BHARAT COKING COAL LTD.
A Mini Ratna Company
(A Subsidiary of Coal India Ltd.)
REGD.Office: KoylaBhawan, Koyla Nagar, Dhanbad-826005
CIN No.U10101JH1972GO1000918
OFFICE OF THE GENERAL MANAGER
BARORA AREA

Ref No.GM/AR-1/SURVEY/ 916 **/2018** **Dated: -** 26.05.18

To
The Director
Ministry of Environment,Forest& CC
Regional Office(ECZ), Bungalow No.-2
Shyamali Colony
Ranchi- 834002

Sub: Six monthly reports on implementation of Environmental measures for the period from Oct' 2017 to March'2018 in respect of Cluster –XVgroups of mines.

Ref:-EC Order No. J-11015/100/2011-IA.II (M)

Dear Sir,

Kindly find enclosed herewith the six monthly report on implementation of Environmental measures for the period from**Oct' 2017 to March'2018**in respect of Cluster – XV groups of mines.

Hope you will find the same in order.

Yours faithfully,
26/5/18
General Manager
Barora Area

Encl: as above
C.C to
1. The Director, 1A monitoring cell
ParyavaranBhawan CGO Complex, New Delhi-110003
2.Regional office, JSPCB ,Housing colony, Dhanbad
3. G.M(Env.) BCCL KoylaBhawan, Dhanbad.
4. Nodal Officer(Env.) Barora Area.
5. Nodal Officer (Env.) Govindpur Area.

ENVIRONMENTAL CLEARANCE COMPLIANCE OF CLUSTER-XV

(GRANTED VIDE J-11015/100/2011-IA.II (M) Dated 16.12.2013)
Oct' 2017 to March'2018

Action Plan for compliance of EC conditions

<table>
<tr><th>SN</th><th>A. Specific Conditions by MoEFCC:</th><th>Compliance</th></tr>
<tr><td></td><td>The maximum production in the cluster shall not exceed beyond that for which environmental clearance has been granted for Cluster –XV as per given below:
<table>
<tr><th rowspan="2">Sl. No.</th><th rowspan="2">Name of Mines</th><th colspan="2">Production capacity (MTY)</th><th rowspan="2">Lease area (H</th></tr>
<tr><th>Normative</th><th>Peak</th></tr>
<tr><td>1</td><td>Kharkharee Coll.</td><td>0.092</td><td>0.12</td><td>584.00</td></tr>
<tr><td>2</td><td>Madhuband coll.</td><td>0.113</td><td>0.147</td><td>393.77</td></tr>
<tr><td>3</td><td>Phularitand coll.</td><td>0.120</td><td>0.156</td><td>340.88</td></tr>
<tr><td>4</td><td>Dharmabandhcoll(Closed for production)</td><td>0</td><td>0</td><td>377.90</td></tr>
<tr><td></td><td>Total</td><td>0.325</td><td>0.423</td><td>1696.55</td></tr>
</table></td><td>The production from the cluster is within the limit for which Environmental clearance has been granted.</td></tr>
<tr><td>i</td><td>The proponent shall prepare a contingency plan for subsidence.</td><td>It is being complied as per the guidelines of DGMS.</td></tr>
<tr><td>ii</td><td>Keeping in view the pattern of the subsidence in the area, no depillaring should be carried out until the rehabilitation of the affected families and shifting of infrastructure.</td><td>It shall be complied. No depillaring is being carried out at present.</td></tr>
<tr><td>v</td><td>The channels adjoining the ML area leading to Jamunia river should not be disturbed and be regularly desilted.</td><td>It is being complied.</td></tr>
<tr><td>v</td><td>The quality of the Jamunia river water should be continuously monitored and in order to prevent silting, a series of check dams should be constructed using boulders. This will help in recharging the ground water.</td><td>It is being complied.</td></tr>
<tr><td>vi</td><td>The coal from the mines will be transported by mechanically covered trucks within two months.</td><td>Conversion of existing truck into mechanically covered trucks in a phased manner has been taken up. Presently, transportation is being done by covering vehicle with tarpaulin.</td></tr>
</table>

	derground mining there is presence of nic gases. These gases are volatile in ture. Due to transmission of air, fire takes lace. The routine mining engineering will not serve the purpose. Therefore, proper studies are carried out to understand underground seams and how these fire areas could be sealed from further spreading.	All the statutory provisions under mines act 1952 and CMR 1957 along with statutes constituted under Mines act are fully complied to prevent any occurrence of fire. Regular monitoring and inspection is done by DGMS.
viii	**Cumulative impact of fire and gases for all the clusters of coal mines in Jharia Coal field is carried out.**	It is being complied. Presently Master Plan approved by Govt. of India is under implementation for this purpose. Fire control in Jharia and its periphery is being done with the recommendation received from CIMFR. An international expression of interest had been invited by BCCL and two bidders submitted their proposals, work shall be awarded as per the recommendation of tender committee.
ix	**National Remote Sensing Agency (NRSA) should be contacted for thermal imaging techniques which are being utilized for assessing the extent of impact of underground of fire. BCCL should consider for an MOU with NRSA for short and long term studies so as to obtain detailed information on Satellite imagery, thermal imagery, subsidence prediction and surface features of the mining area.**	Work Order for delineation of surface coal fire and associated land subsidence in Jharia Coalfield using satellite based remote sensing technique has awarded to NRSC and requested to start the work as early as possible. Action is being taken as specified in EC and as per Jharia Master Plan. Further fire patches are under operation to dig out the fiery coal and combustible materials to save the coal from burning and to stop further spread of the fire.
x	**The Project proponent should monitor the water quality of the Jamunia river as per the standards prescribed by the JSPCB/CPCB to maintain the required BOD in the river water.**	Work of monitoring ambient environment including water quality of the Jamunia river is being done by CMPDIL, Ranchi. **(Soft copy of monitoring report is enclosed)**
xi	**The nullah as adjacent to the river should not be disturbed.**	It is being complied.
xii	**The open cast quarries of the abandoned mines should be backfilled to the ground level and restored with native species.**	It is being complied.
xiii	**All coal from the smaller U/G mines should be transported by high capacity and mechanically covered trucks/tippers.**	Regular maintenance of vehicle is being practiced to kept vehicular emission under control. Coal is being transported in tarpaulin covered trucks.
xiv	**Green belts shall be developed on both sides of the roads.**	Due to absence of permanent roads in the coalfield, avenue plantation couldn't be done but trees were planted near permanent structures to minimize the pollution.

	…n plan for quenching of fires and …abilitation along with the details of master …an be submitted to MOEF for monitoring purpose.	It is being complied. The approved master plan is uploaded on BCCL website (www.bccl.gov.in/PDFs/MPLANBCCL-2008.pdf) and regular monthly progress report is being sent to ministry.
	Presently coal of Munidihwashery from other mines of the cluster is taking place through NH. An alternate route for coal transportation may be explored.	Jharia Coalfield is a densely and highly populated region. Alternative route will further add pollution and rehabilitation problems. It may be explored only after the shifting of population, living in coalfield region.
XVII	**For understanding the composition of emissions from coal mine fires, BCCL may initiate action as proposed in the visit report of the EAC to Dhanbad.**	BCCL has initiated the process to conduct source apportionment study for entire region of JCF. Work Order issued to NEERI Nagpur.
XVIII	**The approved mining plan is submitted to the MOEF.**	Most of the BCCL mines are taken over mines from the erstwhile private owners who were operating mines without mine plans at the time of nationalization and now are being operated as amalgamated collieries/quarries as per the guide lines of DGMS.
XIX	**The measure to identify in the Environmental Plan for Cluster- XV groups of mine and the conditions given in this environmental clearance letter shall be dovetailed to the implementation of the Jharia Action Plan.**	It is being complied.
XX	**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. Measures to prevent ingress of air (Ventilation) in such areas, to prevent restart fresh/spread fires in other areas including in mines of cluster XV shall be undertaken. Expertise available internationally could also be utilized for control of fire in Jharia Coalfields and for their reclamation and to further minimize time for fire and subsidence control. Isothermal mapping using thermal imaging has been got done by NRSA. Measures would be taken prevent ingress of air (Ventilation) in such areas, which may restart fresh fires.**	Work Order for delineation of surface coal fire and associated land subsidence in Jharia Coalfield using satellite based remote sensing technique has awarded to NRSC and requested to start the work as early as possible. Action is being taken as specified in EC and as per Jharia Master Plan. Further fire patches are under operation to dig out the fiery coal and combustible materials to save the coal from burning and to stop further spread of the fire.
XXI	**The embankment constructed along the river boundary shall be of suitable dimensions and critical patches shall be strengthened by stone pitching on the river front side and stabilized with plantation so as to withstand the peak water flow and prevent mine inundation.**	It is being complied.
XXII	**No mining shall be undertaken where underground fires continue. Measure shall be taken to prevent/ check such fire including in**	It is being complied. Mining is being carried out as per the guidelines of DGMS. In area only Open Cast working is being practiced, However sufficient precaution is being

	OB dump areas where the fire could start to presence of coal /shale with sufficient rbon content.	taken to guard against fire.
	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 60m width shall be maintained along the nalas/water bodies.	It is being complied. Mining is being carried out as per the guidelines of DGMS.
XXIV	**Total afforestation plan shall be implemented covering an area of 621.28 Ha. (Additional) at the end of mining which will include, Green belt over an area of 229.12 Ha., density of tree plantation 2500/ Ha. Of plants.**	Being complied.
XXV	**Details of transportation, CSR,R&R and implementation of environmental action plan for the clusters XV should be brought out in a booklet from within a year and regularly updated.**	It is being followed. CSR dept has been established at area level. This year BCCL has constructed over 3500 toilets under "SwacchBharat Abhiyan".**(Soft copy enclosed)**
XXVI	**Specific mitigative measures identified for the Jharia Coalfields in the Environmental Action Plan prepared for Dhanbad as a critically polluted are and relevant for Cluster- XV shall be implemented**	Dhanbad Action Plan is being implemented. The salient actions of this area: 1. Covered transportation of Coal. 2. Water sprinkling. 3. Plantation. 4. Utilization of surplus mine water
XXVII	**The locations of monitoring stations in the Jharia coalfield should be finalized in consultation with Jharkhand State Pollution Control Board. Committee stated that 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 be got carried out for the entire Jharia Coalfields. Mineralogical composition study should be undertaken on the composition of the suspended particulate matter (PM_{10} and $PM_{2.5}$) in Jharia Coalfields and also quantified. These studies would help ascertain source and extent of the air pollution, based on which appropriate mitigative measures could be taken.**	Establishment of ambient environment quality monitoring stations has been finalized with the consultation of Jharkhand State Pollution Control Board. The work of monitoring of ambient environment was done by Central Institute of Mining & Fuel Research (CIMFR), Dhanbad which is a CSIR laboratory recognized under the EP Rules. Now the monitoring work has been taken up by CMPDIL, Ranchi. **Work Order issued to NEERI Nagpur.**
XVIII	**The proponent will continue the existing Road-Rail transport network system in view of the implementation of the Master Plan (For 10 years) and another 5 Years gestation period after the completion of Master Plan for consolidation of the backfilled dug out fire areas and unstable areas is required. All mitigation measures (like covered trucks, green belting on either sides of the roads, enhanced water sprinkling, strengthening and maintaining the roads etc.) shall be adopted up to 15 years (phase-I) with the existing**	At present we are exploring the technology to cover existing trucks mechanically by local technicians and no OEM is available for covered trucks in Indian market until the coal production is being done by tarpaulin covered trucks.

	I- Rail transport system. In phase –II, CL shall implement conveyor-cum-rail ansport to avoid movement of trucks within the cluster for coal transportation in phase-II which shall start after 15 years. Transportation of coal shall be by Rail and Conveyor belt, minimizing the existing road transport system in all the mines of the cluster and shall continue after 15 years. Loading of coal by pay loaders shall be discontinued. Adequate number suitably designed off-take points shall be provided.	
XXIX	**1537 nos. of PAFs should be rehabilitated at cost of Rs.140.03 crores as per the approved Jharia Action Plan.**	It is being complied as per approved Jharia Action Plan.
XXX	**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.**	It shall be complied .No depillaring is being carried out at present.
XXXI	**Coal Extraction shall also be optimized in areas where agricultural production is continuing. Some pillars shall be left below the agricultural land. No depillaring & coal extraction should be carried out below habitation, H.T Lines & beneath road, water bodies.**	It is being complied.
XXXI I	**Subsidence shall be monitored closely and if subsidence is found exceeding the permitted limits, then the land owners shall be adequately compensated with mutual agreement with the land owners.**	No depillaring is being carried out at present.
XXXI II	**3-tiers plantation should be developed 2KM stretch of road from the mine using native species.**	It is being complied.
XXXI V	**Water sprinkling system shall be provided to check fugitive emission from loading operations, conveyor system, haulage roads, transfer points, etc. Major approach roads shall be black topped and properly maintained.**	It is being complied.
XXX V	**A progressive afforestation plan shall be prepared and implemented over the mine lease area acquired and shall include areas under green belt development, areas along roads infrastructure, along ML boundary and township etc, by planting native species in consultation with the local DFO/Agricultural**	It is being complied

	rtment.	
	cid water Treatment Plant, volume of water to be treated and disposal of brine should be provided.	Shall be complied.
	Mine discharge water outside the ML shall be monitored, particularly for TDS and treated to confirm prescribed levels before discharge into the natural environment.	Mine discharge water is being allowed to settle down in the mine sumps before disposal into storage reservoirs. The monitoring of water quality parameters is being done through CMPDIL, Ranchi and parameters are well within the prescribed limit provided by CPCB. **(Soft copy of report is enclosed)**
XXXVIII	**The Company shall put up artificial groundwater recharge measures for augmentation of ground water resource, incase water table shows a declining trend. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mines.**	Presently water is not being discharged outside the ML. Excess mine water is being stored at old quarries and ponds for community use. This will help to recharge the ground water.
XXXIX	**Besides carrying out regular periodic health check up of their workers, 10% of the workers identified from workforce engaged in active mining operations shall be subjected to health check up for occupational disease and hearing impairment, if any, through an agency such as NIOH, Ahemdabad within a period of one year and the results reported to this Ministry and to DGMS.**	NIOH has conducted health surveillance(Medical checkup) and awareness program program in area.
xI	**The mining in the existing mines would be phased out after expiry of the current mining lease and after reclamation of mined over area. The operating mines may be analyzed and monitored for compliance of conditions, having bearing with movement of wild life until such time they are closed/phased out.**	Shall be complied.
xIi	**Sufficient coal pillars shall be left unextractedaround the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.**	It is being complied.
xIii	**High root density tree species shall be selected and planted over likely areas to be affected by subsidence.**	It is being complied.
xIiii	**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.
xIiv	**Solid barriers shall be left below the roads falling within the blocks to avoid any damage to the roads.**	It is being complied.
xIv	**The CSR Action Plan shall consist of need-based CSR Action Plan, CSR Auditing and**	It is being complied.

	itoring mechanism etc. The proponent l spend 5% of the retained earnings of the revious year subject to a minimum of Rs.5/- per tonne of coal production which should be adjusted as per the annual inflation. The progress made there on shall be uploaded on the company website. Monitoring of the impact of the activities under CSR shall be carried out periodically	
xlvi	**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 local youth, who are motivated to carry out the work in future. The gap/space available between the entire mine area should be suitably planted with native species. Plantation should also be made in vacant area and along the road side so as to reduce dust pollution.**	BCCL is implementing CSR activities. A separate CSR committee has been formed at area level of Barora, who will look after the works being executed under CSR. CSR dept is established at the Headquarter level and area level for Executing the CSR Activities. All welfare/ CSR activities are also uploaded in Company web site. TISS has conducted survey to frame CSR policy for better implementation and monitoring of the CSR activities.
xlvii	**Central recreation park with herbal garden should be developed for use of all inhabitants.**	It shall be complied.
xlviii	**The mine water should be treated properly before supply to the villager.**	It is being complied.
xlix	**Mine discharge water shall be treated to meet standards prescribed standards before discharge into natural water courses/agriculture. The quality of water discharge shall be monitored at the outlet and proper records maintained thereof and uploaded regularly on the company website.**	A work order has been issued to CMPDIL, Ranchi. Regular monitoring of Water Quality Parameters is being carried out by CMPDIL. **(Soft copy of report is enclosed)**
I	**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 reclaimed with plantation and or may be used for pisciculture.**	It shall be complied.

<table>
<tr>
<td></td>
<td>ular monitoring of groundwater level and ality of the study area shall be carried out y establishing a network of existing wells and construction of new peizometers. The monitoring for quantity shall be dome 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.</td>
<td>Groundwater level and quality is being monitored by CMPDIL. The Location and design of Piezometers to be installed have been finalized by CMPDIL .

Peizometer installation: Tender was done on 28.04.2017. Only one bidder applied who could not fulfil the eligibility criteria. Hence, that tender was cancelled and retendering done. Work to be awarded soon

3 hydrograph 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 been done in the months of February, April, August &November‘2017 and the Ground water level data is enclosed in the table below:
<table>
<tr><th rowspan="2">Well No.</th><th rowspan="2">Location</th><th colspan="4">Water level (bgl in meters)</th></tr>
<tr><th>Feb’17</th><th>Apr’17</th><th>Aug’17</th><th>No</th></tr>
<tr><td>A-24</td><td>Pipratanr</td><td>10.68</td><td>16.28</td><td>2.33</td><td>4</td></tr>
<tr><td>B-32A</td><td>Madhuband</td><td>2.35</td><td>6.95</td><td>1.60</td><td>2</td></tr>
<tr><td>B-61A</td><td>Kesargora</td><td>1.42</td><td>2.57</td><td>0.62</td><td>0</td></tr>
<tr><td colspan="2">Average GW (bgl)</td><td>4.82</td><td>8.60</td><td>1.52</td><td>2</td></tr>
</table>
Ground Water Level (bgl) varies from 1.42 to 10.68 m during February, 2.57 to 16.28 m during April, 0.62 to 2.33 m during August and 0.82 to 4.18 m during November within the Core Zone of Cluster-XV area.</td>
</tr>
<tr>
<td>1ii</td>
<td>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.</td>
<td>Construction of ETP/Oil grease Trap will be taken-up</td>
</tr>
<tr>
<td>1iii</td>
<td>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 3 years (for any one particular season which is consistent in the time series), and the report submitted to MOEF and its Regional office at Bhubaneswar.</td>
<td>Presently a time series map of vegetation cover in the Jharia Coal Field is being carried out through CMPDI, Ranchi using satellite imagery for every 3 years & it has been uploaded on the official website of company. Further CMPDI has been requested to prepare “Time series of land use maps based on satellite imagery of the core zone and buffer zone in the scale 1:5000</td>
</tr>
</table>

	inal Mine Closure Plan along with details Corpus Fund shall be submitted to the Ministry of Environment & Forests five year before mine closure for approval. Habitat 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 within the lease for reintroduction in the mine during mine reclamation and at the post mining stage for habitat restoration. The mining plan and post –mining plan, closure plan should be prepared and submitted to the Ministry.	CMPDI has prepare the "Final Mine Closure Plan along with a Plan for Habitat Restoration and with details of Corpus Fund". BCCL has deposited the amountina separate ESCROW ACCOUNT for corpus fund as per Mine Closure Guidelines as specified in the mine closure Plan.
1v	**A separate management structure for implementing environment policy and socio-economic issues and the capacity building required in this regard.**	Complied.A full-fledged Environment cell, with a suitable qualified multidisciplinary team of executives has been established. 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. Socio economic issues and capacity building are being evaluated by Tata Institute of Social Science.
1vi	**Corporate Environment Responsibility:** **a) The Company shall have a well laid down Environment Policy approved by the Board of Directors.**	A well defined Corporate Environment Policy has already been laid down and approved by Board of Directors. This is also posted on BCCL website. Complied.
	b) 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.	A hierarchical system of the company to deal with environmental issues from corporate level already exists.
	c) 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	Being complied.
	d) 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.	Being complied.

	eneral Conditions by MoEFCC:	
	No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.	Being complied.
	No change in the calendar plan of production for quantum of mineral coal shall be made.	Being complied.
i	**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 NOx 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 location of monitoring stations in Jharia Coal Field has been finalized in consultation with the Jharkhand State Pollution Control Board. Ambient air quality along withheavy metals such as Hg,As,Ni,Cd,Cr ,etcis regularly monitored by CMPDIL. **(soft copy attached)**
iv	**Data on ambient air quality (PM_{10}, $PM_{2.5}$, SO_2 and NO_x 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.**	Data on ambient air and other monitoring data is being regularly submitted to the Ministry along with compliance report. **.(soft copy attached)**
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.**	It is being Complied in mines and also the Noise levels are below the Ambient Noise Standard (Day time 75 dB & Night Time (70 dB for Industrial Area). Regular maintenance of vehicles and other machineries are being practiced for control of noise level. Ear plugs/muffs are provided to the persons engaged in blasting and drilling operations, operation of HEMM, etc . **(Soft copy of monitoring report is enclosed.)**
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.**	The work of monitoring of ambient environment is being done by CMPDIL, Ranchi.Physico-Chemical characteristics of effluents are well within the prescribed limit. **(Soft copy of monitoring report is enclosed.)**

	...icular emissions shall be kept under ...ntrol and regularly monitored. Vehicles ...sed for transporting the mineral shall be covered with tarpaulins and optimally loaded.	Being complied. Regular maintenance of vehicle is being practiced to kept vehicular emission under control. Coal is being transported in tarpaulin covered trucks.
	Monitoring of environmental 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.	Monitoring of Environmental quality parameters have been regularly done by CMPDIL, Ranchi with proper analysis equipment. **(REPORT ENCLOSED)**
ix	**Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects.**	It is being complied. A separate full-fledged Human Resource Development Department is conducting regular training programme on these issues. Apart from this Vocational Training Centers are existing in all the areas of BCCL, which provides periodical training on the safety and occupational health issue to each of the workers working in the mines.
x	**Occupational health surveillance programme of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective measures, if needed and records maintained thereof. The quality of environment due to outsourcing and the health and safety issues of the outsourced manpower should be addressed by the company while outsourcing.**	Initial Medical Examination (IME) and Periodical Medical Examination (PME) of all the personnel is carried out as per the Statutes and Director General of Mines Safety (DGMS) guideline
xi	**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.**	A full-fledged Environment cell, with a suitable qualified multidisciplinary team of executives has been established. 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. Socio economic issues and capacity building are being evaluated by Tata Institute of Social Science
xii	**The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its Regional Office at Bhubaneswar.**	It is being complied.
xiii	**The Project authorities shall advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the**	complied. Advertisement in local newspaper has been given.

	te Pollution control Board and may also be en at the website of the ministry of Environment & Forests at http://envfor.nic.in.	
	A copy of the environmental clearance letter shall be marked to concern Panchayat/ZilaParishad, 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.	complied. Clearance letter has been displayed on Company web site.
xv	**A copy of the environmental clearance letter shall also 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**	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 of 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.**	Complied.
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 Office s of CPCB and the SPCB.**	Complied/Being complied.
xviii	**The Regional Office of this Ministry located at Bhubaneswar shall monitor compliance of the stipulated conditions. The project authorities shall extend fill cooperation to the office(s) of the Regional Office by furnishing the requisite data/information/monitoring reports.**	Noted. Project authority is ready to extend its full cooperation for any kind of visit and inspection conducted by Regional Office in connection with EC Conditions Compliance.

x	**The Environmental statement for each financial year ending 31 march in Form-V is mandated to be submitted by the project proponent for the concerned state Pollution Control Board as prescribed under Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on company's website along with the status of compliance of Environment condition and shall be sent to the respective Regional Offices of the MOEF by e-mail.**	Environmental statement (Form-V) has been regularly submitted for each financial year to Jharkhand State Pollution Control Board.

18/5/18

General Manager

Govindpur Area

18/5/18

General Manager

Barora Area

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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	Jharkhand State – 1264 mm Dhanbad District - 1271.6 mm (Source: Rainfall Statistics of India-2016, IMD, Ministry of Earth Sciences)
5	Geological Formations	Gondwana Formation (Talchir Formation, Barakar Formation, Barren Measure & Raniganj Formation)
6	Aquifer System	Top Unconfined/Phreatic Aquifer – average thickness 25 m Semi-confined to confined Aquifer – average thickness 50–200 m
7	Hydrogeological properties	Unconfined Aquifer (Damoda BJ Section & Block-III): Hydraulic Conductivity – upto 0.50 m/day Transmissivity – 10 - 42 m^2/day Semi-confined to confined Aquifer (Sitanala & Kumari Block): Hydraulic Conductivity – 0.0006-1.44 & 0.05-0.0027 m/day Transmissivity – 0.06 – 0.573 m^2/day
8	Groundwater Level Monitoring Network	Out of total 254 no 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 is 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 – 0.67 to 16.28 m (Avg. 5.61 m bgl) in '2017 Post-monsoon – 0.15 to 06.97 m (Avg. 2.41 m bgl) in '2017 RCF area (part): Pre-monsoon – 1.93 to 5.80 m (Avg. 3.25 m bgl) in '2017 Post-monsoon – 1.63 to 3.78 m (Avg. 2.47 m bgl) in '2017
10	Groundwater Quality	Potable
11	Proposed Piezometers	New piezometers (23 nos.) have been proposed to monitor impact of coal mining on groundwater regime within the coalfield area (JCF & part of RCF) for maximum depth upto 290 m to monitor deeper aquifers.
12	Stage of Groundwater Development (CGWB)	Dhanbad District – 77% (GWRE-2013)

1.0 INTRODUCTION

1.1 CLIMATE, TEMPERATURE & 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.

The annual rainfall in the Dhanbad District is 1271.60 mm (Rainfall Statistics of India-2016, IMD (Ministry of Earth Sciences), has been considered. The non-monsoon rainfall in the District is 93.60 mm (Winter-19.5 mm, Pre-monsoon-48.8 mm and Post-monsoon-25.3 mm) and the monsoon rainfall is 1178.10 mm of total annual rainfall. Monsoon Rainfall is around 92.65% of total annual rainfall in 2016 in Dhanbad District. Rainfall is the primary source of groundwater recharge.

1.2 GEOMORPHOLOGY

Northern part of the JCF area is 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 are developed over sedimentary rocks or Gondwana formation consisting of Sandstone, Shale, coal, etc. Dissected pediplains are 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.

1.3 DRAINAGE

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 south easterly 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 1:50000 (**Figure No-1**). 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 are 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 to the various coalfield area from Maithon dam, Damodar River, Jamunia River, Topchachi Lake, etc.

2.0 GROUNDWATER SYSTEM

2.1 GEOLOGY OF THE AREA

The Jharia Coalfield covers an area of 453 sq. km. located in Dhanbad District, Jharkhand. The non-coal bearing Talchir Formation is exposed in patches along the northern fringe of the Coalfield. The Barakar Formation which overlies the Talchir is covering the most part of the Jharia Coalfield and having an area of 218 sq. km. This is successively overlain by the non-coal bearing Barren Formation which is mainly exposed in the central part of the Coalfield. This, in turn, is overlain by the Raniganj formation (Coal Bearing horizon) in the south-western part of the Coalfield and covers an area of 54 sq. km.

Chanch-Victoria Area which is located in the western part of Raniganj Coalfield. The Raniganj coalfield represents the eastern most coal basin in the Damodar Valley Region and located in Burdwan District, 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.

2.2 HYDROGEOLOGY OF THE STUDY AREA

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 are constituted of fine to coarse grained 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 AQUIFER DISPOSITION

The aquifer system for shallow and deeper aquifer has been 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 is 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 varies from few meters to 50 m. This un-confined aquifer is more potential than deep seated 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.

2.4 AQUIFER PARAMETERS

PHREATIC/UN-CONFINED AQUIFER – The wells are 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 – Below the un-confined aquifer, the sandstone partings in-between impervious layers of shale and coal seams is 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 been 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.

3.0 GROUNDWATER LEVEL MONITORING

To collect the representative groundwater levels in the study area, CMPDI has established a monitoring network of total 254 monitoring stations out of which 64 located within core zone and rest comes within Buffer zone. 60 dug wells within JCF and 04 dug wells within RCF (part) area (Details of the Hydrograph stations & water level are given in **Annexure-I, IIA** & **IIB**) spread over the entire BCCL leasehold area, **Figure No-1**. Water level monitoring in 254 hydrograph stations has been done in pre-monsoon as well as in post monsoon whereas in 64 stations monitoring done in quarterly (February, May, August and November month of 2017) 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 be 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

**Construction of piezometers within Jharia Coalfield and part of Raniganj Coalfield to monitor groundwater level of deeper aquifers is already in progress.*

3.1 HISTORICAL GROUNDWATER LEVEL

Historical GWL of JCF and part of RCF are given from 2005 to 2017 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 No – 1: 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
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

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 is summarized in the Table No-2.

Table No – 2: Depth to water table

Formation	***Area***		***DTW (bgl, m)*** ***[Year-2017]***		***Average GWL (m)***	
			Pre-monsoon (Apr/May)	***Post-monsoon (Nov/Dec)***	***Pre-monsoon***	***Post-monsoon***
Sedimentary (Gondwana)	Non-mining		1.85-9.80	1.30-5.45	5.20	2.45
	Mining	OC	0.75-10.45	0.50-5.43	4.58	2.20
		UG	1.21-16.28	0.75-7.40	6.96	2.91
Metamorphics	Peripheral part of the Coalfield		0.67-15.15	0.35-9.65	6.40	3.21

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 is given in Table No-3. There is no significant change in hydraulic gradient has been observed. Relatively steep gradient near active opencast mining areas w.r.t., Non-Mining, Underground mines and Metamorphics areas is observed.

Table No – 3: Average hydraulic gradient

Sl. No	***Formation***	***Area***		***Average hydraulic gradient***
1	Sedimentary (Gondwana)	Non-Mining		1.5×10^{-3} to 3.5×10^{-3}
2		Mining	OC	7.75×10^{-3} to 11.82×10^{-3}
3			UG	2×10^{-3} to 5×10^{-3}
4	Metamorphics	Peripheral part of the Coalfield		1.0×10^{-3} to 3.0×10^{-3}

3.3 QUARTERLY GROUNDWATER LEVEL, CLUATER OF MINES (BCCL)

3.3 A Monitoring of Ground Water Levels of Cluster-I

Cluster-I (Damuda Group of Mines) consisting of Damoda (BJ and Gutway section) UG, Damoda (Albion section) OCP, proposed Damoda (B.J.section) OCP and Closed Gutway OCP of Barora Area of BCCL. It is located in the extreme western part of JCF in Bokaro district of Jharkhand.

The present leasehold area of Cluster-I is 575 Ha. The Damoda block area is 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.

4 hydrograph 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 been done in the months of February, April and August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	B-15	Bera Basti	1.45	1.85	0.83	0.15
2	B-21A	Dugdha	7.65	10.00	2.63	5.65
3	B-51	Taranga	3.30	4.98	2.30	2.55
4	B-53	Karmatanr	2.32	4.02	1.24	1.92
Average WL (bgl)			***3.68***	***5.21***	***1.75***	***2.57***

Ground Water Level (in bgl) varies from 1.45 to 7.65 m during February, 4.02 to 10.00 m during April, 0.83 to 2.63 m during August and 0.15 to 5.65 m during November within the Core Zone of Cluster-I area.

3.3 B Monitoring of Ground Water Levels of Cluster-II

Cluster-II consists of seven mines namely; Block-II mixed mine (OCP & UGP), Jamunia OCP, Shatabdi OCP, Muraidih mixed mine (OCP & UGP) and Phularitand OCP is under administrative control of Block-II Area and Barora Area of BCCL. It is located in the extreme western part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-II is 2025.71 Ha. The Damoda block area is 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.

5 hydrograph 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 been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	B-1	Muraidih	1.83	2.33	1.43	1.63
2	B-59	Khodovaly	1.26	5.40	0.85	0.60
3	B-60	Bahiyardih	9.23	13.23	3.13	3.18
4	B-61A	Kesargora	1.42	2.57	0.62	0.82
5	B-62A	Sadiyardih	6.15	8.15	2.65	4.35
Average WL (bgl)			***3.98***	***6.34***	***1.74***	***2.12***

Ground Water Level (in bgl) varies from 1.42 to 9.23 m during February, 2.33 to 13.23 m during April, 0.62 to 3.13 m during August and 0.60 to 4.35 m during November within the Core Zone of Cluster-II area.

3.3 C Monitoring of Ground Water Levels of Cluster-III

Cluster-III consists of nine mines namely, Jogidih UG, Maheshpur UG, South Govindpur UG, Teturiya UG, Govindpur UG, New Akashkinaree mixed mine (OC & UG) and Kooridih/Block-IV mixed mine (OC & UG) under the administrative control of Govindpur Area of BCCL. This Cluster of mines is located in western part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-III is 1420.0 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.

5 hydrograph 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 been done in the months of February, April, August & November'2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb'17	Apr'17	Aug'17	Nov'17
1	A-12	Jamua	1.10	2.55	0.55	0.85
2	A-25	Sinidih	4.88	6.38	1.58	2.88
3	A-29	Dharmaband	3.90	4.40	1.95	1.30
4	B-14	Mathadih	2.64	2.94	0.89	1.84
5	B-60	Sonardih	9.23	13.23	3.13	3.18
Average WL (bgl)			***4.35***	***5.90***	***1.62***	***2.01***

Ground Water Level (in bgl) varies from 1.10 to 9.23 m during February, 2.55 to 13.23 m during April, 0.55 to 3.13 m during August and 0.85 to 3.18 m during November within the Core Zone of Cluster-III area.

3.3 D Monitoring of Ground Water Levels of Cluster-IV

Cluster-IV consists of six mines namely, Salanpur UG, Katras-Choitudih UG, Amalgamated Keshalpur & West Mudidih OC, Amalgamated Keshalpur & West Mudidih UG, Amalgamated Angarpathra & Ramkanali UG and closed Gaslitand UG of Katras Area of BCCL. It is located in the north-central part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-IV is 1123.79 Ha. The area has a general undulating topography, with an overall gentle south-westerly slope. The RL varies from 182 m to 216 m AMSL. Katri River, Kumari Jore and its tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Katri River.

4 hydrograph 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 been done in the months of February, April, August & November'2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb'17	Apr'17	Aug'17	Nov'17
1	A-26	Malkhera	4.28	5.28	2.28	2.53
2	A28A	Lakarka	2.35	4.30	2.15	1.55
3	B-64	Keshalpur	1.35	1.25	0.90	0.85
4	B-65A	Jhinjipahari	3.55	9.05	0.75	1.25
Average WL (bgl)			***2.88***	***4.97***	***1.52***	***1.55***

Ground Water Level (in bgl) varies from 1.35 to 4.28 m during February, 1.25 to 9.05 m during April, 0.75 to 2.28 m during August and 0.85 to 2.53 m during November within the Core Zone of Cluster-IV area.

3.3 E Monitoring of Ground Water Levels of Cluster-V

Cluster-V consists of twelve mines namely; Tetulmari OC & UG mine, Mudidih OC & UG mine, Nichitpur OC, Sendra Bansjora OC & UG, Bansdeopur OCP (proposed) & UG, Kankanee OC & UG and closed Loyabad UG under the administrative control of Sijua Area of BCCL. This Cluster of mines is located in northern part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-V is 1957.08 Ha. The area has a general undulating topography, with an overall gentle south westerly slope. The RL varies from 210 m to 170 m AMSL. Jarian Nala, Nagri Jore, Ekra Jore and its tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Jarian Nala and Ekra Jore.

4 hydrograph 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 been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	A-3	Sijua	0.27	0.67	0.57	0.77
2	A-16	Ekra	2.45	3.65	1.50	2.20
3	A-27	Tetulmari	1.95	2.90	0.85	1.25
4	D-23	Jogta	2.40	2.80	2.20	2.98
Average WL (bgl)			***1.77***	***2.51***	***1.28***	***1.80***

Ground Water Level (in bgl) varies from 0.27 to 2.45 m during February, 0.67 to 3.65 m during April, 0.57 to 2.20 m during August and 0.77 to 2.98 m during November within the Core Zone of Cluster-V area.

3.3 F Monitoring of Ground Water Levels of Cluster-VI

Cluster–VI consists of four coal mines; East Bassuriya OC, Bassuriya UG, Gondudih Khas-Kusunda OC, Godhur Mixed Mines (OC and UG) are under the administrative control of Kusunda Area of BCCL. This Cluster of mines is located in central part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-VI is 876.55 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.

2 hydrograph stations (**D-25 and D-30**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	D-25	Godhur	0.10	2.40	0.45	1.20
2	D-30	Borkiboa	2.54	4.40	0.40	1.25
Average WL (bgl)			***1.32***	***3.40***	***0.43***	***1.23***

3.3 G Monitoring of Ground Water Levels of Cluster-VII

Cluster-VII consists of fourteen mines namely; Dhansar mixed mine, Kusunda OCP, Viswakarma OCP, Industry UG (closed), Alkusa UG, Ena OCP, S.Jharia/Rajapur OCP, Burragarh UG, Simlabahal UG, Hurriladih UG, Bhutgoria UG, Kustore UG (closed) and E.Bhuggatdih UG (closed) under the administrative control of Kusunda Area and Kustore Area of BCCL. This Cluster of mines is located in east central part of Jharia Coalfield in Dhanbad district of Jharkhand.

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.

7 hydrograph 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 been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	D-3	Dhansar	1.30	2.15	1.25	2.30
2	D-4	Jharia	1.11	1.21	0.91	1.46
3	D-33	Kustore	0.60	0.75	0.60	0.75
4	D-34	Kusunda	0.35	0.80	0.90	0.55
5	D-47	Parastanr	3.20	3.15	1.92	2.85
6	D-55	Hariladih	4.52	6.42	2.12	2.37
7	D-80	Bastacolla	3.70	8.65	2.15	3.70
Average WL (bgl)			***2.11***	***3.30***	***1.41***	***2.00***

Ground Water Level (in bgl) varies from 0.35 to 4.52 m during February, 0.75 to 8.65 m during April, 0.60 to 2.15 m during August and 0.55 to 3.70 m during November within the Core Zone of Cluster-VII area.

3.3 H Monitoring of Ground Water Levels of Cluster-VIII

Cluster-VIII consists of ten mines namely; Bastacolla mixed mines (OC & UG), Bera mixed mines (OC & UG), Dobari UG, Kuya mixed (OC & UG), proposed Goluckdih (NC) OC, Ghanoodih OC and Kujama OC under the administrative control of Bastacolla Area of BCCL. This Cluster of mines is located in eastern part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-VIII is 1200.41 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.

4 hydrograph 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 been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	D-8	Alokdiha	4.45	5.15	2.35	1.85
2	D-43	Alagdih	2.85	7.50	2.75	3.60
3	D-49	Galucdih	2.25	2.70	1.48	2.05
4	D-51	Chankuiya	9.05	10.45	5.07	5.43
Average WL (bgl)			***4.65***	***6.45***	***2.91***	***3.23***

Ground Water Level (in bgl) varies from 2.25 to 9.05 m during February, 2.70 to 10.45 m during April, 1.48 to 5.07 m during August and 1.85 to 5.43 m during November within the Core Zone of Cluster-VIII area.

3.3 I Monitoring of Ground Water Levels of Cluster-IX

Cluster-IX consists of eight mines namely; North Tisra/South Tisra Expansion OCP, Lodna UG, Bagdigi UG, Bararee UG and Joyrampur UG and Jealgora UG (closed) are under the administrative control of Lodna Area of BCCL. This Cluster of mines is located in eastern part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-IX is 1942.12 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.

6 hydrograph 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 been done in the months of February, April, August & November'2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb'17	Apr'17	Aug'17	Nov'17
1	D-5	Jiyalgora	6.70	7.90	2.28	5.20
2	D-7	Golden Pahari	6.18	7.33	2.31	2.88
3	D-39	Tilaboni	4.30	6.17	1.60	4.75
4	D-40A	Khapa Dhawra	1.75	1.45	0.75	1.35
5	D-41	Joyrampur	1.25	1.40	0.90	1.20
6	D-74	Bhulan Bararee	6.10	9.25	2.65	3.85
Average WL (bgl)			***4.38***	***5.58***	***1.75***	***3.21***

Ground Water Level (in bgl) varies from 1.25 to 6.70 m during February, 1.40 to 9.25 m during April, 0.75 to 2.65 m during August and 1.20 to 5.20 m during November within the Core Zone of Cluster-IX area.

3.3 J Monitoring of Ground Water Levels of Cluster-X

Cluster-X consists of ten coal mines and one coal Washery namely; Bhowrah North mixed mines (UG & OC), Bhowrah South mixed mines (UG, 3 Pit OCP, Chandan OCP), Patherdih Mixed mines (UG, Chandan OCP), Sudamdih incline UG mine, Sudamdih Shaft UG mine, Amlabad UG (Closed) and Sudamdih Coal Washery under the administrative control of Eastern Jharia Area of BCCL. This cluster of mines is located in the eastern part of Jharia Coalfield in Dhanbad district of Jharkhand.

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.

4 hydrograph 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 been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	A-19	Bhowrah	3.10	6.37	1.50	2.45
2	D-35	Patherdih	7.60	8.80	3.30	3.60
3	D-36	Sudamdih	1.10	1.30	0.40	0.70
4	D-77	Amlabad	3.70	6.50	3.80	4.90
Average WL (bgl)			***3.88***	***5.74***	***2.25***	***2.91***

Ground Water Level (in bgl) varies from 1.10 to 7.60 m during February, 1.30 to 8.80 m during April, 0.40 to 3.80 m during August and 0.70 to 4.90 m during November within the Core Zone of Cluster-X area.

3.3 K Monitoring of Ground Water Levels of Cluster-XI

Cluster–XI consists of eight coal mines and one coal Washery namely; 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 Pootkee Balihari Area and Moonidih UG & Moonidih Washery are under the administrative control of Western Jharia Area of BCCL. This Cluster of mines is located in central part of Jharia Coalfield in Dhanbad district of Jharkhand.

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.

5 hydrograph stations (**A-17, A-18, A-20, A-32 and D-34**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water below (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	A-17	Kachi Balihari	2.24	2.44	1.76	2.24
2	A-18	Baghaband	0.99	1.29	0.55	0.99
3	A-20	Gorbudih	3.17	4.27	2.17	1.77
4	A-32	Baludih	2.68	3.15	0.65	1.55
5	A-34	Bhatdih	8.45	12.45	2.50	4.45
Average GW (bgl)			***3.51***	***4.72***	***1.53***	***2.20***

Ground Water Level (in bgl) varies from 0.99 to 8.45 m during February, 1.29 to 12.45 m during April, 0.55 to 2.50 m during August and 0.99 to 4.45 m during November within the Core Zone of Cluster-XI area.

3.3 L Monitoring of Ground Water Levels of Cluster-XIII

Cluster-XIII consists of one operating mine i.e. Murulidih 20/21 pits UG mine and six abandoned mines (Bhurungiya Colliery, Muchraidih colliery, Hantoodih colliery, Padugora colliery, Murulidih colliery, Bhatdee colliery) of Western Jharia Area of BCCL. It is located in the south-western part of Jharia Coalfield in Dhanbad district of Jharkhand.

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.

5 hydrograph stations (**A-22, A-23, A-33, B-25 and B-48**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	A-22A	Nagdah Basti	2.00	3.40	0.22	1.35
2	A-23	Machhayara	9.47	11.87	5.17	6.97
3	A-33	Mahuda Washery	3.35	6.45	0.90	1.55
4	B-25	Mahuda More	5.40	6.70	1.93	-
5	B-48	Mahuda	3.65	7.70	1.70	4.15
Average GW (bgl)			***4.77***	***7.22***	***1.98***	***3.51***

Ground Water Level (in bgl) varies from 2.00 to 9.47 m during February, 6.40 to 11.87 m during April, 0.22 to 5.17 m during August and 1.35 to 6.97 m during November within the Core Zone of Cluster-XIII area.

3.3 M Monitoring of Ground Water Levels of Cluster-XIV

Cluster-XIV consists of two mines namely; Lohapatty UG and Lohapatty Opencast Patch (proposed). These are under the administrative control of Western Jharia of BCCL. This Cluster of mines is located in western part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-XIV is 1577.22 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.

3 hydrograph 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 been done in the months of February, April, August & November'2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb'17	Apr'17	Aug'17	Nov'17
1	B-23	Lohapatti	2.67	7.74	1.04	2.14
2	B-24	Telmuchu	4.58	10.03	1.63	4.03
3	B-67	Simatanr	8.45	10.00	1.70	2.15
Average GW (bgl)			***5.23***	***9.26***	***1.46***	***2.77***

Ground Water Level (in bgl) varies from 2.67 to 8.45 m during February, 7.74 to 10.03 m during April, 1.04 to 1.70 m during August and 2.14 to 4.03 m during November within the Core Zone of Cluster-XIV area.

3.3 N Monitoring of Ground Water Levels of Cluster-XV

Cluster–XV consists of four coal mines; Kharkharee UG 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 BCCL. This Cluster of mines is located in western part of Jharia Coalfield in Dhanbad district of Jharkhand.

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.

3 hydrograph 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 been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	A-24	Pipratanr	10.68	16.28	2.33	4.18
2	B-32A	Madhuband	2.35	6.95	1.60	2.80
3	B-61A	Kesargora	1.42	2.57	0.62	0.82
Average GW (bgl)			***4.82***	***8.60***	***1.52***	***2.60***

Ground Water Level (bgl) varies from 1.42 to 10.68 m during February, 2.57 to 16.28 m during April, 0.62 to 2.33 m during August and 0.82 to 4.18 m during November within the Core Zone of Cluster-XV area.

3.3 O Monitoring of Ground Water Levels of Cluster-XVI

Cluster-XVI consists of five mines namely, Dahibari-Basantimata OC, Basantimata UG, New Laikidih OC, Laikdih Deep UG and Chunch UG under the administrative control of Chanch-Victoria Area of BCCL. This cluster of mines is located in the western part of Raniganj Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-XVI is 1964.21 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.

4 hydrograph stations (**DB-22, DB-23, DB-24 and DB-25**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of February, April, August & November‘2017 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’17	Apr’17	Aug’17	Nov’17
1	DB-22	Dahibari, Niche Basti	1.93	1.93	1.48	1.63
2	DB-23	Dahibari OC	1.30	2.05	0.80	1.90
3	DB-24	Dahibari	4.45	5.80	3.04	3.78
4	DB-25	Palasya	2.83	3.23	2.03	2.58
Average GW Level			***2.63***	***3.25***	***1.84***	***2.47***

Ground Water Level (in bgl) varies from 1.30 to 4.45 m during February, 1.93 to 5.80 m during April, 0.80 to 3.04 m during August and 1.63 to 3.78 m during November within the Core Zone of Cluster-XVI area.

4.0 GROUNDWATER LEVEL SCENARIO

During the month of February'2017 the depth to water level (in bgl) within 15 nos Cluster of mines varies from 0.10 m to 10.68 m with an average varies from of 1.32 m to 5.23 m. During the month of April'2017 the depth to water level varies from 0.67 m to 16.28 m with an average varies from 2.51 m to 9.26 m. During the month of August'2017 the depth to water level varies from 0.20 m to 5.17 m with an average varies from 0.43 m to 2.91 m. During the month of November'2017 the depth to water level varies from 0.15 m to 6.97 m with an average varies from 1.23 m to 3.51 m. The summarized water level data of all clusters are given in **Table No – 4**.

Depth to water level (in bgl) values described that water level goes down to maximum 16.68 m during pre-monsoon'2017 and maximum upto 6.97 m during post-monsoon'2017. Un-confined aquifer is 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–III**.

Monitoring groundwater (quantity & quality) to assess the present condition and resource has been done regularly in the coalfield areas. Well hydrographs (**Annexure–III**) are prepared and studied to identify potentially adverse trends so that appropriate action can be taken to protect groundwater resource. According to the hydrograph trend analysis of CGWB monitoring wells, no significant decline trend 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 (**Figure No–2**) with collection points details (dug wells) are given in **Annexure–IV**. Locations of proposed Piezometers to monitor deeper aquifers in and around active coal mining area in JCF and RCF (part) is given in **Figure No–3.**

Table No–4: Groundwater level data Cluster-wise

Sl. No.	Cluster of BCCL	No. of Monitoring Wells	Water level fluctuation Below ground level (Feb, Apr, Aug & Nov'17)	Formation
1	I	4 nos.	0.15 to 10.00 m	Barakar
2	II	5 nos.	0.60 to 13.23 m	Barakar
3	III	5 nos.	0.55 to 6.38 m	Barakar
4	IV	5 nos.	0.75 to 9.05 m	Barakar
5	V	4 nos.	0.27 to 3.65 m	Barakar
6	VI	2 nos.	0.10 to 4.40 m	Barakar
7	VII	6 nos.	0.35 to 8.86 m	Barakar
8	VIII	4 nos.	1.48 to 10.45 m	Barakar
9	IX	6 nos.	0.75 to 9.25 m	Barakar
10	X	4 nos.	0.40 to 8.80 m	Barakar
11	XI	5 nos.	0.55 to 12.45 m	Barakar & Barren Measure
12	XIII	5 nos.	0.20 to 11.87 m	Raniganj
13	XIV	3 nos.	1.04 to 10.03 m	Raniganj
14	XV	4 nos.	0.62 to 16.28 m	Barakar & Barren Measure
15	XVI	4 nos.	0.80 to 5.80 m	Barakar

5.0 STAGE OF GROUNDWATER DEVELOPMENT

The groundwater is 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 77%. 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%). The Gondwana sandstones in general, are 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 done by Central Ground Water Board (CGWB), Patna in 2013, the Block wise data of Dhanbad District is given below:

Table No–5: Block-wise Stage of Groundwater development

Sl No.	Administrative Unit		Stage of GW Development	Category
	District	Block		
1	Bokaro	Bermo	156.30%	**Over- exploited**
2	Dhanbad	Baghmara	91.74%	Critical
3	Dhanbad	Baliapur	78.24%	Semi- Critical
4	Dhanbad	Dhanbad	107.50%	**Over- exploited**
5	Dhanbad	Jharia	127.0%	**Over- exploited**
6	Dhanbad	Topchachi	98.45%	Critical

- **Dynamic Groundwater Resource Assessment (as on 31st March, 2013), CGWB**

Table No–6: Cluster-wise Groundwater development scenario

Cluster/ Area	Adminis-trative Blocks/Stage Of GW Develo-Pment (SOD)	Total Water demand (cum/day)				Avg. GW level (bgl in m) 2017		GW level declining trend 2005-2017		Remarks
		Mine Discharge	Surface Water Source	Total Use (Domestic +Industrial +Others)	Excess Or other use	Pre-monsoon	Post-monsoon	Pre-monsoon	Post-monsoon	
Cluster-I	Bermo (SOD: Over-exploited)	2950	NIL	2123	827	5.21	2.57	NO	NO	-
Cluster-II	Baghmara (SOD: Critical)	8350	Jamunia river	7265	1085	6.34	2.12	NO	NO	-
Cluster-III		10,960	NIL	7290	3670	5.90	2.01	NO	NO	-
Cluster-IV		5900	MADA (Damodar river)	5900	NIL	4.97	1.55	NO	NO	
Cluster-V		11,025	MADA	9214	1811	2.51	1.80	YES	NO	Excess water stored into abandoned UG
Cluster-VI	Dhanbad (SOD: Over-exploited)	4150	MADA (Damodar river)	4150	NIL	3.40	1.23	YES	YES	Artificial recharge structure needed
Cluster-VII		14,920	MADA	14,639	281	3.30	2.00	NO	NO	
Cluster-VIII	Jharia (SOD: Over-exploited)	9320	MADA	5474	3846	6.45	3.23	NO	NO	Excess water stored into abandoned UG & FF
Cluster-IX		12,980	MADA	9714	3266	5.40	3.21	NO	NO	Excess water stored into abandoned UG & FF
Cluster-X		11,825	Damodar river	6525	5300	5.74	2.91	YES	NO	Excess water stored into abandoned UG & OC
Cluster-XI	Dhanbad	31,530	MADA & DVC	18,825	12,705	4.72	2.20	NO	YES	Excess water used F.P
Cluster-XIII	Baghmara (SOD: Critical)	4774	Damodar river	4115	659	7.22	3.51	NO	NO	-
Cluster-XIV		2600	DVC	1875	725	9.26	2.77	NO	NO	
Cluster-XV		6200	Jamunia river	4147 +1800 (ponds)	253	8.60	2.60	NO	YES	Excess water store in surface waterbodies
Cluster-XVI	Nirsa (SOD:Safe)	3380	DVC (Barakar river)	2450	930	3.25	2.47	NO	NO	

6.0 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 been 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.

- Roof-top rainwater harvesting (RWH) will be taken 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 be 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 Rain water harvesting and artificial recharge will be given priority. This aspect is usually covered during the Environmental Week celebrated every year (5 to 12 June).

- Monitoring of water quality of mine water discharge, local River/nala and domestic water source (dug well/hand pump wells) will be continued under routine monitoring (February, May, August & November).

Annexure – I

Location of Hydrograph Stations (Dug Wells)

Well No	Latitude	Longitude	Well No	Latitude	Longitude
A-3	23^{0}47'53.35" N	86^{0}19'55.14" E	**B-63**	Abandoned due to OCP	
A-12	23^{0}48'20.31" N	86^{0}16'51.64" E	**B-64**	23^{0}48'43.14" N	86^{0}18'44.25" E
A-16	23^{0}46'57.00" N	86^{0}21'38.57" E	**B-65A**	23^{0}48'53.65" N	86^{0}18'11.82" E
A-17	23^{0}45'09.44" N	86^{0}22'16.35" E	**B-67**	23^{0}43'30.70" N	86^{0}14'01.45" E
A-18	23^{0}44'37.65" N	86^{0}22'58.90" E	**D-3**	23^{0}46'46.31" N	86^{0}24'49.30" E
A-19	23^{0}41'12.86" N	86^{0}23'55.27" E	**D-4**	23^{0}44'29.37" N	86^{0}24'42.88" E
A-20	23^{0}44'56.64" N	86^{0}19'55.35" E	**D-5**	23^{0}42'20.05" N	86^{0}24'86.06" E
A-22	23^{0}43'06.65" N	86^{0}14'48.53" E	**D-7**	23^{0}43'12.08" N	86^{0}27'11.89" E
A-23	23^{0}45'06.38" N	86^{0}15'12.69" E	**D-8**	23^{0}44'06.13" N	86^{0}27'20.72" E
A-24	23^{0}45'20.44" N	86^{0}13'45.12" E	**D-23**	23^{0}47'20.89" N	86^{0}20'09.96" E
A-25	23^{0}47'06.20" N	86^{0}15'27.79" E	**D-25**	23^{0}47'03.28" N	86^{0}23'29.56" E
A-26	23^{0}46'49.24" N	86^{0}18'12.12" E	**D-30**	23^{0}48'36.10" N	86^{0}21'50.07" E
A-27	23^{0}48'42.55" N	86^{0}20'21.80" E	**D-33**	23^{0}45'34.62" N	86^{0}23'18.50" E
A-28A	23^{0}47'34.74" N	86^{0}18'04.18" E	**D-34**	23^{0}45'36.50" N	86^{0}23'02.45" E
A-29	23^{0}47'08.02" N	86^{0}16'02.72" E	**D-35**	23^{0}40'46.54" N	86^{0}25'46.33" E
A-32	23^{0}44'15.56" N	86^{0}20'43.80" E	**D-36**	23^{0}40'19.26" N	86^{0}25'18.98" E
A-33	23^{0}44'32.58" N	86^{0}16'58.28" E	**D-39**	23^{0}43'28.50" N	86^{0}26'0.10" E
A-34	23^{0}42'58.63" N	86^{0}15'19.31" E	**D-40A**	23^{0}43'20.18" N	86^{0}25'45.70" E
B-1	23^{0}48'48.06" N	86^{0}14'16.87" E	**D-41**	23^{0}42'40.00" N	86^{0}26'17.20" E
B-14	23^{0}48'00.81" N	86^{0}16'25.88" E	**D-43***	NA	NA
B-15	23^{0}46'06.92" N	86^{0}08'59.30" E	**D-47**	23^{0}45'20.59" N	86^{0}24'34.86" E
B-21A	23^{0}45'10.50" N	86^{0}09'36.38" E	**D-49**	23^{0}44'08.96" N	86^{0}26'32.71" E
B-23	23^{0}44'13.05" N	86^{0}11'46.56" E	**D-51**	23^{0}44'20.86" N	86^{0}27'11.37" E
B-24	23^{0}44'26.80" N	86^{0}13'09.38" E	**D-55**	23^{0}43'58.37" N	86^{0}24'07.45" E
B-25	23^{0}44'44.98" N	86^{0}13'57.80" E	**D-74**	23^{0}41'33.66" N	86^{0}25'06.10" E
B-32A	23^{0}45'49.18" N	86^{0}13'03.64" E	**D-77**	23^{0}41'00.74" N	86^{0}22'25.55" E
B-48	23^{03}4'35.09" N	86^{0}16'38.30" E	**D-80**	23^{0}46'09.46" N	86^{0}24'33.08" E
B-51	23^{0}47'40.20" N	86^{0}09'11.90" E	**DB-22**	23^{0}43'38.81" N	86^{0}45'09.00" E
B-53	23^{0}45'55.25" N	86^{0}09'35.44" E	**DB-23**	23^{0}43'44.24" N	86^{0}45'06.39" E
B-53A	-	-	**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 – IIA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	R.L. (G.L) (m)	Formation	Owner	Utility
A-3	Sijua	0.53	3.00	5.20	203	Barakar	Govt.	Domestic
A-12	Jamua	0.80	1.90	3.30	202	Barakar	Govt.	Domestic
A-16	Ekra, Kalali More	0.45	3.10	6.50	205	Barakar	Govt.	Domestic
A-17	Kachi Balihari	0.56	1.60	5.30	182	Barakar	Govt.	Domestic
A-18	Bhagabandh	0.61	1.45	3.37	182	Barakar	Govt.	Domestic
A-19	Bhaura	0.54	3.15	11.65	162	Barakar	Govt.	Domestic
A-20	Gorbhudih	0.43	3.30	8.30	181	BM	Govt.	Domestic
A-22	Nagdah, Niche tola	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 (Malkera)	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 (Gobindpur)	0.10	2.60	9.15	186	Barakar	Govt	Domestic
A-32	Baludih	0.55	2.30	6.85	182	BM	Govt	Domestic
A-33	Mahuda	0.75	2.00	10.80	195	BM	BCCL	Domestic
A-34	Bhatdih	0.55	3.50	24.50	162	Raniganj	BCCL	Domestic
B-1	Muraidih	0.47	1.80	5.35	212	Talchir	Govt	Domestic
B-14	Mathadih	0.76	2.15	3.75	201	Barakar	Govt	Domestic
B-15	Bera Basti	0.55	1.60	2.50	221	Talchir	Dhanu Roy	Domestic
B-21A	Dugdha	0.55	2.10	10.35	220	Metamorphics	Govt	Domestic
B-23	Lohapati	0.26	3.60	10.85	204	Raniganj	Govt	Domestic
B-24	Telmuchu	0.67	4.35	10.83	207	Raniganj	Govt	Domestic
B-25	Mahuda More	0.10	2.45	8.45	205	Raniganj	Govt	Domestic
B-32A	Madhuband	0.80	4.30	8.60	205	Barakar	BCCL	Domestic
B-48	Mahuda	0.65	2.10	11.50	181	Raniganj	Mosque	Domestic
B-51	Taranga	0.00	2.50	5.75	215	Metamorphics	Bisun	Irrigation
B-53	Karmatanr	0.58	2.70	13.25	195	Barakar	Govt	Domestic
B-53A	Karmatanr-Damoda OCP							
B-59	Khodovaly	0.60	2.40	9.30	202	Barakar	BCCL	Domestic
B-60	Bahiyardih	0.77	3.00	15.60	196	Barakar	BCCL	Domestic
B-61A	Kesargora	0.48	2.00	11.20	201	Barakar	BCCL	Domestic
B-62A	Sadariyadih	0.15	3.10	9.50	188	Barakar	Govt	Domestic

Annexure – IIA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	R.L. (G.L) (m)	Formation	Owner	Utility
B-63	West Mudidih	0.60	1.70	3.35	196	Barakar	BCCL	Domestic
B-64	Keshalpur	0.65	1.10	3.40	195	Barakar	BCCL	Domestic
B-65A	Jhinjipahari	0.95	2.20	12.40	196	Barakar	Shiv Temple	Domestic
B-67	Simatanr	0.55	2.20	11.80	198	Raniganj	Govt	Domestic
D-3	Dhansar	0.60	1.70	8.70	217	Barakar	Govt	Domestic
D-4	Jharia	0.59	1.90	5.73	218	Barakar	Govt	Domestic
D-5	Jiyalgora	0.70	2.80	10.55	183	Barakar	Govt	Domestic
D-7	Golden Pahari	0.67	2.85	10.05	201	Barakar	BCCL	Domestic
D-8	Alokdiha	0.35	1.75	7.57	201	Metamorphics	BCCL	Domestic
D-23	Jogta (Sindra)	0.40	3.10	7.25	205	Barakar	BCCL	Domestic
D-25	Godhar More	0.60	2.75	5.60	219	Barakar	Govt	Domestic
D-30	Borkiboa	0.70	2.00	5.60	221	Talchir	H.Kumbhakar	Domestic
D-33	Kustore-4	0.55	1.85	3.45	196	Barakar	BCCL	Domestic
D-34	Kusunda-7	0.60	1.50	3.45	201	Barakar	BCCL	Domestic
D-35	Patherdih	0.40	2.00	11.20	160	Barakar	BCCL	Domestic
D-36	Sudamdih	0.90	2.00	6.20	141	Barakar	BCCL	Domestic
D-39	Tilabani	0.85	2.00	5.90	178	Barakar	BCCL	Domestic
D-40A	Khapra Dhaora	0.55	1.95	3.70	180	Barakar	Panchayat	Domestic
D-41	Joyrampur	0.50	1.80	4.00	180	Barakar	BCCL	Domestic
D-43	Alagdih	0.45	2.20	8.90	200	Metamorphics	Govt	Domestic
D-47	Parastanr	0.45	3.20	23.80	206	Barakar	BCCL	Domestic
D-49	Goluckdih	0.55	1.80	6.15	192	Barakar	BCCL	Domestic
D-51	Chankuiya	0.55	3.70	11.90	197	Barakar	BCCL	Domestic
D-55	Hariladih	0.48	2.80	11.80	184	Barakar	Govt	Domestic
D-74	Bhulan Barari	0.10	1.60	12.80	173	Barakar	Govt	Domestic
D-77	Rohoniatanr	0.40	3.15	6.70	156	Barakar	Govt	Domestic
D-80	Bastacolla	0.70	2.50	24.95	219	Barakar	Govt	Domestic
DB-22	Nichebasti	0.67	2.40	10.65	121	Barakar	Govt	Domestic
DB-23	Dahibari OC	0.70	2.30	8.00	-	Barakar	BCCL	Domestic
DB-24	Dahibari	0.60	3.60	13.70	125	Barakar	BCCL	Domestic
DB-25	Palasya	0.37	1.55	5.25	127	Barakar	Govt	Domestic

MP: Measuring Point **R.L.: Reduced Level** **W.L.: Water Level m: Meter**

Abn.: Abandoned **b.g.l.: Below Ground Level** **a.g.l.: Above Ground Level**

G.L.: Ground Level **bmp: Below Measuring Point** **BM: Barren Measure**

Annexure – IIB

Historical Water Level data of Hydrograph Stations

Well No	Water level below ground level (bgl) in meters														
	May, 10	Nov, 10	May, 11	May, 12	Nov, 12	May, 13	Nov, 13	May, 14	Nov, 14	May, 15	Nov, 15	May, 16	Nov, 16	May, 17	Nov, 17
A-3	4.71	3.57	4.77	4.25	1.87	4.47	4.45	4.67	2.37	3.70	3.42	4.87	0.47	0.67	0.77
A-12	2.82	1.60	2.80	2.80	1.30	3.00	1.17	2.45	1.4	3.00	2.68	2.50	0.70	2.55	0.85
A-16	4.17	1.90	5.80	3.53	1.60	3.80	3.35	5.5	2.9	5.55	4.17	5.85	3.15	3.65	2.20
A-17	2.39	2.37	2.24	2.52	2.34	2.32	1.54	2.19	1.91	3.79	2.64	2.44	2.69	2.44	2.24
A-18	2.49	0.94	2.49	2.59	0.90	2.87	0.91	1.76	1.19	2.84	1.29	1.14	0.89	1.29	0.99
A19	3.61	2.81		9.61	2.46	7.46	4.46	3.00	2.75	3.05	2.75	7.81	4.11	6.37	2.45
A-20	7.42	1.87	7.87	7.17	1.57	6.47	0.67	3.97	2.55	4.59	2.93	7.49	3.50	4.27	1.77
A22A				1.90	1.05	1.79	1.00	1.50	2.0	3.20	1.96	3.25	1.75	4.27	1.77
A-23	10.67	11.07	11.92	9.87	4.75	10.57	5.82	8.76	6.82	11.3	9.37	11.87	8.13	6.40	1.50
A-24	14.47	15.88	18.28	18.68	5.23	16.01	3.25	16.28	14.98	17.2	14.5	16.62	12.43	11.87	6.97
A-25	7.23	5.10	6.83	10.23	4.43	10.23	2.98	7.03	5.28	7.78	5.85	7.43	4.58	6.38	2.88
A-26	7.77	3.95	9.18	8.76	4.28	7.56	4.28	7.71	4.58	7.73	3.18	8.93	4.48	5.28	2.53
A-27	1.98	1.42	3.00	2.13	1.10	1.62	1.25	1.63	1.55	4.40	3.95	4.85	1.80	2.90	1.25
A28A	3.29	2.73	3.90	2.90	2.45	3.35	2.45	3.29	1.91	4.35	3.60	3.35	1.47	4.30	1.55
A-29	3.80		5.50	9.30	1.42	6.95	1.67	3.3	2.35	4.55	4.60	5.92	6.96	4.40	1.30
A-32	1.95	1.35	2.30	2.19	1.10	2.45	1.95	3.15	2.45	4.41	2.13	4.75	2.10	3.15	1.55
A-33	3.03	1.85	3.07	5.25	1.25	4.13	1.80	4.08	1.57	4.91	1.97	5.75	2.60	6.45	1.55
A-34	2.85	3.77	2.90	6.95	2.90	6.21	2.50	4.45	4.45	8.40	4.81	4.75	4.45	12.45	4.45
B-1	2.43	1.73	1.78	2.08	1.73	1.53	1.83	2.43	1.81	3.28	2.75	3.58	1.93	2.33	0.85
B-14	1.35	1.09	2.49	1.34	1.42	1.74	1.45	3.24	4.44	2.94	2.29	2.44	0.47	2.94	1.84
B-15	1.40	1.38	1.37	1.27	0.45	1.20	0.55	0.95	1.45	1.50	0.45	1.85	0.55	4.85	0.15
B21A	9.15	5.65	7.60	9.00	5.05	8.01	4.95	9.54	3.7	7.37	4.65	5.55	4.50	8.85	5.65
B-23	6.14	3.56	9.14	3.71	1.74	5.27	1.39	6.57	2.74	7.86	4.29	6.81	2.41	7.74	2.14
B-24	9.45	4.95	10.33		3.09	8.88	2.83	9.40	2.21	10.0	5.78	10.63	4.28	10.03	4.03
B-25	5.88	7.00	8.35	8.35	2.60	7.08	2.15	5.82	5.15	6.88	-	7.05	1.70	6.70	1.40
B32A	6.50	4.32	7.80	7.75	3.22	6.25	2.68	8.33	2.05	7.55	3.32	6.95	3.07	6.95	2.80
B-48	4.10		5.75	5.43	3.85	4.69	3.20	6.38	4.35	7.90	5.42	9.35	4.60	7.70	4.15
B-51	3.94	2.38	3.95	3.60	2.05	3.35	2.49	2.09	1.98	4.65	3.40	4.90	3.18	4.98	2.55
B-53	1.77	1.72	1.67	6.97	1.42	4.15	1.12	3.39	-	5.58	2.82	4.70	1.45	4.02	1.92
B-59	6.75	1.00	8.25	6.90	0.60	7.56	0.30	2.65	1.0	4.12	1.60	4.40	0.50	5.40	0.60
B-60	10.56	5.24	11.44	10.18	5.13	11.29	5.23	9.82	4.59	9.21	5.28	10.33	5.03	13.23	3.18
B61A	4.96	3.36	10.72	5.42	2.40	8.17	2.02	6.93	3.57	6.15	4.52	6.58	3.87	2.57	0.82
B62A	8.37	7.90	8.85	7.85	4.90	7.73	4.63	8.83	5.85	9.10	5.21	9.30	4.95	8.15	4.35

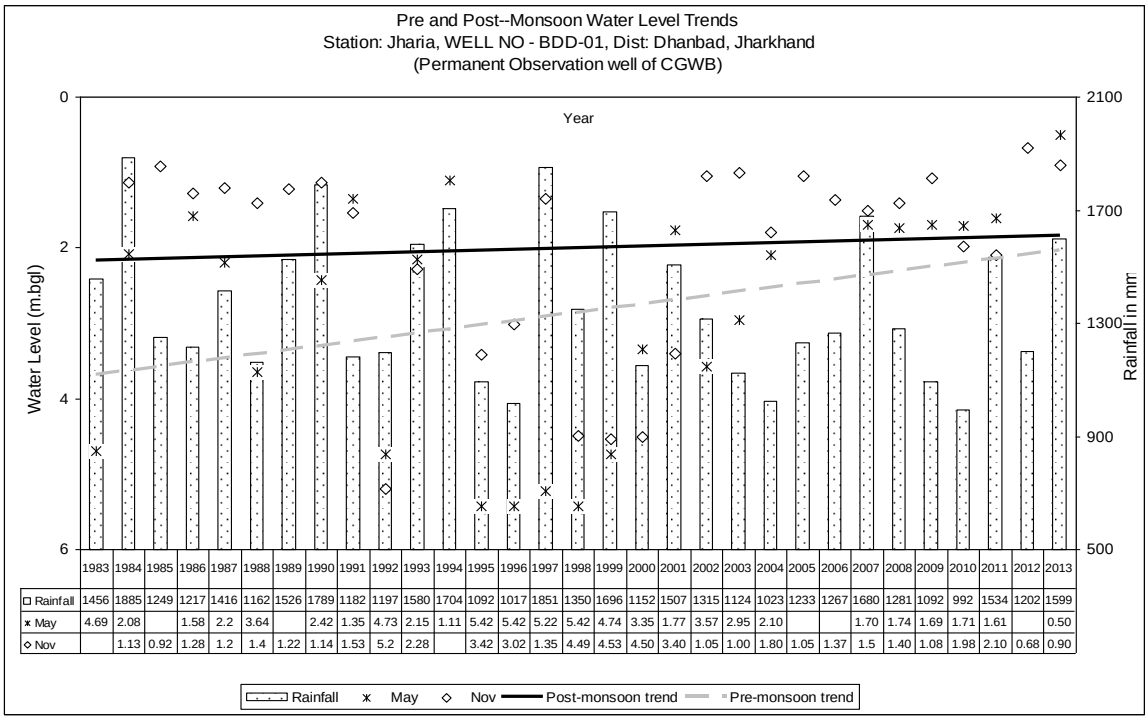
Annexure – IIB

Historical Water Level data of Hydrograph Stations

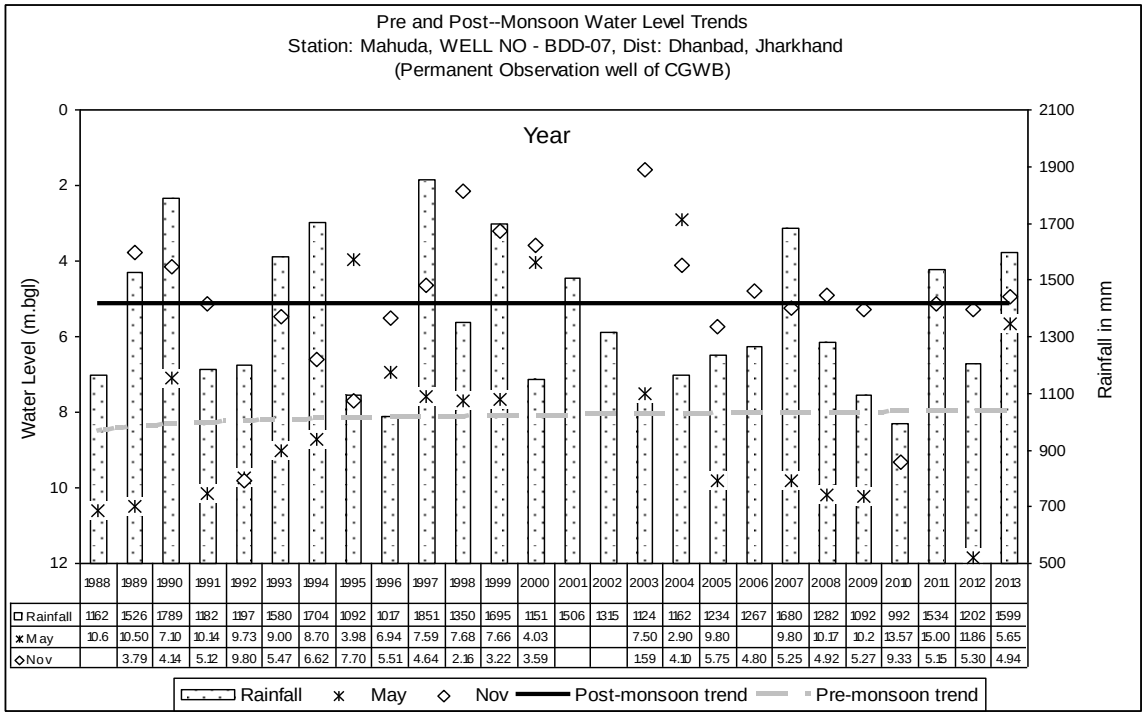
Well No	Water level below ground level (bgl) in meters														
	May, 10	Nov, 10	May, 11	May, 12	Nov, 12	May, 13	Nov, 13	May, 14	Nov, 14	May, 15	Nov, 15	May, 16	Nov, 16	May, 17	Nov, 17
B-63	1.03	1.00	1.05	1.09		1.32	0.80	1.22	0.92	2.46	1.40	2.44	-	-	-
B-64	0.79	1.05	0.85	1.05	1.00	1.35	0.85	0.7	1.15	1.38	0.95	2.35	0.55	1.25	0.85
B65A	11.45	3.39	9.65	11.45	1.73	10.11	1.82	10.45	2.4	7.82	5.87	7.15	2.68	9.05	1.25
B-67	11.00	10.69	11.25	8.55	6.50	9.73	5.31	9.80	3.72	9.23	5.53	9.53	4.30	10.00	2.15
D-3	3.15	2.55	2.55	2.93	1.80	3.45	1.68	2.54	2.11	4.25	2.25	2.35	1.90	2.15	2.30
D-4	2.61	1.46	1.51	1.94	0.91	2.41	0.98	1.23	0.91	2.41	1.27	1.21	1.36	1.21	1.46
D-5	9.05	6.65	9.05	9.50	6.45	9.32	4.59	9.0	7.8	9.37	8.33	9.40	6.40	7.90	5.20
D-7	9.23		9.33	6.08	5.83	7.19	4.63	5.28	5.53	8.25	5.61	7.53	4.03	7.33	2.88
D-8	6.85	6.73	7.75	6.15	3.75	6.65	2.85	7.73	-	6.24	4.38	8.00	3.43	5.15	1.85
D-23	5.85	4.85	6.80	6.00	3.30	6.60	1.20	6.38	2.4	6.55	3.48	5.70	1.63	2.80	2.98
D-25	5.10	2.30	4.70	5.20	3.65	4.26	3.45	4.42	2.9	4.48	2.45	2.40	1.90	2.40	1.20
D-30	2.90	2.23	5.10	3.88	1.80	4.38	3.08	4.17	3.3	4.55	3.15	4.45	3.20	4.40	1.25
D-33	0.94	0.70	0.95	2.85	0.35	1.80	0.45	1.72	0.35	2.25	1.10	2.50	1.95	0.75	0.75
D-34	2.85	2.65	2.85	2.35	2.50	2.50	2.13	2.80	0.30	2.55	1.45	2.30	0.30	0.80	0.55
D-35	7.30	6.15	8.20	8.05	5.55	7.70	4.10	6.94	6.15	9.80	7.90	9.52	6.45	8.80	3.60
D-36	0.85	0.10	1.95	1.55	0.15	1.28	0.80	1.82	0.75	1.66	1.13	0.78	0.95	1.30	0.70
D-39	4.75	3.40	5.05	5.05	3.65	3.98	2.50	5.03	2.25	5.00	2.61	2.18	2.65	6.17	4.75
D40A	2.50	1.65	1.95	2.45	1.70		2.25	2.35	2.45	3.07	2.45	1.40	0.85	1.45	1.35
D-41	1.60	1.55	1.55	1.50	1.50	1.72	1.35	3.20	1.35	2.65	2.32	1.30	1.52	1.40	1.20
D-43	7.95	4.95	7.65	7.05	4.00	6.23	4.05	6.0	4.75	6.61	5.05	8.20	3.35	7.50	3.60
D-47	2.95	2.75	4.35	1.95	2.12	2.60	2.97	8.0	2.37	9.60	3.60	3.18	2.95	3.15	2.85
D-49	1.40	1.81	1.55	1.60	1.65	1.30	1.45	2.51	1.65	3.55	2.35	2.45	1.72	2.70	2.05
D-51	11.03	8.93	10.85	10.00	7.85	8.94	8.35	9.60	9.05	10.48	9.15	11.15	6.45	10.45	5.43
D-55	4.62	2.44	5.97	1.93	1.82	3.90	1.45	1.95	2.07	6.15	1.57	2.52	3.62	6.42	2.37
D-74	4.04	3.80	4.05	4.95	3.60	4.55	3.41	5.0	4.0	10.05	7.20	7.73	5.00	9.25	3.85
D-77	6.40	6.30	6.30	6.50	4.75	4.79	5.10	6.23	6.0	6.44	5.60	4.60	2.90	6.50	4.90
D-80	19.20	3.05	17.45	14.20	3.35	15.25	3.32	13.3	3.15	10.97	3.35	6.55	4.15	8.65	3.70
RCF (part)		May, 11	Nov, 11	May, 12	Nov, 12	May, 13	Nov, 13	May, 14	Nov, 14	May, 15	Nov, 15	May, 16	Nov, 16	May, 17	Nov, 17
DB22		2.90	2.23	2.43	2.38	8.18	2.64	6.48	3.03	4.59	3.53	5.38	3.33	1.93	1.63
DB23		3.25	2.70	2.90	2.33	5.05	3.10	3.95	2.13	3.38	6.04	5.30	0.90	2.05	1.90
DB24							8.25	-	8.45	9.52	8.20	10.65	6.50	5.80	3.78
DB25		4.03	2.13	3.96	1.18	1.33	2.53	3.27	2.73	3.83	2.68	3.61	1.98	3.23	2.58

Annexure – III

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS



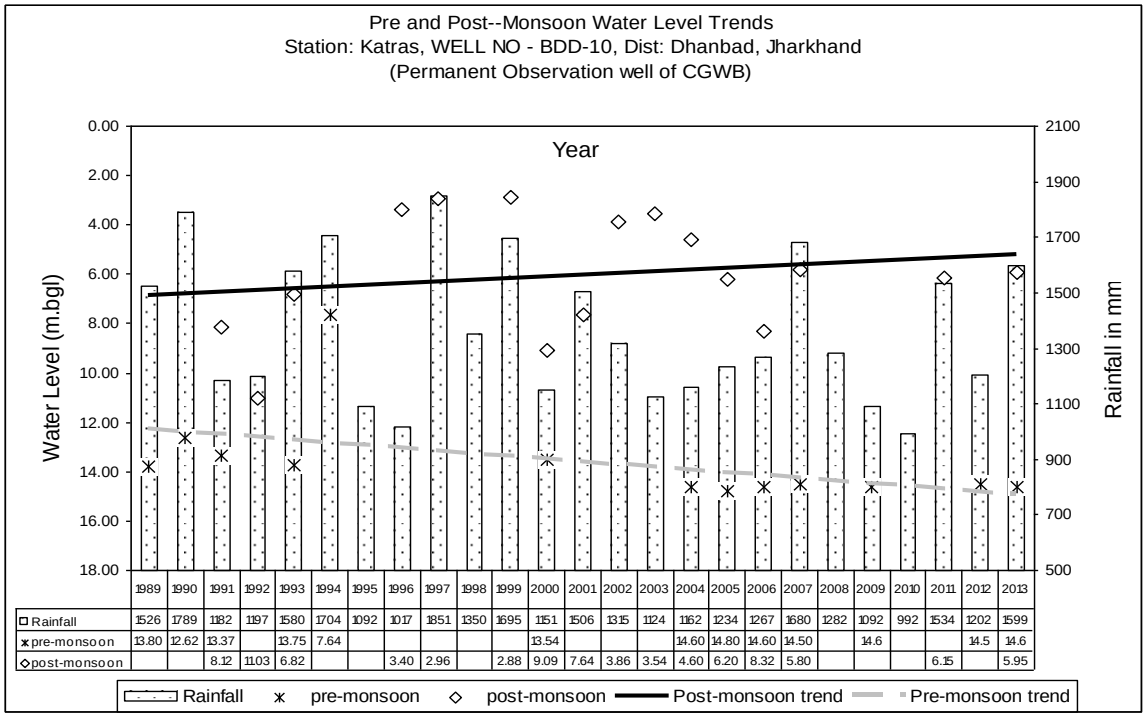
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Rainfall	1456	1885	1249	1217	1416	1162	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1152	1507	1315	1124	1023	1233	1267	1680	1281	1092	992	1534	1202	1599
May	4.69	2.08		1.58	2.2	3.64		2.42	1.35	4.73	2.15	1.11	5.42	5.42	5.22	5.42	4.74	3.35	1.77	3.57	2.95	2.10			1.70	1.74	1.69	1.71	1.61		0.50
Nov		1.13	0.92	1.28	1.2	1.4	1.22	1.14	1.53	5.2	2.28		3.42	3.02	1.35	4.49	4.53	4.50	3.40	1.05	1.00	1.80	1.05	1.37	1.5	1.40	1.08	1.98	2.10	0.68	0.90



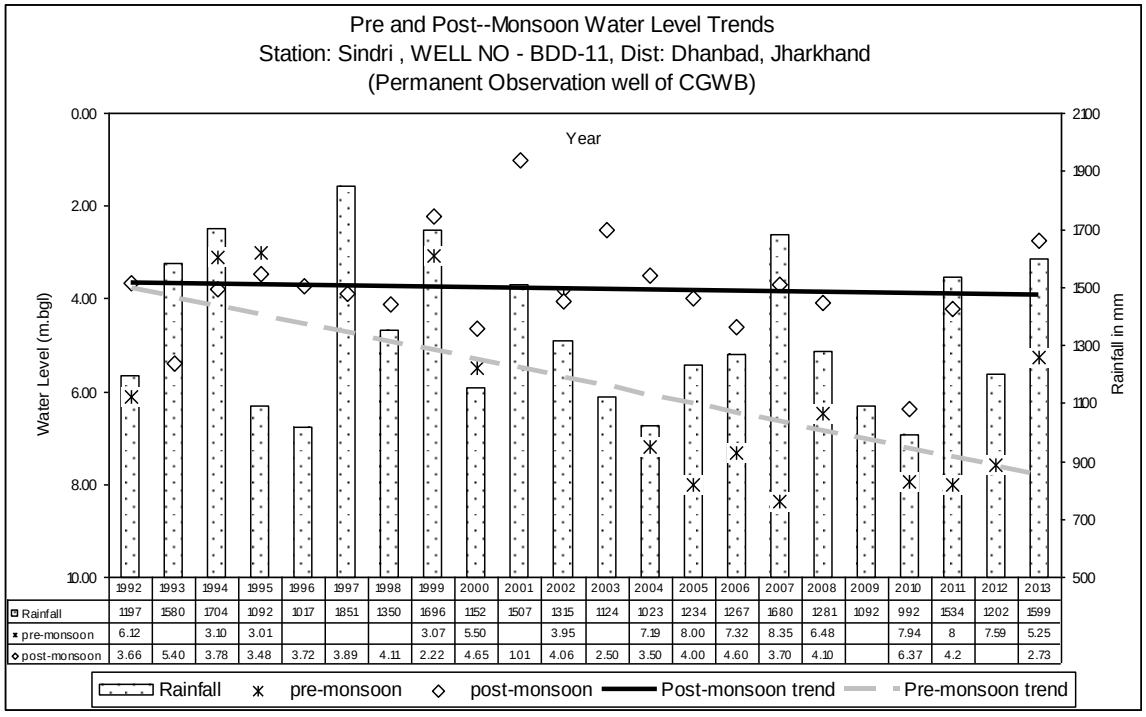
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Rainfall	1162	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1506	1315	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599
May	10.6	10.50	7.10	10.14	9.73	9.00	8.70	3.98	6.94	7.59	7.68	7.66	4.03			7.50	2.90	9.80		9.80	10.17	10.2	13.57	15.00	11.86	5.65
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

Annexure – III

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
Rainfall	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1506	1315	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599
pre-monsoon	13.80	12.62	13.37		13.75	7.64						13.54				14.60	14.80	14.60	14.50		14.6			14.5	14.6
post-monsoon			8.12	11.03	6.82			3.40	2.96		2.88	9.09	7.64	3.86	3.54	4.60	6.20	8.32	5.80				6.15		5.95



	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Rainfall	1197	1580	1704	1092	1017	1851	1350	1696	1152	1507	1315	1124	1023	1234	1267	1680	1281	1092	992	1534	1202	1599
pre-monsoon	6.12		3.10	3.01				3.07	5.50		3.95		7.19	8.00	7.32	8.35	6.48		7.94	8	7.59	5.25
post-monsoon	3.66	5.40	3.78	3.48	3.72	3.89	4.11	2.22	4.65	1.01	4.06	2.50	3.50	4.00	4.60	3.70	4.10		6.37	4.2		2.73

Annexure – IV

GROUNDWATER SAMPLE LOCATION DETAILS

Sampling month: February, June, September & December month of assessment year'2017

Sl No	Name of Cluster	Ground Water Sample	Dug well (CMPDI)	Location	Sampling Date			
					Feb'17	June'17	Sep'17	Dec'17
1	CLUSTER-I	GW-1	B-15	BERA VILLAGE	18.02.17	13.06.17	01.09.17	04.12.17
2	CLUSTER-II	GW-2	B-59	KHODOVALY VILLAGE	18.02.17	13.06.17	01.09.17	04.12.17
3	CLUSTER-III	GW-3	A-29	GOVINDPUR,AMBAGAN VILLAGE	18.02.17	13.06.17	01.09.17	04.12.17
4	CLUSTER-IV	GW-4	B-63	KESHALPUR, BATIGHAR	18.02.17	13.06.17	01.09.17	04.12.17
5	CLUSTER-V	GW-5	D-30	BORKIBOA VILLAGE	18.02.17	13.06.17	01.09.17	04.12.17
6	CLUSTER-VI	GW-6	D-25	GODHUR MORE	18.02.17	13.06.17	01.09.17	05.12.17
7	CLUSTER-VII	GW-7	D-80	DHANSAR MINE RESCUE STN.	17.02.17	14.06.17	02.09.17	05.12.17
8	CLUSTER-VIII	GW-8	D-49	NEAR GHANOODIH OC	17.02.17	14.06.17	02.09.17	05.12.17
9	CLUSTER-IX	GW-9	D-5	JEALGORA, NEAR P.O.	17.02.17	14.06.17	02.09.17	05.12.17
10	CLUSTER-X	GW-10	D-35	PATHERDIH RLY. COLONY	17.02.17	14.06.17	02.09.17	05.12.17
11	CLUSTER-XI	GW-11	A-32	MONNIDIH BAZAR	18.02.17	13.06.17	01.09.17	04.12.17
12	CLUSTER-XIII	GW-13	A-23	MACHHAYARA	18.02.17	13.06.17	01.09.17	04.12.17
13	CLUSTER-XIV	GW-14	B-23	LOHAPATTI VILLAGE	18.02.17	13.06.17	01.09.17	04.12.17
14	CLUSTER-XV	GW-15	B-32A	MADHUBAND VILLAGE	18.02.17	13.06.17	01.09.17	04.12.17
15	CLUSTER-XVI	GW-16	D-22	DAHIBARI,NICHE BASTI	17.02.17	14.06.17	02.09.17	05.12.17

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

ENVIRONMENTAL MONITORING REPORT OF BHARAT COKING COAL LIMITED, CLUSTER – XV

(FOR THE MONTH JANUARY, 2018)

E. C. no. J-11015/100/2011-IA.II (M) dated 16.12.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the fauna and flora. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

2.2 Water sampling stations

The Water sampling stations were selected for mine discharge water.

2.3 Noise level monitoring locations

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The noise levels were recorded in mining area,washery and in residential area.

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM_{10}), Fine Particulate Matter ($PM_{2.5}$), Sulphur Di-oxide (SO_2) and Nitrogen Oxides (NO_X). Respirable Dust Samplers (RDS) were used for

sampling of $PM_{10,}$ SO_2, & NO_X and Fine Dust Sampler ($PM_{2.5}$ sampler) were used for sampling of $PM_{2.5}$ at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.2 Water quality

Water samples were collected as per standard practice. The Mine effluent samples were collected and analyzed for four parameters on fortnightly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory of CMPDI RI- II, Dhanbad.

3.3 Noise level monitoring

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB(A).

4.0 Results and interpretations

4.1 Air quality

It has been seen from the analysis results that the 24 hours average concentration parameters like $PM_{10,}$ $PM_{2.5}$, SO_2 and NO_X are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM_{10}& $PM_{2.5}$ exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

4.2 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, are within permissible limits.

4.3 Noise Level

During the noise level survey it has been observed that the noise level in the sampling locations is within the permissible limits prescribed as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines for Industrial Area and Noise pollution (Regulation and Control) Rules, 2000.

INTRODUCTION

Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

The very purpose of environmental monitoring is to assess the quality of various attributes which affects the environment. As per quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster-XV is in the Western part of the Jharia coalfield. It includes a group of 4 Mines (viz. Kharkharee, Madhuband, Phularitand&Dharmaband). The Cluster – XV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XV are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia Nala.

1.2 The Cluster-XV is designed to produce 0.325 MTPA (normative) and 0.423 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.325 MTPA (normative) and 0.423 MTPA (peak) capacity of coal production vide letter no. J-11015/100/2011-IA.II (M) dated 16th December, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that " Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, SO_2, NOx monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board." And other conditions regarding water / effluent and noise level monitoring.

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MOEF&CC & SPCB and other statutory authorities.

.

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Kharkharee CISF Office (A21): Industrial Area

The location of the sampling station is 23°46' 29.00'' N 86° 14' 37.08''E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

ii) **Madhuband UGP Office (A33): Industrial Area**

The location of the sampling station is 23°45'24.48'' N 086°11'59.44''E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

II. BUFFER ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is 23^0 47' 54.00" N & $86^0$16' 20.00" E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

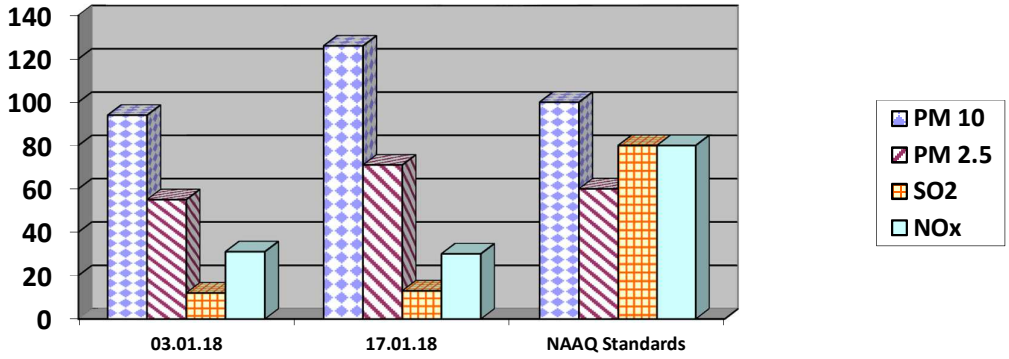
ii) Lohapatti (A20): Industrial Area

The location of the sampling station is 23°44'29.42'' N & 86°16'49.96'' E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

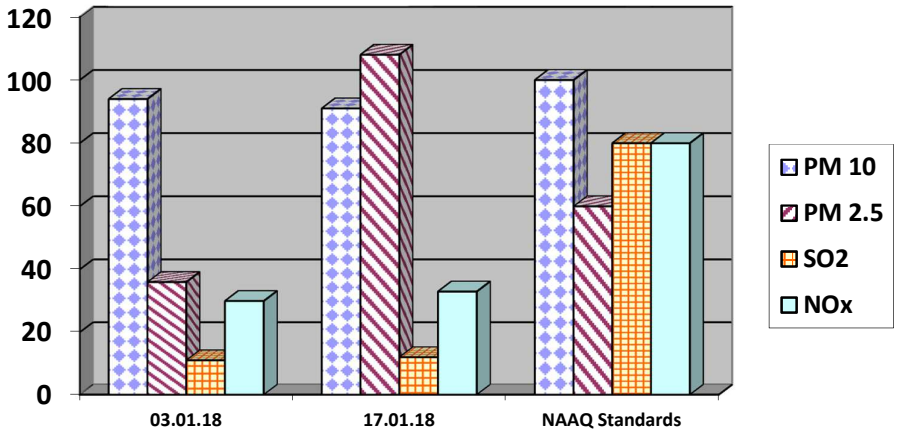
AMBIENT AIR QUALITY DATA

Cluster – XV,Bharat Coking Coal limited Month: **JAN. 2018** Year : **2018-18.**

Station Name: A21 Kharkharee		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	03.01.18	94	55	12	31
2	17.01.18	126	71	13	30
	NAAQ Standards	100	60	80	80



Station Name: A33 Madhuband UGP		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	03.01.18	94	36	11	30
2	17.01.18	91	108	12	33
	NAAQ Standards	100	60	80	80

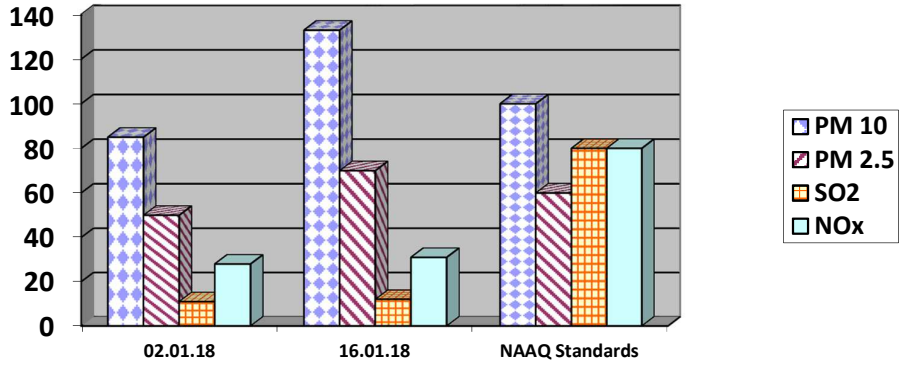


Analysed By
JSA/SA/SSA

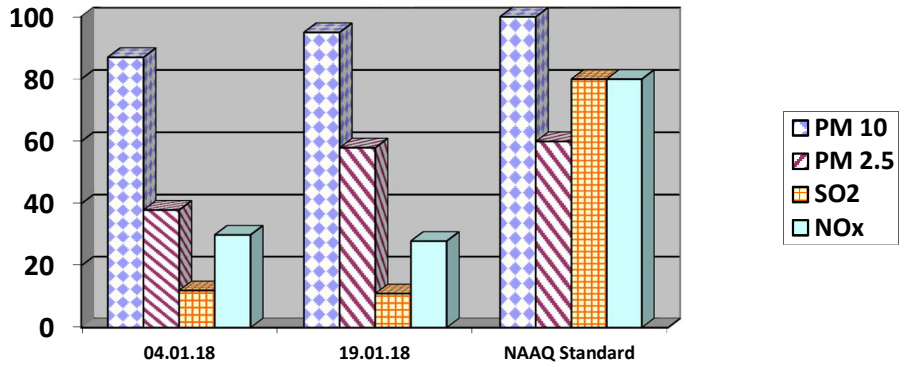
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Station Name: A6 Block IV Kooridih OCP		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	02.01.18	85	50	11	28
2	16.01.18	133	70	12	31
	NAAQ Standards	100	60	80	80



Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_x**
1	04.01.18	87	38	12	30
2	19.01.18	95	58	11	28
	NAAQ Standard	100	60	80	80



- *All values are expressed in microgram per cubic meter.*
  - *24 hours duration*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of KharkhareeUGP (MW15)**

A sampling point is fixed to assess the effluent quality of Mine discharge.

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. The effluent samples were collected and analysed for four parameters on fortnightly basis at the Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -XV**		Month: **JANUARY, 2018**	Name of the Station: **Mine Discharge of Kharkharee UGP**	
Sl. No.	**Parameters**	**MW15** First Fortnight	**MW15** Second Fortnight	**As per MOEF General Standards for schedule VI**
		3/1/2018	19/1/2018	
1	Total Suspended Solids	24	16	*100 (Max)*
2	pH	7.59	7.93	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	32	24	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Kharkharee CISF Office (N21)**

ii) **Madhuband UGP Office (N33)**

iii) **Block IV Kooridih OCP (N6)**

iv) **Lohapatti (N20)**

4.2 Methodology of sampling and analysis

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEFCC. The results of Noise levels recorded during day time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L_{EQ} are presented**.** The observed values at all the monitoring locations are found to be within permissible limits.

NOISE LEVEL DATA

Name of the Project : **Cluster -XV**			Month: **JANUARY, 2018**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	**Kharkharee CISF Office (N21)**	**Industrial area**	03-01-2018	64.2	*75*
2	**Kharkharee CISF Office (N21)**	**Industrial area**	17-01-2018	63.8	*75*
3	**Madhuband UGP Office (N33**	**Industrial area**	03-01-2018	59.8	*75*
4	**Madhuband UGP Office (N33**	**Industrial area**	17-01-2018	62.7	*75*
5	**Block IV Kooridih OCP (N6)**	**Industrial area**	02-01-2018	59.8	*75*
6	**Block IV Kooridih OCP (N6)**	**Industrial area**	16-01-2018	60.1	*75*
7	**Lohapatti (N20)**	**Industrial area**	04-01-2018	63.1	*75*
8	**Lohapatti (N20)**	**Industrial area**	19-01-2018	61.5	*75*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.

*** Day Time: 6.00 AM to 10.00 PM,**

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Ambient Air Quality Standards for Jharia Coal Field
As per the Environment (Protection) Amendment Rules, 2000 notified vide notification G.S.R. 742(E), dated 25.9.2000.

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
III Coal mines located in the coal fields of • Jharia • Raniganj • Bokaro	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 µg/m^3 700 µg/m^3	- High Volume Sampling (Average flow rate not less than 1.1
	Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average * 24 hours **	250 µg/m^3 300 µg/m^3	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide (SO_2)	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as NO_2	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1. Jacob &Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemilumine-scence

Note:

* Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause2.

** 24hourly/8hourlyvaluesshallbemet92%ofthetimeinayear.However,8% of the time it may exceed but not on two consecutivedays.

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th JANUARY 2009

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in supersession of the notification No(s).S.O.384(E), dated 11th April 1994 and S.O.935(E), dated 14th October 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect.

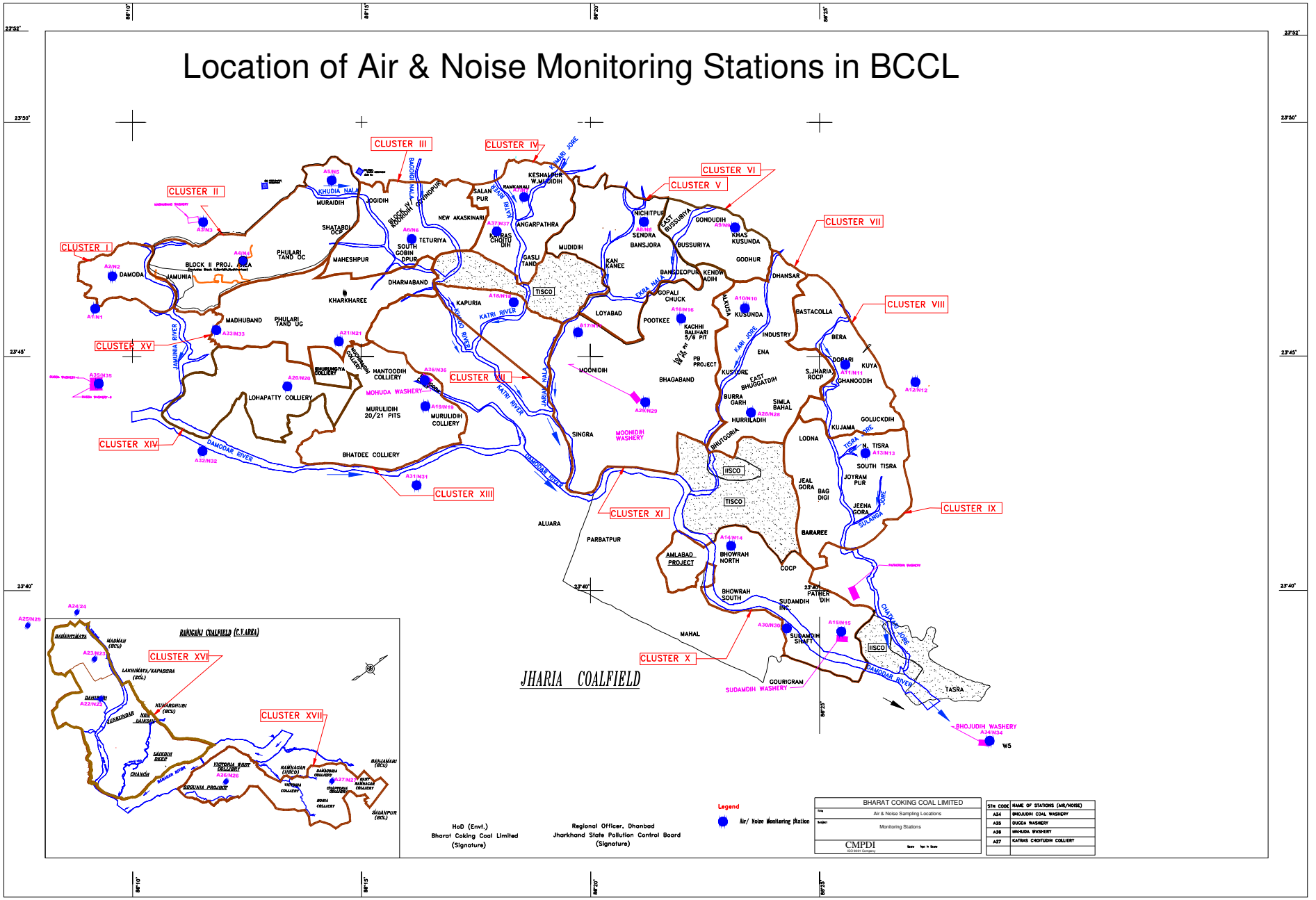
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
Nitrogendioxide (NO_2), µg/m³	Annual * 24 Hours **	40 80	30 80	-Jacob &Hochheiser modified (NaOH-$NaAsO_2$) Method -Gas Phase Chemiluminescence
Particulate Matter (Size less than 10µm) or PM_{10}, µg/m³	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
Particulate Matter (Size less than 2.5µm) or $PM_{2.5}$, µg/m³	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
Ozone (O_3) , µg/m³	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
Lead (Pb) , µg/m³	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
Carbon Monoxide (CO), mg/m³	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
Ammonia (NH_3), µg/m³	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
Benzene (C_6H_6), µg/m³	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
Benzo(a)Pyrene (BaP) Particulate phase only, ng/m³	Annual *	01	01	-Solvent extraction followed byHPLC/GC analysis
Arsenic (As), ng/m³	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni), ng/m³	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

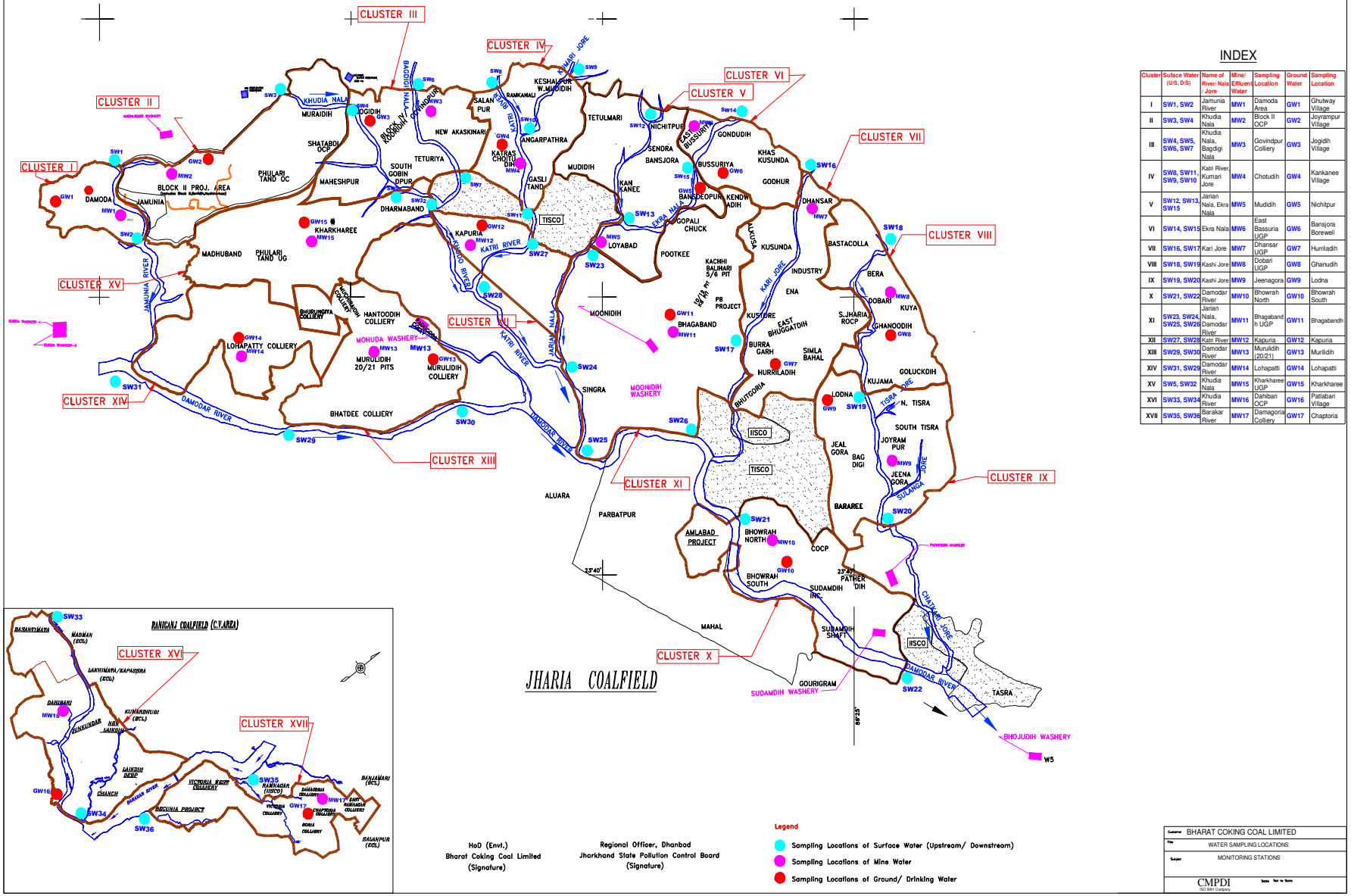
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

NOTE: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigations.

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ghutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogidih Village
IV	SW8, SW11, SW9, SW10	Katri River, Kumari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhansar UGP	GW7	Hurriladih
VIII	SW18, SW19	Kashi Jore	MW8	Dobari UGP	GW8	Ghanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband h UGP	GW11	Bhagabandh
XII	SW27, SW28	Katri River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Murulidih (20/21)	GW13	Murilidih
XIV	SW31, SW29	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudia Nala	MW15	Kharkharee UGP	GW15	Kharkharee
XVI	SW33, SW34	Khudia River	MW16	Dahibari OCP	GW16	Patlabari Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptoria

HoD (Envt.)
Bharat Coking Coal Limited
(Signature)

Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)

Legend
- Sampling Locations of Surface Water (Upstream/ Downstream)
- Sampling Locations of Mine Water
- Sampling Locations of Ground/ Drinking Water

Customer: BHARAT COKING COAL LIMITED
Title: WATER SAMPLING LOCATIONS
Subject: MONITORING STATIONS
CMPDI
ISO 9001 Company
Scale: Not to Scale

ENVIRONMENTAL MONITORING REPORT OF BHARAT COKING COAL LIMITED, CLUSTER – XV

(FOR THE MONTH FEBRUARY, 2018)

E. C. no. J-11015/100/2011-IA.II (M) dated 16.12.2013.

CMPDI

ISO 9001 Company

Regional Institute-II

Dhanbad, Jharkhand

CONTENTS

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the fauna and flora. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

2.2 Water sampling stations

The Water sampling stations were selected for mine discharge water.

2.3 Noise level monitoring locations

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The noise levels were recorded in mining areas,washery areas and in residential areas.

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM_{10}), Fine Particulate Matter ($PM_{2.5}$), Sulphur Di-oxide (SO_2) and Nitrogen Oxides (NO_X). Respirable Dust Samplers (RDS) were used for

sampling of $PM_{10,}$ SO_2, & NO_X and Fine Dust Sampler ($PM_{2.5}$ sampler) were used for sampling of $PM_{2.5}$ at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.2 Water quality

Water samples were collected as per standard practice. The Mine effluent samples were collected and analyzed for four parameters on fortnightly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory of CMPDI RI- II, Dhanbad.

3.3 Noise level monitoring

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB(A).

4.0 Results and interpretations

4.1 Air quality

It has been seen from the analysis results that the 24 hours average concentration parameters like $PM_{10,}$ $PM_{2.5}$, SO_2 and NO_X are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM_{10}& $PM_{2.5}$ exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

4.2 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, are within permissible limits.

4.3 Noise Level

During the noise level survey it has been observed that the noise level in the sampling locations is within the permissible limits prescribed as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines for Industrial Area and Noise pollution (Regulation and Control) Rules, 2000.

INTRODUCTION

Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

The very purpose of environmental monitoring is to assess the quality of various attributes which affects the environment. As per quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster-XV is in the Western part of the Jharia coalfield. It includes a group of 4 Mines (viz. Kharkharee, Madhuband, Phularitand&Dharmaband). The Cluster – XV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XV are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia Nala.

1.2 The Cluster-XV is designed to produce 0.325 MTPA (normative) and 0.423 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.325 MTPA (normative) and 0.423 MTPA (peak) capacity of coal production vide letter no. J-11015/100/2011-IA.II (M) dated 16th December, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that " Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, SO_2, NOx monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board." And other conditions regarding water / effluent and noise level monitoring.

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MOEF&CC & SPCB and other statutory authorities.

.

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Kharkharee CISF Office (A21): Industrial Area

The location of the sampling station is 23°46' 29.00'' N 86° 14' 37.08''E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

ii) **Madhuband UGP Office (A33): Industrial Area**

The location of the sampling station is 23°45'24.48'' N 086°11'59.44''E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

II. BUFFER ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is 23^0 47' 54.00" N & $86^0$16' 20.00" E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

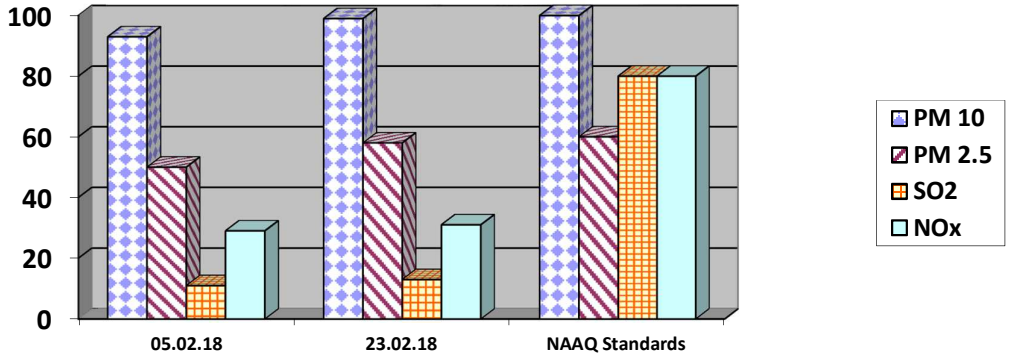
ii) Lohapatti (A20): Industrial Area

The location of the sampling station is 23°44'29.42'' N & 86°16'49.96'' E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

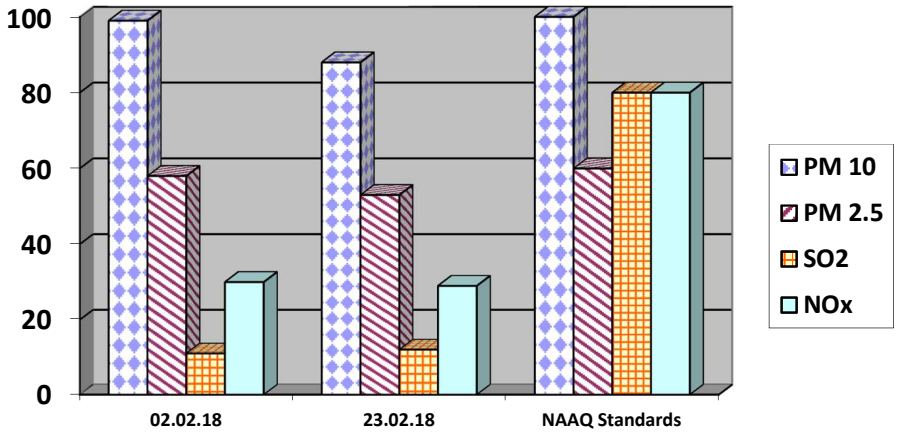
AMBIENT AIR QUALITY DATA

Cluster – XV,Bharat Coking Coal limited Month: **FEB 2018** Year : **2017-18.**

Station Name: A21 Kharkharee		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	05.02.18	93	50	11	29
2	23.02.18	99	58	13	31
	NAAQ Standards	100	60	80	80



Station Name: A33 Madhuband UGP		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	02.02.18	99	58	11	30
2	23.02.18	88	53	12	29
	NAAQ Standards	100	60	80	80

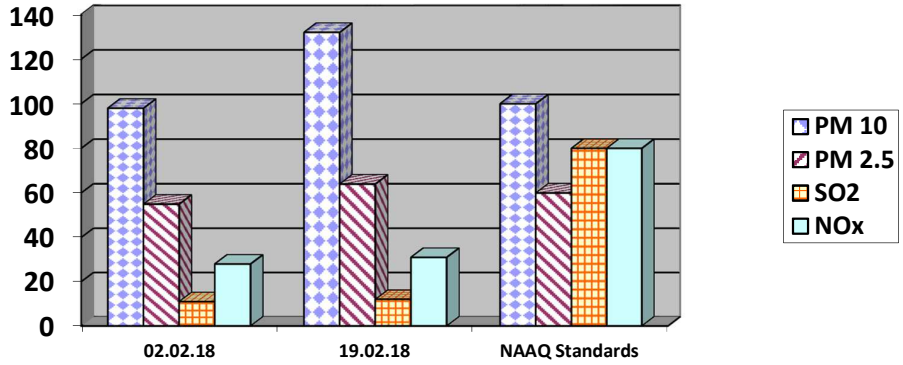


Analysed By
JSA/SA/SSA

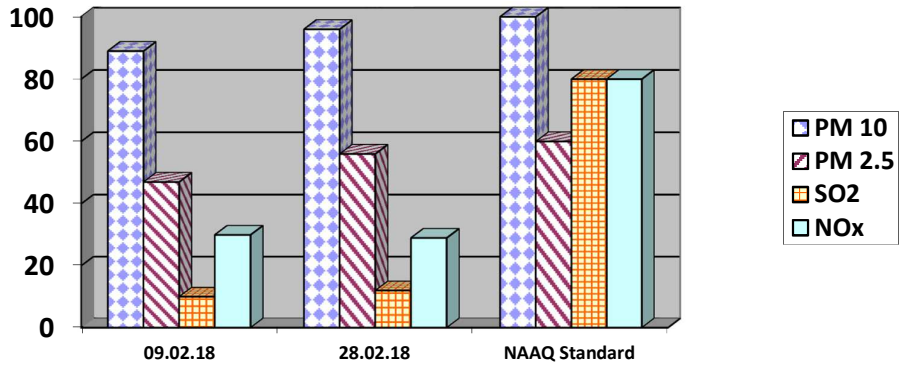
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Station Name: A6 Block IV Kooridih OCP		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	02.02.18	98	55	11	28
2	19.02.18	132	64	12	31
	NAAQ Standards	100	60	80	80



Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	09.02.18	89	47	10	30
2	28.02.18	96	56	12	29
	NAAQ Standard	100	60	80	80



- *All values are expressed in microgram per cubic meter.*
  - *24 hours duration*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Kharkharee UGP (MW15)**

A sampling point is fixed to assess the effluent quality of Mine discharge.

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. The effluent samples were collected and analysed for four parameters on fortnightly basis at the Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -XV**		Month: **FEBRUARY, 2018**	Name of the Station: **Mine Discharge of Kharkharee UGP**	
Sl. No.	**Parameters**	**MW15** First Fortnight	**MW15** Second Fortnight	**As per MOEF General Standards for schedule VI**
		5/2/2018	23/2/2018	
1	Total Suspended Solids	38	30	*100 (Max)*
2	pH	7.41	7.31	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	20	28	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Kharkharee CISF Office (N21)**

ii) **Madhuband UGP Office (N33)**

iii) **Block IV Kooridih OCP (N6)**

iv) **Lohapatti (N20)**

4.2 Methodology of sampling and analysis

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEFCC. The results of Noise levels recorded during day time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L_{EQ} are presented**.** The observed values at all the monitoring locations are found to be within permissible limits.

NOISE LEVEL DATA

Name of the Project : **Cluster -XV**			Month: **FEBRUARY, 2018**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	**Kharkharee CISF Office (N21)**	**Industrial area**	05-02-2018	59.8	*75*
2	**Kharkharee CISF Office (N21)**	**Industrial area**	23-02-2018	62.5	*75*
3	**Madhuband UGP Office (N33**	**Industrial area**	02-02-2018	60.9	*75*
4	**Madhuband UGP Office (N33**	**Industrial area**	23-02-2018	62.4	*75*
5	**Block IV Kooridih OCP (N6)**	**Industrial area**	02-02-2018	64.6	*75*
6	**Block IV Kooridih OCP (N6)**	**Industrial area**	19-02-2018	62.7	*75*
7	**Lohapatti (N20)**	**Industrial area**	09-02-2018	64.5	*75*
8	**Lohapatti (N20)**	**Industrial area**	28-02-2018	60.7	*75*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.

*** Day Time: 6.00 AM to 10.00 PM,**

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Ambient Air Quality Standards for Jharia Coal Field
As per the Environment (Protection) Amendment Rules, 2000 notified vide notification G.S.R. 742(E), dated 25.9.2000.

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
III Coal mines located in the coal fields of • Jharia • Raniganj • Bokaro	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 µg/m^3 700 µg/m^3	- High Volume Sampling (Average flow rate not less than 1.1
	Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average * 24 hours **	250 µg/m^3 300 µg/m^3	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide (SO_2)	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as NO_2	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1. Jacob &Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemilumine-scence

Note:

* Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause2.

** 24hourly/8hourlyvaluesshallbemet92%ofthetimeinayear.However,8% of the time it may exceed but not on two consecutivedays.

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New Delhi the 18th FEBRUARY 2009

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in supersession of the notification No(s).S.O.384(E), dated 11th April 1994 and S.O.935(E), dated 14th October 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect.

Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
Nitrogendioxide (NO_2), µg/m³	Annual * 24 Hours **	40 80	30 80	-Jacob &Hochheiser modified (NaOH-$NaAsO_2$) Method -Gas Phase Chemiluminescence
Particulate Matter (Size less than 10µm) or PM_{10}, µg/m³	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
Particulate Matter (Size less than 2.5µm) or $PM_{2.5}$, µg/m³	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
Ozone (O_3) , µg/m³	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
Lead (Pb) , µg/m³	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
Carbon Monoxide (CO), mg/m³	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
Ammonia (NH_3), µg/m³	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
Benzene (C_6H_6), µg/m³	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
Benzo(a)Pyrene (BaP) Particulate phase only, ng/m³	Annual *	01	01	-Solvent extraction followed byHPLC/GC analysis
Arsenic (As), ng/m³	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni), ng/m³	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

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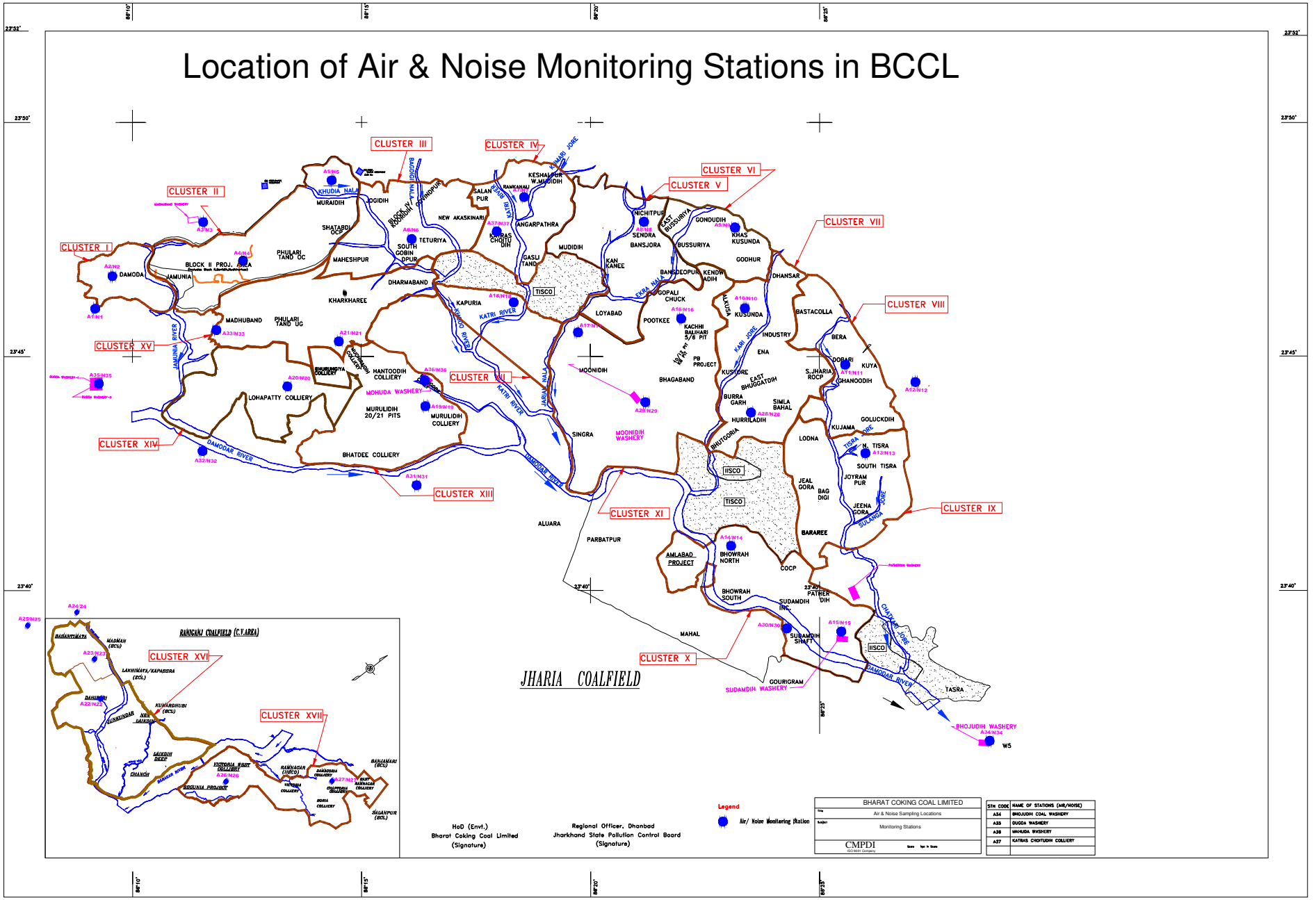

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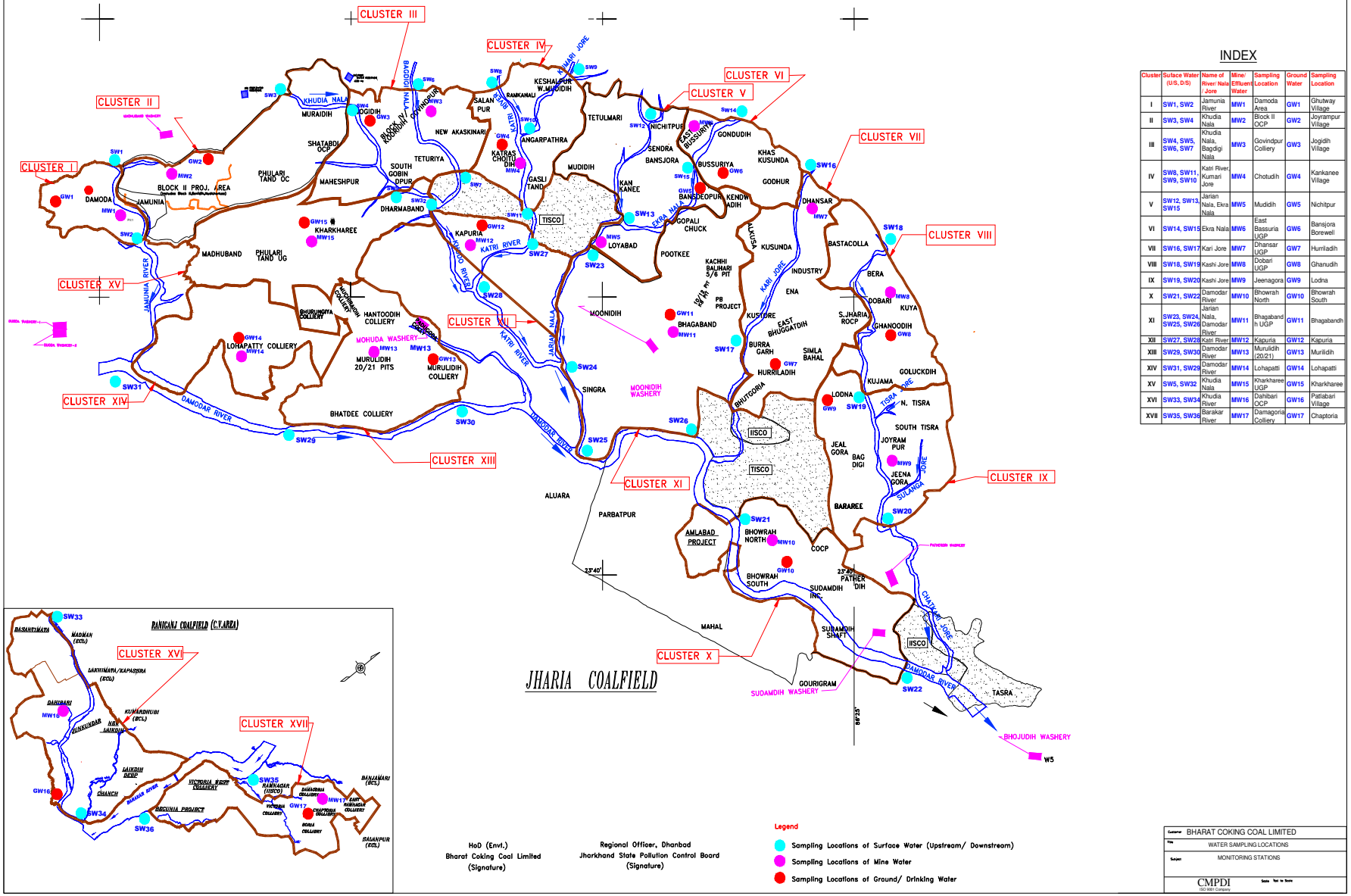

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Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ghutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogidih Village
IV	SW8, SW11, SW9, SW10	Katri River, Kumari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhansar UGP	GW7	Hurriladih
VIII	SW18, SW19	Kashi Jore	MW8	Dobari UGP	GW8	Ghanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband h UGP	GW11	Bhagabandh
XII	SW27, SW28	Katri River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Murulidih (20/21)	GW13	Murilidih
XIV	SW31, SW29	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudia Nala	MW15	Kharkharee UGP	GW15	Kharkharee
XVI	SW33, SW34	Khudia River	MW16	Dahibari OCP	GW16	Patlabari Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptoria

HoD (Envt.)
Bharat Coking Coal Limited
(Signature)

Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)

Legend
- Sampling Locations of Surface Water (Upstream/ Downstream)
- Sampling Locations of Mine Water
- Sampling Locations of Ground/ Drinking Water

Customer: BHARAT COKING COAL LIMITED
Title: WATER SAMPLING LOCATIONS
Subject: MONITORING STATIONS
CMPDI
ISO 9001 Company
Scale: Not to Scale

ENVIRONMENTAL MONITORING REPORT OF BHARAT COKING COAL LIMITED, CLUSTER – XV

(FOR THE MONTH DECEMBER, 2017)

E. C. no. J-11015/100/2011-IA.II (M) dated 16.12.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the fauna and flora. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

2.2 Water sampling stations

The Water sampling stations were selected for mine discharge water.

2.3 Noise level monitoring locations

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM_{10}), Fine Particulate Matter ($PM_{2.5}$), Sulphur Di-oxide (SO_2) and Nitrogen Oxides (NO_X). Respirable Dust Samplers (RDS) were used for

sampling of $PM_{10,}$ SO_2, & NO_X and Fine Dust Sampler ($PM_{2.5}$ sampler) were used for sampling of $PM_{2.5}$ at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.2 Water quality

Water samples were collected as per standard practice. The Mine effluent samples were collected and analyzed for four parameters on fortnightly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory of CMPDI RI- II, Dhanbad.

3.3 Noise level monitoring

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB(A).

4.0 Results and interpretations

4.1 Air quality

It has been seen from the analysis results that the 24 hours average concentration parameters like $PM_{10,}$ $PM_{2.5}$, SO_2 and NO_X are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM_{10}& $PM_{2.5}$ exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

4.2 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, are within permissible limits.

4.3 Noise Level

During the noise level survey it has been observed that the noise level in the sampling locations is within the permissible limits prescribed as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines for Industrial Area and Noise pollution (Regulation and Control) Rules, 2000.

INTRODUCTION

Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

The very purpose of environmental monitoring is to assess the quality of various attributes which affects the environment. As per quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster-XV is in the Western part of the Jharia coalfield. It includes a group of 4 Mines (viz. Kharkharee, Madhuband, Phularitand&Dharmaband). The Cluster – XV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XV are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia Nala.

1.2 The Cluster-XV is designed to produce 0.325 MTPA (normative) and 0.423 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.325 MTPA (normative) and 0.423 MTPA (peak) capacity of coal production vide letter no. J-11015/100/2011-IA.II (M) dated 16th December, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that " Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, SO_2, NOx monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board." And other conditions regarding water / effluent and noise level monitoring.

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MOEF&CC & SPCB and other statutory authorities.

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AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Kharkharee CISF Office (A21): Industrial Area

The location of the sampling station is 23°48.249'N 086°14.717'E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

ii) **Madhuband UGP Office (A33): Industrial Area**

The location of the sampling station is 23°45'24.48'' N 086°11'59.44''E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

II. BUFFER ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is 23°47'21.717'' N 086°13'37.75''E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

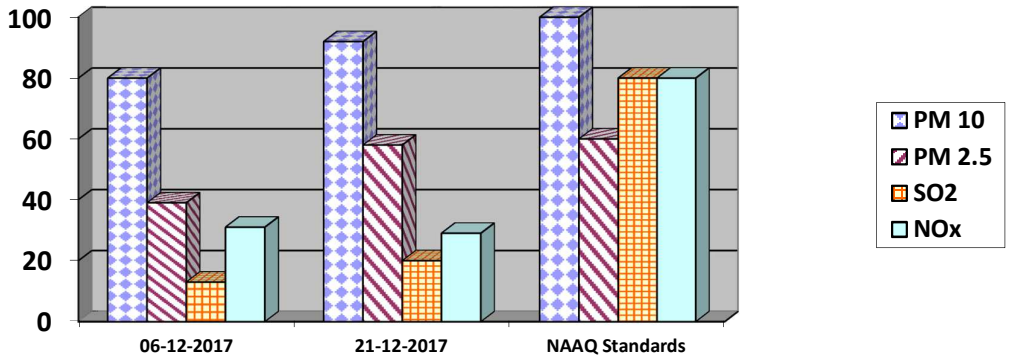
ii) Lohapatti (A20): Industrial Area

The location of the sampling station is 23°44'18.93'' N & 086°13'37.75''E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

AMBIENT AIR QUALITY DATA

Cluster – XV,Bharat Coking Coal limited Month: December **2017** Year : **2017-18.**

Station Name: A21 Kharkharee		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	06-12-2017	80	39	13	31
2	21-12-2017	92	58	20	29
	NAAQ Standards	100	60	80	80



Trace Metal analysis report of Ambient Air Quality

Parameters	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)
Concentration(µg/m³)	<0.005	<0.001	<0.01	<0.001	<0.1	<0.005

Note:

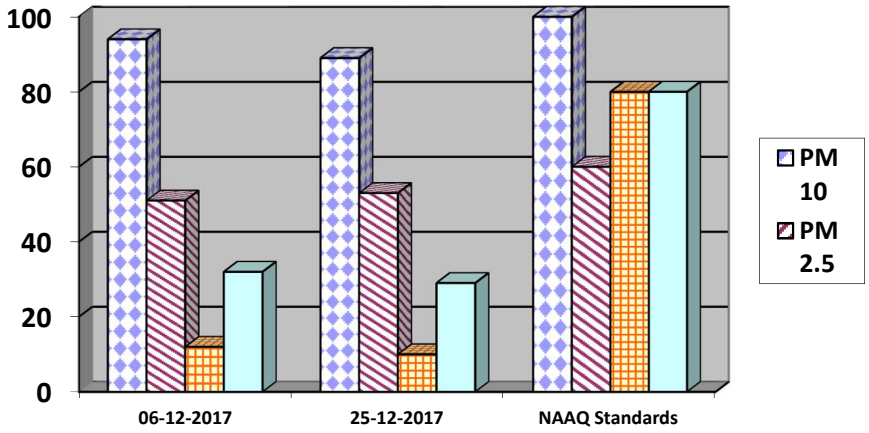
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Station Name: A33 Madhuband UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	06-12-2017	94	51	12	32
2	25-12-2017	89	53	10	29
	NAAQ Standards	100	60	80	80



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Parameters	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)
Concentration(µg/m³)	<0.005	<0.001	<0.01	<0.001	<0.1	<0.005

Note:

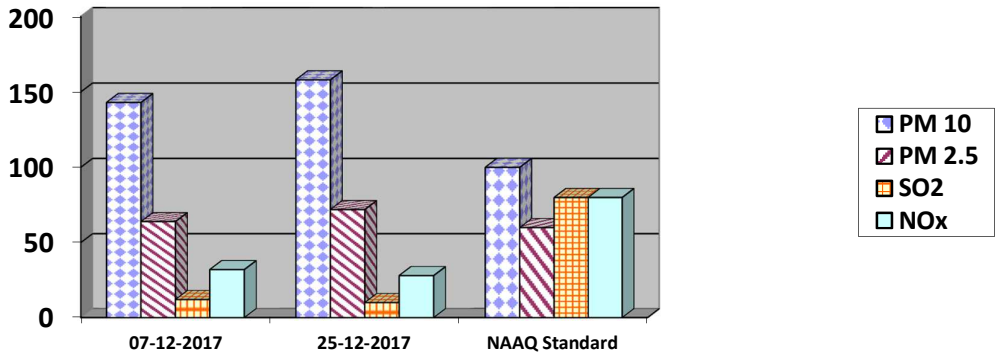
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Station Name: A6, Block IV		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	07-12-2017	143	64	12	32
2	25-12-2017	158	72	10	28
	NAAQ Standard	100	60	80	80



Trace Metal analysis report of Ambient Air Quality

Parameters	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)
Concentration($\mu g/m^3$)	<0.005	<0.001	<0.01	<0.001	<0.1	<0.005

Note:

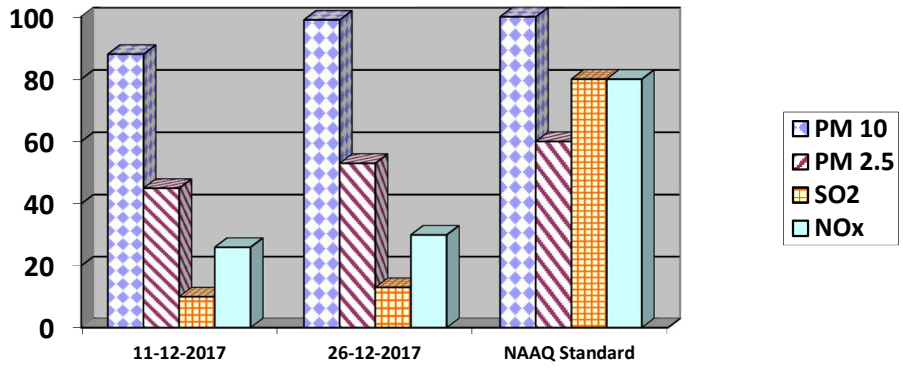
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	11-12-2017	88	45	10	26
2	26-12-2017	99	53	13	30
	NAAQ Standard	100	60	80	80



Trace Metal analysis report of Ambient Air Quality

Parameters	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)
Concentration(µg/m^3)	<0.005	<0.001	<0.01	<0.001	<0.1	<0.005

Note:

- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Kharkharee UGP (MW15)**

A sampling point is fixed to assess the effluent quality of Mine discharge.

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. The effluent samples were collected and analysed for four parameters on fortnightly basis at the Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -XV**		Month: **DECEMBER, 2017**	Name of the Station: **Mine Discharge of Kharkharee UGP**	
Sl. No.	**Parameters**	**MW15** First Fortnight	**MW15** Second Fortnight	**As per MOEF General Standards for schedule VI**
		06.12.2017	21.12.2017	
1	Total Suspended Solids	28	20	*100 (Max)*
2	pH	8.22	8.02	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	36	28	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Kharkharee CISF Office (N21)**
ii) **Madhuband UGP Office (N33)**
iii) **Block IV Kooridih OCP (N6)**
iv) **Lohapatti (N20)**

4.2 Methodology of sampling and analysis

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEFCC. The results of Noise levels recorded during day time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L_{EQ} are presented**.** The observed values at all the monitoring locations are found to be within permissible limits.

NOISE LEVEL DATA

Name of the Project : **Cluster -XV**			Month: **DECEMBER, 2017**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Lohapatti	**Industrial area**	11-12-2017	63.6	*75*
2	Lohapatti	**Industrial area**	26-12-2017	59.2	*75*
3	Kharkharee	**Industrial area**	06-12-2017	62.1	*75*
4	Kharkharee	**Industrial area**	21-12-2017	60.3	*75*
5	Madhuband UGP	**Industrial area**	06-12-2017	61.8	*75*
6	Madhuband UGP	**Industrial area**	25-12-2017	62.6	*75*
7	Block-IV	**Industrial area**	07-12-2017	58.6	*75*
8	Block-IV	**Industrial area**	25-12-2017	59.8	*75*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.
*** Day Time: 6.00 AM to 10.00 PM,**

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Ambient Air Quality Standards for Jharia Coal Field
As per the Environment (Protection) Amendment Rules, 2000 notified vide notification G.S.R. 742(E), dated 25.9.2000.

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
III Coal mines located in the coal fields of • Jharia • Raniganj • Bokaro	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 µg/m^3 700 µg/m^3	- High Volume Sampling (Average flow rate not less than 1.1
	Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average * 24 hours **	250 µg/m^3 300 µg/m^3	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide (SO_2)	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as NO_2	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1. Jacob &Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemilumine-scence

Note:

* Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause2.

** 24hourly/8hourlyvaluesshallbemet92%ofthetimeinayear.However,8% of the time it may exceed but not on two consecutivedays.

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in supersession of the notification No(s).S.O.384(E), dated 11th April 1994 and S.O.935(E), dated 14th October 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect.

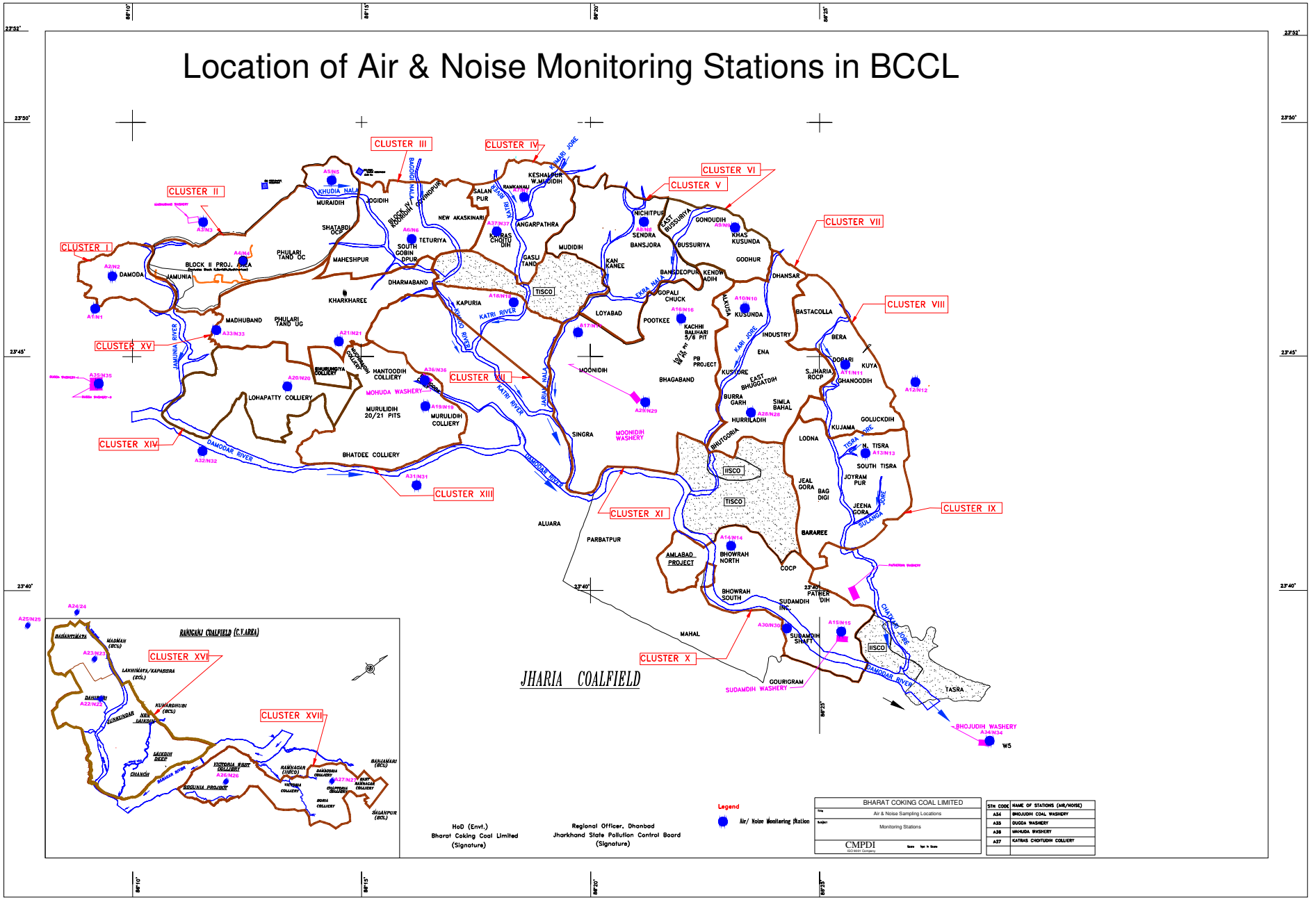
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
Nitrogendioxide (NO_2), µg/m³	Annual * 24 Hours **	40 80	30 80	-Jacob &Hochheiser modified (NaOH-$NaAsO_2$) Method -Gas Phase Chemiluminescence
Particulate Matter (Size less than 10µm) or PM_{10}, µg/m³	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
Particulate Matter (Size less than 2.5µm) or $PM_{2.5}$, µg/m³	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
Ozone (O_3) , µg/m³	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
Lead (Pb) , µg/m³	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
Carbon Monoxide (CO), mg/m³	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
Ammonia (NH_3), µg/m³	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
Benzene (C_6H_6), µg/m³	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
Benzo(a)Pyrene (BaP) Particulate phase only, ng/m³	Annual *	01	01	-Solvent extraction followed byHPLC/GC analysis
Arsenic (As), ng/m³	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni), ng/m³	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

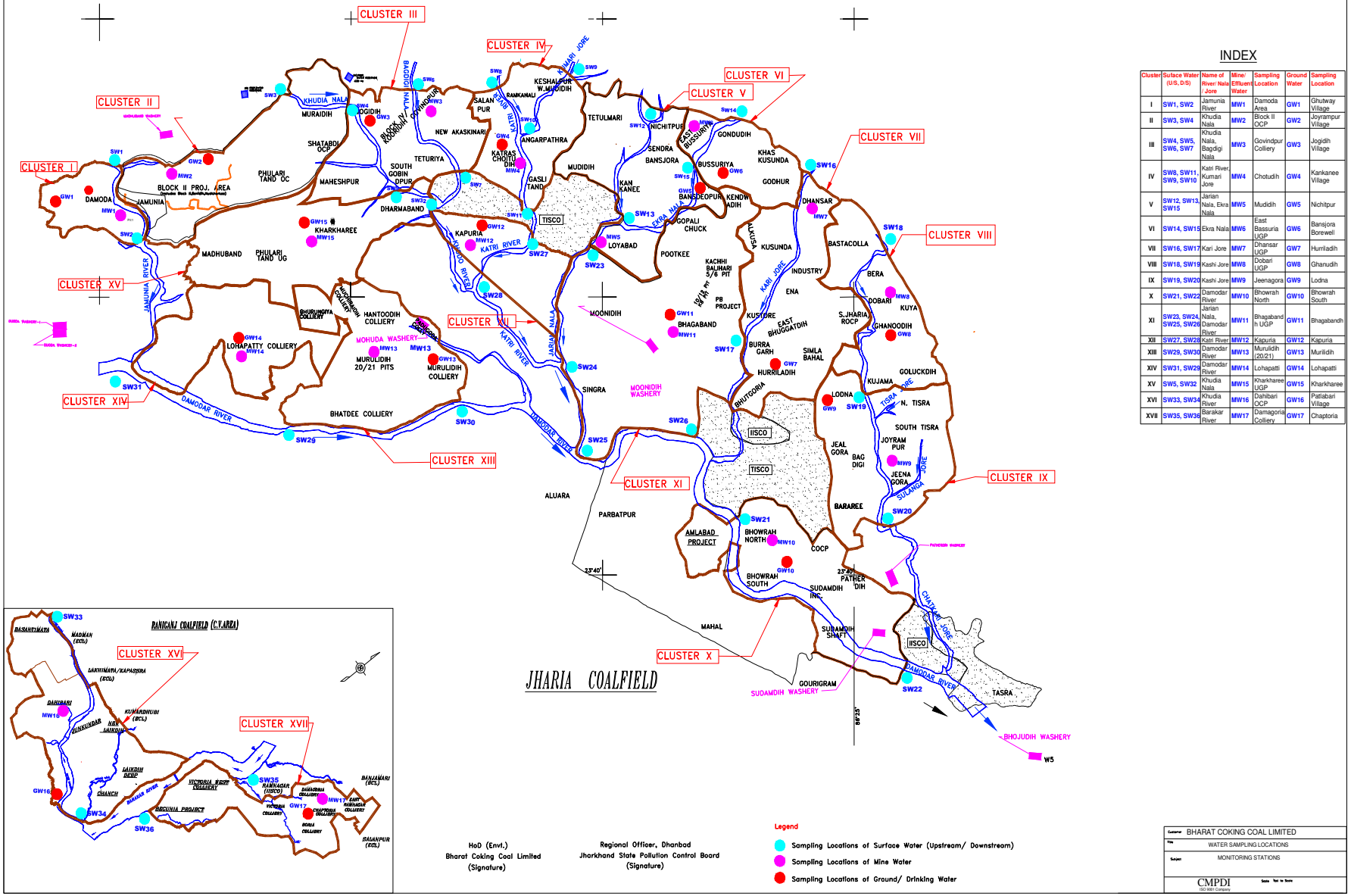
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

NOTE: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigations.

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ghutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogidih Village
IV	SW8, SW11, SW9, SW10	Katri River, Kumari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhansar UGP	GW7	Hurriladih
VIII	SW18, SW19	Kashi Jore	MW8	Dobari UGP	GW8	Ghanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband h UGP	GW11	Bhagabandh
XII	SW27, SW28	Katri River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Murulidih (20/21)	GW13	Murilidih
XIV	SW31, SW29	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudia Nala	MW15	Kharkharee UGP	GW15	Kharkharee
XVI	SW33, SW34	Khudia River	MW16	Dahibari OCP	GW16	Patlabari Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptoria

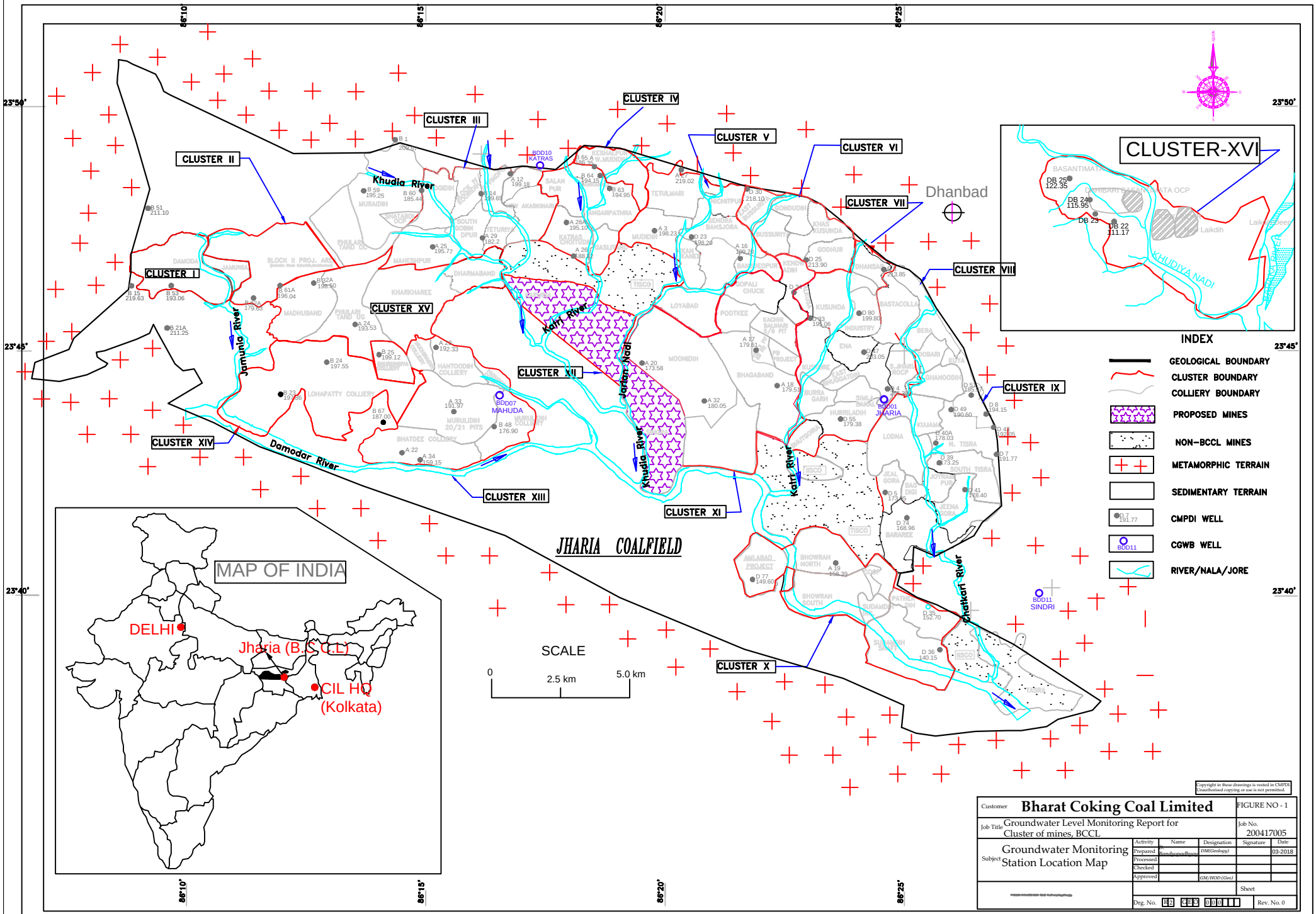
HoD (Envt.)
Bharat Coking Coal Limited
(Signature)

Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)

Legend
- Sampling Locations of Surface Water (Upstream/ Downstream)
- Sampling Locations of Mine Water
- Sampling Locations of Ground/ Drinking Water

Customer: BHARAT COKING COAL LIMITED
Title: WATER SAMPLING LOCATIONS
Subject: MONITORING STATIONS
CMPDI
ISO 9001 Company
Scale: Not to Scale

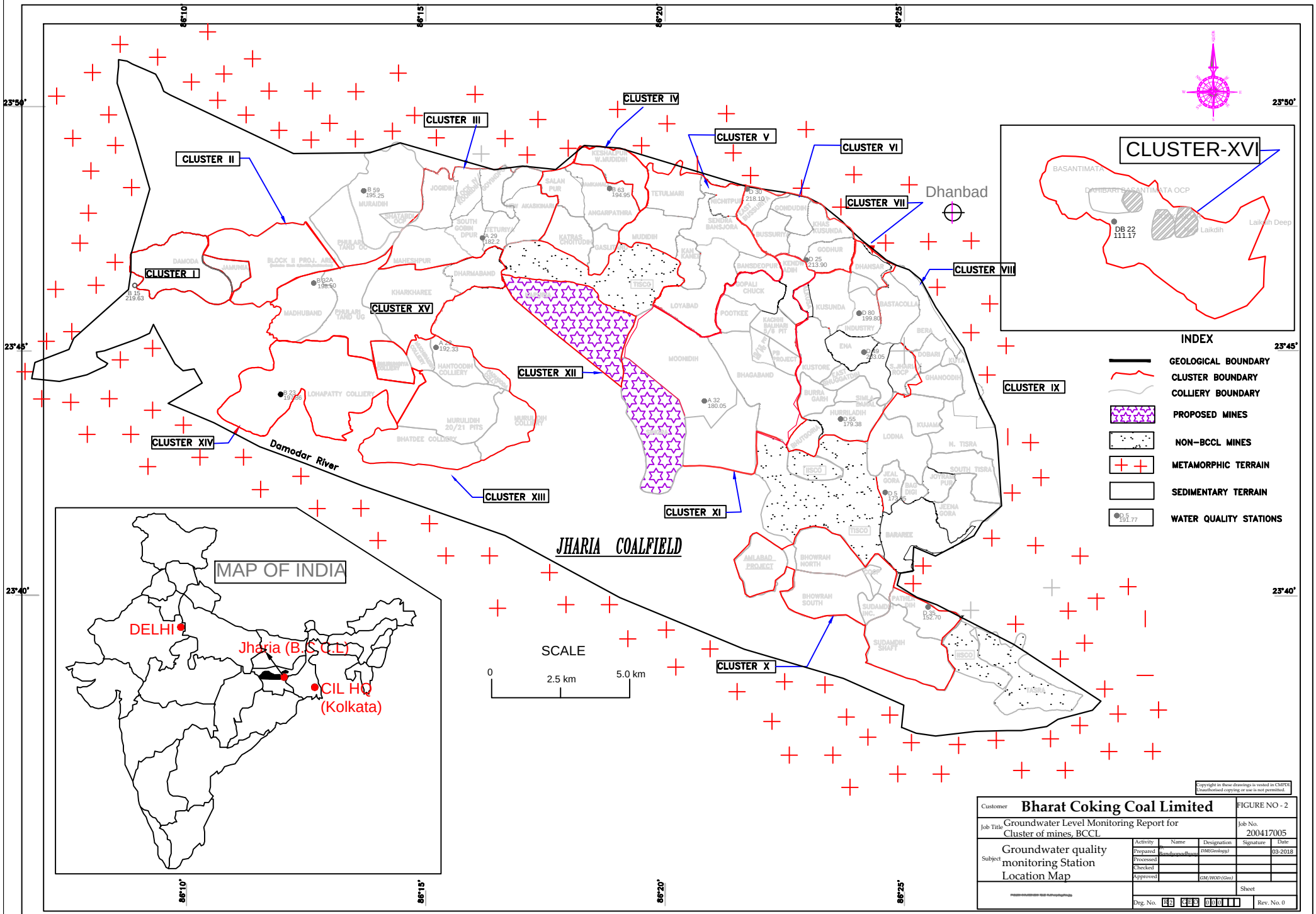
GROUNDWATER MONITORING STATION LOCATION MAP



Customer	**Bharat Coking Coal Limited**	FIGURE NO - 1
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL	Job No. 200417005
Subject	Groundwater Monitoring Station Location Map	Sheet
Drg. No.	HQ CES 000	Rev. No. 0

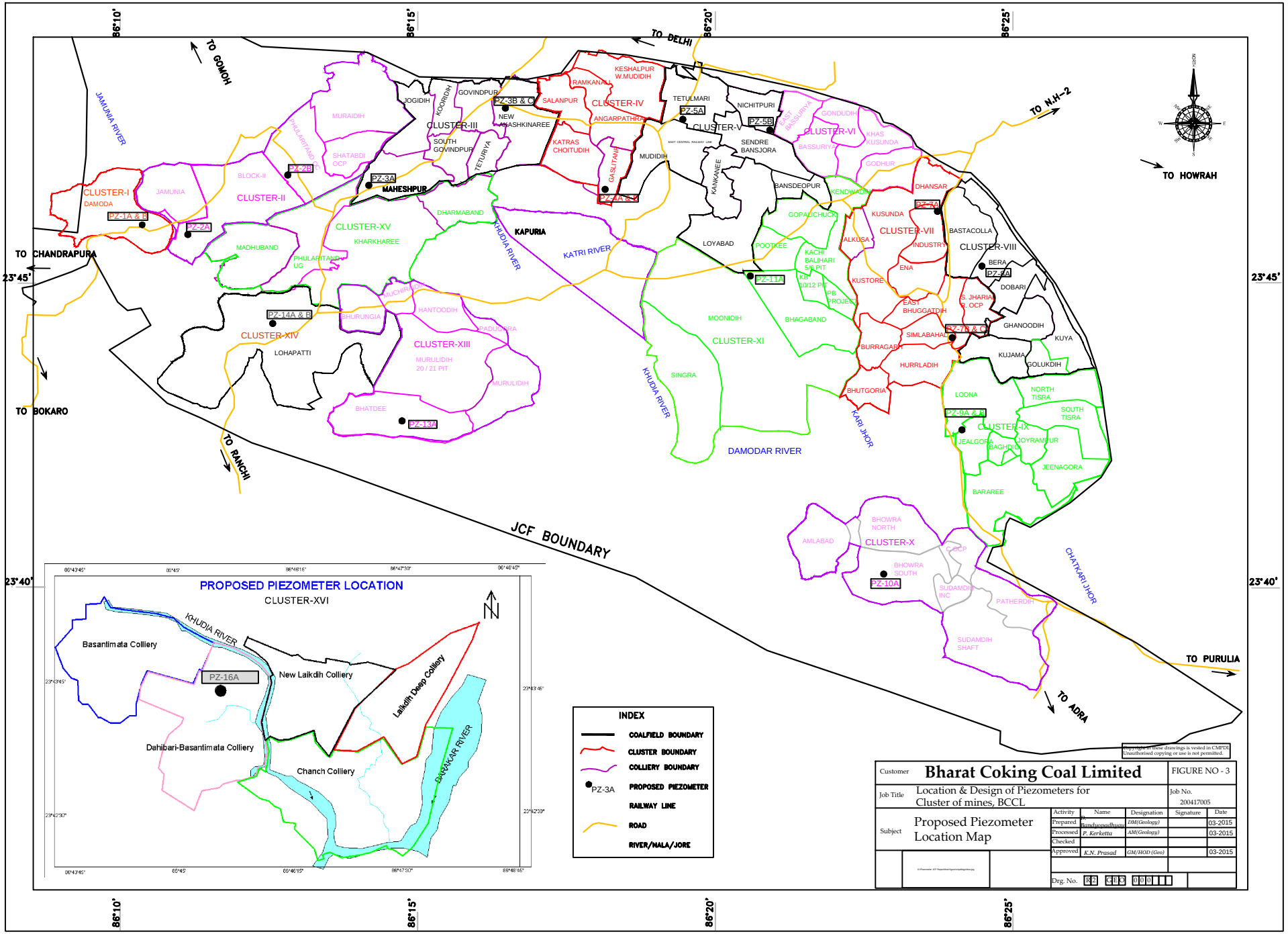
Activity	Name	Designation	Signature	Date
Prepared	Bandyopadhyay	DM(Geology)		03-2018
Processed				
Checked				
Approved		GM/HOD (Geo)		

GROUNDWATER QUALITY MONITORING STATION LOCATION MAP



Customer	**Bharat Coking Coal Limited**					FIGURE NO - 2
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL					Job No. 200417005
Subject	Groundwater quality monitoring Station Location Map	Activity	Name	Designation	Signature	Date
		Prepared	Bandyopadhyay	DM(Geology)		03-2018
		Processed				
		Checked				
		Approved		GM/HOD (Geo)		
						Sheet
		Drg. No.	WC	CBS	000	Rev. No. 0

PROPOSED PIEZOMETER LOCATION MAP, JCF & RCF (part)



CSR Booklet

Barora Area

Bharat Coking Coal Limited

Contents

1.0 INTRODUCTION

Coal India has adopted CSR as a strategic tool for sustainable growth. For Coal India in the present context, CSR means not only investment of funds for Social Activity but also Integration of Business processes with Social processes. Even much before the issue of CSR became global concern; 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 Kms. of the Project sites. This has resulted into a harmonious relationship between Coal India and the peripheral Communities. Coal India has identified land outsee, PAP and those staying within the radius of 25 Kms of the Project as primary beneficiaries. Poor and needy section of the society living in different parts of India is second beneficiaries. For carrying out CSR activities, 80% of the budgeted amount are be spent within the radius of 25 Km of the Project Site/Mines/Area HQ/Company HQ and 20% of the budget to be spent within the States in which operating.

2.0 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 able 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, agro-forestry, 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.

3.0 SOURCE OF FUND

The fund for the CSR should be allocated based on 2% of the average net profit of the Company for the three immediate preceding financial years or Rs. 2.00 per tonne of Coal Production of previous year whichever is higher.

4.0 ACTION PLAN FOR CORPORATE SOCIAL RESPONSIBILITY

When the EC was granted, it was estimated as per prevailing policy, 5% of the retained earnings of the previous year subject to minimum of Rs. 5 per tonne of coal production of the previous year will be provided for Corporate Social Responsibility (CSR).

5.0 STATUS OF CSR ACTIVITIES

5.1 Medical Camps:

(A) During FY 2014-15:

SN	Month	No. of Medical Camp	Beneficiaries	Amount (in Rs.)
1	April 14	24	538	6074.02
2	May 14	15	555	6265.95
3	June 14	17	423	4775.67
4	July 14	11	300	3387.00
5	August 14	13	422	4764.38
6	September 14	19	630	7112.70
7	October 14	14	415	4685.35
8	November 14	15	350	3951.50
9	December 14	15	413	4662.77
10	January 15	10	257	2921.52
11	February 15	17	517	5836.93
12	March 15	11	324	3657.96
	Total	**181**	**5144**	**58095.75**

(B)During FY 2015-16:

SN	Month	No. of Medical Camp	Beneficiaries	Amount (in Rs.)
1	April 15	12	325	3669.25
2	May 15	12	289	3262.81
3	June 15	13	335	3782.15
4	July 15	14	452	5103.08
5	August 15	12	348	3928.92
6	September 15	9	265	2991.85
7	October 15	9	360	4064.40
8	November 15	9	305	3443.45
9	December 15	6	148	1670.92
10	January 16	12	291	3285.39
11	February 16	11	229	2585.41
12	March 16	2	50	564.50
	Total	**121**	**3397**	**38352.13**

(C) **During FY 2016-17:**

SN	Month	Beneficiaries	Amount (in Rs.)
1	May 16	243	13463.00
2	Nov 16	352	16857.00
	Total	**595**	**30320.00**

(D) **During FY 2017-18: NIL**

5.2 Health Awareness Programme:

(A) **During 2014-15:**

SN	Date	Activities	Amount (in Rs.)
1	25.04.2014	Nasa Mukti Abhiyan	10000.00
2	06.06.2014	Blood Pressure Detection	5000.00
4	30.07.2014	Aids Awareness Programme	5000.00
5	20.11.2014	Eye Checkup camp	25000.00

5.3 CSR Clinics :

SN	Month	Beneficiaries 2014-15	Beneficiaries 2015-16	Beneficiaries 2016-17	Beneficiaries 2017-18
1	April	121	115	307	113
2	May	112	101	70	98
3	June	137	152	164	115
4	July	153	132	260	161
5	August	101	120	149	127
6	September	531	109	139	169
7	October	83	86	139	99
8	November	85	87	241	66
9	December	73	80	207	99
10	January	67	80	99	73
11	February	102	158	55	77
12	March	95	81	65	96
	Total	**1660**	**1301**	**1895**	**1293**

5.4 Civil work under CSR:

(A) **During 2014-15:**

S. N.	Details	Award value (In Lac)	Remarks
1	Construction of PCC road at Gonduadih west under Mohanpur village (from Khalil Mahto home to Primary school).	3.98	25.01.2015 to 24.03.2015 (60 days)
2	Construction of Janaja shed at Ramakunda west under Amtand village	3.15	15.10.2014 to 14.12.2014 (60 days)
3	Construction of 1 no. chhathh ghat at Muraidih colony, Hirak road river side	3.01	15.10.2014 to 14.12.2014 (60 days)
4	Construction of Janaja shed at Muraidih colony near river of Hirak road	0.46	31.03.2014 to 29.04.2014 (30 days)
	PCC Road jhunu Rajwar House to Tarkeswar Gope House at Bakaspura Village Luti Pahari (Jhunu Tarkeshwar)Road Length:-	2.30	This is benefiting to approx. 200 families in this locality by all-weather connectivity.
	Making PCC Path from Manoj Matha House to Sahabuddin Ansari house at Ghunghusa Village (Mahato Shahbhuddin)	1.85	This is benefiting to approx. 300 families in this locality by all-weather connectivity
	Steps for Ghat at sarbandh near hirak chowk under B-II Area	2.67	This will ease in performing rituals by local villages of Dumara ,harina & Bada pandeydih.
	Cutting of earth from pond at Chaudhary bandh at Harina Basti,under B-II Area	19.22	This is benefiting to approx 5000 persons in this locality. This pond is used for multipurpose like irrigation,water for households drinking water for animals etc.it will also maintain the water leval in locality.
	Drinking Water pipe line works in hadi basti at Bhamkanali.	0.44	This is benefiting to approx. 150 families in this locality
	Rep/Maint of Hand pump at Bara pandeydih (08 Nos).	0.26	This is benefiting to approx. 500 persons in this locality
	Development work at rehabilitation site at Bhimkanali.	6.45	This is benefiting to approx. 500 persons in this locality
	Construction of community hall at Bara Pandeydih Village Under Block-II Area	11.9	This is benefiting to approx. 1000 persons in this locality
	Surplus mine water supply from Xth seam & Madhuban quarrey of B-II Area Khonathi Pond	400	This is a multipurpose project to provide water for irrigation & other agricultural use along with maintaining water availability throughout the year along with developing a tourist destination in long run.

(B) **During 2015-16:**

S.N.	Details	Award value (In Lac)	Remarks
1	Rep. Of Main road & Drain at Bakashpura rehabilitation site.	9.71	This is benefiting to approx. 1500 persons in this locality
2	Engagement of tankers for drinking water supply in nearby villages of B-II Area	1.9	This is benefiting to approx. 2000 families in Viallages like Benidih Baghmara, Luttipahadi, Harina, Kessurgarh, Rathtand, Nudkhurkee,Pinalgarhia,Mandra.
3	Engagement of departmental tankers for drinking water supply in nearby villages of B-II Area as on need bais.	-	This is benefiting to approx. 2000 families in Viallages like Benidih Baghmara, Luttipahadi Kessurgarh, Madhuban Etc.

(B) **During 2016-17:**

S.N.	Details	Award value (In Lac)	Remarks
1	Construction and maintenance for 5 years of toilets in Government schools in Gumla District under Swachh Vidyalaya Abhiyan. 125 toilets in 69 schools were constructed.	191.67	This is benefiting to approx. 7500 students
2	Construction and maintenance for 5 years of toilets in Government schools in Bokaro District under Swachh Vidyalaya Abhiyan. 179 toilets in 181 schools were constructed.	1702.98	This is benefiting to approx. 10000 students

6.0 COAL TRANSPORTATION PLAN:

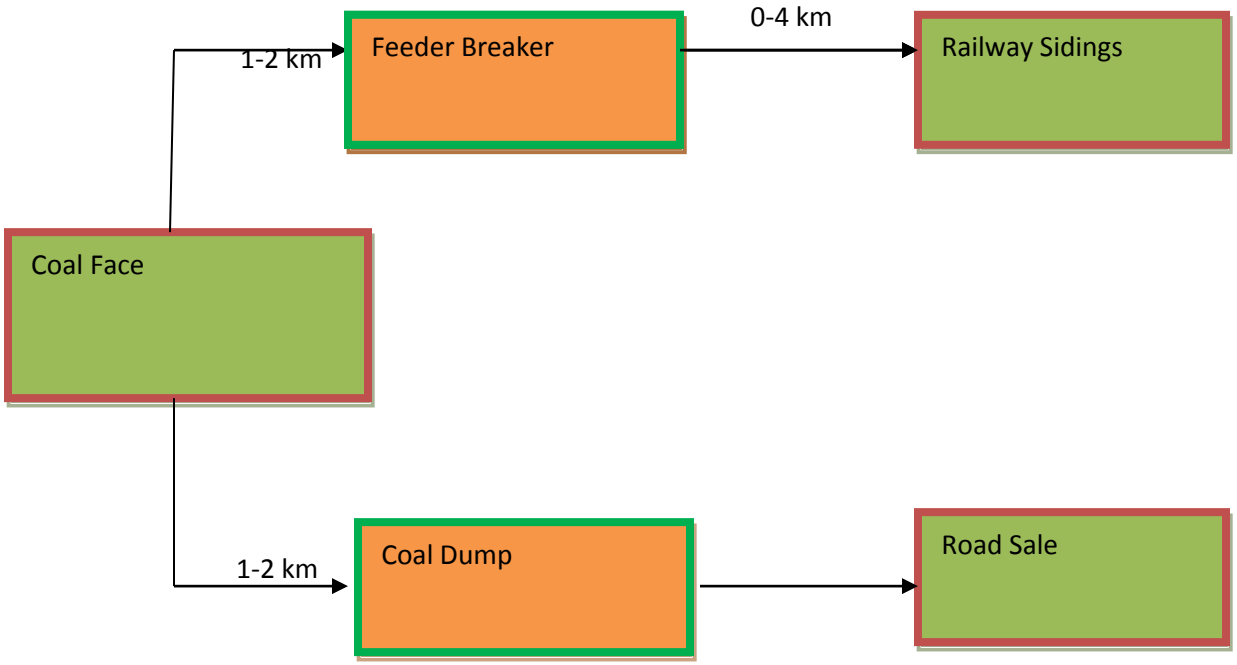


Fig: Coal transportation route

7.0 REHABILITATION AND RESETTLEMENT PLAN:

REHABILITATION AND RESETTLEMENT POLICY OF COAL INDIA LTD 2012.

Preamble

The location and quality of coal reserves, and their distance from major consumers determines to a great extent the selection of mine sites. For reserves that are close to the surface, opencast mining has proven to be the most efficient mining method. Opencast mines require relatively large areas of land. Population growth, particularly in India's eastern region, has made it increasingly difficult for the subsidiary coal companies to acquire the land they need for expanding their operations under the present Resettlement and Rehabilitation policy,2008 of Coal India.

The resettlement and rehabilitation policies followed by the subsidiary companies have evolved over time and undergone numerous changes in response to changing circumstances. As and when the Central or State Governments enact amendments to the Land Acquisition Act, issue new guidelines for resettlement and rehabilitation, as per its requirement Coal India reviews and modifies its resettlement and rehabilitation policy taking into account the changing conditions in coal producing areas.

In addition to compensation for land coal companies provide Rehabilitation and Resettlement (R&R) package for project affected persons to compensate for loss of livelihood. Apart from compensation for house site, house, trees, cow shed, cost of shifting etc., employment is also provided to land oustees. In addition to this, efforts are made to rehabilitate them by construction of houses, building roads, streets, schools, providing water etc. wherever feasible . However, demand for both more land compensation and better R&R package has been raised by project affected persons and has been highlighted in various Parliamentary Committees. Coal Companies often have to face representations and agitations by these land oustees who obstruct the smooth working of existing mines and come in the way of expansion of new projects.

In the past, subsidiaries found it relatively easy to acquire land, if they were able to offer employment. Partly because of this practice, subsidiaries have built up a largely unskilled labour force beyond their needs. This has contributed to the heavy losses and many mines are incurring and has also affected their efficiency and viability. The subsidiaries may still need to hire people in selected locations and continue to give preference to those whose livelihood will be affected by coal mining operations. However, increasingly subsidiaries will need to develop other ways and means to compensate land owners and others adversely affected by their projects and give them the option to choose which method of compensation best suits their needs. Greater emphasis will also need to be given to community requirements like schools, hospitals etc. Only proper resettlement and rehabilitation will elicit the required cooperation of project affected people, and make it possible for Coal India to acquire the land it needs to fulfill the ever increasing demand of coal for the economic development of the Country.

- 1 -

The purpose of the Resettlement and Rehabilitation Policy 2012 is to revise and provide greater flexibility to the basic principles for the resettlement and rehabilitation of people affected by coal mining projects i.e. Project Affect People (PAPs). It attempts to consolidate the different resettlement and rehabilitation practices that are being followed by subsidiaries as per the different State land Acquisition Acts and various decisions of the Coal India Board and to modify the Policy of 2008 so as to give the Board of the subsidiary Companies greater flexibility to deal more effectively with resettlement and rehabilitation issues and determine the rehabilitation packages best suited to local needs in line with this policy. The provisions of the National Rehabilitation and Resettlement Policy, 2007 and the Land Acquisition, Rehabilitation & Resettlement Bill, 2011 have also been kept in mind while framing the policy.

While Coal India's basic philosophy for compensating land-losers and other project-affected people remains substantially unchanged, the revised policy emphasizes the need to cultivate and maintain good relationships with the people affected by Coal India's projects starting as early as possible; it also underscores that the subsidiaries have a responsibility towards the land oustees whose livelihood is often taken away. On the other hand, subsidiaries need to protect themselves more effectively against unjustified claims, redundant manpower and swelling Wage Bills. To this end, the statement proposes that subsidiaries prepare detailed resettlement and rehabilitation action plans (RAPs) that clearly identify, at an early stage, the entitlements of the people affected by coal projects and enables them to exercise a choice between various options. The concept of Annuity in lieu of compensation/employment is also being introduced to mitigate, if not eliminate the ever dependence of Project Affected Families (PAFs) on CIL for provision of employment.

(1) The revised Resettlement & Rehabilitation Policy, 2012 is based on the deliberations of the inter Ministerial Committee set up vide O.M. 490191/2011-PRIW-I dated 01-07-2011 of Ministry of Coal , deliberations of the CMDs meet held on 05/03/2012 at New Delhi and has been approved by the CIL Board in its 279th meeting held on 12th.and 13th March, 2012.

(2) Objectives and general principles of Coal India's Resettlement and Rehabilitation Policy- 2012

A. To re-visit CIL's existing R&R policy 2008 and evolve a PAP friendly policy by incorporating such provisions of the National Policy and The Draft Land Acquisition, Rehabilitation and Resettlement Bill-2011 as considered suitable in light of the growing difficulties many subsidiaries face in land acquisition.

B. To accord the highest priority for avoiding or minimizing disturbance of the local population while taking decisions to open new mines or expand existing ones too (exploring alternative sites and project designs) and to ensure that wherever people are likely to be adversely affected by a project, the subsidiaries will prepare resettlement and rehabilitation action plans for the project.

C. To ensure a humane, participatory, informed consultative and transparent process for land acquisition for coal mining and allied activities with the least disturbance to the owners of the land and other affected families.

D. To provide just and fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and make

adequate provisions for loss of livelihood of such affected persons including their rehabilitation and resettlement.

E. To ensure that the cumulative outcome of compulsory acquisition should be that the affected persons become partners in development leading to an improvement in their post acquisition social and economic status and matters connected therewith or incidental thereto.

F. Through the preparation of resettlement and rehabilitation action plans, subsidiaries will safeguard that project-affected people improve or at least regain their former standard of living and earning capacity after a reasonable transition period. The transition period is to be kept to a minimum. However, the involvement of subsidiaries in resettlement and rehabilitation activities may continue until all the actions specified in the rehabilitation plan have been completed.

G. Involuntary resettlement is conceived and executed as a development programme with project-affected people being provided sufficient resources and opportunities to share in a project's benefits. The efforts of subsidiaries are complementary to the Government's schemes in rural development and the concurrence, approvals and support from concerned Government authorities will be sought.

H. In parallel, subsidiaries will work closely with non-governmental organizations of proven repute which are legally constituted and recognized and also have the confidence of the project-affected people, in the preparation and implementation of rehabilitation plans.

I. Corporate Social Responsibility (CSR) : Activities shall be intensified in and around the villages where land is being acquired in accordance with the CSR Policy of Coal India.

J. Actual implementation of R&R package must follow a detailed survey of the project-affected villages to formulate the list of persons/families affected by the project, nature of the affect, the likely loss of income, etc. For this purpose, if necessary, the services of a reputed NGO with an impressive record of integrity and performance may be engaged.

3. SCOPE:

This Policy may be called "Rehabilitation and Resettlement Policy of Coal India Limited-2012". It extends to the Coal India Limited and its subsidiary companies in India. It shall come into force from the date of its approval by the CIL Board and is applicable to all cases in which land is taken after the date of approval by the CIL Board. While implementing the policy it is to be ensured that the provisions of the concerned Acts applicable and Rules mentioned there under shall not be violated .

4. Definitions

(a) "affected family" means:

(i) a family whose primary place of residence or other property or source of livelihood is adversely affected by the acquisition of land (including direct negotiation) for a project or involuntary displacement for any other reason; or

(ii) any tenure holder, tenant, lessee or owner of other property, who on account of acquisition of land (including plot in the *abadi* or other property) in the affected area or other wise, has been involuntarily displaced from such land or other property; or

(iii) any agricultural or non-agricultural labourer, landless person (not having homestead land, agricultural land, or either homestead or agricultural land), rural artisan, small trader or self-employed person, who has been residing or engaged in any trade, business, occupation or vocation continuously for a period of not less than three years preceding the date of declaration of the affected area, and who has been deprived of earning his livelihood or alienated wholly or substantially from the main source of his trade, business, occupation or vocation because of the acquisition of land in the affected area or being involuntarily displaced for any other reason.

(b) "***family***" includes a person, his/her spouse, son including minor sons, dependant daughters, minor brothers, unmarried sisters, father, mother residing with him or her and dependent on him/her for their livelihood; and includes "***nuclear family***" consisting of a person, his/her spouse and minor children. Provided that where there are no male dependants, the benefit due to a land loser may devolve on dependent daughter nominated by the land loser.

(c) "land owner" includes any person—

(i) whose name is recorded as the owner of the land or part thereof, in the records of the concerned authority; or

(ii) who is entitled to be granted Patta rights on the land under any law of the State including assigned lands; or

(iii) who has been declared as such by an order of the court or District Collector;

(d) Displaced person - means and includes any person who is deprived of his homestead on account of acquisition. Provided that the person/family who does not ordinarily reside in the homestead land acquired for the project can be termed "Displaced" but he will be eligible for compensation only for homestead and not for livelihood.

(e) Ordinarily resides" shall mean residing in the homestead / acquired land for a period more than 6 months every year for at least the preceding 5 years.

5. Socio-economic Survey and preparation of RAP.

A baseline socioeconomic survey will be carried out to identify the PAPs who are enlisted to receive benefits in line with Coal India's Resettlement and Rehabilitation Policy. This survey will be conducted within two months of notification under the relevant land acquisition Acts by the subsidiaries with the help of reputed independent institutional agencies, who are well versed with the social matrix of the area.

The basic objective of the socio-economic study will be to generate baseline data on the social and economic status of the population who are likely to lose their means of livelihood or homestead due to the acquisition of the land for the project. The data base will be used to formulate a viable and practical Rehabilitation Action Plan (RAP) for the affected persons in line with their entitlements. Digital Satellite Maps would also be prepared of the project Area freezing the dwelling units and habitations existing at the time of negotiation for Land Acquisition wherever feasible .The RAP will also address the following-

(A) Implementation, Monitoring and Evaluation, Dispute Mechanism

The rehabilitation action plan will address the following:

i) The project design, including an analysis of alternative designs aimed at avoiding or minimizing resettlement;
ii) Socio-economic survey and activities to ensure restoration of incomes of PAPs in line with Coal India's Resettlement and Rehabilitation Policy;
iii) Description of the institutional and other mechanisms for provision of entitlements;
iv) Time table for the acquisition and preparation of the resettlement site(s);
v) The cost and budgets for the resettlement and rehabilitation of PAFs;
vi) Project-specific arrangements to deal with grievances of PAFs; and
vii) Time tables, benchmarks and arrangements for monitoring the resettlement and rehabilitation effort.

The RAP will be formulated in consultation with PAPs and State government.

(B). Environment Impact Assessment (EIA) will be conducted as per any law, rule and regulation of the locality in which the land has been acquired.

6. Eligibility Criteria -

(A) Eligibility Criteria for Economic Rehabilitation Benefits

This benefit shall accrue only to Entitled Project Affected Person. Entitled Project Affected Person shall be one from the following categories.

(i) Persons from whom land is acquired including tribals cultivating land under traditional rights.
(ii) Persons whose homestead is acquired.
(iii) ,Sharecroppers, land lessees , tenants & day labourers.
(iv) Tribal dependent on forest produce as certified by the District Forest Officer/Revenue Authorities.

(B) Eligibility Criteria for Resettlement Benefits

1 . Only a 'Displaced' family / person shall be eligible for resettlement benefits.

2. A family/person shall be termed 'displaced' and hence eligible for resettlement benefits if such family/person has been a permanent resident and ordinarily residing in the project area on the date of publication of notification U/S 9 of CBA(A&D) 1957 / U/S 11 of LA Act, 1894/ Or both/ on the date of the land vested with the State/ Central government as the case may be.

and

(a) on account of acquisition of his/her homestead land / structure is displaced from such areas

or

(b) He/she is a homesteadless or landless family/person who has been/is required to be displaced.

7 .Census & Identification of displaced families:

1. Within two months of publication of notice U/S 4(1) of the Land Acquisition Act or U/S 7(1) of CBA (A.D) Act 1957 for acquisition of land for the project a census would be undertaken in the manner to be decided by the Collector / project authority for identification of displaced families and for preparing their socio-economic profile and list of eligible persons for the purpose of receiving Rehabilitation & Resettlement Benefits.

2. A photo identity card to each Entitled Project Affected Person shall be issued under the signature of the Collector / project authority concerned indicating the following particulars:

(a) Name of the village/GP/PS :
(b) Name, Father's name and address of the head of the family :
(c)Category of entitlement :
(d)Whether S.C./S.T./O.B.C./General :
(e)Age,Sex,educational qualification of the members of the family :

8. Types of Compensation and Rehabilitation Entitlement

Option to the land losers regarding Rehabilitation & Resettlement Benefit - The land losers shall have the option for Rehabilitation and Resettlement benefits in accordance with the awards for each affected family in terms of the entitlements passed by the Concerned Collector of the State or as per this Policy with the consent of the concerned Collector.

8.1 Eligibility and Compensation

The table below shows the compensation and rehabilitation benefits will be offered by the subsidiaries for each Project Affected Person or family, affected by one of their projects. Evidence to the effect that a person is a legitimate PAP will need to be provided in the form of a written legal document, or reference to a record, such as a revenue officer certificate, electoral roll, ration card or school record.

Category of Persons affected by the Project	***Compensation and Rehabilitation entitlement option***
	Provisions
(i) Persons (including tribals cultivating land under traditional rights) from whom land is acquired.	All land owners with titles will receive monetary compensation for the land acquired from them. The value of the land is determined on the basis of prevailing legal norms. *In respect of tribals cultivating land under traditional rights, authentication of land held under traditional rights by state authorities will be necessary.* In addition to above the following shall apply.

Category of Persons affected by the Project	*Compensation and Rehabilitation entitlement option*
	Provisions
	A). Land Compensation - Land compensation shall be paid as per the provisions of the concerned Act or State Govt. notification. Where no notification of the State Govt. is available the concerned subsidiary Board may decide on the rate of compensation keeping in view the compensation provided by the neighboring states. Authentication of land held under traditional rights by state authorities will be necessary. In addition to above Solatium will be paid as per provisions of the concerned Act / as imposed by the Concerned State Govt. Escalation of land compensation – Escalation will be paid as per provisions of the concerned Act / as imposed by the Concerned State Govt. or Escalation at the rate of 12% per anum for a maximum period of three years. **(B): Employment provision:** Apart from payment of the land compensation, employment may be given in the following manner – **1)** The maximum total number of employments that may by provided to the land losers would be limited to the total no. of acres of land acquired divided by two. However employments will be released in proportion to the land possessed . **2)** For every two acres of land one employment can be considered; 3) Subsidiaries of CIL may give an option to the Land losers having less than two acres of land to club together their land to the extent of two acres and nominate one of the land losers among the groups or their dependent for employment under package deal or employment under Descending order system by preparing the list of eligible land oustees in the descending order of land lost subject to the cut off equivalent to the total number of permissible employments or any other method with the approval of the respective Board of the subsidiary. **4)** The land loser must be a domiciled resident/Mool Niwasi and the certificate to this effect shall be issued by the concerned State Authority **5)** The modalities for offering employment shall be such as may be approved by the Board of the Subsidiary companies as per the unique conditions of the subsidiary provided that - **a)** The initial employment shall be given with pay of Category-I pay scale of NCWA, with training period of 6 months. b) In the seniority list, the seniority of the appointee should be reflected in appropriate manner in order to keep the senior most as senior. **c)** The land loser trainees shall be posted as per requirement, including underground duties.

Category of Persons affected by the Project	*Compensation and Rehabilitation entitlement option*
	Provisions
	(C): Lumpsum Monetary Compensation – 1. All the land losers who are not eligible for employment as above shall be entitled to receive monetary compensation in lieu of employment at the rate of Rs.5,00,000/- (Five Lakhs) for each acre of land on pro-rata basis . 2. Land losers who are offered employment as per principle specified in point No (8.(i)B) above will have the option either to opt for employment or to forego employment and opt for monetary compensation at the rate of Rs.5,00,000/- (Five lakhs) for each acre of land on pro-rata basis with minimum of Rs. 50,000 (Fifty thousands) provided that the employment thus surrendered shall not be available for offer to any other person and will stand lapsed from the total sanctioned number of employments as specified in point No.(8.(i)B1). 3. The Land losers who have clubbed their land in Package Deal can claim employment for only one land loser of the clubbed two acres of land and remaining land losers of the package cannot claim either employment or lump sum monetary compensation in lieu of the land contributed by them. 4. Annuity – All land losers who are entitled to get lump sum monetary compensation may opt for payment of compensation amount in the form of annuity made payable to the land losers monthly, annually or at such intervals (not less than one year) as may be opted for by him. The annuity be paid for a maximum period extending to 60 years of age or the life of the project for which the land has been acquired, whichever is earlier. **Note:** *A person receiving a job forgoes all claims to above compensation and a person receiving above compensation forgoes all claims to employment.*
(ii) Person whose homestead is acquired	I. Compensation for homestead shall be paid as per the standard valuation method of the L.A Act. of the concerned State Govt. II. One time lump sum payment of Rs.3,00,000/- (three lakhs),shall be paid in lieu of alternate House site, Assistance in designing Shifting Allowance,compensation for construction of cattle shed , Monetary compensation for construction of work shed etc.The compensation shall be paid to displaced persons only after vacation and demolition of the homestead/ work shed etc. III. Subsistence allowance :Each affected displaced family will get subsistence allowance at the rate of 25 days (Minimum Agricultural Wage) per month for one year.

Category of Persons affected by the Project	*Compensation and Rehabilitation entitlement option*
	Provisions
(iii)Sharecroppers, land lessees, tenants and day labourers	The subsidiary will assist PAP to take-up non farm self employment through petty contracts or formation of cooperatives. If such co-operatives will not be entitled for awarding work as per Manual for lack of experience, the said co-operative will be facilitated by awarding small jobs to acquire experience after relaxation of the provisions of the Manual pertaining to experience with approval of the Subsidiary Boards. Subsequent jobs may be awarded after getting report of the timely completion / quality / of the awarded jobs from the concerned Department or contractors. Contractors will also be persuaded to give job to eligible PAPs on a preferential basis, where feasible as per terms of contract.
(iv)Landless tribals, Tribal dependent on forest produce	The subsidiary will assist PAP to establish non farm self employment through the provision of infrastructure, petty contracts or formation of cooperatives and encourage provisions of Jobs with contractors. Contractors will be persuaded to give jobs to eligible PAPs on preferential basis, where feasible. - In addition, the subsidiaries will shift the tribal community as a unit and provide facilities to meet the specific needs of the tribal community that will allow them to maintain their unique cultural identity. - Tribal affected family will be given one time financial assistance of 500 days of MAW for loss of customary right or usages of forest produce. Loss of customary rights needs to be authenticated by the district authority. - Tribal affected families resettled out of the district shall be given 25% higher rehabilitation and resettlement benefit.

9. Resettlement & Rehabilitation Committee - A Committee will be constituted at project Level under the chairmanship of the Collector to be called the Rehabilitation and Resettlement Committee with the following objectives to monitor and review the progress of implementation of the Rehabilitation and Resettlement scheme and to carry out post-implementation social audits in consultation with the village panchayat in rural areas and municipality in urban areas in the manner will be decided by the concerned State Govt.

I. To approve the list of land losers and other PAPs;
II. To approve the list of persons eligible to be offered employment as per R&R Policy;
III. To approve the detailed Rehabilitation Plan for the project in consultation with the displaced persons and Gram Sabhas;
IV. To expedite issue of domicile certificates and other necessary documentation required for State Authorities;
V. To monitor and review the progress of the Rehabilitation Scheme, grant of benefits and handing over of possession of land in a smooth manner;
VI. To facilitate the land acquisition process in any other manner as may be required including resolution of disputes;
VII. To carry out post implementation social audit in consultation with the authorities.

10. Community facilities - The subsidiary will provide at the resettlement site a school, road with street light, pucca drain, pond, dugwell and/or tubewell for drinking water supply, community center, place of worship, dispensary, grazing land for cattle and play ground. Similar infrastructural facility, if necessary, will be extended to the host locality. The community facilities and services would be available to all residents of the area, including PAPs and the host population.

The approach for operation of community facilities would be flexible and all efforts will be made to involve the State and local self Government / Panchayat for operating the facilities. To achieve this, subsidiaries will pursue with these agencies to ensure the same. The planning of the community facilities and their construction should be undertaken in consultation with the affected community.

11. Corporate Social Responsibilities - This should be as per Company's Corporate Social Responsibility (CSR) Policy.

12. Monitoring and Evaluation Mechanism.

The RAP will be monitored and evaluated periodically after the completion of the land acquisition process.

I. The resettlement and rehabilitation activities are the responsibility of a separate group, both at the projects and corporate level, which will be constituted for planning, implementation, monitoring and evaluation of the Rehabilitation Action Plan. At the corporate level the group will be headed by a senior manager, whereas at the project, an executive of the rank of manager will head the group. The project group should have at least one member with social science qualification / experience and skills.

II. The project group will closely interact with the state authorities during the implementation of the RAP. Although the subsidiaries will develop the plots and infrastructural facilities in the resettlement colony and actively implement the RAP, assistance of State authorities will be taken for administrative services such as allotment of land. Implementation will be planned, monitored and corrective measures will be incorporated in the RAP, if needed. In addition to the State Government, the PAPs, the village leaders including the Pradhans and NGOs will be consulted and associated with the implementation of the RAP.

III. The Resettlement and Rehabilitation Cell at the corporate level will evaluate the implementation of the RAP after its completion.

13. Flexibility to the Subsidiary Companies – The Subsidiary Companies Boards have been authorised to approve necessary modifications in the R&R Policy with reference to unique conditions prevailing at the concerned Subsidiaries as the policy is not exhaustive.

(The above list is only indicative and not exhaustive)