. 10. Wetting of coal before loading at railway siding. Air quality Monitoring report, Water quality monitoring report and report of Monitoring of Heavy metals have been enclosed as **Annexure XXVI.**

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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 report, Water quality monitoring report and report of Monitoring of Heavy metals are being submitted with six monthly compliance report.
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. At present no U/G mine is in operation which is a high noise area. In the O/C mine, all equipment and machines are regularly maintained and the noise level is within prescribed limits. Noise monitoring data has been enclosed as **Annexure XXVII.**
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 XXVIII.** Oil and grease trap with recycling arrangement 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. PUC Certificate is enclosed as **Annexure XXIX.**
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 report enclosed as **Annexure XXVI.**

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<table>
<tr>
<td>ix</td>
<td>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.</td>
<td>Dust is suppressed at source by water sprinkling. Dust masks are provided to persons working in dusty areas. The Project Proponent has submitted the details of dust masks provided to Personnel workers which are as follows:
<table>
<tr><th>FY</th><th>Dust Mask</th></tr>
<tr><td>2015-16</td><td>1000</td></tr>
<tr><td>2016-17</td><td>940</td></tr>
<tr><td>2017-18</td><td>1000</td></tr>
<tr><td>2018-19</td><td>1000</td></tr>
<tr><td>2019-20</td><td>350</td></tr>
<tr><td>2020-21</td><td>1500</td></tr>
<tr><td>2021-22</td><td>140</td></tr>
<tr><td>2022-23</td><td>260</td></tr>
</table>
Vocational training Centers under separate Human Resource Development Dept. is conducting regular training programme on these issues. Details of training programme are as:
<table>
<tr><th>Year</th><th>Total</th></tr>
<tr><td>2013-14</td><td>1348</td></tr>
<tr><td>2014-15</td><td>1353</td></tr>
<tr><td>2015-16</td><td>2715</td></tr>
<tr><td>2016-17</td><td>1004</td></tr>
<tr><td>2017-18</td><td>2145</td></tr>
<tr><td>2018-19</td><td>1013</td></tr>
<tr><td>2019-20</td><td>794</td></tr>
<tr><td>2020-21</td><td>664</td></tr>
<tr><td>2021-22</td><td>566</td></tr>
<tr><td>2022-23 (upto Sep.)</td><td>288</td></tr>
</table>
</td>
</tr>
<tr>
<td>x</td>
<td>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.</td>
<td>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:
<table>
<tr><th>Year</th><th>IME</th><th>PME</th></tr>
<tr><td>2014</td><td>09</td><td>1710</td></tr>
<tr><td>2015</td><td>333</td><td>1564</td></tr>
<tr><td>2016</td><td>257</td><td>1335</td></tr>
<tr><td>2017</td><td>245</td><td>1134</td></tr>
<tr><td>2018</td><td>Nil</td><td>1400</td></tr>
<tr><td>2019</td><td>380</td><td>1058</td></tr>
<tr><td>2020</td><td>133</td><td>495</td></tr>
<tr><td>2021</td><td>Nil</td><td>1100</td></tr>
<tr><td>2022 (upto sept.)</td><td>Nil</td><td>730</td></tr>
</table>
</td>
</tr>
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21/23

<table>
<tr><td>Xi</td><td>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.</td><td>Separate multidisciplinary environmental management cell at Area Level has already been established. Office Order of the same has been enclosed as Annexure X. 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.</td></tr>
<tr><td>Xii</td><td>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.</td><td>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 XXX.

Separate account for environment protection measures. The details are as follows:
<table>
<tr><th>Accounting ledger</th><th>Items</th></tr>
<tr><td>41100018</td><td>Environmental Expenses-Tree Plantation</td></tr>
<tr><td>41100019</td><td>Environmental Expenses-Other Environmental</td></tr>
<tr><td>41100020</td><td>Environmental Expenses-Statutory payment to SPCB</td></tr>
<tr><td>41100021</td><td>Envt Expenses-Handling/disposal/Hazardous/Bio-MediWastes</td></tr>
<tr><td>41100022</td><td>Environmental Expenses-Air,water, Noise monitoring</td></tr>
<tr><td>41100023</td><td>Envt Expenses-Expenditure on OB dumps reclamation</td></tr>
<tr><td>41100024</td><td>Environmental Expenses-fees for Consent to Operate</td></tr>
<tr><td>41100025</td><td>Environmental Expenses-ISO related Activities</td></tr>
</table></td></tr>
<tr><td>Xiii</td><td>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.</td><td>It has been complied and published timely. Enclosed as Annexure XXXI.</td></tr>
</table>

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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 XXXII.**
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.
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 XXXIII.** 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. The same has been uploaded on Parivesh Portal.
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 XXXIV.**

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(23/23)

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.
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.

22/11/22
Area Manager (Env.)
Lodna Area

25/11/2022
Project Officer
Amal. Joyrampur Colliery

24/11/22
Project Officer
NT-ST (Exp.) OCP

Hussain. 28/11/2022
Addl. General Manager
Lodna Area

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Annexure I

PRODUCTION PROJECTION FOR FY 2022-23				
Name of Area	**Name of Mine**	**Type of Mine**	**Target 2022-23**	
			Coal(MT)	OB(MCuM)
Lodna Area	**NT-ST (Exp.) OCP**	**O/C**	3.737	11.82
	Amal. Joyrampur Colliery	**O/C**	NIL	NIL

Year	**Total Coal (Tonn)**		**Total OBR (M^3)**	
	NT-ST (Expansion) OCP	**Amalgamated Joyrampur Colliery**	**NT-ST (Expansion) OCP**	**Amalgamated Joyrampur Colliery**
2018-19	2484642	NIL	10362176	NIL
2019-20	2534760	NIL	11027419	NIL
2020-21	2264372	NIL	11953215	NIL
2021-22	3813224	NIL	10969702	NIL
2022-23 (upto Sept.)	2548384	NIL	5687352	NIL

Year	**Top soil generated (cum)**	**Backfilling area (Ha.)**	**Reclaimed Area (Ha.)**
2013-14	414332	3.60	Nil
2014-15	420456	4.38	5
2015-16	479584	5.00	7
2016-17	66049	1.60	7
2017-18	492342	4.75	7
2018-19	187598	-	3.8
2019-20	12552	-	0.3
2020-21	5000	-	16
2021-22	8400	-	-
2022-23 (Till sept.)	NIL	6 Ha. (Inpit dumping)	10

Annexure II

Area-wise Action Taken Report

AREA-WISE ACTION TAKEN REPORT FOR EXTINGUISHING THE FIRE IN CLUSTER IX (In compliance of EC Specific Condition no. ii)

Name of Area/site	Name of Mine	Action Taken
Patch-B	NT-ST(Exp.) OCP	Fiery Hotspot are being dealt by only proven excavation method. The work was awarded for extraction of coal with vide ref no. BCCL/GM/SECY/LODNA/HIRING-HEMM-OS/2015/498 dated 30/06/2015 and BCCL/GM/SECY/LODNA/HIRING-HEMM-OS/2019/532 dated 28/03/2019. After Excavation of Fiery Coal, firefighting of coal is being done by directing water through hose pipe before stacking coal in coal dumps. Water is sprayed over stacked coals at coal dump in order to extinguish any left off coal fire.
Patch-F	NT-ST(Exp.) OCP	
Lodna, Near Raksha Kali Mandir	Amal. Joyrampur Colliery	Sand and Loose Materials are used to fill the cracks through which smoke is observed in order to minimize the spontaneous heating
Joyrampur Near Bagdigi Bridge	Amal. Joyrampur Colliery	
Gokul Park	NT-ST(Exp.) OCP	Soil has been spreaded on the slope of the Gokul Park to minimize the spontaneous heating and also some water pool has been created in Gokul Park to minimize the fire.

General Manager Lodna Area	AGM Lodna Area	AM (Env.) Lodna Area	Project Officer Amal. Joyrampur Colliery	Project Officer NT-ST(Exp.) OCP
11/03/22	11/3/22	11/3/22	11/03/2022	11.03.22

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BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Limited)
Office of the Project Officer
Amalgamated Joyrampur Colliery
Lodna Area- X

Ref.No. BAR/AJC/SO/2021/ 419

Date:- 21/12/21

सेवा में,

सहायक समादेष्टा,
सी .आई.एस .एफ,
जियलगोरा कैम्प

विषय :-अवैध खनन की भराई में सहयोग करने हेतु सूचना

महाशय;

दिनांक 22.12.2021 दिन बुधवार को सुबह 10 बजे बरारी कोलियरी में X सीम लक्ष्मी इंकलाइन के पास प्रबंधन द्वारा अवैध खनन की भराई कराई जाएगी | अवैध खनन की भराई शांतिपूर्ण तरीके से हो इसके लिए हमे आपके सहयोग की आवश्यकता है |

अतः आपसे अनुरोध है की तथा कथित स्थान पर अपनी मौजूदगी सुनिश्चित करके भराई का कार्य को शांतिपूर्ण ढंग से करने में सहयोग प्रदान करे |

भवदीय
21/12/21
परियोजना पदाधिकारी
एकीकृत जयरामपुर कोलियरी

प्रतिलिपि:-

१ क्षेत्रीय प्रबंधक (सुरक्षा), लोदना क्षेत्र
२ सुरक्षा पदाधिकारी, अमल॰ जयरामपुर कोलयरी
३ प्रबन्धक, अमल॰ जयरामपुर कोलयरी
४ कार्यालय प्रति

Received
21/12/21
CISD
Amgd Colly
C.I.S.F

Annexure III

Communication with IIT (ISM) and CIMFR, Dhanbad for providing expertise for control of fire.

BHARAT COKING COAL LIMITED
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
OFFICE OF THE GENERAL MANAGER
LODNA AREA-X

Ref No.: BCCL/LA/GM/2022/ 16 Date: 6/5/2022

To
The Director
CIMFR,Dhanbad
Dhanbad,Jharkhand
PIN-826015

Subject: Request for providing your expertise for control of fire and their reclamation in Cluster- IX of BCCL.

Respected sir,
As per inspection done by Integrated Regional Office Ranchi MoEF&CC on dated 23.02.2022 and 24.02.2022 (inspection report enclosed) of cluster IX group of mines of BCCL and specific condition no -xi of Environmental clearance no.-NO.J-11015/307/2010-IA.II (M) (Copy attached), your expertise/ recommendation is needed for control of fire and their reclamation in cluster-IX group of mines of BCCL as cluster-IX groups of mines are fire affected.

You are therefore requested to provide your expertise/recommendations for control of fire and their reclamation in cluster-IX group of mines of BCCL.

I shall be highly obliged to you for this act of kindness.

Thanking you!

Faithfully your's
06/5/22
General Manager
Lodna Area,BCCL

Encl: As above.

Cc to:

1. HoD(Env.),BCCL
2. File.

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BHARAT COKING COAL LIMITED
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
OFFICE OF THE GENERAL MANAGER
LODNA AREA-X

Ref No. : BCCL/LA/GM/2022/17 Date: 6/5/2022

To
The Director
IIT(ISM), Dhanbad
Dhanbad,Jharkhand
PIN-826004

Subject: Request for providing your expertise for control of fire and their reclamation in Cluster- IX of BCCL.

Respected sir,

As per inspection done by Integrated Regional Office Ranchi MoEF&CC on dated 23.02.2022 and 24.02.2022 (inspection report enclosed) of cluster IX group of mines of BCCL and specific condition no -xi of Environmental clearance no.-NO.J-11015/307/2010-IA.II (M) (Copy attached) , your expertise/ recommendation is needed for control of fire and their reclamation in cluster-IX group of mines of BCCL as cluster-IX groups of mines are fire affected.

You are therefore requested to provide your expertise/recommendations for control of fire and their reclamation in cluster-IX group of mines of BCCL.

I shall be highly obliged to you for this act of kindness.

Thanking you!

Faithfully your's

06/5/22
General Manager
Lodna Area,BCCL

Encl: As above.

Cc to:

1. HoD(Env.),BCCL
2. File.

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BHARAT COKING COAL LIMITED
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
OFFICE OF THE GENERAL MANAGER
LODNA AREA-X

Ref No.: BCCL/LA/GM/2022/755 Date: 13/10/2022

To
The Director
CIMFR,Dhanbad
Dhanbad,Jharkhand
PIN-826015

Subject: Request for providing Performa Invoice (PI)/Quotation for providing your expertise for control of fire and their reclamation in Cluster- IX of BCCL.

Respected sir,

As per inspection done by Integrated Regional Office Ranchi MoEF&CC on dated 23.02.2022 and 24.02.2022 (inspection report enclosed) of cluster IX group of mines of BCCL and specific condition no -xi of Environmental clearance no.-NOJ-11015/307/2010-IA.II (M) (Copy attached), your expertise/ recommendation is needed for control of fire and their reclamation in cluster-IX group of mines of BCCL as cluster-IX groups of mines are fire affected.

You are therefore requested to provide Performa Invoice(PI)/Quotation for providing your expertise/recommendations for control of fire and their reclamation in cluster-IX group of mines of BCCL.

I shall be highly obliged to you for this act of kindness.

Thanking you!

Faithfully your's
13/10/22
General Manager
Lodna Area,BCCL

Encl: As above.

Cc to:

1. HoD(Env.),BCCL
2. File.

Scanned with CamScanner

BHARAT COKING COAL LIMITED
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
OFFICE OF THE GENERAL MANAGER
LODNA AREA-X

Ref No. : BCCL/LA/GM/2022/757 Date: 18/10/2022

To
The Director
BIT Sindri, Dhanbad
Dhanbad,Jharkhand
PIN-828123

Subject: Request for providing Performa Invoice (PI)/Quotation for providing your expertise for control of fire and their reclamation in Cluster- IX of BCCL

Respected sir,

As per inspection done by Integrated Regional Office Ranchi MoEF&CC on dated 23.02.2022 and 24.02.2022 (inspection report enclosed) of cluster IX group of mines of BCCL and specific condition no -xi of Environmental clearance no.-NO.J-11015/307/2010-IA.II (M) (Copy attached), your expertise/ recommendation is needed for control of fire and their reclamation in cluster-IX group of mines of BCCL as cluster-IX groups of mines are fire affected.

You are therefore requested to provide Performa Invoice(PI)/Quotation for providing your expertise/recommendations for control of fire and their reclamation in cluster-IX group of mines of BCCL.

We shall be highly obliged to you for this act of kindness.

Thanking you!!

Faithfully your's

18/10/22
General Manager
Lodna Area,BCCL

Encl: As above.

Cc to:

1. HoD(Env.),BCCL
2. File.

CS Scanned with CamScanner

BHARAT COKING COAL LIMITED
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
OFFICE OF THE GENERAL MANAGER
LODNA AREA-X

Ref No. : BCCL/LA/GM/2022/756

Date: 13/10/2022

To
The Director
IIT(ISM), Dhanbad
Dhanbad,Jharkhand
PIN-826004

Subject: Request for providing Performa Invoice (PI)/Quotation for providing your expertise for control of fire and their reclamation in Cluster- IX of BCCL.

Respected sir,

As per inspection done by Integrated Regional Office Ranchi MoEF&CC on dated 23.02.2022 and 24.02.2022 (inspection report enclosed) of cluster IX group of mines of BCCL and specific condition no -xi of Environmental clearance no.-NO.J-11015/307/2010-IA.II (M) (Copy attached), your expertise/ recommendation is needed for control of fire and their reclamation in cluster-IX group of mines of BCCL as cluster-IX groups of mines are fire affected.

You are therefore requested to provide Performa Invoice(PI)/Quotation for providing your expertise/recommendations for control of fire and their reclamation in cluster-IX group of mines of BCCL.

We shall be highly obliged to you for this act of kindness.

Thanking you!

Faithfully your's

13/10/22
General Manager
Lodna Area,BCCL

Encl: As above.

Cc to:

1. HoD(Env.),BCCL
2. File.

Scanned with CamScanner

Annexure IV

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.

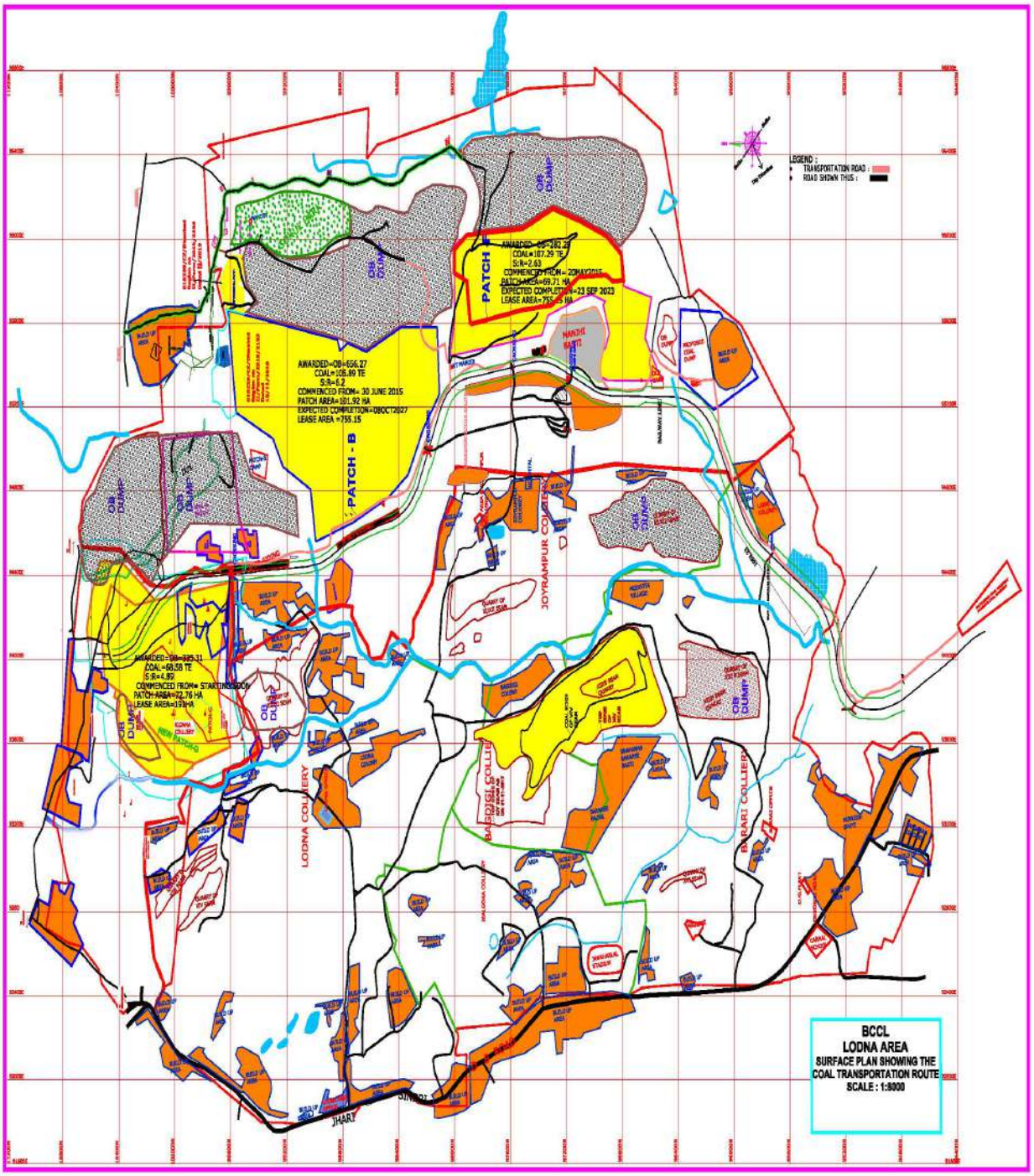
We request you provide us the recommendation made by your institution for dealing the fire in the following address.
Enclosure: EC (Cluster IX)

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 V


LEGEND :
TRANSPORTATION ROAD :
ROAD SHOWN THUS :
PATCH - A
AWARDED=OB=182.23
COAL=107.29 TE
S:R=2.63
COMMENCED FROM= 20MAY2015
PATCH AREA=69.71 HA
EXPECTED COMPLETION=23 SEP 2023
LEASE AREA=755.15 HA
PATCH - B
AWARDED=OB=656.27
COAL=105.89 TE
S:R=6.2
COMMENCED FROM= 30 JUNE 2015
PATCH AREA=101.92 HA
EXPECTED COMPLETION=DBOCT2027
LEASE AREA =755.15
AWARDED=OB=835.21
COAL=68.58 TE
S:R=4.89
COMMENCED FROM= STARTING SOON
PATCH AREA=72.76 HA
LEASE AREA=151HA
OB DUMP
OB STACK
PROPOSED COAL DUMP
BUILD UP AREA
MANDIR
MASJID
MOSQUE
SCHOOL
RAILWAY LINE
RAILWAY STATION
CANAL
JOYRAMPUR COLLIERY
LODNA COLLIERY
BASUDEOPUR COLLIERY
BHARAT COLLIERY
JHARIA
BCCL
LODNA AREA
SURFACE PLAN SHOWING THE
COAL TRANSPORTATION ROUTE
SCALE : 1:9000

TRANSPORTATION PLAN

Fully covered tarpaulene road transport

Annexure VI

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

संलग्नक: यथोपरि

20/12/17
(एन के मार्तण्ड)
महाप्रबंधक (योजना एवं परियोजना)

प्रतिलिपि:
क्षेत्रीय निदेशक, सी एम पी डी आई, क्षेत्रीय संस्थान-II, कोयला भवन परिसर , धनबाद
महाप्रबंधक (वित्त) 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/ फैक्स-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

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

(B.K. Parui)
Company Secretary

1. Addl. GM (F)/C
2. HOD (Budget)
3. Makapple Sahu
4. Board file

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.

Sl. No	Name of Mine/Project	Project Area	Balance Life of Mine	Amount to be deposited to Escrow Account(₹Lakh)			
				1st Year	2nd Year	nth 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

B.K. Parui
Company Secretary
Bharat Coking Coal Limited
Koyla Bhawan
Dhanbad-826005

Annexure VII

Gmail

Environment Lodna Area <envlodna@gmail.com>

Fwd: Mechanically covered trucks for transportation of coal

ARUN KUMAR <gmlodna.bccl@coalindia.in> 19 April 2022 at 13:32
To: agmofficelodna <agmofficelodna@gmail.com>, planninglodna <planninglodna@gmail.com>, TAPAS KUMAR BANDOPADHYAY <tapas.bandopadhyay@coalindia.in>, Pankaj Kumar <pankaj.k3407@coalindia.in>, envlodna <envlodna@gmail.com>

For information and necessary action

From: "Rakesh Dwivedi" <rdwivedi.cil@coalindia.in>
To: "b bhadale" <b.bhadale@tatamotors.com>
Cc: "Pradeep Kumar Sinha" <gmenm.bccl@coalindia.in>, "KUMAR RANJEEV" <gmenv.bccl@coalindia.in>, "ARUN KUMAR" <gmlodna.bccl@coalindia.in>, "Nand Kishore Bharati" <gmcmc.bccl@coalindia.in>, "Shailendra Kumar Singh" <tstodtop.bccl@coalindia.in>, agmofficelodna@gmail.com
Sent: Tuesday, April 19, 2022 12:03:12 PM
Subject: Mechanically covered trucks for transportation of coal

To Sri Bapu Saheb Bhadale
Nodal Officer (Commercial Vehicles)
Tata Motors, Mumbai

Dear Sir,

REF: BCCL Work order no 191 DT 25-11--2011 for 173 nos Tata Tippers (Hywa) LPK2518

Our company Bharat Coking Coal Ltd, a Subsidiary of Coal India Ltd is engaged in the business of mining coking coal . Large no of tipping trucks of Tata make are in operation in our mines for transportation of coal and for reference a` work order issued to Tata Motors for procurement of tipping trucks has been referred above.
Ministry of Environment and Forest, Government of India has issued statutory directives to deploy tipping trucks with a mechanical system for covering the trucks to ensure that there is no spillage during coal transportation. This issue raised with Tata Motors officials and we were informed that Tata Motors would look into the matter

WE will be grateful if you confirm the availability of such mechanically covered tipping trucks in your company. Kindly let us no if it is possible to retrofit the operating Tata Moto Tippers with mechanical covers,

An early reply will be highly appreciated

Dr R. Dwivedi,
General Manager (E&M)/Solar
Bharat Coking Coal Limited
Dhanbad

Avenue Plantation

Annexure VIII

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
18.	01.04.2020- 11.04.2022	723

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
		2021-22	1,80,000
2.	**Middle School, North Tisra**	2017-18	2,49,000
		2018-19	7,47,000
		2019-20	2,19,000
		2021-22	4,20,000
3.	**Jealgora School of Learning, Jealgora**	2017-18	2,37,000
		2018-19	7,11,000
		2019-20	2,37,000
		2021-22	4,20,000

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	3.845	Welfare Building

	COMMUNITY CENTER D/M AT BHAGA UNDER LODNA AREA.		
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	23.716	Other Welfare Work

	SHOP UNDER LA.		
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 NOONUDIH UNDER LODNA AREA.	30.738	Welfare Building
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	69.524	Welfare Building

	BAGDIGI 05 NO UNDER LODNA AREA.		
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 LODNA AREA.	46.021	Welfare Building
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 WORK AT COMMUNITY CENTER(SHIVMANDIR) BYE QRT LODNA COLLIERY UNDER LODNA AREA.	33.230	Welfare Building
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.	34.633	Welfare Work
4.	FOR W/WASH,C/WASH,AND PAINRING AT COMMUNITY CENTER DURGA MANDIR	34.633	Welfare Work

	LODNA COLLIERY UNDER LODNA AREA.		
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

Financial Year 2021-22

Sl. no	Name of the work	Amount	Head
1.	R/M of 03 Nos Shiv Mandirs under Lodna Area	49.055	Welfare Building
2.	R/M of Shiv Mandir at Paharigora, under Lodna Area	7.539	Welfare Building
3.	R/M of raksha kali dham Lodna Area	82.919	Welfare Building
4.	R/M of Hari Mandir @ Jeenagora under Lodna Area	41.709	Welfare Building
5.	R/M 3 Nos Community Centre Dumariyatand under Lodna Area	32.539	Welfare Building
6.	R/M of temple at Bagdigi under Lodna Area	14.781	Welfare Building
7.	R/M of Kali Mandir at Gokul Park under Lodna Area.	14.797	Welfare Building
8.	R/M of Shiv Mandir at alakdiha OP under Lodna Area	19.559	Welfare Building
9.	R/M of Hanuman Mandir at Gokul Dham under Lodna Area	40.864	Welfare Building
10.	R/M of Shiv Mandir Bhaga No. 2 under Lodna Area	9.012	Welfare Building
11.	R/M of Shiv Mandir @ PG Pahari under Lodna Area.	12.415	Welfare Building
12.	Rep. of Shiv Mandir @ jeenagora under Lodna Area	33.474	Welfare Building
13.	R/M of Mandir at Noonudih & Bararee under Lodna Area.	20.540	Welfare Building
14.	R/M of Lodna Masjid under Lodna Area	258.224	Welfare Building
15.	R/m of durga kali mandir @ MOCP Sect 1 under Lodna Area.	44.745	Welfare Building
16.	R/M of Burha Baba Mandir under Lodna Area.	44.938	Welfare Building
17.	Misc. civil works of toilet @ Gokul Park under LOdna Area.	29.917	Welfare Building
18.	R/m of Jeenagora weigh bridge under Lodna Area.	32.620	Welfare Building
19.	R/M of Shiv Mandir b@ PIrkubandh under Lodna Area.	8.333	Welfare Building
20.	R/M of durga Mandir @ Bhaga under Lodna Area.	15.118	Welfare Building
21.	R/M of Shiv Mandir @ Baniahirunder Lodna Area.	68.479	Welfare Building
22.	R/M of Kali Mandir and Durga mandir under lodna Area	36.467	Welfare Building
23.	R/M Durga Mandir @ Lodna Colliery under Lodna Area.	36.820	Welfare Building
24.	R/M of Durga Mandir at MOCP Sector 1 under Lodna Area	25.373	Welfare Building

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 colliery 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:

Details of CSR expenditure of Cluster IX for different activities for last two years is given below:

Name of Activity	Year (Expenditure in lakhs)		
	2019-20	2020-21	2021-22
Expenditure on Filter Plants and Domestic water supply	51.61	50.16	14.16
MADA water supply	725.26	693.80	444.00
Hospital	8.03	14.25	30.09 (including medicine and surgical equipment)
For the use of Community Centres/Auditoriums	27.57	30.24	4.88
Stadium and Sports	18.29	6.51	10.58
Handloom Centre	3.5	1.98	
Other Misc. Work	2.62	6.2	

Details of CSR expenditure of whole BCCL

CSR Budget & Expenditure Summary from 2015-16 to 2020-21

Sl. No.	Fin. Yr.	Obligation as per CSR Policy of Company (₹ in crores)	Expenditure (₹ in crores)
1	2015-16	33.01	50.67
2	2016-17	26.85	11.45
3	2017-18	9.98	2.74
4	2018-19	6.52	1.43
5	2019-20	6.21	6.01
6	2020-21*	5.54	2.39

**Unaudited/ provisional expenditure for the FY 2020-21*

Details of CSR expenditure of whole BCCL for FY 2021-22

FY 2021-22		
Sl No	Particulars	Expenditure incurred(in Rs. Lakh)
1	Depository mode Financial assistance to D.C., Dhanbad for combating COVID-19 situation in Dhanbad	100.00
2	Depository mode Financial assistance to Jharkhand State Disaster Mitigation Fund for distributing home isolation kits to COVID-19 patients	25.00
3	Procurement of masks & hand wash/ sanitizers for distribution amongst public for combating COVID-19	0.72
4	Fooding through Administration department for Doctors and Frontline workers at Covid Ward, CHD, Dhanbad and other miscellaneous COVID-19 expenditure like temporary contract of doctor etc.	36.45
5	Additional financial liability on submission of fresh bills for the work "Boarding and lodging of doctors and paramedical staff engaged in COVID-19 Hospital, CHD"	22.62
6	Cleaning and sanitization of temporary quarantine centres for doctors and paramedic staff engaged in treatment of COVID 19	2.15
7	Training of Youths in Various Plastic Engineering Courses through Central Institute of Plastics Engineering and Technology (CIPET)	14.00
8	Development of 500 Nos. of Aanganwadi Centres in Dhanbad	75.00
9	SVA Survey Expenditure (All Areas)	6.96
10	Distribution of blankets during winter season	3.58
11	Submission of fresh bills for project "Training of mining sirdar for SC/ST PAPs" by PB Area	3.26
12	Submission of fresh bills for "Operation of COVID quarantine centre" by Bastacolla Area	3.80
13	Upgradation of public toilets and approach road in Central Hospital, Dhanbad	3.15
14	Submission of final bills for "Gymnasium at Ambedkar Academy, Dhanbad"	2.35
15	Reversal of Financial Liablity (medical camps)	(8.52)
16	Amount for Aanganwadi deposited in Unspent CSR Account	188.50
17	Amount for CIPET deposited in Unspent CSR Account	14.00
	Total	**493.02**

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 Details												
S. No	**Name of Mine**	**Normative (MTY)**	**Peak (MTY)**	**Leasehold Area (Ha.)**	**2015-16 (Tonn.)**	**2016-17 (Tonn.)**	**2017-18 (Tonn.)**	**2018-19 (Tonn.)**	**2019-20 (Tonn.)**	**2020-21 (Tonn.)**	**2021-22 (Tonn.)**	**2022-23 (upto sept.) (Tonn.)**
1.	Amal. NT-ST-JG Colliery	6.0	7.8	755.15	**3826689**	**3839054**	**3192316**	**2484642**	**2534760**	**2264372**	**3813224**	**2548384**

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

Coal Dispatched by Rail & Road in FY 2021-22

Colliery Name	Dispatch by Rail (Te)	Dispatch by Road (Te)	Total Dispatch (Rail + Road) (Te)
Amal. NT-ST-JG Colliery	3343480	679293	4022773

Coal Dispatched by Rail & Road in FY 2022-23 (upto sept.)

Colliery Name	Dispatch by Rail (Te)	Dispatch by Road (Te)	Total Dispatch (Rail + Road) (Te)
Amal. NT-ST-JG Colliery	2307976	425418	2733394

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:

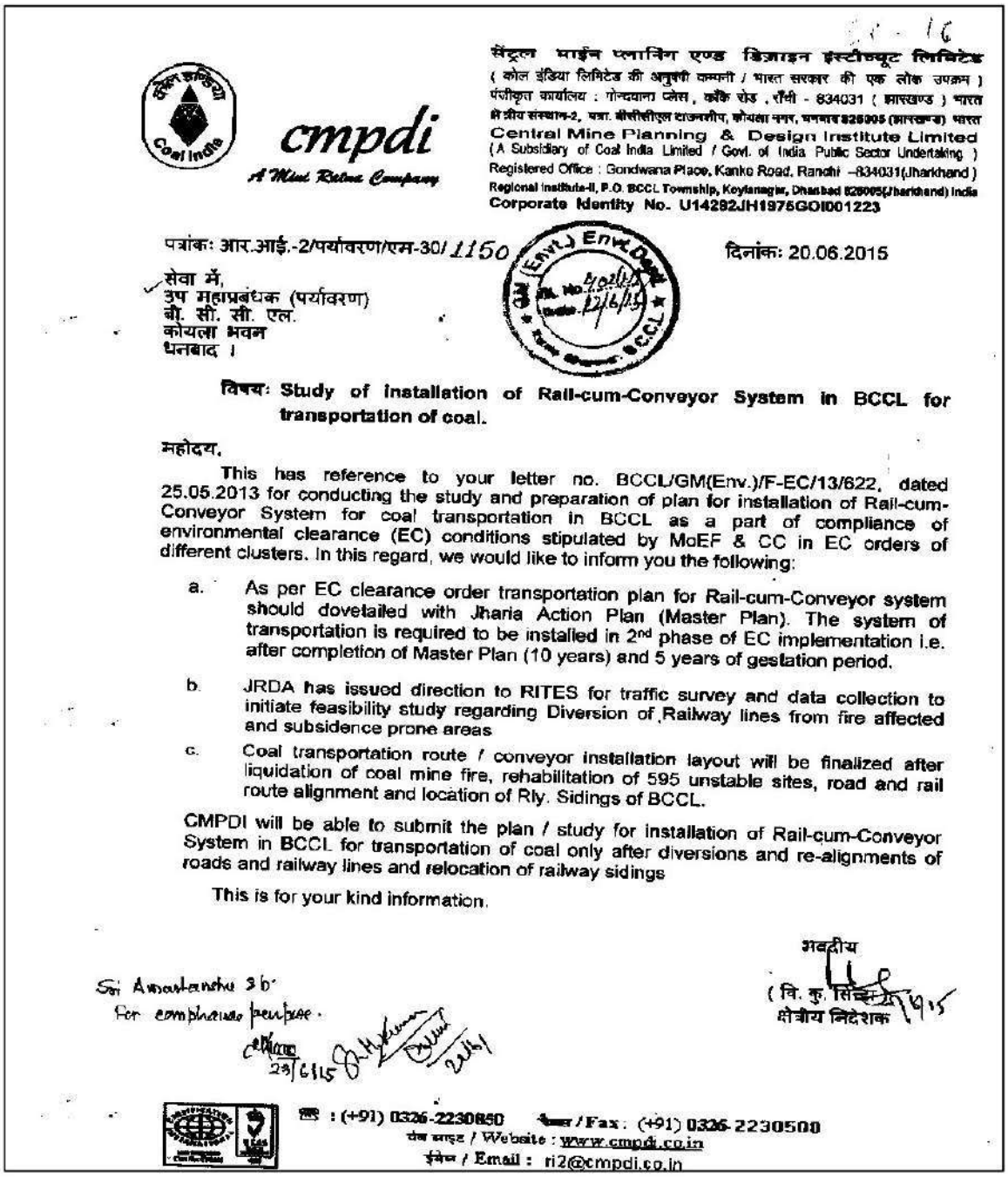
- Maithon Power Limited
- Patherdih Washery
- Steel Plant
- DVC
- Fertilizers
- RTPS
- Haldia
- APNL
- Others

Transportation Plan:

Action has been taken for formulating adequate transportation plan for conveyor-cum-rail system of dispatch. CMPDIL has been requested to prepare the plan. However, CMPDIL had submitted that such transportation plan can be completed only after implementation of Master Plan and dousing of the fire. The copy of the reply submitted by CMPDI is attached.

Transportation is being done by covering vehicle with tarpaulin cover and it is made mandatory in Transportation contracts.

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 : गोन्डवाना 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

cmpdi
A Mini Ratna Company

पत्रांकः आर.आई.-2/पर्यावरण/एम-30/1150

Env. Dept. BCCL

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.

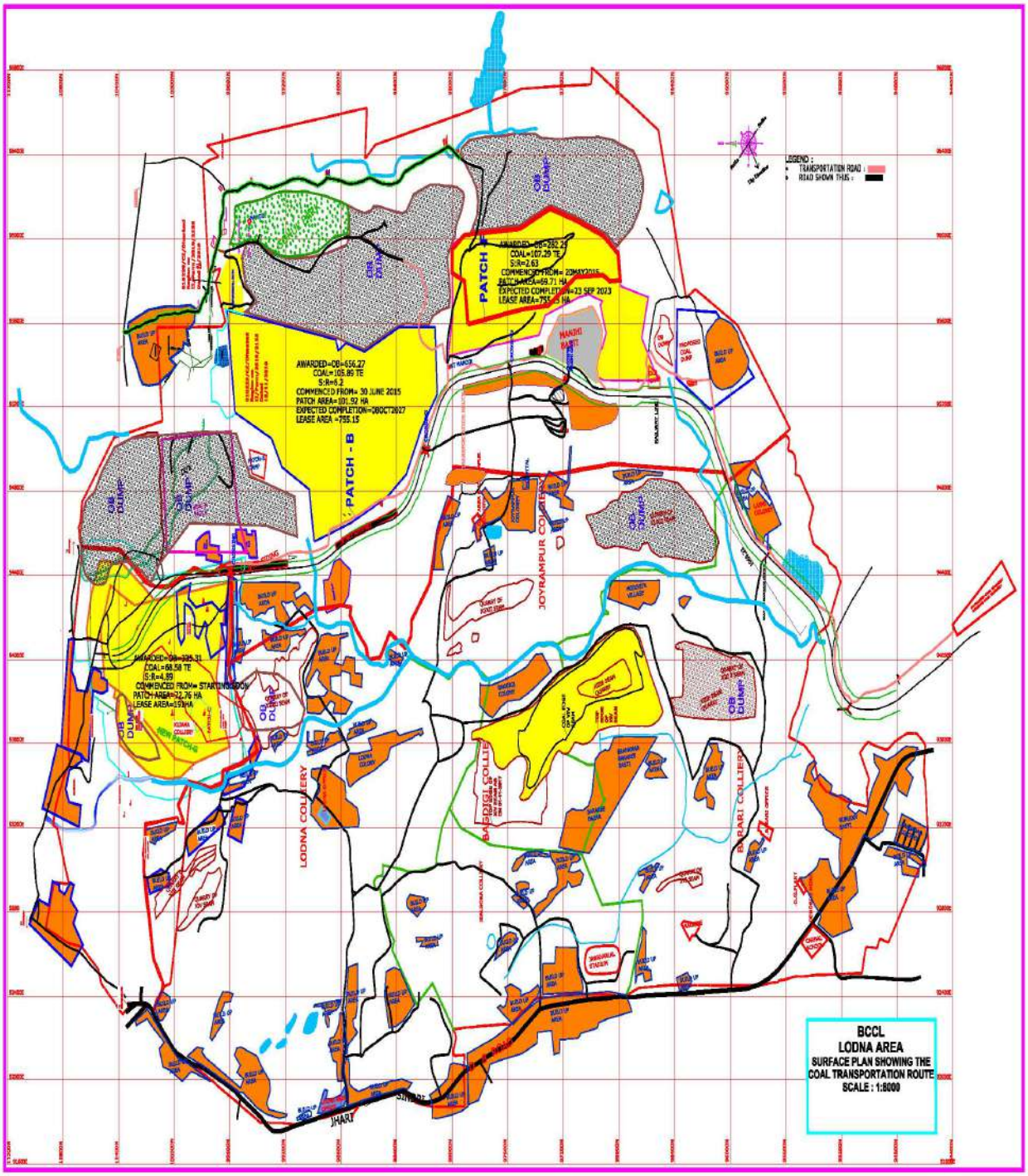
CMPDI will be able to submit the plan / study for installation of Rail-cum-Conveyor System in BCCL for transportation of coal only after diversions and re-alignments of roads and railway lines and relocation of railway sidings

This is for your kind information.

भवदीय
(वि. कु. सिंह)
क्षेत्रीय निदेशक

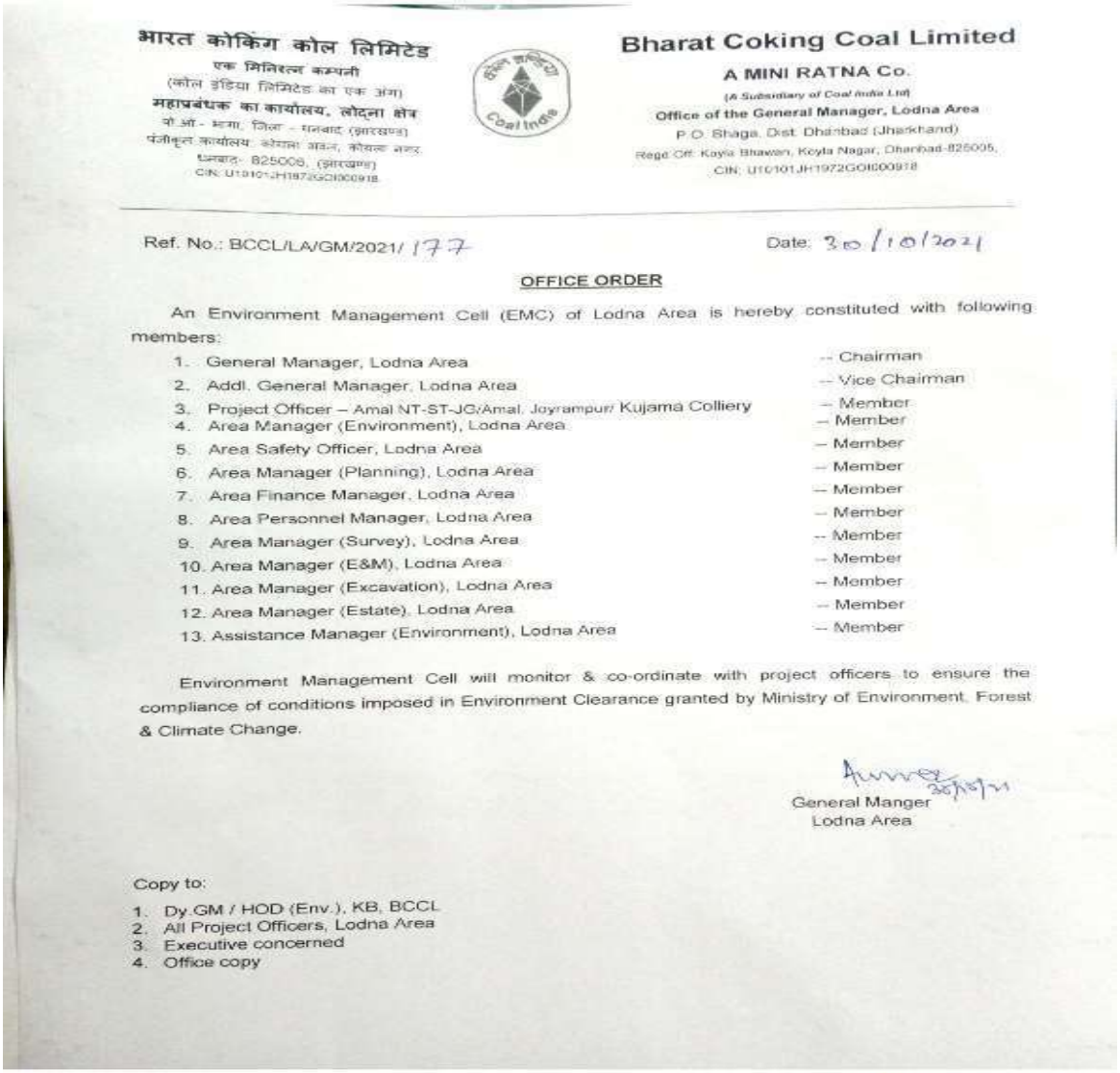
Sri Awasthi Sb
For emphasis please.

फोन : (+91) 0326-2230850 फैक्स / Fax : (+91) 0326-2230500
वेब साइट / Website : www.cmpdi.co.in
ईमेल / Email : ri2@cmpdi.co.in


PATCH - B
PATCH - E
JOYRAMPUR COLLIERY
LODNA COLLIERY
BARARI COLLIERY
OB DUMP
BCCL
LODNA AREA
SURFACE PLAN SHOWING THE COAL TRANSPORTATION ROUTE
SCALE : 1:8000

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
पो.ओ - भगा, जिला - धनबाद (झारखण्ड)
पंजीकृत कार्यालय: कोयला भवन, कोयला नगर
धनबाद- 826005, (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-826005.
CIN: U10101JH1972GOI000918

Ref. No.: BCCL/LA/GM/2021/ 177 Date: 30/10/2021

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. Project Officer – Amal NT-ST-JC/Amal, Joyrampur/ Kujama Colliery	-- Member
4. Area Manager (Environment), Lodna Area	-- Member
5. Area Safety Officer, Lodna Area	-- Member
6. Area Manager (Planning), Lodna Area	-- Member
7. Area Finance Manager, Lodna Area	-- Member
8. Area Personnel Manager, Lodna Area	-- Member
9. Area Manager (Survey), Lodna Area	-- Member
10. Area Manager (E&M), Lodna Area	-- Member
11. Area Manager (Excavation), Lodna Area	-- Member
12. Area Manager (Estate), Lodna Area	-- 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.

30/10/21
General Manger
Lodna Area

Copy to:
1. Dy.GM / HOD (Env.), KB, BCCL
2. All Project Officers, Lodna Area
3. Executive concerned
4. Office copy

Scanned with CamScanner

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:

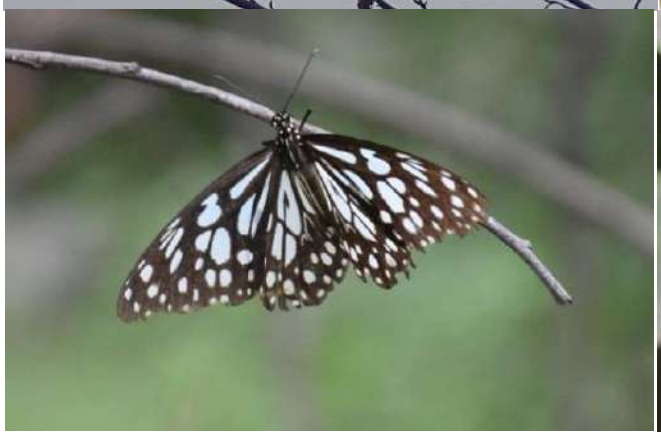
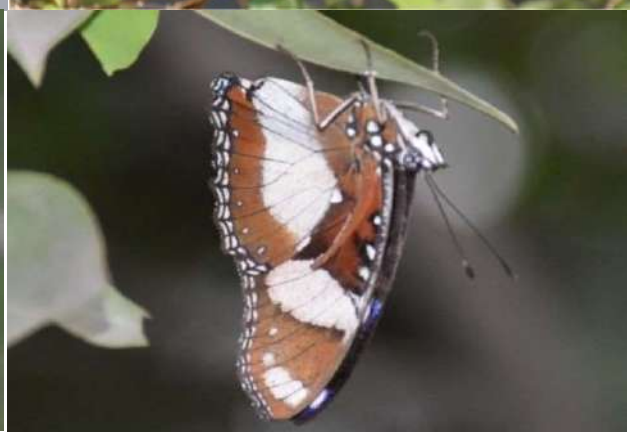
Lodna Area is committed to enhance the bio diversity/green cover in Area by regularly taking up eco restoration work on stabilized OB dumps, Avenue plantation, and block plantation etc.

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.

64MP AI QUAD CAMERA
Shot on realme XT

64MP AI QUAD CAMERA
Shot on realme XT

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.

Annexure IX

सेन्ट्रल माईन प्लानिंग एण्ड डिजाईन इन्स्टीच्यूट लिमिटेड
(कोल इण्डिया लिमिटेड की अनुषंगी कम्पनी / भारत सरकार का एक लोक उपक्रम)
गोन्डवाना प्लेस, कांके रोड, रांची - 834 031, झारखंड (भारत)
Central Mine Planning & Design Institute Limited
(A Subsidiary of Coal India Limited / Govt. of India Public Sector Undertaking)
Gondwana Place, Kanke Road, Ranchi - 834 031, Jharkhand (INDIA)
CORPORATE IDENTITY NUMBER - U14292JH1975GOI001223

Letter No.: पर्यावरण/22/BCCL/

पर्यावरण प्रभाग
Environment Division
क्रम संख्या
Sl. No. 17
दिनांक
Date 08/2/22

Dated: 08/02/2022

सेवा में,

उप महाप्रबन्धक (पर्यावरण)
बी. सी. सी. एल.
कोयला भवन
धनबाद-826005

विषयः Revised Report of Cluster IX group of Mines on "**Study to analyze the Extent of Reduction of Pollution Load every year by reducing coal transportation by Road**".

(Your Email dated 12th Jan 2022)

महोदय,

Please find attached soft copy of the Revised report on "Study to analyze the Extent of reduction of pollution load every year by reducing coal transportation by Road" for the **cluster IX:**

Sl. No.	Name of the Cluster	Peak Production (MTY)
1.	Cluster – IX	8.512

सधन्यवाद,

संलग्नकः यथोक्त

भवदीय

8/2/22

(Abhijit Sinha)
महाप्रबन्धक (पर्यावरण)

प्रतिलिपि:
1. क्षेत्रीय निदेशक, आर.आई- II, कोयला भवन, धनबाद- For Kind information.

फोन नम्बर /Phone No. : +91 651 2230055 फैक्स नम्बर / Fax No : +91 651 2231447
ई मेल /e-mail: gmenv.cmpdi@coalindia.in, gmenv.cmpdi@gmail.com;
वेबसाईट / Website Address: www.cmpdi.co.in

STRICTLY RESTRICTED
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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.

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

(February, 2022)

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 analyze 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

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.

1.4 Meteorological Data

The meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information and it provides an input for prediction models of air quality dispersion. The transport and diffusion of the pollutants in the atmosphere are governed by meteorological factors. Factors like wind velocity, wind direction and atmospheric stability are known as primary/basic meteorological parameters since the dispersion and diffusion of pollutants depend mainly on these factors. Factors like ambient temperature, humidity, rainfall, atmospheric pressure, etc. are known as secondary meteorological parameters as these factors control the dispersion of the pollutants indirectly by affecting the primary factors. Thus, to assess the air pollution impact it becomes essential to collect data of the above mentioned meteorological parameters in the study area.

1.4.1 METHODOLOGY

Data of micrometeorological and microclimatic parameters were recorded by installing an Automatic Weather station at the roof of Moonidih Project Office (inside the premises of existing Moonidih washery) to represent the prevailing micrometeorological aspects of the study area. Automatic Weather station (Make: Ecotech & Model: WM-721) was used to record Ambient temperature, Relative humidity, atmospheric pressure, Cloud cover, Rainfall, wind speed and direction continuously during the study period.

During the study period, hourly reading of wind velocity, wind direction, temperature, relative humidity, cloud cover and rainfall data were recorded and reported.

1.4.2 DATA PRESENTATION

Wind Rose diagram during the study period has been in the Fig. 1.1 for the period from 09th December 2020 to 09th March 2021.

1.4.3 DATA COLLECTION AND ANALYSIS

Meteorological data collected at meteorological station representing the study area during the study period (09th December 2020 to 09th March 2021) reveals the following status:

(i) <u>Wind Speed/Direction</u>

Generally, moderate winds prevailed throughout the season. Moderate Winds prevailed 33.23 % times. Generally, during the night time calm conditions were observed. Wind speed readings throughout the season were ranging from ≤ 0.5 m/sec to 10.3 m/sec. The seasonal average wind speed was observed to be 0.63 m/sec. The wind pattern of the study period is presented below:

The analysis of wind pattern during the season showed that the predominant wind directions were from South South West (SSW) & followed by South West having frequencies 9.30 %, & 6.40 % respectively.

The calm conditions prevailed 50.58%. The analysis of wind speeds during the study period indicated that the low speed of 0.50 - 1.50 m/sec occupied 33.23% while wind speed of 1.50 - 3.50 m/sec occupied 15.69 % and > 3.50 m/sec were recorded as 0.46 % of the total occupancy respectively.

(ii) Temperature

Temperature values ranged between 6.5 ^{O}C to 40.3^{O}C. The seasonal average temperature value during this period was found to be 22.20 ^{O}C.

(iii) Relative Humidity

The daily average relative humidity values were in the range of 12.1 to 94.1%. The seasonal average humidity value was found to be 58.9 %.

(iv) Cloud Cover

Mostly clear sky was predominant during the study period.

(v) Atmospheric Pressure

The average atmospheric pressure value has been found to be around 750.12 mm Hg.

(vi) Rainfall

Total 20 mm rainfall was recorded during the study period. The maximum daily rainfall observed during the season was found to be 4 mm.

1.4.3 SUMMARY

The sky was mostly clear during the study period. The readings of wind velocity were ranging from ≤ 0.5 m/sec to 10.3 m/sec. Predominant wind was blowing from South South West (SSW) direction. The seasonal average wind speed was observed to be 0.63 m/sec. The maximum temperature recorded was 40.3^{O}C and the minimum is 6.5 ^{O}C. The daily average relative humidity values were in the range of 12.1 to 94.1%. %.

Table 1.2: SEASONAL WIND DISTRIBUTION (DEC'2020 -MARCH' 2021)
Period: 09th December '2020 –09th March '2021

	Directions / Wind Classes (m/s)	0.50 - 1.50	1.50 - 3.50	>= 3.50	Total (%)
1	N	0.55	0.23	0.00	0.78
2	NNE	0.51	0.14	0.00	0.64
3	NE	0.83	0.28	0.00	1.10
4	ENE	0.55	0.14	0.00	0.69
5	E	0.97	0.23	0.00	1.20
6	ESE	0.64	0.41	0.00	1.06
7	SE	1.38	0.60	0.05	2.02
8	SSE	3.31	1.66	0.00	4.97
9	S	4.46	1.56	0.00	6.03
10	SSW	6.30	2.85	0.14	9.30
11	SW	4.00	2.25	0.14	6.40
12	WSW	3.22	2.44	0.14	5.80
13	W	2.16	1.15	0.00	3.31
14	WNW	1.43	0.60	0.00	2.02
15	NW	1.33	0.74	0.00	2.07
16	NNW	1.56	0.41	0.00	1.98
	Sub-Total	33.23	15.69	0.46	49.38
	Calms				50.5752
	Missing/Incomplete				0.04602

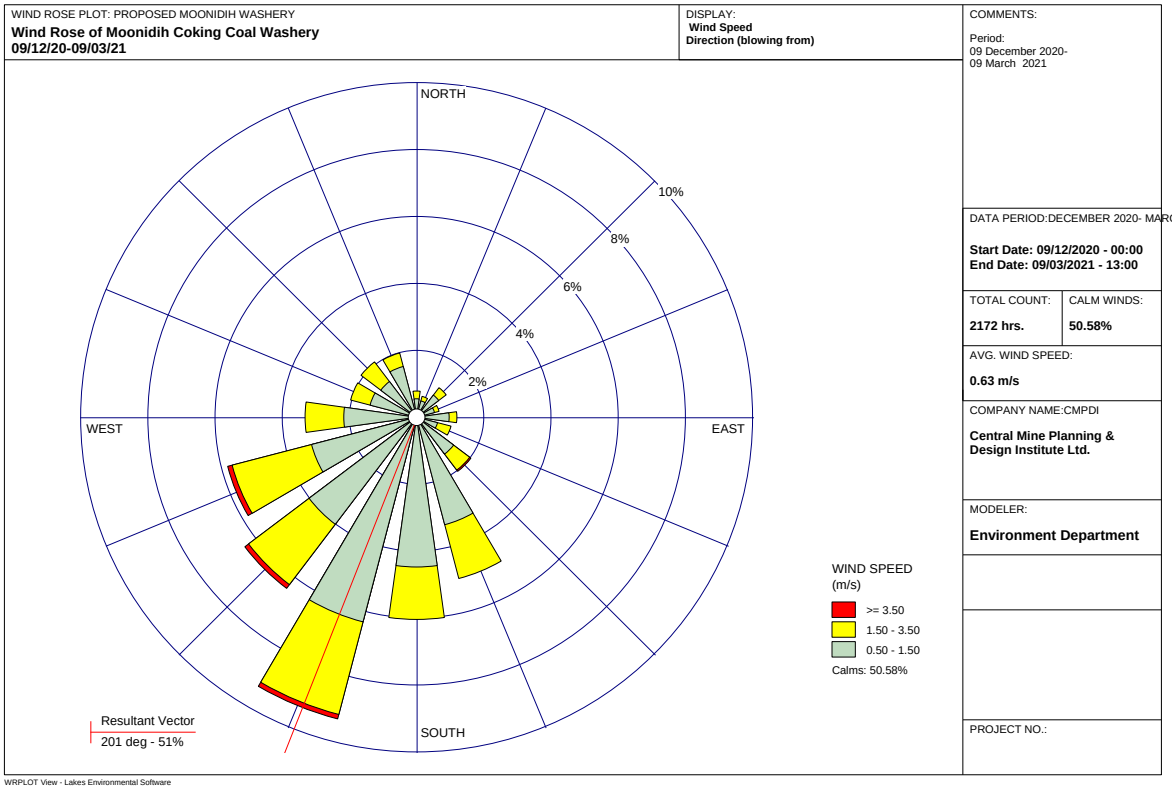


Figure No.-1.1 Wind Rose diagram for the period 9th December 20 to 9th March 2021

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 sidings for 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 Kilometre Travelled**	**Emission Rate for PM 10 (kg/VKT)**	**Pollution Load * Dust Generated Per Day (Kg/day)**	**Dust generated Kg/per tonne**
1	**NT-ST(Exp.) OCP**	18-19	6/9 no. siding	3.5	2484642	7529.21818	20.00	2635.23	0.53	1396.670	
			Total for 18-19			**7529.22**				**1396.670**	0.19
		19-20	6/9 no. siding	3.5	2534760	7681.09091	20.00	2688.38	0.53	1424.842	
			Total for 19-20			**7681.09**				**1424.842**	0.19
		20-21	6/9 no. siding	3.5	2264372	6861.73333	20.00	2401.61	0.53	1272.852	
			Total for 20-21			**6861.73**				**1272.852**	0.19

* In terms of PM 10 expressed as kg/day **Average distance has been considered **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 2020-21, the combined daily coal production of the Cluster was 6862 tones resulting in 1273 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.19 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 4785 kg/day for daily coal production of 25794 tonnes (8.512 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. ** Mining is not in operation

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 :(2020-21 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 2020-21, the combined daily coal production of the Cluster was 6862 tones resulting in 1273 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.19 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):

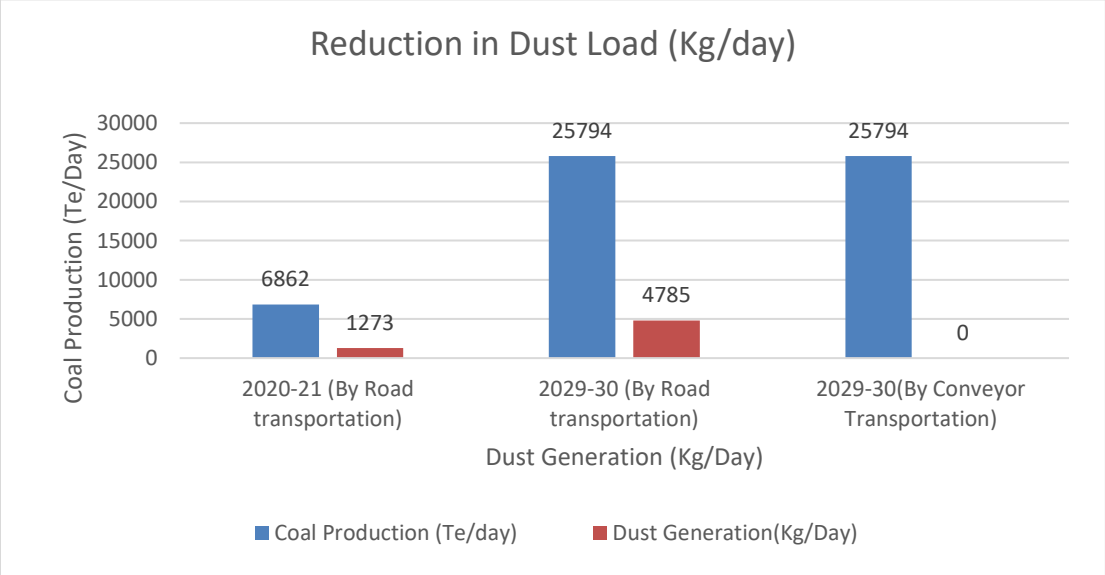
1. As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 4785 kg/day for daily coal production of 25794 tonnes (8.512 MTY) during Phase –II.
2. During Phase –II, dust load will further reduce 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)
2020-21 (By Road transportation)	6862	1273
2029-30 (By Road transportation)	25794	4785
2029-30(By Conveyor Transportation)	25794	0

Figure 2.1: Presentation of reduction in dust generation due to replacement of Road transportation by Conveyor system.



Annexure X

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/2021/ 177 Date: 30/10/2021

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. Project Officer – Amal NT-ST-JG/Amal. Joyrampur/ Kujama Colliery	-- Member
4. Area Manager (Environment), Lodna Area	-- Member
5. Area Safety Officer, Lodna Area	-- Member
6. Area Manager (Planning), Lodna Area	-- Member
7. Area Finance Manager, Lodna Area	-- Member
8. Area Personnel Manager, Lodna Area	-- Member
9. Area Manager (Survey), Lodna Area	-- Member
10. Area Manager (E&M), Lodna Area	-- Member
11. Area Manager (Excavation), Lodna Area	-- Member
12. Area Manager (Estate), Lodna Area	-- 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.

30/10/21
General Manger
Lodna Area

Copy to:

1. Dy.GM / HOD (Env.), KB, BCCL
2. All Project Officers, Lodna Area
3. Executive concerned
4. Office copy

Scanned with CamScanner

Scanned with CamScanner

Annexure XI

(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

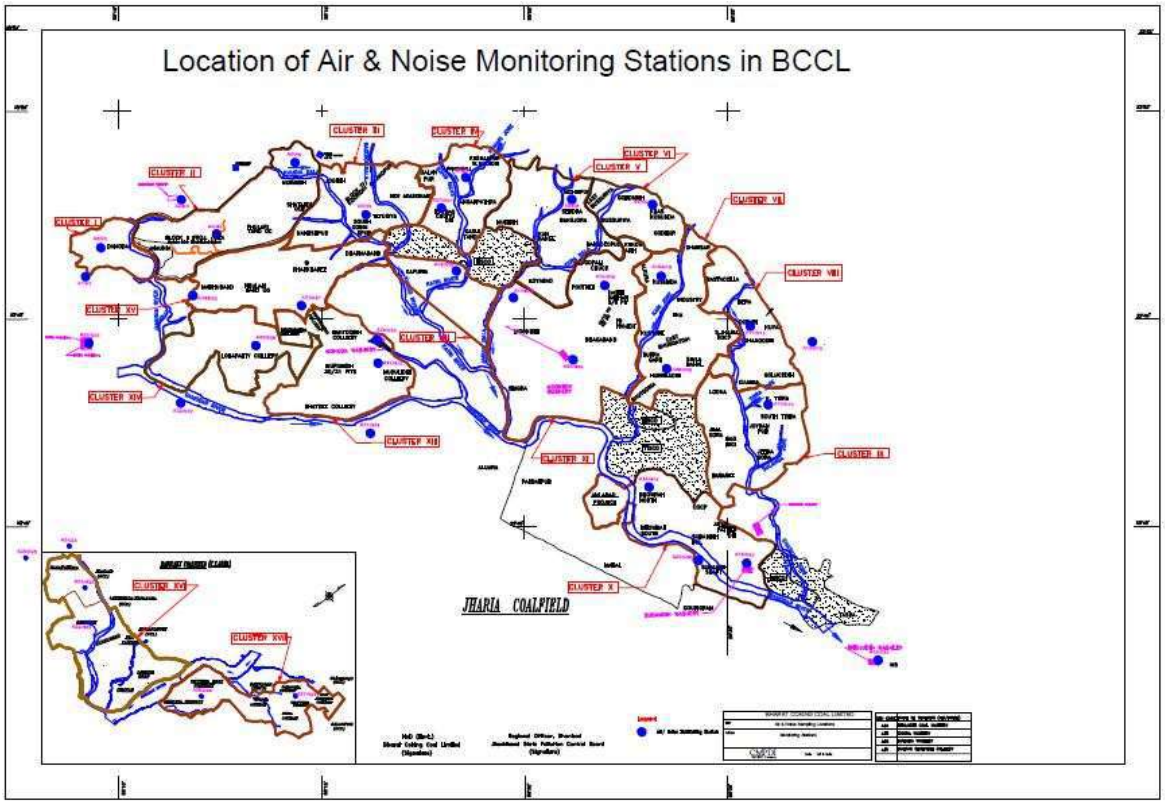
(Dinesh Prasad Singh)
Regional Officer.

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.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CLUSTER XV
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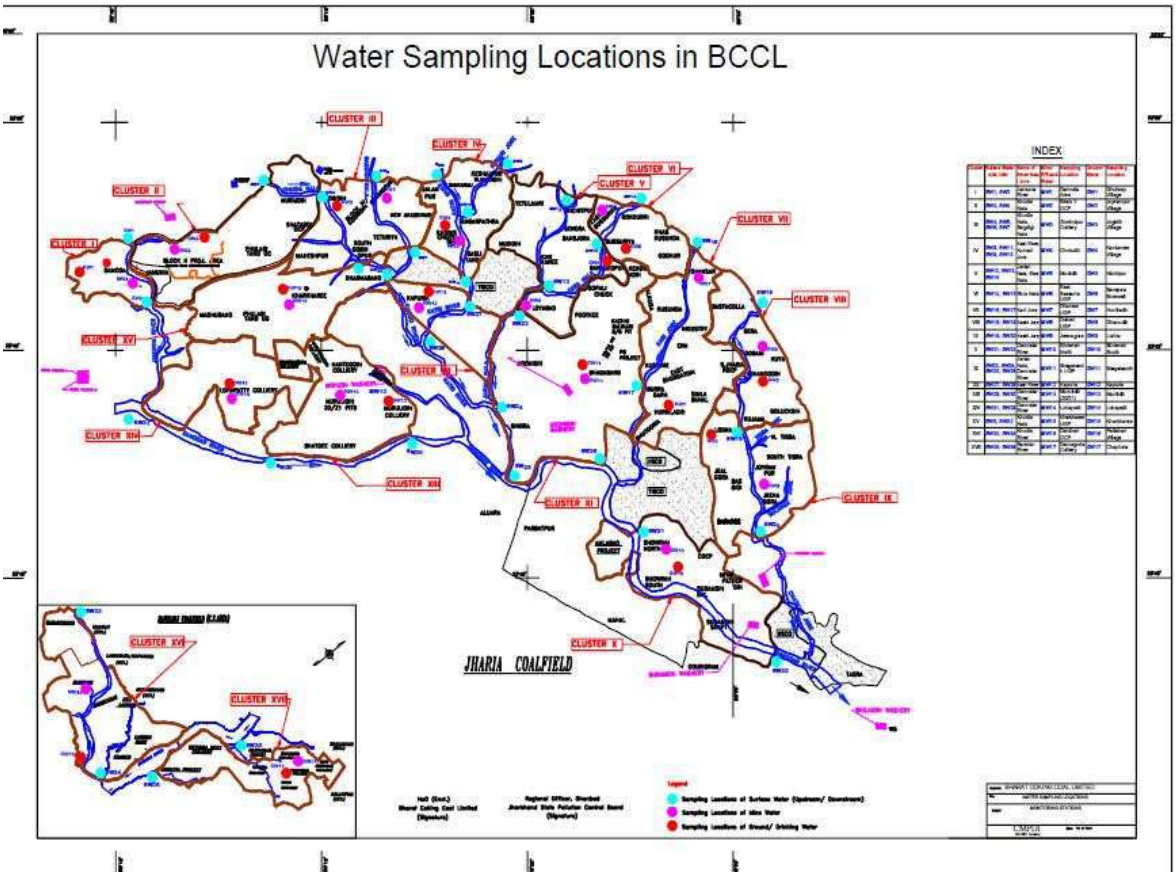
JHARIA COALFIELD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Annexure XII

"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

April 2022

Principal Investigator

Dr. Rajesh Biniwale
Senior Principal Scientist
CSIR-National Environmental
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Ms. Punam Bagde
Ms. Pratiksha Thombre
Mr. Mohit Mahurkar
Mr. Rahul Pawar
Ms. Smita Aditya
Mr. Ankush Rai
Mr. Vijay Selvaraj

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Chapter 1 Introduction

Jharia Coalfield (JCF) is one of the oldest coalfields of India and has been subjected to coal exploitation for more than 100 years. JCF is one of the significant coal-producing areas in the country and occupies an important place in India's industrial and energy scenario by virtue of prime coking coal and is an essential source of coal. Jharia coalfield is crucial and a large coalfield situated in Dhanbad and Bokaro district, Jharkhand. Geographically the JCF is bounded by latitude 23°38' N to 23°49' N and longitude 86°09'E to 86°30'E and encompassing a total area of about 450sq km (Figure 1.1). Jharia is the largest coal producer in India and has an estimated reserved of 19.4 billion tonnes of coking coal. The coalfield contributes to the local economy and directly or indirectly employs the local population.

Bharat Coking Coal Limited, a subsidiary of Coal India Limited, has been operating the majority of the coal mines in the Jharia coalfield regions since its inception in 1972. Jharia, one of the eight blocks in Dhanbad and the main source of metallurgical coal in India can be termed as the country powerhouse since its mines are the only source for the best quality coking coal required by the steel industries and others in the country.

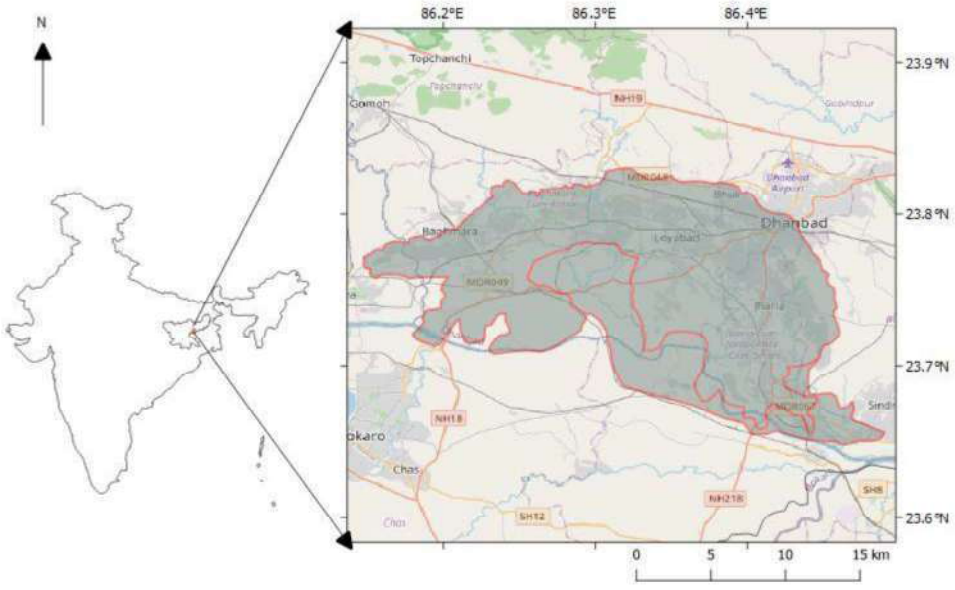


Figure 1.1: Geographical location of Jharia Coalfield in India

1.1. Climate

Dhanbad lies 236 m above the mean sea level and experiences the tropical climate. When compared with the winter, the summers have much more rainfall. The Köppen-Geiger climate classification is Aw (Tropical wet-dry climate) and experiences an average temperature of 25.9 °C and 1203 mm of precipitation falls annually. The driest month is December. There is 3 mm of precipitation in December. In July, the precipitation reaches its peak, with an average of 321 mm. With an average of 32.5 °C, May is the warmest month. At 18.4 °C on average, January is the coldest month of the year. The windrose for the March-June months is presented in Figure 1.2.

1.2. Land use & Land cover

In the present investigation, the Jharia coalfield area (2827.43 sq km) has been undertaken to study the Land use land cover (LULC), For this study, Sentinel-2A satellite image is used in the month of 17 February 2019 having a minimum cloud. These images were downloaded from the United States Geological Survey (USGS) Earth Explorer. Each Sentinel 2A satellite imagery band was geo-referenced to the WGS_84 datum and Universal Transverse Mercator Zone 45 North coordinate system. The Sentinel 2A satellite image stacking of the band-2, band-3, band-4 and band-8 of 10 m resolution was performed on the ArcGIS 10.5 software for studying the LULC of the Jharia coalfield.

For LULC classification, supervised classification was carried out in the study area. Thus allocations of each classified area in sq. km and its percentages are tabulated in Table 1.1. The percentage of areas as classified as; agriculture (74.5%), barren land (7.45%) built-up areas (5.14%), mining (2.64%), vegetation (9.40%) and water body (0.86%) (Figure 1.2).

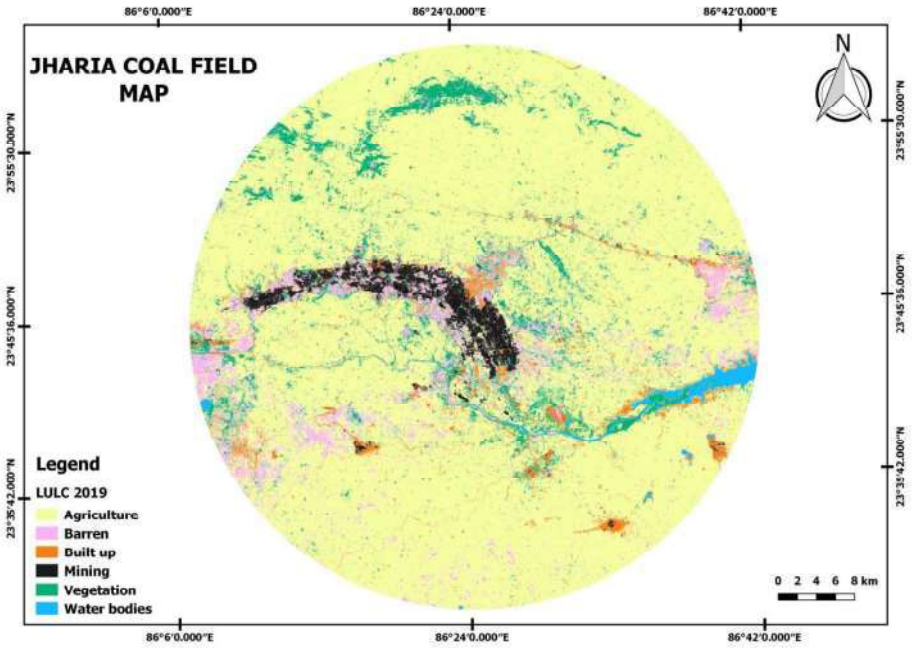


Figure 1.2: Land Use land cover map of Jharia coal field area

Table 1.1: LULC classification of Dhanbad study area

Sr. No	Name	Area in sq. km	Area in %
1.	Agriculture	2106.7	74.51
2.	Barren	210.64	7.45
3.	Built up	145.31	5.14
4.	Mining	74.67	2.64
5.	Vegetation	265.74	9.40
6.	Water bodies	24.37	0.86
Total		**2827.43**	**100**

1.3. Population

The study area covers four district boundaries; namely Dhanbad (1710.2sq km), Bokaro (620.43sq km), Giridih (29.8sq km) in Jharkhand and Puruliya (465.85sq km) district in West Bengal state. The Dhanbad district covers the maximum study area and the population is around 23, 94,434 in the year 2001 and is around 26,84,487 in 2011. The Bokaro district total population is in 2001 is 17, 75,961 and in 2011 it is 20, 62,330. The Giridih district total population is 19, 01,564 in 2001 and is 24,45,474 in 2011. The Puruliya district in West Bengal state total population is in 2001 is 25, 35,233 and in 2011 are 29, 30,115.

Based on the covered study area the total population in the study area is tabulated in Table 1.2. The total population in the study area based on Census book 2001 is 25,32,195 and 2011 is 28,62,600.

Table 1.2: Population in the study area as per 2011 census

District Name	District Area Covered by Study Area	% of Area Covered of District by Study Area	Population of 2001	Population 2001 in Study Area	Population of 2011	Population 2011 in Study Area
Bokaro	620.43	21.50	17,75,961	3,81,791	2,062,330	4,43,353
Dhanbad	1710.2	81.51	23,94,434	19,51,645	2,684,487	21,88,060
Giridih	29.8	0.59	19,01,564	11,275	2,445,474	14,500
Puruliya	465.85	7.40	25,35,233	1,87,484	2,930,115	2,16,686
Total	2826.28		Total Population 2001	25,32,195	Total Population 2011	28,62,600

1.4. Purpose of Study

Urban air pollution is a notable concern across the world. Inferring to the rapid rates of industrialization and urbanization in Indian cities, polluted air quality is considered a key factor in crumbling the quality of life with an adverse effect on the human being. Hence air quality gained a significant role in recent decades since it is worsened by emission from major pollutants including particulate matter (PM_{10} and $PM_{2.5}$), NO_2, SO_2 and O_3 were found to exceed the national ambient air quality standard (NAAQS) limits.

Particulate pollution is a major concern in the field of air pollution. The particulate matter in the air result from dispersion of dust from industrial (mining and non-mining) and allied activities, transportation, local vehicular movement and domestic fuel (Coal, wood-burning etc.) burning. Assessment of the air quality can provide useful insight for the development of the air quality management plan. The database developed on air quality also helps the regulatory agency identify the locations where natural resources and human health could be at risk.

Jharia coal mines having low ash content and high calorific value coals are subjected to intensive mining activities because of the easy availability of coal at shallow depths in thick seams. 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 cause a lot of fugitive gaseous and PM emissions. Hence, the Jharia region has been under scrutiny by various public authorities and the 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 dust, fugitive emissions, fuel oils, household LPG. The percentage contribution of these factors in the ambient depends exclusively on a particular region's economic activities. To improve the existing ambient air quality, the major sources of PM emissions first need to be identified.

Hence, the environmental clearance committee of MoEFCC 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 the Jharia coalfields region to quantify the various sources of PM emissions and suggest an effective environmental management plan.

The study's major objective 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 includes the entire Jharia Coalfield and an area up to 10 Km from the periphery/boundary of BCCL mines.

The detailed objectives are as follows:

i. Ambient Air Monitoring

- Monitoring of ambient air quality at selected receptor locations for pollutants including PM_{10}, $PM_{2.5}$(limited), SO_x, NO_x, PAHs to establish the status of the air quality in Jharia Coalfields and an 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 validate dispersion modelling predictions using measured air quality parameters
- To draw supportive data through the 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 micrometeorological conditions of the Jharia Coalfields

- Emission Inventory related to Jharia Coalfields along with area up to 10 Km from the periphery/boundary of BCCL mines

ii. 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
- Source apportionment
- To identify and apportion the pollution load at receptor level to various sources in the Jharia Coalfields along with an 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 periods of the day and day-of-the-week.
- Any other item in consensus between both BCCL/CIL & NEERI evolved during the study.

1.5. Approach of study

The study approach has many components, each one of them having its importance and interdependence as shown in Figure 1.3. The ultimate objective is source apportionment of ambient air of JCF that primarily requires knowledge of ambient air quality status, sources and emission load. These three objectives were achieved by monitoring air pollutants at 13 locations in Jharia Coalfield using various instruments and multiple analyses. These locations were selected based on land use and activity profile. All monitoring was carried out using varied instruments and all attributes were analysed using standards methodologies. The study's methodology of the study was divided into three parts namely ambient air quality monitoring, sources emission inventory and source apportionment analysis.

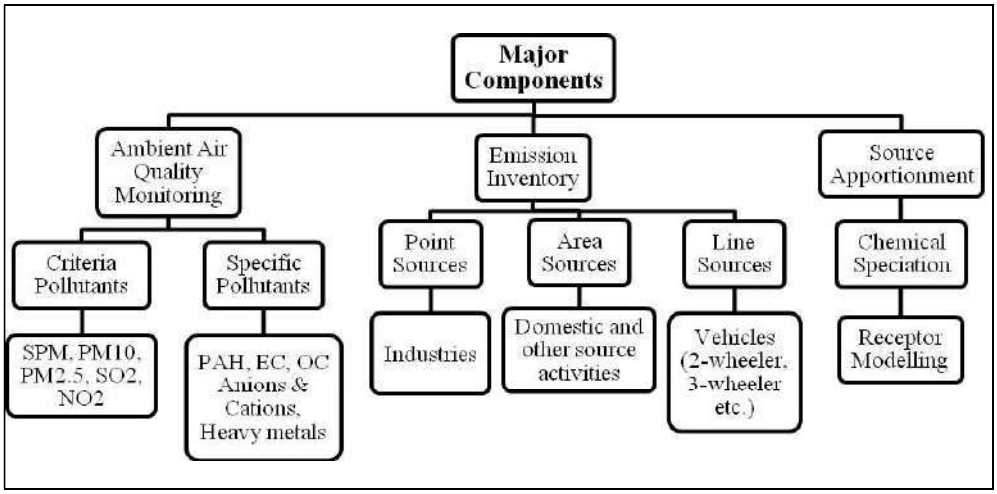


Figure 1.3: Air quality Monitoring & emission source apportionment studies

Chapter 2 Emission Inventory

This section consists of all methodologies that have been applied for the emission inventory and dispersion modelling in the Jharia Coalfield. The emission inventory is the process to identify the possible source and its contribution. Emission inventory and dispersion modelling are based on the primary data collection to calculate emission load from a particular source. It provides fundamental information for air quality modelling and air pollution control strategy development. In the coal mining area, mining, non-mining, industrial, vehicular and other sources are contributing. Air quality monitoring includes the suitable location selected based on the metrological conditions, chemical characterization for identification of the source, CMB model to estimate the source apportionment to $PM_{2.5}$.

Air pollutant emission inventory is a process to identify the possible sources and their contribution. It provides fundamental information for air quality modelling and air pollution control strategy development. Mining, non-mining, industrial, vehicular and other sources are contributing to critical coal mining zone like JCF, India. According to possible emission sources, sources are divided into three categories like point sources, area sources and line sources. The inventory of these sources is important to make a proper source profile.

2.1. Inventory of Point Sources

A point source of pollution is a single identifiable source that is responsible for significant pollution load in the study area, like thermal power stations. A comprehensive list of different point-like industries in the study area was obtained from the regional office of the Jharkhand State Pollution Control Board (JSPCB), at Dhanbad. The industries specific information of includes production capacities, raw material used, manufacturing process, fuel consumption, etc. also collected from the regional office by the CSIR-NEERI team.

2.2. Inventory of Area Sources

Area sources are sources of pollution that emit a substance or radiation from a specified area. Mining activities, domestic/hotel fuel (coal) burning, garbage burning, etc. are the major contributor to area sources. In order to assess the fuel consumption in the study area, the necessary information was collected through surveys at petrol pumps, hotels and restaurants, bakeries, open eat out and crematoria. Also, surveys collected data on the seasonal implication of fuel used particularly wood and coal. The data on trash burning and solid waste generated in the study were collected from Municipal Corporation Dhanbad.

2.3. Inventory of Line Sources

Vehicles contribute a whole range of HCs besides contributing SO_x, NO_x (as NO_2), HC and lead. Diesel vehicles are the primary source of smoke and NO_x in addition to CO and HCs. However, CO and HCs per litre of fuel consumed by diesel vehicles in relatively low compared to gasoline-powered vehicles. In gasoline-powered vehicles, the exhaust is the major source of pollution that contributes 100 % CO and NO_x and 80% of HCs emitted to the atmosphere. The remaining 20% of HCs are emitted from crankcase blow-by and evaporative emissions. In the

two-stroke engine, the crankcase blow-by is absent. The exhaust emissions are the principal sources of pollutants emitting about 40% of fuel supplied without burning due to short circulating, contributing high concentration of HCs. In diesel vehicles, practically all pollutants are emitted through exhaust gases and the contribution to crankcase blow-by and evaporative fuel emission are negligible.

Though the quantity of pollutants emitted by the vehicles is directly proportional to the number of vehicles playing on the road, the intensity of pollution potential depends on several contributory factors such as a geographical location, unplanned development of central business areas, inadequate and ill-maintained road as well as the type of vehicle, unplanned traffic management, meteorological conditions, and non-availability of adequate emission control technology.

Vehicle activity data were collected during the field campaign at 12 road networks in the study area, and the daily average vehicular activity is presented in Table 2.1.

Table 2.1: Daily average vehicle activity on different road network considered during the field survey

Label	Road Network	HDV	LMV	3W	2W	Total
L1	Jharia to Lodna -5 km	1254	1385	3640	9560	15839
L2	Pathardih to Sindri -7 km	1539	5356	4362	15633	26890
L3	Bastacola to Pathardih -13km	2153	8325	3678	10233	24389
L4	Bhuli to Bankmore - 6km	1475	13832	12965	18241	46513
L5	Katras to Harina–12.5 km	1802	7290	3156	15329	27577
L6	Bankmore to Kusunda -5 km	658	2685	1896	10235	15474
L7	Kusunda to Katras - 10 km	1306	4521	5327	15689	26843
L8	Monidih to Kusunda -7 Km	1208	7659	3985	14698	27550
L9	Lohpiti to Mahuda Area Colony - 8 km	1535	4523	2235	6356	14649
L10	Mahuda to Parasia Chowk -7 km	1223	4023	1759	5623	12628
L11	Parasia Chowk To Moonidih - 3 km	269	2159	236	2347	5011
L12	Bhowra to Parbatpur - 13 Km	2135	7856	4258	14578	28827

The vehicle utilization factors (km travelled per day per vehicle type) were adapted from the Auto Fuel Policy Report (Table 2.2). Two-to-four-wheelers Emission factors were taken from various project reports conducted by CPCB and Indian Clean Air Programmed (ICAP) (CPCB 2010; ARAI 2007). The percentage distribution of various types of vehicles moving on the road network considered during the field survey is presented in Fig 2.1. It shows that major numbers of vehicles moving in the considered Road network are two-wheelers (51%), followed by light motor vehicles (26%), three-wheeler (17%) and heavy-duty diesel vehicles (6%).

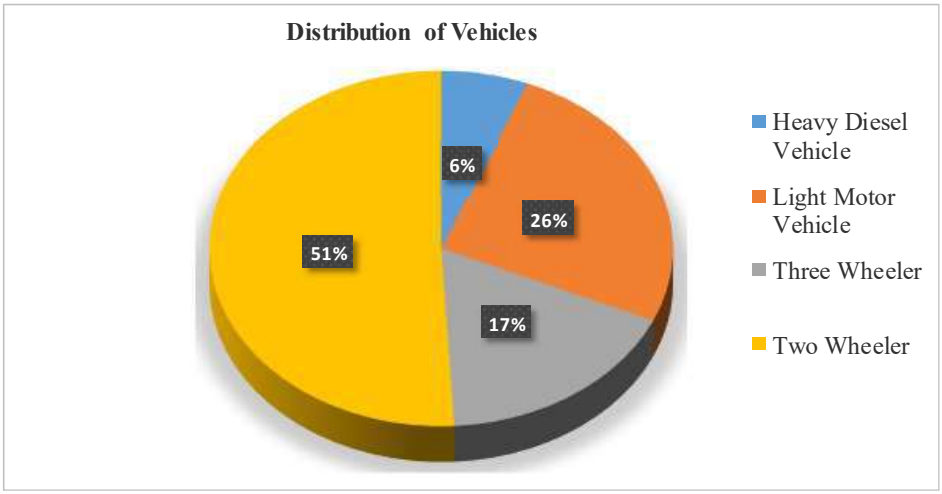


Figure 2.1 Percentage of different types of vehicle surveyed on the road network during the field survey

Table 2.2: Utilization Factors for different types of vehicle

Vehicle Type	km per day
LMV (Car Jeep)	52.6
LMV (Taxi)	77.89
2 Wheeler	25.1
3 Wheeler (Auto)	97.72
HCV	45.5

2.4. Methodology

The following method is adopted to estimate the emission load due to vehicles

$$E_i = N_v \times VKT \times E_f \quad (2.1)$$

Where, E_i is the emission from a particular type of vehicle

N_v is the number of vehicles of a particular type

VKT is the vehicle km travelled

E_i, km is the emission factor for a specific vehicle

Table 2.3: Emission estimate for road transport

Label	Road Network	Emission (kg/day)	
		PM_{10}	$PM_{2.5}$
L1	Jharia to Lodna -5 km	230.12	113.08
L2	Pathardih to Sindri -7 km	379.07	180.37
L3	Bastacola to Pathardih -13km	632.21	451.98
L4	Bhuli to Bankmore - 6km	331.41	187.69
L5	Katras to Harina–12.5 km	719.42	415.63
L6	Bankmore to Kusunda -5 km	308.69	194.34
L7	Kusunda to Katras - 10 km	576.31	277.95
L8	Monidih to Kusunda -7 Km	317.83	114.25
L9	Lohpiti to Mahuda Area Colony - 8 km	360.24	151.99
L10	Mahuda to Parasia Chowk -7 km	241.56	148.24

L11	Parasia Chowk To Moonidih - 3 km	94.26	57.23
L12	Bhowra to Parbatpur - 13 Km	592.82	379.80

Re-suspension of the unpaved and paved roads depends on the 'silt loading' factor and 'vehicles weight' roaming on the road (Table 2.4). The silt loading (S_L) is the mass of the silt-sized material per unit area of the road surface. The amount of dust produces by vehicles movement on a paved road can be appraised by the following equation:

$$E = k. (SL/2)^{0.65} . (W/3)^{1.5} \quad (2.2)$$

Where, 'E' = emission rate of PMs (Table 2.3);

SL is silt load (g/m2);

W is the average weight of the vehicle (Tons);

k is constant (the function of particle size) in g VKT^{-1} (Vehicle Kilometer Travel)

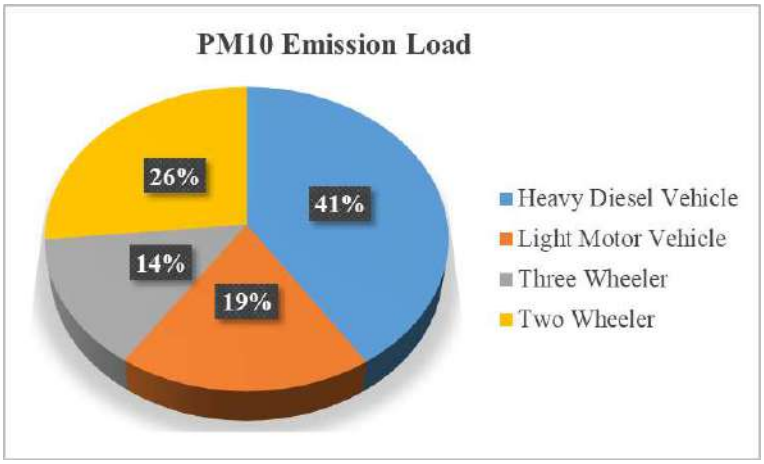


Figure 2.2 PM_{10} emission load for different categories of vehicle

It is observed that 41% of PM_{10} emission is contributed by the Heavy-duty diesel vehicles followed by two-wheelers (26%), Light motor vehicles (19%) and three-wheelers (14%) in the considered road network during the study period.

Table 2.4: Emission rate for the paved and unpaved road

	Emission Rate	
Emission Sector	**PM_{10} (kg/day)**	**$PM_{2.5}$ (kg/day)**
Re-suspension dust from Paved & Unpaved Road	1756	843

2.5. Results

2.5.1. Industrial Emission

Emission inventory estimates are determined based on considering available industrial activity information, emission factors (Table 2.5) and observations. For the current study, industrial and mining information was collected for emission inventory development. Emission inventory information for industries was collected from the regional office of JSPCB. In Dhanbad, the major industries are the power plant and the coking industry. Other

than those are coal mines, thus coal as a fuel is majorly used in industries and households. Emission loads by point source are depicted in Table 2.6 as per emission inventory.

Table 2.5: Emission factor for coal mining activities

EF	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_2
g/Mg Coal	1914	1864	1176	420	820

Table 2.6: Emission load from Industrial sector in Dhanbad

Sr. No	Name of Industry	Type of Fuel	Fuel consumption	Unit	TSP (Ton/ yr)	PM_{10} (Ton/ yr)	$PM_{2.5}$ (Ton/ yr)	SO_2 (Ton/ yr)	NO_2 (Ton/ yr)
1	M/s Mahalaxmi Industries	Coal	4	MT/Oven/ cycle (24hrs)	2.79	2.72	1.72	0.61	1.20
2	GEETEE Hard Coke Traders	Coal	100	TPD	69.86	68.04	42.92	15.33	29.93
3	M/s Shree Gopal Coke Industries	Coal	77.4	TPD	54.07	52.66	33.22	11.87	23.17
4	M/s Laxmi Hard coke Manufacturing Company	Coal	102	TPD	71.26	69.40	43.78	15.64	30.53
5	M/s - Sanjay Hard Coke Industries	Coal	70	TPD	48.90	47.63	30.05	10.73	20.95
6	M/s Inder Hard Coke Industries	Coal	36	TPD	25.15	24.49	15.45	5.52	10.77
7	M/s Shiv Shakti Coke Industries	Coal	80	TPD	55.89	54.43	34.34	12.26	23.94
8	Khetawat Coke Manufacturing Company	Coal	4.5	MT/ Oven/ Batch (24hrs)	3.14	3.06	1.93	0.69	1.35
9	M/s Pawan Hard Coke Industries	Coal	100	TPD	69.86	68.04	42.92	15.33	29.93
10	M/s Ganapati Udyog	Coal	135	TPD	94.31	91.85	57.95	20.70	40.41
11	M/s Aman Soft Coke Industries	Coal	29.76	TPD	20.79	20.25	12.77	4.56	8.91

2.5.2. Area/Distributed source

An area source emission inventory estimates the pollutant loads emanating from several small but numerous individual sources in a specific geographic area and which cannot be included underline no point sources.

Area sources considered for emission inventory for Dhanbad city are:

- Cooking operations in households: Slum and non-slum
- Cooking operations in hotels, restaurants, open eat-outs and bakeries
- Crematoria

The following sections will detail the methodology adopted for estimating emissions from each of the above-mentioned sources and the results thus obtained.

- **Emission load from mining activities**

The emission loads from coal mine activities are depicted in Table 2.7. The emission load is calculated based on the secondary data collected from the BCCL mines covered in the study. The data includes coal and overburden quantity handled per day during loading and unloading, transfer from pit to stockyard through haul road and conveyor, vehicular movement frequency and diesel consumption for HEMM and DG sets. Emission factors from EEA air pollutant emission inventory guidebook 2019 were considered for the estimations of TSP and PM load.

Table 2.7: Emission load from coal mine activities in Jharia coalfield region

Mine	Area (m^2)	PM_{10} (Tone/y)	$PM_{2.5}$ (Tone/y)
ABOCP	2355283	156.1	78.0
ADI Colliery	1444818	47.9	23.9
ASP Colliery	19540	27.7	13.8
Bhowra south	78079	26.9	13.4
Block IV Govindpur	432827	22.5	11.2
DBOCP	605747	64.7	32.4
East Bassuriya Colliery	576494	24.3	12.2
Gopalichuck Colliery	37573	3.7	1.9
Jeenagora OCP	2079123	208.0	104.0
Kuya OCP	1134723	90.1	45.1
NAKC	245205	78.3	39.1
NGK	261847	126.0	63.0
Nichitpur colliery	791140	61.4	30.7
Phularitand colliery	335887	84.1	42.1
Rajapur OCP	1170784	90.4	45.2
Sendra Bansjora	472760	63.0	31.5
Shatabdi colliery (Muraidhih)	34270	77.0	38.5
Tetulmari	876320	23.3	11.7
Total		**1275.4**	**637.7**

- **Cooking operations in non-slum household**

A survey of 20 non-slum household areas was conducted in randomly selected areas of Dhanbad to understand which fuels are being used in these households and their quantities. The survey results indicated that Liquefied Petroleum Gas (LPG) was the fuel of choice in all the households and that each household used about 1 cylinder per month on average. It was assumed that LPG use remains the same for all 365 days of the year. The results obtained are presented in Table 2.8.

Table 2.8: Emissions from the use of LPG in non-slum households in Dhanbad

LPG Pollutant	PM_{10}	SO_2	NO_2	CO	HC
Emission Factor (g/kg)	2.1	0.4	1.8	0.25	0.07
Emission (T/Year)	0.00575	0.0011	0.0049	0.0007	0.0002

- **Cooking operations in slum households**

A survey of 15 areas having slum households was conducted, spread in Jharia Coalfield which was known to have significant slum populations, to understand which fuels are being used in these households and their quantities. It was seen that a majority of the slum households use coal as a cooking fuel (Table 2.9).

Table 2.9: Emission from coal as fuel

Pollutant	SPM	SO_2	NO_2	CO	HC
Emission Factor (g/kg)	20	13.3	3.99	24.92	0.5
Emission (T/Year)	28.354	18.856	5.657	35.330	0.709

- **Emissions from crematorium**

In order to calculate emission from crematoria data were obtained from crematoriums in Dhanbad. Emission from the burning of bodies using woods mainly produces PM_{10}, CO and HC majorly as depicted in Table 2.10.

Table 2.10: Emission from Crematoria using Wood as fuel

Pollutant	PM_{10}	SO_2	NO_2	CO	HC
Emission Factor (g/Kg)	17.3	0.2	1.3	126.3	114.5
Emission (kg/day)	7.178	0.083	0.537	52.183	47.308

- **Emissions from bakeries**

Data were collected from 34 bakeries operating in Dhanbad in which 12 bakeries were using electrical ovens. The emissions from such bakeries were not considered. All the other bakeries were using coal as fuel. Emissions from such bakeries are given in Table 2.11.

Table 2.11: Emission from Bakeries using Coal as fuel

Pollutant	SPM	SO_2	NO_2	CO	HC
Emission Factor (g/kg)	20	13.3	3.99	24.92	0.5
Emission (T/Year)	6.26	4.16	1.25	7.80	0.16

- **Emissions from hotels and restaurants**

Data were collected from 35 hotels in Dhanbad city. It has been found that most hotels/restaurants were using a combination of coal and LPG as cooking fuel. Emission

from coal and LPG were calculated and depicted in Table 2.12 and 2.13.

Table 2.12: Emission from Hotel & Restaurants using Coal

Pollutant	SPM	SO_2	NO_2	CO	HC
Emission Factor (g/kg)	20	13.3	3.99	24.92	0.5
Emission (T/Year)	8.110	5.393	1.618	10.105	0.203

Table 2.13: Emission from Hotel & Restaurants using LPG

Pollutant	PM_{10}	SO_2	NO_2	CO	HC
Emission Factor (g/kg)	2.1	0.4	0.8	0.25	0.07
Emission (T/Year)	0.136	0.026	0.117	0.016	0.005

- **Emission from open eat-outs**

From the survey it has been observed that most of the open eat-outs were using coal as cooking fuel, only a few were using LPG (Table 2.14).

Table 2.14: Emission loads from open eat-outs

Pollutant	SPM	SO_2	NO_2	CO	HC
Emission Factor (g/kg)	20	13.3	3.99	24.92	0.5
Emission (T/Year)	14.07	9.36	2.81	17.54	0.35

2.5.3. Grid wise emission inventory

The grid-wise particulate emission inventory maps were prepared from the primary and secondary data collected during the field surveys and the information received from the open cast mines, respectively. The PM emissions from restaurants, eat-outs, domestic chullahs, vehicles, crematoria, etc. were estimated based on the primary data obtained from the filed campaigns, whereas, the emissions from the mine operations were estimated based on the data received from the mines and the emission factors reported in the literature. Once the emissions rates were estimated, the cumulative emissions (including all types of sources like line, point, and area) were calculated falling under the grid defined (shown in Figure 2.3 and Figure 2.4). From the figures, it can be interpreted that the PM emissions are high on the northeast side of the study area. Whereas, the actual transport and dispersion of these emissions can be interpreted through the dispersion modelling carried out using the AERMOD model.

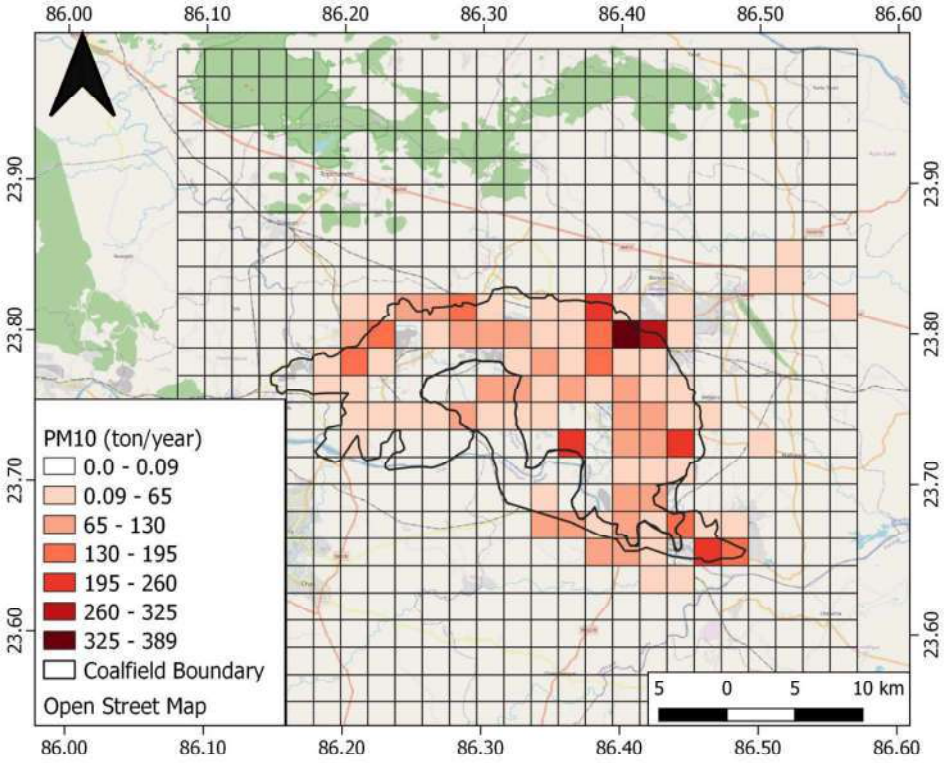


Figure 2.3 Grid-wise emission inventory of PM_{10} in tons/year over the study area

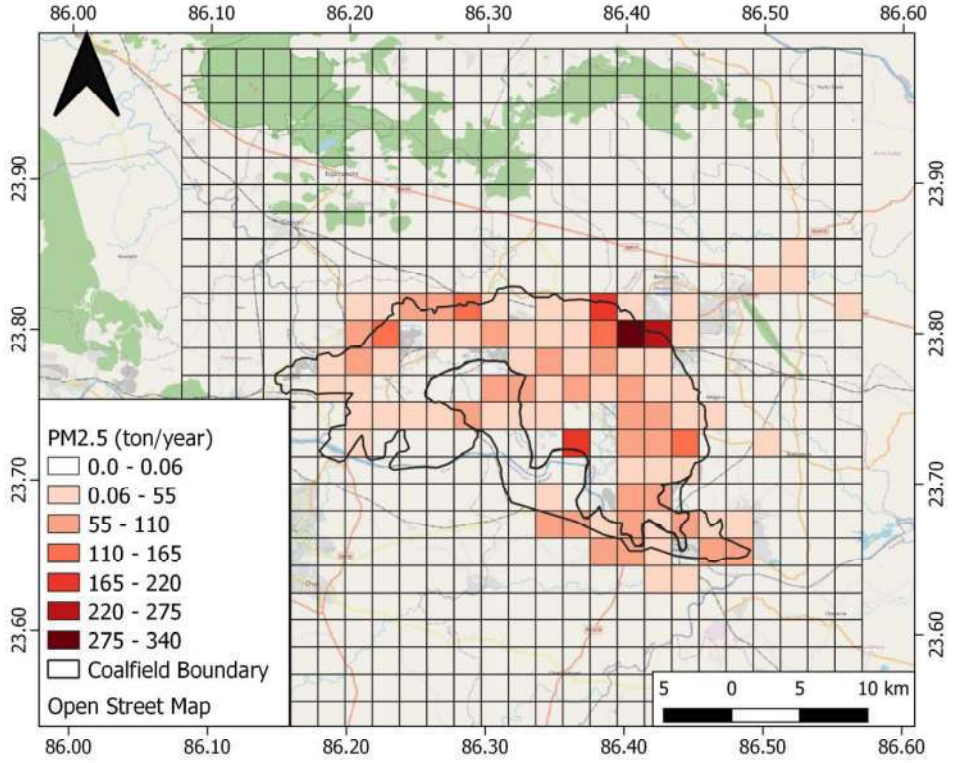
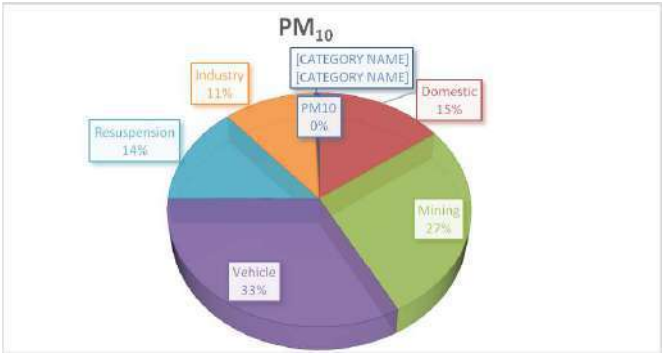


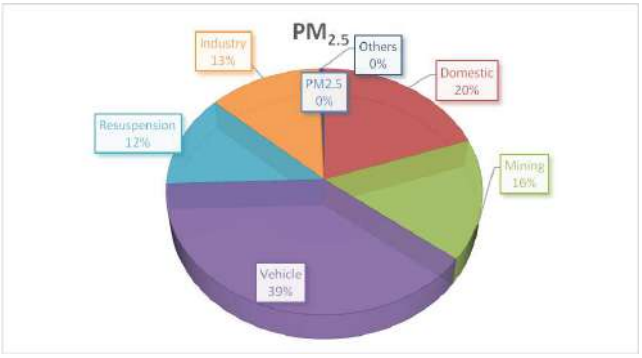
Figure 2.4 Grid-wise emission inventory of PM2.5 in tons/year over the study area

The respective share of various emission sources is represented through pie diagrams shown in Figure 2.5. Data shows that PM_{10} emissions are contributed mostly from vehicular emissions

followed by emissions from the mines whereas, $PM_{2.5}$ emissions are contributed mostly from vehicular emissions, domestic burning and mine activities. The grid-wise emission inventory maps and the information on the pollution sources provide the basis for the policymakers to target the hotspots of pollution generation in order to take effective mitigation actions.



(a)



(b)

Figure 2.5 (a) and (b) represents emission load from various sectors over JCF region for PM_{10} and $PM_{2.5}$ respectively

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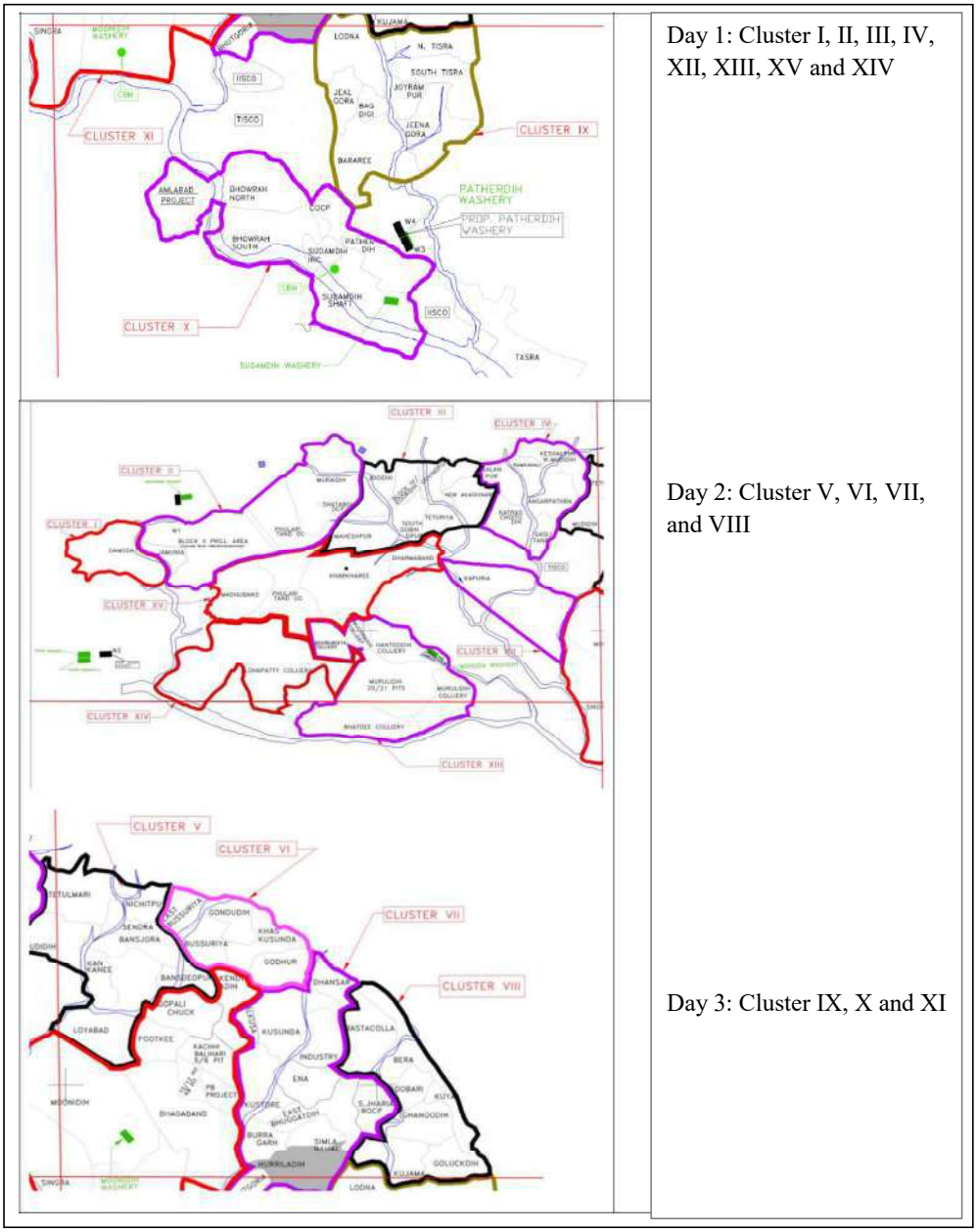
Chapter 3 Air Quality Monitoring and Receptor modelling

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. The details of the visit and mine cluster names are given in Table 3.3.1. The Entire Jharia Coal Field (JCF) is divided into 16 clusters. Both open cast 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 with their 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.

Table 3.3.1: The details of mine cluster in Jharia Coalfield



	Day 1: Cluster I, II, III, IV, XII, XIII, XV and XIV
	Day 2: Cluster V, VI, VII, and VIII
	Day 3: Cluster IX, X and XI

Based on preliminary field visit by NEERI Scientists along with BCCL staffs, the following locations (Figure 3.1) were 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 V- Katras
4. Cluster IX Lodhna
5. Cluster XI Moonidih nearby sources: Coal Mine
6. Cluster X Patherdih: nearby sources: Coal Mine, Steel Industry
7. Cluster VIII Bastacola nearby sources: Coal Mine

- **Buffer Zone**

8. Bank More
9. Harina
10. Bhuli
11. Sindri
12. Parbatpur Electro steel/ Bhaga
13. Background

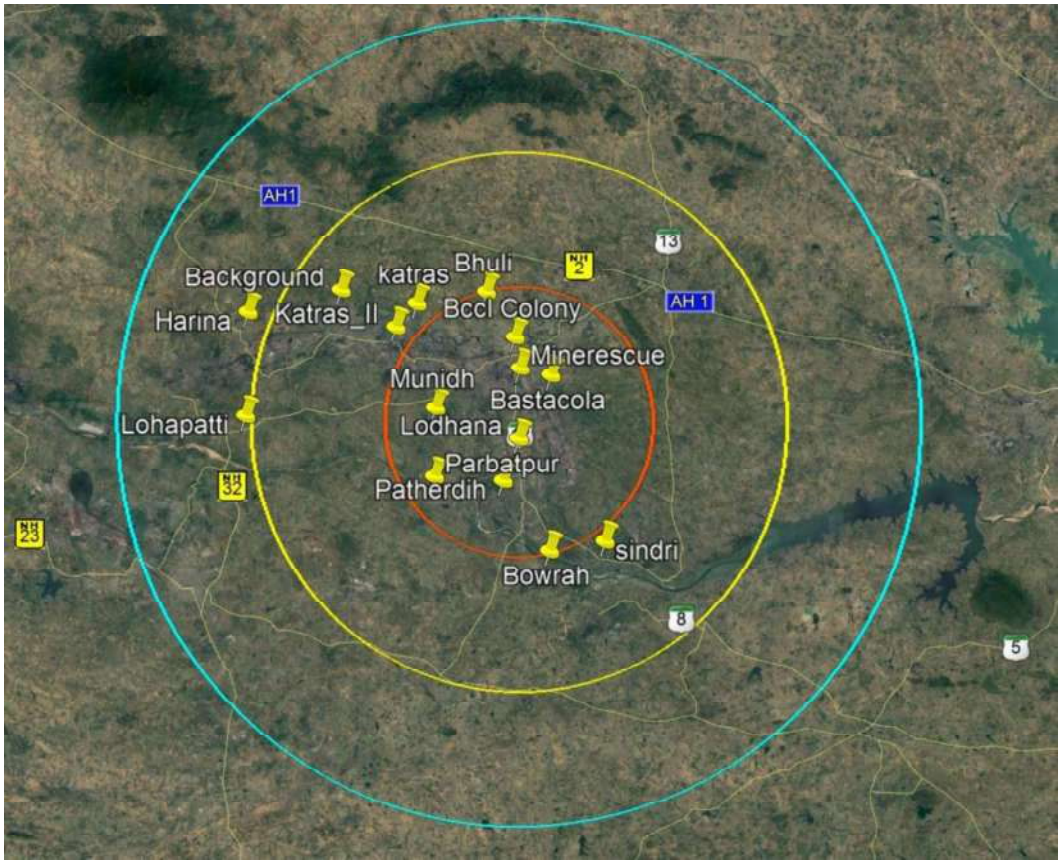


Figure 3.1: Air monitoring sites under 30 km buffer area

3.1. Sampling Method and Schedule

The PM_{10} and $PM_{2.5}$ sampling for Jharia Coalfields was done at all the 13 sampling sites for the period of 24 h using low volume respirable suspended particulate matter samplers (Instrumax, ARA and Envirotech) on Quartz and polytetrafluoroethylene (PTFE) filter paper of 47 mm diameter. Samplers at a flow rate of 16.67 LPM were used. The filter papers were desiccated before and after sampling for 24h at a temperature of 27 ± 3°C and at a relative humidity (RH) of 55 ± 2% to remove the moisture present in them. The PM_{10} and $PM_{2.5}$ field samples were collected periodically throughout the sampling period. The sampling frequency and types of equipment used for monitoring are described in Table 3.3.2 and 3.3.3. The national Ambient quality and Standards for Coal Mines (Stipulated by Ministry of Environment and Forests are depicted in Table 3.3.4. and Table 3.3.5.

Table 3.3.2: Frequency of Air pollutants sampling in Jharia Coalfields

Parameter	Number of Days	Change of Filter/ absorbing media	Reporting
PM_{10}	10	24 hourly, Teflon: 5 Days Quartz: 5 Days	24 hourly
$PM_{2.5}$	10	24 hourly Teflon: 5 Days Quartz: 5 Days	24 hourly
NO_2	10	8 hourly	8 hourly
SO_2	10	8 hourly	8 hourly

Table 3.3.3: Ambient Air Quality Sampling/Analysis Methodology for Target Pollutants

Particulars	Parameters			
	PM_{10}	**$PM_{2.5}$**	**NO_2**	**SO_2**
Sampling Instrument	INSTUMEX and ARA-N-FRM Sampler	INSTUMEX and ARA-N-FRM Sampler	APM sampler	APM sampler
Sampling Principle	Cyclonic Flow Technique	Cyclonic Flow Technique	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	7 days continuous, Teflon and quartz on alternate days	7 days continuous, Teflon and quartz on alternate days	7 days continuous	7 days continuous
Analytical Instrument	Electronic Micro Balance	Electronic Micro Balance	Spectrophotometer	Spectrophotometer
Analytical Method	Gravimetric	Gravimetric	Modified Jacob and Hochheiser method	Colorimetric Improved West & Gaeke Method
Minimum reportable value	5µg/m^3	5µg/m^3	9µg/m^3	4µg/m^3

Table 3.3.4: National Ambient Air Quality Standards (2009)

Sr. No.	Pollutant	Time Weighted Average	Concentration in ambient Air (in µg/m^3) Industrial, Residential Rural & Other Areas	Concentration in ambient Air (in µg/m3) Ecologically Sensitive Area	Concentration In ambient Air (in µg/m^3) Methods of Measurement
1	Sulphur Dioxide (SO_2)	Annual*	50	20	Improved West & Geake, Ultraviolet fluorescence
		24Hours**	80	80	
2	Nitrogen Dioxide (NO_2)	Annual*	40	30	Modified Jacob & Hochheiser (Na-Arsenite) Chemiluminescence
		24Hours**	80	80	
3	Particulate matter (Size less than 10µm) or PM_{10}	Annual*	60	60	Gravimetric, TOEM, Beta attenuation
		24Hours**	100	100	
4	Particulate matter (Size less than 2.5µm) or $PM_{2.5}$	Annual*	40	40	Gravimetric, TOEM, Beta attenuation
		24Hours**	60	60	
5	Ozone (O_3)	8 Hours*	100	100	UV photometric, Chemiluminescence chemical method
		1 Hour	180	180	
6	Lead (Pb)	Annual*	0.5	0.5	ASS / ISP method after sampling on EPM 2000 or equivalent filter paper ED-XRF using Teflon filter
		24Hours**	1	1	
7	Carbon Monoxide (CO)	Annual*	0.2	0.2	Non-dispersive Infra-Red (NDIR) Spectroscopy
		24Hours**	0.4	0.4	
8	Ammonia (NH_3)	Annual*	100	100	Chemiluminescence, Indo-phenol's blue method
		24Hours**	400	400	
9	Benzene (C_6H_6)	Annual*	0.5	0.5	Gas Chromatography based continuous analyzer. Adsorption and description followed by GC analysis
10	Benzo (a) Pyene (BaP)-particulate phase only	Annual*	0.1	0.1	Solvent extraction followed by HPLC / GC analysis
11	Arsenic (As)	Annual*	0.6	0.6	AAS/ ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni)	Annual*	20	20	

Table 3.3.5 Standards for Coal Mines (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)

Pollutant	Time weighted Average	Concentration in Ambient Air	
		New Coal Mines (commenced after 25.09.2000)	Existing Coal Mines (commenced prior to 25.09.2000)
Suspended Particulates Matter (SPM)	Annual Average 24 hours	360µg/m3 500µg/m3	430µg/m3 600µg/m3
Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average 24 hours	180µg/m3 250µg/m3	215µg/m3 300µg/m3
Sulphur Dioxide (SO_2)	Annual Average 24 hours	80µg/m3 120µg/m3	80µg/m3 120µg/m3
Oxides of Nitrogen as NO_2	Annual Average 24 hours	80µg/m3 120µg/m3	80µg/m3 120µg/m3

3.2. Chemical Analysis

3.2.1. Gravimetric analysis

The exposed filters were analysed by gravimetric technique using a weighing balance for PM_{10} particles and using a microbalance for $PM_{2.5}$ particles with a precision of 5µg with automatic (internal) calibration.

3.2.2. Elemental analysis

PM_{10} samples collected on glass fibre filters were digested in a microwave digester. The samples were made up to 50ml using deionized distilled water. Similarly, the exposed filters containing $PM_{2.5}$ particles were cut equally into 2 halves. A part of the exposed filter was used for ions analysis. Whereas, the other half was cut into tiny fragments and digested and made up to 15mL using distilled deionized water. The obtained samples (both PM_{10} and $PM_{2.5}$) after digestion were stored in vials and refrigerated at 4°C until further analysis. These samples were later subjected to estimate the elemental composition using ICP-OES (Thermo Scientific, USA).

3.2.3. Analysis of SO_2 and NO_2

SO_2 analysis: Modified West and Gaeke method was followed for sampling and analysis of Sulfur dioxide in ambient air. SO_2 from the air is absorbed in a solution of potassium tetracholo-mercute (TCM). A dichlorosulphitomercurate complex, which resists oxidation by the oxygen in the air was formed. Once formed, that complex was stable to strong oxidants such as ozone and oxides of nitrogen and therefore, the absorber solution may be stored for some time prior to analysis. The complex was made to react with pararosaniline and formaldehyde to form the intensely colored pararosanline methylsulphonic acid. The absorbance of the solution was measured by means of a suitable spectrophotometer.

NO_2 analysis: Modified Jacobs and Hochheiser method was followed for sampling and analysis of NO_2 in ambient air. Ambient NO_2 was collected by bubbling air through a solution of sodium hydroxide and sodium arsenite. The concentration of nitrite ion produced during sampling was determined calorimetrically by the nitrite ion reaction with phosphoric acid, sulphanilamide, and N-(1-napthyl)-ethlylenediamine di-hydrochloride (NEDA) and the absorbance of the highly colored azo dye was measured at 540nm.

3.2.4. Ion analysis

The filter papers containing both PM_{10} and $PM_{2.5}$ samples were extracted and subjected to ion analysis as per standards. The filter papers were divided into tiny fragments and moistened with isopropanol slightly before extraction since the filters are hydrophobic. Further 25 mL of deionized distilled water was added and sonicated using an ultrasonic bath for 60 min at 60°C. The samples were then kept overnight after sonication. Furthermore, the samples were then filtered using nylon filter discs (25mm, 0.45mm) and were refrigerated at 4°C until further analysis. The extracted samples were subjected to IC to analyse the ions (anions and cations) present in them.

3.2.5. Polycyclic Aromatic Hydrocarbons (PAH) analysis

Filter papers were cut into pieces using scissors and transferred to a 100 ml beaker and 50 ml of Dichloromethane (DCM) (GC/HPLC grade) was added. The samples were extracted with DCM using an ultrasonic bath for about 30 minutes. The extracted samples were filtered with Whatman filter paper containing 2gm Anhydrous Sodium Sulphate. After filtration, the filtrate is concentrated using a rotary vacuum evaporator to 2ml final volume. Solid-phase extraction may be used to clean up the impurities of the sample and re-concentrated in a rotary evaporator. The samples were analyzed through GC with conditions as injector 300℃ and FID temperature 320℃.

3.2.6. EC & OC analysis

This is a thermal/optical-transmittance (TOT) method that speciates carbon in particulate matter collected on a quartz-fiber filter into OC, EC, and CC. In the first (or non-oxidizing) heating stage, organic and carbonate carbon is thermally desorbed from the filter under a flow of helium with controlled temperature ramps. The oven is then partially cooled, and the original flow of helium is switched to an oxidizing carrier gas (He/O_2). In the second (or oxidizing) heating stage, the original elemental carbon component plus pyrolyzed organic carbon formed during the first heating stage are oxidized/desorbed from the filter with another series of controlled temperature ramps. All carbon evolved from the sample is converted to CO_2 in an oxidizing oven immediately downstream from the desorption oven, and the CO_2 is converted to methane (CH_4) by a methanator oven before being measured with a flame ionization detector (FID). (https://www3.epa.gov/ttnamti1/files/ambient/pm25/spec/RTIOCECSOP.pdf)

3.3. Results

3.3.1. Mass concentration of PM_{10} and $PM_{2.5}$

In summer monitoring, the mean mass concentrations of PM_{10} particles in all 13 sampling sites were found to be in the range of 74-184µg/m^3 with the highest concentration of 184µg/m^3 at mine rescue site and lowest concentration of 74µg/m^3 at Bastacola site. Also, the mean mass concentration of $PM_{2.5}$ particles was found in the range of 49-117µg/m^3 with the highest concentration of 117µg/m^3 and the lowest concentration of 49µg/m^3 recorded at Harina and Lohapatti site respectively.

The average concentrations of PM_{10} and $PM_{2.5}$ in two seasons are described in Table 3.6 and 3.7. Results revealed that the average concentrations of PM_{10} are within the prescribed limits of MoEF notification guidelines for coal mine areas. In the case of $PM_{2.5}$, there is no Govt. notified standard for mining areas but in the case of buffer zones, National Ambient Air Quality Standard, NAAQS, 2009 may be applicable. The highest PM_{10} and $PM_{2.5}$ concentrations were found in Mine rescue and Harina (Figure 3.2 and 3.3).

Table 3.6: Average concentration of PM_{10} and $PM_{2.5}$ in Summer of Jharia Coalfield

Monitoring Sites		**Average Concentration (µg/m^3)-Summer**	
	Site Description	**PM_{10} (µg/m^3)**	**$PM_{2.5}$ (µg/m^3)**
Lohapatti	Core Zone	133.7	49.42
		(83-203)	(44-83)
Mines Rescue	Core Zone	184.8	83.43
		(124-255)	(55-205)
Katras	Core Zone	141.4	80.01
		(100-216)	(42-150)
Lodhna	Core Zone	156.8	63.98
		(100-303)	(32-99)
Moonidih	Core Zone	118.4	62.84
		(80-153)	(34-94)
Patherdih	Core Zone	94.7	67.22
		(50-119)	(37-91)
Bastacola	Core Zone	74.21	62.85
		(52 -209)	(36-96)
BCCL colony	Buffer Zone	157.35	74.37
		(113-222)	(47-103)
Harina	Buffer Zone	177.7	117.3
		(73-265)	(42-175)
Bhuli	Buffer Zone	141.7	105.89
		(85-243)	(44-161)
Sindri	Buffer Zone	122.2	76.05
		(82-139)	(18-127)
Parabatpur	Buffer Zone	122.4	110.98
		(86-171)	(70-150)
Background	Buffer Zone	144.4	57.13
		(24-255)	(23-97)

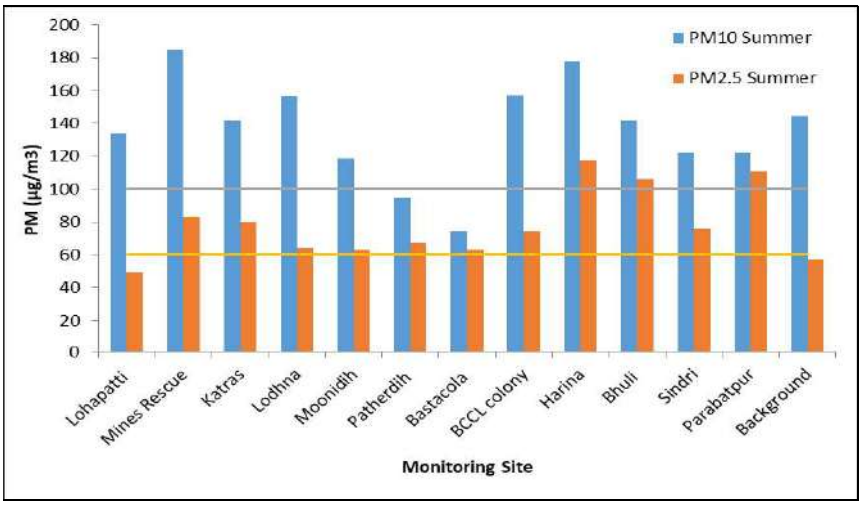


Figure 3.2: Average concentration of PM_{10} and $PM_{2.5}$ in JCF region in summer compared to NAAQS (2009)

Table 3.7: Average concentration of PM_{10} and $PM_{2.5}$ in winter of Jharia Coalfield.

Monitoring Sites	Site Description	Average Concentration (µg/m^3)-Winter	
		PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
Lohapatti	Core Zone	174.28	139.59
		(122-241)	(114-236)
Mines Rescue	Core Zone	303.49	176.97
		(175-350)	(114-233)
Katras	Core Zone	230.06	50.87
		(134-332)	(24-78)
Lodhna	Core Zone	322.8	112.17
		(243-412)	(98-209)
Moonidih	Core Zone	300.16	188.27
		(128-728)	(64-600)
Patherdih	Core Zone	222.71	113.23
		(182-246)	(111-167)
Bastacola	Core Zone	332.05	176.48
		(251-663)	(54-425)
BCCL colony	Buffer Zone	219.98	128.79
		(155-300)	(94-175)
Harina	Buffer Zone	130.73	42.93
		(65-215)	(44-98)
Bhuli	Buffer Zone	174.75	151.66
		(150-200)	(89-180)
Sindri	Buffer Zone	171.82	167.07
		(81-210)	(142-184)
Parabatpur	Buffer Zone	228.76	148.16
		(75-660)	(101-192)
Background	Buffer Zone	233	121.18
		(195-254)	(63-170)
Katras II		107.13	98.42
	Core Zone	(128-181)	(94-104)

Whereas in winter monitoring, the highest PM_{10} mass concentration was found to be 332µg/m^3 at Bastacola site (exceeding the prescribed limit of **GSR 742(E)**) along with other core mining zones like Mines Rescue, Moonidih. The lowest average concentration of PM_{10} was found in Katras II (Table 3.7).

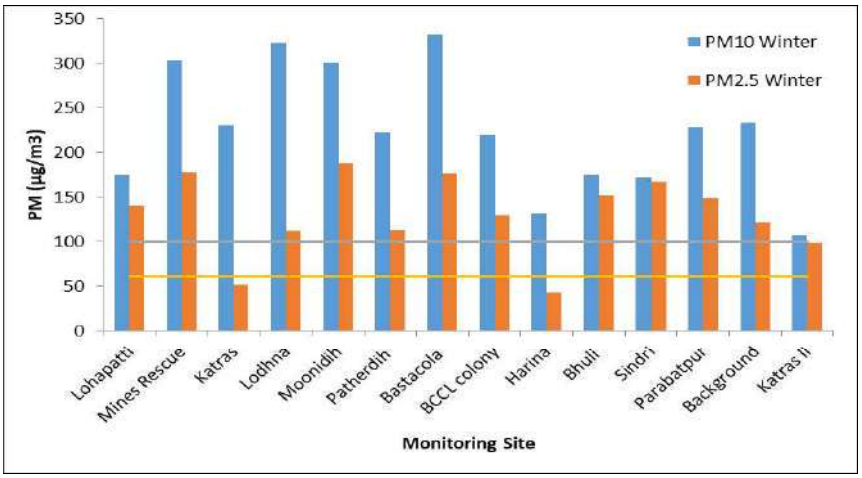


Figure 3.3: Average concentration of PM_{10} and $PM_{2.5}$ in JCF region during Winter compared to NAAQS (2009)

3.3.2. Elemental concentration of PM_{10} and $PM_{2.5}$ in summer

The digested samples of PM_{10} and $PM_{2.5}$ particles from all the 13 sampling sites were subjected to estimate the elemental composition using ICP-OES. The analysis of PM_{10} particles yields 11 different elements such as Al, As, Cd, Co, Cu, M, Ni, Pb, Zn, Fe and Cr. Similarly, the samples containing $PM_{2.5}$ particles revealed the same elements as PM_{10}. It was observed that Al and Fe were found to be higher for both PM_{10} and $PM_{2.5}$ particles. Al is the most abundant element. The concentration of Al was detected in the range of 6.32-14.62µg/m^3. Maximum Al concentrations were found at BCCL colony, Parbatpur, Harina and Background. The concentrations of Fe and Cr were estimated as 0.78-7.74µg/m3 and 0.075-1.32µg/m3 respectively. The highest concentrations of both Fe (7.74µg/m3) & Cr (1.32µg/m3) were found at the Bastacola site Figure 3.4. Similarly, in the case of PM2.5 particles the concentrations of Al (4.87-14.47µg/m3), Fe (0.44-11.77µg/m3) and Cr (0.066-2.17µg/m3) were found higher than other elements. For PM2.5 particles, maximum concentrations of Fe (11.77µg/m3) and Cr (2.17µg/m3) were obtained at the Mine Rescue site and Al (14.47µg/m3) at Katras. Since, the elements such as Al, Fe and Cr possess higher concentrations in the PM10 elemental composition, Al would have been emitted from road dust, whereas Fe would have been emitted from the re-suspension of dust containing deposits from the emissions of vehicular and other anthropogenic activities Figure 3.5.

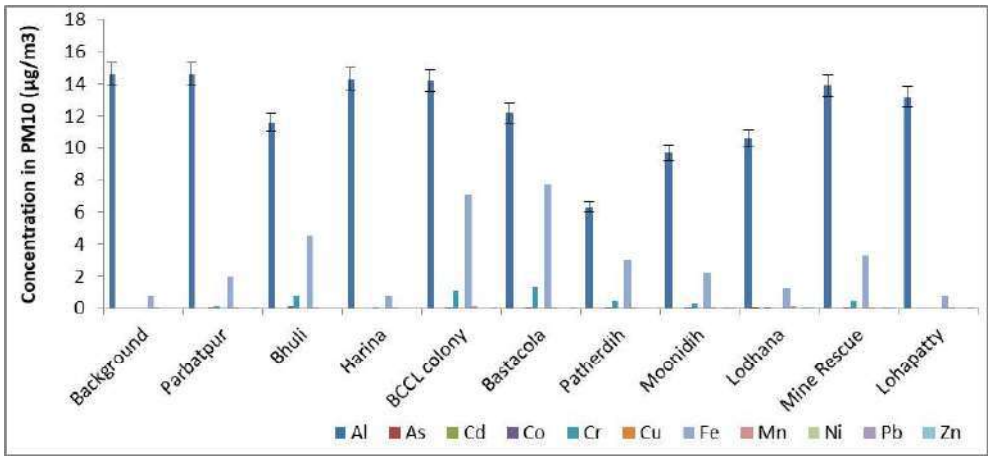


Figure 3.4: Metal concentration of PM_{10} in the summer season

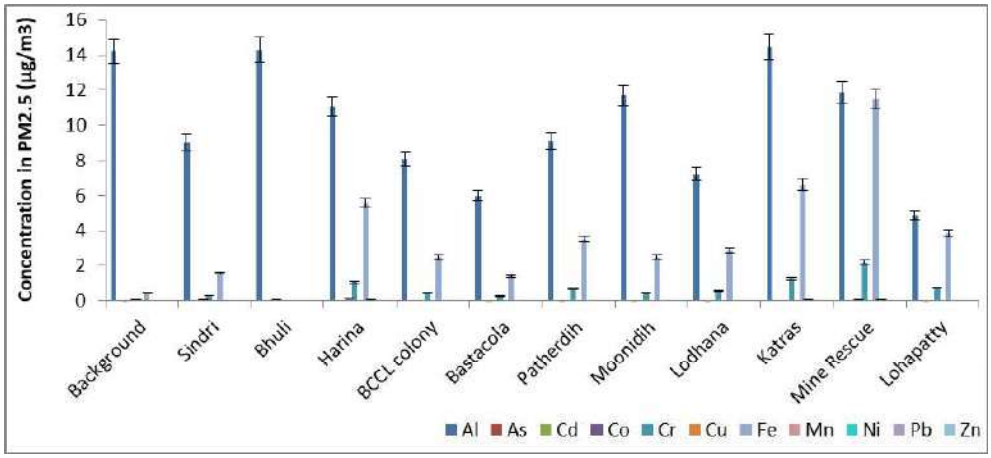


Figure 3.5: Metal concentration of $PM_{2.5}$ in the summer season

3.3.3. Elemental Concentration of PM_{10} and $PM_{2.5}$ in Winter

The elemental analysis was performed using inductively coupled plasma optical emission spectroscopy (ICP-OES). For the air quality assessment, the concentrations of 11 elements i.e. Al, As, Cd, Cr, Cu, Fe, K, Mn, Ni, Pb, and Zn in PM_{10} and $PM_{2.5}$ samples, were measured. Among all the elements, Al, Fe, and K concentrations were found considerably higher for PM_{10} samples in the winter season. Al was observed in the range of 2.02-10.77µg/m3 followed by Fe (0.79-9.26µg/m3) and K (0.90-4.19µg/m3). Maximum Al concentration (10.77µg/m^3) was observed at the BCCL colony, followed by Lodhna (10.29µg/m^3). The Highest Fe concentration (9.26µg/m^3) was observed at Bastacola while K (4.19µg/m^3) at the Lodhna site. This may be due to vehicular emissions, paved roads, construction dust, coal combustion, soil dust, etc. The concentration of As, Ni, Pb was found within the limits of CPCB standards. The remaining elements i.e. Cd, Cr, Cu, Mn, and Zn were found very low (Figure 3.6).

Similarly, in the case of $PM_{2.5}$ samples concentrations of Al, Fe and K were detected higher than other elements. The concentration of Al, Fe, and K was obtained as 0.11-2.91µg/m^3, 0.05-1.93µg/m^3 and 0.08-2.12µg/m^3. For $PM_{2.5}$ particles, maximum Al and K were found at the Munidih site, which were 2.91µg/m^3 and 2.12µg/m^3 respectively. The highest concentration of

Fe i.e. 1.93µg/m^3 was detected at Lodhna site. The concentrations of all other analysed elements were low (Figure 3.7).

From the elemental analysis of the summer and winter seasons, it was observed that the average Al concentration obtained was more in the summer season than in the winter season. In contrast, the average concentration of Cr was more in the winter season.

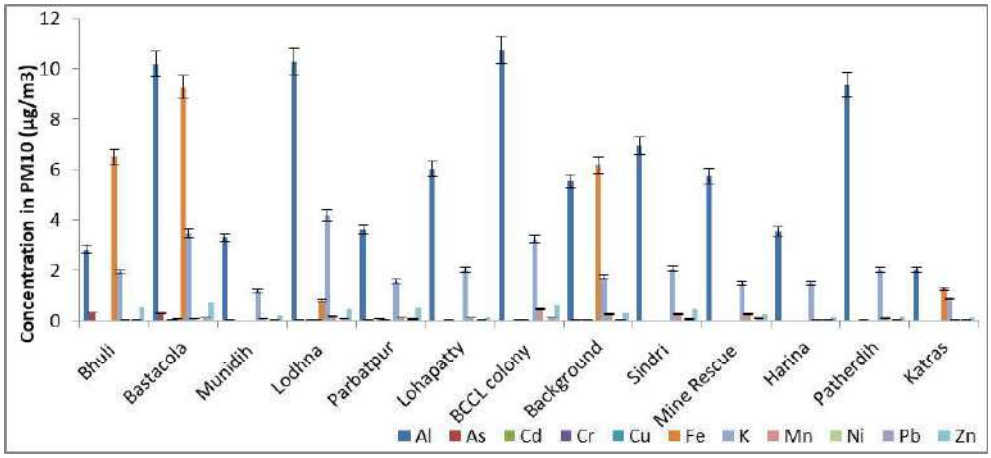


Figure 3.6: Metal concentration of PM_{10} in winter season

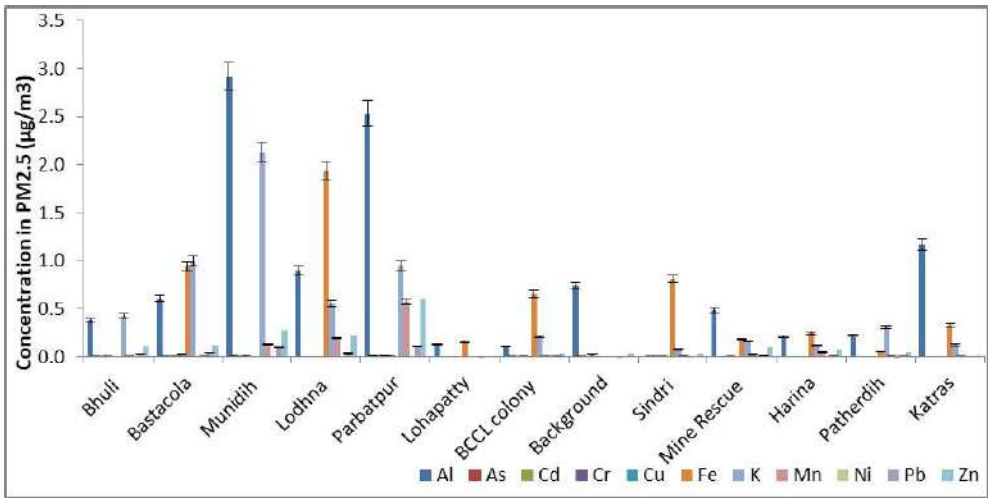


Figure 3.7: Metal concentration of PM 2.5 in winter season

3.3.4. SO_2 and NO_2 concentration in ambient air in the Summer season

The mean average SO_2 concentration in the summer season among all the monitoring stations ranged between 11µg/m^3 (Harina & Bastacola) and 24.5µg/m^3 (Moonidih), being well below the threshold limits of 80µg/m^3 (residential or industrial). The 8-hour average NO_2 concentrations were between 10.3µg/m^3 (Background) and 40.9µg/m^3 (Lodhana), well within the standard limits of 80µg/m^3 (residential or industrial) Figure 3.8. The SO_2 in the residential areas may be received from the open burning of raw coal and other domestic and commercial activities.

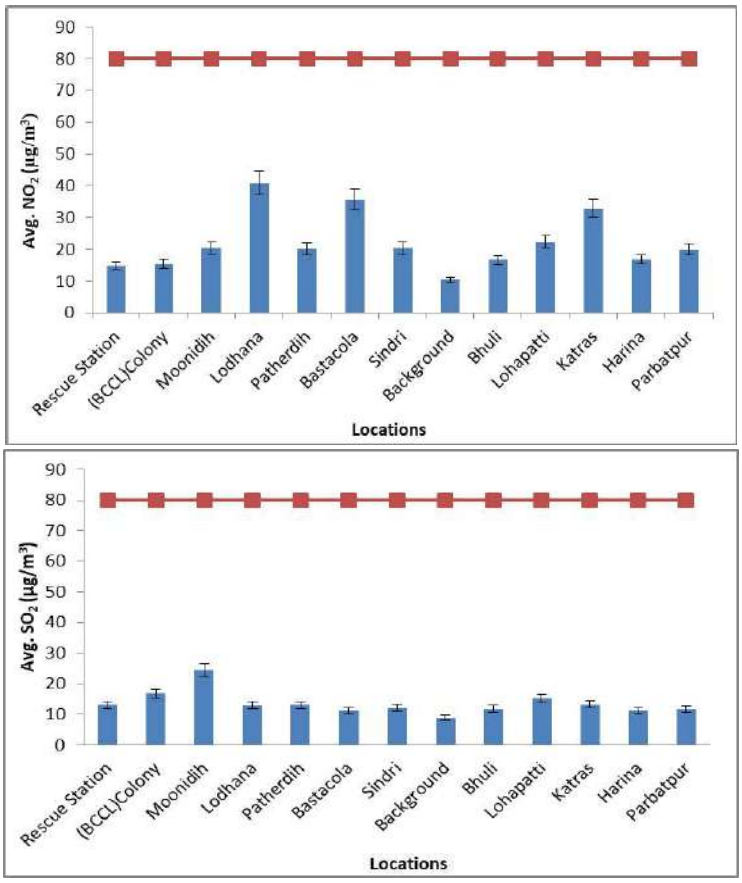


Figure 3.8: NO_2 and SO_2 Concentration of all monitoring sites in summer season

3.3.5. SO_2 and NO_2 concentration in ambient air in Winter season

The mean concentration of NO_2 and SO_2 in the winter season was found below the threshold limit i.e. 80µg/m^3. The concentration of SO_2 was below 10µg/m^3 in Katra, BCCL colony, Mine Rescue, Bastacola, Lodhana and Munidih. Bastacola and Bhuli site has a NO_2 concentration above 10µg/m^3 (Figure 3.9). It has been observed that the concentration of NO_2 and SO_2 in the winter and summer seasons were below the standard limit. But the average concentration of NO_2 and SO_2 in the summer season was higher than in the winter season.

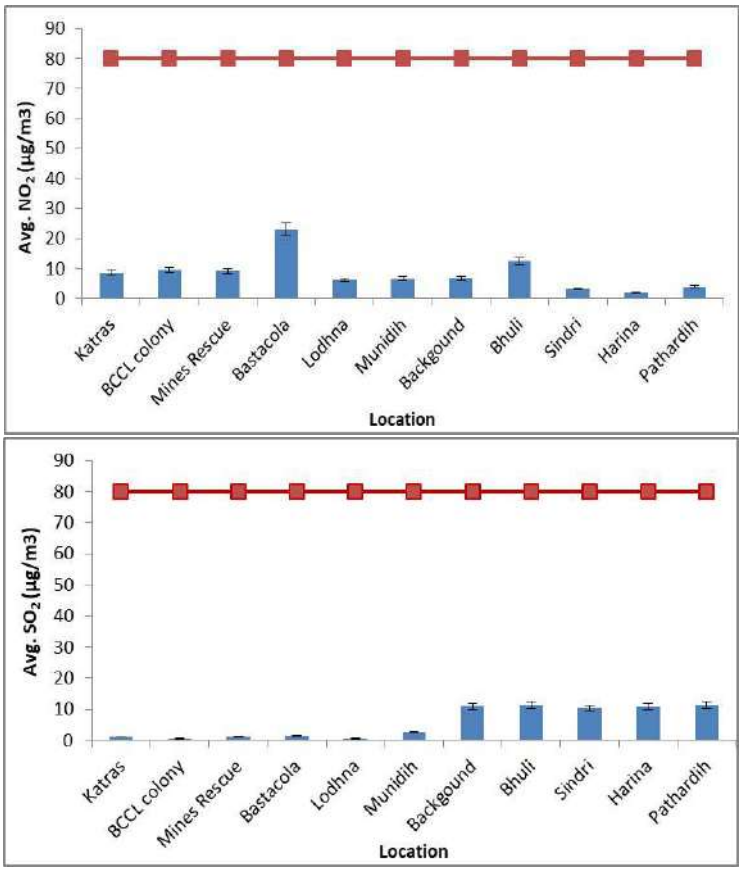


Figure 3.9: NO_2 and SO_2 Concentration of all monitoring sites in Winter season

3.3.6. Carbonaceous Aerosol/EC & OC in Summer

Data were obtained for four OC fractions (OC1, OC2, OC3 and OC4 in He atmosphere at 140, 280, 480 and 580°C, respectively) and three EC fractions (EC1, EC2, and EC3 in a 2% O2/98% He atmosphere at 580, 740 and 840°C, respectively). The IMPROV protocol defines OC as OC1 + OC2 + OC3 + OC4 and EC as EC1 + EC2 + EC3. The mass concentration of organic matter (OM) in the atmosphere was estimated by multiplying OC by 1.6 (conversion factor for urban aerosol). The total carbonaceous aerosol (TCA) was calculated as the sum of OM and EC. The highest concentration of OC and EC in $PM_{2.5}$ was found in the BCCL colony site i.e. 37.85 and 42.33µg/m^3, respectively, and the lowest OC concentration was 15.36µg/m^3 and EC was 13.08µg/m^3 in Sindri site. In comparison, the concentration of OC (67.35µg/m3) and EC (81.67µg/m^3) in PM_{10} were higher in the BCCL colony among all the sites. The lowest OC concentration as 17.95µg/m^3 was in Bastacola and EC in Parbatpur i.e. 15.44µg/m^3 (Figure 3.10).

3.3.7. Carbonaceous Aerosol/EC & OC in winter

The mass concentration of EC and OC in PM_{10} and $PM_{2.5}$ are more significant than 100µg/m^3 and 70µg/m^3, respectively in Bastacola, Katras, Mine Rescue, Background, and Sindri. The highest concentration of EC in PM_{10} and $PM_{2.5}$ was observed in the Sindri site, whereas OC was found higher in Sindri and Bastacola. OC contributing to PM_{10} mass concentration was lowest in

Harina followed by Lohapatti and Patherdih. In the case of $PM_{2.5,}$ Parbatpur was found to have the lowest concentration among other sites.

The higher mean concentration of EC and OC in winter were likely related to the influence of emissions from residential heating (in addition to traffic source) and, on the other hand, to the unfavourable meteorological conditions leading to more excellent dispersion of pollutants in the atmosphere during this season. Elemental carbon is emitted directly into the atmosphere during incomplete combustion emissions, such as motor vehicle exhaust, fuel burning, and biomass burning (Figure 3.11).

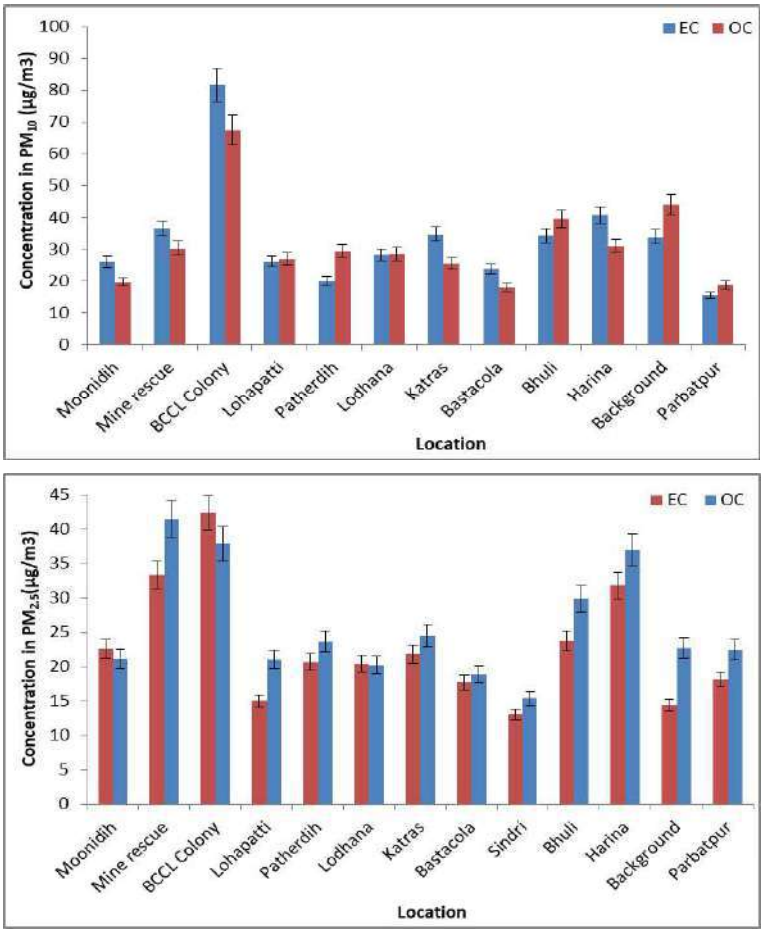


Figure 3.10: EC & OC concentration in PM_{10} and $PM_{2.5}$ in Summer season

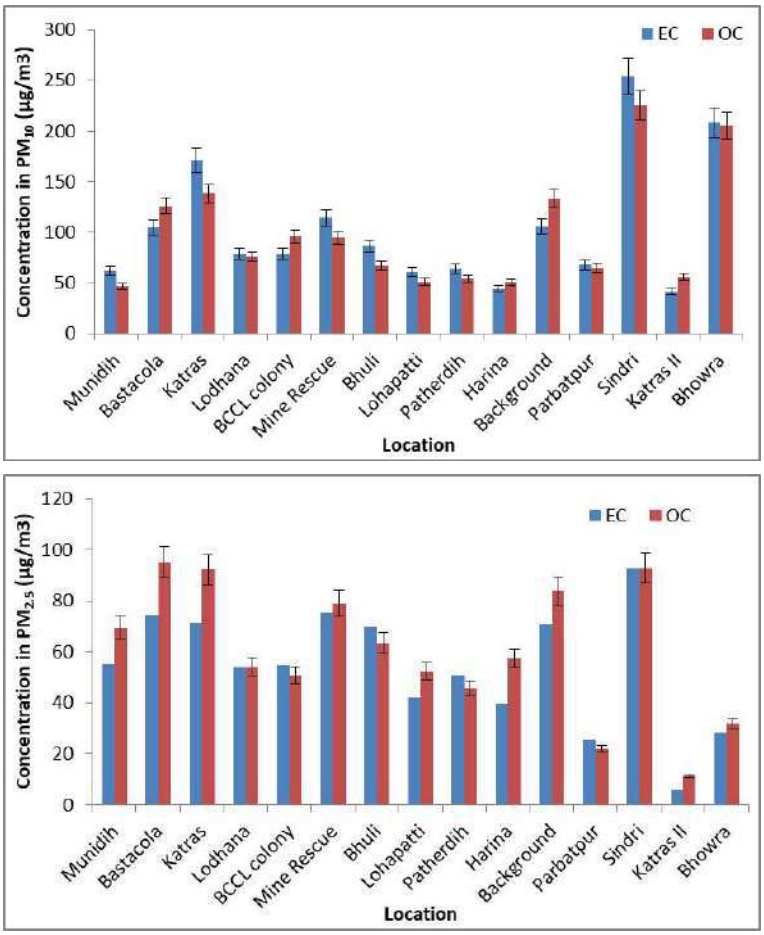


Figure 3.11: EC & OC concentration in PM_{10} and $PM_{2.5}$ in Winter Season

3.3.8. Ionic composition of PM_{10} and $PM_{2.5}$ in Summer season

The anions (SO_4^{2-}, NO_3^- and Cl^-) and cations (NH_4^+, Na^+, Ca^{2+}, K^+) are the water-soluble inorganic ions found in abundance. In summer, the mass concentration of SO_4^{2-} in PM_{10} was in the range of 1.06-20.17µg/m^3 where a higher concentration was observed in Harina, BCCL colony, and Lodhana sites. Likewise, NO_3^- was in the range of 0.32-19.2µg/m^3 with the highest in the Harina site. PO_4^{3-} and Cl^- concentration was highest in Harina and < 2µg/m^3 in other locations. NH_4^+ was in the range of 0.75-16.24µg/m^3, Harina with the highest concentration, and Bastacola with the lowest concentration. Na^+ concentration (0.18-8.6µg/m^3) was highest in Harina followed by BCCL colony and less than 2µg/m^3 in remaining sites. Ca^{2+} concentration (1.5-11.77µg/m^3) was highest in Lohapatti and BCCL colony while lowest in Katras. K^+ ion was also observed in the Harina site with a concentration of 5.85µg/m^3 (Figure 3.12).

The mass concentration of SO_4^{2-} in $PM_{2.5}$ was highest in Patherdih with a concentration of 15.13µg/m^3 and lowest in Bhuli. In Bastacola site, the concentration of NO_3^- (2.85µg/m^3), Cl^- (2.04µg/m^3), K^+ (1.84µg/m^3) were the highest among the other sites. Ca^{2+} (6.17µg/m^3) and Mg^{2+} (0.57µg/m^3) concentration was highest in Lohaptti site (Figure 3.13).

3.3.9. Ionic composition of PM_{10} and $PM_{2.5}$ in Winter season

PM_{10} ions concentration in Bastacola and Background were highest among all the monitoring

sites which followed the increasing order of $Na^+ < Mg^{2+} < F^+ < K^+ < Ca^{2+} < Cl^- < NH_4^+ < SO_4^{2-} < NO_3^-$. It has been observed that SO_4^{2-}, NO_3^- and NH_4^+ ions were present in abundant in PM_{10} mass concentration, and concentration of NO_3^- in these sites contributes majorly to PM_{10}. Ions concentration in Katras, Lohapatti, and Bhuli sites were observed having lower ionic concentration Figure 3.14.

The ionic composition of $PM_{2.5}$ comprises mainly of SO_4^{2-}, NO_3^-, Cl^-, NH_4^+, Ca_2^+ and K^+ ions. Locations such as Bastacola and Parbatpur have higher concentration of ions compared to remaining sites in following order: $Mg^{2+} < Na^+ < Ca^{2+} < K^+ < Cl^- < NH_4^+ < SO_4^{2-} < NO_3^-$. The same trend has been observed i.e. SO_4^{2-}, NO_3^- and NH_4^+ ions contribute mainly in $PM_{2.5}$ mass concentration. The average concentration of SO_4^{2-} and NO_3^- in winter was higher than in summer.

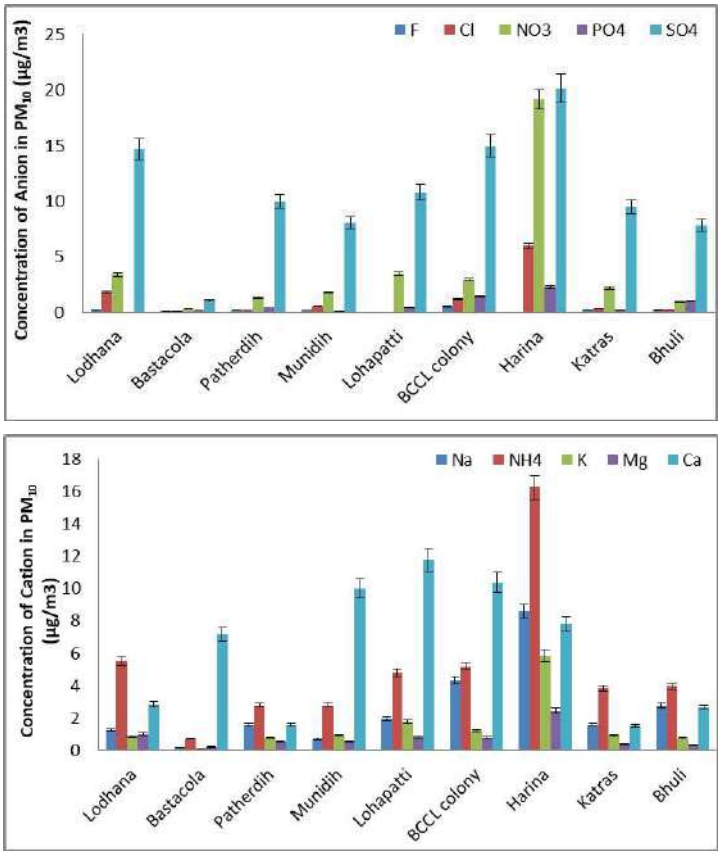


Figure 3.12: Anion and Cation concentration in PM_{10} in summer

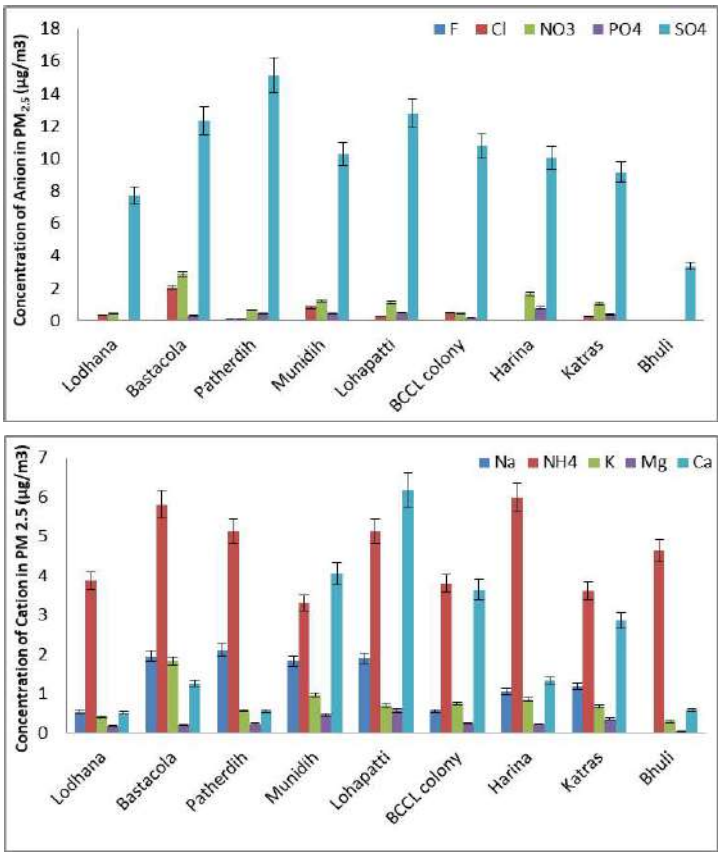


Figure 3.13: Anion and Cation concentration in $PM_{2.5}$ in summer

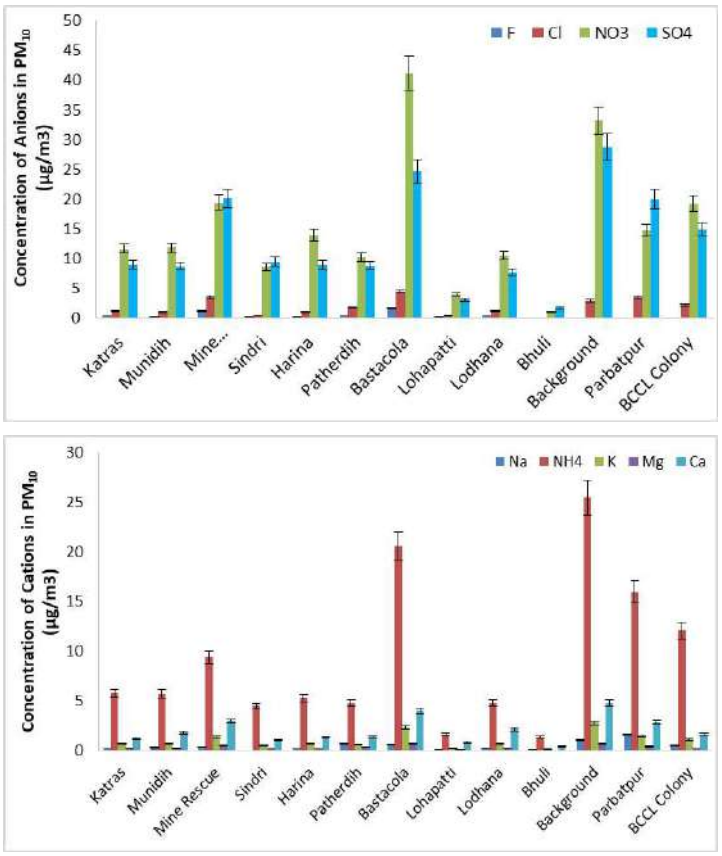


Figure 3.14: Anion and Cation concentration in PM_{10} in winter

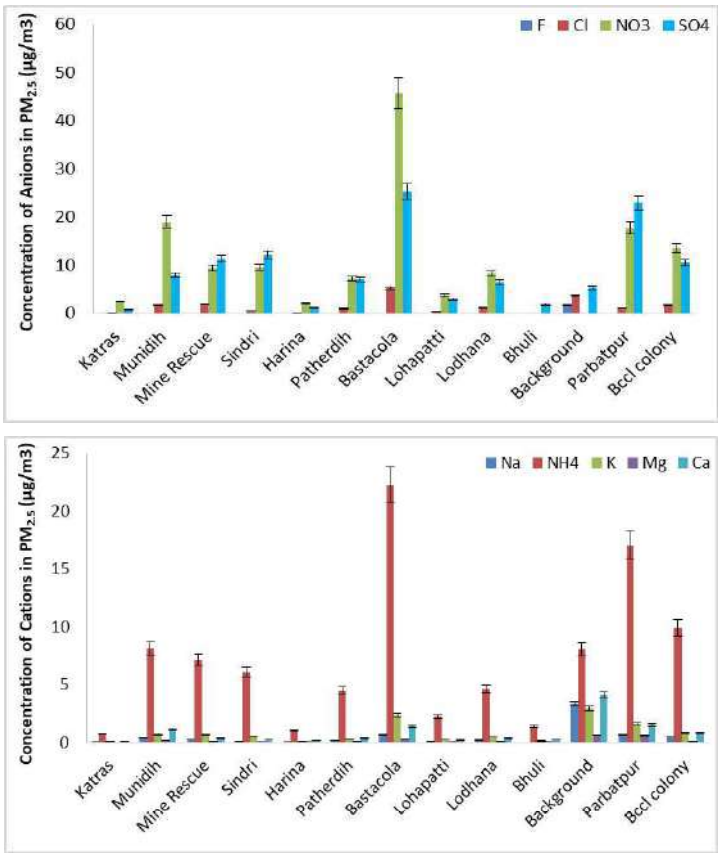


Figure 3.15: Anion and Cation concentration in $PM_{2.5}$ in winter

Chapter 4 Receptor modelling

4.1. Source Apportionment

The source apportionment study was carried out to identify the potential sources contributing to the particulate matter of aerodynamic size less than 10 µm in the Jharia coalfield (JCF) using a receptor modelling approach. In receptor modelling, the particulate matter (PM_{10}) characterization in terms of metal, ions, elementary and organic carbon profiles is statistically matched with that of various source profiles in the study area. For the source apportionment study of JCF, the area is divided into various zones (buffer, core and background zone). And the ambient PM_{10} characterization obtained from the multiple monitoring locations in the study area is conflated and compared with source profiles viz. industrial (mining and non-mining) and allied industrial activities, transportation, local vehicular movement and domestic fuel (coal wood burning, etc.). The chemical mass balance (CMB) model EPA-CMB v8.2 is one of the several receptor models and is most trusted for coarse and fine particulate matter source apportionment. The CMB model estimates source contributions by determining the best linear combination of emission source profiles and the chemical composition of ambient particulate, aerosol, and volatile organic compound samples. The study is studying the apportionment of particulate matter is considered owing to the nature of high particulate matter pollution in the study area. The source apportionment study is useful for devising an effective action plan for abatement of emission load in the region; thereby the region's overall air quality can be improved.

Jharia is one of the eight blocks in Dhanbad and is the main source of metallurgical coal in India, and is termed as the powerhouse of the country owing to its best quality coking coal, which is required by the steel and other industries in India. Dhanbad lies between 23°37'3" N and 24°4' N latitude and between 86°6'30" E and 86°50' E longitude with an average elevation of 222 m. Its geographical length, extending from North to South, is 43 miles and width 47 miles, stretching across East to West. It shares its boundaries with West–Bengal in the Eastern and Southern parts, Dumka and Giridih in the North, Bokaro in the west. It is the administrative headquarter of the district and Dhanbad Municipal Corporation (DMC).

The air quality status is determined by dividing the study area into background, core, and buffer zones. Thirteen sites were selected to represent various regions, including two references or background sites. The sampling locations are shown in Figure 3.1.

4.1.1. Chemical Mass Balance (CMB)

A mass balance equation can be written to account for all the chemical species in the samples as contributions from independent sources:

$$C_i = \sum_j m_j X_{ij} a_{ij} \qquad 4.1$$

C_i is the concentration of species i measured at a receptor site (derived from the chemical analysis), X_{ij} is the i^{th} elemental concentration measured in the j^{th} sample, and m_j is the airborne mass concentration of material from the j^{th} source contributing to the j^{th} sample. The term a_{ij} is

included as an adjustment for any gain or loss of species i between the source and receptor. The term is assumed to be unity for most of the chemical species.

The CMB 8.2 software (USEPA 1997) is used in this study. It is windows-based software that requires input data on ambient (at receptor locations) and source profiles of PM characterization. The model runs multiple iterations to provide optimum goodness of fit among the sources and receptors and verifies the model with various checks viz. Chi-square statistic, t-tests, mass percentage, and correlation coefficient. The following assumptions should be understood before proceeding with the CMB analysis.

The CMB model assumptions are:

- The concentration of emissions sources is constant throughout ambient and source sampling;
- Chemical species do not react with each other (i.e., they add linearly);
- All sources with potential for contributing to the receptor have been identified and have had their emissions characterized;
- The number of sources or source categories is less than or equal to the number of species;
- The source profiles are linearly independent of each other; and
- Measurement uncertainties are random, uncorrelated, and normally distributed.

The following steps are followed for running the CMB model:

- Identification of the contributing emission source types based on primary survey and emission inventory data collected around the monitoring sites.
- The selection of chemical species to be included in the CMB modelling calculation is based on the Central pollution control board (CPCB) guidelines.
- The source profiles with the fraction of each chemical species and uncertainty are withdrawn from the SPECIATE 5.1 database. SPECIATE 5.1 is US-EPA's repository of organic gas and particulate matter (PM) speciation profile of air pollution sources.
- Estimate ambient concentration (ambient data) is based on chemical analysis of the PM samples collected at the respective site during monitoring. The uncertainty of the chemical species is mainly based on the instrument uncertainty.
- The CMB 8.2 model run provides the solution of the chemical mass balance equation.

For source apportionment of PM_{10}, CMB 8.2 software (USEPA 1997) provides many goodness's of fit tests to verify the accuracy of the model. The normal checks, as specified in the manual by USEPA (1997) to accept the model are; t-statistics i.e., source contribution divided by the error of source contribution should be greater than 2, χ^2 (chi-square) is the weighted sum of squares of the differences between calculated and measured fitting species concentrations divided by the effective variance and the degrees of freedom, it should be less than 4. The weighting is inversely proportional to the squares of the precision in the source profiles and ambient data for each species. Ideally, χ^2 would be zero, there would be no difference between calculated and measured species concentrations. The χ^2 less than one indicate a very good fit for the data. Values greater than 4 indicate that one or more of the fitting species concentrations are

not well-explained by the source contribution estimates (SCE). The source contribution estimate approximates the total mass concentration which is a convenient check on the %mass explained value. When the SCE is less than its standard error, the source contribution is undetectable. Two or three times the standard error may be taken as the upper limit of the SCE in this case. Assuming that the errors are normally distributed, there is about a 66% probability that the true source contribution is within one standard error and about a 95% probability that the true concentration is within two standard errors of the SCE.

R^2 is determined by the linear regression of the measured versus model-calculated values for the fitting species. R^2 ranges from 0 to 1. The closer the value is to 1.0, the better the SCEs explain the measured concentrations. When R^2 is less than 0.8, the SCEs does not explain the observations very well with the given source profiles. The percentage mass explained should be between 80% and 120%, the ratio of the computed and the measured concentration of each element (C/M ratio) should be close to 1 and R/U ratio, i.e., the ratio of residuals to uncertainty should be less than 2. As the model requires the source contribution estimates and receptor concentrations in ambient air, the significant sources in the area need to be identified first. The investigation of sources of PM_{10} to be accounted for in the CMB model is carried out using emission inventory studies.

4.1.2. Source profiling

The Chemical profile needs to be developed for the air-polluting source as input to the receptor-oriented source apportionment models like CMB8.2 (chemical mass balance). The U.S Environmental Protection Agency's (EPA) SPECIATE database and several studies carried out in other parts of the world provide an extensive collection of source profiles. The source profiles required in this study are extracted from SPECIATE5.1 the database.

The source of the particulate matter in JCF accompanies various coal handling activities such as opencast coal mining and its associated activities, thermal power stations, automobiles, generator sets fuel burning, construction activities, domestic coal, cooking gas burning, etc. and even the background contribution of natural dust (crustal origin) cannot be ruled out, particularly, in the zones having loose topsoil (Roy and Singh 2014). So, the sources profiles considered here are coal dust, coal combustion, road dust, heavy vehicle diesel, light vehicle gasoline, etc.

4.1.3. Ambient profiling

As discussed in Chapter 3**,** the samples collected from the sampling location undergo chemical characterization. The species obtained from the chemical analysis used in ambient profile structuring and the uncertainty is based on the instrument.

The overall methodology used in the source apportionment study is depicted by the flow diagram as follows:

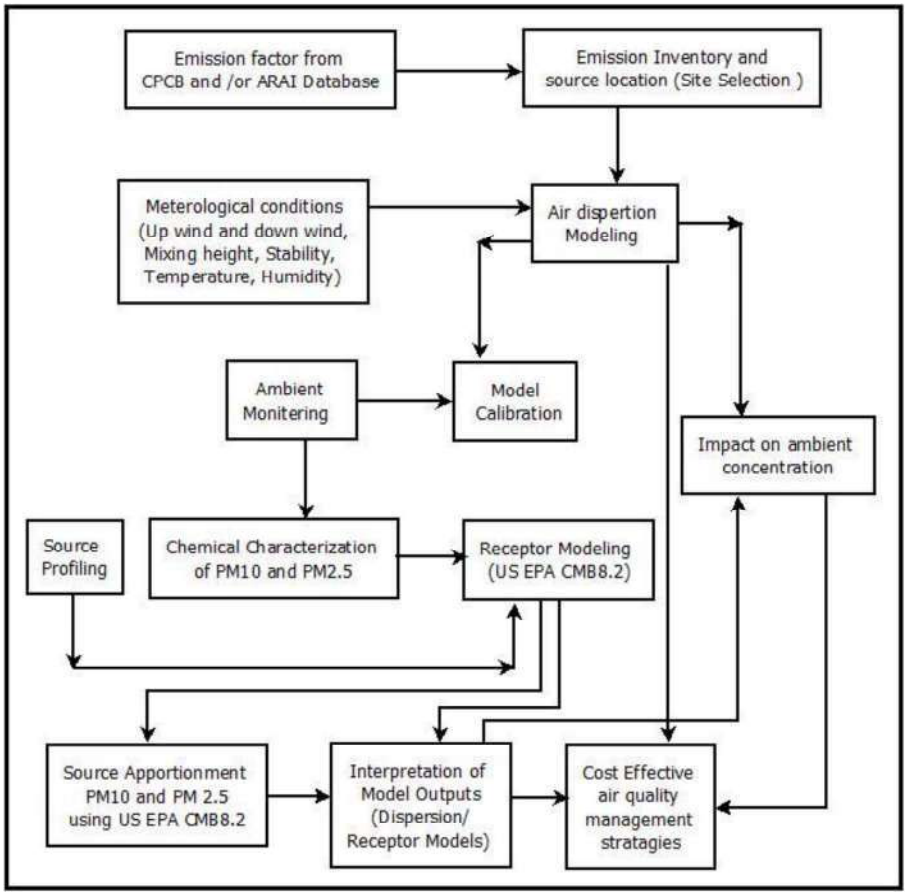


Figure 4.1: General methodology followed in the source apportionment studies

4.2. Results of the Chemical Mass Balance

CMB8.2 is performed for all the air quality monitoring locations. The significant sources in the area are identified first based on the field surveys. The general category of sources included in the model for all the sites are composites of all the vehicular sources, domestic combustion, road dust, agricultural waste burning, Industries, etc (Summary of relevant air quality studies from major Indian cities is given in Table 4.1). However, the choice of sources varies concerning the activities prevailing in the area and CMB model performance. A similar approach also applies to the selection of species. Efforts were made to include as many species in the model as possible. The choice was, however, restricted based on model performance. The source contributions are shown in the following Figures 4.3. The CMB model performance with respect to various sources is shown in Annexure 1.

4.2.1. Domestic combustion

In the summer season, the foremost emission source was domestic combustion for PM_{10} and $PM_{2.5}$. The domestic combustion percentage was observed at 22% and 25% for PM_{10} and $PM_{2.5}$ in the summer season. In the winter season, domestic combustion contribution was the second most percentage contributor for PM_{10} and $PM_{2.5}$. The PM_{10} percentage was 23% while the $PM_{2.5}$

percentage contribution was 28% in this season. The higher concentration of Cl^-, F^-, Cr, and Br. Cl^- and F^- are the markers of coal-burning and wood-burning (Jain et al., 2020). High Br along with Cl^- suggests the contributions from coal combustion.

4.2.2. Industrial Emission

The industrial combustion percentage contribution observed 16% in PM_{10} and 13% in $PM_{2.5}$ in the summer season. In the winter season, contribution to industries is determined to be 15% in PM_{10} and 24% in $PM_{2.5}$. The abundances of elements like As, Zn, Fe, Cu, Cr, Pb, and S indicate the industrial source's emissions. Kumar et al. (2001) used Cu, Mn, and Ni as tracers for industrial emissions in Mumbai; Sharma et al. (2014b) used Cu, Cr, Mn, Ni, Co, and Zn as industrial emission tracers for metal manufacturing plants in Delhi; Kulshrestha et al. (2009) used a combination of Ni, Cu, Fe, and Cr as a marker for construction activities in Agra; and Karet al. (2010) used Zn, Cu, and Ni as tracers of galvanizing, metallurgy, and electroplating industries while Cr from tannery industry in Kolkata.

4.2.3. Coal Mining

Opencast coal mining activity comprises heavy-duty diesel vehicle usage, blasting, Coal handling and overburden management. During the summer season, the coal mining activity in PM_{10} and $PM_{2.5}$ is observed to be 8% and 7% respectively while in the winter season it contributes somewhat 6% and 5% in PM_{10} and $PM_{2.5}$ respectively.

4.2.4. Transportation

The overall transportation contribution is 25% for PM_{10} and 32% for $PM_{2.5}$ in the summer season. In the winter season, the transportation emission contribution is examined at 16% for PM_{10} and 18% for $PM_{2.5}$. The OC/EC ratio is a convenient diagnostic tool for investigating the sampling site and its emission sources. In the present study, the OC/EC ratio shows significant seasonal variations for a coarser fraction of PM than for a finer fraction. It is well established that OC/EC ratio values between 1.4 and 4 indicate emissions from gasoline catalyst vehicles and 0.3 to 1 suggest diesel vehicle emissions (Amato et al., 2016; Cesari et al., 2018). Assessing the ratio of nss-K+/EC is another diagnostic check for estimating the relative loading of vehicular emissions, where nss-K+ is a non-sea-salt water-soluble potassium ion (calculated as K+- 0.129Na+) (Andreae and Merlet, 2001).

4.2.5. Secondary Inorganic Aerosol

During summer, the secondary inorganic aerosol contribution to PM_{10} and $PM_{2.5}$ is about 8% and 16%, respectively. Secondary inorganic aerosols contribution found in winter is about 14% and 17%, respectively for PM_{10} and $PM_{2.5}$. The secondary inorganic aerosol source is a high concentration of nitrate (NO_3^-), sulphate (SO_4^{2-}), and ammonium ((NH_4^-). These secondary products are formed in the atmosphere, being emitted either by natural or anthropogenic sources. The oxidation of NO_x forms the secondary nitrate. It is favoured by low temperature (Li et al.2004), while high temperature and strong solar radiations favour the formation of secondary sulfates through photochemical reactions (Seinfieldand Pandis, 2016). Secondary inorganic aerosol formation from precursors (SO_2 and NO_2) enhances the pollution burden over the

vicinity. Biomass burning, the presence of metal traces (Fe, Al, Mn, Zn, Cr etc.) from vehicular or industrial emission play a key role to neutralise the oxides of nitrogen and sulphur and thus raises the amount of secondary inorganic aerosols in the atmosphere.

4.2.6. Agriculture

The agriculture contribution observed that 5% for PM_{10} and 2% for $PM_{2.5}$ in the study period during the summer season. In the winter season, the contribution is 3% and 2% for PM_{10} and $PM_{2.5}$ respectively. Agricultural activities contribute ammonium to the atmosphere (Pant and Harrison, 2012; Jain et al., 2019). The OC and EC are also significant agricultural activity sources (Ram and Sarin 2011; Sharma et al.2016a).

4.2.7. Open burning

The contribution of open burning in the summer season is 5% for both PM_{10} and $PM_{2.5.}$ In winter, the garbage burning contribution is 6% and 2% for PM_{10} and $PM_{2.5}$ respectively during study time. The abundance of tracers like K^+, Pb, Br and consider-able Cl^- marks this garbage/biomass burning source. K^+ and levoglucosan are globally employed as biomass burning markers. Biomass consists of residential and agricultural wastes, post-harvest residue, cow dung, dry leaves, fuelwood, and wildfires (Almeida et al., 2006; Khare and Baruah, 2010; Shridhar et al., 2010). The OC and EC are also traced insignificant amounts along with K+, indicating the biomass burning emanations (Cesari et al., 2018; Sharma et al., 2014; Jain et al., 2018).

4.2.8. Road Resuspension dust

The re-suspension dust is a significant contributor to PM_{10}. The contribution of resuspension dust is during the summer season 12% while in the winter season the emission contribution is 10% for PM_{10}. In the summer season, resuspension dust's contribution is higher because of the high wind velocity and dry condition. The lower percentage contribution of road dust to fine particulate matter is attributed to substantial road dust particulates in coarse mode, found in other studies (Gupta et al., 2007; Masri et al., 2015). Crustal elements are significant constituents of airborne soil and re-suspension road dust. Generally, they contribute to coarse aerosols, including Al, Si, Ca, Ti, Mg, Fe, and Na used as tracers for soil dust or crustal re-suspension (Lough et al.2005; Begum et al. 2011). The marker elements that have been used in India for the identification of soil dust include Al, Si, Ca, Ti, Fe, Pb, Cu, Cr, Ni, Co, and Mn (Sharma et al., 2017). Cu, Zn, and Ba are associated with road dust/re-suspension dust due to the release of these marker elements from cars and non-exhaust sources.

4.2.9. Other emission Contribution

Other area sources contributed in the summer season is 12% for PM_{10} and 7% for $PM_{2.5}$ during the study period. In the winter season, emission contribution is 14% for PM_{10} and 9% for $PM_{2.5}$.

4.3 Inferences

The receptor modelling (CMB) results (Figure 4.3) revealed that the transport sector and domestic combustion are the predominant emission sources contributing to the receptor levels. During the summer season, the contribution of the transport sector was found maximum in both PM_{10} (23%) and $PM_{2.5}$ (30%) followed by the contribution of domestic combustion (17% and 23% for PM_{10} & $PM_{2.5}$ respectively). While in the winter season, the contribution of domestic combustion outruns the contribution of the transport sector. During the winter season, domestic combustion has contributed 22% (PM_{10}) and 28% ($PM_{2.5}$) whereas the transport sector has contributed 16% (PM_{10}) and 21% ($PM_{2.5}$) of the total emission.

After transport sector and domestic combustion, Industrial emission (12% of PM_{10} emission) and Road Resuspension (12% of PM_{10} emission) followed by Coal mining activity and secondary inorganic aerosol formation (both 8%) are contributing majorly to PM_{10} emission at receptor during the summer season.

In $PM_{2.5}$ source contribution, secondary inorganic aerosol formation contributed majorly (16% & 15% in summer and winter seasons respectively) after domestic combustion and transport sector. Secondary inorganic aerosol formation from precursors (SO_2 and NO_2) enhances the pollution burden over the vicinity. Biomass burning, the presence of metal traces (Fe, Al, Mn, Zn, Cr etc.) from vehicular or industrial emission play a key role to neutralise the oxides of nitrogen and sulphur and thus raises the amount of secondary inorganic aerosols in the atmosphere.

Industrial activity contributed 12% and 11% of total PM_{10} load in summer and winter respectively but in the case of finer dust ($PM_{2.5}$), it contributed 17% in the winter season at the receptor level. This may be due to the calm winter conditions that allow finer dust ($PM_{2.5}$) to settle near to ground than that of summer conditions that allow more turbulence mixing in the atmosphere.

Road re-suspension of dust contributes significantly in PM_{10} load at receptor both in summer (12%) and in winter (8%). As these are larger and heavier particles, they contribute to PM_{10} fraction and are not found in $PM_{2.5}$ fraction at the receptor.

After the contribution of the industrial sector, coal-mining activity contributed around 8% and 6% of the total PM_{10} receptor dust load during summer and winter respectively. In the case of $PM_{2.5}$ dust load at the receptor, coal-mining activity contributed 7% and 5% during summer and winter respectively.

From the results and analysis of receptor modelling, it can be summarised that mitigation and abatement of the emissions from domestic combustion and transport sector alone may reduce receptor dust load by 40% (approx.).

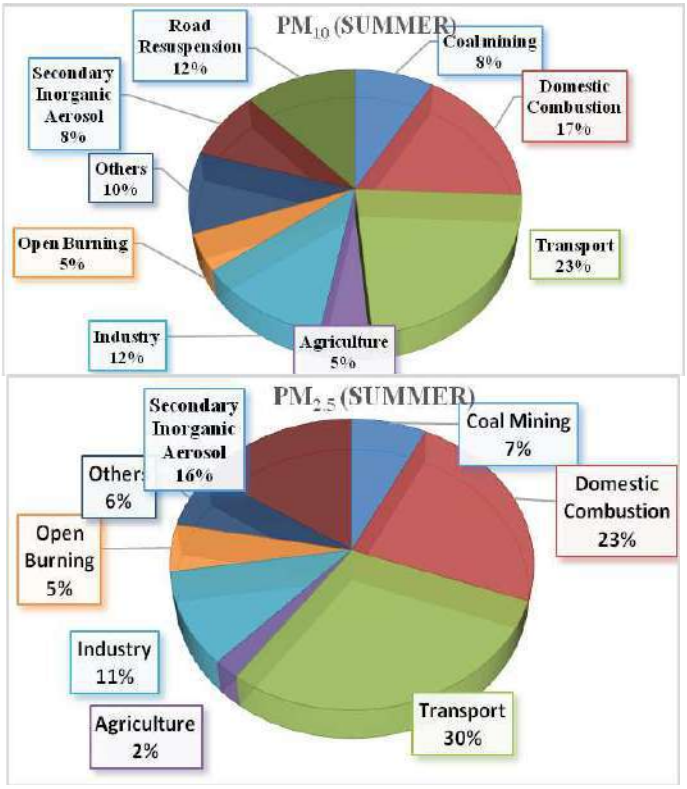


Figure 4.2: Source contribution at receptor locations of PM_{10} and $PM_{2.5}$ in summer

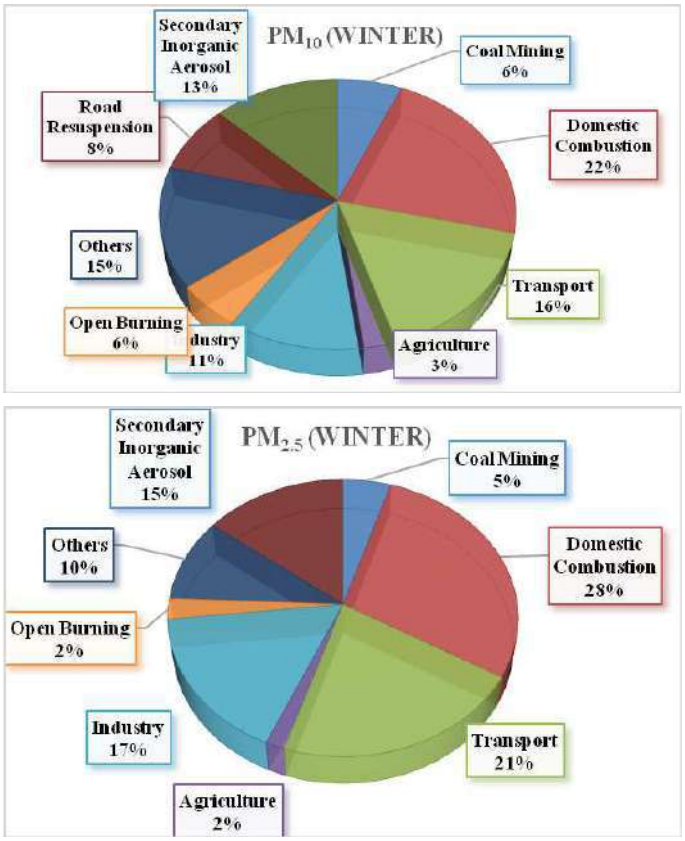


Figure 4.3: Source contribution at receptor locations of PM_{10} and $PM_{2.5}$ in winter

Table 4.1: Summary of relevant air quality studies from major Indian cities.

Area/Location	Particle size	Sources	Elements and Ions	References
Delhi	PM_{10} and $PM_{2.5}$	Secondary Nitrate, Secondary Sulfate, Vehicular emission, Biomass burning, Soil dust, Fossil fuel combustion, Sodium and magnesium salt, Industrial emission	Al, Mg, Ca, Ti, Fe, Cr, Mn, Zn, As, Pb, Br, M, F^-, Cl^-, NO_3^-, SO_4^{2-}, K^+, NH_4^+, and Na^+	Jain et. Al., 2020
Mangalore	PM_{10} and $PM_{2.5}$	Construction dust, Diesel generator, Tyre wear emission, Brake lining emission, Sand dust emission, gasoline vehicle emission, Diesel vehicle emission, Unpaved and paved road emission, Biomass burning, LPG stove emission, Solid fuel emission, Ferrous and steel industries emission, Fabrication and welding emission, Kerosene stove emission	As, Ba, Cd, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sr, Zn, F^-, Cl^-, NO_3^-, PO_4^{3-}, SO_4^{2-}, Na^+, K^+, Mg^{2+} and Ca^{2+}	G. Kalaiarasan et al. 2018
Delhi NCR	PM_{10} and $PM_{2.5}$	Dust construction, Vehicle emission, Biomass Burning, Industrial emission, Secondary Pollutants, DG sets emission,	Al, Si, P, S, Cl, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ca, F^-, Cl^-, NO_3^-, Br^-, NO_2^-, SO_4^{2-}, Na^+, K^+, Mg^{2+} and Ca^{2+}	Report No. ARAI/16-17/DHI-SA-NCR/Final Report August 2018
Delhi	$PM_{2.5}$	Secondary Aerosol, Vehicular emission, Biomass burning, Soil dust, Fossil fuel combustion, Sea salt, Industrial emission	Al, Mg, S, Si, Cl, K, Ca, Ti, Cu, Mn, Fe, Zn, Br, Cr, As, Pb, F^-, Cl^-, NO_3^-, SO_4^{2-}, K^+, NH_4^+, and Na^+	Jain et. Al., 2017
Nagpur	$PM_{2.5}$	DG sets, biomass burning, resuspended dust, secondary aerosol and mobile sources.	Al, Ba, Cd, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Si, Zn. F^-, Cl^-, NO_3^-, PO_4^{3-}, SO_4^{2-}, Na^+, K^+, Mg^{2+} and Ca^{2+}	Pipalatkar et al., 2014
Raipur	$PM_{2.5}$	Brick kiln process, steel re-rolling mills, steel processing industries, biomass burning, metallurgical industrial emissions and coal burning	Al, As, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, S, Sb, Se, V, Zn, Na^+, K^+, Mg^{2+} NH_4^+, F^-, Cl^-, NO_3^-, SO_4^{2-}, and Ca^{2+}	Matawle et al., 2014
Hyderabad	PM_{10} and $PM_{2.5}$	Vehicles exhaust, resuspension of dust, secondary sulfates, secondary nitrates, biomass	Na, Mg, K, Al, Si, Ca, Fe, Cl, SO_4^{2-}, NO_3, NH_4^+	Guttikunda et al., 2013

		burning, coal burning.		
Pune	PM_{10} and $PM_{2.5}$	Vehicles, DG sets, construction dust, solid fuels emissions, resuspended dust	Al, Pb, Cu, Zn, As, Se, Br, Ni, Fe, Mn, Mg, Cr, Ti, Ca, Cd, S, Si, Na, Ba, Sb, Cd, Sr, Cl^-, NO_3^-, SO_4^{2-}, K^+, NH_4^+	ARAI, 2010
Kanpur	PM_{10} and $PM_{2.5}$	Vehicles, open burn, road dust, domestic wood, coal and LPG, metal smelting, DG sets.	Cl^-, NO_3^-, SO_4^{2-}, K^+, NH_4^+, Na^+, Ca^{2+}, Mg^{2+} Si, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Cd, Sn, Sb, Pb	CPCB, 2010b
Mumbai	PM_{10} and $PM_{2.5}$	Wood combustion, Fuel oil combustion, kerosene combustion, biomass burning, LPG, ammonium sulfate, ammonium nitrate, heavy duty diesel vehicles emissions, soil dust.	Na, Mg, Al, Si, P, S, Cl, Ca, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ga, Rb, Y, Zr, Pd, Ag, In, Sn, La, Se, Sr, Mo, Cr, Cd, Sb, Ba, Hg, and Pb. F^-, Cl^-, Br., NO_2^-, NO_3^-, SO_4^{2-}, K^+, NH_4^+, Na^+, Ca^{2+}, Mg^{2+}	CPCB, 2010a
Chennai	PM_{10} and $PM_{2.5}$	Vehicles, DG sets, bakeries, soil dust, construction dust, paved road dust, kerosene and LPG emissions.	As, Ag, Ca, Na, Fe, Mg, Cu, Zn and other metals. Cl^-, $NO3^-$, $SO4^{2-}$, K^+, NH_4^+, Na^+, Mg^{2+}	IIT Madras, 2010
Bangalore	PM_{10} and $PM_{2.5}$	Petrol vehicles, diesel vehicles, secondary particulates, fuel oil burning, wood domestic wood burning, DG set, kerosene generator set, paved road dust re suspension, soil dust.	Na, Mg, Al, Si, P, S, Cl, Ca, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ga, Rb, Y, Zr, Pd, Ag, In, Sn, La, Se, Sr, Mo, Cr, Cd, Sb, Ba, Hg, and Pb. F^-, Cl^-, Br^-, NO_2^-, NO_3^-, SO_4^{2-}, Na^+, K^+, Mg^{2+} and Ca^{2+}	TERI, 2010

DG - Diesel generators; LPG - Liquefied petroleum gas; OC - Organic carbon; EC - Elemental carbon.

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Chapter 5 Dispersion Modelling

Air quality modeling includes four major processes (a) emission of pollutants, (b) transportation of the pollutants due to mean wind profile (c) chemical transformations and (d) deposition/removal. In the present study the particulate matter emissions, transportation and dispersion are carried out using the AERMOD model, which is developed by USEPA. AERMOD model estimates the spatial profile of pollutants based on the Gaussian plume equation, which is an analytical solution to the steady-state approximation of the advection-diffusion phenomenon. The boundary conditions about the atmospheric mixing height and other thermodynamic vertical profiles for the simulations are derived from the mesoscale model. The model relies on the atmospheric stability classes for deriving the dispersion coefficients across the multiple dimensions with respect to the distance away from the sources. In this study, only the ground level concentrations of the particulate matter are simulated during the study period. The study domain envelops the Jharia Coal Fields situated in the Jharkhand state of India. The methodology followed in the present study is shown in Figure 5.1. The southwest part of the Dhanbad City shares borders with the study area, but the majority of emission load used in the study is included from the JCF.

5.1. Wind data analysis

The nearest IMD (India Meteorological Department) observations are at Patna and Kolkata, which are approximate >150km from the study area. Hence, hourly meteorological observations required for the study for the AERMOD dispersion model were simulated through the Weather Research and Forecast, version-3.9 (WRF), which is a meteorological model that dynamically downscales the global NCAR/UCAR meteorological data to the regional level data (www.mmm.ucar.edu). Nested domains of grid resolution 12km and 4km, respectively were laid over the study area for simulation of hourly meteorological variables using the WRF model (Figure 5.2). Hourly meteorological data, including both the surface variables and upper atmosphere variables, were simulated for the study period viz. 23 May to 12 June 2019 and 23 January to 12 February 2020, representing the summer and winter seasons, respectively.

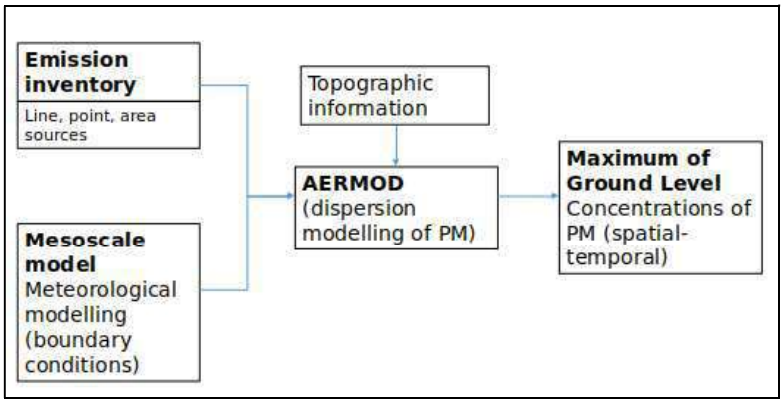


Figure 5.1: Methodology followed in the study.

The mesoscale model interface program MMIF (https://www.epa.gov/) converter tool was used

to convert the inner domain's gridded WRF model simulated meteorological data into a format suitable for the AERMOD model. The AERMOD receptor grid covering the study area is shown in Figure 5.3. A Cartesian receptor grid having 21 rows and 21 columns with a resolution of 2000 m was laid for the simulation of particulate matter dispersion /concentration at the receptor locations. Overall there are 20 grids in each direction covering an area of 40 km by 40 km enveloping the JCF.

The spatial pattern of the predominant wind profile over the study area is plotted using the windrose diagrams for the summer (March to May 2019) and winter season (November 2019 to February 2020), shown in Figures 5.2 and 5.3, respectively. Results show that the study area is experiencing the predominant wind (having high frequency) flow from east to west direction followed by north-west to south-east direction during summer, while in winter the predominant wind direction is from north to south. The wind speeds vary in the range of 0.5 to 11.1m/s during the summer predominantly in the range of 2.1 to 3.6m/s whereas wind speeds vary in the range of 0.5 to 8.8m/s during the winter, predominantly in the range of 2.1 to 3.6m/s.

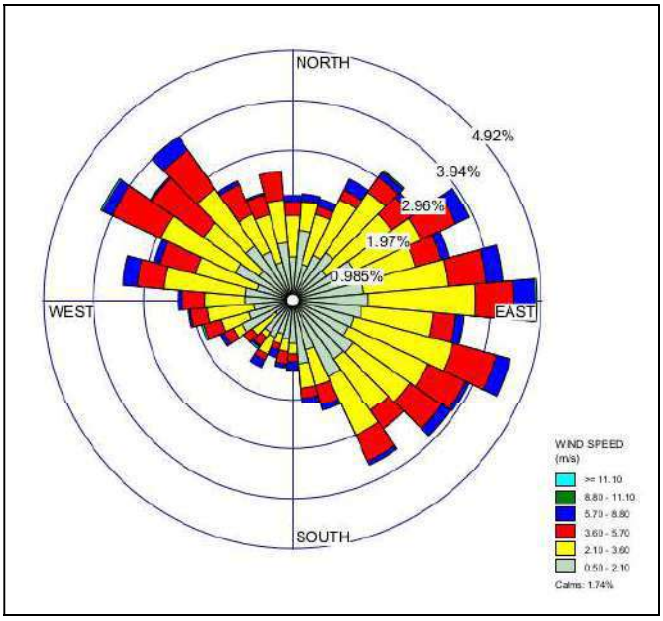


Figure 5.2: Windrose of the study area during March-June, 2019 (wind direction blowing towards the center)

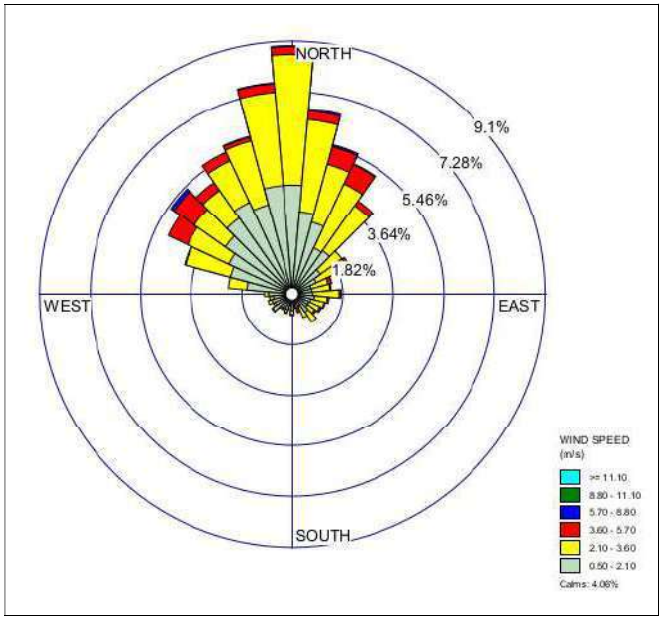


Figure 5.3: Windrose of the study area during November-December 2019 (wind direction blowing towards the centre)

5.2. Dispersion of Particulate matter

Spatial profiles of maximum ground-level concentrations of 24-hour average values of PM_{10} and $PM_{2.5}$ were simulated using the AERMOD Gaussian plume model. The emission rates of particulate matter from multiple source types including the point, line, and area were derived from the field monitoring of the emission inventory. Point sources mainly include the emissions from the industries situated in the study area that mainly use coke/coal as the fuel. The line sources include the emissions from the vehicular exhaust. Emission inventory of traffic pollution was carried out in the study area by noting down the vehicular activity. The vehicular activity of different vehicular types such as trucks, light motor vehicles, three-wheeled vehicles, motorbikes, etc. was multiplied by the corresponding emission factors for the estimation of gaseous pollution. The summation of emissions from all vehicle types adds to the overall line sources contributing to the pollution load in the study area. The area sources include emissions from the open cast mining emissions (including all the activities in the mine premises) and domestic burning (including emissions from crematoria, bakeries, open eat-outs, restaurants, chulha burning from the slum, etc.).

The emissions in grams per second were calculated from the emission inventory survey, for the line and point sources. Whereas, the emission rates in $g/s/m^2$ were calculated for the area sources including mining. These emission rates from each source type have been computed in the study area and fed into the AERMOD model domain for the simulation of spatial average concentrations of PM_{10} and $PM_{2.5}$. In the present study, the maximum GLC (ground level concentrations, in $\mu g/m^3$) was simulated at several receptor grid locations in AERMOD domains. The AERMOD model was run during the sampling period in May 2019 and November 2019, representing the pre-monsoon and post-monsoon seasons, respectively.

Analysis of WRF model simulated wind speed and direction data shows that the wind is

predominantly flowing from south-east direction to north-west direction, followed by the reversal in the direction, during the monitoring in summer, representing pre-monsoon conditions (Figure 5.5). The wind speeds during the monitoring period in summer month varied between 0.5 and 8.8m/s. During the monitoring period in winter (post-monsoon), the wind predominantly flowed from the north-east to south-west direction having wind speeds in the range of 0.5 to 3.6m/s (Figure 5.5).

The wind blowing from different directions in the study area determines the direction of pollution dispersion. The Gaussian plume equation used in the AERMOD model estimates the diffusion and advection of the pollutants concerning the emission rates and meteorology (wind speed, direction and atmospheric stability categories). The model simulated maximum ground level concentration of the particulate matter (PM_{10} and $PM_{2.5}$) in the study area covering the JCF is shown through the isopleths. The isopleths (contours connecting the regions with the same ground level concentration in the context of the present study) of maximum GLC of PM_{10} and $PM_{2.5}$ were observed to form a pattern according to the predominant wind directions flowing in different monitoring seasons. It is observed that the line sources in the study area have contributed the maximum to the surface GLC of PM_{10}, following the open cast mines. The AERMOD model simulated the value of GLC of PM_{10} due to line sources, open cast mines, and all sources are 927, 286, and 978µg/m^3, respectively, for the summer season. The $PM_{2.5}$ maximum GLC contributed by the line sources, open cast mines, and all sources included are 809, 143, and 835µg/m^3, respectively. It is evident from the result that the line sources are significantly contributing to the overall particulate pollution in the study area during summer.

The analysis of the PM_{10} and its maximum GLC simulated by the AERMOD model for the winter season also follows a similar pattern as of summer. The contribution of line sources, open cast mines, and all sources included are 1565, 597, and 1679µg/m^3, respectively. The $PM_{2.5}$ maximum GLCs during the winter are 1004, 299, 1167µg/m^3 as contributed by line, open cast mines, and all sources including, respectively. Based on the emission inventory and the prevailing meteorological conditions during the winter season have in general contributed to the higher particulate matter than that of the summer season.

Pockets of maximum concentrations of PM_{10} (200-1000 µg/m^3 and above) are observed in the vicinity to roads nearer to the open cast mines south of Dhanbad City during the winter (Figure 5.5). The localities of the high concentrations of PM_{10} are Sabji Patti road and Sudamdih mine area, which is reflected in the figure. The area covering the Dhanbad city and the mines situated in the southwest have PM_{10} concentrations in the range of 200-900µg/m^3. The fringes of the JCF have recorded the PM_{10} concentrations in the range of 100-250µg/m^3. In contrast, the PM_{10} concentrations for the summer season have significantly lower and the majority of the study area have PM_{10} < 100µg/m^3, however, the area extending from south of Dhanbad City and Sudamdih mine have relatively high PM_{10} concentration in the range of 100-500µg/m^3. Baghmara and Sonardih mine area in the west of Dhanbad City have also been observed to have high GLC of PM_{10} in the range of 100-500µg/m^3.

A similar pattern of the spatial distribution of $PM_{2.5}$ is reflected as of PM_{10}. As the underlying meteorological conditions are the same for both the PM_{10} and $PM_{2.5}$ simulations the

spatial pattern is nearly similar. High concentrations of $PM_{2.5}$ (100-500µg/m^3) are observed in the southwest direction of Dhanbad City (Figure 5.6). The maximum GLC of PM_{10} is found to be higher than $PM_{2.5}$ during both the monitoring seasons, and higher concentrations are observed during the winter season. The prevailing winter meteorology in the region has lower wind speeds and mixing heights, which poses an unfavorable situation for the dispersion of particulate matter, hence containing a high chance of accumulation of airborne pollutants. The significant contribution of particulate matter from the line sources is observed in the study area, followed by the area sources (from open cast mining, domestic burning, bakeries, open eat-outs, and restaurants)**.** The locations of the highly polluted can be interpreted from the images shown in Figures 5.6 (a) and 5.6 (b) for devising realistic and grass-root level mitigation strategies.

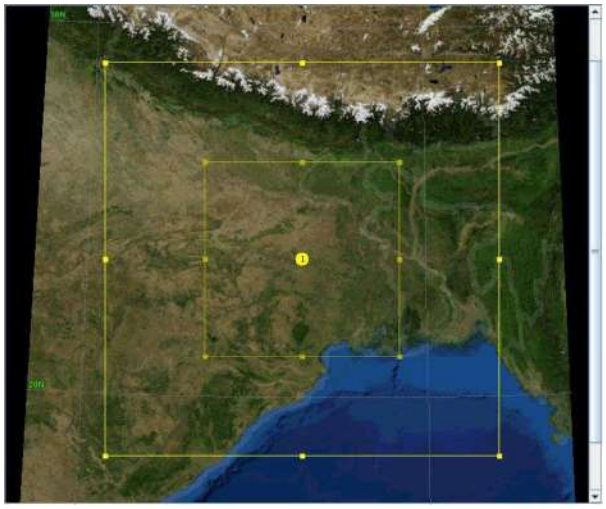


Figure 5.4: AERMOD grid covering the Jharia Coal Fields (JCF). The line, area, and point sources covered in the study are indicated in red color. The UTM coordinates of the left bottom point are x=406111 and y=2603492, and the coordinates of the right top point are x=456248 and y=2653417.

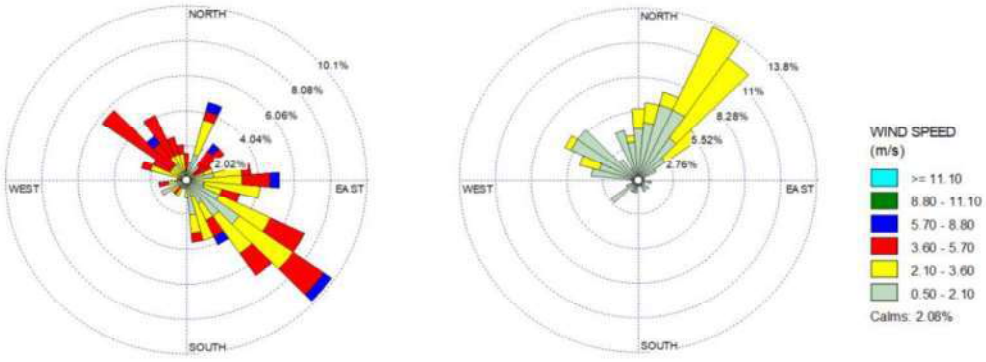
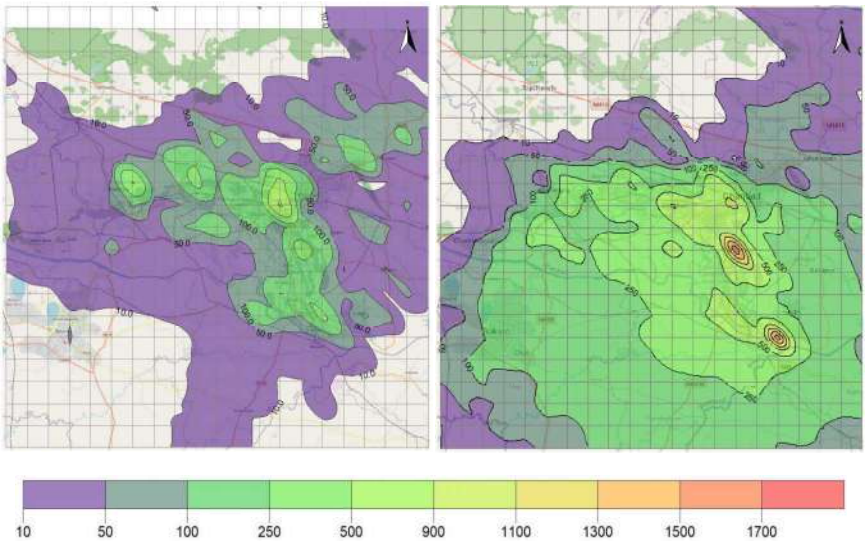
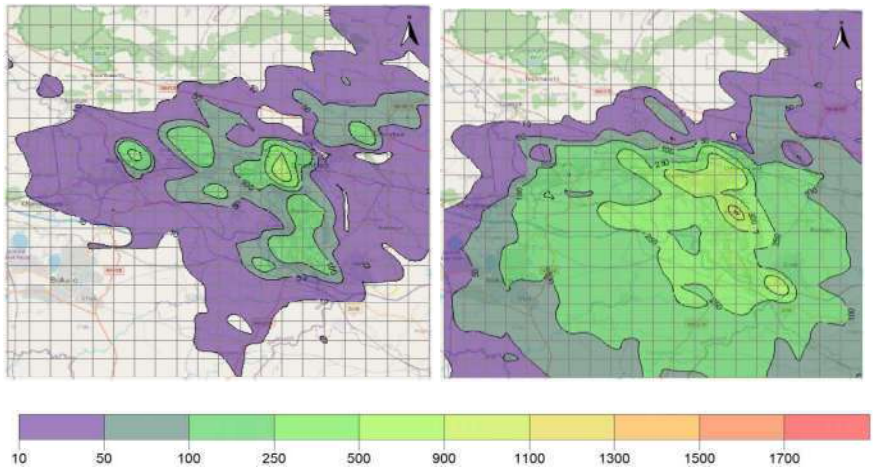


Figure 5.5: Windrose diagram for the summer (left) and winter seasons (right) at Jharia Coal Fields during the sampling period. Wind direction is flowing towards the centre.



(a)



(b)

Figure 5.6: 24-hour average maximum ground level concentration of PM contours in the study area simulated during the study periods in summer (left) and winter (right) seasons (a) PM_{10} ($\mu g/m^3$) and (b) $PM_{2.5}$ ($\mu g/m^3$)

5.3 Validation of the model

Comparison between the model simulated period average PM and the measured PM concentrations was made to determine the overall efficiency of the dispersion model. In the present study, the model validation metrics viz. mean bias (MB), normalized mean bias (NMB), mean gross error (MGE), normalized mean gross error (NMGE), and Pearson's correlation (r) were calculated for PM_{10} and $PM_{2.5}$ separately including data of both seasons. At some of the monitoring locations like Mines Rescue, Katras, Patherdih, Harina, Lodhna, and Lohapatti the discrepancies between the modeled and observed data were found to be high, for both summer and winter seasons. At remaining locations for both seasons, the results indicate an acceptable/fair degree of model performance in simulating the particulate dispersion. Results show that the correlation coefficient between the measured and modeled PM_{10} is 0.6, which is

fair enough in environmental open systems, similarly, for $PM_{2.5}$ the correlation value is around 0.7 (Table 5.1).

Table 5.1 Performance Stimulation Metric

Model metric	PM_{10}	$PM_{2.5}$
MB	-19.46	20.67
NMB	-0.11	0.24
NMGE	0.32	0.37
Correlation Coefficient	0.6	0.7

The NMB values are observed to be lower for PM_{10} (-0.11) than $PM_{2.5}$ (0.24), which indicates the slight negative bias in PM_{10} simulations (under-prediction of the concentrations) and positive bias in $PM_{2.5}$ (over-prediction of the concentrations). Whereas, the NMGE for both PM_{10} and $PM_{2.5}$ are 0.32 and 0.37, respectively, which indicates the variation in the model simulations deviate around 30% from the mean values on average (which is a result due to some extreme values in the simulations). However, this discrepancy could be minimized if long-term simulations are carried out, which is highly computationally intensive. Nevertheless, the model performance metrics in terms of correlation and normalized mean gross error infer that the model could capture the spatial profile of the particulate matter distribution to a good extent.

Chapter 6 Recommendation

6.1. Mine industries

1. The project proponent might consider installing conveyor systems for transporting the coal from the coal handling plant to the railway siding or to the nearest thermal power plant (if feasible).
2. A sufficient number of plants should be planted around the mine pit to arrest the movement of particulate matter or dust into the surrounding areas.
3. Scientific studies might be necessary to design a green belt with an optimized dimension of plot size and direction as per the prevailing meteorology. Similar studies are required to design a wind barrier for optimized benefits.
4. Adequate dust control measures should be in place, like mechanized sweeping, water sprinkling or mist spraying systems on the haul roads and at loading sites. Long-range misting or fogging canons are also should be in place.
5. Dust suppression measures at all operations of mining should be ensured.
6. Ensuring the complete coverage of the trucks and railway wagons that carry coal with a tarpaulin sheet is necessary.
7. In the long-run mobilization of closed trucks to carry the coal is preferable.
8. The coal transport roads should not be left with open curb sides. End to end covering up of curb side is essential to avoid the re-suspension of coal due to the truck movement.

6.2. Area Sources

Area sources are mainly domestic sources of fuel (coal, wood, kerosene, LPG) burning, trash/MSW combustion, bakeries, hotels/restaurants etc. and re-suspension of dust. Based on the survey and assessment, the following recommendations emerge:

1. Construction and demolition of buildings in the urban area give high local dust contribution resulting health problems. These practices need to follow compliance guidelines to reduce emissions.
2. Road and pavement should be well constructed to suppress road dust. The standard specifications and code of practice for road construction should be followed and implemented as per the Indian Road Congress (IRC) guidelines or international standard guidelines.
3. Strategically placed green cover in urban and semi-urban areas can help to improve local air quality.
4. Manage agricultural residues, including strict enforcement of bans on open burning
5. Strictly enforce bans on the open burning of household waste.
6. Use clean fuels – electricity, natural gas, liquefied petroleum gas (LPG) in cities, and LPG and advanced biomass cooking and heating stoves in rural areas; substitution of coal by briquettes
7. Use incentives to improve the energy efficiency of household appliances, buildings, lighting, heating and cooling; encourage roof-top solar installations
8. Promote the use of electric vehicles

9. Encourage centralized waste collection with source separation and treatment, including gas utilization.
10. There is a substantial population that also uses available coal. These houses could be given a combination of improved chulla or free/subsidised power for cooking purposes.
11. Hotels and dhabas need to be educated and compulsorily asked to use LPG for its cooking purposes.
12. The trash and MSW burning is very common. Some of the places contain a mix of plastics and thermocol. The combustion of these materials is very harmful to human health.
13. Coal depot pollution is due to open storage and unregulated buying, selling and transportation. These coal depots are responsible for nearby air pollution peaks. However, the contribution of the same need to be assessed.

6.3. Line Source

The vehicular sector in cities has been seen to be a major source of gaseous and fine particulate matter. The action plan for this sector would need a combination of efforts:

1. Vehicle inspection and maintenance: Enforce mandatory checks and repairs for vehicles.
2. Improved public transport: Encourage a shift from private passenger vehicles to public transport.
3. Set up a mechanism of Inspection and Maintenance programme for all vehicles in the district through RTO with automated system assessment.
4. The Inspection & Maintenance (I & M) centre shall also test all vehicles for their inbuilt emission tests.
5. All commercial vehicles should be phased out after 8 years of age or subjected to two years extension after rigorous I&M tests
6. All private vehicles should be subjected to proper assessment and fitness tests through I&M centres.
7. All autos and buses shall also be subjected to I&M tests
8. Dhanbad city does not have a designated place for truck parking and maintenance related activities. A separate designated place should be allocated to prevent illegal parking and repair shops on the roads and kerbside.
9. Dhanbad city does not have a designated place for Auto-rikshaw. A separate designated place should provide to prevent traffic congestion and control vehicle emission.
10. Major haul trucks with heavy loads should not pass through the main city. The plan being made should be implemented in the next 1-1.5 years.
11. Overloading is a common phenomenon in the region resulting in poor road quality. This can be avoided through online checking when vehicles leave industries with a guarantee that the vehicle is not carrying more material than its designated loads.

6.4. Others

- There is a need to explore various options for controlling air pollutants to tackle increased emissions in future.
- The local authority should stress sustainable and affordable public transport keeping clean air goals in mind.
- Frequent (time to time) arrangement of campaign/awareness programmes for lawmakers, stakeholders, health professionals, academicians to brainstorm about the future scenario and importance of clean air.
- Strategic installation of continuous air quality monitoring systems at various locations of urban, semi-urban and rural areas to check the existing air quality and information dissemination to the general public.

Annexure -1

[A] Cumulative receptor sample of PM_{10} for source profiling with fitting parameters

Source contribution estimate	**Source profiles**	**Std Error**	**R-square**	**Chi-square**
82.7% mass	Unpaved road	0.056	0.96	2.41
	Coal combustion	0.643		
	Light Duty vehicle	1.60		
	Heavy Diesel vehicle	2.19		
	Residential combustion	5.59		
	Iron and steel industry	7.16		
	Agriculture soil dust	0.212		
	Solid waste	1.37		

[B] Cumulative receptor sample of $PM_{2.5}$ for source profiling with fitting parameters

Source contribution estimate	**Source profiles**	**Std Error**	**R-square**	**Chi-square**
88.1% mass	Residential combustion	3.34	0.98	2.44
	Coal combustion	0.094		
	Light Duty vehicle	0.30		
	Heavy Diesel vehicle	1.91		
	Agriculture soil dust	0.10		
	Flyash	0.51		

Annexure XIII

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Dt. 07-Oct-2021
Hyderabad.

To,
Director (Tech),
Bharat Coking of Coal Limited (BCCL),
Environment Department, Koyla Bhawan,
Koyla Nagar, Dhanbad – 826 005.
JHARKHAND.

Dear Sir,

The project titled "DELINEATION OF SURFACE COAL FIRE AND ASSOCIATED LAND SUBSIDENCE IN THE JHARIA COALFIELD, JHARKHAND USING SATELLITE BASED REMOTE SENSING TECHNIQUES" is now completed. Please find enclosed the final project report and the necessary supporting files as per the MoU, in soft and hard copy format.

Kindly send confirmation after receipt of Data and Report which will help us to close Project. Your feedback on the project work is highly appreciated.

Yours faithfully

(Dr. K.Vinod Kumar)
Group Director,
Geosciences Group / RSAA.

Enclosed:

1) CD
2) Reports
3) Maps.

DELINEATION OF SURFACE COAL FIRE AND ASSOCIATED LAND SUBSIDENCE IN THE JHARIA COALFIELD, USING SATELLITE BASED REMOTE SENSING TECHNIQUES

GEODYNAMICS AND GEOHAZARDS DIVISION
GEOSCIENCES GROUP
REMOTE SENSING APPLICATIONS AREA
NATIONAL REMOTE SENSING CENTRE
INDIAN SPACE RESEARCH ORGANISATION
DEPT. OF SPACE, GOVT. OF INDIA
HYDERABAD-500 037

AUGUST, 2021

DELINEATION OF SURFACE COAL FIRE AND ASSOCIATED LAND SUBSIDENCE IN THE JHARIA COALFIELD, USING SATELLITE BASED REMOTE SENSING TECHNIQUES

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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Coal fire is a serious problem in Jharia coal field, where high grade coals are gradually burnt due to these fires. The combined effect of surface and sub-surface fires and mining related subsidence has affected 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 data 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, 2021 have been used. The band 10 (10.60-11.19 μm) of Landsat-8 data are used to derive the relative radiant temperature. Further ALOS-PALSAR 2, L band microwave data have been used to delineate zone of probable land subsidence (using differential interferometry) due to mining. The study reflects that, compared to 2017, the eastern flanks (Lodna and Tisra etc) show a significant reduction in total fire area. The western flank (Block II and Shatabdi) and the northern flank (Katras and Gaslitand) show isolated fire pockets in active mines as well as in OB dumps. The current total fire area mapped is 1.8 sq.km. Apart from this, one distinctive area of land subsidence has been identified using interferometric method. These are primarily caused by older or active underground mining in the Moonidih Project. The coal mine fire and subsidence areas are further verified on the ground. The final coal mine fire and subsidence maps of Jharia coal field are prepared by using remote sensing data analysis with field validation.

PROJECT TEAM

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2. **Dr. Tapas R. Martha**, Head, Geodynamics and Geohazards Division
   Review and report preparation
3. **Shri Priyom Roy,** Scientist 'SE'
   Image processing, interpretation, field survey, maps and report preparation

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EXECUTIVE SUMMARY

Coal fire is a serious problem in Jharia coal field, where high grade coals are gradually burnt due to these fires. The combined effect of surface and sub-surface fires and mining related subsidence has affected 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 has been addressed. Thermal band data 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, 2021 have been used. The band 10 (10.60-11.19 μm) of Landsat-8 data are used to derive the relative radiant temperature. Further ALOS-PALSAR 2, L band microwave data have been used to delineate zone of probable land subsidence (using differential interferometry) due to mining. The study reflects that, compared to 2017, the eastern flanks (Lodna and Tisra etc) show a significant reduction in total fire area. The western flank (Block II and Shatabdi) and the northern flank (Katras and Gaslitand) show isolated fire pockets in active mines as well as in OB dumps. The current total fire area mapped is 1.8 sq.km. Apart from this, one distinctive area of land subsidence has been identified using interferometric method. These are primarily caused by older or active underground mining in the Moonidih Project. The coal mine fire and subsidence areas are further verified on the ground. The final coal mine fire and subsidence maps of Jharia coal field are 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. An operational fire and subsidence mapping activity was taken up in 2017. In view of the past experiences, based on the letter (Ref. no. MP/19/270) from General manager (JMP), BCCL addressed to Director, NRSC on 24-10-2019, 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 7th August, 2020.

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 2020 time period.
II. To compare the change in the coal fire distribution in the Jharia coalfield between the period of 2017 and 2020.
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 approximately within latitudes 23º 42' N and 23º 50'N and longitudes 86º 09'E and 86º 30'E.

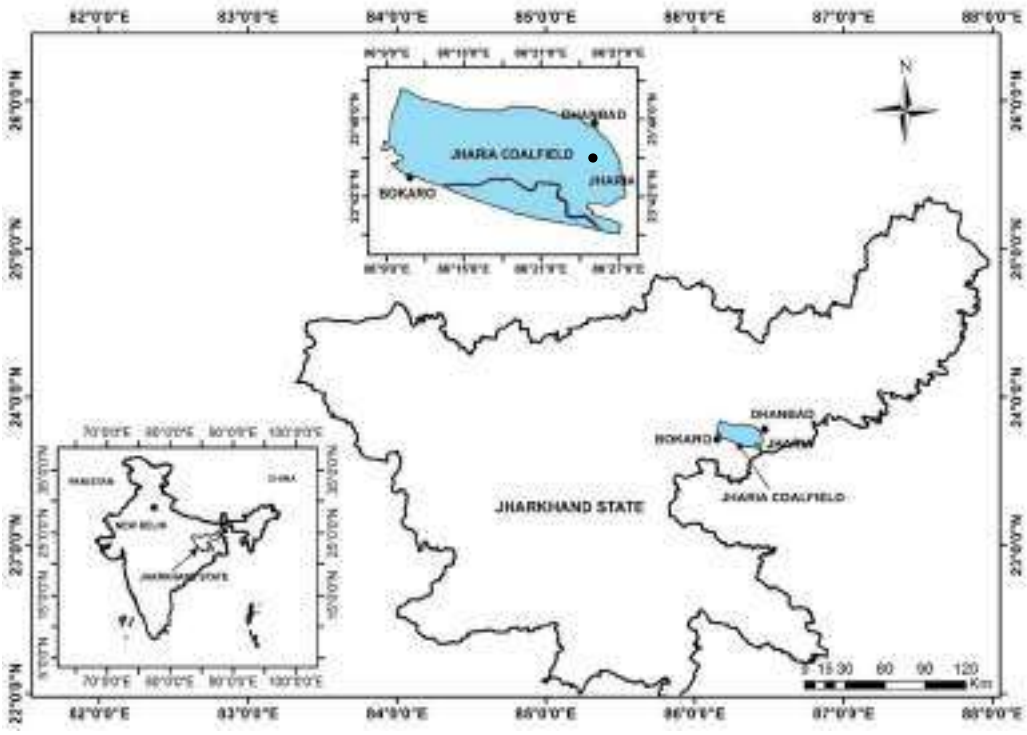

Figure 1: Study area map of Jharia Coalfied, Jharkhand

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.

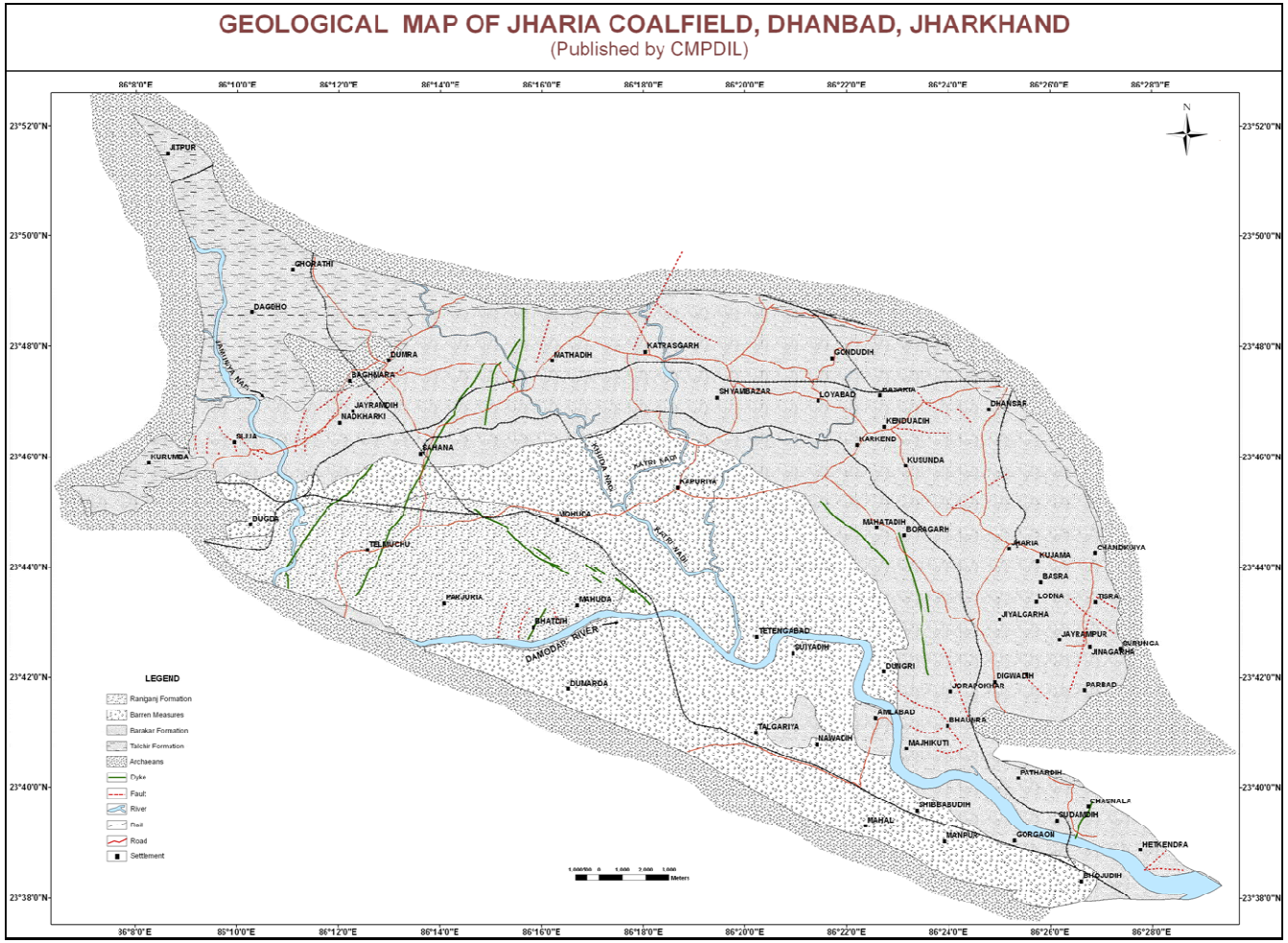

Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (published by CMPDIL)

CHAPTER III

DATA REQUIREMENTS

3.1 Remote Sensing Data

Coal fire map was created from LANDSAT 8 TIRS data of 22 May 2020. Further, the coal fire map of 2017 prepared by NRSC (NRSC, 2017) from LANDSAT 8 data (of 14 May 2017), was used as a reference to identify the changes that has occurred in the extent and disposition of the fires from 2017 to 2020.

For the land subsidence study, L-band microwave data from ALOS-PALSAR satellite (JAXA) were used. Five scenes of "Fine Beam mode" SLC data were taken from PALSAR-2 archives over a period from September, 2017 to February, 2020. 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.

Satellite	Sensor	Resolution	Time	Date	Data source
LANDSAT-8	TIRS	100m resampled to 30m	Daytime	22 May 2020	USGS, USA
ALOS	PALSAR-2 (Fine Beam mode)	10 m	NA	30 September 2017	JAXA, Japan
				3 March 2018	
				19 January 2019	
				02 March, 2019	
				29 February. 2020	

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 are 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 (Gangopadhyay et al. 2012). In present study, band 10 of TIRS sensor (acquired on 22 May, 2020) has been used coal fire mapping. 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/ (m^2 * 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 (L_λ) for 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 literature (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/ (m^2 *srad*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. 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 36.5°C (Figure 4). Based on this cut-offs, regional coal fire map was prepared (Figure 5).

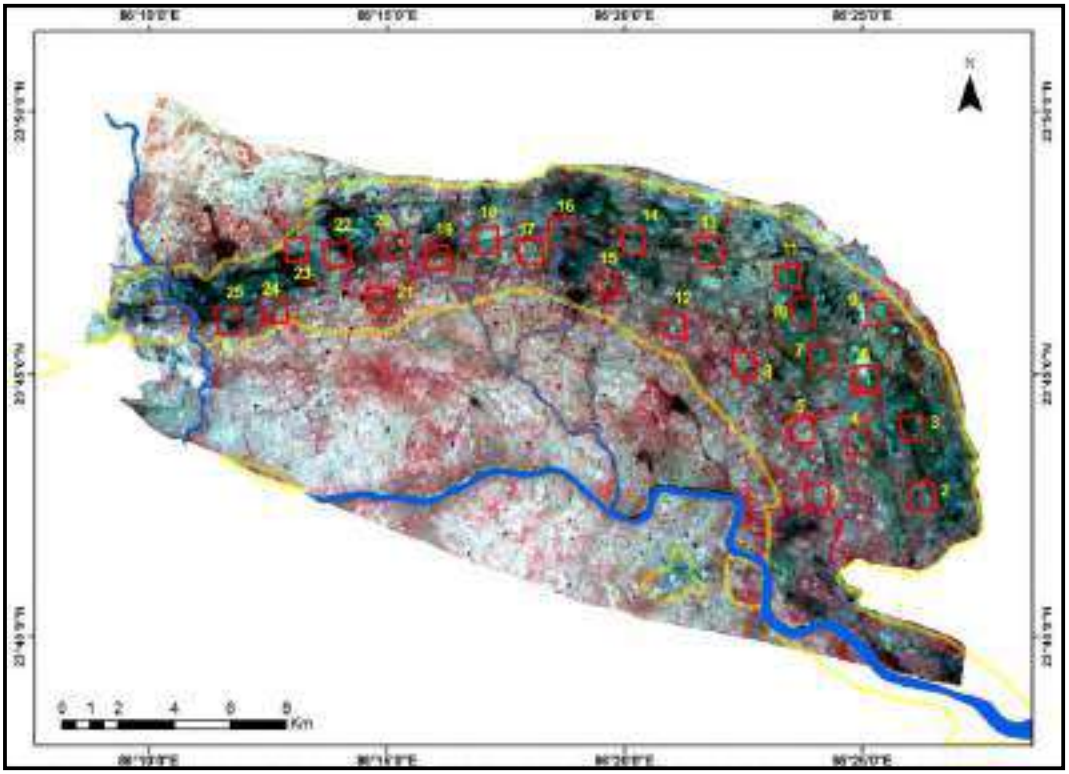

Figure 3. False colour composite image of Jharia Coalfield, with subset blocks (in red boxes) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.

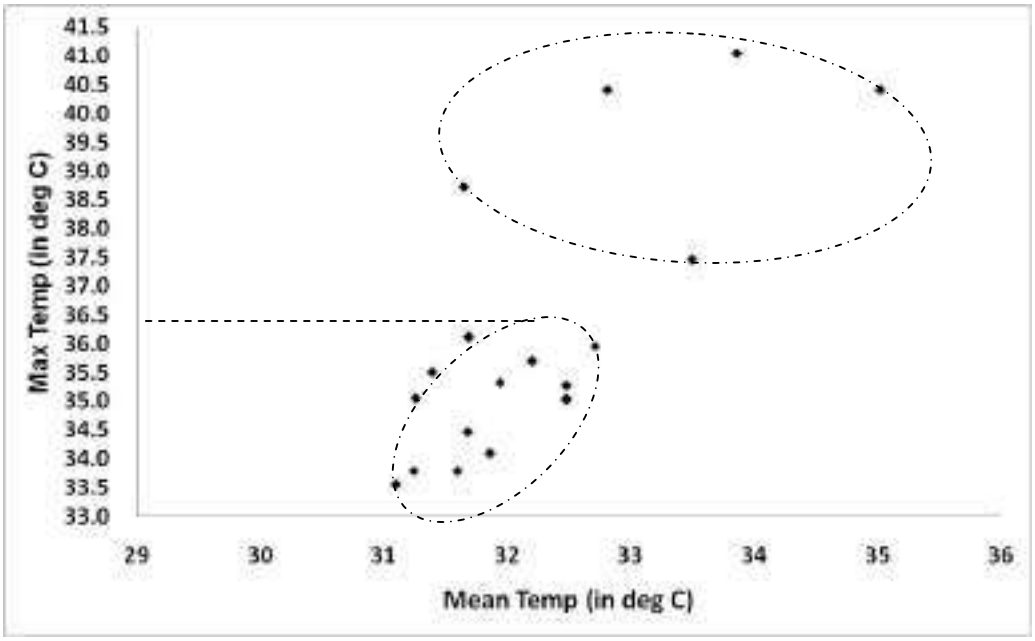

Figure 4. Maximum temperature plotted against mean temperature for various locations; cluster separation observed around 36.5 °C (marked with arrow)

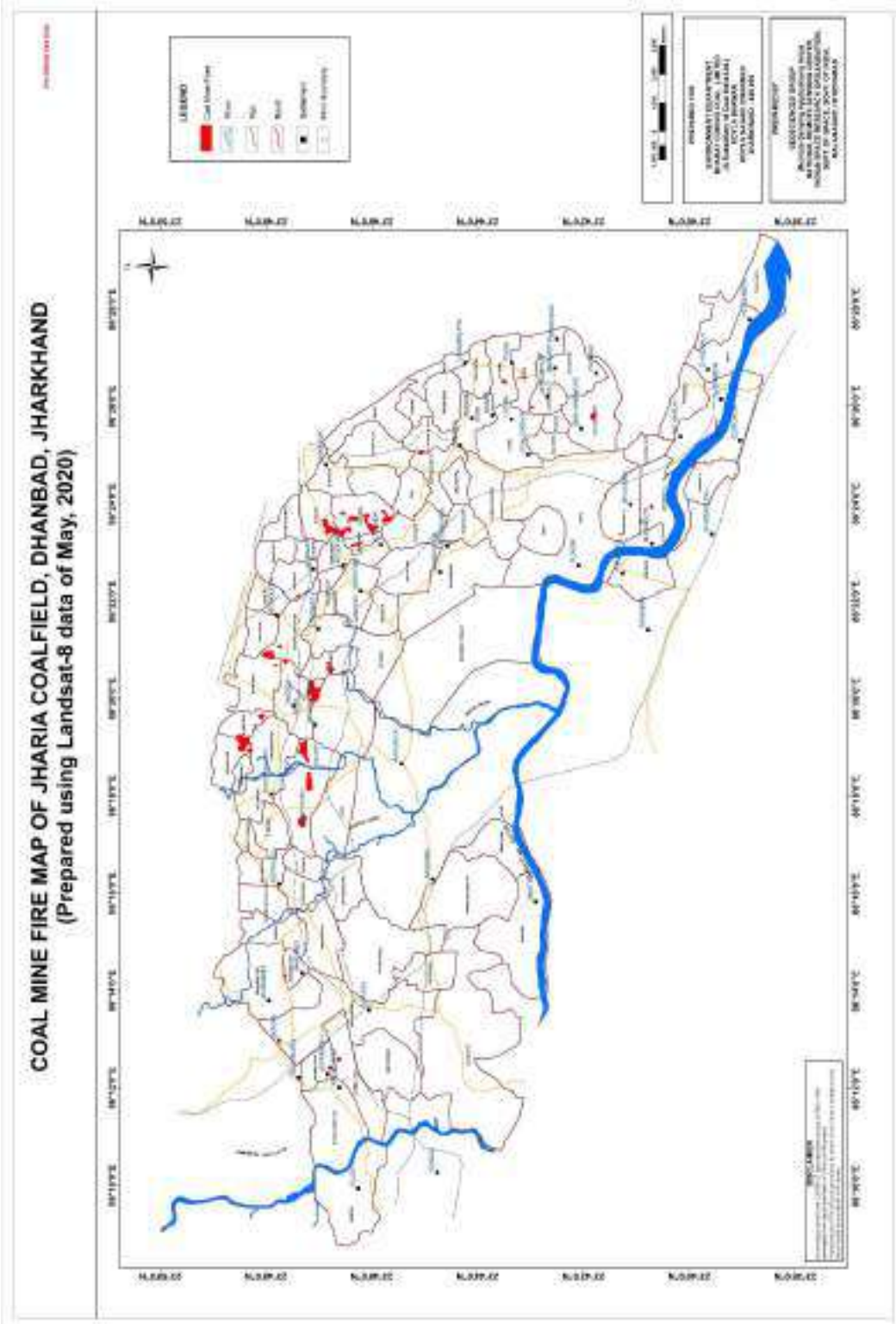

Figure 5: Coal mine fire map (May, 2020) of Jharia coal field, Dhanbad. The fire areas shown in this map have been verified in the field as per field points in figure 12.

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).

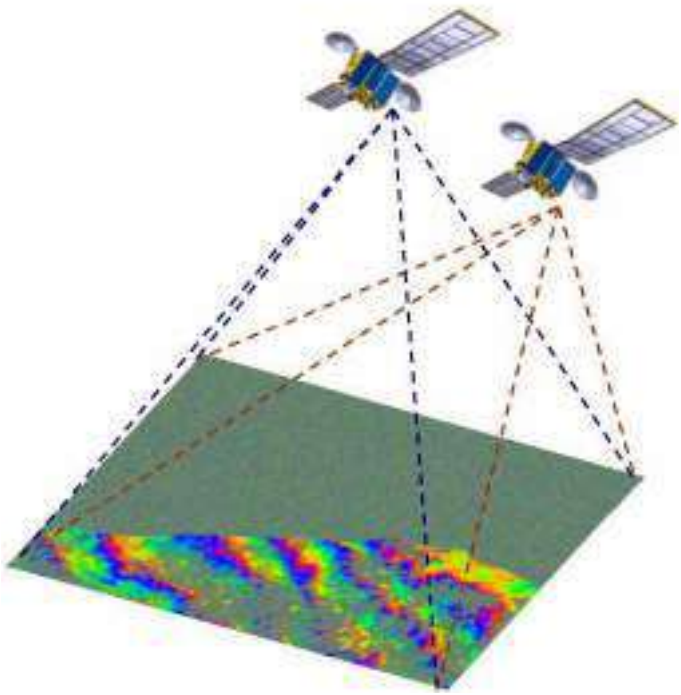

Figure 6. DInSAR acquisition scheme.

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.

$$\Delta\Phi dif = \Phi ErrorTopo + \Phi Mov + \Phi Atm + \Phi Noise \quad (4)$$

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 (Carnec et al., 1996; Bürgmann et al., 2000).

Broad work flow diagram for generating land subsidence map using satellite based DInSAR technique is shown in Figure 7.

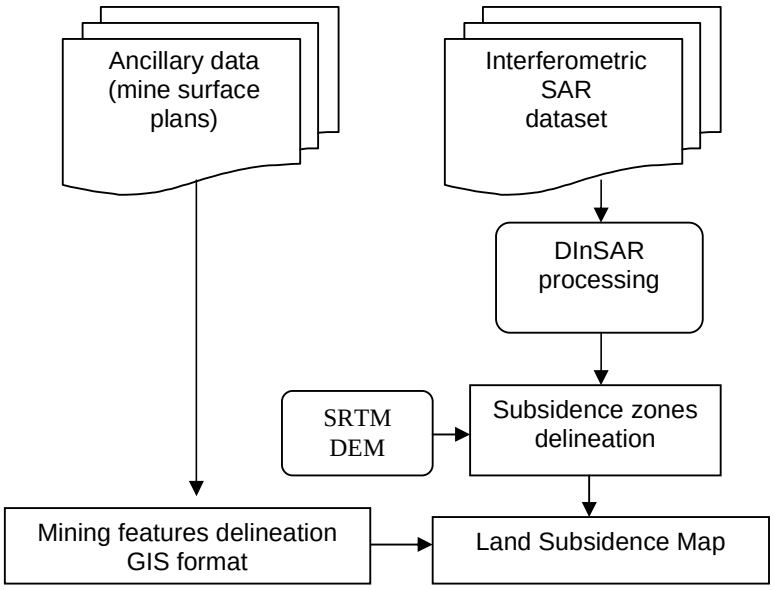

Figure 7. Work flow diagram for generating land subsidence map using DInSAR technique.

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 base lines include master slave pairs of time difference of six months to one year, whereas long temporal baselines include data pairs of time difference of ~ one year.

This has been illustrated in figure 8.

		SLAVE IMAGE				
		30 September 2017	03 March 2018	19 January 2019	02 March 2019	29 February 2020
MASTER IMAGE	30 September 2017					
	03 March 2018					
	19 January 2019					
	02 March 2019					
	29 February 2020					
		Short Temporal Baseline Pair (less than 1 year)				
		Long Temporal Baseline Pair (~ 1 year)				

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).

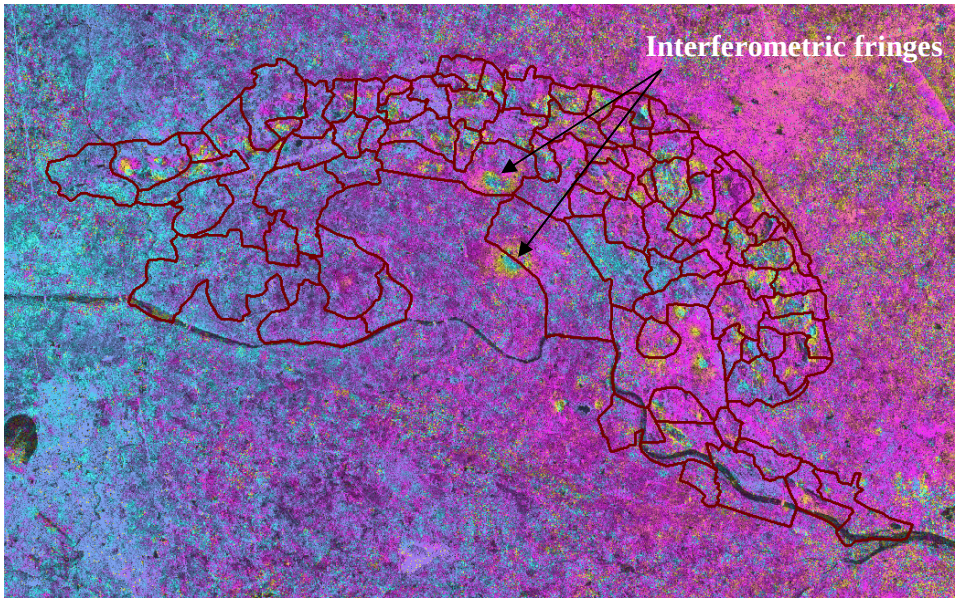

Figure 9. Fringe patterns generated from short baseline processing (e.g. Master: Oct, 19, Slave: Feb, 20).

On the other hand, master-slave pairs of long temporal baseline (approximately one year 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 (figure10)

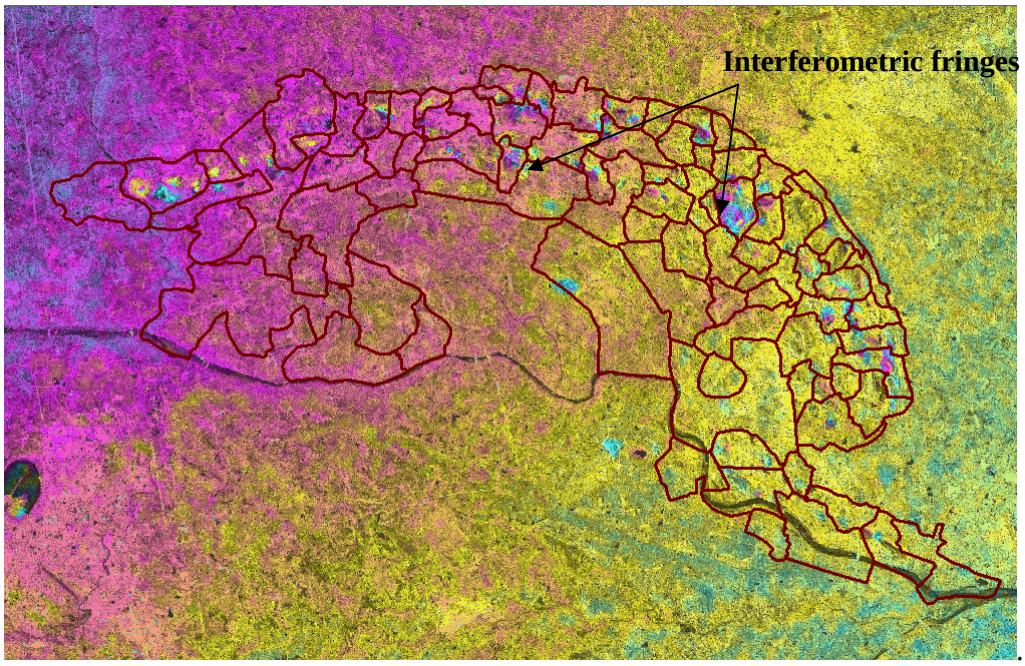

Figure 10. Fringe patterns generated from long baseline processing (e.g. Master: Sept, 17, Slave: Feb, 2020).

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 subsidence map of the Jharia Coalfield was generated due to mining activities and subsidence areas (Figure 11).

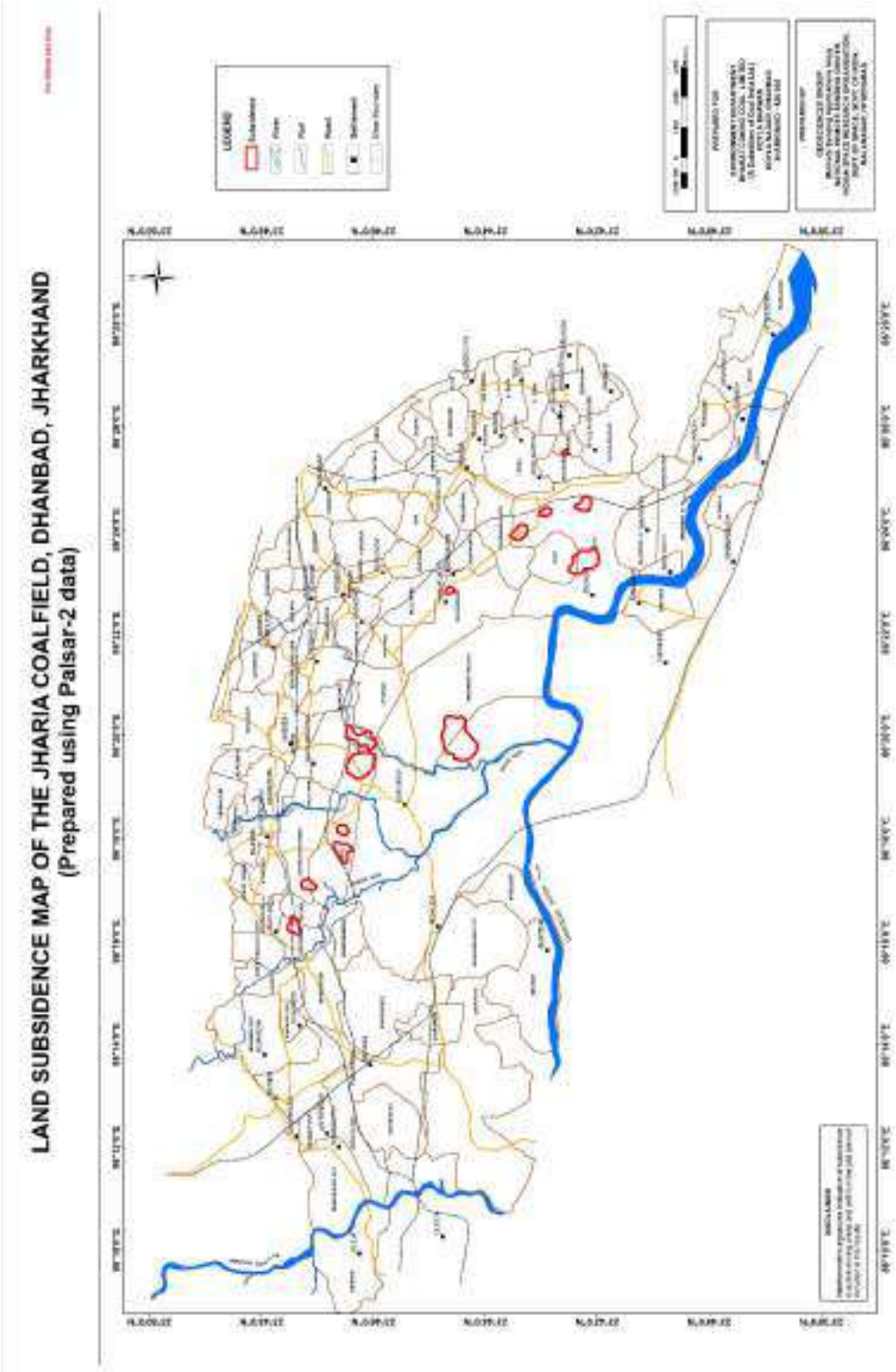

Figure 11: Subsidence map (2017-2020) of the Jharia coal field, Dhanbad.

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 during 2nd to 8th August, 2021. Both the coal fire and the subsidence locations were further independently verified by NRSC during the fieldwork. A total of 39 coal fire points and 13 land subsidence locations were identified from the satellite data analysis (figure 12). All 39 points were confirmed to be fire bearing as per the present status of fire in Jharia coalfield. The field observations of coal fire at each location are provided in table 3.

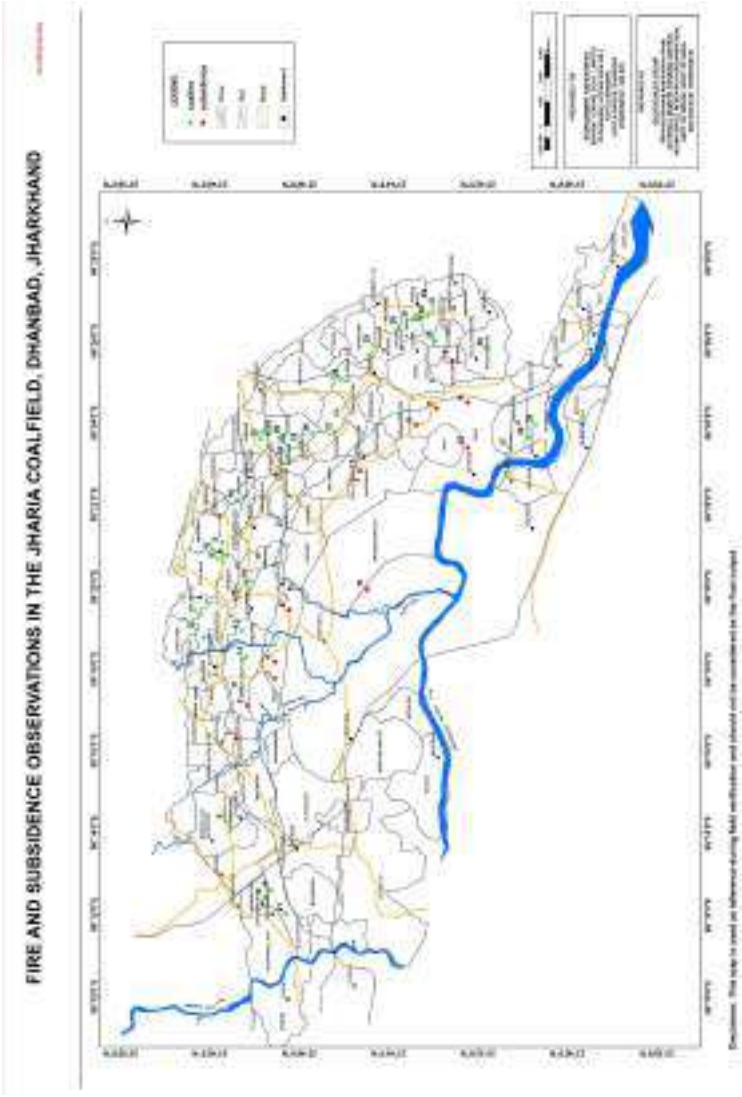

Figure 12. Field data points for coal fire and subsidence verification

Table 3: Summary of field observations (refer figure 12)

Field observation Point	Mine	Status of Fire (comments)*
1	Keshalpur	Active mine fire
2	Keshalpur	Active mine fire
3	W. Mudidih	Active mine fire
4	W. Mudidih	Active mine fire
5	Sendra Bansjora	Active mine fire
6	Tetulmari	Active mine fire
7	Sendra Bansjora	Active mine fire
8	Shatabdhi	Old Fire patch (minor fires)
9	Sendra Bansjora	Active mine fire
10	Sendra Bansjora	OB dump fire
11	Katras-Chotudih	Active mine fire (Confirmed by BCCL)
12	Gaslitand	Active mine fire
13	Katras-Chotudih	Active mine fire (Confirmed by BCCL)
14	Mudidih	Active mine fire
15	Godhar	Active mine fire
16	Benedih OCP	Active mine fire
17	Kankanee	Active mine fire
18	Block II OCP	Active mine fire
19	Kusunda	Active mine fire
20	Godhar	Active mine fire (High Risk)
21	Block II OCP	Active mine fire
22	Kusunda	Active mine fire
23	Kusunda	Active mine fire
24	Alkusha	Active mine fire
25	Kusunda	Active mine fire
26	Kusunda	Active mine fire
27	Ena	OB dump fire (small pockets of active mine fire)
28	R -OCP	Active mine fire
29	Goonhodih	Abandoned mine Fire(Fire cutting planned)
30	NT-ST	OB dump fire (small pockets)
31	NT-ST	Active mine fire (Ongoing mitigation measures)
32	NT-ST	Active mine fire (Ongoing mitigation measures)
33	NT-ST	Active mine fire (Ongoing mitigation measures)
34	NT-ST	Active mine fire (Ongoing mitigation measures)
35	Jayrampur	Abandoned mine Fire
36	Bhulanbarari	OB dump fire
37	Bhaura	OB dump fire (small pockets of active mine fire)
38	Bhaura	OB dump fire (small pockets of active mine fire)
39	Bhaura	OB dump fire (small pockets of active mine fire)

** Fire Temperature reading from hand held IR thermometer were seen to be inconsistent due to rains and wet ground condition and hence are not reported.*

Subsidence location observations:

1. Subsidence locations as identified by the data are 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 13 identified subsidence locations from the microwave data, 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 sagged ground are observed in the area.
3. Three other minor subsidence areas are identified within the South Govindpur, Bhagaband and Bagdigi mines, where old underground workings are present. However, there was no clear evidence of subsidence from the field based observations.
4. The 9 other locations where subsidence is seen from microwave data, falls within the mining lease of TISCO and IISCO, hence are not under the purview of BCCL mining authorities.

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 2020. Landsat-8 data of 22 May, 2020 was used to prepare the coal mine fire map (Figure 5) for the year 2020. 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 2020 when compared to map of 2017 (NRSC, 2017) 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 2020 (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 Tisra (North and South) and Bhaura, Bhulanbarari and R-OCP are affected by multiple small fire pockets. In Bhaura, the fire is seen mostly in OB dumps with minor presence of active mine fires. Similarly in Bhulanbarari, fire is seen in the OB dump only. The North and South Tisra mines have visible presence of fire, mostly manifested by high temperature fume cracks. Active fires are also seen in the R-OCP. Further, towards the north east, in Ena, Alkusha 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 the related to the mining areas of Katras, Gaslitand, Mudidih and Sendra Bansjora. 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. An older fire patch is also seen in the Shatabdi mine.

Comparison of the 2020 coal fire map with that of 2017 (NRSC, 2017) 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 2017, the 2020 map shows that the significant decrease of fires in the eastern flank, namely Bhaura, Tisra (North and Soth), Lodna and R-OCP etc. Similar decrease is also observed in Bastacolla and Bhulanbarari.
ii. The areal extent of major fire zone around Kusunda and Ena also appears to have decreased with change in the spatial location of the anomalies. This is probably due to the mitigation and active fire 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.
iv. The spatial disposition of fire areas around Katras, Keshalpur, Gaslitand and Mudidih show minor increase. The fire pockets observed in 2017, have given away to a few fire zones of moderate disposition.

In summary, there is a change in the areal disposition of the fires from 2017 to 2020. Satellite and field observations both suggest that there has been an overall decrease in the extent of fire in the JCF. A quantitative comparison of the 2017 and 2020 data was carried out. As compared 2017, when the total fire affected extent of the JCF was about 3.28 km^2; in 2020 total fire affected extent is about 1.89 km^2 (including TISCO mines).Within the mining lease of BCCL (excluding TISCO) in comparison 2017, when the total fire affected extent of the JCF was about 3.27 km^2; in 2020 total fire affected extent is about 1.86 km^2. The colliery wise break-up of change in fire area from 2017 to 2020 is given in Annexure-I. Herein, it should be noted that the minimum mapable unit from satellite image it 30m by 30m or 0.0009 km^2.

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 2017 to 2020 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 4 subsidence areas, within the BCCL mine boundary. 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 three areas are south of South Govindpur, Bagdigi and Bhagaband mines, however, the field evidences of the same are not conclusive. No quantitative estimates of the subsidence have 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 2020 and in comparison with the previous study done in 2017, there has been a change in areal extent and disposition of the fire affected areas. On the other hand, persistent subsidence is seen in the Moonidih area due to underground mining activities.
2. Compared to 2012, the eastern flanks (Lodna, Tisra, Bhulanbarai areas) show considerable decrease in fire disposition and the western flank (Shatabdi and Block II area) show diminished fire presence.
3. The fires are continuation of existing fire affected areas as seen in the 2017 study.
4. The mines in Kusunda remain to be the worst affected with maximum presence of active fires.
5. There is a decrease in areal extent of the fire from 2017 to 2020. As compared 2017, when the total fire affected extent of the JCF was about 3.28 km^2; in 2020 total fire affected extent is about 1.89 km^2 (including TISCO mines). Within the mining lease of BCCL (excluding TISCO) in comparison 2017, when the total fire affected extent of the JCF was about 3.27 km^2; in 2020 total fire affected extent is about 1.86 km^2.

Note: *The minimum mapable unit from satellite image it 30m by 30m or 0.0009 km^2.* ***.*** *Estimations of fire extent (in terms of sq.km.) both in 2017 and in the present 2020 study are pixel based. They may differ from 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.*

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 4.1.2, 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 are 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.

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) Considering the precision of DInSAR data for different wavelengths, topographic and atmospheric errors, slow subsidence rates may not be detected. Further, the displacement measured is along the line of sight of the sensor and not vertical displacement.

8) Temporal decorrelation and noise due to adverse land use and land cover may affect DInSAR based detection and monitoring of land subsidence. Changes vegetation pattern over time can cause significant decorrelation between the master and slave image, thus producing a very low coherent output. Under such conditions, subsidence information may not be retrieved

9) 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

Colliery wise break-up of change in fire area from 2017 to 2020

COLLIERY AREA NAME	FIRE AREA 2017 (SQ. KM.)	FIRE AREA 2020 (SQ. KM.)	AREA CHANGE (SQ. KM.)	Increase/Decrease
BENEDIH OCP	0.045	0.020	-0.026	DECREASE
BLOCK-II OCP	0.135	0.034	-0.101	DECREASE
MURAIDIH OCP	0.002	0.006	0.004	INCREASE
SHATABDI OCP	0.036	0.005	-0.031	DECREASE
PHULARITAND	0.021	0.000	-0.021	DECREASE
KATRAS-CHOITUDIH	0.137	0.214	0.077	INCREASE
KESHALPUR	0.001	0.134	0.132	INCREASE
BASURIA	0.000	0.012	0.012	INCREASE
TETULMARI	0.022	0.011	-0.011	DECREASE
GODHAR	0.000	0.132	0.132	INCREASE
INDUSTRY	0.051	0.000	-0.051	DECREASE
KUSUNDA	0.740	0.399	-0.340	DECREASE
SENDRA-BANSJORA	0.027	0.110	0.083	INCREASE
BASTACOLLA	0.081	0.000	-0.081	DECREASE
GOLUCKDIH	0.112	0.000	-0.112	DECREASE
KUJAMA	0.240	0.000	-0.240	DECREASE
S. JHARIA-R. OCP	0.112	0.010	-0.102	DECREASE
GONHOODIH	0.032	0.001	-0.031	DECREASE
ENA	0.043	0.004	-0.040	DECREASE
N. TISRA	0.180	0.031	-0.149	DECREASE
LODNA	0.353	0.000	-0.353	DECREASE
S. TISRA	0.102	0.021	-0.081	DECREASE
BARAREE	0.107	0.040	-0.068	DECREASE
KENDUADIH	0.000	0.001	0.001	INCREASE
GASLITAND	0.122	0.156	0.034	INCREASE
KANKANEE	0.052	0.057	0.004	INCREASE
MUDIDIH	0.110	0.220	0.110	INCREASE
LOYABAD	0.006	0.000	0.079	DECREASE
E.BHUGGATDIH	0.021	0.020	-0.001	DECREASE
ALKUSHA	0.029	0.046	0.016	INCREASE
KUSTORE	0.046	0.014	-0.032	DECREASE
ANGARAPATRA	0.015	0.036	0.021	INCREASE
BHOWRAH. N	0.098	0.006	-0.092	DECREASE
BAGDIGI	0.021	0.000	-0.021	DECREASE
JEALGORA	0.007	0.000	-0.007	DECREASE
JEENAGORA	0.047	0.000	-0.047	DECREASE
JOYRAMPUR	0.104	0.011	-0.093	DECREASE

TOTAL AREA	**3.3**	**1.8**	**1.5**	**DECREASE**

Note:

1) The minimum mapable unit from satellite image it 30m by 30m or 0.0009 km^2

2) "INCREASE" implies, increase in fire area OR emergence of fire areas not identified in 2017 study

3) "DECREASE" implies, decrease in fire area OR fire areas in 2017 not identified in present study *(either absent or below sensor resolution)*

4) Values marked in "blue" are collieries where fire has was reported in 2017 study but presently shows no such signatures.

Annexure –II

Figure 13: Active fires in Keshalpur-West Mudidih. (Points 1, 2, 3 & 4 in figure 12)

Figure 14: Active fires in Sendra-Bansjora Mines (Points 5, 6, 7 & 9 in figure 12)

Figure 15: OB dump fires in Sendra Bansjora (Points 10 in figure 12)

Figure 16: Active fires in Godhar-Kusunda Mines (Points 20 to 24 in figure 12)

Figure 17: Fire in R-OCP. (Point 28 in figure 12)

Figure 18: Active fires in N-S Tisra mines (Points 31-33 in figure 12).

Figure 19: Subsidence area in Bagdigi Mines

Figure 20: Subsidence (sag ponds) around Moonidih mine area

Annexure –III

Coordinates of Fire locations.

Mine	UTM_X	UTM_Y	Longitude	Latitude
Keshalpur	430560.28	2633068.44	86.3183	23.8074
Keshalpur	430287.86	2632817.14	86.3156	23.8051
W. Mudidih	430935.00	2632710.00	86.3220	23.8042
W. Mudidih	431468.57	2632417.14	86.3273	23.8015
Kendra Bansjora	433626.56	2632140.94	86.3484	23.7991
Tetulmari	433245.00	2631915.00	86.3447	23.7971
Kendra Bansjora	433899.00	2631765.00	86.3511	23.7958
Shatabdhi	422415.00	2631645.00	86.2384	23.7942
Kendra Bansjora	433383.75	2631563.75	86.3461	23.7939
Kendra Bansjora	435666.92	2631113.08	86.3685	23.7899
Katras-Chotudih	427797.06	2630997.35	86.2913	23.7886
Gaslitand	430270.06	2630936.18	86.3156	23.7881
Katras-Chotudih	429170.29	2630763.09	86.3048	23.7865
Mudidih	432313.36	2630596.98	86.3356	23.7851
Godhar	438450.00	2630085.00	86.3959	23.7808
Benedih OCP	419198.18	2630070.00	86.2069	23.7798
Kankanee	433072.50	2629995.00	86.3431	23.7797
Block II OCP	419491.36	2629772.73	86.2098	23.7771
Kusunda	438532.86	2629547.14	86.3967	23.7759
Godhar	438187.50	2630145.00	86.3933	23.7813
Block II OCP	418545.00	2629200.00	86.2006	23.7719
Kusunda	437910.00	2629005.00	86.3906	23.7710
Kusunda	438335.37	2629195.97	86.3948	23.7727
Alkusha	437452.80	2629068.00	86.3861	23.7715
Kusunda	438007.50	2628495.00	86.3916	23.7664
Kusunda	438392.33	2628011.36	86.3954	23.7620
Ena	438465.00	2627070.00	86.3962	23.7535
R -OCP	440644.55	2626785.45	86.4176	23.7510
Goonhodih	442050.00	2625480.00	86.4314	23.7393
NT-ST	442815.00	2624385.00	86.4389	23.7294
NT-ST	443100.00	2623890.00	86.4418	23.7250
NT-ST	443205.00	2623410.00	86.4428	23.7206
NT-ST	443253.33	2623211.67	86.4433	23.7189
NT-ST	443910.00	2623110.00	86.4497	23.7180
Jayrampur	442200.00	2622915.00	86.4330	23.7161
Bhulanbarari	441898.64	2620804.77	86.4301	23.6971
Bhaura	437768.57	2619865.71	86.3896	23.6884
Bhaura	438202.50	2619131.25	86.3939	23.6818
Bhaura	438720.00	2618775.00	86.3990	23.6786

Annexure XIV

BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Limited)
Office of the Project Officer
Amalgamated Joyrampur Colliery
Lodna Area- X

Ref.No. BAR/AJC/SO/2021/ 419

Date:- 21/12/21

सेवा मे,
सहायक समादेष्टा,
सी .आई.एस .एफ,
जियलगोरा कैम्प

विषय :-अवैध खनन की भराई में सहयोग करने हेतु सूचना

महाशय;

दिनांक 22.12.2021 दिन बुधवार को सुबह 10 बजे बरारी कोलियरी में X सीम लक्ष्मी इंकलाइन के पास प्रबंधन द्वारा अवैध खनन की भराई कराई जाएगी। अवैध खनन की भराई शांतिपूर्ण तरीके से हो इसके लिए हमें आपके सहयोग की आवश्यकता है।

अत: आपसे अनुरोध है की तथा कथित स्थान पर अपनी मौजूदगी सुनिश्चित करके भराई का कार्य को शांतिपूर्ण ढंग से करने में सहयोग प्रदान करे।

भवदीय
परियोजना पदाधिकारी
एकीकृत जयरामपुर कोलियरी

प्रतिलिपि:-
१ क्षेत्रीय प्रबंधक (सुरक्षा), लोदना क्षेत्र
२ सुरक्षा पदाधिकारी, अमल॰ जयरामपुर कोलयरी
३ प्रबन्धक, अमल॰ जयरामपुर कोलयरी
४ कार्यालय प्रति

Received 21/12/21 AMO Amal/Kaya 03.5F

Lodna, Near Raksha Kali Mandir

Joyrampur Near Bagdigi Bridge

Gokul Park and on its Slope

Water Pool Created on Gokul Park

Annexure XV

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.

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2021-22)

[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 – 2022

Job no - 200421008

GROUNDWATER LEVEL & QUALITY REPORT

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KOYLA BHAWAN (DHANBAD)

Prepared by

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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 CGWA)

(Accredited as a GWCO by QCI-NABET)

(Accredited by NABL, CMPDI, RI-II, Lab)

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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 (IMD-report)	Jharkhand State: 1264.10 mm Rainfall data given in **Annexure-IV**.
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 (Aquifer Pump Test)	Unconfined Aquifer (Damoda BJ Section & Block-II): 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 – 0.62 to 11.26 m (Avg. 5.23 m bgl) in '2021-22 Post-monsoon – 0.05 to 7.62 m (Avg. 2.28 m bgl) in '2021-22 RCF area (part): Pre-monsoon – 2.0 to 6.20 m (Avg. 3.34 m bgl) in '2021-22 Post-monsoon – 1.10 to 5.25 m (Avg. 2.44 m bgl) in '2021-22
10	Groundwater Quality	Potable as per GEC-2015 Norms (**Annexure- VIII**)
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 Fluoride.
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-I***). 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).

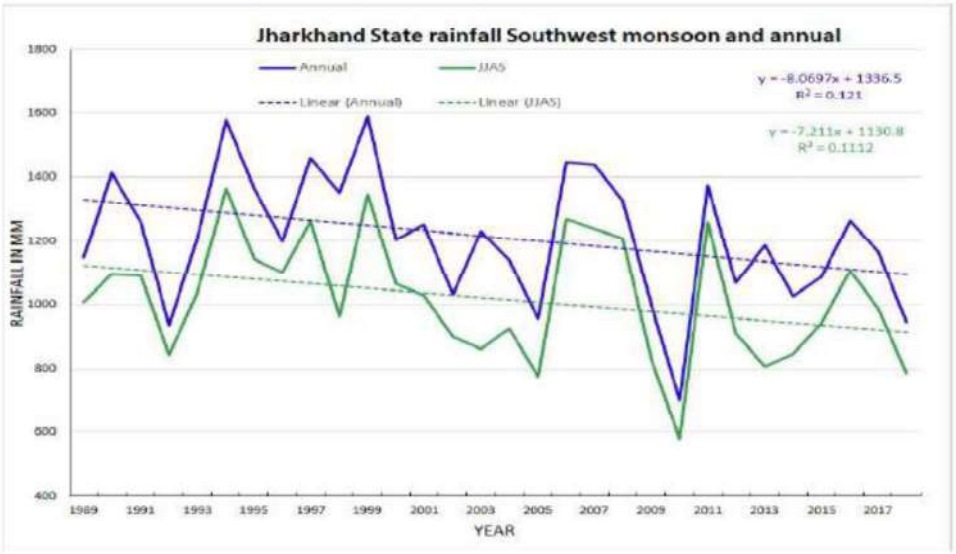


Fig-1.

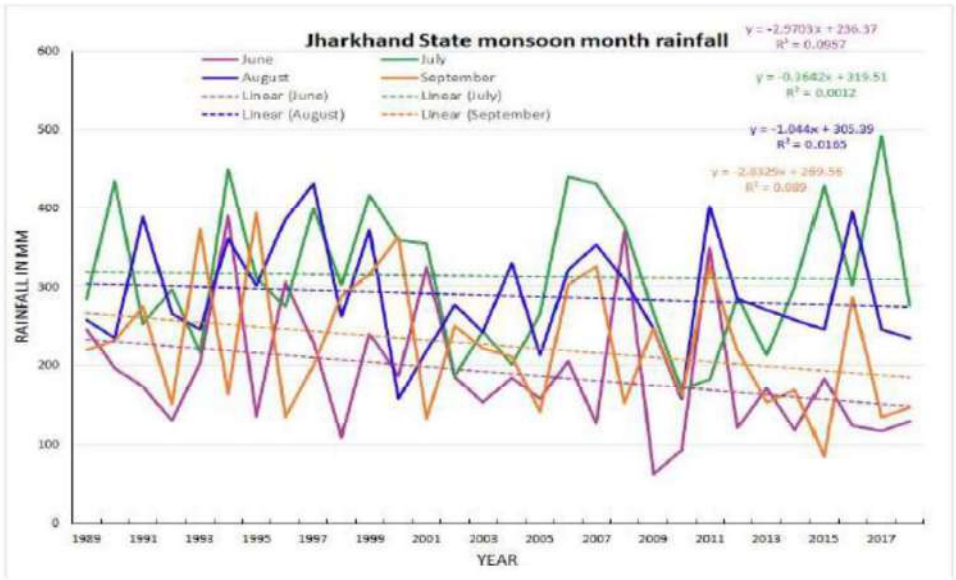


Fig-2.

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 2 km)	Buffer zone (within 10 km)
1.	Unconfined	0 – 50 (Avg. 25)	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-I**. 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'21, Aug'21, Nov'21 and Jan'22) 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 2021 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
	2021	0.62	11.26	5.23	0.05	7.62	2.28	0.15	9.03	2.94
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
	2021	2.00	6.20	3.34	1.10	5.25	2.44	0.80	0.95	0.90

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-2021-22]*		*Average GWL (m)*	
			Pre-monsoon (Apr/May)	*Post-monsoon (Nov/Dec)*	*Pre-monsoon*	*Post-monsoon*
Sedimentary (Gondwana)	Non-mining		1.45-8.20	0.35-3.70	5.10	2.00
	Mining	OC	1.40-10.35	0.84-5.65	4.66	2.15
		UG	1.09-10.13	0.55-7.62	5.75	2.80
Metamorphics (Hard rock)	Peripheral part of the Coalfield		0.62-11.75	0.50-7.45	6.80	3.60

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 3.25×10^{-3}
		Mining	OC	1.0×10^{-2} to 4.0×10^{-3}
			UG	1.0×10^{-2} to 3.0×10^{-3}
2	Metamorphics (Hard rock)	Peripheral part of the Coalfield		1.0×10^{-3} to 3.5×10^{-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.

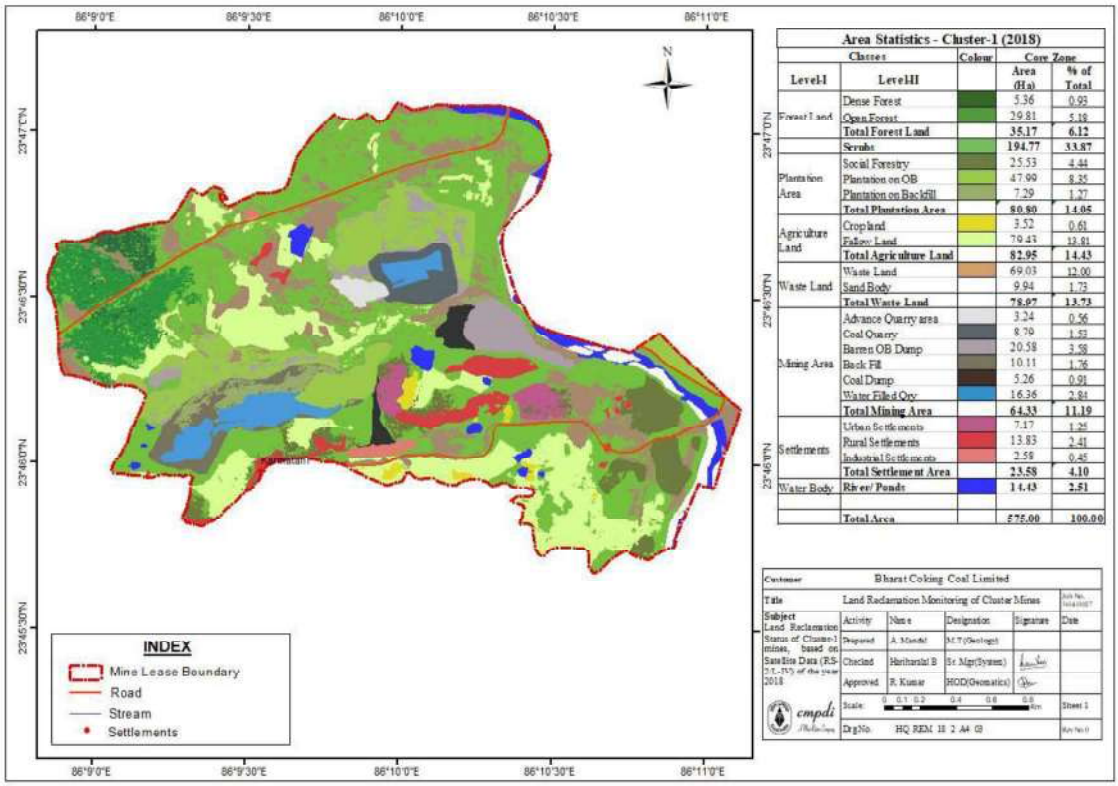
Monitoring stations (**B-15, B-21A, B51 and B-53**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	B-15	Bera Basti	1.46	0.25	0.35	1.01	3.70	0.15	1.47	1.70	1.90	0.45	1.65	2.65
2	B21A	Dugdha	8.38	2.5			10.00	4.15	5.80	6.70	9.45	1.90	-	-
3	B-51	Taranga	5.70	0.90	1.00	4.88	5.00	0.88	2.10	3.00	5.10	1.10	2.70	2.90
4	B-53	Karmatanr	4.85	1.52	1.87	2.87	3.12	1.07	1.40	1.92	3.22	0.97	1.42	2.12
Average WL (bgl)			5.10	1.29	1.07	2.92	3.70	0.15	1.47	1.70	4.92	1.11	1.92	2.56

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.46 m Max – 10.00 m
Post-monsoon GW Level (m): Min – 0.35 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	0.0	393.69 x 10^4
2	Open Land	204.89 x 10^4	0.0	204.89 x 10^4
3	Road/ Paved Area	09.0 x 10^4	0.0	09.0 x 10^4
4	Rooftop area of building/ sheds	14.58 x 10^4	0.0	14.58 x 10^4
5	Total	575.00 x 10^4	0.0	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.

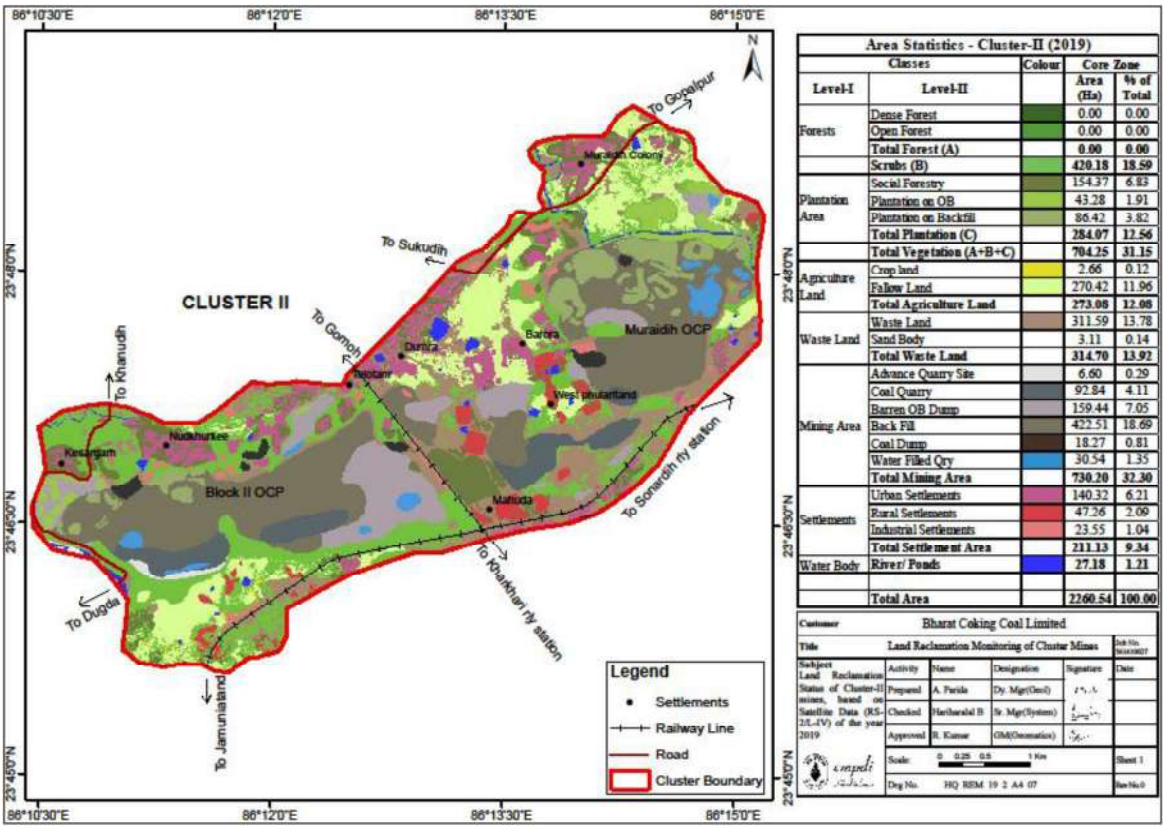
Monitoring stations (**B-1, B-59, B-60, B-61A and B-62A**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	B-1	Muraidih	2.58	0.58	1.91	2.03	3.28	0.73	1.63	1.73	3.18	1.33	1.73	1.98
2	B-59	Khodovaly	5.49	0.30	0.90	0.95	5.25	0.67	1.40	2.10	6.20	0.80	0.90	1.20
3	B-60	Bahiyardih	11.26	1.33	2.23	6.53	10.33	0.91	3.21	6.13	8.13	1.23	3.23	4.93
4	B61A	Kesargora	4.42	0.47	0.97	0.97	3.32	0.85	1.60	2.07	3.32	1.39	0.52	1.12
5	B62A	Sadiyardih	6.87	1.35	4.50	4.60	6.95	2.77	3.00	4.95	7.55	2.80	3.25	4.95
Average WL (bgl)			6.12	0.81	2.10	3.02	5.83	1.19	2.17	3.40	5.68	1.51	1.93	2.84

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.57 m Max – 11.26 m
Post-monsoon GW Level (m): Min – 0.52 m Max – 4.50 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	2.00
	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. 50430807
Subject	Activity	Name	Designation	Signature	Date
Land Reclamation Status of Cluster-II mines, based on Satellite Data (IRS-2/L-IV) of the year 2019	Prepared	A. Parida	Dy. Mgr(Geol)		
	Checked	Harbansilal 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 x 10^4	0.0	977.33 x 10^4
2	Open Land	1072.08 x 10^4	0.0	1072.08 x 10^4
3	Road/ Paved Area	140.32 x 10^4	0.0	140.32 x 10^4
4	Rooftop area of building/ sheds	70.81 x 10^4	0.0	70.81 x 10^4
5	Total	2260.54 x 10^4	0.0	2260.54 x 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.

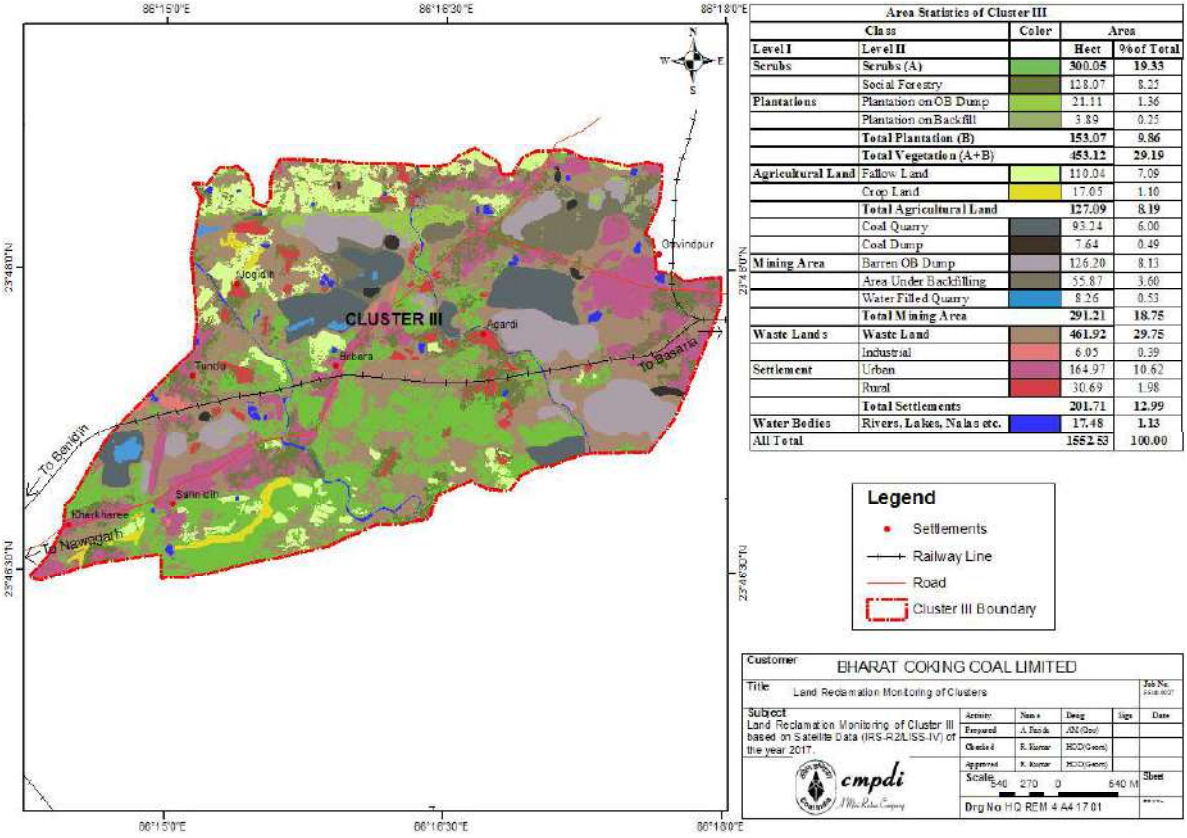
Monitoring stations (**A-12, A-25, A-29, B-14 and B-60**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A12	Jamua	1.92	0.50	1.10	1.72	2.60	0.32	0.50	1.20	2.10	0.29	0.45	0.75
2	A25	Sinidih	5.78	1.73	2.43	2.53	2.98	1.30	1.83	2.53	6.08	1.43	1.93	2.48
3	A29	Dharmaband	6.49	2.90	5.90	6.65	6.20	1.21	3.20	3.25	4.85	1.20	3.40	3.65
4	B14	Mathadih	2.84	0.24	2.04	2.10	2.44	0.32	1.04	1.69	2.24	0.54	0.94	2.04
5	B60	Sonardih	11.26	1.33	2.23	6.53	10.33	0.91	3.21	6.13	8.13	1.23	3.23	4.93
Average WL (bgl)			5.66	1.34	2.74	3.91	4.91	0.81	1.96	2.96	4.68	0.94	1.99	2.77

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.92 m Max – 11.26 m
Post-monsoon GW Level (m): Min – 0.45 m Max – 5.90 m

LAND USE / LAND COVER MAP OF THE CLUSTER-III MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	580.21 x 10^4	0.0	580.21 x 10^4
2	Open Land	770.61 x 10^4	0.0	770.61 x 10^4
3	Road/ Paved Area	164.97 x 10^4	0.0	164.97 x 10^4
4	Rooftop area of building/ sheds	36.74 x 10^4	0.0	36.74 x 10^4
5	Total	1552.53 x 10^4	0.0	1552.53 x 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-west 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.

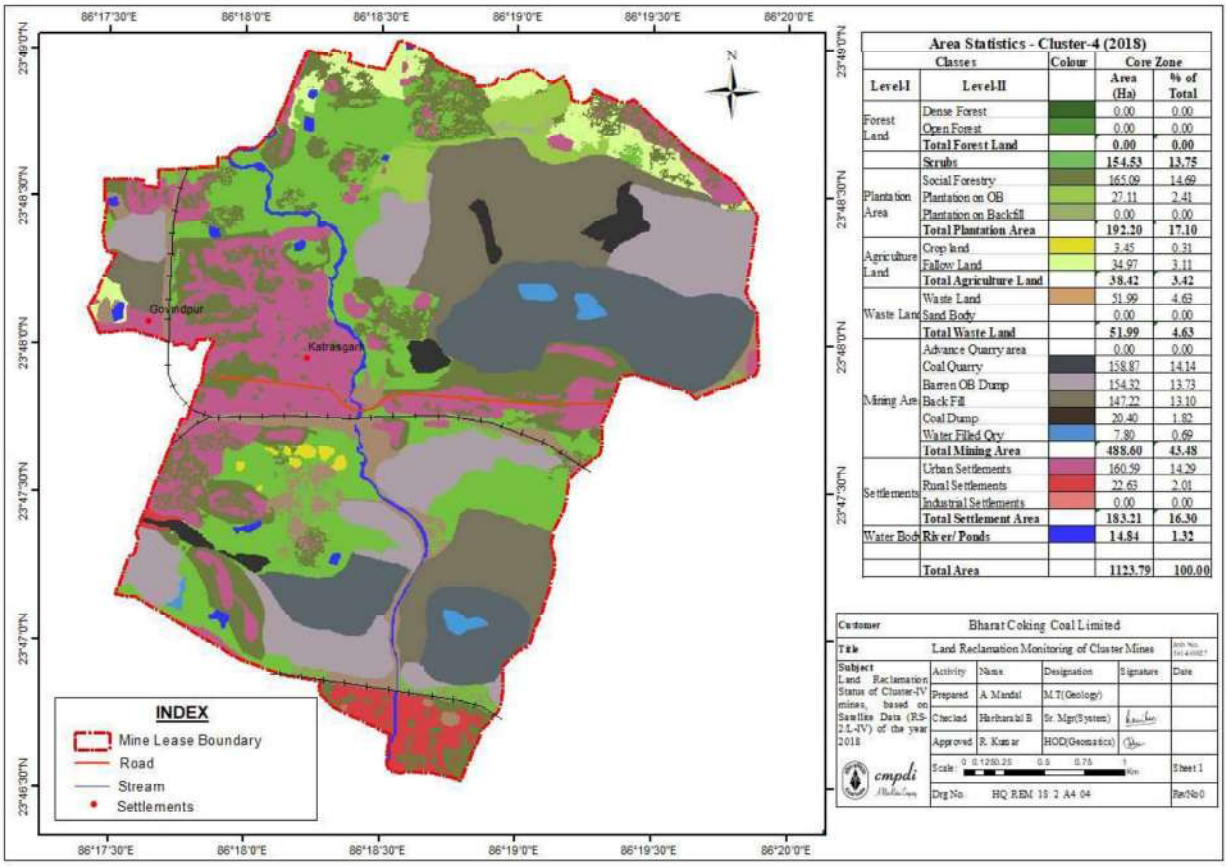
Monitoring stations (**A-26, A28A, B-64 and B-65A**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A-26	Malkhera	6.70	2.10	2.73	3.63	6.98	2.69	3.18	4.78	6.58	2.23	3.33	3.83
2	A28A	Lakarka	6.23	0.53	3.75	4.47	4.00	1.33	3.03	3.35	2.45	1.25	3.15	3.60
3	B-64	Keshalpur	2.35	0.30	0.95	1.00	1.85	0.93	0.50	1.37	0.95	0.30	0.45	1.20
4	B65A	Jhinjipahari	9.03	0.45	1.42	2.80	9.25	0.03	2.30	4.10	11.05	1.85	0.95	2.95
Average WL (bgl)			6.08	0.85	2.21	2.98	5.52	1.25	2.25	3.40	5.26	1.41	1.97	2.90

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 – 3.75 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 x 10^4	0.0	385.15 x 10^4
2	Open Land	555.43 x 10^4	0.0	555.43 x 10^4
3	Road/ Paved Area	160.59 x 10^4	0.0	160.59 x 10^4
4	Rooftop area of building/ sheds	22.63 x 10^4	0.0	22.63 x 10^4
5	Total	1123.79 x 10^4	0.0	1123.79 x 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-west 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.

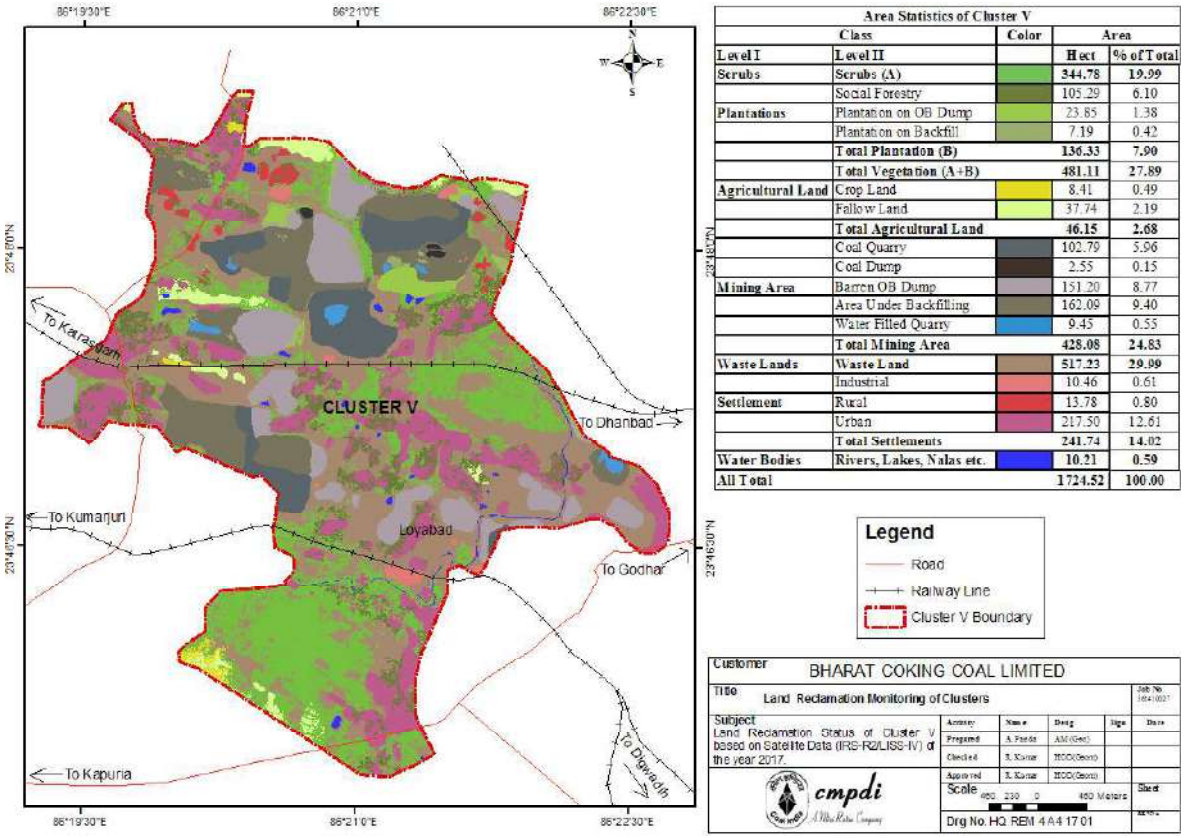
Monitoring stations (**A-3, A-16, A-27 and D-23**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A-3	Sijua	0.62	0.07	0.05	0.07	1.57	0.02	0.47	0.77	3.47	0.32	0.47	0.62
2	A-16	Ekra	3.45	1.90	2.00	3.00	7.15	1.34	1.75	3.20	5.45	1.65	1.95	4.55
3	A-27	Tetulmari	1.67	0.80	0.90	1.13	2.40	0.03	1.10	1.90	2.40	0.15	0.92	1.30
4	D-23	Jogta	5.43	1.87	1.60	1.65	5.60	1.69	3.35	3.70	4.70	1.65	1.40	1.50
Average WL (bgl)			2.79	1.16	1.14	1.46	4.18	0.77	1.67	2.39	4.01	0.94	1.19	1.99

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 0.62 m Max – 5.60 m
Post-monsoon GW Level (m): Min – 0.05 m Max – 3.35 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	0.0	527.26×10^4
2	Open Land	973.52×10^4	0.0	973.52×10^4
3	Road/ Paved Area	217.50×10^4	0.0	217.50×10^4
4	Rooftop area of building/ sheds	24.24×10^4	0.0	24.24×10^4
5	Total	1724.52×10^4	0.0	1724.52×10^4

F. GROUND WATER LEVEL OF CLUSTER-VI

Cluster–VI consists of four coalmines; 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.

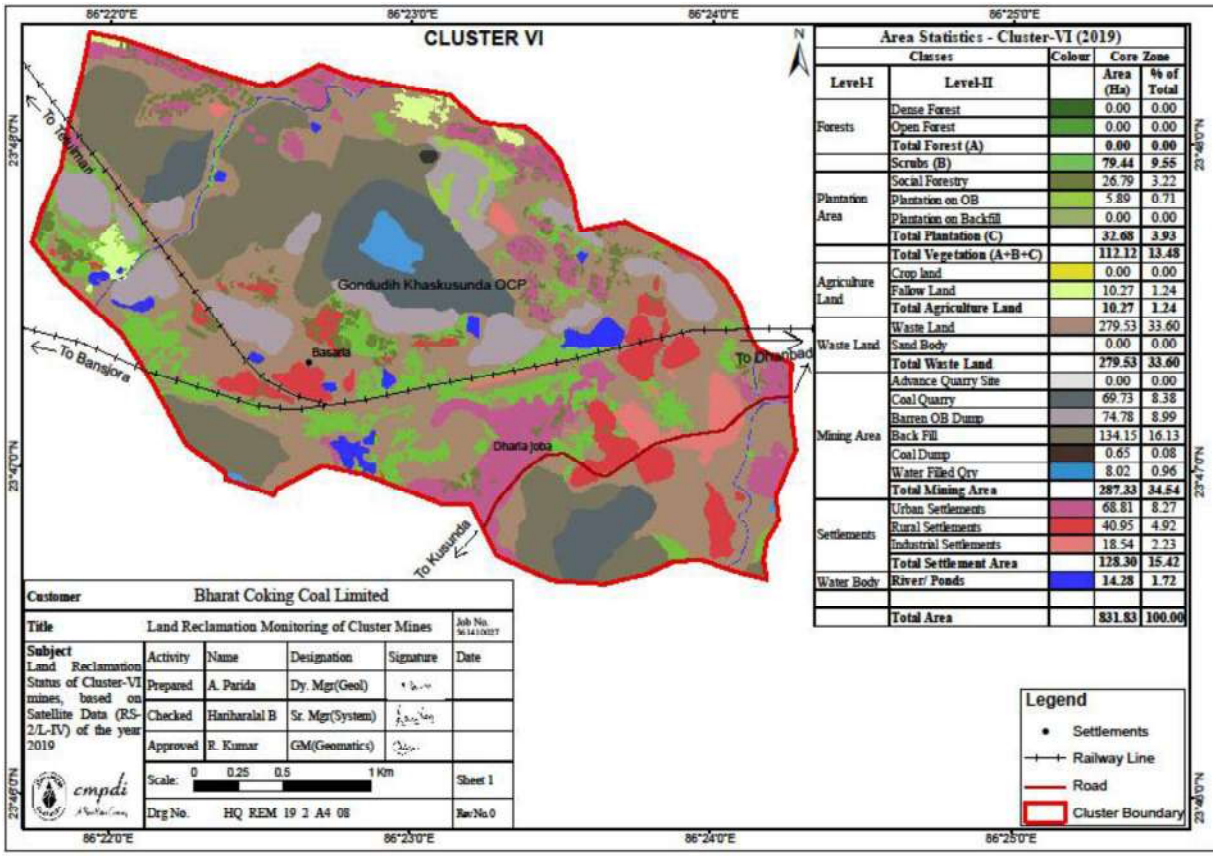
Monitoring stations (**D-25 and D-30**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	D25	Godhur	10.50	2.90	3.80	4.40	10.50	2.28	5.62	6.40	9.90	4.35	5.38	5.50
2	D30	Borkiboa	4.23	0.60	0.84	1.80	4.50	1.65	1.35	2.40	4.60	0.38	0.75	1.95
Average WL (bgl)			7.37	1.75	2.32	3.10	7.50	1.97	3.49	4.40	**7.25**	**2.37**	**3.07**	**3.73**

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 4.23 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	0.0	122.39 X 10^4
2	Open Land	581.14 X 10^4	0.0	581.14 X 10^4
3	Road/ Paved Area	68.81 X 10^4	0.0	68.81 X 10^4
4	Rooftop area of building/ sheds	59.49 X 10^4	0.0	59.49 X 10^4
5	Total	831.83 X 10^4	0.0	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.

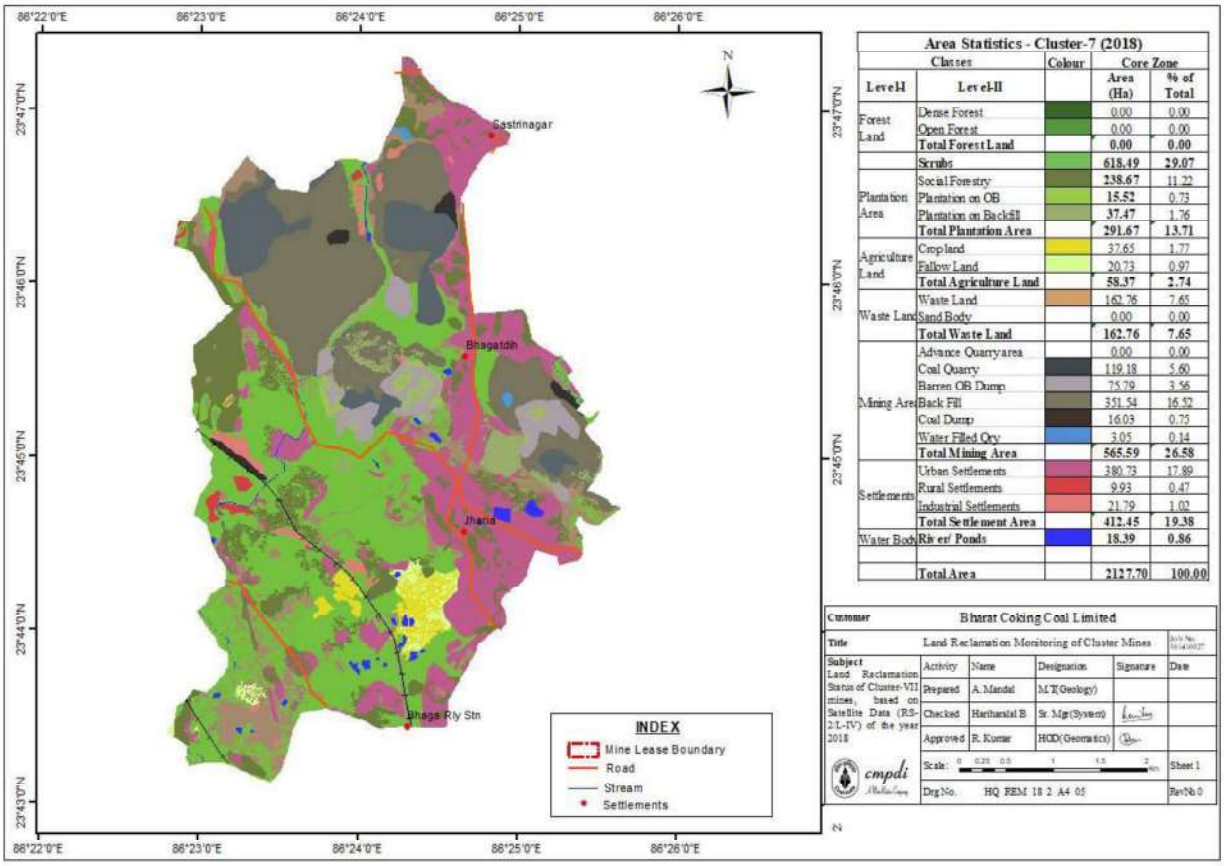
Monitoring stations (**D-3, D-4, D-33, D-34, D-47, D-55 and D-80**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	D-3	Dhansar	3.41	0.80	0.85	1.30	5.40	0.56	1.38	1.90	1.75	1.05	1.30	1.45
2	D-4	Jharia	3.01	1.41	1.16	1.61	3.41	0.51	1.41	2.26	2.81	1.16	1.71	2.16
3	D33	Kustore	1.75	0.62	0.85	1.60	3.65	0.48	1.45	1.80	2.35	0.25	1.65	2.35
4	D34	Kusunda	3.78	2.05	2.90	2.95	3.30	2.00	2.80	2.95	4.75	2.10	2.40	2.55
5	D47	Parastanr	4.05	3.22	2.45	4.88	9.45	3.41	5.45	5.83	4.55	1.90	4.35	4.20
6	D55	Hariladih	9.52	5.62	7.62	9.02	9.42	3.88	8.60	8.62	8.42	2.97	5.47	8.62
7	D80	Bastacolla	7.10	2.17	2.55	3.10	4.30	2.08	4.90	5.00	5.00	2.30	3.05	3.80
Average WL (bgl)			4.66	2.27	2.63	3.49	5.56	1.85	3.71	4.05	4.23	1.68	2.85	3.59

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.75 m Max – 9.52 m
Post-monsoon GW Level (m): Min – 0.85 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	0.0	968.53 x 10^4
2	Open Land	746.72 x 10^4	0.0	746.72 x 10^4
3	Road/ Paved Area	380.73 x 10^4	0.0	380.73 x 10^4
4	Rooftop area of building/ sheds	31.71 x 10^4	0.0	31.71 x 10^4
5	Total	2127.70 x 10^4	0.0	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.

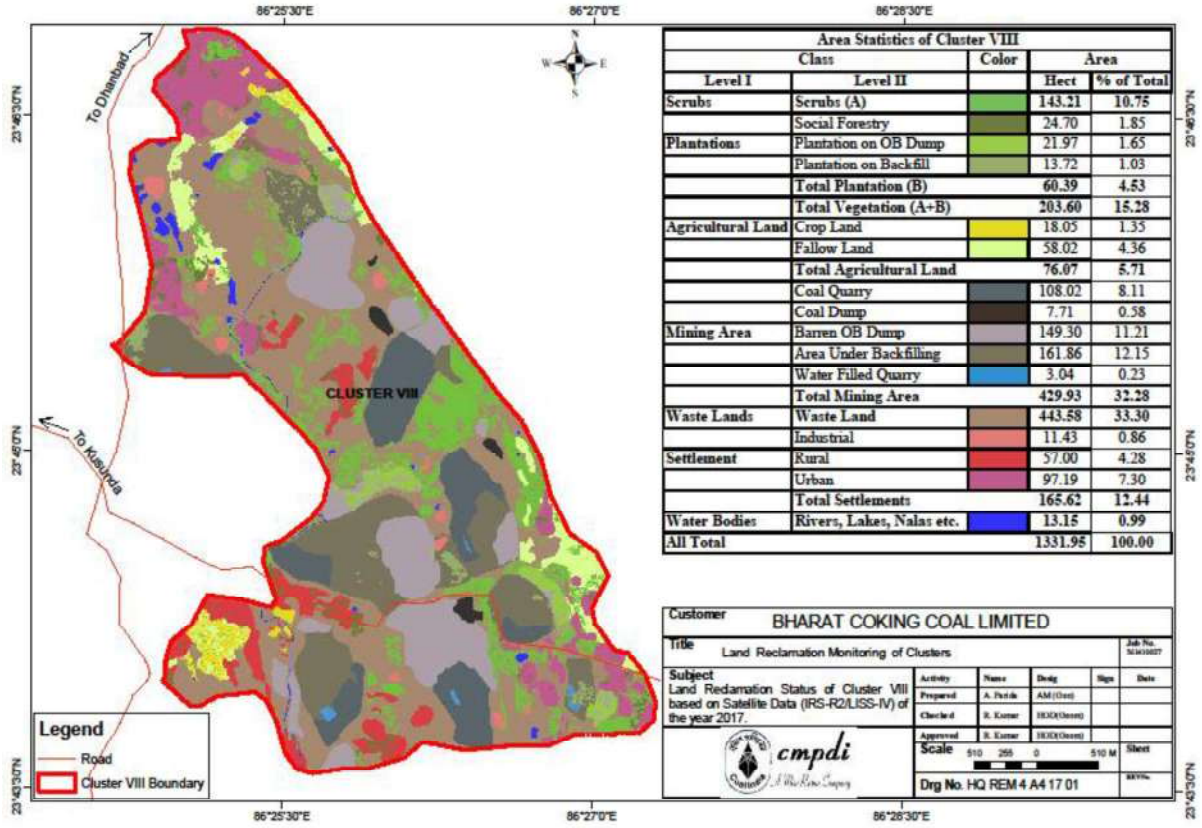
Monitoring stations (**D-8, D-43, D-49 and D-51**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	D-8	Alokdiha	4.55	1.85	2.27	3.20	5.83	1.70	2.75	3.20	4.80	1.95	2.85	4.25
2	D43	Alagdih	4.65	2.40	2.60	3.35	6.60	2.31	2.55	3.05	7.35	3.55	2.70	4.25
3	D49	Galucdih	1.40	0.73	0.85	1.00	3.25	1.41	1.65	1.98	1.75	0.60	1.50	1.25
4	D51	Chankuiya	9.43	5.65	5.65	7.50	8.45	6.03	5.70	7.35	9.95	8.05	5.75	7.75
Average WL (bgl)			5.01	2.66	2.84	3.76	6.03	2.86	3.16	3.90	5.96	3.54	3.20	4.38

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.40 m Max – 9.95 m
Post-monsoon GW Level (m): Min – 0.85 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	0.0	279.69 x 10^4
2	Open Land	886.66 x 10^4	0.0	886.66 x 10^4
3	Road/ Paved Area	97.19 x 10^4	0.0	97.19 x 10^4
4	Rooftop area of building/ sheds	68.43 x 10^4	0.0	68.43 x 10^4
5	Total	1331.95 x 10^4	0.0	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.

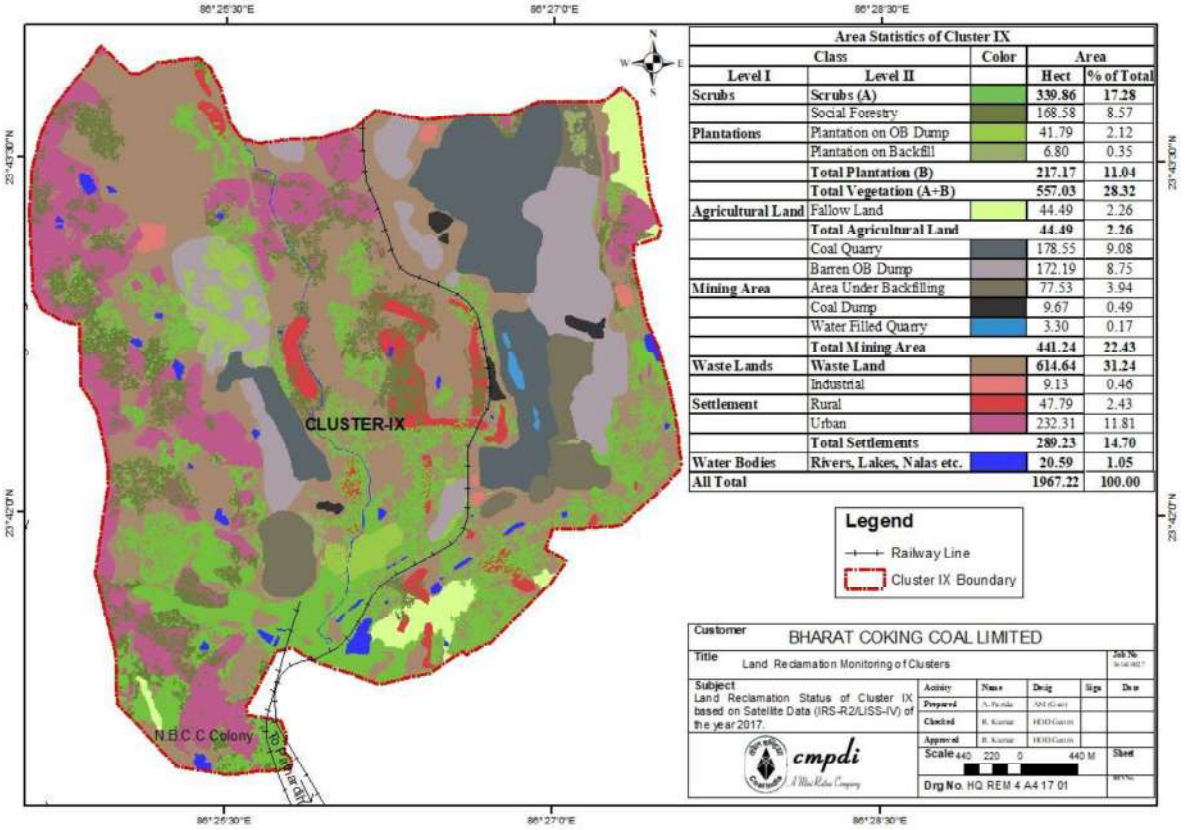
Monitoring stations (**D-5, D-7, D-39, D-40A, D-41 and D-74**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	D-5	Jiyalgora	7.28	3.35	4.00	6.40	8.60	3.20	7.70	7.90	8.25	2.90	4.85	8.20
2	D-7	Golden Pahari	6.08	2.38	2.63	3.88	7.33	2.56	5.13	5.35	8.23	1.88	3.28	4.86
3	D-39	Tilaboni	10.70	4.60	5.10	8.15	9.40	3.35	6.05	6.78	12.60	4.00	5.95	12.45
4	D40A	Khapa Dhawra	1.95	1.35	1.80	2.35	1.95	0.30	1.43	6.78	1.85	1.50	1.45	1.95
5	D-41	Joyrampur	1.95	1.34	1.38	1.45	3.30	1.43	1.45	1.60	2.30	0.70	1.25	1.40
6	D-74	BhulanBararee	6.93	3.20	2.90	3.70	4.30	2.58	3.93	4.00	5.80	2.35	3.57	4.95
Average WL (bgl)			5.82	2.70	2.97	4.32	5.81	2.24	4.28	4.54	6.51	2.22	3.39	5.64

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.85 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 x 10^4	0.0	601.52 x 10^4
2	Open Land	1076.47 x 10^4	0.0	1076.47 x 10^4
3	Road/ Paved Area	232.31 x 10^4	0.0	232.31 x 10^4
4	Rooftop area of building/ sheds	56.92 x 10^4	0.0	56.92 x 10^4
5	Total	1967.22 x 10^4	0.0	1967.22 x 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.

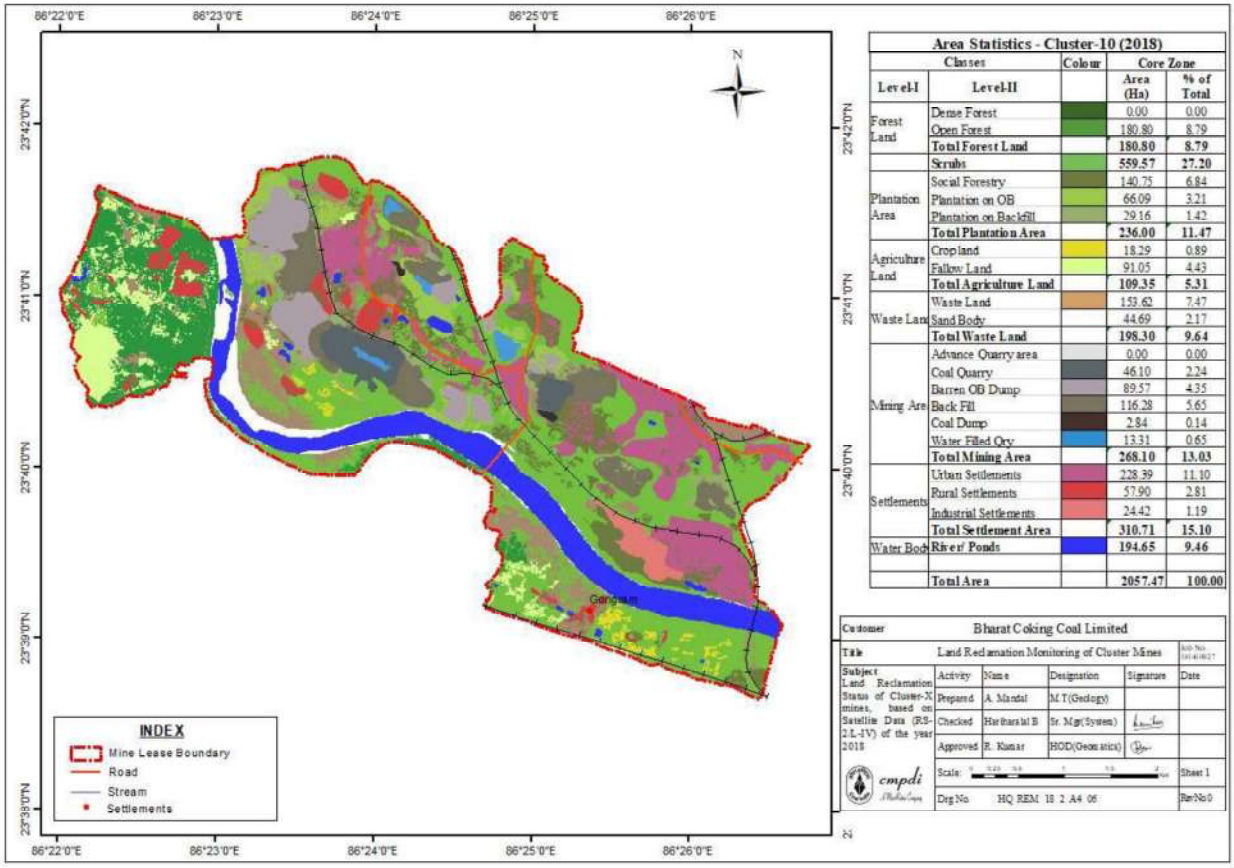
Monitoring stations (**A-19, D-35, D-36 and D-77**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A-19	Bhowrah	3.30	1.95	1.90	2.20	6.05	2.30	3.25	3.70	4.85	0.95	3.43	4.95
2	D-35	Patherdih	6.60	2.70	2.90	4.30	8.20	2.98	5.40	5.62	8.00	3.15	3.80	5.90
3	D-36	Sudamdih	2.02	0.45	0.55	0.55	2.10	0.06	1.00	1.15	1.20	0.10	0.55	0.65
4	D-77	Amlabad	5.98	2.60	4.69	5.60	6.40	5.90	3.50	4.25	6.40	2.80	3.20	4.50
Average WL (bgl)			4.48	1.93	2.51	3.16	5.69	2.81	3.29	3.68	5.11	1.75	2.75	4.00

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.20 m Max – 8.20 m
Post-monsoon GW Level (m): Min – 0.55 m Max – 4.69 m

LAND USE / LAND COVER MAP OF THE CLUSTER-X MINES, BCCL



Level-I	Level-II	Colour	Core Zone Area (Ha)	Core Zone % of Total
Forest Land	Dense Forest		0.00	0.00
	Open Forest		180.80	8.79
	Total Forest Land		**180.80**	**8.79**
	Scrubs		559.57	27.20
Plantation Area	Social Forestry		140.75	6.84
	Plantation on OB		66.09	3.21
	Plantation on Backfill		29.16	1.42
	Total Plantation Area		**236.00**	**11.47**
Agriculture Land	Cropland		18.29	0.89
	Fallow Land		91.05	4.43
	Total Agriculture Land		**109.35**	**5.31**
Waste Land	Waste Land		153.62	7.47
	Sand Body		44.69	2.17
	Total Waste Land		**198.30**	**9.64**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		46.10	2.24
	Barren OB Dump		89.57	4.35
	Back Fill		116.28	5.65
	Coal Dump		2.84	0.14
	Water Filled Qry		13.31	0.65
	Total Mining Area		**268.10**	**13.03**
Settlements	Urban Settlements		228.39	11.10
	Rural Settlements		57.90	2.81
	Industrial Settlements		24.42	1.19
	Total Settlement Area		**310.71**	**15.10**
Water Body	River/ Ponds		194.65	9.46
	Total Area		**2057.47**	**100.00**

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1085.72 x 10^4	0.0	1085.72 x 10^4
2	Open Land	661.04 x 10^4	0.0	661.04 x 10^4
3	Road/ Paved Area	228.39 x 10^4	0.0	228.39 x 10^4
4	Rooftop area of building/ sheds	82.32 x 10^4	0.0	82.32 x 10^4
5	Total	2057.47 x 10^4	0.0	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.

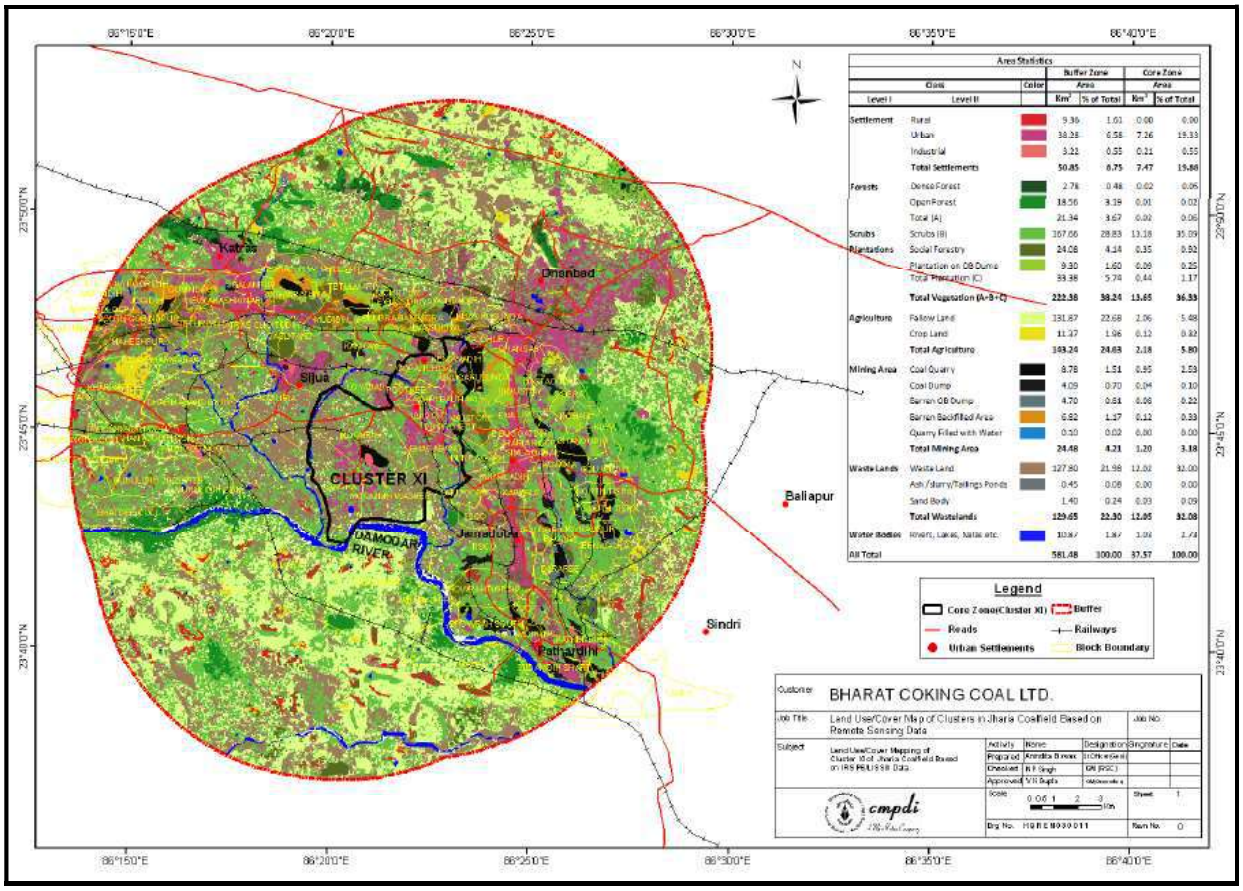
Monitoring stations (**A-17, A-18, A-20 and A-32**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A-17	Kachi Balihari	3.36	1.62	2.37	2.54	2.14	0.64	1.69	1.79	2.94	0.34	2.24	2.42
2	A-18	Baghaband	1.09	0.54	0.57	0.74	1.09	0.39	0.34	0.89	2.29	1.09	0.69	1.09
3	A-20	Gorbudih	5.47	1.47	2.02	3.07	8.47	1.44	3.87	4.42	4.57	3.32	1.82	4.02
4	A-32	Baludih	2.35	0.73	0.96	1.50	1.90	0.36	1.75	1.80	2.75	0.62	0.95	1.65
Average WL (bgl)			3.07	1.09	1.48	1.96	3.40	0.71	1.91	2.23	3.14	1.34	1.43	2.30

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.09 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 x 10^4	0.0	1293.46 x 10^4
2	Open Land	1518.33 x 10^4	0.0	1509.06 x 10^4
3	Road/ Paved Area	171.08 x 10^4	0.0	171.08 x 10^4
4	Rooftop area of building/ sheds	777.56 x 10^4	0.0	563.06 x 10^4
5	Total	3527.58 x 10^4	0.0	3527.58 x 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.

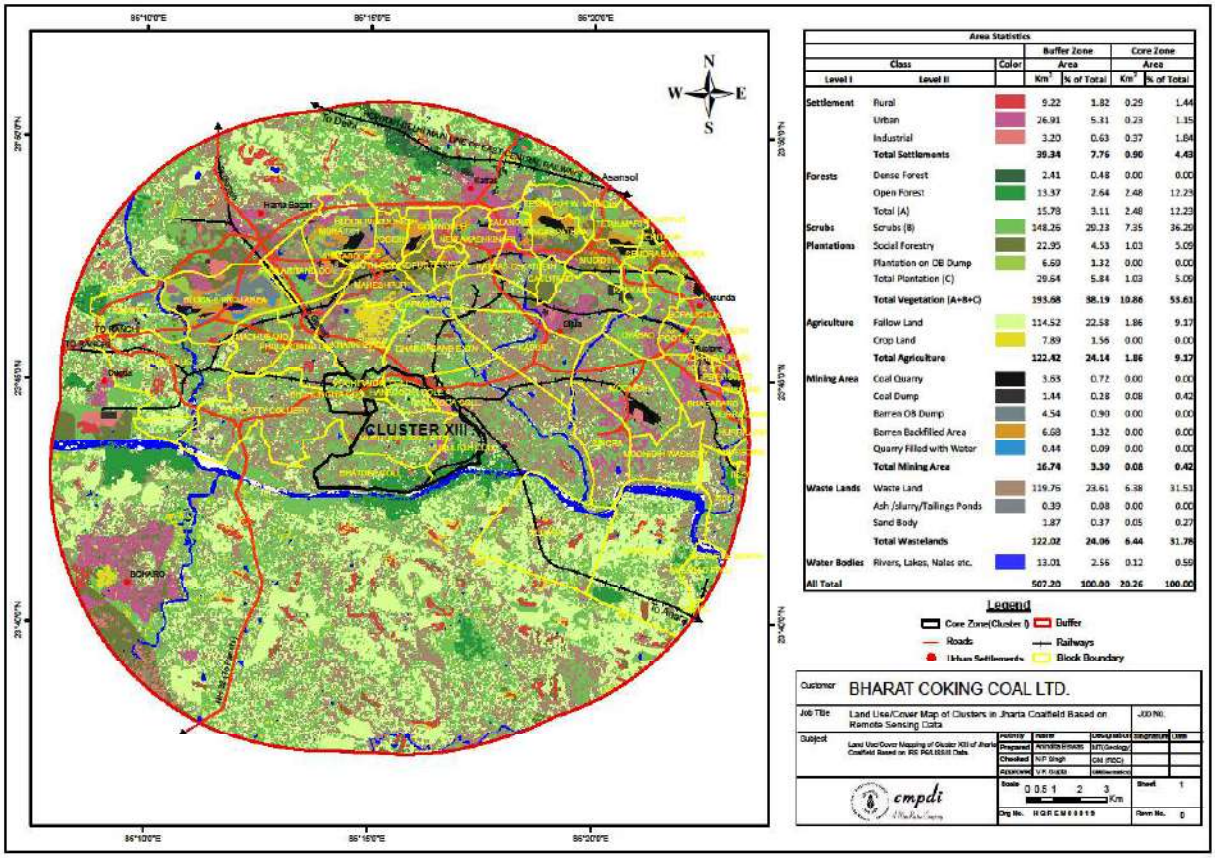
Monitoring stations (**A-22, A-23, A-33, A-34, B-25 and B-48**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A22A	Nagdah	2.90	0.40	1.10	1.50	2.90	0.20	1.98	2.00	2.60	1.75	2.00	2.85
2	A-23	Machhayara	9.52	1.87	2.82	4.82	8.92	1.12	5.62	7.12	11.97	5.37	3.77	6.57
3	A-33	Mahuda Wa	2.85	0.80	0.85	1.33	4.55	0.38	1.85	2.85	3.65	0.55	1.25	1.55
4	A-34	Mahuda vil.	5.20	1.83	3.55		8.35	3.43	3.45	5.35	6.35	3.45	3.95	5.45
5	B-25	Mahuda more	5.10	1.98	2.58	3.30	7.90	3.02	2.55	3.45	4.80	1.38	1.40	3.50
6	B-48	Mahuda	7.23	2.28	6.05	6.60	8.20	3.37	3.85	4.51	7.05	2.85	4.35	5.45
Average WL (bgl)			5.47	1.53	2.83	3.51	6.80	1.92	3.22	4.21	6.07	2.56	2.79	4.23

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.85 m Max – 11.97 m
Post-monsoon GW Level (m): Min – 0.85 m Max – 6.05 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XIII MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1484.41 x 10^4	0.0	1570.48 x 10^4
2	Open Land	183.28 x 10^4	0.0	97.22 x 10^4
3	Road/ Paved Area	71.84 x 10^4	0.0	71.83 x 10^4
4	Rooftop area of building/ sheds	159.09 x 10^4	0.0	159.09 x 10^4
5	Total	1898.62 x 10^4	0.0	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.

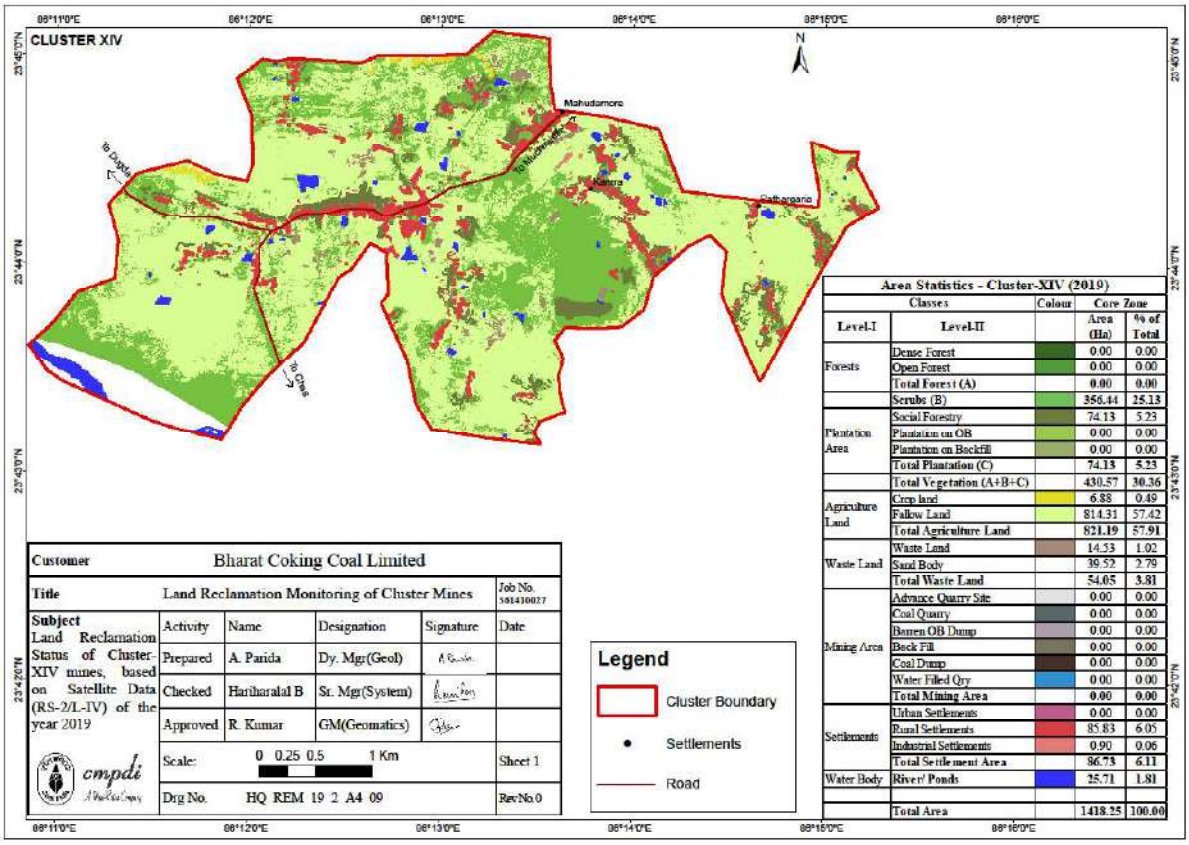
Monitoring stations (**B-23, B-24 and B-67**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	B-23	Lohapatti	4.12	1.24	1.44	1.81	3.24	0.77	1.76	2.69	2.84	1.12	1.34	2.24
2	B-24	Telmuchu	5.68	1.55	2.08	3.07	5.48	1.13	3.53	4.38	4.58	1.23	2.33	3.63
3	B-67	Simatanr	8.95	2.45	2.95	3.65	7.55	1.83	3.95	5.90	8.57	3.37	4.35	4.65
Average WL (bgl)			6.25	1.75	2.16	2.84	5.42	1.24	3.08	4.32	5.33	1.91	2.67	3.51

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.84 m Max – 8.95 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	0.0	1251.76 x 10^4
2	Open Land	79.76 x 10^4	0.0	79.76 x 10^4
3	Road/ Paved Area	85.83 x 10^4	0.0	85.83 x 10^4
4	Rooftop area of building/ sheds	0.90 x 10^4	0.0	0.90 x 10^4
5	Total	1418.25 x 10^4	0.0	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.

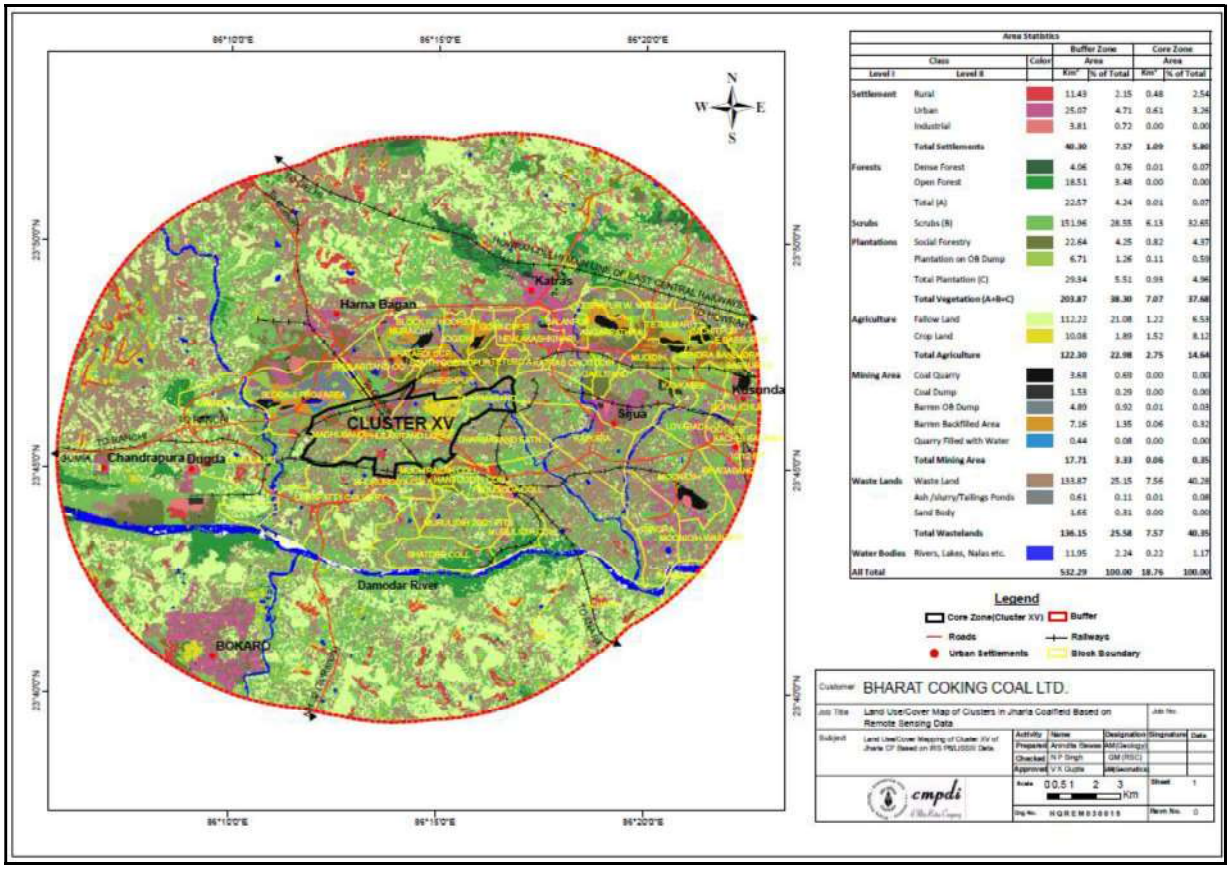
Monitoring stations (**A-24, B-32A and B-61A**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A24	Pipratanr	10.13		2.78	4.55	4.88	-	4.28	4.68	15.88	1.73	2.48	4.08
2	B32A	Madhuband	5.60	1.34	1.70	2.30	3.30	1.18	2.00	2.21	5.55	1.25	1.70	2.35
3	B61A	Kesargora	4.42	0.47	0.97	0.97	3.32	0.85	1.60	2.07	3.35	1.39	0.52	1.12
Average WL (bgl)			6.72	0.91	1.82	2.61	3.83	1.02	2.63	2.99	5.39	7.97	3.63	4.27

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 3.32 m Max – 15.88 m
Post-monsoon GW Level (m): Min – 0.52 m Max – 4.28 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 x 10^4	0.0	957.34 x 10^4
2	Open Land	1130.53 x 10^4	0.0	538.37 x 10^4
3	Road/ Paved Area	101.67 x 10^4	0.0	101.67 x 10^4
4	Rooftop area of building/ sheds	99.17 x 10^4	0.0	99.17 x 10^4
5	Total	1696.55 x 10^4	0.0	1696.55 x 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.

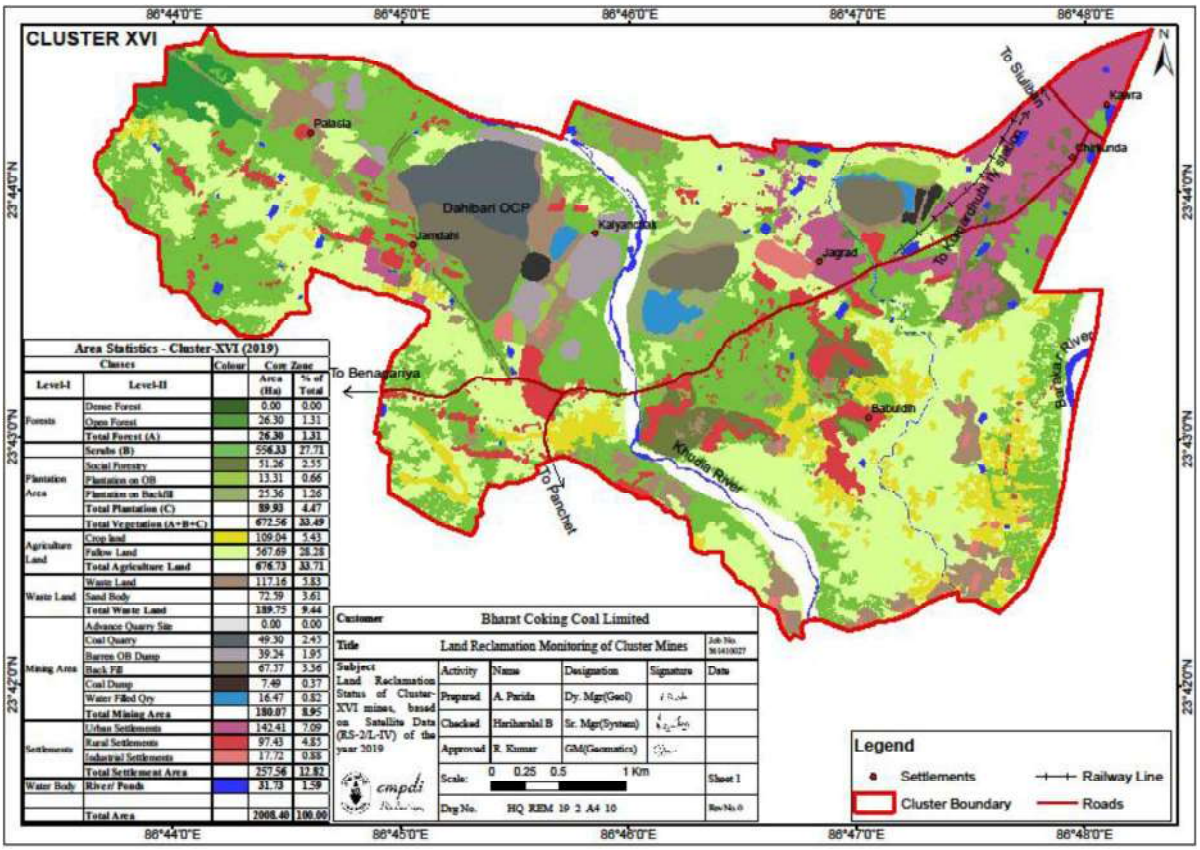
Monitoring stations (**DB-22, DB-23, DB-24 & DB-25**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'21, August'21, and Nov'21 and January'22, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2021-22				2020-21				2019-20			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	DB22	Dahibari, Basti	2.31	1.55	1.38	1.57	2.63	1.30	2.25	2.38	4.93	1.38	1.63	1.73
2	DB23	Dahibari OC	2.00	1.05	1.10	1.70	2.50	0.70	1.95	2.17	1.60	0.88	0.80	1.00
3	DB24	Dahibari	6.20	4.20	5.25	5.80	3.60	1.57	5.70	5.90	9.35	3.20	3.88	4.80
4	DB25	Basantimata UG	2.83	1.01	2.03	2.63	3.98	1.19	2.63	2.68	-	-	-	-
Average WL (bgl)			3.34	1.95	2.44	2.93	3.18	1.19	3.13	3.28	4.53	1.82	2.10	2.51

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	0.0	1349.29 x 10^4
2	Open Land	401.55 x 10^4	0.0	401.55 x 10^4
3	Road/ Paved Area	142.41 x 10^4	0.0	142.41 x 10^4
4	Rooftop area of building/ sheds	115.15 x 10^4	0.0	115.15 x 10^4
5	Total	2008.40 x 10^4	0.0	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'21 & Jan'22)	Avg. Fluctuation (in meters) during 2021-22	Geological Formation
1	I	4 nos.	0.25 to 8.38 m	2.93 m	Barakar
2	II	5 nos.	0.30 to 11.26 m	4.02 m	Barakar
3	III	5 nos.	0.24 to 11.26 m	2.92 m	Barakar
4	IV	4 nos.	0.30 to 9.03 m	3.87 m	Barakar
5	V	4 nos.	0.07 to 5.43 m	1.66 m	Barakar
6	VI	2 nos.	0.60 to 10.50 m	5.05 m	Barakar
7	VII	7 nos.	0.62 to 9.52 m	2.03 m	Barakar
8	VIII	4 nos.	0.73 to 9.43 m	2.17 m	Barakar
9	IX	6 nos.	1.34 to 10.70 m	2.85 m	Barakar
10	X	4 nos.	0.45 to 6.60 m	1.97 m	Barakar
11	XI	4 nos.	0.54 to 5.47 m	1.80 m	Barakar & Barren Measure
12	XIII	6 nos.	0.40 to 9.52 m	2.64 m	Raniganj
13	XIV	3 nos.	1.24 to 8.95 m	4.09 m	Raniganj
14	XV	3 nos.	0.47 to 10.13 m	4.90 m	Barakar & Barren Measure
15	XVI	3 nos.	1.01 to 6.20 m	0.90 m	Barakar

Depth to water level (in bgl) values described that water level goes down to maximum 11.26 m during pre-monsoon'2021 and maximum upto 7.62 m during post-monsoon'2021. 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–VI**. 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**) are prepared and studied to identify long-term trends. Hydrograph trend analysis of CGWB monitoring wells and observation well reveals increasing groundwater level trends in most of the Cluster of mines. However, decline trends in both Pre

and Post-monsoon GW level in Cluster-I, Cluster-V, Cluster-VI and Cluster-VII is recorded 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

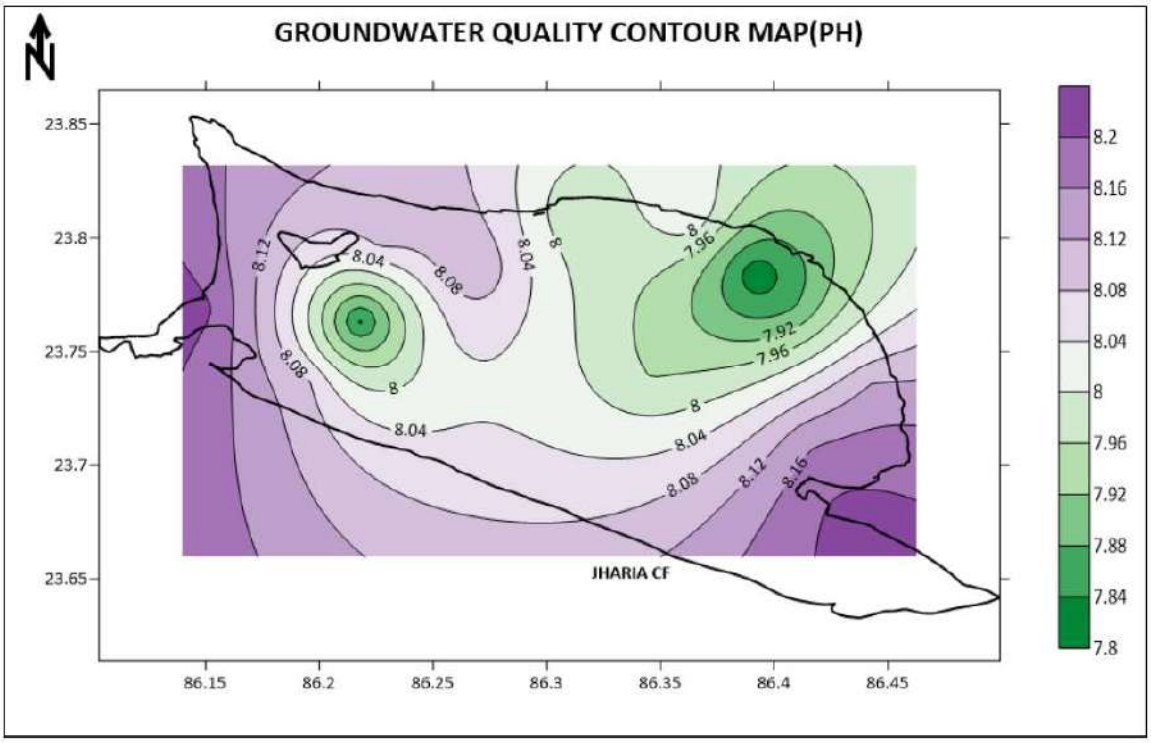
The ground water sample of the study area (15 nos. of Cluster of mines, BCCL) collected from dug wells and analyzed. Fifteen ground water samples (GW-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15 & 16) analyzed during the month of June'2021 at CMPDI, RI-II, Dhanbad. The water sampling details given in **Annexure–V** and Water sample locations shown in **Plate-II**. The water quality data enclosed in **Annexure–VII.**

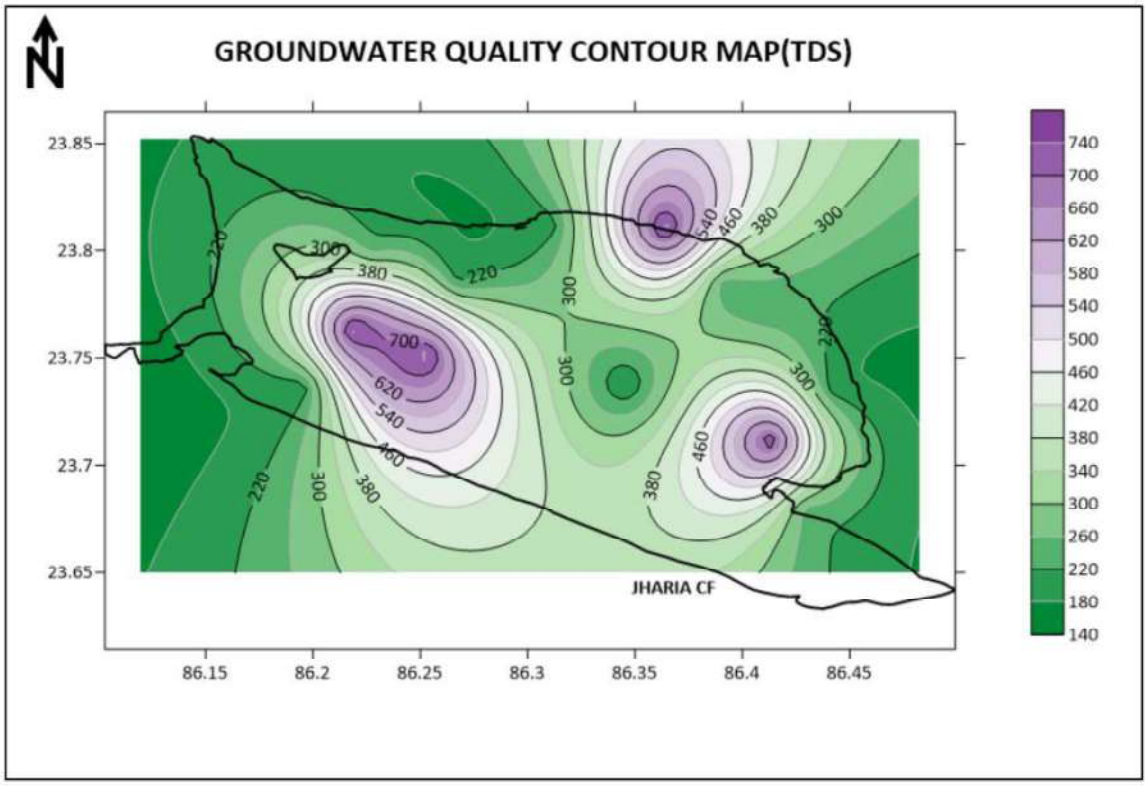
The study of the variations in water quality parameters described below:

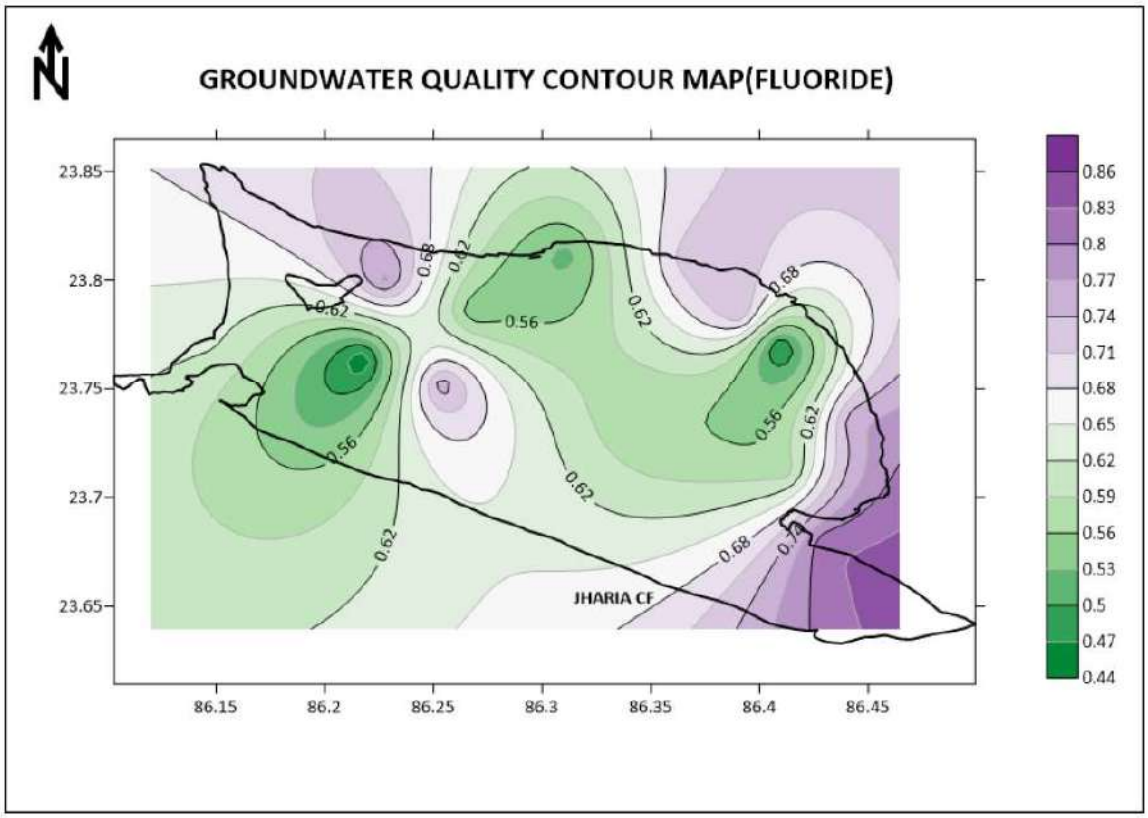
The pH of the groundwater samples varies between 7.65 (GW-5) to 8.15 (GW-11), the pH is within the IS 10500 limit of drinking water standard.

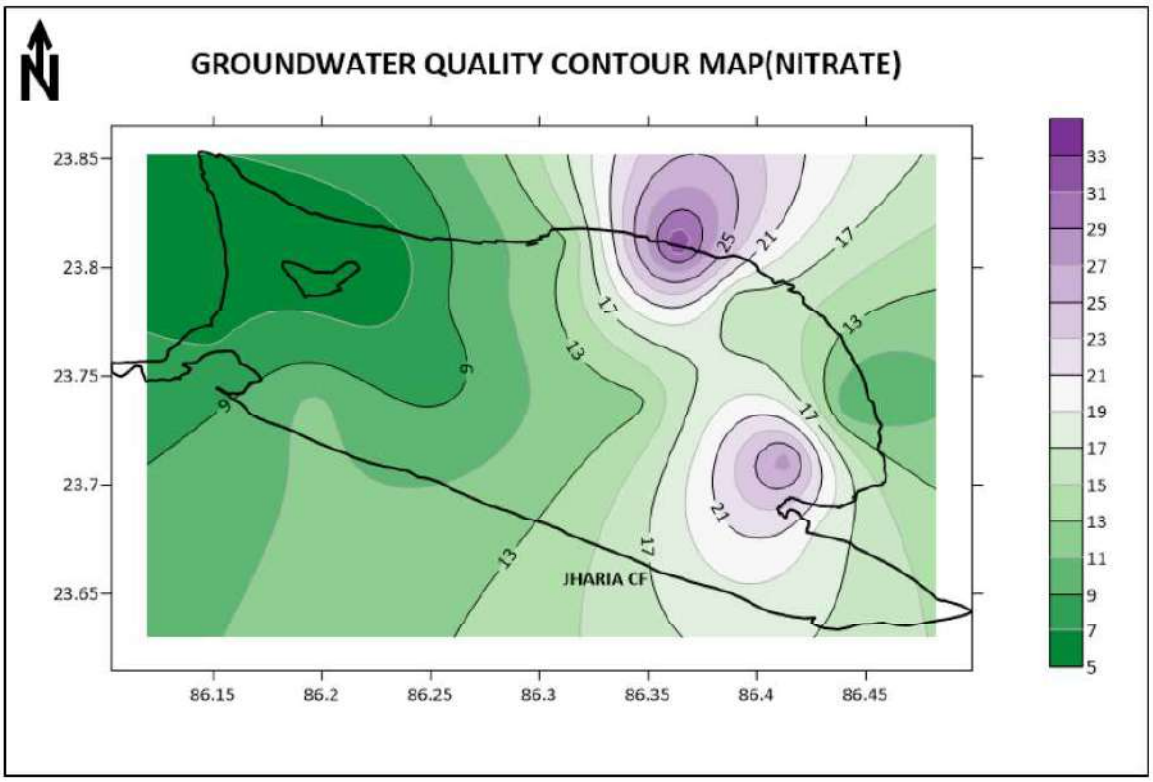
The mineral constituents dissolved in water constitute the dissolved solids. The total dissolve solids vary from 425 (GW-1) to 889 mg/l (GW-9), the TDS values ranges slightly above the IS 10500:2012 standards limits of drinking water.

The alkalinity of the water samples varies from 101 (GW-14) to 182 mg/l (GW-7) and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 41 (GW-1) to 158 mg/l (GW-13) and are ***slightly above*** the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 226 (GW-8) to 638 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 31 (GW-1) to 187 mg/l (GW-16) 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.


GROUNDWATER QUALITY CONTOUR MAP(PH)
N
23.85
23.8
23.75
23.7
23.65
86.15
86.2
86.25
86.3
86.35
86.4
86.45
JHARIA CF
8.2
8.16
8.12
8.08
8.04
8
7.96
7.92
7.88
7.84
7.8


GROUNDWATER QUALITY CONTOUR MAP(TDS)
N
23.85
23.8
23.75
23.7
23.65
86.15
86.2
86.25
86.3
86.35
86.4
86.45
JHARIA CF
740
700
660
620
580
540
500
460
420
380
340
300
260
220
180
140


GROUNDWATER QUALITY CONTOUR MAP(FLUORIDE)
23.85
23.8
23.75
23.7
23.65
86.15
86.2
86.25
86.3
86.35
86.4
86.45
0.62
0.68
0.56
JHARIA CF
0.86
0.83
0.8
0.77
0.74
0.71
0.68
0.65
0.62
0.59
0.56
0.53
0.5
0.47
0.44


GROUNDWATER QUALITY CONTOUR MAP(NITRATE)
23.85
23.8
23.75
23.7
23.65
86.15
86.2
86.25
86.3
86.35
86.4
86.45
25
21
17
13
9
JHARIA CF
33
31
29
27
25
23
21
19
17
15
13
11
9
7
5

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) 2021-22		GW level declining trend 2005-2021		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	5.10	1.07	YES	YES	Recharge structure needed
Cluster-II	Baghmara (SOD: Critical)	8350	Jamunia river	6737 (2755+3982)	1613	6.12	2.10	NO	NO	Excess mine water needed to be utilized
Cluster-III		12760 (10960+1800)	NIL	8946 (7849+1097)	3814	5.66	2.74	NO	NO	
Cluster-IV		5900	MADA	5100 (3605+1495)	800	6.08	2.21	NO	NO	
Cluster-V		12690 (11025+1665)	MADA	11063 (5710+5353)	1897	2.80	1.15	YES	YES	
Cluster-VI	Dhanbad (SOD: Over-exploited)	4150	MADA	4150 (1664+2486)	0.0	7.37	2.32	YES	NO	--
Cluster-VII		21565	MADA	20826 (17596+3230)	739	4.66	2.63	YES	YES	Excess mine water needed to be utilized water
Cluster-VIII	Jharia (SOD: Over-exploited)	9320	MADA	5294 (3730+1564)	4026	5.01	2.84	NO	NO	
Cluster-IX		12980	MADA	9358 (4549+4809)	3622	5.82	2.97	NO	NO	
Cluster-X		11825	Damodar river	6201 (4255+1946)	5624	4.48	2.51	YES	NO	
Cluster-XI	Dhanbad (SOD: Over-exploited)	24960	MADA & DVC	19425 (14015+5410)	5535	2.82	1.48	NO	NO	
Cluster-XIII	Baghmara (SOD: Critical)	750	Damodar river	692	58.0	5.47	2.83	NO	NO	--
Cluster-XIV		943	NA	668	275	6.25	2.16	NO	NO	--
Cluster-XV		6200	NA	5941 (4600+1341)	259	6.72	1.82	NO	NO	--
Cluster-XVI	Nirsa (SOD:Safe)	1910	DVC (Barakar river)	1730 (1380+350)	180	3.34	2.44	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 x 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 coalmine 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.

Annexure-III

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

Annexure – IV

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-64**	23^{0}48'43.14" N	86^{0}18'44.25" E
A-12	23^{0}48'20.31" N	86^{0}16'51.64" E	**B-65A**	23^{0}48'53.65" N	86^{0}18'11.82" E
A-16	23^{0}46'57.00" N	86^{0}21'38.57" E	**B-67**	23^{0}43'30.70" N	86^{0}14'01.45" E
A-17	23^{0}45'09.44" N	86^{0}22'16.35" E	**D-3**	23^{0}46'46.31" N	86^{0}24'49.30" E
A-18	23^{0}44'37.65" N	86^{0}22'58.90" E	**D-4**	23^{0}44'29.37" N	86^{0}24'42.88" E
A-19	23^{0}41'12.86" N	86^{0}23'55.27" E	**D-5**	23^{0}42'20.05" N	86^{0}24'86.06" E
A-20	23^{0}44'56.64" N	86^{0}19'55.35" E	**D-7**	23^{0}43'12.08" N	86^{0}27'11.89" E
A-22	23^{0}43'06.65" N	86^{0}14'48.53" E	**D-8**	23^{0}44'06.13" N	86^{0}27'20.72" E
A-23	23^{0}45'06.38" N	86^{0}15'12.69" E	**D-23**	23^{0}47'20.89" N	86^{0}20'09.96" E
A-24	23^{0}45'20.44" N	86^{0}13'45.12" E	**D-25**	23^{0}47'03.28" N	86^{0}23'29.56" E
A-25	23^{0}47'06.20" N	86^{0}15'27.79" E	**D-30**	23^{0}48'36.10" N	86^{0}21'50.07" E
A-26	23^{0}46'49.24" N	86^{0}18'12.12" E	**D-33**	23^{0}45'34.62" N	86^{0}23'18.50" E
A-27	23^{0}48'42.55" N	86^{0}20'21.80" E	**D-34**	23^{0}45'36.50" N	86^{0}23'02.45" E
A-28A	23^{0}47'34.74" N	86^{0}18'04.18" E	**D-35**	23^{0}40'46.54" N	86^{0}25'46.33" E
A-29	23^{0}47'08.02" N	86^{0}16'02.72" E	**D-36**	23^{0}40'19.26" N	86^{0}25'18.98" E
A-32	23^{0}44'15.56" N	86^{0}20'43.80" E	**D-39**	23^{0}43'28.50" N	86^{0}26'0.10" E
A-33	23^{0}44'32.58" N	86^{0}16'58.28" E	**D-40A**	23^{0}43'20.18" N	86^{0}25'45.70" E
A-34	23^{0}42'58.63" N	86^{0}15'19.31" E	**D-41**	23^{0}42'40.00" N	86^{0}26'17.20" E
B-1	23^{0}48'48.06" N	86^{0}14'16.87" E	**D-43***	NA	NA
B-14	23^{0}48'00.81" N	86^{0}16'25.88" E	**D-47**	23^{0}45'20.59" N	86^{0}24'34.86" E
B-15	23^{0}46'06.92" N	86^{0}08'59.30" E	**D-49**	23^{0}44'08.96" N	86^{0}26'32.71" E
B-21A	23^{0}45'10.50" N	86^{0}09'36.38" E	**D-51**	23^{0}44'20.86" N	86^{0}27'11.37" E
B-23	23^{0}44'13.05" N	86^{0}11'46.56" E	**D-55**	23^{0}43'58.37" N	86^{0}24'07.45" E
B-24	23^{0}44'26.80" N	86^{0}13'09.38" E	**D-74**	23^{0}41'33.66" N	86^{0}25'06.10" E
B-25	23^{0}44'44.98" N	86^{0}13'57.80" E	**D-77**	23^{0}41'00.74" N	86^{0}22'25.55" E
B-32A	23^{0}45'49.18" N	86^{0}13'03.64" E	**D-80**	23^{0}46'09.46" N	86^{0}24'33.08" E
B-48	23^{03}4'35.09" N	86^{0}16'38.30" E	**DB-22**	23^{0}43'38.81" N	86^{0}45'09.00" E
B-51	23^{0}47'40.20" N	86^{0}09'11.90" E	**DB-23**	23^{0}43'44.24" N	86^{0}45'06.39" E
B-53	23^{0}45'55.25" N	86^{0}09'35.44" E	**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	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-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-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	May 21	Nov 21
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	0.62	0.05
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	1.92	1.10
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	3.45	2.00
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	3.36	2.37
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	1.09	0.57
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	3.30	1.90
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	5.47	2.02
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	2.90	1.10
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	9.52	2.82
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	10.13	2.78
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	5.78	2.43
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	6.70	2.73
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	1.67	0.90
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	6.23	3.75
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	6.49	5.90
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	2.35	0.96
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	2.85	0.85
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	5.20	3.55
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	2.58	1.91
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	2.84	2.04
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	1.46	0.35
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	8.38	-
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	4.12	1.44
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	5.68	2.08
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	5.10	2.58
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	7.23	6.05
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	7.23	6.05
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	5.70	1.0
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	4.85	1.87
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	5.49	0.90
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	11.26	2.23
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	4.42	0.97
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	6.87	4.50

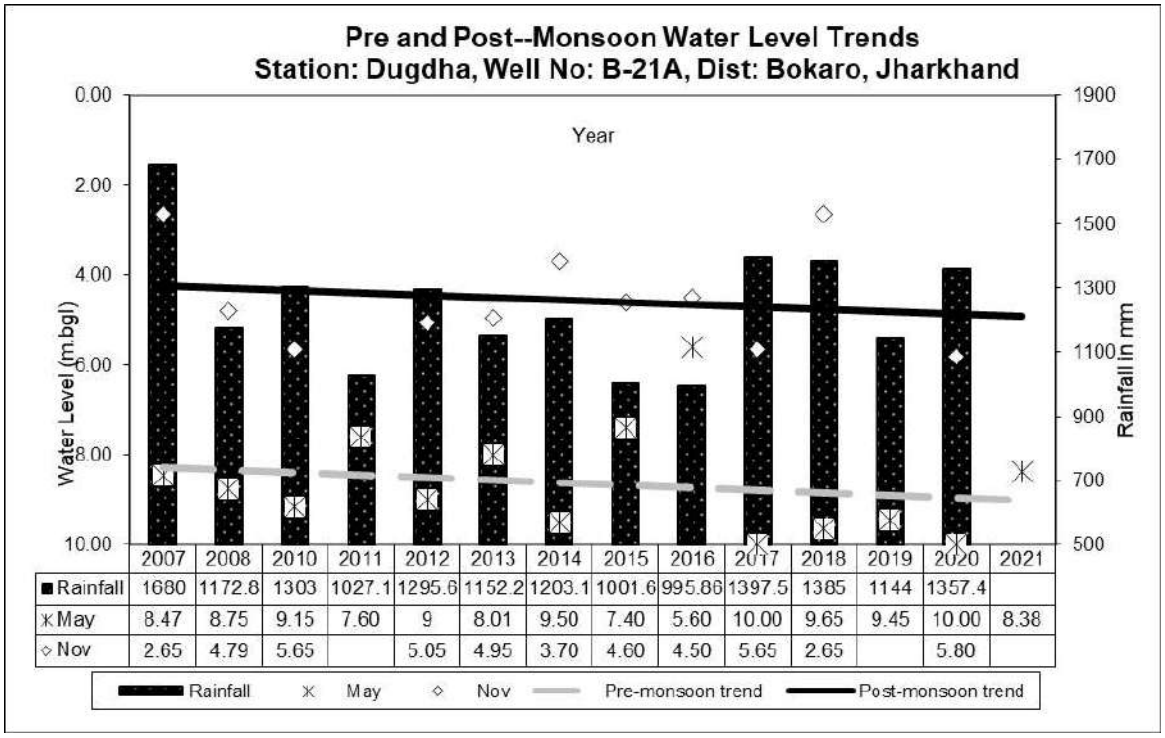
Annexure – VB

Historical Water Level data of Hydrograph Stations

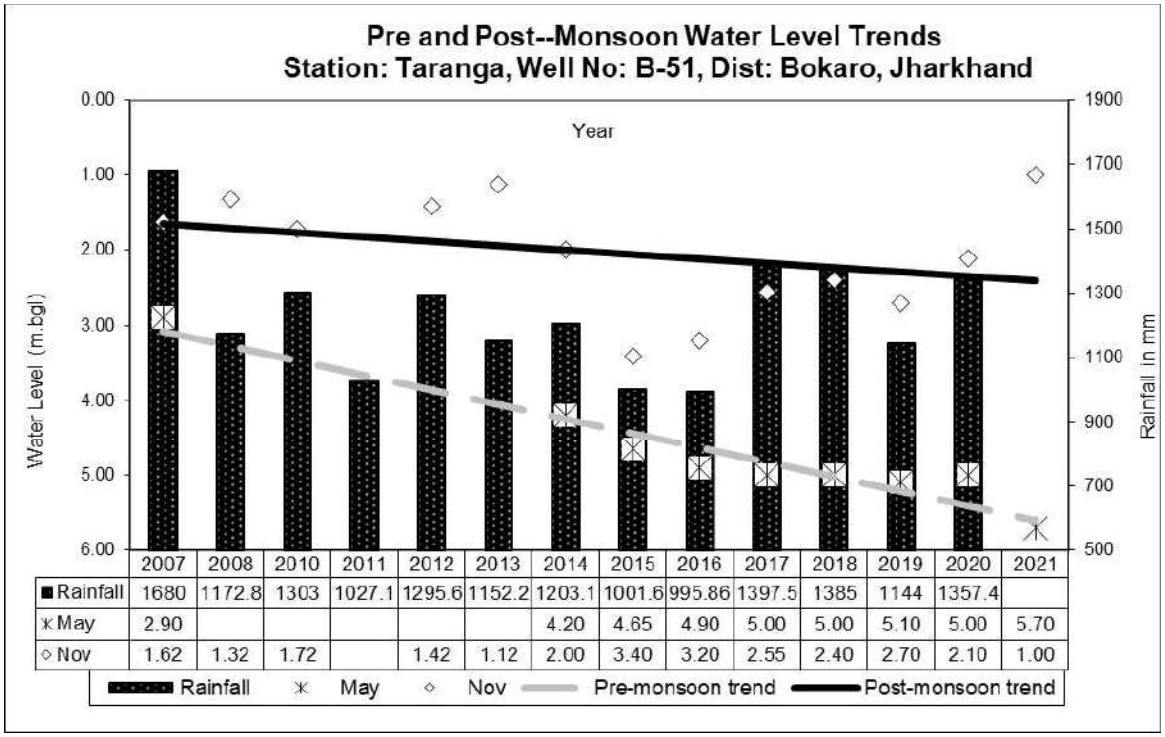
Well No	Water level below ground level (bgl) in meters															
	May 14	Nov 14	May 15	Nov 15	May 16	Nov 16	May 17	Nov 17	May 18	Nov 18	May 19	Nov 19	May 20	Nov 20	May 21	Nov 21
B-64	0.7	1.15	1.38	0.95	2.35	0.55	1.25	0.85	2.15	1.85	0.95	0.45	1.85	0.50	2.35	0.95
B65A	10.45	2.4	7.82	5.87	7.15	2.68	9.05	1.25	10.03	2.40	11.05	0.95	9.25	2.30	9.03	1.42
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	8.95	2.95
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	3.41	0.85
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	3.01	1.16
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	7.28	4.00
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	6.08	2.63
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	4.55	2.27
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	5.43	1.60
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	10.50	3.80
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	4.23	0.84
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	1.75	0.85
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	3.78	2.90
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	6.60	2.90
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	2.02	0.55
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	10.70	5.10
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	1.95	1.80
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	1.95	1.38
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	4.65	2.60
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	4.05	2.45
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	1.40	0.85
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	9.43	5.65
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	9.52	7.62
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	6.93	2.90
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	5.98	4.69
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	7.10	2.55
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	May 21	Nov 21
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	2.31	1.38
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	2.00	1.10
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	6.20	5.25
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	2.83	2.03

***New well**

HYDROGRAPHS OF CLUSTER-I

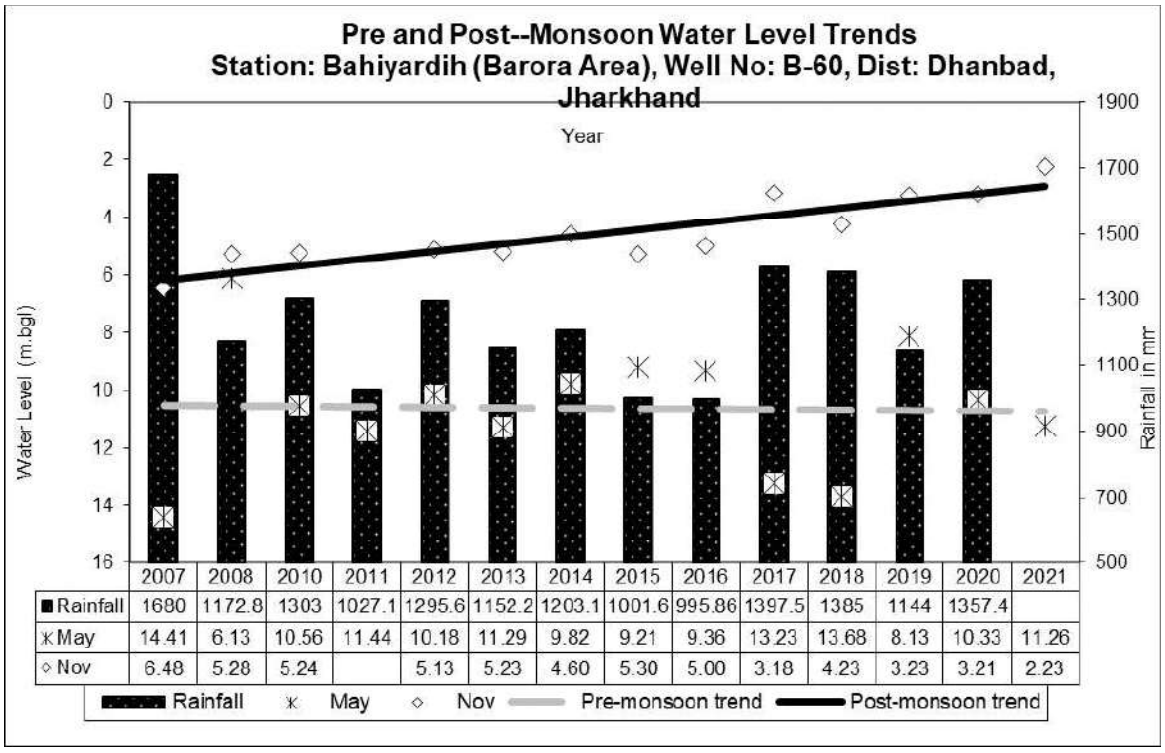


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	8.47	8.75	9.15	7.60	9	8.01	9.50	7.40	5.60	10.00	9.65	9.45	10.00	8.38
Nov	2.65	4.79	5.65		5.05	4.95	3.70	4.60	4.50	5.65	2.65		5.80	

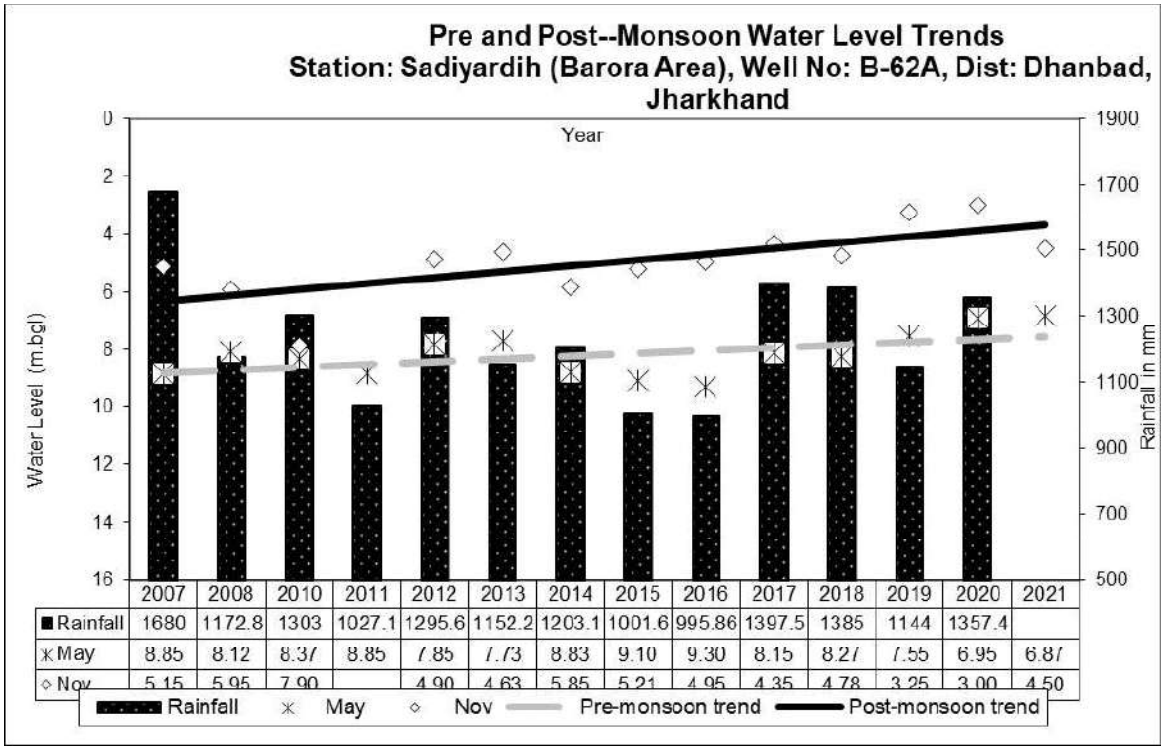


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	2.90						4.20	4.65	4.90	5.00	5.00	5.10	5.00	5.70
Nov	1.62	1.32	1.72		1.42	1.12	2.00	3.40	3.20	2.55	2.40	2.70	2.10	1.00

HYDROGRAPHS OF CLUSTER-II

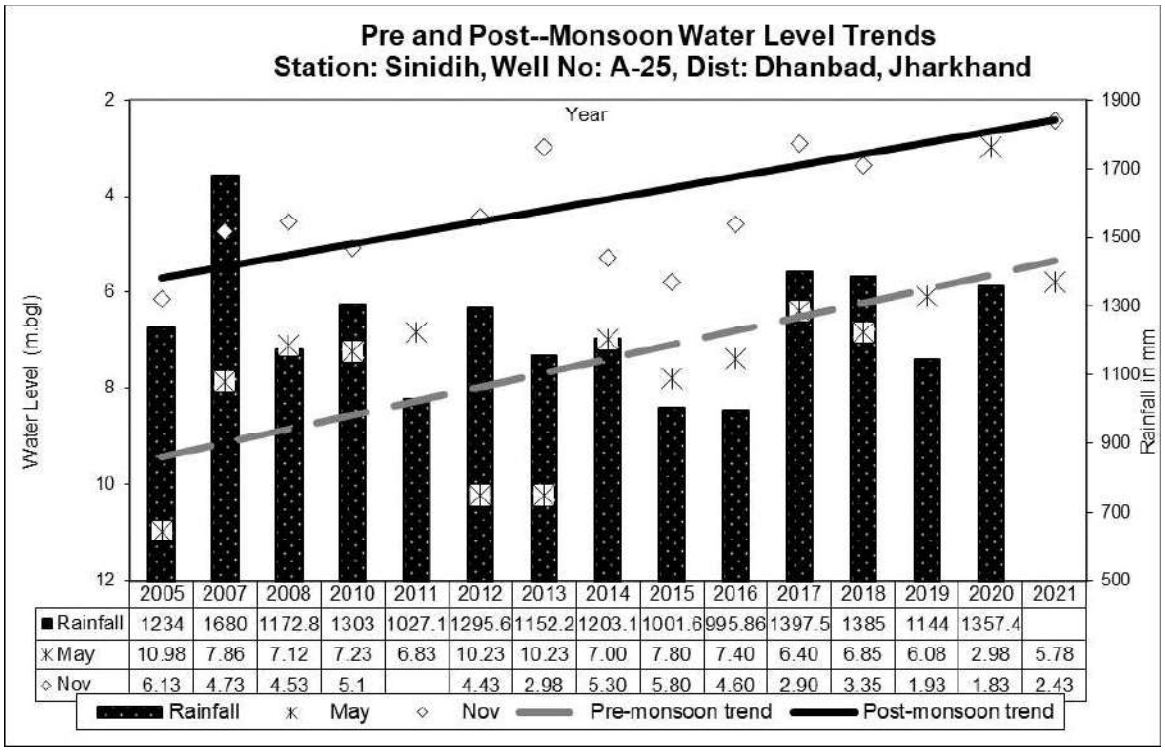


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	14.41	6.13	10.56	11.44	10.18	11.29	9.82	9.21	9.36	13.23	13.68	8.13	10.33	11.26
Nov	6.48	5.28	5.24		5.13	5.23	4.60	5.30	5.00	3.18	4.23	3.23	3.21	2.23

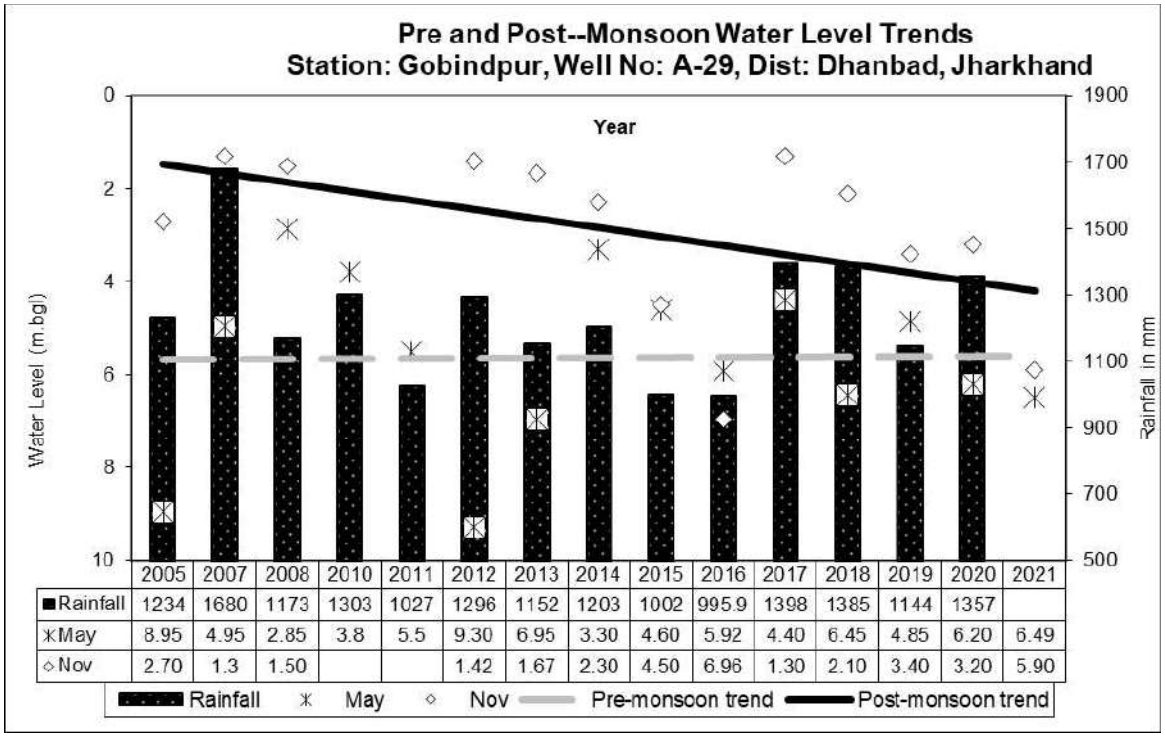


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	8.85	8.12	8.37	8.85	7.85	7.73	8.83	9.10	9.30	8.15	8.27	7.55	6.95	6.87
Nov	5.15	5.95	7.90		4.90	4.63	5.85	5.21	4.95	4.35	4.78	3.25	3.00	4.50

HYDROGRAPHS OF CLUSTER-III

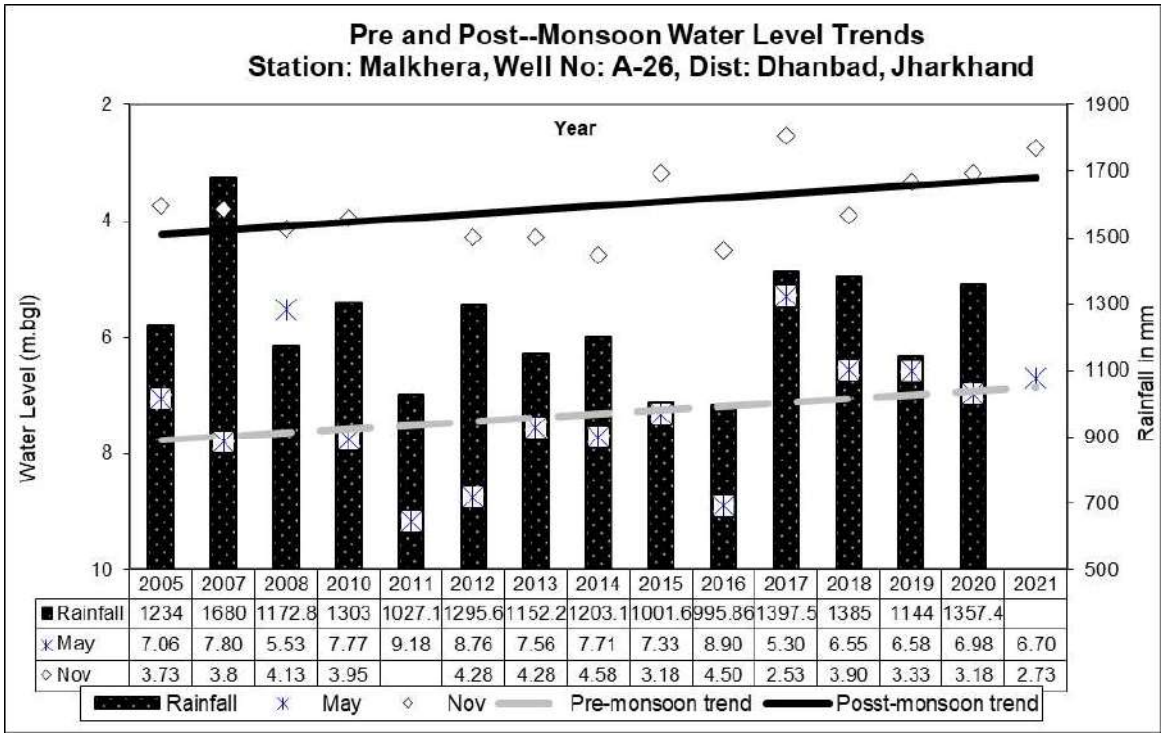


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	10.98	7.86	7.12	7.23	6.83	10.23	10.23	7.00	7.80	7.40	6.40	6.85	6.08	2.98	5.78
Nov	6.13	4.73	4.53	5.1		4.43	2.98	5.30	5.80	4.60	2.90	3.35	1.93	1.83	2.43

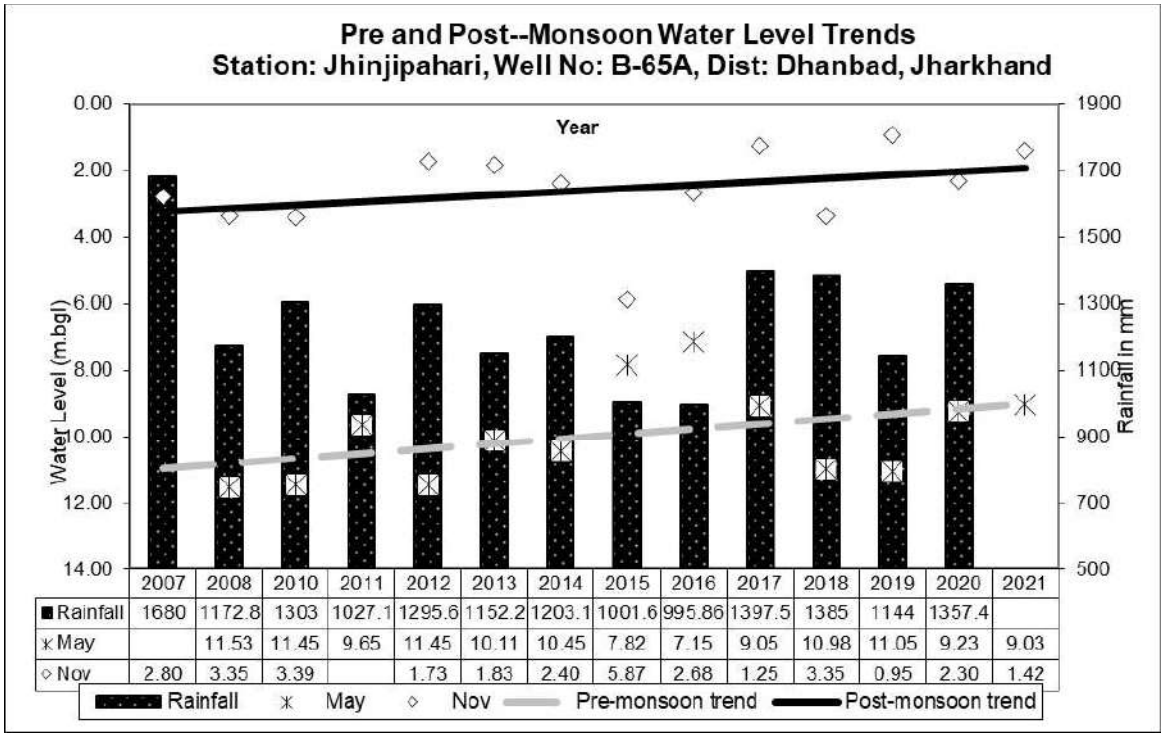


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1173	1303	1027	1296	1152	1203	1002	995.9	1398	1385	1144	1357	
May	8.95	4.95	2.85	3.8	5.5	9.30	6.95	3.30	4.60	5.92	4.40	6.45	4.85	6.20	6.49
Nov	2.70	1.3	1.50			1.42	1.67	2.30	4.50	6.96	1.30	2.10	3.40	3.20	5.90

HYDROGRAPHS OF CLUSTER-IV

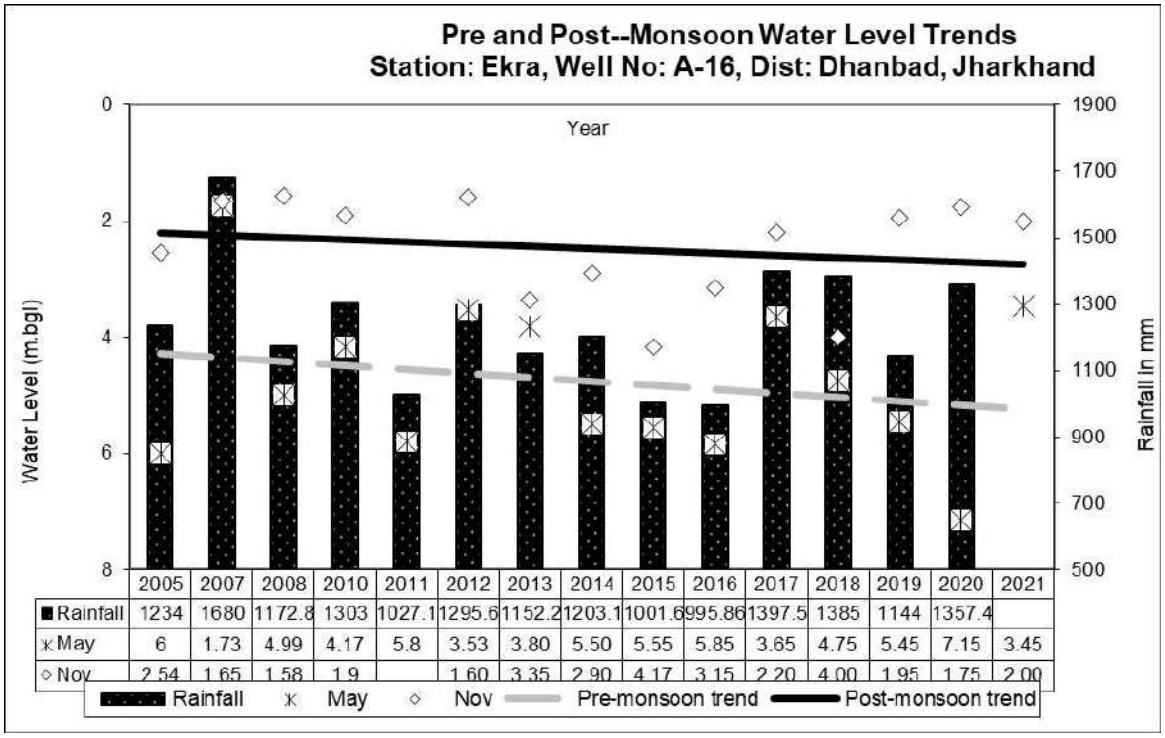


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	7.06	7.80	5.53	7.77	9.18	8.76	7.56	7.71	7.33	8.90	5.30	6.55	6.58	6.98	6.70
Nov	3.73	3.8	4.13	3.95		4.28	4.28	4.58	3.18	4.50	2.53	3.90	3.33	3.18	2.73

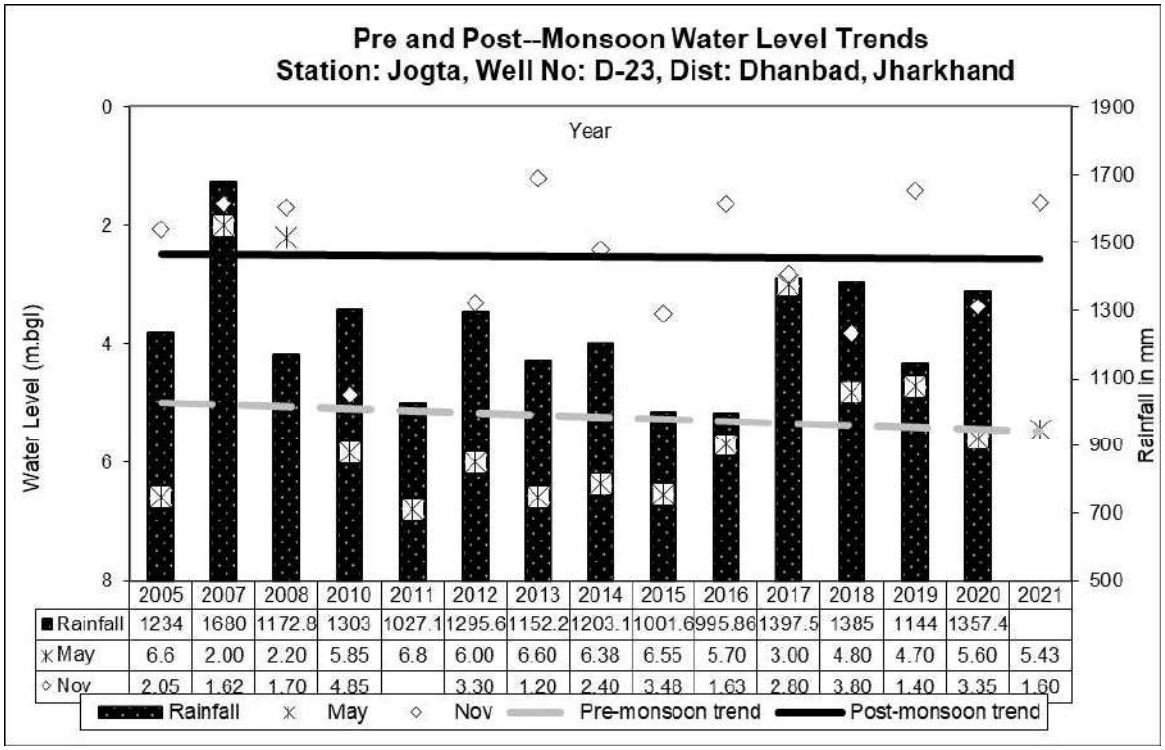


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May		11.53	11.45	9.65	11.45	10.11	10.45	7.82	7.15	9.05	10.98	11.05	9.23	9.03
Nov	2.80	3.35	3.39		1.73	1.83	2.40	5.87	2.68	1.25	3.35	0.95	2.30	1.42

HYDROGRAPHS OF CLUSTER-V

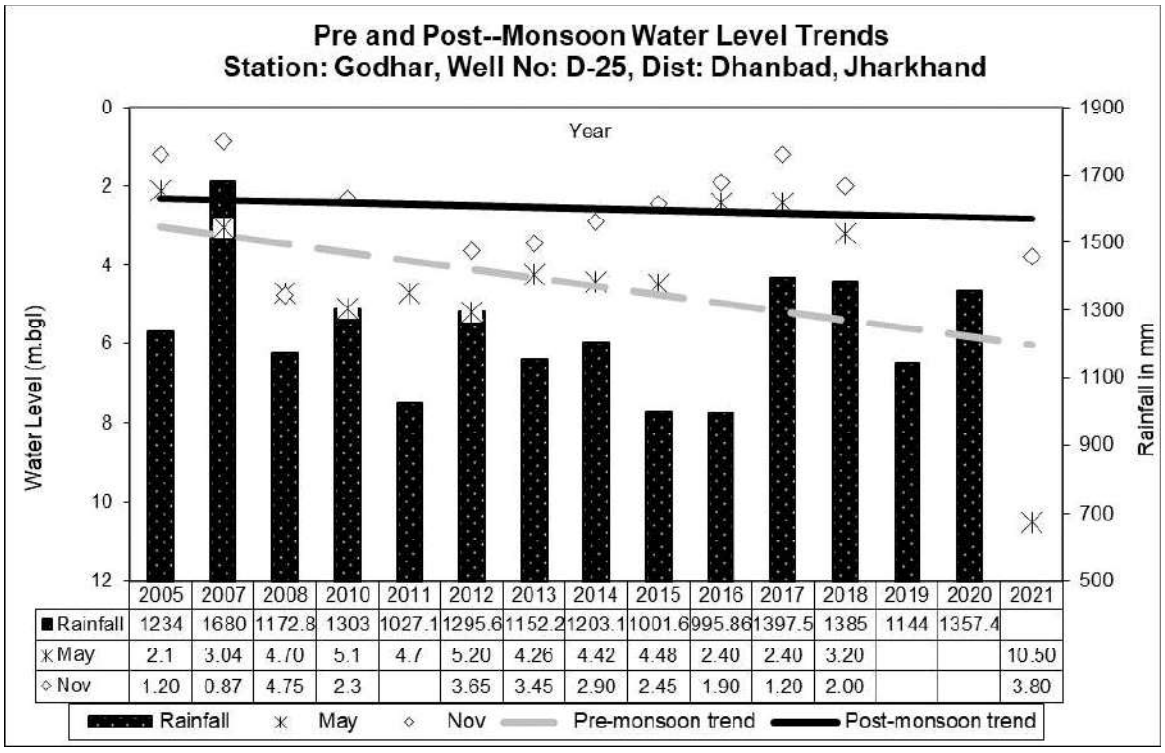


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	6	1.73	4.99	4.17	5.8	3.53	3.80	5.50	5.55	5.85	3.65	4.75	5.45	7.15	3.45
Nov	2.54	1.65	1.58	1.9		1.60	3.35	2.90	4.17	3.15	2.20	4.00	1.95	1.75	2.00

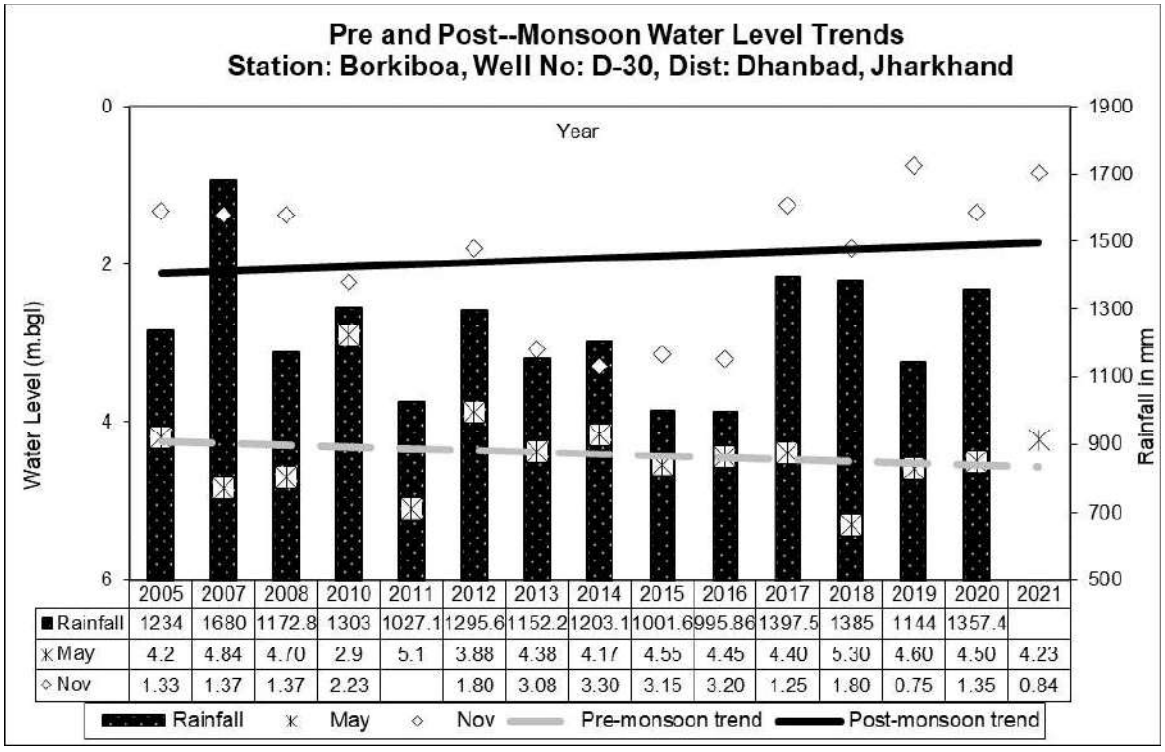


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	6.6	2.00	2.20	5.85	6.8	6.00	6.60	6.38	6.55	5.70	3.00	4.80	4.70	5.60	5.43
Nov	2.05	1.62	1.70	4.85		3.30	1.20	2.40	3.48	1.63	2.80	3.80	1.40	3.35	1.60

HYDROGRAPHS OF CLUSTER-VI

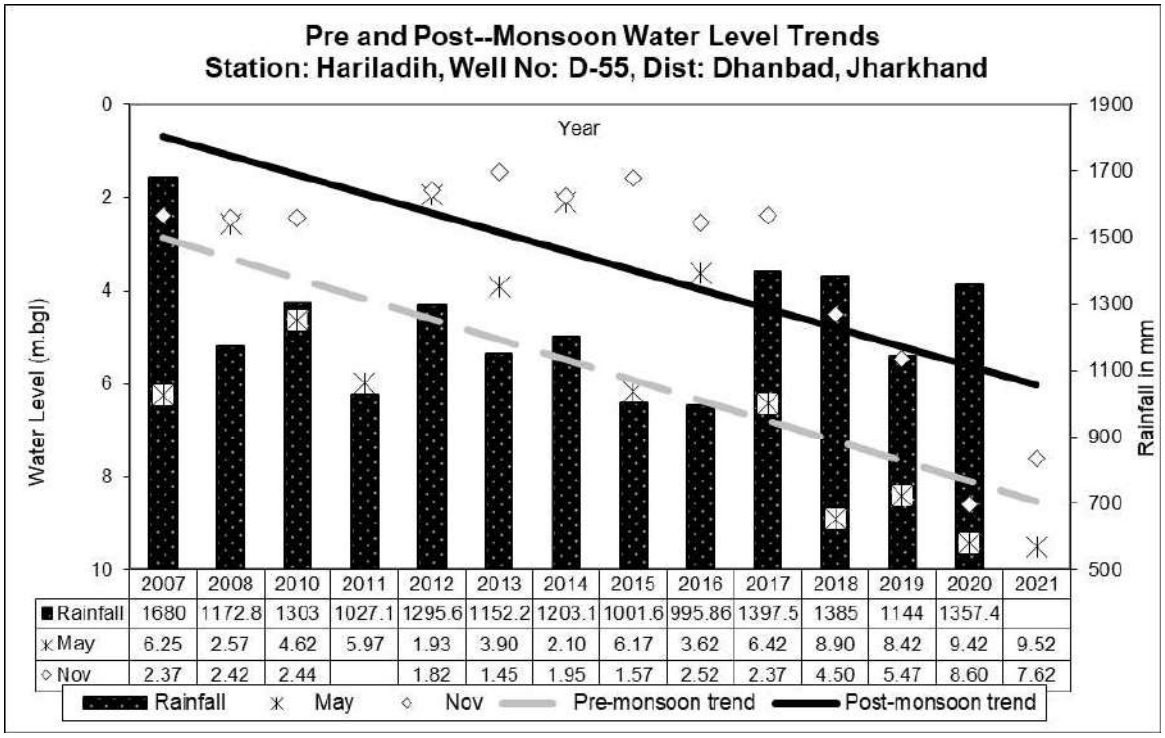


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	2.1	3.04	4.70	5.1	4.7	5.20	4.26	4.42	4.48	2.40	2.40	3.20			10.50
Nov	1.20	0.87	4.75	2.3		3.65	3.45	2.90	2.45	1.90	1.20	2.00			3.80

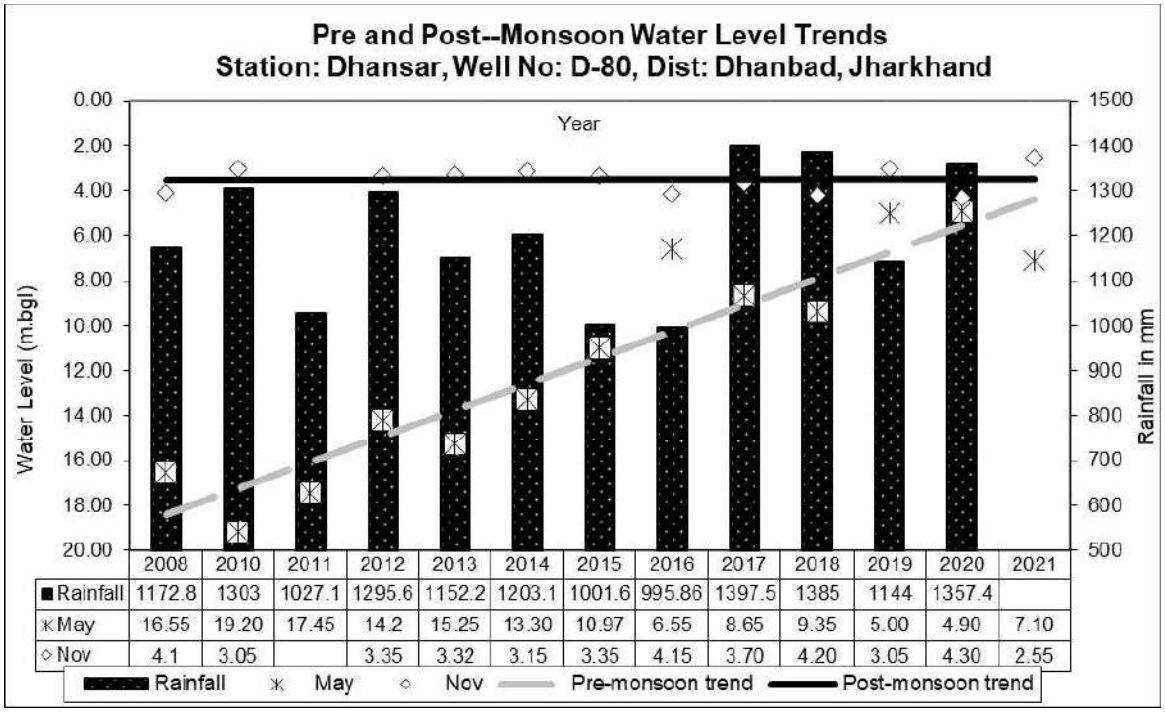


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	4.2	4.84	4.70	2.9	5.1	3.88	4.38	4.17	4.55	4.45	4.40	5.30	4.60	4.50	4.23
Nov	1.33	1.37	1.37	2.23		1.80	3.08	3.30	3.15	3.20	1.25	1.80	0.75	1.35	0.84

HYDROGRAPHS OF CLUSTER-VII

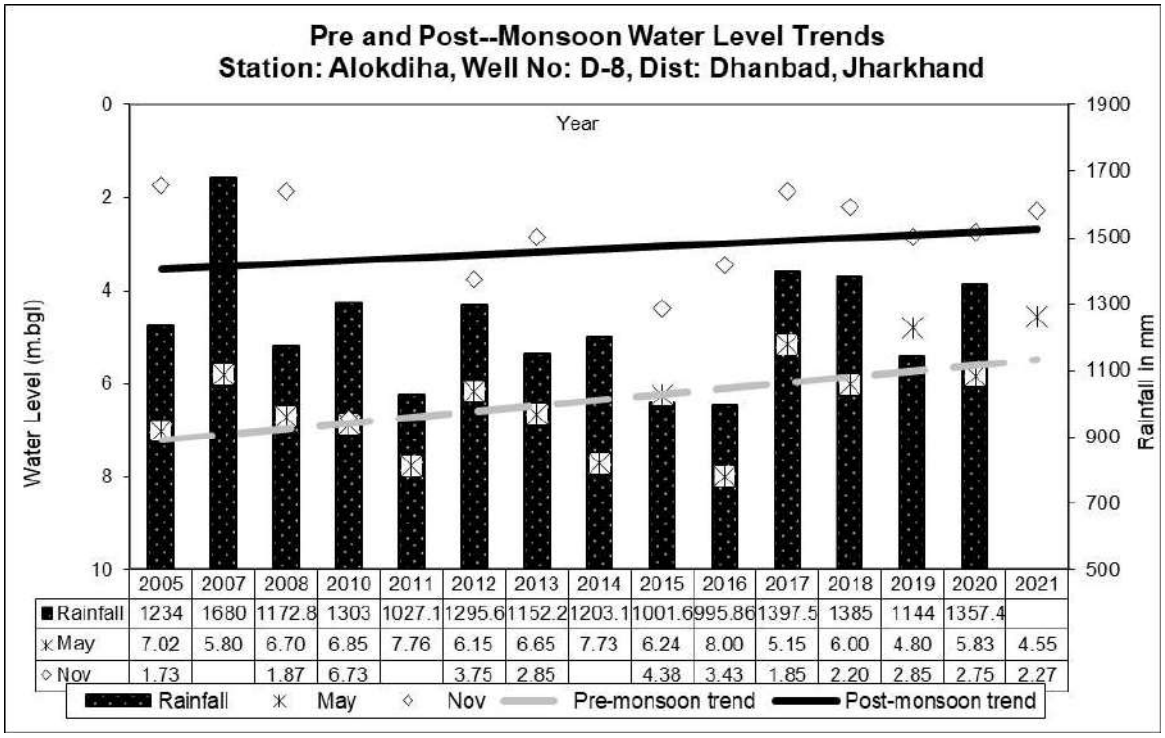


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	6.25	2.57	4.62	5.97	1.93	3.90	2.10	6.17	3.62	6.42	8.90	8.42	9.42	9.52
Nov	2.37	2.42	2.44		1.82	1.45	1.95	1.57	2.52	2.37	4.50	5.47	8.60	7.62

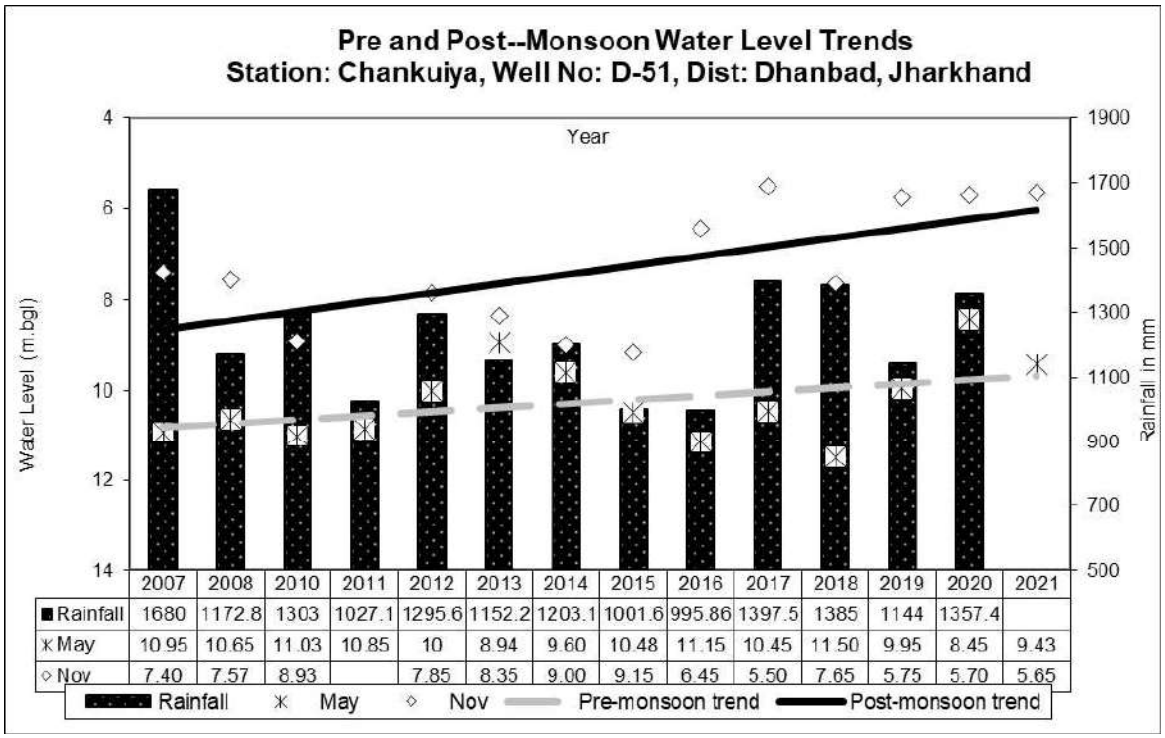


	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	16.55	19.20	17.45	14.2	15.25	13.30	10.97	6.55	8.65	9.35	5.00	4.90	7.10
Nov	4.1	3.05		3.35	3.32	3.15	3.35	4.15	3.70	4.20	3.05	4.30	2.55

HYDROGRAPHS OF CLUSTER-VIII

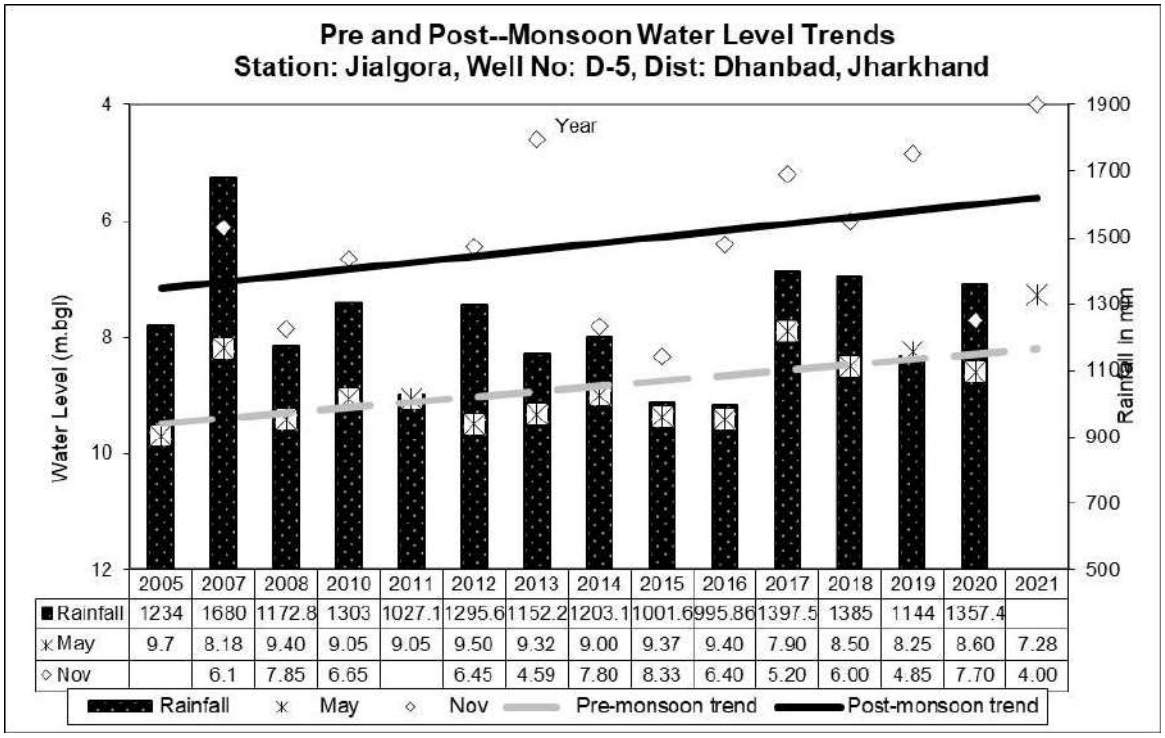


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	7.02	5.80	6.70	6.85	7.76	6.15	6.65	7.73	6.24	8.00	5.15	6.00	4.80	5.83	4.55
Nov	1.73		1.87	6.73		3.75	2.85		4.38	3.43	1.85	2.20	2.85	2.75	2.27

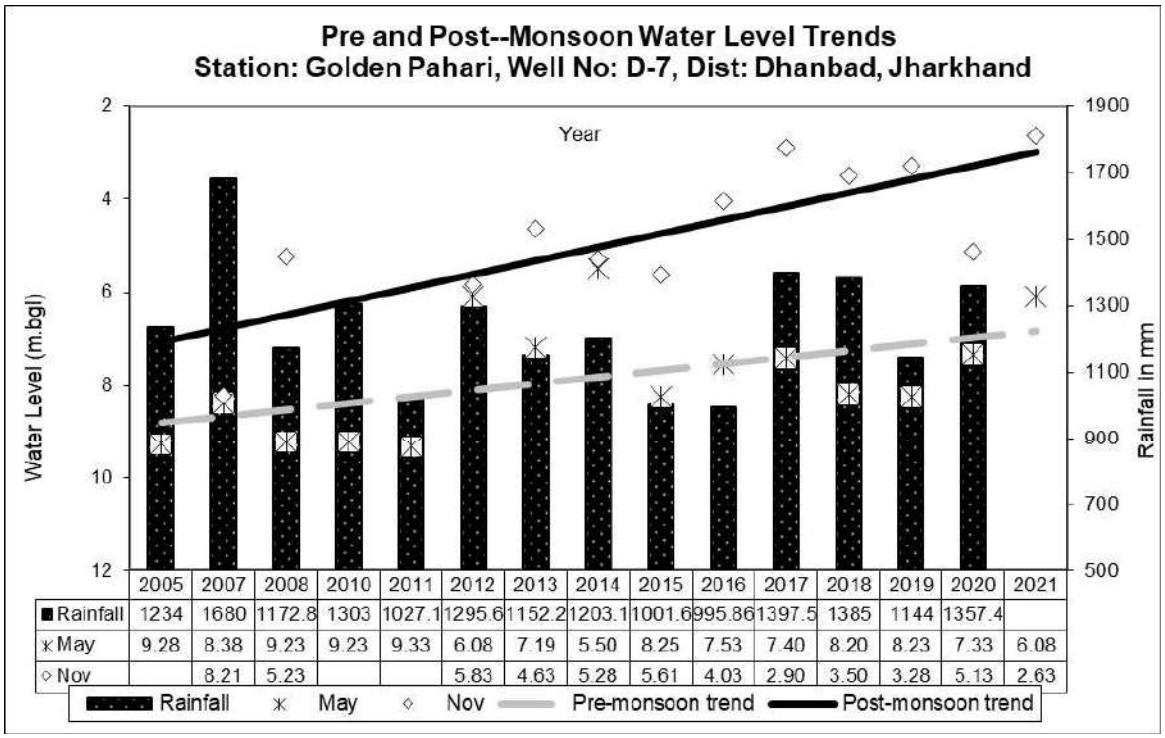


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	10.95	10.65	11.03	10.85	10	8.94	9.60	10.48	11.15	10.45	11.50	9.95	8.45	9.43
Nov	7.40	7.57	8.93		7.85	8.35	9.00	9.15	6.45	5.50	7.65	5.75	5.70	5.65

HYDROGRAPHS OF CLUSTER-IX

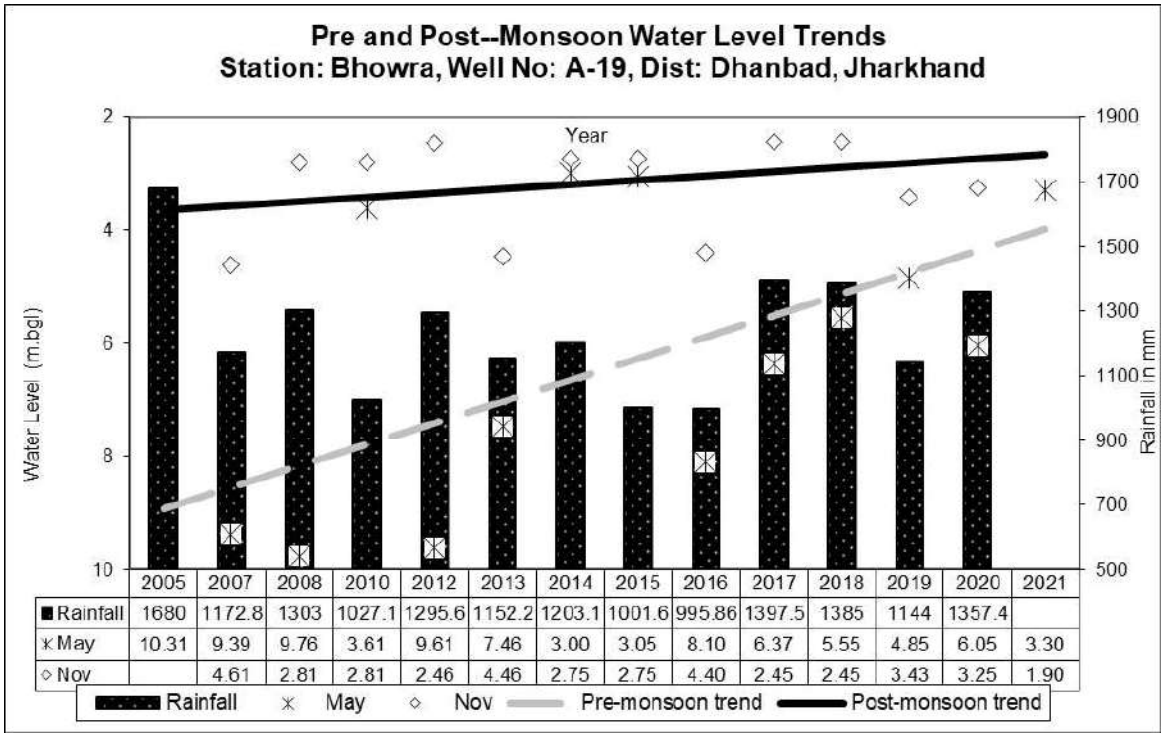


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	9.7	8.18	9.40	9.05	9.05	9.50	9.32	9.00	9.37	9.40	7.90	8.50	8.25	8.60	7.28
Nov		6.1	7.85	6.65		6.45	4.59	7.80	8.33	6.40	5.20	6.00	4.85	7.70	4.00

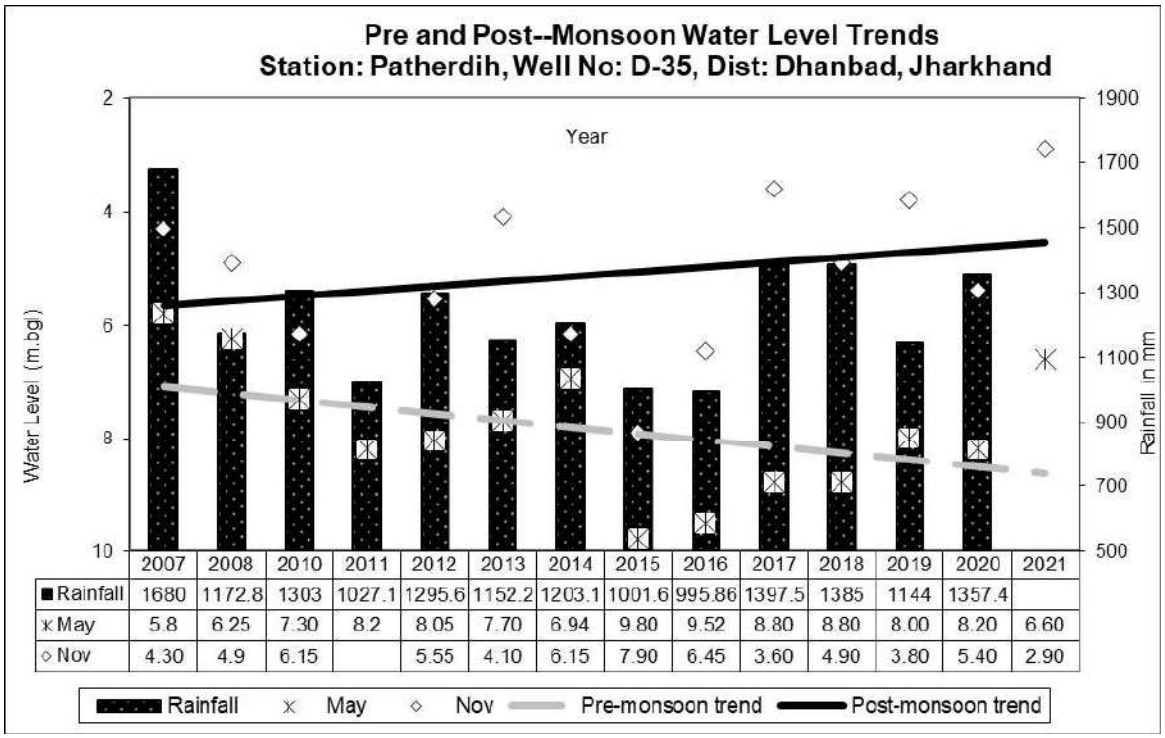


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	9.28	8.38	9.23	9.23	9.33	6.08	7.19	5.50	8.25	7.53	7.40	8.20	8.23	7.33	6.08
Nov		8.21	5.23			5.83	4.63	5.28	5.61	4.03	2.90	3.50	3.28	5.13	2.63

HYDROGRAPHS OF CLUSTER-X

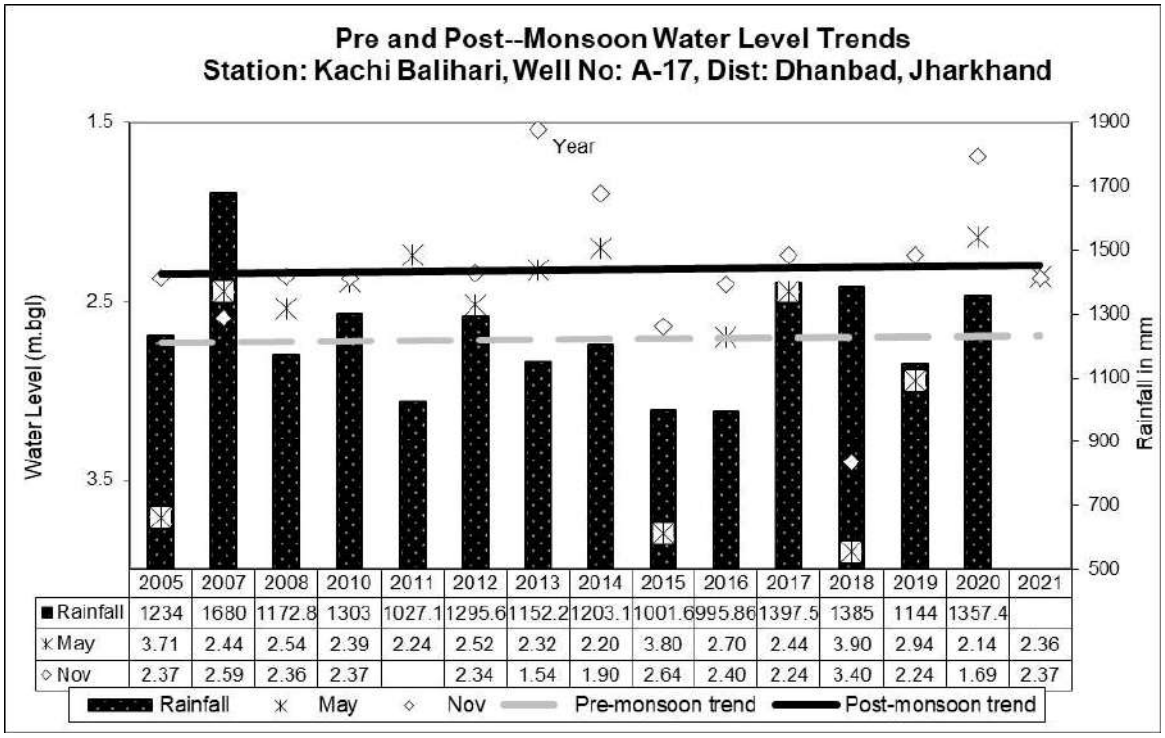


	2005	2007	2008	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	10.31	9.39	9.76	3.61	9.61	7.46	3.00	3.05	8.10	6.37	5.55	4.85	6.05	3.30
Nov		4.61	2.81	2.81	2.46	4.46	2.75	2.75	4.40	2.45	2.45	3.43	3.25	1.90

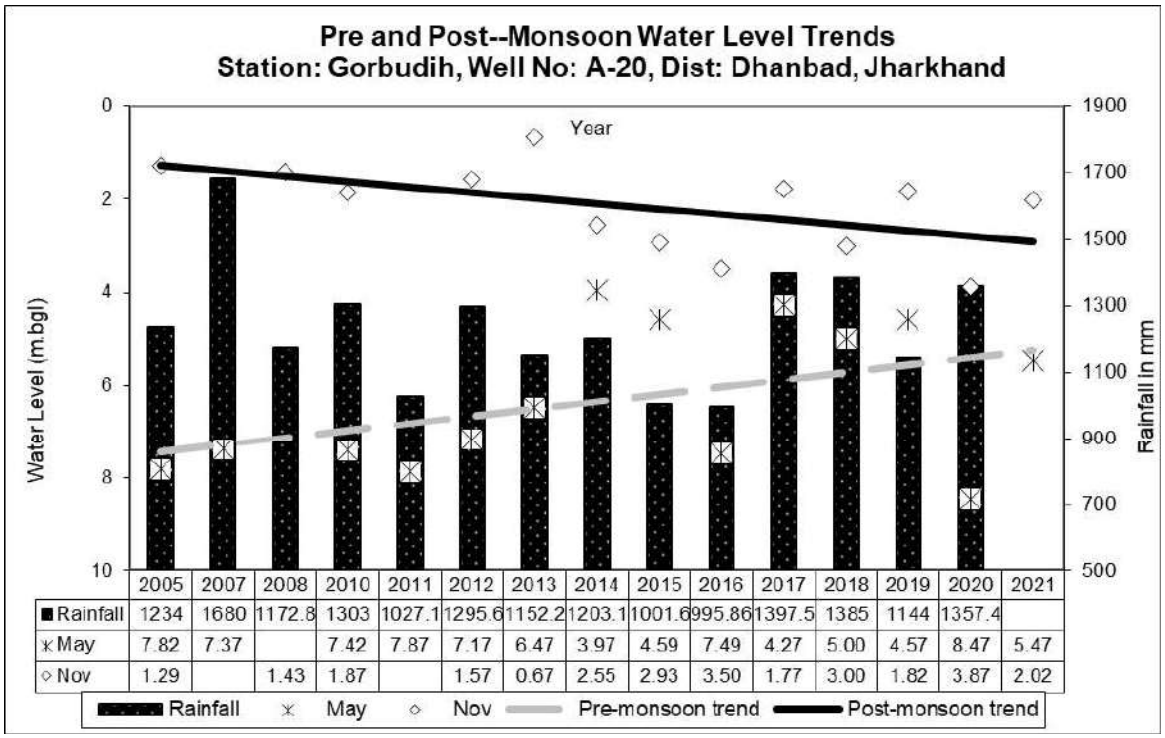


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	5.8	6.25	7.30	8.2	8.05	7.70	6.94	9.80	9.52	8.80	8.80	8.00	8.20	6.60
Nov	4.30	4.9	6.15		5.55	4.10	6.15	7.90	6.45	3.60	4.90	3.80	5.40	2.90

HYDROGRAPHS OF CLUSTER-XI

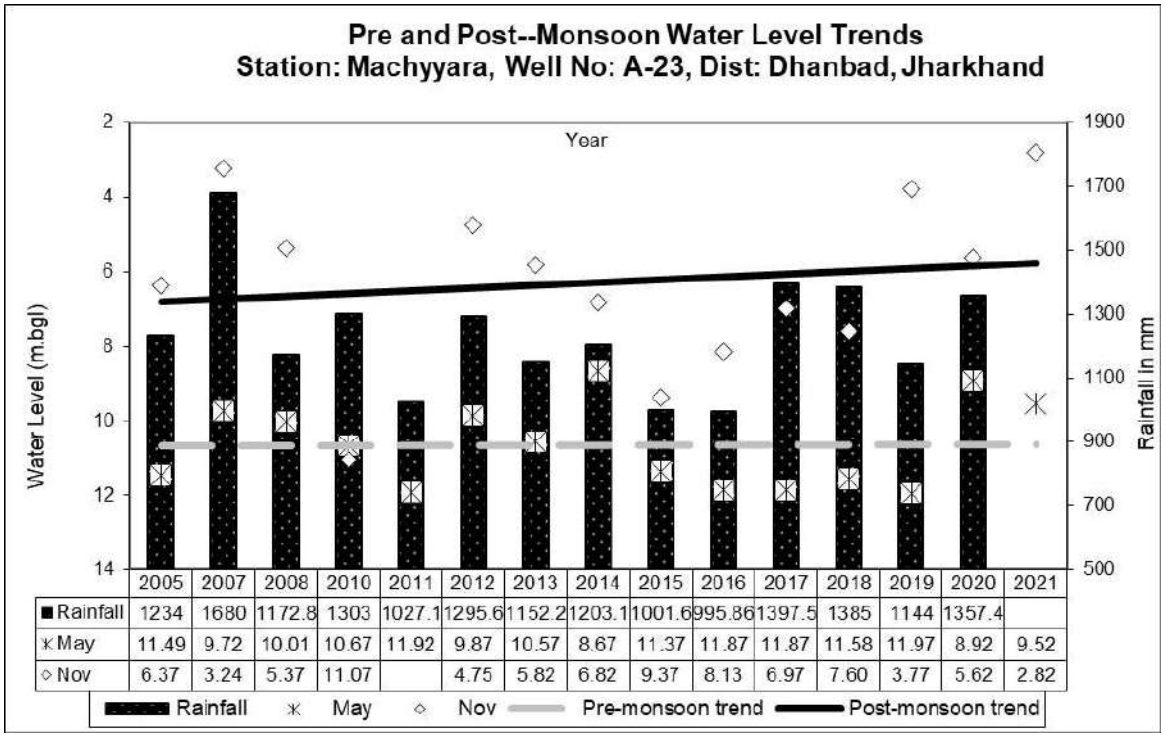


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	3.71	2.44	2.54	2.39	2.24	2.52	2.32	2.20	3.80	2.70	2.44	3.90	2.94	2.14	2.36
Nov	2.37	2.59	2.36	2.37		2.34	1.54	1.90	2.64	2.40	2.24	3.40	2.24	1.69	2.37

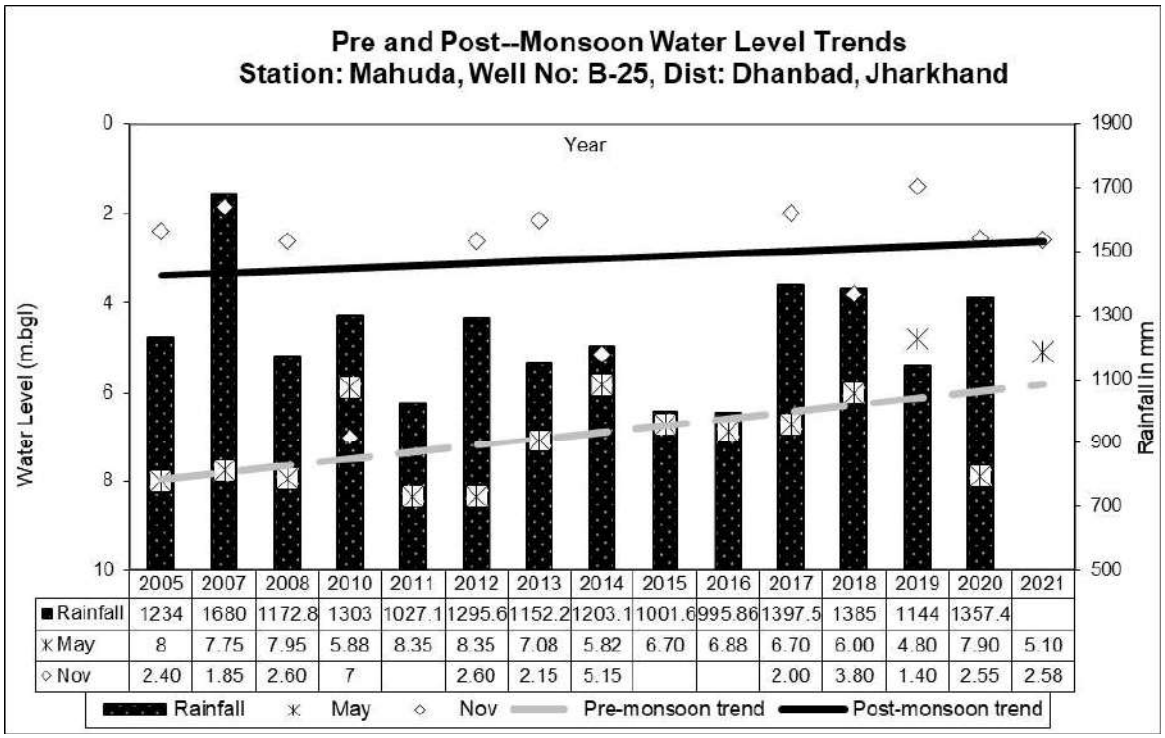


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	7.82	7.37		7.42	7.87	7.17	6.47	3.97	4.59	7.49	4.27	5.00	4.57	8.47	5.47
Nov	1.29		1.43	1.87		1.57	0.67	2.55	2.93	3.50	1.77	3.00	1.82	3.87	2.02

HYDROGRAPHS OF CLUSTER-XIII

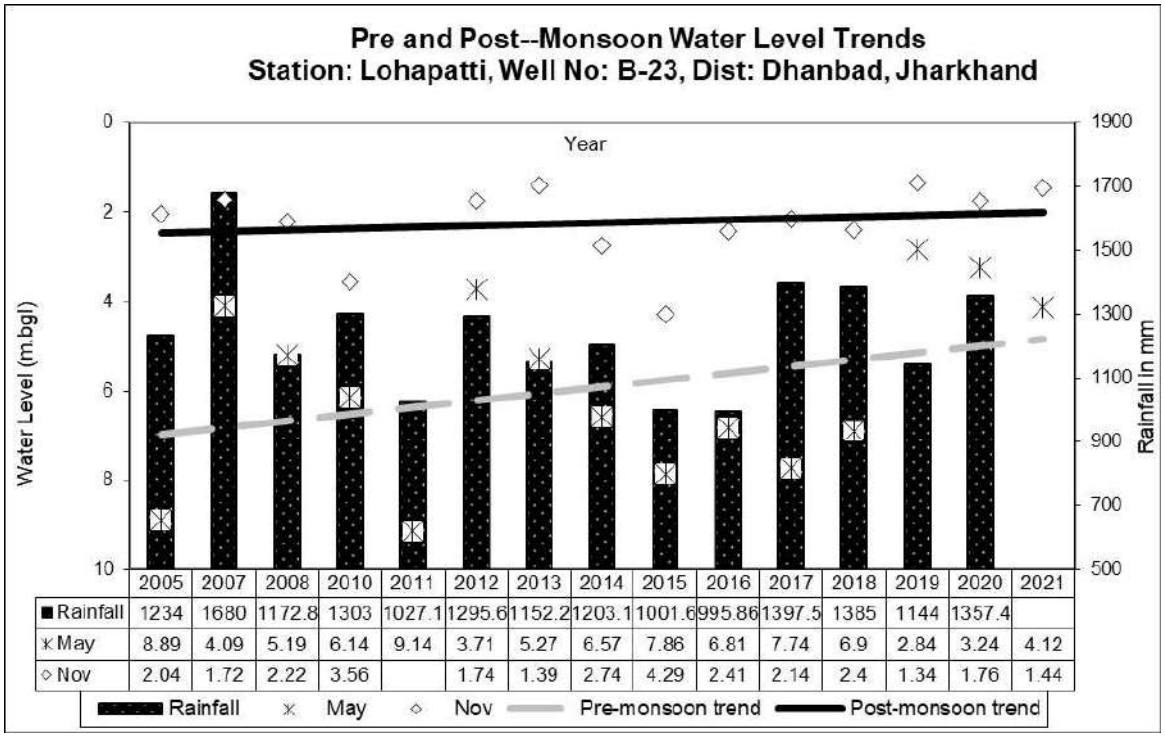


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	11.49	9.72	10.01	10.67	11.92	9.87	10.57	8.67	11.37	11.87	11.87	11.58	11.97	8.92	9.52
Nov	6.37	3.24	5.37	11.07		4.75	5.82	6.82	9.37	8.13	6.97	7.60	3.77	5.62	2.82

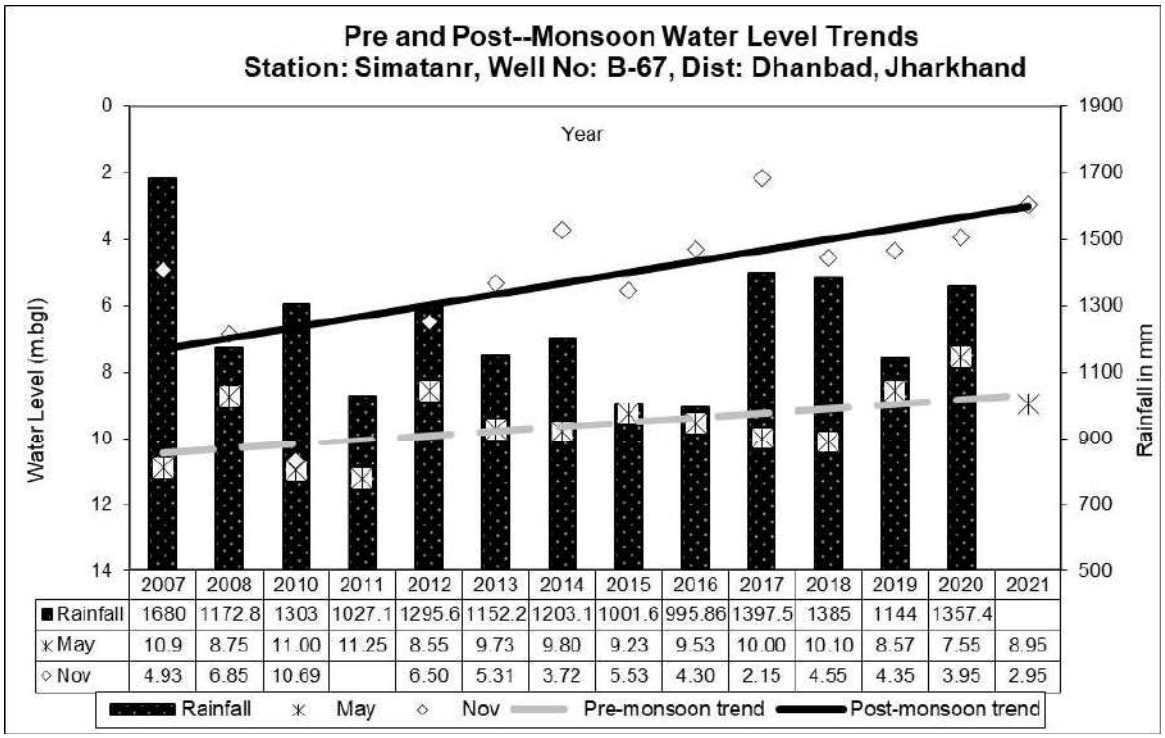


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	8	7.75	7.95	5.88	8.35	8.35	7.08	5.82	6.70	6.88	6.70	6.00	4.80	7.90	5.10
Nov	2.40	1.85	2.60	7		2.60	2.15	5.15			2.00	3.80	1.40	2.55	2.58

HYDROGRAPHS OF CLUSTER-XIV

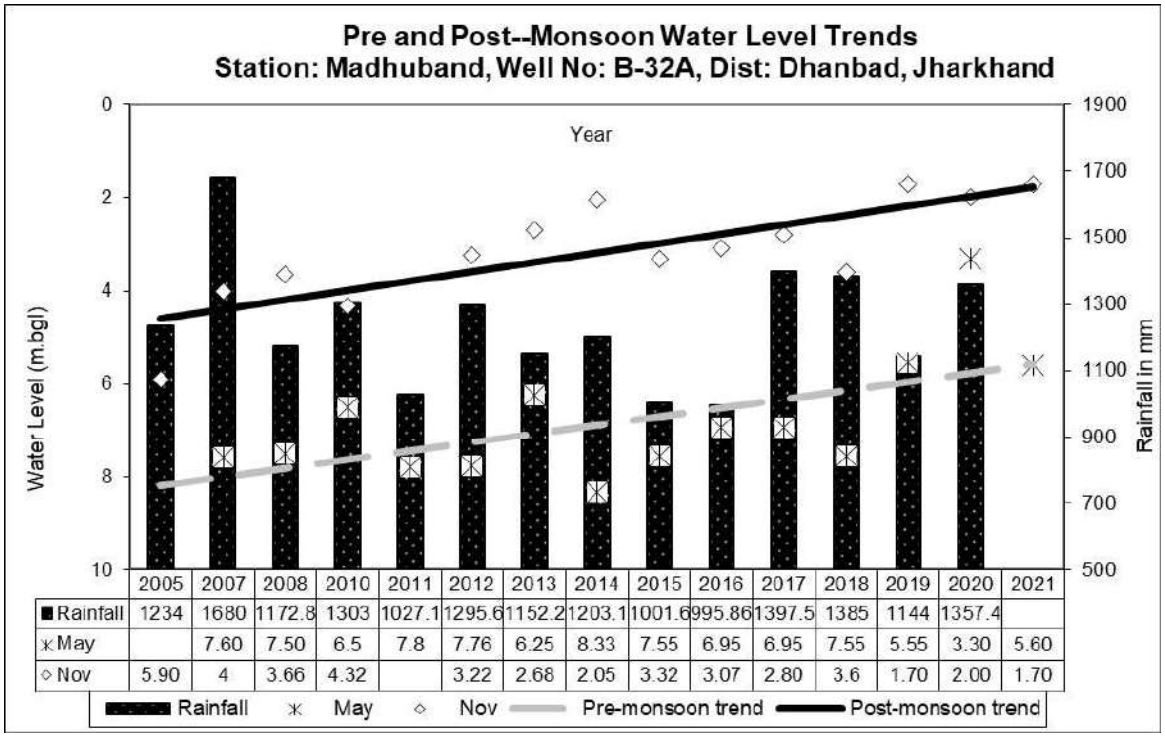


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	8.89	4.09	5.19	6.14	9.14	3.71	5.27	6.57	7.86	6.81	7.74	6.9	2.84	3.24	4.12
Nov	2.04	1.72	2.22	3.56		1.74	1.39	2.74	4.29	2.41	2.14	2.4	1.34	1.76	1.44

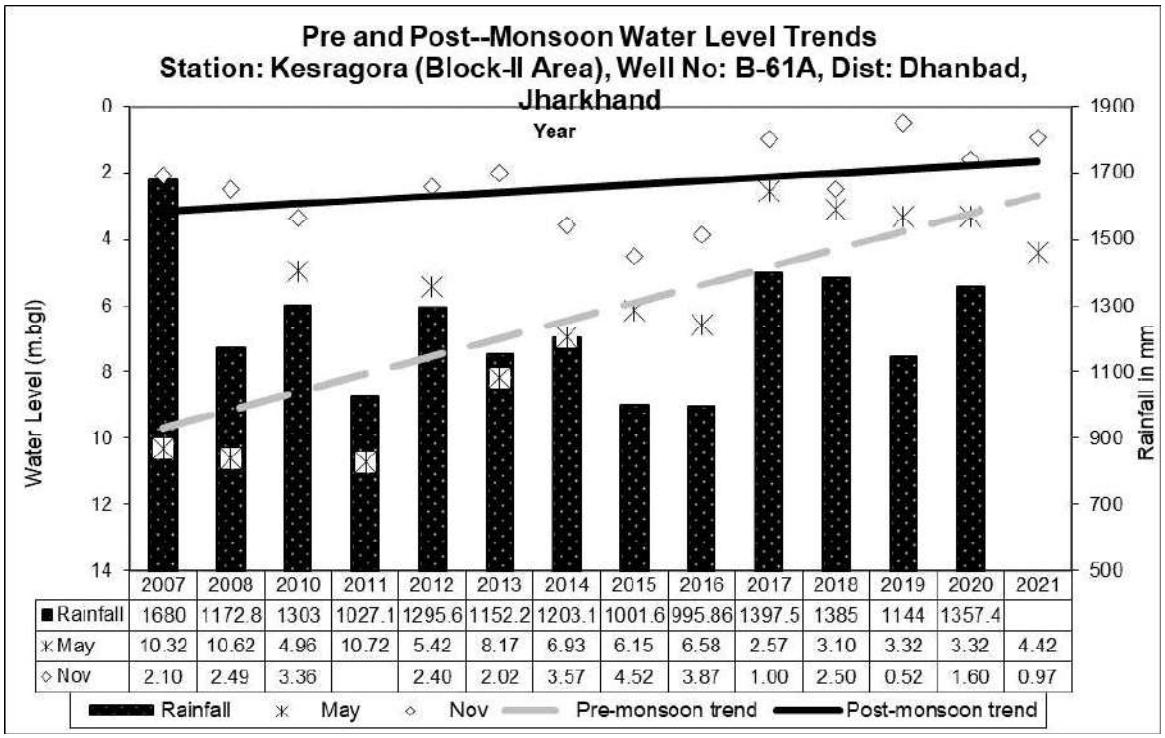


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	10.9	8.75	11.00	11.25	8.55	9.73	9.80	9.23	9.53	10.00	10.10	8.57	7.55	8.95
Nov	4.93	6.85	10.69		6.50	5.31	3.72	5.53	4.30	2.15	4.55	4.35	3.95	2.95

HYDROGRAPHS OF CLUSTER-XV

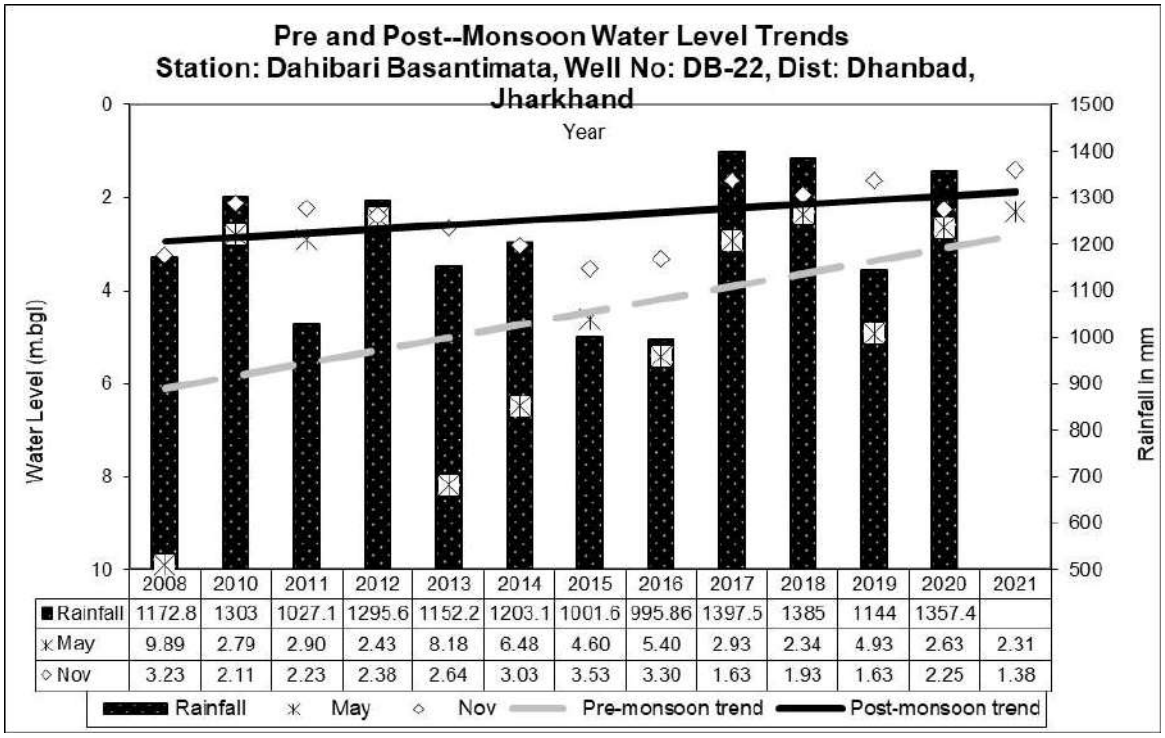


	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May		7.60	7.50	6.5	7.8	7.76	6.25	8.33	7.55	6.95	6.95	7.55	5.55	3.30	5.60
Nov	5.90	4	3.66	4.32		3.22	2.68	2.05	3.32	3.07	2.80	3.6	1.70	2.00	1.70

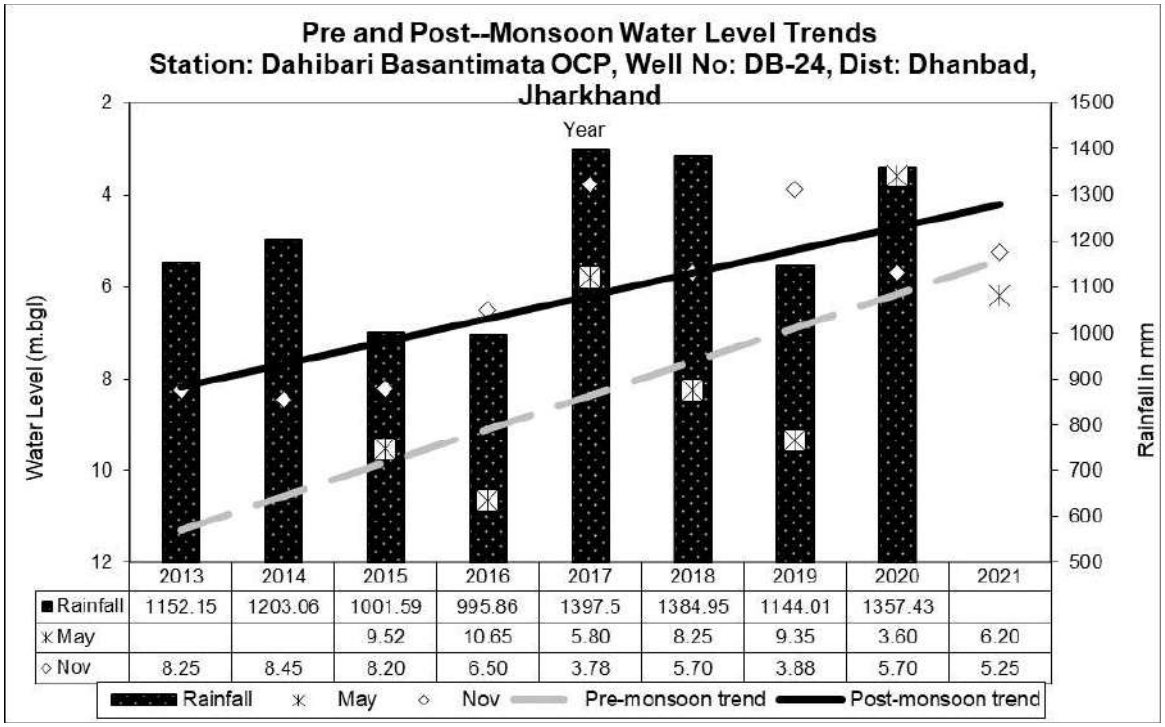


	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	10.32	10.62	4.96	10.72	5.42	8.17	6.93	6.15	6.58	2.57	3.10	3.32	3.32	4.42
Nov	2.10	2.49	3.36		2.40	2.02	3.57	4.52	3.87	1.00	2.50	0.52	1.60	0.97

HYDROGRAPHS OF CLUSTER-XVI

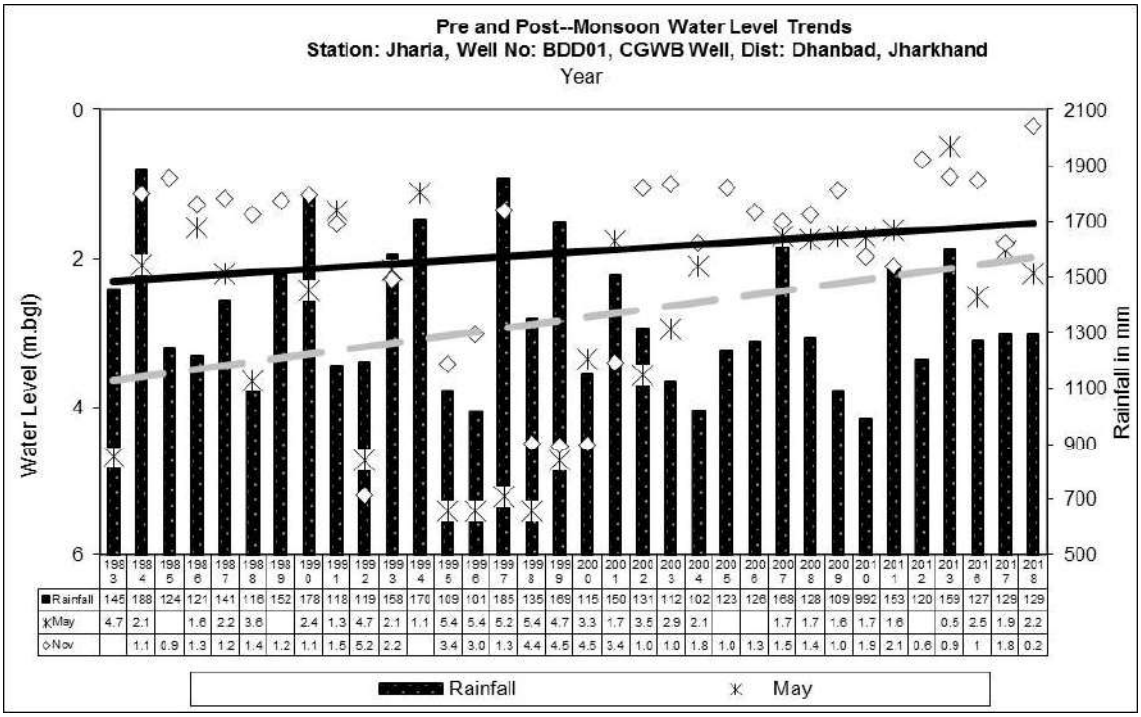


	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4	
May	9.89	2.79	2.90	2.43	8.18	6.48	4.60	5.40	2.93	2.34	4.93	2.63	2.31
Nov	3.23	2.11	2.23	2.38	2.64	3.03	3.53	3.30	1.63	1.93	1.63	2.25	1.38

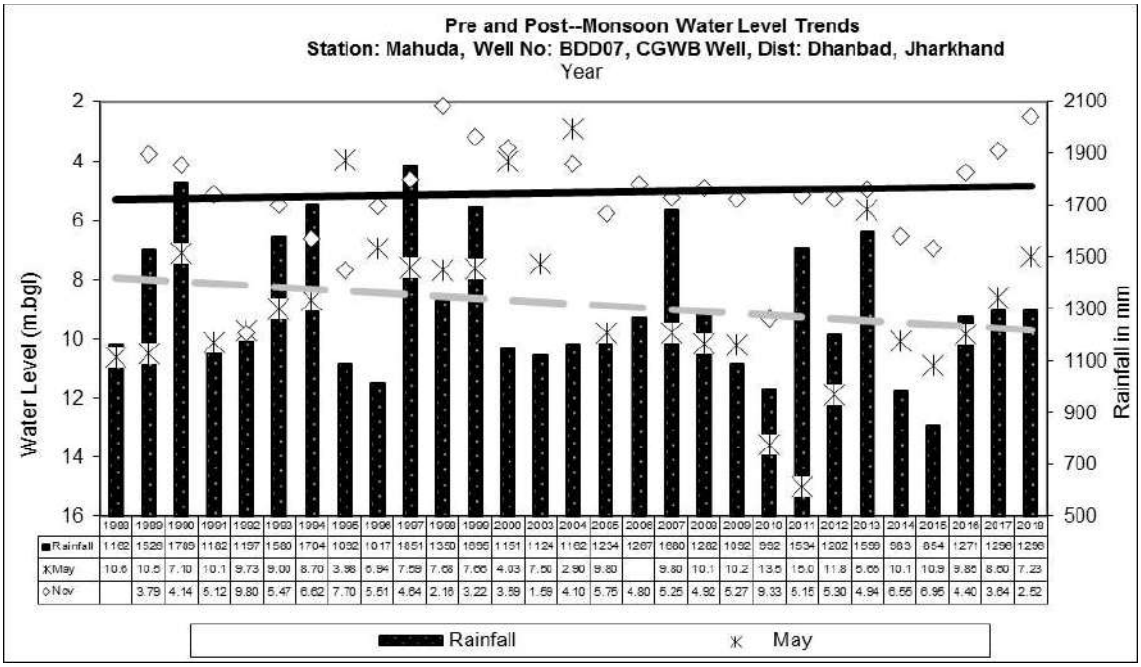


	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall	1152.15	1203.06	1001.59	995.86	1397.5	1384.95	1144.01	1357.43	
May			9.52	10.65	5.80	8.25	9.35	3.60	6.20
Nov	8.25	8.45	8.20	6.50	3.78	5.70	3.88	5.70	5.25

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS

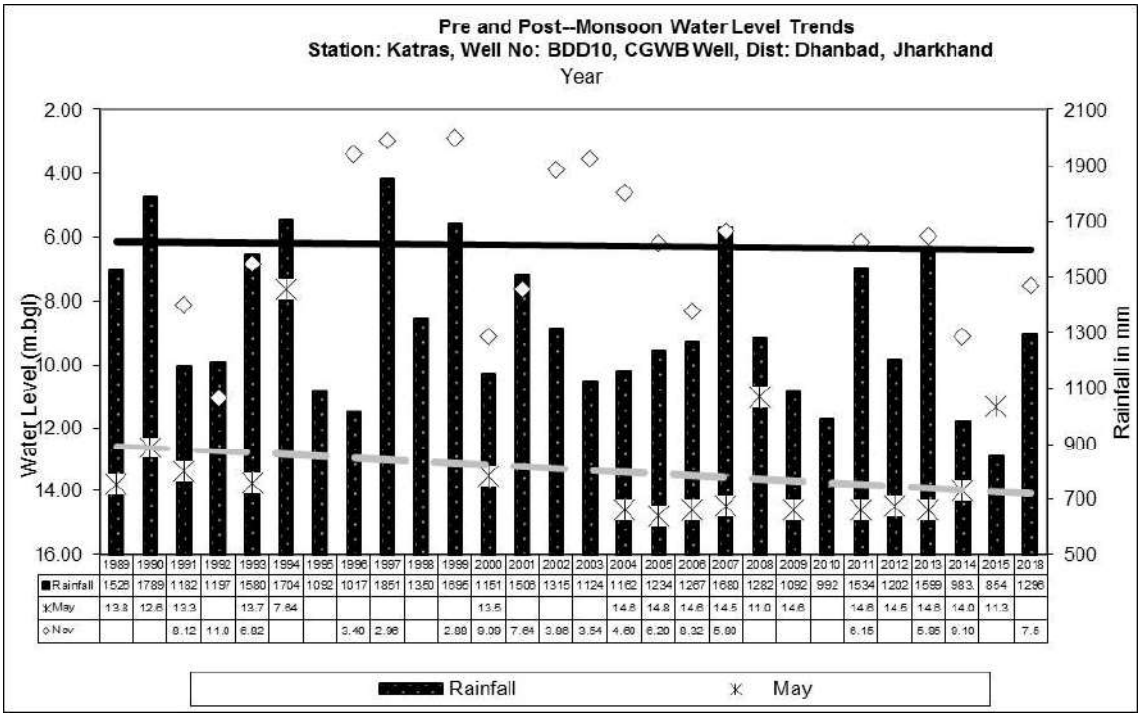


	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	145	188	124	121	141	116	152	178	118	119	158	170	109	101	185	135	169	115	150	131	112	102	123	126	168	128	109	992	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		

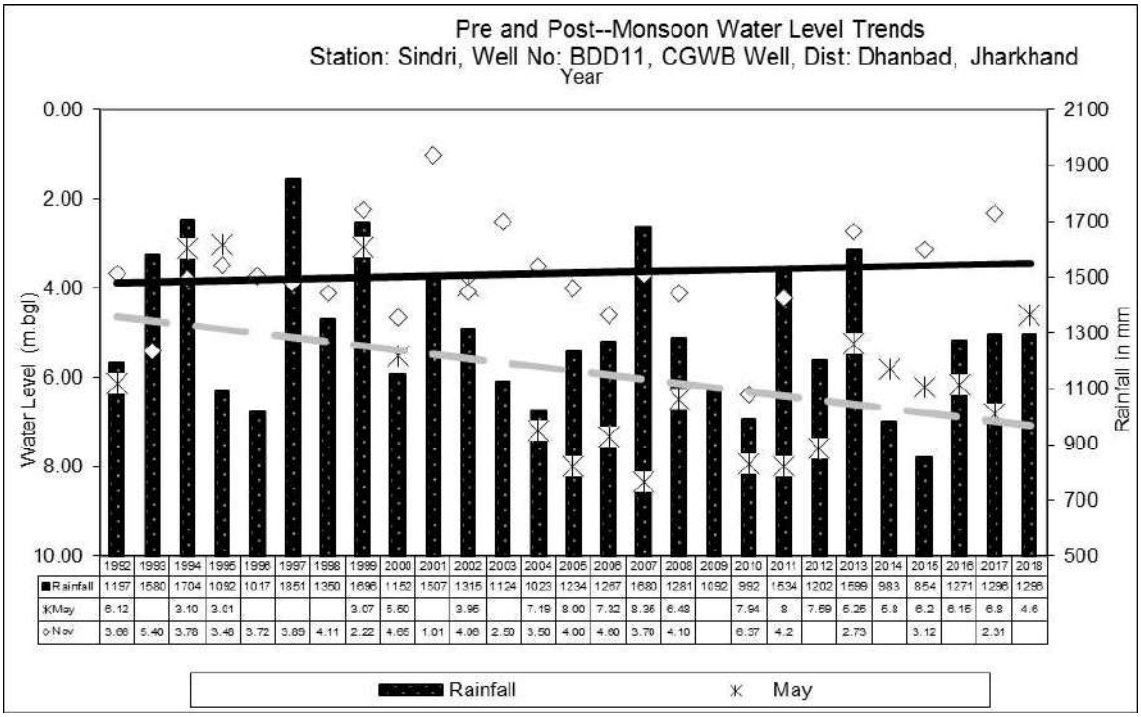


	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1162	1528	1785	1162	1157	1580	1704	1032	1017	1651	1350	1695	1151	1124	1162	1234	1267	1680	1262	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	10.6	10.5	7.10	10.1	9.73	9.09	8.70	3.98	6.94	7.59	7.06	7.06	4.03	7.50	2.90	9.80		9.80	10.1	10.2	13.5	15.0	11.8	5.66	10.1	10.9	9.86	8.50	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	2016
Rainfall	1528	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1505	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				14.8	14.8	14.6	14.5	11.0	14.6		14.8	14.5	14.8	14.0	11.3	
Nov			8.12	11.8	6.82			3.40	2.96		2.89	9.09	7.64	3.98	3.54	4.89	6.20	8.32	5.89				6.15		5.85	9.10		7.8



	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	5.60		3.95		7.19	8.00	7.32	8.36	6.48		7.94	8	7.69	5.26	6.8	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	2.59	3.50	4.00	4.60	3.79	4.10		6.37	4.2		2.73		3.12		2.31	

Annexure – VII

GROUNDWATER SAMPLE LOCATION DETAILS

Sampling month: June month of the assessment year of 2021-22

Sl No	Name of Cluster	Ground Water Sample	Dug well (CMPDI)	Location	Sampling Date
					June'2021
1	CLUSTER-I	GW-1	B-15	BERA VILLAGE	16.06.2021
2	CLUSTER-II	GW-2	B-59	KHODOVALY VILLAGE	16.06.2021
3	CLUSTER-III	GW-3	A-29	GOVINDPUR,AMBAGAN VILLAGE	16.06.2021
4	CLUSTER-IV	GW-4	B-64	KESHALPUR, BATIGHAR	16.06.2021
5	CLUSTER-V	GW-5	D-30	BORKIBOA VILLAGE	16.06.2021
6	CLUSTER-VI	GW-6	D-25	GODHUR MORE	16.06.2021
7	CLUSTER-VII	GW-7	D-80	DHANSAR MINE RESCUE STN.	16.06.2021
8	CLUSTER-VIII	GW-8	D-49	NEAR GHANOODIH OC	15.06.2021
9	CLUSTER-IX	GW-9	D-5	JEALGORA, NEAR P.O.	15.06.2021
10	CLUSTER-X	GW-10	D-35	PATHERDIH RLY. COLONY	15.06.2021
11	CLUSTER-XI	GW-11	A-32	MONNIDIH BAZAR	16.06.2021
12	CLUSTER-XIII	GW-13	A-23	MACHHAYARA	16.06.2021
13	CLUSTER-XIV	GW-14	B-23	LOHAPATTI VILLAGE	16.06.2021
14	CLUSTER-XV	GW-15	B-32A	MADHUBAND VILLAGE	16.06.2021
15	CLUSTER-XVI	GW-16	DB-22	DAHIBARI,NICHE BASTI	15.06.2021

WATER QUALITY
(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW1 16.06.2021	GW2 16.06.2021	GW3 16.06.2021			
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	2	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	41	84	127	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	47	78	124	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	0.77	0.71	0.59	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.004	<0.004	<0.004	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	0.28	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	0.24	<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	9.62	7.03	14.76	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Aggreable	Aggreable	Aggreable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.72	7.85	7.91	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	31	64	42	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	105	121	137	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	<0.004	<0.004	<0.004	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	425	510	622	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	226	384	487	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2	2	3	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: 2021-22

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW4 16.06.2021	GW5 16.06.2021	GW6 16.06.2021			
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	3	3	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	49	122	78	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	74	132	60	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	0.50	0.83	0.80	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	0.41	<0.2	0.32	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	0.16	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	11.32	29.01	14.21	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	8.03	7.65	7.77	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	54	148	58	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	103	119	139	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	455	659	522	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	281	531	329	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	4	2	2	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	0.18	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: 2021-22

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW7 16.06.2021	GW8 15.06.2021	GW9 15.06.2021			
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	2	2	3	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	117	65	139	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	97	85	124	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	0.44	0.68	0.75	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	16.27	11.81	25.78	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	7.71	7.35	7.86	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	75	35	159	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	182	115	135	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	783	724	889	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	440	309	554	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	1	5	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: 2021-22

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW10 15.06.2021	GW11 16.06.2021	GW13 16.06.2021			
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	2	3	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	82	54	158	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	80	39	103	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	0.54	0.60	0.43	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	0.18	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	17.24	11.47	9.23	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	7.75	8.15	8.05	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	99	44	183	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	119	178	115	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	666	578	782	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_ac_{03}), mg/l, Max	356	246	566	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	3	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

WATER QUALITY
(GROUND WATER- ALL PARAMETERS)

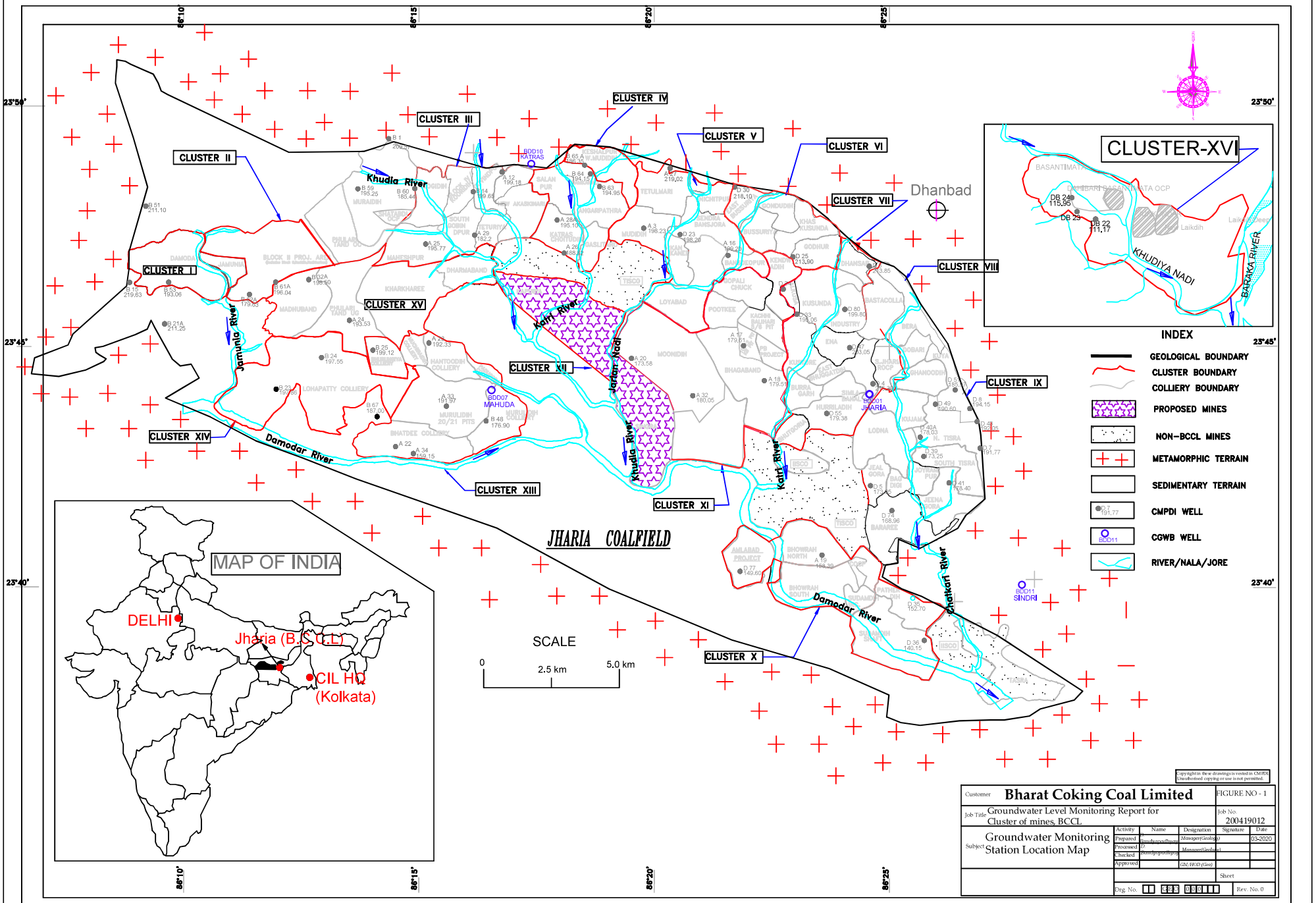
Year: 2021-22

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW14 16.06.2021	GW15 16.06.2021	GW16 15.06.2021			
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	2	2	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	52	101	154	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	54	136	119	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	0.61	0.78	0.55	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	0.10	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	14.83	9.44	15.73	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	8.06	7.95	7.86	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	58	142	187	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_{O3}),, mg/l, Max	101	127	155	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	569	766	807	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_ac_{O3}), mg/l, Max	309	539	638	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2	3	3	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	0.1	0.84	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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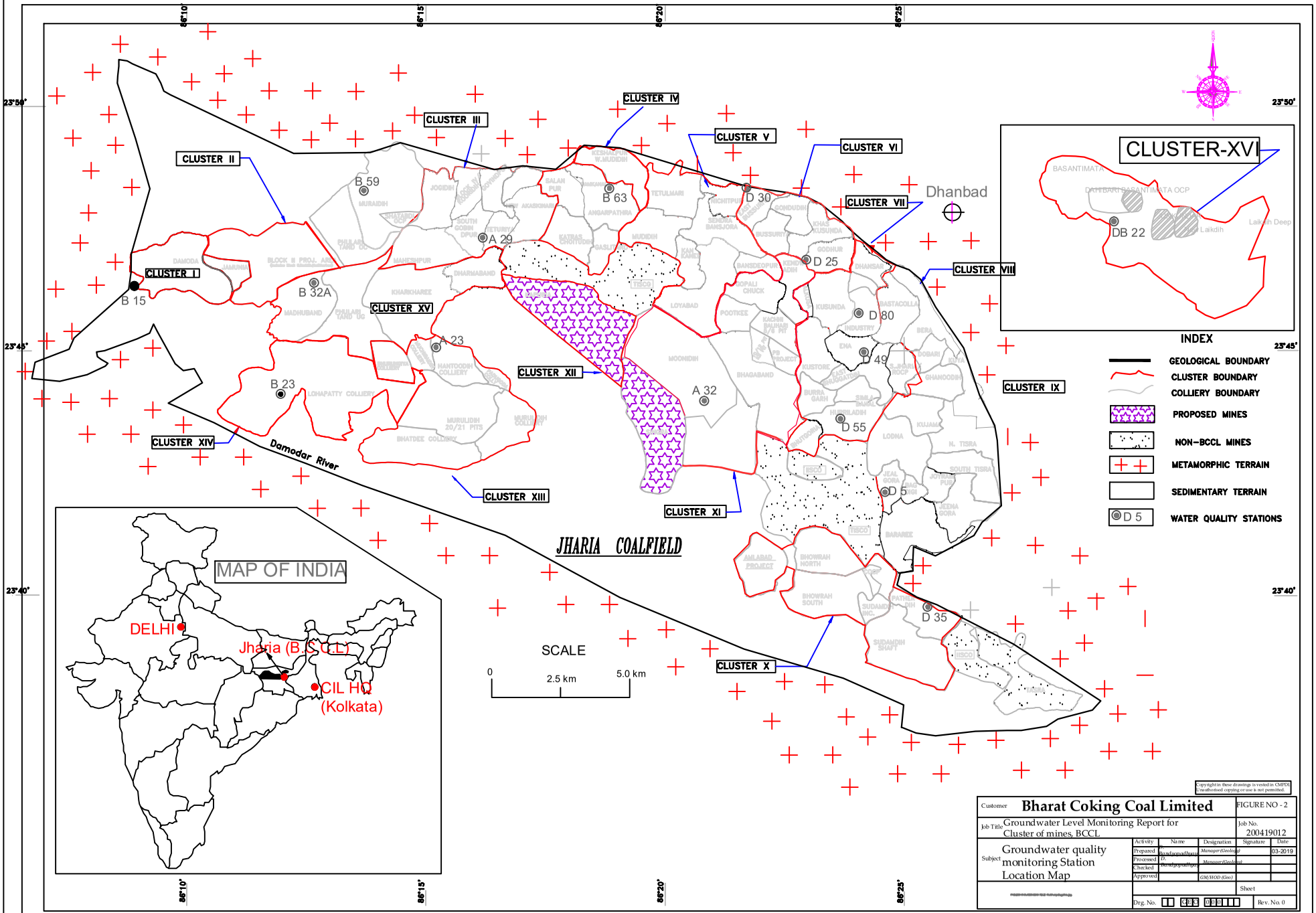
Customer	**Bharat Coking Coal Limited**		FIGURE NO - 1
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL		Job No. 200419012
Subject	Groundwater Monitoring Station Location Map		

Activity	Name	Designation	Signature	Date
Prepared		Manager(Geology)		03-2020
Processed		Manager(Geology)		
Checked				
Approved		GM/HOD (Geo)		

Sheet

Drg. No. [redacted] Rev. No. 0

GROUNDWATER QUALITY MONITORING STATION LOCATION MAP



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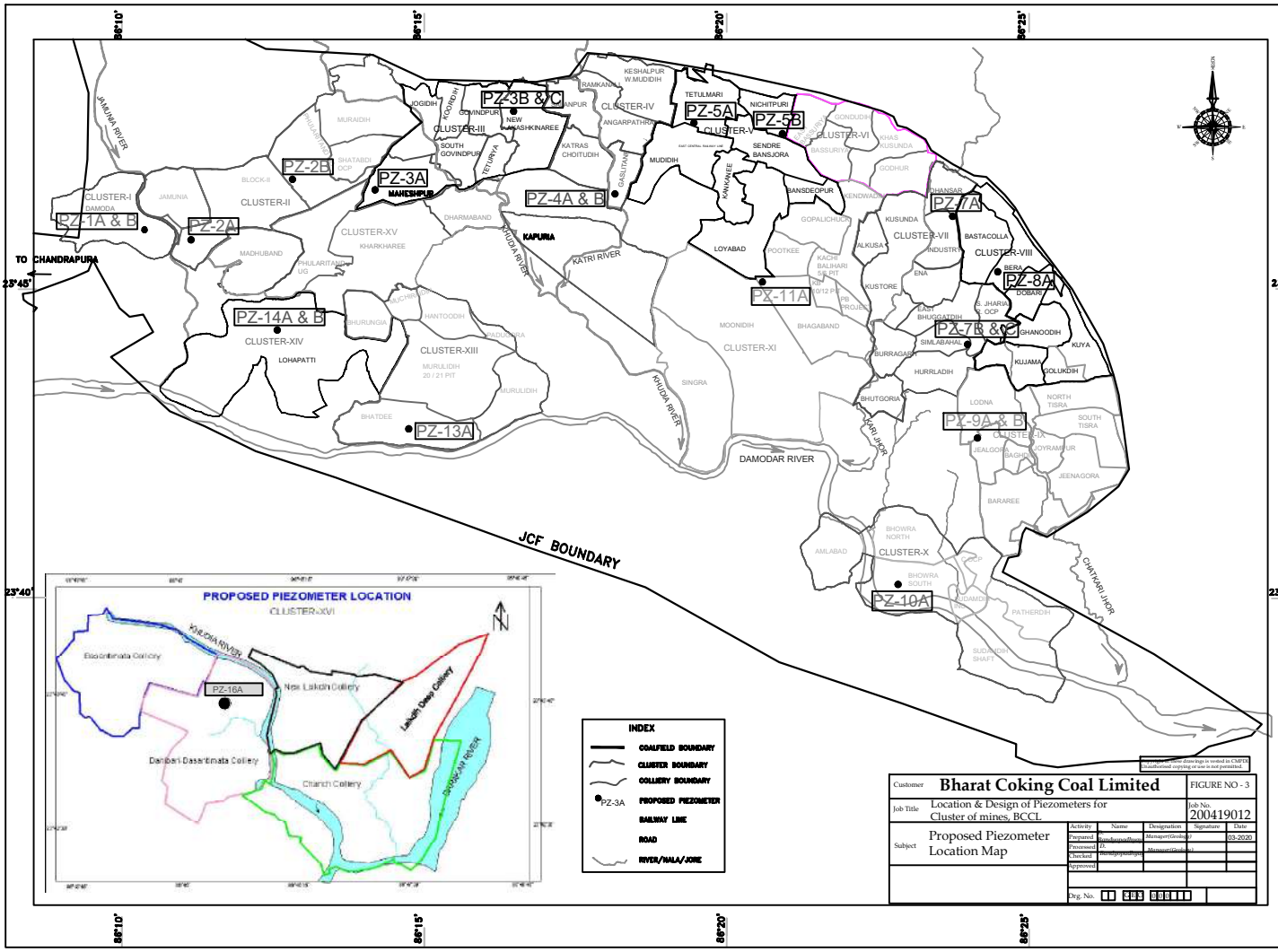
Customer	**Bharat Coking Coal Limited**				FIGURE NO - 2
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL				Job No. 200419012
Subject	Groundwater quality monitoring Station Location Map	Activity	Name	Designation	Signature	Date
		Prepared		Manager(Geology)		03-2019
		Processed	D. Barik/Jayadhar	Manager(Geology)		
		Checked				
		Approved		GM/HOD (Geo)		
					Sheet	
					Drg. No. CBS 000	Rev. No. 0

PROPOSED PIEZOMETER LOCATION MAP, JCF & RCF (part)



WATER TABLE CONTOUR MAP OF PRE-MONSOON 2020-21

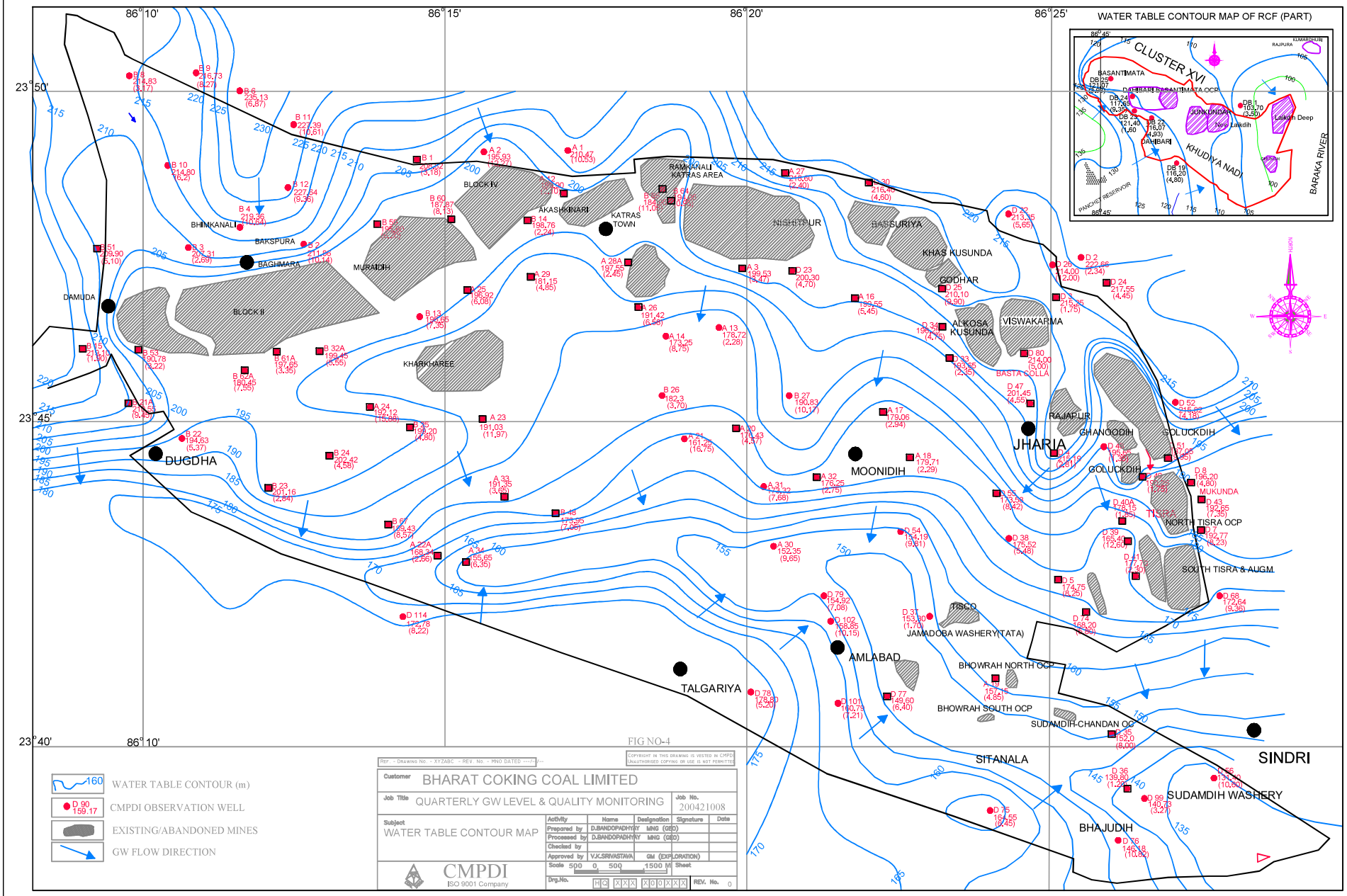


FIG NO-4

Ref. - DRAWING No. - XYZABC - REV. No. - MN0 DATED ---/A/--

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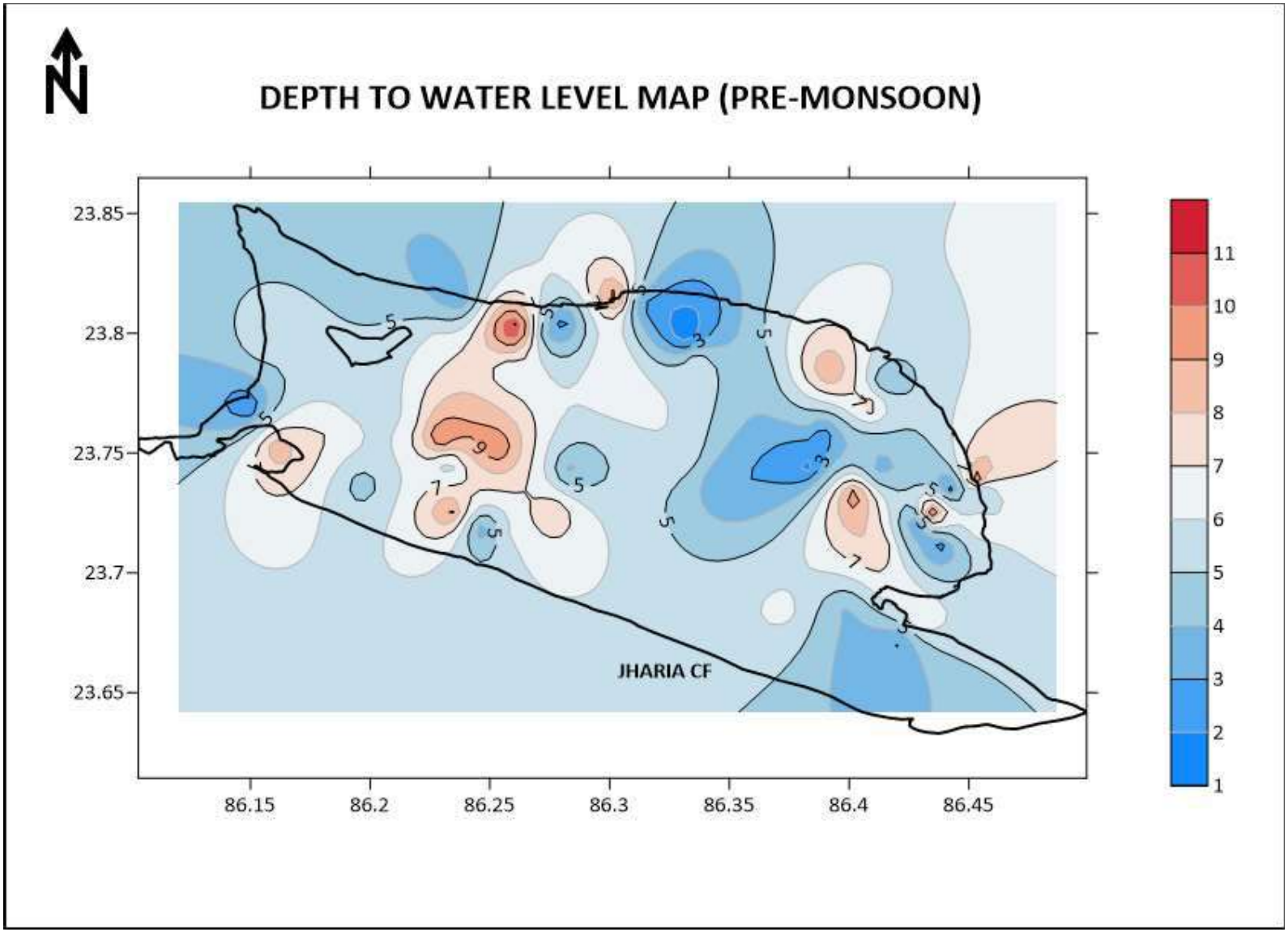
Customer	BHARAT COKING COAL LIMITED
Job Title	QUARTERLY GW LEVEL & QUALITY MONITORING
Job No.	200421008
Subject	WATER TABLE CONTOUR MAP

Activity	Name	Designation	Signature	Date
Prepared by	D.BANDOPADHYAY	MNG (GEO)		
Processed by	D.BANDOPADHYAY	MNG (GEO)		
Checked by				
Approved by	V.K.SRIVASTAVA	GM (EXPLORATION)		

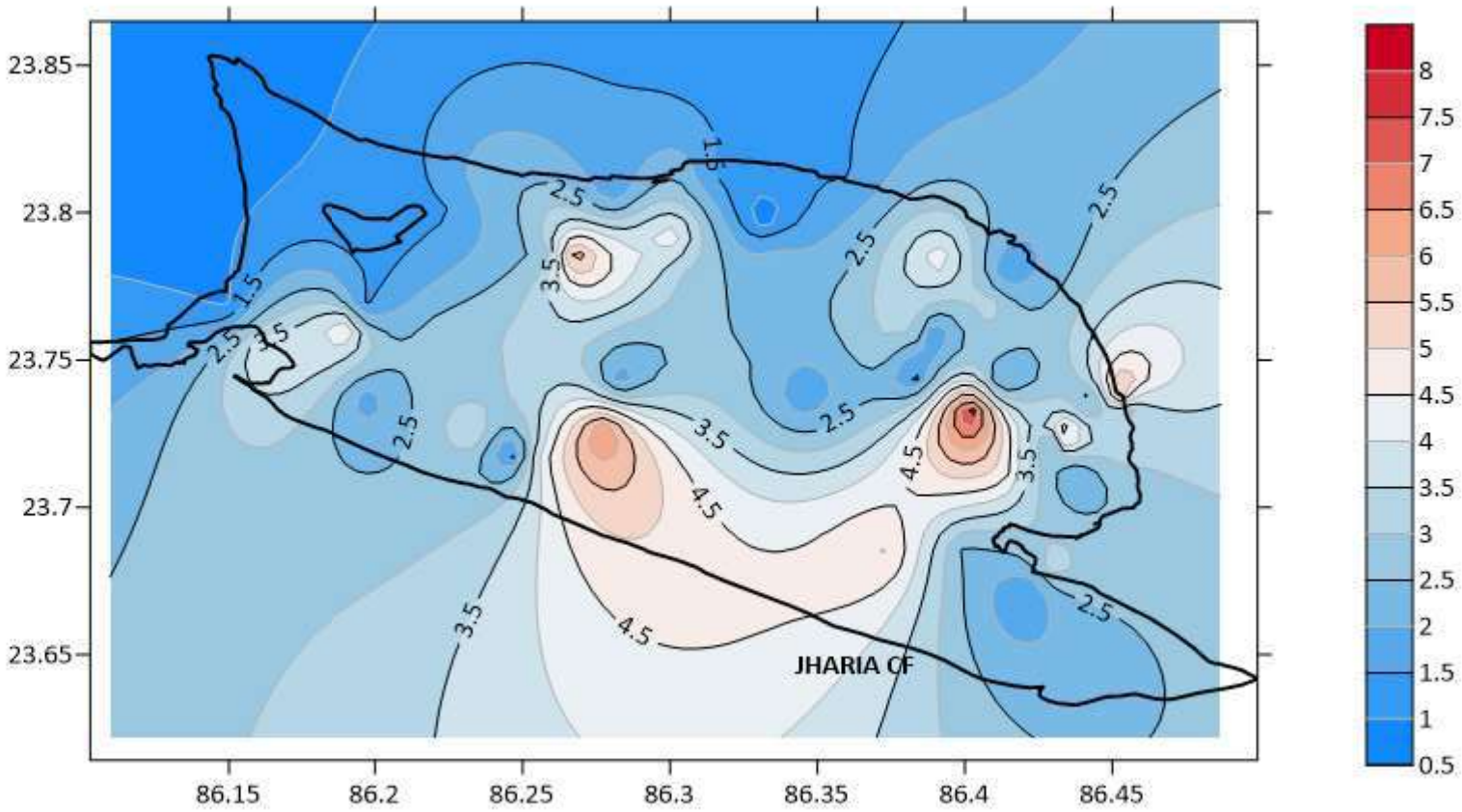
Scale 500 0 500 1500 M | Sheet

CMPDI ISO 9001 Company

Drg.No. HQ XXX X00XXX | REV. No. 0


DEPTH TO WATER LEVEL MAP (PRE-MONSOON)
23.85
23.8
23.75
23.7
23.65
86.15
86.2
86.25
86.3
86.35
86.4
86.45
JHARIA CF
11
10
9
8
7
6
5
4
3
2
1

DEPTH TO WATER LEVEL MAP(POST-MONSOON)



Accreditation Board of CGWA

Certificate of Accreditation

M/s. Central Mine Planning and Design Institute Ltd. (CMPDIL)
Ranchi, Jharkhand

Has been accredited as a Ground Water Professionals to prepare reports in the Functional Areas of

- *Hydrogeological conditions in mining projects.*

Valid from : 15.02.2021
Valid thru : 14.02.2026

Certificate No. : CGWA/RGI/013
Dated : 07.07.2021

क्षेत्रीय निदेशक
Regional Director
आरजीएनजीडब्ल्यूटीआरआई
RGNGWT&RI

सदस्य
Member
आरजीएनजीडब्ल्यूटीआरआई
RGNGWT&RI

भारत सरकार
Government of India
जल शक्ति मंत्रालय
Ministry of Jal Shakti
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
Department of Water Resources, River Development & Ganga Rejuvenation
केन्द्रीय भूमि जल बोर्ड / Central Ground Water Board
राजीव गांधी राष्ट्रीय भूमि जल प्रशिक्षण एवं अनुसंधान संस्थान
Rajiv Gandhi National Ground Water Training & Research Institute
फोन / Phone No. 07712220701
ई-मेल / E-mail: rgi-cgwb@nic.in
वेबसाइट / Website: cgwb.gov.in / ngwtri.org
सेक्टर 23, तुता, अटल नगर, नया रायपुर 492016 (छ.ग.)
Sector - 23, Tuta, Atal Nagar, Naya Raipur 492016 (C.G.)

E-877816
15.11.21

File No. 29/TS/RGI/Accreditation/20-21-295

Date 02.08.2021

To,

The CMPDIL
Gondwana Place, Kanke Road
Ranchi, (Jharkhand)
PIN- 834031

Sub: - Accreditation Certificate – Reg.

Sir,

Please find enclosed the Certificate of Accreditation in respect of The CMPDIL for the period 2021-2026.

Please acknowledge the receipt of the Certificate

Encl : As Above

Yours Faithfully

02/08/2021

(Satish Kumar)
Regional Director
RGNGWTRI, Raipur

Quality Council of India

National Accreditation Board for Education and Training

ITPI Building, 6th Floor, 4 - A, Ring Road, I P Estate, New Delhi - 110002

CERTIFICATE OF ACCREDITATION

Under the QCI-NABET Scheme
for
Ground Water Consultant Organisation

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

CMPDI, GONDWANA PLACE, KANKE ROAD, RANCHI, JHARKHAND -834031

S.No.	SCOPE COVERAGE		
	Industrial Use	Mining Projects	Infrastructure Projects
1	Hydrogeological report: Comprehensive report on groundwater condition/situation		
2	Impact Assessment Reports without modelling studies		

Note: Names of approved Project Coordinators and Technical Area Experts are mentioned in IA AC Minutes dated Oct 14, 2021 on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in NABET's letter of accreditation bearing no. QCI/NABET/ENV/GWCO/21/57 dated Oct 27, 2021. The accreditation needs to be renewed before the expiry date by Oct 13, 2026 following due process of assessment.

Sr. Director, NABET
Issue Date : Oct 27, 2021

Certificate No.
NABET/GWCO/IA/GW021

Valid Upto
Oct 13, 2026

National Accreditation Board for Education and Training

Ref. No. - QCI/NABET/ENV/GWCO/ACO/21/57 October 27, 2021

To,

M/s Central Mine Planning and Design Institute Limited
Gondwana Place, Kanke Road,
Ranchi, Jharkhand- 834031

Sub: Accreditation under NABET Scheme of Ground Water Consultant Organization (GWCO)

Ref.: With reference to your application No. QCI/NABET/GWCO/0011/IA dated October 22, 2020.

Dear Sir

QCI-NABET is hereby pleased to accredit 'Central Mine Planning and Design Institute Limited' for the scope coverage as mentioned in the Certificate of Accreditation.

The validity of accreditation is subject to continued compliance to the Scheme and the terms & conditions mentioned in **Annexure I to IV.**

NABET always look forward for your association and continued support.

With best regards,

27/10/2021

A K Jha
Senior Director
QCI- NABET

Annexure-I

Ref. No.: QCI/NABET/ENV/GWCO/ACO/21/57
Date October 27, 2021
Name of organization: Central Mine Planning and Design Institute Limited

Accreditation of Ground Water Consultant Organization (GWCO) under NABET Scheme

Marks obtained in various aspect of Initial Assessment

Sl. No.	Aspect	Marks Scored	Out of
1.	**Quality and performance of personnel**		
	i. Project Coordinator/s	18.29 (Average)	25
	ii. Technical Area Expert/s	13.29 (Average)	20
2.	**Infrastructure and software and hardware**	13.20	15
3.	**Field Invest. & Laboratory system**	13.80	20
4.	**Quality Management System**	10.88	15
5.	**Organizational Commitment**	4.20	5
	Total	73.66	**100**
	Overall Score	**73.66%**	

The organization has scored 73.66% overall and awarded 3-Star (★★★

Criteria for Star Rating:

S. No	Overall Score	Star Rating
1	40% to 60%	★
2	61% to 70%	★ ★
3	71% and Above	★ ★ ★

National Accreditation Board for Testing and Calibration Laboratories

NABL

CERTIFICATE OF ACCREDITATION

ENVIRONMENT LABORATORY, REGIONAL INSTITUTE -II, CMPDI DHANBAD

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

CMPDIL, RI-2, KOYLABHAWAN, KOYLANAGAR, DHANBAD, JHARKHAND, INDIA

in the field of

TESTING

Certificate Number: TC-10122

Issue Date: 07/12/2021 **Valid Until:** 06/12/2023

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : CENTRAL MINE PLANNING AND DESIGN INSTITUTE LTD.

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

REGISTERED OFFICE

Gondwana Place, Kanke Road
Ranchi -834 031
(Jharkhand)

REGIONAL INSTITUTES

क्षेत्रीय संस्थान-I
वेस्ट एंड, जी.टी.रोड
आसनसोल-713 301
(पश्चिम बंगाल)

क्षेत्रीय संस्थान-II
कोयला भवन, कोयला नगर
धनबाद- 826 005
(झारखंड)

क्षेत्रीय संस्थान-III
गोंदवाना प्लेस,कांके रोड
राँची- 834 031
(झारखंड)

क्षेत्रीय संस्थान-IV
जरीपटका, कस्तूरबा नगर
नागपुर-440 014
(महाराष्ट्र)

क्षेत्रीय संस्थान-V
सीपत रोड
बिलासपुर-495 001
(छत्तीसगढ़)

क्षेत्रीय संस्थान-VI
पोस्ट :जयंत कॉलरी,
जिला : सिंगरौली
पिन नं0- 486 890
(मध्य प्रदेश)

क्षेत्रीय संस्थान-VII
गृह निर्माण भवन
सचिवालय मार्ग
भुवनेश्वर-751001
(उड़ीसा)

Regional Institute - I
West End, G.T Road
Asansol - 713 301
(West Bengal)

Regional Institute - II
Koyla Bhawan, Koyla Nagar
Dhanbad - 826 005
(Jharkhand)

Regional Institute - III
Gondwana Place, Kanke Road
Ranchi- 834 031
(Jharkhand)

Regional Institute - IV
Jaripathka, Kasturba Nagar
Nagpur - 440 014
(Maharashtra)

Regional Institute - V
Seepat Road
Bilaspur - 495 001
(Chattisgarh)

Regional Institute - VI
P.O Jayant Colliery
Dist. - Singrauli
PIN - 486 890
Madhya Pradesh

Regional Institute - VII
Grih Nirman Bhawan
Sachivalaya Marg
Bhubneswar - 751 001
(Orissa)

सेन्ट्रल माईन प्लानिंग एंड डिजाइन इन्स्टीच्यूट लिमिटेड

(कोल इंडिया की अनुषंगी कम्पनी)
एक मिनी रत्न कम्पनी

Central Mine Planning & Design Institute Limited

(A Subsidiary of Coal India Limited)
A Mini Ratna Company

गोंदवाना प्लेस, काँके रोड, राँची - 834 031, भारत
दूरभाष : (91-0651) 2230002, 2230483
फैक्स : (91-0651) 2231447
वेबसाईट : www.cmpdi.co.in

Gondwana Place, Kanke Road, Ranchi - 834 031, INDIA
Phone : (91 - 0651) 2230002, 2230483
Fax : (91 - 0651) 2231447
website : www.cmpdi.co.in

REGISTERED OFFICE

Gondwana Place, Kanke Road
Ranchi -834 031
(Jharkhand)

REGIONAL INSTITUTES

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क्षेत्रीय संस्थान-II
कोयला भवन, कोयला नगर
धनबाद- 826 005
(झारखंड)

क्षेत्रीय संस्थान-III
गोंदवाना प्लेस,कांके रोड
राँची- 834 031
(झारखंड)

क्षेत्रीय संस्थान-IV
जरीपटका, कस्तूरबा नगर
नागपुर-440 014
(महाराष्ट्र)

क्षेत्रीय संस्थान-V
सीपत रोड
बिलासपुर-495 001
(छत्तीसगढ़)

क्षेत्रीय संस्थान-VI
पोस्ट :जयंत कॉलरी,
जिला : सिंगरौली
पिन नं0- 486 890
(मध्य प्रदेश)

क्षेत्रीय संस्थान-VII
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भुवनेश्वर-751001
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Regional Institute - II
Koyla Bhawan, Koyla Nagar
Dhanbad - 826 005
(Jharkhand)

Regional Institute - III
Gondwana Place, Kanke Road
Ranchi- 834 031
(Jharkhand)

Regional Institute - IV
Jaripathka, Kasturba Nagar
Nagpur - 440 014
(Maharashtra)

Regional Institute - V
Seepat Road
Bilaspur - 495 001
(Chattisgarh)

Regional Institute - VI
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Dist. - Singrauli
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Madhya Pradesh

Regional Institute - VII
Grih Nirman Bhawan
Sachivalaya Marg
Bhubneswar - 751 001
(Orissa)

सेन्ट्रल माईन प्लानिंग एंड डिजाइन इन्स्टीच्यूट लिमिटेड

(कोल इंडिया की अनुषंगी कम्पनी)
एक मिनी रत्न कम्पनी

Central Mine Planning & Design Institute Limited

(A Subsidiary of Coal India Limited)
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गोंदवाना प्लेस, कांके रोड, राँची - 834 031, भारत
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Phone : (91 - 0651) 2230002, 2230483
Fax : (91 - 0651) 2231447
website : www.cmpdi.co.in

Annexure XVI

Gmail — Environment Lodna Area <enviodna@gmail.com>

Submission of Ground Level and Quality Report (Assessment Year 2021-22)
1 message

Environment Lodna Area <enviodna@gmail.com> — 13 May 2022 at 10:59
To: ROR MoEFCC <ro.ranchi-mef@gov.in>, ccb.cpcb@nic.in, ranchijspcb@gmail.com, dhanbadjspcb@gmail.com
Cc: HOD Environment <envbccl2020@gmail.com>

Dear Sir,
As per Specific condition no. XXXII of environment Clearance granted on dated: 21.05.2013, We are submitting herewith Ground Water Level and Quality Report (Assessment Year 2021-22) in respect of Cluster IX.

This is for your kind information

with regards,
Environment department
Cluster IX

2021-22.pdf
13318K

Annexure XVII

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
MINE EFFLUENT ANALYSIS TEST REPORT

CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
DHANBAD. -826005
Phone:0326-223-850
mail: rdri2cmpdi@coalindia.in

Month & Year	QUARTER ENDING JUNE 2022	Cluster VI	CLUSTER IX	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Jeenagora Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW9	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW9	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-1000.0	2	30
2	Colour	APHA,23RD Edition ,2120-B- 2017	2	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 23rd Edition 5220 C Titrimetric Method	32	4.0-800.0	4	250
4	Copper (as Cu), mg/l, *Max*	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	<0.1	0.1-5	0.1	5
6	Fluoride (as F) mg/l, *Max*	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)	0.9	0.2-2	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.4	0.01	0.1
8	Iron (as Fe), mg/l, *Max*	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 23rd Edition, AAS-GTA	<0.2	0.1-10	0.005	0.1
10	Nickel (as Ni), mg/l, *Max*	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.2	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, *Max*	APHA, 23rd Edition,UV-Spectrphotometric	6.92	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2017, Electrometric	8.03	1-14	0.1	5.5 to 9.0
14	Temperature (°C)	IS-3025/09:1984, Thermometeric	33.6	1-100		Shall not exceed 5° C above the receiving temp
15	Total Chromium (as Cr), mg/l, *Max*	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.2	0.1-8	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2017, Gravimetric	43	10-5000	10	100
17	Zinc (as Zn), mg/l, *Max*	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.2	0.1-2.0	0.1	5
18	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
DHANBAD. -826005
Phone:0326-223-850
mail: rdri2cmpdi@coalindia.in

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER IX	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Jeenagora Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW9	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW9	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nesseler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, *Max*	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame	<0.005	0.2-10	0.2	2
5	Phenolic compounds	APHA, 23rd Edition4-Amino Antipyrine	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S^{2-}) mg/l Max.	APHA 23rd Edition Methylene Blue Method	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nesseler's	<1.0	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 23rd Edition, , 4500-Cl B (Iodometric Method-I)	<0.04		0.04	1

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
DHANBAD. -826005
Phone:0326-223-850
mail: rdri2cmpdi@coalindia.in

MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER 1X	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Lodna Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part-1)
Sampling Stations	MW18	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW18	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-1000.0	2	30
2	Colour	APHA,23RD Edition ,2120-B-:2017	4	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 23rd Edition 5220 C Titrimetric Method	28	4.0-800.0	4	250
4	Copper (as Cu), mg/l, *Max*	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	<0.1	0.1-5	0.1	5
6	Fluoride (as F) mg/l, *Max*	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)	0.53	0.2-2	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.4	0.01	0.1
8	Iron (as Fe), mg/l, *Max*	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 23rd Edition, AAS-GTA	<0.2	0.1-10	0.005	0.1
10	Nickel (as Ni), mg/l, *Max*	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.2	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, *Max*	APHA, 23 rd Edition,UV-Spectrphotometric	2.71	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2017, Electrometric	7.66	1-14	0.1	5.5 to 9.0
14	Temperature (°C)	IS-3025/09:1984, Thermometeric	33.6	1-100	-	Shall not exceed 5° C above the receiving temp
15	Total Chromium (as Cr), mg/l, *Max*	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.2	0.1-8	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2017, Gravimetric	37	10-5000	10	100
17	Zinc (as Zn), mg/l, *Max*	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.2	0.1-2.0	0.1	5
18	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

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KOYLA BHAWAN COMPLEX
DHANBAD. -826005
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MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER IX	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Lodna Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW18	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW18	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nesseler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, *Max*	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame	<0.005	0.2-10	0.2	2
5	Phenolic compounds	APHA, 23rd Edition4-Amino Antipyrine	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S^{2-}) mg/l Max.	APHA 23rd Edition Methylene Blue Method	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nesseler's	<1.0	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 23rd Edition, , 4500-Cl B (Iodometric Method-I)	<0.04		0.04	1

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

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MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER 1X	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Joyrampur Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW19	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW19	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-1000.0	2	30
2	Colour	APHA,23RD Edition ,2120-B-:2017	2	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 23rd Edition 5220 C Titrimetric Method	20	4.0-800.0	4	250
4	Copper (as Cu), mg/l, *Max*	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	<0.1	0.1-5	0.1	5
6	Fluoride (as F) mg/l, *Max*	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)	0.99	0.2-2	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.4	0.01	0.1
8	Iron (as Fe), mg/l, *Max*	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 23rd Edition, AAS-GTA	<0.2	0.1-10	0.005	0.1
10	Nickel (as Ni), mg/l, *Max*	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.2	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, *Max*	APHA, 23 rd Edition,UV-Spectrphotometric	2.8	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2017, Electrometric	8.05	1-14	0.1	5.5 to 9.0
14	Temperature (°C)	IS-3025/09:1984, Thermometeric	33.6	1-100		Shall not exceed 5° C above the receiving temp
15	Total Chromium (as Cr), mg/l, *Max*	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.2	0.1-8	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2017, Gravimetric	44	10-5000	10	100
17	Zinc (as Zn), mg/l, *Max*	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.2	0.1-2.0	0.1	5
18	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

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MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER IX	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Joyrampur Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW19	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW19	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nesseler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, *Max*	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame	<0.005	0.2-10	0.2	2
5	Phenolic compounds	APHA, 23rd Edition4-Amino Antipyrine	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S^{2-}) mg/l Max.	APHA 23rd Edition Methylene Blue Method	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nesseler's	2	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 23rd Edition, , 4500-Cl B (Iodometric Method-I)	<0.04		0.04	1

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

ANALYSED BY

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MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER 1X	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	NT-ST Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW20	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW20	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-1000.0	2	30
2	Colour	APHA,23RD Edition ,2120-B-:2017	4	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 23rd Edition 5220 C Titrimetric Method	20	4.0-800.0	4	250
4	Copper (as Cu), mg/l, *Max*	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	<0.1	0.1-5	0.1	5
6	Fluoride (as F) mg/l, *Max*	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)	0.62	0.2-2	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.4	0.01	0.1
8	Iron (as Fe), mg/l, *Max*	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 23rd Edition, AAS-GTA	<0.2	0.1-10	0.005	0.1
10	Nickel (as Ni), mg/l, *Max*	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.2	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, *Max*	APHA, 23 rd Edition,UV-Spectrphotometric	3.45	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2017, Electrometric	7.98	1-14	0.1	5.5 to 9.0
14	Temperature (°C)	IS-3025/09:1984, Thermometeric	33.6	1-100	-	Shall not exceed 5° C above the receiving temp
15	Total Chromium (as Cr), mg/l, *Max*	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.2	0.1-8	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2017, Gravimetric	39	10-5000	10	100
17	Zinc (as Zn), mg/l, *Max*	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.2	0.1-2.0	0.1	5
18	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

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MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER IX	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	NT-ST Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW20	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW20	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nesseler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, Max	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame	<0.005	0.2-10	0.2	2
5	Phenolic compounds	APHA, 23rd Edition4-Amino Antipyrine	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S^{2-}) mg/l Max.	APHA 23rd Edition Methylene Blue Method	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nesseler's	<1.0	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 23rd Edition, , 4500-Cl B (Iodometric Method-I)	<0.04		0.04	1

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

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HOD's Signature

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MINE EFFLUENT ANALYSIS TEST REPORT

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Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER 1X	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Bararee Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW21	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW21	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-1000.0	2	30
2	Colour	APHA,23RD Edition ,2120-B-:2017	3	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 23rd Edition 5220 C Titrimetric Method	24	4.0-800.0	4	250
4	Copper (as Cu), mg/l, *Max*	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	<0.1	0.1-5	0.1	5
6	Fluoride (as F) mg/l, *Max*	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)	0.55	0.2-2	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.4	0.01	0.1
8	Iron (as Fe), mg/l, *Max*	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 23rd Edition, AAS-GTA	<0.2	0.1-10	0.005	0.1
10	Nickel (as Ni), mg/l, *Max*	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.2	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, *Max*	APHA, 23 rd Edition,UV-Spectrphotometric	3.16	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2017, Electrometric	7.95	1-14	0.1	5.5 to 9.0
14	Temperature (°C)	IS-3025/09:1984, Thermometeric	33.6	1-100	-	Shall not exceed 5° C above the receiving temp
15	Total Chromium (as Cr), mg/l, *Max*	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.2	0.1-8	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2017, Gravimetric	49	10-5000	10	100
17	Zinc (as Zn), mg/l, *Max*	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.2	0.1-2.0	0.1	5
18	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

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MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER IX	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Bararee Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW21	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW21	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nesseler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, *Max*	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame	<0.005	0.2-10	0.2	2
5	Phenolic compounds	APHA, 23rd Edition4-Amino Antipyrine	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S^{2-}) mg/l Max.	APHA 23rd Edition Methylene Blue Method	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nesseler's	<1.0	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 23rd Edition, , 4500-Cl B (Iodometric Method-I)	<0.04		0.04	1

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

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CHECKED BY

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MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Jealgora Colliery	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part-1)
Sampling Stations	MW22	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW22	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-1000.0	2	30
2	Colour	APHA,23RD Edition ,2120-B-:2017	4	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 23rd Edition 5220 C Titrimetric Method	32	4.0-800.0	4	250
4	Copper (as Cu), mg/l, *Max*	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	<0.1	0.1-5	0.1	5
6	Fluoride (as F) mg/l, *Max*	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)	0.77	0.2-2	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.4	0.01	0.1
8	Iron (as Fe), mg/l, *Max*	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 23rd Edition, AAS-GTA	<0.2	0.1-10	0.005	0.1
10	Nickel (as Ni), mg/l, *Max*	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.2	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, *Max*	APHA, 23 rd Edition,UV-Spectrphotometric	3.25	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2017, Electrometric	7.73	1-14	0.1	5.5 to 9.0
14	Temperature (°C)	IS-3025/09:1984, Thermometeric	33.6	1-100	-	Shall not exceed 5° C above the receiving temp
15	Total Chromium (as Cr), mg/l, *Max*	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.2	0.1-8	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2017, Gravimetric	47	10-5000	10	100
17	Zinc (as Zn), mg/l, *Max*	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.2	0.1-2.0	0.1	5
18	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
DHANBAD. -826005
Phone:0326-223-850
mail: rdri2cmpdi@coalindia.in

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	QUARTER ENDING JUNE 2022	Cluster	CLUSTER	Report No.	RI-2/MW/2022-23/HY/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	25.10.2022
Project	Jealgora	Sample Ref. No.	REM/BCCL/2022/MW/06/01	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)
Sampling Stations	MW22	Date of Sampling	20.06.22	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent	

Period of Analysis: JUNE TO SEPT'2022

Sl. No.	Parameter	Method of Analysis	MW22	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nesseler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, *Max*	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame	<0.005	0.2-10	0.2	2
5	Phenolic compounds	APHA, 23rd Edition4-Amino Antipyrine	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S^{2-}) mg/l Max.	APHA 23rd Edition Methylene Blue Method	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nesseler's	<1.0	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 23rd Edition, , 4500-Cl B (Iodometric Method-I)	<0.04		0.04	1

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Annexure XVIII

Letter and subsidence monitoring report

BHARAT COKING COAL LIMITED
(A subsidiary of CIL)
REGD. Office: Koyla Bhavan, Koyla Nagar, Dhanbad-826005
CIN No. U10101JH1972GOI000918
Office of the Project Officer
Amalgamated Joyrampur Colony
Lodna Area

To whom it may concern

This is to certify that there is no mining induced subsidence movement over and around the working area of Cluster IX Coal mining Projects, Lodna Area, namely Amalgamated Joyrampur Colliery (OC) and NT-ST (Expansion) OCP after obtaining Environmental Clearance granted on 21.05.2013.

Project Officer
NT-ST (Expansion) OCP

28/12/2021
Manager/Project Officer
Amal. Joyrampur Colliery

Colliery surveyor
Amal. Joyrampur Colliery

SUBSIDENCE RECORD
LOCATION:- JOYRAMPUR, ESHASH MODE.

STN.	Date of Measur. 4/11/21 R.L	Date of Meas. - 7/2/22 R.L.	Subsidence R.L
S. 93	174. 082	174. 082	0
S. 94	174. 277	174. 277	0
S. 95	174. 503	174. 503	0
S. 96	174. 839	174. 839	0
S. 97	175. 255	175. 255	0
S. 98	175. 753	175. 753	0
S. 99	176. 355	176. 355	0
S. 100	177. 024	177. 024	0
S. 114	172. 959	172. 959	0
S. 115	173. 091	173. 091	0
S. 116	173. 285	173. 285	0
S. 117	173. 502	173. 502	0
S. 118	173. 638	173. 638	0
S. 119	173. 796	173. 796	0
S. 120	173. 988	173. 988	0
S. 121	174. 205	174. 205	0
S. 122	174. 512	174. 512	0
S. 123	174. 791	174. 791	0
S. 124	175. 172	175. 172	0
S. 125	175. 636	175. 636	0
S. 126	176. 165	176. 165	0
S. 127	176. 856	176. 856	0
S. 128	177. 262	177. 262	0
S. 129	174. 74	174. 74	0
S. 130	178. 392	178. 392	0
S. 141	172. 846	172. 846	0
S. 142	172. 712	172. 712	0

Date STN.	4/11/21 R.L	7/2/22 R.L.	Subsidence R.L
S. 143	172. 95	172. 95	0
S. 144	173. 401	173. 401	0
S. 145	173. 598	173. 598	0
S. 146	173. 758	173. 758	0
S. 147	174. 027	174. 027	0
S. 148	174. 341	174. 341	0
S. 149	174. 618	174. 618	0
S. 150	174. 859	174. 859	0
S. 151	175. 085	175. 085	0
S. 152	175. 413	175. 413	0
S. 153	175. 681	175. 681	0
S. 154	176. 326	176. 326	0
S. 155	176. 972	176. 972	0
S. 156	177. 486	177. 486	0
S. 157	177. 97	177. 97	0
S. 169	172. 573	172. 573	0
S. 170	172. 962	172. 962	0
S. 171	173. 417	173. 417	0
S. 172	173. 602	173. 602	0
S. 173	173. 77	173. 77	0
S. 174	174. 12	174. 12	0
S. 175	174. 506	174. 506	0
S. 176	174. 71	174. 71	0
S. 177	174. 907	174. 907	0
S. 178	175. 057	175. 057	0
S. 179	175. 236	175. 236	0
S. 180	175. 424	175. 424	0
S. 181	175. 768	175. 768	0

Scanned with CamScanner

Date STN.	4/11/21 R.L	7/2/22 R.L.	Subsidence R.L
S. 182	176. 357	176. 357	0
S. 183	176. 918	176. 918	0
S. 184	177. 274	177. 274	0
S. 185	178. 614	178. 614	0
S. 196	172. 591	172. 591	0
S. 197	172. 942	172. 942	0
S. 198	173. 38	173. 38	0
S. 199	173. 563	173. 563	0
S. 200	173. 876	173. 876	0
S. 201	174. 29	174. 29	0
S. 202	174. 616	174. 616	0
S. 203	174. 773	174. 773	0
S. 204	174. 876	174. 876	0
S. 205	175. 049	175. 049	0
S. 206	175. 242	175. 242	0
S. 207	175. 454	175. 454	0
S. 208	175. 749	175. 749	0
S. 209	176. 003	176. 003	0
S. 210	176. 26	176. 26	0
S. 211	176. 882	176. 882	0
S. 212	177. 373	177. 373	0
S. 225	173. 149	173. 149	0
S. 226	173. 547	173. 547	0
S. 227	173. 903	173. 903	0
S. 228	174. 449	174. 449	0
S. 229	174. 744	174. 744	0

Scanned with CamScanner

Annexure XIX

Certificate of high root density plant for controlling subsidence

This is to certify that BCCL has been doing plantation/ecological restoration under the guidelines of Forest Research Institute. The various species selected for the restoration are having a tap root system with branches which serve the purpose. These species have high root density and are already being planted at all the ecorestoration/plantation sites of BCCL. The various species having tap root system are given below.

S.No.	Species	Common name
1.	*Acacia nilotica*	Kikkar
2.	*Albizia odoratissima*	Kala siris
3.	*Bauhinia variegata*	Kachnar
4.	*Cassia fistula*	Amaltas
5.	*Ficus benghalensis*	Baniyan /bargad
6.	*Ficus racemosa*	Gular
7.	*Ficus religiosa*	Pipal
8.	*Cimelina arborea*	Ghamar
9.	*Lagerstroemea parviflora*	Jarul
10.	*Lannea coromandelica*	Zhingan
11.	*Madhuca latifolia*	Mahua
12.	*Mangifera indica*	Aam
13.	*Morus alba*	Shahtoot
14.	*Phyllanthus emblica*	Aonla
15.	*Pithecellobium dulce*	Jangal jalebi
16.	*Pongamia pinnata*	Karanj
17.	*Tamarindus indica*	Imli
18.	*Trema orientalis*	Tree
19.	*Terminalia arjuna*	Arjun
20.	*Terminalia bellerica*	Bahera
21.	*Dalbergia sissoo*	Shisham
22.	*Syzizium cuminii*	Jamun
23.	*Azadirachta indica*	Neem
24.	*Holoptelea integrifolia*	Indian elm
25.	*Butea monosperma*	Palash /dhak

Scientist / Scientist
वन पारिस्थितिकी एवं जलवायु परिवर्तन प्रभाग
Forest Ecology & Climate Change Division
वन अनुसंधान संस्थान, देहरादून - 248006
Forest Research Institute, Dehradun-248006

Scanned by CamScanner

Annexure XX

BHARAT COKING COAL LIMITED
(A subsidiary of CIL)
REGD. Office: Koyla Bhawan, Koyla Nagar, Dhanbad-826005
CIN No. U10101JH1972GOI000918
Office of the Project Officer
Amalgamated Joyrampur Colony
Lodna Area

No Depillaring below the township/Colony

It is stated that No depillaring operation has been done below the township/colony Since Environment Clearance granted on dated 21.05.2013.

28/12/2021
Project Officer
Amal. Joyrampur Colliery

28.12.2021
Colliery surveyor
Amal. Joyrampur Colliery

Annexure XXI

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 : गोन्डवाना 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

cmpdi
A Mini Ratna Company

पत्रांक: आर.आई.-2/पर्यावरण/एम-30/1150

दिनांक: 20.06.2015

सेवा में,
उप महाप्रबंधक (पर्यावरण)
बी. सी. सी. एल.
कोयला भवन
धनबाद ।

विषय: 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 Anantanshu Sir
For compliance pl/pse.

फोन : (+91) 0326-2230850 फैक्स / Fax : (+91) 0326-2230500
वेब साइट / Website : www.cmpdi.co.in
ईमेल / Email : ri2@cmpdi.co.in

Annexure XXII

Impact Assessment of CSR projects undertaken by Bharat Coking Coal Limited, Dhanbad FY(2015-16)

By

National CSR Hub

Tata Institute of Social Sciences, Mumbai

RESEARCH TEAM AT NATIONAL CSR HUB

Project Director

Prof. B. Venkatesh Kumar

Senior Consultant

Ms. Dilnavaz Munshi

Project Co-ordinator

Ms. Dipty Nisha

Data collection, Analysis & Report Writing

Ms. Prachi Kathuria

Mr. Sumit Jagtap

Research Investigators

Mr. Monu Kumar

Mr. Ajay Kumar Singh

Mr. Dinesh Kumar

Mr. Suraj Kumar

Secretariat Support

Ms. Vaishali Gajbiye

Ms. Rajisha Ramankutty

Ms. Sushma Kir

ACKNOWLEDGEMENT

This Impact Assessment Study of CSR project of Bharat Coking Coal Limited, Dhanbad for the FY 2015-16 has been undertaken by National CSR Hub, Tata Institute of Social Sciences (TISS) as a part of the MoU with CIL and TISS.

At the outset, we would like to thank BCCL for granting this project to National CSR Hub, TISS. We express heartfelt gratitude to Director (Personnel), BCCL for giving us the opportunity to carry out the Impact Assessment study of CSR projects for the FY 2015-16. We express our gratitude to the General Manager, CSR and the entire CSR department of BCCL for their continuous support and guidance to the research team of NCSR Hub.

We also extend our gratefulness to respective area General Managers, Medical Officers (Health Department) and concerned project in-charge appointed by BCCL (CSR officials) for making all the arrangements for the study and making us comfortable with their warm hospitality.

Prof. B. Venkatesh Kumar
Director
National Corporate Social Responsibility Hub
TISS, Mumbai

EXECUTIVE SUMMARY

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. 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. As per the CSR guideline, BCCL has partnered with Tata Institute of Social Sciences to conduct evaluation studies for the completed CSR projects.

For the purpose of this report, impact assessment studies were carried out for four projects, namely, Scheme for Multi-Purpose Utilisation of Mine Water, Mobile Medical Van, Village Adoption and Construction of PCC/Bituminous Road.

The primary data collection for the impact assessment studies was completed in September 2017 by a six member team from TISS. Mixed research methodology was used while In-Depth Interviews, Household Surveys and focused group discussions were the main methods implemented to collect data. 1000 samples were collected from 13 operational areas of BCCL for the impact assessment study.

The objectives of the impact assessment were:

(i) To assess if the objectives of individual projects have been met;

(ii) To understand the continued relevance of the individual projects in their respective contexts; and

(iii) To identify issues in programmatic implementation and provide recommendation to fulfill the objectives efficiently.

Mobile Medical Van has aimed to provide quality health services to the rural poor residing in the operational areas of BCCL. The impact of the project on the community has been remarkable as it provides doorstep medical services to the poor, reduces the medical expenditures, reached the most remote villages and awareness generation. Limited health services, awareness campaigns and limited regularity are the major drawbacks of the project.

In the project Scheme for Multi-Purpose Utilisation of Mine Water, 352 samples were collected, 13 FGDs and 4 Key Informant Interviews (KII) were conducted. There is strong demand for the supply of mine water in the renovated ponds especially during water scarcity periods, which have been stopped for the last couple of months. The mine water is used for household and cattle consumption. Livelihood generation activities have not commenced as yet.

BCCL also adopted Lahbera village, situated in Jharia block of Dhanbad district and committed to the holistic development of the village. Various infrastructural and economic projects were implemented in the village. Although the project has been a huge success, a lapse in monitoring, incomplete projects and limited resources for employment generation have inhibited the successful completion of the project.

BCCL also constructed roads at 7 locations across Dhanbad districts. The roads had led to improved connectivity and enhanced hygienic living conditions, but lack of monitoring, limited connectivity and lack of participatory approach have been some of the shortcomings of the project.

TISS has also provided recommendation such as regular monitoring, creation of employment generation activities, the formation of SHGs etc. for efficient execution of future projects.

LIST OF ABBREVIATIONS

ADC	**-**	Adult Education Center
BCCL	**-**	Bharat Coking Coal Limited
CHC	**-**	Community Healthcare Center
CSR	**-**	Social Corporate Responsibility
CTP	**-**	Computer Training Program
FGD	**-**	Focused Group Discussion
GM	**-**	General Manager
HHI	**-**	Household Interviews
IDI	**-**	In – depth Interviews
IT	**-**	Information and Technology
KII	-	Key Informant Interviews
LVA	**-**	Lahbera – Village Adoption
MMV	**-**	Mobile Medical Van
MUMW	-	Scheme for multipurpose utilization of abandoned mine water
PCC	**-**	Plain Cement Concrete
PHC	**-**	Primary Health Care Center
SHG	**-**	Self Help Group
ST	**-**	Schedule Tribes
STC	**-**	Sewing Training Centre
STP	**-**	Sewing Training Program
EJ	–	Eastern Jharia
WJ	–	Western Jahria
WWD	_	Western Washery Division
CV	–	Chanch Victora

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CHAPTER 1 - INTRODUCTION

Businesses are the most powerful constituents of the society, and they do not operate in isolation; there is an increased realization that not only can companies affect society at large, but they are also in a unique position to influence society and a make positive impact.

> "The Organization for Economic Co-operation and Development[1] (OECD) established a set of guidelines for multinational enterprises in 1976 and was thus a pioneer in developing the concept of CSR. The purpose of these guidelines was to improve the 'investment' climate and encourage the positive contribution multinational enterprises can make to economic and social progress".

An evaluation is 'the systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results. The aim is to determine the relevance and fulfilment of objectives, development efficiency, effectiveness, impact and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision-making process of both recipient and donors.' (OECD Publications, 2010)

1.1. About Bharat Coking Coal Limited

Bharat Coking Coal Limited (BCCL) is a subsidiary of Coal India Limited, a Maharatna Company. The company is 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. 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. Towards achieving this objective and understand the interest levels of the local community, BCCL has undertaken a departmental baseline survey cum Skill Gap Analysis study at some locations. The recommendations from the study would form the basis for the design and deployment of the various skill development initiatives to be planned.

[1] http://www.oecd.org/about/

1.2 About National Corporate Social Responsibility Hub, TISS

National Corporate Social Responsibility Hub, (NCSR Hub) was established in 2011 by the Department of Public Enterprises to enable the Public Sector Enterprises to design and implement holistic and rights-based CSR initiatives. Tata Institute of Social Sciences (TISS), Mumbai and Department of Public Enterprises (DPE), Government of India had come to realize that there is a need to have a centralized system where core functions of CSR including learning and knowledge dissemination take place. The core activities of the Hub are:

- Vision and strategic direction setting for Policy and Programme
- Advisory role for PSEs on Policy and Programme implementation
- Research and development and 'evidence-based' policy advocacy
- Capacity building of PSEs, partners and civil society institution
- Impact assessment, monitoring and evaluation
- Empanelment and partner management

1.3 Project Backgrounds

Bharat Coking Coal Limited (BCCL) sanctioned impact evaluation studies for four projects in different stages of completion which were carried out by National CSR Hub in August-September 2017. The following report details the evaluation of projects undertaken by Bharat Coking Coal Limited in accordance with their CSR policy laid out in 2014. A cogent CSR policy is a requirement laid out in the Companies (CSR Policy) Rules, 2014 conferred under the Companies Act, 2013.

As stated above, for this report four projects were evaluated namely: *Mobile Medical Van, Scheme for multipurpose utilisation of abandoned mine water, Village adoption program and construction of PCC/Bituminous road.*

a) **Mobile Medical Van (*Swastha Ratha*) -** The service of Mobile Medical Van for villagers under command areas of BCCL started in 2009 with the help of 2 Mobile Medical Vans. Now BCCL has fourteen Medical Mobile Vans (MMVs) equipped with doctors, paramedical staff serving different 203 villages situated in and around the mining areas on working days. The villagers are examined by the experienced clinicians

and medicines are dispensed free of cost to them. This provision has been made by BCCL exclusively under CSR activities for the benefit of villagers by providing them free medical assistance.

Objective: To provide health services in peripheral villages in and around BCCL command area to provide medical facilities with a focused service on identification, screening, diagnosis and treatment to provide free medical; assistance.

Location of implementation: 203 villages in the peripheral areas of BCCL

b) **Scheme for multipurpose utilisation of abandoned mine water -** BCCL since inception has felt the importance of water and endeavoured for effective and gainful utilisation of mine water from abandoned mines which has to be taken out compulsorily in the course of the mining process. For harnessing such water, BCCL has taken upon the task of holding the mine water into the water bodies by restricting them to flow into the natural drainage course like village reservoirs which gets dried during summers by laying out a pipeline network of approximately 45 km.

Objective of the project: Harnessing mine water for its gainful multipurpose utilisation in the peripheral villages of BCCL command area.

Location: Two reservoirs are situated in Khonathi and Behrakudar villages of Baghmara block of Dhanbad district.

c) **Lahbera Village Adoption Program** - In order to develop peripheral villages of BCCL in an integrated manner, including their economic development, infrastructure upliftment, providing opportunities for social empowerment and other aspects of overall human development. i.e. education, health, drinking water supply, providing training and tools for self-employment etc. This would include economic development, infrastructure development and other aspects of human development, i.e. education, health, drinking water supply and credit linkage.

Objective of the project: The objective of Village Adoption Programme is to develop the selected village in an integrated manner ensuring the holistic and integrated development of village through capacity building and participation of local people and institutions.

Location: Lahbera Village in Jharia block of Dhanbad district

d) **Construction of PCC/Bituminous road -** Understanding the importance of Road BCCL had Constructed PCC Roads in and around eight villages of the BCCL command area. Roads are of vital importance to make a nation grow and develop. In addition, providing access to employment, social, health and education services makes a road network crucial in fighting against poverty. They open up areas of economic and social development.

Objective of the project: Enabling and increasing the connectivity from semi-rural to urban areas by constructing PCC Road.

Location:

SN	Name of Village/Area	Construction in Km/Meters
1	Kacharra Arah Tola , Hatudih Panchayat	400 meters
2	Lahbera Village	1.5 Km
3	Aamtal Village, Aamtal Panchayat (Kusunda)	1.5 km
4	Satitand Village, Bauakala Panchayat (Kusunda)	500 meters
5	Padugora Village, Padugora Panchayat (WJ area)	400 meters
6	Kandra Village, Kandrta Panchayat	500 meters
7	Bakaspura Village, Luti Pahari Panchayat	400 meters

CHAPTER 2 – RESEARCH METHODOLOGY

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it, one studies the various steps that are adopted by a researcher in studying his research problem along with the logic behind them (Kothari, 2004). This chapter outlines the research methodology and also examines the objectives of the study and the research question. The chapter also includes the research design, methods, and level of engagement for data collection, on and off the field. The stage of data collection has also been explained in the chapter with a subsequently the steps utilized to analyze the data that is already collected from the field.

2.1 Objective of Study

The very purpose of the research is to discover answers to the question through the application of the scientific procedures (Kothari, 2004). The aim of the study was to understand the extent of the impact of projects on the socio-economic conditions of the targeted beneficiaries.

The Impact Assessment was conducted on four major projects namely:

1. Mobile Medical Van (MMV),
2. Scheme for multipurpose utilization of abandoned mine water (MUMW),
3. Road Construction, and
4. Labhera village adoption project (LVA)

Therefore the objective of each project has some variation from the other even though having that the main objectives were as follows:

i. To Analyzed the key impact areas of the project
ii. To Analyzed the extent of impact on the beneficiaries
iii. To suggest recommendation for improvement for the project.

2.2 Research Design

The research design refers to the overall strategy that one choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring one will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data (De Vaus, 2001)

This study is an **Evaluation** research study as it is designed to assess the outcomes of an intervention so that the findings will provide insights useful for the organizations that have funded and implemented the project. The study is an end line evaluation study, which implies that the findings would be useful if the Company intent to reintroduce the project.

The project undertaken for impact assessment studies were those which are implemented by the BCCL CSR and which covers a mixed chunk of populate spread across the BCCL Command area. As there were four projects that required studying, the research team had developed two research designs based on the project objectives and population covered. This study employs a mixture of Quantitative and Qualitative research methods to evaluate the key aspects of the two projects namely; MMV and MUMV. If one has to define mixed method research it can be 'In general, mixed methods research represents research that involves collecting, analyzing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon.' (Leech N, Onwuegbuzie A, 2008). The study has attempted not just to generate summary statistics that reveal the overall performance of the projects but has also attempted to delve into the individual stories, histories, life experiences and psyche of the beneficiaries through intensive beneficiary-specific case studies (of selected beneficiaries. While conducting the study of MMV and MUMW the research team used two major tools for data collection mainly: Focused Group Discussion (FGD) and Household Survey (HH). These methods were felt appropriate by the research team as it helped in fulfilling the appropriate size and appropriate response.

Simultaneously a different research design was formed for studying the impact of LVA and Road Construction. The qualitative research design enabled the research team to understand the impact of project in their daily life. Along with it, the project had limited beneficiaries that provided the research team with the opportunity to study and to understand the lived narratives of the beneficiaries and also the impact of LVA and road in their day to day life.

2.3 Tools for Data Collection

The tool is one of the essential components of a research study. It is an instrument that helps the researcher to meet the objectives of the research. There are various kinds of tools that are utilized based on the needs and objectives of the research. In the current study the research team undertook certain sets of tool they are listed below;

Major tools involved in the study were:

i. **i. House Hold Interview (Survey) (HHI)**: As a few projects had greater coverage in terms of area and population the household survey was used to get details from the identified villages and areas/panchayats

ii. **ii. Focused Group Discussion (FGD):** FGDs where conducted in all the four project, and the interviewers for the FGD was the village members, Ward/Gram Panchayat Representative, ASHA, Women Representative, SHGs Group Women's, Youth group member etc.

iii. **iii. In-depth Interviews (IDI):** Similarly IDI was conducted with village members who were directly affected by the project

iv. **iv. Case studies:** Case studies were used to get life narratives of the beneficiaries and to understand the impact of the project on their socio-economic and cultural lives

v.

2.4 Data collection methods

The sampling type used for data collection was stratified random sampling method. **The primary data** was collected using the following methods, selected as per the above-explained research design:

a. Survey of beneficiaries through questionnaire
b. Semi-structured interview (using interview schedule) and In-depth interviews. The in-depth interviews were open-ended with complete scope for probing and getting detailed information from the participants.
c. Participatory research methods such as transect walk
d. Document analysis (review of project reports)
e. Direct observation (home visit, village/town visit and institution visit)

2.5 Participants of Data Collection

This study emphasizes the obtaining of perspectives from multiple stakeholders. Accordingly, the following participants and stakeholders were covered through the data collection done in this study:

i. Beneficiaries, i.e. people impacted by the project

i. ii. Higher authorities of BCCL, Area GM, Medical Officers

ii. iii. Village level stakeholders (Community Leaders):, Sarpanch, ward members and former Sarpanch

iii. iv. Project In-charge appointed by BCCL (CSR officials) – the monitoring authority involved in the project

2.6 Sampling with Location for Data Collection

Table 1 – Showing sampling of Multipurpose Utilization of Mine Water (MUMW) through Household Survey

Sr No	Village Name	Block	District	Sample Achieved
1	Darda	Baghmara	Dhanbad	82
2	Sidhwatand	Baghmara	Dhanbad	65
3	Behrakhurd	Baghmara	Dhanbad	34
4	Nisithpur	Baghmara	Dhanbad	82
5	Konati	Baghmara	Dhanbad	93
			Total	**356**

Table 2 – Showing sampling of Mobile Medical Van (MMV) through Household Survey

Sr No	Village Name	Block	District	Sample Achieved
1	Karma Tand	Chandrapura	Bokaro	13
2	Patra Kuli	Chandrapura	Bokaro	8
3	Uper Devghara	Baghmara	Dhanbad	15
4	Chhatawad Kailudih	Baghmara	Dhanbad	10

5	Power House	Dhanbad	Dhanbad	26
6	Madhuban	Baghmara	Dhanbad	13
7	Rathtand	Baghmara	Dhanbad	10
8	Chanchpotri	Agra Khurd	Dhanbad	12
9	Barora	Kulti	Bangal	25
10	Mohlidih	Katras	Dhanbad	20
11	Khanodih	Baghmara	Dhanbad	6
12	Bhim Kanali	Baghmara	Dhanbad	3
13	Bakaspura	Baghmara	Dhanbad	10
14	Bhagabandh	Dhanbad	Dhanbad	19
15	Manjhla Dih	Dhanbad	Dhanbad	19
16	Bhatdih	Jhariya	Dhanbad	19
17	Manpur	Chandan Kyari	Bokaro	19
18	Amlabad	Chandan Kyari	Bokaro	19
19	Sona Nagar	Baghmara	Dhanbad	14
20	Mandal Kedwari	Baghmara	Dhanbad	9
21	Gudri Bera	Baghmara	Dhanbad	18
22	Southari	Dhanbad	Dhanbad	19
23	Betenga bandh	Dhanbad	Dhanbad	12
24	Kari Tand	Dhanbad	Dhanbad	7
25	Basjoda	Dhanbad	Dhanbad	24
26	Lavera Manjhi Tola	Jhariya	Dhanbad	20
27	Ranguni	Baghmara	Dhanbad	18
28	Bangali Kothi	Baliyapur	Dhanbad	20
29	Aamtalbauritola	Baliyapur	Dhanbad	18
30	Nunudih	Jhariya	Dhanbad	20

31	Idgah Pathar tola	Jhariya	Dhanbad	20
32	Pathaldih(Pandiya Tola)	Jhariya	Dhanbad	18
			Total	**503**

The Data collection for Lebhara and Road construction were through FGD where the research team intend to capture the live narrative of the beneficiaries impacted by the project, therefore in FDG the interviews mostly consisted of Sarpanch, Village members, Women Representative, Senior citizen, Children, youths and BCCL higher authorities

2.7 Data Analysis

As previously mentioned, this study employs a mixture of qualitative and quantitative methods. Accordingly, SPSS was used for the quantitative data analysis of the study (such as the analysis of the responses of closed-ended questions in the questionnaires). The responses from the in-depth interviews and the other qualitative data were subjected to coding for detecting patterns. The data from interviews and discussions were analyzed **thematically,** and the data from all the sources was integrated as per the responses to understand, assess and evaluate the entire process of implementation. Being a qualitative study, there was an emphasis on understanding and analyzing the perceptions, views and experiences of the beneficiaries and other key stakeholders with respect to the scholarship project.

2.8 Challenges of the study

1. **Language Barrier:** The major hurdle in data collection was the language barriers, few of the villagers were speaking Bengali, and few were oddia.

2. **Limited documentation:** The Limited documentation of CSR project was another hurdle faced by the research team as it had to completely rely on primary data. Most of the employees working on the projects were mostly retrained and even in a few projects, documentation was not available.

CHAPTER 3 –MOBILE MEDICAL VAN (SWASTHA RATH)

3.1 Introduction

Health is an important aspect of human life; it plays a very vital role in our social, economic and other spheres of our life. The better the health, the better the other factors. Mobile Medical Van or Swastha Rath was one of the popular projects that aimed at treating the general illness in the command area population of BCCL. The project was initiated with only 2 Mobile Medical Van in 2009, had now covered more than 203 villages with 14 Mobile Medical Vans. The staffs in the van consist of the doctor, paramedical staff and a driver to provide free consultancy and medicine for general illness.

3.2 Objectives of the Project

The objective of the project was to provide medical health facilities with a focus on identification, screening, diagnosis and treatment of general illness by providing free consultancy and medicine.

3.3 Locations of project

The project location covers the command area of BCCL. This includes rural, semi-rural and urban areas. Following is the list of villages and town where the Swastha rath facility is being provided.

Table 3 – Showing list of villages covered under Mobile Medical Van services (Swastha Rath)

SN	Name of Area	Name of Village
1	BARORA	1. PatraKulh 2. Karmatand 3. Manpur 4. Amlabad
2	BLOCK-II	1. Rath Tand Basti 2 Bakaspur Basti 3. Mahato Tola Bhim Canali Basti 4. Khanudih Basti
3	GOVINDPUR	1. Chhatawad Kailudih, 2. Uper Devghara
4	EJ	1. Lavera Manjhi Tola 2. Idgah Pathar tola
5	WJ	1. Moonidih Basti 2. Bhawardaha Basti
6	WWD	1. Southari 2. Betenga bandh 3. Kari Tand
7	KATRAS	1. Alakdiha 2. Mohlidih
8	SIJUA	1. Pandeydih Basti
9	KUSUNDA	1. Lahbera Basti 2. Rawani Basti
10	BASTACOLLA	1. Sonar Basti. 2. Amtal Basti 3. Bangali Kothi
11	PB	1. Surguja Basti 2. Kaligarh Basti
12	LODNA	1. Nunudih Basti 2. Bhatdih
13	CV	1. Bhatnidih 2. Dispur Basti

3.4 Impact of the project on community

i. Door to door accessibility of health service

Due to the lack and poor health services most of the people in the command face difficulties in accessing the health services as services in government CHC, PHC are not up to the mark. The people used to do self-diagnosis and just randomly take medicine from the pharmacist without any proper consent from the doctor and which

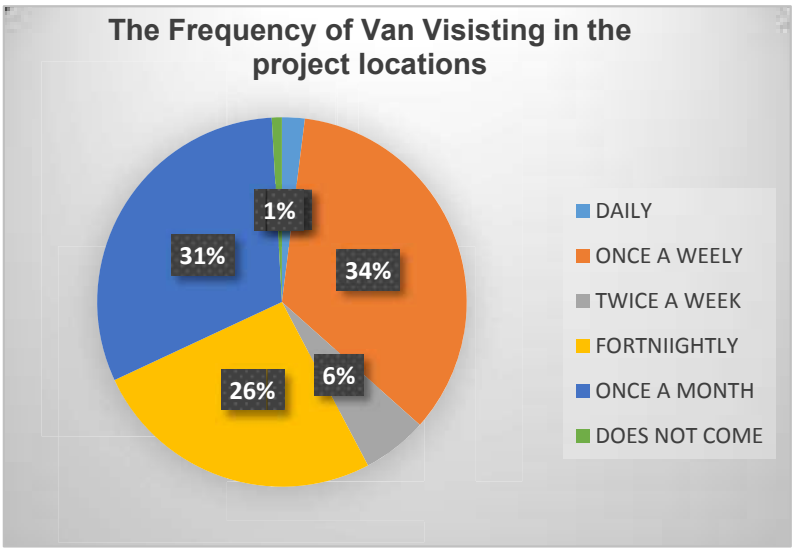

Figure 1 – Frequency of Van Visiting in the project locations

eventually seems to be one of the major cause for the adverse impact on their health. To avoid this and provide basic health care service to the people in the command area of BCCL, Swastha Rath was introduced. The Swastha Rath used to visit at least twice in each village. The respond gathered from the respondent through FGD and HH shows positive impacts of the project on the people in terms of the door to door accessibility of the project.

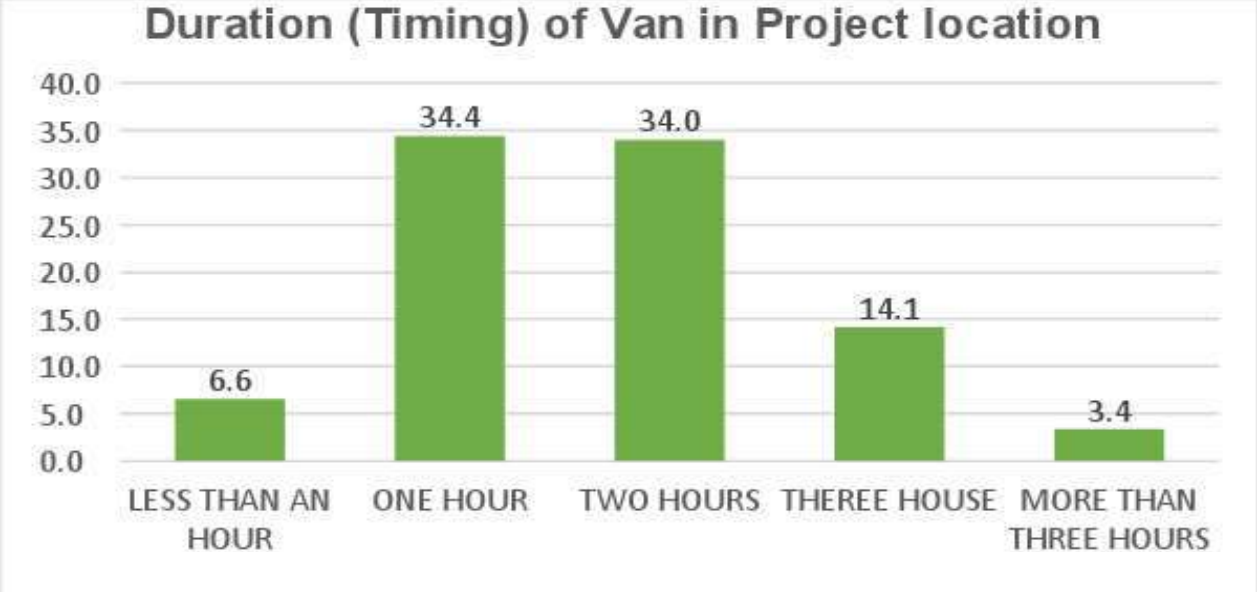

Figure 2 – Duration (Timing) of Van in project location

When interviewed, out of 503 respondents, 93.4 per cent responded that the medical van used to halt on fixed locations. Around 54.9 per cent people reported that the Medical Van had fixed timing and date of visits, which was informed by the Mobile Medical Team prior to its arrival. The locations were selected by keeping in mind the centre point of the villages or near the vital resource area of the villages such as Samaj Mandir, panchayat office etc. 70 % of respondent reported that the Swastha Rath used to wait at least 1 to 2 hours in each village making sure that all the people approaching them are checked and medicines were provided.

When interviewed people regarding the satisfaction of the duration of stay of van in their villages, 47.9 per cent people reported that they are satisfied by the duration (Time) of the van in their villages. Whereas, around 44.1 per cent people responded that they are not satisfied by the timing of the van. Similarly, around 92.8 per cent respondent reported that the location of Swastha rath was easily accessible by them as well as by their family members.

ii. **Filling the gap in health service**

Health is a primary and essential need of human being. It plays an important role in human life. The government hospital lacks in quality health care, infrastructure and accessibility because of which people mostly avoid going to the government-run hospital. To avoid this and provide basic health services, BCCL started Swastha Rath which aims in providing basic health service at the doorstep. Also, the service has enabled people to get access to basic health services at free of cost. Thus the service was a boon to the villagers.

Availability of health services

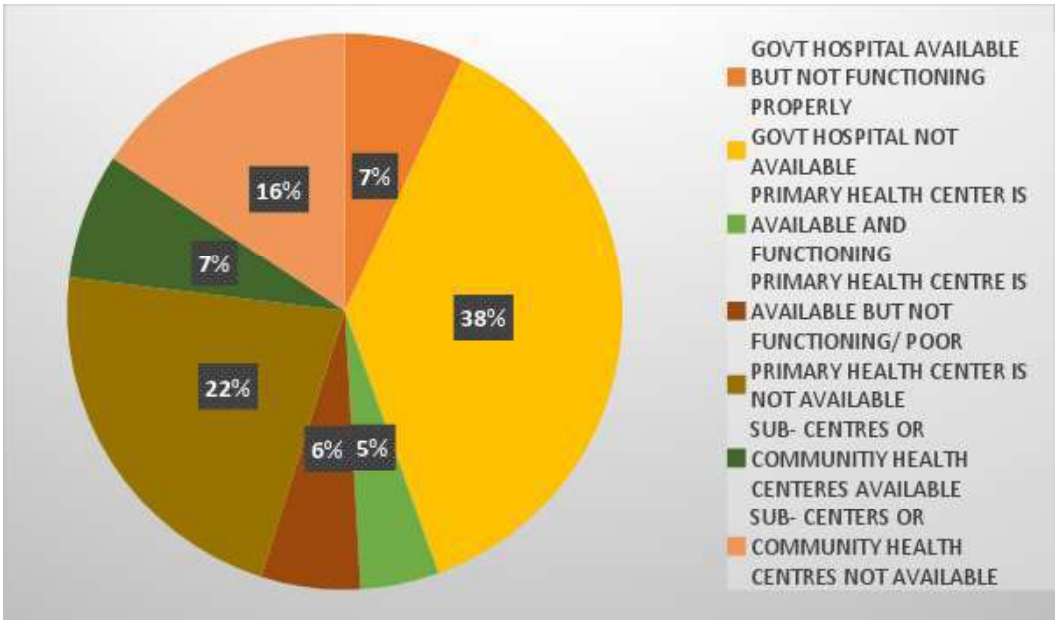

Figure 3 – Availability of health services

The above figure was derived by interviewing 505 households, out of which 38 per cent beneficiaries reported that government hospitals are not available, 22 per cent reported non-availability of primary health center and 16 per cent reported government hospital available but not functioning. Around 90 per cent respondent responded saying the nearest government heath care center is around 6 to 8 km away from their villages. Besides that, one of the major hurdles in reaching the health centre is the non-availability of adequate road infrastructure.

Around 95 per cent of people reported that the roads leading to the PHCs, CHC and Government hospital are mainly kaccha and thus is inaccessible. Therefore by understanding and analyzing the needs of the people regarding health services, BCCL felt the need of starting the Mobile

Medical Van called *Swastha Rathi* that would aim at providing primary health care service to these needy and disadvantaged group on their door step at free of cost.

iii. Awareness about health and hygiene :

Awareness generation was one of the core aspects of Swastha Rath. The MMV team used to provide information regarding healthy surrounding, general cleanness, tuberculosis, maternal and child health care, hygienic water consumption and hygienic sanitation. Many respondent also reported that the team used to practice healthy habits so that people can easily understand. Besides that around 95 per cent people knew that the swastha rath was run by BCCL. And in that around 29 per cent people reported that they came to know about this by seeing the BCCL name on the van.

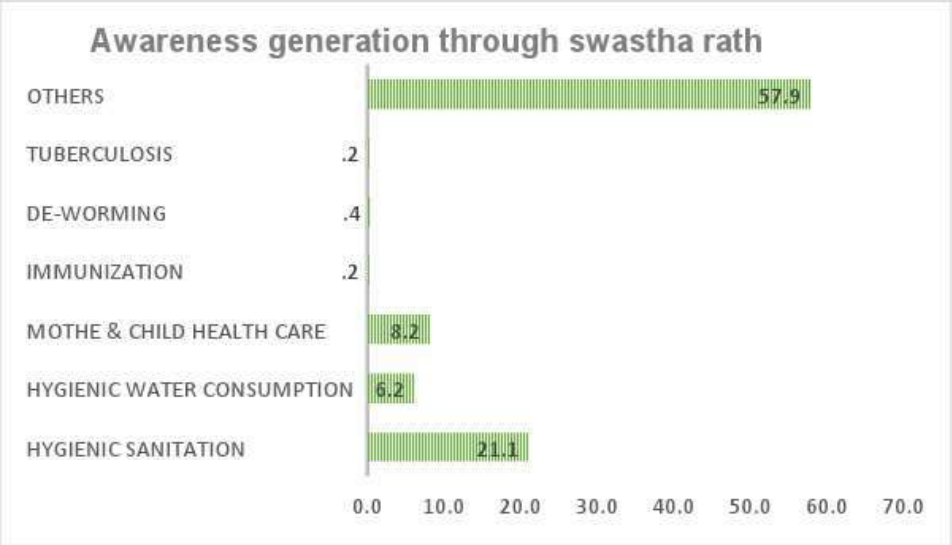

Figure 4 – Awareness generation through swastha Rath

iv. Reduce Economic Burden

Most common disease reported in the region is fever, cough, cold, anaemia, diarrhoea, and skin infection. Since there is no availability of medical services in the entire region, the villagers have to suffer a lot. The average income of the household were not good as the villagers are mainly engaged in agricultural work or work as a labourer. So, their

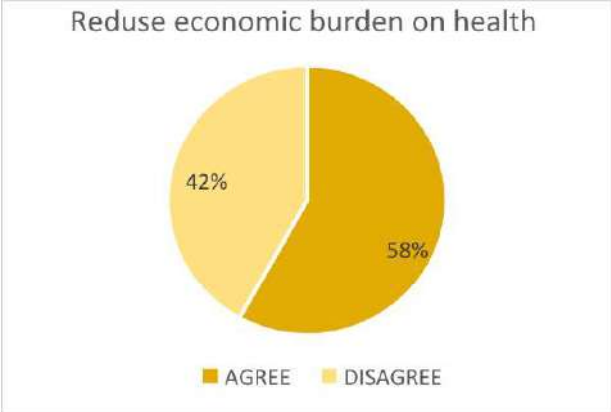

Figure 5 – Reduction in economic burden on health

earning is not sufficient and somehow people manage to survive and fulfil their basic needs. And if someone from family falls ill, then it's a significant economic burden on them to buy medicines because they have to go private hospitals or privately run clinics to purchase medicines even for normal fever or a cough and cold. Therefore, they are thankful to Swastha Rath for providing them medicines and eventually reducing their economic burden.

v. Addressing the health needs of people

Health care services in the entire region are dismal in terms of accessibility, infrastructure and quality. There are only a few Sub Health Centres in the entire area which is functional, but due to lack of such basic medical facilities, people were forced to travel at least 5 to 10 km to avail such medical facilities. Besides that, the transportation system is also very expensive and so accessing the existing health care facilities, which is at a quite long distance, becomes a crucial issue for the villagers. So, Swastha Rath was great hope for them as they are getting services at their doorstep without paying a single penny; in fact, it's saving their money and time as they are getting free services and medicines and also saving their travelling time and transportation cost.

Major ailments in the families

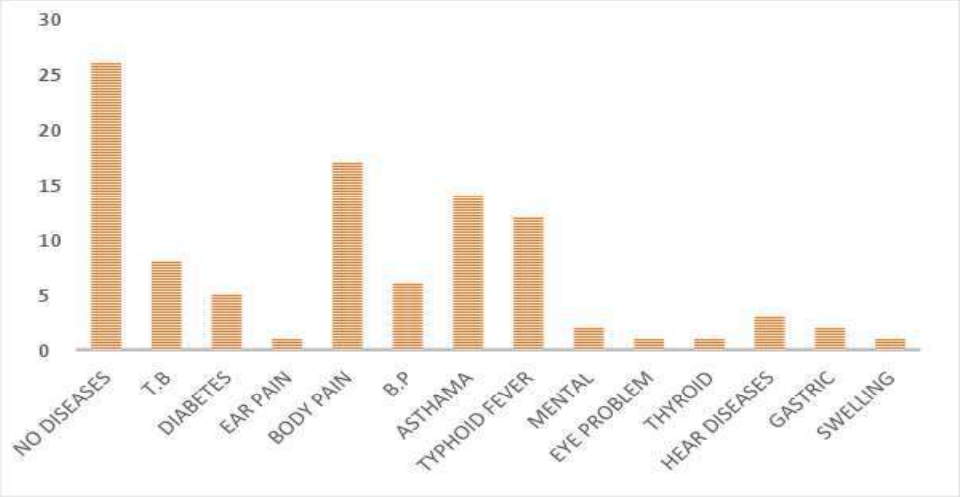

Figure 6 – Major ailments in the families

The major ailments that were reported by the respondent were Body pain, Asthma and Typhoid. When asked further, the respondents replied saying that the working environment and the pollution caused by the open cast mining illness such as respiratory tract infections have had an adverse impact on their health.

vi. Reduction in sickness

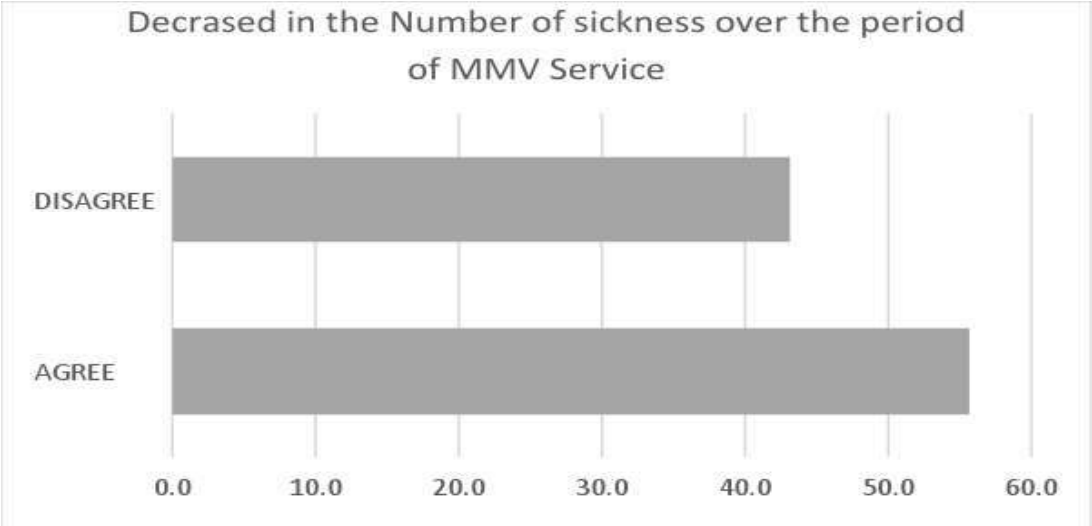

Figure 7 – Decrease in number of sicknesses over the period of MMV service

The above graph shows that 56% of the beneficiaries agreed about the fact that there was decrease in occurrence of sickness over the period of MMV services. While 44% beneficiaries disagreed about this fact.

3.5 Gap identified in the project

a. Limited Regularity of Swastha Rath

Even though the intention of the project was noble, but the regularity was the big hurdle in proper implementation of the project. The Swastha Rath had the target to visit the villages at least twice a month, but during the study it was identified that a few of the places were kept untouched by the project and these areas were mostly near to the colliery areas. As mentioned above around 34 per cent people reported that the Swastha Rath visits once in a week and 31 per cent people reported that it used to report once in a month. The reason for the same reported by medical team of BCCL was availability of limited number of vans. Each BCCL area had only 1 to 2 Swastha Rath. It becomes difficult for the doctors and also to the staffs to reach all the

villages, as each area only gets a van for only 15 days and thus this also limits their accessibility in terms of reaching all the villages.

b. Limited Awareness campaign

In spite of having awareness campaign as the core idea of swastha rath around 93 per cent of people reported that no such awareness campaign has been done by the Swastha Rath. Whereas only 7 per cent of people reported that awareness campaign has been conducted by the Swastha Rath

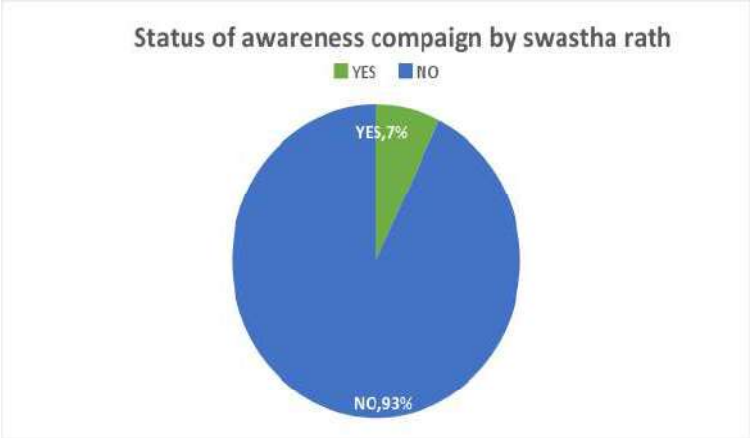

Figure 8 – Status of awareness campaign by Swastha Rath

c. Limited Health Services

The Basic/Primary health services is very limited that is only free health checkup and medicine supply. In some villages, it was also found that the doctor used to visit sometimes and only the pharmacist and the driver use to go and distribute the medicine without any proper diagnosis process being followed. In addition to that blood pressure check and weight checkup were not conducted. At the village level, there was no appointed person who could look after the health services in absences of Swastha Rath. Around 99 per cent people raised the concerns stating that there is scope for improvement and enhancement of the Swastha Rath. 3.6

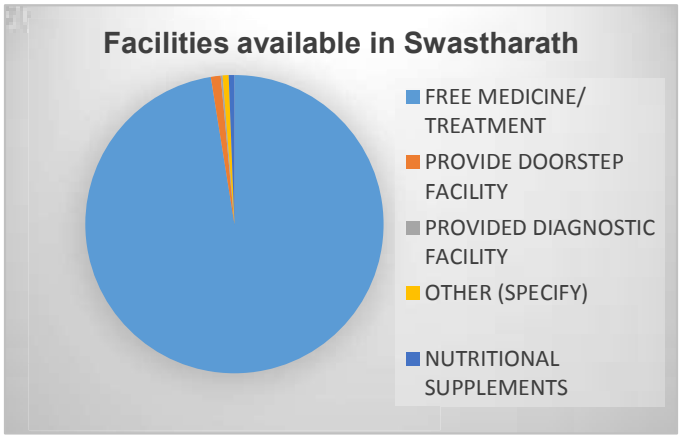

Figure 9 – Facilities available in Swastha Rath

Multi-stakeholder Perspective on Swastha Rath

a. **BCCL Officials:** BCCL being a responsible corporate in Dhanbad region had always been active in providing basic health services to the people of the company's command area since a long time. Therefore BCCL started Swastha Rath with the intention of providing basic health care service in the remote areas for those who are unable to access them or afford them. Besides that, the company aims at creating general awareness about health and hygiene. The Project was run in 206 villages and has targeted more than 2 lakhs people.

b. **Village People:** The Swastha Rath was very useful. It has helped the villagers in many ways. The accessibility of health care has increased as medicines and treatments are being provided free of cost at their doorstep. The economic burden has been reduced. Now people neither travel nor go to the private hospitals and clinics. At the same time, the cost of the travelling is also being saved. Along with this various awareness campaign are conducted wherein the people are being provided with the informations regarding health and hygiene.

3.6 Beneficiaries' point of view on Swastha Rath

3.6.1 Vinay Bhal, 49 year old: a resident of fulwar basti is a laborer in coal mine says "Since the time Swastha Rath had started coming we are very happy because we are staying here for a very long time and health is the major problem that we are facing. The nearest Sub-centre is around 8 km away and that too is not in good condition. It was difficult for us to travel so long, with no other option left, we used to go to local pharmacy and tell them our sickness, and accordingly they use to give us the medicine, and we use to have it. Swastha Rath comes in the village twice a month and provides us medicines free of cost. They treat us all. The doctor behaviour is good. He checks us and also make us aware of the health and hygienic conditions in we should dwell. Since Swastha Rath started coming to our village, our money is being saved and also the medicines are effective".

3.6.2 Meena Rahman 25 year old, resident of Amlabad village says: "Coming from a poor background we are unable to afford to go to private clinics or hospitals. The nearest government Sub-centre is around 7 km away. From where do we bring the money? We work as a wage earner. There is no guarantee of the job. We would get tomorrow or not, we don't know. Thanks to BCCL Swastha Rath! Since the time it has started coming to the village, the economic burden of health has been reduced. We get free treatment and medicines. The van comes twice a month and check all of us. Now we don't get worried so much as the van comes and check us and treat us for free."

3.7 Recommendation of the project

1. **Frequency of the Swasth Rath Should be Increased**

One of the most important demands that came from the public was that the frequency of the Rath should be increased. As it was supposed to visit the targeted villages twice a month, but as mentioned previously that the Rath was unable to visit a few villages. Similarly in many villages, the Rath only visited once in two to three months. Therefore the frequency of the Rath should be increased and should be available in the areas/ villages where it is needed the most and also the availability should be increased.

Frequency of Swastha Rath in Village

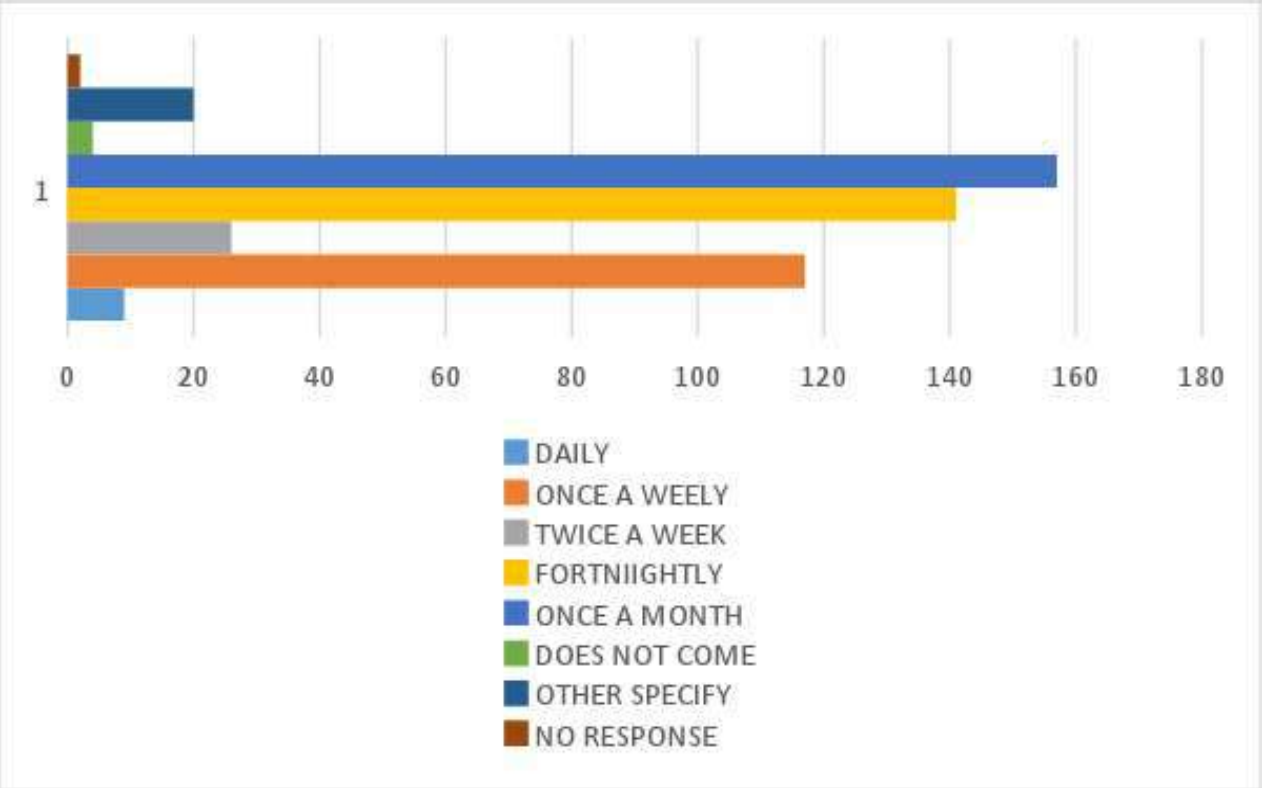

Figure 10 – Frequency of Swastha Rath

The above graph highlights that the frequency of Swastha Rath in the targeted village. Around 157 people responded that the Swastha Rath came once in a month, whereas 141 respondents reported that the Swastha Rath used to come once in fortnight. Again, around 117 people reported that every once a week the Swastha Rath used to come.

2. Need for female doctor and nurse

It was highlighted by the statistical data that out of 500 samples 99.8 per cent reported that there is a need for female doctors and nurses in the Swastha Rath as the women feel uncomfortable to open up their sicknesses in front of male doctors.

3. Need of a health worker at the village level

It is recommended that there should be a health worker appointed at the village level that would look after the health services and status of the village and subsequently could report to the nearest BCCL regional or area hospital. At the same time, medical stock should be provided to this appointed health worker, who in times of emergency could provide necessary medicines as per the need of the villagers.

ii. 4. Necessary Provision for Emergency

Around 98.5 per cent of people responded the need of emergency services in Swastha Rath, and this could be done by printing the emergency helpline number on the van so that during the emergency the people can avail the services.

iii. 5. Need of Additional Services

Additional services such as blood pressure check, BMI, Weight test and malnutrition test should be conducted and if significant issues found in the test results, then further treatment should also be provided to the beneficiaries by referring them to the nearby BCCL area hospitals.

CHAPTER 4 – MULTIPURPOSE UTILIZATION OF MINE WATER

4.1 Background of the project

Since its inception, BCCL has felt the importance of water and endeavoured for effective and gainful utilisation of mine water from abandoned mines which has to be taken out of course of mining process necessarily. For harnessing such water, BCCL has taken upon the task of holding the mine water into the water bodies by restricting them to flow into the natural drainage course like village reservoirs which gets dried during summers, by laying out a pipeline network of approximately 45 km.

With the help of this scheme, approximately 47 million gallon surplus mine water is presently being discharged into natural water courses from the mines of Barora, Block-II & Govindpur areas of BCCL. This water is being stored in two reservoirs situated in Khonathi and Behrakudar villages with storage capacities 16 million gallon & 31 million gallon and with area of about 4.0 ha & 4.5 ha respectively.

Under this scheme of BCCL, the farmers residing nearby and having their cultivation fields in reasonable proximity will benefit in carrying out their agricultural works, in all seasons, which at present is totally dependent on rainwater in monsoon.

This provision will certainly enhance the Socio-Economic status of the area and will also result in more opportunities in secondary & tertiary fields of employment. This water could also be used for drinking purposes after required treatment. In these reservoirs, Pisciculture could also be adopted with the help of self-help groups for their livelihood.

4.2 Objective of the project

To harness mine water for its gainful multipurpose utilisation in the peripheral villages of BCCL command area.

4.3 Location of Implementation

Two reservoirs situated in Khonathi and Behrakudar villages of Baghmara block of Dhanbad district.

4.4 Study sample details

Out of the 352 samples collected by the research team in the villages near the two ponds in Baghmara block, 72 per cent respondents belong to the OBC category while SC makes up 10.5 per cent of the sample studied. Again, 8.2 per cent are Scheduled Tribe and 7.4 per cent belong to the General category. Apart from these categories, a few samples from Nomadic Tribe and Denotified Tribe (around 0.9% each) were also taken into consideration for the study.

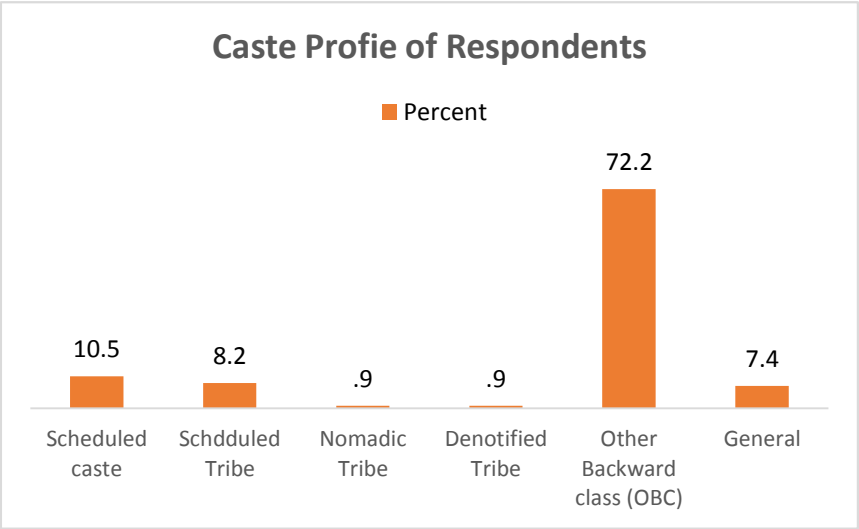

Figure 11 – Caste profile of respondents

42.3 per cent respondents reside in 'pucca' houses while 34.1 per cent resides in semi-pucca houses. 15.3 per cent respondents owned kutcha houses, and 8.2 per cent of the respondents reside in huts. Focused Group Discussions revealed that houses in the villages were not accurate depictions of income and wealth of respondents as the most of the houses were inherited which housed two to three families dwelling together, i.e. 10-15 people in a two bedroom house. Therefore, the respondents staying in houses made of brick and mortar do not necessarily have high-income sources. Electrification of the villages has been a success as 92.9 per cent of the respondents' houses were electrified although the electricity is supplied for 3-4 hours daily. Open defecation is an overarching phenomenon in the villages with 51.7 per cent of respondents opt for this option while 41.5 per cent use their pit toilets.

Private sources of water are scarce as 45.2 per cent of respondents rely on community hand-pump for their potable water needs. While the quality of water could not be ascertained, 38.6 per cent respondents boil the water as a method of water purification, 16.5 per cent respondents sieve the water, and 6.3 per cent do not do anything for water purification.

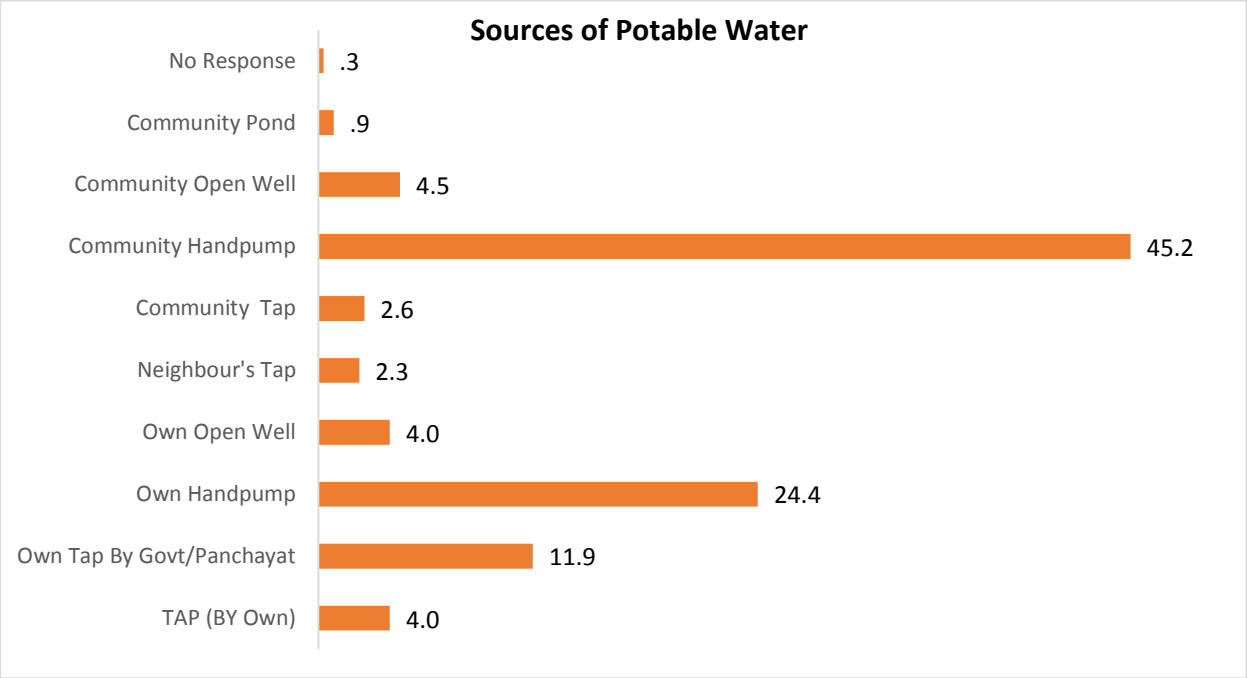

Figure 12 – Sources of potable water

4.5 Impact on the community

i. Use of Mine water supply for filling ponds

The respondents are compelled to use whatever water is available to them for their daily needs. To wash clothes, 49.4 per cent respondents use the mine water ponds while only 0.3 per cent respondents use the ponds for agricultural activities.

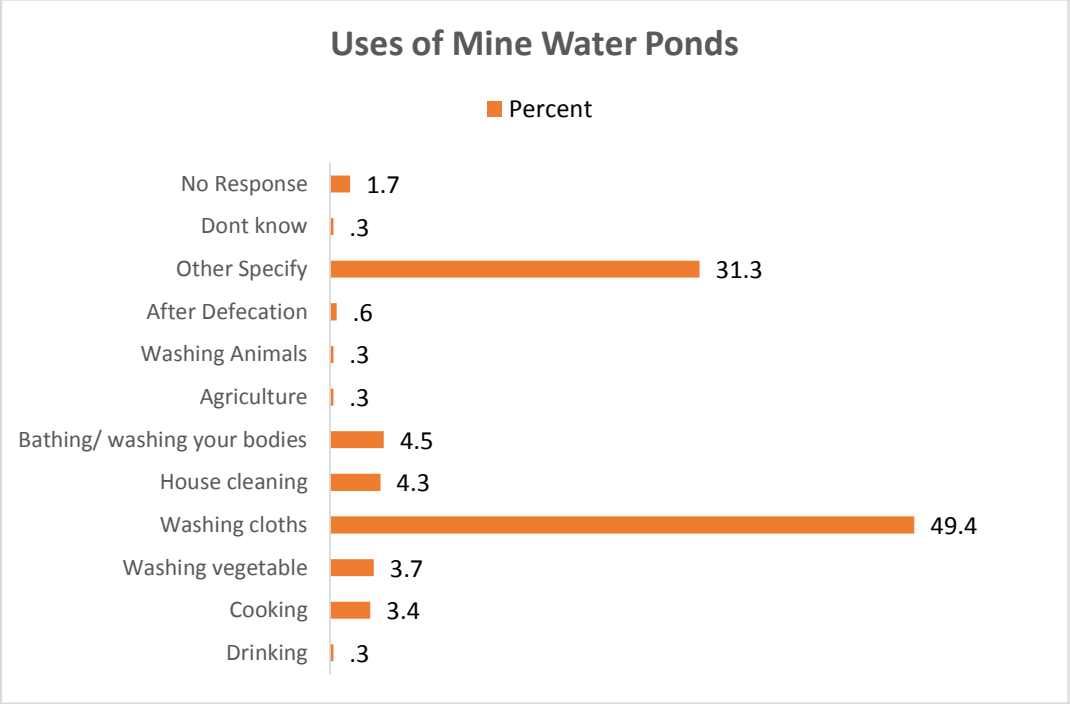

Figure 13 – Uses of mine water ponds

ii. Land holdings and irrigation sources

64.5 per cent respondents claimed they owned agricultural land while 35.5 per cent were found landless. According to the landed respondents, 35.5 per cent of them use the mine water pond for irrigation while 4 per cent have no sources of irrigation. Borewells near the farmland are another source of irrigation which is depicted in the 'other' category in figure no 14. The major crops grown by the respondents are paddy (65.3 per cent), vegetables (21 per cent) and maize (11.3 per cent).

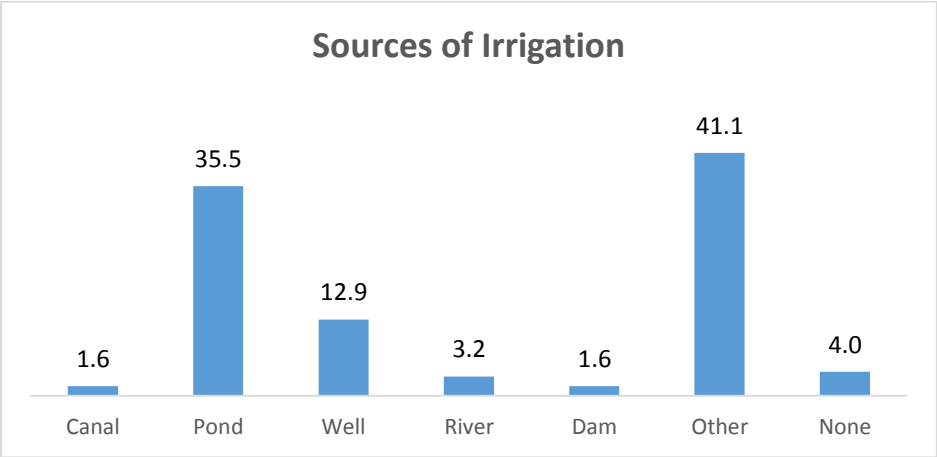

Figure 14 – Sources of irrigation

iii. Renovation activities of the ponds:

For the impact assessment study, it is primarily important to gauge the opinions and perceptions of the beneficiaries about the mine water ponds. BCCL has been operational in the Baghmara block for several years and has created a rapport with the residents of the villages. Therefore 59.1 per cent respondents knew that the mine water was drained into ponds. The respondents were enquired about the activities done by BCCL for the pond. 54.3 per cent of them knew that embankment or stone pitching was done around the bank, while 17 per cent knew that the *ghats*/stairs were constructed. 16.8 per cent respondents did not knew any of these activities, mainly due to the farther distance from the pond or not being present at the time, etc.

Table 4 – Beneficiaries awareness about activities done by BCCL for the pond

Activity	Percentage of respondent responses
Embankment or stone pitching around the bank	54.3
Inlet and Outlets	2.6
Ghats/Stairs	17.0
Repair	8.5
Don't know any of the above	16.2
Don't know	.6
No Response	.9
Total	100.0

Approximately 70 per cent of beneficiaries came to know about the renovation of the pond by physically observing the activities while 9.1 per cent came to know through the display boards put up by BCCL. Only 2.3 per cent were informed in the *gram sabha*.

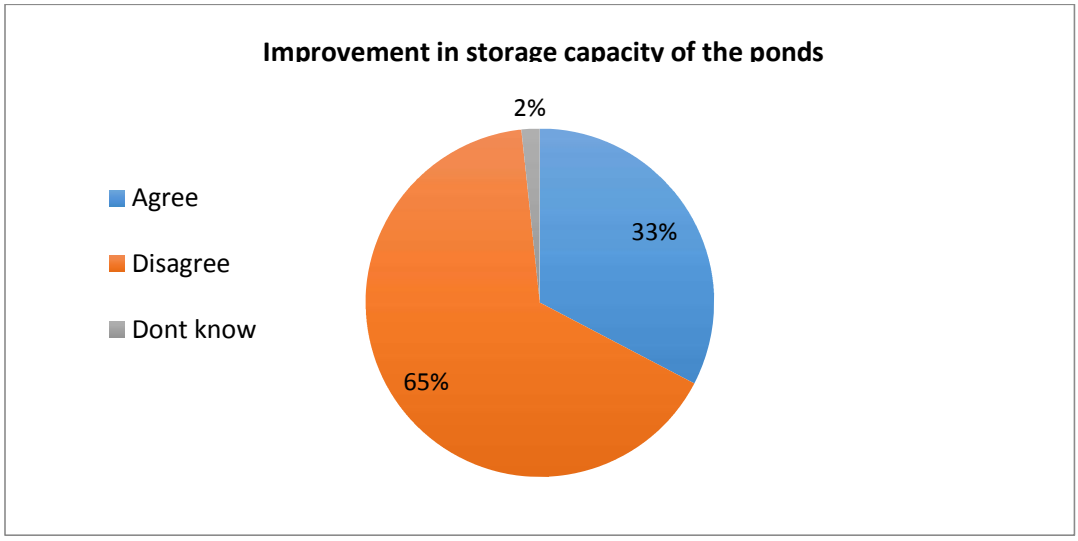

Figure 15 – Improvement in storage capacity of the ponds

It is of great importance that the beneficiaries are being involved in the planning process of a project so that their needs and problems are accounted during the intervention.

During FGDs it was found that heavy machinery such as excavators, loaders and trucks were used to finish the work in less than ten days as manual labour would have extended the time of completion of work to 30-35 days. It was also mentioned that the work in one of the ponds was proposed to be carried out in monsoon. But due to monsoon, the pond was full of water and therefore many areas in the pond was left unexcavated.

4.6 Gaps Identified

i. Minimal improvement in storage capacity

During the discussions, it was discovered that the ponds lie in the natural catchment area of rainwater, therefore, the water in the ponds did not dried up during the summer season before the renovation.

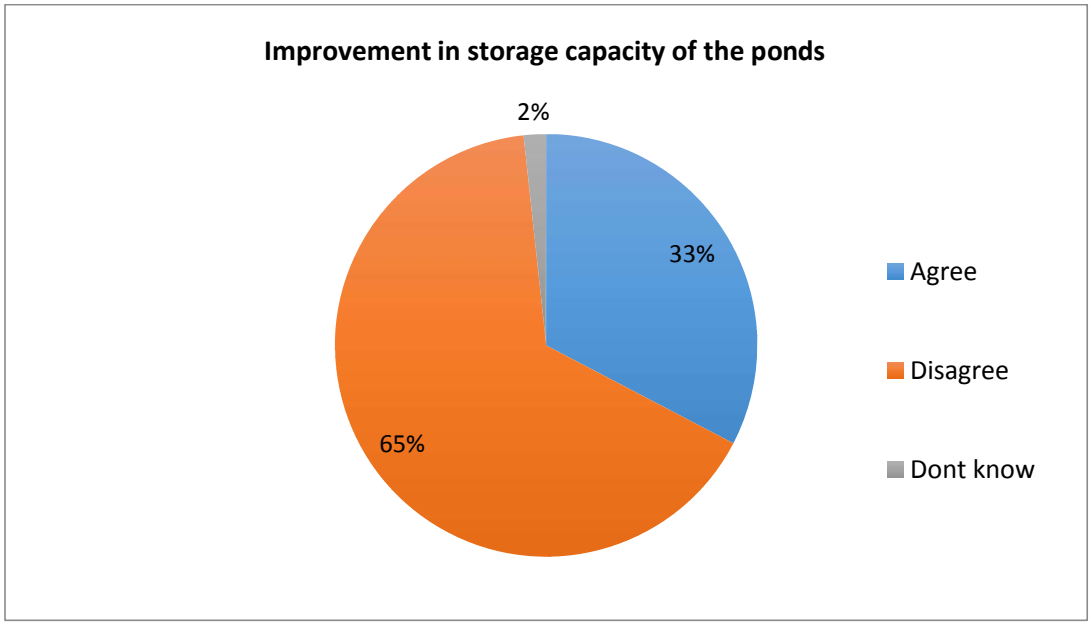

Figure 16 - Improvement in storage capacity of the ponds

Even though the ponds do not dry up, the water is scarce and the population depending on it for routine activities is increasing every year. Respondents also shared that they have to skip bathing for many days so as to preserve water for cooking and drinking. Therefore, 65.6 per cent of the respondents disagreed when asked about the improvement in storage capacity after the renovation of ponds. Also, as evident in Figure 17, 69.3 per cent respondents states that the scarcity of water has not reduced.

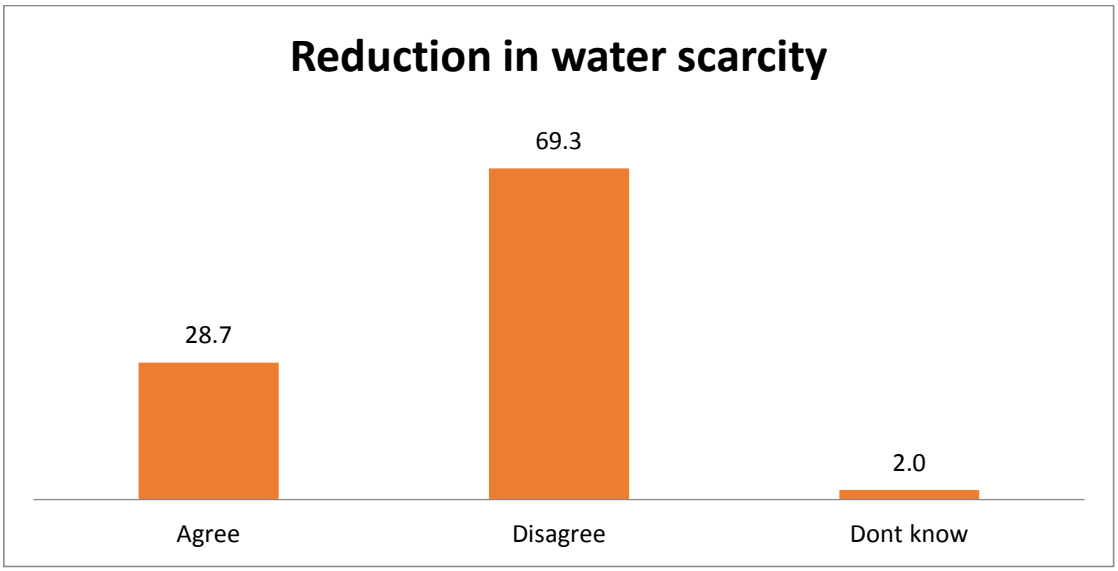

Figure 17 – Reduction in water scarcity

ii. Lack of employment generation activities

Employment generation would have been an important gainful use from the ponds as duckery and fishery activities were proposed in the project. But 92.3 per cent respondents feel that no new job opportunities have been created with the renovation of the ponds.

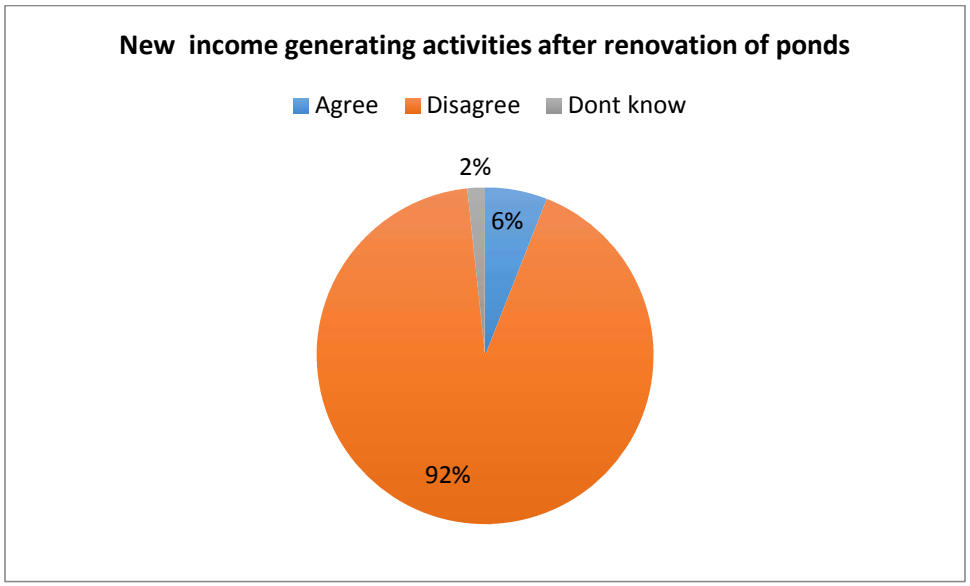

Figure 18 - New income generating activities after renovation of ponds

The respondents also stated their concern to the research team that these gainful activities are being carried out by contractors for their profits, and therefore, the villagers are unofficially banned from carrying out these activities.

iii. Minimal increase in agricultural production

Further, 86.6 per cent respondents believe that the pond has not aided in critical irrigation requirements as there are farmlands of hardly four to five farmers near the pond. Most of th e farmlands are significantly at greater distances. In such cases, the cost of machinery to lift the water to these far away farms is high that residents avoid taking water for irrigation from these ponds. Therefore, the number of crops grown per year by most of the respondents has also remained unchanged after the renovation of ponds.

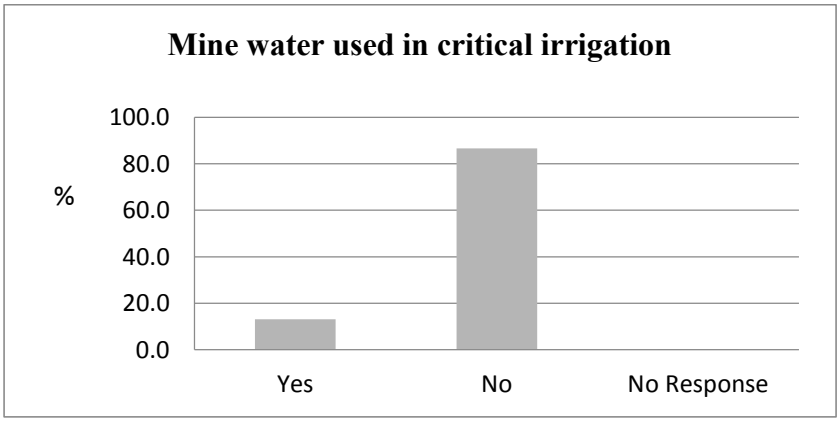

Figure 19 – Mine water used in critical irrigation

As per 90.3 respondents, agricultural production does not happen beyond personal consumption. As a result, the small and marginal farmers go to cities in search of work at least 15 days a month in order to feed their families.

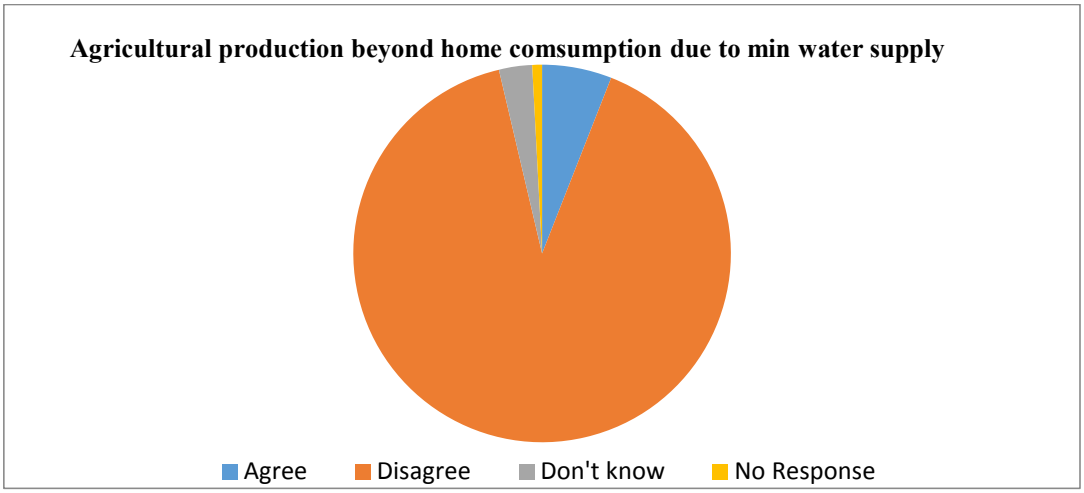

Figure 20 - Agricultural production beyond home consumption due to min water supply

Therefore, when asked if there has been a cumulative increase in the income of the household post- renovation of ponds, 94.9 per cent of the respondents replied negatively.

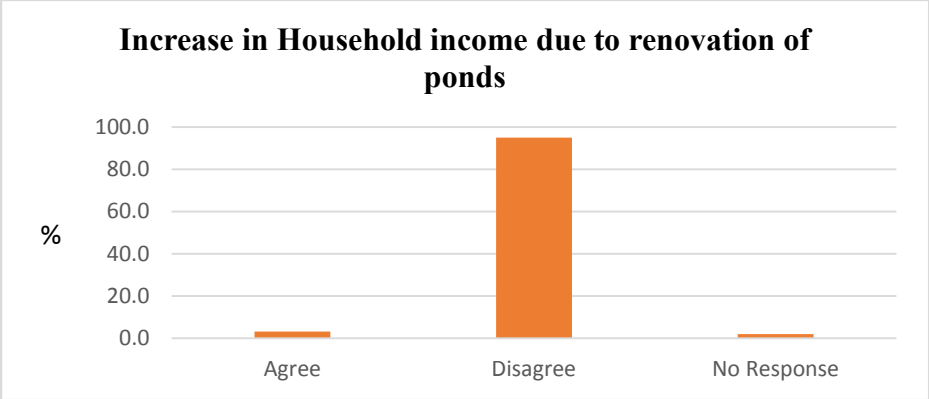

Figure 21 - Increase in Household income due to renovation of ponds

iv. Irregular supply of mine water

Another motive of conducting the impact assessment of this project was to find out from the beneficiaries whether there is any need of improvement in the projects and in which areas. In FGDs, respondents overwhelming suggested that there is an urgent need for improvement in the project in terms of mine water supply. Officially, 70 per cent respondents did not know how often the mine water is being supplied, but 83.2 per cent respondents agreed that there should be a timely supply of mine water.

v. Lack of participatory planning

94.3 per cent respondents claim that no village meeting was conducted before the supply of mine water in the ponds. This highlights the lack of participatory nature of the activity. It can further be showcased when the respondents were asked regarding their participation through *shramdaan* (voluntary labour) and 84.9 per cent responded negatively. Apart from these concerns, 51.1 per cent of the respondents did not know who carries out repair and maintenance of ponds, while 8.8 per cent claimed that BCCL is responsible for the same.

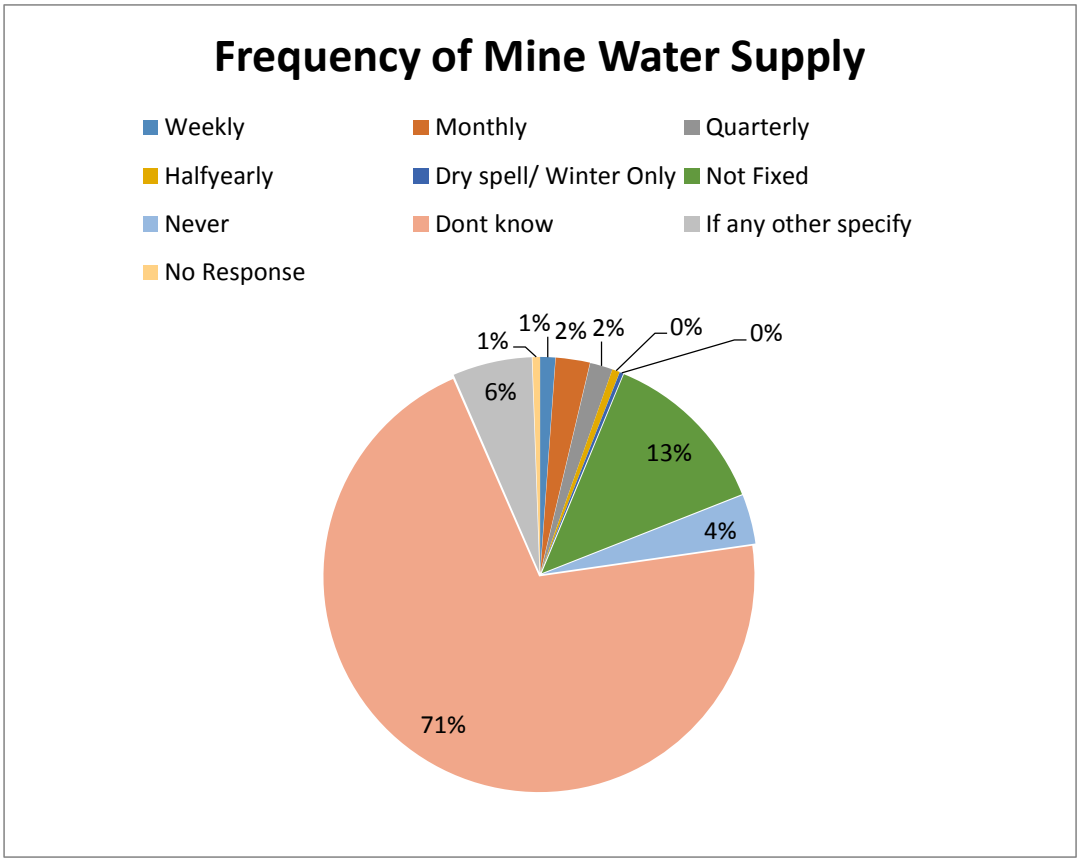

Figure 22 – Frequency of mine water supply

The respondents stated that since the renovation of the pond had taken place, only two or three times the mine water had been supplied. And eventually it was not sufficient for consumption by all the beneficiaries of the ponds.

Table 5 – Beneficiaries response on last supply of mine water.

Last supply of mine water	Percentage
Last three months	.6
Last six months	1.7
Last one year	9.1
More than a Year	47.2
Don't know	40.1
No Response	1.4
Total	100.0

It is of utmost importance to note that 94.3 per cent of the respondents want BCCL to resume supplying mine water to the ponds as they believe that even though there may be no short-term benefits of the project, long-term benefits will help the future generations in leading a better quality of life.

4.7 Recommendations

Due to various reasons, mine water supply to both the ponds has been halted for the past one year. According to the beneficiaries, they have not been able to reap any benefits from the projects. In the project proposal, 25000+ beneficiaries were identified who would be able to avail the benefits of the mine water supply project. However, it was found that only around 1000 families were able to use the ponds. Also, the project proposal had stated further highlighting that the beneficiaries would see a marked improvement in the household income after the pond renovation as they will be able to carry out multiple income generating activities. But as of now, the beneficiaries uses the ponds for only household consumption which was the case prior to the pond renovation as well. Overall, they insist that the mine water project was a fruitful venture but the supply of mine water is insufficient to bring about a change in their income or general quality of life.

Following are the main recommendations for the improvement of the Mine Water supply project:

- Participatory approach: Participatory project development is necessary to gauge the perception and needs of the beneficiarie,s and hence the project needs to be modelled around that.
- Pond upkeep: Repairs and maintenance of the ponds need to be carried out regularly with an immediate attention to Khonati pond as one of the pipes laid near this pond has been damaged.
- Sharing of information: For proper dissemination of the information regarding project cost, project details and maps, boards need to be put up at various locations so that damage to the pipelines could be avoided.
- Focus on employment generation: A plan needs to be developed to ensure effective utilisation of the mine water supplied to the ponds which would subsequently lead to augmentation of household incomes of the beneficiaries.
- BCCL should conduct a cost-benefit analysis as well as Social Return on Investments (SROI) analysis in such large-scale projects.

CHAPTER 5 - VILLAGE ADOPTION PROJECT (LAHBERA)

5.1 Introduction

Lahbera, a village situated in Jharia block of Dhanbad district, Jharkhand is one of the centers attraction of BCCL CSR activities. The village mainly consists of the tribal population of 392 people with 63 households. The charm of this project lies in many facts, one of which is the integrated module of development experimented by the BCCL. The BCCL adopted the village in the year 2009 with an intention of integrated development of tribal for their economic and social development through various schemes and program run by them. As the part of the CSR activities, various infrastructural and economic projects were set up that could help the villagers in their economic development.

5.2 Objectives of the Study

The main objectives of the project is to develop the selected village in an integrated manner ensuring its holistic and integrated development through capacity building and participation of local people and institutions, and this is done through establishing and creating various infrastructures such as:

a. *Construction of Primary School*
b. *Masala Chakki,*
c. *Health Centre*
d. *Sewing Training Centre*
e. *Multipurpose Hall*
f. *Adult Education Centre*
g. *Pipeline for water supplies*
h. *PCC Road and Drainage lines*
i. *Solar lights*
j. *Playground*

5.3 **Projects and their Impacts**

I. Multipurpose Hall

The hall as its name suggest was used for multiple reasons. It was constructed in the year 2009. It is located in the premises of playground and having the area of approx 800 – 1000 sq ft. The amount invested in this infrastructure was Rs.650851/-. The hall is used for various programs such as conducting health camps, adult education centre, village meetings, social gatherings, marriages, family functions and various other programs. The hall was equipped with tube lights, fans and toilet facilities that have impressed the people, utilizing it for various purposes.

Beneficiaries' viewpoint

Meera Marandi, a residence of labhera village says: 'this hall has helped us a lot, especially during our adult education centre; we use to come here daily at 4 pm and study till 6 pm. Not only this, we also used hall for various occasions such as marriages, meetings and other family functions. She also added further admitting that her brother marriage was also fixed here. When we were small, our family used to have functions in our aangana. But after the hall was constructed we are utilizing it for many purposes, and it does not cost us anything as it is free for us. When asked for maintenance, Meera said that usually BCCL looks into it. But she feels it's also her's responsibility to take care of the hall as it is very beneficial for them.

II. Adult Education Centre

The Center started in the year 2009 and was run by the two mentors which were appointed to teach by the BCCL. The aim of the Centre was to provide basic and primary education skill sets to those who were unable to get benefit from the regular education system but were dedicated to learn. The classes were held in the hall where 150 students including young girls and married women were taught in one batch, from 4 pm to 6 pm, for five days a week. The course design was from simple to complex or from known to unknown. The classes include subjects that were related to the daily life of people such as basic mathematics and hindi. Besides that, subject such as English was also encouraged. The session on gender sensitization and human biology were also being taught. Teaching and writing skills to the women was one of the important aspects of the AEC. Girls and women used to like the classes and the mentor's way of teaching.

Beneficiaries' viewpoint

Rani, a construal laborer in a mine and also the residences of lahbera village says: 'from the time the classes had started, I used to come here for studying. Coming from a poor family, I was unable to get school education as I had to assist my parents in coal mines. I wanted to study, but my family condition didn't allow me. Then through BCCL, we got this education centre, where the master used to teach us - how to speak, read and write. In the beginning, I was very shy but then the master always used to motivate me and call me in front and asked me to talk about myself. I used to be very shy and reluctant. But gradually I started speaking and slowly writing and reading too. Now, I also understand basic maths that helps me to calculate the numbers of days my friends and I work and the salary we deserve for it.Earlier we used to be paid less. Because of these classes, I feel empowered and confident now. I can directly speak to my malik

(Boss) and other people.' Rani now feels she is empowered and also has the courage. She also motivates other girls like her to come and join the classes. But it is unfortunate that the classes are not running now as the salary of a few of the mentors has not been paid yet by the BCCL. Hence, the mentors have stopped coming to teach.

III. Health Centre

The Health Centre was also established in the year 2009 and was operation till 2015. The aim of this project was to provide primary health care services to the people of lahbera village. The total cost of construction of health centre was Rs.373096/-. The Health Centre was used to run with the help of the Kusuda Area Medical team. The team consisting of doctors and nurses used to visit the hospital on a regular basis. The health team used to provide services such as consultations and medicine free of cost to all the villagers. Besides that, services such as blood pressure checking and weight measurement were also been provided. In addition to these services, awareness generation on health and hygiene was also provided periodically. The timing of the hospital was mostly 11 am to 2 pm. In case of emergency, the case was transferred to

Kusuma area hospital for further treatment. Health camps were also organized in the village whereby services such as eye checkup and other primary health care treatment were provided. When the research team asked the people about the medical services, a common replay come from all of them was that, 'the health centre must start again'. The impact of this health services was not only limited to the lahbera village, but it was also beneficial for the people from the nearby villages. From the response that the team got from the people states that medicines were mostly provided on general and seasonal illness. And for terminal sickness, the patients were recommended to visit the regional hospitals or the central hospital in Dhanbad.

Beneficiaries' viewpoint

Ravi Mhatto, a residence of lahbera says: 'the health centre was very helpful for us. In the older days we have walk a few kilometres to get access to the health services. Most of the people use to just go to the medical shop and ask for the medicines, and the shopkeeper just used to give them medicines without any knowledge about the sickness. But, when the health centre started, people started coming here. They used to get free treatment and medicines. The doctor's behaviour was also good and kind. But from past few years, the health centre is closed. Since then, it's the same condition as before.' He added: 'we are adopted village and health is the most basic things that we need. We request BCCL that they should start the health centre once again'.

IV. Masala Chakki

Masala Chakki was one of the economic empowerment projects of BCCL. BCCL had provided the Masala Chakki to the villages. The total cost spend on the masala chakki project was Rs.394918/-, and it was run by the group formed by the villagers itself, consisting both male and female members of villages. The aim of Masala Chakki project was to provide self-employment and develop entrepreneurship at the village level. The Masala Chakki was operational only for a few weeks after which the group stopped it. The reasons highlighted for the same was that there was no market linkages, no proper monitoring and no guidance to run the Chakki and even no proper financial management. Hence, it was nonfunctional project as said by the people.

V. Sewing Training Centre

The Sewing Training Centre was another economic empowerment activity of BCCL which intended to provide sewing skills sets to young girls and women through practical teaching. The course was started in the year 2009. The investment made by the BCCL CSR was Rs.378459/-.

The centre was run in collaboration with BCCL CSR and Nari Shakti Samiti, a branch of women development of BCCL. The training was provided to girls and women from the lahbera village which was free of cost but for other participants from nearby villagers was Rs.50/- for admission and Rs.25/- as monthly fees. The training was taught by the two mentors appointed by the BCCL and Nari Shakti Samiti. The training consisted of sewing training of various types such as dress, fall biding, bed sheets and a few others. The total batches run till now were two with the targeted beneficiaries of 156. After the completion of course, a certificate was also issued to the participants. The duration of the first batch was for nine months and for the second batch was six months. The training program also had the practical exam whereby the participants were told to demonstrate the skills that they had learned during the sewing classes.

Beneficiaries' viewpoint

'I did not know what is called sewing', says Nelam Marandi, a girl of 18 years coming from a poor family. She only got a chance to educate herself till STD 4 after which she was told to assist her family by working with them in coal mines. Nelam was very much fond of clothes, especially designing and sewing. But due to no proper skill sets she used to get disappointed. Since the sewing course had started, she joined in. She was the student of the first batch. Over a period of months she started enjoying the training program as it was something that she liked. She learned about different type of fabric cloth, stitching, dress designs and much more. Over the period, she was empowered. Her skills in sewing was improved considerably, along with that her confidence too! After completing the course, she got a job of the assistant tailor in a tailor shop where she experimented her skills and also gathered enough money to buy a new sewing machine for her'. She says, 'I was working hard, saved the money which I got from my job and bought a machine for me. Now, I work from home and I earn around Rs.2000/- a month from this'. She was very thankful to the training centre and also motivated many others like her.

VI. Solar Lights

As on paper, 20 stands of solar lights were to be installed in and around village. But on field, it was observed that only 6 solar lights were present and that too around the corner of the park. Also, the batteries of these 6 solar lights stands were stolen and thus it was not functioning.

VII. Primary School Building

One of the major infrastructural developments in Lahbera was the primary school building. As per the information obtained from the residents, the school was constructed in 2014 but not yet inaugurated. The school intended in providing primary education to the children of lahbera village and other nearby villages. Since the construction had been completed, the school building is not being inaugurated and thus left abandoned.

VIII. Computer Training Center

The centre was started in collaboration with Nari Shakti Samiti and BCCL CSR. Around eight computers were provided to Lehbera CTP. The purpose of the project was to develope IT skills among the youths of Lahbera. The project was functional only for a few months, without any expected outcome.

IX. Drainage line and PCC Road

The Construction of Drainage line and PCC Road in Lahbera covered only a particular region of the whole village. The drainage line physically observed was less than 400 metres, and half the work of the drainage system had been left incomplete. Same was the case with the PCC road construction. A few areas of the village had incomplete road construction as well as unrepaired kaccha roads. The amount of money spent on drainage line and PCC road was Rs.7, 27,949/-.

X. Water supply

Before the village had been adopted, it was facing water scarcity issues. The villagers had to walk a few kilometres to fetch water. The situation didn't change even after the adoption. BCCL installed only three water pipelines that were observed on the field against the population of 392 peoples. As observed on the field, the water flow was very slow and also the water supply was only for 3 hours a day. In place of taps, BCCL had just provided a pipe with no proper measures to control the flow of water and to avoid the wastage of water. The total cost spent on the project seems to be more considering the negligible impact caused by it.

5.4 Multi-stakeholder Perspectives on village Adoption project

Table 6 – Multi – stakeholder perspectives on village adoption project

Projects	Villagers	BCCL
Multipurpose Hall	The Hall was very useful for them as it is easily accessible and can be used for both, personal and community functions purposes.	The BCCL was aware of the need of community hall as it was used for important purpose, both at personal and community level.
Health Center	The Health centre was useful as it was providing medical treatment free of cost. But now disappointed as the centre is closed from past two years and even the MMV project has been stopped. So people now depend upon the privately run clinics.	As a part of adoption project, health was seen as an important aspect. Thus the Health Centre was constructed.
School Building	The school building is constructed. However, it has not yet started and thus need to start.	BCCL was aware of the educational problem of villagers and so they constructed the school. But the school has not started yet as the procurement is under process.
Masala Chakki	The people were upset as it had provided employment only for a few weeks.	Intention was to generate employment opportunity by providing the required infrastructure.
AEC	The centre was very useful as it had helped many girls and women to learn basic reading and writing skills and hence villagers demanded to start it once again.	Intention was to provide basic skills of writing and learning.
STC	The Training was useful, but at times there was discrimination among the girls as the girls from Lahbera were	The intention was to provide entrepreneur skills to the girls and women by providing them sewing

	given preferences, and girls from other villages were not allowed to use the machine in spite of paying the fees.	training skillsets.
Drainage line and PCC Road	The project was good as it had reduced the mosquito breeding spots and has made the communication with main road easy. But the construction is left incomplete and only a few lanes have PCC road and drainage system.	The intention was to increase the communication and reduce the unhygienic condition in Lahbera
Water Connection	The scarcity of water prevailed before, and even now the villagers bring water from outskirts. Only three pipelines are being installed for the whole village which is not sufficient.	Intended to provide water for the entire village by providing pipeline supply system.
CTP	It was useful but was shut down after some time. reason was not to know	Intended to develop IT skills among the student of Lahbera village.
Solar Lights	It was not useful for people, as it is only limited to a few spots. The villagers get electricity connection through state supply electricity connection.	The intention was to provide electrification to the village.

5.5 Gaps and Scope for Improvement

i. **Lack Monitoring:** The proposed project intented towards the integrated development of Lahbera village. But since past few years, no monitoring has been done by the BCCL and that had led to the ineffectiveness of the projects. Some of the projects have been unsuccessful, namely Health Center, STP, CTP, and AEC, due to lack of monitoring.

ii. **Unfinished projects: A** Few of the projects/infrastructures such as school building, road and drainage lines, solar light stands and water connection is partially done and that had created a negative image of the company in the eyes of villagers.

iii. **Lack of Execution:** Among nine projects that were aimed at developing the village four projects have been unsuccessful, namely Water pipeline connection, Solar Stand Lights, School and Masala chakki**.**

iv. **Limited Resources in training centre:** The resource supply in training centre especially STP was very limited. The number of students in a batch was more than 50 but the sewing machines available were only 4. A few batchmates even complaint for not allowing them to use the machines.

v. **No Scope for employment generation:** One of the common gaps found among the STP and the Computer centre was that there was no scope for the students, neither for future training nor employment generation, as this centre only provided basic training. In case of masala chakki, no market linkages were made for the production and sale of masala.

vi. **Limited growth through training program:** The training programs such as STP, AEC, and CTP had very limited growth outcome as teachers/mentors teaching the courses were not upgraded, and also the salaries of the mentors were not paid. Thus, it was reflected in their teaching. In case of STP and CTP, no linkages were created.

5.6 Recommendations

i. **Creating a local sustainable mechanism to look over the monitoring of the projects:** It is essential that a village development committee consisting of BCCL officials, village members and the panchayat representative should be formed. This committee must be autonomous and should monitor and recommend projects that are essential for the developing Lehbera as an ideal village. At the same time, periodic training should be provided to the villagers for increasing their skills sets and capability.

ii. **Formation of SHGs:** Self Help Groups have played an important role in development of individual and as well as the community. Therefore, SHGs especially of women and youth should be formed, and they should be provided training on capacity building and entrepreneur skills rather than just providing infrastructure.

iii. **Need Base Assessment should be done:** The demand for a particular project or infrastructure should come from the voices of people rather than from the BCCL. Therefore, proper need base assessment should be done.

iv. **Creating Jobs and Market linkages:** Linkages should be created for jobs so that after the training the students can get jobs. At the same time, market linkages such as textile and spice market should be created, might be within BCCL, where the product produced by the villagers could be sold.

v. **Rejuvenating the existing project:** The projects such as CTP, ADC, STP, and Health Centre should be rejuvenated, as these projects had created good impacts on the villagers. At the same time, it is essential that required resources and periodic upgradation should be done. Emergency medical vans should be made available. A female doctor should be available in the health centre.

vi. **Linking the villages with existing government schemes:** It was evident during the field visit that most of the villagers belong to the ST community. Hence, they could be linked with various government schemes and services that are available for them by creating awareness generation for the same.

CHAPTER 6 - CONSTRUCTION OF PCC ROAD

6.1 Introduction

Roads are primary mean of transportation. These provide human access to different places. Roads make a crucial contribution to economic development and growth and bring important social benefits. They are of vital importance in order to make a nation grow and develop. In addition, providing access to employment, social, health and education services makes a road network crucial in fighting against poverty. Roads open up more areas and stimulate economic and social development. Hence understanding the importance of Road BCCL had Constructed PCC Roads in and around eight villages of the BCCL command area.

6.2 Objective of the project

Enabling and increasing the connectivity from semi-rural to urban areas by constructing PCC Road.

6.3 Location of implementation

Table 7 – Location of implementation of road projects in various areas

SN	Name of Village/Area	Construction in Km/Meters
1	Kacharra Arah Tola , Hatudih Panchayat	400 meters
2	Lahbera Village	1.5 Km
3	Aamtal Village, Aamtal Panchayat (Kusunda)	1.5 km
4	Satitand Village, Bauakala Panchayat (Kusunda)	500 meters
5	Padugora Village, Padugora Panchayat (WJ area)	400 meters
6	Kandra Village, Kandrta Panchayat	500 meters
7	Bakaspura Village, Luti Pahari Panchayat	400 meters

6.4 Impact of Road on Community

1. Improved Connectivity

The most important aspect of this project is improved connectivity of people from both rural and urban area to the main town or urban world. The road has helped these communities by increasing their accessibility and communication to various vital resources centres such as health, market, schools and employment places. Hence people have now been easily accessing this place without any difficulty.

Beneficiaries' viewpoint

Sunil Mahato Resident of Kahcharra arah Tola, Hadudih Panchayat says: 'the road has helped us. The connectivity has increased. Health centre, schools and marketplaces are now easily accessible. Besides that, there is increase in the rate of vehicles after completion of the road.'

2. Enhanced Hygienic Living Condition

The Construction of Road has enhanced hygienic living condition. PCC road had reduced the risk of getting malaria and other vector-borne diseases. Besides that, there is also improvement in communication from one part to another part of village and also to the other vital resources centres

Beneficiaries' viewpoint

'The road has improved our living condition. We had Kaccha road in rainy season. There was always water logging and slushy pathways that made all of us difficult to walk, Children use to fall on the road. Besides that, due to the slushy pathways we also faced health issues such as malaria. Mosquitos were all around, especially in rainy season. But, since the PCC road has been constructed, it has prevented water logging and slushy pathways and even had reduced the mosquito breeding spots. Thus our health issues are also being reduced'; says Krishna Singh, Resident of Amtal Village.

6.5 Gaps identified in the project

i. Inferior Quality of Road Construction

Almost all the road constructed under the CSR project was of inferior quality. The quality of the road had started diminishing after a few months from its construction. In many places, potholes and cracks were found by the research team. It was reported by the community that the construction of the road involved several unscrupulous means.

ii. Limited Connectivity

Most of the road constructed had limited connectivity. The road which was constructed was the internal road, which at some places was not even connecting to the main road. For example, the road constructed in lahbera was mostly internal and no connection was made with the main road. Thus, the people highlighted regarding its limited social value. A few of the road constructions were left incomplete. Besides that, lack of maintenance was also reported by the people.

iii. Participatory Approach

It was reported by the people that the participatory approach was neither utilized before nor during the construction of the road. Opinion and views of the people should be taken into consideration. The people reported that consent during infrastructure development such as in road was mostly avoided.

iv. Lack of monitoring from the BCCL

All the villages and areas where the road had been constructed, people reported that no monitoring or follow-up was done after the construction of the road. It was also told to the research team that after the construction of the road that is after two to three years, it is only now that the BCCL officials have come to inspect the road, along with the research team. People reported that they were highly unsatisfied for the negligence of BCCL officials in terms of monitoring and inspection.

6.6 Multi-stakeholder Perspective

i. BCCL officials - The aim of the project was to provide connectivity, connecting the small villages to the main town or main road that would subsequently enhance the productivity of the people and also the standard of living.

ii. **Villagers -** The road is useful to villagers in many ways. For example, it has increased the accessibility of vital resource centres such as schools, market, hospitals, etc. It has also increased the communication from one village to another and also from the village to the main town.

6.7 Recommendations

i. **Periodic monitoring** should be conducted by the BCCL. This would enable the company to identify the gaps in implementation of project, and at the same time while doing this; the creditability of the organization will also increase among the people/community.

ii. **Considering People's opinion and view** will enable the BCCL to implement the project in more effectively. Besides that good rapport will develope between both the parties.

iii. **Regular Maintenances** should be done by the BCCL. Similarly expansion should be done based on the needs and demands of the people/community.

iv. **Improvisation of road quality** by tendering the project to a contractor with better credibility and good quality work record in the past.

v. Participation of community should be encouraged before as well as during the construction of road as it would provide an opportunity to the villagers to monitor and supervise the construction process in terms of higher transparency, accountability and sustainability.

ANNEXURE

Confidential (for research purpose only- property of TISS)

HOUSEHOLD QUESTIONNAIRE

Project - Mobile Medical Van (*Swasth Rath*)

(As this questionnaire requires input from male and female members of household, it should be administered to head of household in the presence of other responsible adult male and female members.)

IDENTIFICATION PARTICULARS

Before Starting Interview

Name of District _____Code:_____
Name of Taluka _____Code:_____
Name of Block _____Code:_____
Gram Panchayat _____Code:_____
Name of the village_____Code:_____

Name of the Mining Area _____

Date of Interview (DD/MM/YY): _____/_____/_____
Time of starting Interview (HH.MM): _____. _____ AM/PM

After Ending Interview

Time of ending interview (HH.MM): _____. _____ AM/PM
Names of Respondents 1: _____ MID: _____
2: _____ MID: _____
3: _____ MID: _____
Name of Interviewer: _____ Code: _____

After Checking/Editing Questionnaire

Name of Supervisor: _____Code: _____
Name of Editor: _____Code:
_____

A: HOUSEHOLD PROFILE AND HEALTH SEEKING BEHAVIOR

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
A01	What is your religion?	HINDU….....1 MUSLIM….....2 CHRISTIAN….....3 SIKH….....4 BUDHHIST….....5 JAIN….....6 OTHER _____7 NO RELIGION….....8	
A02	Do you come under scheduled caste, scheduled tribe, nomadic tribe, or other backward class? Which one?	SCHEDULED CASTE….....1 SCHEDULED TRIBE….....2 NOMADIC TRIBE….....3 DENOTIFIED TRIBE….....4 OTHER BACKWARD CLASS (OBC)…….5 GENERAL….....6 DON'T KNOW….....7	
A03	From where do you fetch water for your household? (ask for all sources)	TAP (BY OWN).....1 OWN TAP BY GOVT/PANCHAYAT .....2 OWN HANDPUMP.....3 OWN OPEN WELL.....4 NEIGHBOUR'S TAP.....5 COMMUNITY TAP.....6 COMMUNITY HANDPUMP.....7 COMMUNITY OPEN WELL.....8 OTHER(SPECIFY)_____9	
A04	If household members fall sick, where do you go or whom do you consult first?	TRADITIONAL HEALER/DAI.....1 LOCAL DOCTOR/RMP.....2 CHEMIST SHOP.....3 MOBILE CLINIC OF JHARKHAND GOVERNMENT.....4 SHC/ASHA/ANGANWADI.....5 PHC/CHC.....6 GOVT HOSPITAL.....7 PRIVATE CLINIC.....8 PRIVATE HOSPITAL.....9 COMPANY/AIDED HOSPITAL.....10 SEEK NO TREATMENT.....11 DEPENDS ON AILMENT.....12 MOBILE MEDICAL VAN OF BCCL....13	

		OTHER_____14	
A05	During the last 12 months, which are the agencies did you/your household members visit for consultation and/or treatment? (ASK FOR ALL SOURCES)	TRADITIONAL HEALER/DAI.....1 LOCAL DOCTOR/RMP.....2 CHEMIST SHOP.....3 MOBILE CLINIC.....4 SHC/ASHA/ANGANWADI.....5 PHC/CHC.....6 GOVT HOSPITAL.....7 PRIVATE CLINIC.....8 PRIVATE HOSPITAL.....9 COMPANY/AIDED HOSPITAL.....10 MOBILE MEDICAL VAN OF BCCL.....11 MOBILE CLINIC OF JHARKHAND GOVERNMENT.....12 OTHER_____13 NO TREATMENT.....14 NOBODY FELL SICK.....15	
A06	How the purification techniques followed at household level?	BOIL THE WATER.....1 ADD BLEACH/CHLORINE.....2 SIEVE IT THROUGH CLOTH.....3 WATER FILTER (CERAMIC, SAND, COMPOSITE, ETC.).....4 LET IT STAND AND SETTLE.....5 OTHER _____6 DON'T KNOW.....7	
A07	What type of toilet facility do you have?	FLUSH TOILET (OWN).....1 PIT TOILET(OWN).....2 FLUSH TOILET(COMMUNITY).....3 PIT TOILET(COMMUNITY).....4 OTHER _____5 GO FOR OPEN DEFECATION.....6	
A08	Do you wash hand properly after defecation?	YES.....1 NO.....2	
A09	What is the status of health infrastructures availability in the villages or nearest location in terms of government services?	GOVT HOSPITAL AVAILABLE BUT NOT FUNCTIONING PROPERLY.....1 GOVT HOSPITAL NOT AVAILABLE…..2 PRIMARY HEALTH CENTER IS AVAILABLE AND FUNCTIONING.....3 PRIMARY HEALTH CENTER IS AVAILABLE BUT NOT	

		FUNCTIONING/POOR.....4 PRIMARY HEALTH CENTER IS NOT AVAILABLE.....5 SUB-CENTRES OR COMMUNITY HEALTH CENTRES AVAILABLE .....6 SUB-CENTRES OR COMMUNITY HEALTH CENTRES NOT AVAILABLE.....7	
A10	How is the access to health facilities in terms of connectivity to/from villages, type of approach road?	KUCCHA ROAD.....1 PACCA ROAD IN GOOD CONDITION....2 PACCA ROAD IN BAD CONDITION.....3 ROAD INSIE THE VILLAGE IS GOOD..4 ROAD INSIDE THE VILLAGE IS NOT GOOD.....5	
A11	What are the major Ailments in your family?	COUGH & COLD.....1 SKIN DISEASES (ITCHING ETC.)....2 WATER BORNE DISEASE .....3 MALARIA/ DENGUE.....4 OTHER (SPECIFY)_____5	
A12	What is the mode of transport used for referral cases?	AMBULANCE.....1 HIRED VAN/TRAKER/TAXI/AUTO RICKSHAW.....2 JUTE COT (KHATIA).....3 MAN DRIVEN RIKSHAW.....4 OTHER(SPECIFY) _____5	

B. SERVICES OF MOBILE MEDICAL VAN (*Swastha Rath*)

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
B01	Are you aware that Mobile Medical Van (Swastha Rath) is sponsored by BCCL?	YES.....1 NO.....2	
B02	How long back the van been coming?	MORE THAN FIVE YEARS.....1 FIVE YEARS.....2 FOUR YEARS.....3 THREE YEARS.....4 TWO YEARS.....5 ONE YEARS.....6 DON'T KNOW/REMEMBER.....7	
B03	How does the BCCL plan to publicize and make the communities in the village aware of their visits as they have a set a time for their visits	ANNOUNCEMENT BY MUKHIYA IN GRAM SABHA.....1 ANNOUNCEMENT THOUGH LOUDSPEAKER BY BCCL.....2 BY ASHA WORKER/VILLAGE VOLUNTEERS.....3 BCCL REPRESENTATIVES CALL FOR VILLAGE MEETING.....4	

		OTHER MEANS(SPECIFY)_____5	
B04	Do you think the van comes frequently enough?	DAILY.....1 ONCE A WEEKLY.....2 TWICE A WEEK.....3 FORTNIIGHTLY.....4 ONCE A MONTH.....5 DOES NOT COME.....6 OTHER SPECIFY.....7	
B05	Is there a fixed point where the van comes and waits?	YES.....1 NO.....2 DON'T KNOW.....3	
B06	If yes, specify:		
B07	Does fixed date and time of visit is maintained by the Mobile Medical Van?	YES.....1 NO.....2 DON'T KNOW.....3	
B08	How long does the van wait in the village?	LESS THAN AN HOUR.....1 ONE HOUR.....2 TWO HOURS.....3 THREE HOURS.....4 MORE THAN THREE HOURS.....5 DON'T KNOW.....6	
B09	Do you think this time is enough?	YES.....1 NO.....2 CAN'T SAY.....3	
B10	If no, how much longer should it wait? (Write as it is)		
B11	How is the priority in beneficiary selection governed?	FIRST COME FIRST SERVE.....1 AGED PERSONS.....2 INFANTS/CHILDREN.....3 DIFFERENTLY ABLED.....4 PREGNANT WOMEN.....5 RANDOM, NO PRIORITY AS SUCH....6 VISIBLY VERY UNWELL PERSON.....7	

B12	Facilities available in the van	FREE MEDICINE/ TREATMENT.....1 PROVIDE DOORSTEP FACILITIES....2 PROVIDE DIAGNOSTIC FACILITY....3 PROVIDE ALL THE FACILITIES THAT ARE PROVIDED IN A HOSPITAL.....4 OTHER(SPECIFY)_____5	
B13	Does the medical team give awareness about the followings?	HYGIENIC SANITATION.....1 HYGIENIC WATER CONSUMPTION.....2 MOTHER & CHILD HEALTH CARE.....3 IMMUNIZATION.....4 ANAEMIA.....5 DE-WORMING.....6 VECTOR BORNE DISEASES.....7 HEPATITIS.....8 TYPHOID.....9 COMMON CARDIAC PROBLEMS.....10 HIV.....11 DIABETES.....12 SNAKE BITE.....13 TUBERCULOSIS.....14 OTHERS_____15	
B14	Does the medical team diagnose the following?	BLOOD PRESSURE.....1 HEMOGLOBIN LEVELS.....2 OXYGEN SATURATION.....3 MALARIA.....4 HEPATITIS.....5 DENGUE.....6 TYPHOID.....7 DIABETES.....8 OTHERS_____9	
B15	What kind of services do you get from the van as far as cure is concern?	MEDICINES.....1 NUTRITIONAL SUPPLEMENTS.....2 DE-WORMING.....3 TONICS.....4 OTHERS_____5	
B16	Is it convenient for your family to reach the MMV point? (Ask specific to women, children, senior citizen, and differently abled if any in the family).	WOMEN.....YES(1) NO(2) CHILDREN.....YES(1) NO(2) SENIOR CITIZEN.....YES(1) NO(2)	

		PWD.....YES(1) NO(2)	
B17	If no, then what is the difficulty?	LONG DISTANCE.....1 NO INTERNAL ROAD.....2 NO APPROACH ROAD.....3 NO CONNECTING BRIDGE.....4 KUTTCHA ROAD.....5 NO MODE OF TRANSPORTATION.....6 INCONVINIENT TIMING OF THE MMV.7 OTHERS SPECIFY_____8	
B18	Who are present in the Mobile Medical Van of BCCL?	DOCTOR.....1 COMPOUNDER/PHARMACIST.....2 NURSE/ANM.....3 DRIVER.....4 ALL THE ABOVE.....5 OTHER(SPECIFY)_____6	
B19	What is the availability of doctor in the Van?	ALWAYS PRESENT .....1 SOMETIMES PRESENT.....2 NEVER PRESENT.....3	
B20	If no, then who facilitate the service? (Write as it is)		
B21	Do you able to convey your problems to the Doctor/pharmacist? (probe behavior of the medical team)	YES.....1 NO.....2	
B22	What if a person falls ill in the period when Van is not visiting? (Write as it is)	VISIT PRIVATE PRACTIONER.....1 VISIT RMP.....2 NEAREST HEALTH GOVERNMENT HEALTH CENTER.....3 NEAREST PRIVATE CLINIC/HOSPITAL..4 WAIT FOR MMV FOR NEXT VISIT.....5 OTHERS(SPECIFY)_____6	
B23	Does the medical team provide awareness campaign?	YES.....1 NO.....2 CAN'T SAY.....3	
B24	If yes, what are they?	HIV/AIDS/SMOKING/ALCHOLISM.....1 PUBLICITY AND SENSITIZATION CAMPAIGN.....2 CLEANINESS AND HYGIEN.....3	

		MATERNITY CARE.....4 OTHER(SPECIFY)_____5	

C. BENEFICIARIES' FEEDBACK ON MMV SERVICE

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
C01	Do you think the frequency of doctor's visit to private clinic/hospital or government health center has been reduced due to service of MMV provided by BCCL?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C02	Do you think monthly expenditure on health checkups /medicine has been reduced due to the service of MMV provided by BCCL?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C03	Do you think that your time has been saved due to the service of MMV provided by BCCL?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C04	Do you think travelling cost has been saved due to service provided by MMV of BCCL?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C05	Do you think you get free advice by a qualified trained/ qualified doctors at your door step?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C06	Do you think major ailments in your family have been reduced due to awareness given by the medical team of BCCL through MMV? OR your family is healthier than before?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C07	Is there any scope of improvement in MMV? If yes, answer the question from **C08 to C12**	YES.....1 NO.....2 CAN'T SAY.....3	
C08	MMV should reach on time/ time should be fixed	YES.....1 NO.....2 CAN'T SAY.....3	
C09	There should be fixed/ convenient time of reaching the MMV (any)	YES.....1 NO.....2 CAN'T SAY.....3	
C10	Quantity/ variety of medicines should be increased (any)	YES.....1 NO.....2 CAN'T SAY.....3	

C11	Frequency/coverage of MMV should be increased (any)	YES.....1 NO.....2 CAN'T SAY.....3	
C12	Requirement of a lady doctor/nurse	YES.....1 NO.....2 CAN'T SAY.....3	
C13	How would you rate (out of 5) the service of Mobile Medical Van provide by BCCL.	POOR(1/5).....1 BELOW AVERAGE(2/5).....2 AVERAGE(3/5).....3 GOOD(4/5).....4 EXCELLENT(5/5).....5	
C14	Do you think this service by BCCL should be continued?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	

HOUSEHOLD QUESTIONNAIRE

Project - Scheme for multipurpose utilization of abandoned mine water

(As this questionnaire requires input from male and female members of household, it should be administered to head of household in the presence of other responsible adult male and female members.)

IDENTIFICATION PARTICULARS

Before Starting Interview

Name of District

_____Code:_____

Name of Taluka

_____Code:_____

Name of Block

_____Code:_____

Gram Panchayat

_____Code:_____

Name of the

village_____Code:_____

Pond Name_____

Date of Interview (DD/MM/YY): _____/_____/_____

Time of starting Interview (HH.MM): _____. _____

AM/PM

After Ending Interview

Time of ending interview (HH.MM): _____. _____

AM/PM

A: HOUSEHOLD PROFILE AND AGRICULTURE AND WATER AVAILABILITY

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
A01	What is your religion?	HINDU….....1 MUSLIM….....2 CHRISTIAN….....3 SIKH….....4 BUDHHIST….....5 JAIN….....6 OTHER _____7 NO RELIGION….....8	
A02	Do you come under scheduled caste, scheduled tribe, nomadic tribe, or other backward class? Which one?	SCHEDULED CASTE….....1 SCHEDULED TRIBE….....2 NOMADIC TRIBE….....3 DENOTIFIED TRIBE….....4 OTHER BACKWARD CLASS (OBC)……..5 GENERAL….....6 DON'T KNOW….....7	
A03	Type of house (record as per guidelines based on type of wall, roof and floor)	RCC .....1 PUCCA .....2 SEMI-PUCCA .....3 KUCHCHA .....4 HUT .....5 TENT (MAKESHIFT).....6	
A04	House electrified?	YES.....1 NO.....2	
A05	From where do you fetch potable water for your household? (ask for all sources)	TAP (BY OWN).....1 OWN TAP BY GOVT/PANCHAYAT .....2 OWN HANDPUMP.....3 OWN OPEN WELL.....4 NEIGHBOUR'S TAP.....5 COMMUNITY TAP.....6 COMMUNITY HANDPUMP.....7 COMMUNITY OPEN WELL.....8 COMMUNITY POND.....9 OTHER(SPECIFY)_____10	
A06	How far is the water source from your household?	JUST OUTSIDE.....1 WITHIN 1/2 KM.....2 WITHIN 1 KM.....3 MORE THAN 1 KM.....4	

A07	If it is used for drinking, what is purification techniques followed at household level?	BOIL THE WATER.....1 ADD BLEACH/CHLORINE.....2 SIEVE IT THROUGH CLOTH.....3 WATER FILTER (CERAMIC, SAND, COMPOSITE, ETC).....4 LET IT STAND AND SETTLE .....5 OTHER (SPECIFY).....6 DON'T KNOW.....7	
A08	What is the purpose of mine water utilization through pond?	DRINKING.....1 COOKING.....2 WASHING VEGETABLES .....3 WASHING CLOTHES.....4 HOUSE CLEANING.....5 BATHING/WASHING YOUR BODIES....6 AGRICULTURE.....7 WASHING ANIAMLS.....8 AFTER DEFECATION.....9 OTHER(SPECIFY) 10	
A09	What type of toilet facility do you have?	FLUSH TOILET (OWN).....1 PIT TOILET(OWN).....2 FLUSH TOILET(COMMUNITY).....3 PIT TOILET(COMMUNITY).....4 OTHER _____5 GO FOR OPEN DEFECATION.....6	
A10	Do you use pond water after open defecation?	YES.....1 NO.....2	
A11	Does your household own any agricultural land including any plantation land?	YES.....1 NO.....2	
A12	How much agriculture land do you own?	_____ACRS _____(LOCALE MEASUREMENT SCALE)	
A13	How much of the land cultivated by you is irrigated?	NIL..... 0 _____ACRS _____(LOCALE MEASUREMENT SCALE)	
A14	What are the sources of irrigation? Do not record rain as a method of irrigation (ASK FOR ALL SOURCES)	CANAL.....1 POND.....2 WELL.....3 RIVER.....4 MOTOR PUMP.....5 TUBE WELL.....6	

		BORE WELL.....7 DAM.....8 OTHER_____9 NONE.....10	
C15	What is the lift irrigation equipment used by you to draw water from pond to agriculture field?	DIESEL ENGINE/PUMP.....1 ELECRIC MOTOR..... .....2 SUBMERGIBLE PUMP.....3 OTHER (SPECILFY)_____4	
A16	Major crops grown	1) _____ 2) _____ 3) _____ 4) _____ 5) _____	

B. AWARENESS ABOUT MINE WATER SUPPY, REPAIRS, RENOVATION & RESTORATION OF THE PONDS AT KHONATHI AND BEHRAKUDAR BY BCCL

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
B01	Do you know that BCCL is supplying mine water to the pond?	YES.....1 NO.....2	
B02	Do you know about the activities done by BCCL for the pond?	EMBANKMENT OR STONE PITCHNG AROUND THE BANK .....1 INLET AND OUTLETS.....2 GHATS/STAIRS .....3 REPAIRE.....4 INCREASED THE CATCHMENT/RESTORATION.....5 DON'T KNOW ANY OF THE ABOVE.....6	
B03	How you come to know that BCCL has renovated the pond?	DISPLAY BOARD BY BCCL.....1 GRAM SABHA.....2 OBSERVED RENOVATION WAS GOING.....3 OTHER SOURCE (PLEASE MENTION)..4 _____	
B04	Whether BCCL conducted any village meeting along with Mukhiya before supplying mine water to the pond?	YES.....1 NO.....2 DON'T KNOW.....3	

B05	When and how many meetings were held? (Specify the number with month and year)		
B06	Does the pond dry up initially during summer?	YES.....1 NO.....2 DON'T KNOW.....3	
B07	How often the mine water is supplied to the village pond by BCCL?	WEEKLY.....1 MONTHLY.....2 QUARTERLY.....3 HALFYEARLY.....4 DRY SPELL/WINTER ONLY.....5 NOT FIXED.....6 NEVER..... .....7 DON'T KNOW.....8 IF ANY OTHER, SPECIFY.....9	
B08	How many hours/day is water supplied?	30 MINUTES.....1 45 MINUTES.....2 ONE HOUR.....3 TWO HOURS.....4 MORE THAN TWO HOURS.....5	
B09	Is the quantity of water supplied sufficient for your village?	YES.....1 NO.....2 DON'T KNOW.....3	
B10	Has there been any case of illness die to poor water quality? If yes, please specify	NO YES (SPECIFY) _____ _____	
B11	What is alternative source of water in case the existing facility is damaged? (Specify)		
B12	When was the last mine water supplied by BCCL?	LAST MONTH….....1 LAST THREE MONTHS….....2 LAST SIX MONTHS….....3 LAST ONE YEAR.....4 MORE THAN A YEAR(HOW LONG,SPECIFY) _____5	

B13	When was the last monitoring done by BCCL regarding utilization of mine water?	LAST MONTH….....1 LAST THREE MONTHS….....2 LAST SIX MONTHS….....3 LAST ONE YEAR….....4 MORE THAN A YEAR(HOW LONG,SPECIFY) _____5 NEVER.....6 DON'T KNOW.....7	

C. IMPACT AFTER THE INTERVENTION ON UTILIZATION OF MINE WATER FOR DOMENSTIC AND AGRICULTURAL USE

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
C01	Is water available throughout the year?	YES.....1 NO.....2	
C02	What you think, the availability of water in the pond throughout the year is due to?	MINE WATER SUPPLIED BY BCCL...1 NATURALLY DUE TO RAIN WATER...2 GROUND WATER REGENERATION.....3 DON'T KNOW.....4 OTHER REASONS(SPECIFY)_____ _____5	
C03	Is there any improvement in water storage capacity or catchment areas of tank seen after the renovation of pond by BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C04	Do you think that water scarcity has reduced during dry spell/winter due to mine water supply provided by BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C05	Do you find adequate quantity of water during summer/winter due to mine water supply provided by BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C06	Do you think the impact of flood has been reduced during monsoon due to renovation of pond by BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C07	Do you think the distance of water availability has been reduced for animals especially for those who can't go long distance to drink water due to mine water supply of BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	

C08	Do you think you get water for household easily and timely due to mine water supply of BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C09	Do you think that villages has developed new job opportunity like duckery and fishery in dry season and use their time better than before?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C10	Do you utilize pond water for critical irrigation?	YES.....1 NO.....2	
C11	Do you think you are able to produce two crops (Winter crops) in a year due to mine water supply of BCCL	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C12	Do you think you produce beyond your home consumption and get money to be used for different purposes due to mine water supply of BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C13	Are any new crops grown due to this intervention, which were not sown before due to unavailability of water during winter/dry spell?	YES.....1 NO.....2	
C14	The new crops grown are	1)_____ 2)_____ 3)_____ 4)_____ 5)_____	
C15	Was any increase in land under irrigation seen?	YES.....1 NO.....2	
C16	How much land under irrigation increased?	_____ACRS _____(LOCALE MEASUREMENT SCALE)	
C17	Do you think your income has been increased due to pond renovation and mine water supply?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C18	Do you think your agricultural production has been increased due to pond renovation and mine water supply?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C19	Have you used pond for fishery or duckery	YES.....1 NO.....2	
C20	How much income have you gained?	RS._____/MONTH	

C21	Do you think there is scope for improvement with regards to mine water supply? If yes, answer **C22 to C24**	YES.....1 NO.....2	
C22	Mine water should be reached on time/ time should be fixed	YES.....1 NO.....2 CAN'T SAY.....3	
C23	Frequency of mine water supply should be increased	YES.....1 NO.....2 CAN'T SAY.....3	
C24	Quantity and quantity of water should be improved	YES.....1 NO.....2 CAN'T SAY.....3	
C25	How would you rate (out of 5) the quantity of water service provide by BCCL.	POOR(1/5).....1 BELOW AVERAGE(2/5).....2 AVERAGE(3/5).....3 GOOD(4/5).....4 EXCELLENT(5/5).....5	
C26	How would you rate (out of 5) the quality of water service provide by BCCL.	POOR(1/5).....1 BELOW AVERAGE(2/5).....2 AVERAGE(3/5).....3 GOOD(4/5).....4 EXCELLENT(5/5).....5	
C27	Do you think BCCL should continue supplying Mine water?	YES.....1 NO.....2	

D. MANAGEMENT OF POND

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
D01	Have community participated during pond renovation through *"shramdaan"*?	YES.....1 NO.....2 DON'T KNOW.....3	
D02	Is there any evidence that the pond has been recently undergone maintenance/ de-silting?	YES.....1 NO.....2 DON'T KNOW.....3	
D03	Does community also participate in maintenance/ de-silting?	YES.....1 NO.....2 DON'T KNOW.....3	

D04	If the BCCL water supply facility gets damaged, who repair it? (write as it is)		
D05	Maintenance is carried out?	FUND RAISED BY COMMUNITY(*CHANDA*) .....1 MUKHIYA DEVELOPMENT FUND.....2 BCCL CSR FUND.....3 MP/MLA FUND.....4 OTHER(SPECIFY)_____5	
D06	Constraint in O & M	**INEFFECTIVE COORDINATION AMONG USERS**.....1 **LACK OF FUND REHABILITAION**....2 NEGELGENCE OF LOCAL AUTHORITY.3 OTHER(SPECIFY)_____4	

QUESTIONNAIRE
VILLAGE ADOPTION PROGRAMME (Lahbera, Dhanbad)

1. Date Time

2. Village:
   Panchayat:
   Block:
   District:
   State:

3. Mukhiya/Sarpanch/Ward member/Participant:
   Name:
   Contact No.:

4. Population:

Multipurpose hall

Questions

1. When was the hall built? How much time did the construction take?
2. Who built it? (Mention implementing agency). Who provided the land for the same.
3. Why was the need felt to build this hall?
4. Were the villagers consulted before constructing the hall?
5. What is the cost of the building? (How many respondents know?)
6. Was there any board displayed during/after the construction of the hall providing information related to it?
7. Is the hall useful?
8. What is the hall used for? • SHG Meetings • Wage Payments • Bank related details • Gram Sabha • Awareness Campaigns • Meetings with BCCL • Trainings • Functions (community) • Functions (individuals) • Livelihood activities • Fairs • Lodging • Others (Please specify)
9. Is the access to multi-purpose hall affected by any factor? • Caste • Religion • PRI Members • Gender • Gram Sachiv • Other govt. employee • Others (Please specify)
10. Who has the control over or authority related to the multi-purpose hall? • Gram Sabha • Sarpanch • Specific committee/group • Individual (Please specify) • BCCL • Others
11. What is the procedure to use the hall for any purpose? Is there a system devised? If yes, please specify.
12. How can this hall be better utilized?

Masala Chakki:

Questions for Beneficiaries

1. When was the Masala Chakki made operational? How much time did the process of operationalization take?
2. Who installed it? (Mention implementing agency). Who provided the land/building for the same?
3. Why was the need felt to start this initiative?

4. Were the villagers consulted before starting this initiative?
5. What is the cost of the initiative? (How many respondents know?)
6. Was there any board displayed during/after the installation and operationalization of the Masala Chakki providing information related to it?
7. Is the Masala Chakki useful?
   - Enhancing livelihood
   - Making grinding easier
   - Others (Mention)
8. What is the impact of this initiative for participants?
   - Tangible (income)
     - Earnings of individual workers
     - Collective income of the community
     - Profit by owners
     - Others
   - Intangible
     - Services/sales/production increase or decrease
     - Empowerment
     - Drudgery Reduction
     - Negative impacts if any (pollution/disputes/others)
     - Are they now able to make Investment in areas like:
       - Health
       - Education
       - Malnutrition
       - Transportation
       - Other (Specify)
     - Others (Mention)
9. What is the mechanism of selling the products? Where are the masalas sold? How is the demand in market?
10. What is the technical support provided for production as well as marketing? What more is expected?
11. How can we make this initiative better?
    - To enhance positive impacts
    - To reduce negative impact
12. Are impacts overall positive or negative? For whom?
13. What are the most important impacts? According to whom?
14. How significant are they? In what way?
15. Do changes alter livelihood strategies and security, or do they just add one element (a coping strategy) within existing approaches? Can impacts be summarised in terms of changes in livelihood security or robustness?

***Health Centre*:**

Questions

1. What was the scenario before the Health Centre was started?
   - Doctors
   - Health workers
   - Nearest Health Centre
   - Access to medicines
   - Access to screening tests
   - Others (Mention)
2. Why was the health centre set up in the village?
3. Were people of the village involved in the decision making?
   - Need Assessment
   - Location of Health Centre
   - Others (Specify)
4. What is the basic infrastructure available?
   - Electricity
   - Water
   - Drinking water
   - Ambulance
   - Others (Mention)
5. What is the human resource deployed at the health Centre?
   - Doctor (qualification)
   - Nurse/ANM
   - Pharmacist
   - Lab-technician
   - Others (Specify)
6. How is the behaviour of the staff?

7. Population Coverage by the Health Centre
8. How is the utilization of the medical services at the Health centre?
9. Institutional Deliveries • Vaccination • First Aid • General Check ups • Ante natal services • Others
10. What diseases do people generally suffer from?
11. Name the diseases/symptoms. Also mention if they receive treatment for the mentioned diseases at the health centre
12. Are referral services provided?
13. What are the timings of the Health Centre?
14. How are emergencies handled?
15. Are people satisfied with the health Centre? If yes provide reasons.
16. What are people dissatisfied about? • Staff unavailable • Non-examination by staff • Improper attention • Centre not clean • Medicines not available • Others (Mention)
17. Are the services provided for free? If not, how much do they pay for treatment/medicines?
18. Is education/awareness provided at the health centre?
19. Complaints/Improvement suggestion for health centre.

Sewing Training Centre

Question

1. Why was the Sewing Machine initiative started?
2. Who use the Sewing Machine Initiative? Name the stakeholders. • Direct Participants o Owners o Workers o Customers • Non-participants (local residents) • Others o Government o NGO o CBO o PRI o Co-operatives
3. What is the criterion to be a part of this initiative?
4. Who is not a part of it or stays out of it?
5. Specify who and the reason. Following maybe the reasons: • Gender • Power Dynamics • Education • Poverty • Disability • Other
6. How can participation be encouraged?
7. How is it beneficial?
8. What is the impact of livelihoods for participants? • Tangible (income) o Earnings of individual workers o Collective income of the community o Profit by owners • Intangible (empowerment) • Direct (services/sales/production) • Positive • Negative • Intended • Unintended

9. What impact does it have on the quality of life?
10. How has the investment pattern changed? • Health • Education • Malnutrition • Transportation • Other (Specify)
11. What is sown or stitched? Where are the clothes sold? How is the demand in market?
12. What is the technical support provided for production as well as marketing? What more is expected?
13. How can we make this initiative better? • To enhance positive impacts • To reduce negative impact
14. What are the most important impacts? According to whom?
15. How significant are they? In what way?
16. Why did only 6 women start earning? How can that be improved?

Adult Education Centre:

Questions:

1. What is the literacy percentage of the village? Male and female both.
2. Why did the need to have arisen to have the adult education centre?
3. How long has it been functional?
4. What subjects are taught?
5. How many students are enrolled? How many attend
6. How is the attendance of the students? Do they enjoy coming?
7. Anyone who has dropped out from the Adult Education centre? If yes, Why?
8. Why are only women studying? What is the selection criterion?
9. What is the impact of the initiative on the following? • Employment • Basic Reading Skills • Health • Personal Goals • Further Education • Skill Development • Other outcomes
10. How can we encourage participation of enrolling illiterate people irrespective of barriers? What are the barriers? How can we overcome them?
11. Who is the teacher? How does he/she evaluate the progress?
12. Any complaints
13. Any success story

Primary School building:

Questions

1. When was the school constructed? Since when is it functional?
2. How many students study in school? Male/Female
3. What is the human resource and the respective strength in the school?
4. What is the average number of students in a class?
5. What is the infrastructure at the primary school? • Classrooms • Benches • Electricity • Lights • Fans • Toilets and water supply • Drinking Water • Other (mention)
6. Are teachers good? What is the learning level of children? • Good 4-5 • Average 2-3 • Bad-0-1
7. Do children enjoy going to school?
8. Are children benefitting from the school? In what ways (Mention)?
9. Any complaints?

Water supply

Questions

1. What difficulties were faced by the villagers before the intervention?
2. How far are the other water sources from the village?
3. Why did the need of laying down pipelines arise?
4. Who all were involved in the decision making process?
5. Where is the water supplied (individual households/common storage)? If it is a common storage how do people take it home for use?
6. How many people benefit from this?
7. What do the people use the water for?
8. How does it affect their life? • Education • Livelihood • Sanitation • Commercial • Domestic affairs • Others
9. What are the areas with water deficit? How does this initiative benefit those areas?
10. Any complaints?
11. How can this be improved?

Drainage:

Questions
1. How was the drainage managed before the initiative?
2. What is the drainage for?
3. What are benefits that are reaped by the people after the initiative?
4. Where is the waste water directed to?
5. Does it have an impact on health? • Positives • Negatives
6. Were people of the village provided information before implementing the project?

Solar Lights:

Questions

1. How is the supply of electricity in the village?
2. What were the issues faced by the villagers before the solar light intervention?
3. What is the use of the installed solar lights?
4. Why are the provided for public usage and not for individual usage?
5. Success stories
6. Complaints

QUESTIONNAIRE

CONSTRUCTION OF PCC/ BITUMINOUS ROAD FOR THE COMMUNITY

5. Date Time

6. Village:
   Panchayat:
   Block:
   District:
   State:

7. Mukhiya/Sarpanch/Ward member/Participant:
   Name:
   Contact No.:

8. Population:

1.	When was this road constructed?
2.	Do you know the agency who created this road? a. BCCL b. State Government c. Local MLA d. MP e. Others -
3.	If BCCL, How you know about this fact? a. Display board by BCCL b. Gram Sabha/Village Meeting c. Witnessed/passing while construction was going d. Villages e. Others
4.	What is the length of the road? (In kms.)
5.	What was the condition before the construction of the road? a. Pucca b. PCC but damaged
6.	What is the condition after the construction of the road?
7.	How far is the road from your place? (in kms)
8.	How many villages or towns does this road connect? (The geographical scale, names of the villages)
9.	Has this road been benefitted or affected your situation? Please elaborate.
10.	Please state <u>your</u> uses of this road.
11.	Did the community contribute in any way during the construction? If yes, how?
12.	Do you know anyone who was directly involved in the construction of road? a. Yes, who? b. No
13.	How has this road improved the quality of the life in this particular area? the following questions mark YES or NO. If yes, kindly elaborate.
	a. Has there been an increase in amount (volume/proportion) of the commercial profit agricultural production in the area?

	b. Has it become easier to reach the markets with the produce of the area?
	c. Have you noticed an increase employment of people in this area?
	d. Are more people engaging in the non-agricultural employment like businesses,eg. groceries, artisans, labourers,etc.?
14.	Has this road improved the connectivity of this area to other places, causing decrease in transportation cost and time to reach places? If yes, how?
	For the following questions mark YES or NO. If yes, kindly elaborate.
	Education:
	a. Has it helped to access the educational institutes more easily? Does it take less time to reach them? b. Has there been an increase in attendance in primary and high schools of the area after the construction?
	c. How far are the high schools from here?
	d. Has it become more convenient to reach them now?
	e. Are more children from this area going to school now?
	f. Can you use transports like cycles or rickshaws to reach these places now?
	Health:
	a. Is there any health care facility in your area? i. Primary Health Centre ii. Community Health Centre iii. Referral Hospital iv. Private Nursing home/Dispensary v. Others
	b. How far is the closest healthcarefacility or hospital? i. Less than half Km ii. Less than 1 Km iii. More than 1 Km iv. More than 5 Kms. v. Others
	c. Has road made it more convenient to access these centres now?
	d. Are you provided with MMV services here?
	e. How often? i. Weekly: ii. Monthly:
	f. Have you seen an overall improvement of health because of this?
	g. Has there been an increase in the utilization of hospitals or healthcare centres after the construction of road?
	h. Has the maternal health improved since the construction of the road?
	i. Do you see any improvement in rates institutional delivery of infants in this area?
15.	Has there been any repairs or upkeep after the construction of the road? If yes, who is responsible for the upkeep? a. Fund raising in the villages b. Mukhiya Fund c. Others:
16.	How does this road serve you during rains?

17.	Have you faced any problems after the construction? If yes, what? Please elaborate.
18.	How the village does contributes to the upkeeping of the road?
19.	How would rate the quality and viability of this road on a scale a. Very poor b. Poor c. Average d. Good e. Excellent
20.	Kindly provide any additional comments, concerns and/or observations/suggestions to improve this project?

Mid- term Evaluation of Project *Swablamban* - Reeling and Spinning Training Projecr under CSR (Sustainable Development Department), Bharat Coking Coal Limited, Dhanbad FY(2015-16)

By

National CSR Hub

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Prof. B. Venkatesh Kumar
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EXECUTIVE SUMMARY

The purpose of this report, mid-term evaluation study was conducted for Reeling and Spinning training as a skill development project. The locations of the study were Alakdiha and Mukunda training centres, in Dhanbad. The primary data collection for the mid-term evaluation was completed in September 2017 by a 6 member team from TISS. Qualitative research methodology was used while in-depth interviews and focused group discussions were the main methods employed.

The Reeling and Spinning training project was conducted in association with Jharkhand Silk Textile and Handicraft Development Corporation (JHARCRAFT), a Government of Jharkhand undertaking under Industry Department, registered under section 26 Companies Act. 1956.

While BCCL provided monetary support and infrastructure, JHARCRAFT provided skilled trainers, handlooms and raw material for the training. The Primary beneficiaries of the project were 150 underprivileged women across locations. Five training centres were proposed in the project proposal out of which two centres were selected as pilot initiatives of the project.

After successful completion of two month long training course at both the centres, beneficiaries were given access to handloom machinery to hone their skills and earn an income in the process. Currently, only one centre is functional with 20-25 beneficiaries regularly coming to the training centre. The project in the mid-implementation phase faces certain challenges such as minimal increase in household income and lack of orders from JHARCRAFT, these if overcome, can result in effective and efficient implementation of the reeling and spinning training project.

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CHAPTER 1- INTRODUCTION

Businesses are the most powerful constituents of the society and they do not operate in isolation; there is an increased realization that not only can companies affect society at large, but they are also in a unique position to influence society and make positive impact.

> "The Organization for Economic Co-operation and Development[1] (OECD) established a set of guidelines for multinational enterprises in 1976, and was thus a pioneer in developing the concept of CSR. The purpose of these guidelines was to improve the 'investment' climate and encourage the positive contribution multinational enterprises can make to economic and social progress".

An evaluation is 'the systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results. The aim is to determine the relevance and fulfillment of objectives, development efficiency, effectiveness, impact and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision-making process of both recipient and donors.' (OECD Publications, 2010)

1.1. About Bharat Coking Coal Limited

Bharat Coking Coal Limited (BCCL) is a subsidiary of Coal India Limited, a Maharatna Company. The company is 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. The CSR strategy 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. Towards achieving this objective and to understand the interest levels of the local community, BCCL undertook a departmental baseline survey cum Skill Gap Analysis study at some locations. The recommendations from the study formed the basis for the design and deployment of the skill development initiatives.

[1] http://www.oecd.org/about/

1.2. About National Corporate Social Responsibility Hub, TISS

National Corporate Social Responsibility Hub, (NCSR Hub) was established in 2011 by the Department of Public Enterprises to enable the Public Sector Enterprises to design and implement holistic and rights-based CSR initiatives. Tata Institute of Social Sciences (TISS), Mumbai and Department of Public Enterprises (DPE), Government of India had come to realize that there is a need to have centralized system where core functions of CSR including learning and knowledge dissemination take place. The core activities of the Hub are:

- Vision and strategic direction setting for Policy and Programme
- Advisory role for PSEs on Policy and Programme implementation
- Research and development and 'evidence-based' policy advocacy
- Capacity building of PSEs, partners and civil society institution
- Impact assessment, monitoring and evaluation
- Empanelment and partner management

1.3. Project Background

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.

1.4. 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.

3. To help improve overall quality of life by providing employment to women especially the weaker section of the society.

1.5. Mid Term Evaluation study for Reeling And Spinning project of BCCL

Bharat Coking Coal Limited (BCCL) sanctioned mid-term evaluation of the reeling and spinning skill development project to National CSR Hub in August-September 2017. The following report details the evaluation of projects undertaken by Bharat Coking Coal Limited in accordance to their CSR policy laid out in 2014.

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.

CHAPTER 2– RESEARCH METHODOLOGY

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it, one studies the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them (Kothari, 2004). This chapter outlines the research methodology and also examines the objectives of the study and the research question. The chapter also includes the research design, methods, and level of engagement for data collection, on and off the field as well as the ethics of research and the limitations that the researcher has kept in consideration.

2.1 Objective of Study

The very purpose of the research is to discover answers to the question through the application of the scientific procedures (Kothari, 2004). These objectives help in exploring answers and understanding the behaviour, condition or phenomenon prevalent in the population under study. The aim of the study was to understand the extent of the impact of the project on the socio-economic conditions of the targeted beneficiaries. Further, following are the main objectives of the study:

i. To assess if the objectives of individual projects are being met/have been met;
ii. To understand the continued relevance of the individual projects in their respective contexts;
iii. To identify issues in programmatic implementation and provide recommendation to fulfil the objectives efficiently.

2.2 Key issues addressed

- Implementation mechanisms used by the Implementation Agencies;
- Monitoring mechanisms undertaken by the IAs;
- Scope of improvement as articulated by various stakeholders;
- Efforts towards ensuring sustainability of the project
- Documentation of the project design, outcomes and achievements.

2.3 Research Design

The research design refers to the overall strategy that one chooses to integrate the different components of the study in a coherent and logical way, thereby, ensuring one will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data (De Vaus, 2001)

This study is an **Evaluation** research study as it is designed to assess the outcomes of an intervention, so that the findings will provide insights useful for the organizations that have funded and implemented the project. For the purpose of the mid-term evaluation of reeling and spinning training project, qualitative research design was developed.

2.4 Research Methods

Tools for Data Collection

The tool is one of the essential components of a research study. It is an instrument that helps the researcher to meet the objectives of the research. There are various kinds of tools that are utilized based on the needs and objectives of the research. In the current study the research team made use of certain sets of tools which are as follows:

- **Focused Group Discussion (FGD):** FGDs where conducted in all the 4 project, and those interviewed for the FGD were the village members, Ward/Gram Panchayat Representative, ASHA workers, Women Representatives, SHGs Youth group members etc.
- **In-depth Interviews (IDI):** Similarly IDI was conducted with village members who were directly affected by the project
- **Case studies:** Case studies were used to get life narratives of the beneficiaries and to understand the impact of the project on their socio-economic and cultural lives

2.5 Data collection methods

The sampling type used for Data collection was Random Stratified sampling. **Primary data** was collected using the following methods, selected as per the above-explained research design:

a. Survey of beneficiaries through questionnaire

b. Semi-structured interview (using interview schedule) and In-depth interviews. The in-depth interviews were open-ended with complete scope for probing and getting detailed information from the participants.
c. Participatory research methods such as transect walk
d. Document analysis (review of project reports)
e. Direct observation (home visit, village/town visit and institution visit)

Secondary data: Secondary data, wherever made available by the implementing agencies, consisted of Annual reports, Project Proposals, Baseline studies and project blue prints

2.6 Participants of Data Collection

This study aims to capture perspectives from multiple stakeholders. Accordingly the following participants and stakeholders were covered through the data collection done in this study:

- Beneficiaries i.e. people (here SHG/Women's group) impacted by the project
- Officials of BCCL (Sustainable Development Department)
- Village level stakeholders (Community Leaders):, Sarpanch, ward members and former Sarpanch

2.7 Data Analysis

As previously mentioned, this study employs qualitative methods. The responses from the in-depth interviews and the other qualitative data were subjected to coding for detecting patterns. The data from interviews and discussions was analyzed **thematically** and the data from all the sources was integrated as per the responses to understand, assess and evaluate the entire process of implementation. This being a qualitative study, there is an emphasis on understanding and analyzing the perceptions, views and experiences of the beneficiaries and other key stakeholders with respect to the skilled development project.

2.8 Challenges of the study

1. **Language Barrier:** The major hurdle in data collection was the language barriers, few of the villagers were speaking Bengali and few were Oriya/Odia.

2. **Limited documentation:** The Limited documentation of the CSR project was another hurdle faced by the research team. It rendered primary data as the only source of information

CHAPTER 3–FINDINGS FROM THE FIELD

3.1 Introduction

"Swaavlambi Project" is a Skill Development initiative of BCCL and JHARCRAFT, an undertaking of Government of Jharkhand. They have mutually agreed to develop skills in weaving and reeling to assure sustainable livelihoods to underprivileged and unemployed women of Dhanbad District of Jharkhand. Mukunda, Alakdiha, Gareia, Panchmohali and Nootangram are the chosen villages to implement this employment generation program. The purpose of the intervention is to develop an infrastructure to train women, employ them in the centres and assure a market linkage for sustainability. The aim is to ensure maximum possible monetary benefits to these women.

3.2 Background

"Swaavlambi Project" is a Skill Development initiative of BCCL and JHARCRAFT, an undertaking of Government of Jharkhand. They have mutually agreed to develop skills in weaving and reeling to assure sustainable livelihoods to underprivileged and unemployed women of Dhanbad District of Jharkhand. Mukunda, Alakdiha, Gareia, Panchmohali and Nootangram are the chosen villages to implement this employment generation program. The purpose of the intervention is to develop an infrastructure to train women, employ them in the centres and assure a market linkage for sustainability. The aim is to ensure minimum monetary benefits to these women, BCCL and JHARCRAFT have entered into an agreement to share the responsibilities of the Weaving and Reeling Training Program. JHARCRAFT imparted skill development training to a group of thirty women on Reeling and Spinning of cotton and silk thread in two locations for a period of one month. After having received training, the women were found to be skilled enough, to produce the cotton and silk handlooms. The training centre was the production centre and guidance was provided by the trainers and officials of JHARCRAFT. Apart from training, JHARCRAFT was responsible for generating a market for the produce. The Emporiums across the country were the platforms to exhibit and sale the finished products. The money earned from the sale was to be transferred to the bank accounts of women.

Reeling and spinning training project is a CSR initiative which is a skill development and employment generation project under "*Swaavlambee* Project" of BCCL. Itis focussed on willing unemployed groups of women of the villages *Mukunda, Alakdiha, Gareia, Panchmohali* and *Nootangram* belonging to Dhanbad District. To generate employment opportunities for the women, BCCL and Jharkhand Silk Textile and Handicraft Development Corporation Ltd. (JHARCRAFT) have entered into an agreement for implementation of the project. JHARCRAFT is a Government of Jharkhand undertaking under Industry Department and is registered under section 26 under Companies Act. 1956. It is operating such projects successfully at Khraswan in Jameshdpur, Nagri in Ranchi and Bhagahiya in Sahebganj. Besides this, their projects are also being implemented as CSR activities of Gua Ore Mines, Megahatburu, Kirkburn, Durgapur plant of SAIL and NTPC Hazaribagh, THIESS Minaces, JINDAL Power Patratuas organisations.

In the first phase, for one month, JHARCRAFT imparted skill development training to a group of thirty women on Reeling and Spinning of cotton and silk thread in two locations, Mukunda and Alakdiha. Once trained, these women started production of cotton and silk fabrics under the guidance of JHARCRAFT trainers and officials for the remaining project period. According to the agreement, JHARCRAFT also managed production of the silk products produced by the trained women and promoted marketing of the products through their emporiums spread over various locations of the country. Money earned from the sale of the silk products is being transferred to bank accounts of the women.

This project, therefore, intended to provide a sustainable employment generation for the women of the target communities

3.3 Objectives of the reeling and spinning training project

a) Skill enhancement through Training and shortening the learning curve of skilled and semi-skilled women.
b) Self-Employment generation and enhancing employability of women groups in the villages.
c) To help improve overall quality of life by providing employment to women especially the weaker section of the society.

3.4 Implementation of the Project

BCCL is the donor partner and JHARCRAFT the Implementing Agency for the Reeling and Spinning Training Program. JHARCRAFT is responsible to train the women and guide the production of cotton and silk handloom for the period of two years. The Agency is also liable for promoting and marketing the produce with sales. Both parties are accountable to each other for the period of mutual agreement as per the MoU. In the documents presented and official's accounts collected, it was found that there was no clear exit strategy after the completion of the project. The officials reported that bimonthly monitoring visits were made to ensure the efficient implementation of the project.

The primary beneficiaries of the project were thirty women pre centre. The beneficiaries were selected on the basis of their vulnerable background and willingness to acquire skills and participate in production post training. These women belonged to socio-economically vulnerability groups. The indirect beneficiaries were, thus, the families of these women.

Out of five proposed locations, centres have been started at Mukunda and Alakdiha. The other centres will be gradually started after analyzing the results of the pilot
Proposed Location of Implementation:

Table No. 1 – Proposed Location of implementation

Sl.No.	Name of Village	Name of *panchayat*	Name of police Station	District	State
1	Mukunda	Mukunda	Tisra	Dhanbad	Jharkhand
2	Alakdiha	Alakdiha	Tisra	Dhanbad	Jharkhand
3	Gareria	Gareria	Kenduadih	Dhanbad	Jharkhand
4	Panchmohali	Panchmohali	Chirkunda	Dhanbad	Jharkhand
5	Nootangram	Nootangram	Chirkunda	Dhanbad	Jharkhand

3.5 Observations of the Mid Term Evaluation

Focused Group Discussions with the beneficiaries and Key Informant Interviews with the officials of BCCL were conducted to gain insights on the ongoing projects. BCCL provided financial support to JHARCRAFT so as to develop an infrastructural facility to conduct trainings and manufacture the handlooms. Whereas, JHARCRAFT provided training and guidance for the duration of two years. They also arranged for required resources like raw materials, reeling and spinning equipment, technical support and a network for promotion of sale of the produce from these centres.

During the study, it was observed that out of two, only one centre at Mukunda is functional with only twenty to twenty-five women working for five days a week. The other centre at Alakdiha is non-operational. However, thirty women were provided training at the location. A negotiation is on-going between BCCL, JHARCRAFT and group of women to re-initiate the centre and start the production.

3.6 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.

Beneficiaries with a finished handloom product and reeling *charkha*

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 and enhancement 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.

3.7 Alakdiha Training Centre

The Research Investigators were unable to interact with any of the respondents from this centre as it was not functional at the time of the study.

The training centre at Alakdiha is non-operational due to many unfortunate constraints accumulated over a period of time. Thirty women were successfully trained and were about to initiate the process of production but everything halted at the demand of mechanized reeling machines. These machines reduce the human labour and time required to weave the handlooms.

At present, all stakeholders are discussing and negotiating in order to reach a mutual consent to re-initiate the centre and avoid further delays loses losses to any of the shareholders.

The BCCL officials explained that the beneficiaries belong to the highly marginalised communities and their villages are located amidst the mining activities of BCCL. Public and private transport rarely plies to these villages making them cut-off from the nearest towns and cities. In these situations, the beneficiaries expected an avenue of income generation located in their vicinity but they feel that this training program has been unsuccessful in providing the same.

Further, there is a strong demand of a mechanised machine for reeling the threads which will reduce their manual labour on reeling on a manual charkha and focus the remaining time on weaving the thread. This matter has been escalated at the level of BCCL and JHARCRAFT and both the organisations are amidst negotiations with the beneficiaries and among themselves to come to a fruitful conclusion.

Table no. 2 – Summary of concerns in Alakdiha Centre

Sr.No	Stakeholder	Concerns in regard to mechanised reeling machine	Recommendation
1	Beneficiaries	Decreases the reeling time by at least 60%.	Demand for mechanised reeling machine.
2	BCCL	No budgetary allowances for the same in the MoU	Negotiation meeting to be scheduled with JHARCRAFT
3	JHARCRAFT	No budgetary allowances for the same in the MoU	

Secondly, the travelling is another major area of concern of these women. There are no public or private transport services bridging the distances between the centre and habitat of the women. These women hail from highly marginalized communities and reside at the sites amidst of the mining activities of BCCL. They remain disconnected with the main cities as there is no consistent and assured mode of transport which is 15-20 kms away. The beneficiaries have also demanded for the production near their vicinity. They expressed that their expectations were not fulfilled and the project was not considerate enough to support these women from the far places.
In spite of extreme difficulties, the recipients of training acknowledged the quality of training, the skills of the trainer, infrastructural facilities, tools & techniques and other necessary resources of the training program.

BCCL and JHARCRAFT are interacting with the women to find best possible solution to terminate the conflicts and re-start the process of manufacturing at the centre.

3.8 Concerns regarding the project

When asked about the challenges being faced by the beneficiaries from both training facilities in the past two years of the reeling and spinning training program, following are the main responses:

- Minimal increase in household income: even though the beneficiaries received Rs. 3000 per month for the period of the training, the beneficiaries' state that the income posts that has dwindled. In Mukunda, the women have persevered in the hope of learning new skill as they hail from economically stable families while in Alakdiha, lack of income is of primary concern as they are situated in geographically and economically remote areas. Therefore, lack of income coupled with spending a full working day at the loom is not feasible for the beneficiaries of Alakdiha centre.

- Lack of mechanised tools: the beneficiaries expressed concern about the time manual reeling machines take as compared to ones that have a motor attached. According to the beneficiaries, the mechanised reeling machine can save up to 60% of their time spent in the reeling activities in preparation of fabric production. They note that the time spent on the production of fabric can be increased if the time on reeling the thread is reduced. Currently, they spend at least 10 days on reeling the threads on a manual *charkha* which is then used in the handlooms. They claim that on a mechanised *charkha*, the same reeling process will take 4 days instead of 10 days.

- Lack of orders from JHARCRAFT: the beneficiaries have expressed that there has been a decrease in orders from the aforementioned organisation and they are not provided a variety of threads to work with. They were hoping to be working on bigger orders by now but according to their trainer some of the beneficiaries are still learning and once their skills are further developed they will be able to work with other thread varieties to produce fabric on the handloom.

CHAPTER 4 - RECOMMENDATIONS

Table no. 3 – Summary of recommendations

Sr.No	Recommendation	Purpose
1	The internal conflicts can be mutually resolved by discussions and provisions of viable demands.	To revive the existing centres (operational & non-operational) with increased productivity and enhanced quality.
2	Market Linkages can be multiplied by creating avenues like online sale, participation in exhibitions, display in retail chains and B2B contracts	To assure consistent sale for sustainability.
3	Branding, product innovation, design development, technical training and technological support can be imparted for better quality product and higher goodwill.	To compete with the changing trends of fashion and offer products at affordable prices.
4	Training in Entrepreneurship can be conducted as part of the training program.	To motivate the trainees to own the responsibility of sustaining the centres of production.
5	Trainees can be educated on forming SHGs and availing micro-finance from the financial intuitions.	To make the collective self-reliable and self-sufficient.
6	Introduce and link with State and Government schemes in Handloom Sector, Women Entrepreneurship, Micro-Finance, Market Linkages, Procurement of raw material & other technical support,	To assure support and sustainability of the enterprise.
7	A website can be launched with Brand Name	To reach to the new

	and portal for online payments to promote the produce and increase the sale. Social Media can be used as a platform for publicity and awareness.	community of online purchasers and increase the sale multi-fold.
8	Training on data management, financial management, logistics management, etc can be imparted to the beneficiaries.	To educate beneficiaries on aspects of managerial skills for analysing the state of the enterprise to plan the line of action.
9	Backward and forward linkages can be identified and specialised services can be exchanged.	To withstand the uncertainties of the market and minimise the risks by sharing it with multiple stakeholders.
10	Exposure to interact with established cluster collectives.	To learn the process of formation of an enterprise from a small no.of beneficiaries,and extending the participation for more benefits.

ANNEXURE

.

QUESTIONNAIRE FOR BENEFICIARIES

SKILL DEVELOPMENT ON REELING AND SPINNING TRAINING UNDER CSR OF BCCL

Date:

Time:

Village:

1.	Details of the beneficiary:
a)	Name:
b)	Age:
c)	Educational Qualification:
d)	Income:
2.	Are you currently employed? If yes, with whom?
3.	Are you working as a skill artisan?
4.	Or are there initiatives taken to make you self-sufficient entrepreneurs?
5.	What do you know of this training? (Objectives)
6.	When did this training start?
7.	How did you know about this training?
8.	What made you join this training?
9.	What were you trained for?
10.	How were you trained?
11.	What was the duration of the training?
12.	Were you satisfied with the trainer?
13.	How has this training benefitted you?

14.	Has there been an increase in the household income?
15.	What personal skills did you develop?
16.	Has it brought about any perceptional change in your family?
17.	What did you like about the training?
18.	What did you not like about the training?
19.	What were the immediate effects after training? Social: Familial: Economic:
20.	Did you earn from the products made during the training? How much did you earn?
21.	Was it more or less according to your expectations?
22.	Were you given any stipend during the training?
23.	Can you teach others what you have learnt?
24.	Who do you sell your products to?
25.	Do they give you a target to achieve in a month?
26.	What are the transactions terms by the buyer?
27.	Were the beneficiaries given the final assessment at the end of the training? If yes, what was it?
28.	Are the beneficiaries' parts of a Self Help Group?
29.	What other skills were imparted to them?
30.	Was the community involved? If yes, in what ways?
31.	How has this project shown improvement in the quality of the life in the beneficiaries? Please elaborate (medical insurances, bank accounts, etc.)
32.	What has been the response/feedback from the beneficiaries to Jharcraft on this project?
33.	Did Jharcraft face any challenges while engaging with the community?
34.	To your knowledge, are there any other organizations working with a similar programme in this geographical area? If yes, could you provide the names of those organizations?
35.	Budget of running the particular project:

36.	What was the cost decided upon?
37.	Was there any deviance?
38.	Please provide details about the team who were assigned the project: *What was their role? What was the input and the output?*
39.	What are the strengths and weaknesses of this project?
40.	Has Jharcraft faced any challenges in engaging with BCCL? What were the key challenges faced during this project?
41.	What are the key achievements of this project?
42.	According to you should there be additional measures taken to improve this project?
43.	Kindly provide any additional comments, concerns and/or observations/suggestions to improve this project?

INTERVIEW SCHEDULE FOR BHARAT COKING COAL LIMITED

DATE:

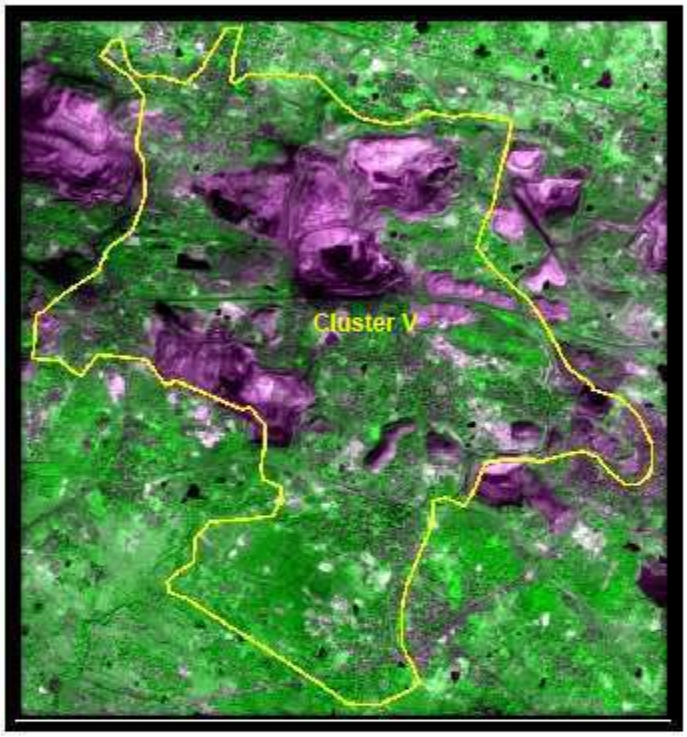
TIME:

44.	Details of the Company:	
e)	Name:	
f)	Designation:	
g)	Contact No.:	
h)	Address:	
45.	Name of project:	
46.	Date of Implementation:	
47.	Objectives of the project:	
48.	List which of these objectives were achieved and which were not achieved?	
49.	Please explain the process of collaboration with Jharcraft. The rationale is stated in the proposal, was that idea accomplished?	
50.	Why and how did BCCL choose Jharcraft to implement this project?	
51.	As per the MoU, did Jharcraft do any baseline study before commencing the program?	
52.	State the geographical areas the project is being implemented in.	
53.	No. of villages:	Names of villages:
54.	What is the total number of beneficiaries? (please attach scanned copy of total number of beneficiaries mentioning their phone numbers)	

55.	Is there a deviance from the numbers decided upon initially? If yes, why?
56.	How did you decide upon the beneficiaries?
57.	Since when has BCCL been funding this project?
58.	What resources did BCCL contribute? E.g.: Infrastructure, monetary contribution, etc.
59.	Was the community involved? If yes, in what ways?
60.	Are the beneficiaries aware of the role of BCCL in this project? Has a display board used to make them aware?
61.	How has this project shown improvement in the quality of the life in the beneficiaries? What has been the response/feedback from the beneficiaries to BCCL on this project?
62.	Did BCCL face any challenges while engaging with the community?
63.	Did the community know that BCCL is the funder agency of this project?
64.	To your knowledge, are there any other organizations working with a similar programme in this geographical area? If yes, could you provide the names of those organizations?
65.	Budget of running the particular project:
	What was the cost decided upon? Was there any deviance?
66.	Please provide details about the team who were assigned the project: What was their role? What was the input and the output?
67.	What are the strengths and weakness of this project?
	Strengths:
	Weakness:
68.	Has BCCL undertaken monitoring of the said project? How many times? Kindly provide documents if any.
69.	Has Jharcraft conducted any evaluation of the project?
70.	Has BCCL received any monthly reports from Jharcraft? If yes, how many? Please provide with the documents.
71.	Has BCCL faced any challenges in engaging with Jharcraft? What were the key challenges faced during this project?
72.	What are the key achievements of this project?
73.	According to you should there be additional measures taken to improve this project?
74.	Would you replicate this model in future as your CSR project in more villages? Has this model been already replicated?
75.	What changes would you include in the replication of the project?
76.	Kindly provide any additional comments, concerns and/or observations/ suggestions to improve this project?

Annexure XXIII

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 Mini-Ratna 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"'.

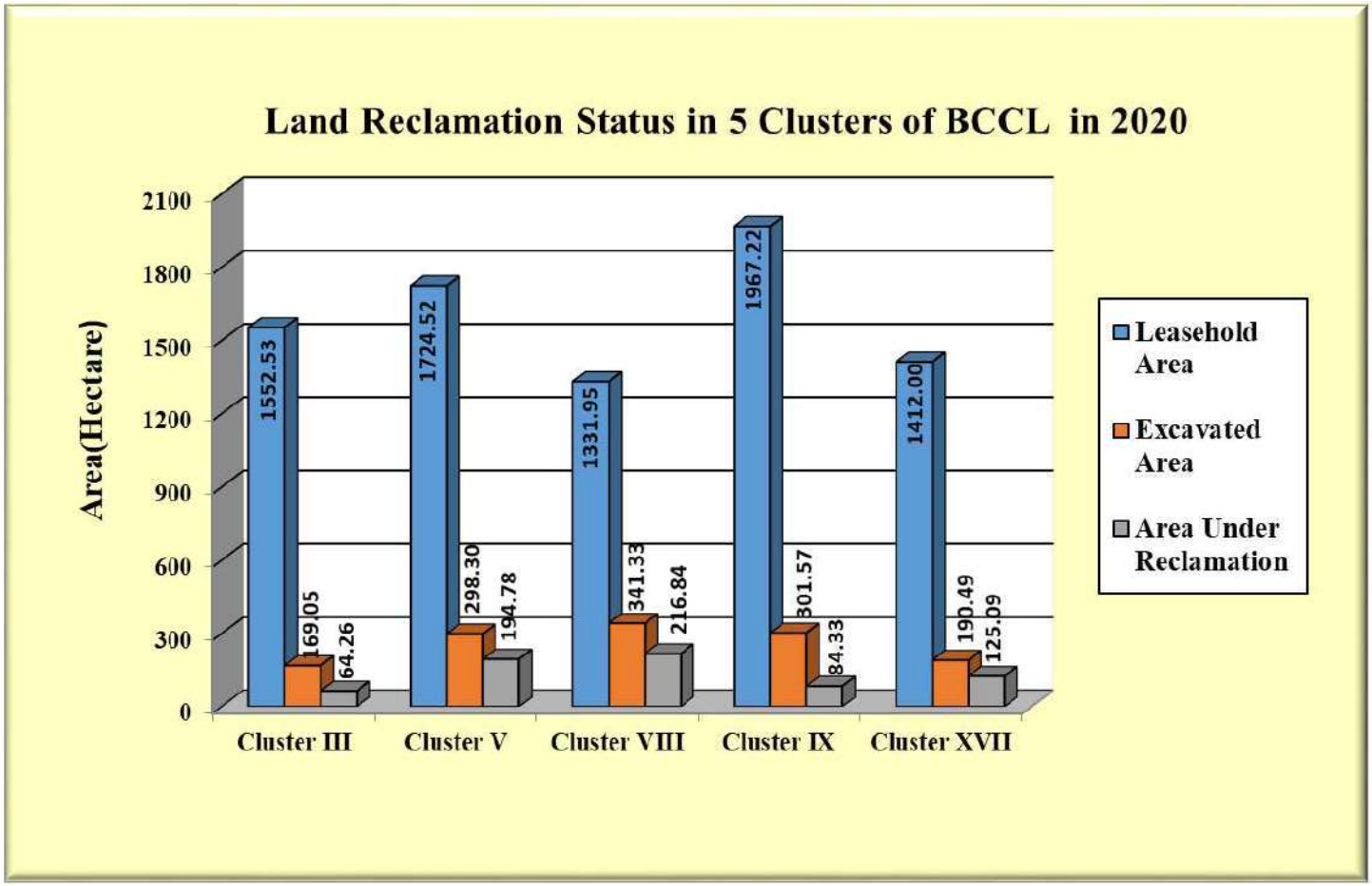


Fig. 1: Cluster wise Land Reclamation Status in five Clusters - 2020 (BCCL)

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:

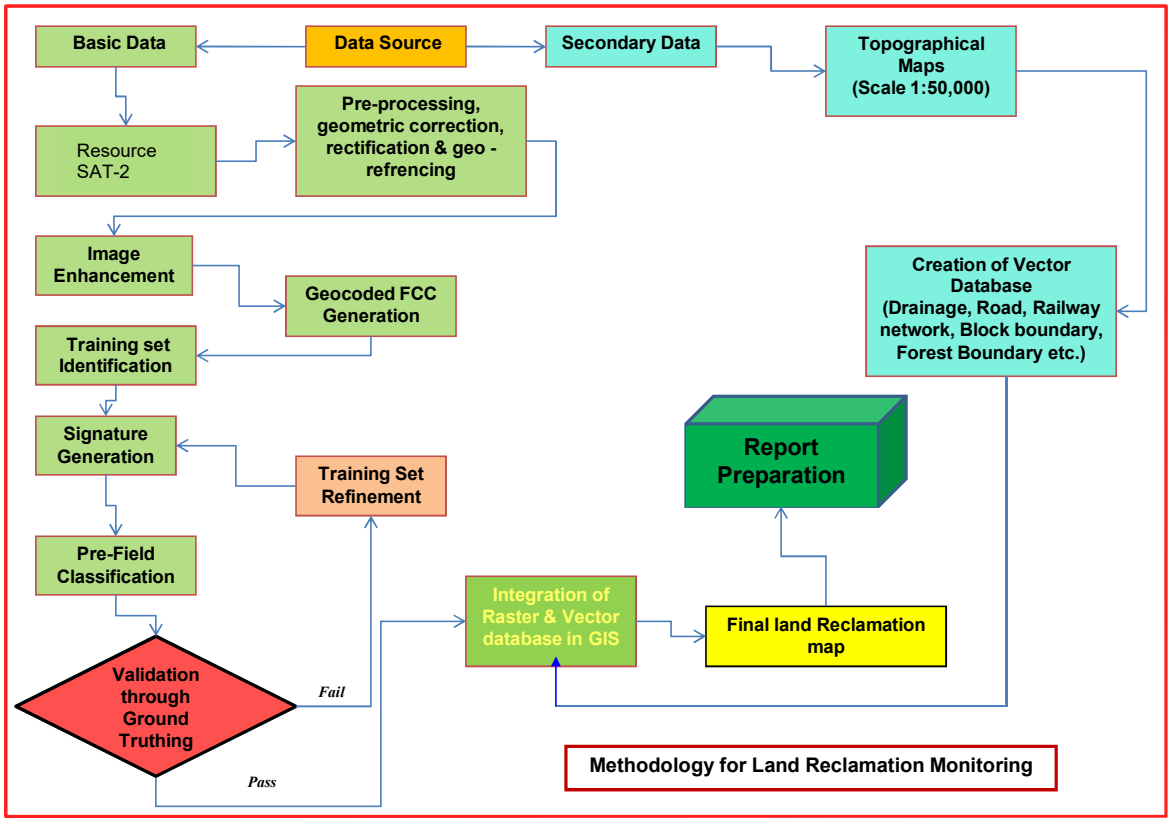


Fig. 2: Methodology of Land Reclamation Monitoring

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.

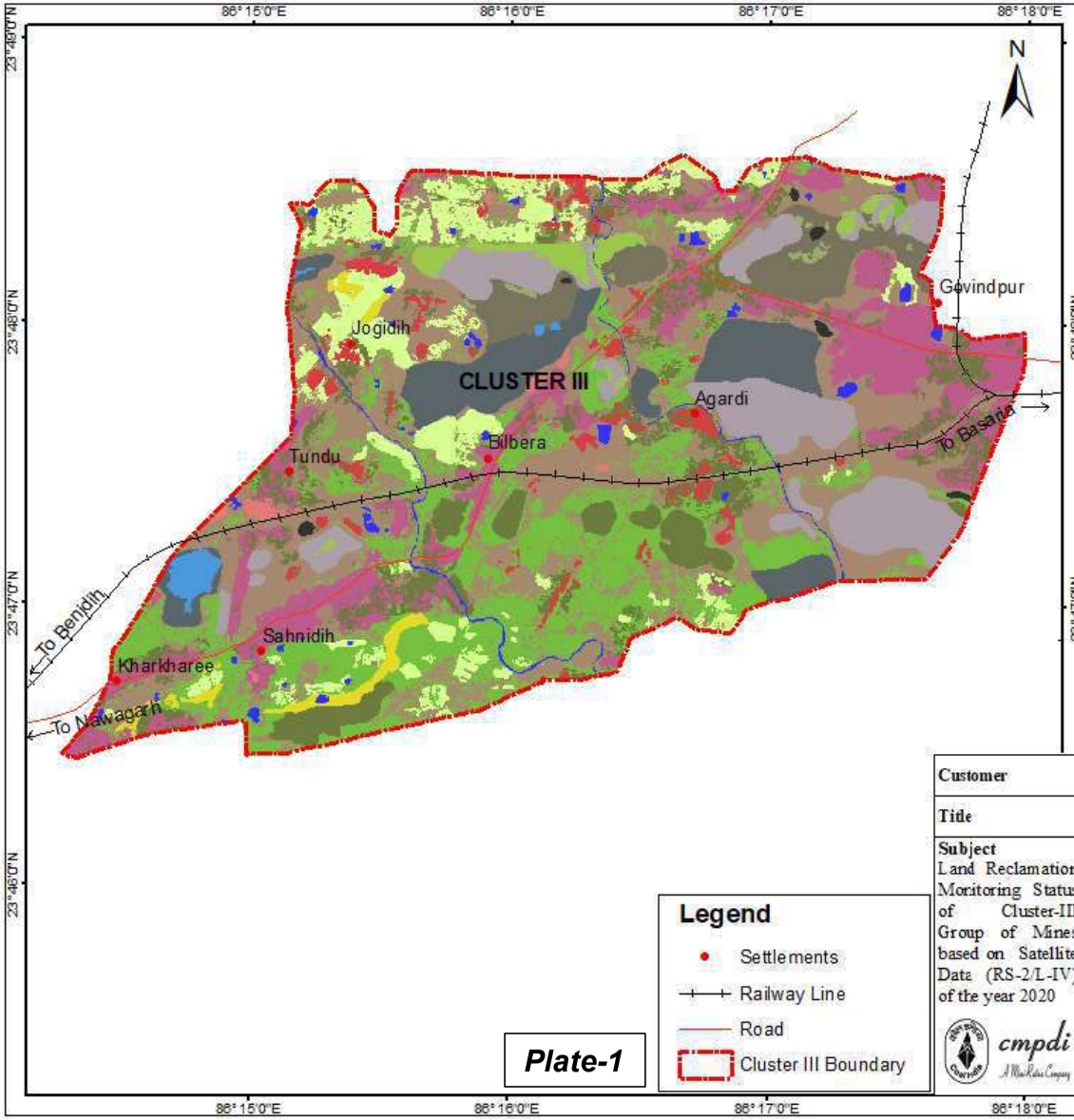
Table 2

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 Moritoring 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)		
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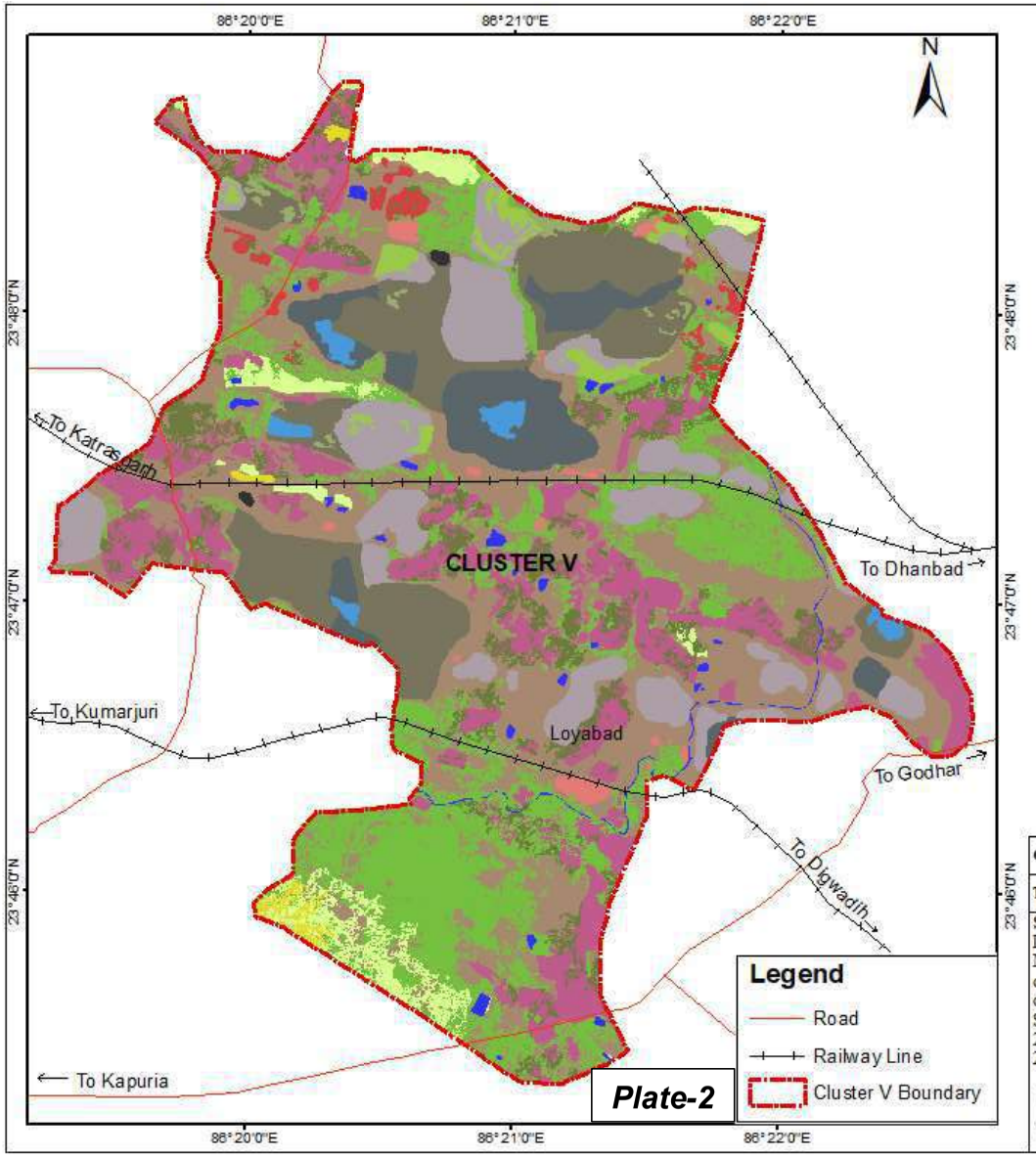
	Drg No.	HQREM20 R2 A4 CL-III			RevNo.0



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)		
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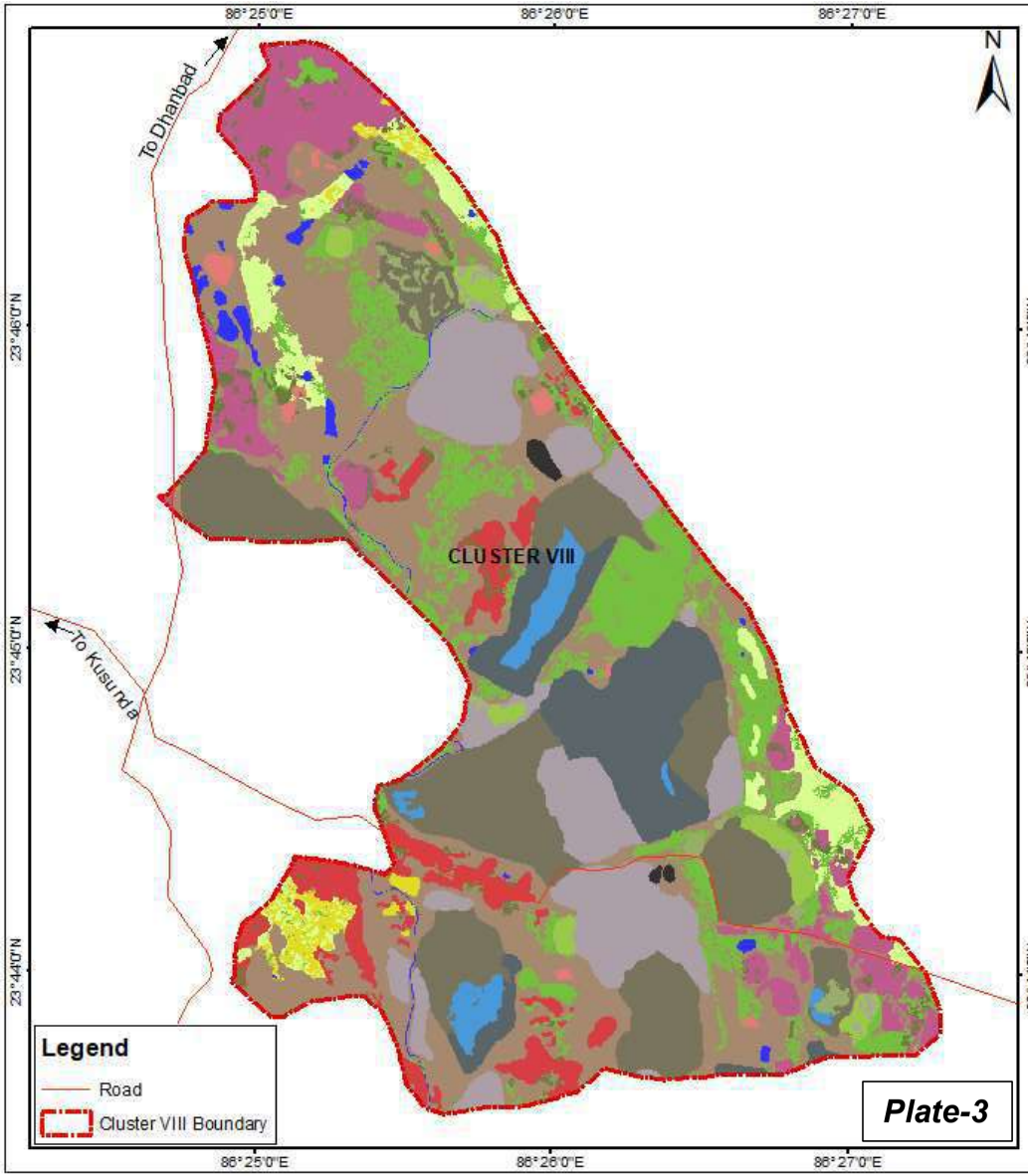
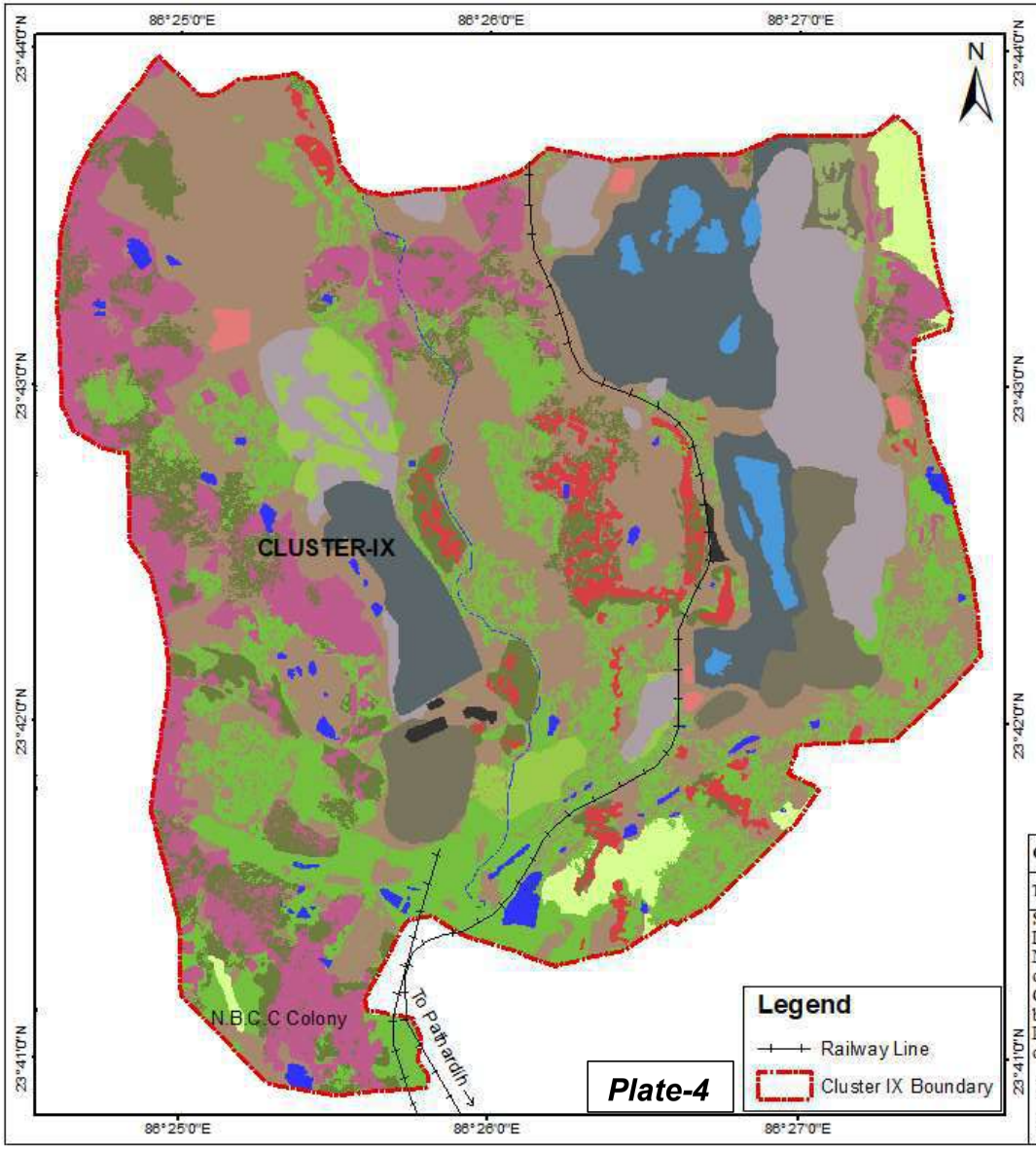
	Drg No.	HQ REM 20 R2 A4 CL-V			Rev No.0



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**

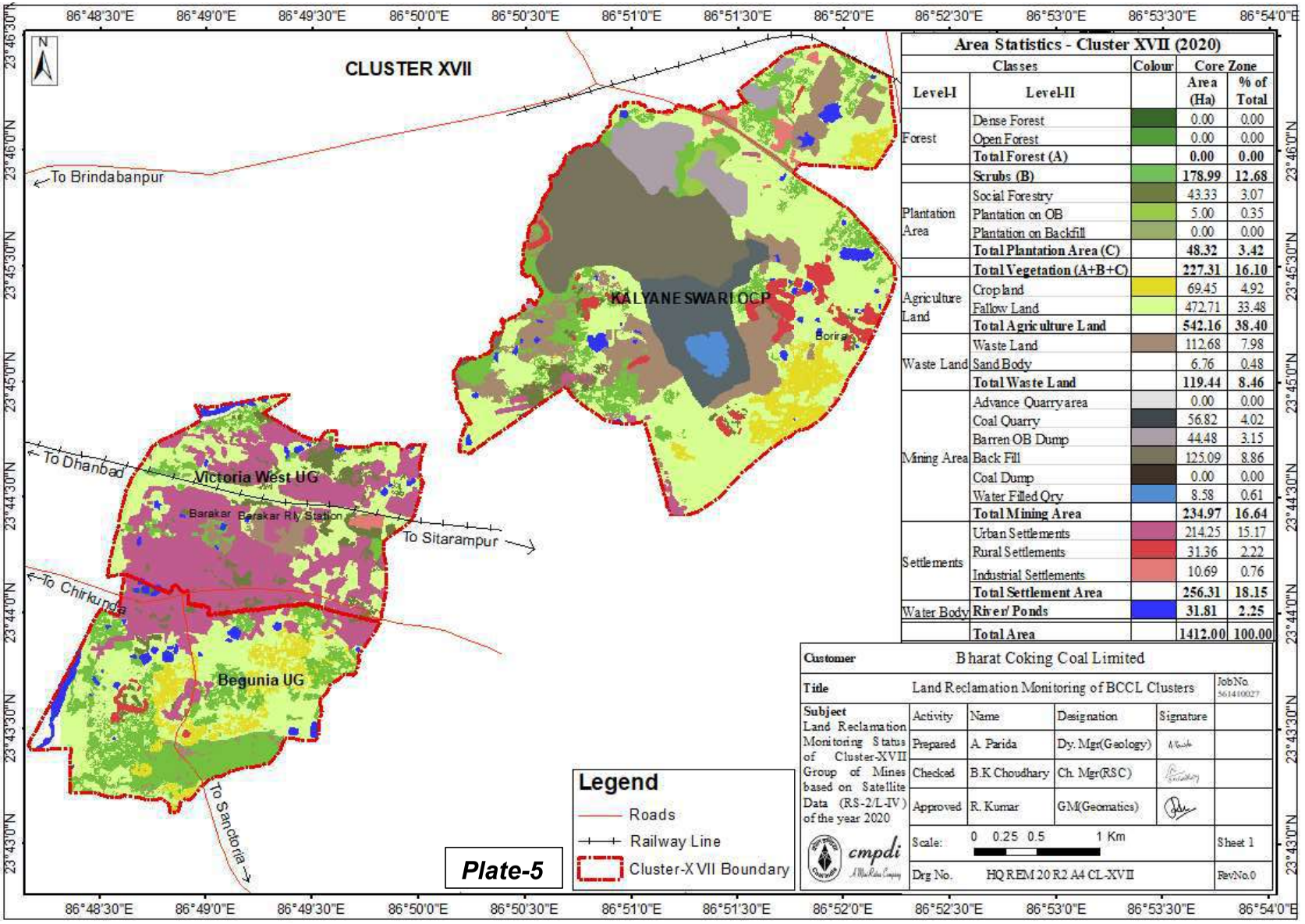
Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 561410027
Subject: Land Reclamation Monitoring Status of Cluster-VIII Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2020	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Dy. 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)		
	Scale:	0 0.25 0.5 1 Km			Sheet 1
	Drg No.	HQ REM 20 R2 A4 CL-XVII			RevNo.0

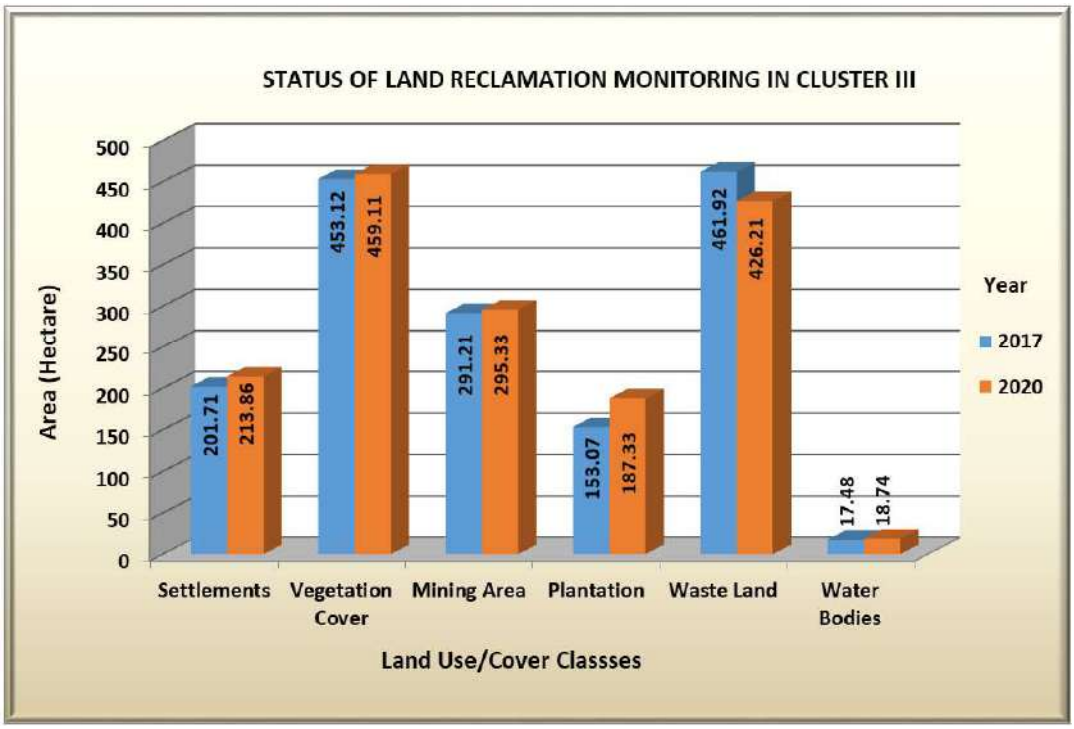


Fig. 3: Land Reclamation Status of Cluster III

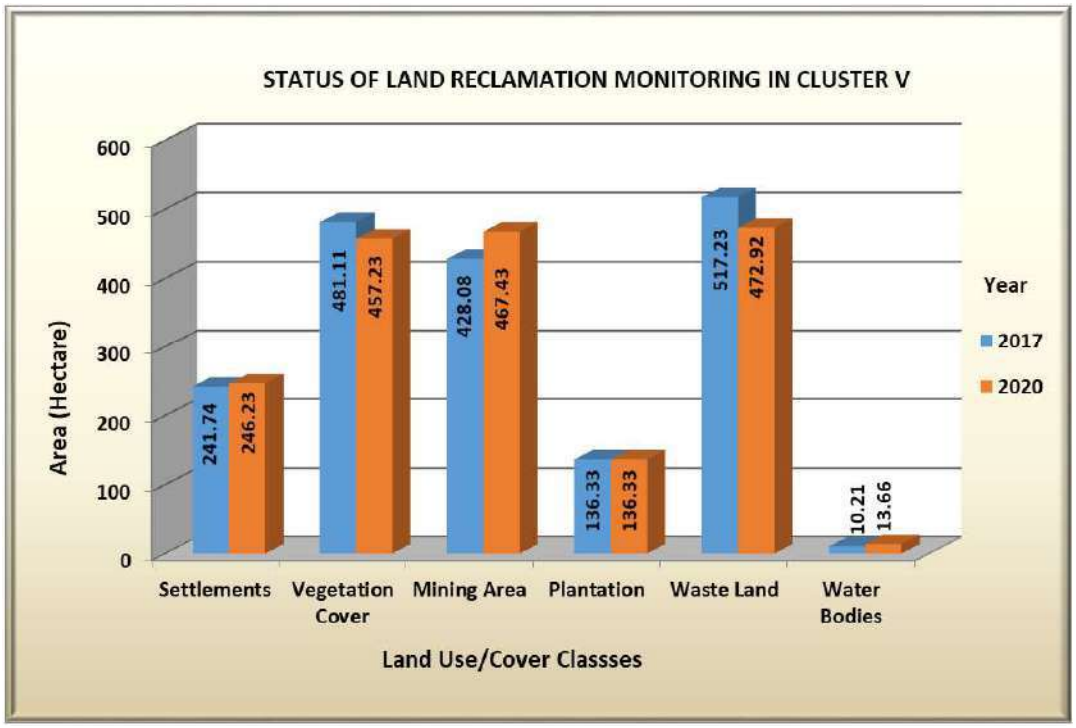


Fig. 4: Land Reclamation Status of Cluster V

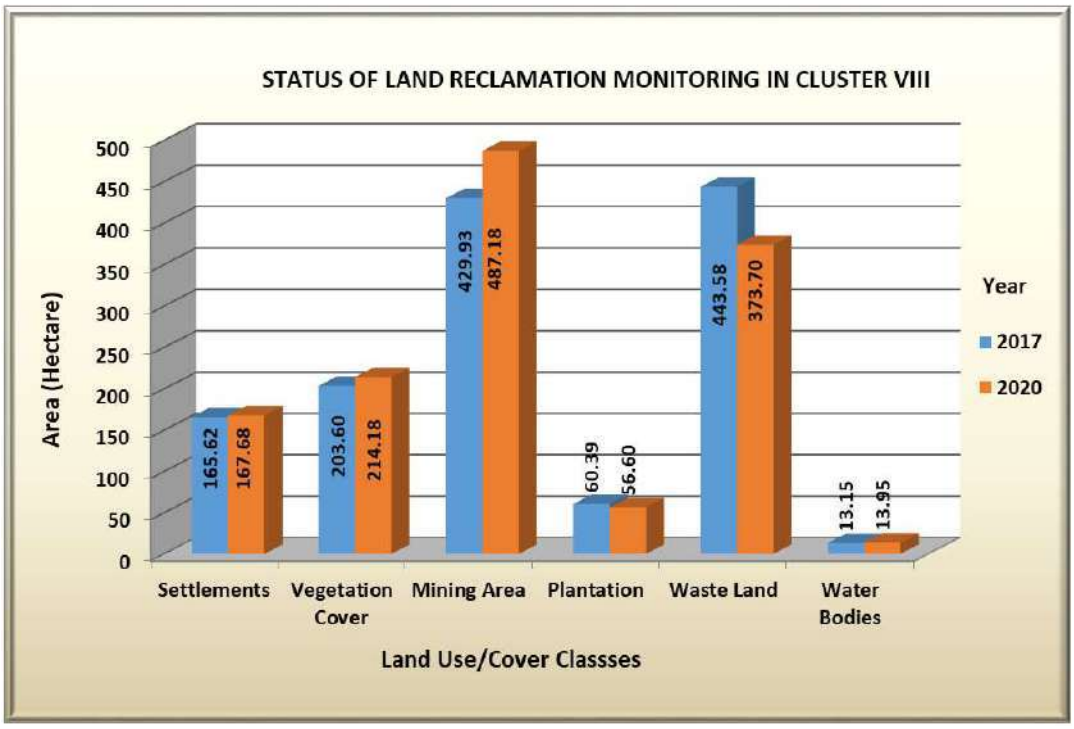


Fig. 5: Land Reclamation Status of Cluster VIII

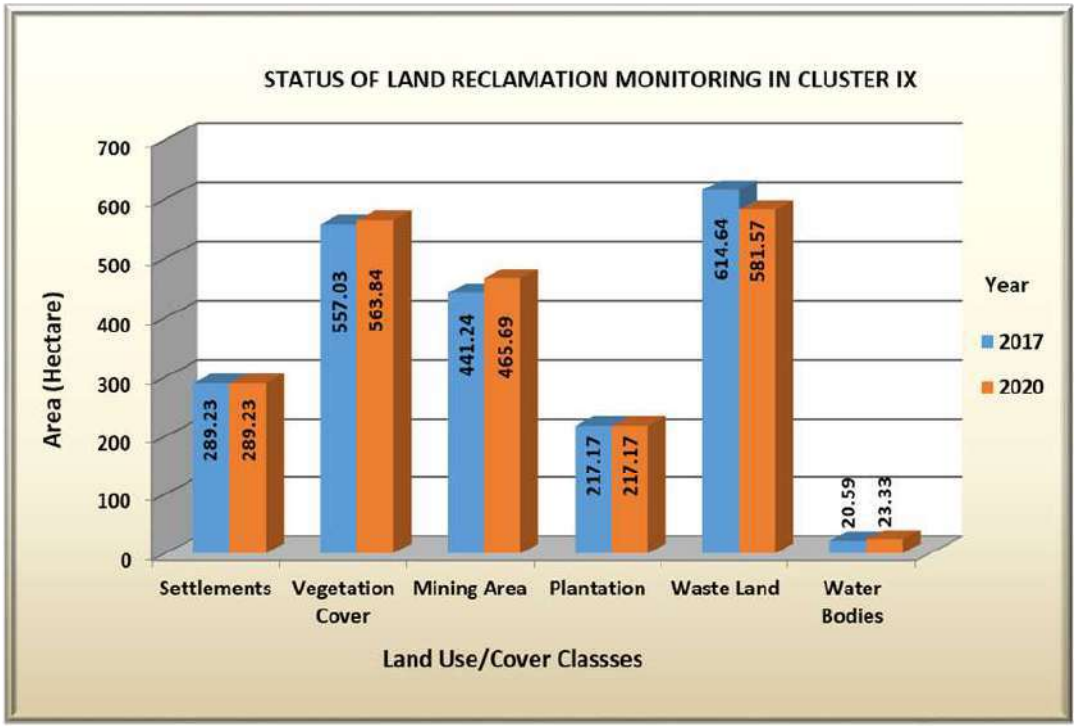


Fig. 6: Land Reclamation Status of Cluster IX

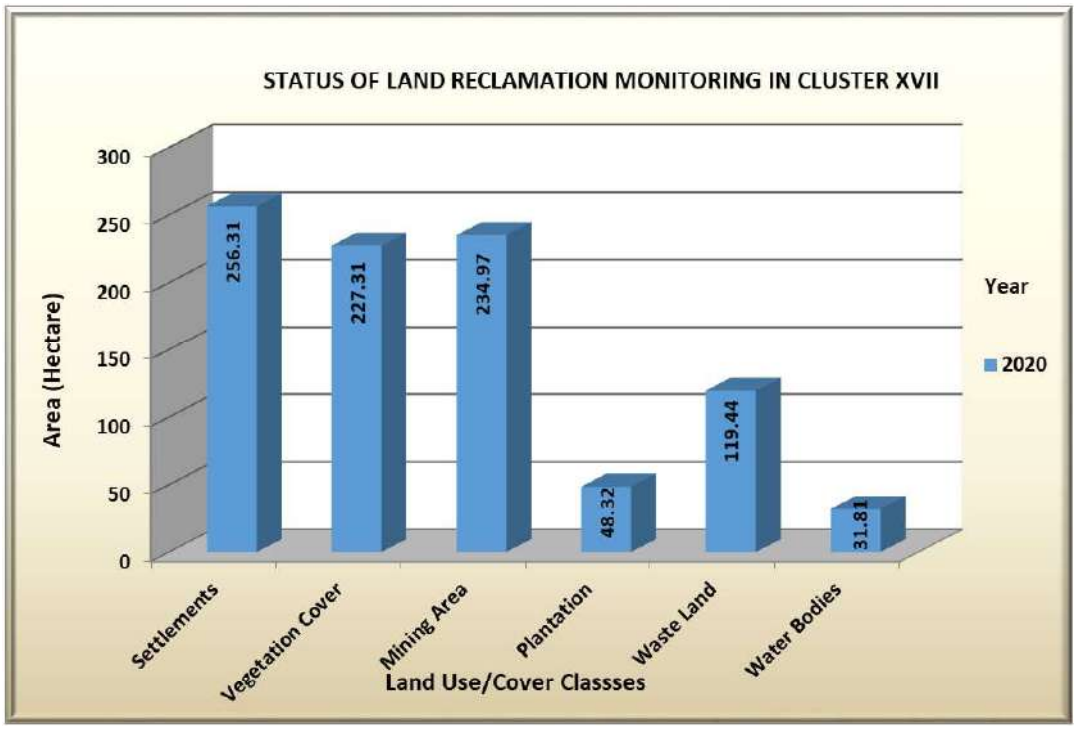


Fig. 7: Land Reclamation Status of Cluster XVII

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

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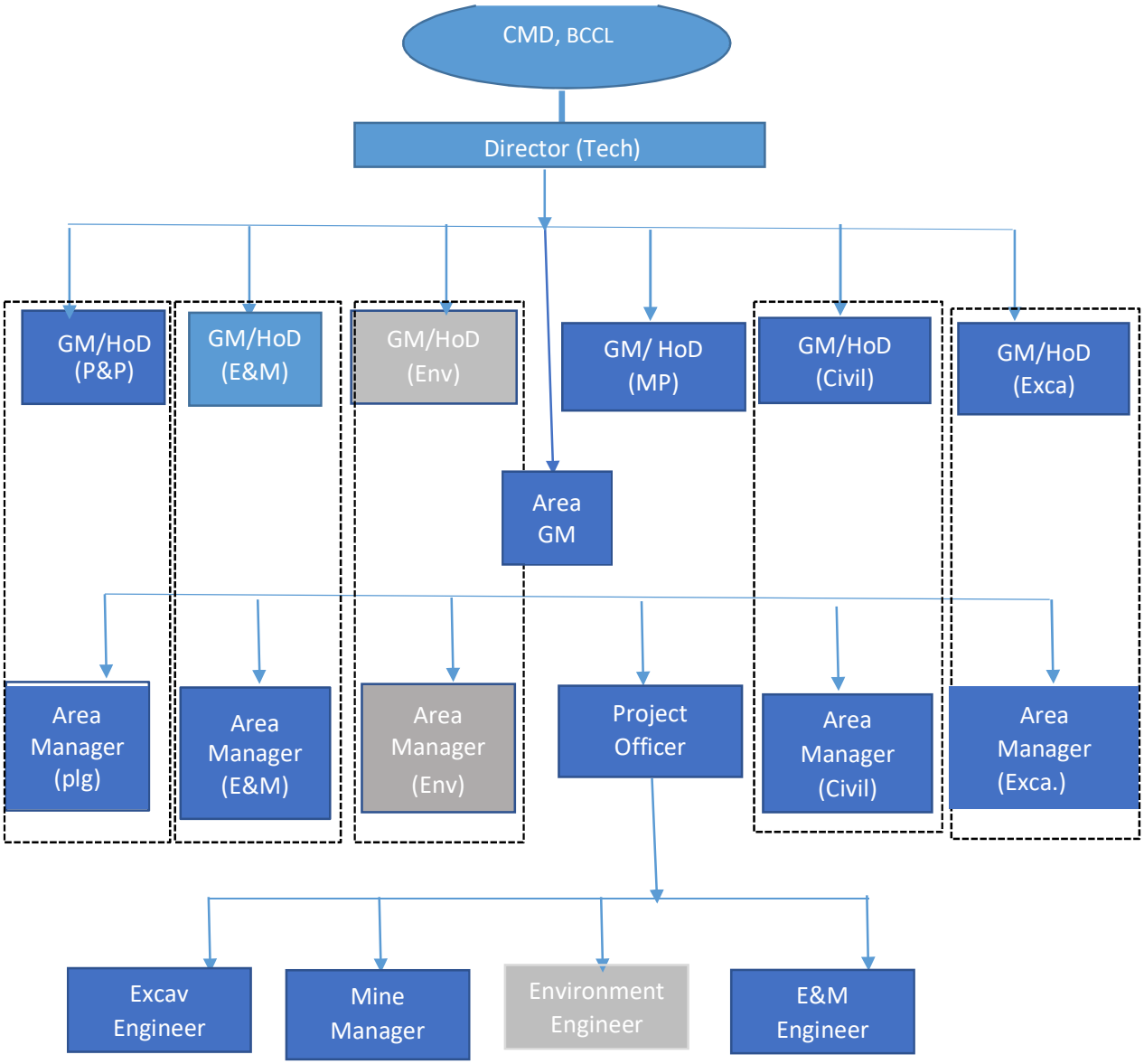
Wesite : www.cmpdi.co.in, Email : cmpdihq@cmpdi.co.in

Annexure XXIV



Annexure XXV

ANNEXURE-A

Letter by Under Secretary Coal regarding quarterly basis monitoring of safety, Environment and Quality of coal in Board Meetings

No. 23/3/ 2015 AGD/BA
Government of India
Ministry of Coal
******

New Delhi, 26th April, 2017

To

CMDs of Coal India Limited/ NLC India Limited & all Subsidiaries.

Subject: Quarterly review in the Board Meetings – Safety, Environment & Quality.

Sir,

Ministry of Coal has identified four thrust areas – Safety, Environment, Quality & New Technologies. It is necessary that these areas are incorporated in the functioning of the coal companies and monitored at the Board level.

2. It has therefore been decided that agenda items on the performance of the concerned company on each of the three aspects, viz Safety, Environment and Quality of Coal shall be placed in the Board meeting, thoroughly discussed and monitored by the Board on quarterly basis along with quarterly accounts.

3. The agenda item on safety shall include the implementation and effectiveness of all safety related aspects / mechanism required as per law and directions of Ministry/ CIL. Similarly, the agenda item on environment shall consist of the compliance with regard to the conditions of environment clearance, forest clearance, water and air pollution norms, requirements of mining plan, mining closure plan and reclamation of mined out areas as well as utilization of mined water. The quality aspect would include proper siting of coal & adherence to supply of declared grade of coal and elimination of grade slippage, etc.

4. Concerned Director (Technical) in the Company would be responsible to ensure the compliance to safety, environment and quality related aspects in the company. The Govt. nominee Director on the Board of the company is requested to see that the agenda items on these aspects are comprehensive and guide the discussion to ensure effective monitoring by the board.

You are requested to ensure compliance of these instructions.

Yours faithfully,

(Sanjib Bhattacharya)
Under Secretary to the Government of India

Copy to all Govt. nominee Directors of each company.

CS Scanned with CamScanner

Annexure XXVI

AMBIENT AIR QUALITY DATA

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Air Quality Test Report

CMPDIL, RI-II
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DHANBAD. -826005
Phone:0326-223-850
email: rdri2cmpdi@coalindia.in

Test Report for Ambient Air Samples

Month & Year	04/2022	Cluster	Cluster IX	Report No.	RI-II/AIR/2022-23/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	05.07.2022
Project		Sample Ref. No.	REM/BCCL/2022/04	Sampling Method	CMPDI/RI-II/LPM 13 , (IS 5182)
Sampling Stations	i	Jeenagora	Date of Sampling	01.04.2022 – 21.04.2022	Zone of Station: Core Zone

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³) 1st FN	Observed Values (in µg/m³) 2nd FN	Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
1	PM_{10}	IS -5182(Part 23):2006, R-2017	124	94	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	67	53	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	10	11	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	27	23	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*
***All units are in µg/m3, 24 hourly Average,*

ANALYSED BY (Gaurav Kant) ***CHECKED BY*** (Amit Raj Mishra) ***HOD's Signature***

Note: *The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.*

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AMBIENT AIR QUALITY DATA

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Air Quality Test Report

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email: rdri2cmpdi@coalindia.in

Test Report for Ambient Air Samples

Month & Year	05/2022	Cluster	Cluster IX	Report No.	RI-II/AIR/2022-23/02
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	05.08.2022
Project		Sample Ref. No.	REM/BCCL/2022/05	Sampling Method	CMPDI/RI-II/LPM 13 , (IS 5182)
Sampling Stations	i	Jeenagora	Date of Sampling	07.05.22 – 20.05.22	Zone of Station: Core Zone

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³) 1st FN	Observed Values (in µg/m³) 2nd FN	Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
1	PM_{10}	IS -5182(Part 23):2006, R-2017	98	89	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	58	56	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	11	10	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	30	26	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*
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ANALYSED BY (Gaurav Kant) ***CHECKED BY*** (Amit Raj Mishra) ***HOD's Signature***

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Test Report for Ambient Air Samples

Month & Year	06/2022	Cluster	Cluster IX	Report No.	RI-II/AIR/2022-23/03
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	05.08.2022
Project		Sample Ref. No.	REM/BCCL/2022/06	Sampling Method	CMPDI/RI-II/LPM 13 , (IS 5182)
Sampling Stations	i	Jeenagora	Date of Sampling	16.06.22 – 23.06.22	Zone of Station: Core Zone

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³) 1st FN	2nd FN	Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
1	PM_{10}	IS -5182(Part 23):2006, R-2017	96	110	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	55	53	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	<10	11	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	28	29	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

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Test Report for Ambient Air Samples

Month & Year	07/2022	Cluster	Cluster IX	Report No.	RI-II/AIR/2022-23/04
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	07.10.2022
Project		Sample Ref. No.	REM/BCCL/2022/07	Sampling Method	CMPDI/RI-II/LPM 13 , (IS 5182)
Sampling Stations	i	Jeenagora	Date of Sampling	07.07.22 – 25.07.22	Zone of Station: Core Zone

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³) 1st FN	2nd FN	Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
1	PM_{10}	IS -5182(Part 23):2006, R-2017	89	137	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	48	58	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	10	10	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	23	22	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*
***All units are in µg/m3, 24 hourly Average,*

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AMBIENT AIR QUALITY DATA

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Ambient Air Quality Test Report

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Test Report for Ambient Air Samples

Month & Year	08/2022	Cluster	Cluster IX			Report No.	RI-II/AIR/2022-23/05
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	26.10.2022
Project		Sample Ref. No.	REM/BCCL/2022/08	Sampling Method		CMPDI/RI-II/LPM 13 , (IS 5182)	
Sampling Stations	i	Jeenagora	Date of Sampling	02.08.22	22.08.22	Zone of Station:	Core Zone

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³)		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
			1st FN	2nd FN				
1	PM_{10}	IS -5182(Part 23):2006, R-2017	116	87	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	65	53	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	10	11	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	8	12	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*
***All units are in µg/m3, 24 hourly Average,*

ANALYSED BY (Gaurav Kant) ***CHECKED BY*** (Amit Raj Mishra) ***HOD's Signature***

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Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
DHANBAD. -826005
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Test Report for Mine Effluent samples

Month & Year	**04/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/01**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**05.07.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/04**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Jeenagora**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	11.04.2022	25.04.2022

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	46	41	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.07	8.19	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	24	40	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

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Test Report for Mine Effluent samples

Month & Year	**04/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/01**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**05.07.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/04**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of LODNA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	11.04.2022	25.04.2022

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	50	26	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.92	8.05	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	24	28	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

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Test Report for Mine Effluent samples

Month & Year	**04/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/01**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**05.07.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/04**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JOYRAMPUR**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	11.04.2022	25.04.2022

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	34	21	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.65	7.72	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	28	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

CMPDIL, RI-II
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Test Report for Mine Effluent samples

Month & Year	**04/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/01**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**05.07.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/04**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of NTST**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	11.04.2022	25.04.2022

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	41	27	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.85	7.93	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	32	32	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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Test Report for Mine Effluent samples

Month & Year	**04/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/01**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**05.07.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/04**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of BARAREE**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	11.04.2022	25.04.2022		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	31	24	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.05	7.94	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.1	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	28	32	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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Test Report for Mine Effluent samples

Month & Year	**04/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/01**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**05.07.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/04**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JEALGORA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	11.04.2022	25.04.2022		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	60	46	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.69	7.72	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	44	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***Grab sampling carried out for water samples.*
***All units in mg/L unless specified otherwise.*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

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Test Report for Mine Effluent samples

Month & Year	**05/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/02**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/05**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Jeenagora**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	09.05.2022	23.05.2022

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	23	47	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.85	7.79	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	24	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

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Test Report for Mine Effluent samples

Month & Year	**05/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/02**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/05**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of LODNA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	09.05.2022	23.05.2022

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	47	59	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.75	7.69	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	32	36	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

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Test Report for Mine Effluent samples

Month & Year	**05/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/02**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/05**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JOYRAMPUR**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	02.05.2022	16.05.2022

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	46	38	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.94	7.99	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	32	40	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

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Test Report for Mine Effluent samples

Month & Year	**05/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/02**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/05**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of NTST**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	02.05.2022	16.05.2022

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	56	47	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.62	7.67	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	28	36	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

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Test Report for Mine Effluent samples

Month & Year	**05/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/02**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/05**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of BARAREE**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	02.05.2022	16.05.2022		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	32	34	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.72	7.68	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.1	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	44	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

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Test Report for Mine Effluent samples

Month & Year	**05/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/02**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/05**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JEALGORA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	02.05.2022	16.05.2022		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	48	56	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.95	7.68	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	40	40	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***Grab sampling carried out for water samples.*
***All units in mg/L unless specified otherwise.*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

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Test Report for Mine Effluent samples

Month & Year	**06/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/03**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/06**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Jeenagora**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	06.06.2022	20.06.2022

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	38	43	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.99	8.03	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	24	32	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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Test Report for Mine Effluent samples

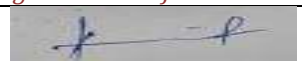
Month & Year	**06/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/03**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/06**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of LODNA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	06.06.2022	20.06.2022

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	35	37	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.66	7.98	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	28	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY



(Amit Raj Mishra)
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Test Report for Mine Effluent samples

Month & Year	**06/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/03**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/06**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JOYRAMPUR**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	06.06.2022	20.06.2022

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	37	44	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.05	7.77	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	28	20	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

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Test Report for Mine Effluent samples

Month & Year	**06/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/03**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/06**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of NTST**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	06.06.2022	20.06.2022

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	54	39	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.98	7.81	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	20	20	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY (Kumar Vaibhav) ***CHECKED BY*** (Amit Raj Mishra) ***HOD's Signature***

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Test Report for Mine Effluent samples

Month & Year	**06/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/03**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/06**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of BARAREE**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	06.06.2022	20.06.2022		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	47	49	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.95	7.84	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.1	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	24	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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Test Report for Mine Effluent samples

Month & Year	**06/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/03**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**10.08.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/06**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JEALGORA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	06.06.2022	20.06.2022		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	56	47	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.73	8.03	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	32	32	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***Grab sampling carried out for water samples.*
***All units in mg/L unless specified otherwise.*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

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Test Report for Mine Effluent samples

Month & Year	**07/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/04**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**07.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/07**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Jeenagora**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	11.07.22	18.07.22

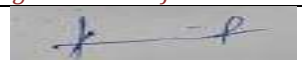
Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	39	44	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.01	8.04	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	28	36	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY



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Test Report for Mine Effluent samples

Month & Year	**07/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/04**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**07.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/07**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of LODNA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	04.07.22	25.07.22

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	37	36	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.64	7.95	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	32	24	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

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Test Report for Mine Effluent samples

Month & Year	**07/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/04**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**07.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/07**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JOYRAMPUR**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	04.07.22	25.07.22

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	37	43	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.02	7.71	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	24	24	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

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Test Report for Mine Effluent samples

Month & Year	**07/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/04**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**07.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/07**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of NTST**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	04.07.22	25.07.22

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	56	41	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.94	7.8	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	20	24	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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Test Report for Mine Effluent samples

Month & Year	**07/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/04**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**07.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/07**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of BARAREE**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	04.07.22	25.07.22		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	48	50	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.96	7.84	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.1	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	32	28	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

ANALYSED BY	(Kumar Vaibhav) ***CHECKED BY***	(Amit Raj Mishra) ***HOD's Signature***

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Test Report for Mine Effluent samples

Month & Year	**07/2022**	**Cluster**	**Cluster IX**		**Report No.**	**RI-II/WATER/2022-23/04**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**07.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/07**		**Sampling Method**	**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JEALGORA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling		04.07.22 / 25.07.22		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	57	48	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.72	8.05	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	32	28	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***Grab sampling carried out for water samples.*
***All units in mg/L unless specified otherwise.*

ANALYSED BY

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CHECKED BY

(Amit Raj Mishra)
HOD's Signature

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Test Report for Mine Effluent samples

Month & Year	**08/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/05**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**26.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/08**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Jeenagora**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	08.08.22	22.08.22

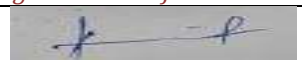
Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	43	47	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.01	8.04	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	28	36	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY



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Test Report for Mine Effluent samples

Month & Year	**08/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/05**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**26.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/08**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of LODNA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	01.08.22	22.08.22

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	38	39	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.66	7.98	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	28	28	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

CMPDIL, RI-II
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Test Report for Mine Effluent samples

Month & Year	**08/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/05**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**26.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/08**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JOYRAMPUR**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	01.08.22	22.08.22

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	38	45	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.01	7.69	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	24	24	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

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Test Report for Mine Effluent samples

Month & Year	**08/2022**	**Cluster**	**Cluster IX**	**Report No.**	**RI-II/WATER/2022-23/05**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**26.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/08**	**Sampling Method**	**IS 3025 (Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of NTST**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			Date of Sampling	01.08.22	22.08.22

Sl. No.	Parameter	Method of Analysis	Observed Values		STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
			First Fortnight	Second Fortnight		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	54	43	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.92	7.82	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	24	24	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise **Grab sampling carried out for water samples.*

ANALYSED BY | (Kumar Vaibhav) ***CHECKED BY*** | (Amit Raj Mishra) ***HOD's Signature***

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

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Test Report for Mine Effluent samples

Month & Year	**08/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/05**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**26.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/08**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of BARAREE**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	01.08.22	22.08.22		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	51	51	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.94	7.81	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.1	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	28	32	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***All units in mg/L unless specified otherwise. **Grab sampling carried out for water samples.*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT

CMPDIL, RI-II
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Test Report for Mine Effluent samples

Month & Year	**08/2022**	**Cluster**	**Cluster IX**	**Report No.**		**RI-II/WATER/2022-23/05**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**26.10.2022**
Project		**Sampling Ref. No.**	**REM/BCCL/2022/08**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Mine Discharge of JEALGORA**	**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**				
			Date of Sampling	01.08.22	22.08.22		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			First Fortnight	**Second Fortnight**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	58	49	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.73	8.02	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	28	32	*250 (Max)*	4

**LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***Grab sampling carried out for water samples.*
***All units in mg/L unless specified otherwise.*

ANALYSED BY

(Kumar Vaibhav)
CHECKED BY

(Amit Raj Mishra)
HOD's Signature

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---- End of Report ----

AMBIENT AIR QUALITY DATA

Name of the Company: **Bharat Coking Coal Limited** Year :2021-22

Name of the Cluster : **Cluster -IX** PERIOD: **Q. E. DEC- 2021.**

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	0.028	2.46	0.073
Jeenagora (A13)	<0.001	<0.001	<0.005	0.033	3.02	0.171
Bhowrah North (A14)	<0.001	<0.001	<0.005	0.031	2.66	0.173
Hurriladih UGP (A28)	<0.001	<0.001	<0.005	0.043	4.43	0.110

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Annexure XXVII

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Noise Level Test Report

Month & Year	04/2022	Cluster	Cluster IX				Report No.	RI-II/NOISE/2022-23/01
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	05.07.2022
Project		Sample Ref. No.	REM/BCCL/2022/04		Sampling Method		CMPDI/RI-II/LPM 13	
Sampling Stations	i	Jeenagora	Date of Sampling	01.04.2022	22.04.2022	Zone Category of Station:		Core Zone

Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	47.0	45.1	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	47.3	47.4					
3		08:00 - 09:00	51.8	49.7					
4		09:00 – 10:00	57.6	50.2					
5		10:00 - 11:00	60.4	55.2					
6		11:00 - 12:00	57.6	55.2					
7		12:00 - 13:00	60.3	58.5					
8		13:00 - 14:00	61.6	56.6					
9		14:00 - 15:00	56.2	53.9					
10		15:00 - 16:00	56.3	52.2					
11		16:00 - 17:00	54.8	53.0					
12		17:00 - 18:00	54.3	52.1					
13		18:00 - 19:00	53.5	51.3					
14		19:00 - 20:00	52.5	50.4					
15		20:00 - 21:00	50.1	48.2					
16		21:00 - 22:00	47.6	45.9					
		Leq DAY	**56.4**	**53.0**					
1	Noise Level dB(A)Leq -Night	22:00-23:00	44.0	41.9	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	43.3	41.2					
3		00:00- 01:00	42.8	40.7					
4		01.00-02.00	42.4	40.4					
5		02.00-03.00	42.0	40.0					
6		03.00-04.00	41.3	39.1					
7		04.00-05.00	40.9	38.9					
8		05:00-06:00	40.5	38.5					
		Leq Night	**42.3**	**40.2**					

***All noise measurements are integrated for a 01 hour period, All units in dB(A) *LDL Indicates Lower Detection Limit*

Sampling Assistants — (Gaurav Kant) — (Amit Raj Mishra)
ANALYSED BY — ***CHECKED BY*** — ***HOD's Signature***

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Noise Level Test Report

Month & Year	05/2022	Cluster	Cluster IX				Report No.	RI-II/NOISE/2022-23/02
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	10.08.2022
Project		Sample Ref. No.	REM/BCCL/2022/05		Sampling Method		CMPDI/RI-II/LPM 13	
Sampling Stations	i	Jeenagora	Date of Sampling	06.05.22	19.05.22	Zone Category of Station:		Core Zone

Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	47.0	48.7	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	47.3	51.3					
3		08:00 - 09:00	51.8	53.7					
4		09:00 – 10:00	57.6	55.7					
5		10:00 - 11:00	60.4	61.1					
6		11:00 - 12:00	57.6	59.7					
7		12:00 - 13:00	60.3	58.9					
8		13:00 - 14:00	61.6	59.6					
9		14:00 - 15:00	56.2	58.2					
10		15:00 - 16:00	56.3	57.3					
11		16:00 - 17:00	54.8	57.1					
12		17:00 - 18:00	54.3	56.3					
13		18:00 - 19:00	53.5	55.5					
14		19:00 - 20:00	52.5	54.4					
15		20:00 - 21:00	50.1	53.5					
16		21:00 - 22:00	47.6	53.2					
		Leq DAY	**56.4**	**56.9**					
1	Noise Level dB(A)Leq -Night	22:00-23:00	46.1	45.6	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	43.5	43.5					
3		00:00- 01:00	42.5	42.9					
4		01.00-02.00	41.9	42.0					
5		02.00-03.00	40.8	41.5					
6		03.00-04.00	41.0	40.1					
7		04.00-05.00	40.8	39.5					
8		05:00-06:00	40.0	39.2					
		Leq Night	**42.5**	**42.3**					

***All noise measurements are integrated for a 01 hour period, All units in dB(A) *LDL Indicates Lower Detection Limit*

Sampling Assistants — (Gaurav Kant) — (Amit Raj Mishra)
ANALYSED BY — ***CHECKED BY*** — ***HOD's Signature***

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Noise Level Test Report

Month & Year	06/2022	Cluster	Cluster IX				Report No.	RI-II/NOISE/2022-23/03
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	10.08.2022
Project		Sample Ref. No.	REM/BCCL/2022/06		Sampling Method		CMPDI/RI-II/LPM 13	
Sampling Stations	1	Jeenagora	Date of Sampling	06.05.22	19.05.22	Zone Category of Station:	Core Zone	

Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	47.2	53.3	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	47.2	56.3					
3		08:00 - 09:00	51.9	59.6					
4		09:00 – 10:00	57.5	61.3					
5		10:00 - 11:00	63.3	69.2					
6		11:00 - 12:00	62.6	72.0					
7		12:00 - 13:00	60.4	63.0					
8		13:00 - 14:00	61.5	63.6					
9		14:00 - 15:00	59.3	66.6					
10		15:00 - 16:00	56.7	65.4					
11		16:00 - 17:00	54.2	62.2					
12		17:00 - 18:00	54.8	61.4					
13		18:00 - 19:00	53.4	59.5					
14		19:00 - 20:00	55.5	63.8					
15		20:00 - 21:00	50.2	61.3					
16		21:00 - 22:00	48.1	62.6					
		Leq DAY	**57.9**	**64.8**					
1	Noise Level dB(A)Leq -Night	22:00-23:00	46.3	45.8	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	43.4	43.4					
3		00:00- 01:00	42.6	43.0					
4		01.00-02.00	41.8	41.9					
5		02.00-03.00	42.8	43.5					
6		03.00-04.00	44.7	43.6					
7		04.00-05.00	40.9	39.6					
8		05:00-06:00	39.9	39.1					
		Leq Night	**43.2**	**43.0**					

***All noise measurements are integrated for a 01 hour period, All units in dB(A) *LDL indicates Lower Detection Limit*

Sampling Assistants — (Gaurav Kant) — (Amit Raj Mishra)

ANALYSED BY — ***CHECKED BY*** — ***HOD's Signature***

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Noise Level Test Report

Month & Year	07/2022	Cluster	Cluster IX				Report No.	RI-II/NOISE/2022-23/04
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	07.10.2022
Project		Sample Ref. No.	REM/BCCL/2022/07		Sampling Method		CMPDI/RI-II/LPM 13	
Sampling Stations	1	Jeenagora	Date of Sampling	07.07.22	25.07.22	Zone Category of Station:	Core Zone	

Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	46.3	45.5	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	48.7	47.8					
3		08:00 - 09:00	51.1	50.1					
4		09:00 – 10:00	56.7	55.7					
5		10:00 - 11:00	51.6	57.0					
6		11:00 - 12:00	56.7	55.7					
7		12:00 - 13:00	56.5	61.2					
8		13:00 - 14:00	55.4	59.6					
9		14:00 - 15:00	59.5	54.3					
10		15:00 - 16:00	52.0	53.1					
11		16:00 - 17:00	51.5	53.0					
12		17:00 - 18:00	45.6	52.5					
13		18:00 - 19:00	54.5	51.8					
14		19:00 - 20:00	48.5	50.8					
15		20:00 - 21:00	54.0	50.4					
16		21:00 - 22:00	49.2	50.3					
		Leq DAY	**54.0**	**55.0**					
1	Noise Level dB(A)Leq -Night	22:00-23:00	46.1	45.6	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	45.1	44.2					
3		00:00- 01:00	42.5	42.9					
4		01.00-02.00	42.0	42.0					
5		02.00-03.00	40.8	41.5					
6		03.00-04.00	40.2	40.1					
7		04.00-05.00	40.1	39.5					
8		05:00-06:00	40.0	39.2					
		Leq Night	**42.7**	**42.4**					

***All noise measurements are integrated for a 01 hour period, All units in dB(A) *LDL indicates Lower Detection Limit*

Sampling Assistants — (Gaurav Kant) — (Amit Raj Mishra)

ANALYSED BY — ***CHECKED BY*** — ***HOD's Signature***

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Page -1 of 1

AMBIENT AIR QUALITY DATA

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Air Quality Test Report

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Test Report for Ambient Air Samples

Month & Year	08/2022	Cluster	Cluster IX	Report No.	RI-II/AIR/2022-23/05
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	26.10.2022
Project		Sample Ref. No.	REM/BCCL/2022/08	Sampling Method	CMPDI/RI-II/LPM 13 , (IS 5182)
Sampling Stations	i	Jeenagora	Date of Sampling	02.08.22 – 22.08.22	Zone of Station: Core Zone

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³)		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
			1st FN	2nd FN				
1	PM_{10}	IS -5182(Part 23):2006, R-2017	116	87	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	65	53	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	10	11	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	8	12	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*
***All units are in µg/m3, 24 hourly Average,*

ANALYSED BY (Gaurav Kant) ***CHECKED BY*** (Amit Raj Mishra) ***HOD's Signature***

Note: *The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.*

---- End of Report ----

Annexure XXVIII

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date	:	**07/09/2022**
Time	:	**08:57:22 AM**
Validity upto	:	**06/03/2023**

Certificate Sl. No.	:	JH01002200003318
Registration No.	:	JH13B5629
Date of Registration	:	23/Oct/2014
Month & Year of Manufacturing	:	September-2014
Valid Mobile Number	:	******7121
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100220
GSTIN	:	
Fees	:	Rs.300.00 (GST to be paid extra as applicable)
MIL observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm

Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	0.02

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile number to registered vehicle by logging to https://vahan.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

Scanned with CamScanner

Scanned with CamScanner

Form 59

[See rules 115 (2)]

...ion Under Control Certificate

...orised By :

Government of Jharkhand

Date	:	**14/07/2022**
Time	:	**08:50:51 AM**
Validity upto	:	**13/01/2023**

Certificate Sl. No	:	JH01003440000032
Registration No.	:	JH10CC4908
Date of Registration	:	05/Feb/2010
Month & Year of Manufacturing	:	February-2010
Valid Mobile Number	:	******4222
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100344
GSTIN	:	
Fees	:	Rs.300.00 (GST to be paid extra as applicable)
MI observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm

Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	0.42

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

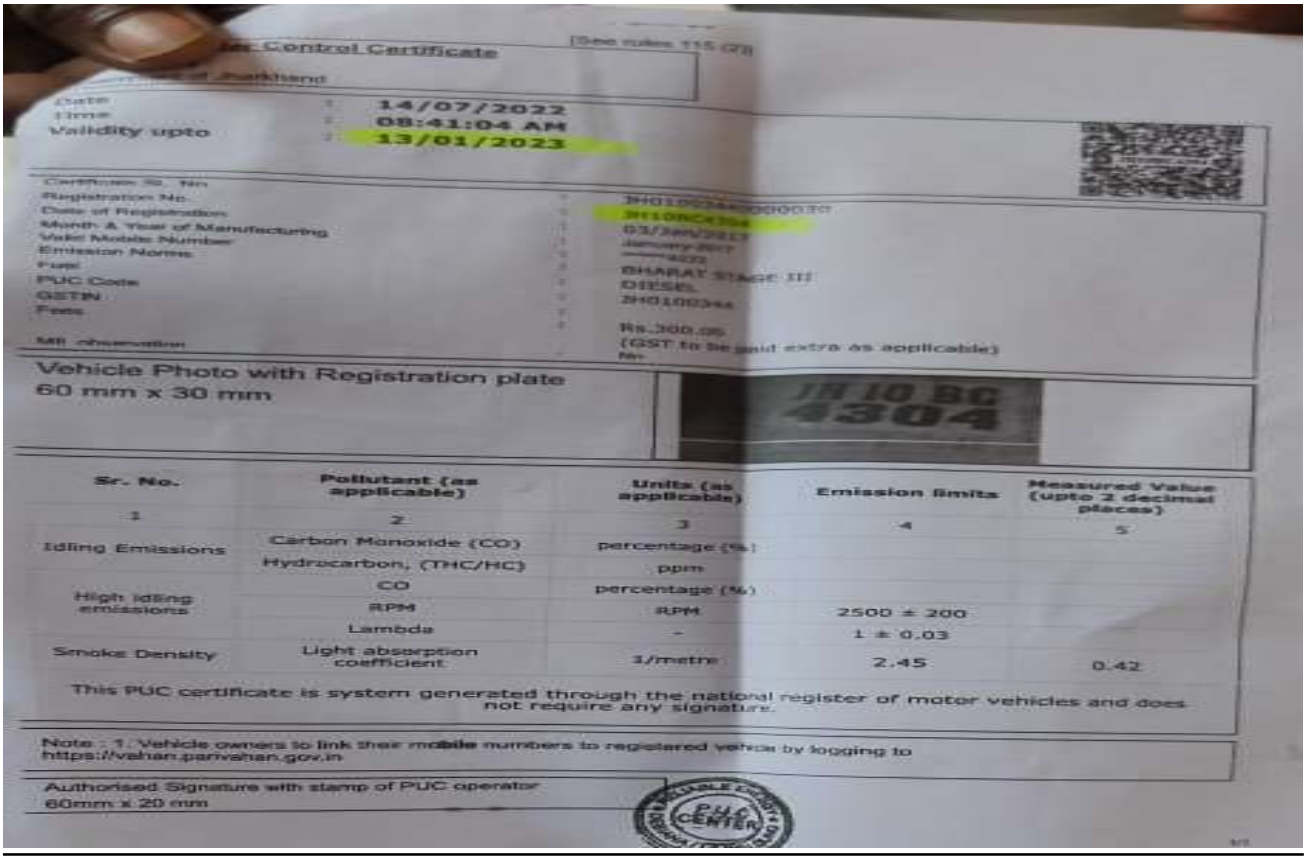
Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://vahan.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

RELIABLE ENERGY * P.U.C CENTER * DEBIANA / GOPAL GANJ

1/1

Scanned with CamScanner



[See rules 115 (2)]

Control Certificate

of Jharkhand

Date	:	14/07/2022
Time	:	08:41:04 AM
Validity upto	:	13/01/2023
Certificate SL. No.	:	
Registration No.	:	
Date of Registration	:	
Month & Year of Manufacturing	:	
Valid Mobile Number	:	
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	
GSTIN	:	
Fees	:	Rs.300.00
MIL observation	:	(GST to be paid extra as applicable)

Vehicle Photo with Registration plate
60 mm x 30 mm

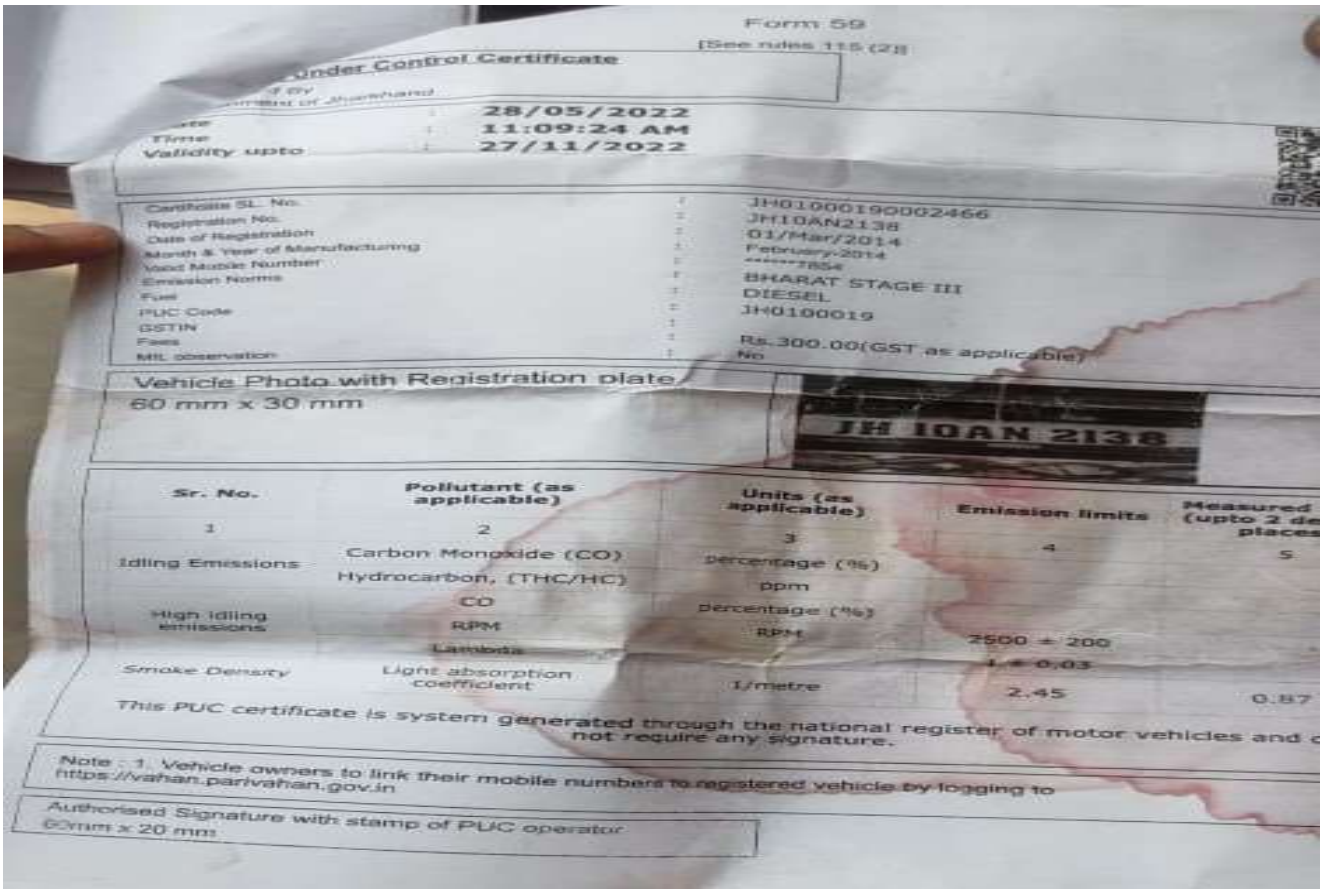
Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	0.42

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://vahan.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

PUC CENTER



Form 59

[See rules 115 (2)]

Under Control Certificate

of Jharkhand

Date	:	28/05/2022
Time	:	11:09:24 AM
Validity upto	:	27/11/2022
Certificate SL. No.	:	JH01000190002466
Registration No.	:	JH10AN2138
Date of Registration	:	01/Mar/2014
Month & Year of Manufacturing	:	February-2014
Valid Mobile Number	:	******7854
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100019
GSTIN	:	
Fees	:	Rs.300.00(GST as applicable)
MIL observation	:	No

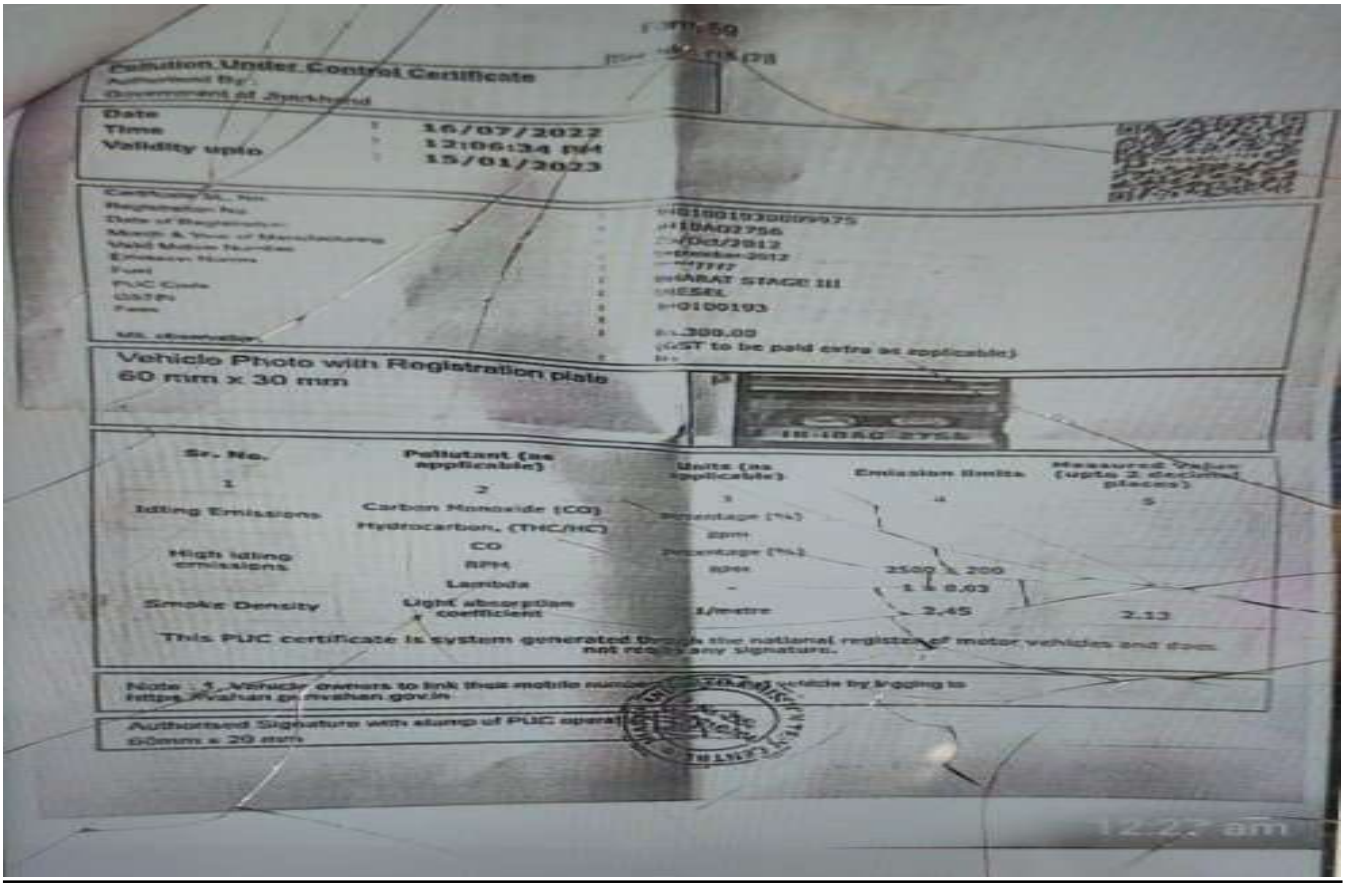
Vehicle Photo with Registration plate
60 mm x 30 mm

Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured (upto 2 de places
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda		1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	0.87

This PUC certificate is system generated through the national register of motor vehicles and d not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://vahan.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm



Pollution Under Control Certificate
Authorised By :
Government of Jharkhand

Date	:	16/07/2022
Time	:	12:06:34 PM
Validity upto	:	15/01/2023

Certificate SL. No.	:	JH01019300009975
Registration No.	:	JH10BA2756
Date of Registration	:	[illegible]/Dec/2012
Month & Year of Manufacturing	:	[illegible]-2012
Valid Mobile Number	:	[illegible]
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100193
GSTIN	:	
Fees	:	Rs.300.00
MB. observation	:	(GST to be paid extra as applicable)

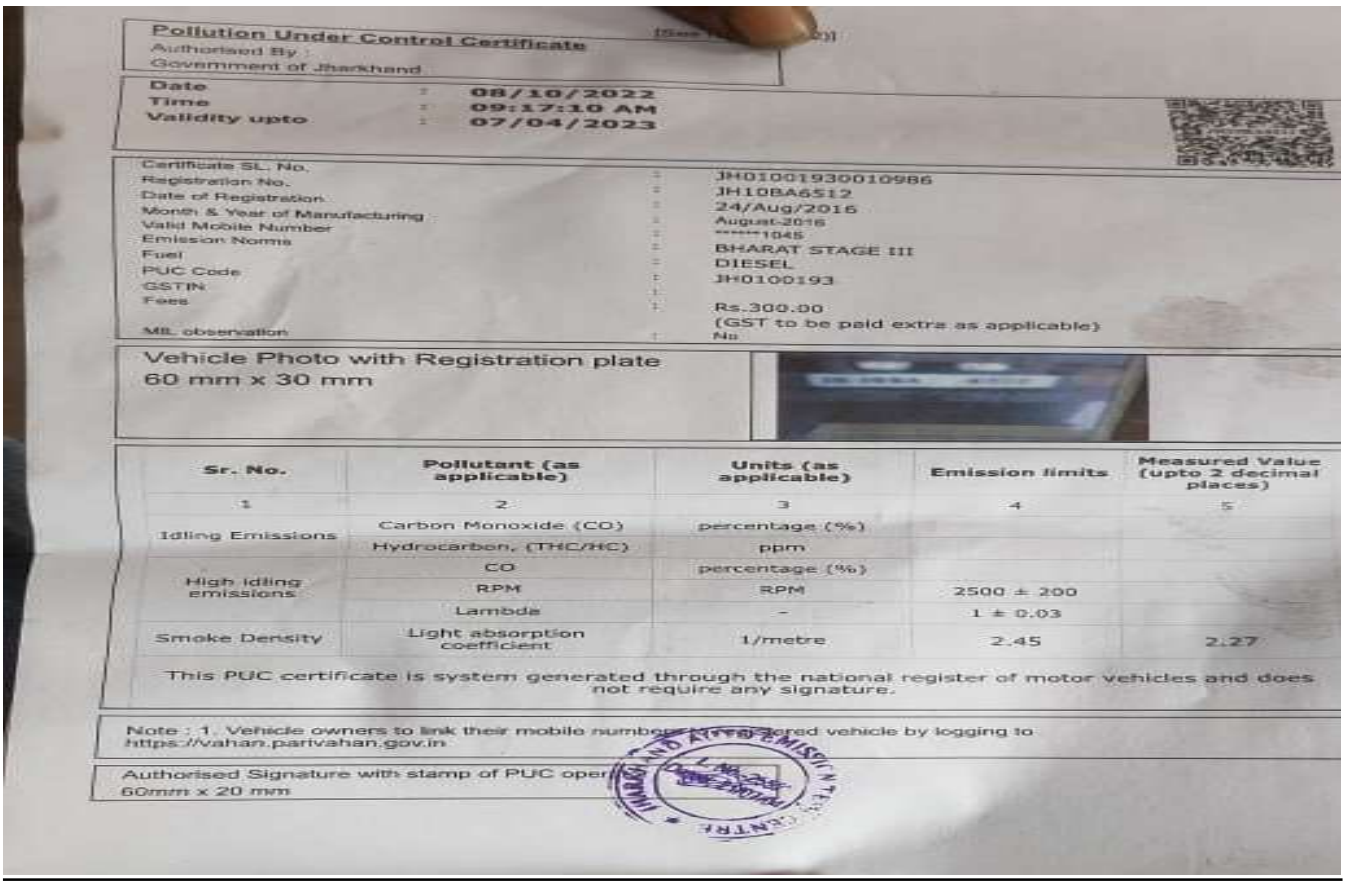
Vehicle Photo with Registration plate
60 mm x 30 mm

Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	Percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	Percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	2.13

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile number to registered vehicle by logging to https://vahan.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm



Pollution Under Control Certificate
Authorised By :
Government of Jharkhand

Date	:	08/10/2022
Time	:	09:17:10 AM
Validity upto	:	07/04/2023

Certificate SL. No.	:	JH01001930010986
Registration No.	:	JH10BA6512
Date of Registration	:	24/Aug/2016
Month & Year of Manufacturing	:	August-2016
Valid Mobile Number	:	******1045
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100193
GSTIN	:	
Fees	:	Rs.300.00
MB. observation	:	(GST to be paid extra as applicable) No

Vehicle Photo with Registration plate
60 mm x 30 mm

Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	2.27

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile number to registered vehicle by logging to https://vahan.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

Form 59

[See rules 115 (2)]

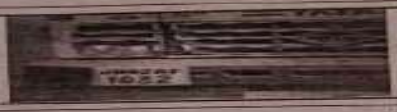
Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date	:	19/11/2022
Time	:	12:35:49 PM
Validity upto	:	18/05/2023

Certificate SL. No	:	JH01000090008454
Registration No.	:	JH02AF1032
Date of Registration	:	16/Apr/2015
Month & Year of Manufacturing	:	February-2015
Valid Mobile Number	:	******111
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100009
GSTIN	:	
Fees	:	Rs.300.00 (GST to be paid extra as applicable)
MIL observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm



Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
	CO	percentage (%)		
High idling emissions	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	2.35

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://vahan.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By
Government of Jharkhand

Date	:	17/09/2022
Time	:	11:04:50 AM
Validity upto	:	16/03/2023

Certificate SL. No	:	JH01002200003374
Registration No	:	JH10AQ9302
Date of Registration	:	04/Jul/2014
Month & Year of Manufacturing	:	July-2014
Valid Mobile Number	:	******8836
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100220
GSTIN	:	
Fees	:	Rs.300.00 (GST to be paid extra as applicable)
MIL observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm

Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
	CO	percentage (%)		
High idling emissions	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	0.02

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://vahan.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

Annexure XXIX

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	-
9.	Procurement of 15 nos. of Rain Gun type fixed sprinkler for Railway Siding	2019-20	2.12	-
10.	Procurement of Truck Mounted Fog Cannon	2021-22	24.80	
11.	Procurement of 02 nos. of PM10 Analyzer	2021-22	42.69	

Revenue Cost of Environment Management

Sl. No.	Item	Actual cost incurred (lakhs)						Remarks
		FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20	FY 2020-21	FY 2021-22	
1.	Air quality Monitoring Cost	Approx. 5.8428	Approx. 25.26503	Approx. 30.07068	Approx. 20.97	Approx. 8.53	Approx. 11.03	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)	208.85581 (4079 nos. of Manpower with EMS @ 5120.27)	225.84768 (4832 nos. of Manpower with EMS @ 4674.00)	329.20915 (4723 nos. of Manpower with EMS @ 6970.34.00)	Manpower Cost incurred on Green Belt Development
5.	Ecological Restoration	33.31425	5.49459	43.00402	47.77211	**7.28**	**27.38**	-
6.	CSR	1145	274	143	601	**239 (provisional exp.)**		**Being Done at M/S BCCL HQ**
7.	Miscellaneous	189.32444	229.15276	318.48138				Protective measures taken for the prevention of dust generation from the waste material. Water Sprinkling on haul roads

1. EMP Preparation Cost: **Rs.107.21 Lakhs** (As per information provided by Env. Deptt. HQ, BCCL)
2. Toe wall Construction (**2020-21**)- **Rs.2,30,000.00**
3. Separate Reservoir of Oil and water in O&G Trap- **Rs.70,000.00**
4. Plantation Cost (16 Ha. of OB dump reclaimed by- **Rs.99,287.00**
   DFO, Dhanbad) - for the FY 2020-21
5. Maintenance of Gokul park- **Rs.**1.2 lakh/year
6. CTE of NT-ST-JG GROUP OF MINES- **Rs.**8,33,280.00
7. CTO (upto March'23) of NT-ST-JG GROUP OF MINES- **Rs.**10,99,882.00
8. CTE of Amal. Joyrampur OC- **Rs.**75,000.00
9. CTO (upto June'22) of Amal. Joyrampur OC- **Rs.**3,37,500.00
10. Plantation Cost (Approx.) (16 Ha. of OB dump reclaimed by **Rs.** 15,88,599.00
    DFO, Dhanbad) - for the FY 2020-21
11. Plantation Cost (Approx.) (16 Ha. of OB dump reclaimed by **Rs.** 06,76,834.00
    DFO, Dhanbad) - for the FY 2021-22
12. Avenue Plantation Cost FY 2020-21 (to be done by **Rs.** 12,29,190.00
    DFO, Dhanbad)
13. Avenue Plantation Cost FY 2021-22 (to be done by **Rs.** 06,70,776.00
    DFO, Dhanbad)

Annexure XXX

था। यहां नहीं, पूजा के बाद आदित्य का नाम अभिनेत्री कंगना रणावत के साथ जुड़ा।

अपने परिजनों को बताई। परिजनों ने मामले की जानकारी पुलिस को दी। पुलिस ने मेडिकल कराकर रेप का केस दर्जकर लिया।

भारत कोकिंग कोल लिमिटेड
(कोल इंडिया लिमिटेड का एक अंग)

पर्यावरण विभाग

कोयला भवन : धनबाद

झारखंड

सभी संबंधित व्यक्तियों को सूचित किया जाता है कि भारत कोकिंग कोल लिमिटेड के क्लस्टर-9 को पर्यावरण एवं वन मंत्रालय के द्वारा पर्यावरणीय स्वीकृति दी गई है जो इस प्रकार है:-

क्रम संख्या	क्लस्टर (खान समूह) का नाम	स्वीकृति पत्र संख्या एवं दिनांक
1.	झरिया कोलफिल्ड में स्थित भारत कोकिंग कोल लिमिटेड का क्लस्टर-9 जिसका कुल खान पट्टा क्षेत्र 1942.12 हेक्टर है एवं उत्पादन क्षमता सामान्य 6.548 मिलियन टन प्रति वर्ष एवं अधिकतम क्षमता 8.512 मिलियन टन प्रति वर्ष है और जिसमें लोदना, जयरामपुर, बरारी, जियलगोरा, जिनागोरा, एन टी-एस टी एवं प्रस्तावित एन टी-एस टी विस्तार शामिल है।	J-11015/307/2010-IA.II(M) दिनांक 21 मई, 2013

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।

भारत कोकिंग कोल लिमिटेड
(कोल इंडिया लिमिटेड का एक अंग)
पर्यावरण विभाग
कोयला भवन : धनबाद, झारखण्ड

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 दी गई है जो इस प्रकार है :-

क्रम संख्या	क्लस्टर (खान समूह) का नाम	स्वीकृति पत्र संख्या एवं दिनांक
1.	झरिया कोलफिल्ड में स्थित भारत कोकिंग कोल लिमिटेड का क्लस्टर-9 जिसका कुल खान पट्टा क्षेत्र 1942.12 हेक्टर है एवं उत्पादन क्षमता सामान्य 6.548 मिलियन टन प्रति वर्ष एवं अधिकतम क्षमता 8.512 मिलियन टन प्रति वर्ष है और जिसमें लोदना, जयराम-पुर, बरारी, जियलगोरा, जिनागोरा, एन टी-एस टी एवं प्रस्तावित एन टी-एस टी विस्तार शामिल है.	J-11015/ 307/2010- IA.II (M) दिनांक 21 मई, 2013

पर्यावरणीय स्वीकृति की प्रतिलिपि झारखंड राज्य प्रदूषण नियंत्रण बोर्ड के पास उपलब्ध है तथा इसे पर्यावरण एवं वन मंत्रालय की आधिकारिक वेबसाईड http://envfor.nic.in और भारत कोकिंग कोल लिमिटेड के आधिकारिक वेबसाईड http://www.bccl.gov.in पर उपलब्ध है.

Annexure XXXI

No. J-11015/307/2010-IA.II (M)
Government of India
Ministry of Environment & Forests

Paryavaran Bhawan,
CGO Complex,
New Delhi-110510.

To

Dated: 21st May, 2013

General Manager (Environment)
M/s Bharat Coking Coal Ltd.
Koyala Bhawan,
Dhanbad-826005
Jharkhand

Sub. : - Cluster IX group of six mines (combined preproduction capacity of 6.548 MTPA with a peak capacity of 8.512 MTPA in a total combine ML area of 1942.12 ha) of M/S Bharat Coking Coal Limited located in Jharia Coal Field (EC based on TOR granted on 23. 12.2010) -Environment Clearance –reg.

Sir,

This has reference to the letter no. 430II/40/2010-CPAM dated 05th October, 2010 of Ministry of Coal along with your application for Terms of Reference (TOR) and this Ministry's grant of TOR on 23.12.2010. Reference is also invited to the letters no. BCCL/GM (Env.)/ /F-EMP-Cluster-IX/2012/490 dated 16.06.2012, 28/29.12.2012 and 31.01.2013 on the above-mentioned subject.

2. The Ministry of Environment & Forests has considered the application. It is noted that the proposal is for **Cluster IX group of six mines (combined preproduction capacity of 6.548 MTPA with a peak capacity of 8.512 MTPA in a total combine ML area of 1942.12 ha) of M/S Bharat Coking Coal Limited located in Jharia Coal Field**, dist. Dhanbad, Jharkhand. The proponent has informed that:

21/12/2021
श्रीमति बबिता गोराई
पार्षद
वार्ड संख्या-49
धनबाद नगर निगम

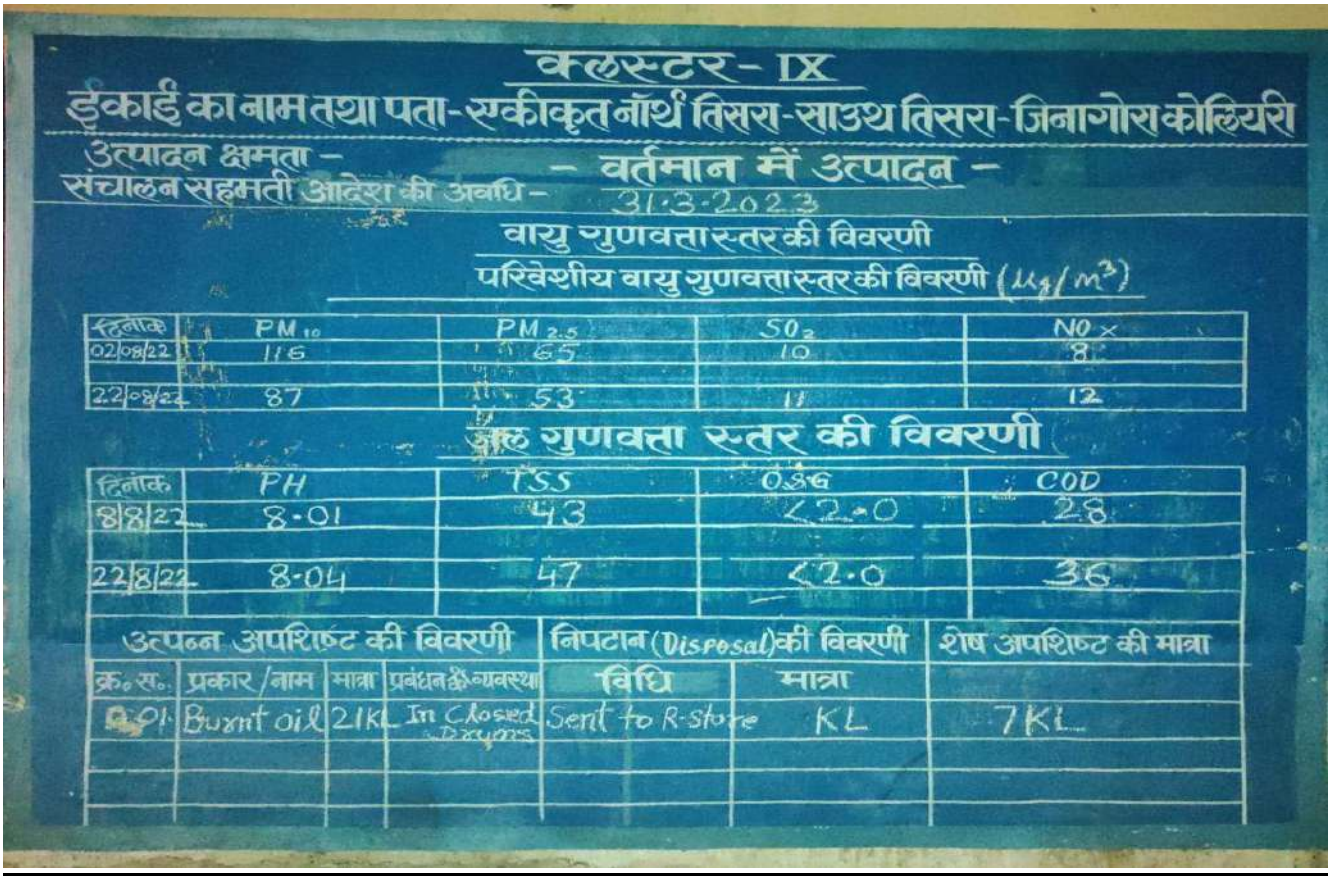
i. There are 6 underground mines (5 operating and 1 UG mine closed for operation only) and 2 OCP mines. The operating underground mines are Lodna UG, North Tisra(UG), Joyrampur (UG), Barari UG, Jealgora (UG), one Jeenagora Underground mine(closed for operation, mine not closed) and two opencast mines are Jeenagora OCP & proposed north Tisra/South Tisra expansion of OCP (NT/ST OCP). The cluster IX is in East-Central part of Jharia Coalfield Nearest Railway station is Bhaga Railway station which is located at 4 Km from Lodna area. Cluster IX mines of BCCL is located in the eastern part of Jharia Coal Field. The Cluster is bounded in the east by metamorphics, in the west by cluster cluster VII mines of BCCL and TISCO mines, in the north by Cluster VIII mines of BCCL and in the south by Cluster X mines of BCCL and metamorphics.

ii. As per the cluster approach, the production capacity of cluster IX is 6.548 MTPA (Normative) and 8.512 MTPA (Peak) in total lease area of 1942.12 ha.

iii. This proposal does not involve change in technology or change in product mix in the mines.

iv. This cluster is severely affected by mine fires and unstable areas. 2.245 sq km of habitated surface area is affected by mine fires and instability consisting of 98 unstable sites as per the approved Jharia Action Plan. In order to deal with the severe problem of fires and unstable sites, it is proposed to amalgamate/ merge some of the

Annexure XXXII



क्लस्टर - IX

इकाई का नाम तथा पता - एकीकृत नॉर्थ तिसरा - साउथ तिसरा - जिनागोरा कोलियरी

उत्पादन क्षमता -

संचालन सहमती आदेश की अवधि - 31.3.2023

- वर्तमान में उत्पादन -

वायु गुणवत्ता स्तर की विवरणी

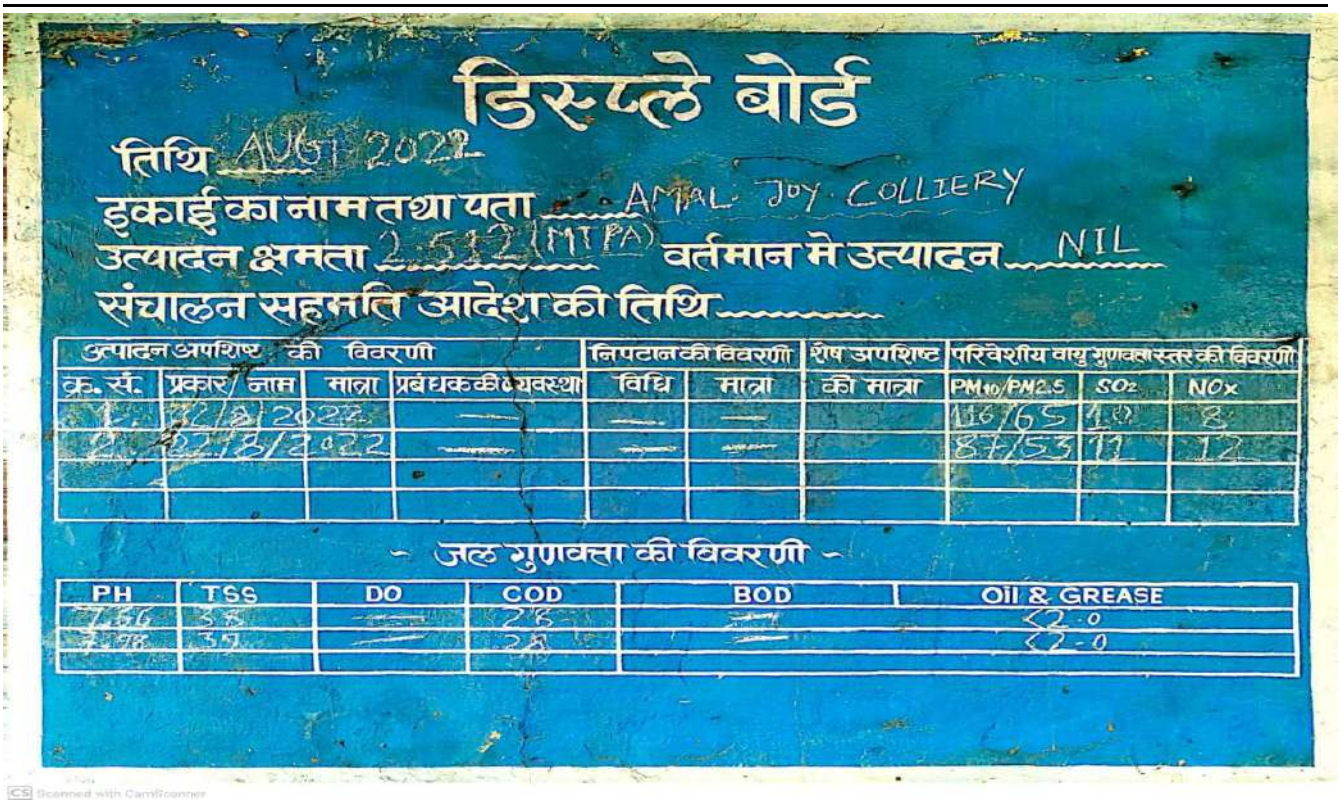
परिवेशीय वायु गुणवत्ता स्तर की विवरणी ($\mu g/m^3$)

दिनांक	PM_{10}	$PM_{2.5}$	SO_2	NO_x
02/08/22	116	65	10	8
22/08/22	87	53	11	12

जल गुणवत्ता स्तर की विवरणी

दिनांक	PH	TSS	O&G	COD
8/8/22	8.01	43	<2.0	28
22/8/22	8.04	47	<2.0	36

उत्पन्न अपशिष्ट की विवरणी				निपटान (Disposal) की विवरणी		शेष अपशिष्ट की मात्रा
क्र.सं.	प्रकार/नाम	मात्रा	प्रबंधन की व्यवस्था	विधि	मात्रा	
01	Burnt oil	21KL	In Closed Drums	Sent to R-Store	KL	7KL



डिस्प्ले बोर्ड

तिथि AUG 2022

इकाई का नाम तथा पता ..... AMAL JOY COLLIERY

उत्पादन क्षमता 2.512 (MTPA) वर्तमान मे उत्पादन NIL

संचालन सहमति आदेश की तिथि .....

उत्पादन अपशिष्ट की विवरणी				निपटान की विवरणी		शेष उपशिष्ट की मात्रा	परिवेशीय वायु गुणवत्ता स्तर की विवरणी		
क्र. सं.	प्रकार/नाम	मात्रा	प्रबंधक की व्यवस्था	विधि	मात्रा		PM10/PM2.5	SO2	NOx
1.	02/8/2022	—	—	—	—		116/65	10	8
2.	22/8/2022	—	—	—	—		87/53	11	12

- जल गुणवत्ता की विवरणी -

PH	TSS	DO	COD	BOD	Oil & GREASE
7.66	38	—	28	—	<2.0
7.98	39	—	28	—	<2.0

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Annexure XXXIII

BHARAT COKING COAL LIMITED
(A SUBSIDIARY OF COAL INDIA LIMITED)
OFFICE OF THE PROJECT OFFICER
NT-ST(Exp.)OCP

Ref..No: BCCL/NT-ST/2022/ 694 Dated:- 28.9.2022

To,
The Member Secretary
Jharkhand State Pollution Control Board Ranchi
PIN-834004

Sub:- Submission of form V Environmental Statement for the financial year 2021-22 in respect of NT-ST(Exp.)OCP, Lodna Area.

Sir,

Please find enclosed herewith Environmental Statement duly filled in form V for the financial year 2021-22 in respect of NT-ST(Exp.)OCP, Lodna Area.

This is for your kind information.

Enclosure: as above.

Yours faithfully,

28/09/22

Project Officer
NT-ST(Exp.)OCP

Cc to:-
1. Regional officer. HIG1 Housing Colony Bartand Dhanbad.
2. AM (Env.), Lodna Area
3. File

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Environmental Statement [FORM – V]
(See rule 14)

Environmental Statement for the financial year ending with 31st March 2022.

PART – A

(i) Name and address of the owner/occupier of the industry operation or process:
Name: Shri. S.K Sinha
Designation: Project Officer
Address: NT-ST(Exp.) OCP
M/s BCCL,
P.O. – Pargha
Dist. - Dhanbad
State- Jharkhand
Pin – 828201

(ii) Industry category: Primary (Coal Mining)

(iii) Production capacity- 7.8MTPA (Peak Production Capacity) and 6MTPA (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 – 23.09.2021

PART – B

Water and Raw Material Consumption

I (A) Water consumption m3/d:

Process-Nil
Cooling/spraying:17566m3/day (approx.)
Domestic-:3253m3/day(approx.)

II. Raw Material Consumption:

Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial year (2020-21)	During the current financial year (2021-22)
1. Diesel	Coal	5.90Ltrs/te (Dept. Patch)	4.121Ltrs/te (Dept. Patch)
2. Explosive	Coal	4.09Kg/te	2.13Kg/te

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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	Analysis report is enclosed	Analysis report is enclosed for cluster IX	-
b) Air	Analysis report is enclosed	Analysis report is enclosed for cluster IX	-

PART - D

Hazardous Wastes

As specified under Hazardous Waste Management and Handling Rules, 1989

Hazardous Wastes	Total Quantity (Kg.)	
	During the previous Financial Year (2020-21)	During the current Financial year (2021-22)
1. From Process: (a) Burnt Oil (Used/Spent Oil)	3KL	21KL
2. From Pollution Control Facilities	NIL	NIL

PART - E

Solid Wastes

Solid Wastes	Total quantity(Kg)	
	During the previous Financial Year (2020-21)	During the current Financial year (2021-22)
From process (Over Burden)	11953232.1 m^3	10699701m^3
Form pollution control facility	NIL	NIL
Quantity recycled or re-utilized within the unit	NA(overburden used in backfilling)	NA(overburden used in backfilling)

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.

1. Hazardous waste (Burnt oil) : Burnt oil is sent to reginal store for onward disposal in closed drums.
2. Over Burden (overlying rocks)- Utilized in backfilling of queries.

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PART – G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

1. Protection of ambient environment -reduction in particulate matter concentration in ambient air, maintenance of surface and ground water quality control of noise pollution, restoration 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. Procurement of truck mounted fog cannon has been done and used in dust suppression .
2. Procurement of trolley mounted fog cannon for dust suppression is under process.
3. Online PM10 Analyzer has been installed at railway siding.
4. Procurement ,commissioning and installation of CAAQMS for cluster IX is under process.

PART – I
MISCELLANEOUS

Any other particulars in respect of environmental protection and abatement of pollution

1. Mobile water sprinklers and mobile mist sprinkler are used for dust suppression in dust prone areas.
2. Plantation in mine area,coal transportation road , schools ,offices colonies etc.
3. Distribution of plant saplings among locals to encourage plantation.
4. Oil and grease cum -settling tank to treat workshop effluents.
5. Ecological restoration of 38Ha of OB Dump.

Project Officer
NT-ST(Exp.) OCP

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BHARAT COKING COAL LIMITED
(A SUBSIDIARY OF COAL INDIA LIMITED)
OFFICE OF THE PROJECT OFFICER
AMAL. JOYRAMPUR COLLIERY

Ref..No: BCCL/LA/AJC/2022/272 Dated:- 23/09/22

To,
The Member Secretary
Jharkhand State Pollution Control Board Ranchi
T.A Division Building (Ground floor), HEC Campus, Dhurwa, Ranchi-834004

Sub:- Submission of form V Environmental Statement for the financial year 2021-22 in respect of Amal. Joyrampur Colliery, Lodna Area.

Sir,

Please find enclosed herewith Environmental Statement duly filled in form V for the financial year 2021-22 in respect of Amal. Joyrampur Colliery, Lodna Area.

This is for your kind information.

Enclosure: as above.

Yours faithfully,

23/09/2022
Project Officer
Amal. Joyrampur Colliery

Cc to:-

1. Regional officer. HIG1 Housing Colony Bartand Dhanbad.
2. AM (Env.), Lodna Area
3. File

Received
27/09/2022
JHARKHAND STATE POLLUTION CONTROL BOARD • DHANBAD •

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Environmental Statement [FORM – V]
(See rule 14)

Environmental Statement for the financial year ending with 31st March 2022.

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 – 25.09.2021

PART – B

Water and Raw Material Consumption

I (A) Water consumption m3/d:

Name of products	Water consumption (m3/d) (2021-22)	
	Mining Operation	Domestic Supply
	4528	6793 (Community use)

I (B) Process water consumption per unit of product output:

Name of Products	During the previous financial Year (2020-21) (m3/Te)	During the Current Financial Year (2021-22) (m3/Te)
Coal	NIL	NIL

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II. Raw Material Consumption:

Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial year (2020-21)	During the current financial year (2021-22)
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	Analysis report is enclosed	Analysis report is enclosed for cluster IX	-
b) Air	Analysis report is enclosed	Analysis report is enclosed for cluster IX	-

PART – D

Hazardous Wastes

As specified under Hazardous Waste Management and Handling Rules, 1989

Hazardous Wastes	Total Quantity (Kg.)	
	During the previous Financial Year (2020-21)	During the current Financial year (2021-22)
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 (2020-21)	During the current Financial year (2021-22)
a. From process	NIL	N/A
b. Form pollution control facility	NIL	NIL
c. Quantity recycled or re-utilized within the unit	NIL	NIL

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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.
- Monitoring of ambient air quality parameters is being done by CMPDIL regularly.

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.
- 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.

23/09/2022
Project Officer
Amal. Joyrampur Colliery

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