भारत कोकिंग कोल लिमिटेड
एक मिनी रत्न कम्पनी
(महारत्न कम्पनी कोल इंडिया का एक उपक्रम)
पंजीकृत कार्यालय : कोयला भवन, कोयला नगर,
धनबाद–826005
सीआइएन : U10101JH1972GOI000918
महाप्रबंधक का कार्यालय
पश्चिमी झरिया क्षेत्र
पो. मुनीडीह, जिला: धनबाद (झारखण्ड)-828129
फोन नं. 0326 2273483, फैक्स: 0326 2273445, ई-मेल: cgmwj@bccl.gov.in

Bharat Coking Coal Limited
A Mini Ratna Company
(A Subsidiary of Coal India Limited: A Maharatna Company)
Regd. Off. : Koyla Bhawan, Koyla Nagar
Dhanbad - 826005
CIN : U10101JH1972GOI000918
OFFICE OF THE GENERAL MANAGER
WESTERN JHARIA AREA
PO: MOONIDIH, DISTT: DHANBAD (JHARKHAND) - 828129
PHONE NO: 0326 2273483, FAX NO: 0326 2273445, e-mail : cgmwj@bccl.gov.in

Ref: - WJA/MND/ENV/2020/ 1189

Date: - 29/05/2020

To,
The Director,
Ministry of Environment & Forest and Climate Change
Regional Office (ECZ), Bungalow No. A-2,
Shyamali Colony, Ranchi – 834002

Sub: - Submission of six monthly reports on implementation of Environment measures for the period From October'19 to March'20 in respect Cluster-XI group of mines of BCCL.

Ref: EC Order No – **J-11015/77/2011-IA. II(M) Dated: - 26.08.2013**

Dear Sir,

Please find enclosed herewith the six-monthly reports on implementation of Environment protection measures for the period from October'19 to March'20 in respect of **Cluster XI** group of mines of BCCL. We hope you wil find in order.

Thanking you,

Encl: - As Above

Yours faithfully
29-5-2020
Genral Manager
WJ Area, Moonidih

C C to:-

1. The Director, 1A Monitoring Cell, Paryavaran Bhawan, CGO Complex, New Delhi – 110003.
2. The Member Secretary , Jharkhand State Polluction Control Board, TA- Division Building , Dhurwa – Ranchi – 834004
3. HoD (Env.), BCCL, Koyla Bhawan Dhanbad
4. A.G.M., P.B.Area
5. Project Officer, Moonidih Colliery
6. Project Officer , Moonidih Washery
7. Nodal Officer (Env.), WJ Area

"Copy for uploading online on "parivesh portal" of MoEF&CC and send by e-mail"

ENVIRONMENTAL CLEARANCE COMPLIANCE OF CLUSTER-XI (GRANTED VIDE EC No. J-11015/77/2011-IA. II M Dated 26.08.2013)

(*From* October '2019 *to* March'2020)

Sl. No	A. Specific Conditions by MOEF:	Compliance
i.	**No mining shall be undertaken in/under the forestland until prior forestry clearance has been obtained under the provisions of FC Act 1980.**	Application for forest clearance has been submitted online for Moonidih mine with reference number FP/JH/MIN/9699/2015 in feb'2019, it is presently under process. At present there is no mining activity undertaken in/under the forestland.
ii.	**You will need to seek and obtain approval under the FC Act for diversion of the entire forest land located within the mining lease within a period of two years from 1.2.2013 i.e. date of issue of FC Division's guidelines vide no. 11-362/2012-FC, failing which the mining lease area will be reduced to the non-forest area plus the forest area for which you have been able to obtain the FC at the end of this time period. In the case of reduction in mine lease area, you will need to get a revised mining plan approved from the Competent Authority for reduced area and enter into a new mining lease as per reduced lease area. The EC will be construed to be available for the mining lease area as per the revised mining lease deed.**	Amendment in EC is granted for 1982.90 Ha. Leasehold area of Moonidih UG mine on 26th July 2019 for Cluster XI group of mines.
iii.	**The maximum production in the cluster shall not exceed beyond that for which environmental clearance has been granted for the cluster XI.**	**It is being complied.** The production from the cluster is within the limit for which environmental clearance has been granted. Washery is operating within the permissible limit of 1.6 MTPA. Enclosed as **ANNEXURE I.**
iv.	**The open cast quarries of the abandoned mines should be backfilled to the ground level and restored with native species.**	Shall be complied. Presently it is not applicable.
v.	**All coal from smaller UG mines should be transported by high capacity and mechanically covered trucks/ tippers.**	**Complied.** Various mechanically covered trucks Manufacturers for the transportation of Coal and OB in India have been contacted and things are under process. At present coal transportation has been done by trucks with tarpaulin cover. Covering of truck has been made mandatory in the transportation contract.
vi.	**Green belts shall be developed on both sides of the roads.**	**Complied.** Time to time plantation is done either departmental or with the help of forest department Dhanbad.
vii.	**Action plan for quenching of fires and rehabilitation along with the details of master plan be submitted to the MoEF for monitoring purpose.**	**Complied.** Master Plan is already uploaded on BCCL website and under implementation.

viii.	**Presently coal to Moonidih washery from other mines of the cluster is taking place through NH.** **An alternate route for coal transportation may be explored.**	Coal from P.B. Area is direct feed coal and hence washing is not required. Presently coal from Moonidih mine transported to Moonidih washery through conveyor belt.
ix.	**For understanding the composition of emissions from coal mine fires, BCCL may**	Agreed.
x.	**Initiate action as proposed in the visit report of the EAC to Dhanbad.**	Action as proposed in the visit report of EAC has initiated.
xi.	**The approved mining plan be submitted to the MoEF.**	Revised Mining plan along with Mine closure plan of Moonidih colliery of cluster XI was approved by the Board empowered sub-committee meeting of BCCL held on 29.01.2019.
xii.	**The measure to identify in the Environmental Plan for Cluster- XI groups of mine and the conditions given in this environmental clearance letter shall be dovetailed to the implementation of the Jharia Action Plan.**	Environmental plan for Custer XI group of mines and the condition given on the environment clearance has been dovetailed with Jharia Action Plan.
xiii.	**The proponent shall prepare time -series maps of the Jharia Coalfields through NRSC 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 II 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 NRSC. Measures would be taken to prevent ingress of air (ventilation) in such areas, which may re-start fresh fires.**	**It has been complied.** NRSC was engaged for preparation of time series maps to monitor and prevent fire problems of Jharia Coalfield by Isothermal mapping/imaging and monitoring temperatures of the coal seams and NRSC has submitted their final report in January 2018 in which the area of fire has been reduced from 9.00 Km^2 to 3.28 km^2. NRSC report is enclosed as **ANNEXURE II.**
xiv.	**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.
xv.	**No mining shall be undertaken where underground fires continue. Measure shall be taken to prevent/check such fire including in old OB dump areas where the fire could start due to presence of coal/shale with sufficient carbon content.**	It is being complied
xvi.	**Mining shall be carried out as per statuette from the streams/nalas flowing within the lease and maintaining a safe distance from the**	Complied as per statute.

	Nalas flowing along the lease boundary. A safety barrier of a minimum 60m width shall be maintained along the nalas/water bodies.	
xvii.	**Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. A total area of 254.67 ha shall be reclaimed and afforested.**	In FY 2019-20, Compensatory Afforestation of 3200 gabion plantation was done with the help of Forest Department. Reclamation work on 12 Ha OB dump has been started with the help of Forest Department. A proposal for compensatory afforestation of 32760 trees is under process.
xviii	**Details of transportation, CSR, R&R and implementation of environmental action plan for the clusters-XI should be brought out in a booklet form within a year and regularly updated.**	Complied. Enclosed as **Annexure III**
xix.	**Specific mitigative measures identified for the Jharia Coalfields in the Environmental Action Plan prepared for Dhanbad as a critically polluted area and relevant for Cluster XI shall be implemented.**	**It is being complied** in the name of Dhanbad Action Plan. It has been prepared in consultation with Jharkhand Pollution Control Board for entire BCCL and not on cluster basis. It is being implemented comprehensively for all the mines of BCCL. Some of the salient actions of this cluster are as under: **Enclosed as Annexure IV**
xx.	**The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board. The Committee stated that smoke/dust emission 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.**	**It is being complied.** Establishment of ambient environment quality monitoring stations has been finalized with the consultation of Jharkhand State Pollution Control Board. **Enclosed as Annexure V** Work Order for Source Apportionment Study has been issued to NEERI Nagpur on 12.05.2018. And work has been started in September 2018. Field data collection for Summer season has been done and winter data collection is in process. Final Report will be submitted once data collection is completed.
xxi.	**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 road-rail transport system. In phase-II, BCCL shall implement conveyor-cum-rail transport to avoid movement of trucks within the cluster**	Action has been taken for conveyor-cum-rail transport system. Meanwhile transportation is being done by covering vehicle with tarpaulin cover. **Enclosed as Annexure VI**

	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 of suitably designed off-take points shall be provided.	
xxii.	**16944 nos of PAFs should be rehabilitated at cost of Rs 53776.60 Lakhs as per the approved Jharia Action Plan.**	Implementation of master plan has already been started through Jharia Rehabilitation and Development Authority (JRDA), Dhanbad
xxiii	**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 is being complied and will be implemented as the case may be. Regular subsidence monitoring is done at underground mines.
xxiv	**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. Being implemented as per statute.
xxv.	**Subsidence shall be monitored closely and if subsidence is found exceeding the permitted limits, then the landowners shall be adequately compensated with mutual agreement with the landowners.**	It is being complied.
xxvi.	**3-tier plantation should be developed 2 km stretch of road from the mine using native species.**	**It is being complied.** Plantation is being done on roadside in non-coal bearing areas and colonies.
xxvii.	**Water sprinkling system shall be provided to check fugitive emissions from loading operations, conveyor system, haulage roads, transfer points, etc. Major approach roads shall be black topped and properly maintained.**	It is being complied in respect of all mines of P.B. Area. Mobile water tankers are used for spraying water. Sprinkler arrangement provided in respect of Moonidih washery and Moonidih mine. Water sprinkler are provided at Moonidih Underground at transfer and coal cutting points to reduce coal dust.
xxviii	**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/Agriculture Department.**	**It is being complied.** 1. 1380 plants were planted near algaria site till March 2016 2. 2000 plants are planted between April and September 2016 3. 4000 saplings have been Planted from April'17 to March'18 4. 5000 saplings are planted from April'18 to till date. 5. 500 Sapling are planted from April'19 to till date in Moonidih.

xxix.	**Acid Water Treatment Plant, volume of water to be treated and disposal of brine should be provided.**	Agreed Presently there is no acid water mines of Cluster-XI.
xxx.	**Mine discharge water outside the ML shall be monitored, particularly for TDS and treated to conform to prescribed levels before discharge into the natural environment.**	**It is being complied.** Being Monitored. Moonidih washery is operating under closed water circuit system. Pilot scale Mine Water Treatment Plant is also installed in P.B. Area to convert mine water into drinking water. 2 nos. of pressure filter are installed in Moonidih mine to supply clean water.
xxxi.	**The Company shall put up artificial groundwater recharge measures for augmentation of groundwater resource, in case 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 mine.**	**It is being complied.** Mine water is being used for the industrial as well as domestic non drinking purpose. Mine water is also utilized for the community and irrigation purposes.
xxxii.	**Besides carrying out regular periodic health checkup of their workers, 10% of the workers identified from workforce engaged in active mining operations shall be subjected to health checkup for occupational diseases and hearing impairment, if any, through an agency such as NIOH, Ahmadabad within a period of one year and the results reported to this Ministry and to DGMS.**	**It is being complied.** Draft report submitted by NIOH has been scrutinized by Medical department, BCCL. NIOH have been requested to arrange a final closure presentation at BCCL and to submit the final report as well. NIOH also done an Awareness workshop occupational disease. Enclosed as Annexure VII
xxxiii.	**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.**	Complied
xxxiv.	**Sufficient coal pillars shall be left un extracted around the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.**	Complied. Already implemented in case of Moonidih Mine. Complied in respect of all mines of P.B.Area.
xxxv.	**High root density tree species shall be selected and planted over areas likely to be affected by subsidence.**	Plantation in BCCL is being done on 3-tier basis, in which both, Monocotyledonae (Monocots) such as grasses, bamboo etc and Dicotyledonae (Dicots) such as sheesham, mango etc are being planted for developing an extensive root system. The Monocots having fibrous root system. The Monocots having fibrous root system helps in developing roots density at the topsoil level while, Diocots having the tap root system have a distributed root density topsoil, subsoil and regolith layer of soil. These two root system together forms the high root density system.
xxxvi.	**Depression due to subsidence resulting in water accumulating within the low lying areas shall be filled up or drained out by cutting drains.**	Being Complied.
xxxvii.	**Solid barriers shall be left below the roads falling within the blocks to avoid any damage**	Being Complied.

	to the roads.	
xxxviii.	**The CSR Action Plan shall consist of need-based CSR Action Plan, CSR Auditing and monitoring mechanism etc. The proponent will spend 5 % of the retained earnings of the previous year subject to a minimum of Rs. 5/- per ton of coal production which should be adjusted as per the annual inflation The progress made thereon shall be uploaded on the company annually on the company website. Monitoring of the impacts of activities under CSR shall be carried out periodically.**	**Complied.** CSR work is handled at Headquarter level and every area is assigned work. CSR work carried out in FY 2019-20 (October'19 till March'20) is enclosed as **Annexure – III**
xxxix.	**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.**	It is being Complied.
xl.	**Central recreation park with herbal garden should be developed for use of all inhabitants.**	Sneh-Smriti Upvan is constructed at P.B. Area Office and Near Moonidih Guesthouse 200 fruit bearing saplings have been planted.
xli.	**The mine water should be treated properly before supply to the villager.**	**It is being complied.** An action plan for the utilization and treatment of surplus Mine Water has been prepared by Environment, Civil and CSR department conjointly. In this regard, 26 Mines have been identified for the implementation of scheme in the Phase-I. A pilot scale mine water treatment plant in collaboration with CSIR, CIMFR is installed at P.B. Area office to convert mine water into drinking water.
xlii	**Mine discharge water shall be treated to meet standards prescribed standards before discharge into natural water courses /agriculture. The quality of the water discharged shall be monitored at the outlet points and proper records maintained thereof and uploaded regularly on the company website.**	**It is being complied.** Mine discharge water is being allowed to settle down in the mine sumps before passing through sedimentation tank. The monitoring of water quality parameters is being carried out by CMPDIL.

xliii	**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.**	As working in P.B. area does not approached combined seam therefore water reservoir cannot be formed. In due course we will be able to comply this point in future
xliv	**Regular monitoring of groundwater level and quality of the study area shall be carried out by establishing a network of existing wells and construction of new piezometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for quality including Arsenic and Fluoride during the month of May. Data thus collected shall be submitted to the Ministry of Environment & Forest and to the Central Pollution Control Board/SPCB quarterly within one month of monitoring. Rainwater harvesting measures shall be undertaken in case monitoring of water table indicates a declining trend.**	**Complied.** CMPDI RI-II has prepared a report for Location and design of Piezometers. Groundwater monitoring data has been enclosed as **Annexure VIII**
xlv	**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.**	There is no CHP under P.B.Area of Cluster XI. Effluents from mine is treated before discharge.
xlvi	**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 Ranchi.**	**Complied.** Presently a time series map of vegetation cover in the Jharia Coal Field is being carried out through CMPDI, Ranchi using satellite imagery. Further CMPDI has been requested to prepare "Time series of land use maps based on satellite imagery of the core zone and buffer zone.
xlvii.	**A Final Mine Closure Plan along with details of 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;**	**It shall be complied.** It will be complied when mine life will reach its final phase. Mine Closure Plan of Moonidih Colliery is approved.

xlviii.	**A separate management structure for implementing environment policy and socio-economic issues and the capacity building required in this regard.**	Agreed
xlix.	**The raw coal, washed coal and coal wastes (rejects) shall be stacked properly at earmarked**	Agreed. Being Complied
l	**Site(s) within stockyards fitted with wind breakers/shields. Adequate measures shall be taken to ensure that the stored minerals do not catch fire.**	Being Complied
li.	**Hoppers of the coal crushing unit and washery unit shall be fitted with high efficiency bag filters and mist spray water sprinkling system shall be installed and operated effectively at all times of operation to check fugitive emissions from crushing operations, transfer points of closed belt conveyor systems and from transportation roads.**	Being Complied. Some more water sprinkler have been added nearby Hopper of Coal Crushing unit and loading points for water spraying and also mobile water tanker are used for spraying and also mobile water tanker are used for spraying water spraying water in transportation road.
lii.	**All approach roads shall be black topped and internal roads shall be concreted. The roads shall be regularly cleaned with mechanical sweepers.**	**Compliance under process.** Different agencies are contacted for mechanical sweepers. Presently cleaning of roads done manually.
liii.	**Green belt of 3 ha shall be developed all along the periphery of the site, along the areas such as the washery unit, crushing unit, and stockyard. A 3-tier avenue plantation would be developed along vacant areas, near washery, storage yards, loading points and transfer points and along internal roads and main approach roads and on the road upto the railway siding and at the siding. The road between the coal washery and the main -road shall be black topped and thick 3-tier vegetation between the washery and villages/habitations shall be developed. In addition, a 10m thick green avenue plantation in the transportation route from washery to Majhri Railway Siding (of WCL) shall be provided in consultation with and approval of WCL under CSR.**	Being Complied. There is no Majhri Railway siding (of WCL).
liv.	**Trucks engaged for mineral transportation outside the washery up to the railway siding shall be optimally loaded. The trucks shall be properly maintained and emissions shall be below notified limits. Facilities for parking of trucks carrying raw coal from the linked coalmines shall be created within the Unit.**	**Complied.** Certificate of Vehicle Fitness (Form 38) under Motor Vehicle Rules 1989 issued by DTO, Dhanbad.

lv.	**Records of quantum of coal (in TPD) and ash content of raw coal being washed, clean coal and coal rejects produced from every batch of washing shall be maintained and details thereof uploaded on the company website.**	Records of Coal fines/Slurry are Maintained and are regularly updated in the Website.
lvi.	**The washery unit shall be a zero-discharge facility and no wastewater shall be discharged from the washery into the drains/natural watercourses. Recycled water shall be used for development and maintenance of green belt and in the Plant Operations.**	There is a Zero discharge from the washery and the water are recycled for the plant operations and for the development of the Green belts, inside the Washery premises.
lvii.	**Coal fines shall be recovered from the coal slurry, washery discharge and used in power generation and records of quantum of coal fines collected and used shall be properly maintained.**	Stock of slurry is maintained, Records of Coal Fines are Maintained.
lviii.	**No additional groundwater shall be used for the Plant Operations. Any additional water requirement envisaged shall be obtained by recycle/reuse to the maximum extent and from rainwater harvesting measures.**	**Complied.**
lix.	**Heavy metal content in raw coal, and washed coal shall be analyzed once in a year and records maintained thereof.**	Agreed. Proposal has been sent to IIT(ISM), Dhanbad for analysis.
lx	**Corporate Environment Responsibility:**	**Enclosed as Annexure-IX**
a	**The Company shall have a well laid down Environment Policy approved by the Board of Directors.**	Agreed
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.**	Agreed
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.**	Agreed
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.**	Agreed
Sl. No	**B. General Conditions by MOEF:**	**Compliance**
i.	**No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.**	Complied.

ii.	**No change in the calendar plan of production for quantum of mineral coal shall be made.**	Being Followed.
iii.	**Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for PM_{10}, PM $_{2.5}$, SO_2 and NO_x monitoring.**	The fixing up of locations of monitoring stations in the Jharia Coalfields has been taken up with the Jharkhand State Pollution Control Board. **Enclosed as Annexure V** The work of monitoring of ambient environment has been done through CMPDI, Regional Institute Dhanbad having laboratory recognized under EPA Rules.
iv.	**Data on ambient air quality (PM_{10}, $PM_{2.5}$, SO_2 and NO_x) and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly submitted to the Ministry including its Regional Office at Ranchi 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.**	Complied. Monitoring for the same is done by CMPDI having own laboratory recognized under EPA Rules. **Enclosed as Annexure X**
v.	**Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc. shall be provided with ear plugs/muffs.**	Being Complied.
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.**	CMPDI Dhanbad is carrying out monitoring of environment quality work. There is arrangement for treatment of effluent discharge to prescribed standards.
vii.	**Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.**	**Complied.** Work Order had already been issued to NEERI Nagpur on 12.05.2018. And work has been started in September 2018. Field data collection is scheduled in Summer 2019.
viii.	**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, 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.**	Presently, CMPDI Dhanbad is carrying out regular monitoring of environmental quality work.
	Personnel working in dusty areas shall wear protective respiratory devices and they shall	**Being Complied.** Vocational training Centers under Separate Human Resource Development Dept. is

ix.	**also be provided with adequate training and information on safety and health aspects.**	Conducting regular training programme on these issues. Enclosed as **Annexure XI**
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 are carried out as per the Statutes and Director General of Mines Safety (DGMS) guidelines. Enclosed as **Annexure XII**
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 Department, headed by a HOD (Environment) along with a suitable qualified multidisciplinary team of executives which includes Environment, Mining, Excavation, Civil, Survey, Electrical & mechanical, Forestry disciplines executives and technicians (4 nos.) has been established in Headquarters. They are also trained in ecological restoration, sustainable development, rainwater Harvesting methods etc. At the project level, one Executive in each area has also been nominated as Project Nodal Officer (Environment) and is also entrusted with the responsibility of compliance and observance of the environmental Acts/ Laws including environment protection measures. The activities are monitored on regular basis at Area and at Headquarters levels. GM (Environment) at head quarter level, co-ordinates with all the Areas and reports to the Director (Technical) and in turn he reports to the CMD of the company. The team is multidisciplinary and very much motivated under the guidance of company's Director (Technical) and CMD. Further capacity building at both corporate and operating level is being done.
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 Ranchi.**	**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 State Pollution control Board and may also be seen at the website of the ministry of Environment & Forests at http://envfor.nic.in.**	**Complied.**

xiv.	**A copy of the environmental clearance letter shall be marked to concern Panchayat / Zila Parishad, 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.**
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 NOx (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.**
xviii.	**The Regional Office of this Ministry located at Ranchi shall monitor compliance of the stipulated conditions. The Project authorities shall extend full cooperation to the office(s) of the Regional Office by furnishing the requisite data/ information/monitoring reports.**	**Complied.**
xix.	**The Environmental statement for each financial year ending 31 March in Form –V is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MoEF by e-mail.**	**Complied.**

xx	The proponent shall abide by all the commitments and recommendations made in the EIA/EMP report so also during their presentation to the EAC.	Complied.
xxi	The proponent is required to obtain all necessary clearances/approvals that may be required before the start of the project.	Complied.
xxii	The Ministry or any other competent authority may stipulate any further condition for environmental protection.	Complied.
xxiii	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment (Protection) Act, 1986.	Complied.
xiv	The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules. The proponent shall ensure to undertake and provide for the costs incurred for taking up remedial measures in case of soil contamination, contamination of groundwater and surface water and occupational and other diseases due to the mining operations.	Complied.
xv	The Environmental Clearance is subject to the outcome of the Writ Petition filed by M/S Bharat Coking Coal Limited (BCCL) in response to the closure orders issued by the Jharkhand State Pollution Control Board which is pending in the Jharkhand High Court.	Complied.

29.5.2020

Additional General Manager
Additional General Manager
POOTKEE BALIHARI AREA
B.C.C.L. DHANBAD

29.5.20.

Project Officer
Moonidih Washery
PROJECT OFFICER
MOONIDIH COAL WASHERY

29.5.20.

Project Officer
Moonidih Colliery
PROJECT OFFICER/AGENT
MOONIDIH COLLIERY
B.C.C. LTD.

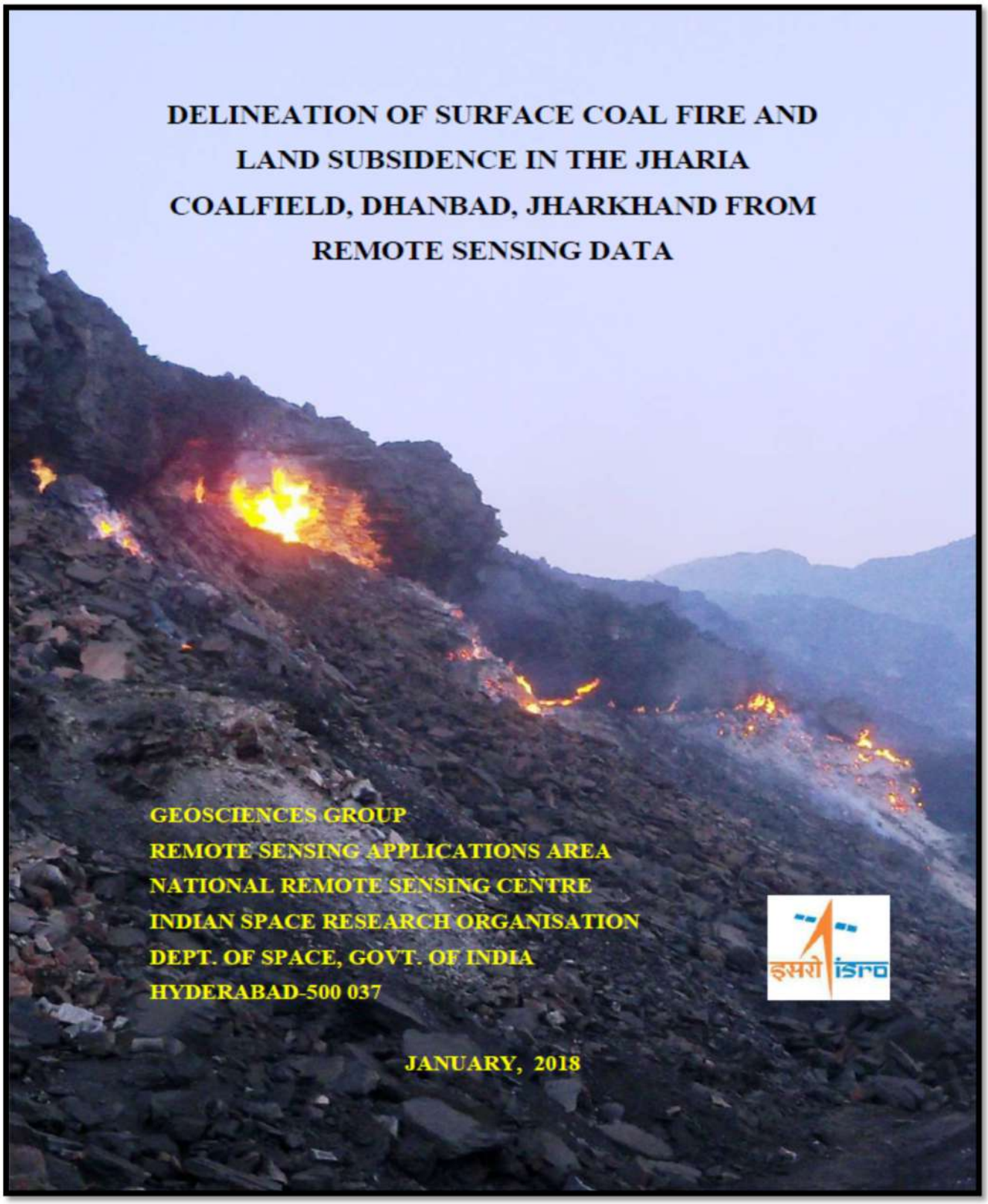
ANNEXURE- I

EC grant for cluster XI is 6.474 MTPA (Peak Production). The production from area is 0.43 MT for six months, which is well within the limits.

Production From October'19 to March'20 (Tonne)	
Cluster XI	**Production**
Production from P.B. mines	**139417**
Production from Moonidih Colliery	**292099**
Total Production from cluster XI is	**431516**

ANNEXURE-II

As per specific condition no xiii. 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.



Annexure –I

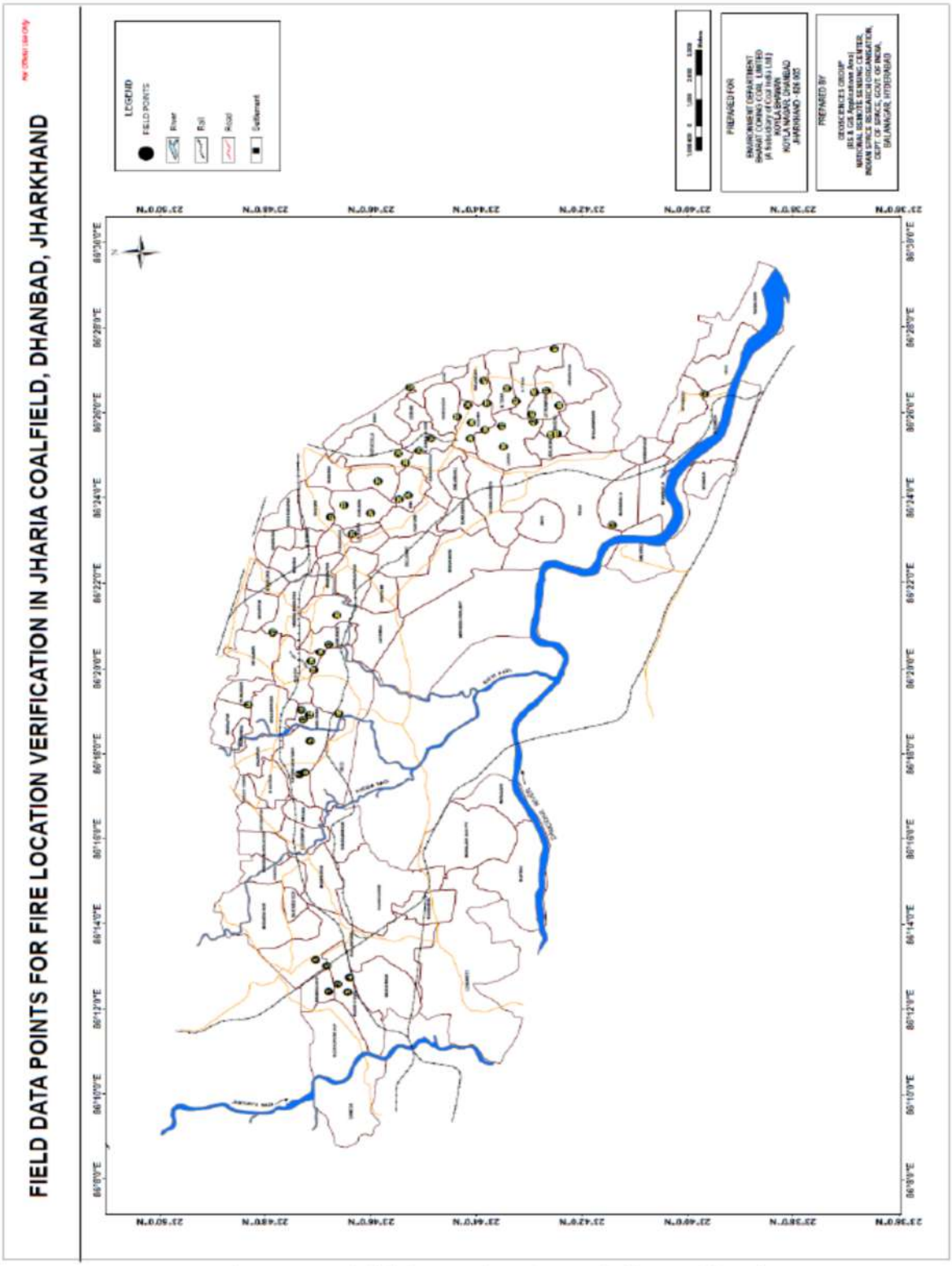


Figure 13. Field data points for coal fire verification

Annexure –III

SL. NO.	COLLIERY AREA NAME	FIRE AREA 2012 (SQ. KM.)	FIRE AREA 2017 (SQ. KM.)	AREA CHANGE (SQ. KM.)	Increase/Decrease
1	DAMODA	0.0000	0.0000	0.000	NO FIRE
2	TISCO (west)	0.0000	0.0000	0.000	NO FIRE
3	IISCO	0.0000	0.0000	0.000	NO FIRE
4	TISCO (north)	0.0885	0.0153	-0.073	DECREASE
5	NUDKHURKEE OCP	0.0000	0.0000	0.000	NO FIRE
6	BENEDIH OCP	0.0530	0.0453	-0.008	DECREASE
7	BLOCK-II OCP	0.0530	0.1353	0.082	INCREASE
8	MURAIDIH OCP	0.1478	0.0022	-0.146	DECREASE
9	SHATABDI OCP	0.0378	0.0361	-0.002	DECREASE
10	TETURIA	0.0000	0.0000	0.000	NO FIRE
11	S.GOVINDPUR	0.0000	0.0000	0.000	NO FIRE
12	KORIDIH BLOCK-IV OCP	0.0000	0.0000	0.000	NO FIRE
13	JOGIDIH	0.0000	0.0000	0.000	NO FIRE
14	DHARAMABAND	0.0000	0.0000	0.000	NO FIRE
15	MAHESHPUR	0.0000	0.0000	0.000	NO FIRE
16	PHULARITAND	0.0133	0.0205	0.007	INCREASE
17	MADHUBAND	0.0000	0.0000	0.000	NO FIRE
18	AKASH KINARI	0.0000	0.0000	0.000	NO FIRE
19	GOVINDPUR	0.0000	0.0000	0.000	NO FIRE
20	E. KATRAS	0.0133	0.0000	-0.013	DECREASE
21	KATRAS-CHOITUDIH	0.1021	0.1368	0.035	INCREASE
22	KESHALPUR	0.0000	0.0013	0.001	INCREASE
23	RAMKANALI	0.0000	0.0000	0.000	NO FIRE
24	NICHITPUR	0.0000	0.0000	0.000	NO FIRE
25	E. BASURIA	0.0000	0.0000	0.000	NO FIRE
26	KHAS KUSUNDA	0.0000	0.0000	0.000	NO FIRE
27	GONDUDIH	0.0000	0.0000	0.000	NO FIRE
28	W. GODHAR	0.0012	0.0000	-0.001	DECREASE
29	BASURIA	0.0000	0.0000	0.000	NO FIRE
30	TETULMARI	0.0223	0.0220	0.000	DECREASE
31	DHANSAR	0.0000	0.0000	0.000	NO FIRE
32	GODHAR	0.1073	0.0000	-0.107	DECREASE
33	INDUSTRY	0.0119	0.0513	0.039	INCREASE
34	KUSUNDA	0.4243	0.7398	0.315	INCREASE
35	SENDRA-BANSJORA	0.0796	0.0275	-0.052	DECREASE
36	BASTACOLLA	0.0663	0.0810	0.015	INCREASE
37	BERA	0.0000	0.0000	0.000	NO FIRE
38	KUYA	0.0000	0.0000	0.000	NO FIRE
39	GOLUCKDIH	0.0301	0.1122	0.082	INCREASE
40	KUJAMA	0.0398	0.2404	0.201	INCREASE

41	S. JHARIA-R. OCP	0.0244	0.1118	0.087	INCREASE
42	DOBARI	0.0000	0.0000	0.000	NO FIRE
43	GONHOODIH	0.0398	0.0322	-0.008	DECREASE
44	SIMLABAHAL	0.0000	0.0000	0.000	NO FIRE
45	HURRILADIH&STD	0.0000	0.0000	0.000	NO FIRE
46	ENA	0.0918	0.0432	-0.049	DECREASE
47	BURRAGARH	0.0000	0.0000	0.000	NO FIRE
48	N. TISRA	0.0098	0.1802	0.170	INCREASE
49	LODNA	0.0000	0.3527	0.353	INCREASE
50	S. TISRA	0.0000	0.1015	0.102	INCREASE
51	BARAREE	0.1037	0.1074	0.004	INCREASE
52	AMLABAD	0.0000	0.0000	0.000	NO FIRE
53	PATHERDIH	0.0000	0.0000	0.000	NO FIRE
54	SUDAMDIH	0.0000	0.0000	0.000	NO FIRE
55	SITANALA	0.0000	0.0000	0.000	NO FIRE
56	MURULIDIH 20/21 PIT	0.0000	0.0000	0.000	NO FIRE
57	MURULIDIH	0.0000	0.0000	0.000	NO FIRE
58	BHATDIH	0.0000	0.0000	0.000	NO FIRE
59	LOHAPATTY	0.0000	0.0000	0.000	NO FIRE
60	IISCO	0.0000	0.0000	0.000	NO FIRE
61	TASRA-IISCO	0.0000	0.0000	0.000	NO FIRE
62	KENDUADIH	0.0610	0.0000	-0.061	DECREASE
63	BULLIHARY	0.0000	0.0000	0.000	NO FIRE
64	GOPALICHUCK	0.0000	0.0000	0.000	NO FIRE
65	POOTKEE	0.0000	0.0000	0.000	NO FIRE
66	BHURUNGIA	0.0000	0.0000	0.000	NO FIRE
67	KHARKHAREE	0.0000	0.0000	0.000	NO FIRE
68	GASLITAND	0.1194	0.1215	0.002	INCREASE
69	KANKANEE	0.0530	0.0525	-0.001	DECREASE
70	MUDIDIH	0.1141	0.1104	-0.004	DECREASE
71	W. MUDIDIH	0.0171	0.0000	-0.017	DECREASE
72	LOYABAD	0.0133	0.0063	-0.007	DECREASE
73	BHAGABAND	0.0000	0.0000	0.000	NO FIRE
74	MOONIDIH PROJECT	0.0000	0.0000	0.000	NO FIRE
75	E.BHUGGATDIH	0.0022	0.0214	0.019	INCREASE
76	ALKUSHA	0.0326	0.0294	-0.003	DECREASE
77	KUSTORE	0.0524	0.0463	-0.006	DECREASE
78	ANGARAPATRA	0.1331	0.0149	-0.118	DECREASE
79	SALANPUR	0.0000	0.0000	0.000	NO FIRE
80	BHOWRAH. N	0.0133	0.0980	0.085	INCREASE
81	BHOWRAH. S	0.0000	0.0000	0.000	NO FIRE
82	BAGDIGI	0.0000	0.0209	0.021	INCREASE
83	JEALGORA	0.0000	0.0067	0.007	INCREASE
84	JEENAGORA	0.0000	0.0470	0.047	NO FIRE

85	JOYRAMPUR	0.0099	0.1042	0.094	INCREASE
86	CHANDAN OCP	0.0000	0.0000	0.000	NO FIRE
87	BANSDEOPUR	0.0000	0.0000	0.000	NO FIRE
	TOTAL AREA	**2.18**	**3.28**	**1.10**	INCREASE

Table 6: Colliery wise break-up of change in fire area from 2012 to 2017

Note:
1) **"NO FIRE"** implicates that the fire has not been identified satellite data *(either absent or below sensor resolution)*
2) **"INCREASE"** implies, increase in fire area OR emergence of fire areas not identified in 2012 study.
3) **"DECREASE"** implies, decrease in fire area OR fire areas of 2012, which are not identified in present study *(either absent or below sensor resolution)*.
4) Estimations of fire extent (in terms of sq.km.) both 2012 and in present 2017 study are pixel based. They do not represent the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.

NRSC/RSAA/GSG/BCCL/Project Report/JAN2018

***Note:** Estimations of fire extent (in terms of sq.km.) both in 2012 and in the present 2017 study are pixel based. They do not represent the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.*

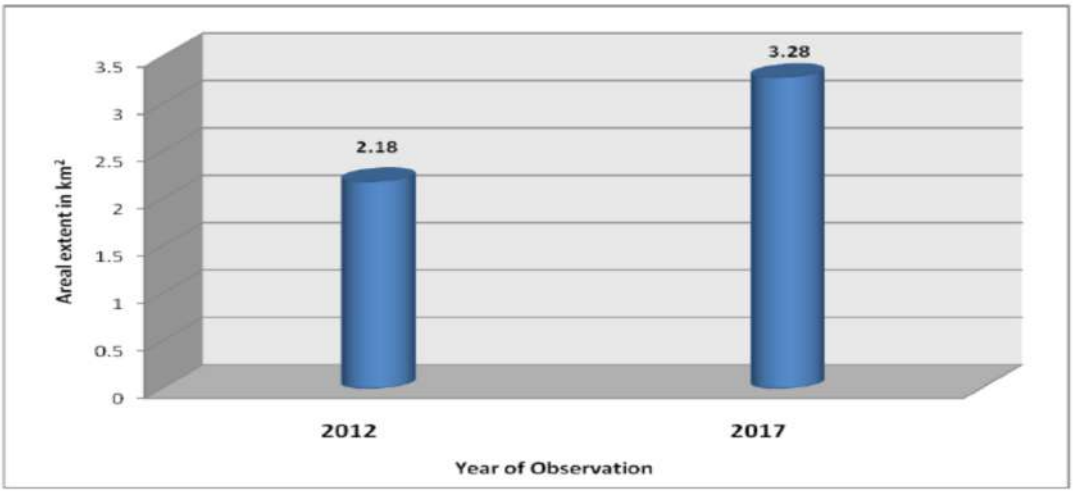


Figure 12: Total fire area statistics

ANNEXURE-III

CSR, R&R and Transportation Plan of Cluster XI

As per EC Condition

(Specific Condition No XVIII)

Details of transportation, CSR, R&R and implementation of environmental action plan for each of the 17 clusters should be brought out in a booklet form

Bharat Coking Coal Limited

(A Mini Ratna Company)

P.B Area

Dhanbad

UNDERSTANDING THE SCOPE OF CSR INTERVENTION

(BASELINE STUDY REPORT)

FOR

BHARAT COKING COAL LTD. (BCCL)

DHANBAD

BY-

NATIONAL CORPORATE SOCIAL RESPONSIBILITY HUB

TISS, MUMBAI

25th NOVEMBER 2013

CIL'S POLICY FOR CORPORATE SOCIAL RESPONSIBILITY (CSR)

Introduction

Mining of coal has profound impact on the people living in and around the areas where the mines are established. The obvious impact of the introduction of any production activity in such areas change the traditional lifestyle of the original inhabitants and indigenous communities and also change the socio-economic profile of the Area. Hence, the primary beneficiaries of CSR for the company are:

- Land oustees
- PAPs and
- Those staying within the radius of 25 Kms of the Project.

Poor and needy section of the society living in different parts of India are the second beneficiaries.
In the aforesaid backdrop, policy on Corporate Social Responsibility of CIL has been framed after incorporating the features of the Companies Act 2013 and as per notification issued by Ministry of Corporate Affairs, Govt. of India on 27.02.2014 as well as DPEs guidelines and broadly covers the following: -

a) Welfare measures for the community at large, so as to ensure the poorer section of the Society derived the maximum benefits.
b) Contribution to the society at large by way of social and cultural development, imparting education, training and social awareness especially with regard to the economically backward class for their development and generation of income to avoid any liability of employment.
c) Protection and safeguard of environment and maintaining ecological balance.

Objectives

The main objective of CSR policy is to lay down guidelines for the coal companies to make CSR a key business process for sustainable development for the society. It aims at supplementing the role of the Govt. in enhancing welfare measures of the society based on the immediate and long term social and environmental consequences of their activities. CIL will act as a good Corporate Citizen, subscribing to the principles of Global Compact for implementation.

Areas Covered under CSR

- The poor and needy Section of the Society living in different parts of India are covered.
- The CSR Programme also covers the existing components of Special Component Plan (SCP) and Tribal Sub Plan (TSP) for development of the SC and ST population besides development components for the entire population.

80% of the budgeted amount is spent within the radius of 25 Km of the Project Site/Mines/Area HQ/Company HQ and 20% of the budget is spent within the State.

Allocation of Fund

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

Scope

As per Schedule VII of New Companies Act 2013, the following are the Scope of Activities under Corporate Social Activities:

i) Eradicating hunger, poverty and malnutrition, promoting healthcare including preventive health care and sanitation and making available safe drinking water.

ii) Promoting education, including special education and employment enhancing vocation skills especially among children, women, elderly, and differently abled and livelihood enhancement projects;

iii) 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;

iv) 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;

v) 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;

vi) Measures for the benefit of armed forces veterans, war widows and their dependents

vii) Training to promote rural sports, nationally recognized sports, Paralympics sports and Olympic sports;

viii) 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;

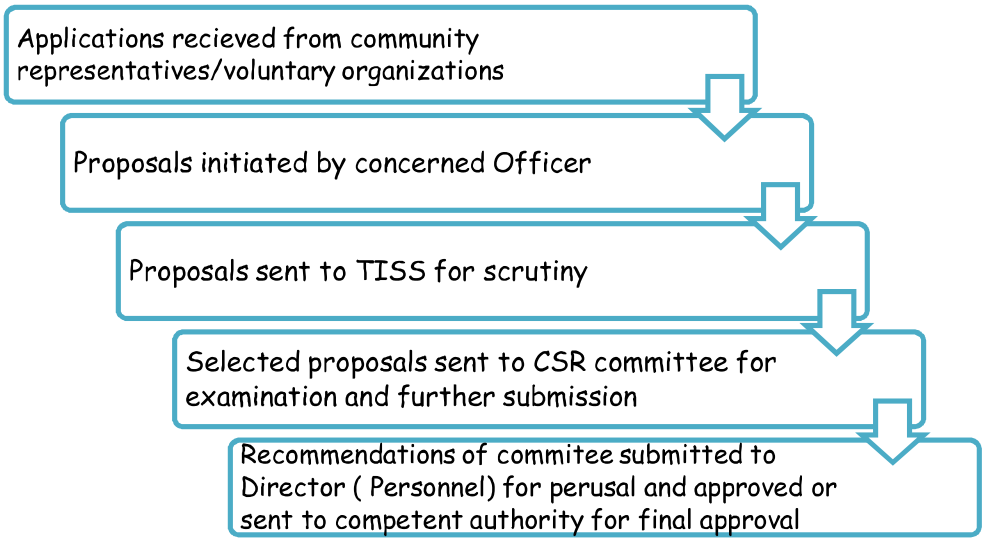
ix) Contributions or funds provided to technology incubators located within academic institutions which are approved by the Central Government;

x) Rural development projects

Implementation

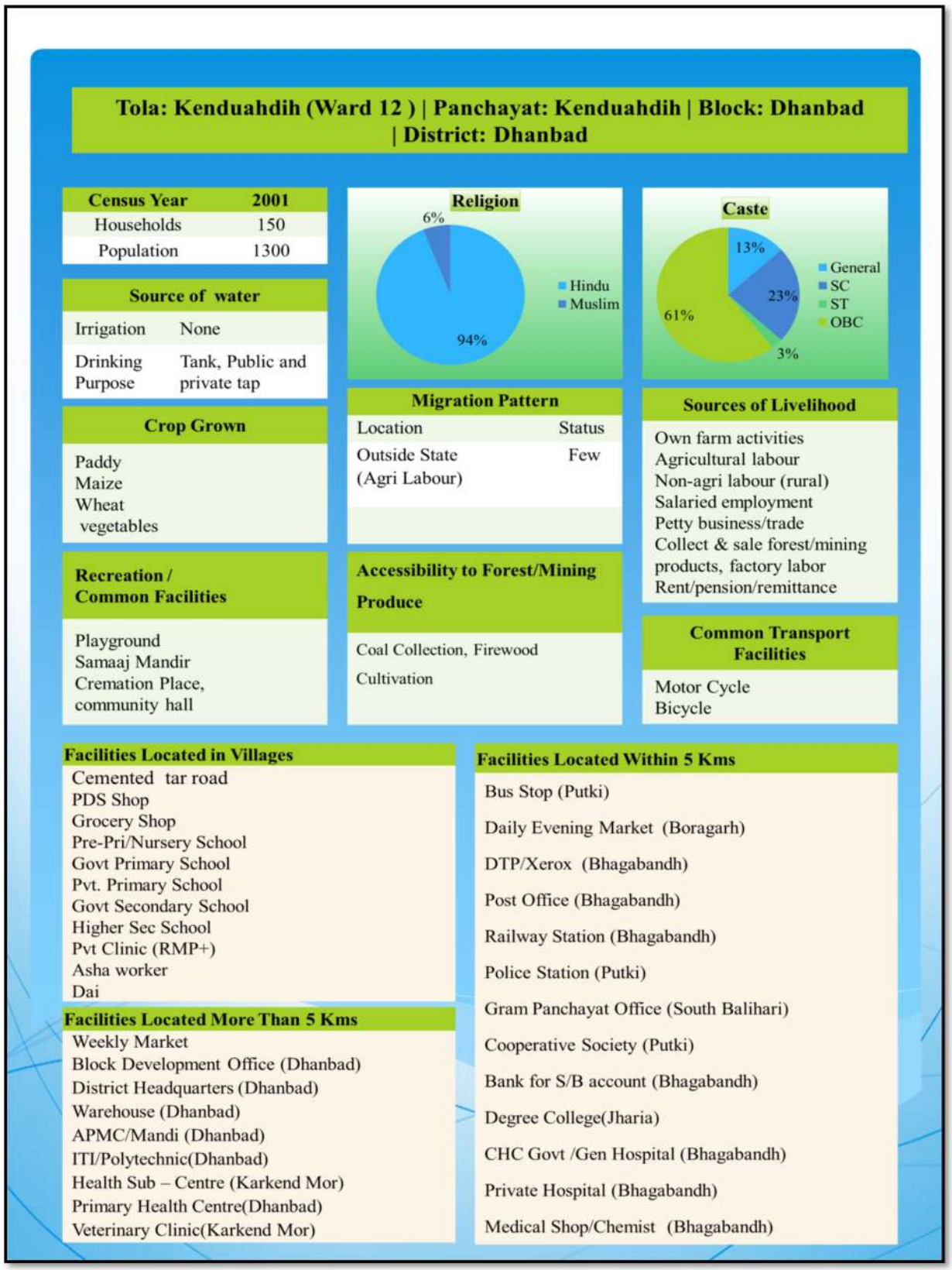
- The investment in CSR is project based and for every project time framed periodic mile stones should be finalized at the outset.
- Project activities identified under CSR are implemented by Specialized Agencies. Specialized Agencies are made to work singly or in tandem with other agencies. Specialized agencies that are included presently for implementation of CSR projects in Cluster VII are through Contracted agencies for civil works.

Institutional Arrangement



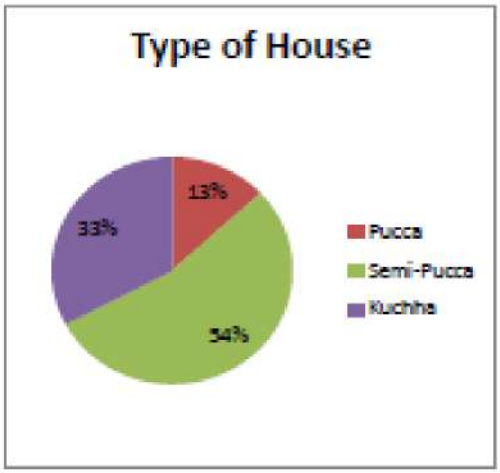
Baseline study done by TISS (Putki Balihari Area)

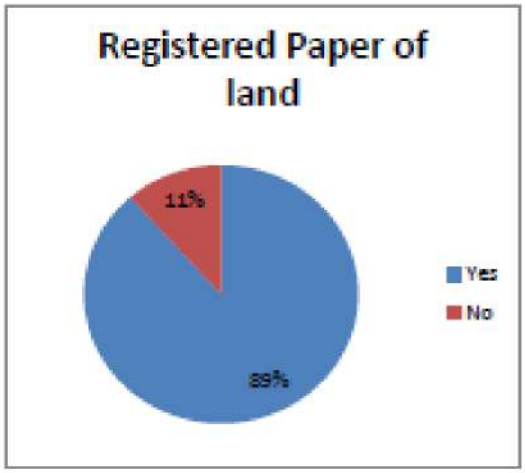
KENDUAHDIH



HOUSEHOLD STATUS

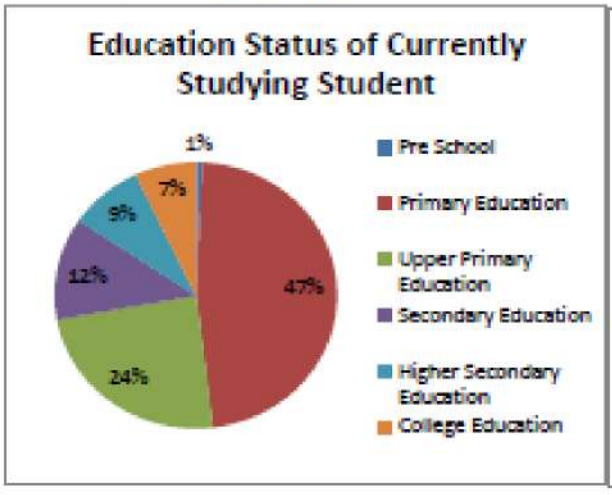
4.10.1.1 HOUSEHOLD STATUS

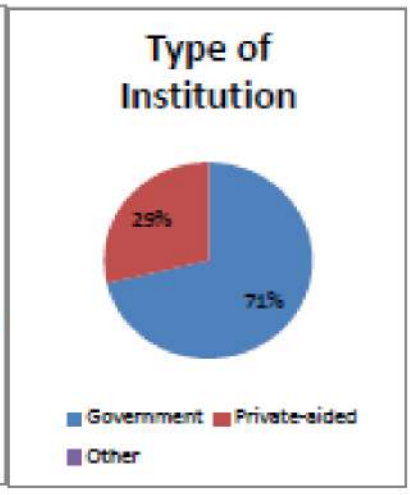




In Kenduahdih Basti, 40% of the households are found to be Semi- Pucca while 48% are Kuchha and 12% are Pucca. 95% of the houses are registered while only 5% was found to be non-registered. Nearly 85% of the houses in this village are electrified.

4.10.1.2 EDUCATION





In Kenduahdih Basti, it has been found that 35% of the students are enrolled in Primary education followed by 28% in Upper primary, 10% in secondary education, and 5% in higher secondary, 3% in college. Education after 12th standard is found comparatively less with any

Major Problems and Recomendations

Area	Major problems and Recommendations
Education	There is no road which can join schools to main working road
	No electricity and in-house circuiting of lights and fans in the class room of primary school
	Shakti Nath Mehto School needs school boundary and toilet in school premises
Water Supply	Pipeline already exists in this village. More number of pipelines are required in Harijan Basti of Kenduahdih
Health Care	Mobile medical Van should treat children every month in primary school
	Maternity health camp should be initiated through MMV
Social Empowerment	Nearly 5-6 SHG has been identified in this village. SHG *(Ma Saraswati Mahila Samuh)* already exist in the village. They need are trained in agriculture. They need support of land to start collective farming of horticultural crops. They are also trained in preparation *Agarbatti* and bangles made from lac.
	Vocational training school for girls and boys is needed in this village. School building of Shakti Nath Mehto School can be used for providing vocation al training center in the weekends or after the school hours with prior permission of the school administration. Not only that the training center for women to start small enterprise can be establish in the same school premises.
Sanitation	No toilets in any of the households. Toilets is needed to construct
Infrastructural Development	There *Kuccha* road in the village which creates problem during rainy season
	On hand pump/tap point is needed in ICDC
	One kitchen room is required in primary school
	Playground boundary in needed with gate in primary school

Bhagabandh

4.10.2 BHAGABANDH

Tola: Bhagabandh(Ward 12) | Panchayat:Bhagabandh| Block: Dhanbad | District: Dhanbad

Census Year	2001
Households	720
Population	4409

Source of water

Irrigation	None
Drinking Purpose	Tank, public and private tap

Crop grown

Paddy
Maize
Vegetables

Recreation / Common Facilities

Playground
Samaaj Mandir
Creration Place

Religion

Caste

Migration Pattern

Location	Status
Outside State (Agri Labour)	Rarely

Accessibility to Forest/Mining Produce

Coal Collection, fire wood
Cultivation

Sources of Livelihood

Own farm activities
Cattle rearing
Non-agri labour (rural)
Salaried employment
Petty business/trade
Collect & sale forest/mining products, factory labor
Rent/pension/remittance

Common Transport Facilities

Motor Cycle, Share Auto
Bicycle

Facilities Located Within the village

Cemented tar road
Grocery Shop
DEP/Kerox
PDS Shop
Post Office
Bank for S/B account
Pre-Pri/Nursery School
Govt Primary School
Govt Secondary School
Pvt. Secondary School
CHC Govt /Gen Hospital
Pvt Clinic (MBBS/BAMS+)
Medical Shop/Chemist
Asha worker
Dai(Trained/Untrained)
Pvt Clinic (RMP+)

Facilities Located with 5 kms

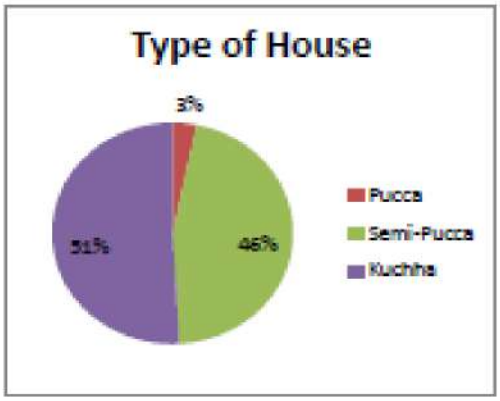
Bus Stop (Putki)
Daily Evening Market (Putki)
Weekly Market (Putki)
Police Station (Putki)
Veterinary Clinic (Putki)
Health Sub – Centre (Putki)

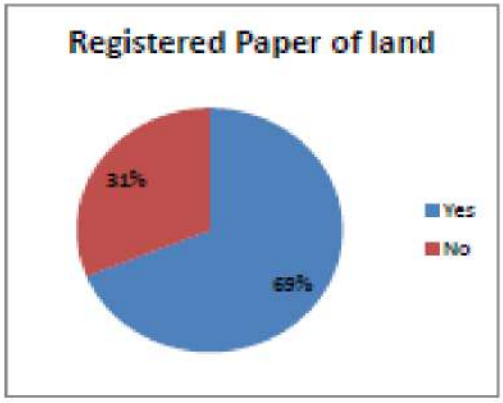
Facilities Located more than 5 kms

Railway Station (Dhanabd)
Block Development Office (Dhanabd)
District Headquarters (Dhanabd)
Warehouse (Dhanabd)
APMC/Mandi (Dhanabd)
Degree College (Dhanabd)
Primary Health Centre (Dhanabd)

Household Status

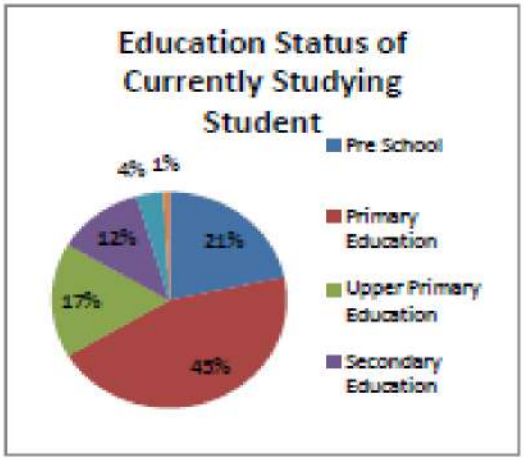
4.10.2.1 HOUSEHOLD STATUS

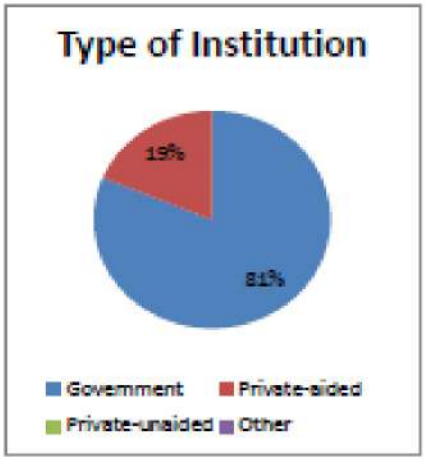




In Bhagabandh Village, 3% of the sample is living in pucca house and 51% were having kuccha house while 46% were having semi -pucca house. Among the sample 69% of the people have registered paper of land while 31% of them do not have registered paper of land. 94% of the sample is living in electrified.

4.10.2.2 EDUCATION





In Bhagabandh Village, status of education does not seem positive as far as college education is considered, only 1% of the children among sample households are found at the time of data collection enrolled in higher education. Among the students of sample households who are currently studying, 45% are currently studying in primary school, 17% are in upper primary school, 12% in secondary school and another 4% is studying in

293

Major Problems and Recommendations

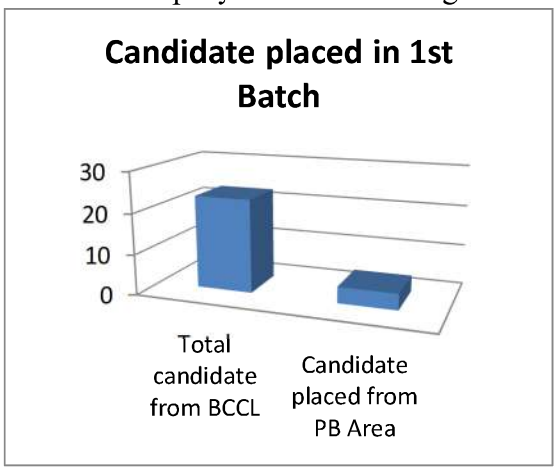
AREA	MAJOR PROBLEMS AND RECOMMENDATIONS
Education	There should scholarship for the children belongin to underprivileged section of the society who is going for education after matriculation to schools of Dhanbad by BCCL
	Library is required in this village
	Evening school has been requested by the people
Water Supply	More number of tap points are required in Manjhi Tola of Bhagabandh Basti
Health Care	Maternity health ccmpa
	Regular check-up of primary school children
Rural Electrification	School should have in-house electric fitting of fans and light
Sports & Culture	Sports equipment should be provided to the sports club
Sanitation	No toilets in houses.
	There should be provision for garbage disposal By BCCL at regular interval along with fumigation
	Ponds should be cleaned with involving community by providing them daily wage as followed in MNREGS
Social Empowerment	SHG for women and men should be formed to start Income Generation activity
	Group activity on Piggery and poultry has been requested by the people. But for that a formal group has to be formed who have to register in the local bank
	Women who are not getting widow pension should be supported with livestock's like poultry, duckery and goatry
Infrastructural Development	Playground for children with boundary
	Repair of damage road should be done so that medical vans or ambulance should reach at the door step for pregnant women
	Playground with boundary should be constructed
	There is requirement of High school covering students from nearby villages like Bhagabandh. It can be done constructing additional school building in government secondary school in the village itself

1. CSR Activities (October, 2019 to March, 2020)

➢ Skill Development Training of Project Affected People (PAPs)

CSR department of BCCL in collaboration with the Central Institute of Plastics Engineering and Technology (CIPET), a Government of India Institute, has conducted counselling for PAP candidates for 1st Batch. Selected candidates are getting free residential, technical skill development training at the CIPET campus in Hajipur, Bihar. This endeavor, aimed at benefitting the unemployed PAPs belonging to economically backward sections in peripheral project areas of BCCL.

Total 4 candidates from PB Area got placed in Chennai based company which is working in the field of Plastic Engineering Technology. After successful completion of 6 months residential training, candidates took part in job placement/interview organized by CIPET. Companies which are working in the field of Plastic Engineering and Technology were called for placement process (37 Male and 10 Female) filled their application from



P.B Area in 1st Batch. 70 % of the candidates are Undergraduate and 30 % are Graduate with few candidates having technical degrees in ITI. The project is aimed at equipping the skill sets in young people who are the major driving force for economic development and technology innovation and to impart job oriented skill development training to the underprivileged/ unemployed PAPs for developing technical and professional skills thereby enhancing the employability of underprivileged/ unemployed youth through skill development in Plastic Engineering and Technology..

➢ *"BCCL Ke Lal and BCCL Ki Ladli"* Scheme Batch 2019-21:

Bharat Coking Coal Limited (BCCL)under its CSR Programme started "BCCL Ke Lal and BCCL Ki Ladli" scheme to provide free educational support to under-privileged meritorious students of PAPs (Project Affected Persons), and people residing in the command area of BCCL or son/daughter of BCCL wage board Employee. These students particularly belong to poor and weaker section of the society and BCCL's objective is to provide them free school education, coaching from experts to prepare them to appear in admission in Engineering colleges like IITs, NITs and other prestigious colleges of the country.

Eligibility Criteria

A Screening Test (Multiple Choice Questions based) is conducted for selection of students. The final merit list is published only for those candidates who have secured at least 60% aggregate (for CBSE, ICSE, JAC and Other Board) in Class 10th Board Examinations. The Gross Annual income of the

Parents/ Guardians of the candidates should preferably be less than Rs. 6,00,000 (Rupees Six Lakhs Only). The candidates shall be required to submit the income certificate at the time of admission.

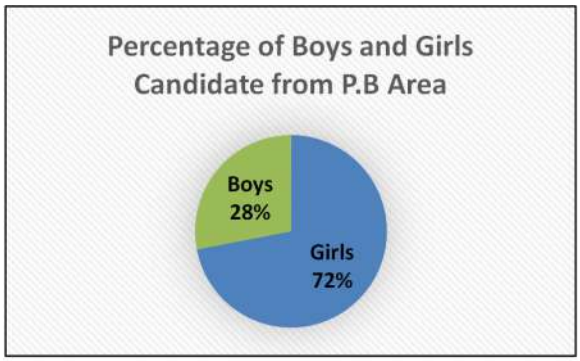
Details of Study Centres:

Four Coaching Centers were set-up where in classes are conducted through Video Conferencing. Each centre has maximum 50 Students seat each (200 Students in all). 10 seats are reserved for Female Students at each VC Centre. These centers are established at:

a. Kalyan Bhawan, Jagjiwan Nagar (Dhanbad District)
b. Lodna Area (Dhanbad District)
c. Katras Area (Dhanbad District)
d. Block II Area (Dhanbad District)

Profile of Candidates who submitted applications from P.B Area:

Based on eligibility criteria for "BCCL Ke Lal and BCCL Ki Ladli" scheme, applications were invited from students who were appearing or appeared in Class 10thBoard Exam in 2019. Total 25 students submitted their application form at P.B Area office. There is an increase in percentage of Girl applicants from last year as in last year the percentage of girl applicant was 59% out of total applicant but this year the percentage of girl applicant increased to 72% out of total applicant. Entrance Test was conducted on 20thApril, 2019 at DAV Public School Koylanagar, Dhanbad by BCCL.



All students of VC Centres is getting the facility of Smart Class for coaching at 4 Centres of BCCL (Barora, Katras, Lodna and HRD, Jagjiwan Nagar, Dhanbad) with online Video & Audio interactive session facility with two such setup a teach centre for class 11th & 12th separately.

Details of the "BCCL Ke Lal and BCCL Ki Ladli" Batch 2018-20 Scheme till now is as under:

Based on Based on eligibility criteria for "BCCL Ke Lal and BCCL Ki Ladli" scheme, applications were invited from students who were appeared inClass 10thBoard Exam in 2017. Total 116 students submitted their application form at P.B Area office. These students were appeared in Entrance Test conducted by BCCL under "BCCL Ke Lal and BCCL Ki Ladli" scheme. Among 116 students, 18 students got selected for admission in VC Centre. Regular PTA (Parent Teacher Association Meeting) with students for interaction and review of student's performance and analysis of needs of the parents are organized at regular intervals. Regular Doubt Clearing Classes along with regular tests are conducted for continuous improvement of the students.

VC Center Kalyan Bhawan, Jagjiwan Nagar

Area VC Center

2. **Rehabilitation & Resettlement during October, 2019 to March, 2020: Nil**
3. **Civil work carried out under CSR during October, 2019 to March, 2020: Nil**
4. **Medical Camps/Health Awareness camp organized during October, 2019 to March, 2020:**

A free Medical Health Check-up camp was organized by Doctors of Kustore Regional Hospital, P.B Area in collaboration with *Pragati Mahila Mandal* (a voluntary group of Officer's Wife functioning in PB Area) at Kendwadih on 17th December, 2019 and at Kustore Regional Hospital, P.B Area on 3rd March, 2020. The objective of the camp was to provide information regarding Blood Pressure, diet, diabetics, exercise and weight control.

Free medicines have been provided to patients who were diagnosed with High Blood Pressure, diabetics etc. and advised them to follow up with doctors or dispensaries or with Kustore Regional hospital doctors. Follow up has been done with those subjects who have been diagnosed with High Blood Pressure, diabetics on a regular basis by our trained local volunteers and physicians for compliance with their medications and ascertain that their blood pressure and/or blood sugar are controlled.

Along with this, a health awareness and check-up camp for females was organized at Area Vocational Training Centre of PB Area on 14th March, 2020. The objective of the camp was to provide information on prevention of disease in females like breast cancer, PCOD, menstrual hygiene, fibroids; hormonal imbalance etc. is also spread by the health related instructions given by the medical team to the female employees and villagers. By adopting these measures, villagers are able to take better care of their health.

Health camp at Kendwadih

Health camp at Kenduadih

Health camp for female at VTC, P.B Area

CSR Work in Moonidih: -

- CSR Clinic for local villagers held everyday at Regional Hospital, Moonidih – 7333 beneficiaries
- Wellness Clinic held for 35 days – 1598 beneficiaries
- Random Blood sugar diagnostic camp held on 18th Feb at Gopinathdih – 127 beneficiaries
- Awareness Camp on Nutrition and cleanliness held on 25th Feb at Lalpur Middle School
- Health Camp held on 03rd March at Rajkiye Madhya Vidhyalaya, Moonidih Basti

Catering to the water needs of the community:-

- Mine water and drinking water is being supplied to nearby villages for daily use
- It covers nearly 3360 HH of 14 villages in which water connection is provided at 42 points and 6 ponds
- 5 schools and 1 Aagan Badi Centre is also supplied with drinking water

ANNEXURE-IV

COMPLIANCE OF DHANBAD ACTION PLAN

(1) Covering of loaded transport vehicles

It has been complied. The clause of covering of loaded coal transport vehicle has also been incorporated in the transport agreement/ contract.

(2) Coal transport roads shall be made pucca

Mine	Proposed pucca road in Mtrs	Work Completed in	Proposal processed /approved	Likely date of completion
P.B. project	150			Owing to the restriction due to implementation of Govt. of India approved Master Plan and The Jharkhand State Restriction on construction in unsafe areas, Act 2002. BCCL is in the process of constructing 5.10 km WBM Roads.

(3) All drillings to be done with dust containment and suppression systems. Sprinklers will be installed including at all coal stock & sidings

Complied. At present mobile water sprinklers are used. Proposal for installation of fixed sprinklers has been initiated by Civil Department vide ref. no. P.B.Area office/Spraying water/2017-18/683 dated 12.10.2019

(4) Mobile Sprinklers

Sl. no.	Mine/Workshop	No. of Fixed Sprinklers	No. of Mobile Sprinklers	Total Capacity(KL)	Trips per day
1	Bhagabandh UG Mine	1 (At coal Unloading Site)	0	N.A	N.A
2	P.B. project Colliery UG Mine	1 (At coal Unloading Site)	1	40	2
3	Central Auto Workshop	Nil	1	8	2
4	Kendwadih Workshop	Nil	1	45	2
5	Moonidih Colliery	12 in UG	1	4	2

(5) The direction of surface run-off of the premises of collieries shall be diverted to created water bodies.
Creation of water bodies in coal bearing area will pose safety threats to nearby mine and it will be violation of mines act. However, artificial ponds have been created where, there are no chances of future coal extraction.

Pond Constructed for Villagers at KB 10/12 Colliery

Pond Created for Villagers at Kendwadih

(6) Dealing of mine fires

A Master plan for Dealing with fires and subsidence and rehabilitation in the Leasehold of BCCL has been approved by Govt. of India vide letter no- 22020/1/2005-CRC dated 12 08 09. In fire patch of V/VI/VII/VIII seam of Gareria Secn. At East Bassuriya about 1, 70,000 cu. m. mitti and non-combustible material has been filled, rest will be filled by quarry OB.

(7) The waste water shall be passed through oil separator-cum-filtration system

Complied. 1 number of Oil Separator has been constructed at P.B. Project Colliery.

(8) The removed OBs shall be utilized for low land filling or for making roads

N.A

(9) Tree plantation on the dumps

Complied. Eco restoration Site is under lease hold of Bhagabandh. 5 Ha site was taken up in FY 2015-16 and 2 Ha in FY 2016-17.

4000 saplings planted from April'18 till date.

Approximately 1500 Saplings have been planted starting from April'17 till September'17(2017-18). Apart from that 500 saplings were distributed to collieries, nearby schools, etc.

Around 2500 saplings are planted at ecological park sites and collieries (till September'18).

12 Ha site for OB Dump reclamation is handed over to Forest Department (in FY 2018-19)

2500 Gabion Plantation done with the help of Forest Deptt., Dhanbad

500 tree plantation was done in and around P.B Area office premises

Proposal of 32760 compensatory afforestation by Forest Department, Dhanbad is under process

(10) **All hazardous wastes shall be disposed off**

Complied.

a. All working units have applied for authorization as per Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules.

b. Burnt/used oil is disposed of as per rule.

c. Disposal of Hazardous waste, burnt Oil / batteries is being done through E-auctioning to authorized recycler/ re-processor having valid authorization from CPCB/ SPCB. Return are also being filed.

d. Burnt oil from Moonidih mine is re-used for lubrication of mine machinery.

(11) Monitoring and Reporting six monthly

Complied. Monitoring work is being done by CMPDI, Dhanbad as per work order issued by BCCL HQ.

(12) Introduction of GIS/ GPS

CMPDI, HQ has been given the job of satellite surveillance of the Jharia coal field through NRSA Hyderabad and the information is being uploaded in the website.

ANNEXURE-V

(7)

Ph: 0326-2204933

झारखण्ड राज्य प्रदूषण नियंत्रण पर्षद्
Jharkhand State Pollution Control Board
HIG-1, Housing Colony, Dhanbad-826001

Letter No....2650 Dated ....6/7/13....

From,
Regional Officer,
Dhanbad

To,
HOD (Envt.),
M/s. B.C.C.L.,
Koyla Bhawan, Koyla Nagar,
Dhanbad.

Sub: **Fixing up monitoring station/Sampling location of Air, Water & Noise.**

Sir,

With reference to you letter no. GM(Env.)/F-JSPCB/2013/783, dt. 06.07.2013 We have approved Air, Water & Noise monitoring Station/Sampling location after verification and return a copy of the map.

Encl-A/a.

Your's faithfully,

6/7/13

(Dinesh Prasad Singh)
Regional Officer.

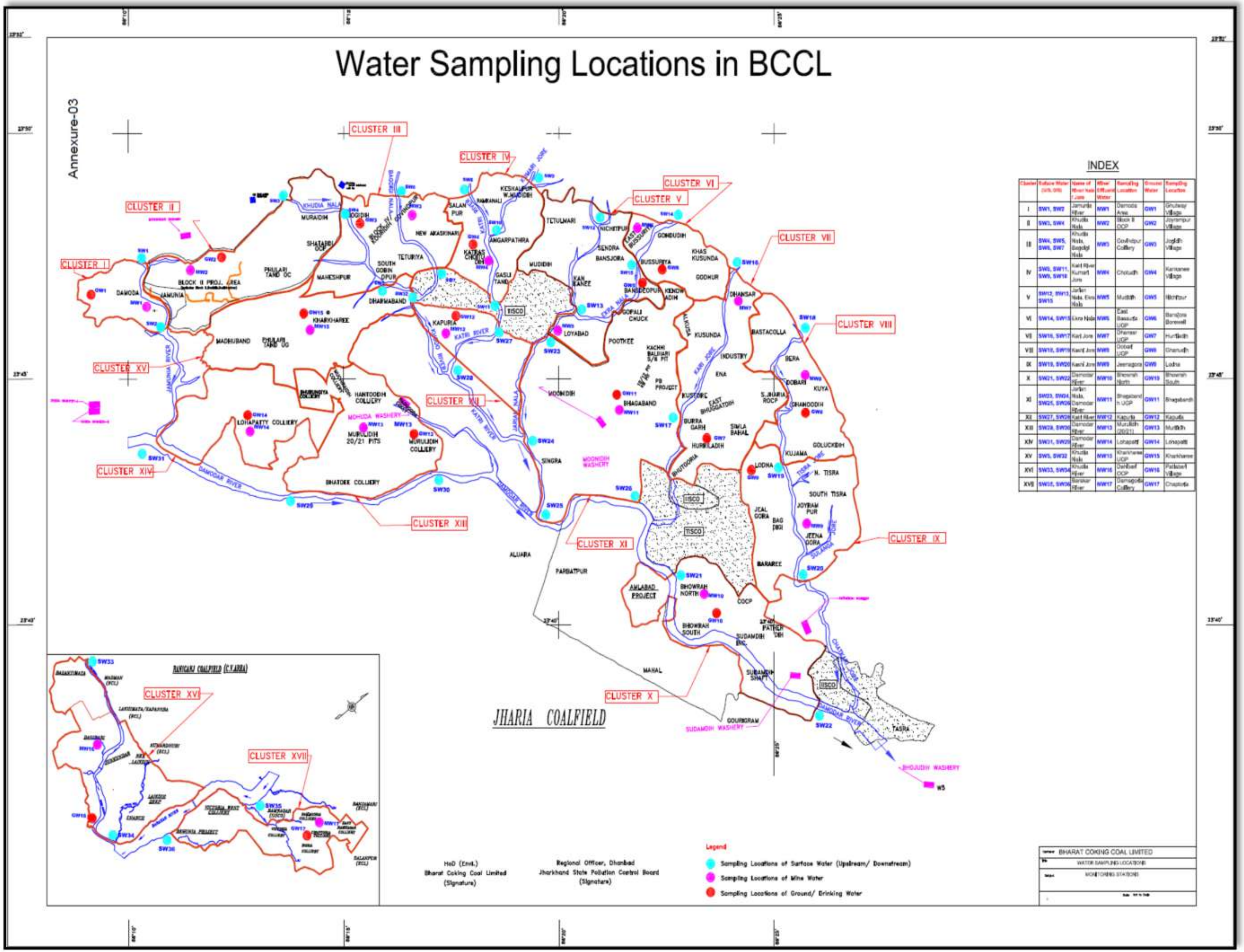
Memo..... Dhanbad, dated.....

Copy to: The Member Secretary, Jharkhand State Pollution Control Board for information & enclose a copy of the map for necessary action.

Encl-A/a.

(Dinesh Pd. Singh)
Regional Officer.

Printed by Sandip

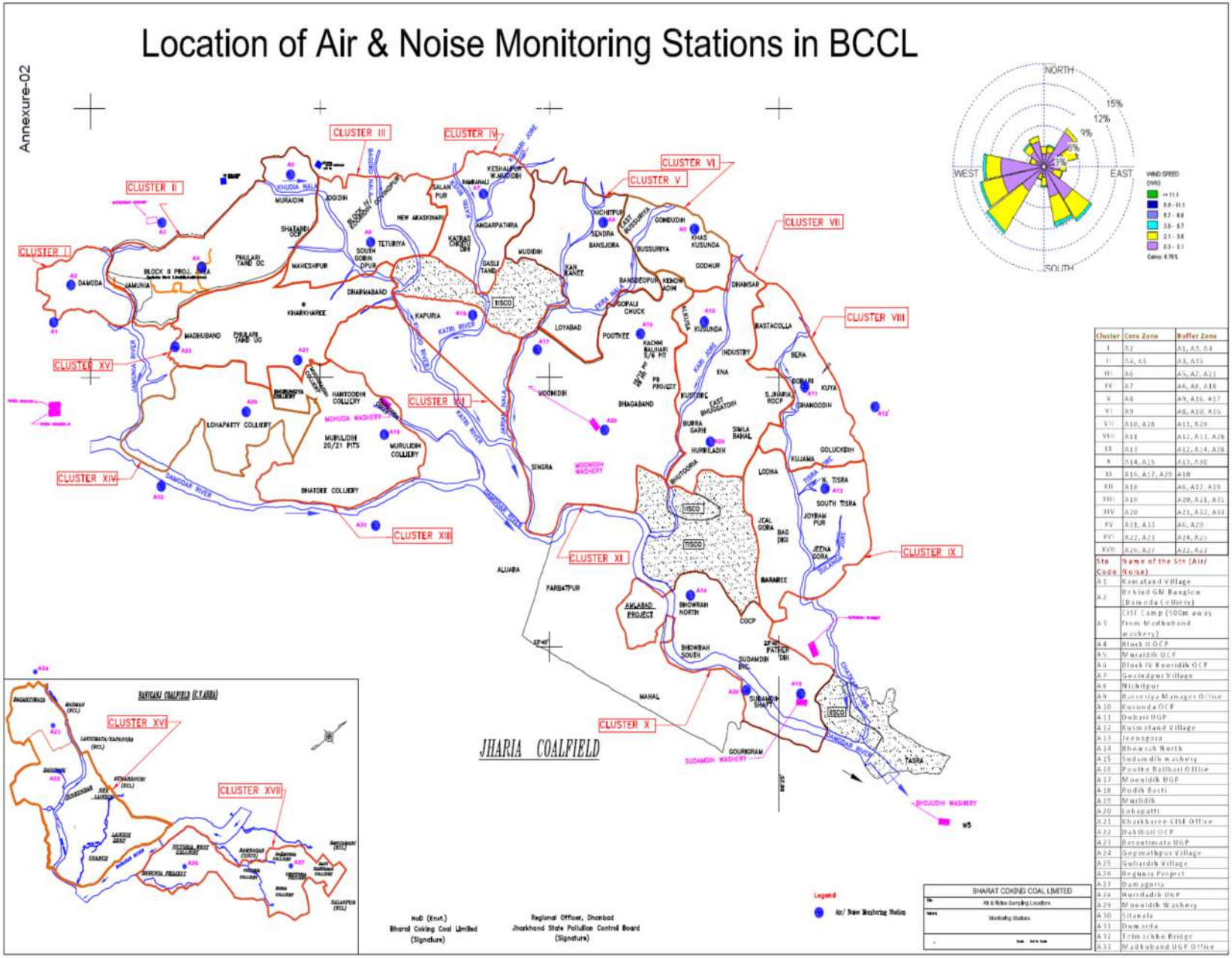


INDEX

Cluster	Surface 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	Bhagabandh UGP	GW11	Bhagabandh
XII	SW27, SW28	Katri River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Muralidih (20/21)	GW13	Muridih
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

Location of Air & Noise Monitoring Stations in BCCL

Annexure-02



Cluster	Core Zone	Buffer Zone
I	A2	A1, A3, A4
II	A6, A5	A3, A31
III	A6	A5, A7, A21
IV	A7	A6, A8, A18
V	A8	A9, A16, A17
VI	A9	A8, A10, A15
VII	A10, A28	A11, A29
VIII	A11	A12, A13, A28
IX	A13	A12, A14, A28
X	A14, A25	A13, A30
XI	A16, A17, A29	A10
XII	A18	A6, A17, A19
XIII	A19	A20, A21, A31
XIV	A20	A21, A32, A33
XV	A23, A33	A6, A20
XVI	A22, A25	A24, A25
XVII	A26, A27	A22, A27

Stn Code	Name of the Stn (Air/ Noise)
A1	Kumatand Village
A2	Behind GM Banglow (Damoda Colliery)
A3	CISF Camp (500m away from Madhuband washery)
A4	Block II OCP
A5	Muraidih OCP
A6	Block IV Kooridih OCP
A7	Govindpur Village
A8	Nichitpur
A9	Bassuriya Manager's Office
A10	Kusunda OCP
A11	Dobari UGP
A12	Kusumtand Village
A13	Jeenagora
A14	Bhowrah North
A15	Sudamdih washery
A16	Punthe Baliari Office
A17	Moonidih UGP
A18	Rudih Basti
A19	Murlidih
A20	Lohapatti
A21	Kharkharee CISF Office
A22	Dahibari OCP
A23	Basantimata UGP
A24	Gopinathpur Village
A25	Gulaudih Village
A26	Begunia Project
A27	Damagoria
A28	Murlidih UGP
A29	Moonidih Washery
A30	Sitanala
A31	Dumarda
A32	Tetulchhko Bridge
A33	Madhuband UGP Office

ANNEXURE-VI

Point XVI

सेंट्रल माईन प्लानिंग एण्ड डिज़ाइन इंस्टीच्यूट लिमिटेड
(कोल इंडिया लिमिटेड की अनुषंगी कम्पनी / भारत सरकार की एक लोक उपक्रम)
पंजीकृत कार्यालय : गोन्दवाना प्लेस, काँके रोड, राँची - 834031 (झारखण्ड) भारत
क्षेत्रीय संस्थान-2, पत्रा. बीसीसीएल टाउनशीप, कोयला नगर, धनबाद 826005 (झारखण्ड) भारत
Central Mine Planning & Design Institute Limited
(A Subsidiary of Coal India Limited / Govt. of India Public Sector Undertaking)
Registered Office : Gondwana Place, Kanke Road, Ranchi –834031(Jharkhand)
Regional Institute-II, P.O. BCCL Township, Koylanagar, Dhanbad 826005(Jharkhand) India
Corporate Identity No. U14292JH1975GOI001223

cmpdi
A Mini Ratna Company

पत्रांक: आर.आई.-2/पर्यावरण/एम-30/ 1150

दिनांक: 20.06.2015

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

विषय: Study of installation of Rail-cum-Conveyor System in BCCL for transportation of coal.

महोदय,

This has reference to your letter no. BCCL/GM(Env.)/F-EC/13/622, dated 25.05.2013 for conducting the study and preparation of plan for installation of Rail-cum-Conveyor System for coal transportation in BCCL as a part of compliance of environmental clearance (EC) conditions stipulated by MoEF & CC in EC orders of different clusters. In this regard, we would like to inform you the following:

a. As per EC clearance order transportation plan for Rail-cum-Conveyor system should dovetailed with Jharia Action Plan (Master Plan). The system of transportation is required to be installed in 2nd phase of EC implementation i.e. after completion of Master Plan (10 years) and 5 years of gestation period.

b. JRDA has issued direction to RITES for traffic survey and data collection to initiate feasibility study regarding Diversion of Railway lines from fire affected and subsidence prone areas

c. Coal transportation route / conveyor installation layout will be finalized after liquidation of coal mine fire, rehabilitation of 595 unstable sites, road and rail route alignment and location of Rly. Sidings of BCCL.

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

This is for your kind information.

भवदीय

(वि. कु. सिन्हा) 20/6/15
क्षेत्रीय निदेशक

Sri Amarendu Sb.
For compliance purpose.
23/6/15

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

ANNEXURE-VII

Study of Occupational diseases and Hearing impairments of Coal Mines workers of BCCL directly involved in active mining operations

CMS/699(L)/11/10/19

11/10/19
GM (Environment)

REGIONAL OCCUPATIONAL HEALTH CENTRE (EASTERN), KOLKATA

&

NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH, AHMEDABAD

(Indian Council of Medical research)

Study of Occupational diseases and Hearing impairments of Coal Mines workers of BCCL directly involved in active mining operations

REGIONAL OCCUPATIONAL HEALTH CENTRE (EASTERN), KOLKATA

&

NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH, AHMEDABAD

(Indian Council of Medical research)

CONTENTS

LIST OF PARTICIPANTS

Investigators

Dr Sunil Kumar, Director

Dr H G Sadhu, Scientist F

Dr Asim Saha, Scientist E

Dr D S Munda, Scientist D

Dr R R Tiwari, Ex- Scientist E (Involvement in initial planning and framing the project, write up)

Technical Staff

Mr. Sk. J. Alam, Technical Assistant

Mr. M. K. Chakraborty, Technical Assistant

Mr. A. Das, Technician C

Mr. S. Meena, Technician C

Mr. T. K. Dasgupta, Technician B

Mr. B. B. Patel, Technician B

BACKGROUND

Although coal remains a major energy resource worldwide, coal mining causes environmental problems, whereas the inhaled coal particles at the work place may lead to the development of coal workers' pneumoconiosis (CWP). Typically, coal workers pneumoconiosis takes many years to develop and to be manifested. Further, once initiated the disease is progressive in nature, often leading to lungfunction impairment, disability. The workers' exposure to coal dust generally occurs during mining operations. Coal mining can also increase the risk of developing asthma and chronic obstructive pulmonary disease (COPD), such as emphysema and chronic bronchitis. It is suggested that coal mining operations may also induce noise induced hearing impairment among the workers.

A request was received from Bharat Coking Coal Limited, Dhanbad to assess the health status of their workers involved in the mining activities in Cluster 11 and 15 areas around Dhanbad. About 10% of the subjects involved in mining activities were to be included in this study. The workers were to be assessed for their health status, presence of any occupational disease and hearing impairments. Under this circumstance, in consultation of the scientists of National Institute of Occupational Health (NIOH) and the concerned officers of Bharat Coking Coal Limited, it was decided that an epidemiological study would be carried out involving workers involved in mining activities.

INTRODUCTION

Coal is an aggregate of heterogeneous substances composed of organic and inorganic materials. The four major coal types ranked in order of increasing heat value are lignite, sub-bituminous, bituminous, and anthracite. The inorganic portion of coal can range from a few percent to >50% (by weight) and is composed of phyllo-silicates (kaolinite, illite, etc.), quartz, carbonates, sulfides, sulfates, and other minerals. In general, aluminum and iron are the main metals in the coals. Arsenic, nickel, zinc, cadmium, cobalt, and copper are trace metals that represent only a very small fraction of the mineral matter[1].

Coal mining in India has a long history of commercial exploitation covering nearly 220 years starting in 1774 in the Raniganj Coalfield along the Western bank of river Damodar. However, for about a century the growth of Indian coal mining remained sluggish for want of demand but the introduction of steam locomotives in 1853 gave a fillip to it. As on 2011, India had 285 billion tonnes of resource. The production of coal was 532.69 million tonnes in 2010-11. The production of lignite was 37.73 million tonnes in 2010-11. As on 2011, India ranked 3rd in world coal production.[2]

Coal remains a major energy resource worldwide. In the United States, > 50% of electricity is generated in coal-fired power plants. However, coal mining causes environmental problems such as acid mine drainage, whereas the inhaled coal particles at the work place may lead to the development of coal workers' pneumoconiosis (CWP).[3,4]Typically, coal workers pneumoconiosis takes many years to develop and be manifested requiring a surveillance for a longer duration. Further once initiated the disease is progressive in nature often leading to lung function impairment, disability, and premature death.

Coal mining can also increase the risk of developing asthma and chronic obstructive pulmonary disease (COPD), such as emphysema and chronic bronchitis.[5-7]It is suggested that coal dust stimulates the recruitment of neutrophils to the lungs and both these neutrophils and resident alveolar macrophages show evidence of activation, secreting free radicals and proteolytic enzymes, plausible mediators of tissue injury in emphysema[8-10].

Considering the environmental – occupational hazards involved, regular and periodic monitoring of environmental conditions and the health status of the workers is always advised and recommended. A request was received from Bharat Coking Coal Limited, Dhanbad to assess the health status of their workers involved in the mining activities in Cluster 11 and 15 areas around Dhanbad. The workers were to be assessed for their health status, presence of any occupational disease and hearing impairments. Under this background the present project is developed with the aim of studying the coal mining as well as coal dust related health effects in the mining workers.

AIM AND OBJECTIVES

AIMS

To study the coal mining as well as coal dust related health effects in the coal mining workers.

OBJECTIVES

1. To understand health status of workers through questionnaire survey, health examination.
2. To study respiratory health in coal field mining workers.
3. To assess ventilatory functions of coal field mining workers.
4. To analyze hearing ability through audiometric evaluation.

METHODOLOGY

An occupational health study was conducted involving different mines of Cluster 11 and 15 of Bharat coking Coal Limited, Dhanbad. This study was undertaken among the exposed workers mainly from active mining activity. Representative sample from workers working in such occupations is included in this study. Initially the aim of the study was explained to the workers, informed consent was obtained after which they were enrolled for this study. Every individual subject was interviewed with a pre-designed questionnaire to collect information in relation to personal, occupational and morbidity details of the workers. The participants of this study were subjected to following interview/examination/investigations:

- Detailed personal, occupational and medical history.
- Clinical examination with special emphasis on examination of respiratory system.
- Haematological examination.
- Lung function test.
- Audiometry.
- Ophthalmological assessment.

Study design: Cross sectional study

Study subjects: This study covered 351 subjects from Kustore sector and 140 subjects from Bagmara sector of BCCL Collieries. Among the subjects of Kustore sector 49 were from Kachi Balihari mines, 51 from Bhagabandh mines, 40 from Gopali Chawk mines and 100 from Munidi mines. PB project mines contributed 111 subjects. Similarly among the subjects of Bagmara sector, Kharkharee mines and Phularitand mines contributed 75 subjects and 65 subjects respectively. Workers actively involved in mining actively were mainly included in this study. However, few subjects of this study were enrolled from supervisory staffs in order to have a complete and comprehensive understanding of the occupational health condition. These workers were randomly selected from the total workforce in the selected clusters and mines.

Data collection: The information regarding demographic, occupational and clinical history was collected on a pre-designed and pre-tested proforma through interview of subject. This was followed by complete clinical examination, spirometry, audiometry and chest radiography of each subject. The audiometer and spirometer were brought by NIOH team while for chest radiography the facilities at BCCL hospitals were used. The processing of exposed films was done by the technicians at BCCL hospital. The ophthalmological examination and haematological – biochemical estimations were also done using facilities and expertise at BCCL hospitals.

Data analysis: Data entry and analysis were done in standard statistical software. The statistical analysis included calculation of differences, proportions and application of tests of significance etc, to ascertain health effects especially respiratory health conditions.

Lung function test was carried out in all subjects. Forced vital capacity (FVC), and Peak Expiratory Flow Rate (PEFR) were recorded by Spirovit-sp-10 (Schiller Health Care Ltd, Switzerland). Three successive recording of FVC and PEFR were made in standing posture and the nose clip was used. The best of the three performances was considered for calculation purpose. The different flow volumes like FEV_1, FEV_1% was calculated from the same tracings. All volumes

obtained were expressed in body temperature on atmospheric pressure of air saturated with water vapour (BTPS). Body height and body weight were measured in bare feet on a standard scale. Pulmonary function test values were predicted from the standard prediction equation. The instrument was calibrated every day before starting the experiment.

Blood was collected from each worker by venipuncture taking all aseptic precautions. Hematological and biochemical analysis was carried out using standard procedure.

Audiometric Evaluation of Hearing:

The following criteria were maintained for non- inclusion of workers as subjects in audiometry:

- Whose present hearing level was not amenable to quantitative description, who had served in the armed forces, or had been exposed to gunfire, or whose past noise exposure was different from that of their present occupation.
- Who were known to have existing or previous ear disease or abnormality.
- Head injury with history of unconsciousness or skull fracture.

Criteria for acceptance (inclusion criteria) as test subjects:

The following criteria were applied for categorizing ears as acceptable for the test

- Tympanic membrane intact
- No history of congenital or acquired conditions associated with sensory neural hearing loss e.g. congenital deafness, meningitis, unconsciousness, treatment with ototoxic drugs, vertigo, etc.

Criteria for normal hearing:

Hearing impairment is considered to occur when the average of the hearing threshold levels at audiometric frequencies of both ears exceed 25 dBA. Pure tone air conduction hearing threshold

was obtained in a quiet room. Threshold of hearing is defined as the minimum decibel level (dB) at which the subjects respond at least two times on ascending trial. The data for each subject was obtained. Pure tone threshold were obtained using descending- ascending threshold crossing technique. The data was analyzed for each ear of the subjects for all test frequencies. Hearing threshold at test frequencies was averaged for all subjects to assess hearing sensitivity.

Measurement of hearing:

Pure tone audiometry was carried out for the present investigation. In the individual experiment, subjects were briefed about the nature and purpose of the study. He was then seated in a chair, the earphones were fitted on his ears, and the door of the room was closed. They were instructed to respond by raising their fingers when they could just hear the tone lasting for 2 sec. The pulsing of the tone was set at 0.5/ sec. The intensity of the tone was raised by 5 dB until the threshold of hearing was determined at each test frequency viz 125Hz, 250Hz, 500Hz, 1KHz, 1.5KHz, 2KHz, 3KHz, 4KHz, 6KHz.and 8KHz. The actual measurement was started following a brief practice trial session. The better ear followed by the other ear was tested. The right ear was tested first in cases where both the ears were reported to be nearly equal in hearing sensitivity. It was ensured that the subject would fully cooperate. Care was taken to ensure reliable reporting of the subjects' 'just audible sound'. Misses (error of omission) and false alarms (error of commission) were avoided.

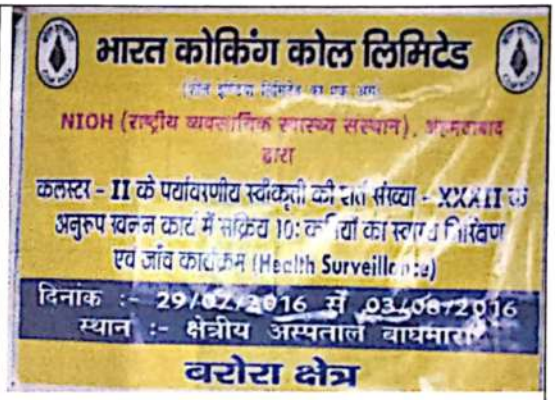
Equipment (Audiometer):

An audiometer was used as the source of pure tone audiometry. It has all the facilities of mask attenuation, frequency setting (125-8000 Hz.), decibel setting of pure tone and pulse setting. It has also a pair of earphone attachment. The audiometer is calibrated periodically as per the specification of International Standards Organization.

Questionnaire survey

Medical Examination

Pulmonary Function Test



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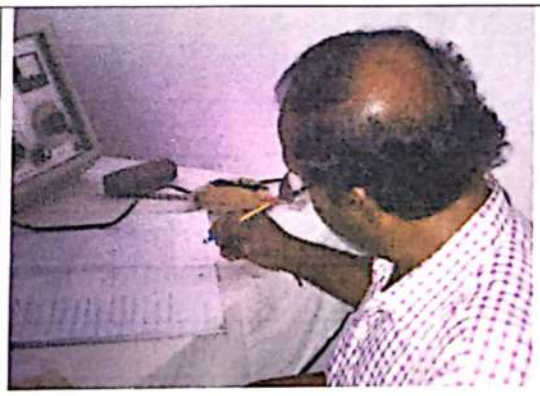

Audiometry

Haematology & Radiology Examination

RESULT

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DISCUSSION

(Total subjects)

This study covered 351 subjects from Kustore sector and 140 subjects from Baghmara sector of BCCL Collieries. Among the subjects of Kustore sector 49 were from Kachi Balihari mines, 51 from Bhagabandh mines, 40 from Gopali Chawk mines and 100 from Munidi mines. PB project mines contributed 111 subjects (Table 1). Similarly among the subjects of Baghmara sector, Kharkharee mines and Phularitand mines contributed 75 subjects and 65 subjects respectively. Workers actively involved in mining activity were mainly included in this study. However, about 10% subjects of this study were enrolled from supervisory staffs in order to have a complete and comprehensive understanding of the occupational health condition.

Table 1: Distribution of Supervisory workers and coal miners according to the name of the mine

Sector	Mine Name	Supervisory workers	Coal Miners	Total
		N (%)	N (%)	N (%)
Kustore	10/12 KACHI BALIHARI PITS	8 (2)	41 (12)	49 (14)
	BHAGABANDH COLLIARY	10 (3)	41 (12)	51 (15)
	GOPALI CHAWK COLLIARY	7 (2)	33 (9)	40 (11)
	MUNIDI COLLIARY	17 (5)	83 (24)	100 (29)
	P.B.PROJECT COLLIARY	5 (1)	106 (30)	111 (31)
Total		47 (13)	304 (87)	351
Baghmara	KHARKHAREE COLLIARY	5 (4)	70 (50)	75 (54)
	PHULARITAND COLLIARY	1 (1)	64 (45)	65 (46)
Total		6 (5)	134 (95)	140
Grand Total		**53 (10)**	**438 (90)**	**491 (100)**

Mean age of the workers was 45.9 ± 8.36 years. Most of the workers were between 35-54 years age group. Mean age of supervisory staffs was slightly higher than that of miners. About 98% workers were married. As far as education is concerned majority (56%) had middle school education. Only 4% subjects had graduate level education or higher (Table 2).

Table 2: Demographic characteristics of the study subjects

Demographic characteristics	Supervisory workers	Coal Miners	Total
Age group (in years)	**N (%)**	**N (%)**	**N (%)**
<25	0(0)	4(1)	4(1)
25 - 34	5(1)	34(7)	39(8)
35 - 44	9(2)	148(30)	157(32)
45 - 54	18(4)	175(36)	193(40)
≥55	16(3)	77(16)	93(19)
Mean age (in years)	**48.31 ± 9.47**	**45.55 ± 8.189**	**45.9 ± 8.36**
Marital status			
Single	2(0.5)	6(1.5)	8(2)
Married	46(8.5)	432(89.5)	478(98)
Education status			
Illiterate	0(0)	102(21)	102(21)
Primary schooling	1(0)	15(3)	16(3)
Middle schooling	18(4)	256(53)	274(56)
Secondary schooling	19(4)	56(12)	75(15)
Graduate and above	10(2)	9(2)	19(4)

So far as personal habits are concerned, 86% of subjects were non-smokers, 10% were smokers and 3% were ex-smokers. Tobacco chewing habit was present in 61% subjects and occasional alcohol intake history was found in 39% workers (Table 3).

Table 3: Personal habits of the study subjects

Demographic characteristics	Supervisory workers	Coal Miners	Total
Smoking habits	N (%)	N (%)	N (%)
Non-smoker	38(8)	382(79)	420(86)
Smoker	9(2)	40(8)	49(10)
Ex-smoker	1(0)	16(3)	17(3)
Tobacco chewer			
No	27(6)	160(33)	187(39)
Yes	21(4)	283(57)	304(61)
Alcohol drinking habit			
No	34(7)	264(54)	298(61)
Yes	14(3)	174(36)	188(39)

Mean job experience was 11.72 ± 8.49 years. About 83% workers had job experience of up to 20 years, 3% workers had experience more than 30 years (Table 4). Mean experience was a little higher in supervisory employee group than miners group.

Table 4: Occupational characteristics of Supervisory workers & Coal miners

Demographic characteristics	Supervisory workers	Coal Miners	Total
Duration of job (in years)	N (%)	N (%)	N (%)
<10	23(5)	241(49)	264(54)
10 - 20	12(2)	129(26)	141(29)
21 - 30	13(3)	60(12)	73(15)
>30	0(0)	13(3)	13(3)
Mean duration of job (years)	**12.65 ± 9.31**	**11.61 ± 8.39**	**11.72 ± 8.49**

Most common symptoms complained by study subjects were musculoskeletal pain (34%) (Table 5). Other complaints were Cough, difficulty in breathing, chest pain, loose teeth, and soreness of mouth and colicky pain in abdomen. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects.

Table 5: Distribution of symptoms among study subjects

Symptoms	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Cough	1 (0.5)	23 (4.5)	24 (5)
Cough with Phlegm	0 (0)	7 (1)	7 (1)
Difficulty in Breathing	2 (0.5)	27 (5.5)	29 (6)
Chest Pain	2 (0.5)	23 (4.5)	25 (5)
Colicky pain	1 (0.5)	14 (2.5)	15 (3)
Loose Teeth	5 (1)	36 (7)	41 (8)
Soreness of mouth/throat	3 (1)	21 (4)	24 (5)
Urinary problems	1 (0.25)	5 (0.75)	6 (1)
Musculoskeletal pain	21 (4)	146 (30)	167 (34)
Headache/sleep difficulty /weakness/dizziness/tremor	6 (2)	46 (9)	52 (11)

Table 8: Pulmonary function impairments among study subjects

Pulmonary function category	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
FVC/PFVC			
<80%	0 (0.0)	15 (3.0)	15 (3.0)
≥80%	53 (11.0)	423 (86.0)	476 (97.0)
$FEV_{1\%}$			
< 70 %	2 (0.5)	29 (6.0)	31 (6.5)
70- 79.99 %	21 (4.5)	158 (32.0)	179 (36.5)
≥ 80 %	30 (6.0)	251 (51.0)	281 (57.0)
FVC/PFVC <80% + $FEV_{1\%}$ <70%	0 (0.0)	3 (0.6)	3 (0.6)

FVC – Forced Vital Capacity; PFVC – Predicted Forced Vital Capacity; FEV_1 – Forced Expiratory Volume in first second

Table 9: Forced Vital Capacity according to study variables among study subjects

Study variables	Forced Vital Capacity [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	**Mean ± SD (litres)**	**Mean ± SD (litres)**	**Mean ± SD (litres)**
< 45	3.85 ± 0.585	3.71 ± 0.646	3.72 ± 0.641
≥ 45	3.53 ± 0.576	3.36 ± 0.64	3.38 ± 0.634
	t = 3.120;df =1;p=0.083	t=30.586;df=1;p=0.00	t=32.016;df=1;p=0.00
Duration of exposure (yrs)			
< 20	3.64 ± 0.562	3.52 ± 0.65	3.53 ± 0.643
≥ 20	3.55 ± 0.672	3.47 ± 0.71	3.48 ± 0.702
	t=0.264;df=1;p=0.610	t=0.430;df=1;p=0.512	t=0.519;df=1;p=0.472
Smoking habit			
Never smoker	3.6 ± 0.587	3.5 ± 0.655	3.51 ± 0.649
Ever smoker	3.76 ± 0.613	3.49 ± 0.616	3.54 ± 0.619
	t=0.210;df=1;p=0.649	t=0.115;df=1;p=0.735	t=0.317;df=1;p=0.574

Similar trend was observed in case of FEV1 values also (Table 10). Significant difference was observed between subject of less than 45 years and rest of the workers. This difference was more prominent in miners than supervisory staffs. No such remarkable difference was observed when compared in relation to job experience and smoking habit.

Table 10: Forced Expiratory Volume in first second according to study variables among study subjects

Study variables	Forced Expiratory Volume in first second [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	**Mean ± SD (litres)**	**Mean ± SD (litres)**	**Mean ± SD (litres)**
< 45	3.073 ± 0.3887	3.028 ± 0.5229	3.031 ± 0.5139
≥ 45	2.837 ± 0.4553	2.685 ± 0.5597	2.705 ± 0.5486
	t=2.95;df=1;p=0.092	t=42.02;df=1;p=0.001	t=43.53;df=1;p=0.001
Duration of exposure (yrs)			
< 20	2.945 ± 0.4025	2.844 ± 0.5556	2.854 ± 0.5427
≥ 20	2.791 ± 0.5426	2.769 ± 0.6072	2.772 ± 0.5962
	t=1.259;df=1;p=0.267	t=1.319;df=1;p=0.25	t=1.872;df=1;p=0.172
Smoking habit			
Never smoker	2.886 ± 0.4428	2.836 ± 0.5617	2.841 ± 0.5509
Ever smoker	2.972 ± 0.5042	2.763 ± 0.5127	2.805 ± 0.5129
	t=0.208;df=1;p=0.650	t=0.131;df=1;p=0.72	t=0.018;df=1;p=0.895

Same pattern could be found in case of Peak Expiratory Flow Rate also (Table 11). Significant difference was present in relation to age (more so in miners than supervisor), however, smoking and duration of exposure wise classification did not show any significant difference.

Table 11: Peak Expiratory Flow Rate according to study variables among study subjects

Study variables	Peak Expiratory Flow Rate [Mean ± SD (litres/minute)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean±SD (litres/minute)	Mean±SD (litres/minute)	Mean ± SD (litres/minute)
< 45	465 ± 63.579	473.23 ± 65.358	472.65 ± 65.113
≥ 45	479.47 ± 60.402	444.83 ± 85.172	449.4 ± 83.078
	t=0.571;df=1;p=0.458	t=14.37;df=1;p=0.00	t=10.97;df=1;p=0.001
Duration of exposure (yrs)			
< 20	474.86 ± 59.704	458.15 ± 75.028	459.79 ± 73.769
≥ 20	477.33 ± 66.167	450.2 ± 89.349	453.97 ± 86.752
	t=0.01;df=1;p=0.896	t=0.785;df=1;p=0.376	t=0.506;df=1;p=0.477
Smoking habit			
Never smoker	475.37 ± 61.851	456.31 ± 78.316	458.17 ± 77.012
Ever smoker	475 ± 63.64	461.75 ± 76.691	464.4 ± 73.849
	t=0.002;df=1;p=0.962	t=0.193;df=1;p=0.661	t=0.301;df=1;p=0.583

So far as chest radiographic findings are concerned, 93% subjects (Table 12) had findings within normal limits. 3% subjects showed findings suggestive of opacities in lung and almost 1.5% had other features on chest X-ray (mostly suggestive of Koch's infection of lung).

Table 12: Chest radiographic findings among the study subjects

Chest X ray findings	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Within normal limit	50 (10)	408 (83)	458 (93)
Pulmonary Opacities	1 (0.5)	12 (2.5)	13 (3)
Koch's infection	0 (0)	7 (1.5)	7 (1.5)
Not Done	2 (0.5)	11(2.0)	13(2.5)
Total	**53 (11)**	**438 (89)**	**491 (100)**

Haematological and biochemical findings of the subjects were mostly within normal limits. Almost 11% workers had random blood sugar level >140. Mean Hemoglobin level in 13.1±0.8 gm%. Mean ESR was 7.0±2.1 unit. Random Blood sugar, blood urea and creatinine was 114.7±36.4 unit, 22.7±3.6 unit and 0.8±0.1unit respectively (Table 13).

Table 13: Haematological & Biochemical findings of study subjects

Parameter	Minimum	Maximum	Mean ± SD
Haemoglobin (g/dL)	10	15	13.15 ± 0.845
Erythrocyte Sedimentation Rate (mm/h)	3	20	7.046 ± 2.144
Total Leucocyte Count (mcL)	5500	12600	9064.61 ± 1167.13
Neutrophil	46	89	61.77 ± 5.826
Lymphocyte	20	62	31.97 ± 6.013
Eosinophil	2	13	5.62 ± 1.77
Monocyte	0	8	0.80 ± 0.905
Besophil	0	0	0.00
Random Blood Sugar (mg/dL)	55	300	114.74 ± 36.46
Blood Urea (mg/dL)	14	38	22.75 ± 3.63
Serum Creatinine (mg/dL)	.30	7.00	0.83 ± 0.32

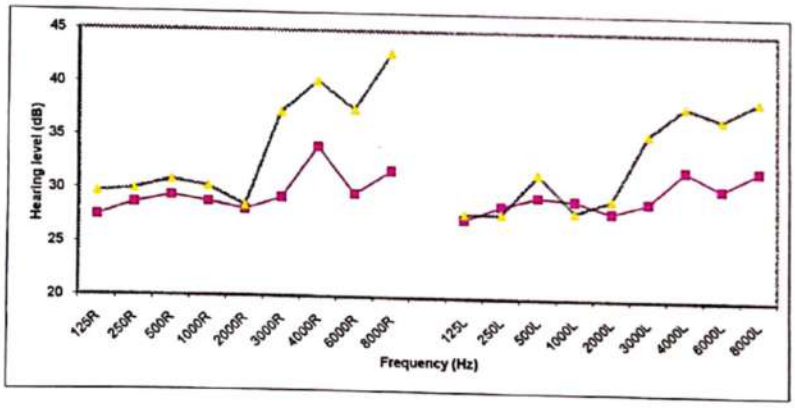
As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision (although using spectacles) and 9% subjects had Cataract in eyes. Colour blindness was also observed in few subjects (Table 14).

Table 14: Ophthalmological findings of study subjects

	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
People having uncorrected vision after correction	1 (0.5)	24 (4.5)	25 (5)
Colour Blindness	0	6 (1)	6 (1)
Cataract	4 (1)	29 (8)	33 (9)
Glaucoma	0 (0)	2 (1)	2 (1)
Muscular Pathology	0	1	1
Pterygium	0	1	1

Figure 1 describes hearing ability of workers examined by audiometry. Two curves depict the median hearing ability of subjects with <10 years (lower curve), and ≥ 10 years (higher curve) of job experience. On preliminary observation, decreased hearing ability at high frequency was observed in some workers. Difference of hearing ability with increasing duration of exposure was also observed at higher frequency; however, this observation also is subject to adjustment for age and other probable factors that can affect hearing ability. Moreover, hearing assessment was done in field condition where despite best efforts ideal experimental chamber condition could not be achieved, which may also be a contributing factor.

Figure 1: Distribution of hearing ability according to job experience



RESULT

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DISCUSSION

(Kustore area subjects)

This study covered 351 subjects from Kustore sector of BCCL Collieries. Among the subjects of Kustore sector 49 were from Kachi Balihari mines, 51 from Bhagabandh mines, 40 from Gopali Chawk mines and 100 from Munidi mines. PB project mines contributed 111 subjects (Table 15). Workers actively involved in mining activity were mainly included in this study.

Table 15: Distribution of Supervisory workers and coal miners of Kustore area

Sector	Mine Name	Supervisory workers	Coal Miners	Total
		N (%)	N (%)	N (%)
Kustore	10/12 KACHI BALIHARI PITS	8 (2)	41 (12)	49 (14)
	BHAGABANDH COLLIARY	10 (3)	41 (12)	51 (15)
	GOPALI CHAWK COLLIARY	7 (2)	33 (9)	40 (11)
	MUNIDI COLLIARY	17 (5)	83 (24)	100 (29)
	P.B.PROJECT COLLIARY	5 (1)	106 (30)	111 (31)
	Total	47 (13)	304 (87)	351

Mean age of the workers was 46.3 ± 8.36 years. Most of the workers were between 35-54 years age group. Mean age of supervisory staffs was slightly higher than that of miners. About 98% workers were married. As far as education is concerned majority (53%) had middle school education. Only 5% subjects had graduate level education or higher (Table 16).

Table 16: Demographic characteristics of the study subjects of Kustore area

Demographic characteristics	Supervisory workers	Coal Miners	Total
Age group (in years)	N (%)	N (%)	N (%)
< 25	0 (0)	2 (1)	2 (1)
25-34	4 (1)	22 (6)	26 (7)
35-44	8 (2)	104 (30)	112 (32)
45-54	18 (5)	118 (34)	136 (39)
≥ 55	17 (5)	58 (17)	75 (21)
Mean age (in years)	49.06 ± 8.928	48.87 ± 8.21	46.30 ± 8.368
Marital status			
Single	2 (1)	5 (1)	7 (2)
Married	45 (13)	299 (85)	344 (98)
Education status			
Illiterate	0 (0)	72 (20)	72 (20)
Primary schooling	1 (0.5)	12 (3.5)	13 (4)
Middle schooling	17 (5)	169 (48)	186 (53)
Secondary schooling	18 (5)	44 (13)	62 (18)
Graduate and above	11 (3)	7 (2)	18 (5)

So far as personal habits are concerned (Table 17), 83% of subjects were non-smokers, 12% were smokers and 5% were ex-smokers. Tobacco chewing habit was present in 61% subjects and occasional alcohol intake history was found in 38% workers.

Table 17: Personal habits of the study subjects of Kustore area

Demographic characteristics	Supervisory workers	Coal Miners	Total
Smoking habits	**N (%)**	**N (%)**	**N (%)**
Non-smoker	38 (11)	254 (72)	292 (83)
Smoker	8 (2)	34 (10)	42 (12)
Ex-smoker	1 (0.5)	16 (4.5)	17 (5)
Tobacco chewer			
Yes	22 (6)	193 (55)	215 (61)
No	25 (7)	111 (32)	136 (39)
Alcohol drinking habit			
No	35 (10)	183 (52)	218 (62)
Yes	12 (3)	121 (34)	133 (38)

Mean job experience was 12.68 ± 8.9 years. About 78% workers had job experience of up to 20 years, 3% workers had experience more than 30 years. Mean experience was a little higher in supervisory employee group than miners group (Table 18).

Table 18: Occupational characteristics of Supervisory workers & Coal miners of Kustore area

Demographic characteristics	Supervisory workers	Coal Miners	Total
Duration of job (in years)	N (%)	N (%)	N (%)
<10	21 (6)	153 (43)	174 (49)
10 - 20	13 (4)	88 (25)	101 (29)
21 - 30	13 (4)	52 (15)	65 (19)
>30	0 (0)	11 (3)	11 (3)
Mean duration of job (years)	13.48 ± 9.28	12.56 ± 8.85	12.68 ± 8.90

Most common symptoms complained by study subjects were musculoskeletal pain (34%). Other complaints were Cough, difficulty in breathing, and loose teeth. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects (9%) (Table 19).

Table 19: Distribution of symptoms among study subjects of Kustore area

Symptoms	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Cough	2 (1)	18 (5)	20 (6)
Cough with Phlegm	1 (0.5)	4 (1)	5 (1.5)
Difficulty in Breathing	3 (1)	18 (5)	21 (6)
Chest Pain	2 (1)	12 (3)	14 (4)
Colicky pain	1 (0.5)	10 (2.5)	11 (3)
Loose Teeth	5 (1)	30 (9)	35 (10)
Soreness of mouth/throat	3 (1)	8 (2)	11 (3)
Urinary problems	0 (0)	3 (1)	3 (1)
Musculoskletal pain	19 (5)	99 (28)	118 (34)
Headache/sleep difficulty/weakness/dizziness/tremor	5 (2)	26 (7)	31 (9)

Mean height was 160.8 ± 6.3 cm and mean weight was 66.1 ± 11.9 kg for miners. Mean height was slightly higher in supervisory staffs whereas mean weight was considerably higher. This may be result of sedentary lifestyle and relative lack of exercise. Mean systolic and diastolic blood pressure of miners was 131.4±19.1 and 85.0± 10.6 mm of Mercury (Table 20). About 19% subjects had systolic blood pressure >140 as well as diastolic blood pressure > 90 mm of Mercury. 10% workers had only higher systolic blood pressure and 13% had only higher diastolic blood pressure (Table 21).

Table 20: Distribution of salient clinical findings among study subjects of Kustore area

Clinical examination findings	Supervisory workers	Coal Miners	Total
	Mean ± SD	Mean ± SD	Mean ± SD
Mean Height (cm)	162.53 ± 5.88	160.84 ± 6.37	161.07 ± 6.33
Mean Weight (Kgs)	71.94 ± 9.78	66.19 ± 11.93	66.96 ± 11.81
MSBP (mm Hg)	131.11 ± 15.79	131.42 ± 19.11	131.37 ± 18.68
MDBP (mm Hg)	85.57 ± 8.78	85.02 ± 10.62	85.10 ± 10.38

MSBP - Mean Systolic Blood Pressure; MDBP - Mean Diastolic Blood Pressure

Table 21: Distribution of Blood pressure among study subjects of Kustore area

	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Blood Pressure (mm Hg) >140 & <90	4 (1)	32 (9)	36 (10)
Blood Pressure (mm Hg) <140 & >90	8 (2)	37 (11)	45 (13)
Blood Pressure (mm Hg) <140 & <90	26 (7)	179 (51)	205 (58)
Blood Pressure (mm Hg) >140 & >90	9 (3)	56 (16)	65 (19)

As far as pulmonary functional status of study subjects in concerned, about 3 % subjects had restrictive type of abnormality (FVC/PFVC < 80%) and 0.3% subjects had combined type of abnormality (FVC/PFVC <80 % and $FEV_{1\%}$ <70%). A good number of subjects (40.5%) had $FEV_{1\%}$ values between 70% and 80% (Table 22).

Table 22: Pulmonary function impairments among study subjects of Kustore area

Pulmonary function category	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
FVC/PFVC			
<80%	0 (0.0)	10 (3.0)	10 (3.0)
≥80%	47 (13.0)	294 (84.0)	341 (97.0)
$FEV_{1\%}$			
< 70 %	2 (0.5)	17 (5.0)	19 (5.5)
70- 79.99 %	17 (5.0)	125 (35.5)	142 (40.5)
≥ 80 %	28 (8.0)	162 (46.0)	190 (54.0)
FVC/PFVC <80% + $FEV_{1\%}$ <70%	0 (0.0)	1 (0.3)	1 (0.3)

FVC – Forced Vital Capacity; PFVC – Predicted Forced Vital Capacity; FEV_1 – Forced Expiratory Volume in first second

Mean FVC values were lower among the subjects of age 45 years or above. The difference was significant among the miners but not significant statistically among the supervisory staffs. Such significant difference of FVC values was not observed when compared between higher and lower job experience groups. Similarly difference was not prominent in relation to smoking habit of the subjects (Table 23).

Table 23: Forced Vital Capacity according to study variables among study subjects of Kustore area

Study variables	Forced Vital Capacity [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	**Mean ± SD (litres)**	**Mean ± SD (litres)**	**Mean ± SD (litres)**
< 45	3.86 ± 0.60	3.82 ± 0.66	3.82 ± 0.65
≥ 45	3.61 ± 0.55	3.46 ± 0.67	3.48 ± 0.65
	t=0.192;df=1;p=0.19	t=21.85;df=1;p= 0.00	t=0.344;df=1;p=0.558
Duration of exposure (yrs)			
< 20	3.69 ± 0.56	3.63 ± 0.67	3.64 ± 0.66
≥ 20	3.64 ± 0.61	3.52 ± 0.72	3.54 ± 0.70
	t =0.071;df=1;p=0.791	t=1.536;df=1;p=0.216	t=1.533;df=1;p=0.217
Smoking habit			
Never smoker	3.67 ± 0.56	3.63 ± 0.68	3.63 ± 0.66
Ever smoker	3.67 ± 0.65	3.52 ± 0.75	3.55 ± 0.73
	t=0.000;df=1;p=0.996	t=0.905;df=1;p=0.342	t=0.768;df=1;p=0.381

Similar trend was observed in case of FEV1 values also (Table 24). Significant difference was observed between subject of less than 45 years and rest of the workers. This difference was more prominent in miners than supervisory staffs. No such remarkable difference was observed when compared in relation to job experience and smoking habit.

Table 24: Forced Expiratory Volume in first second according to study variables among study subjects of Kustore area

Study variables	Forced Expiratory Volume in first second [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres)	Mean ± SD (litres)	Mean ± SD (litres)
< 45	3.075 ± 0.40	3.10 ± 0.52	3.09 ± 0.51
≥ 45	2.91 ± 0.41	2.75 ± 0.58	2.78 ± 0.56
	t=1.388;df=1;p=0.245	t=28.214;df=1;p=0.00	t=28.69;df=1;p= 0.00
Duration of exposure (yrs)			
< 20	2.99 ± 0.37	2.93 ± 0.56	2.93 ± 0.54
≥ 20	2.86 ± 0.48	2.82 ± 0.63	2.82 ± 0.60
	t=1.025;df=1;p=0.317	t=2.033;df=1;p=0.155	t=2.64;df=1;p=0.105
Smoking habit			
Never smoker	2.95 ± 0.40	2.92 ± 0.57	2.93 ± 0.55
Ever smoker	2.98 ± 0.47	2.79 ± 0.63	2.82 ± 0.61
	t=0.035;df=1;p=0.853	t=2.156;df=1;p=0.143	t=1.769;df=1;p=0.184

Same pattern could be found in case of Peak Expiratory Flow Rate also (Table 25). Significant difference was present in relation to age (more so in miners than supervisor), however, smoking and duration of exposure wise classification did not show any significant difference.

Table 25: Peak Expiratory Flow Rate according to study variables among study subjects of Kustore area

Study variables	Peak Expiratory Flow Rate [Mean ± SD (litres/minute)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres/minute)	Mean ± SD (litres/minute)	Mean ± SD (litres/minute)
< 45	460 ± 67.42	474.38 ± 65.54	473.14 ± 65.58
≥ 45	486.18 ± 57.74	447.8 ± 87.25	454.02 ± 84.27
	t=1.671;df=1;p=0.20	t=8.416;df=1;p=0.004	t=5.137;df =1;p= 0.02
Duration of exposure (yrs)			
< 20	476.56 ± 61.88	460.98 ± 74.17	462.93 ± 72.82
≥ 20	485.71 ± 59.83	451.31 ± 92.80	456.49 ± 89.22
	t=0.217;df=1;p=0.64	t=0.867;df=1;p=0.353	t=0.471;df=1;p=0.493
Smoking habit			
Never smoker	478.92 ± 60.50	458.56 ± 79.93	461.15 ± 77.94
Ever smoker	481.11 ± 65.47	461.2 ± 79.94	464.24 ± 77.73
	t=0.009;df=1;p=0.92	t=0.046;df=1;p=0.83	t=0.077;df=1;p=0.781

So far as chest radiographic findings are concerned, about 94% subjects had findings within normal limits. About 2.5% subjects showed findings suggestive of opacities in lung and almost 1% had other features on chest X-ray (mostly suggestive of Koch's infection of lung) (Table 26).

Table 26: Chest radiographic findings among the study subjects of Kustore area

Chest X ray findings	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Within normal limit	44 (13)	285 (81)	329 (94)
Pulmonary Opacities	1 (0.5)	7 (2.0)	8 (2.5)
Koch's infection	0 (0)	4 (1)	4 (1)
Not Done	2 (0.5)	8 (2.0)	10 (2.5)
Total	**47 (14)**	**304 (86)**	**351 (100)**

Haematological and biochemical findings of the subjects were mostly within normal limits. 9% workers had random blood sugar level >140. Mean Hemoglobin level in 13.4±0.4 gm%. Mean ESR was 7.0±2.1 mm/h. Random Blood sugar, Blood urea and Serum creatinine was 117.6±35.3 mg/dl, 23.5±2.7 mg/dl and 0.9±0.05 mg/dl respectively (Table 27).

Table 27: Haematological & Biochemical findings of study participants of Kustore area

Parameters	Minimum	Maximum	Mean ± SD
Haemoglobin (g/dL)	12	14	13.47 ± 0.483
Erythrocyte Sedimentation Rate (mm/h)	3	20	7.046 ± 2.14
Total Leucocyte Count (mcL)	6100	12600	9509.86 ± 838.53
Neutrophil	50	72	61.48 ± 5.60
Lymphocyte	23	62	33.072 ± 5.15
Eosinophil	3	9	5.01 ± 0.91
Monocyte	0	2	0.56 ± 0.65
Besophil	0	0	0.00
Random Blood Sugar (mg/dL)	75	270	117.64 ± 35.35
Blood Urea (mg/dL)	18	36	23.57 ± 2.77
Serum Creatinine (mg/dL)	.71	1.00	0.90 ± 0.05

Table 28: Ophthalmological findings of study participants of Kustore area

Findings	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
People having uncorrected vision after correction	1 (0.5)	16 (4.5)	17 (5)
Cataract	4 (1)	29 (8)	33 (9)
Glaucoma	0 (0)	2 (1)	2 (1)
Mascular Pathology	0	1	1
Pterygium	0	1	1

As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision (although using spectacles) and 9% subjects had Cataract in eyes (Table 28).

RESULT

&

DISCUSSION

(Baghmara area subjects)

This study covered 140 subjects from Baghmara sector of BCCL Collieries (Table 29). Among the subjects of Baghmara sector, Kharkharee mines and Phularitand mines contributed 75 subjects and 65 subjects respectively. Workers actively involved in mining activity were mainly included in this study. However, about 5% subjects of this study were enrolled from supervisory staffs in order to have a complete and comprehensive understanding of the occupational health condition.

Table 29: Distribution of Supervisory workers and coal miners of Baghmara area

Sector	Mine Name	Supervisory workers	Coal Miners	Total
		N (%)	N (%)	N (%)
Baghmara	KHARKHAREE COLLIARY	5(4)	70(50)	75(54)
	PHULARITAND COLLIARY	1(1)	64(45)	65(46)
Total		6 (5)	134 (95)	140 (100)

Mean age of the workers was 44.9 ± 8.2 years. Most of the workers were between 35-54 years age group. Mean age of supervisory staffs was slightly higher than that of miners. About 99% workers were married. As far as education is concerned majority (66%) had middle school education. Only 1% subjects had graduate level education or higher (Table 30).

Mean job experience was 9.4 ± 6.8 years. About 93% workers had job experience of up to 20 years. Mean experience was a little higher in supervisory employee group than miners group (Table 32).

Table 32: Occupational characteristics of Supervisory workers & Coal miners of Baghmara area

Demographic characteristics	Supervisory workers	Coal Miners	Total
Duration of job (in years)			
<10	5 (3)	85 (61)	90 (64)
10 - 20	1 (1)	39 (28)	40 (29)
21-30	0 (0)	8 (6)	8 (6)
>30	0 (0)	2 (1)	2 (1)
Mean duration of job (years)	**6.17 ± 7.17**	**9.56 ± 6.83**	**9.41 ± 6.85**

Most common symptoms complained by study subjects were musculoskeletal pain (36%). Other complaints were difficulty in breathing, chest pain and soreness of mouth. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by good number of subjects (15%) (Table 33).

Table 33: Distribution of symptoms among study subjects of Baghmara area

Symptoms	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Cough	0 (0)	5 (4)	5 (4)
Cough with Phlegm	0 (0)	3 (2)	3 (2)
Difficulty in Breathing	0 (0)	9 (6)	9 (6)
Chest Pain	0 (0)	11 (8)	11 (8)
Colicky pain	0 (0)	4 (3)	4 (3)
Loose Teeth	0 (0)	6 (4)	6 (4)
Soreness of mouth/throat	0 (0)	13 (9)	13 (9)
Urinary problems	1 (1)	2 (1)	3 (2)
Musculoskletal pain	4 (2)	47 (34)	51 (36)
Headache/sleep dificulty/weakness/dizziness/tremor	1 (1)	20 (14)	21 (15)

Mean highly was 159.3 ± 6.7 cm and mean weight was 61.9 ± 11.5 kg. Mean systolic and diastolic blood pressure was 130.1± 19.2 and 82.9± 10.7 mm of Mercury (Table -34).

Table 34: Distribution of salient clinical findings among study subjects of Baghmara area

Clinical examination findings	Supervisory workers	Coal Miners	Total
	Mean ± SD	Mean ± SD	Mean ± SD
Mean Height (cm)	163.67 ± 6.28	159.18 ± 6.72	159.37 ± 6.74
Mean Weight (Kgs)	67.83 ± 11.0	61.70 ± 11.50	61.96 ± 11.51
MSBP (mm Hg)	134.33 ± 19.16	129.97 ± 19.26	130.16 ± 19.21
MDBP (mm Hg)	80.67 ± 9.35	83.01 ± 10.86	82.91 ± 10.78

MSBP – Mean Systolic Blood Pressure; MDBP - Mean Diastolic Blood Pressure

About 23% subjects had systolic blood pressure >140 as well as diastolic blood pressure > 90 mm of Mercury. 6% workers had only higher systolic blood pressure and 6% had only higher diastolic blood pressure (Table 35).

Table 35: Distribution of Blood pressure among study subjects of Baghmara area

	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Blood Pressure (mm Hg) >140 & <90	3 (2)	6 (4)	9 (6)
Blood Pressure (mm Hg) <140 & >90	0 (0)	9 (6)	9 (6)
Blood Pressure (mm Hg) <140 & <90	2 (1)	88 (63)	90 (64)
Blood Pressure (mm Hg) >140 & >90	1 (1)	31 (22)	32 (23)

As far as pulmonary functional status of study subjects in concerned, about 3.5 % subjects had restrictive type of abnormality (FVC/PFVC < 80%) and 1.43% subjects had combined type of abnormality (FVC/PFVC <80 % and $FEV_{1\%}$ <70%). A good number of subjects (26.5%) had $FEV_{1\%}$ values between 70% and 80% (Table 36).

Similar trend was observed in case of FEV1 values also. Significant difference was observed between subject of less than 45 years and rest of the workers. This difference was prominent in miners and supervisory staffs. No such remarkable difference was observed when compared in relation to job experience and smoking habit (Table 38).

Table 38: Forced Expiratory Volume in first second according to study variables among study subjects of Baghmara area

Study variables	Forced Expiratory Volume in first second [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres)	Mean ± SD (litres)	Mean ± SD (litres)
< 45	3.06 ± 0.44	2.87 ± 0.49	2.87 ± 0.49
≥ 45	2.18 ± 0.27	2.52 ± 0.46	2.50 ± 0.46
	t=9.88;df=1;p=0.035	t=17.48;df=1;p=0.00	t=21.13;df=1;p=0.00
Duration of exposure (yrs)			
< 20	2.614 ± 0.46	2.69 ± 0.51	2.69 ± 0.51
≥ 20	1.780	2.5 ± 0.41	2.45 ± 0.43
	t=2.687;df=1;p=0.176	t=1.863;df=1,p=0.175	t=3.03;df=1;p=0.084
Smoking habit			
Never smoker	2.29 ± 0.40	2.66 ± 0.50	2.65 ± 0.50
Ever smoker	2.85 ± 0.74	2.94 ± 0.61	2.92 ± 0.59
	t=1.654;df=1;p=0.268	t=1.77;df=1;p=0.186	t=2.152;df=1;p=0.145

Same pattern could be found in case of Peak Expiratory Flow Rate also (Table 39). Significant difference was present in relation to age (more so in miners than supervisor), however, smoking and duration of exposure wise classification did not show any significant difference.

Table 36: Pulmonary function impairments among study subjects of Baghmara area

Pulmonary function category	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
FVC/PFVC			
<80%	0 (0.0)	5 (3.5)	5 (3.5)
≥80%	6 (4.5)	129 (92.0)	135 (96.5)
$FEV_{1\%}$			
< 70 %	0 (0.0)	12 (8.5)	12 (8.5)
70- 79.99 %	4 (3.0)	33 (23.5)	37 (26.5)
≥ 80 %	2 (1.0)	89 (64.0)	91 (65.0)
FVC/PFVC <80% + $FEV_{1\%}$ <70%	0 (0.0)	2 (1.43)	2 (1.43)

FVC – Forced Vital Capacity; PFVC – Predicted Forced Vital Capacity; FEV_1 – Forced Expiratory Volume in first second

Mean FVC values were significantly lower among the subjects of age 45 years or above (Table 37). The difference was more prominent among the miners in comparison to supervisory staffs. Such significant difference of FVC values was not observed when compared between higher and lower job experience groups. Similarly difference was not prominent in relation to smoking habit of the subjects.

Table 37: Forced Vital Capacity according to study variables among study subjects of Baghmara area

Study variables	Forced Vital Capacity [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	**Mean ± SD (litres)**	**Mean ± SD (litres)**	**Mean ± SD (litres)**
< 45	3.82 ± 0.68	3.46 ± 0.53	3.47 ± 0.53
≥ 45	2.90 ± 0.41	3.13 ± 0.50	3.12 ± 0.50
	df=1;p=0.098	df=1;p= 0.00	df=1;p= 0.00
Duration of exposure (yrs)			
< 20	3.38 ± 0.55	3.29 ± 0.54	3.29 ± 0.54
≥ 20	2.35	3.14 ± 0.55	3.09 ± 0.56
	df=1;p=0.162	df=1;p=0.316	df=1;p=0.158
Smoking habit			
Never smoker	2.99 ± 0.44	3.26 ± 0.53	3.25 ± 0.53
Ever smoker	3.18 ± 0.74	3.34 ± 0.56	3.42 ± 0.55
	df=1;p=0.138	df=1;p=0.187	df=1;p = 0.099

Similar trend was observed in case of FEV1 values also. Significant difference was observed between subject of less than 45 years and rest of the workers. This difference was prominent in miners and supervisory staffs. No such remarkable difference was observed when compared in relation to job experience and smoking habit (Table 38).

Table 38: Forced Expiratory Volume in first second according to study variables among study subjects of Baghmara area

Study variables	Forced Expiratory Volume in first second [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	**Mean ± SD (litres)**	**Mean ± SD (litres)**	**Mean ± SD (litres)**
< 45	3.06 ± 0.44	2.87 ± 0.49	2.87 ± 0.49
≥ 45	2.18 ± 0.27	2.52 ± 0.46	2.50 ± 0.46
	t=9.88;df=1;p=0.035	t=17.48;df=1;p=0.00	t=21.13;df=1;p=0.00
Duration of exposure (yrs)			
< 20	2.614 ± 0.46	2.69 ± 0.51	2.69 ± 0.51
≥ 20	1.780	2.5 ± 0.41	2.45 ± 0.43
	t=2.687;df=1;p=0.176	t=1.863;df=1,p=0.175	t=3.03;df=1;p=0.084
Smoking habit			
Never smoker	2.29 ± 0.40	2.66 ± 0.50	2.65 ± 0.50
Ever smoker	2.85 ± 0.74	2.94 ± 0.61	2.92 ± 0.59
	t=1.654;df=1;p=0.268	t=1.77;df=1;p=0.186	t=2.152;df=1;p=0.145

Same pattern could be found in case of Peak Expiratory Flow Rate also (Table 39). Significant difference was present in relation to age (more so in miners than supervisor), however, smoking and duration of exposure wise classification did not show any significant difference.

Table 39: Peak Expiratory Flow Rate according to study variables among study subjects of Baghmara area

Study variables	Peak Expiratory Flow Rate [Mean ± SD (litres/minute)]		
	Supervisory workers	**Coal Miners**	**Total**
Age group (in years)	**Mean ± SD (litres/minute)**	**Mean ± SD (litres/minute)**	**Mean ± SD (litres/minute)**
< 45	495 ± 21.21	470.69 ± 65.45	471.5 ± 64.54
≥ 45	422.5 ± 59.09	437.77 ± 80.15	436.99 ± 78.98
	t=2.566;df=1;p=0.18	t=6.423;df=1;p=0.012	t=7.56;df=1;p=0.007
Duration of exposure (yrs)			
< 20	464 ± 47.22	453.22 ± 76.53	453.66 ± 75.46
≥ 20	360.00	443.93 ± 69.12	438.33 ± 70.04
	t=4.042;df=1;p=0.115	t=0.188;df=1;p=0.665	t=0.559;df=1;p=0.456
Smoking habit			
Never smoker	442.5 ± 74.11	451.79 ± 75.05	451.5 ± 74.76
Ever smoker	455 ± 35.36	461.67 ± 93.47	460 ± 80.18
	t=0.047;df=1;p=0.839	t=0.09;df=1;p=0.756	t=0.097;df=1;p=0.756

So far as chest radiographic findings are concerned, about 92% subjects had findings within normal limits. 4% subjects showed findings suggestive of opacities in lung and almost 2% had other features on chest X-ray (mostly suggestive of Koch's infection of lung) (Table 40).

Table 40: Chest radiographic findings among the study participants of Baghmara area

Chest X ray findings	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Within normal limit	6 (4)	123 (88)	129 (92)
Pulmonary Opacities	0 (0)	5 (4)	5 (4)
Koch's infection	0 (0)	3 (2)	3 (2)
Not Done	0 (0)	3 (2)	3 (2)
Total	**6 (4)**	**134 (96)**	**140 (100)**

Haematological and biochemical findings of the subjects were mostly within normal limits. 15% workers had random blood sugar level >140. Mean hemoglobin level in 11.9±0.8 gm%. Random Blood sugar, blood urea and Serum creatinine was 107.5±38.2 unit, 20.7±4.5 unit and 0.6±0.5 unit respectively (Table 41).

Table 41: Haematological & Biochemical findings of study participants of Baghmara area

Parameters	Minimum	Maximum	Mean
Haemoglobin (g/dL)	10	15	11.98 ± 0.87
Total Leucocyte Count (mcL)	5500	10500	7957.86 ± 1134. 57
Neutrophil	46	89	62.49 ± 7.37
Lymphocyte	20	50	29.24 ± 7.06
Eosinophil	2	13	7.13 ± 2.40
Monocyte	0	8	1.38 ± 1.16
Besophil	0	0	0.00
Random Blood Sugar (mg/dL)	55	300	107.51 ± 38.28
Blood Urea (mg/dL)	14	38	20.7 ± 4.57
Serum Creatinine (mg/dL)	.30	7.00	0.64 ± 0.55

As far as ophthalmological findings are concerned, 6% subjects had uncorrected vision (although using spectacles). Colour blindness was also observed in few subjects (Table 42).

Table 42: Ophthalmological findings of study participants of Baghmara area

	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
People having uncorrected vision after correction	0 (0)	8 (6)	8 (6)
Colour Blindness	0 (0)	6 (4)	6 (4)

CONCLUSION

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RECOMMENDATION

CONCLUSION

- This study covered 351 subjects from Kustore sector and 140 subjects from Baghmara sector of BCCL Collieries. Mean age of the workers was 45.9 ± 8.36 years. Most of the workers were between 35-54 years age. Mean job experience was 11.72 ± 8.49 years.

- Most common symptoms complained by study subjects were musculoskeletal pain (34%). Other complaints were Cough, difficulty in breathing, chest pain, soreness of mouth etc. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects.

- About 20% subjects had systolic blood pressure >140 as well as diastolic blood pressure > 90 mm of Mercury. 9% workers had only higher systolic blood pressure and 11% had only higher diastolic blood pressure.

- As far as pulmonary functional status of study subjects in concerned, about 3% subjects had restrictive type of abnormality (FVC/PFVC < 80%) and 0.6 % subjects had combined type of abnormality (FVC/PFVC <80 % and FEV1% <70%). A good number of subjects (36.5%) had FEV1% values between 70% and 80%. Mean FVC values were significantly lower among the subjects of age 45 years or above.

- So far as chest radiographic findings are concerned, 93% subjects had findings within normal limits. 3% subjects showed findings suggestive of opacities in lung and almost 1.5% had other features on chest X-ray (mostly suggestive of Koch's infection of lung). Such findings may be due to pneumoconiotic changes in lung, hence these subjects should be properly followed up and necessary medical, ethical, legal, administrative actions may be initiated as necessary.

- Haematological and biochemical findings of the subjects were mostly within normal limits. Almost 11% workers had random blood sugar level more than 140 units. As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision and 9% subjects had Cataract in eyes.

- Decline in hearing ability with increasing duration of exposure was observed more at higher frequency; however, this observation is subject to adjustment for age and other probable factors.

- The subjects for this study are selected from workplaces identified by BCCL, Govt. of India, as required for the purpose of this study. The findings of this study may thus be restricted to the concerned workplaces and may not be generalisable.

RECOMMENDATION

- Prevalence of musculoskeletal pain during work in a good number of workers reflects that manual work of the work processes might be causing some discomfort for the workers. Training on proper method of manual material handling may prove useful of these workers. On the other hand regular proper exercise should be promoted among workers especially supervisory employees to get rid of ill effects of sedentary activities.

- Special emphasis should be given to protection of respiratory health, hearing ability. Periodic relevant examination (lung function test, audiometry) at regular interval is recommended.

- Industrial hygiene survey (periodic monitoring of dust and other environmental hazards) at regular interval should be undertaken including noise level monitoring in different operations.

- Some prevalent symptoms observed may be representation of nervous system effect due to exposures to toxicants. In order to exclude the possibility of exposure from occupational environment, environmental study should include assessment of exposure to metals.

- Measures like using protective appliances (e.g. PPEs), pre-placement- and periodic medical examination, for the control and prevention of relevant health hazards, are to be implemented and maintained by all the mining areas to protect the health of the workers.

REFERENCES:

1. Finkelman RB.1995. Modes of occurrence of environmentally-sensitive trace elements in coal. In: Environmental Aspects of Trace Elements (Swaine DJ, Goodarzi F, eds). Boston: Kluwer Academic Publishers, 24–50.
2. "Coal & Lignite - Indian Minerals year book - 2011". Indian Bureau of Mines, Government of India. October 2012. Retrieved 26 December 2013
3. Castranova V, Vallyathan V. Silicosis and coal workers' pneumoconiosis. Environ Health Perspect.2000; 108(suppl 4):675–684.
4. Demchak J, Skousen J, McDonald LM. Longevity of acid discharges from underground mines located above the regional water table. J Environ Qual. 2004; 33:656–668.
5. Attfield MD, Kuempel ED. Pneumoconiosis, coalmine dust and the PFR. Ann Occup Hyg.2003; 47:525–529.
6. Ruckley VA, Gauld SJ, Chapman JS, Davis JM, Douglas AN, Fernie JM, et al. Emphysema and dust exposure in a group of coal workers. Am Rev Respir Dis. 1984; 129:528–532.
7. Soutar CA, Hurley JF, Miller BG, Cowie HA, Buchanan D. Dust concentrations and respiratory risks in coalminers: key risk estimates from the British Pneumoconiosis Field Research. Occup Environ Med. 2004; 61:477–481.
8. Rom WN. Basic mechanisms leading to focal emphysema in coal workers' pneumoconiosis. Environ Res 1990; 53:16–28.
9. Rom WN. Relationship of inflammatory cell cytokines to disease severity in individuals with occupational inorganic dust exposure. Am J Ind Med 1991; 19:15–27.
10. Brown GM, Donaldson K. Inflammatory responses in lungs of rats inhaling coalmine dust: enhanced proteolysis of fibronectin by bronchoalveolar leukocytes. Br J Ind Med 1989; 46:866–72.

EXECUTIVE SUMMARY

BACKGROUND

Although coal remains a major energy resource worldwide, coal mining causes environment problems, whereas the inhaled coal particles at the work place may lead to the development of coal workers' pneumoconiosis (CWP). Typically, coal workers pneumoconiosis takes many years to develop and to be manifested. Further, once initiated the disease is progressive in nature, often leading to lungfunction impairment, disability.
The workers' exposure to coal dust generally occurs during mining operations.
Coal mining can also increase the risk of developing asthma and chronic obstructive pulmonary disease (COPD), such as emphysema and chronic bronchitis. It is suggested that coal mining operations may also induce noise induced hearing impairment among the workers.

A request was received from Bharat Coking Coal Limited, Dhanbad to assess the health status of their workers involved in the mining activities in Cluster 11 and 15 areas around Dhanbad. About 10% of the subjects involved in mining activities were to be included in this study. The workers were to be assessed for their health status, presence of any occupational disease and hearing impairments. Under this circumstance, in consultation of the scientists of National Institute of Occupational Health (NIOH) and the concerned officers of Bharat Coking Coal Limited, it was decided that an epidemiological study would be carried out involving workers involved in mining activities.

OBJECTIVES

5. To understand health status of workers through questionnaire survey, health examination.
6. To study respiratory health in coal field mining workers.
7. To assess ventilatory functions of coal field mining workers.
8. To analyze hearing ability through audiometric evaluation.

METHODOLOGY

An occupational health study was conducted involving different mines of Cluster 11 and 15 of Bharat coking Coal Limited, Dhanbad. This study was undertaken among the exposed workers mainly from active mining activity. Representative sample from workers working in such occupations is included in this study. Initially the aim of the study was explained to the workers, informed consent was obtained after which they were enrolled for this study. Every individual subject was interviewed with a pre-designed questionnaire to collect information in relation to personal, occupational and morbidity details of the workers. The participants of this study were subjected to following interview/examination/investigations:

- Detailed personal, occupational and medical history.
- Clinical examination with special emphasis on examination of respiratory system.
- Haematological examination.
- Lung function test.
- Audiometry.
- Ophthalmological assessment.

Study design: Cross sectional study

***Study subjects*:** This study covered 351 subjects from Kustore sector and 140 subjects from Bagmara sector of BCCL Collieries. Among the subjects of Kustore sector 49 were from Kachi Balihari mines, 51 from Bhagabandh mines, 40 from Gopali Chawk mines and 100 from Munidi mines. PB project mines contributed 111 subjects. Similarly among the subjects of Bagmara sector, Kharkharee mines and Phularitand mines contributed 75 subjects and 65 subjects respectively. Workers actively involved in mining actively were mainly included in this study. However, few subjects of this study were enrolled from supervisory staffs in order to have a complete and comprehensive understanding of the occupational health condition. These workers were randomly selected from the total workforce in the selected clusters and mines.

Data collection: The information regarding demographic, occupational and clinical history was collected on a pre-designed and pre-tested proforma through interview of subject. This was followed by complete clinical examination, spirometry, audiometry and chest radiography of each subject. The audiometer and spirometer were brought by NIOH team while for chest radiography the facilities at BCCL hospitals were used. The processing of exposed films was done by the technicians at BCCL hospital. The ophthalmological examination and haematological – biochemical estimations were also done using facilities and expertise at BCCL hospitals.

Data analysis: Data entry and analysis were done in standard statistical software. The statistical analysis included calculation of differences, proportions and application of tests of significance etc, to ascertain health effects especially respiratory health conditions.

RESULTS

- This study covered 351 subjects from Kustore sector and 140 subjects from Baghmara sector of BCCL Collieries. Mean age of the workers was 45.9 ± 8.36 years. Most of the workers were between 35-54 years age. Mean job experience was 11.72 ± 8.49 years.

- Most common symptoms complained by study subjects were musculoskeletal pain (34%). Other complaints were Cough, difficulty in breathing, chest pain, soreness of mouth etc. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects.

- About 20% subjects had systolic blood pressure >140 as well as diastolic blood pressure > 90 mm of Mercury. 9% workers had only higher systolic blood pressure and 11% had only higher diastolic blood pressure.

- As far as pulmonary functional status of study subjects in concerned, about 3% subjects had restrictive type of abnormality (FVC/PFVC < 80%) and 0.6 % subjects had combined type of abnormality (FVC/PFVC <80 % and FEV1% <70%). A good number of subjects (36.5%) had FEV1% values between 70% and 80%. Mean FVC values were significantly lower among the subjects of age 45 years or above.

- So far as chest radiographic findings are concerned, 93% subjects had findings within normal limits. 3% subjects showed findings suggestive of opacities in lung and almost 1.5% had other features on chest X-ray (mostly suggestive of Koch's infection of lung). Such findings may be due to pneumoconiotic changes in lung, hence these subjects should be properly followed up and necessary medical, ethical, legal, administrative actions may be initiated as necessary.

- Haematological and biochemical findings of the subjects were mostly within normal limits. Almost 11% workers had random blood sugar level more than 140 units. As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision and 9% subjects had Cataract in eyes.

- Decline in hearing ability with increasing duration of exposure was observed more at higher frequency; however, this observation is subject to adjustment for age and other probable factors.

- The subjects for this study are selected from workplaces identified by BCCL, Govt. of India, as required for the purpose of this study. The findings of this study may thus be restricted to the concerned workplaces and may not be generalisable.

RECOMMENDATION

- Prevalence of musculoskeletal pain during work in a good number of workers reflects that manual work of the work processes might be causing some discomfort for the workers. Training on proper method of manual material handling may prove useful of these workers. On the other hand regular proper exercise should be promoted among workers especially supervisory employees to get rid of ill effects of sedentary activities.

- Special emphasis should be given to protection of respiratory health, hearing ability. Periodic relevant examination (lung function test, audiometry) at regular interval is recommended.

- Industrial hygiene survey (periodic monitoring of dust and other environmental hazards) at regular interval should be undertaken including noise level monitoring in different operations.

- Some prevalent symptoms observed may be representation of nervous system effect due to exposures to toxicants. In order to exclude the possibility of exposure from occupational environment, environmental study should include assessment of exposure to metals.

- Measures like using protective appliances (e.g. PPEs), pre-placement- and periodic medical examination, for the control and prevention of relevant health hazards, are to be implemented and maintained by all the mining areas to protect the health of the workers.

ANNEXURE

(Sample proforma for undertaking occupational health studies)

Study of occupational diseases and hearing impairments of coalmine workers directly involved in active mining operations

Date:□□/□□/□□□□ Code No.□□□

PERSONAL AND RESIDENTIAL INFORMATION

Name: _____

Age (completed years): Sex: 1.Male 2. Female

Marital status: 1. Single 2. Married 3. Divorcee 4. Widow(er)

Education: 1) Illiterate 2) 1-4 3) 5-10 4) 11-12 5) College

Number of family members: Mine Name._____

Residential address: _____

Smoking history: 1) Non-smoker 2) Smoker 3) Past smoker

A. ***Type of smoking***: 1) Beedi 2) Cigarette 3) Other (specify)

B. ***Frequency (Number per day)*** C. ***Duration (years)***

Reason from Abstaining From Smoking: 1. Respiratory Problem 2.Any Other Reason

Do You Chew Tobacco: 1. Yes 2. No If Yes, Duration (Yrs.) Frequency: No/day

Do You Drink Alcohol?: 1. Yes 2. No If yes, Duration (Yrs)

Frequency: 1. Regularly 2. Occasionally

OCCUPATIONAL HISTORY

Since how many years you are working in this job

Present Occupational History

No	Designation	Nature of job	Duration (years)
1.			
2.			
3.			

Past Occupational History

No	Designation	Nature of job	Duration (years)
1.			
2.			
3.			

PAST MEDICALHISTORY:

Have you suffered from any of the following diseases in the past?

PTB☐Chronic bronchitis☐Recurrent cough and cold☐Bronchial asthma☐HT☐Jaundice☐CKD☐

Any other major illness 1. No 2. Yes☐If yes, specify _____

Family history: Has anybody in your family or blood relation suffered from any of the following diseases? (Also mention the relationship)

PTB☐Chronic bronchitis☐Recurrent cough and cold☐Bronchial asthma☐HT☐Jaundice☐CKD☐

Any other major illness 1. No 2. Yes☐If yes, specify _____

PRESENT MEDICAL HISTORY:

Cough:Do you have cough? 1. No 2. Yes☐If 'Yes',Is it Productive☐Non productive☐
If productive go to next symptom

Phlegm:Do you usually bring up phlegm from your chest first thing in the morning? 1. No 2. Yes☐
(If 'Yes, please go to the next question. If 'No', go to the next symptom)

Do you bring up phlegm like this on most days for as much as 3 months per year? 1 No 2.Yes☐

If yes since how many years☐☐

Have you ever coughed up blood in sputum? 1. No 2. Yes☐

If 'Yes', when did you have the last haemoptysis (weeks back)?☐☐

Dyspnoea: Do you suffer from breathlessness? 1. No 2.Yes☐*(If 'Yes', go to next question. If 'No' go to next symptom)*

Are you ever troubled by shortness of breath, while hurrying on the level or walking up a slight hill?

1. No 2. Yes ☐ *(If 'No', grade is 1. If 'Yes', proceed to next question)*

Do you get short of breath while walking with a person of approximately your age and sex?

1. No 2. Yes ☐ *(If 'No', grade is 2. If 'Yes', proceed to next question)*

Do you have to stop for breath when walking at your pace on the level?

1. No 2. Yes ☐ *(If 'No', grade is 3. If 'Yes', proceed to next question)*

Are you short of breath while washing or dressing up or other routine activity?1. No 2 Yes☐
(If 'No', grade is 4. If 'Yes', grade is 5)

Final assessment of the grade of dyspnoea (grade 1-5) ☐

Do you have attacks of breathlessness at night? 1 No 2. Yes☐

Chest pain:Do you have chest pain? 1. No 2. Yes☐*(If 'Yes', go to the next question. If 'No', go to next symptom.)*

Is it increased by deep inspiration/Coughing/Sneezing 1. No 2. Yes☐

Mention the site(s) of chest pain _____

Any other information, specify_____

Do you have following symptoms

Symptom	1.Present/ 2.Absent	Duration (years)	Symptom	1.Present/ 2.Absent	Duration (years)
GENERAL AND SKIN			**D. MUSCULOSKELETAL**		
Tiredness	☐	☐☐	Muscle cramps	☐	☐☐
Weight loss	☐	☐☐	Muscle pains	☐	☐☐
Recurrent infections	☐	☐☐	Backache	☐	☐☐
Skin rashes	☐	☐☐			
Itching	☐	☐☐	**E. CENTRAL NERVOUS SYSTEM**		
ORAL CAVITY AND G.I.TRACT			Headache	☐	☐☐
Excessive salivation	☐	☐☐	Dizziness	☐	☐☐
Loose teeth	☐	☐☐			
Soreness of throat	☐	☐☐	Difficulty in hearing	☐	☐☐
Soreness of mouth	☐	☐☐	Difficulty in speech	☐	☐☐
			Irritability	☐	☐☐
Loss of appetite	☐	☐☐	Inability to concentrate	☐	☐☐
Nausea	☐	☐☐	Forgetfulness	☐	☐☐
Vomiting	☐	☐☐			
Diarrhoea	☐	☐☐	Sleep difficulty / disturbances	☐	☐☐
Colicky pain in abdomen	☐	☐☐	Muscular weakness	☐	☐☐
RENAL			Tingling in extremities	☐	☐☐
Decreased urine	☐	☐☐	Numbness in extremities	☐	☐☐
Hematuria	☐	☐☐			
Edema over face	☐	☐☐	Tremors	☐	☐☐
			Convulsions	☐	☐☐

MEDICAL EXAMINATION

General Examination

Height(cms):_____ Weight (kgs):_____Pulse/min:☐☐☐

BSA (m^2)_____ Pallor: 1.Present 2. Absent☐

B P: Systolic:_____mm/Hg Diastolic: _____ mm/Hg

Nails: 1. Normal 2. Abnormal Specify_____

Cyanosis: 1. Present 2. Absent Others(oedema, LNpathy, varicose etc.): 1. Present 2. Absent

Skin: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Mouth and lips: 1. Normal 2. Angular stomatitis 3.Pigmentation 4.Ulceration 5. Blue line over gums

Systemic Examination

Respiratory System

Inspection: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Palpation: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Percussion: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Auscultation: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Intensity: 1. Normal 2.Increased 3. Decreased ☐

Character: 1. Vesicular 2.Broncho-vesicular 3. Bronchial ☐

Added sounds: 1. Fine crepts 2.Coarse crepts 3.Rhonchi 4. Rub ☐

Basal Crepitations: 1. Present 2. Absent ☐

If present, which side: 1. Right 2. Left ☐

Other Systems

Abdomen: Liver: 1. Normal 2.Enlarged ☐ Spleen: 1. Normal 2.Enlarged

CVS: 1. Normal 2. Abnormal ☐ Specify abnormality _____

CNS: Higher functions: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Tremors: 1. Present 2. Absent ☐ If present, specify_____

Motor system abnormality: 1. Present 2. Absent If present, specify_____

Sensory system abnormality: 1 Present 2. Absent If present, specify_____

Abnormal Reflexes: 1. Present 2. Absent If present, specify_____

Any other abnormality 1. Present 2. Absent If present, specify_____

PULMONARY FUNCTION TESTS

Physical Characteristics:

1. Age: _____Yrs. 2. Height: _____Cm 3. Weight: _____Kg. 4. BSA: _____m^2

Pulmonary Function Test

SVC_____ (l) FVC_____ (l)
FEV 1.0_____ (l) FEV1.0/FVC_____
FEF0.2 – 1.21_____ (l/s) FEF 25 -75 %_____ (l/s)
FEF 75 – 85 %_____ (l/s)
PEFR _____ (l/m)

PFT Diagnosis. 1. Normal 2.Obstructive 3.Restrictive 4. Combined ☐

X Ray findings: _____

Final Diagnosis: _____

ANNEXURE-VIII

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A Mini Ratna Company

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GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2019-20)

[CLUSTER – I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV & XVI of Mines, BCCL]

JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)

For

(BHARAT COKING COAL LIMITED)

(A Subsidiary of Coal India Limited)

KOYLA BHAWAN (DHANBAD)

Prepared by

Hydrogeology Department

Exploration Division

CMPDI (HQ), Ranchi

MARCH – 2020

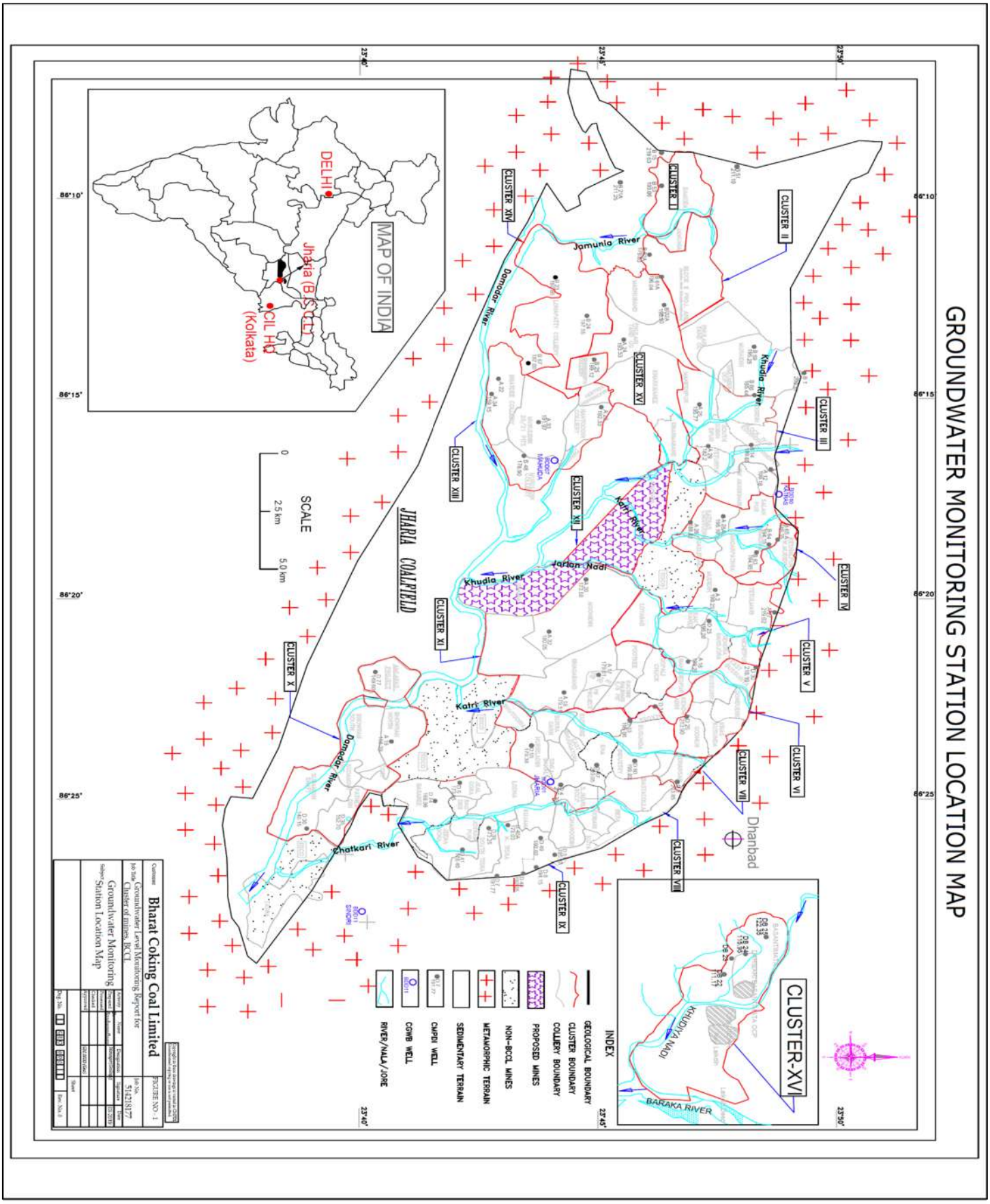
Cluster–XI consists of eight coal mines and one coal Washery namely; Gopalichak UG Project, Kachi Balihari 10/12 Pit UG, Pootkee Balihari Project UG, Bhagaband UG, Kendwadih UG (closed), Pootkee UG (closed), Kachi Balihari 5/6 Pit UG (closed) are under the administrative control of Pootkee Balihari Area 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.

4 hydrograph stations (**A-17, A-18, A-20 and A-32**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water below (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-17	Kachi Balihari	2.94	0.34	2.24	2.42
2	A-18	Baghaband	2.29	1.09	0.69	1.09
3	A-20	Gorbudih	4.57	3.32	1.82	4.02
4	A-32	Baludih	2.75	0.62	0.95	1.65
Average GW (bgl)			3.14	1.34	1.43	2.30

Ground Water Level (in bgl) varies from 2.29 to 4.57 m during May'19, 0.34 to 3.32 m during August'19, 0.69 to 2.24 m during November'19 and 1.09 to 4.02 m during January'20 within the Core Zone of Cluster-XI area.


GROUNDWATER MONITORING STATION LOCATION MAP
MAP OF INDIA
DELHI
Jharia (BCCL)
CIL HQ (Kolkata)
JHARIA COALFIELD
SCALE
0
2.5 km
5.0 km
CLUSTER I
CLUSTER II
CLUSTER III
CLUSTER IV
CLUSTER V
CLUSTER VI
CLUSTER VII
CLUSTER VIII
CLUSTER IX
CLUSTER X
CLUSTER XI
CLUSTER XII
CLUSTER XIII
CLUSTER XIV
CLUSTER XV
CLUSTER-XVI
Damodar River
Jamunia River
Khudia River
Katri River
Jarian Nadi
Chatkari River
Dhanbad
BARAKA RIVER
KHUDIYA NADI
INDEX
GEOLOGICAL BOUNDARY
CLUSTER BOUNDARY
COLLIERY BOUNDARY
PROPOSED MINES
NON-BCCL MINES
METAMORPHIC TERRAIN
SEDIMENTARY TERRAIN
CMPDI WELL
CGWB WELL
RIVER/NALA/JORE
Bharat Coking Coal Limited
FIGURE NO.- 1
Groundwater Level Monitoring Report for
Cluster of mines, BCCL
Groundwater Monitoring Station Location Map

ANNEXURE-IX

BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Limited – A Maharatna Company)

CORPORATE ENVIRONMENTAL POLICY

Bharat Coking Coal Limited (BCCL), a subsidiary of Coal India Limited, is a Public Sector Undertaking engaged in mining of coal and allied activities. It is the only producer of Prime Coking Coal in India. BCCL was incorporated in 1972 to operate coking coal mines operating in the Jharia and Raniganj Coalfields. Currently, the Company operates 66 coal mines and 8 Coal Washeries.

Our mission is to produce the planned quantity of coal efficiently and economically with due regard to safety, conservation and quality. BCCL affirms its commitment for environment friendly mining with right mitigation of pollution, reclamation of the degraded land, preservation of biodiversity and proper disposal of waste following the best environmental practices including judicious use of the non-renewable energy on the path of continual improvement. Towards this commitment, BCCL shall endeavor to:

- Conduct mining and associated operations in an environmentally responsible manner to comply with applicable laws and other requirements related to environmental aspects.
- Design projects with due consideration of Sustainable Development by integrating sound environmental management practices in all our activities.
- Prevent pollution of surrounding habitation by continuous monitoring and adopting suitable measures for environment protection.
- Ensure compliance of all applicable Environmental and Forest Clearance conditions and other statutory conditions issued by regulatory agencies.
- Implement the Environmental Management Plans in all our mines effectively to mitigate pollutions on air, water and noise; proper disposal of wastes and reclamation and ecological restoration of degraded land; and by also dovetailing the Jharia action/ Master Plan for dealing with Fires, Subsidence and Rehabilitation of affected people with the Environmental Management Plans under the Cluster Concept.
- Strive to conserve Bio-Diversity through Ecological restoration methods.
- Conserve natural resources through recycling of wastes on the principle of Reduce, Recycle and Reuse. Put special thrusts on efficient energy utilization as a measure to reduce carbon foot-print.
- Strive for continual improvement in our environmental performances by setting targets, measuring progress and taking corrective action.
- Create environmental awareness among the employees and the local communities through pro-active communication and training and encourage our business associates to adopt similar approach for environmental protection.

Place: Dhanbad
Date: 25.5.12

Chairman-cum-Managing Director

Chairman-cum-Mg. Director
BHARAT COKING COAL LIMITED
Koyla Bhawan, Dhanbad-826 005

ANNEXURE-X

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

(FOR THE MONTH OCTOBER, 2019)

E. C. no. J-11015/77/2011-IA.II (M) dated 26.08.2013.

CMPDI

ISO 9001 Company

Regional Institute-II

Dhanbad, Jharkhand

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) Pootkee Balihari Office (A16): Industrial Area

The location of the sampling station is 23°45'17.23"N 86°21'46.27"E. The sampler was placed at an elevated platform approx. 1.5m above ground level at Project Office.

ii) Moonidih UGP (A17): Industrial Area

The location of the sampling station is 23°44'30.00"N 86°20'56.00"E. The sampler was placed at an elevated platform approx. 1.5m above ground level at project office.

iii) Moonidih Washery (A29): Industrial Area

The location of the sampling station is 23°44'26.00"N 86°21'16.00"E. The sampler was placed at a height of approx. 1.5m above ground level at Project office.

II. BUFFER ZONE Monitoring Location

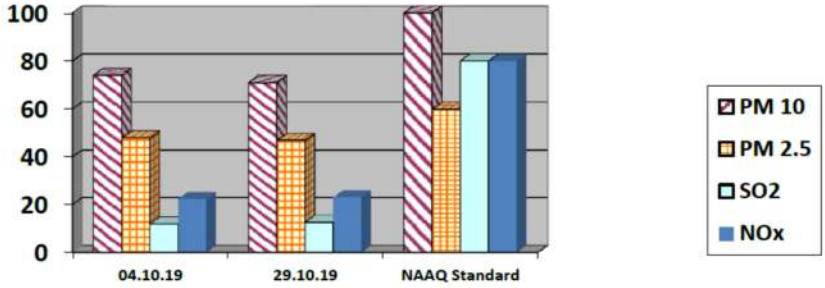
I) Kusunda OCP (A10)

The location of the sampling station is 23°46'49.07"N 86°24'15.71"E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

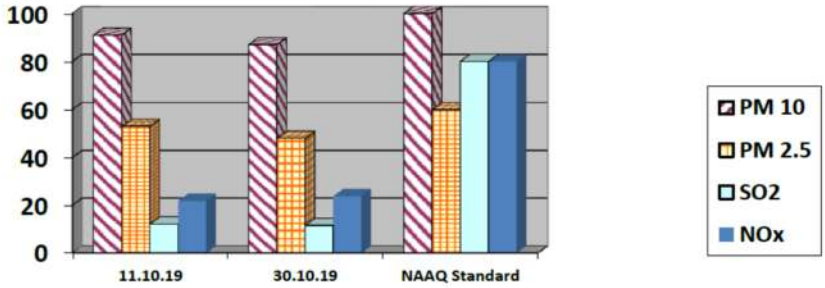
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: **SEPT,2019** Year: **2019-20.**

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	04.10.19	74	48	11.89	22.39
2	29.10.19	71	47	12.63	23.11
	NAAQ Standard	100	60	80	80



Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	11.10.19	91	53	12.09	21.84
2	30.10.19	87	48	11.47	23.80
	NAAQ Standard	100	60	80	80

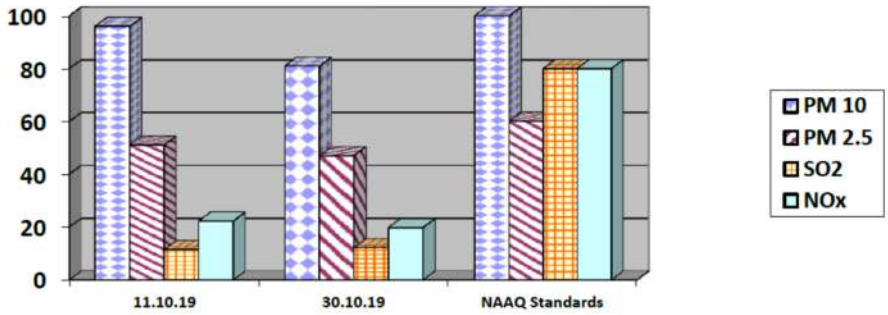


Analysed By
JSA/SA/SSA

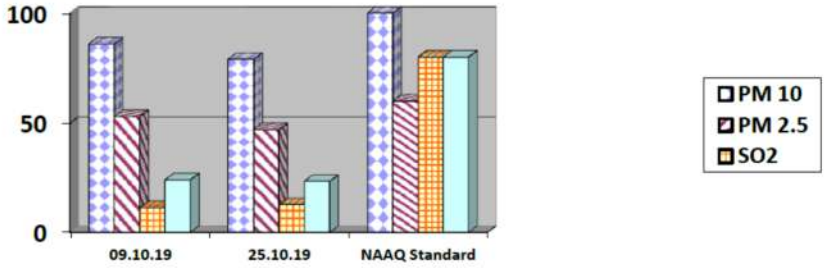
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Station Name:A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	11.10.19	96	51	11.50	22.27
2	30.10.19	81	47	12.28	19.78
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	09.10.19	86	53	11.34	24.02
2	25.10.19	79	47	12.80	23.40
	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(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER quality monitoring

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Bhagabandh (MW11)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Kari jore.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **OCTOBER , 2019**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight	**MW11** Second Fortnight	**As per MOEF General Standards for schedule VI**
		07.10.2019	30.10.2019	
1	Total Suspended Solids	49	52	*100 (Max)*
2	pH	7.91	7.86	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	56	52	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JSA/SA/SSA

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

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. **Pootkee Balihari Office (N16)**
2. **Moonidih UGP (N17)**
3. **Moonidih Washery (N29)**
4. **Kusunda OCP (N10)**

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).

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -XI**			Month: **OCTOBER, 2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Pootkee Balihari Office (N16)	Industrial area	04.10.19	65.1	75
2	PootkeeBalihari Office (N16)	Industrial area	29.10.19	65.5	75
3	MoonidihUGP (N17)	Industrial area	11.10.19	59.6	75
4	MoonidihUGP (N17)	Industrial area	30.10.19	63.4	75
5	Moonidih Washery (N29)	Industrial area	11.10.19	55.7	75
6	Moonidih Washery (N29)	Industrial area	30.10.19	67.6	75
7	KusundaOCP (N10)	Industrial area	09.10.19	60.1	75
8	KusundaOCP (N10)	Industrial area	25.10.19	65.6	75

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

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

Analysed By
JSA/SA/SSA

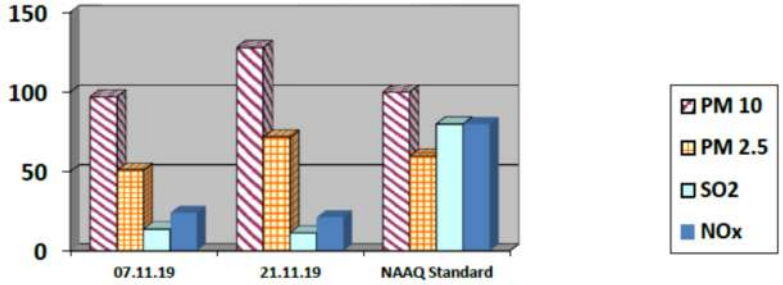
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

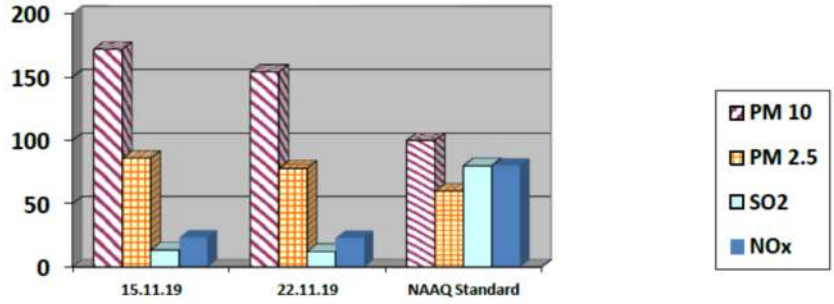
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: **NOV,2019** Year: **2019-20.**

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	07.11.19	97	51	13.74	23.94
2	21.11.19	128	72	11.39	21.11
	NAAQ Standard	100	60	80	80



Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	15.11.19	172	86	13.48	23.33
2	22.11.19	154	78	12.26	22.85
	NAAQ Standard	100	60	80	80

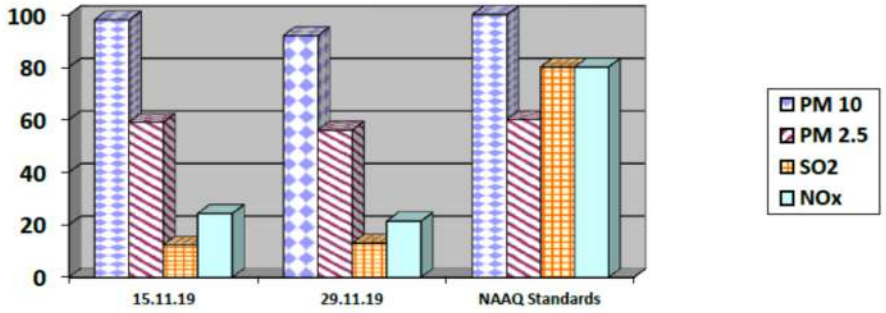


Analysed By
JSA/SA/SSA

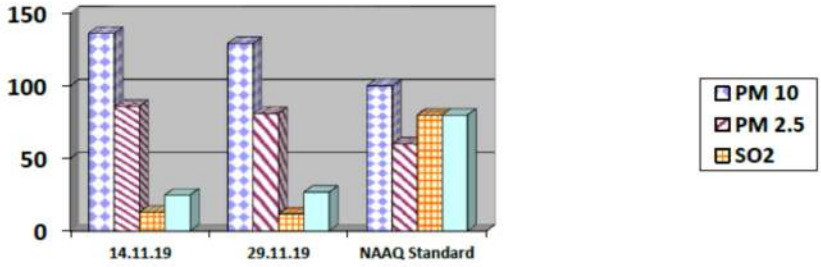
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Station Name:A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	15.11.19	98	59	12.35	24.25
2	29.11.19	92	56	13.03	21.37
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	14.11.19	136	86	13.17	24.86
2	29.11.19	129	81	11.89	26.85
	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(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER quality monitoring

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Bhagabandh (MW11)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Kari jore.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **NOV , 2019**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight	**MW11** Second Fortnight	**As per MOEF General Standards for schedule VI**
		01.11.2019	20.11.2019	
1	Total Suspended Solids	24	25	*100 (Max)*
2	pH	8.01	8.03	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	44	36	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JSA/SA/SSA

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

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. **Pootkee Balihari Office (N16)**
2. **Moonidih UGP (N17)**
3. **Moonidih Washery (N29)**
4. **Kusunda OCP (N10)**

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).

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -XI**			Month: **NOV, 2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Pootkee Balihari Office (N16)	Industrial area	07.11.19	62.1	75
2	PootkeeBalihari Office (N16)	Industrial area	21.11.19	66.8	75
3	MoonidihUGP (N17)	Industrial area	15.11.19	57.8	75
4	MoonidihUGP (N17)	Industrial area	22.11.19	65.7	75
5	Moonidih Washery (N29)	Industrial area	15.11.19	55.5	75
6	Moonidih Washery (N29)	Industrial area	29.11.19	56.3	75
7	KusundaOCP (N10)	Industrial area	14.11.19	58.6	75
8	KusundaOCP (N10)	Industrial area	29.11.19	59.2	75

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

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

Analysed By
JSA/SA/SSA

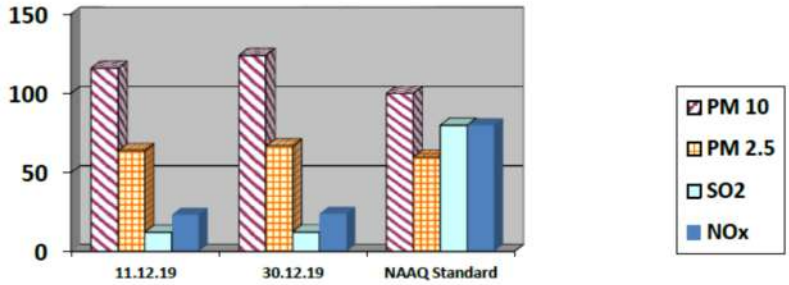
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

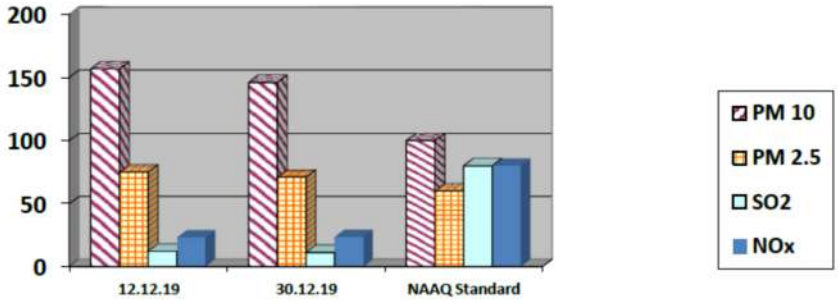
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: **DEC,2019** Year: **2019-20.**

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	11.12.19	116	64	12.14	23.29
2	30.12.19	124	67	12.26	23.91
	NAAQ Standard	100	60	80	80



Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	12.12.19	157	75	12.12	23.11
2	30.12.19	146	71	11.13	23.51
	NAAQ Standard	100	60	80	80



Analysed By
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RI-2, CMPDI, Dhanbad

Approved By
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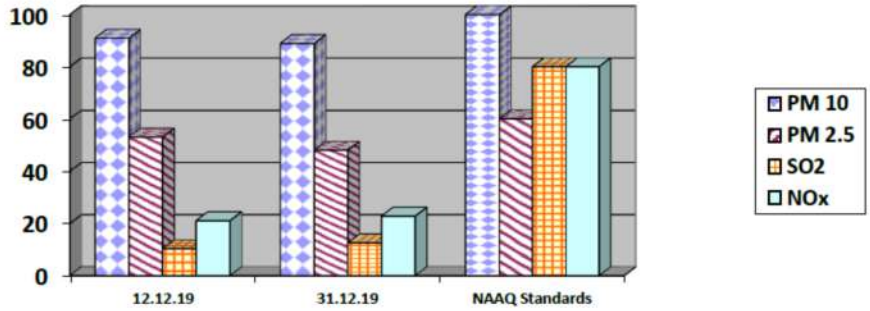
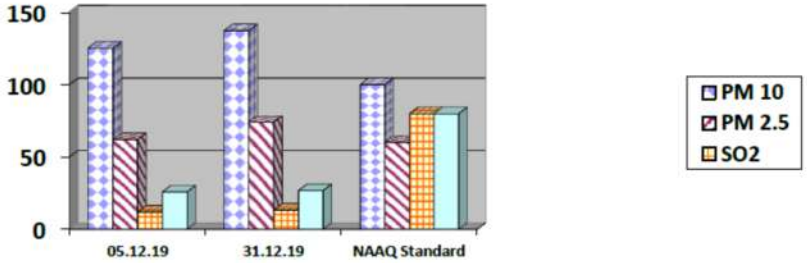
RI-2, CMPDI, Dhanbad

Station Name:A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	12.12.19	91	53	10.26	21.05
2	31.12.19	89	48	12.49	22.78
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	05.12.19	125	62	11.88	25.77
2	31.12.19	137	74	13.35	26.67
	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(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER quality monitoring

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Bhagabandh (MW11)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Kari jore.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **DEC , 2019**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight	**MW11** Second Fortnight	**As per MOEF General Standards for schedule VI**
		12.12.19	30.12.19	
1	Total Suspended Solids	17	18	*100 (Max)*
2	pH	7.91	8.26	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	40	32	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JSA/SA/SSA

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

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. **Pootkee Balihari Office (N16)**
2. **Moonidih UGP (N17)**
3. **Moonidih Washery (N29)**
4. **Kusunda OCP (N10)**

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).

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -XI**			Month: **DEC, 2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Pootkee Balihari Office (N16)	Industrial area	11.12.19	63.2	75
2	PootkeeBalihari Office (N16)	Industrial area	30.12.19	67.1	75
3	MoonidihUGP (N17)	Industrial area	12.12.19	56.7	75
4	MoonidihUGP (N17)	Industrial area	30.12.19	65.2	75
5	Moonidih Washery (N29)	Industrial area	12.12.19	54.2	75
6	Moonidih Washery (N29)	Industrial area	31.12.19	68.7	75
7	KusundaOCP (N10)	Industrial area	05.12.19	57.1	75
8	KusundaOCP (N10)	Industrial area	31.12.19	67.2	75

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

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

Analysed By
JSA/SA/SSA

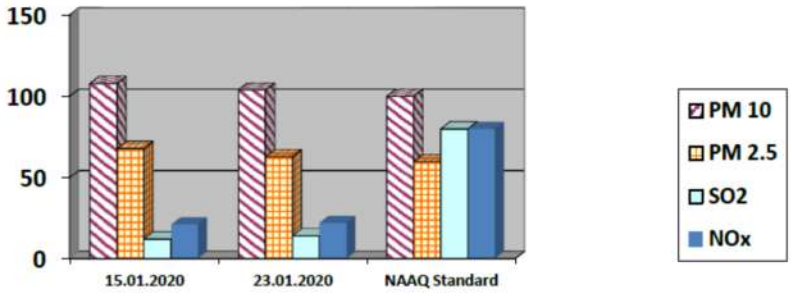
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

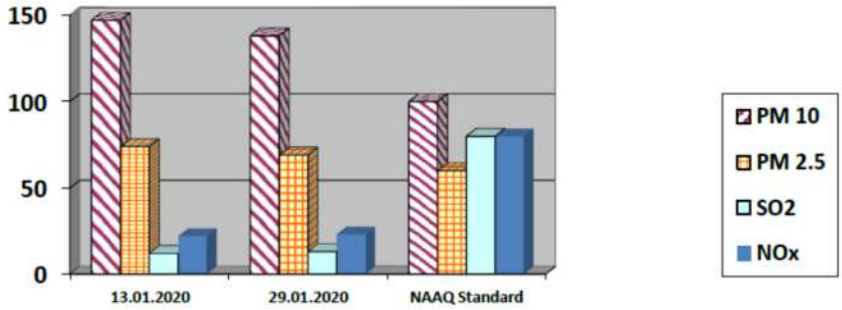
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: **JAN.2020** Year: **2019-20.**

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	15.01.2020	108	68	12	21
2	23.01.2020	104	63	14	22
	NAAQ Standard	100	60	80	80



Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	13.01.2020	147	74	12	22
2	29.01.2020	138	69	13	23
	NAAQ Standard	100	60	80	80



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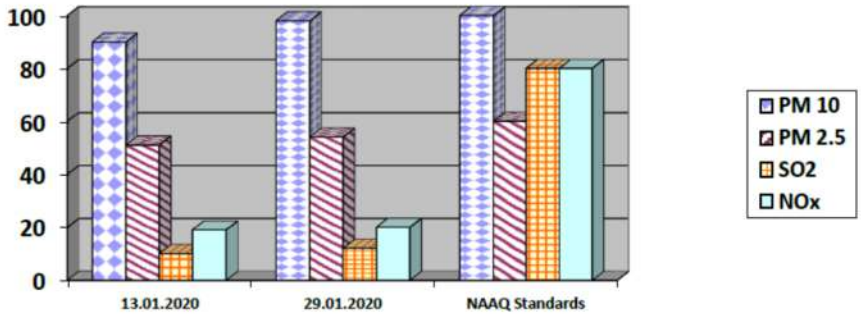
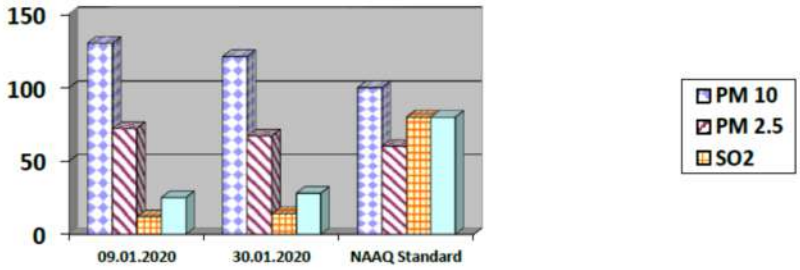
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Station Name:A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	13.01.2020	90	51	10	19
2	29.01.2020	98	54	12	20
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	09.01.2020	130	72	12	25
2	30.01.2020	121	67	14	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(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER quality monitoring

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Bhagabandh (MW11)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Kari jore.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **JAN, 2020**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight	**MW11** Second Fortnight	**As per MOEF General Standards for schedule VI**
		14.01.2020	29.01.2020	
1	Total Suspended Solids	30	38	*100 (Max)*
2	pH	7.84	8.2	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	44	36	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JSA/SA/SSA

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

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

1. **Pootkee Balihari Office (N16)**
2. **Moonidih UGP (N17)**
3. **Moonidih Washery (N29)**
4. **Kusunda OCP (N10)**

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).

4.2Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -XI**			Month: **JAN, 2020**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Pootkee Balihari Office (N16)	Industrial area	15.01.2020	62.5	75
2	PootkeeBalihari Office (N16)	Industrial area	23.01.2020	62.3	75
3	MoonidihUGP (N17)	Industrial area	13.01.2020	58.7	75
4	MoonidihUGP (N17)	Industrial area	29.01.2020	57.1	75
5	Moonidih Washery (N29)	Industrial area	13.01.2020	52.2	75
6	Moonidih Washery (N29)	Industrial area	29.01.2020	56.8	75
7	KusundaOCP (N10)	Industrial area	09.01.2020	56.4	75
8	KusundaOCP (N10)	Industrial area	30.01.2020	56.2	75

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

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

Analysed By
JSA/SA/SSA

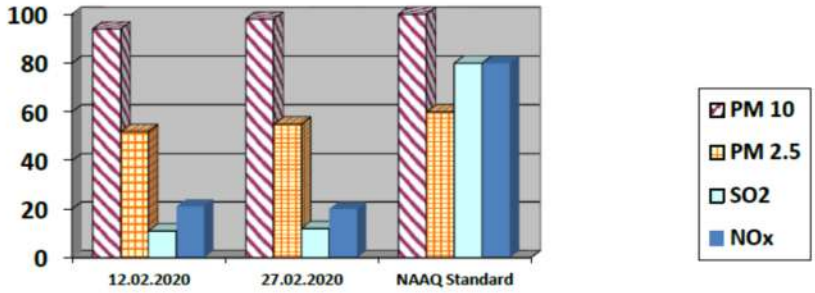
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

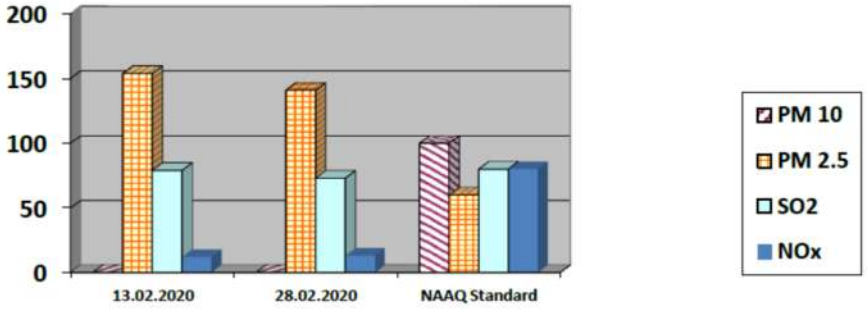
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: **FEB ,2020** Year: **2019-20.**

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	12.02.2020	94	52	11	21
2	27.02.2020	98	55	12	20
	NAAQ Standard	100	60	80	80



Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	13.02.2020	154	79	12	21
2	28.02.2020	141	73	13	23
	NAAQ Standard	100	60	80	80

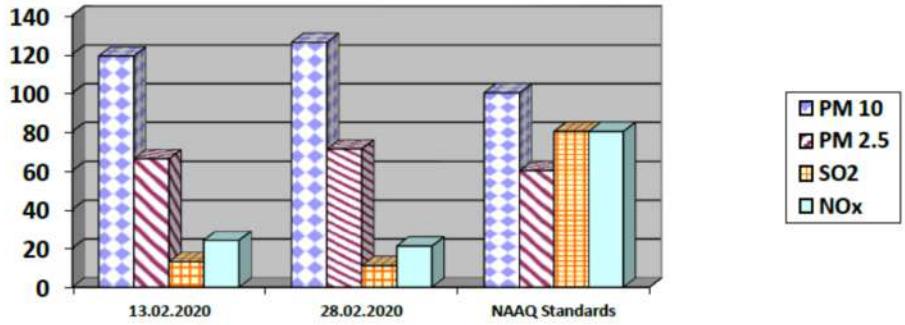


Analysed By
JSA/SA/SSA

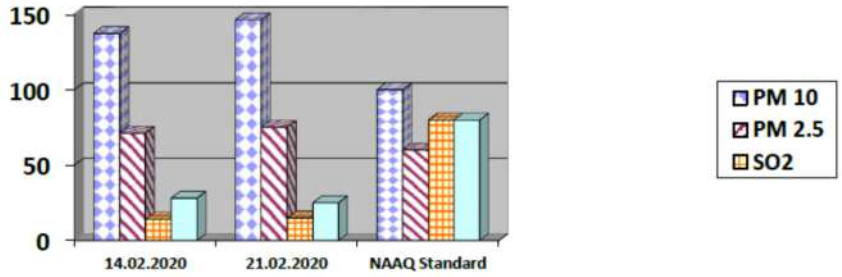
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Station Name:A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	13.02.2020	119	66	13	24
2	28.02.2020	126	71	11	21
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	14.02.2020	137	71	14	28
2	21.02.2020	146	75	15	25
	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(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER quality monitoring

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Bhagabandh (MW11)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Kari jore.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **FEB , 2020**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight	**MW11** Second Fortnight	**As per MOEF General Standards for schedule VI**
		13.02.2020	28.02.2020	
1	Total Suspended Solids	34	37	*100 (Max)*
2	pH	7.88	8.13	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	36	40	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JSA/SA/SSA

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

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. **Pootkee Balihari Office (N16)**
2. **Moonidih UGP (N17)**
3. **Moonidih Washery (N29)**
4. **Kusunda OCP (N10)**

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).

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -XI**			Month: **FEB, 2020**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Pootkee Balihari Office (N16)	Industrial area	12.02.2020	69.4	75
2	PootkeeBalihari Office (N16)	Industrial area	27.02.2020	67.8	75
3	MoonidihUGP (N17)	Industrial area	13.02.2020	63.3	75
4	MoonidihUGP (N17)	Industrial area	28.02.2020	62.3	75
5	Moonidih Washery (N29)	Industrial area	13.02.2020	65.4	75
6	Moonidih Washery (N29)	Industrial area	28.02.2020	64.3	75
7	KusundaOCP (N10)	Industrial area	14.02.2020	61.1	75
8	KusundaOCP (N10)	Industrial area	21.02.2020	60.5	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(In-charge) Environment
RI-2, CMPDI, Dhanbad

ANNEXURE-XI

भारत कोकिंग कोल लिमिटेड

(कोल इंडिया लिमिटेड का एक अंग)

BHARAT COKING COAL LIMITED

(A Subsidiary of Coal India Limited)

Corporate Identity No. (CIN): U10101JH1972GOI000918

Civil Engineering Department, Koyla Nagar, Dhanbad – 826 005 (JH), India.

Phone: 0326-2230338, FAX: 0326-2230338, e-mail: gmcivil@bccl.gov.in

Ref. No.: BCCL/CED/GM (C)/E-NIT-46//2014-15/1637 Date: 31.03.2015

Cancellation of Tender

Name of the Work : **To conduct Source Apportionment Study for varying sources of gasses/smoke/dust emission from source to source for the entire Jharia Coalfields (within and up to 10 K.M from the periphery / boundary of BCCL, Dhanbad, Jharkhand).**

NIT Ref. No. : **BCCL/CED/TC/e-NIT-46/2014-15/1289 dtd. 20.01.2015**

Estimated Cost : Rs. 56,00,000.00

The above referred tender stands cancelled. Out of 3 bidders, no bidders qualified in Part – I tender. This issues with competent approval.

Sd/-

General Manager (Civil)

Copy to:-

1) CVO/D (T) P&P/D(T) OP, BCCL ..... for kind information
2) GM (Envt.), Koyla Bhawan
3) Chief Manager (Civil), TC
4) Prof (Dr.) L.C Singhi, IAS (Retd.), L-31, Third Floor, Kailash Colony, New Delhi-110048
5) Shri Naresh Chaturvedi, IAS, (Retd.), CL-14, Sector – II, Salt Lake, Kolkata – 700 091
6) M/s Automotive Research Association of India, S. No. 102, Vetal Hill, Off Paud Road, Kothrud, Pune – 411 038, MH
7) The Energy and Resources Institute (TERI), Darbari Set Block, IHC Complex, Lodhi Road, New Delhi – 110 003
8) M/s Bhagavathi Ana Labs Limited, #8-2-248/5/A/42, Venkateshwara Hills, RoadNo. 3, Banjara Hills, Hyderabad – 500 034
9) Notice Board.

ANNEXURE-XII

A. Training from (October'19 to March'20)
(As provided by Vocational Training Center)

No of employees (Departmental & Contractual) received training in Cluster XI (October'19 to March'20)	
Types of Training	**Numbers**
Refresher Training	338
Special Training	438
Initial Training	39
Training of Contractual workers	253

B. PME report for cluster XI from October'19 to March'20
(As provided by Safety Dept.)

PME from P.B. Area and Moonidih Mine (Departmental & Contractual) under cluster XI	
PME from P.B. Area	**Numbers**
Gopalichuck, Pootkee, Bhagabandh, KB 10-12, PBP colliery, P.B. Area Office, etc.	684

भारत कोकिंग कोल लिमिटेड
एक मिनी रत्न कम्पनी
(महारत्न कम्पनी कोल इंडिया का एक उपक्रम)
पंजीकृत कार्यालय : कोयला भवन, कोयला नगर,
धनबाद–826005
सीआइएन : U10101JH1972GOI000918
महाप्रबंधक का कार्यालय
पश्चिमी झरिया क्षेत्र
पो. मुनीडीह, जिला: धनबाद (झारखण्ड)–828129
फ़ोन नं. 0326 2273483; फ़ैक्स: 0326 2273445, ई-मेल: cgmwj@bccl.gov.in

Bharat Coking Coal Limited
A Mini Ratna Company
(A Subsidiary of Coal India Limited: A Maharatna Company)
Regd. Off. : Koyla Bhawan, Koyla Nagar
Dhanbad - 826005
CIN : U10101JH1972GOI000918
OFFICE OF THE GENERAL MANAGER
WESTERN JHARIA AREA
PO: MOONIDIH, DISTT: DHANBAD (JHARKHAND) - 828129
PHONE NO: 0326 2273483, FAX NO: 0326 2273445, e-mail : cgmwj@bccl.gov.in

Ref:- BCCL/WJA/MND/2019/ 1141(A)

Date:- 29/08/2019

To,
The Member Secretary,
Jharkhand State Pollution Control Board
T.A. Division Building, HEC Dhurwa,
Ranchi – 834004

Sub : Environmental Statement for the year ending 31st March 2019 in respect of Moonidih Colliery, W.J. Area, BCCL.

Dear Sir,

Please find enclosed herewith the Environmental Statement of Moonidih Colliery, Western Jharia, BCCL (Dhanbad) for the year ending 31st March 2019.

Thanking You,

You're faithfully

29.8.19.
Project Officer
Moonidih Colliery

Copy to:-

1. Regional Officer, JSPCB, HIG-1, Housing colony, Bartand Dhanbad, Pin- 826015(By Speed Post)
2. GM, W.J. Area, Moonidih
3. Dy GM (Env.), BCCL Koyla Bhawan, Dhanbad
4. AM (Env.), W.J. Area, Moonidih

FORM- V

ENVIRONMENTAL STATEMENT

For the Financial year ending

31st March 2019

MOONIDIH PEOJECT
WESTERN JHARIA AREA

BHARAT COKING COAL LIMITED

[1][FORM – V]

(See rule 14)

Environmental Statement for the financial year ending the 31st March 2019

PART – A

(i)	Name and address of the owner/occupier of the industry operation or process	NAME :- Sri Rakesh Kumar Designation:- Director (Tech) P&P, Bharat Coking Coal Limited Address:-KOYLA BHAWAN, P.O.-KOYLA NAGAR DISTT- DHANBAD (JHARKHAND) PIN:- 826005 Telephone:- 0326 2230163
(ii)	Industry category Primary ----(STC code) Secondary.-----(SIC Code)	Coal Mining Large Scale
(iii)	Production capacity.----Units----	4.0 MTY (Normative) 5.2 MTY Peak
(iv)	Year of establishment	1964
(v)	Date of the last environmental statement submitted	28.07.2018

PART – B

Water and Raw Material Consumption:

(i) Water consumption m^3/d:

- **a. Process:** Sprinkling or any other 4 KL/day. (Treated Mine Water)
- **b. Cooling:** Nil
- **c. Domestic:** 2000 KL/Day (River water and Treated Mine Water)

	Name of Products	Process water consumption per unit of product output.	
		During the previous financial Year	During current financial Year
1	Coal	Nil	Nil

[1] . Substituted by Rule 2 (b) of the Environment (Protection) Amendment Rules, 1993 notified vide G.S.R 3'6 (E) dated 22.04.1993.

ii) Raw Material Consumption - (NIL)

*Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial year	During the current financial year
Not Application	Coal	NIL	NIL

*Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.

PART - C

Pollution discharged to environment/unit of output: (Parameter as specified in the consent issued)

1) Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
a) Water	4000 KL, All the pollutants are within limit.	Within the prescribed limit.	% below the limit Below 60% to 70% of permissible Limit.
b) Air	12792 cum/min (UG ventilation air)	The emissions are mainly from fugitive sources (non-point sources) which are difficult to be assessed.	
SPM	Within the prescribed limit.		
SO_2			
NOx			

Enclosed: - (i) Monitoring report done by CMPDI.
(ii) Water Analysis Report

PART – D

Hazardous Wastes

(As specified under Hazardous Waste Management and Handling Rules, 1989)

Hazardous Wastes	Total Quantity (Kg.)	
	During the previous Financial year (2017-18)	During the current Financial Year (2018-19)
a). From Process	(a) Burnt Oil- 1.8 KL (approx.) (b)Jute cloth/Soft Cotton- 60 Kg	(a) Burnt Oil- 1.8 KL (approx.) (b)Jute cloth/Soft Cotton- 60 Kg
	Note: - Burnt Oil- Reused for lubrication of plant and Machineries. Jute/Cotton- Burnt on the surface.	
b). From pollution control facilities	Nil	

PART – E
Solid Wastes

Solid Wastes	Total Quantity (Kg.)	
	During the previous Financial year	During the current Financial Year
m) From Process	NIL (U/G Mine)	NIL (U/G Mine)
n) From pollution control facilities	NIL	NIL
o) (i) Quantity recycled or re-utilized within the unit	NIL	NIL
(ii) Soil	NIL	NIL
(iii) Disposed	NIL	NIL

PART – F

Please specify the characterizations (in terms of composition of quantum) of Hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

Composition (Chemical form): Hydrocarbon and Natural Fiber.

Treatment: - Burnt Oil- Reused for lubrication of plant and Machineries.

Jute/Cotton- Burnt on the surface.

Moonidih Project being an underground no solid wastes are generated.

PART – G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

Various pollution abatement measures are practiced by which the impacts on the environment become positive. Due care is taken to conserve the natural resources and protect the environment and all its components.

Following pollution abatement measures are undertaken:-

1. **Water sprinkling:** Water sprinkling is done on roads, sidings, coal transportation pointers, CHP to control dust. The water sprinkling greatly reduces fugitive dust emission thereby reducing the air pollution levels.
2. **Road maintenance:** Maintenance of all roads within the unit leasehold area is being done to control dust. This also helps in reducing the vehicle exhaust.
3. **Tree plantation:** Tree plantation is done as a part of biological reclamation. Plantation helps in reducing noise, dust, as soil erosion control etc.
4. **Noise abatement:** Noise abatement is done by proper maintenance of vehicles and other machines. Workers are provided with air muffs. Trees have been planted near the work place on surface that helps in dampening the extra noise.
5. **Soil erosion Control:** Various soil erosion control measures like tree plantation, construction of diversion channels, settling ponds/ditches, contour terracing, drains is done. It is ensured the minimum amount of soil is lost.
6. **Machine maintenance:** Proper and timely maintenance of the machine/vehicles operating in the unit are done which help in reducing of vehicle exhausts and noise pollution.
7. **Vehicular exhaust Control:** Exhaust monitoring is done occasionally and vehicle exhausts are controlled by proper and timely maintenance of vehicle.
8. **Ambient air, water & noise monitoring:** Monitoring of ambient air, water quality and noise levels are periodically done.
9. **Community awareness:** Welfare offices are there in the unit to propagate awareness regarding environmental protection measures like tree plantation, soil erosion control, domestic exhaust control etc. among colony/village resident. Tree plantation, sapling distribution, Safety awareness and culture programs are organized on important occasions.

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution.

Huge plantation all round Project has done. Discharge water is passing though settling ponds. Water harvesting plan is being prepared and enforced.

PART – I

Any other particulars for improving the quality of the environment:

- Water sprinkling is regularly done on road and surface working area.
- The surface working area has been concreted to avoid dust formation and regular sweeping and dust removal is carried out.
- Huge plantation (more than two lakh) has been done which are adequately cared on and weeds are removed whenever required.
- Ambient air, water quality level are periodically assessed.
- Improved sanitation and drainage is being practiced in all houses of the colony.
- Employees are dissuaded from open burning of coal through reimbursement of their bills of cooking gas.
- EIA (Environmental impact Assessment) is being done at corporate level. This helps in identifying the environmental impact and thereby adopting necessary mitigation measures.

29.08.19.

Project Officer
Moonidih Colliery
Western Jharia Area
Bharat Coking Coal Limited

PROJECT OFFICER/ AGENT
MOONIDIH COLLIERY
B.C.C.L. LTD.

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कम्पनी)
(कोल इंडिया लिमिटेड का एक अंग)
भागाबांध कोलियरी
पुटकी बलिहारी क्षेत्र

Ref No.: BCCL/PBA/BHG/2019/ 491

Date: 28/06/2019

To,
The Member Secretary,
JSPCB, Ranchi.

Sub: Environmental Statement and Annual Return for hazardous waste for the FY' 2018-19 in respect of Bhagabandh Colliery.

Dear Sir,
Please find enclosed herewith copies of Environmental Statement and Annual Return for hazardous waste for the Financial Year 2018-19 in respect of Bhagabandh Colliery.

This is for your kind information and record please.

Thanking You,
Yours Sincerely,

28.6.19

Project Officer,
Bhagabandh Colliery.
परियोजना पदाधिकारी
बी० सी० सी० एल०
भागाबाँध कोलियरी

Received
29/06/2019
Jharkhand State Pollution Control Board
Regional Office
Dhanbad

C.c to:
Regional Officer, JSPCB, Dhanbad.

[FORM – V]

Environmental Statement for the financial year ending the 31st March 2019

PART – A

(i) Name and address of the owner/occupier of the industry operation or process:
Shri P. M Prasad, DT(OP) (Nominated owner)
Koyla Bhawan, Koyla Nagar, BCCL, Dhanbad

(ii) Industry category Primary ----(STC code) Secondary. -----(SIC Code): **Red**
(iii) Production capacity: 0.104 **MTPA (peak production as per EC)**
(iv) Year of establishment: 1971-72
(v) Date of the last environmental statement submitted: 09 July'2018

PART – B

Water and River Material Consumption

(i) Water consumption (m^3/d):

Process: 180 m^3/d (mine water)

Cooling: **NIL**

Domestic: 600 m^3/d

Name of the product	Process water consumption per unit of product output	
	During the previous financial year	During the current financial year
Raw coal	1.56 m^3/ton	1.69 m^3/ton

(ii). Raw Material Consumption

*Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial Year	During the current financial Year
TIMBER		0.427 feet/ton	0.432 feet/ton
LUBRICANTS		0.075 litre/ton	0.036 litre/ton
GREASE		0.003 kg/ton	0.004 kg/ton
DIESEL		0.183 litre/ton	0.159 litre/ton
HFDU68		0.115 litre/ton	0.0132 litre/ton
Oil (Compressor, transformer, etc.)		0.072 litre/ton	0.183 litre/ton
DETONATOR		0.437 units/ton	0.56 unit/ton
EXPLOSIVES	COAL	.233 kg/ton	0.268 kg/ton

*Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials

used.

PART - C

Pollution discharged to environment/unit of output (Parameter as specified in the consent issued)

1) Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
a. Water	WITHIN PRESCRIBED LIMIT (ANALYSIS REPORT ATTACHED)		
b. Air			

PART – D

Hazardous Wastes

(As specified under Hazardous Waste Management and Handling Rules, 1989)

Hazardous Wastes	**Total Quantity (Kg.)**	
	During the previous Financial Year	During the current Financial year
a) From Process	No hazardous waste generated in the previous financial year	No hazardous waste generated in the current financial year
b) From pollution control facilities		

PART – E

Solid Wastes

	Total Quantity	
	During the previous Financial Year	During the current Financial Year

(a) From process (b) Form pollution control facility (c) 1. Quantity recycled or re-utilized Within the unit 2. Sold 3. Disposed	No solid waste generated during the previous financial year	No solid waste generated during the current financial year

PART – F

Please specify the characterizations (in terms of composition of quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

No hazardous waste generated

PART – G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

Improvement is observed in nearby environment.

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution.

a) Measures taken to prevent water pollution:

(i) Mine water discharge is used for industrial purpose like dust suppression and for domestic non drinking purpose.

(ii) Although, no integrated DETP exist, practice of septic tanks and soak pits are provided for quarters.

(iii) 1 no. of artificial; pond is created at Aralgaria village for domestic (nondrinking) purpose for nearby people.

b) Measures taken to prevent air pollution:

(i) Mobile water sprinkler (1 water tanker with capacity 5kl) and one fixed water sprinkler is used for dust suppression.

(ii) Truck is covered with tarpaulin cover during transportation of coal

(iii) Tree plantation is done regularly

PART – I

Any other particulars for improving the quality of the environment.

(i) Eco logical park is under construction.

(ii) Mine water is used for drinking purposes after proper treatment.

(iii) Mine water is also reused in mine for various purposes.

28.6.19

SIGNATURE

(Project Officer)

परियोजना पदाधिकारी
बी० सी० सी० एल०
भगबन्धौं कोलियरी

Bhagabandh Colliery, PB Area

P.O Kusunda, Dhanbad

Jharkhand, 828116

BHARAT COKING COAL LIMITED

(A subsidiary of Coal India Limited)

GOPALICHUCK COLLIERY, P.B. AREA

Ref no:-Gop/P B A/Envt./19/462 Date 27/06/2019

To,

The Regional Officer,

Jharkhand state Pollution Control Board,

HIG-1, Housing Colony,

Bartand, Dhanbad

Subject:-Environmental Statement for the Financial year 2018-19 in respect of Gopalichuck colliery under P.B.Area,B.C.C.L.

Dear Sir,

Enclosed please find the Environmental statement for the financial year 2018-19 in respect of Gopalichuck Colliery under P.B.Area. Kindly acknowledge the receipt.

Thanking you,

Encl.As above-

27/6/19

Project Officer

Gopalichuck colliery

P.B.AREA

Received 27/6/19

Copy to:

1.Member Secretary,JSPCB,T.A.Building,HEC Dhurwa,Ranchi-834004

2.GM (Environment),BCCL,Koyla Bhawan-for information

3.Nodal Officer(Environment),P.B.Area

4.Office copy

[FORM - V]
[See rule 14]

Environmental Statement for the financial year ending the 31st March 2019

PART - A

(i) Name and address of the owner/occupier of the industry operation or process
Shri P M Prasad, DH (OP) (Nominated owner)
Kuela Bhawan, Kuela Nagar, Bt C L, Dhanbad

(ii) Industry category Primary (STC code) Secondary (SIC Code) RED

(iii) Production capacity Coal 0.144 Peak Rated Capacity

(iv) Year of establishment 1971-72

(v) Date of the last environmental statement submitted 30 November 2018

PART - B

Water and Raw Material Consumption

1 Water consumption (m³/d)

Process 700

Cooling Nil

Domestic 2945 (Mine Discharge for Domestic non drinking)

Name of Products	Process water consumption per unit of product output	
	During the previous financial Year	During the Current financial Year
	(1)	(2)
(1) Coal	50.98 m³/ton	41.97 m³/ton

1 Substituted by Rule 2 (b) of the Environment (Protection) Amendment Rules, 1993 notified vide G S R 176 (E) dated 22.04.1993

ii) **Raw Material Consumption**

*Name of raw materials	Name of products	Consumption of raw material per unit of output	
		During the previous financial year	During the current financial year
Explosives	Coal		
Detonator	Coal		
Timber			
Diesel			
Lubricant			
Grease			

*Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used

PART - C

Pollution discharged to environment/unit of output (Parameter as specified in the consent issued)

i) Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standard with reasons
a Water	Within Limit		
b Air	Within Limit		

Environment monitoring report for cluster XI is enclosed

PART – D

Hazardous Wastes

(As specified under Hazardous Waste Management and Handling Rules, 1989)

Hazardous Waster	Total Quantity (Kg.)	
	During the previous Financial Year	During the current Financial year

a) From process Nil

b) From pollution control facilities N.A

PART - F
Solid Wastes

This is underground mine, hence OB production/solid waste is Nil

	Total Quantity	
	During the previous Financial Year	During the current Financial Year
(a) From process		
(b) From pollution control facility		
(c)		
1 Quantity recycled or re utilized Within the unit		
2 Sold		
3 Disposed		

PART - F

Please specify the characteristics (in terms of composition of quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes

N A

PART - G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production

Improvement in observed in nearby environment

PART - H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution

a) Measures taken to prevent water pollution

(i) Mine water discharge is used for industrial purpose like dust suppression and for domestic non drinking purpose

(ii) Although, no integrated ETP exist, practice of septic tanks and soak pits are provided for quarters

b) Measures taken to prevent air pollution

(i) Truck is covered with tarpaulin cover during transportation of coal

(ii) Tree plantation is done regularly

PART – I

Any other particulars for improving the quality of the environment.

(i) Spraying is done regularly to prevent fugitive emissions

(ii) Regular plantation is carried out

28/4/19

SIGNATURE

(Project Officer)

Gopalichuck Colliery, PB Area

Dhanbad

भारत कोकिंग कोल लिमिटेड
(कोल इण्डिया लिमिटेड का एक अंग)
एक मिनीरत्न कम्पनी
क्षेत्र सं. – 7

Bharat Coking Coal Limited
(A Subsidiary of Coal India Limited)
A Miniratna Company
P.B. Area No. VII
OFFICE OF THE PROJECT OFFICER
P.O. – Kusunda, Dhanbad, Pin-828116
CIN : U10101JH1972GOI000918

Ref. No.: BCCL/PBA/KB10-12/2019-20/ 230 Date: - 26.07.2019

To

The Chairman.

Jharkhand State Pollution Control Board,

T.A. Division Building (Ground Floor),

H.E.C. Dhruva, Ranchi – 834004

Subject: Environment Statement of KB 10-12 Colliery for FY 2018-19.

Respected Sir,

Please find enclosed herewith environment statement copy of KB 10-12 Colliery for FY 2018-19.

This is for your information, please.

Thanking you,

Your's sincerely

Project Officer
KB 10/12 Pits Colliery
परियोजना अधिकारी
के0 बी0 10/12 पीट कोलियरी

Copy to;

1. Regional Officer, JSPCB, Bartand Dhanbad, Jharkhand
2. N.O (Env.), Env. Dpt., P.B. Area
3. Office Copy

[FORM – V]
(See rule 14)

Environmental Statement for the financial year 2018-19

PART – A

(i) Name and address of the owner/occupier of the industry operation or process:
Shri P. M Prasad, DT(OP) (Nominated owner)
Koyla Bhawan, Koyla Nagar, BCCL, Dhanbad

(ii) Industry category Primary ----(STC code) Secondary. -----(SIC Code): RED

(iii) Production capacity. ----Units----: 0.143 Peak Prod. (As per EC)
(iv) Year of establishment: 1971-72
(v) Date of the last environmental statement submitted: 30.09.2016 (Production is stopped due to water lodging)

PART – B

Water and River Material Consumption

1. Water consumption (m^3/d)

Process: 800

Cooling: Nil

Domestic: 1100 (Mine Discharge Domestic non drinking)

Name of Products	Process water consumption per unit of product output.	
	During the previous financial Year	During the Current financial Year
	(1)	(2)
(1) Coal	Only Fallen Coal has been Collected as there is water lodging in mine	91.7 m^3/ton (Due to flooding there was less production and excess pumping of water in colliery)

1. Substituted by Rule 2 (b) of the Environment (Protection) Amendment Rules, 1993 notified vide G.S.R 3'6 (E) dated 22.04.1993.

ii) **Raw Material Consumption**

*Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial Year	During the current Financial Year
Explosives	Coal	0.30 kg/ton	Nil
Detonator	Coal	0.71 Num./ton	Nil

*Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.

PART - C

Pollution discharged to environment/unit of output (Parameter as specified in the consent issued)

I) Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
a. Water	Within Limit		
b. Air	Within Limit		

Environment monitoring report for cluster XI is enclosed

PART – D

Hazardous Wastes

(As specified under Hazardous Waste Management and Handling Rules, 1989)

Hazardous Waster	Total Quantity (Kg.)	
	During the previous Financial Year	During the current Financial year

a) From process Nil

b) From pollution control facilities. N.A

PART – E
Solid Wastes

This is underground mine; hence OB production/solid waste is Nil.

	Total Quantity	
	During the previous Financial Year	During the current Financial Year
(a) From process		
(b) Form pollution control facility		
(c)		
1. Quantity recycled or re-utilized Within the unit		
2. Sold		
3. Disposed		

PART – F

Please specify the characterizations (in terms of composition of quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

N.A

PART – G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

Improvement in observed in nearby environment

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution.

a) Measures taken to prevent water pollution:

(i) Mine water discharge is used for industrial purpose like dust suppression and for domestic non drinking purpose.

(ii) Although, no integrated DETP exist, practice of septic tanks and soak pits are provided for quarters.

b) Measures taken to prevent air pollution:

(i) Truck is covered with tarpaulin cover during transportation of coal

(ii) Tree plantation is done regularly

PART – I

Any other particulars for improving the quality of the environment.

(i) Eco restoration park is under construction; 3200 saplings plantation is under process by District Forest Department.

SIGNATURE

(Project Officer)

KB 10/12, PB Area

Dhanbad

Project Officer
K.B. 10/12 Pits Colliery
परियोजना पदाधिकारी
के0 बी0 10/12 पीट कोलियरी

भारत कोकिंग कोल लिमिटेड (कोल इंडिया लिमिटेड का एक अंग) एक मिनीरत्न कंपनी क्षेत्र संख्या - 7 परियोजना पदाधिकारी का कार्यालय पी. बी . प्रोजेक्ट कोलियरी	Coal India Limited A Maharatna Company www.coalindia.in	Bharat Coking Coal Limited (A Subsidiary of Coal India Limited) A Miniratna Company Area No. VII OFFICE OF THE PROJECT OFFICER P.B. PROJECT COLLIERY P.O. – Kusunda, Dhanbad, Pin- 828116

Reference No. PBPC/PO/Env/2019/ 593

Date 28.06.2019
29

To,
The Member Secretary,
Jharkhand State Pollution Control Board
JSPCB TA Division Building, HEC, Dhurwa
Ranchi – 834004

Sub: - **Environmental Statement for the financial year 2018-19 in respect of P.B.Project Colliery under P.B. Area.**

Dear Sir

Please find enclosed herewith duly filled copy of Environmental Statement (Form V) for the financial year 2018-19 in respect of P.B. Project Colliery, under P.B. Area.

This is for your kind information and record.

Yours faithfully
28/06/19
Project officer
P.B. Project Colliery

Copy to:-

1. The Regional Officer, Jharkhand State Pollution Control Board, HIG – 1, Housing colony, Bartand, Dhanbad, 826001.
2. Nodal Officer, Environment, P.B. Area.
3. Office Copy.

[FORM – V]

Environmental Statement for the financial year ending the 31st March 2019

PART – A

(xi) Name and address of the owner/occupier of the industry operation or process :
Shri P.M. Prasad, DT (OP) (Nominated owner)
Kovla Bhawan, Kovla Nagar, BCCL,Dhanbad

(xii) Industry category Primary ----(STC code) Secondary.-----(SIC Code) : **Red**
(xiii) Production capacity: **1.04MTY**
(xiv) Year of establishment : **1981**
(xv) Date of the last environmental statement submitted :**30.07.2018**

PART – B

Water and River Material Consumption

2. Water consumption (m^3/d):

Process: **1000m^3/ day (Mine water)**

Cooling: **Nil**

Domestic: **870.42m^3/ day**

Name of the product	Process water consumption per unit of product output	
	During the previous financial year (1)	During the current financial year (2)
Raw coal	22.46m^3/tonne	9.42m^3/tonne

iv) **Raw Material Consumption**

*Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial Year	During the current financial Year
TIMBER	COAL	.904 feet/tonne	.688 feet/tonne
LUBRICANTS		.141 litre/tonne	.092 litre/tonne
GREASE		.008 kg/tonne	.005 kg/tonne
DIESEL		.200 litre/tonne	.197 litre/tonne
ACETELENE		.022 m^3/tonne	.014 m^3/tonne
HFDU68		.191 litre/tonne	.128 litre/tonne
SS150/SS40/HLP46		.111 litre/tonne	.110 litre/tonne
DETONATOR		.648/tonne	.351/tonne
EXPLOSIVES		.343kg/tonne	.189kg/tonne

*Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.

PART - C

Pollution discharged to environment/unit of output (Parameter as specified in the consent issued)

1) Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
a. Water	WITHIN PRESCRIBED LIMIT (ANALYSIS REPORT ATTACHED)		
b. Air			

PART – D

Hazardous Wastes

(As specified under Hazardous Waste Management and Handling Rules, 1989)

Hazardous Wastes	Total Quantity (Kg.)	
	During the previous Financial Year	During the current Financial year
a. From Process b. From pollution control facilities	No hazardous waste generated in the previous financial year	No hazardous waste generated in the current financial year

PART – E

Solid Wastes

	Total Quantity	
	During the previous Financial Year	During the current Financial Year
a. From process b. Form pollution control facility c. 1. Quantity recycled or re-utilized within the unit 2. Sold 3. Disposed	No solid waste generated during the previous financial year	No solid waste generated during the current financial year

PART – F

Please specify the characterizations (in terms of composition of quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

No hazardous waste generated

PART – G

pact of the pollution abatement measures taken on conservation of natural resources and on the ost of production.

Improvement is observed in nearby environment.

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution.

Measures taken to prevent water pollution:

a. Mine water discharge is used for industrial purpose like dust suppression and for domestic non-drinking purpose.

b. Although, no integrated DETP exist, practice of septic tanks and soak pits are provided for quarters.

c. One no. of artificial pond is created at Aralgaria village for domestic (nondrinking) purpose for nearby people.

d. Oil trap is constructed to separate oil from water coming out from compressor house. Oil so trapped is reused.

Measures taken to prevent air pollution:

a. Mobile water sprinkler (1 water tanker with capacity 5kl) and fixed water sprinklers are used for dust suppression.

b. Truck is covered with tarpaulin cover during transportation of coal

c. Tree plantation is done regularly by Environment department of P.B Area

PART – I

Any other particulars for improving the quality of the environment:

a. Eco-restoration Park is being maintained by Environment dept.
b. Mine water is used for drinking purposes after proper treatment.
c. Mine water is also reused in mine for various purposes.

28/06/19

SIGNATURE
(Project Officer)
PB Project Colliery, PB Area
P.O Kusunda, Dhanbad
Jharkhand, 828116

BHARAT COKING COAL LIMITED

(A Subsidiary of Coal India Limited)

Office of the Project Officer

Moonidih Coal Washery

P.O: Moonidih, Dist: Dhanbad - 828129

Ref No. : BCCL/MND/MCW/PO/ENV Statement/2019/ E-1013 **Date: 03.09.2019**

To
The Member Secretary
Jharkhand State Pollution Control Board
T.A Division Building, HEC
Dhurwa – 834004
(Jharkhand)

Subject: Environmental Statement for the Year 2018-19

Dear Sir,

We are enclosing herewith the Environmental Statement for the **Year 2018-19** of Moonidih **Coal Washery**.

This is for your kind information and necessary action please.

Encl: **As above**

Yours Faithfully

3/9/19

Project Officer
Moonidih Coal Washery

Project Officer
Moonidih Coal Washery
WWZ

Copy to:

1. Regional Officer, JSPCB, Dhanbad
2. GM/AGM (WWZ), Mahuda
3. G.M (ENV), KB, Dhanbad
4. SRM (CP)/ENV, WD
5. O/Copy
6. M/File

ENVIRONMENTAL STATEMENT

OF

MOONIDIH COAL WASHERY

P.O. MOONIDIH, DIST: DHANBAD

JHARKHAND

FOR

THE YEAR

2018 - 2019

[1][FORM – V]

(See rule 14)

Environmental Statement for the financial year ending the 31st March

PART – A

(i)	Name and address of the owner/occupier of the industry operation or process	NAME:- Gautam Kundu Designation:- General Manager Western Washery Zone, BCCL Address:-WWZ, P.O.-MAHUDA DISTT- DHANBAD (JHARKHAND) PIN:- 828129 Telephone:- 0326 2273144
(ii)	Industry category Primary ----(STC code) Secondary.-----(SIC Code)	Primary, Moonidih Coal Washery
(iii)	Production capacity.----Units----	Coal Washing / 0.8 MTPA
(iv)	Year of establishment	1983
(v)	Date of the last environmental statement submitted	28.09.2018 (2017 – 18)

PART – B

Water and River Material Consumption

(1) Water consumption m^3/d:- 105 m^3 / day (It is based on the Raw Coal Feed i.e. 1.5 X Raw Coal Feed) as directed by JSPCB

Process – N/A
Cooling – N/A
Domestic – N/A

	Name of Products	Process water consumption per unit of product output.	
		During the previous financial Year **(2017 – 18)**	During current financial Year **(2018 -19)**
1	Coal Washing	0.176 m^3	**0.214** m^3

ii) **Raw Material Consumption -**

*Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		during the current financial year **(2017 – 18)**	during the current financial year **(2018 – 19)**
1. RAW COAL **2. MAGNETITE** **3. LUBRICANT** **4. DIESEL**	**WASHED COAL**	1.176 MT 1.058 KG / T 0.018 Lit/T 0.203 Litres	1.426 MT 4.607 KG / T 0.040 Lit/T 0.295 Litres

*Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.

PART - C

Pollution discharged to environment/unit of output
(Parameter as specified in the consent issued)

1) Pollutants		Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
a) Water	TSS BOD	**N.A**	**N.A**
	COD SPM SO_2 NOX	Air Monitoring Report is Enclosed	**N.A**
b) Air			

PART – D

Hazardous Wastes

(As specified under Hazardous Waste Management and Handling Rules, 1989) \

Remarks: **Project not started as yet**

Hazardous Waster	**Total Quantity (Kg.)**	
	During the previous Financial Year **(2017-18)**	During the current Financial year **(2018-19)**
a) From Process	NIL	NIL
b) From Pollution Control Facilities	NIL	NIL

PART – E

Solid Wastes

SOLID WASTES	**TOTAL QTY. (in KG)**		
	During the current financial year **(2017 – 18)**	During the current financial year **(2018 – 19)**	
a) From Process	16372	26676	
b) From Pollution Control Facilities	----------	----------	
1. Qty. Recycled or Reutilized with the unit. 2. Solid 3. Disposal	6198.01	2472.45	

PART – F

F-1: There is no generation of the Hazardous waste either from the Process or from its Pollution Control facilities.

F-2: Some Solid Waste was generated from its Plant, Which was sold in the Market.

F-3: There was no generation of Solid Waste from its other Sources.

PART – G

G-1: The Parameter of AAO were found to be within the prescribed limit.

G-2: The Sewage was being discharged into Septic Tank – cum-Soak Pit (S). The Silage was being utilized in its garden.

G-3: The Industrial waste water underwent treatment in its pollution control system. Its quality was found to nearly to confirm the standard prescribed by the Board.

G-4: The noise level was not monitored. However, this type of industries seldom causes environmental noise pollution.

PART – H

Additional measures have been undertaken to control the Water pollution & Air pollution.

H-1: Continuous Excavation of Slurry from Ponds are done and stocked for disposal-off. Additionally, one 'TATA HITACHI' Poclain was procured to further enhance the excavation. It is working well.

H-2: Water Tank is used for spraying on roads inside and outside washery including main road up- to Putkee till Raw Coal is being received from outside collieries. Conversion of one more tipper into tanker is in progress.

H-3: Water Sprinkler is in operation on some road of the washery. 15 (Fifteen) Nos. of more Water Sprinklers are included in next year capital budget for Environment.

H-4: The last three settling ponds viz, Pond No. 7, 8-A and 8-B are completely emptied for accumulation of process and rain water for re-circulating to plant for use as process water.

H-5: Scope of "Rain Water Harvesting" is under study.

H-6: Boulder pitching of Slurry Ponds is included in the capital budget for Environment.

H-7: A concrete boundary wall encircling the entire reject dump has been proposed in the capital budget of Financial Year 2016-17 for Environment.

PART – I

Most of the available space for plantation of Moonidih Coal Washery has already been planted.

3/9/19

Project Officer
Moonidih Coal Washery

Project Officer
Moonidih Coal Washery
WWZ

03/09/19

Deputy Manager (E&M)
Moonidih Coal Washery

RAHUL MAYUR
DY. MANAGER (E&M)
MOONIDIH COAL WASHERY
WWZ

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

(FOR THE MONTH MARCH, 2020)

E. C. no. J-11015/77/2011-IA.II (M) dated 26.08.2013.

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 sump water.

2.3 Noise level monitoring locations

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

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

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

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

3.2 Water quality

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

3.3 Noise level monitoring

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

4.0 Results and interpretations

4.1 Air quality

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

The following preventive and suppressive mitigative measures can be undertaken to contain the pollution level within prescribed level:-

- Wet drilling and controlled blasting should be practice.
- Explosive used should be optimised to restrict the dust generation.
- Transportation roads should be permanently asphalted free of ruts, potholes etc.
- Water should be sprayed on coal transportation road, service road more frequently and at regular interval.
- Dust from roads should be removed physically or mechanically.
- Greenbelts around industrial sites, service building area besides Avenue plantation along roads should be created.
- Coal dust should be suppressed by using fixed sprinklers.
- Regular maintenance of plant and machinery should be undertaken.

4.2 Water quality

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

4.3 Noise Level

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

INTRODUCTION

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

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

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

1.1 The Cluster-XI is in the Western & Southern part of the Jharia coalfield. It includes a group of 5 Mines (viz. Gopalichak UG Mine**,** KachhiBalihari 10/12 Pit UG Mine**,** PB UG Project, Bhagabandh UG Mine, MoonidihUG mine. The Cluster – XI is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XI 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 Jarian nala &DamodarRiver.

1.2 The Cluster-XI is designed to produce 5.08 MTPA (normative) and 6.604 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forests and Climate Change (MoEF&CC) for a rated capacity 1.762 MTPA (normative) and 2.289 MTPA (peak) capacity of coal production vide letter no. J-11015/380/2010-IA.II (M) dated 06thFebruary, 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, other conditions regarding water / effluent and noise level monitoring in consultation with the State Pollution Control Board."

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

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Pootkee Balihari Office (A16): Industrial Area

The location of the sampling station is 23°45'17.23"N 86°21'46.27"E. The sampler was placed at an elevated platform approx. 1.5m above ground level at Project Office.

ii) Moonidih UGP (A17): Industrial Area

The location of the sampling station is 23°44'30.00"N 86°20'56.00"E. The sampler was placed at an elevated platform approx. 1.5m above ground level at project office.

iii) Moonidih Washery (A29): Industrial Area

The location of the sampling station is 23°44'26.00"N 86°21'16.00"E. The sampler was placed at a height of approx. 1.5m above ground level at Project office.

II.BUFFER ZONE Monitoring Location

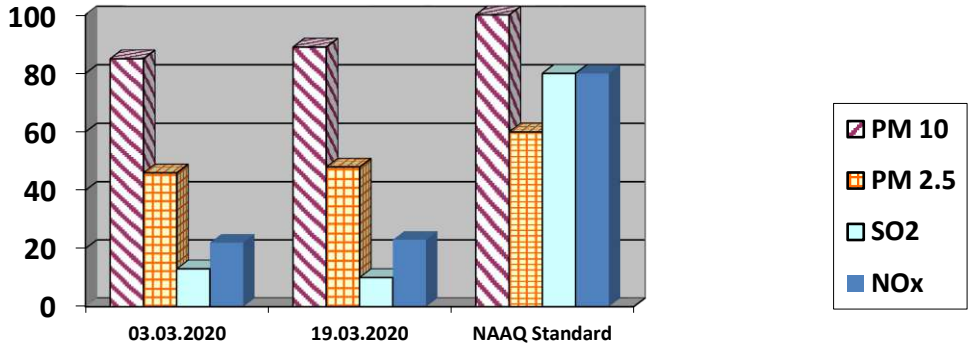
I) Kusunda OCP (A10)

The location of the sampling station is 23°46'49.07"N 86°24'15.71"E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

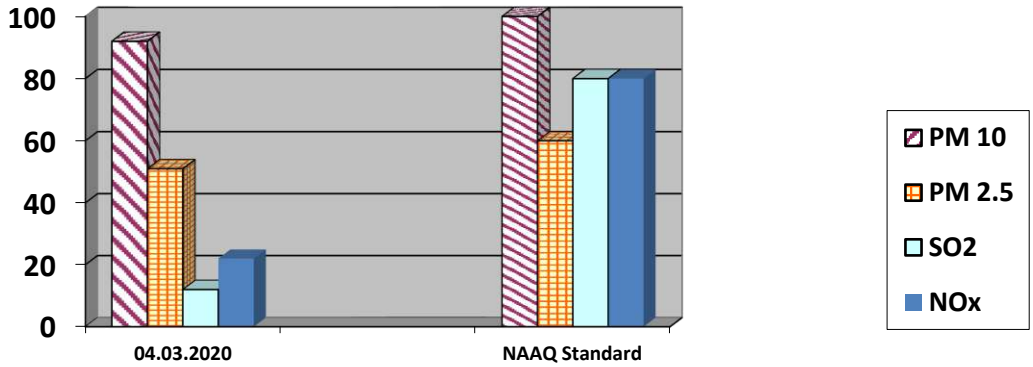
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: **MAR ,2020** Year: **2019-20.**

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	03.03.2020	85	46	13	22
2	19.03.2020	89	48	10	23
	NAAQ Standard	100	60	80	80



Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	04.03.2020	92	51	12	22
N/A –Due to Nationwide Lockdown					
	NAAQ Standard	100	60	80	80

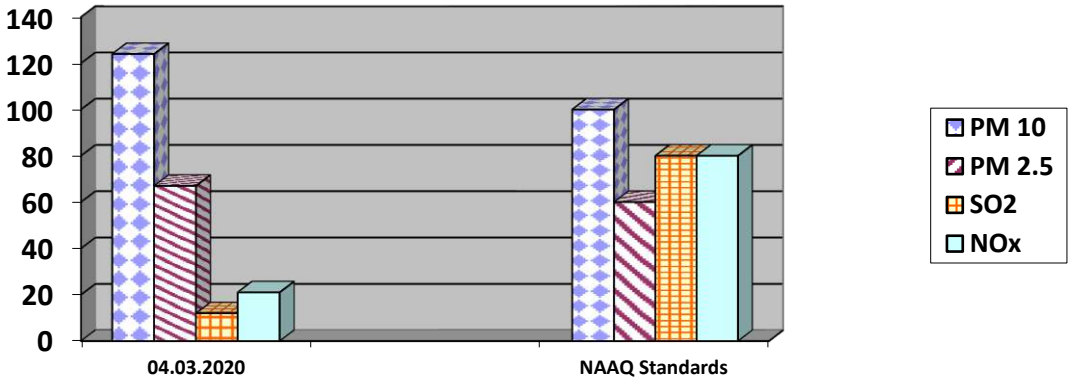


Analysed By
JSA/SA/SSA

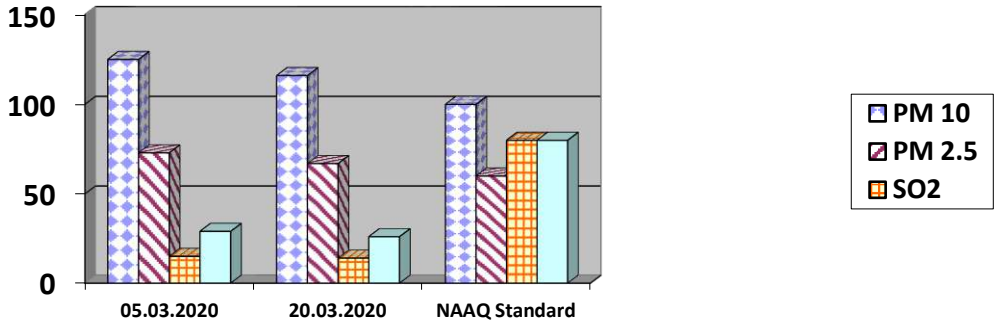
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Station Name: A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	04.03.2020	124	67	12	21
N/A –Due to Nationwide Lockdown					
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	05.03.2020	125	73	15	29
2	20.03.2020	116	67	14	26
	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(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER quality monitoring

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Bhagabandh (MW11)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Kari jore.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **MAR, 2020**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight	**MW11** Second Fortnight	**As per MOEF General Standards for schedule VI**
		05.03.2020	19.03.2020	
1	Total Suspended Solids	31	32	*100 (Max)*
2	pH	7.85	8.02	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	32	28	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JSA/SA/SSA

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

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

1. **Pootkee Balihari Office (N16)**
2. **Moonidih UGP (N17)**
3. **Moonidih Washery (N29)**
4. **Kusunda OCP (N10)**

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).

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project : **Cluster -XI**			Month: **MAR, 2020**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Pootkee Balihari Office (N16)	Industrial area	03.03.2020	69.1	*75*
2	PootkeeBalihari Office (N16)	Industrial area	19.03.2020	53.5	*75*
3	MoonidihUGP (N17)	Industrial area	04.03.2020	67.6	*75*
4	MoonidihUGP (N17)	Industrial area	N/A –Due to Nationwide Lockdown		
5	Moonidih Washery (N29)	Industrial area	04.03.2020	65.7	*75*
6	Moonidih Washery (N29)	Industrial area	N/A –Due to Nationwide Lockdown		
7	KusundaOCP (N10)	Industrial area	05.03.2020	61.4	*75*
8	KusundaOCP (N10)	Industrial area	20.03.2020	58.2	*75*

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

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

Analysed By
JSA/SA/SSA

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

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

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

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

Note:

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

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

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 AUGUST 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.

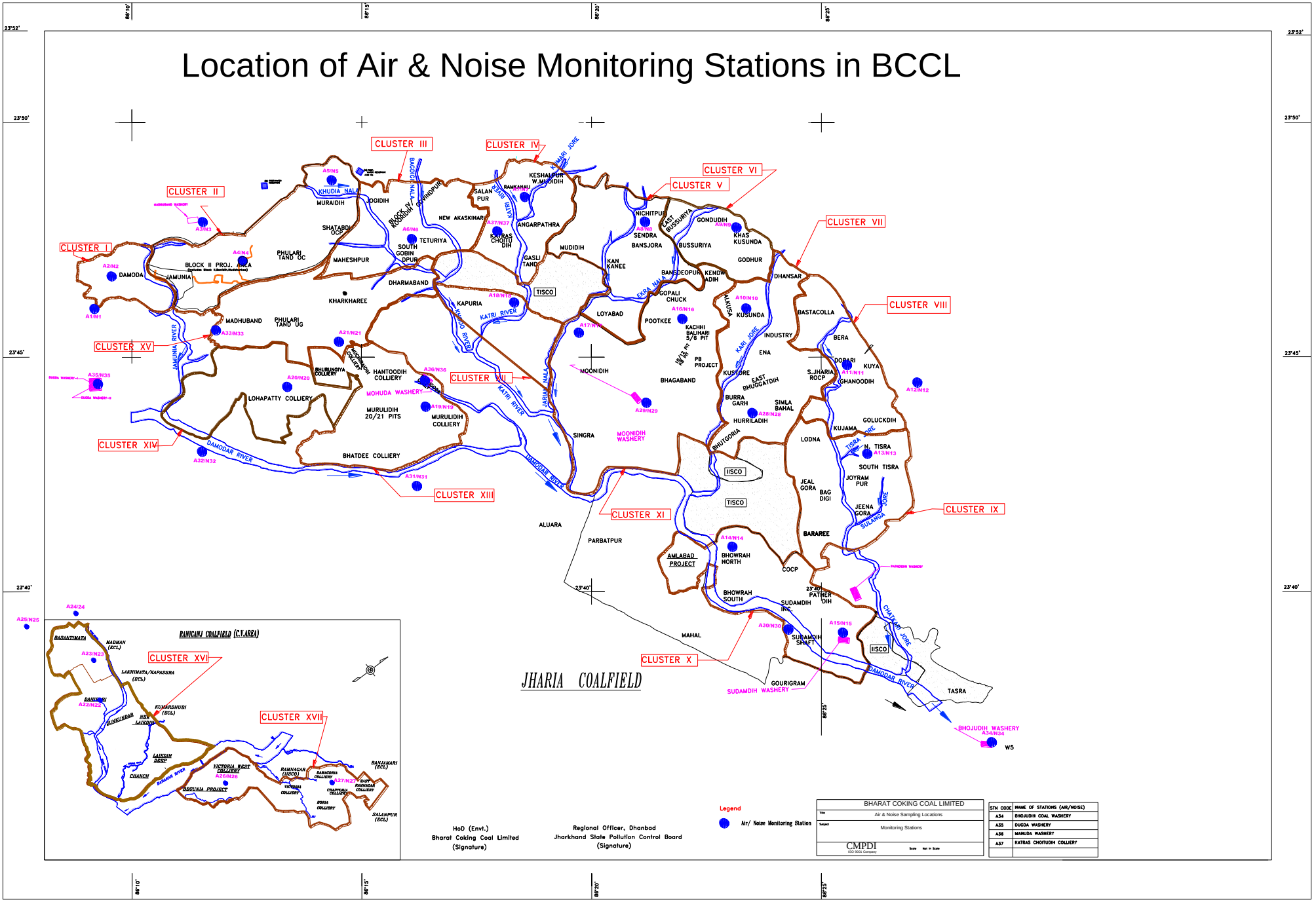
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet 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.

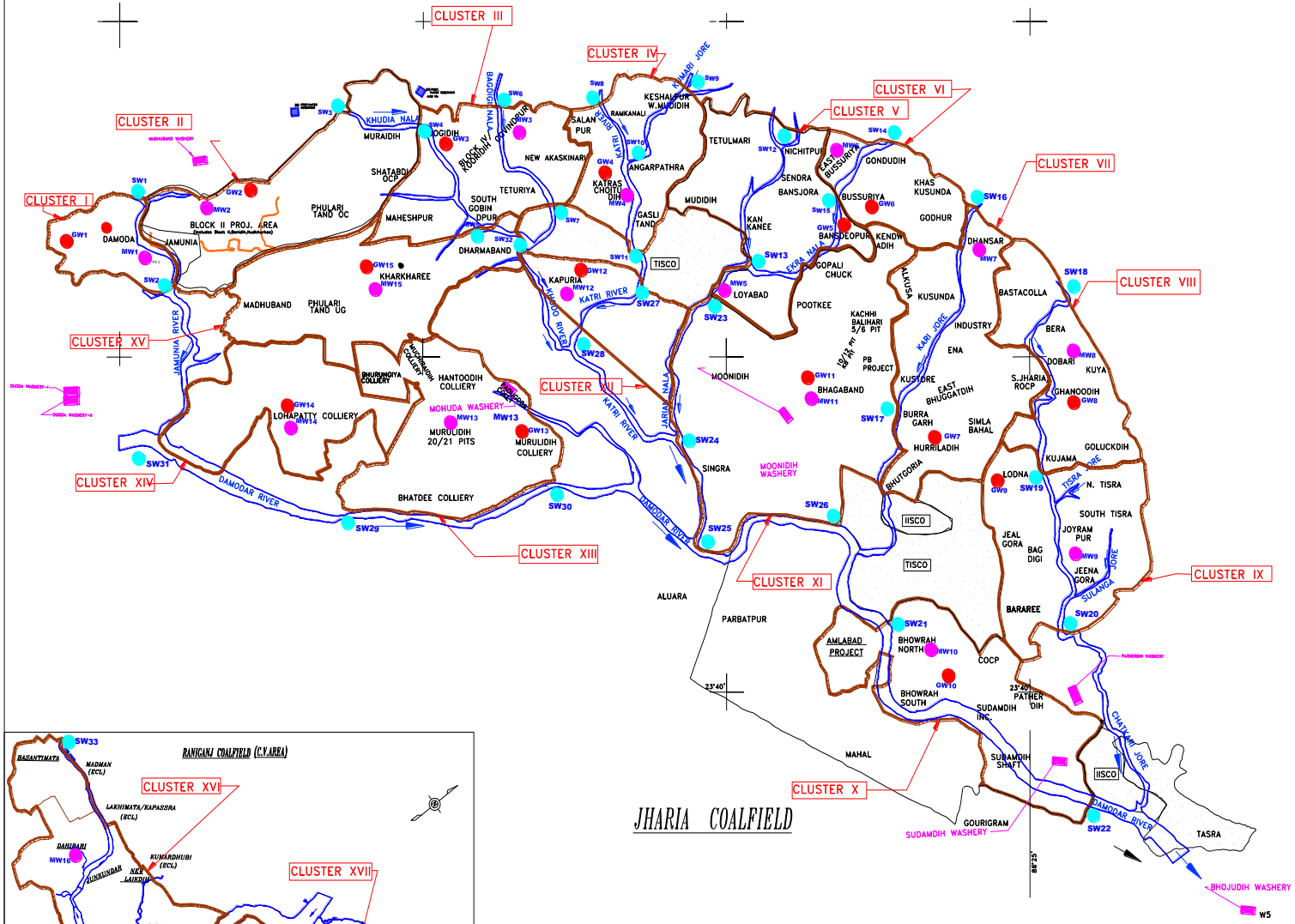
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they AUGUST exceed the limits but not on two consecutive days of monitoring.

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



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Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent	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	Bhagabandh 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

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

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2019-20)

[CLUSTER – I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV & XVI of Mines, BCCL]

JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)

For

(BHARAT COKING COAL LIMITED)

(A Subsidiary of Coal India Limited)

KOYLA BHAWAN (DHANBAD)

Prepared by

Hydrogeology Department

Exploration Division

CMPDI (HQ), Ranchi

MARCH – 2020

Job no-200419012

GROUNDWATER LEVEL & QUALITY REPORT

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MARCH – 2020

PERSONNEL ASSOCIATED

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HYDROGEOLOGICAL DOCUMENTATION

Debasis Bandyopadhyay Manager (Geology)

OVERALL GUIDANCE

Dr. A.K. Panda General Manager (Exploration)

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LIST OF FIGURES

LIST OF ANNEXURES

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 – 1264.0 mm Dhanbad District - 1271.60 mm (Source: Rainfall Statistics of India-2018, IMD, Ministry of Earth Sciences) Normal Rainfall – 1296.30 mm Dhansar Mine Rescue Station – 1315 mm (2018)
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 63 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 3 Nos. of Groundwater monitoring well (Dug Wells) in RCF (CV Area).
9	Groundwater Levels Below Ground Level (bgl)	JCF area: Pre-monsoon – 0.95 to 15.88 m (Avg. 5.46 m bgl) in '2019 Post-monsoon – 0.45 to 05.95 m (Avg. 2.34 m bgl) in '2019 RCF area (part): Pre-monsoon – 1.60 to 9.35 m (Avg. 5.29 m bgl) in '2019 Post-monsoon – 0.80 to 3.88 m (Avg. 2.10 m bgl) in '2019
10	Groundwater Quality	Potable (Annexure- IV)
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-76.30% (GWRE-2017)

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 1240.70 mm (Rainfall Statistics of India-2017, IMD (Ministry of Earth Sciences), has been considered. The non-monsoon rainfall in the District is 259.50 mm (Winter-9.50 mm, Pre-monsoon-73.80 mm and Post-monsoon-176.20 mm) and the monsoon rainfall is 981.30 mm of total annual rainfall. Monsoon Rainfall is around 80% of total annual rainfall in 2017 in Dhanbad District. Rainfall is the primary source of groundwater recharge. The normal rainfall of Jharkhand is 1296.30 mm (2015) as documented in MOSPI, Govt. of India.

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 1:50,000 (**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.

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 varying 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.

Aquifer Type	Hydraulic Conductivity (m/day)	Transmissivity (m^2 /day)	Remarks
Unconfined	0.50	10.68 – 41.48	Site: Damuda (BJ Section) and Block-III area
Semi-confined	0.0006 – 1.44 (1) 0.0027 – 0.05 (2)	-	Site: (1): Sitanala Block (2): Kumari Block

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 (March, May, August and November month of 2018) 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 2019 of CMPDI monitoring stations (total 63 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
	2018	1.20	14.58	5.55	0.40	7.17	2.83	0.20	9.45	2.68
	2019	0.95	15.88	5.46	0.45	5.95	2.34	0.20	13.40	3.05
RCF (part)	2008	5.02	10.50	7.59	2.85	4.90	3.71	1.82	6.60	3.87
	2010	2.20	8.85	4.74	2.78	9.58	4.63	0.68	1.10	0.89
	2011	3.57	8.02	4.98	2.50	6.21	3.75	0.55	1.90	1.23
	2012	3.10	7.34	4.59	1.55	7.00	3.66	0.05	2.78	0.94
	2013	1.70	9.87	6.54	2.90	8.85	4.71	1.02	5.54	2.84
	2014	3.27	6.48	4.57	2.13	3.03	2.63	0.54	3.45	1.94
	2015	3.38	9.52	5.33	2.68	8.20	5.11	1.06	1.32	1.81
	2016	3.61	10.65	6.24	0.90	6.50	3.18	1.63	4.40	3.06
	2017	1.93	5.80	3.25	1.63	3.78	2.47	1.63	3.78	0.78
	2018	2.34	8.70	4.35	1.75	5.70	2.75	0.41	2.55	1.59
	2019	1.60	9.35	5.29	0.80	3.88	2.10	0.80	5.47	3.20

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-2019]***		***Average GWL (m)***	
			Pre-monsoon (Apr/May)	***Post-monsoon (Nov/Dec)***	***Pre-monsoon***	***Post-monsoon***
Sedimentary (Gondwana)	Non-mining		1.30-11.22	0.65-4.52	5.50	2.50
	Mining	OC	0.95-12.60	0.45-5.95	5.16	2.21
		UG	1.20-15.88	0.55-4.57	5.95	2.74
Metamorphics	Peripheral part of the Coalfield		0.45-15.10	0.35-9.20	7.15	3.95

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 2.0×10^{-3}
2		Mining	OC	5.0×10^{-2} to 4.0×10^{-3}
3			UG	2.0×10^{-2} to 3.0×10^{-3}
4	Metamorphics	Peripheral part of the Coalfield		1.0×10^{-3} to 2.0×10^{-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 May, August, November‘2019 and January’2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May’19	Aug’19	Nov’19	Jan’20
1	B-15	Bera Basti	1.90	0.45	1.65	2.65
2	B-21A	Dugdha	9.45	1.90	-	-
3	B-51	Taranga	5.10	1.10	2.70	2.90
4	B-53	Karmatanr	3.22	0.97	1.42	2.12
Average WL (bgl)			4.92	1.11	1.92	2.56

Ground Water Level (in bgl) varies from 1.90 to 9.45 m during May’19, 0.45 to 1.90 m during August’19, 1.42 to 2.70 m during November’19 and 2.12 to 2.90 m during January’20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	B-1	Muraidih	3.18	1.33	1.73	1.98
2	B-59	Khodovaly	6.20	0.80	0.90	1.20
3	B-60	Bahiyardih	8.13	1.23	3.23	4.93
4	B-61A	Kesargora	3.32	1.39	0.52	1.12
5	B-62A	Sadiyardih	7.55	2.80	3.25	4.95
Average WL (bgl)			5.68	1.51	1.93	2.84

Ground Water Level (in bgl) varies from 3.18 to 8.13 m during May'19, 0.80 to 2.80 m during August'19, 0.52 to 3.25 m during November'19 and 1.12 to 4.95 m during January'20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-12	Jamua	2.10	0.29	0.45	0.75
2	A-25	Sinidih	6.08	1.43	1.93	2.48
3	A-29	Dharmaband	4.85	1.20	3.40	3.65
4	B-14	Mathadih	2.24	0.54	0.94	2.04
5	B-60	Sonardih	8.13	1.23	3.23	4.93
Average WL (bgl)			4.68	0.94	1.99	2.77

Ground Water Level (in bgl) varies from 2.10 to 8.13 m during May'19, 0.29 to 1.43 m during August'19, 0.45 to 3.40 m during November'19 and 0.75 to 4.93 m during January'20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-26	Malkhera	6.58	2.23	3.33	3.83
2	A28A	Lakarka	2.45	1.25	3.15	3.60
3	B-64	Keshalpur	0.95	0.30	0.45	1.20
4	B-65A	Jhinjipahari	11.05	1.85	0.95	2.95
Average WL (bgl)			5.26	1.41	1.97	2.90

Ground Water Level (in bgl) varies from 0.95 to 11.05 m during May'19, 0.30 to 2.23 m during August'19, 0.45 to 3.33 m during November'19 and 1.20 to 3.83 m during January'20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-3	Sijua	3.47	0.32	0.47	0.62
2	A-16	Ekra	5.45	1.65	1.95	4.55
3	A-27	Tetulmari	2.40	0.15	0.92	1.30
4	D-23	Jogta	4.70	1.65	1.40	1.50
Average WL (bgl)			4.01	0.94	1.19	1.99

Ground Water Level (in bgl) varies from 2.40 to 5.45 m during May'19, 0.15 to 1.65 m during August'19, 0.47 to 1.95 m during November'19 and 0.62 to 4.55 m during January'20 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 May, August, November‘2019 and January’2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May’19	Aug’19	Nov’19	Jan’20
1	D-25	Godhur	9.90	4.35	5.38	5.50
2	D-30	Borkiboa	4.60	0.38	0.75	1.95
Average WL (bgl)			**7.25**	**2.37**	**3.07**	**3.73**

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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	D-3	Dhansar	1.75	1.05	1.30	1.45
2	D-4	Jharia	2.81	1.16	1.71	2.16
3	D-33	Kustore	2.35	0.25	1.65	2.35
4	D-34	Kusunda	4.75	2.10	2.40	2.55
5	D-47	Parastanr	4.55	1.90	4.35	4.20
6	D-55	Hariladih	8.42	2.97	5.47	8.62
7	D-80	Bastacolla	5.00	2.30	3.05	3.80
Average WL (bgl)			4.23	1.68	2.85	3.59

Ground Water Level (in bgl) varies from 1.75 to 8.42 m during May'19, 0.25 to 2.97 m during August'19, 1.30 to 5.47 m during November'19 and 1.45 to 8.62 m during January'20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	D-8	Alokdiha	4.80	1.95	2.85	4.25
2	D-43	Alagdih	7.35	3.55	2.70	4.25
3	D-49	Galucdih	1.75	0.60	1.50	1.25
4	D-51	Chankuiya	9.95	8.05	5.75	7.75
Average WL (bgl)			5.96	3.54	3.20	4.38

Ground Water Level (in bgl) varies from 1.75 to 9.95 m during May'19, 0.60 to 8.05 m during August'19, 1.50 to 5.75 m during November'19 and 1.25 to 7.75 m during January'20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	D-5	Jiyalgora	8.25	2.90	4.85	8.20
2	D-7	Golden Pahari	8.23	1.88	3.28	4.86
3	D-39	Tilaboni	12.60	4.00	5.95	12.45
4	D-40A	Khapa Dhawra	1.85	1.50	1.45	1.95
5	D-41	Joyrampur	2.30	0.70	1.25	1.40
6	D-74	Bhulan Bararee	5.80	2.35	3.57	4.95
Average WL (bgl)			6.51	2.22	3.39	5.64

Ground Water Level (in bgl) varies from 1.85 to 12.60 m during May'19, 0.70 to 4.00 m during August'19, 1.25 to 5.95 m during November'19 and 1.40 to 12.45 m during January'20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-19	Bhowrah	4.85	0.95	3.43	4.95
2	D-35	Patherdih	8.00	3.15	3.80	5.90
3	D-36	Sudamdih	1.20	0.10	0.55	0.65
4	D-77	Amlabad	6.40	2.80	3.20	4.50
Average WL (bgl)			5.11	1.75	2.75	4.00

Ground Water Level (in bgl) varies from 1.20 to 8.00 m during May'19, 0.95 to 3.15 m during August'19, 0.55 to 3.80 m during November'19 and 0.65 to 4.95 m during January'20 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.

4 hydrograph stations (**A-17, A-18, A-20 and A-32**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water below (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-17	Kachi Balihari	2.94	0.34	2.24	2.42
2	A-18	Baghaband	2.29	1.09	0.69	1.09
3	A-20	Gorbudih	4.57	3.32	1.82	4.02
4	A-32	Baludih	2.75	0.62	0.95	1.65
Average GW (bgl)			3.14	1.34	1.43	2.30

Ground Water Level (in bgl) varies from 2.29 to 4.57 m during May'19, 0.34 to 3.32 m during August'19, 0.69 to 2.24 m during November'19 and 1.09 to 4.02 m during January'20 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.

6 hydrograph stations (**A-22, A-23, A-33, A-34, B-25 and B-48**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-22A	Nagdah Basti	2.60	1.75	2.00	2.85
2	A-23	Machhayara	11.97	5.37	3.77	6.57
3	A-33	Mahuda Washery	3.65	0.55	1.25	1.55
4	A-34	Mahuda Mosque	6.35	3.45	3.95	5.45
5	B-25	Mahuda More	4.80	1.38	1.40	3.50
6	B-48	Mahuda	7.05	2.85	4.35	5.45
Average GW (bgl)			6.07	2.56	2.79	4.23

Ground Water Level (in bgl) varies from 2.60 to 11.97 m during May'19, 0.55 to 5.37 m during August'19, 1.40 to 4.35 m during November'19 and 1.55 to 6.57 m during January'20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	B-23	Lohapatti	2.84	1.12	1.34	2.24
2	B-24	Telmuchu	4.58	1.23	2.33	3.63
3	B-67	Simatanr	8.57	3.37	4.35	4.65
Average GW (bgl)			5.33	1.91	2.67	3.51

Ground Water Level (in bgl) varies from 2.84 to 8.57 m during May'19, 1.12 to 3.37 m during August'19, 1.34 to 4.35 m during November'19 and 2.24 to 4.65 m during January'20 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 May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-24	Pipratanr	15.88	1.73	2.48	4.08
2	B-32A	Madhuband	5.55	1.25	1.70	2.35
3	B-61A	Kesargora	3.35	1.39	0.52	1.12
Average GW (bgl)			8.25	1.46	1.57	2.52

Ground Water Level (in bgl) varies from 3.35 to 15.88 m during May'19, 1.25 to 1.73 m during August'19, 0.52 to 2.48 m during November'19 and 1.12 to 4.08 m during January'20 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.

3 hydrograph stations (**DB-22, DB-23, DB-24**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	DB-22	Dahibari, Niche Basti	4.93	1.38	1.63	1.73
2	DB-23	Dahibari OC	1.60	0.88	0.80	1.00
3	DB-24	Dahibari	9.35	3.20	3.88	4.80
Average GW Level			4.53	1.82	2.10	2.51

Ground Water Level (in bgl) varies from 1.60 to 9.35 m during May'19, 0.88 to 3.20 m during August'19, 0.80 to 3.88 m during November'19 and 1.00 to 4.80 m during January'20 within the Core Zone of Cluster-XVI area.

4.0 GROUNDWATER LEVEL SCENARIO

During the month of May'2019 the depth to water level (in bgl) within 15 nos Cluster of mines varies from 0.95 m to 15.88 m with an average of 5.46 m. During the month of August'2019 the depth to water level varies from 0.10 m to 8.05 m with an average of 1.77 m. During the month of November'2019 the depth to water level varies from 0.45 m to 5.95 m with an average of 2.34 m. During the month of January'2020 the depth to water level varies from 0.62 m to 12.45 m with an average of 3.30 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 15.88 m during pre-monsoon'2019 and maximum upto 9.35 m during post-monsoon'2019. 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 and VI**) 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 and CMPDI observation wells, there are decline trends in both Pre and Post-monsoon GW level trends (max. upto 0.50 cm/year in Cluster-V and Cluster-VI) but no significant decline trend (>1.0 m/year) of water level is noticed in any particular area for the last 10 years within the coalfield area. Regarding quality monitoring, the water sample location map (**Figure No–2**) with collection points details (dug wells) are given in **Annexure–IV** and Quality is given in **Annexure–V**.

Table No–4: Groundwater level data Cluster-wise

Sl. No.	Cluster of BCCL	No. of Monitoring Wells	Water level fluctuation Below ground level (May, Aug, Nov'19 & Jan'20)	Avg. Fluctuation (in meters)	Formation
1	I	4 nos.	0.45 to 9.45 m	3.00 m	Barakar
2	II	5 nos.	0.80 to 8.13 m	2.85 m	Barakar
3	III	5 nos.	0.29 to 6.08 m	2.70 m	Barakar
4	IV	4 nos.	0.30 to 11.05 m	3.30 m	Barakar
5	V	4 nos.	0.15 to 4.70 m	2.80 m	Barakar
6	VI	2 nos.	0.38 to 9.90 m	4.20 m	Barakar
7	VII	7 nos.	0.25 to 8.62 m	1.50 m	Barakar
8	VIII	4 nos.	0.60 to 9.95 m	2.75 m	Barakar
9	IX	6 nos.	0.70 to 12.60 m	3.10 m	Barakar
10	X	4 nos.	0.10 to 8.00 m	2.35 m	Barakar
11	XI	4 nos.	0.34 to 4.57 m	1.70 m	Barakar & Barren Measure
12	XIII	6 nos.	0.55 to 11.93 m	3.30 m	Raniganj
13	XIV	3 nos.	1.12 to 8.57 m	2.65 m	Raniganj
14	XV	3 nos.	0.52 to 15.88 m	6.70 m	Barakar & Barren Measure
15	XVI	3 nos.	0.80 to 9.35 m	3.20 m	Barakar

Maximum water level fluctuation observed in Cluster-XV (6.70 m) and minimum fluctuation observed in Cluster-VII (1.50 m). However, 3-5 m water level fluctuation observed in Cluster-I, IV, VI, IX, XIII, XV and XVI, 5-7 m water level fluctuation observed in Cluster-XV, 7-9 m water level fluctuation and beyond 9 m is not observed in any of the Cluster of mines of BCCL.

5.0 GROUNDWATER QUALITY

The ground water sample of the study area (15 nos. of Cluster of mines, BCCL) have been collected from dug wells and analysed. Fifteen ground water samples (GW-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15 & 16) were analysed during the month of May'2019 at CMPDI, RI-II, Dhanbad. The water sampling details are given in **Annexure–IV** and Water sample locations are shown in **Figure No-2**. The water quality data are enclosed in **Annexure–V.**

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

The pH of the groundwater samples varies between 7.64 (GW-6) to 8.14 (GW-7) in May 2019, the pH is within the ISI limit of drinking water standard.

The mineral constituents dissolved in water constitute the dissolved solids. The total dissolve solids vary from 366 (GW-5) to 796 mg/l (GW-6) in May 2019, the TDS values are above the IS 10500 standards of drinking water.

During the month of May'19 the alkalinity of the water samples varies from 66 (GW-11) to 124 mg/l (GW-7) and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 28 (GW-16) to 84 mg/l (GW-6) and are ***slightly above*** the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 170 (GW-16) to 420 mg/l (GW-3) and the value of total hardness in water samples are ***above*** the permissible limit (200 mg/l). The sulphate ranges between 68 (GW-14) to 136 mg/l (GW-3) and the value of sulphate in water sample are within the permissible limit (200 mg/l). The Iron, Copper, Manganese, Lead, Zinc and Chromium concentration in the water samples are found to be below the upper ISI limits for drinking water.

6.0 STAGE OF GROUNDWATER EXTRACTION

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 76.30% (as per 2017 GWRE). The highest stage of development is in Jharia Block (127.0%) & Dhanbad Block (107.50%) and lowest stage of development is in Baliapur Block (78.24%) as per GWRE-2013. The Gondwana sandstones in general, 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 2017, 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 (GWRE-2013)	Category (GWRE-2017)
	District	Block			
1	Bokaro	Bermo	156.30%	**Over- exploited**	**Over- exploited**
2	Dhanbad	Baghmara	91.74%	Critical	Critical
3	Dhanbad	Baliapur	78.24%	Semi- Critical	Semi- Critical
4	Dhanbad	Dhanbad	107.50%	**Over- exploited**	**Over- exploited**
5	Dhanbad	Jharia	127.0%	**Over- exploited**	**Over- exploited**
6	Dhanbad	Topchachi	98.45%	Critical	Critical

- **Dynamic Groundwater Resource Assessment, CGWB as per 2013 & 2017.**

Table No–6: Cluster-wise Groundwater development scenario

Cluster/ Area	Adminis-trative Blocks/Stage Of GW Develo-Pment (SOD)	Total Water demand (Lakh cum/year)				Avg. GW level (bgl in m) 2019		GW level declining trend 2005-2019		Quantity Storage / future use (Lakh Cum/ Year)
		Mine Discharge (GW + Rainwater)	Surface Water Source	Total Use (Domestic + Industrial)	Excess Or other use	Pre-monsoon	Post-monsoon	Pre-monsoon	Post-monsoon	
Cluster-I	Bermo (SOD: Over-exploited)	9.56	NIL	7.42	2.14	4.92	1.92	YES	YES	NIL
Cluster-II	Baghmara (SOD: Critical)	170.17	Jamunia river	22.55	23.83	5.68	1.93	NO	NO	123.75
Cluster-III		58.18	NIL	2.58	12.65	4.68	1.99	NO	NO	42.95
Cluster-IV		68.84	MADA (Damodar river)	18.47	12.31	5.26	1.97	NO	NO	38.06
Cluster-V		127.29	MADA	77.92	31.02	4.01	1.19	YES	YES	18.35
Cluster-VI	Dhanbad (SOD: Over-exploited)	3.86	MADA (Damodar river)	3.69	0.0	7.25	3.07	YES	YES	NIL (loss due to FF)
Cluster-VII		93.33	MADA	27.70	6.87	4.23	2.85	NO	NO	58.76
Cluster-VIII	Jharia (SOD: Over-exploited)	29.27	MADA	24.04	1.18	5.96	3.20	NO	NO	4.05
Cluster-IX		310.34	MADA	160.28	45.05	6.51	3.39	NO	NO	105.01
Cluster-X		59.38	Damodar river	11.47	0.0	5.11	2.75	YES	NO	47.91
Cluster-XI	Dhanbad (SOD: Over-exploited)	249.67	MADA & DVC	19.86	43.92	3.14	1.43	NO	NO	185.89
Cluster-XIII	Baghmara (SOD: Critical)	64.61	Damodar river	10.09	9.86	6.07	2.79	NO	NO	44.66
Cluster-XIV		NA	NA	NA	NA	5.33	2.67	NO	NO	NA
Cluster-XV		5.11	Jamunia river	0.0	5.11	8.25	1.57	NO	NO	0.0
Cluster-XVI	Nirsa (SOD:Safe)	29.78	DVC (Barakar river)	14.60	6.57	5.29	2.10	NO	NO	8.61

7.0 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	DO	DO	**DB-24**	23^{0}43'53.00" N	86^{0}45'03.88" E
B-59	23^{0}47'59.87" N	86^{0}13'37.97" E	**DB-25**	23^{0}44'10.75" N	86^{0}44'35.84" E
B-60	23^{0}48'7.87" N	86^{0}15'37.12" E			
B-61A	23^{0}45'59.85" N	86^{0}11'40.80" E			
B-62A	23^{0}45'44.15" N	86^{0}11'27.80" E			

Annexure – 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, 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	May, 18	Nov 18	May 19	Nov 19
A-3	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	1.27	0.47	3.47	0.47
A-12	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	2.80	1.0	2.10	0.45
A-16	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	4.30	3.65	5.45	1.95
A-17	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	3.34	2.84	2.94	2.24
A-18	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	1.24	0.99	2.29	0.69
A-19		9.61	2.46	7.46	4.46	3.00	2.75	3.05	2.75	7.81	4.11	6.37	2.45	5.55	2.45	4.85	3.43
A-20	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	4.57	2.57	4.57	1.82
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	3.35	1.30	2.60	2.00
A-23	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	11.15	7.17	11.97	3.77
A-24	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	14.58	6.88	15.88	2.48
A-25	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	6.63	3.13	6.08	1.93
A-26	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	6.23	3.88	6.58	3.33
A-27	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	2.90	1.0	2.40	0.92
A28A	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	4.15	2.51	2.45	3.15
A-29	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	6.45	2.10	4.85	3.40
A-32	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	2.80	0.70	2.75	0.95
A-33	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	4.07	2.35	3.65	1.25
A-34	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	5.90	3.70	6.35	3.95
B-1	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	2.88	2.08	3.18	1.73
B-14	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	3.64	2.84	2.24	0.94
B-15	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	1.85	0.85	1.90	1.65
B21A	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	9.65	2.65	9.45	-
B-23	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	6.64	2.14	2.84	1.34
B-24	10.33	-	3.09	8.88	2.83	9.40	2.21	10.0	5.78	10.63	4.28	10.03	4.03	9.28	4.33	4.58	2.33
B-25	8.35	8.35	2.60	7.08	2.15	5.82	5.15	6.88	-	7.05	1.70	6.70	1.40	5.90	3.70	4.80	1.40
B32A	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	6.75	3.90	5.55	1.70
B-48	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	7.33	3.97	7.05	4.35
B-51	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	5.02	2.42	5.10	2.70
B-53	1.67	6.97	1.42	4.15	1.12	3.39	-	5.58	2.82	4.70	1.45	4.02	1.92	3.92	1.42	3.22	1.42
B-59	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	5.47	1.10	6.20	0.90
B-60	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	13.68	4.23	8.13	3.23
B61A	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	2.57	2.02	3.32	0.52
B62A	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	8.27	4.78	7.55	3.25

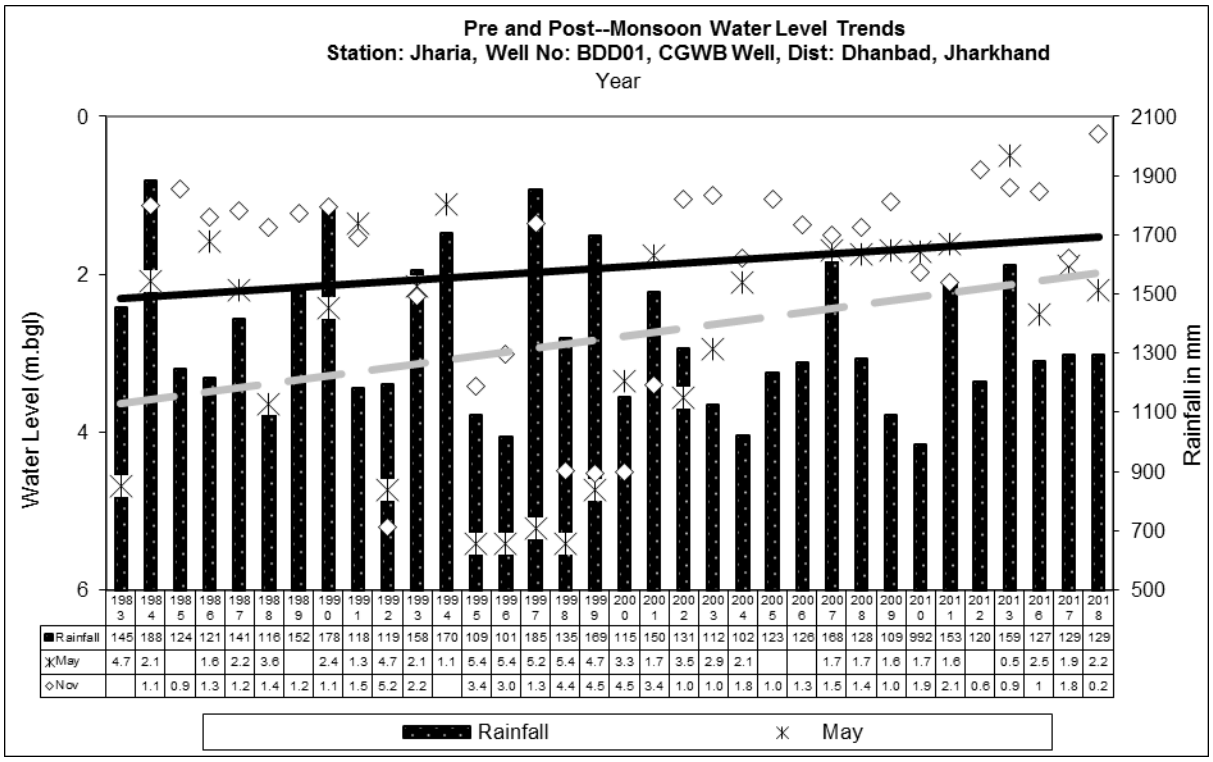
Annexure – IIB

Historical Water Level data of Hydrograph Stations

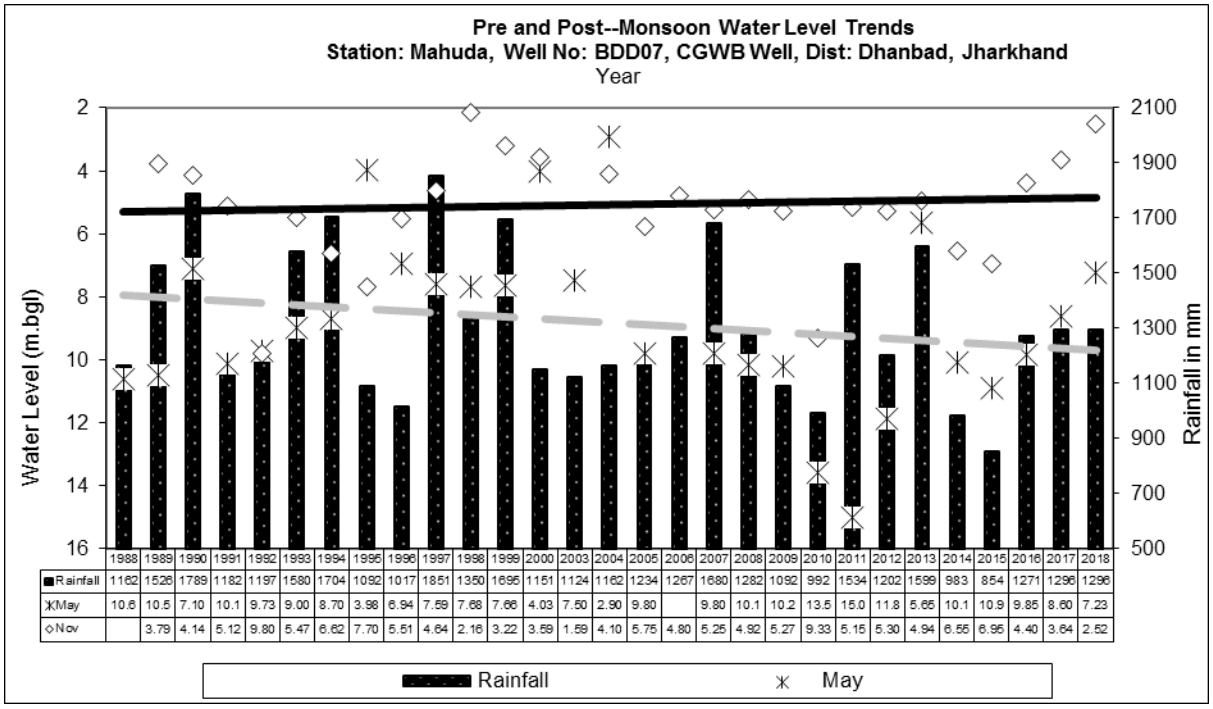
Well No	Water level below ground level (bgl) in meters																
	May, 11	May, 12	Nov, 12	May, 13	Nov, 13	May, 14	Nov, 14	May, 15	Nov, 15	May, 16	Nov, 16	May, 17	Nov, 17	May, 18	Nov, 18	May 19	Nov 19
B-64	0.85	1.05	1.00	1.35	0.85	0.7	1.15	1.38	0.95	2.35	0.55	1.25	0.85	2.15	1.85	0.95	0.45
B65A	9.65	11.45	1.73	10.11	1.82	10.45	2.4	7.82	5.87	7.15	2.68	9.05	1.25	10.03	2.40	11.05	0.95
B-67	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	9.55	4.0	8.57	4.35
D-3	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	3.43	2.45	1.75	1.30
D-4	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	1.91	1.56	2.81	1.71
D-5	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	7.80	5.30	8.25	4.85
D-7	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	7.53	2.83	8.23	3.28
D-8	7.75	6.15	3.75	6.65	2.85	7.73	-	6.24	4.38	8.00	3.43	5.15	1.85	5.65	1.85	4.80	2.85
D-23	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	4.40	3.40	4.70	1.40
D-25	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	2.60	2.40	*9.90	*5.38
D-30	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	4.58	1.10	4.60	0.75
D-33	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	2.85	0.95	2.35	1.65
D-34	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	2.80	0.45	4.75	2.40
D-35	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	8.40	4.45	8.00	3.80
D-36	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	1.20	0.60	1.20	0.55
D-39	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	4.95	4.35	*12.60	*5.95
D40A	1.95	2.45	1.70		2.25	2.35	2.45	3.07	2.45	1.40	0.85	1.45	1.35	2.10	1.40	1.85	1.45
D-41	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	1.59	1.32	2.30	1.25
D-43	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	7.15	3.45	7.35	2.70
D-47	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	5.33	2.55	4.55	4.35
D-49	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	3.45	2.45	1.75	1.50
D-51	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	10.93	7.10	9.95	5.75
D-55	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	8.42	1.57	8.42	5.47
D-74	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	8.60	4.80	5.80	3.57
D-77	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	6.30	5.20	6.40	3.20
D-80	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	9.35	4.20	5.00	3.05
RCF (part)		May, 12	Nov, 12	May, 13	Nov, 13	May, 14	Nov, 14	May, 15	Nov, 15	May, 16	Nov, 16	May, 17	Nov, 17	May, 18	Nov, 18	May 19	Nov 19
DB22		2.43	2.38	8.18	2.64	6.48	3.03	4.59	3.53	5.38	3.33	1.93	1.63	2.34	1.93	4.93	1.63
DB23		2.90	2.33	5.05	3.10	3.95	2.13	3.38	6.04	5.30	0.90	2.05	1.90	2.85	1.75	1.60	0.80
DB24		-	-	-	8.25	-	8.45	9.52	8.20	10.65	6.50	5.80	3.78	8.25	5.70	9.35	3.88
DB25		3.96	1.18	1.33	2.53	3.27	2.73	3.83	2.68	3.61	1.98	3.23	2.58	3.93	1.63	-	-

Annexure – III

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS



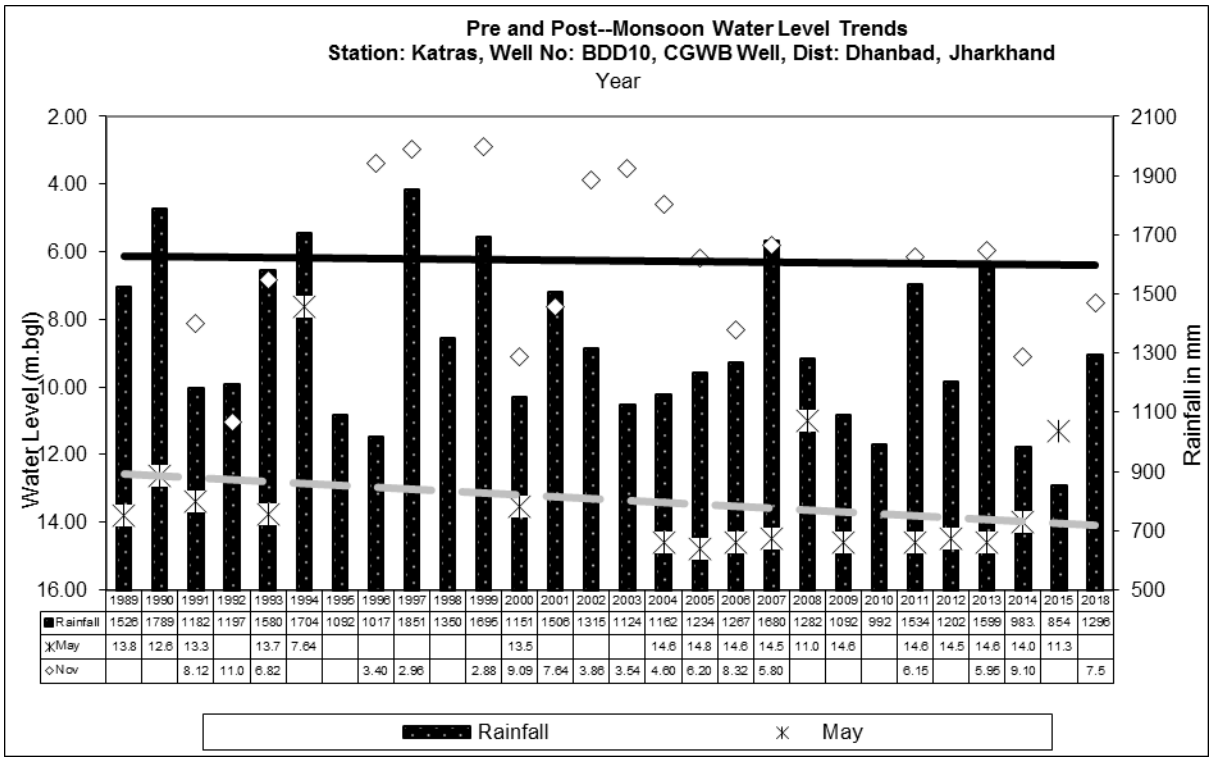
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2016	2017	2018
Rainfall	145	188	124	121	141	116	152	178	118	119	158	170	109	101	185	135	169	115	150	131	112	102	123	126	168	128	109	992	153	120	159	127	129	129
May	4.7	2.1		1.6	2.2	3.6		2.4	1.3	4.7	2.1	1.1	5.4	5.4	5.2	5.4	4.7	3.3	1.7	3.5	2.9	2.1			1.7	1.7	1.6	1.7	1.6		0.5	2.5	1.9	2.2
Nov		1.1	0.9	1.3	1.2	1.4	1.2	1.1	1.5	5.2	2.2		3.4	3.0	1.3	4.4	4.5	4.5	3.4	1.0	1.0	1.8	1.0	1.3	1.5	1.4	1.0	1.9	2.1	0.6	0.9	1	1.8	0.2



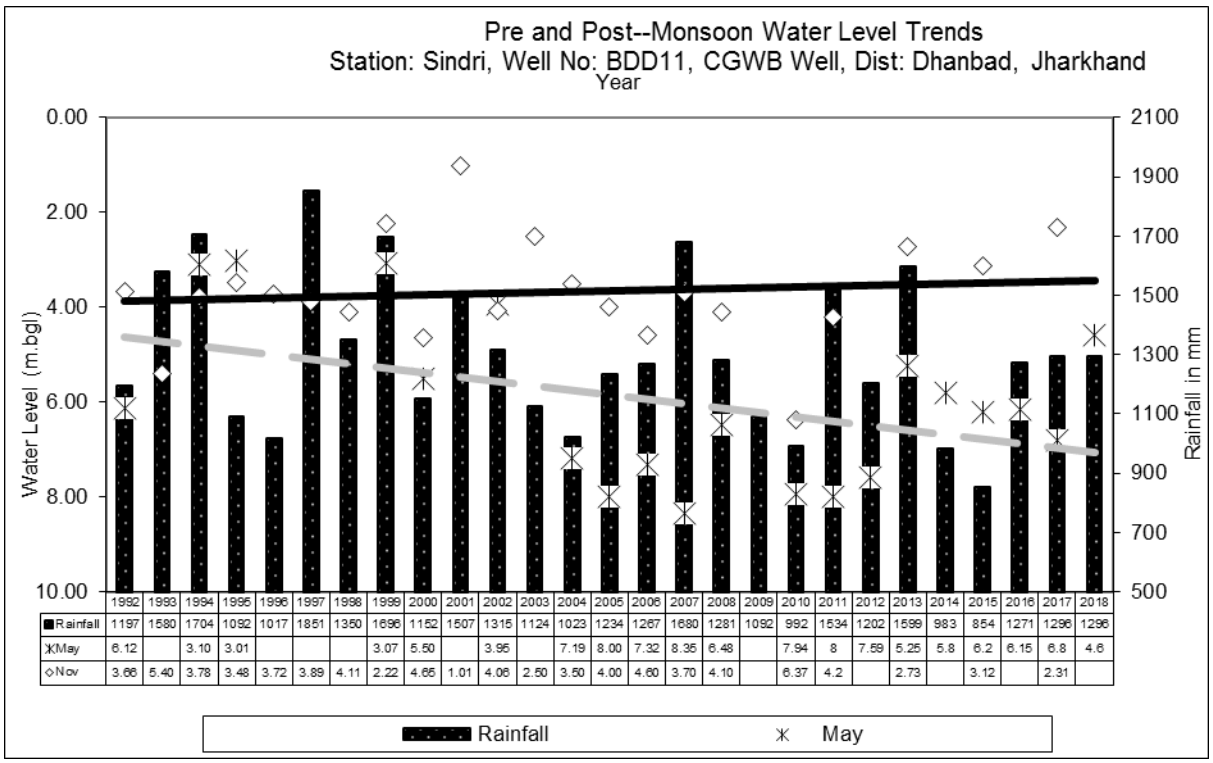
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1162	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	10.6	10.5	7.10	10.1	9.73	9.00	8.70	3.98	6.94	7.59	7.68	7.66	4.03	7.50	2.90	9.80		9.80	10.1	10.2	13.5	15.0	11.8	5.65	10.1	10.9	9.85	8.60	7.23
Nov		3.79	4.14	5.12	9.80	5.47	6.62	7.70	5.51	4.64	2.16	3.22	3.59	1.59	4.10	5.75	4.80	5.25	4.92	5.27	9.33	5.15	5.30	4.94	6.55	6.95	4.40	3.64	2.52

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	2014	2015	2018
Rainfall	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1506	1315	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983	854	1296
May	13.8	12.6	13.3		13.7	7.64						13.5				14.6	14.8	14.6	14.5	11.0	14.6		14.6	14.5	14.6	14.0	11.3	
Nov			8.12	11.0	6.82			3.40	2.96		2.88	9.09	7.64	3.86	3.54	4.60	6.20	8.32	5.80				6.15		5.95	9.10		7.5



	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1197	1580	1704	1092	1017	1851	1350	1696	1152	1507	1315	1124	1023	1234	1267	1680	1281	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	6.12		3.10	3.01				3.07	5.50		3.95		7.19	8.00	7.32	8.35	6.48		7.94	8	7.59	5.25	5.8	6.2	6.15	6.8	4.6
Nov	3.66	5.40	3.78	3.48	3.72	3.89	4.11	2.22	4.65	1.01	4.06	2.50	3.50	4.00	4.60	3.70	4.10		6.37	4.2		2.73		3.12		2.31	

Annexure – IV

GROUNDWATER SAMPLE LOCATION DETAILS

Sampling month: May month of the assessment year of 2019

Sl No	Name of Cluster	Ground Water Sample	Dug well (CMPDI)	Location	Sampling Date
					May'2019
1	CLUSTER-I	GW-1	B-15	BERA VILLAGE	28.05.2019
2	CLUSTER-II	GW-2	B-59	KHODOVALY VILLAGE	28.05.2019
3	CLUSTER-III	GW-3	A-29	GOVINDPUR,AMBAGAN VILLAGE	28.05.2019
4	CLUSTER-IV	GW-4	B-63	KESHALPUR, BATIGHAR	28.05.2019
5	CLUSTER-V	GW-5	D-30	BORKIBOA VILLAGE	28.05.2019
6	CLUSTER-VI	GW-6	D-25	GODHUR MORE	28.05.2019
7	CLUSTER-VII	GW-7	D-80	DHANSAR MINE RESCUE STN.	29.05.2019
8	CLUSTER-VIII	GW-8	D-49	NEAR GHANOODIH OC	29.05.2019
9	CLUSTER-IX	GW-9	D-5	JEALGORA, NEAR P.O.	29.05.2019
10	CLUSTER-X	GW-10	D-35	PATHERDIH RLY. COLONY	29.05.2019
11	CLUSTER-XI	GW-11	A-32	MONNIDIH BAZAR	29.05.2019
12	CLUSTER-XIII	GW-13	A-23	MACHHAYARA	28.05.2019
13	CLUSTER-XIV	GW-14	B-23	LOHAPATTI VILLAGE	28.05.2019
14	CLUSTER-XV	GW-15	B-32A	MADHUBAND VILLAGE	28.05.2019
15	CLUSTER-XVI	GW-16	DB-22	DAHIBARI,NICHE BASTI	28.05.2019

Annexure – V

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: May 2019

Sampling details is given in Annexure-IV.

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW 1 28.05.19	GW-2 28.05.19	GW-3 28.05.19			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3	2	4	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	40	64	76	1.6	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	24	28	18	2	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	0.03	<0.03	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.64	0.49	0.52	0.02	1.0	APHA, 23rd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 23rd Edition , DPD
8	Iron (as Fe), mg/l, Max	0.15	0.12	0.06	0.06	1.0	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 23rd Edition ,AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	9.62	15.33	12.82	0.5	45	APHA, 23rd Edition., UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.83	8.03	7.98	2.5	6.5 to 8.5	IS-3025/11:1983, R-1996, Electrometric
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.001	APHA, 23rd Edition.,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 56:2003, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	98	112	136	2.00	200	APHA, 23rd Edition.
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA, 23rd Edition. Taste
18	Total Alkalinity ($c_ac_{O_3}$),, mg/l, Max	102	94	116	4.00	200	IS-3025/23:1986, Titration
19	Total Arsenic (as As), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 37:1988 R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	462	536	642	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness ($c_ac_{O_3}$), mg/l, Max	210	360	420	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2	1	2	1.0	5.0	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	0.06	0.14	0.03	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025/ 54 : 2003, AAS-Flame

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW 4 28.05.19	GW-5 28.05.19	GW-6 28.05.19			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	2	2	1	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	72	56	84	1.6	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	32	22	28	2	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.44	0.48	0.69	0.02	1.0	APHA, 23rd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 23rd Edition , DPD
8	Iron (as Fe), mg/l, Max	0.09	0.06	0.12	0.06	1.0	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 23rd Edition ,AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	11.27	15.18	13.03	0.5	45	APHA, 23rd Edition., UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.07	7.99	7.64	2.5	6.5 to 8.5	IS-3025/11:1983, R-1996, Electrometric
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.001	APHA, 23rd Edition.,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 56:2003, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	108	82	90	2.00	200	APHA, 23rd Edition.
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA, 23rd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	104	96	72	4.00	200	IS-3025/23:1986, Titration
19	Total Arsenic (as As), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 37:1988 R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	428	366	796	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	330	290	400	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	4	3	1	1.0	5.0	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	0.06	0.27	0.05	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025/ 54 : 2003, AAS-Flame

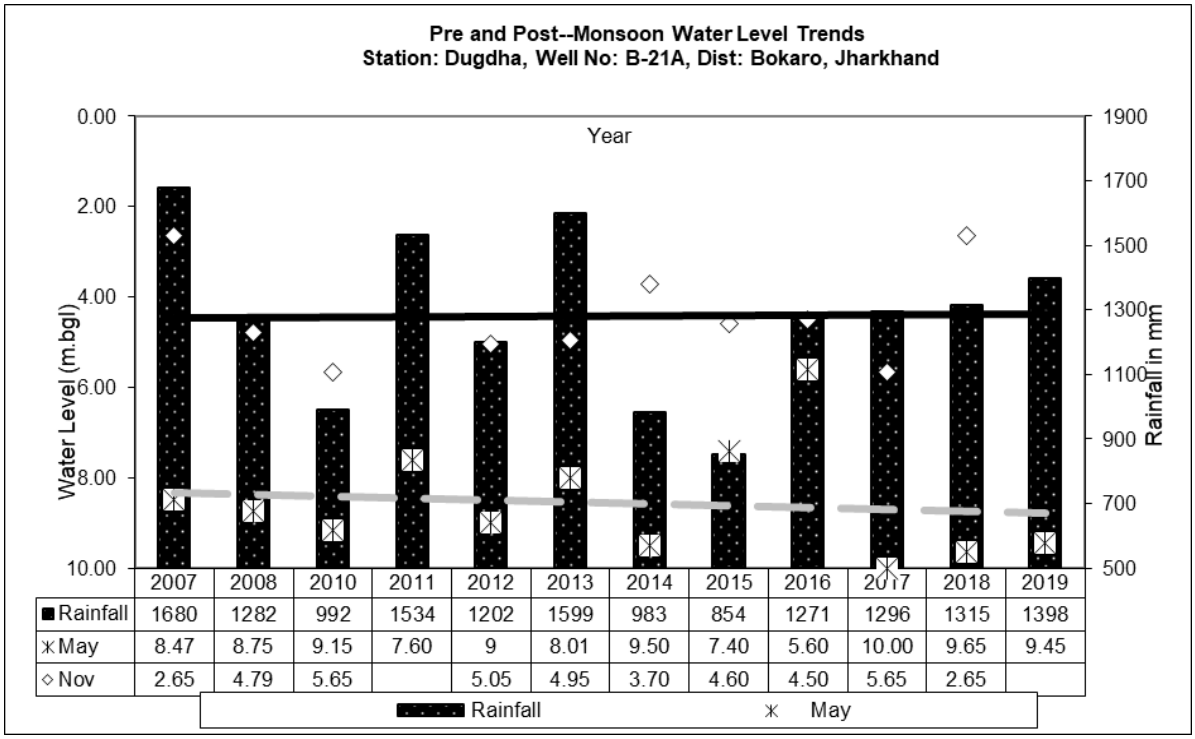
Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW 7 29.05.19	GW-8 29.05.19	GW-9 29.05.19			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3	2	2	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	32	68	80	1.6	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	34	36	24	2	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025/42 : 1992, R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.70	0.62	0.67	0.02	1.0	APHA, 23rd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 23rd Edition ,DPD
8	Iron (as Fe), mg/l, Max	0.24	0.08	0.06	0.06	1.0	IS 3025 /53 : 2003,R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 23rd Edition ,AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	IS-3025/59:2006,AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	16.22	15.64	11.20	0.5	45	APHA, 23rd Edition.,UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.14	7.81	8.01	2.5	6.5 to 8.5	IS-3025/11:1983, R-1996, Electrometric
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.001	APHA, 23rd Edition.,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 56:2003, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	126	106	114	2.00	200	APHA, 23rd Edition.
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA, 23rd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	124	86	112	4.00	200	IS-3025/23:1986,Titration
19	Total Arsenic (as As), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 37:1988R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	388	544	612	25.00	500	IS 3025 /16:1984, R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	190	320	410	4.00	200	IS-3025/21:1983,R-2002, EDTA
23	Turbidity, NTU, Max	4	2	3	1.0	5.0	IS-3025/10:1984 R-1996,Nephelometric
24	Zinc (as Zn), mg/l, Max	0.04	0.02	0.08	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025/ 54 : 2003, AAS-Flame

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW 10 29.05.19	GW-11 29.05.19	GW-13 28.05.19			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3	2	2	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	76	48	52	1.6	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	26	20	16	2	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.55	0.68	0.78	0.02	1.0	APHA, 23rd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 23rd Edition , DPD
8	Iron (as Fe), mg/l, Max	0.18	0.06	0.09	0.06	1.0	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 23rd Edition ,AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	14.62	13.11	10.37	0.5	45	APHA, 23rd Edition., UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.10	7.85	7.77	2.5	6.5 to 8.5	IS-3025/11:1983, R-1996, Electrometric
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.001	APHA, 23rd Edition.,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 56:2003, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	82	104	132	2.00	200	APHA, 23rd Edition.
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA, 23rd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	106	66	94	4.00	200	IS-3025/23:1986, Titration
19	Total Arsenic (as As), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 37:1988 R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	604	484	462	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	370	230	270	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	1	1	1	1.0	5.0	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	0.14	0.02	0.08	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025/ 54 : 2003, AAS-Flame

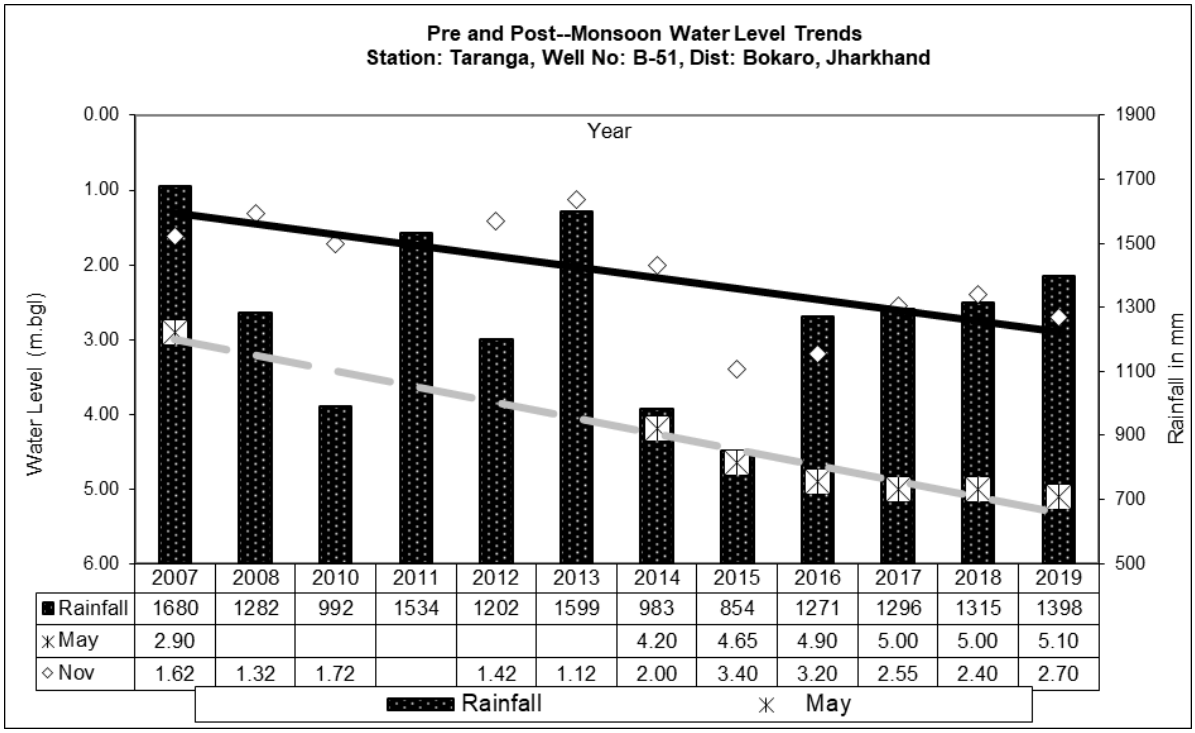
Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW 14 28.05.19	GW-15 28.05.19	GW-16 28.05.19			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1	2	1	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	60	44	28	1.6	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	42	30	18	2	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.53	0.46	0.51	0.02	1.0	APHA, 23rd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 23rd Edition , DPD
8	Iron (as Fe), mg/l, Max	0.12	0.06	0.15	0.06	1.0	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 23rd Edition ,AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	12.32	14.10	10.97	0.5	45	APHA, 23rd Edition., UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.07	7.82	8.04	2.5	6.5 to 8.5	IS-3025/11:1983, R-1996, Electrometric
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.001	APHA, 23rd Edition.,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 56:2003, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	68	118	122	2.00	200	APHA, 23rd Edition.
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA, 23rd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	100	92	76	4.00	200	IS-3025/23:1986, Titration
19	Total Arsenic (as As), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 37:1988 R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	538	468	398	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	340	280	170	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2	2	1	1.0	5.0	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	0.06	0.18	0.03	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025/ 54 : 2003, AAS-Flame - Flame

Annexure – VI

HYDROGRAPHS OF CLUSTER-I



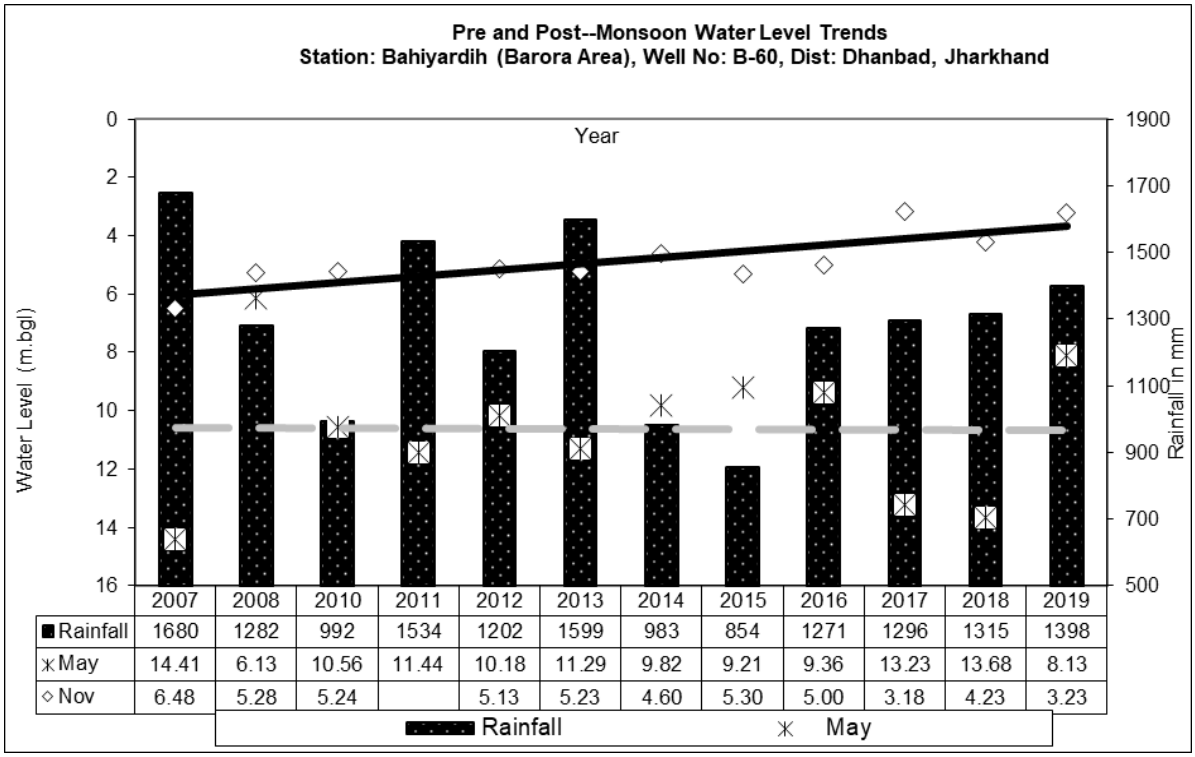
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	8.47	8.75	9.15	7.60	9	8.01	9.50	7.40	5.60	10.00	9.65	9.45
Nov	2.65	4.79	5.65		5.05	4.95	3.70	4.60	4.50	5.65	2.65	



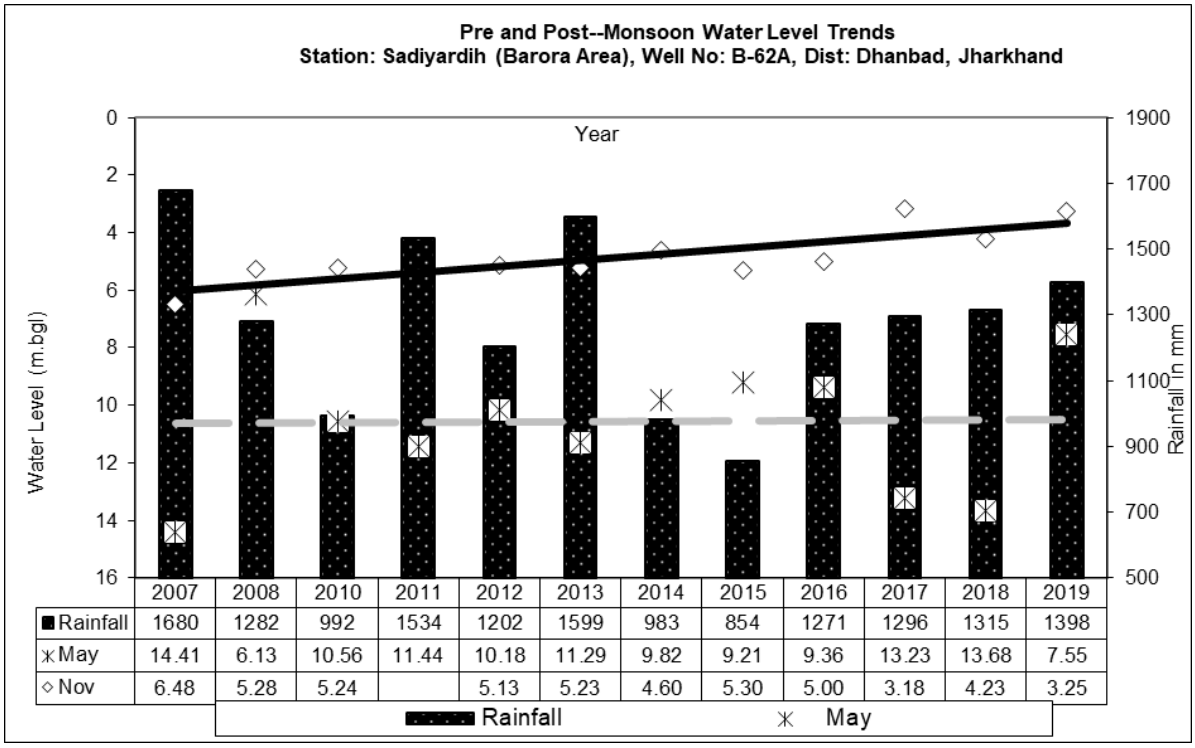
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	2.90						4.20	4.65	4.90	5.00	5.00	5.10
Nov	1.62	1.32	1.72		1.42	1.12	2.00	3.40	3.20	2.55	2.40	2.70

Annexure – VI

HYDROGRAPHS OF CLUSTER-II



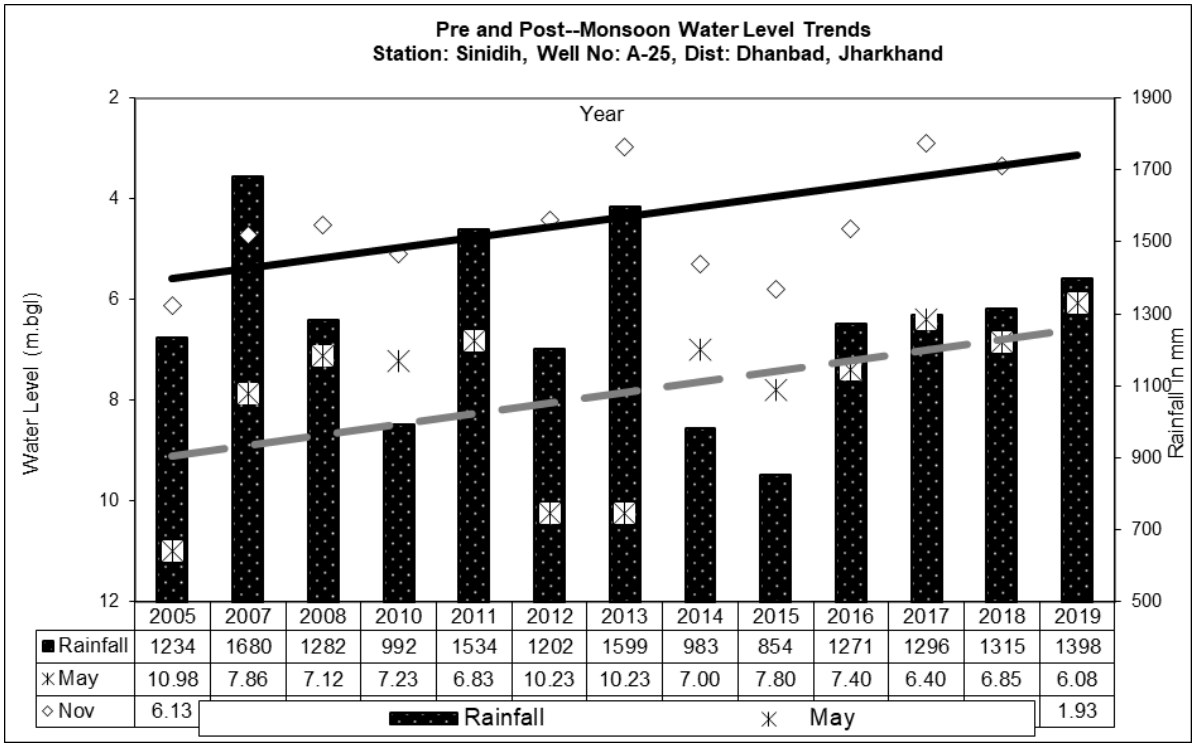
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	14.41	6.13	10.56	11.44	10.18	11.29	9.82	9.21	9.36	13.23	13.68	8.13
Nov	6.48	5.28	5.24		5.13	5.23	4.60	5.30	5.00	3.18	4.23	3.23



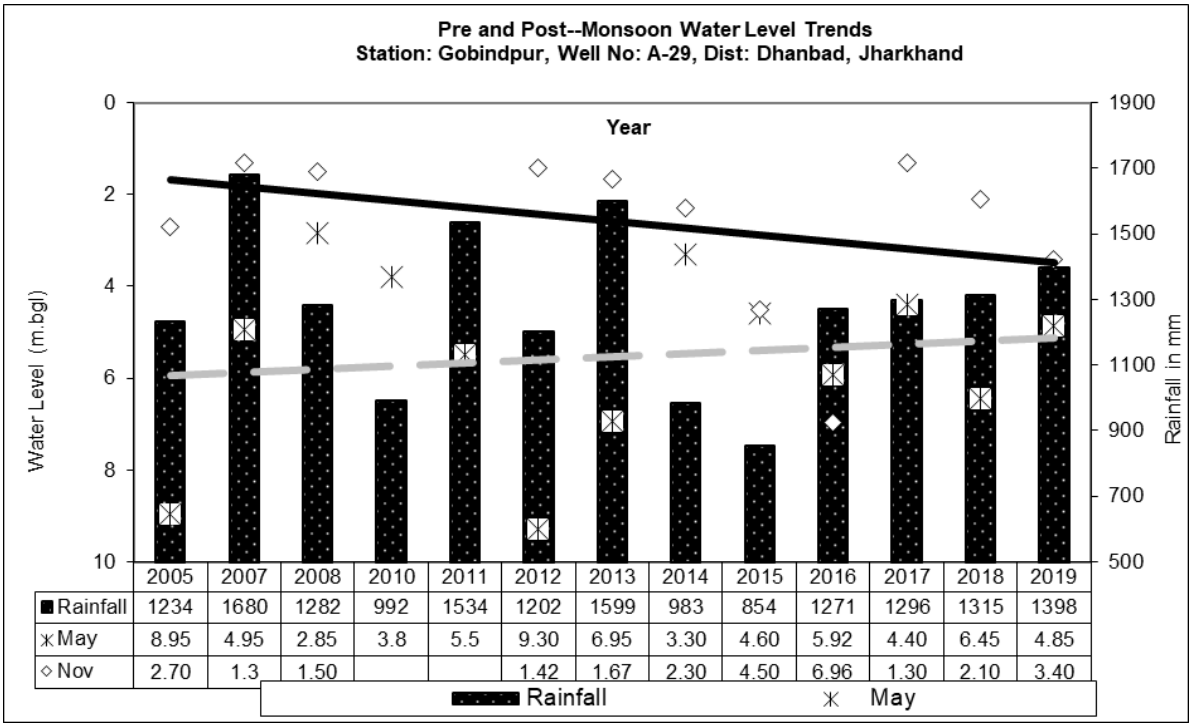
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	14.41	6.13	10.56	11.44	10.18	11.29	9.82	9.21	9.36	13.23	13.68	7.55
Nov	6.48	5.28	5.24		5.13	5.23	4.60	5.30	5.00	3.18	4.23	3.25

Annexure – VI

HYDROGRAPHS OF CLUSTER-III



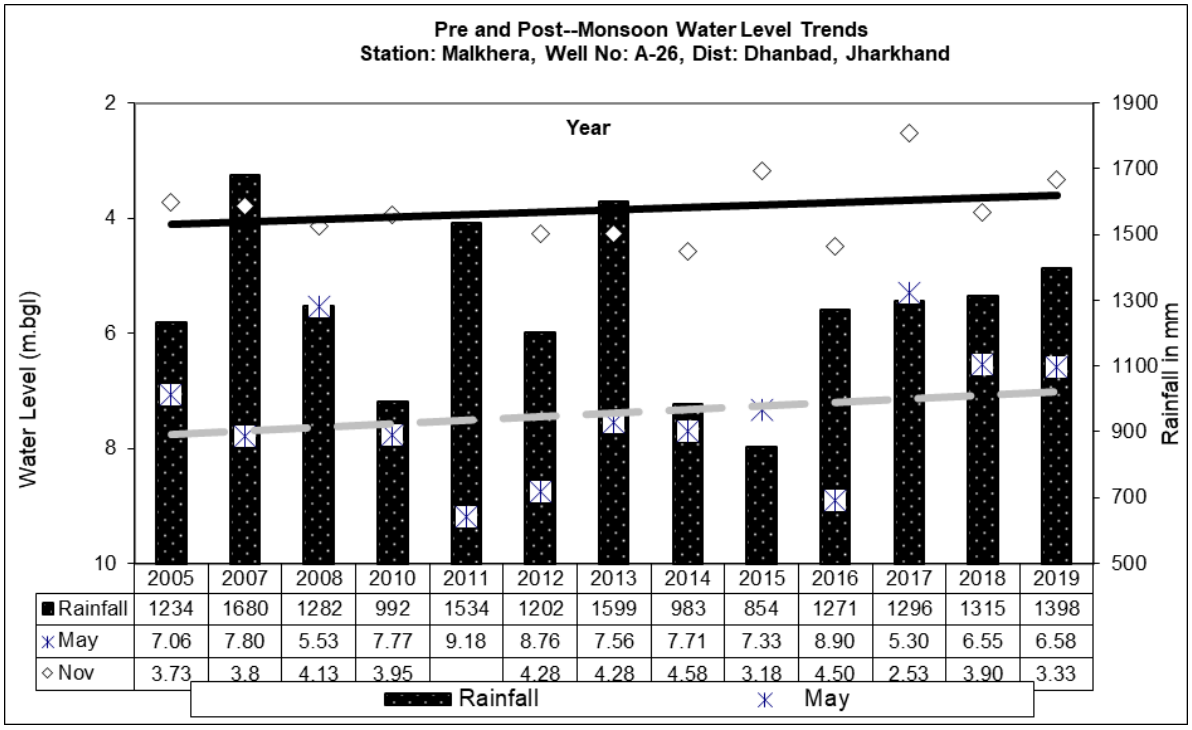
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	10.98	7.86	7.12	7.23	6.83	10.23	10.23	7.00	7.80	7.40	6.40	6.85	6.08
Nov	6.13												1.93



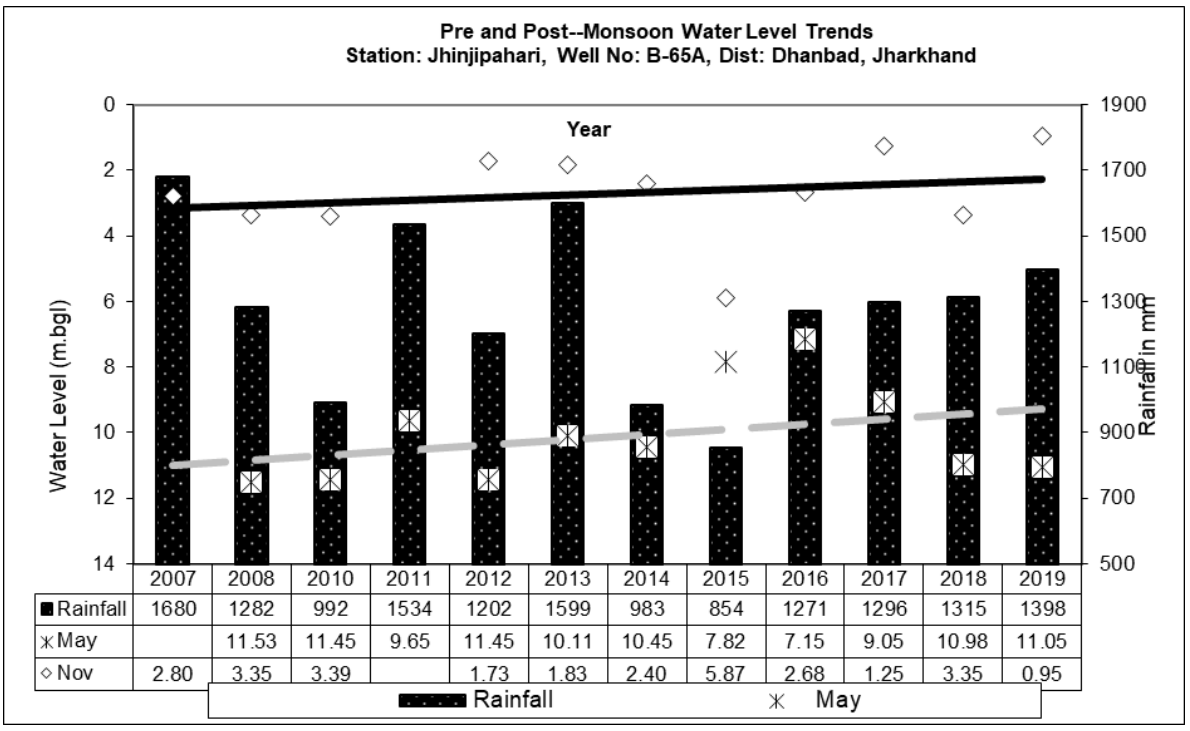
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	8.95	4.95	2.85	3.8	5.5	9.30	6.95	3.30	4.60	5.92	4.40	6.45	4.85
Nov	2.70	1.3	1.50			1.42	1.67	2.30	4.50	6.96	1.30	2.10	3.40

Annexure – VI

HYDROGRAPHS OF CLUSTER-IV



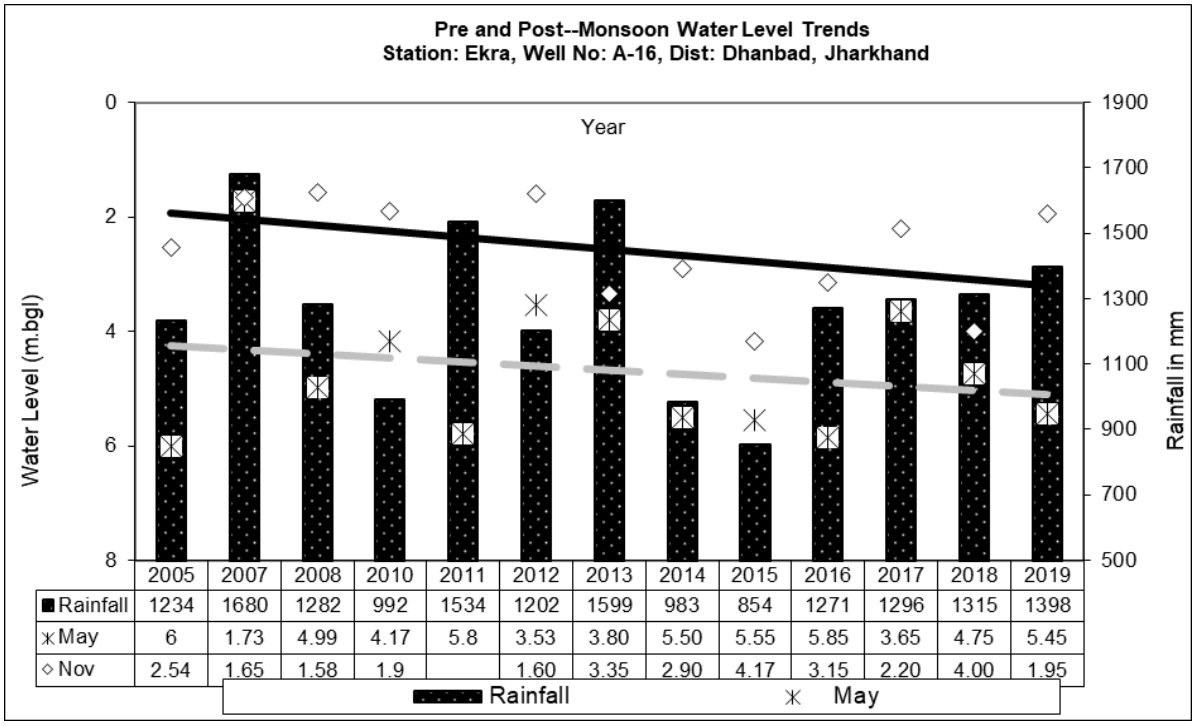
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	7.06	7.80	5.53	7.77	9.18	8.76	7.56	7.71	7.33	8.90	5.30	6.55	6.58
Nov	3.73	3.8	4.13	3.95		4.28	4.28	4.58	3.18	4.50	2.53	3.90	3.33



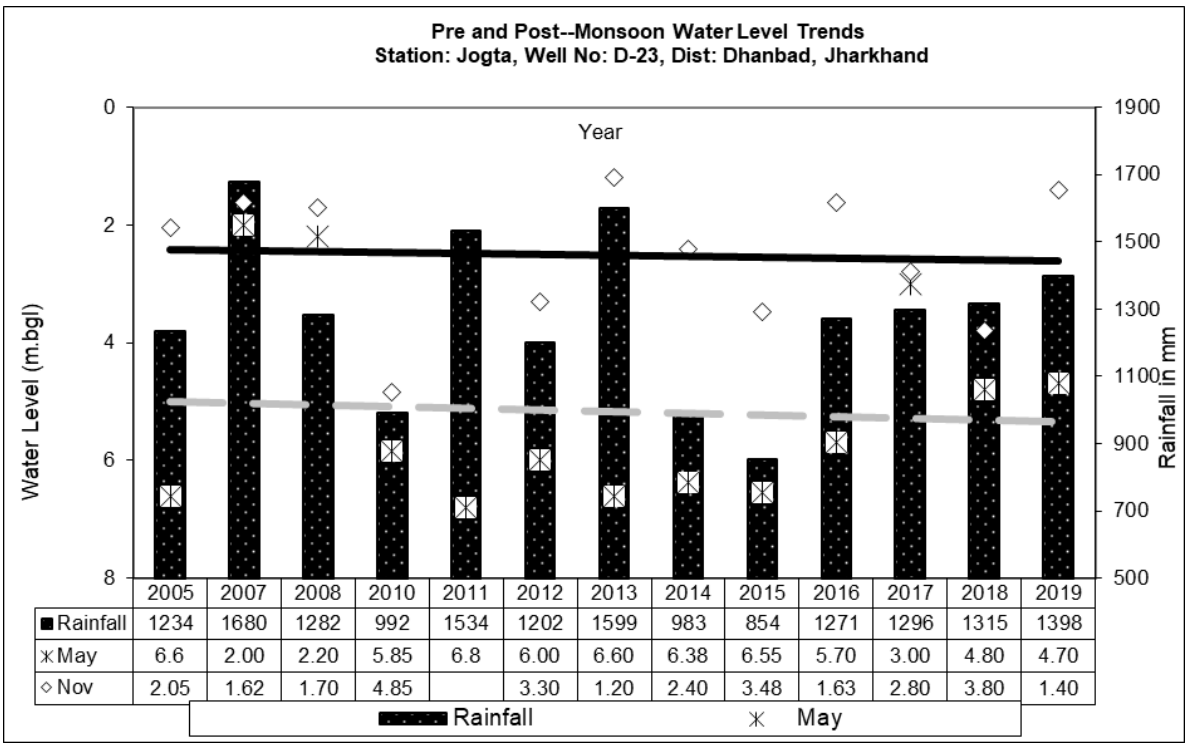
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May		11.53	11.45	9.65	11.45	10.11	10.45	7.82	7.15	9.05	10.98	11.05
Nov	2.80	3.35	3.39		1.73	1.83	2.40	5.87	2.68	1.25	3.35	0.95

Annexure – VI

HYDROGRAPHS OF CLUSTER-V



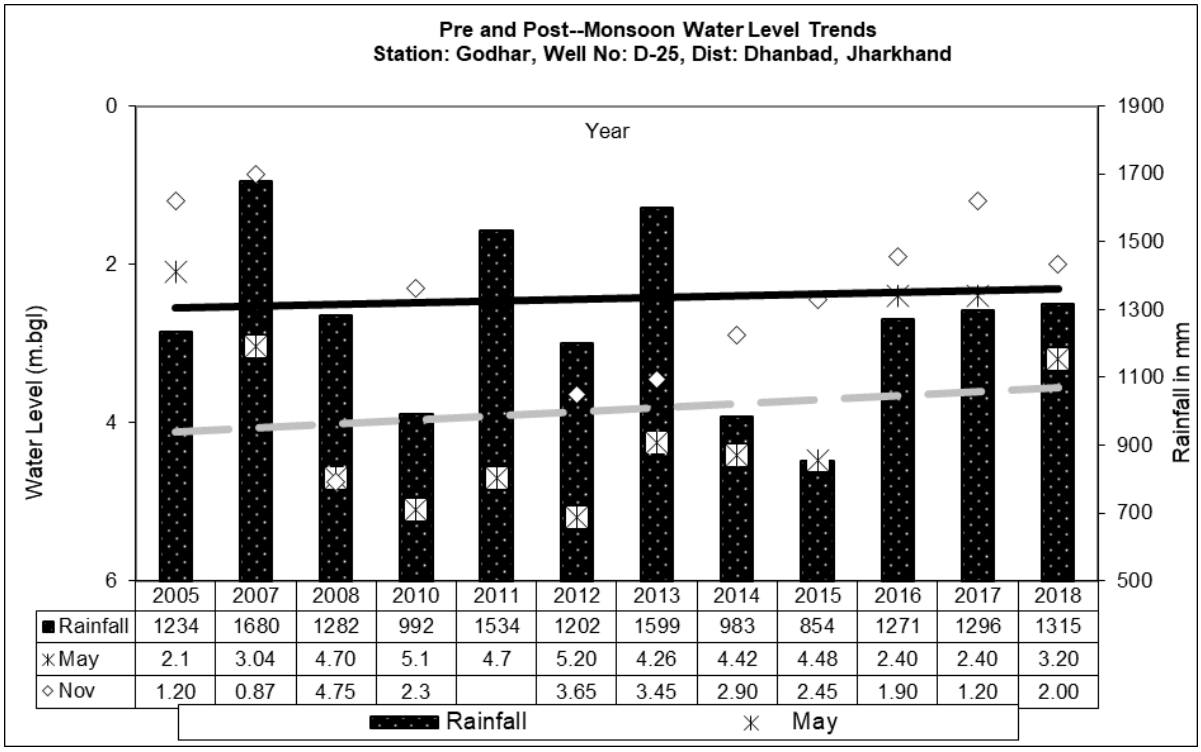
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	6	1.73	4.99	4.17	5.8	3.53	3.80	5.50	5.55	5.85	3.65	4.75	5.45
Nov	2.54	1.65	1.58	1.9		1.60	3.35	2.90	4.17	3.15	2.20	4.00	1.95



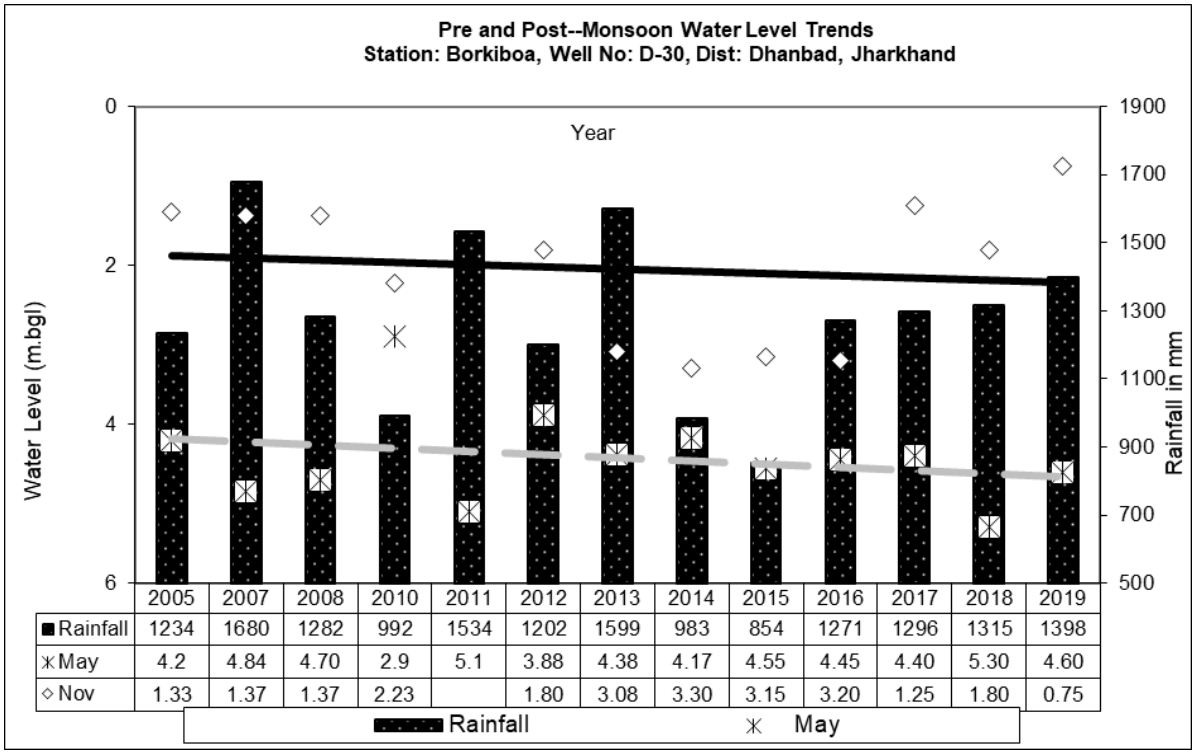
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	6.6	2.00	2.20	5.85	6.8	6.00	6.60	6.38	6.55	5.70	3.00	4.80	4.70
Nov	2.05	1.62	1.70	4.85		3.30	1.20	2.40	3.48	1.63	2.80	3.80	1.40

Annexure – VI

HYDROGRAPHS OF CLUSTER-VI



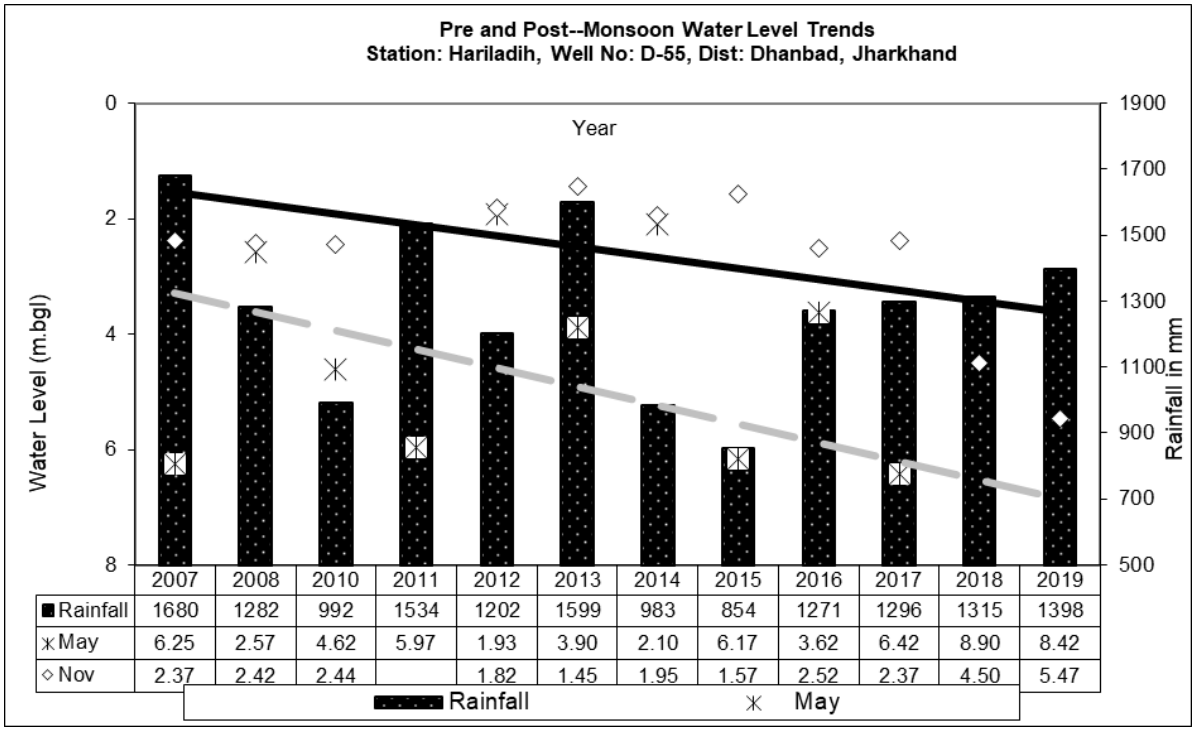
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315
May	2.1	3.04	4.70	5.1	4.7	5.20	4.26	4.42	4.48	2.40	2.40	3.20
Nov	1.20	0.87	4.75	2.3		3.65	3.45	2.90	2.45	1.90	1.20	2.00



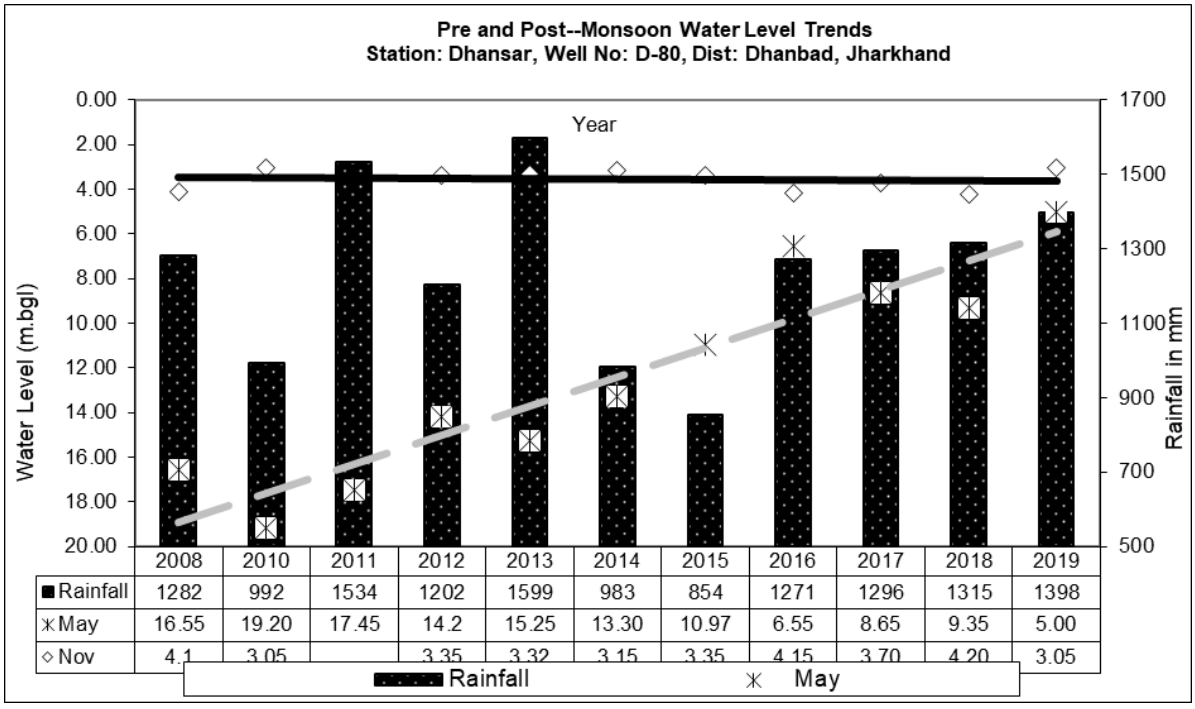
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	4.2	4.84	4.70	2.9	5.1	3.88	4.38	4.17	4.55	4.45	4.40	5.30	4.60
Nov	1.33	1.37	1.37	2.23		1.80	3.08	3.30	3.15	3.20	1.25	1.80	0.75

Annexure – VI

HYDROGRAPHS OF CLUSTER-VII



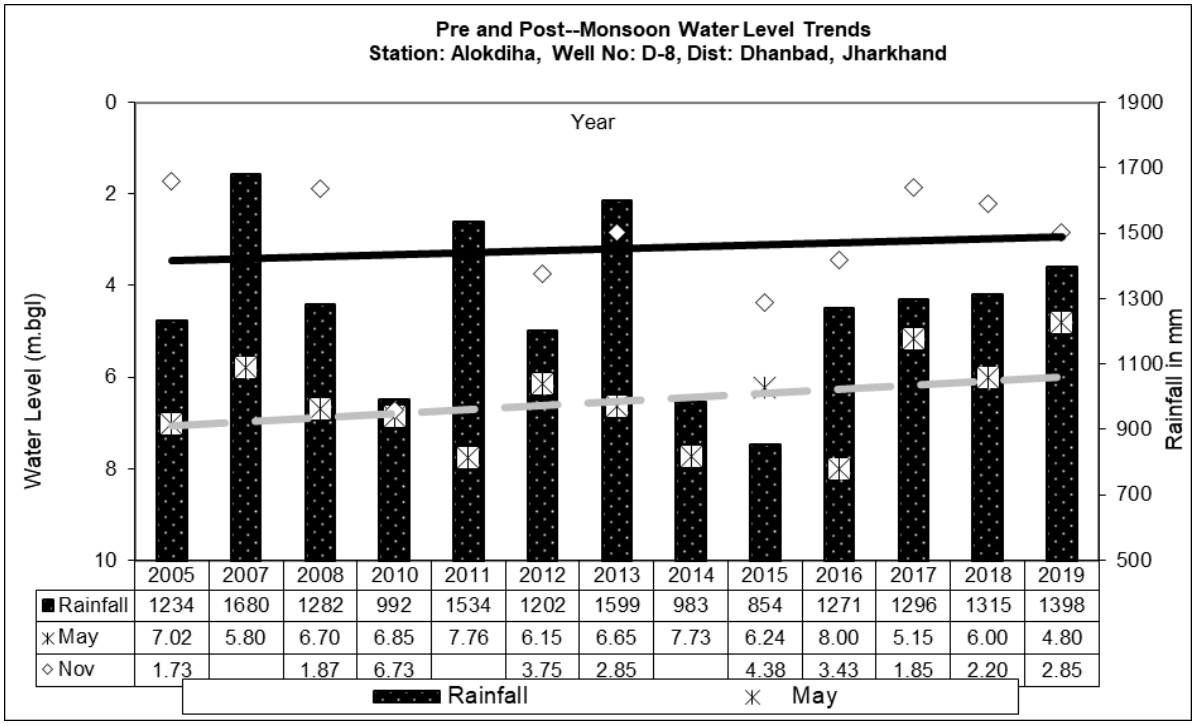
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	6.25	2.57	4.62	5.97	1.93	3.90	2.10	6.17	3.62	6.42	8.90	8.42
Nov	2.37	2.42	2.44		1.82	1.45	1.95	1.57	2.52	2.37	4.50	5.47



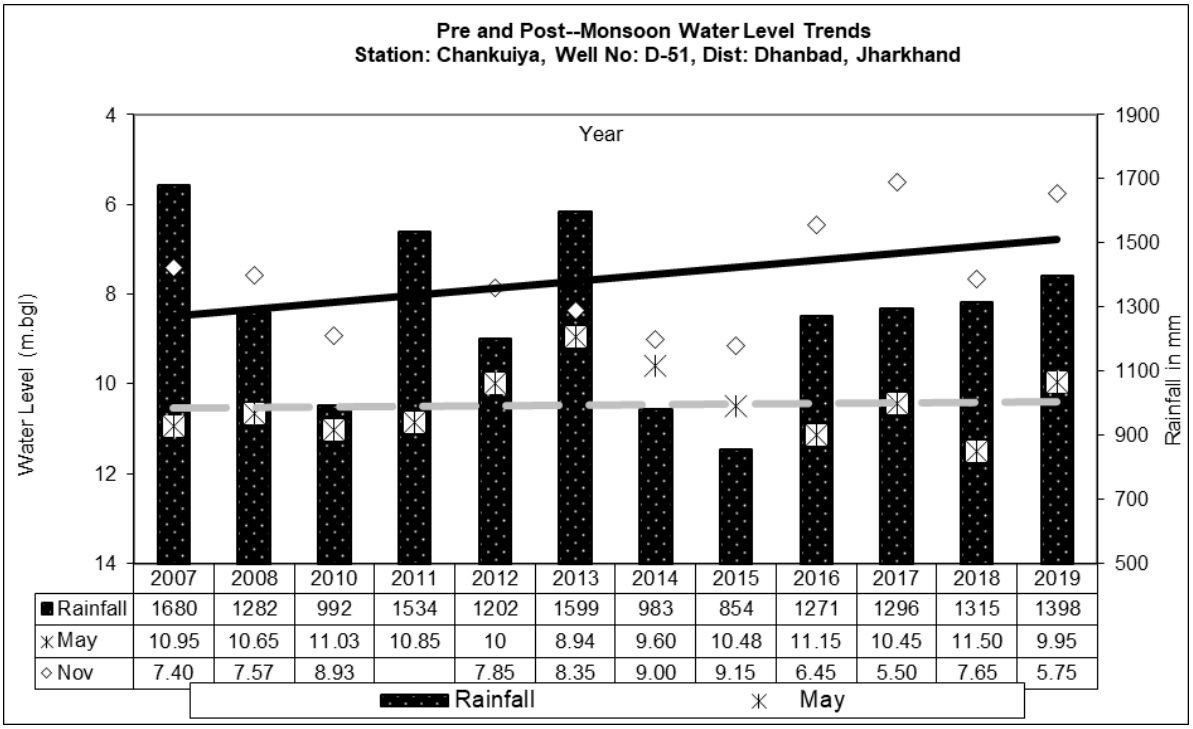
	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	16.55	19.20	17.45	14.2	15.25	13.30	10.97	6.55	8.65	9.35	5.00
Nov	4.1	3.05		3.35	3.32	3.15	3.35	4.15	3.70	4.20	3.05

Annexure – VI

HYDROGRAPHS OF CLUSTER-VIII



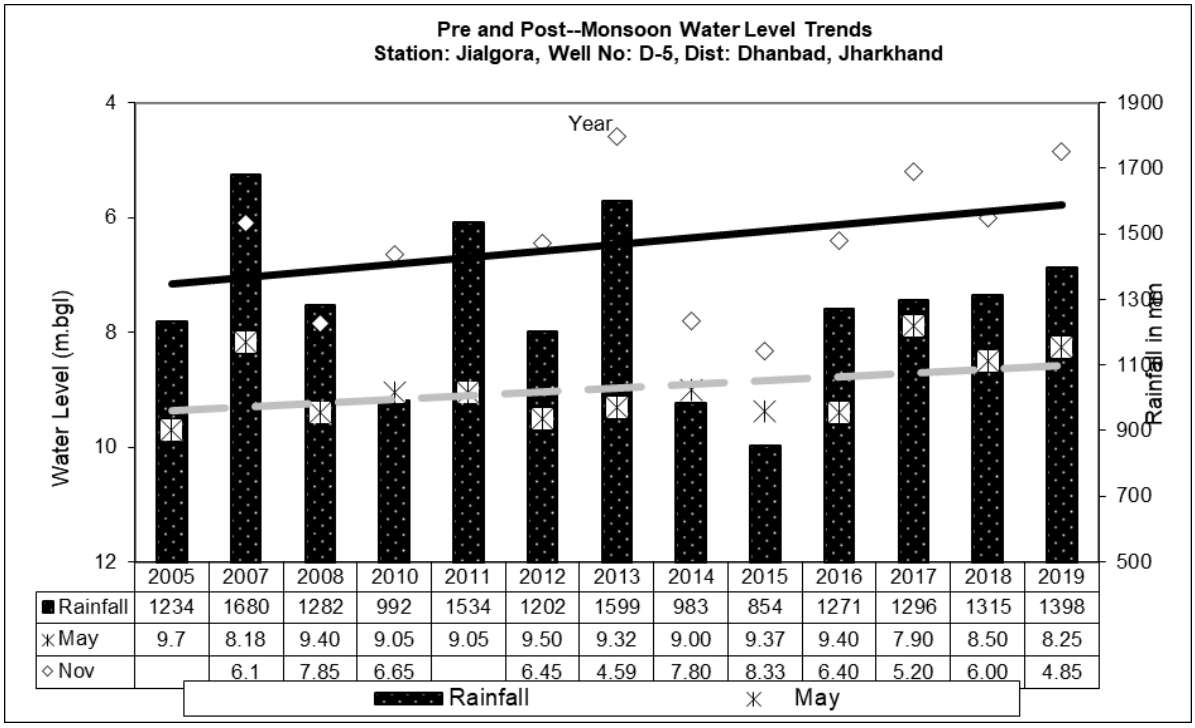
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	7.02	5.80	6.70	6.85	7.76	6.15	6.65	7.73	6.24	8.00	5.15	6.00	4.80
Nov	1.73		1.87	6.73		3.75	2.85		4.38	3.43	1.85	2.20	2.85



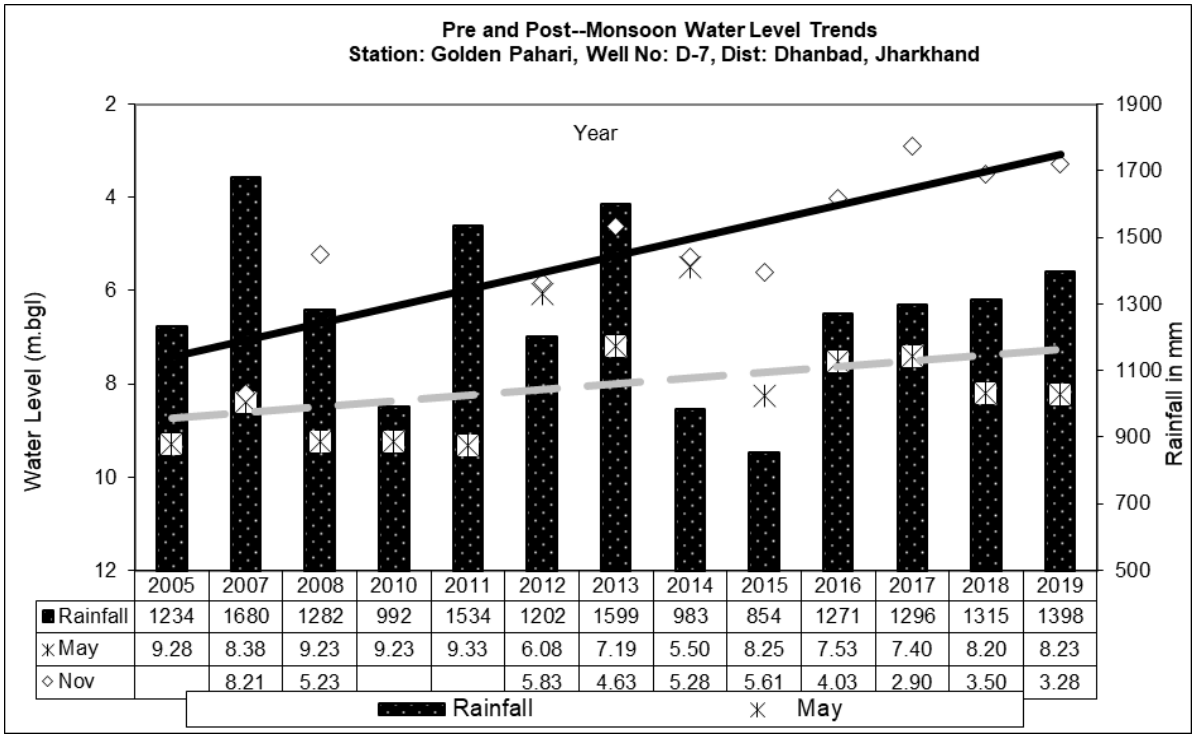
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	10.95	10.65	11.03	10.85	10	8.94	9.60	10.48	11.15	10.45	11.50	9.95
Nov	7.40	7.57	8.93		7.85	8.35	9.00	9.15	6.45	5.50	7.65	5.75

Annexure – VI

HYDROGRAPHS OF CLUSTER-IX



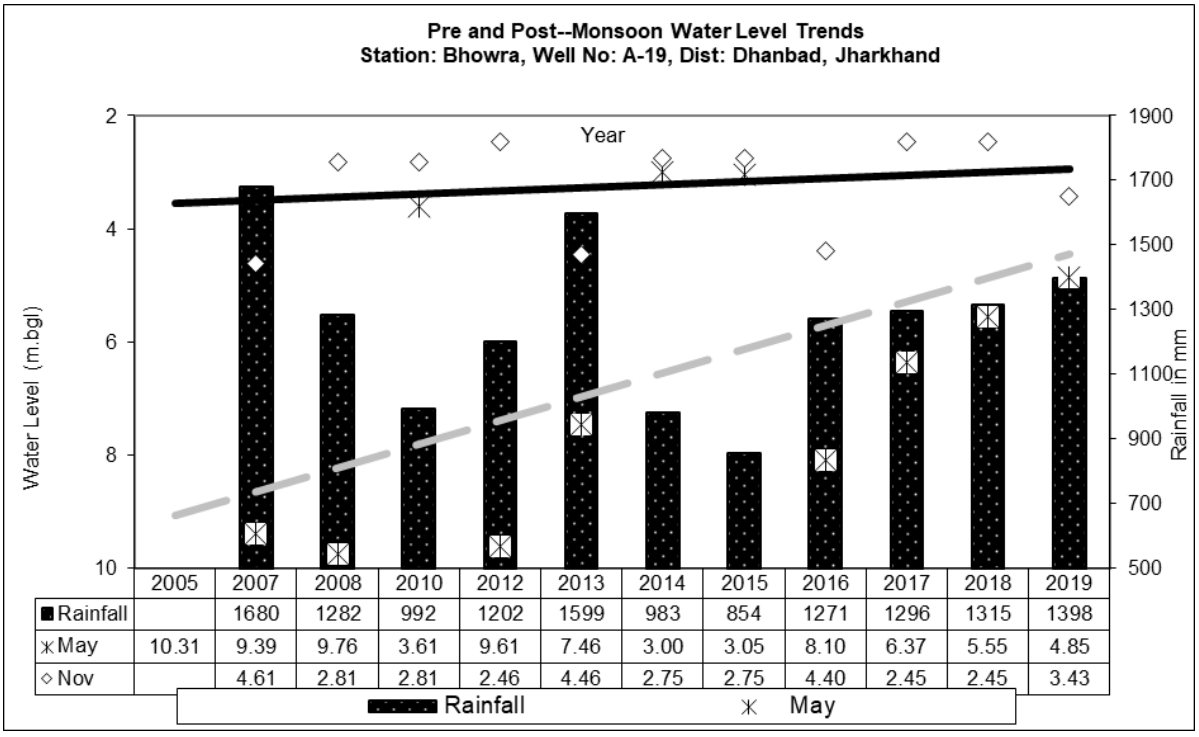
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	9.7	8.18	9.40	9.05	9.05	9.50	9.32	9.00	9.37	9.40	7.90	8.50	8.25
Nov		6.1	7.85	6.65		6.45	4.59	7.80	8.33	6.40	5.20	6.00	4.85



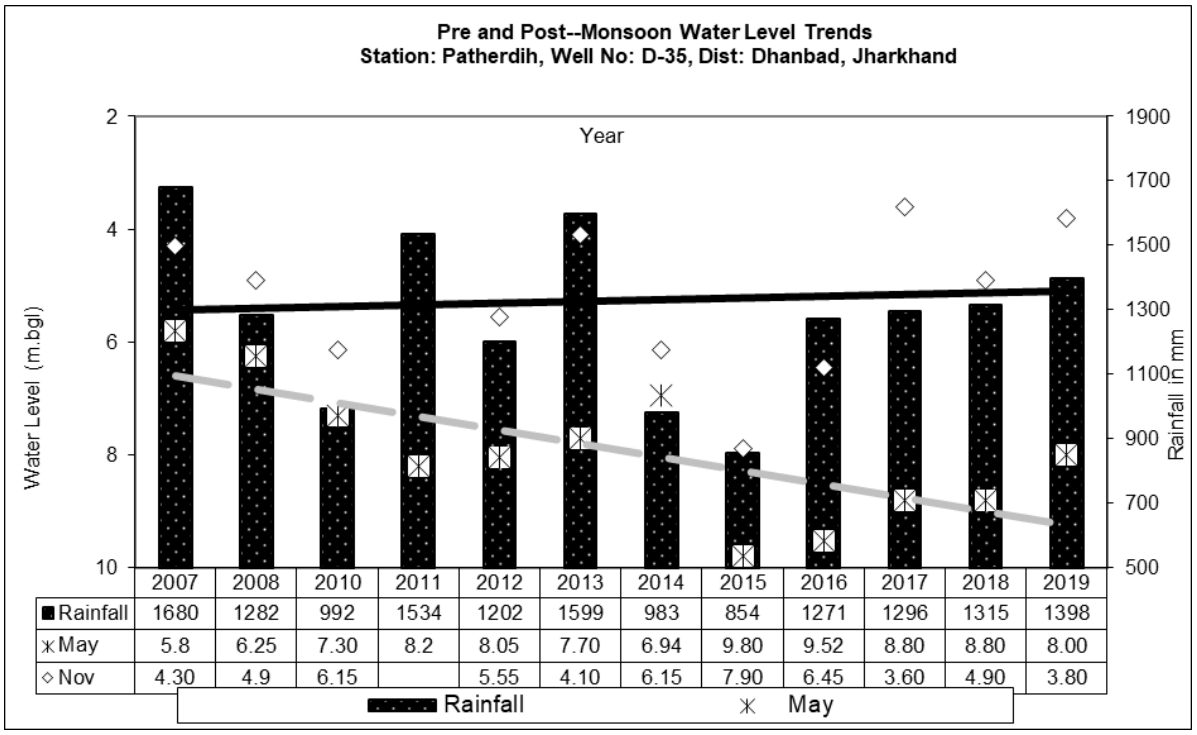
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	9.28	8.38	9.23	9.23	9.33	6.08	7.19	5.50	8.25	7.53	7.40	8.20	8.23
Nov		8.21	5.23			5.83	4.63	5.28	5.61	4.03	2.90	3.50	3.28

Annexure – VI

HYDROGRAPHS OF CLUSTER-X



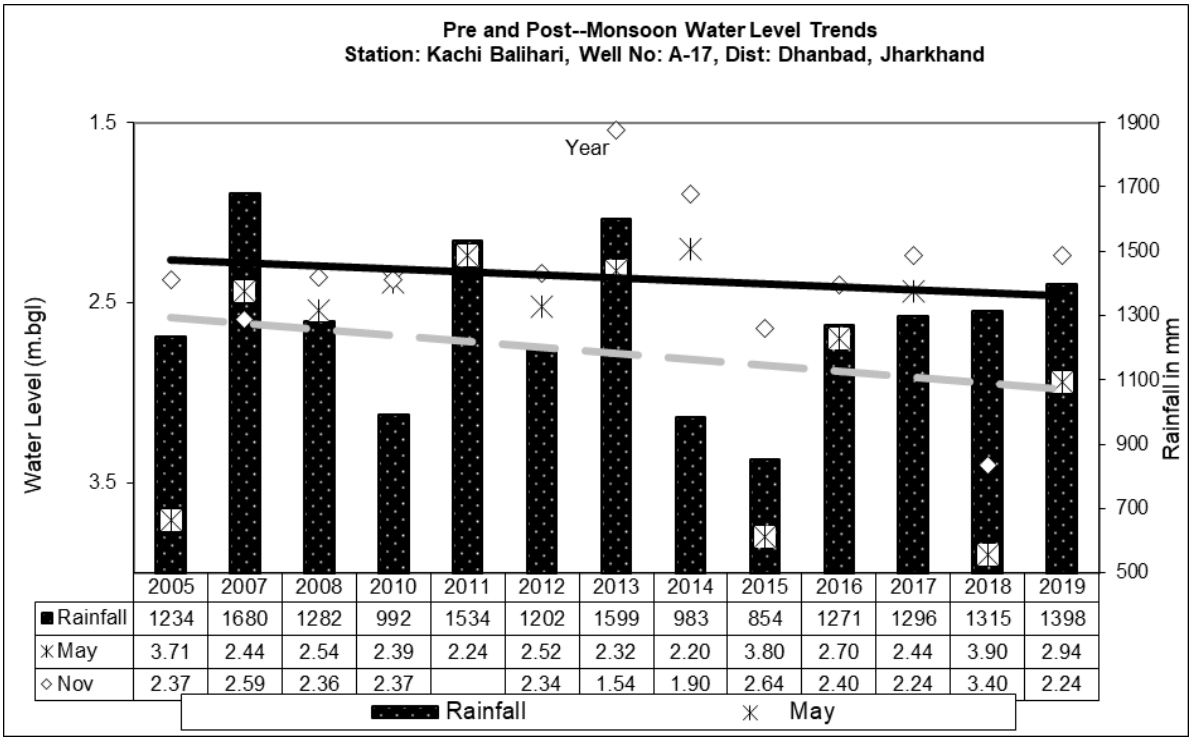
	2005	2007	2008	2010	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall		1680	1282	992	1202	1599	983	854	1271	1296	1315	1398
May	10.31	9.39	9.76	3.61	9.61	7.46	3.00	3.05	8.10	6.37	5.55	4.85
Nov		4.61	2.81	2.81	2.46	4.46	2.75	2.75	4.40	2.45	2.45	3.43



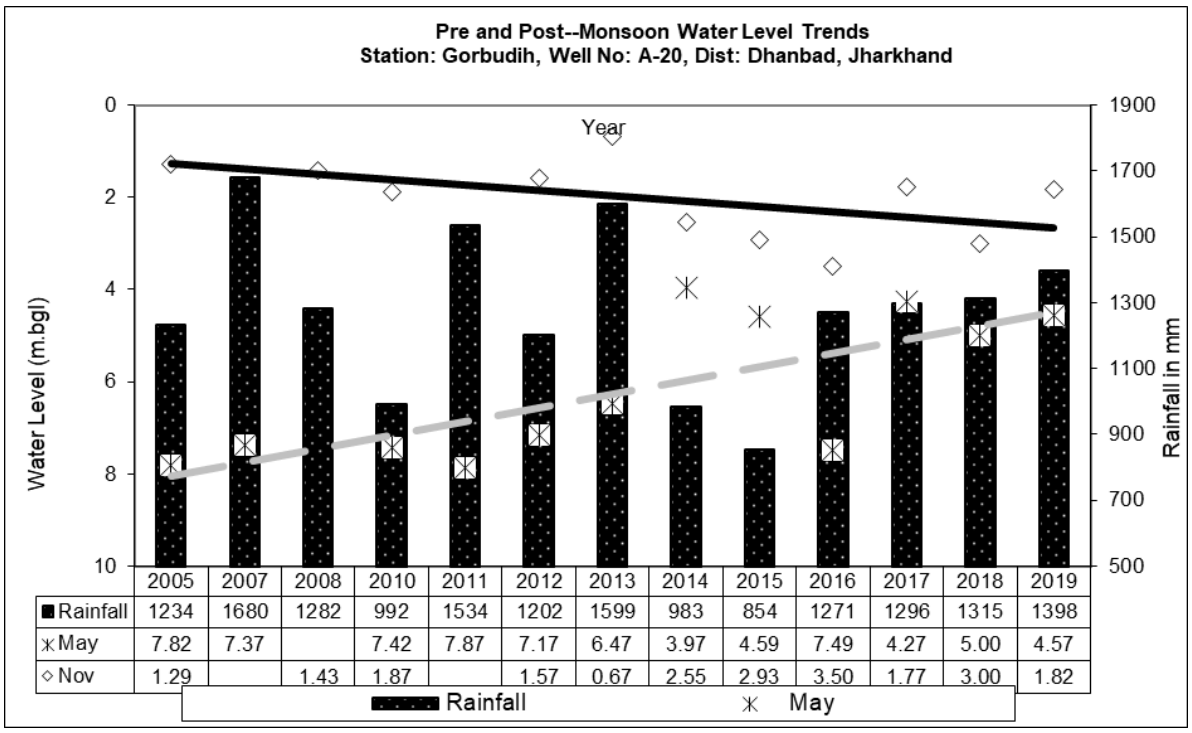
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	5.8	6.25	7.30	8.2	8.05	7.70	6.94	9.80	9.52	8.80	8.80	8.00
Nov	4.30	4.9	6.15		5.55	4.10	6.15	7.90	6.45	3.60	4.90	3.80

Annexure – VI

HYDROGRAPHS OF CLUSTER-XI



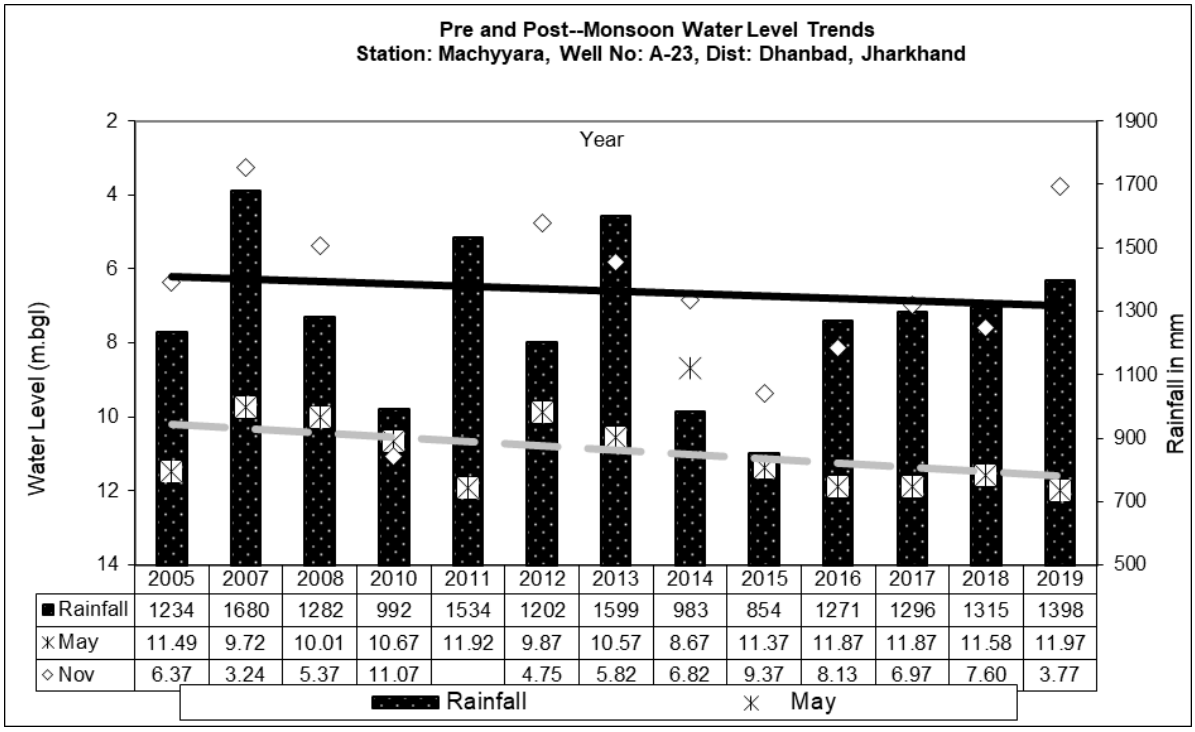
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	3.71	2.44	2.54	2.39	2.24	2.52	2.32	2.20	3.80	2.70	2.44	3.90	2.94
Nov	2.37	2.59	2.36	2.37		2.34	1.54	1.90	2.64	2.40	2.24	3.40	2.24



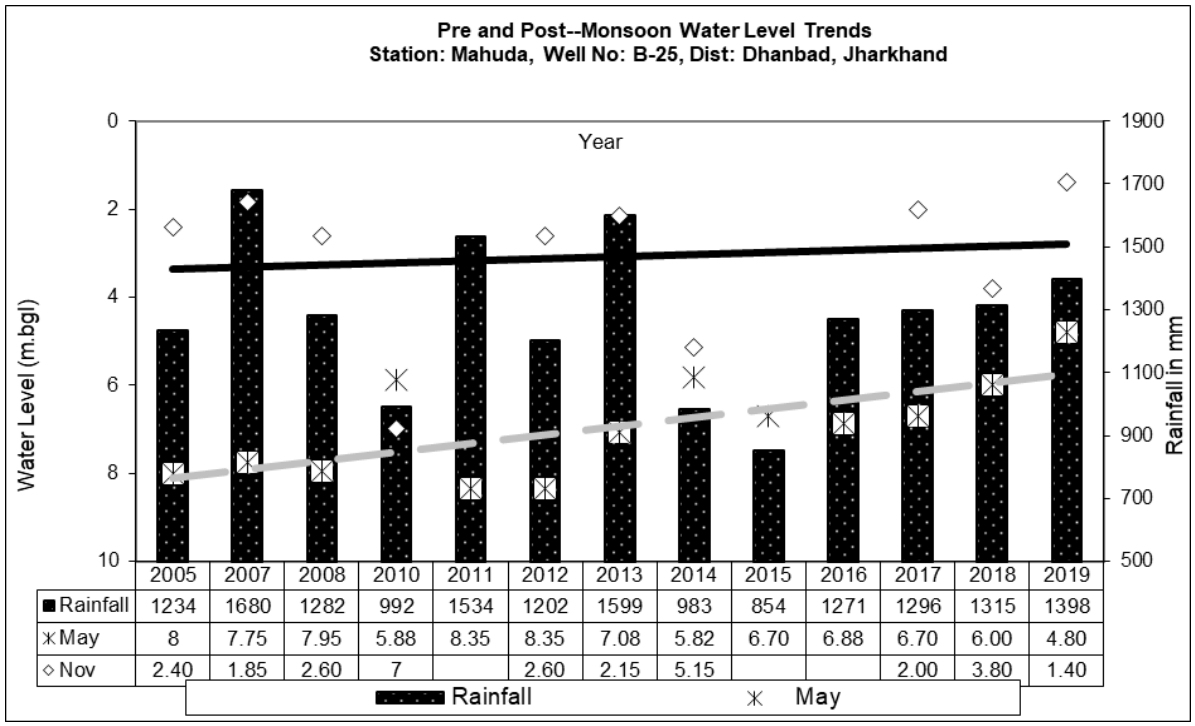
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	7.82	7.37		7.42	7.87	7.17	6.47	3.97	4.59	7.49	4.27	5.00	4.57
Nov	1.29		1.43	1.87		1.57	0.67	2.55	2.93	3.50	1.77	3.00	1.82

Annexure – VI

HYDROGRAPHS OF CLUSTER-XIII



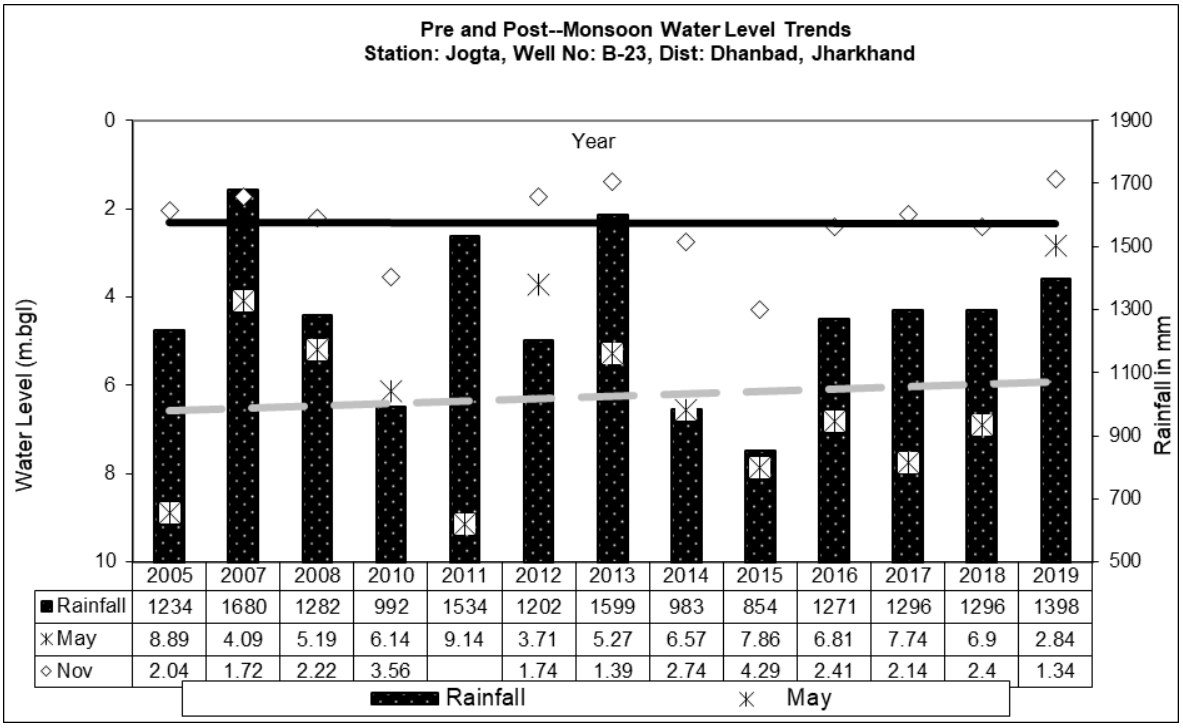
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	11.49	9.72	10.01	10.67	11.92	9.87	10.57	8.67	11.37	11.87	11.87	11.58	11.97
Nov	6.37	3.24	5.37	11.07		4.75	5.82	6.82	9.37	8.13	6.97	7.60	3.77



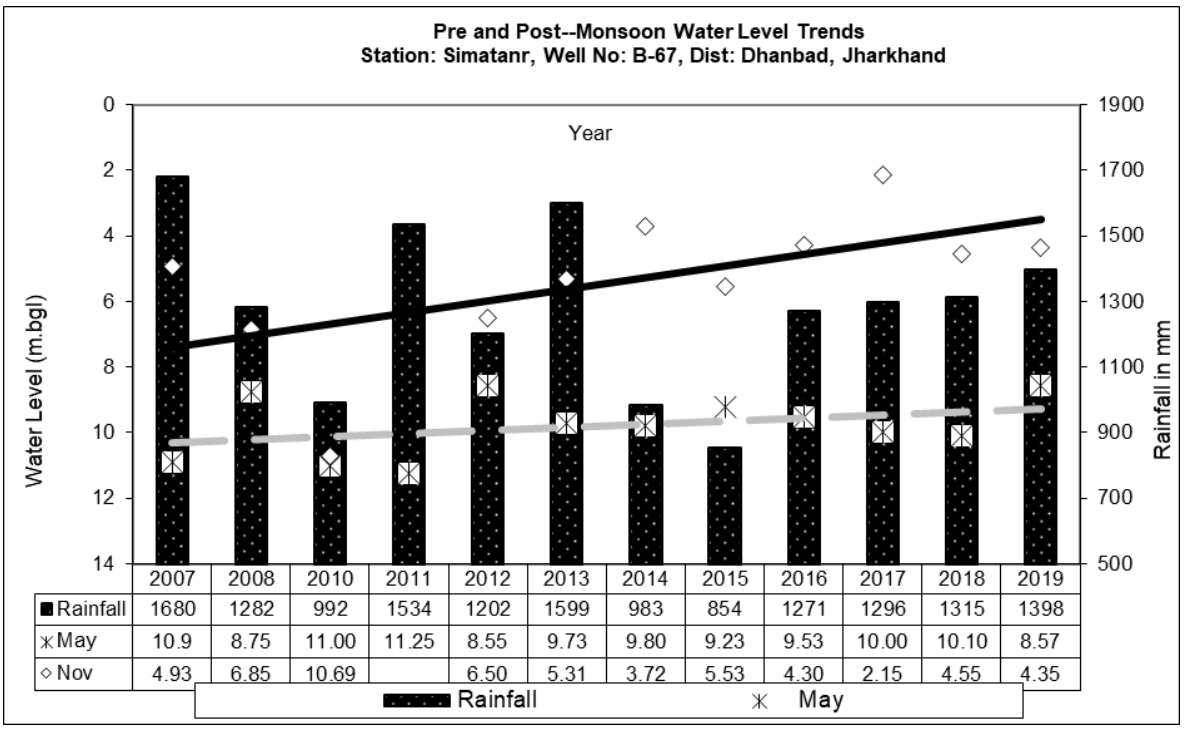
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	8	7.75	7.95	5.88	8.35	8.35	7.08	5.82	6.70	6.88	6.70	6.00	4.80
Nov	2.40	1.85	2.60	7		2.60	2.15	5.15			2.00	3.80	1.40

Annexure – VI

HYDROGRAPHS OF CLUSTER-XIV



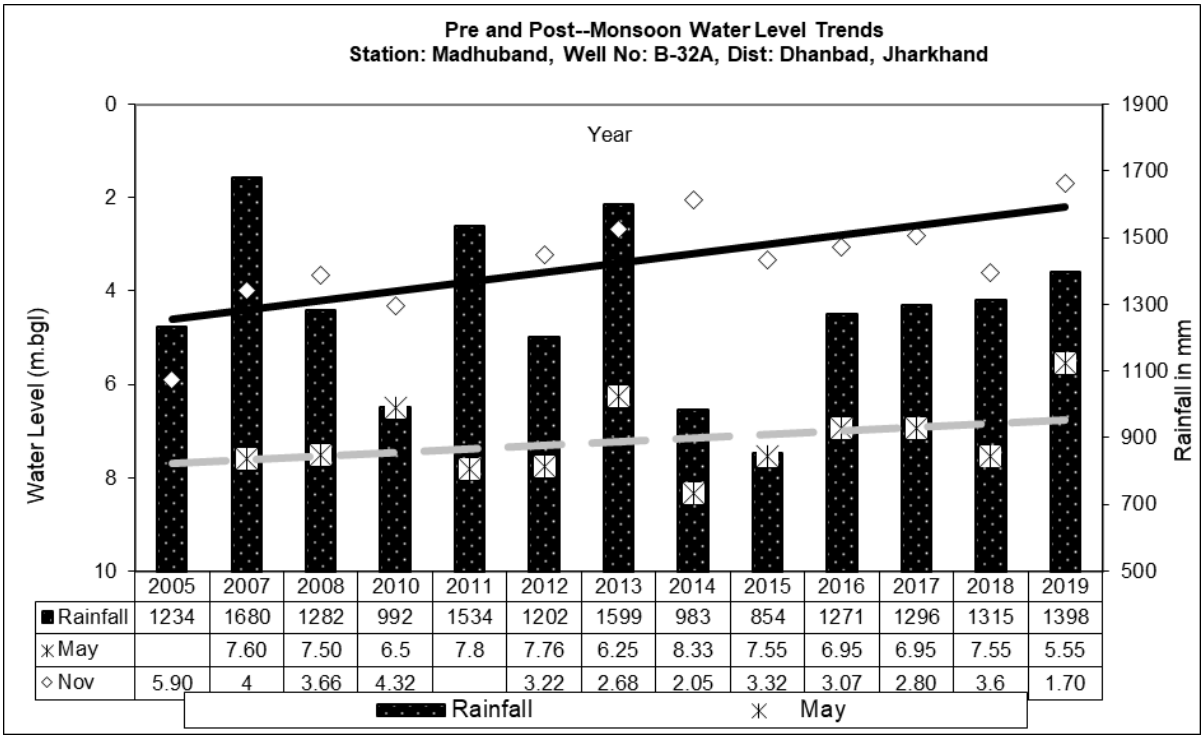
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1296	1398
May	8.89	4.09	5.19	6.14	9.14	3.71	5.27	6.57	7.86	6.81	7.74	6.9	2.84
Nov	2.04	1.72	2.22	3.56		1.74	1.39	2.74	4.29	2.41	2.14	2.4	1.34



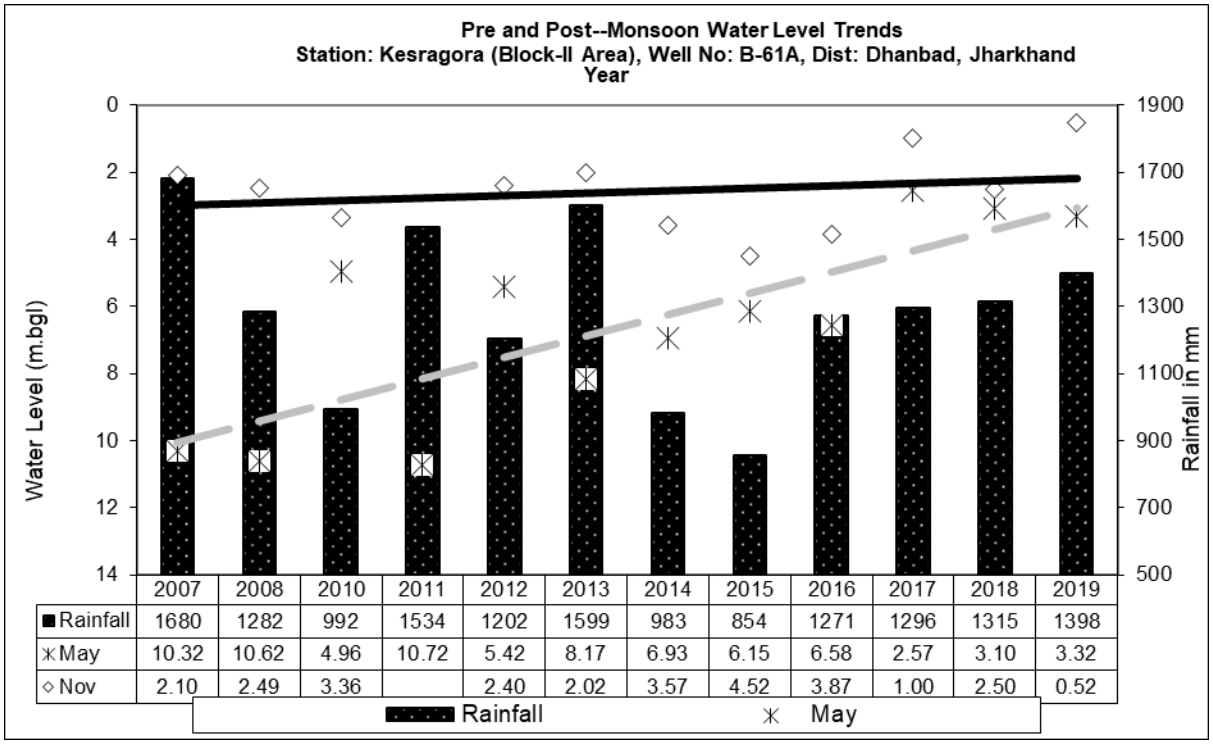
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	10.9	8.75	11.00	11.25	8.55	9.73	9.80	9.23	9.53	10.00	10.10	8.57
Nov	4.93	6.85	10.69		6.50	5.31	3.72	5.53	4.30	2.15	4.55	4.35

Annexure – VI

HYDROGRAPHS OF CLUSTER-XV



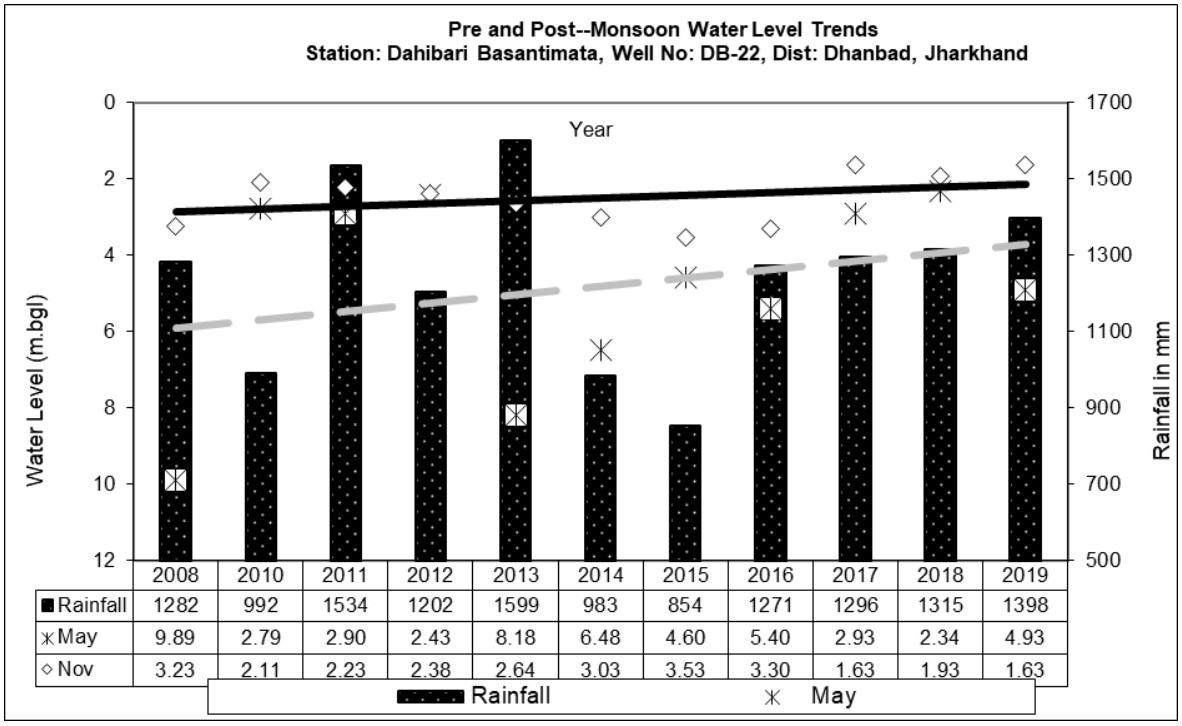
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May		7.60	7.50	6.5	7.8	7.76	6.25	8.33	7.55	6.95	6.95	7.55	5.55
Nov	5.90	4	3.66	4.32		3.22	2.68	2.05	3.32	3.07	2.80	3.6	1.70



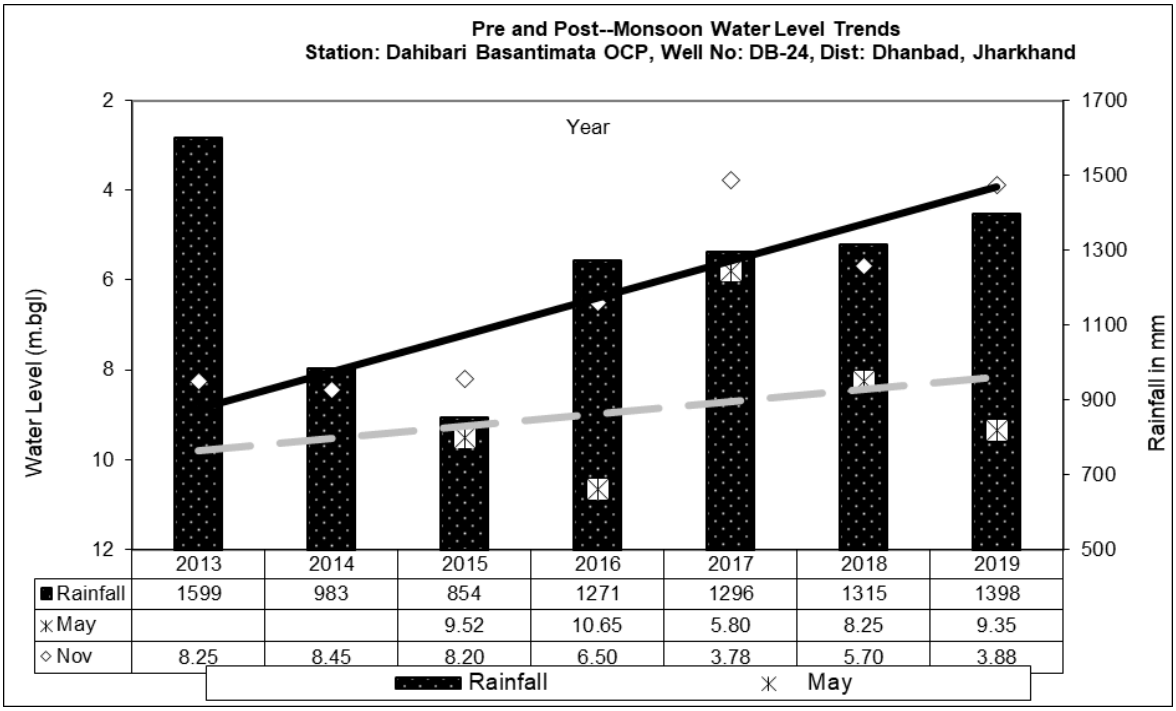
	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	10.32	10.62	4.96	10.72	5.42	8.17	6.93	6.15	6.58	2.57	3.10	3.32
Nov	2.10	2.49	3.36		2.40	2.02	3.57	4.52	3.87	1.00	2.50	0.52

Annexure – VI

HYDROGRAPHS OF CLUSTER-XVI



	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	9.89	2.79	2.90	2.43	8.18	6.48	4.60	5.40	2.93	2.34	4.93
Nov	3.23	2.11	2.23	2.38	2.64	3.03	3.53	3.30	1.63	1.93	1.63



	2013	2014	2015	2016	2017	2018	2019
Rainfall	1599	983	854	1271	1296	1315	1398
May			9.52	10.65	5.80	8.25	9.35
Nov	8.25	8.45	8.20	6.50	3.78	5.70	3.88

Abbreviations

AMSL: Above mean sea level

Avg.: Average

APT: Aquifer Pumping Test

BCCL: Bharat Coking Coal Ltd.

bgl: Below Ground Level

Buffer zone: periphery of the 10 km radius from the project boundary

Core zone: Project / mine / colliery boundary (leasehold area)

CMPDI: Central Mine Plan & Design Institute

DVC: Damodar Valley Corporation

DTW: Depth to water level

GW: Groundwater

IMD: Indian Meteorological Division

JCF: Jharia Coalfield

RCF: Raniganj Coalfield

MADA: Mineral Area Development Authority

MCM: Million Cubic Meter

MGD: Million Gallon per day

NTU: Nephlometric Turbidity unit

OC / UG: Opencast / Underground

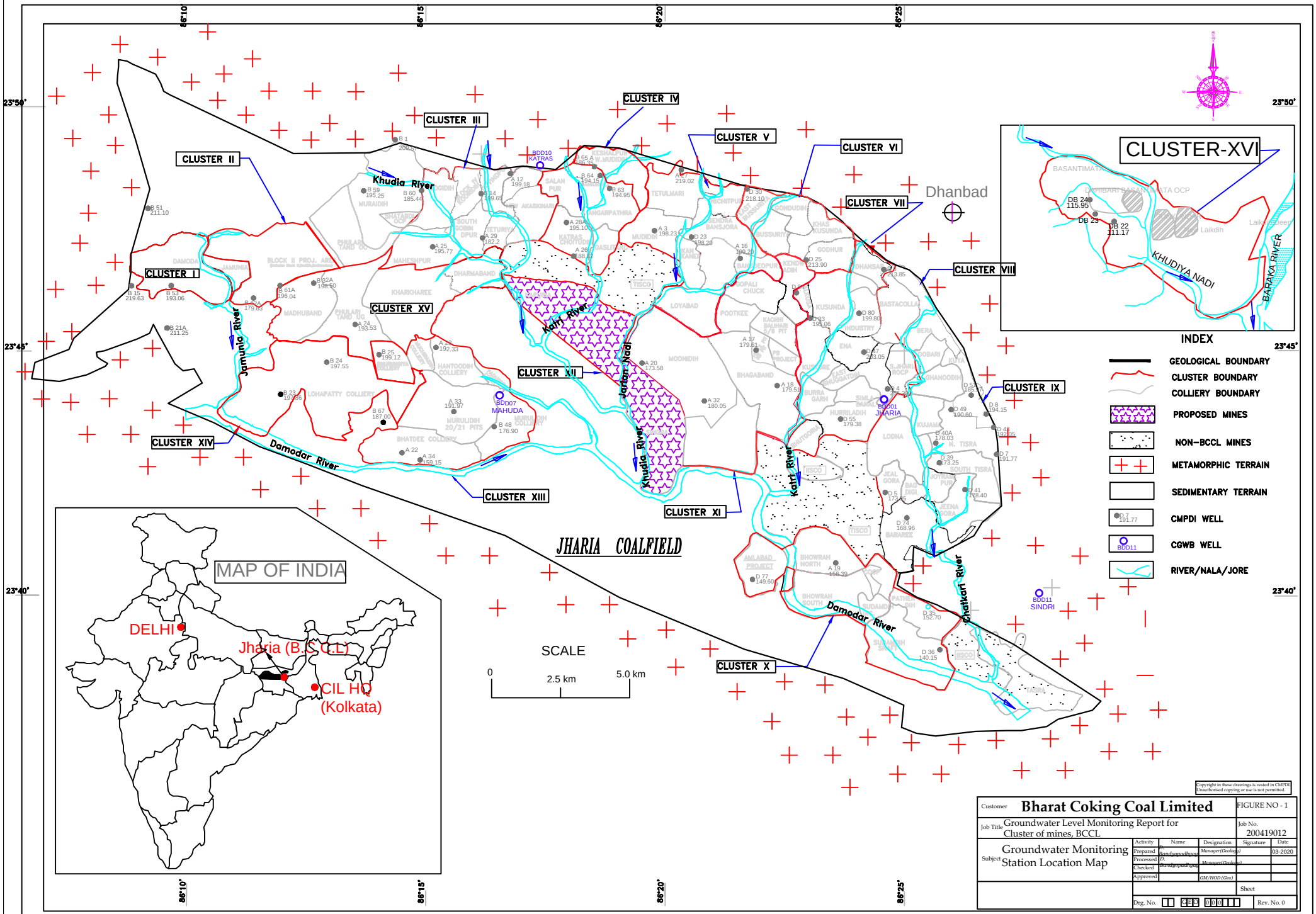
OCP / UGP: Opencast Project / Underground Project

RL: Reduced Level

RWH: Rainwater Harvesting

FF: Fire Fighting

GROUNDWATER MONITORING STATION LOCATION MAP



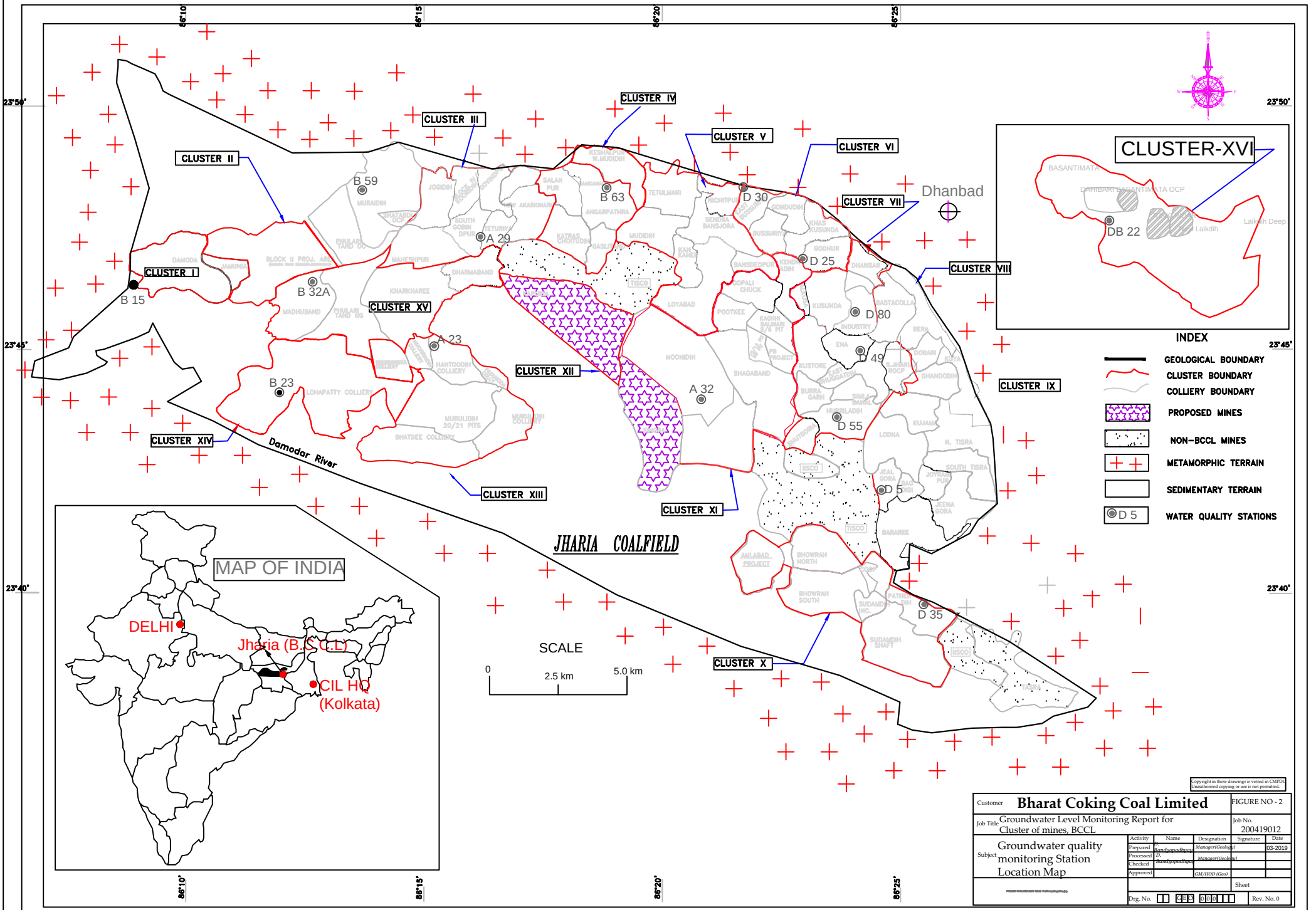
Customer	**Bharat Coking Coal Limited**	FIGURE NO - 1
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL	Job No. 200419012
Subject	Groundwater Monitoring Station Location Map	

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

Sheet

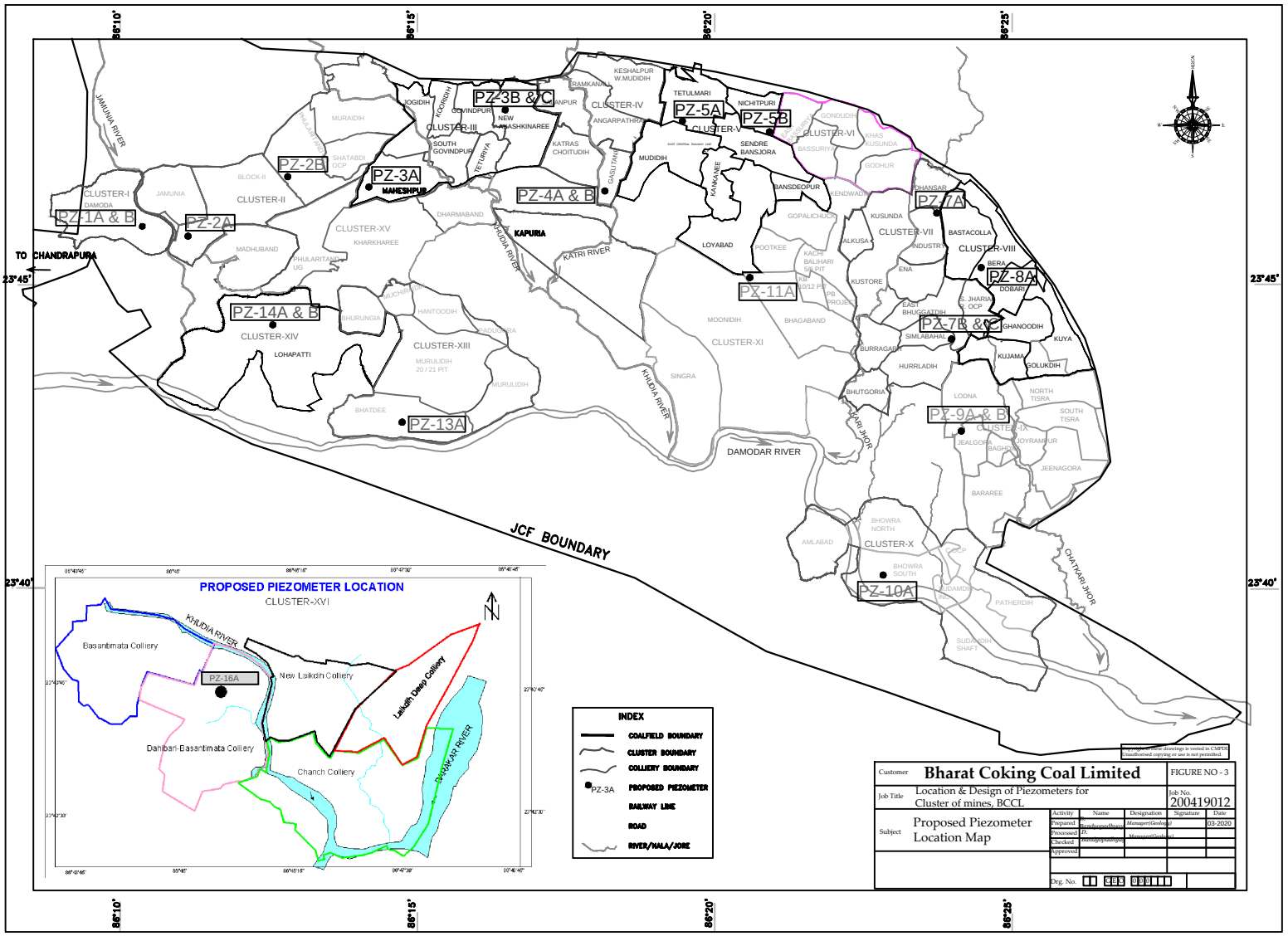
Drg. No. [redacted] Rev. No. 0

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. 200419012
Subject	Groundwater quality monitoring Station Location Map	Prepared: S. Bandyopadhyay, Manager(Geology), 03-2019	
		Processed: D. Bandyopadhyay, Manager(Geology)	
		Checked	
		Approved: GM/HOD (Geo)	
		Sheet	
		Drg. No. CES 000	Rev. No. 0

PROPOSED PIEZOMETER LOCATION MAP, JCF & RCF (part)



Customer: **Bharat Coking Coal Limited** — FIGURE NO - 3

Job Title: Location & Design of Piezometers for Cluster of mines, BCCL — Job No. 200419012

Subject: Proposed Piezometer Location Map

Activity	Name	Designation	Signature	Date
Prepared		Manager(Geology)		03-2020
Processed	D. Bandyopadhyay	Manager(Geology)		
Checked	D. Bhuniya	Manager(Geology)		
Approved				

Org. No. 11 483 00811

WATER TABLE CONTOUR MAP OF PRE-MONSOON 2019