Bharat Coking Coal Ltd.
(A Subsidiary of Coal India Limited)
Office of the General Manager, Katras Area
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Ref. No.-BCCL/ IV/2019/ 484

Dated- 19/06/2019

To
The Director,
Ministry of environment, forest and climate charge
Regional office (ECZ)
Bungalow office no.42, Shyamali colony
Ranchi-834002

Sub:-six monthly compliance report on implementation of environmental measures for the period from Oct 2018 to March 2019

Dear Sir

Kindly find enclosed herewith the six monthly compliance report on implementation of environmental measures for the period from Oct 2018 to March 2019 in respect of cluster IV group of mines under Katras Area, BCCL.

Hope you will find in order.

Enclosed:-As Above.

Yours Faithfully

19/06/19

Area Manager(ENV)
Cluster-IV, BCCL

Copy:-

1.The Director,IA Monitoring cell,Paryavaran Bhawan,CGO Complex, New Delhi-110003
2. Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, DELHI - 110 032, INDIA
3. The Director,(S) Ministry of Environment & Forest,Govt.of India –Bhuneshwar751023
4.The Member Secretary, Jharkhand state Pollution Control Board,Ranchi-834004
5. The Regional Officer, Jharkhand state Pollution Board,Dhanabad-826001
6.Dy.GM(ENV),BCCL,Koyla Bhawan,Dhanbad
6.Office Copy

SL. No.	condition	Compliance Status
1	The environmental clearance shall be valid for a period of one year from the issue of this letter. Further extension/continuance of the project shall be based on evaluation of the action taken on each of the observations of this Ministry's Regional Office during their site visit on 22nd August, 2016.	Agreed
2	The project proponent shall obtain Consent to establish from the State Pollution Control Boards of Jharkhand for the proposed peak capacity of 9.55 MTPA prior to commencement of the increased production.	Agreed.
3	Transportation of coal from face to Coal heap shall be carried out by truck. Further, the coal transportation from Coal heap to Coal Handling Plant shall be carried out through covered trucks.	It is being complied.
4	Mitigative measures to be undertaken to control dust and other fugitive emissions all along the roads by providing sufficient numbers of water sprinklers.	It is being complied. Fixed Water sprinklers have been installed in length approx 2 KM.
5	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.	It is Being Complied. Sufficient coal pillars have been left un-extracted around the air shaft
6	Solid barrier shall be left below the roads falling within the block to avoid any damage to the roads and no depillaring operation shall be carried out below the township/colony.	Solid barrier have been left below the roads falling within the block to avoid any damage to the roads and no depillaring operation have been carried out below the township/colony.
7	Depression due to subsidence resulting in water accumulating within the low lying areas shall be filled up or drained out by cutting drains.	It is being complied.
8	Sufficient number of pumps of adequate capacity shall be deployed to pump out mine water during peak rain fall.	It is being complied.
9	The company shall obtain approval of CGWA for use of groundwater for mining operations at its enhanced capacity of 9.55 MTPA.	Application for obtaining approval of CGWA for use of groundwater for mining operations at its enhanced capacity of 9.55 MTPA have been made. Application status is in progress.
10	Continuous monitoring of occupational safety and other health hazards, and the corrective actions need to be ensured.	It is being complied.
11	The fire dealing operations by excavating out fire should be expedited.	It is being complied.

Six Monthly Environmental clearance Compliance of Cluster IV for the period from Oct-March 2019

SL. No.	Mining	Compliance
1	Mining shall be carried out under strict adherence to provisions of the Mines Act, 1952 and subordinate legislations made there-under as applicable.	It is being Complied.
2	Mining shall be carried out as per the approved mining plan(including Mine Closure Plan) abiding by mining laws related to coal mining and the relevant circulars issued by Directorate General Mines Safety (DGMS).	It is being Complied.
3	No mining shall be carried out in forest land without obtaining Forestry Clearance as per Forest (Conservation) Act, 1980	There is no forest land existing under the leasehold of Cluster IV.
4	No change in mining method i.e. UG to OC, calendar programme and scope of work shall be made without obtaining prior approval of the Ministry of Environment, Forests and Climate Change (MoEFCC).	It is being Complied.
5	Underground work place environmental conditions shall be rendered ergonomic and air breathable with adequate illumination in conformance with DGMS standards.	It is being Complied.
	Land reclamation and water conservation	
1	Digital Survey of entire lease hold area/core zone using Satellite Remote Sensing survey shall be carried out at least once in three years for monitoring land use pattern and report in 1:50,000 scale or as notified by the Ministry of Environment, Forest and Climate Change from time to time shall be submitted to MoEFCC/Regional Office.	The proponent has got a study carried out through NRSC Hyderabad. NRSC has been awarded the work to prepare time series map by isothermal mapping after getting EC vide BCCL/D(T) OP/F-Env/2012/148(A) dated 11.02.2013. The last report was submitted by NRSC on April, 2014. The report concluded that there is a decrease in areal extent of fire from 3.01 sq.km. in 2006 to 2.18 sq.km. in 2012 based on the satellite data available for Dec, 2012 and validation by ground truth in done in the year 2013. A Global EOI was floated to control fire in Jharia Coalfield. Two parties participated. The technical committee did not find the international parties had expertise in controlling liquidating mine fire. It is informed to HPCC of MoC. Presently, Study is being done by ISM Dhanbad & CIMFR, Dhanbad. All unworked pit and incline has been sealed to protect entry of air to fire area.

2	The surface drainage plan including surface water conservation plan for the area of influence affected by the said mining operations, considering the presence of river/rivulet/pond/lake etc, shall be prepared and implemented by the project proponent. The surface drainage plan and/or any diversion of natural water courses shall be as per the approved Mining Plan/EIAIEMP report and with due approval of the concerned State/Go I Authority. The construction of embankment to prevent any danger against inrush of surface water into the mine should be as per the approved Mining Plan and as per the permission of DGMS or any other authority as prescribed by the law.	The surface drainage plan including surface water conservation plan for the area of influence affected by the said mining operations, considering the presence of river/rivulet/pond/lake etc, has been prepared and implemented by the project proponent. The surface drainage plan and/or any diversion of natural water courses is being done as per the approved Mining Plan/EIAIEMP report and with due approval of the concerned State/Go I Authority. The construction of embankment to prevent any danger against inrush of surface water into the mine is as per the approved Mining Plan and as per the permission of DGMS or any other authority as prescribed by the law.
3	The final mine void depth should preferably be as per the approved Mine Closure Plan, and in case it exceeds 40 m, adequate engineering interventions shall be provided for sustenance of aquatic life therein. The remaining area shall be backfilled and covered with thick and alive top soil. Post-mining land be rendered usable for agricultural/forestry purposes and shall be diverted. Further action will be treated as specified in the guidelines for preparation of Mine Closure Plan issued by the Ministry of Coal dated 2th August, 2009.	The final mine void depth will preferably be as per the approved Mine Closure Plan. At the end of mining all the remaining excavated area will be leveled and reclaimed physically as well as Biologically. Till date 15.70 ha area has been Physically as well as Biologically reclaimed.
4	The entire excavated area, backfilling, external OB dumping (including top soil) and afforestation plan shall be in conformity with the "during mining"/"post mining" land-use pattern, which is an integral part of the approved Mining Plan and the EIA/EMP submitted to this Ministry. Progressive compliance status vis-a-vis the post mining land use pattern shall be submitted to the MOEFCC/RO.	The entire excavated area, backfilling, external OB dumping (including top soil) and afforestation plan is being in conformity. Land use pattern has been submitted to ministry. Green belt over an area of 192.20 Ha (27.11 Ha over OB dumps, 165.09 Ha social forestry & Avenue Plantation) can be observed within IV as per CMPDIL land reclamation monitoring Report-2018.
5	Fly ash shall be used for external dump of overburden, backfilling or stowing of mine as per provisions contained in clause (i) and (ii) of subparagraph (8) of fly ash notification issued vide S.0.2804 (E) dated 3rd November, 2009 as amended from time to time. Efforts shall be made to utilize gypsum generated from Flue Gas Desulfurization (FGD), if any, along with fly ash for external dump of overburden, backfilling or stowing of mines. Compliance report shall be submitted to Regional Office of MoEF&CC, CPCB and SPCB.	There is no generation of fly ash in cluster IV.

6	It shall be ensured that as per the time schedule specified in mine closure plan it should remain live till the point of utilization. The top soil shall temporarily be stored at earmarked site(s) only and shall not be kept unutilized. The top soil shall be used for land reclamation and plantation purposes. Active OB dumps shall be stabilised with native grass species to prevent erosion and surface run off. The other overburden dumps shall be vegetated with native flora species. The excavated area shall be backfilled and afforested in line with the approved Mine Closure Plan. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry.	It is being Complied. Total three OB dump have been stabilized and re-vegetated through eco-restoration process (one 3.4 hectare, another 3.02 hectare & 3.58 Ha) since 2014. Total 27.11 Ha area of plantation has been done till date over dumps under cluster leasehold. Flora and fauna can be seen at the said site. Backfilling of quarry is going on with mining operation. At the end of mining there shall be no void and external OB dumps, area will be re- vegetated and reclaimed.
7	Post-mining land shall be rendered usable for agricultural/forestry purposes and handed over to the respective State Government, as specified in the Ministry of Coal Guidelines dated 27th August, 2009 for Preparation of Mine Closure Plan.	It will be complied.
8	Regular monitoring of subsidence movement on the surface over and around the working areas and its 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 beyond the limit prescribed, appropriate effective mitigation measures shall be taken to avoid loss of life and materials. Cracks should be effectively plugged in with ballast and clay soil/suitable material.	No depillaring in underground mine is going on hence no mining induced subsidence is taking place. Regular monitoring of subsidence is being done by subsidence monitoring committee of the area.
9	A separate team for subsidence monitoring and surface mitigation measures shall be constituted and continuous monitoring & implementation of mitigation measures be carried out.	It is being complied. A Certificate of Project Officers and General Manager of the Cluster IV, indicating no subsidence due to mining operation has been submitted.
10	Thorough inspection of the mine lease area for any cracks developed at the surface due to mining activities below ground shall be carried out to prevent inrush of water in the mine.	It is being complied.
11	Native tree species shall be selected and planted over areas affected by subsidence.	Plants like seesam, Gamhar, Aam, Peepal,Bargad, Sagwan, Kathal etc. has been planted over areas likely to be affected by subsidence.

	Emissions, effluents, and waste disposal	
1	Transportation of coal, to the extent permitted by road, shall be carried out by covered trucks/conveyors. Effective control measures such as regular water/mist sprinkling/rain gun etc shall be carried out in critical areas prone to air pollution (with higher values of PM1Q/PM2.s)such as haul road, loading/unloading and transfer points. Fugitive dust emissions from all sources shall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters confirm to the norms prescribed by the Central/State Pollution Control Board.	Vehicular emission is kept under control by proper maintenance of vehicles. Vehicular emissions are being monitored in every prescribed period. Only those vehicles are being allowed to run having PUC. In addition to the above coal transportation is done by tarpaulins covered and optimally loaded vehicles. The project authorities are regularly checking all the loaded trucks/dumpers coming inside the plant about their valid PUC. Total 40 nos of mobile water sprinkler at haul road has been deployed for control to air pollution. In addition to that 45 no of fixed sprinkler installed along the siding/CHP, throwing approx 10-12m and distance between sprinkler is about 10-15m.
2	Greenbelt consisting of 3-tier plantation of width not less than 7.5 m shall be developed all along the mine lease area as soon as possible. The green belt comprising a mix of native species (endemic species should be given priority) shall be developed all along the major approach/ coal transportation roads.	Three tier plantations at 15.60 Ha areas at mine lease area have been done. 1785 Nos of Bamboo gabion plantation has also been done along mine boundary. work order for 600 Nos of Bamboo Gabion plantation have been awarded to DFO dhanbad and same be planted in FY 2019-20. Remaining area will be 3 tiers ecologically restored.
3	The transportation of coal shall be carried out as per the provisions and route envisaged in the approved Mining Plan or environment monitoring plan. Transportation of the coal through the existing road passing through any village shall be avoided. In case, it is proposed to construct a 'bypass' road, it should be so constructed so that the impact of sound, dust and accidents could be appropriately mitigated.	It is being complied. Only 500 m public road is being used for coal transportation.
4	Vehicular emissions shall be kept under control and regularly monitored. All the vehicles engaged in mining and allied activities shall operate only after obtaining 'PUC' certificate from the authorized pollution testing centres.	Vehicular emissions are being monitored in every prescribed period. Only those vehicles are being allowed to run having PUC. In addition to the above coal transportation is done by tarpaulins covered and optimally loaded vehicles. The project authorities are regularly checking all the loaded trucks/dumpers coming inside the plant about their valid PUC.
5	Coal stock pile/crusher/feeder and breaker material transfer points shall invariably be provided with dust suppression system. Belt-conveyors shall be fully covered to avoid air borne dust. Side cladding all along the conveyor gantry should be made to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.	It is being complied. Dust suppression arrangement has been made at crusher. Fixed type water sprinkler have been installed. Installation of Belt conveyor system may leads to fire Hazard as the existence of fiery coal seam in our command area.

6	Coal handling plant shall be operated with effective control measures w.r.t. various environmental parameters. Environmental friendly sustainable technology should be implemented for mitigating such parameters.	It is being complied. Dust suppression arrangement has been made at coal Handling plants. 3 mobile water sprinkler have been deployed for control to air pollution in CHP. In addition to that 45 no of fixed sprinkler installed along the siding/CHP, throwing range approx 10-12m and distance between sprinkler is about 10-15m.
7	Ground water, excluding mine water, shall not be used for mining operations. Rainwater harvesting shall be implemented for conservation and augmentation of ground water resources.	It is being complied. Only mine water is used for industrial purpose i.e fire dealing ,watering the mine area, roads, green belt development etc. Regular monitoring of ground water level and quality are being monitored by CMPDIL, Ranchi. Rain water Harvesting arrangement has been made.
8	Catch and or garland drains and siltation ponds in adequate numbers and appropriate size shall be constructed around the mine working, coal heaps & OB dumps to prevent run off of water and flow of sediments directly into the river and water bodies. Further, dump material shall be properly consolidated/ compacted and accumulation of water over dumps shall be avoided by providing adequate channels for flow of silt into the drains. The drains/ ponds so constructed shall be regularly de-silted particularly before onset of monsoon and maintained properly. Sump capacity should provide adequate retention period to allow proper settling of silt material. The water so collected in the sump shall be utilised for dust suppression and green belt development and other industrial use. Dimension of the retaining wall constructed, if any, at the toe of the OB dumps within the mine to check run-off and siltation should be based on the rainfall data. The plantation of native species to be made between toe of the dump and adjacent field/habitation/water bodies.	It is being complied.
9	Adequate groundwater recharge measures shall be taken up for augmentation of ground water. The project authorities shall meet water requirement of nearby village(s) after due treatment conforming to the specific requirement (standards).	Five nos of Rain water Harvesting pond has been created. Water is being supplying to nearby villages after treatment of mine water as per requirement.
10	Solid waste/hazardous waste generated in the mines shall be addressed in accordance to the MSW Rules, 2016.	It is being complied. Solid waste/hazardous waste generated in the mines is being addressed in accordance to the MSW Rules, 2016.
11	The water pumped out from the mine, after siltation, shall be utilized for industrial purpose viz. watering the mine area, roads, green belt development etc. The drains shall be regularly desilted particularly after monsoon and maintained properly.	It is being complied. Pumped out water are being utilized for water sprinkling on haul road, green belt development, fire dealing etc.
12	Major approach roads shall be black topped and properly maintained.	It is being complied.

13	The project proponent shall not alter major water channels around the site. Appropriate embankment shall be provided along the side of the river/nallah flowing near or adjacent to the mine. The embankment constructed along the river/nallah boundary shall be of suitable dimensions and critical patches shall be strengthened by stone pitching on the river front side, stabilized with plantation so as to withstand the peak water pressure preventing any chance of mine inundation.	The embankment constructed along the river boundary is of suitable dimension and critical patches has been strengthened by concreting and stone pitching as per design made by Central Mine Planning and Design Institute Limited (CMPDIL) on the river front side and stabilized with plantation to withstand the peak water flow and prevent mine inundation. Construction of concrete embankment at critical patch of nallah/Jore has been done. Total length of constructed embankment is 3000 meter.
14	Garland drains (of suitable size, gradient and length) around the critical areas i.e. mine shaft and low lying areas, shall be designed keeping at least 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine sites. The sump capacity shall also provide adequate retention period to allow proper settling of silt material of the surface runoff.	It is being complied. Garland drains (of suitable size, gradient and length) around the critical areas i.e. mine shaft and low lying areas, has been designed.
15	Industrial waste water from coal handling plant and mine water shall be properly collected and treated so as to conform to the standards prescribed under the Environment (Protection) Act, 1986 and the Rules made there under, and as amended from time to time. Oil and grease trap shall be installed before discharge of workshop effluent. Sewage treatment plant of adequate capacity shall be installed for treatment of domestic waste water.	It is being complied. Oil and grease trap has been installed at AKWMC and Angarpathra , Katras Area before discharge of workshop effluent. Installation of sewage treatment plant is under process.
	Illumination, noise & vibration	
1	Adequate illumination shall be ensured in all mine locations (as per DGMS standards) and monitored weekly. The report on the same shall be submitted to this ministry & its RO on six-monthly basis.	It is being complied. The report on the same will be submitted to ministry.
2	Adequate measures shall be taken for control of noise levels as per noise pollution Rules, 2016 in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with personal protective equipments (PPE) like ear plugs/muffs in conformity with the prescribed norms and guidelines in this regard. Adequate awareness programme for users to be conducted.	Personnel operating near HEMMs, drilling machine comply with safety regulation and are equipped with Personal Protective Equipment. Awareness programmes are being given to all the personnel at Vocational training center and mine site.
3	Controlled blasting techniques shall be practiced in order to mitigate ground vibrations, fly rocks, noise and air blast etc. as per the guidelines prescribed by the DGMS.	It is being complied. Controlled blasting techniques are being practiced in order to mitigate ground vibrations, fly rocks, noise and air blast etc. as per the guidelines prescribed by the DGMS.
4	The noise level survey shall be carried out as per the prescribed guidelines to assess noise exposure of the workmen at vulnerable points in the mine premises, and report in this regard shall be submitted to the Ministry/RO on six-monthly basis.	It is being complied. Noise level is being monitored by CMPDIL.

	Occupational health & safety	
1	The project proponent shall undertake occupational health survey for initial and periodical medical examination of the personnel engaged in the project and maintain records accordingly as per the provisions of the Mines Rules, 1955 and DGMS circulars. Besides regular periodic health check-up, 20% of the personnel identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any, as amended time to time.	It is being complied. 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) guideline.
2	Personnel working in core zone shall wear protective respiratory devices and shall also be provided with adequate training and information on safety and health aspects.	Training and awareness programmes are being given to all the personnel working in dusty areas. All personnel working in such areas are also provided with mask to wear themselves.
	Ecosystem and biodiversity conservation	
1	The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered/endemic flora/fauna, if any, spotted/reported in the study area. The Action plan in this regard, if any, shall be prepared and implemented in consultation with the State Forest and Wildlife Department.	Ecological restoration are being done in consultation with FRI, dehradun. Road Map of Ecological restoration has been made and submitted to ministry.
2	The project proponent shall take all precautionary measures to ensure riverine/riparian ecosystem in and around the coal mine upto a distance of 5 km. A riverine/riparian ecosystem conservation and management plan should be prepared and implemented in consultation with the irrigation/water resource department in the State Government.	Monitoring of river water are being done regularly. Special affords has been made for cleaning of river water, drives like swachhta pakhwada are being organised regularly.
	Public Hearing, R&R and CSR	
1	Implementation of the action plan on the issues raised during the public hearing shall be ensured. The project proponent shall undertake all the tasks/measures as per the action plan submitted with budgetary provisions during the public hearing. Land oustees shall be compensated as per the norms laid down in the R&R policy of the company/State Government/Central Government, as applicable.	It is being complied. Compliance report of public hearing has been sent to ministry. Land oustees are getting their compensation as per norms laid down in R&R policy of the company.
2	The project proponent shall ensure the expenditure towards socio-economic development in and around the mine every financial year in pursuance of the Corporate Social Responsibility Policy as per the provisions under Section 135 of the Companies Act, 2013.	It is being complied. Expenditure towards socio-economic development has been ensured.

3	The project proponent shall follow the mitigation measures provided in this Ministry's OM NO.Z-11013/5712014-IA.11 (M) dated 29th October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'.	It is being complied.
4	The project proponent shall make necessary alternative arrangements, if grazing land is involved in core zone, in consultation with the State government to provide alternate areas for livestock grazing, if any. In this context, the project proponent shall implement the directions of Hon'ble Supreme Court with regard to acquiring grazing land.	No grazing land is involved in core zone.
	Corporate environment responsibility	
1	The Company shall have a well laid down environment policy duly approved by Board of Directors. The environment policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions. Also, the company shall have a defined system of reporting of non-compliances/violations of environmental norms to the Board of Directors and/or shareholders/stakeholders.	It is being complied. Corporate Environmental policy has been made, approved by CMD of M/s BCCL and it is being implemented. Environment management cell has also been made to ensure implementation of environmental management plan.
2	The project proponent shall comply with the provisions contained in this Ministry's OM dated 1st May, 2018, as applicable, regarding Corporate Environment Responsibility.	It is being complied. Corporate Environmental policy has been made, approved by CMD of M/s BCCL and it is being implemented.
3	A separate environmental management cell both at the project and company headquarter level, with suitable qualified personnel shall be set-up under the control of a Senior Executive, who will report directly to the Board level executive/Head of the Organization.	It is being Complied. A separate Environment management cell has been made to ensure implementation of environmental management plan.
4	Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.	It is being complied. Action plan has been submitted to ministry, work is being done accordingly. Year wise funds earmarked for environmental protection measure has been kept separately.
5	Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.	It is being complied. CCO has been engaged for the audit of plantation done per year. IIEST, Shibpur is attached for auditing of Mine closure activity done in Katras Area.

6	Skill training as per safety norms specified by DGMS shall be provided to all workmen including the outsourcing employees to ensure high safety standards in mines.	Skill training as per safety norms specified by DGMS are being provided to all workmen including the outsourcing employees to ensure high safety standards in mines.
7	Effective arrangement shall be made to provide and maintain at suitable points conveniently situated, a sufficient supply of drinking water for all the persons employed.	It is being Complied.
	Statutory Obligations	
1	This environmental clearance shall be subject to obtaining Forest Clearance from the concerned regulatory authority, Wildlife clearance from the Standing Committee of National Board for Wildlife, as applicable to the project.	There is no forest land existing under the leasehold of Cluster IV.
2	The project proponent shall obtain the necessary permission from the Central Ground Water Authority (CGWA) if applicable.	It is being Complied. Application has been made to CGWA.
3	The Environmental clearance shall be subject to orders of Hon'ble Supreme Court of India, Hon'ble High Courts, NGT and any other Court of Law, from time to time, and as applicable to the project.	It is being complied.
4	The project proponent shall obtain Consent to Establish/Operate under the Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from concerned SPCB.	It is being complied.
	Monitoring of project	
1	Continuous ambient air quality monitoring stations as prescribed in the statue be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely PM1o, PM2.5, S02 and NOx. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Online ambient air quality monitoring stations may also be installed in addition to the regular monitoring stations as per the requirement and/or in consultation with the SPCB. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc to be carried out at least once in six months.	Location of Monitoring station in the Jharia Coal Field have been finalized with the Jharkhand State Pollution Control Board. Four ambient air quality monitoring station has been established at AARC agent office (Ramkanali), Mine office - Kooridih OCP, Mine office- Nichitpur and RudhiBasti. Presently we are doing air quality monitoring at five locations namely Katras Chatudih, AARC agent office (Ramkanali), Mine office - Kooridih OCP, Mine office- Nichitpur and RudhiBasti. Monitoring data regularly submitted to the Ministry including its Regional Office at Ranchi. Monitoring of air quality is being done by Central Mining & Planning Design Institute (CMPDIL), Dhanbad.

2	The Ambient Air Quality monitoring in the core zone shall be carried out to ensure the Coal Industry Standards notified vide GSR 742 (E) dated 25.9.2000 and as amended from time to time by the Central Pollution Control Board. Data on ambient air quality and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly reported to the Ministry/Regional Office and to the CPCB/SPCB.	It is being complied. CMPDIL has been engaged for Air Quality monitoring as well as heavy metals.
3	The effluent discharge (mine waste water, workshop effluent) shall be monitored in terms of the parameters notified under the Water Act, 1974 Coal Industry Standards vide GSR 742 (E) dated zs" September, 2000 and as amended from time to time by the Central Pollution Control Board.	Monitoring of River water are being done by CMPDIL regularly in Upstream and Downstream.
4	The monitoring data shall be uploaded on the company's website and displayed at the project site at a suitable location. The circular No. J-20012/1/2006-IA.11 (M) dated 27th May, 2009 issued by the Ministry shall also be referred in this regard for compliance.	It is being complied.
5	Regular monitoring of ground water level and quality shall be carried out in and around the mine lease area by establishing a network of existing wells and constructing new piezometers during the mining operations. The monitoring of ground water levels shall be carried out four times a year i.e. pre-monsoon, monsoon, post-monsoon and winter and water quality once a year, and the data thus collected shall be sent regularly to MoEFCC/RO.	It is in progress.
6	Monitoring of water quality upstream and downstream of water bodies shall be carried out once in six months and record of monitoring data shall be maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office.	It is being complied. Monitoring of water quality upstream and downstream of water bodies is being carried out once in six months and record of monitoring data has been maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office.
7	The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental conditions to the MOEFCC/RO. For half yearly monitoring reports, the data should be monitored for the period of April to September and October to March of the financial years.	It is being Complied. Six monthly reports on the status of the implementation of the stipulated environmental conditions are being submitted to the MOEFCC/RO.

8	The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.	It is being complied.
	Miscellaneous	
1	Efforts should be made to reduce energy consumption by conservation, efficiency improvements and use of renewable energy.	LED bulb has been distributed among employees. Training has also been provided regarding the same. Installation of Solar power plant is in line.
2	The project authorities shall inform to the Regional Office of the MOEFCC regarding commencement of mining operations.	It is being Complied.
3	A copy of the environmental clearance shall be marked to concerned Panchayat. A copy of the same shall also be sent to the concerned State Pollution Control Board, Regional Office of the MOEFCC, District Industries Centre and Collector's Office/Tehsildar Office for information in public domain within 30 days.	It is being complied.
4	The EC shall be uploaded on the company's website. The compliance status of the stipulated EC 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.	It is being Complied. EC has uploaded on the company's website. Six monthly compliance status are also being uploaded on company's website.
5	The project authorities shall advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue 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 also at web site of this Ministry at www.environmentclearance.nic.in and a copy of the same shall be forwarded to the Regional Office.	It is being Complied.

6	The environmental statement for each financial year ending 31st March in Form-V is mandated to be submitted by the project proponent for 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&CC by email.	It is being Complied.
7	The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during their presentation to the EAC.	It is being Complied. EIA/EMP is being implemented.
8	Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in revocation of this EC and attract action under the provisions of Environment (Protection) Act, 1986.	Agreed.
9	The above conditions will be enforced inter-alia, under the provrsrons 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 and any other orders passed by the Hon'ble Supreme Court of India/High Courts and any other Court of Law relating to the subject matter.	Agreed.
10	Adequate ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely particulates, S02 and NOx. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive receptors in consultation with the State Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc. to be carried out at least once in six months. Online ambient air quality monitoring station/stations may also be installed in addition to the regular air monitoring stations as per the requirement and/or in consultation with the SPCB.	Location of Monitoring station in the Jharia Coal Field have been finalized with the Jharkhand State Pollution Control Board. Four ambient air quality monitoring station has been established at AARC agent office (Ramkanali), Mine office - Kooridih OCP, Mine office- Nichitpur and RudhiBasti. Presently we are doing air quality monitoring at five locations namely Katras Chatudih, AARC agent office (Ramkanali), Mine office - Kooridih OCP, Mine office- Nichitpur and RudhiBasti. Monitoring data regularly submitted to the Ministry including its Regional Office at Ranchi. Monitoring of air quality is being done by Central Mining & Planning Design Institute (CMPDIL), Dhanbad.

General Manager
Katras Area

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

(FOR THE MONTH MARCH, 2019)

E. C. no. J-11015/212/2010-IA.II (M) dated 06.02.2013.

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 analysed for four parameters on fortnightly basis. Thereafter the samples were preserved and analysed 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, are within permissible limits.

4.3 Noise Level

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

INTRODUCTION

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

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

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

The Cluster IV is in the Northern part of the Jharia coalfield. It includes SalanpurOCP, KatrasChoitodihUG, Amalgamated Keshalpur – West Mudidih OCP & UG Mines, Amalgamated Ramkanali – Angarpathra OCP & UG mines, Gaslitand UG. The cluster– IV is situated about 25 - 30kms from Dhanbad Railway Station. The mines of this cluster- IV 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 KatriRiver and KumariJore.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.851 Mtpa (normative) and 3.706 Mtpa peak capacity of coal production vide letter no. J-11015/212/2010-IA.II (M) dated 06th February, 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) Govindpur Village (A7): Industrial Area

The location of the sampling station is 23^0 48'34" N, 86^0 18'22" E. The sampler was placed at 1.5 m above the ground level at AARC agent Office.

ii) Katras Chotudih (A37): Industrial Area

The location of the sampling station is at the roof top of the Manager Office.

II. BUFFER ZONE Monitoring Location

i) Block IV (A6) : industrial area

The location of the sampling station is 23^0 47.916' N 86^0 15.333' E. The sampler was placed at a height of 1.5 m above the ground level in Safety office of Block IV OCP.

ii) Nichitpur (A8): Industrial Area

The location of the sampling station is 23^0 48'20" N 86^0 21'30" E. The sampler was placed at roof top at Safety office of Nichitpur.

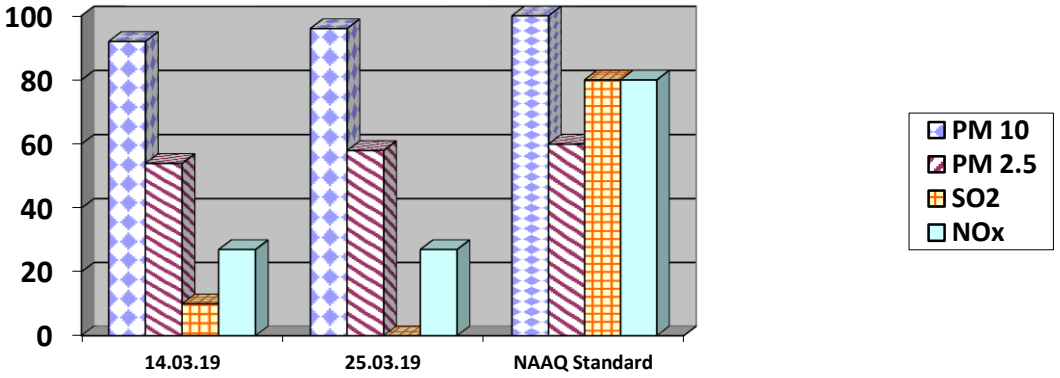
iii) Rudhi Basti(A18): **Residential Area**

The sampler was placed at a height of 1.5 m above the ground level at Rudhi Basti.

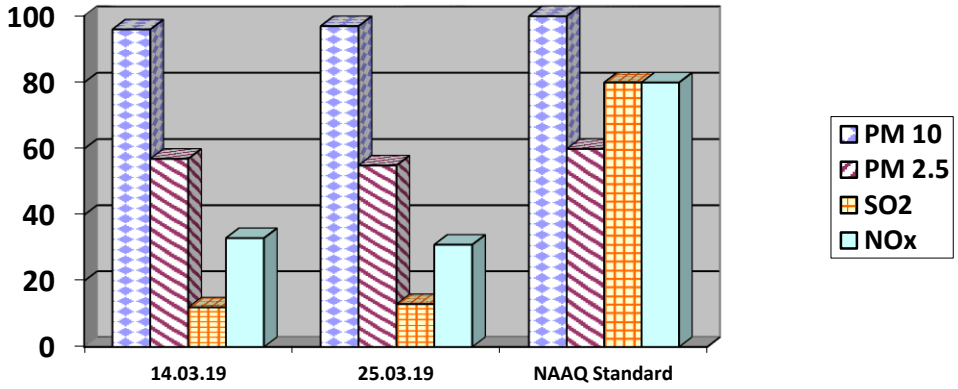
AMBIENT AIR QUALITY DATA

Cluster – IV, Bharat Coking Coal limited Month: **MARCH, 2019** **Year**: **2018-19.**

Station Name: A7, Govindpur		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	14.03.19	92	54	10	27
2	25.03.19	96	58	<10	27
	NAAQ Standard	100	60	80	80



Station Name: A37, Katras Chotudih		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	14.03.19	96	57	12	33
2	25.03.19	97	55	13	31
	NAAQ Standard	100	60	80	80

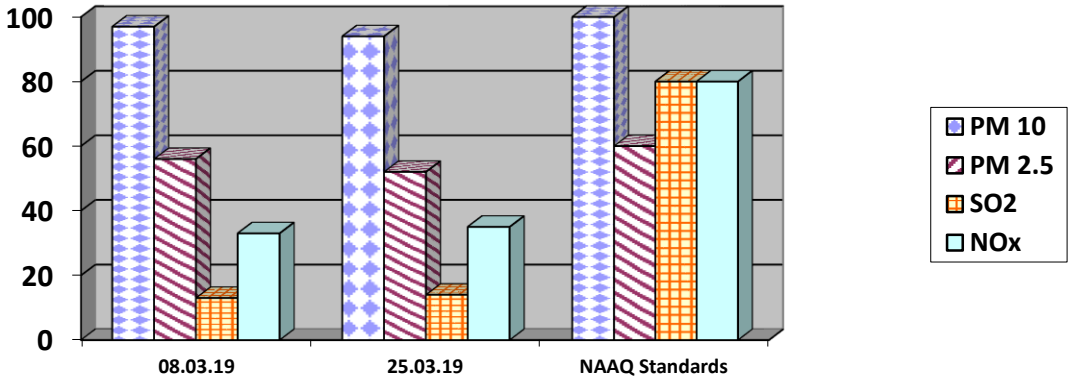


Analysed By
JSA/SA/SSA

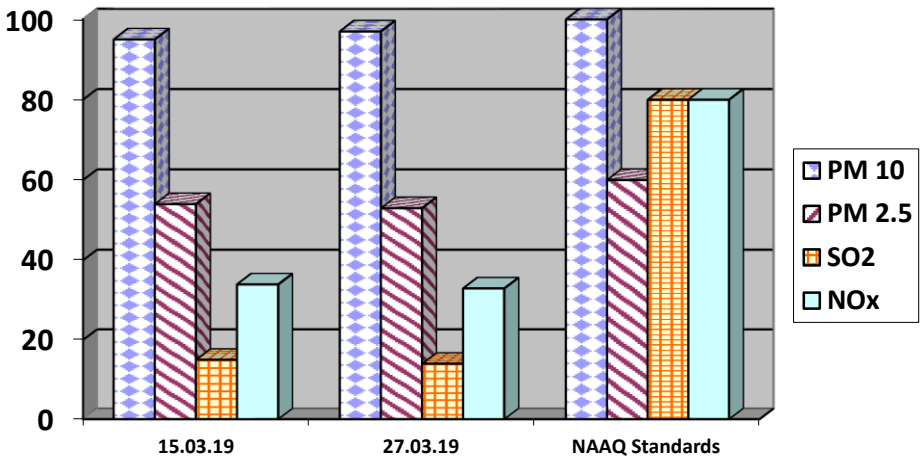
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A6,Block IV		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	08.03.19	97	56	13	33
2	25.03.19	94	52	14	35
	NAAQ Standards	100	60	80	80



Station Name: A8,Nichitpur		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	15.03.19	95	54	15	34
2	27.03.19	97	53	14	33
	NAAQ Standards	100	60	80	80

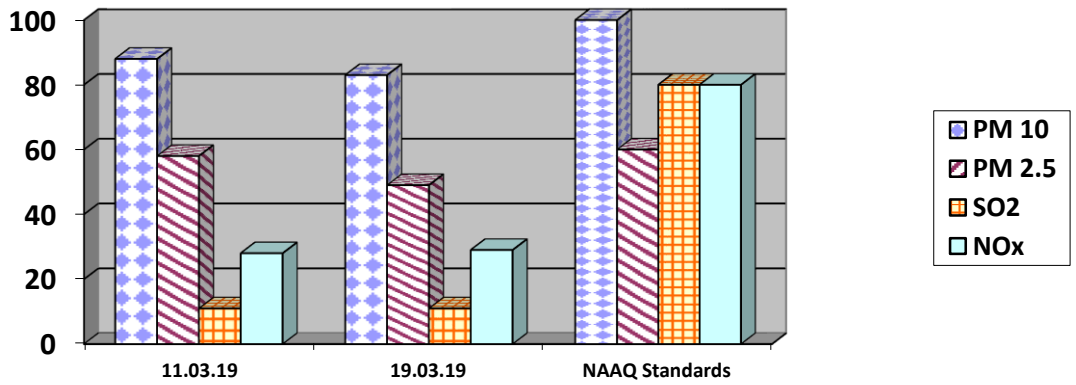


Analysed By
JSA/SA/SSA

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

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

Station Name: A18,Rudhi Basti		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	11.03.19	88	58	11	28
2	19.03.19	83	49	11	29
	NAAQ Standards	100	60	80	80



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

Analysed By
JSA/SA/SSA

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

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

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) Mine Discharge of Chotudih (MW4)

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Katri River and Kumari Jore.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -IV**		Month: **MARCH, 2019**	Name of the Station: **Mine Discharge of Chotudih**	
Sl. No.	**Parameters**	**MW4** First Fortnight **14.03.19**	**MW4** Second Fortnight **25.03.19**	**As per MOEF General Standards for schedule VI**
1	Total Suspended Solids	28	48	*100 (Max)*
2	pH	7.9	8.05	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	52	36	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Govindpur (N7)**
ii) K**atras Chotudih (N37)**
iii) **Block IV(N6)**
iv) **Nichitpur(N8)**
v) **RudhiBasti (N18)**

4.2 Methodology of sampling and analysis

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

4.3 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -IV**			Month: **MARCH, 2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Block IV(N6)	Industrial area	08.03.19	57.3	*75*
2	Block IV	Industrial area	25.03.19	59.1	*75*
3	Govindpur Village(N7)	Industrial area	14.03.19	54.2	*75*
4	Govindpur Village	Industrial area	25.03.19	61.2	*75*
5	Nichitpur(N8)	Industrial area	15.03.19	51.7	*75*
6	Nichitpur	Industrial area	27.03.19	58.8	*75*
7	Katras Chotudih(N37)	Industrial area	14.03.19	53.4	*75*
8	Katras Chotudih	Industrial area	25.03.19	58.9	*75*
9	Rudhi Basti(N18)	Residential area	11.03.19	41.3	*55*
10	Rudhi Basti	Residential area	19.03.19	45.8	*55*

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	Checked By	Approved By
JSA/SA/SSA	Lab In Charge RI-2, CMPDI, Dhanbad	HOD(Mining/Environment) RI-2, CMPDI, Dhanbad

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

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

Note:

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

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

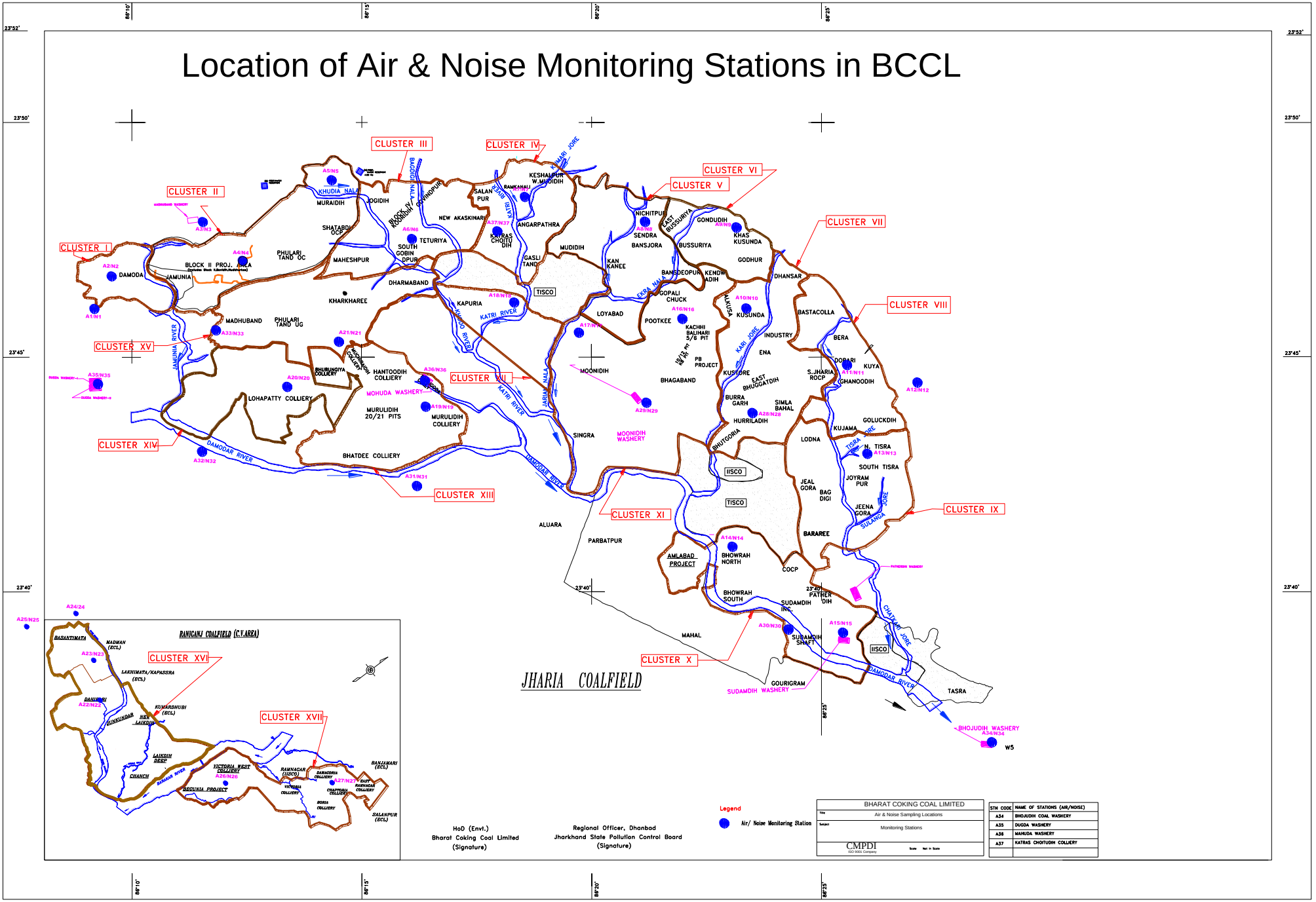
In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in supersession of the notification No(s).S.O.384(E), dated 11th April 1994 and S.O.935(E), dated 14th October 1998, the Central Pollution Control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

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

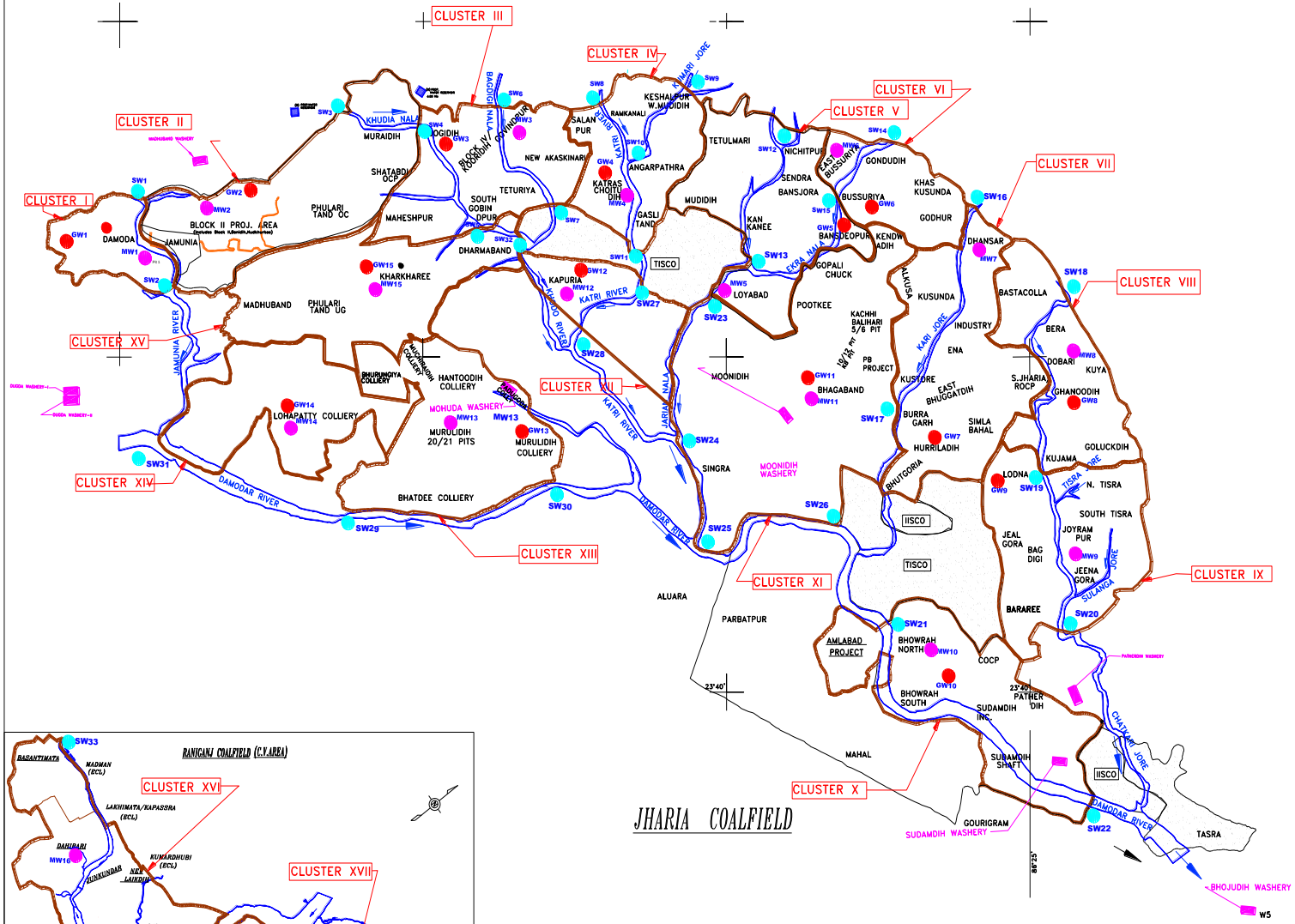
* Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

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

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


Location of Air & Noise Monitoring Stations in BCCL
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
CLUSTER XVII
JHARIA COALFIELD
RANIGANJ COALFIELD (CV AREA)
DAMODAR RIVER
KHUDIA NALA
BAGDIGI NALA
KATRI RIVER
KHUDIA RIVER
JAMUNIA RIVER
KARI JORE
SULANGA JORE
CHANAKI JORE
TISRA JORE
BARAREE
COCP
TISCO
IISCO
MOONIDIH WASHERY
MOHUDA WASHERY
SUDAMDIH WASHERY
BHOJUDIH WASHERY
Legend
Air/ Noise Monitoring Station
HoD (Envt.)
Bharat Coking Coal Limited
(Signature)
Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)
BHARAT COKING COAL LIMITED
Air & Noise Sampling Locations
Monitoring Stations
CMPDI
STN CODE
NAME OF STATIONS (AIR/NOISE)
A34 BHOJUDIH COAL WASHERY
A35 DUGDA WASHERY
A36 MAHUDA WASHERY
A37 KATRAS CHOITUDIH COLLIERY

Water Sampling Locations in BCCL



INDEX

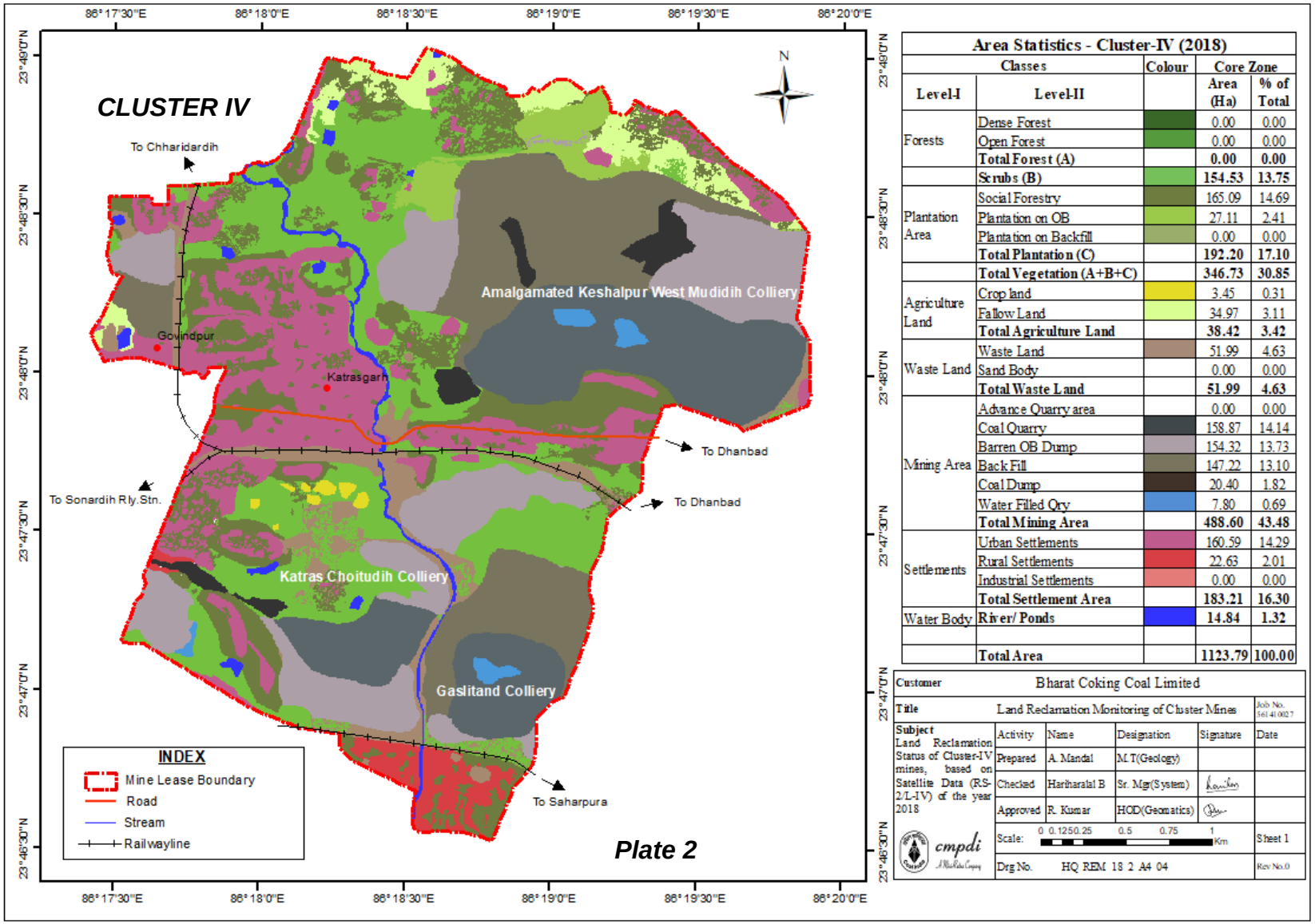
Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ghutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala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

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

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

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

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



Area Statistics - Cluster-IV (2018)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**154.53**	**13.75**
Plantation Area	Social Forestry		165.09	14.69
	Plantation on OB		27.11	2.41
	Plantation on Backfill		0.00	0.00
	Total Plantation (C)		**192.20**	**17.10**
	Total Vegetation (A+B+C)		**346.73**	**30.85**
Agriculture Land	Crop land		3.45	0.31
	Fallow Land		34.97	3.11
	Total Agriculture Land		**38.42**	**3.42**
Waste Land	Waste Land		51.99	4.63
	Sand Body		0.00	0.00
	Total Waste Land		**51.99**	**4.63**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		158.87	14.14
	Barren OB Dump		154.32	13.73
	Back Fill		147.22	13.10
	Coal Dump		20.40	1.82
	Water Filled Qry		7.80	0.69
	Total Mining Area		**488.60**	**43.48**
Settlements	Urban Settlements		160.59	14.29
	Rural Settlements		22.63	2.01
	Industrial Settlements		0.00	0.00
	Total Settlement Area		**183.21**	**16.30**
Water Body	**River/ Ponds**		**14.84**	**1.32**
	Total Area		**1123.79**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 561410027
Subject: Land Reclamation Status of Cluster-IV mines, based on Satellite Data (RS-2/L-IV) of the year 2018	Activity	Name	Designation	Signature	Date
	Prepared	A. Mandal	M.T(Geology)		
	Checked	Hariharalal B	Sr. Mgr(System)		
	Approved	R. Kumar	HOD(Geomatics)		
cmpdi	Scale: 0 0.125 0.25 0.5 0.75 1 Km				Sheet 1
	Drg No. HQ REM 18 2 A4 04				Rev No.0

भारत कोकिंग कोल लिमिटेड
एक मिनी रत्न कम्पनी
(कोल इंडिया लिमिटेड का एक अंग)
उप महाप्रबंधक (पर्यावरण) का कार्यालय
कोयला भवन,कोयला नगर, धनबाद-826005
826005 CIN :
CIN : U10101JH1972GOI000918

Bharat Coking Coal Limited
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
Office of the Dy. GM (Environment)
Koyla Bhawan, Koyla Nagar, Dhanbad -
U10101JH1972GOI000918

पत्रसंख्या: BCCL/KA-IV/GM/19/2323 दिनांक: 14.01.2019

सेवामें,
वन प्रमंडल पदाधिकारी
धनबाद।

Corrigendum

Sub.: **Work Order for the work of "600 nos. bamboo gabion plantation" to DFO, Dhanbad**

Ref:

(i) **Our offer letter no.भाकोकोलि/उपमहाप्रबंधक (पर्या)/संचिका-DFO/16/1211हि०, dt 16.06.2016**
(ii) **Your letter no.503, dated 18.03.2017**

माननीय महोदय,

This has reference to our offer letter no.भाकोकोलि/उपमहाप्रबंधक(पर्या)/संचिका-DFO/16/1211हि०, dated 16.06.2016 and subsequently your letter no.503, dated 18.03.2017, the Competent Authority has approved DFO, Dhanbad for **"600 nos. bamboo gabion plantation""** for a total value of Rs. 12,01,250.00 (Twelve lakhs one thousand two hundred and fifty rupees only) inclusive of additional contingency charges at the rate of 5% for three years. You are required to comply the following terms and conditions in respect of above mentioned work:-

1. The Period of work from the date of acceptance of work order will be 04 years

2. **SCOPE OF WORK**

This work shall be done with the following attributes:

(i) Fully developed / self-sustaining / healthy plantation at the end of project period.
(ii) The plants planted shall be of thick canopy and/or fruit bearing.
(iii) The plantation shall be done at the sites suggested by BCCL Management i.e. at Lakurka siding, new area office, nearby GM bungalow road, in front of AKWMC office road, Around CISF camp and check post, along OB dump near Ramkanali office under katras Area.
(iv) As the plantation is of gabion type, therefore, 100 % survival rate at the end of the project period.

3. Annual Joint Inspection report of the inspection carried out by joint team of Forest Department and BCCL personnel from Katras area & Environment Deptt of BCCL(HQ) should indicate name of the site, date and survival rate. The report shall also have name of species planted for the aforesaid work.

4. The display boards shall be installed at all the plantation sites indicating the no. of plantation, name of site of plantation.

5. All the materials & manpower required with regard to the aforesaid work shall be arranged by you at your own cost.

6. **TERMS OF PAYMENT**

Total project cost is Rs. 12,01,250.00 (Twelve lakhs one thousand two hundred and fifty rupees only) inclusive of additional contingency charges at the rate of 5% for three years.

The payment schedule is as follows: -

S. No	Financial Year	Amount (Rs.)	Remarks
1.	2018-19	5,31,723.21	On the acceptance of the work order
2.	2019-20	2,56,033.26	Submission of utilization certificate of the previous payment made to you in respect of this work order along with the Demand letter for payment.
3.	2020-21	2,06,746.78	Submission of utilization certificate of the previous payment made to you in respect of this work order along with the Demand letter for payment
4.	2021-2022	2,06,746.78	Submission of utilization certificate of the previous payment made to you in respect of this work order along with the Demand letter for payment.
Total		**12,01,250.00**	

7. **Paying Authority:** AFM, Katras Area, BCCL.

8. All the payment will be made by ELECTRONIC MODE through bank in the account of DFO, Dhanbad.

9. For release of the payment, you have to submit the utilization certificate of the previous payment made to you in respect of this work order along with the Demand letter for payment. The utilization certificates shall be accepted by the accepting authority General Manager, Katras Area/Dy GM(ENV).

10. BCCL shall not have any liability in case of any accident etc. towards Forest Department's personnel/ staffs /workers during the execution of the work.

11. Child labour is prohibited under Mines Act, therefore, child labour shall not be deployed in the aforesaid work.

12. All other conditions stipulated in your letter no. 503dated 18.03.2017

14/1/19

General Manager
Katras Area

Copy to:-

1. ES to D (T) OP, BCCL..... for kind information.
2. ES to CVO, BCCL..... for kind information.
3. Prof (Dr.) L.C Singhi, IAS (Retd.), L-31 Third Floor, Kailash Colony, New Delhi-110048.
4. CGM (Environment), CIL, Kolkata.
5. HOD, (Pay)/ In-charge Pay Office, BCCL HQ, Koyla Bhawan, Dhanbad.
6. Master File/Office Copy

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 (2016) Dhanbad District - 1271.60 mm (2016) Normal Rainfall – 1296.30 mm (Source: Rainfall Statistics of India-2016, IMD, Ministry of Earth Sciences)
5	Geological Formations	Gondwana Formation (Talchir Formation, Barakar Formation, Barren Measure & Raniganj Formation)
6	Aquifer System	Top Unconfined/Phreatic Aquifer – average thickness 25 m Semi-confined to confined Aquifer – average thickness 50–200 m
7	Hydrogeological properties	Unconfined Aquifer (Damoda BJ Section & Block-III): Hydraulic Conductivity – upto 0.50 m/day Transmissivity – 10 - 42 m^2/day Semi-confined to confined Aquifer (Sitanala & Kumari Block): Hydraulic Conductivity – 0.0006-1.44 & 0.05-0.0027 m/day Transmissivity – 0.06 – 0.573 m^2/day
8	Groundwater Level Monitoring Network	Out of total 254 no of monitoring stations 64 nos located within core mining area and rest comes within Buffers zone. 60 Nos. of Groundwater monitoring well (Dug Wells) network is established by CMPDI to record groundwater level data in and around the Core Zone of JCF and 4 Nos. of Groundwater monitoring well (Dug Wells) in RCF (CV Area).
9	Groundwater Levels Below Ground Level (bgl)	JCF area: Pre-monsoon – 1.20 to 14.58 m (Avg. 5.55 m bgl) in '2018 Post-monsoon – 0.40 to 07.17 m (Avg. 2.83 m bgl) in '2018 RCF area (part): Pre-monsoon – 2.34 to 8.70 m (Avg. 4.35 m bgl) in '2018 Post-monsoon – 1.75 to 5.70 m (Avg. 2.75 m bgl) in '2018
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 – 77% (GWRE-2013)

1.0 INTRODUCTION

1.1 CLIMATE, TEMPERATURE & RAINFALL

The Jharia Coalfield (JCF) and part of Raniganj Coalfield (RCF) area in Dhanbad District belongs to sub-humid tropical climatic region. The maximum temperature during summer shoots upto 45^{o} C and falls between 10^{o} C to 5^{o} C in winter. The maximum rainfall occurs during the period between June and September.

The annual rainfall in the Dhanbad District is 1271.60 mm (Rainfall Statistics of India-2016, IMD (Ministry of Earth Sciences), has been considered. The non-monsoon rainfall in the District is 93.60 mm (Winter-19.5 mm, Pre-monsoon-48.8 mm and Post-monsoon-25.3 mm) and the monsoon rainfall is 1178.10 mm of total annual rainfall. Monsoon Rainfall is around 92.65% of total annual rainfall in 2016 in Dhanbad District. Rainfall is the primary source of groundwater recharge. 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 to the various coalfield area from Maithon dam, Damodar River, Jamunia River, Topchachi Lake, etc.

2.0 GROUNDWATER SYSTEM

2.1 GEOLOGY OF THE AREA

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

Chanch-Victoria Area which is located in the western part of Raniganj Coalfield. The Raniganj coalfield represents the eastern most coal basin in the Damodar Valley Region and located in Burdwan District, West Bengal. The Coalfield is almost elliptical in shape and covers an area of about 1530 sq. km. out of which only 35 sq. km. comes under leasehold area of BCCL out of which 19.64 sq. km is the study area (Cluster-XVI only). The coal bearing formations of the area belongs to Barakar Formation of the Lower Gondwana.

2.2 HYDROGEOLOGY OF THE STUDY AREA

The permeable formations mainly composed of sandstone behave as aquifer units. The coal seam and shales developed in the area act as impermeable beds i.e. aquiclude. The aquifer materials of Gondwana Formation are constituted of fine to coarse grained sandstone having primary porosity of intergranular void space. The secondary porosity formed due to presence of faults, fracture, joints, etc. Sandstone of Gondwana formations in JCF and RCF are very hard, compact and cemented sandstone and forming less potential aquifer, particularly the deeper aquifer system. The secondary porosity along with primary porosity forms a conduit system making these formations good aquifers for movement and storage of ground water.

2.3 AQUIFER DISPOSITION

The aquifer system for shallow and deeper aquifer has been established through hydrogeological studies, exploration, surface and subsurface geophysical studies in the JCF and RCF (part) covering all geological formations. The aquifer can be divided into two zones – Un-confined/Phreatic (shallow) and Semi-confined to confined (deeper) aquifer.

PHREATIC/UN-CONFINED AQUIFER

The top aquifer occurred above the top most coal seam/shale bed is called un-confined or water table aquifer and it consists of relatively permeable formation such as weathered sandstone and loose soil. The thickness of the un-confined aquifer is varies from few meters to 50 m. This un-confined aquifer is more potential than deep seated semi-confined to confined aquifer.

SEMI-CONFINED TO CONFINED AQUIFER

The semi-confined to confined aquifer consisting of sandstone bed is sandwiched with coal seams/shale beds and multiple aquifer system developed due to presence of multiple numbers of coal seams/shale beds. With the presence of intercalated shale and carbonaceous shale beds and reduction in permeability with depth, the lower aquifers are poor in potential.

2.4 AQUIFER PARAMETERS

PHREATIC/UN-CONFINED AQUIFER – The wells are tested by CMPDI for determination of aquifer parameters in Damuda (BJ Section) and Block-III area of JCF. The hydraulic conductivity of the un-confined aquifer is 0.50 m/day as computed from pumping tests on the wells. The transmissivity of the unconfined aquifer ranges from 10.68 m^2 /day to 41.48 m^2 /day.

SEMI-CONFINED TO CONFINED AQUIFER – Below the un-confined aquifer, the sandstone partings in-between impervious layers of shale and coal seams is designated as semi-confined / confined aquifers. The sandstones in these aquifers are fine to coarse grained, hard and compact with very low porosity. Mostly groundwater occurs in the weak zones formed due to weathering, fracture, faults, which create the secondary porosity. The hydrogeological parameter has been determined by CMPDI in Sitanala Block by conducting aquifer performance test (APT). The hydraulic conductivity (K) of semi-confined aquifer in Barakar Formation ranges from 0.0006 m/day to 1.44 m/day. The hydrogeological parameter has also been determined at Kumari OCP Block in the central JCF by conducting aquifer performance test. The hydraulic conductivity (K) of semi-confined aquifer in Barakar Formation in this area ranges from 0.0027 m/day to 0.05 m/day.

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 2018 of CMPDI monitoring stations (total 66 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
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

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-2018]***		***Average GWL (m)***	
			Pre-monsoon (Apr/May)	***Post-monsoon (Nov/Dec)***	***Pre-monsoon***	***Post-monsoon***
Sedimentary (Gondwana)	Non-mining		1.85-9.65	0.85-3.70	5.47	2.49
	Mining	OC	1.59-10.93	0.45-7.10	5.00	2.57
		UG	1.20-14.58	0.60-7.17	6.52	3.28
Metamorphics	Peripheral part of the Coalfield		0.75-13.68	0.45-8.00	7.12	3.90

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 D Monitoring of Ground Water Levels of Cluster-IV

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

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

4 hydrograph stations (**A-26, A28A, B-64 and B-65A**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of February, April, August & November‘2018 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb’18	Apr’18	Aug’18	Nov’18
1	A-26	Malkhera	4.75	6.23	3.58	3.88
2	A28A	Lakarka	2.22	4.15	2.00	2.51
3	B-64	Keshalpur	1.42	2.15	0.55	1.85
4	B-65A	Jhinjipahari	4.18	10.03	2.10	2.40
Average WL (bgl)			3.14	5.64	2.16	2.66

Ground Water Level (in bgl) varies from 1.42 to 4.75 m during February, 2.15 to 10.03 m during April, 0.55 to 3.58 m during August and 1.85 to 3.88 m during November within the Core Zone of Cluster-IV area.

4.0 GROUNDWATER LEVEL SCENARIO

During the month of February'2018 the depth to water level (in bgl) within 15 nos Cluster of mines varies from 0.50 m to 11.68 m with an average varies from of 1.55 m to 5.39 m. During the month of April'2018 the depth to water level varies from 1.20 m to 14.58 m with an average varies from 3.12 m to 8.50 m. During the month of August'2018 the depth to water level varies from 0.80 m to 6.47 m with an average varies from 0.80 m to 3.73 m. During the month of November'2018 the depth to water level varies from 0.40 m to 7.17 m with an average varies from 1.75 m to 4.26 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 14.58 m during pre-monsoon'2018 and maximum upto 8.50 m during post-monsoon'2018. 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 Patherdih/D-35) 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 (Feb, Apr, Aug & Nov'18)	Formation
1	I	4 nos.	0.75 to 9.65 m	Barakar
2	II	5 nos.	0.90 to 13.68 m	Barakar
3	III	5 nos.	0.40 to 6.63 m	Barakar
4	IV	4 nos.	0.55 to 10.03 m	Barakar
5	V	4 nos.	0.37 to 4.40 m	Barakar
6	VI	2 nos.	0.50 to 4.58 m	Barakar
7	VII	7 nos.	0.45 to 9.35 m	Barakar
8	VIII	4 nos.	1.45 to 10.93 m	Barakar
9	IX	6 nos.	1.08 to 8.60 m	Barakar
10	X	4 nos.	0.45 to 8.40 m	Barakar
11	XI	5 nos.	1.0 to 3.65 m	Barakar & Barren Measure
12	XIII	6 nos.	1.10 to 11.15 m	Raniganj
13	XIV	3 nos.	1.74 to 9.55 m	Raniganj
14	XV	3 nos.	1.27 to 14.58 m	Barakar & Barren Measure
15	XVI	4 nos.	1.20 to 8.70 m	Barakar

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 quarterly (March, May, August and November'2018) 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–VA, VB, VC and VD**.

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

During the month of March, May, August and December'2018:

The pH of the groundwater samples varies between 7.45 to 7.92 in March'18, 7.19 to 8.11 in May'18, 7.71 to 8.23 in August'18 and 7.14 to 8.24 in December'18. The pH is within the ISI limit of drinking water standard.

During the month of March, May, August and December'2018:

The mineral constituents dissolved in water constitute the dissolved solids. The total dissolve solids varies from 188 to 485 mg/l in March'18, from 286 to 566 in May'18, from 320 to 1060 in August'18 and from 132 to 830 in December'2018. The TDS values are above the IS 10500 standards of drinking water.

During the month of March, May, August and December'2018:

During the month of March'18 the alkalinity of the water samples varies from 64 to 132 mg/l and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 30 to 46 mg/l and are within the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 68 to 196 mg/l and the value of total hardness in water samples are within the permissible limit (200 mg/l). The sulphate ranges between 08 to 96 mg/l 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.

During the month of May'18 the alkalinity of the water samples varies from 70 to 188 mg/l and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 29 to 58 mg/l and are within the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 132 to 326 mg/l and the value of total hardness in water samples are ***above*** the permissible limit (200 mg/l). The sulphate ranges between 65 to 180 mg/l 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.

During the month of August'18 the alkalinity of the water samples varies from 45 to 152 mg/l and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 30 to 194 mg/l and are above the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 130 to 740 mg/l and the value of total hardness in water samples are above the permissible limit (200 mg/l). The sulphate ranges between 34 to 228 mg/l and the value of sulphate in water sample are ***slightly above*** the permissible limit (200 mg/l). The Iron (***slightly above the limit***), Copper, Manganese, Lead, Zinc and Chromium concentration in the water samples are found to be below the upper ISI limits for drinking water.

During the month of December'18 the alkalinity of the water samples varies from 112 to 212 mg/l and are ***slightly above*** the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 12 to 28 mg/l and are within the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 286 to 602 mg/l and the value of total hardness in water samples are ***above*** the permissible limit (200 mg/l). The sulphate ranges between 48 to 84 mg/l and the value of sulphate in water sample are within the permissible limit (200 mg/l). The Iron, Manganese (***slightly above the limit***), Copper, 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 DEVELOPMENT

The groundwater is mainly utilized for domestic needs and for irrigation purposes. The groundwater abstraction is mainly through dug wells and bore wells. The stage of groundwater development in Dhanbad District is 77%. The highest stage of development is in Jharia Block (127.0%) & Dhanbad Block (107.50%) and lowest stage of development is in Baliapur Block (78.24%). The Gondwana sandstones in general, are known to constitute good aquifers at many places. However, the yield potential of the area adjoining to active mines in the coal belt is poor. The active mines often act as groundwater "sinks". In contrast, the water logged abandoned mines and pits act as potential sources of groundwater. As per the assessment done by Central Ground Water Board (CGWB), Patna in 2013, the Block wise data of Dhanbad District is given below:

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

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

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

Table No–6: Cluster-wise Groundwater development scenario

Cluster/ Area	Adminis-trative Blocks/Stage Of GW Develo-Pment (SOD)	Total Water demand (Lakh cum/year)				Avg. GW level (bgl in m) 2018		GW level declining trend 2005-2018		Quantity Recharge/ 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	5.11	1.84	YES	YES	NIL
Cluster-II	Baghmara (SOD: Critical)	170.17	Jamunia river	22.55	23.83	6.57	2.84	YES	NO	123.75
Cluster-III		58.18	NIL	2.58	12.65	6.64	2.64	NO	YES	42.95
Cluster-IV		68.84	MADA (Damodar river)	18.47	12.31	5.64	2.66	NO	NO	38.06
Cluster-V		127.29	MADA	77.92	31.02	3.22	2.13	YES	YES	18.35
Cluster-VI	Dhanbad (SOD: Over-exploited)	3.86	MADA (Damodar river)	3.69	0.0	3.60	1.75	YES	YES	NIL (loss due to FF)
Cluster-VII		93.33	MADA	27.70	6.87	4.87	2.50	YES	NO	58.76
Cluster-VIII	Jharia (SOD: Over-exploited)	29.27	MADA	24.04	1.18	6.80	3.71	NO	NO	4.05
Cluster-IX		310.34	MADA	160.28	45.05	5.43	3.33	NO	NO	105.01
Cluster-X		59.38	Damodar river	11.47	0.0	5.36	3.18	YES	NO	47.91
Cluster-XI	Dhanbad (SOD: Over-exploited)	249.67	MADA & DVC	19.86	43.92	3.20	2.16	YES	YES	185.89
Cluster-XIII	Baghmara (SOD: Critical)	64.61	Damodar river	10.09	9.86	6.88	3.97	YES	YES	44.66
Cluster-XIV		NA	NA	NA	NA	8.49	3.49	NO	NO	NA
Cluster-XV		5.11	Jamunia river	0.0	5.11	7.97	4.27	NO	YES	0.0
Cluster-XVI	Nirsa (SOD:Safe)	29.78	DVC (Barakar river)	14.60	6.57	4.34	2.75	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	-	-	**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
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
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
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
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
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
A19		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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

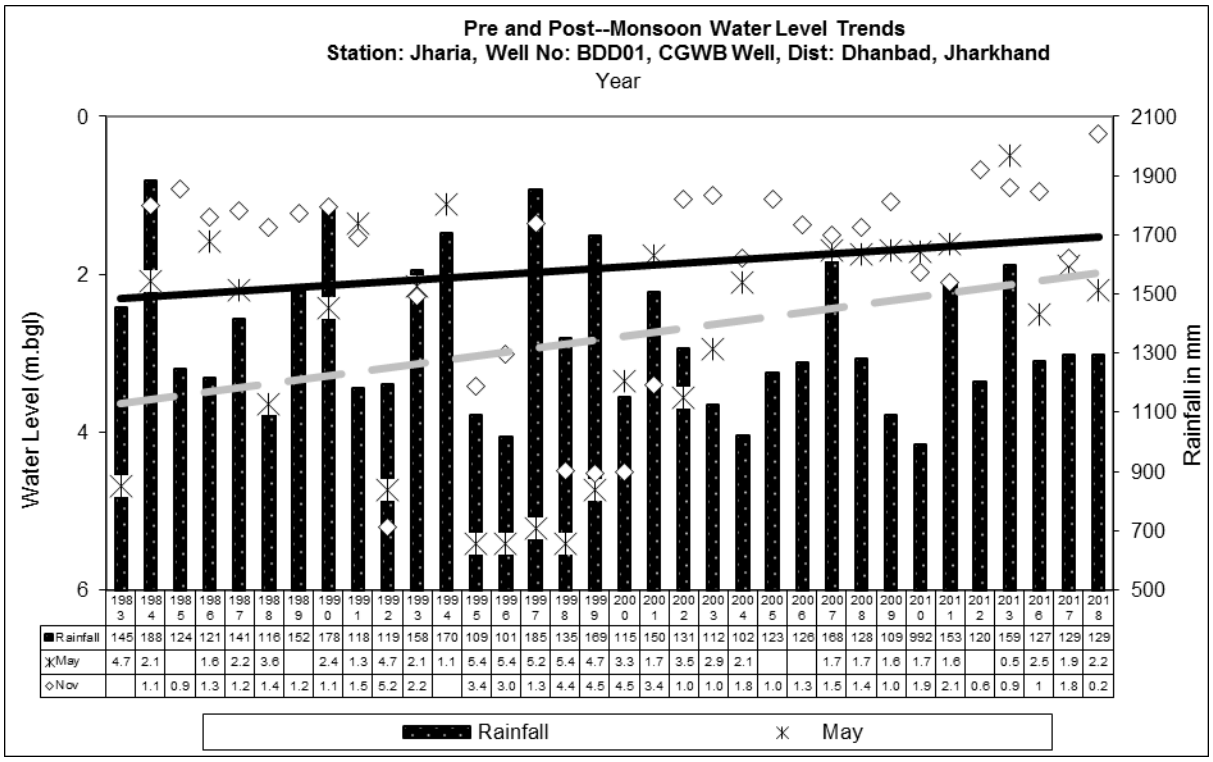
Annexure – IIB

Historical Water Level data of Hydrograph Stations

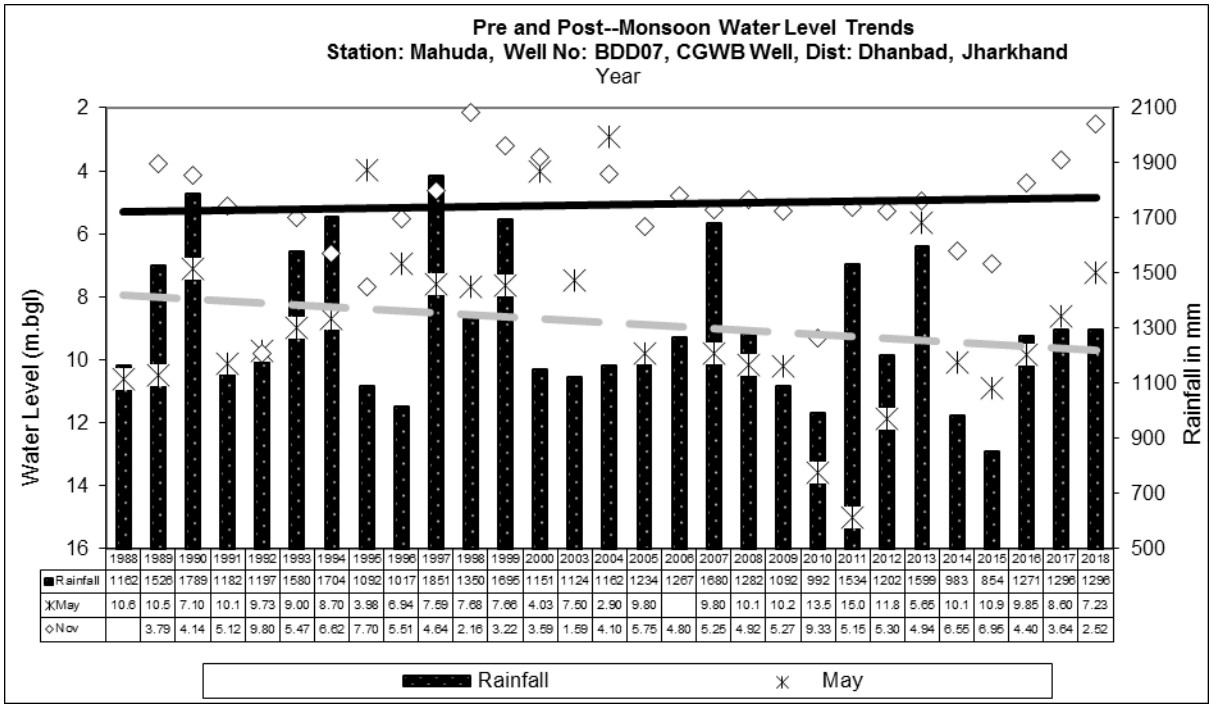
Well No	Water level below ground level (bgl) in meters														
	May, 11	May, 12	Nov, 12	May, 13	Nov, 13	May, 14	Nov, 14	May, 15	Nov, 15	May, 16	Nov, 16	May, 17	Nov, 17	May, 18	Nov, 18
B-64	0.85	1.05	1.00	1.35	0.85	0.7	1.15	1.38	0.95	2.35	0.55	1.25	0.85	2.15	1.85
B65A	9.65	11.45	1.73	10.11	1.82	10.45	2.4	7.82	5.87	7.15	2.68	9.05	1.25	10.03	2.40
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
DB24		-	-	-	8.25	-	8.45	9.52	8.20	10.65	6.50	5.80	3.78	8.25	5.70
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



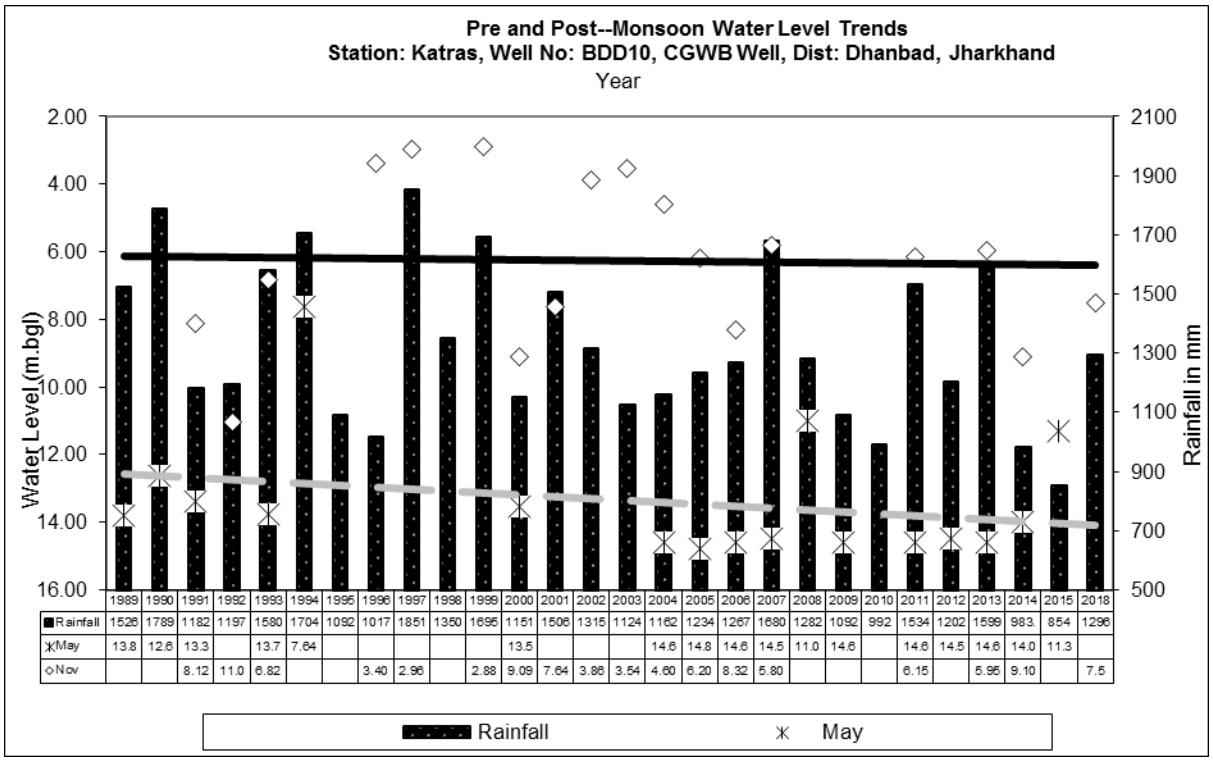
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	145	188	124	121	141	116	152	178	118	119	158	170	109	101	185	135	169	115	150	131	112	102	123	126	168	128	109	992	153	120	159	127	129	129		
May	4.7	2.1		1.6	2.2	3.6		2.4	1.3	4.7	2.1	1.1	5.4	5.4	5.2	5.4	4.7	3.3	1.7	3.5	2.9	2.1			1.7	1.7	1.6	1.7	1.6		0.5	2.5	1.9	2.2		
Nov		1.1	0.9	1.3	1.2	1.4	1.2	1.1	1.5	5.2	2.2		3.4	3.0	1.3	4.4	4.5	4.5	3.4	1.0	1.0	1.8	1.0	1.3	1.5	1.4	1.0	1.9	2.1	0.6	0.9	1	1.8	0.2		



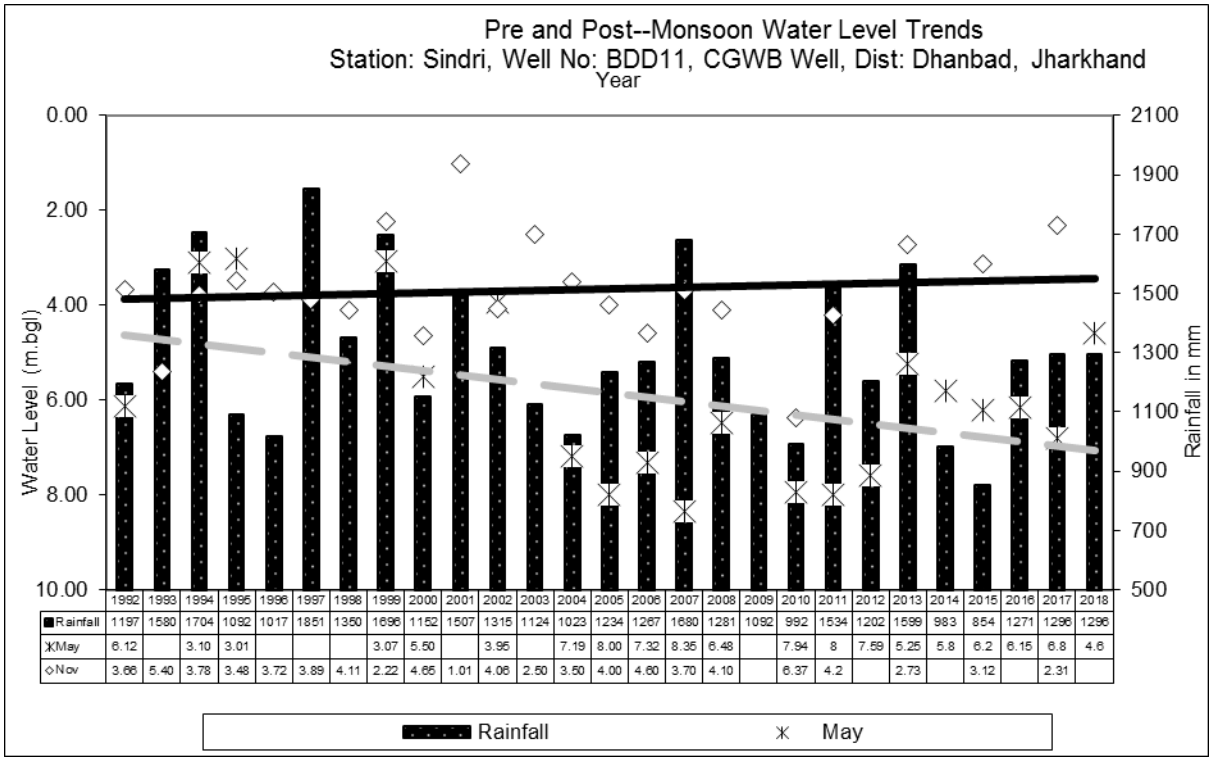
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1162	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	10.6	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: March, May, August & December month of assessment year'2018

Sl No	Name of Cluster	Ground Water Sample	Dug well (CMPDI)	Location	Sampling Date			
					March'18	May'18	Aug'18	Dec'18
1	CLUSTER-I	GW-1	B-15	BERA VILLAGE	08.03.18	30.05.18	16.08.18	10.12.18
2	CLUSTER-II	GW-2	B-59	KHODOVALY VILLAGE	08.03.18	30.05.18	16.08.18	10.12.18
3	CLUSTER-III	GW-3	A-29	GOVINDPUR,AMBAGAN VILLAGE	08.03.18	30.05.18	16.08.18	10.12.18
4	CLUSTER-IV	GW-4	B-63	KESHALPUR, BATIGHAR	08.03.18	30.05.18	16.08.18	10.12.18
5	CLUSTER-V	GW-5	D-30	BORKIBOA VILLAGE	08.03.18	30.05.18	16.08.18	10.12.18
6	CLUSTER-VI	GW-6	D-25	GODHUR MORE	08.03.18	30.05.18	16.08.18	11.12.18
7	CLUSTER-VII	GW-7	D-80	DHANSAR MINE RESCUE STN.	07.03.18	31.05.18	17.08.18	11.12.18
8	CLUSTER-VIII	GW-8	D-49	NEAR GHANOODIH OC	07.03.18	31.05.18	17.08.18	11.12.18
9	CLUSTER-IX	GW-9	D-5	JEALGORA, NEAR P.O.	07.03.18	31.05.18	17.08.18	11.12.18
10	CLUSTER-X	GW-10	D-35	PATHERDIH RLY. COLONY	07.03.18	31.05.18	17.08.18	11.12.18
11	CLUSTER-XI	GW-11	A-32	MONNIDIH BAZAR	08.03.18	30.05.18	18.08.18	10.12.18
12	CLUSTER-XIII	GW-13	A-23	MACHHAYARA	08.03.18	30.05.18	18.08.18	10.12.18
13	CLUSTER-XIV	GW-14	B-23	LOHAPATTI VILLAGE	08.03.18	30.05.18	18.08.18	10.12.18
14	CLUSTER-XV	GW-15	B-32A	MADHUBAND VILLAGE	08.03.18	30.05.18	18.08.18	10.12.18
15	CLUSTER-XVI	GW-16	D-22	DAHIBARI,NICHE BASTI	07.03.18	31.05.18	17.08.18	11.12.18

Annexure – VA

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: March'2018

Stations: 1. Cluster-I (GW-1), Bera Village, Date: 08/03/2018
2. Cluster-II (GW-2), Khodovaly village, Date: 08/03/2018
3. Cluster-III (GW-3), Govindpur, Date: 08/03/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		1	2	3			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	02	03	4.0	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	34	44	30	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	28	34	52	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.43	0.26	0.38	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.12	0.08	0.18	0.06	0.3	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, 22nd 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	6.20	15.20	8.9	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.63	7.45	7.92	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	65.0	82.0	75	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	76.0	84.0	78.0	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	301	442	393	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	156	188	172	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2.0	4.0	3.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VA

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: March'2018

Stations: 4. Cluster-IV (GW-4), Keshalpur Village, Date: 08/03/2018
5. Cluster-V (GW-5), Borkiboa village, Date: 08/03/2018
6. Cluster-VI (GW-6), Godhur, Date: 08/03/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		4	5	6			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	03	03	1.0	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	32	46	34	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	24	38	48	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.19	0.32	0.45	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.14	0.06	0.12	0.06	0.3	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, 22nd 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	14.10	15.10	3.9	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.81	7.69	7.54	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	64.0	78.0	82	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	104	94.0	88.0	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	459	456	485	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	186	168	192	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	4.0	2.0	1.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VA

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: March'2018

Stations: 7. Cluster-VII (GW-7), Dhansar, Date: 07/03/2018
8. Cluster-VIII (GW-8), Ghanudih, Date: 07/03/2018
9. Cluster-IX (GW-9), Jealgora, Date: 07/03/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		7	8	9			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	04	02	4.0	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	42	36	30	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	34	38	52	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.33	0.28	0.16	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.06	0.06	0.08	0.06	0.3	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, 22nd 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	6.70	2.60	12.40	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.49	7.88	7.67	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	8.0	58.0	46	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	98	72.0	86.0	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	396	272	224	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{03}), mg/l, Max	182	168	96	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	3.0	2.0	2.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VA

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: March'2018

Stations: 10. Cluster-X (GW-10), Patherdih, Date: 07/03/2018
11. Cluster-XI (GW-11), Moonidih, Date: 08/03/2018
12. Cluster-XIII (GW-13), Machhayara, Date: 08/03/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		10	11	12			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	03	01	1.0	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	42	38	32	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	24	36	30	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.24	0.31	0.40	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.10	0.06	0.08	0.06	0.3	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, 22nd 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	3.50	4.40	7.90	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.84	7.87	7.72	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	38.0	72.0	62	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{O3}),, mg/l, Max	64	108	124	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	188	344	316	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{O3}), mg/l, Max	68	156	148	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	3.0	2.0	1.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VA

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: March'2018

Stations: 13. Cluster-XIV (GW-14), Lohapatti, Date: 08/03/2018
14. Cluster-XV (GW-15), Madhuband, Date: 08/03/2018
15. Cluster-XVI (GW-16), Dahibari, Date: 07/03/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		13	14	15			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	04	01	05	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	46	40	34	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	42	36	32	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.35	0.17	0.26	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.06	0.16	0.08	0.06	0.3	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, 22nd 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	4.40	1.70	19.70	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.61	7.98	7.80	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	65.0	70.0	96	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	70	92	132	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	290	364	434	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{03}), mg/l, Max	132	174	196	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2.0	1.0	1.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VB

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: May'2018

Stations: 1. Cluster-I (GW-1), Bera Village, Date: 30/05/2018
2. Cluster-II (GW-2), Khodovaly village, Date: 30/05/2018
3. Cluster-III (GW-3), Govindpur, Date: 30/05/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		1	2	3			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	05	04	05	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	35.2	57.6	44.8	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	36	44	102	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.37	0.14	0.94	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	0.02	0.03	0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.07	0.08	0.06	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 22nd 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	7.1	18.30	11.7	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.54	7.19	7.82	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	81	178	90	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	144	104	96	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	312	566	404	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	164	236	196	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2.0	1.0	4.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV.**

Annexure – VB

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: May'2018

Stations: 4. Cluster-IV (GW-4), Keshalpur Village, Date: 30/05/2018
5. Cluster-V (GW-5), Borkiboa village, Date: 30/05/2018
6. Cluster-VI (GW-6), Godhur, Date: 30/05/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		4	5	6			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	04	03	05	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	43.2	41.6	48	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	48	80	72	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.12	0.17	0.38	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	0.02	0.03	0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.06	0.08	0.06	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 22nd 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	13.6	12.80	4.7	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.38	7.21	8.07	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	132	153	172	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	108	92	172	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	470	454	490	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{03}), mg/l, Max	188	180	196	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2.0	1.0	3.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VB

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: May'2018

Stations: 7. Cluster-VII (GW-7), Dhansar, Date: 31/05/2018
8. Cluster-VIII (GW-8), Ghanudih, Date: 31/05/2018
9. Cluster-IX (GW-9), Jealgora, Date: 31/05/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		7	8	9			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	05	04	04	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	41.6	46.4	33.6	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	78	34	46	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	0.003	0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.71	0.31	0.58	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	0.03	0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.19	0.11	0.08	0.06	0.3	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, 22nd 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	8.3	3.7	16.3	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.45	7.92	7.76	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	147	176	107	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	116	112	104	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	418	478	334	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{03}), mg/l, Max	176	184	152	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2.0	2.0	2.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VB

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: May'2018

Stations: 10. Cluster-X (GW-10), Patherdih, Date: 31/05/2018
11. Cluster-XI (GW-11), Moonidih, Date: 30/05/2018
12. Cluster-XIII (GW-13), Machhayara, Date: 30/05/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		10	11	12			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	02	03	03	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	28.8	48	49.6	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	66	44	68	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.64	0.03	0.72	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	0.03	0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.06	0.09	0.21	0.06	0.3	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, 22nd 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	4.8	7.9	6.1	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.33	7.98	8.11	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	78	180	119	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	100	124	188	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	286	488	398	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{03}), mg/l, Max	132	212	192	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	1.0	3.0	1.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VB

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: May'2018

Stations: 13. Cluster-XIV (GW-14), Lohapatti, Date: 30/05/2018
14. Cluster-XV (GW-15), Madhuband, Date: 30/05/2018
15. Cluster-XVI (GW-16), Dahibari, Date: 31/05/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		13	14	15			
1	Boron (as B), mg/l, Max	<0.20	<0.20	<0.20	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	04	01	05	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	46	40	34	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	42	36	32	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.35	0.17	0.26	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	<0.06	0.16	0.08	0.06	0.3	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, 22nd 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	4.4	1.7	19.7	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.61	7.98	7.80	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	65	70	96	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	70	92	132	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	290	364	434	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{03}), mg/l, Max	132	174	196	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2.0	1.0	3.0	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VC

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: August'2018

Stations: 1. Cluster-I (GW-1), Bera Village, Date: 16/08/2018
2. Cluster-II (GW-2), Khodovaly village, Date: 16/08/2018
3. Cluster-III (GW-3), Govindpur, Date: 16/08/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		1	2	3			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	12	1	16	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	43.2	40	52.8	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	24	26	20	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	0.02	0.03	0.03	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.27	0.19	0.24	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.32	<0.06	0.18	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	0.02	0.005	<0.005	0.005	0.01	APHA, 22nd 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	3.86	0.21	3.81	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.16	8.13	8.15	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	40	34	47	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	118	145	140	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	0.1	0.1	0.1	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	156	142	154	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	134	134	130	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2	1	2	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VC

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: August'2018

Stations: 4. Cluster-IV (GW-4), Keshalpur Village, Date: 16/08/2018
5. Cluster-V (GW-5), Borkiboa village, Date: 16/08/2018
6. Cluster-VI (GW-6), Godhur, Date: 16/08/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		4	5	6			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	3	4	4	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	40	177.6	59.2	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	24	104	30	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	0.02	0.02	0.02	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.22	0.53	0.15	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	<0.06	0.01	<0.06	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	0.01	0.009	0.008	0.005	0.01	APHA, 22nd 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	0.40	4.83	7.50	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.12	7.73	8.07	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	40	228	85	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	152	95	105	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	0.1	0.1	0.2	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	144	830	204	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{03}), mg/l, Max	130	740	192	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	1	<1	<1	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VC

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: August'2018

Stations: 7. Cluster-VII (GW-7), Dhansar, Date: 17/08/2018
8. Cluster-VIII (GW-8), Ghanudih, Date: 17/08/2018
9. Cluster-IX (GW-9), Jealgora, Date: 17/08/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		7	8	9			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	6	16	5	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	68.8	49.6	163.2	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	34	20	88	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	0.04	0.04	0.005	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.18	0.20	0.66	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.08	0.08	0.12	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	0.005	0.006	0.005	0.01	APHA, 22nd 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	39.70	4.55	4.87	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.19	8.23	7.71	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	84	48	225	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	45	135	90	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	0.1	0.1	0.2	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	226	140	782	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	144	134	732	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	1	1	1	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	0.16	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VC

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: August'2018

Stations: 10. Cluster-X (GW-10), Patherdih, Date: 17/08/2018
11. Cluster-XI (GW-11), Moonidih, Date: 16/08/2018
12. Cluster-XIII (GW-13), Machhayara, Date: 16/08/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		10	11	12			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	5	3	3	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	49.6	30.4	187.2	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	58	28	96	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	0.005	0.005	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.31	0.24	0.58	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.08	0.12	0.12	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	0.02	0.01	<0.005	0.005	0.01	APHA, 22nd 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	7.07	0.90	4.88	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.02	8.15	7.88	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	225	93	39	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	102	147	95	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	0.2	0.1	0.1	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	220	132	792	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	202	126	722	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	<1	<1	1	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VC

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: August'2018

Stations: 13. Cluster-XIV (GW-14), Lohapatti, Date: 16/08/2018
14. Cluster-XV (GW-15), Madhuband, Date: 16/08/2018
15. Cluster-XVI (GW-16), Dahibari, Date: 17/08/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		13	14	15			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	7	3	4	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	51.2	193.6	115.2	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	46	98	64	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	0.02	0.02	0.005	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.32	0.61	0.44	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	<0.06	<0.06	0.08	0.06	0.3	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, 22nd 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	5.74	5.16	43.57	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.78	8.05	8.06	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	81	226	144	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	107	102	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/ 37:1988 R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	0.04	0.1	0.1	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	210	776	552	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	200	710	584	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	1	<1	<1	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VD

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: December'2018

Stations: 1. Cluster-I (GW-1), Bera Village, Date: 10/12/2018
2. Cluster-II (GW-2), Khodovaly village, Date: 10/12/2018
3. Cluster-III (GW-3), Govindpur, Date: 10/12/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		1	2	3			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	3	2	4	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	24	12	16	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	28	20	22	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.28	0.16	0.62	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.47	0.11	<0.06	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 22nd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	0.38	0.02	<0.02	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	12.8	15.6	14.4	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.19	8.21	8.11	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	64	48	56	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	112	185	178	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	612	720	686	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	432	518	408	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	3	3	1	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	0.08	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VD

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: December'2018

Stations: 4. Cluster-IV (GW-4), Keshalpur Village, Date: 10/12/2018
5. Cluster-V (GW-5), Borkiboa village, Date: 10/12/2018
6. Cluster-VI (GW-6), Godhur, Date: 11/12/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		4	5	6			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	4	2	3	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	20	16	28	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	26	24	34	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.33	0.29	0.18	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.5	<0.06	0.47	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	0.009	<0.005	0.005	0.01	APHA, 22nd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	0.08	<0.02	0.13	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	22.6	10.4	16.7	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.08	8.12	7.96	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	68	56	84	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{O3}),, mg/l, Max	165	212	190	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	832	764	592	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{O3}), mg/l, Max	532	602	338	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	5	4	1	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VD

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: December'2018

Stations: 7. Cluster-VII (GW-7), Dhansar, Date: 11/12/2018
8. Cluster-VIII (GW-8), Ghanudih, Date: 11/12/2018
9. Cluster-IX (GW-9), Jealgora, Date: 11/12/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		7	8	9			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	1	1	4	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	12	16	12	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	36	26	24	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.18	0.25	0.17	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	<0.06	<0.06	<0.06	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 22nd 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	17.8	14.4	20.8	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.67	8.05	7.46	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	56	78	62	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{O3}),, mg/l, Max	176	192	201	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	938	664	704	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{O3}), mg/l, Max	528	420	386	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2	2	2	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VD

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: December'2018

Stations: 10. Cluster-X (GW-10), Patherdih, Date: 11/12/2018
11. Cluster-XI (GW-11), Moonidih, Date: 10/12/2018
12. Cluster-XIII (GW-13), Machhayara, Date: 10/12/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		10	11	12			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	3	3	2	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	12	24	16	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	32	26	34	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.26	0.44	0.19	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	<0.06	<0.06	0.11	0.06	0.3	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, 22nd 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	12.7	18.1	19.6	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.01	8.17	8.19	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	61	57	65	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	148	169	188	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	556	804	728	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	286	536	444	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	1	3	4	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

*Sampling location details and sampling date has been given in **Annexure-IV**.

Annexure – VD

GROUNDWATER QUALITY DATA (DUG WELLS)
Month: December'2018

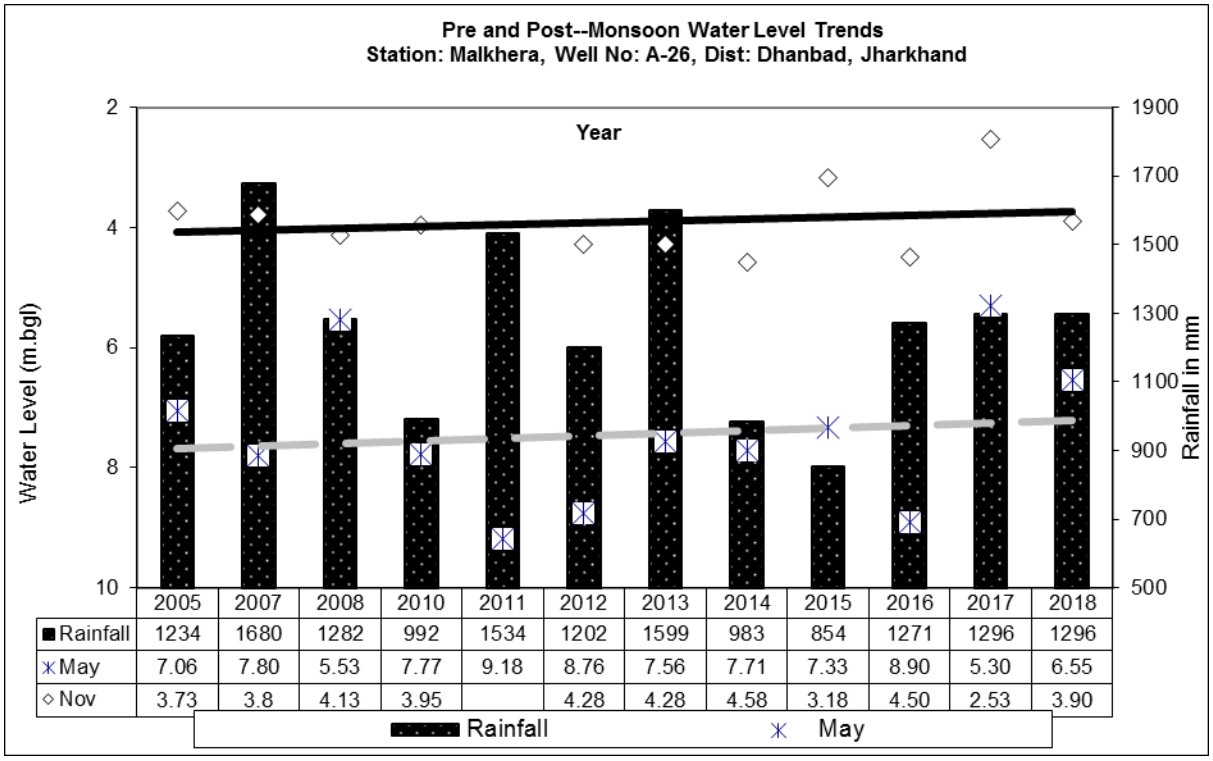
Stations: 13. Cluster-XIV (GW-14), Lohapatti, Date: 10/12/2018
14. Cluster-XV (GW-15), Madhuband, Date: 10/12/2018
15. Cluster-XVI (GW-16), Dahibari, Date: 11/12/2018

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		13	14	15			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.20	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	4	4	3	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	20	16	12	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	18	26	30	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.001	<0.001	<0.001	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.37	0.31	0.43	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	0.14	<0.06	<0.06	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 22nd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	0.22	0.08	0.14	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	9.6	13.6	11.4	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	8.24	7.98	7.14	0.2	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, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	APHA, 22nd Edition, AAS-GTA
16	Sulphate (as SO_4) mg/l, Max	72	52	65	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Acceptable	Acceptable	Qualitat-ive	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	147	172	196	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	638	704	802	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_ac_{03}), mg/l, Max	308	416	556	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2	1	4	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	<0.01	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l max	<0.005	<0.005	<0.005	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

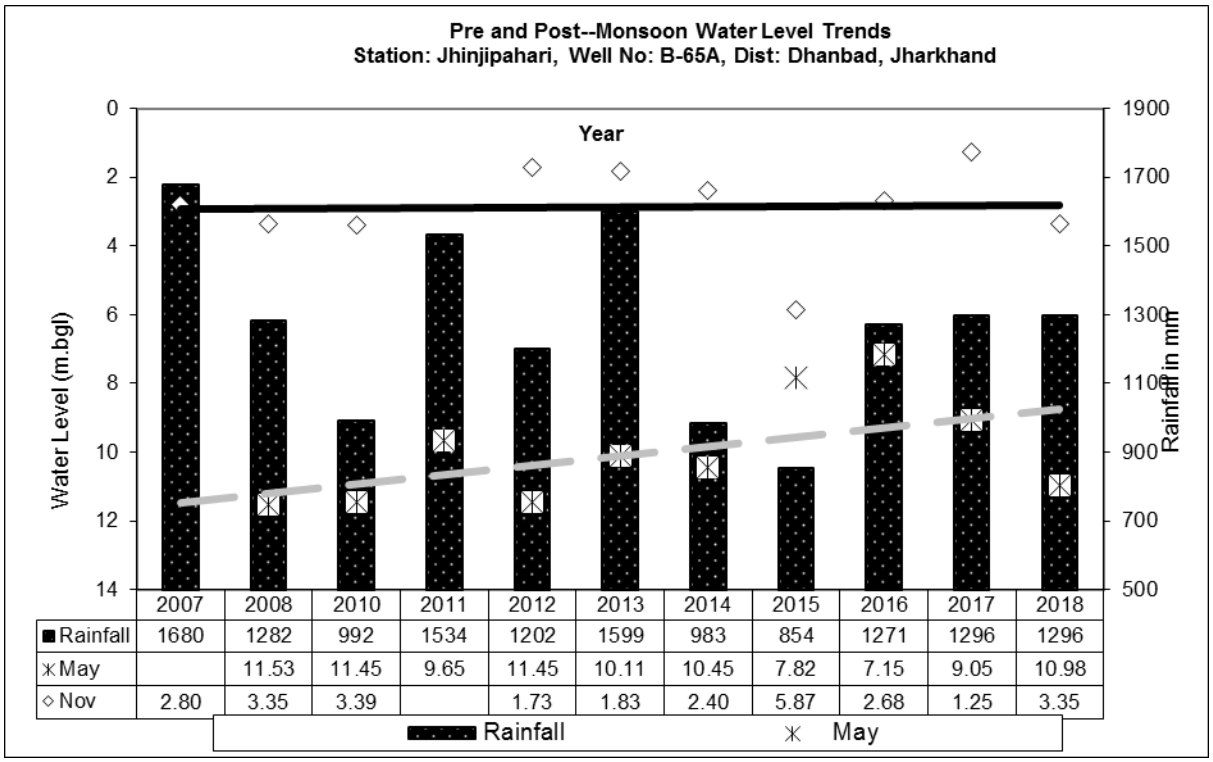
*Sampling location details and sampling date has been given in **Annexure-I**

Annexure – VI

HYDROGRAPHS OF CLUSTER-IV



	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1296
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
Nov	3.73	3.8	4.13	3.95		4.28	4.28	4.58	3.18	4.50	2.53	3.90



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

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

भारत कोकिंग कोल लिमिटेड

(कोल इंडिया लिमिटेड का 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

NIT Ref. No.: BCCL/CED/TC/eNIT-20/2018-19/ 1098 Date: 14.02.2019

E – Tender Notice

Open E-Tender invited vide BCCL/CED/TC/eNIT-20/2018-19/ dated: 14.02.2019, for the work of "Drilling for establishment of 23 nos. Piezohetric wells for cluster of mines of BCCL Command Area for Ground Water Monitoring."

Estimated cost: ₹ 48,93,151.75 **EMD: ₹ 61,200.00** **Period of Work: 180 days**

The tender documents can be downloaded from **01.03.2019 to 12.03.2019**. All prospective bidders are advised to visit website **https://coalindiatenders.nic.in** for further details and to participate against this tender. Full details of this tender are also available on website **"eprocure.gov.in"**.

(Shiv Raj)
Asst. Manager (Civil), TC

Copy to:-

1) CVO, D.(T), P&P, D.(P), BCCL ——— for kind information.
2) Prof (Dr.) L.C Singhi, IAS (Retd.), L-21, Third Floor, Kailash Colony, New Delhi-110048
3) Shri Pramod Deepak Sadhalar, IAS (Retd.), A-002, Sicilar Part Apartments, C-58,24 Sector-62, Noida (UP) - 201301
4) CGMs/GMs of all Areas of BCCL
5) GM (Systems), Koyla Bhawan
6) General Manager (Civil), CSD HQ
7) HOD (Elect.), BCCL, Koyla Bhawan
8) HOD (Finance), Pay Section, Koyla Bhawan
9) Builders Association of India, Central Akashkinnree Kunta, Katras Garh, Dhanbad-828113.
10) PRO, BCCL – with 5 copies for wide publication of the following abridged NIT in News Paper
   - put BCCL notice **on or before 01.03.2019.**
11) Notice Board

Site identification report for

“Source apportionment of ambient air particulate matter in Jharia coalfields region, Jharkhand”

Sponsor

Bharat Coking Coal Limited (BCCL)

CSIR-National Environmental
Engineering Research Institute, Nagpur

Report summary:

This report has been prepared by CSIR-NEERI for BCCL for the sponsored project on "Source apportionment of ambient air particulate matter in Jharia coalfields region, Jharkand". According to the agreed terms, the PM monitoring sites in the Jharia-coalfield needs to be identified to commence the project activities. Hence, the NEERI team has visited BCCL's 15 coal clusters in the coalfields of Jharia for 3 complete days with assistance from BCCL's team. Based on the visit to mines and initial reconnaissance survey, the tentative PM monitoring sites have been identified and presented in this report. This study has been taken-up under the MoU signed between CIL & NEERI, which is extended to all subsidiaries of CIL.

1. Project Background:

Bharat Coking Coal Limited, a subsidiary of Coal India Limited, has been operating majority of the coal mines in the Jharia coal field regions since its inception in 1972. Jharia coalmines are special for its low ash content and high calorific value coals. Therefore, they are often used directly in iron and steel plants for metal oxide reduction after washing. Although these coal mines are highly priced for their high quality coal, they are notorious for their mine fires, which causes lot of fugitive gaseous and PM emissions. Hence, Jharia region has been under scrutiny by various public authorities and common public with a vision to improve the ambient air quality.

Various sources contribute to high particular matter concentration in the Jharia region: vehicles, mining activities, re-suspended dusts, fugitive emissions, fuel oils, household LPGs, etc. The percentage contribution of these factors in the ambient depends exclusively on the economic activities of that particular region. In order to improve the existing ambient air quality, the major sources of PM emissions first need to be identified. Hence, the environmental clearance committee of MoEF has directed BCCL to conduct a source apportionment study for particulate matter. In this context, BCCL has approached CSIR-NEERI to conduct a source apportionment study of ambient air particulate matter in Jharia coalfields region in order to quantify the various sources PM emissions and suggest an effective environmental management plan.

2. Project objectives

The major objective of the study is to assess the current ambient air quality, sources of air pollution and propose the priorities for the actions for improvement of air quality. The study

to include the entire Jharia Coalfield along with area up to 10 Km from the periphery / boundary of BCCL mines.

The detailed objectives are as following:

i. Ambient Air Monitoring related

- Monitoring of ambient air quality at selected receptor locations for pollutants including PM10, PM 2.5(limited), SO2, NOx, PAHs to establish the status of the air quality in Jharia Coalfields along with area up to 10 K.M from the periphery/boundary of BCCL mines. Also, review of the available air quality monitoring data from Central Pollution Control Board (CPCB) /Jharkhand State Pollution Control Board (JSPCB).
- To calibrate dispersion modelling predictions using measured air quality parameters
- To draw supportive data through specific site related monitoring regarding impact causing sources such as kerbside monitoring.
- To establish the impact of meteorological conditions on a few select indicator pollutants in different micro meteorological conditions of the Jharia Coalfields.

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

- To identify the pollution load grid wise for point, line and area source
- To establish possibilities of receptor level concentrations of air pollutants by matching dispersion modelling and air quality-monitoring data.

iii. Source apportionment related

- To identify and apportion the pollution load at receptor level to various sources in the Jharia Coalfields along with area up to 10 Km from the periphery / boundary of BCCL mines.
- To carry out the source apportionment using molecular markers for a limited number of samples through a time resolved sample collection at various period of the day and day-of-the-week.

iv. Any other item in consensus between both BCCL/CIL & NEERI evolved during the study

3. Field visit:

In connection with the above objectives, the NEERI's team and BCCL's team visited BCCL's Jharia coal filed for 3 days from 23 September to 27 September 2018. The NEERI's team includes Dr. Anibun Middey (Scientist) and Er. Praveen Siluvai Antony (Scientist). The BCCL's team includes Mrs. Mariya Ahsan (Assistant Manager, environment), Mr. Amartanshu Srivastav (Assistant Manager, environment), and Mr. Adarsh (Assistant Manager, environment). The team covered the entire Jharia coalfield, which spans roughly 30km in length and 22 km wide in three days with the following purpose.

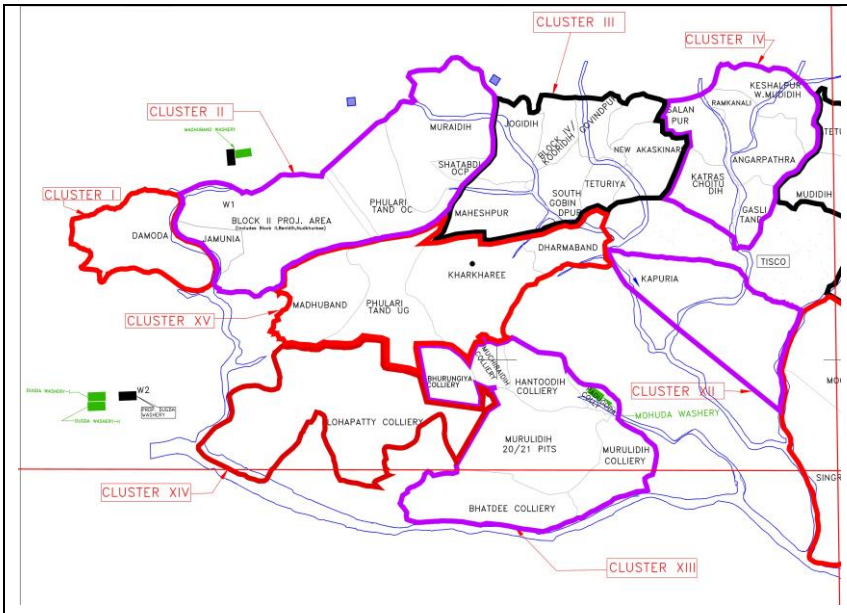
- To determine the probable sources of particulate matter for source apportionment study
- To visit the already existing PM monitoring site of BCCL
- To tentatively identify PM sampling sites for NEERI based on point, area and line sources
- To initiate the project after the initial study.

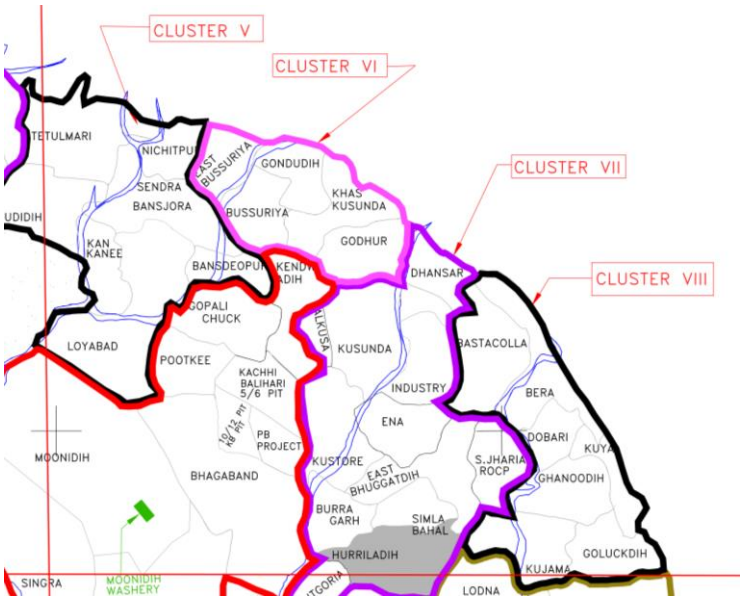
Apart from the site visit, two official meetings were arranged with Dr. E. V. Raju (HOD/Deputy GM, Environment, BCCL) and Dr. Hemant Hazarika (Regional Officer, MoEF&CC) to clearly delineate the purpose of this project and the detail outcomes envisaged are listed below.

- ✓ To identify the sources of Particulate Matter (PM 10) in the Jharia region
- ✓ To find the emission hotspots (e.g. Coal mining, Vehicle, etc.)
- ✓ Detail emission load from various sources

Jhari coalfield maps:

BCCL environmental department provided the map of the Jharia region. The site visit was carried out with assistance from BCCL's team. The 15 Jharia mines coal fields were segregated into three parts and details of the visit along with mine cluster names are given in Table 1.





Day 1:

Cluster VI, VII, VIII, and X

Day 2: I, II,III, IV, V, XI, XII, XIII, and XV

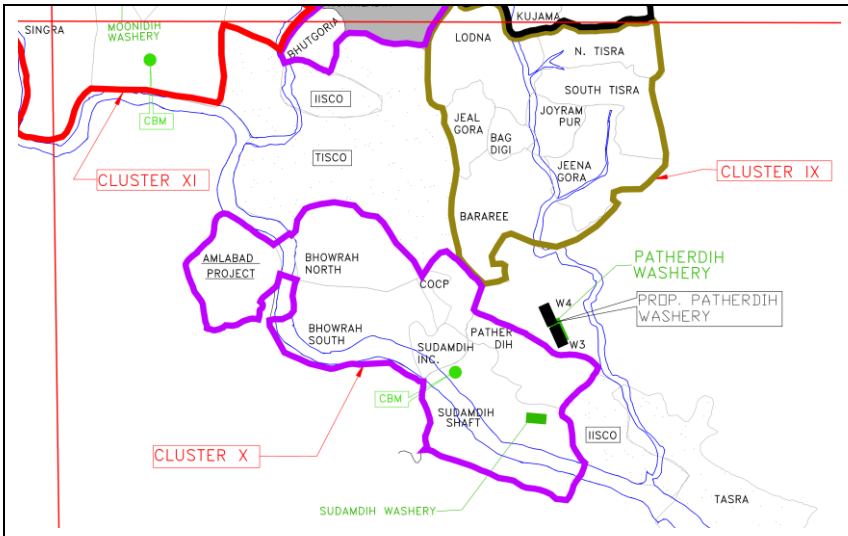
	**Day 3:** Cluster IX

Table 1 Jharia coalfields Site visit on cluster-basis

Mine visit pictures:

Based on the objectives and outcomes envisaged, the various mine areas were visited to identify sources of emissions such dumpsite emissions, fugitive emissions, blasting emissions. Furthermore, the already existing PM monitoring sites of BCCL were also visited to explore of possibility of installing NEERI's PM monitoring stations.

	
1. Fugitive emissions from coking of coal by localities	2. Dousing the fugitive emissions in the coal storage units

 3. Underground mining station at BCCL Cluster V.	 4. Air quality-monitoring stations of BCCL Cluster III.
 5. NEERI and BCCL team at Coal Handling Plant (CHP) at cluster II.	 6. Overburden Dump at Cluster II.
 7. Non-working mine at Cluster I.	

Table 2 Picture from various mines of Jharia coalfield

5. Site Identification:

The Entire Jharia Coal Field (JCF) is divided into 16 clusters. Both opencast and underground mines are operational in JCF. Standard mining operations like drilling, blasting, hauling, accumulation, and transfer are the major sources of emissions and air pollution. Apart from that, a typical emission source, mine fire, is prevailing at JCF. Besides, JCF encompasses large non-mining regions, which have their own emission sources like vehicular emission in congested traffics, road dust, Power Plant emission, other industrial emissions (coke oven plants, brick kilns, stone crushers, etc.), crematoria, domesting burning, open burning etc.

Based on preliminary field visit by NEERI Scientists along with BCCL staffs, the following locations are selected for the establishment of Air Quality Monitoring Stations for source apportionment study;

Core Zone

1. In Cluster I (Damuda) or Cluster XIV (Lohapatty) – nearby sources: Chandrapura Thermal Power Plant

2. In Cluster VII (Kusunda)- nearby sources: Coal Mine, Industry

3. Cluster IV or Cluster V – Banssuriya or Katras

4. Cluster IX (Lodhna)

5. Cluster XI (Moonidih)

6. Cluster X (Patherdih): nearby sources: Coal Mine, Steel Industry

7. Cluster VIII (Bastacolla)

Buffer Zone

8. Bank More

9. Harina

10. Bhuli

11. Sindri

12. Parbatpur Electrosteel/ Bhaga

13. Background site (Upwind & away from sources) and also secondary Data from DVC, CCL mines Sail Bokaro and Jharkhand pollution Control Board will be obtained.

Above selected locations are tentative and based on the initial site visit. The exact locations of instrument installation are subjected to availabality of secure place, power connection, safety etc. and will be finalised by discussing with BCCL officials on spot.

Monitoring Approach:

The present study of source apportionment at Jharia Coal Field (JCF) will be carried out using two distinct approaches. The first approach deals with field monitoring and chemical characterization of particulate matter samples followed by receptor modelling to derive source contributions. The second approach covers source specific emission inventory with meteorological condition as input to dispersion modelling to simulate pollutant concentrations.

The following approach will be adopted;

- Comprehensive exercise of air quality monitoring will be carried out for two seasons at 13 locations. The sites will cover kerbside, industrial, commercial, residential and background which has different sources of activity.
- Chemical speciation of particulate matter collected on filter paper will be analysed for various categories like ions, elements, carbon fraction etc.
- Receptor modelling using USEPA's CMB 8.2
- Source specific emission inventory for point, area, line. Primary surveys and secondary data from various reliable agencies and Govt. or semi-Govt. bodies in coordination with BCCL.
- Simulation of air quality through dispersion modelling (USEPA's AERMOD).

Study to Analyze the Extent of Reduction of Pollution Load Every Year by reducing Coal Transportation by Road

CLUSTER IV GROUP OF MINES

(Amalgamated Keshalpur and West Mudidih (Mixed), Amalgamated Angarpathra Ramkanali (UG), Katras Choitudih (OC) Salanpur (Mixed) and Gaslitand (OC))

Normative Production : 2.851MTPA
Peak Production : 3.706 MTPA
Lease Hold Area : 1123.79 Ha

Bharat Coking Coal Limited

(March, 2017)

Prepared by

Environment Division

Central Mine Planning & Design Institute Limited

CMPDI (HQ)

Gondwana Place

Kanke Road, Ranchi-834008

CONTENTS

Chapter – I

Introduction

1.1 Genesis:

MOEF provided Environmental Clearance to the various mines of the Cluster – IV vide letter No.. J-11015/212 /2010-IA.II (M) Dated: 6th February, 2013.

As per the Environmental Clearance Conditions given by the Ministry of Environment & Forest Clause No. (xvii)- "A study should be initiated to analyse extent of reduction in pollution load every year by reducing road transport of coal". Therefore the present study has been carried out to quantify the pollution load due to coal transportation.

1.2 Methodology:

In order to find out the pollution load due to coal transportation a Questionnaire was developed by the Environment Division of CMPDI Headquarter and Regional Institute –II, Dhanbad. The Questionnaire was circulated to the various mines of BCCL for collection of the requisite inputs for this study. The quantification of pollution load for PM-10 has been carried out on the basis of the field visit, data provided by BCCL officials and interaction with them.

1.3 General Information about Cluster – IV group of mines:

1.3.1 Brief Description:

Cluster-IV group of mines of BCCL is a group of five mines consisting of opencast and underground mines of the Bharat Coking Coal Limited in the Dhanbad District of Jharkhand state. BCCL is the proponent of the cluster and it is under the administrative control of Coal India Limited. All the mines in the cluster are taken over mine from their owner after Nationalization and were reorganized to form five mines. The five mines have been clustered to form Cluster-IV mines of Bharat Coking Coal Limited under the 'Cluster Concept' approved by MoEF.

1.3.2 Nature and Size of the Cluster:

The Cluster IV consists of two mixed mines (UG & OC), two UG mines and one closed mine proposed to be worked out by opencast mine.

The details of the mines showing normative/ peak productions, lease hold areas and life are given in Table no. 1.1.

Table 1.1: Details of the Mines of Cluster – IV

Name of Mine	Production (MTY)		Leasehold Area (ha)
	Normative	Peak	
Salanpur Colliery	0.15	0.195	177.49
Katras Choitudih Colliery	0.22	0.286	228.00
West Mudidih Colliery & Keshalpur Colliery	2.19	2.847	325.00
Angarpathra Colliery & Ramkanali colliery	0.291	0.378	254.64
Gaslitand Colliery	0.00	0.00	138.66
Total	**2.851**	**3.706**	**1123.79**

1.3.3 Impact of Fire Control on Ambient Air Quality:

A total of 358270 Sq, M area is under active fire in Cluster IV. It will be tackled by digging out burning coal and quenching fire at a total cost of Rs 34.99 Crores. Coal recovered will be sent to the consumers. In – situ mine fire generates dust and other pollutants. The fire control will lead to reduction of pollution load and improvement of background pollution level.

1.3.4 Impact of Resettlement on Ambient Air Quality:

A total of 7012 nos. of households will be shifted for implementation of Jharia Action Plan (JAP) for which a sum of Rs.26274.00 lakhs has been sanctioned. The reduction in number of households within the leasehold area of Cluster IV will lead to reduction in generation of air pollutants due to reduction in movement of man & materials apart from decrease in consumption of coal as a domestic fuel.

1.4 Meteorological Data

A meteorological data generated during 1st January 16 to 31st March 2016 has been presented in this report .The micro meteorological set up was established at the roof of BCCL Dugda Guest house and parameters like temperature, relative humidity, wind speed and directions, cloud cover and rainfall were recorded. The data were collected on hourly basis during the entire study period.

Generally, moderate winds prevailed throughout the study period. The wind velocity ranged between ≤ 0.5 m/s to 13.2 m/s. The seasonal average wind speed was observed to be 0.69 m/s. Wind-roses were made by using latest WRPLOT View of Lakes Environmental Software.

The analysis of wind pattern during the season showed that the predominant wind directions were from North-West & West followed by North-East having frequencies 15.71%, 11.45% & 4.67% respectively. The receptors located in the Downwind directions i.e. SE and East from the dust generating sources are likely to be affected. The dispersion of air borne dust during calm period (45% of time) will be very poor and buildup of pollutant concentration during this period will occur.

The maximum temperature recorded was 39.3^{0}C and the minimum was 6.2^{0}C. The daily average relative humidity values were in the range of 32.2 to 65.0%. The sky was mostly clear during the study period. The average atmospheric pressure value has been found to be around 732.3 mm Hg. Total 94.5mm rainfall was recorded during the study period. The average rainfall during the season was found to be 1.04 mm.

Table 1.2: SEASONAL WIND DISTRIBUTION
Period: 01st JAN.'2016 – 31st MAR.'2016

Wind Direction	Wind Velocity (m/s) & Duration (%)				
	< 0.5	0.6 -1.5	1.6 -3.5	>3.5	Total
N		1.61	0.78	0.00	2.38
NNE		0.83	0.37	0.00	1.19

Wind Direction	Wind Velocity (m/s) & Duration (%)				
	< 0.5	0.6 -1.5	1.6 -3.5	>3.5	Total
NE		3.17	1.47	0.05	4.67
ENE		0.41	0.14	0.00	0.55
E		1.10	0.69	0.00	1.79
ESE		0.50	0.37	0.00	0.87
SE		1.28	0.41	0.05	1.74
SSE		0.64	0.18	0.00	0.82
S		0.41	0.09	0.00	0.50
SSW		0.28	0.05	0.00	0.32
SW		2.29	0.60	0.00	2.88
WSW		1.06	0.41	0.00	1.47
W		8.99	2.48	0.00	11.45
WNW		1.24	1.01	0.00	2.24
NW		11.47	4.22	0.05	15.71
NNW		2.11	0.73	0.00	2.84
CALM	48.40	-	-	-	48.40
Total	48.40	37.32	13.97	0.15	100

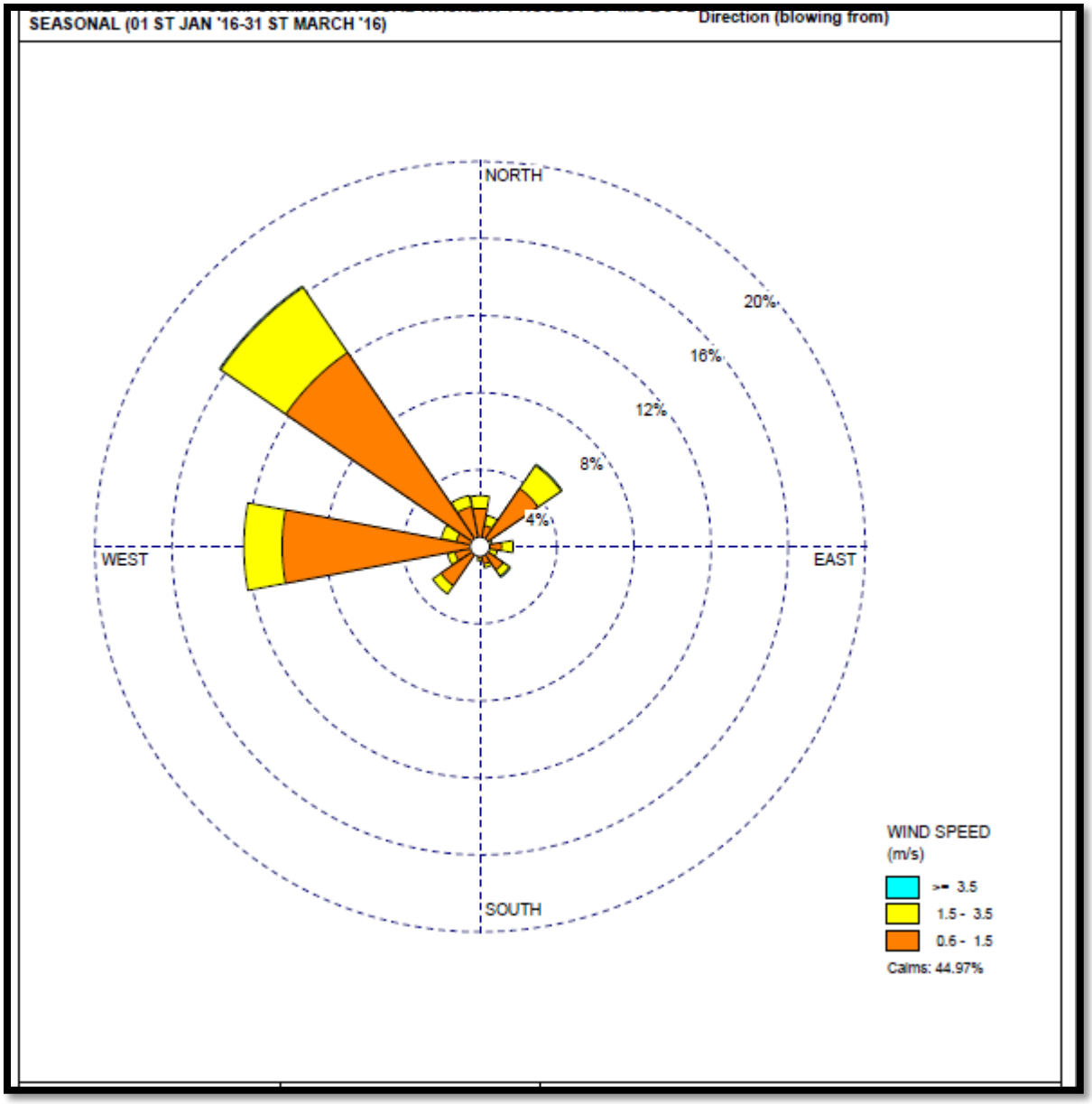


Figure No.-1.1 Wind Rose diagram for the period 1St Jan to 31St March 2016

Chapter – II

Fugitive Dust Generation Due To Movement of Coal

2.1 Introduction

The coal produced by the five mines within the Cluster IV moves to the consumers via Road & Rail. Coal from the mine face is brought to the surface dumps and bulk of it goes to the nearby railway sidings for further movement to the consumer- end through rail. The journey from the mine face to the railway siding is covered by road. A portion of the coal produced by the mine directly goes to the consumers via road. Transportation of coal by rail is an environmentally better option than the road transportation. Road Transportation results in generation of fugitive dust from road surface apart from other pollutants released due to consumption of Diesel.

The fugitive dust generated due to coal transportation through road depend upon the following factors:

1. Speed and Weight of the moving vehicles.
2. Silt Content of the Road Dust (Particles less than 200 mesh size is considered as silt)
3. Silt loading of the road dust (Kg/m^2).
4. Moisture Content of the dust lying on the road surface.
5. Ambient Temperature, Humidity & wind velocity.

The dust generation will be lower if the quantity of dust (silt loading) lying on the road surface is minimum and the moisture content of the loose material lying on the road surface is high.

2.2 Movement of Coal

Distance travelled by coal and subsequent release of fugitive dust during its journey towards the consumer end for different mines of the cluster – IV has been described and dust load has been worked out for the year 2013-14, 2014-15 and 2015-16.

2.2.1 Amalgamated Keshalpur and West Mudidih Colliery (AKWMC) :

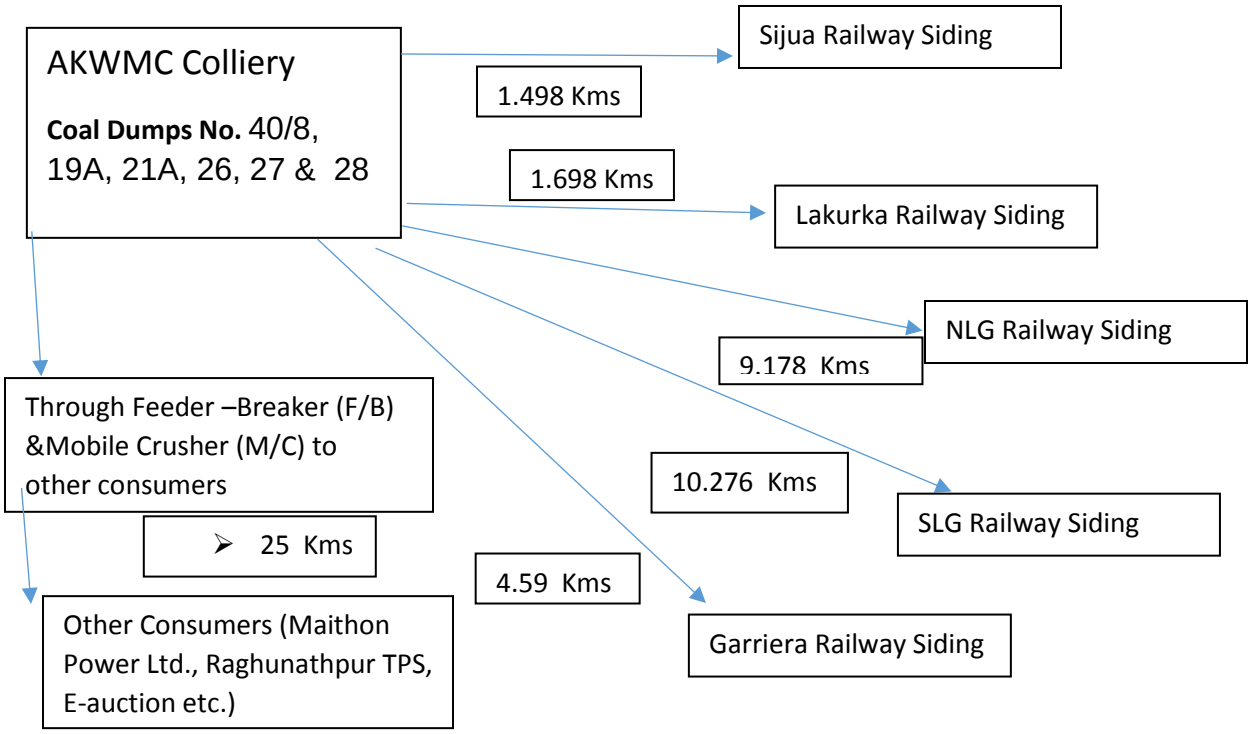


Table: 2.1 Dust Generation (Kg/day)

Name of the Mine	Year	Location	Distance from Face to Siding	Coal Transferred (TPA)	Daily Coal Production (TePD)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 (kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)
AKWMC	13-14	Sijua Siding	1.498	5292.600	16.000	30.000	1.598	0.530	0.847
	13-14	Lakurka Siding	1.698	5292.600	16.000	30.000	1.811	0.530	0.960
	13-14	NLG Siding	9.178	5292.600	16.000	30.000	9.790	0.530	5.189
	13-14	SLG Siding	10.276	5292.600	16.000	30.000	10.961	0.530	5.809
	13-14	Garerria Siding	4.595	5292.600	16.000	30.000	4.901	0.530	2.598
	13-14	New F/B	1.120	106733.000	323.000	15.000	48.235	0.530	25.564
	13-14	M/C	1.635	106734.000	323.000	15.000	70.414	0.530	37.319
								Total For 13-14 =	**78.286**
	14-15	Sijua Siding	1.498	790809.000	2396.000	30.000	239.281	0.530	126.819
	14-15	Lakurka Siding	1.698	790809.000	2396.000	30.000	271.227	0.530	143.750
	14-15	NLG Siding	9.178	790809.000	2396.000	30.000	1466.033	0.530	776.997
	14-15	SLG Siding	10.276	790809.000	2396.000	30.000	1641.420	0.530	869.952
	14-15	Garerria Siding	4.595	790809.000	2396.000	30.000	733.975	0.530	389.007
	14-15	New F/B	1.120	170269.500	516.000	15.000	77.056	0.530	40.840
	14-15	M/C	1.635	170269.500	516.000	15.000	112.488	0.530	59.619
								Total For 14-15 =	**2406.984**
	15-16	Sijua Siding	1.498	796377.800	2413.000	30.000	240.978	0.530	127.718
	15-16	Lakurka Siding	1.698	796377.800	2413.000	30.000	273.152	0.530	144.770
	15-16	NLG Siding	9.178	796377.800	2413.000	30.000	1476.434	0.530	782.510
	15-16	SLG Siding	10.276	796377.800	2413.000	30.000	1653.066	0.530	876.125
	15-16	Garerria Siding	4.595	796377.800	2413.000	30.000	739.182	0.530	391.767
	15-16	New F/B	1.120	328264.500	995.000	15.000	148.587	0.530	78.751
	15-16	M/C	1.635	328264.500	995.000	15.000	216.910	0.530	114.962
								Total For 15-16 =	**2516.604**

* In terms of PM 10 expressed as kg/day, ** Average distance has been considered, *** Capacities of Dumpers used in transportation of coal from face to siding taken as 30Te, to Washery 20Te, and Outside Transport 15 Te. ..## Emission rate for PM_{10} has been taken from the S&T work (funded by MoC) carried out by CMPDI during 2002-2007.

Total fugitive dust (PM-10) generated during 2013-14, 2014-15 and 2015-16 due to road transportation of coal is 78.3 kg/day, 2407.0 kg/day & 2516.6 kg/day respectively. The corresponding values of daily coal production and daily dust generation per tonne are 726 te/day, **0.11 kg/te** (13-14), 13012 te/day, **0.18 kg/te** (14-15) and 2516 te/day, **0.18 kg/te**.

2.2.2 Amalgamated Angarpathra Ramkanali Colliery (AARC):

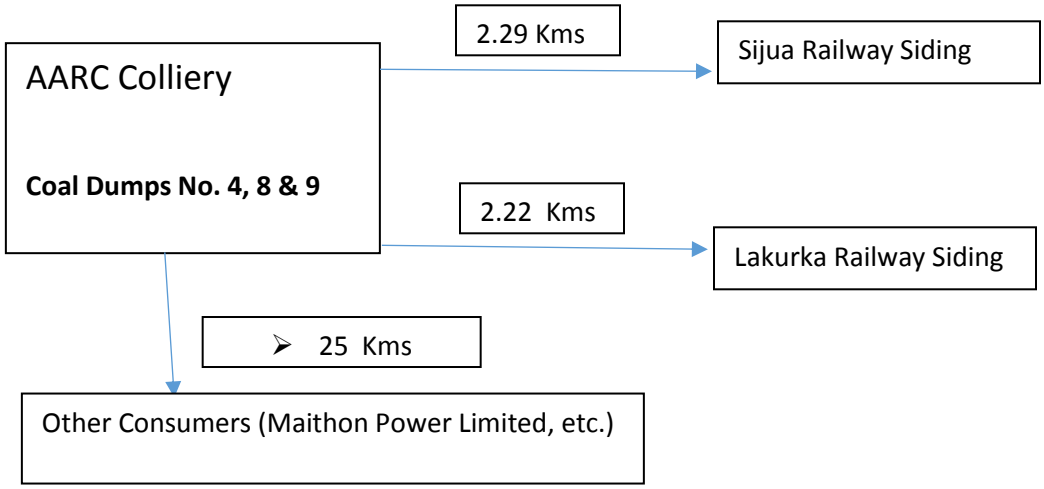


Table: 2.2 Dust Generation (Kg/day)

Name of the Mine	Year	Location	Distance from Face to Siding	Coal Transferred (TPA)	Daily Coal Production (TePD)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 (kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)
AARC	13-14	Sijua Siding	2.290	3341.000	10.000	30.000	1.527	0.530	0.809
	13-14	Lakurka Siding	2.220	3341.000	10.000	30.000	1.480	0.530	0.784
	13-14	Others	25.000	76065.000	231.000	15.000	770.000	0.530	408.100
								Total For 13-14 =	**409.694**
	14-15	Sijua Siding	2.290	0.000	0.000	30.000	0.000	0.530	0.000
	14-15	Lakurka Siding	2.220	0.000	0.000	30.000	0.000	0.530	0.000
	14-15	Others	25.000	57721.000	175.000	15.000	583.333	0.530	309.167
								Total For 14-15 =	**309.167**
	15-16	Sijua Siding	2.290	0.000	0.000	30.000	0.000	0.530	0.000
	15-16	Lakurka Siding	2.220	0.000	0.000	30.000	0.000	0.530	0.000
	15-16	Others	25.000	46390.000	141.000	15.000	470.000	0.530	249.100
								Total For 14-15 =	**249.100**

*In terms of PM 10 expressed as kg/day, ** Average distance has been considered, *** Capacity of Dumpers used in Transportation to siding assumed as 30Te, to Washery 20Te, and Outside Transport 15 Te..## Emission rate for PM_{10} has been taken from the S&T work (funded by MoC) carried out by CMPDI during 2002-2007.

Total average fugitive dust (PM-10) generated during 2013-14, 2014-15 and 2015-16 due to road transportation of coal is 409.7 kg/day, 309.2 kg/day & 249.1 kg/day respectively.

The corresponding values of daily coal production and daily dust generation per tonne are 251 te/day, 1.63 kg/te (13-14), 175 te/day, 1.76 kg/te (14-15) and 141 te/day, 1.76 kg/te.

2.2.3 Katras Choitudih Colliery(KCC):

It started coal production from 1st April, 2015.

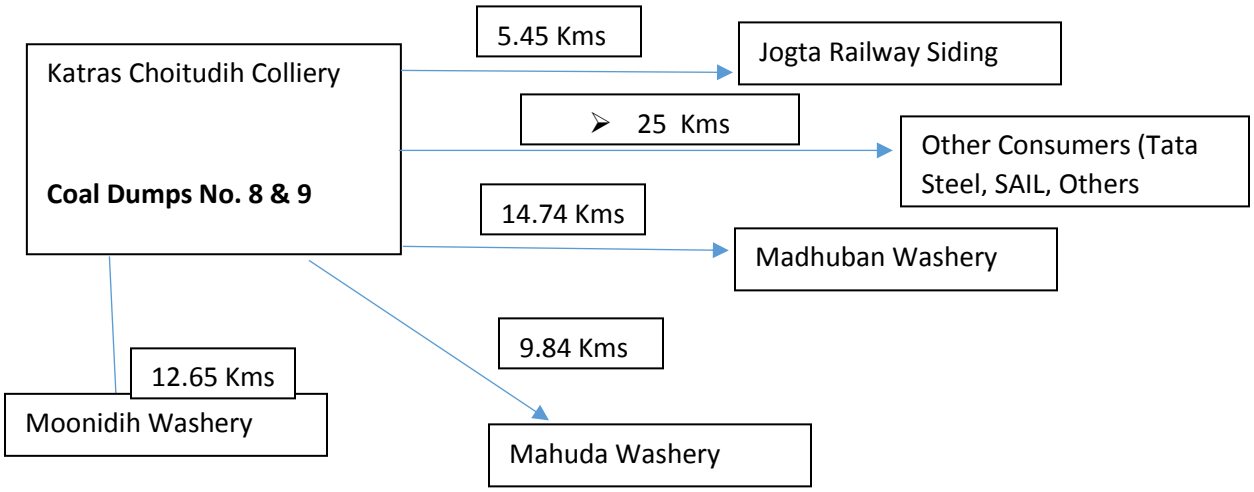


Table: 2.3 Dust Generation (Kg/day)

Name of the Mine	Year	Location	Distance from Face to Siding	Coal Transferred	Daily Coal Production (Te)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 (kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)
Katras	15-16	Jogta Siding	5.45	37465	113.530303	30	41.249343	0.53	21.86215202
	15-16	Mahuda Washery	9.84	100427	304.3242424	20	299.4550545	0.53	158.7111789
	15-16	Madhuban	14.74	100427	304.3242424	20	448.5739333	0.53	237.7441847
	15-16	Moonidih	12.65	100428	304.3272727	20	384.974	0.53	204.03622
	15-16	Others	25	30000	90.90909091	15	303.030303	**0.53**	**160.6060606**
								Total for 15-16=	**782.9597962**

*In terms of PM 10 expressed as kg/day, ** Average distance has been considered, *** Capacity of Dumpers used in transportation to siding assumed as 30Te, to Washery 20Te, and Outside Transport 15 tonne. ..## Emission rate for PM_{10} has been taken from the S&T work (funded by MoC) carried out by CMPDI during 2002-2007.

Total average fugitive dust (PM-10) generated during 2015-16 due to road transportation of coal is 783.0 kg/day.

The corresponding values of daily coal production and daily dust generation per tonne during 2015 -16 are 1117.4 te/day and **0.70 kg/te.**

2.2.4 Salanpur Colliery:

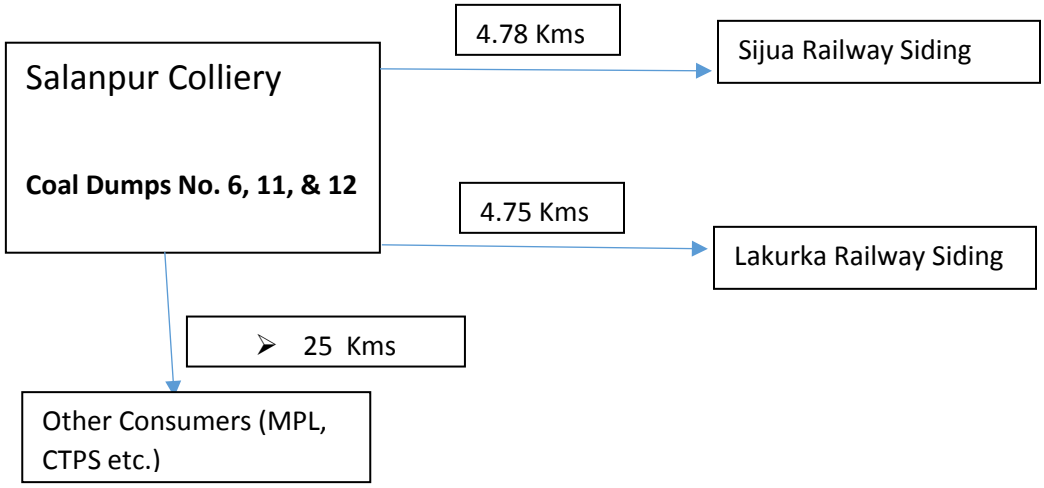


Table: 2.4 Dust Generation (Kg/day)

Name of the Mine	Year	Location	Distance from Face to Siding	Coal Transferred (TPA)	Daily Coal Production (TePD)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 (kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)
Salanpur	13-14	Sijua Siding	4.780	6125.000	19.000	30.000	6.055	0.530	3.209
	13-14	Lakurka Siding	4.750	6125.000	19.000	30.000	6.017	0.530	3.189
	13-14	Others	25.000	44849.000	136.000	15.000	453.333	0.530	240.267
								Total For 13-14 =	**246.664**
	14-15	Sijua Siding	4.780	0.000	0.000	30.000	0.000	0.530	0.000
	14-15	Lakurka Siding	4.750	0.000	0.000	30.000	0.000	0.530	0.000
	14-15	Others	25.000	118257.000	358.000	15.000	1193.333	0.530	632.467
								Total For 14-15 =	**632.467**
	15-16	Sijua Siding	4.780	0.000	0.000	30.000	0.000	0.530	0.000
	15-16	Lakurka Siding	4.750	0.000	0.000	30.000	0.000	0.530	0.000
	15-16	Others	25.000	133823.000	406.000	15.000	1353.333	0.530	717.267
								Total For 14-15 =	**717.267**

*In terms of PM 10 expressed as kg/day, ** Average distance has been considered, *** Capacity of Dumpers used in Transportation to siding assumed as 30Te, to Washery 20Te, and Outside Transport 15 Te. ..## Emission rate for PM_{10} has been taken from the S&T work (funded by MoC) carried out by CMPDI during 2002-2007.

Total average fugitive dust (PM-10) generated during 2013-14, 2014-15 and 2015-16 due to road transportation of coal is 246.7 kg/day, 632.45 kg/day & 717.3 kg/day respectively.

The corresponding values of daily coal production and daily dust generation per tonne are 174 te/day, 1.42 kg/te (13-14), 358 te/day, 1.76 kg/te (14-15) and 406 te/day, 1.76 kg/te.

2.2.5 Gaslitand Colliery:

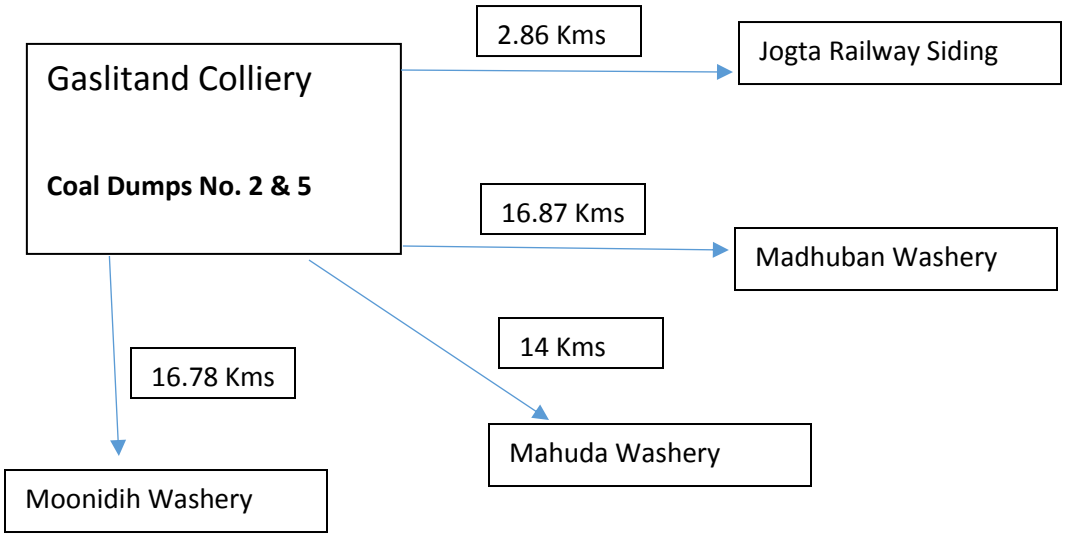


Table: 2.5 Dust Generation (Kg/day)

Name of the Mine	Year	Location	Distance from Face to Siding	Coal Transferred	Daily Coal Production (Te)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 (kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)
Gaslitand	13-14	Jogta Siding	2.86	34575.00	105.00	30.00	20.02	0.53	10.611
	13-14	Mahuda Washery	14.00	55868.00	169.00	20.00	236.60	0.53	125.398
	13-14	Madhuban	16.87	55868.00	169.00	20.00	285.10	0.53	151.105
	13-14	Moonidih	16.78	55869.00	169.00	20.00	283.58	0.53	150.298
		Total For 13-14 =							**437.412**
	14-15	Jogta Siding	2.86	39976.00	121.00	30.00	23.07	0.53	12.227
	14-15	Mahuda Washery	14.00	7958.00	24.00	20.00	33.60	0.53	17.808
	14-15	Madhuban	16.87	7957.00	24.00	20.00	40.49	0.53	21.459
	14-15	Moonidih	16.78	7957.00	24.00	20.00	40.27	0.53	21.344
		Total For 14-15 =							**72.838**
	15-16	Jogta Siding	2.86	75006.00	227.00	30.00	43.28	0.53	22.939
	15-16	Mahuda Washery	14.00	64007.00	194.00	20.00	271.60	0.53	143.948
	15-16	Madhuban	16.87	64007.00	194.00	20.00	327.28	0.53	173.457
	15-16	Moonidih	16.78	64007.00	194.00	20.00	325.53	0.53	172.532
		Total For 15-16 =							**512.876**

*In terms of PM 10 expressed as kg/day, ** Average distance has been considered, *** Capacity of Dumpers used in transportation to siding assumed as 30Te, to Washery 20Te, and Outside Transport 15 Te. ..## Emission rate for PM_{10} has been taken from the S&T work (funded by MoC) carried out by CMPDI during 2002-2007.

Total average fugitive dust (PM-10) generated during 2013-14, 2014-15 and 2015-16 due to road transportation of coal is 437.4 kg/day, 72.8 kg/day & 512.9 kg/day respectively.

The corresponding values of daily coal production and daily dust generation per tonne are 612 te/day, 0.714 kg/te (13-14), 193 te/day, 0.377 kg/te (14-15) and 809 te/day, 0.63 kg/te.

2.3 Optimum Coal Transportation scheme in the Present Scenario:

Phase – I (for 10 + 05 Years)

As suggested by the Environmental Appraisal Committee, it is proposed to continue the existing Road–Rail transport network system in view of the implementation of the Jharia Action Plan (JAP) for 10 years and another 05 years gestation period after the completion of the JAP for consolidation of the backfilled dug out fire areas and unstable areas is required. Thus the period of 15 years, make the Phase – I. All mitigation measures like covered trucks, green belting on either side of the road, enhanced water sprinkling, proper maintenance of roads, removal of spilled materials etc shall be adopted for 15 years with the existing road – rails transport system.

2.4 Conceptual Plan of Proposed Integrated Coal Transportation Network for Cluster – IV

Phase – II (after 15 Years):

As suggested by the EAC Members, BCCL shall implement conveyor –cum-rail transport to avoid movement of trucks within the cluster for coal transportation in Phase –II which shall start after 15 years from now. Loading of coal by pay–loaders shall be discontinued. A conceptual plan for coal transportation for the Phase – II has been presented in Table 2.6.

During 2015-16, the combined daily coal production form all 05 mines of Cluster – IV was 16528.4 tones resulting in 4778.8 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.29 kg/te. As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 972 kg/day for daily coal production of 3351.5 tonnes (1.106MTY) during Phase –II.

Table 2.6: Proposed Infrastructure for Coal Transportation (phase – II)

Cluster	Mines in Operation in Phase - II	Peak Production	Proposed Transport Infrastructure in Phase – II
IV	Salanpur Colliery	0.195 MTY	Coal transport by Conveyor to Railway Siding
	Katras Choitudih Colliery	0.286 MTY	
	Amalgamated Keshalpur – West Mududih Colliery UG	0.247 MTY	
	Amalgamated Angarpathra Ramkanali Colliery UG	0.378 MTY	
	Total	1.106 MTY = 3351.5 te/day	

2.5 Conclusion:

On the basis of the study undertaken to assess the impact of coal transportation on pollution load, the followings may be concluded:

Phase – I: (2013-14 to 2028 -29) :

1. During Phase – I, business as usual (BAU) scenario will prevail and the existing road cum rail transport network system will be used for coal dispatch to the consumers. During 2015-16, the combined daily coal production form all 05 mines of Cluster – IV was 16528.4 tones resulting in 4778.8 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.29 kg/te. The increase

in coal production will cause corresponding increase in fugitive dust generation due to coal transportation by road.

2. The generation of fugitive dust due to transportation of coal by road can be further reduced by enforcing covering of loaded trucks, periodical removal of loose materials lying on the road surface and black topping of coal transportation roads.
3. Avenue plantation, effective wetting of the road surface and proper maintenance of roads will further result in mitigation of the impact of road generated dust on ambient air quality.
4. Better road condition, by the use of Mechanical Sweeper or vacuum cleaner dust generation may be minimized.

Phase – II :(From 2029-30 Onwards):

1. As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 972 kg/day for daily coal production of 3351.5 tonnes (1.106MTY) during Phase –II.

2. During Phase –II, dust load will further reduce due to quenching of mine fire and domestic coal consumption after resettlement of general population dwelling within the command area of cluster –IV, as a result of implementation of Jharia Action Plan. It will result in significant improvement in ambient air quality.

3. **Coal Production Vs. Dust Generation due to Road Transportation is presented below:**

Table: 2.7 Coal Production Vs. Dust Generation due to Road Transportation

Year	Coal Production (Te/day)	Dust Generation(Kg/Day)
2015-16 (By Road transportation)	16528.4	4778.8
2029-30 (By Road transportation)	3351.5	972
2029-30(By Conveyor Transportation)	3351.5	0

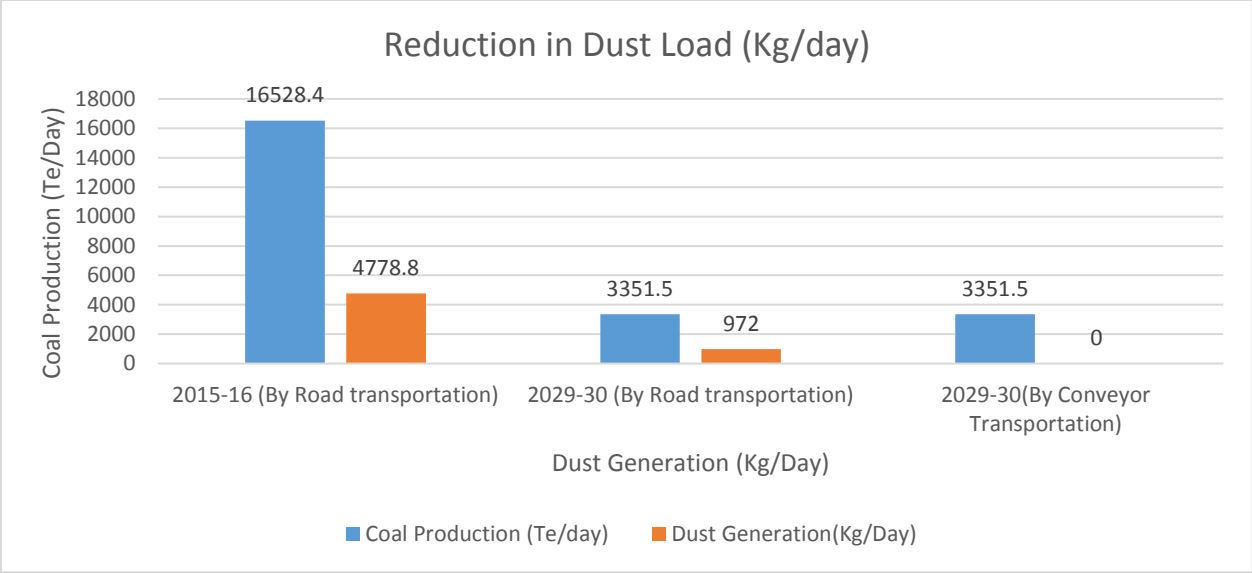


Figure 2.1: Presentation of reduction in dust generation due to replacement of Road transportation by Conveyor system.

ANNEXURE

ENVIRONMENTAL STATEMENT FORM-V
(See rule 14)

Environmental Statement for the financial year ending with 31st March of 2019 of ***Katras Choitudih Colliery, Katras Area****, BCCL, Dhanbad.*

PART-A

i. Name and address of the owner/ occupier of the industry operation or process. – Sri Rakesh Kumar, Director (Tech) Project & Planning BCCL, At + Po Koyla Bhawan, Dhanbad– 826004, Jharkhand

ii. Industry category – RED (Coal Mining Industry)

iii. Production category Units. - ***Katras Choitudih Colliery*** *is within cluster IV, BCCL, for which Environmental Clearance has been granted by Ministry of Environment & Forests vide letter no. J-11015/212/2010-1A. II(M), dated 06.02.2013 & J-11015/372/2013-IA-II(M), dated 16th July 2018. The production capacity of the cluster IV mines as per granted Environment clearance is 9.55 MTPA and lease area is 1123.79 ha.*

iv. Year of establishment - Colliery operating since pre nationalization period and vested to BCCL through Coal Mines Nationalization act 1972-73.

v. Date of the last environmental statement submitted. - 30/08/2018

PART B

Water and Raw Material Consumption:

i. Water consumption in m^3/d

Process : Water is not utilized as a process water in mining operation. The pumping from mine sump is done to save mine from flooding. Water pumped out from the mine is for the purpose of safety and to facilitate mining.

Cooling : 420 KL/day

Domestic : 1730 KL/day

Dust Control: 558 KL/day

Name of Products	Process water consumption per unit of products	
	During the previous financial year	During the current financial year
1. *Coal*	*NIL*	*NIL*

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
NIL	*NA*	*NA*	*NA*

** 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)

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water	*NIL*	*Water analysis report is enclosed.*	
(b) Air		*Ambient air quality report is enclosed.*	

PART-D

HAZARDOUS WASTES

(as specified under Hazardous Wastes (Management & Handling Rules, 1989). Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.

Hazardous Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
1. From Process	*NA*	*NA*
2. From Pollution Control Facilities	*NA*	*NA*

The quantity of spent oil/used oil generated during year 2018-19 = 1.1 KL

PART E SOLID

***WASTES**:*

Solid Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
a. From process	*NIL*	*NIL*
b. From Pollution Control Facility	*NIL*	*NIL*
c. Quantity recycled or reutilised within the unit.	*NIL*	*NIL*

There is no solid waste generated from mine, overburden is generated from the production of coal, which is kept temporary outside the pit area/excavation ara for the reasons of safety and to facilitate mining. After the complete exploration of the coal from the mine the overburden will be reutilized as a backfill material, after that technical reclamation and biological reclamation of the overburden will be done.

PART F

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

Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.
Collected used oil is sent to regional store for disposal.
Characteristics of the generated hazardous waste is hydrocarbon.

PART-G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.
For the sustainable relief from water scarcity the rain water harvesting is being done. Formation of green cover and ecological restoration is being developed to conserve biodiversity and maintain greenery. Cost of production is increased.

PART H

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

PART I

MISCELLANEOUS:

Any other particulars in respect of environmental protection and abatement of pollution.

1. *Green cover development.*
2. *Dust suppression through water sprinkling.*
3. *Ecological Restoration.*
4. *Rain Water Harvesting.*

Sudipta chatterjee.

Project officer
Katras Choitudih Colliery

17/5/19

ANNEXURE

ENVIRONMENTAL STATEMENT FORM-V
(See rule 14)

Environmental Statement for the financial year ending with 31st March of 2019 of ***Salanpur Colliery, Katras Area****, BCCL, Dhanbad.*

PART-A

i. Name and address of the owner/ occupier of the industry operation or process. – Sri Rakesh Kumar, Director (Tech) Project & Planning

BCCL, At + Po Koyla Bhawan, Dhanbad– 826004, Jharkhand

ii. Industry category – RED (Coal Mining Industry)

iii. Production category Units. -Salanpur Colliery is within cluster IV, BCCL, for which Environmental Clearance has been granted by Ministry of Environment & Forests vide letter no. J-11015/212/2010-1A. II(M), dated 06.02.2013 & J-11015/372/2013-IA-II(M), dated 16th July 2018. The production capacity of the cluster IV mines as per granted Environment clearance is 9.55 MTPA and lease area is 1123.79 ha.

iv. Year of establishment - Colliery operating since pre nationalization period and vested to BCCL through Coal Mines Nationalization act 1972-73.

v. Date of the last environmental statement submitted. - 30/08/2018

PART B

Water and Raw Material Consumption:

i. Water consumption in m^3/d

Process : Water is not utilized as a process water in mining operation. The pumping from mine sump is done to save mine from flooding. Water pumped out from the mine is for the purpose of safety and to facilitate mining.

Cooling : NIL

Domestic : 600 KL/day
Dust Control: 245 KL/day

Name of Products	Process water consumption per unit of products	
	During the previous financial year	During the current financial year
1. *Coal*	*NIL*	*NIL*

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
NIL	*NA*	*NA*	*NA*

** 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)

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water	*NIL*	*Water analysis report is enclosed.*	
(b) Air		*Ambient air quality report is enclosed.*	

PART-D

HAZARDOUS WASTES

(as specified under Hazardous Wastes (Management & Handling Rules, 1989). Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.

Hazardous Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
1. From Process	*NA*	*NA*
2. From Pollution Control Facilities	*NA*	*NA*

The quantity of spent oil/ used oil generated during year 2018-19 = 0.4 KL

PART E SOLID

***WASTES**:*

Solid Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
a. From process	*NIL*	*NIL*
b. From Pollution Control Facility	*NIL*	*NIL*
c. Quantity recycled or reutilised within the unit.	*NIL*	*NIL*

There is no solid waste generated from mine, overburden is generated from the production of coal, which is kept temporary outside the pit area/ excavation ara for the reasons of safety and to facilitate mining. After the complete exploration of the coal from the mine the overburden will be reutilized as a backfill material, after that technical reclamation and biological reclamation of the overburden will be done.

PART F

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

Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.
Collected used oil is sent to regional store for disposal.
Characteristics of the generated hazardous waste is hydrocarbon.

PART-G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.
For the sustainable relief from water scarcity the rain water harvesting is being done. Formation of green cover and ecological restoration is being developed to conserve biodiversity and maintain greenery. Cost of production is increased.

PART H

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

PART I

MISCELLANEOUS:

Any other particulars in respect of environmental protection and abatement of pollution.
1. *Green cover development.*
2. *Dust suppression through water sprinkling.*
3. *Ecological Restoration.*
4. *Rain Water Harvesting.*

Project officer
Salanpur Colliery
18/5/19

ANNEXURE

ENVIRONMENTAL STATEMENT FORM-V
(See rule 14)

Environmental Statement for the financial year ending with 31st March of 2019 of ***Gaslitand Colliery, Katras Area****, BCCL, Dhanbad.*

PART-A

i. Name and address of the owner/ occupier of the industry operation or process. – Sri Rakesh Kumar, Director (Tech) Project & Planning BCCL, At + Po Koyla Bhawan, Dhanbad– 826004, Jharkhand

ii. Industry category – RED (Coal Mining Industry)

iii. Production category Units. -Gaslitand Colliery is within cluster IV, BCCL, for which Environmental Clearance has been granted by Ministry of Environment & Forests vide letter no. J-11015/212/2010-1A. II(M), dated 06.02.2013 & J-11015/372/2013-IA-II(M), dated 16th July 2018. The production capacity of the cluster IV mines as per granted Environment clearance is 9.55 MTPA and lease area is 1123.79 ha.

iv. Year of establishment - Gaslitand Colliery operating since pre nationalization period and vested to BCCL through Coal Mines Nationalization act 1972-73.

v. Date of the last environmental statement submitted. - 30/08/2018

PART B

Water and Raw Material Consumption:

i. Water consumption in m^3/d

Process : Water is not utilized as a process water in mining operation. The pumping from mine sump is done to save mine from flooding. Water pumped out from the mine is for the purpose of safety and to facilitate mining.

Cooling : 160 (Firefighting)

Domestic : 298 KL/day
Dust Control: 207KL/day

Name of Products	Process water consumption per unit of products	
	During the previous financial year	During the current financial year
1. *Coal*	*NIL*	*NIL*

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
NIL	*NA*	*NA*	*NA*

** 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)

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water	*NIL*	*Water analysis report is enclosed.*	
(b) Air		*Ambient air quality report is enclosed.*	

PART-D

HAZARDOUS WASTES

(as specified under Hazardous Wastes (Management & Handling Rules, 1989). Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.

Hazardous Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
1. From Process	*NA*	*NA*
2. From Pollution Control Facilities	*NA*	*NA*

The quantity of spent oil/ used oil generated during year 2018-19 = 0.5 KL

PART E SOLID

WASTES:

Solid Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
a. From process	*NIL*	*NIL*
b. From Pollution Control Facility	*NIL*	*NIL*
c. Quantity recycled or reutilised within the unit.	*NIL*	*NIL*

There is no solid waste generated from mine, overburden is generated from the production of coal, which is kept temporary outside the pit area/ excavation ara for the reasons of safety and to facilitate mining. After the complete exploration of the coal from the mine the overburden will be reutilized as a backfill material, after that technical reclamation and biological reclamation of the overburden will be done.

PART F

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

Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.
Collected used oil is sent to regional store for disposal.
Characteristics of the generated hazardous waste is hydrocarbon.

PART-G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.
For the sustainable relief from water scarcity the rain water harvesting is being done. Formation of green cover and ecological restoration is being developed to conserve biodiversity and maintain greenery. Cost of production is increased.

PART H

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

PART I

MISCELLANEOUS:

Any other particulars in respect of environmental protection and abatement of pollution.

1. *Green cover development.*
2. *Dust suppression through water sprinkling.*
3. *Ecological Restoration.*
4. *Rain Water Harvesting.*

Sudipta chatterjee.
Project officer
Gaslitand Colliery
17/5/19

ANNEXURE

ENVIRONMENTAL STATEMENT FORM-V
(See rule 14)

Environmental Statement for the financial year ending with 31st March of 2019 of ***Amalgamated Keshalpur west mudidih colliery, Katras Area****, BCCL, Dhanbad.*

PART-A

i. Name and address of the owner/ occupier of the industry

operation or process. – Sri Rakesh Kumar, Director (Tech) Project & Planning

BCCL, At + Po Koyla Bhawan, Dhanbad– 826004, Jharkhand

ii. Industry category – RED (Coal Mining Industry)

iii. Production category Units. - ***Amalgamated Keshalpur west mudidih colliery*** *is within cluster IV, BCCL, for which Environmental Clearance has been granted by Ministry of Environment & Forests vide letter no. J-11015/212/2010-1A. II(M), dated 06.02.2013 & J-11015/372/2013-IA-II(M), dated 16th July 2018. The production capacity of the cluster IV mines as per granted Environment clearance is 9.55 MTPA and lease area is 1123.79 ha.*

iv. Year of establishment - Colliery operating since pre nationalization period and vested to BCCL through Coal Mines Nationalization act 1972-73.

v. Date of the last environmental statement submitted. - 30/08/2018

PART B

Water and Raw Material Consumption:

i. Water consumption in m^3/d

Process : Water is not utilized as a process water in mining operation. The pumping from mine sump is done to save mine from flooding. Water pumped out from the mine is for the purpose of safety and to facilitate mining.

Cooling : 450 (Firefighting)

Domestic : 2587 KL/day
Dust Control: 465 KL/day

Name of Products	Process water consumption per unit of products	
	During the previous financial year	During the current financial year
1. *Coal*	*NIL*	*NIL*

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
NIL	*NA*	*NA*	*NA*

** 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)

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water	*NIL*	*Water analysis report is enclosed.*	
(b) Air		*Ambient air quality report is enclosed.*	

PART-D

HAZARDOUS WASTES

(as specified under Hazardous Wastes (Management & Handling Rules, 1989). Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.

Hazardous Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
1. From Process	*NA*	*NA*
2. From Pollution Control Facilities	*NA*	*NA*

The quantity of spent oil/ used oil generated during year 2018-19 = 2.8 KL

PART E SOLID

WASTES:

Solid Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
a. From process	*NIL*	*NIL*
b. From Pollution Control Facility	*NIL*	*NIL*
c. Quantity recycled or reutilised within the unit.	*NIL*	*NIL*

There is no solid waste generated from mine, overburden is generated from the production of coal, which is kept temporary outside the pit area/ excavation ara for the reasons of safety and to facilitate mining. After the complete exploration of the coal from the mine the overburden will be reutilized as a backfill material, after that technical reclamation and biological reclamation of the overburden will be done.

PART F

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

Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.
Collected used oil is sent to regional store for disposal.
Characteristics of the generated hazardous waste is hydrocarbon.

PART-G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.
For the sustainable relief from water scarcity the rain water harvesting is being done. Formation of green cover and ecological restoration is being developed to conserve biodiversity and maintain greenery. Cost of production is increased.

PART H

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

PART I

MISCELLANEOUS:
Any other particulars in respect of environmental protection and abatement of pollution.
1. *Green cover development.*
2. *Dust suppression through water sprinkling.*
3. *Ecological Restoration.*
4. *Rain Water Harvesting.*
5. *Toe Wall and Garland Drain*
6. *Oil and grease trap*

Project officer
Amalgamated Keshalpur west mudidih colliery

19/5/19

ANNEXURE

ENVIRONMENTAL STATEMENT FORM-V
(See rule 14)

Environmental Statement for the financial year ending with 31st March of 2019 of ***Amalgamated Angarpathra Ramkanali Colliery, Katras Area****, BCCL, Dhanbad.*

PART-A

i. Name and address of the owner/ occupier of the industry operation or process. – Sri Rakesh Kumar, Director (Tech) Project & Planning BCCL, At + Po Koyla Bhawan, Dhanbad– 826004, Jharkhand

ii. Industry category – RED (Coal Mining Industry)

iii. Production category Units. - ***Amalgamated Angarpathra Ramkanali Colliery*** *is within cluster IV, BCCL, for which Environmental Clearance has been granted by Ministry of Environment & Forests vide letter no. J-11015/212/2010-1A. II(M), dated 06.02.2013 & J-11015/372/2013-IA-II(M), dated 16th July 2018. The production capacity of the cluster IV mines as per granted Environment clearance is 9.55 MTPA and lease area is 1123.79 ha.*

iv. Year of establishment - Colliery operating since pre nationalization period and vested to BCCL through Coal Mines Nationalization act 1972-73.

v. Date of the last environmental statement submitted. - 30/08/2018

PART B

Water and Raw Material Consumption:

i. Water consumption in m^3/d

Process : Water is not utilized as a process water in mining operation. The pumping from mine sump is done to save mine from flooding. Water pumped out from the mine is for the purpose of safety and to facilitate mining.

Cooling : 223 KL/day (Firefighting)

Domestic : 3113 KL/day
Dust Control: 900 KL/day

Name of Products	Process water consumption per unit of products	
	During the previous financial year	During the current financial year
1. *Coal*	*NIL*	*NIL*

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
NIL	*NA*	*NA*	*NA*

** 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)

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water	*NIL*	*Water analysis report is enclosed.*	
(b) Air		*Ambient air quality report is enclosed.*	

PART-D

HAZARDOUS WASTES

(as specified under Hazardous Wastes (Management & Handling Rules, 1989). Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.

Hazardous Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
1. From Process	*NA*	*NA*
2. From Pollution Control Facilities	*NA*	*NA*

The quantity of spent oil/ used oil generated during year 2018-19 = 0.8 KL

PART E SOLID

WASTES:

Solid Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
a. From process	*NIL*	*NIL*
b. From Pollution Control Facility	*NIL*	*NIL*
c. Quantity recycled or reutilised within the unit.	*NIL*	*NIL*

There is no solid waste generated from mine, overburden is generated from the production of coal, which is kept temporary outside the pit area/ excavation ara for the reasons of safety and to facilitate mining. After the complete exploration of the coal from the mine the overburden will be reutilized as a backfill material, after that technical reclamation and biological reclamation of the overburden will be done.

PART F

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

Machineries are used for production and to control air pollution from dust generation, Lubricants oil is used in these machineries are replaced periodically as per scheduled. Replaced lubricants oil is collected in drum as Hazardous waste with proper care and safety.
Collected used oil is sent to regional store for disposal.
Characteristics of the generated hazardous waste is hydrocarbon.

PART-G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.
For the sustainable relief from water scarcity the rain water harvesting is being done. Formation of green cover and ecological restoration is being developed to conserve biodiversity and maintain greenery. Cost of production is increased.

PART H

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

PART I

MISCELLANEOUS:

Any other particulars in respect of environmental protection and abatement of pollution.

1. *Green cover development.*
2. *Dust suppression through water sprinkling.*
3. *Ecological Restoration.*
4. *Rain Water Harvesting.*

Project officer
Amalgamated Angarpathra Ramkanali Colliery

17/5/19