

SIX MONTHLY COMPLIANCE REPORT OF ENVIRONMENTAL CLEARANCE (EC)

600 (1x600) MW THERMAL POWER PLANT

At

**BADE BHANDAR VILLAGE, PUSSORE TEHSIL
RAIGARH DISTRICT CHHATTISGARH**

Submitted to:

**Regional Office (WCZ)
Ministry of Environment Forest, Climate Change
Central Pollution Control Board, New Delhi &
Chhattisgarh Environment Conservation Board, Raipur**



Submitted By:

**Environment Management Department,
Raigarh Energy Generation Limited,
Bade & Chhote Bhandar Village, Pussore Tehsil
Raigarh District,
Chhattisgarh**

PERIOD: April'2020 – September'2020

Raigarh Energy Generation Limited
1x600 MW Coal Based Thermal Power Plant

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Compliance Status of Environmental Clearance

vide Letter no.: F. No. J 13012/57/2008-IA.II (T), dated: 20.05.2010
and its subsequent amendment vide letter dated: 16.04.2015 and extension dated
26.11.2019 & 17 & 30.07.2020

Sr. No.	EC Conditions	Compliance Status
A.	Specific Conditions	
i	Detailed hydro-geological study shall be conducted and submitted within six months from an institute/organization of repute to assess impact of surface water regime. Specific mitigation measures shall be spelt out and action plan for implementation of the same shall be provided. It shall be ensured that the area drainage is not disturbed due to the proposed power plant.	Complied. Hydro-geological study has been done by reputed institute "National Institute of Hydrology, Roorkee" and report has already been submitted. The entire plant area is almost flat. There are no streams within the plant premises. Regular water quality monitoring being carried out by an agency accredited by NABL & recognized by MoEF&CC.
ii	Hydro-geological study of the area shall be also reviewed annually and results submitted to the Ministry and concerned agency in the State Govt. In case adverse impact on ground water quantity and quality is observed at any stage, immediate mitigating steps to contain any adverse impact on ground water shall be undertaken.	Being Complied. The annual review of hydro-geology has been carried out by reputed institute and study report is enclosed as Annexure – IV .
iii	Source of water for meeting the requirement during lean season shall be specified and submitted to the Regional Office of the Ministry within three months.	Being complied. 15 MCM Water has been allotted from Mahanadi River by Water Resources Dept. Govt. of Chhattisgarh vide letter no. 2705/F4-66/S-2/31/OJPRE/07, Raipur dated 25.04.2018. This quantity is adequate to meet the plant's requirement, including the lean season.
iv	No ground water shall be extracted for use in operation of the power plant even in lean season.	Noted, Complied.
v	No water bodies including natural drainage system in the area shall be disturbed due to activities associated with the setting up/operation of the power plant.	Noted There is no water body within the power plant premises.
vi	COC of 5.0 shall be adopted.	COC of 5.0 is being maintained during plant operation.

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vii	Local employable youth shall be trained in skills relevant to the project for eventual employment in the project itself. The action taken report and details thereof to this effect shall be submitted to the Regional Office of the Ministry and the State Govt. Dept. concerned from time to time.	Being Complied. Around 70 Number of regular employment has been created which is 36% of total on Roll employees. For contractual side we deploy 340 number we have deployed which is 43% of total contract manpower.
viii	Additional soil for levelling of the proposed site shall be generated within the sites (to the extent possible) so that natural drainage system of the area is protected and improved.	The entire plant area is almost flat. There are no streams within the plant premises.
ix	Provision for installation of FGD shall be provided for future use.	Space for FGD is provided in plant layout. As per CPCB directions vide letter no. B33014/07/2017-18/IPC-II/TPP/15860 dated 11.12.2017 "The Plant shall install FGD by March 31, 2022.
x	A stack 275 m with flue gas velocity of 25 m/s shall be installed.	Complied. Flue Stack of 275 meter constructed. The designed flue gas velocity is more than 25 m/sec.
xi	High Efficiency Electrostatic Precipitators (ESPs) shall be installed to ensure that particulate emission does not exceed 50 mg/Nm ³ .	A High Efficiency Electrostatic Precipitators has been provided (ESP) to meet particulate emission less than 50 mg/Nm ³ . Monitoring report enclosed as Annexure- I
xii	Adequate dust extraction system such as cyclones/ bag filters and water spray system in dusty areas such as in coal handling and ash handling points, transfer areas and other vulnerable dusty areas shall be provided.	Adequate dust suppression system like water sprinkling system, dust extraction system, dry fog dust suppression system has been installed throughout coal handling chain and bag filters in LHS, RHS bunkers and crusher house, The high concentrated slurry disposal system and closed transferring pipelines have installed for ash disposal in dyke.
xiii	Utilization of 100% Fly Ash generated shall be made from 4 th year of operation of the plant. Status of implementation shall be reported to the Regional Office of the Ministry from time to time.	100% of Fly Ash utilization is achieved in FY 19-20. Fly ash utilization for the period of April'2020 to September'2020 was 54.20%. The reflected deviation observed is primarily because of travelling restrictions due to COVID-19 and restrictions of ash utilization in low lying areas in Raigarh district. Fly Ash utilization report is attached as Annexure - II .

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xiv	Fly ash shall be collected in dry form and storage facility (silos) shall be provided. Unutilized fly ash shall be disposed-off in the ash pond in the form of slurry form. Mercury and other heavy metals (As, Hg, Cr, Pb etc.) will be monitored in the bottom ash as also in the effluents emanating from the existing ash pond. No ash shall be disposed off in low lying area.	Being Complied. We have established two nos. of silo (Intermediate and Main) with capacity of 1000 MT & 2500 MT respectively for utilization of dry fly ash. High concentration slurry disposal system is provided for disposal of unutilized ash in ash pond. Ash water circulation system is provided. Monitoring of Mercury and other heavy metals (As, Cr, Pb etc.) is being carried out regularly and report is enclosed in Annexure - I .
xv	Ash pond shall be lined with HDP/LDP lining or any other suitable impermeable media such that no leachate takes place at any point of time. Adequate safety measures shall also be implemented to protect the ash dyke from getting breached.	Well-designed Ash pond with LDPE lining has been established as per guidelines of MoEF/CEA/CPCB. Safety measure such as bund with toe wall and lining of side slope done to prevent any leachate.
xvi	For disposal of Bottom Ash in abandoned mines (if proposed to be undertaken) it shall be ensured that the bottom and sides of the mined out areas are adequately lined with clay before Bottom Ash is filled up. The project proponent shall inform the State Pollution Control Board well in advance before undertaking the activity.	Compliance assured.
xvii	Green Belt consisting of 3 tiers of plantations of native species around plant and at least 100 m width shall be raised. Wherever 100 m width is not feasible a 50 m width shall be raised and adequate justification shall be submitted to the Ministry. Tree density shall not less than 2500 per ha with survival rate not less than 75 %.	Green belt / plantation are being developed. Approximate 205,974 trees have been planted. Local plant species being preferred for the plantation as fast growing with thick canopy cover adequate height with longer duration of foliage, Perennial and evergreen along with fruit bearing plants in adequate have also been planted. Greenbelt development plan has been approved by DFO. Greenbelt development status is enclosed as Annexure - III .
xviii	Two nearest village shall be adopted and basic amenities like development of roads, drinking water supply, primary health centre, primary school etc. shall be developed in co-ordination with the district administration.	Being Complied Four project villages are adopted for development of basic amenities such as construction of approach road, community hall, school room, safe drinking water facilities have been completed in all the adopted

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		villages. Pond deepening work has been undertaken in village Badebhandar and Sarwani. Tailoring training has been started from September 2020. The activities carried earlier are being monitored and sustained by the beneficiaries.
xix	The project proponent shall also adequately contribute in the development of the neighbouring villages. Special package with implementation schedule for providing fluoride free potable drinking water supply in the nearby villages and schools shall be undertaken in a time bound manner.	CSR activities being carried out in consultation / guidance with district administration for the development of neighbouring villages. Also actively participating in GOI flagship program "Swachh Bharat Abhiyan" in coordination with district administration. Extended support for Mason and helper for construction of 141 individual household toilets in five nearby villages. Water analysis report attached is showing fluoride data in nearby ground water regime.
xx	A good action plan for R&R (if applicable) with package for the project affected persons be submitted and implemented as per prevalent R&R policy within three months from the date of issue of this letter.	The project is out of Abadi/population area. The R&R plan has already been prepared, implemented, under progress and submitted to MoEF & CECB, Raipur.
xxi	An amount of Rs 6.0 Crores shall be specially earmarked for development activities for tribals of the nearby villages as committed by the project proponent vide its letter dated 23.03.2010. Specific schemes for upliftment of tribal families mentioning sustainable livelihood schemes shall be submitted to the Ministry within three months with time bound implementation and in-built monitoring programme. The above amount shall be over and above the fund earmarked for CSR activities.	The requisite amount for tribal development has been spent and the expenditure report of 6.52 crore has been submitted. Specific livelihood schemes like poultry, mushroom production and vegetable cultivation is being carried out for upliftment of the tribal families. Tailoring training is also undergoing where interested tribal women is attending the training. Self-Help-Groups (SHGs) of women have been formed in the villages to take up various livelihood schemes. Two tribal cooperatives formed to take up various livelihood schemes. These are registered cooperative society. Besides above, infrastructure development activities like construction of CC road, community hall, sanskritik manch, drinking water facility etc. have been undertaken in the tribal villages for their upliftment.
xxii	Further an amount of Rs 15.0 Crores shall be earmarked as one time capital cost for	Being complied The CSR activities undertaken for:

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	<p>CSR programme as committed by the project proponent vide its letter dated 23.03.2010. Subsequently a recurring expenditure of Rs 3.0 Crores per annum shall be earmarked as recurring expenditure for CSR activities. Details of the activities to be undertaken shall be submitted within one month along with road map for implementation.</p>	<ol style="list-style-type: none"> 1. Infrastructure development in the villages, 2. Livelihood Enhancement and training, 3. Quality Education, 4. Community Health and 5. Promotion of Sports and Culture. Activities under Swachh Bharat Abhiyan also executed in neighbouring villages. Extended support for Mason and helper for construction of 141 individual household toilets in five nearby villages. <p>Two community shed constructed in two villages.</p> <p>The activities carried earlier are being monitored and sustained by the beneficiaries.</p>
xxiii	<p>While identifying CSR programme the company shall conduct need based assessment for the nearby villages to study economic measures with action plan which can help in upliftment of poor section of society. Income generating projects consistent with the traditional skills of the people besides development of fodder farm, fruit bearing orchards, vocational training etc. can form a part of such programme. Company shall provide separate budget for community development activities and income generating programmes. This will be in addition to vocational training for individuals imparted to take up self-employment and jobs.</p>	<p>Need Assessment Study conducted and submitted with previous compliance report</p> <p>Income generating activities consists of poultry farming, mushroom production, vegetable cultivation, dairy farming, cross breeding of non-descriptive cattle, grocery shops etc. 20th batch of 4-months tailoring training is running, by end of 18th batch total 497 women has been trained out of which 120 belongs to ST. Three cooperative societies formed for income generation named Surbhi Dugdh Utpadan Samiti, Gram Vikas Kamgar Samiti and Mahanadi Gramin Mahila Bahudesiye Sahkari Samiti. These cooperative societies are functional and members are having income out of it.</p> <p>Executed MOA under PPP for up-gradation of ITI Saria, Raigarh district, constituted IMC.</p> <p>Conducted clean drive, rallies, street plays, poster competition, rangoli competition under Swachhta Abhiyan at ITI Saria. Also conducted safety awareness program to the ITI students.</p>
xxiv	<p>It shall be ensured that in-built monitoring mechanism for the schemes identified is in place and annual social audit shall be got done from the nearest government institute of repute in the region. The project proponent shall also submit the</p>	<p>Social audit has been carried out by Govt. Reputed institute IISWBM, Kolkata. Audit report is enclosed as Annexure – V.</p>

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Sr. No.	EC Conditions	Compliance Status
	status of implementation of the scheme from time to time.	
xxv	Harnessing solar power within the premises of the plant particularly at available roof tops shall be undertaken and status of implementation shall be submitted periodically to the Regional Office of the Ministry.	Being complied. Solar geysers are installed in roof top of residential complexes within plant premises.
xxvi	A long term study on radio activity and heavy metals contents on coal to be used shall be carried out through a reputed institute. Thereafter mechanism for an in-built continuous monitoring for radio activity and heavy metals in coal and fly ash (including bottom ash) shall be put in place.	Being complied. The radioactive monitoring & analysis is carried out by Board of Radiation and Isotope Technology, Department of Atomic Energy, Govt. of India. However the plant was under breakdown since 22 nd May'2017 to Dec'2019, Analysis report for coal and fly ash report is enclosed as Annexure - I .
xxvii	Mercury emissions shall also be monitored on periodic basis.	Analytical report for Mercury emission monitoring from stack is enclosed in Annexure - I .
xxix	Fly ash shall not be used for agricultural purpose. No mine void filling will be undertaken as an option for ash utilization without adequate lining of mine with suitable media such that no leachate shall take place at any point of time. In case, the option of mine void filling is to be adopted, proper detailed study of soil characteristics of the mine area shall be undertaken from an institute of repute and adequate clay lining shall be ascertained by the State Pollution Control Board and implementation done in close co-ordination with the State Pollution Control Board.	Noted & being complied
xxx	Green Belt shall also be developed around the ash pond over and above the Green Belt around the plant boundary.	Being Complied Green belt / plantation are being developed. Approximate 205,974 trees have been planted. Local plant species being preferred for the plantation as fast growing with thick canopy cover adequate height with longer duration of foliage, Perennial and evergreen along with fruit bearing plants in adequate have also been planted.

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		Greenbelt development plan has been approved by DFO. Greenbelt development status is enclosed as Annexure - III .
xxxii	An Environmental Cell comprising of at least one expert in environmental science/ engineering, ecology, occupational health and social science, shall be created preferably at the project site itself and shall be headed by an officer of appropriate superiority and qualification. It shall be ensured that the Head of the Cell shall directly report to the Head of the Plant who would be accountable for implementation of environmental regulations and social impact improvement/ mitigation measures.	Complied. We have already established an Environmental Management Cell headed by Manager & supported by Environmental Engineer, Officer, Chemist & Horticulturist.
xxxii	The project proponent shall formulate a well laid Corporate Environmental Policy and identify and designate responsible officers at all levels of its hierarchy for ensuring adherence to the policy and compliance with the conditions stipulated in this clearance letter and other applicable environmental laws and regulations.	Noted. Complied
B.	GENERAL CONDITIONS	
i	The treated effluents conforming to the prescribed standards only shall be re-circulated and reused within the plant. There shall be no discharge outside the plant boundary except during monsoon. Arrangements shall be made that effluents and storm water do not get mixed.	ETP has been established to treat effluents and treated water is being reuse within the premises. The concept of "Zero Discharge Condition" is implemented. Separate drainage network is established for storm water. Effluent water quality report is enclosed in Annexure - I .
ii	A sewage treatment plant shall be provided (as applicable) and the treated sewage shall be used for raising greenbelt/plantation.	Sewage Treatment Plants has been installed and the treated effluent is being used for plantation/greenbelt. Analysis report of STP is enclosed in Annexure - I .
iii	Rainwater harvesting should be adopted. Central Groundwater Authority/ Board shall be consulted for finalization of appropriate rainwater harvesting technology within a period of three months	A rain water harvesting & recharging system has already been constructed. 08 nos. of rain water harvesting ponds have been constructed within premises.

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	from the date of clearance and details shall be furnished.	
iv	Adequate safety measures shall be provided in the plant area to check/minimize spontaneous fires in coal yard, especially during summer season. Copy of these measures with full details along with location plant layout shall be submitted to the Ministry as well as to the Regional Office of the Ministry.	Adequate safety personnel's are available in the plant site to take preventive control measures. Fire hydrant system provided for prevention of spontaneous fires in coal yard, especially during summer season. Emergency preparedness plan is submitted at respective authorities.
v	Storage facilities for auxiliary liquid fuel such as LDO and/ HFO/LSHS shall be made in the plant area in consultation with Department of Explosives, Nagpur. Sulphur content in the liquid fuel will not exceed 0.5%. Disaster Management Plan shall be prepared to meet any eventuality in case of an accident taking place due to storage of oil.	The fuel such as LDO and HFO are properly stored in minimum risk area & in consultation with Department of Explosives, Nagpur after getting NOC for the same. Disaster management plan (DMP) has been prepared to handle the any eventuality in case of an accident taking place due to storage of oil.
vi	Regular monitoring of ground water level shall be carried out by establishing a network of existing wells and constructing new piezometers. Monitoring around the ash pond area shall be carried out particularly for heavy metals (Hg, Cr, As, Pb) and records maintained and submitted to the Regional Office of this Ministry. The data so obtained should be compared with the baseline data so as to ensure that the ground water quality is not adversely affected due to the project.	Peizometric wells are installed within the premises. Ground water analysis results are enclosed as Annexure - I .
vii	Monitoring surface water quantity and quality shall also be regularly conducted and records maintained. The monitored data shall be submitted to the Ministry regularly. Further, monitoring points shall be located between the plant and drainage in the direction of flow of ground water and records maintained. Monitoring for heavy metals in ground water shall be undertaken.	The surface water samples being collected and analysis report is enclosed as Annexure - I .

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viii	First Aid and sanitation arrangements shall be made for the drivers and other contract workers during construction phase.	First aid and sanitation for labours was provided during the construction.
ix	Noise levels emanating from turbines shall be so controlled such that the noise in the work zone shall be limited to 75 dBA. For people working in the high noise area, requisite personal protective equipment like earplugs/ear muffs etc. shall be provided. Workers engaged in noisy areas such as turbine area, air compressors etc shall be periodically examined to maintain audiometric record and for treatment for any hearing loss including shifting to non-noisy/less noisy areas.	Necessary action has been taken to maintain noise levels in work zone area within 75 dB (A) from source during the plant operation. The personal protective equipment's (PPE) are provided to workers & employees working in noisy areas. Noise level monitoring is carried out regularly. Periodic audiometric check-up is being carried out.
x	Regular monitoring of ground level concentration of SO ₂ , NO _x , PM _{2.5} & PM ₁₀ and Hg shall be carried out in the impact zone and records maintained. If at any stage these levels are found to exceed the prescribed limits, necessary control measures shall be provided immediately. The location of the monitoring stations and frequency of monitoring shall be decided in consultation with SPCB. Periodic reports shall be submitted to the Regional Office of this Ministry. The data shall also be put on the website of the company.	Regular monitoring of SO ₂ , NO _x , PM _{2.5} & PM ₁₀ CO and Hg is being carried and records are being maintained during construction phase as well as operational phase. Environmental monitoring report is enclosed as Annexure - I . Three online Continuous Ambient Air Quality Monitoring Station (CAAQM) System and one mobile Van for Ambient Air Quality Monitoring have been establish within plant premise in consultation with Regional Office, Chhattisgarh Environment Conservation Board, Raigarh.
xi	Provision shall be made for the housing of construction labour (as applicable) within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	Complied. All necessary facilities were provided during construction for contractual labours.
xii	The project proponent shall advertise in at least two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned within seven days from the date of this clearance	Complied. Advertised in three newspapers Hindustan Times, Dainik bhaskar & Nai Duniya on 28.02.2010

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	letter, informing that the project has been accorded environmental clearance and copies of clearance letter are available with the State Pollution Control Board/Committee and may also be seen at Website of the Ministry of Environment and Forests at http://envfor.nic.in .	
xiii	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parisad / Municipal Corporation, urban local Body and the Local NGO, if any, from whom suggestions/ representations, if any, received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent.	Complied. Copy of Environment Clearance has been provided to concerned authority. Previous compliance status updated in company website. http://www.adanipower.com
xiv	A separate Environment Management Cell with qualified staff shall be set up for implementation of the stipulated environmental safeguards.	Being Complied. We have already established an Environment Management Cell with well qualified staff for implementation of the stipulated environmental safeguards.
xv	The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MOEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; SPM, RSPM (PM _{2.5} & PM ₁₀), SO ₂ , NO _x (ambient levels as well as stack emissions) shall be displayed at a convenient location near the main gate of the company in the public domain.	Being Complied. Regular Environmental Monitoring report is being submitted to Regional office, MoEF, CPCB and CECB, Chhattisgarh. The environmental parameters display board provided at main gate of the plant. Previous compliance status was updated in company website. http://www.adanipower.com
xvi	The environment statement for each financial year ending 31 st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of	The Environment Statement for the year 2019-20 has been submitted to Chhattisgarh Environment Conservation Board (CECB) vide letter no. REGL/ENV/Sept./1, dated-21/09/2020.

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	environmental clearance conditions and shall also be sent to the respective Regional Offices of the Ministry by e-mail.	
xvii	The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment and Forests, its Regional Office, Central Pollution Control Board and State Pollution Control Board. The project proponent shall upload the status of compliance of the environment of the environmental clearance conditions on their website and update the same periodically and simultaneously send the same by e-mail to the Regional Office, Ministry of Environment and Forests.	Being Complied. Six monthly Environmental Clearance compliance status report is regularly submitted to MoEF, CPCB and SPCB. The same is sent by email also. Last compliance report for the period of October'2019 - March'2020 had been submitted to your good office via our letter no. REGL/EMD/EC/MoEF/122/20 dated- 23/05/2020.
xviii	Regional Office of the Ministry of Environment & Forests will monitor the implementation of the stipulated conditions. A complete set of documents including Environmental Impact Assessment Report and Environment Management Plan along with the additional information submitted from time to time shall be forwarded to the Regional Office for their use during monitoring. Project proponent will up-load the compliance status in their website and up-date the same from time to time at least six monthly basis. Criteria pollutants levels including NOx (from stack & ambient air) shall be displayed at the main gate of the power plant.	Complied
xix	Separate funds shall be allocated for implementation of environmental protection measures along with item-wise break-up. These cost shall be included as part of the project cost. The funds earmarked for the environment protection measures shall not be diverted for other purposes and year-wise expenditure should be reported to the Ministry.	Being Complied A separate fund has already been allocated for implementation of environmental protection.

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Sr. No.	EC Conditions	Compliance Status
xx	The project authorities shall inform the Regional Office as well as the Ministry regarding the date of financial closure and final approval of the project by the concerned authorities and the dates of start of land development work and commissioning of plant.	Complied.
xxi	Full cooperation shall be extended to the Scientists/Officers from the Ministry / Regional Office of the Ministry at Bangalore / CPCB/ SPCB who would be monitoring the compliance of environmental status.	Noted, Full co-operation shall be extended to all concerned authorities.
Conditions of EC Amendment Letter		
i	The coal shall be transported on road through mechanically covered trucks.	Noted. The vehicles are engaged for coal transporting are mechanically covered and periodic refresher training is also being imparted on traffic for safety and environment rules.
ii	Avenue plantation of 2/3 rows all along the road for transportation of coal shall be carried out by the project proponent at its own expenses in consultation with the State Government Authorities.	The joint inspection of coal transportation route has been carried out with by Van Vikas Nigam (Govt. of Chhattisgarh). Agency has given a preliminary proposal for plantation in available avenue of around 10 km out of 50 km. The proposal is under scrutiny and finalization for execution.
iii	Periodic maintenance of the roads used for transportation of coal shall be carried out by the project proponent at its own expenses and shall also facilitate the traffic control on the roads in consultation with State Government Authorities.	Noted, The proposed coal transportation road has been recently constructed by NHAI, therefore no maintenance is required. Traffic vigilance and controls are provided as and when required by state authorities.

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EC amendment – MoEF&CC notification vide letter number S.O. 1561 (E) dated 21st May, 2020

Sl. No.	Condition of Notification	Compliance Status
1)	<p>Setting up technology solution for emission norms</p> <p>i) Compliance of specified emission norms for Particulate Matter, as per extent notifications and instructions of Central Pollution Control Board, issued from time to time.</p> <p>ii) In case of washeries, middling and rejects to be utilized in FBC (Fluidised Bed Combustion) technology based thermal power plant. Washery to have linkage for middling and rejects in Fluidised Bed Combustion plants.</p>	<p>Noted.</p> <p>i) Technology solutions are being implemented for mitigating fugitive emissions of Particulate Matter.</p> <p>ii) Washeries, middling and rejects are not applicable for this Thermal Power Plant.</p>
2)	<p>Management of Ash Ponds</p> <p>i) The thermal power plants shall comply with conditions, as notified in the Fly Ash notifications issued from time to time, without being entitled to additional capacity of fly ash pond (for existing power generation capacity) on ground of switching from washed coal to unwashed coal.</p> <p>ii) Appropriate Technology solutions shall be applied to optimise water consumption for Ash management.</p> <p>iii) The segregation of ash may be done at the Electro- Static Precipitator stage, if required, based on site specific conditions, to ensure maximum utilisation of fly ash</p> <p>iv) Subject to 2(i) above, the thermal power plants to dispose fly ash in abandoned or working mines (to be facilitated by mine owner) with environmental safeguards.</p>	<p>i) Noted & being complied. Fly ash is disposed to nearby stone quarry and being supplied to brick manufacturer. Fly Ash generation and utilization is regularly submitted to MoEF, CPCB, CECB & CEA, Please refer Annexure II</p> <p>ii) Water requirement is being restricted to 15 MCM. Optimization of water has been incorporated as part of plant design and COC is being maintained more than 5.0</p> <p>iii) Noted & being complied</p> <p>iv) Noted & will be complied as & when fly ash is disposed in abandoned or working mines</p>
3)	<p>Transportation</p> <p>i) Coal transportation may be undertaken by covered Railway wagon (railway wagons covered by tarpaulin or other means) and/or covered conveyor beyond the mine area. However, till such time enabling Rail transport/conveyer beyond infrastructure is not available, road transportation may be undertaken in trucks, covered by tarpaulin or other means.</p> <p>ii) It shall be ensured by the thermal power plant that</p> <p>a) Rail siding facility or conveyer facility is set up at or near the power plant, for transportation by rail or conveyer; and</p>	<p>i) We have taken EC amendment for the Coal transportation by road, till the time railway line will be constructed/ commission.</p> <p>ii) Currently, we are transporting coal by road with tarpaulin covered truck.</p> <p>a) Coal is being unloaded at Vimla siding nearby Bhudevapur railway station in Raigarh district.</p> <p>b) Coal is being transported by tarpaulin covered truck from off-take site from being supplied</p>

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	b) If transportation by rail or conveyor facility is not available, ensure that the coal is transported out from the Delivery Point of the respective mine in covered trucks (by tarpaulin or other means), or any mechanized closed trucks by roads.	Vimla siding as well as other market purchasing.
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ANNEXURE -I

1st Quarterly Environmental Monitoring Report



Submitted To:

**M/s Raigarh Energy Generation Ltd.
Village Chhote Bhandar, Post office Bade Bhandar,
Tehsil Pussore, Dist.-Raigarh -496100 (Chhattisgarh)**

Conducted by:

**M/s Vardan EnviroLab
Plot no. 82A, Sector-5, IMT Manesar, Gurugram (Haryana)**

(Recognized by MoEF & CC, NABL Government of India)

PREFACE

The growing concern for environmental protection and the passing of various environmental legislations have increased the responsibilities of Ministry of Environment, Forests & Climate Change, Pollution Control boards in many folds. Besides enforcing the various environmental legislations MoEF&CC, CPCB & SPCB strive to propagate the necessity awareness regarding the various legal provisions and environmental protection measures in the country.

Electric Power scenario has occupied a significant place in the development program of the country. Development and environment can neither be separated nor ignored. In fact, they are complimentary to each other. These issues have become a concern of the community, particularly the environment impact due to industries in the developing countries.

However, the prerequisite for sustainable development is judicious planning of environmental status, likely impacts of the approach adopted on the environment including inhabitants of the locality, availability of the eco-friendly technology, emerging waste disposal and waste utilization processes, techniques of land reclamation for the restoration of aesthetic beauty and soon.

M/s Raigarh Energy Generation Ltd., Village Chhote Bhandar, Post Office Bade Bhandar, Raigarh-496100, India, has engaged M/S Vardan EnviroLab, Gurugram, (HR) to provide Environmental Services in respect of ambient air quality monitoring, stack emission, noise level monitoring & Sampling and Analysis of ground water quality, surface water quality, treated effluent sewage, effluent water from ETP, and soil for Raigarh Energy Generation Ltd., Raigarh district of Chhattisgarh, as per guidelines of MoEF & CC and CPCB Gazette notification.

M/S Vardan EnviroLab, Gurugram, (HR) has deployed entirely its own personnel, facilities and expertise for doing this service. Sampling / Monitoring Stations were identified by the Environmental Officer of Raigarh Energy Generation Ltd., The samples were analyzed partly at site and partly at our MoEF Recognized laboratory situated at Gurugram (HR).

This report presents the data generated for the period from 24th June 2020 to 26th June 2020, i.e. for First quarter which includes sampling locations, Methodology, testing procedure and compilation for the Environmental parameters i.e. Air, Water & Noise with a view to evaluate the impact due to the thermal power plant activities.

During the course of our operations for the above task, the staff and management of Raigarh Energy Generation Ltd., were extremely co-operative. We are grateful to them for their invaluable support and assistance rendered to us during the course of the sampling and monitoring.

Date : 3/7/2020



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Chapter - 1.0

INTRODUCTION

M/s Raigarh Energy Generation Ltd., a subsidiary of Adani Power, is a power generation company based at Raigarh in the State of Chattisgarh. Raigarh Energy Generation Ltd., has recently commissioned its Thermal Power Plant first 600MW Unit at Village Chhote Bhandar, Post Office Bade Bhandar, Raigarh- 496100, India. The second unit of 600MW is under implementation.

Raigarh Energy Generation Ltd., is also committed towards the environment and the community it operates in. It has successfully implemented several community welfare schemes in the field of livelihood, infrastructure, community health and education which has so far benefited over 60,000 people from close to 75 villages.



Figure No.1. Raigarh Energy Generation Ltd.

Chapter – 2.0

PROJECT PROFILE

2.1 Topography & Drainage

Topography of this area is generally undulating. The area is drained by Mand River approximately 3 km. away from plant in North direction and Mahanadi River approximately 5 km. away from plant in South direction.

2.2 Location

Plant is bounded by Northern Latitudes of 21° 44' 00" to 21° 44' 42" and Eastern Longitude of 83° 16' 30" to 83° 17' 18". This area falls in the survey of India toposheet no. 64 O/1, 64 O/2, 64 O/5 and 64 O/6. The location of the mine area is shown in **Fig. No. 2**

2.3 Climate

The climate of the area is Sub-tropical type. It is in the zone of humid tropic climate where temperature and humidity of air are very high. The temperature varies from the minimum - maximum temperature range between 29.5°C - 49 °C in summer, and 8°C - 25 °C in winter. The humidity varies from 35% to 82%. The annual average rainfall in the area is about 1300 mm.

2.4 Communication

The nearest railway station is Kirodimal, which is at a distance of ~23 Km towards North direction. The area is well connected with N.H. No. 216. Nearest Airport is Raipur ~250 km in SW direction. Nearest village is Bade Bhandar ~ 1 km. in North direction and nearest town is Raigarh ~21 km. in North-East direction.

2.5 Location Map

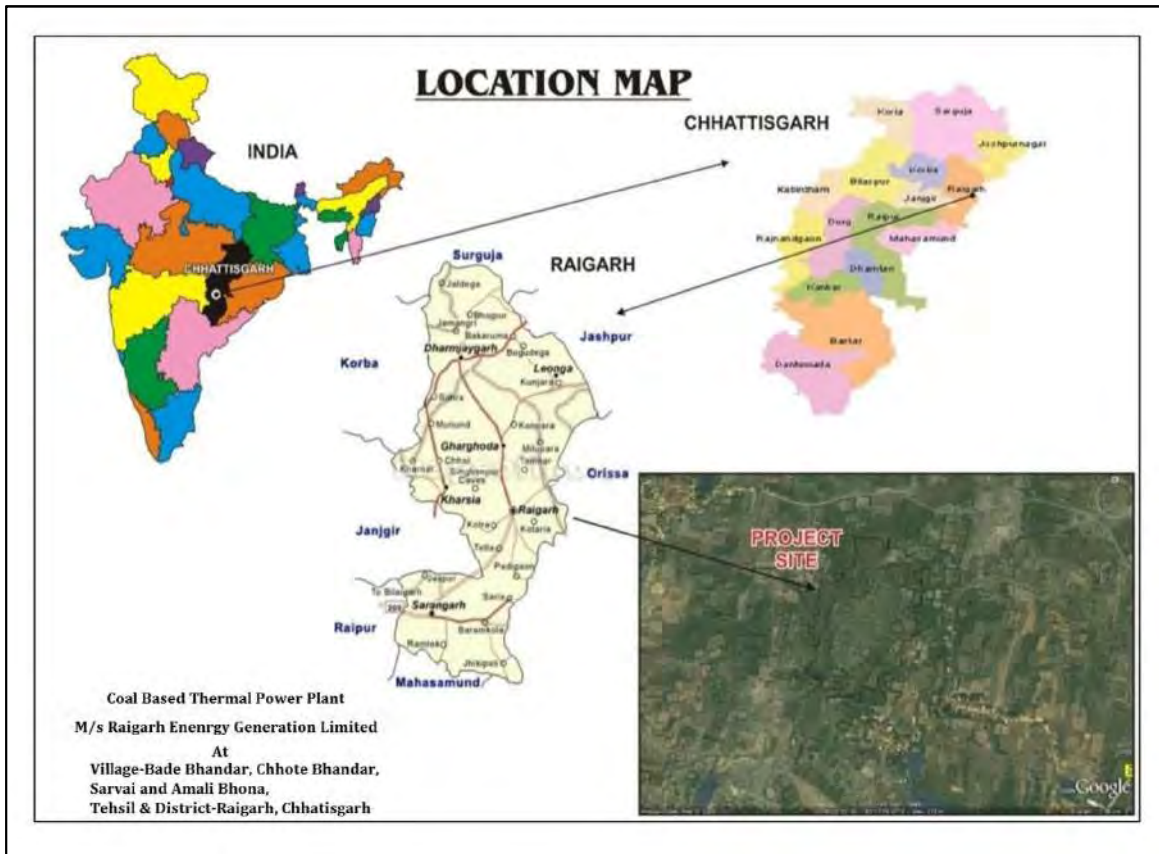


Figure No.2. Location Map

Chapter – 3.0

SCOPE OF STUDY AND METHODOLOGY

3.1 Scope of Study

The scope of study includes Environmental Services in respect of ambient air quality monitoring, noise level monitoring & Sampling and Analysis of ground water quality, surface water quality, treated effluent sewage, effluent water from ETP and soil.

3.2 Methodology

As mentioned in the scope of work covering the various Environmental components monitoring and sampling and its analysis was carried out on the basis of guidelines of Ministry of Environment Forest & Climate Control of Government of India & Chattisgarh State Pollution Control Board. Sampling procedure method reference and Analysis procedure method reference are mentioned in monitoring reports.

3.2.1 Ambient Air Quality Monitoring

The ambient air quality has been carried out at various sources of air pollution surrounding and in the Plant. The prime objective of the ambient air quality monitoring is to assess the existing air quality of the area.

The ambient air quality monitoring was carried out for 24 hours at each station. At all stations SO₂, NO₂, PM₁₀, PM_{2.5}, CO and Mercury were monitored. All the samples collected were analyzed for quantitative analysis of various pollutants.

The ambient air quality sampling locations were identified by the Environmental Officer of Raigarh Energy Generation Ltd.

3.2.2 Water Environment

The ground water samples, surface water samples were collected from selected locations in two liter sterilized plastic cans. These samples were analyzed as per IS 10500:2012. The domestic effluent and Industrial effluent samples were collected and analyzed for parameters: pH, Total suspended solids, Biochemical Oxygen Demand, Chemical Oxygen Demand and Oil & Grease.

3.2.3 Noise Environment

Sound level meter was used to know the sound levels generated due to plant activities at different locations. The measurements were taken for Equivalent sound level over a time period for day and night which is expressed in dB(A).

3.2.4 Soil

The Soil samples were collected from selected locations. These samples were analyzed for Physico-Chemical parameters including heavy metals.

Chapter – 4.0

SAMPLING LOCATION MAP AND ANALYSIS REPORTS

4.1 Ambient Air Quality Monitoring



Figure No.3. Plan Showing Ambient Air Quality Location Map

Location Code: -

- A1- Site Office
- A2- PalsadaVillage
- A3- Kathali Village
- A4- Chhote Bhandar Village
- A5- Bade Bhandar Village



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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/A/2006280002
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/A/2006280002
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Period of Analysis : 28/06/2020-03/07/2020
 Receipt Date : 28/06/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Site Office

Sample Collected by : vardan representative

Sampling Equipment used : RDS/FPS

Instrument Code : VEL/RDS/FPS/01

Instrument Calibration Status : Calibrated

Latitude : -

Longitude : -

Meteorological condition during monitoring : Clear Sky

Date of Monitoring : 24/06/2020 To 25/06/2020

Time of Monitoring : 10:17 am to 09:59 am

Ambient Temperature (°C) : MIN. 31° , Max. 41°

Surrounding Activity : Human & vehicular Plant Activities

Scope of Monitoring : Regulatory Requirement

Sampling & Analysis Protocol : IS 5182

Sampling Duration : 24 Hrs.

Parameter Required : As per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P-23), Gravimetric Method, RA:2006	78.26	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS: 5182 (P-24), 2019	42.50	µg/m ³	60
3	Nitrogen Dioxides (as NO2)	IS:5182 (P-6), Jacob & Hochheiser, RA:2006	23.26	µg/m ³	80
4	Sulphur Dioxide (as SO2)	IS:5182 (P-2), Modified West and Gaeke, RA:2012	15.00	µg/m ³	80
5	Carbon Monoxide (as CO)	IS:5182 (P-10) Gas Chromatography, RA:2003	0.36	mg/m ³	4.0
6	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (*DL1.0 ng/m ³)	µg/m ³	-

End of Report


 (Checked By)



Note: a) The results listed refer only to the tested samples & applicable parameters
 b) Total liabilities of our lab will be restricted to the invoice amount only
 c) The Sample will be destroyed after retention time unless otherwise specified
 d) This report is not to be reproduced wholly or in part and cannot be used as evidence in the court of law



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MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/2006280003

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.

Village Lihante Khanjar, Post Lihate Hade Hader
Tehsil Pussore, Dist-Raigarh-490100 (Chhattisgarh)

Report No. : VEL/2006280003

Format No : 7 8 F-01

Party Reference No : NIL

Reporting Date : 03/07/2020

Period of Analysis : 28/06/2020-03/07/2020

Receipt Date : 28/06/2020


Sample Description : AMBIENT AIR

General Information

Sampling Location : Village Palsada
Sample Collected by : vardan representative
Sampling Equipment used : RDS/FPS
Instrument Code : VEL/RDS/FPS/02
Instrument Calibration Status : Calibrated
Latitude : -
Longitude : -
Meteorological condition during monitoring : Clear Sky
Date of Monitoring : 24/06/2020 To 25/06/2020
Time of Monitoring : 10:32 am to 10:20 am
Ambient Temperature (°C) : MIN. 23° , Max. 47°
Surrounding Activity : Human & vehicular Activities
Scope of Monitoring : Regulatory Requirement
Sampling & Analysis Protocol : IS 5182
Sampling Duration : 24 Hrs.
Parameter Requested : As per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P-23), Gravimetric Method, RA:2006	71.38	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS: 5182 (P-24), 2019	38.75	µg/m ³	60
3	Nitrogen Dioxides (as NO ₂)	IS:5182 (P-6), Jacob & Hochheiser, RA:2006	21.81	µg/m ³	80
4	Sulphur Dioxide (as SO ₂)	IS:5182 (P-2), Modified West and Gaeke, RA:2012	13.64	µg/m ³	80
5	Carbon Monoxide (as CO)	IS:5182 (P-10) Gas Chromatography, RA:2003	0.62	mg/m ³	4.0
6	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (±DL1.0 ng/m ³)	µg/m ³	--

End of Report


(Checked By)



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Test Report

Sample Number : VEL/A/2006280004

Report No. : VEL/A/2006280004

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Puzoorc, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Period of Analysis : 28/06/2020-03/07/2020
 Receipt Date : 28/06/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village Kethli
 Sample Collected by : vardan representative
 Sampling Equipment used : RDS/FPS
 Instrument Code : VFI/RDS/FPS/03
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 24/06/2020 To 25/06/2020
 Time of Monitoring : 11:20 am to 10:38 am
 Ambient Temperature (°C) : MIN.21° , Max. 46°
 Surrounding Activity : Human & vehicular Activities
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS:5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P-23), Gravimetric Method, RA:2006	74.35	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS: 5182 (P-24), 2019	40.00	µg/m ³	60
3	Nitrogen Dioxides (as NO2)	IS:5182 (P-6), Jacob & Hochheiser, RA:2006	24.72	µg/m ³	80
4	Sulphur Dioxide (as SO2)	IS:5182 (P-2), Modified West and Gaeke, RA:2012	12.27	µg/m ³	80
5	Carbon Monoxide (as CO)	IS:5182 (P-10) Gas Chromatography, RA:2003	0.73	mg/m ³	4.0
6	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (*DL1.0 ng/m ³)	µg/m ³	--

End of Report


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Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/A/2006280005

Report No. : VEL/A/2006280005

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7.8 F-01
Party Reference No : NIL
Reporting Date : 03/07/2020
Period of Analysis : 28/06/2020-03/07/2020
Receipt Date : 28/06/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village Chhote Bhandar
Sample Collected by : vardan representative
Sampling Equipment used : RDS/FPS
Instrument Code : VEL/RDS/FPS/03
Instrument Calibration Status : Calibrated
Latitude : --
Longitude : --
Meteorological condition during monitoring : Clear Sky
Date of Monitoring : 25/06/2020 To 26/06/2020
Time of Monitoring : 10:30 am to 11:20 am
Ambient Temperature (°C) : MIN. 24° , Max. 46°
Surrounding Activity : Human & vehicular Activities
Scope of Monitoring : Regulatory Requirement
Sampling & Analysis Protocol : IS:5182
Sampling Duration : 24 Hrs.
Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P-23), Gravimetric Method, RA:2006	76.41	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS: 5182 (P-24), 2019	42.50	µg/m ³	60
3	Nitrogen Dioxides (as NO ₂)	IS:5182 (P-6), Jacob & Hochheiser, RA:2006	26.17	µg/m ³	80
4	Sulphur Dioxide (as SO ₂)	IS:5182 (P-2), Modified West and Gaeke, RA:2012	10.91	µg/m ³	80
5	Carbon Monoxide (as CO)	IS:5182 (P-10) Gas Chromatography, RA:2003	0.83	mg/m ³	4.0
6	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (*DL 1.0 ng/m ³)	µg/m ³	--

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
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 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/A/2006280006

Report No. : VEL/A/2006280006

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Period of Analysis : 28/06/2020-03/07/2020
 Receipt Date : 28/06/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village Bade Bhandar
 Sample Collected by : vardan representative
 Sampling Equipment used : RDS/FPS
 Instrument Code : VELRDS/FPS/02
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 25/06/2020 To 26/06/2020
 Time of Monitoring : 10:20 am to 09:50 am
 Ambient Temperature (°C) : MIN. 23° , Max. 44°
 Surrounding Activity : Human & vehicular Activities
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS 5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P-23), Gravimetric Method, RA:2006	79.10	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS: 5182 (P-24), 2019	42.60	µg/m ³	60
3	Nitrogen Dioxides (as NO ₂)	IS:5182 (P-6), Jacob & Hochheiser, RA:2006	24.72	µg/m ³	80
4	Sulphur Dioxide (as SO ₂)	IS:5182 (P-2), Modified West and Gaeke, RA:2012	12.27	µg/m ³	80
5	Carbon Monoxide (as CO)	IS:5182 (P-10) Gas Chromatography, RA:2003	0.85	mg/m ³	4.0
6	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (*DL1.0 ng/m ³)	µg/m ³	--

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4.2 Noise Level Monitoring



Figure No.4. Plan Showing Noise Level Monitoring Location Map

Ambient Noise Level Monitoring Locations

Location Code: - N1- Field Hostel
N2- Palsada Village
N3- Kathali Village
N4- Chote Bhandar Village
N5- Bade Bhandar Village

Work Zone Noise Level Monitoring Locations

Location Code: - N6- Site Office
N7- Behind Switchyard
N8- Railway Entry Gate



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 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/N/2006280001
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bada Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2006280001
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Receipt Date : 28/06/2020
 Sampling Duration : 24 Hrs
 Sample Collected by : Vardan EnviroLab Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9889; IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Field Hostel
 Instrument Code : VEL/SLM/01
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 24/06/2020 To 25/06/2020
 Time of Monitoring : 6.00 to 6.00 AM
 Ambient Temperature (°C) : Min. 30°C Max. 43°C
 Surrounding Activity : Human & Vehicular Acti.
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876-1981	54.2	51.7
2	L min	IS: 9989-1981, IS 9876-1981	42.8	40.4
3	Leq	IS: 9989 1081, IS 9876: 1081	54.10	49.52

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

- Day Time is from 6.00 AM to 10.00 PM.
 - Night Time is reckoned between 10.00 PM to 6.00 AM
 - Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
- Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

End of Report


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- Note: a) The results listed refer only to the tested samples & applicable parameters
 b) Total liabilities of our lab will be restricted to the invoice amount only
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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/N/2006280002
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhole Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No : VFI/N/2006280002
 Format No : / B F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Receipt Date : 28/06/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : Vardan EnviroLab Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989; IS 9876
 Instrument Used : SLM

General Information


Sampling Location : Village Palsada
 Instrument Code : VEL/SLM/02
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 24/06/2020 To 25/06/2020
 Time of Monitoring : 6:00 to 6:00 AM
 Ambient Temperature (°C) : Min. 31°C Max 44°C
 Surrounding Activity : Human & Vehicular Acti,
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	LEVEL MASURED IN (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	66.2	64.2
2	L min	IS: 9989-1981, IS 9876: 1981	43.4	38.6
3	Leq	IS: 9989-1981, IS 9876: 1981	54.77	43.32

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1. Day Time is from 6.00 AM to 10.00 PM.
 2. Night Time is reckoned between 10.00 PM to 6.00 AM
 3. SilenceZone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
 Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

End of Report


 (Checked By)



Note: a) The results listed refer only to the tested samples & applicable parameters
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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/N/2006280003

Report No. : VEL/N/2006280003

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhhattisgarh)

Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Receipt Date : 28/06/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : Vardan EnviroLab Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9080, IS 9876
 Instrument Used : SLM

General Information

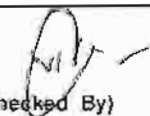
Sampling Location : Village - Kathli
 Instrument Code : VEL/SLM/03
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 24/06/2020 To 25/06/2020
 Time of Monitoring : 6.00 to 6.00 AM
 Ambient Temperature (°C) : Min. 31°C Max. 44°C
 Surrounding Activity : Human & Vehicular Acti.
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	64.6	49.4
2	L min	IS: 9989-1981, IS 9876: 1981	42.3	36.8
3	Leq	IS: 9989-1981, IS 9876: 1981	53.60	42.01

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

- Day Time is from 6:00 AM to 10:00 PM.
 - Night Time is reckoned between 10:00 PM to 6:00 AM
 - Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
- Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

End of Report


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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/N/2006280004
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2006280004
 Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Receipt Date : 28/06/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : Vardan EnviroLab Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989; IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Village Chhote Bhandar
 Instrument Code : VEL/SLM/01
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 25/06/2020 To 26/06/2020
 Time of Monitoring : 6.00 to 6.00 AM
 Ambient Temperature (°C) : Min. 30°C Max. 45°C
 Surrounding Activity : Human & Vehicular Acti.
 Parameter Required : As Per Work Order

S No	Fast Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	64.1	53.3
2	L min	IS: 9989-1981, IS 9876: 1981	43.7	41.2
3	Leq	IS: 9989-1981, IS 9876: 1981	53.92	44.42

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1. Day Time is from 6.00 AM to 10.00 PM.
 2. Night Time is reckoned between 10.00 PM to 6.00 AM
 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
- Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/N/2006280005
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhoto Bhandar, Post Office Dade Bhandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2006280005
 Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Receipt Date : 28/06/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : Vardan EnviroLab Team
 Instrument : Calibrated
 Calibration Status :

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989; IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Village Bade Bhandar
 Instrument Code : VEL/SLM/02
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 25/06/2020 To 26/06/2020
 Time of Monitoring : 6.00 to 6.00 AM
 Ambient Temperature (°C) : Min. 30°C Max. 45°C
 Surrounding Activity : Human & Vehicular Acti.
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	66.8	59.5
2	L min	IS: 9989-1981, IS 9876: 1981	44.2	38.8
3	Leq	IS: 9989-1981, IS 9876: 1981	53.11	43.52

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1. Day Time is from 6.00 AM to 10.00 PM.
 2. Night Time is reckoned between 10.00 PM to 6.00 AM
 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
 Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

End of Report


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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/N/2006280006
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2006280006
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Receipt Date : 28/06/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : Vardan EnviroLab Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989, IS 9870
 Instrument Used : SLM

General Information

Sampling Location : Site office
 Instrument Code : VEL/SLM/01
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 26/06/2020 To 27/06/2020
 Time of Monitoring : 6.00AM to 6.00 AM
 Ambient Temperature (°C) : Min 30°C Max 45°C
 Surrounding Activity : Human & Vehicular & Plant Acti.
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day time	Night time
1	L max	IS: 9989-1981, IS 9876: 1981	64.2	54.1
2	L min	IS: 9989-1981, IS 9876: 1981	41.7	39.5
3	Leq	IS: 9989-1981, IS 9876: 1981	54.14	42.2

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

- Day Time is from 6.00 AM to 10.00 PM.
 - Night Time is reckoned between 10.00 PM to 6.00 AM
 - Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/N/2006280007
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhole Bhandar, Post Office Badc Bendar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2006280007
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Receipt Date : 28/06/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : Vardan EnviroLab Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989: IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Behind Swith Yard
 Instrument Code : VEL/SLM/02
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 26/06/2020 To 27/06/2020
 Time of Monitoring : 6.00 AM to 6.00 AM
 Ambient Temperature (°C) : Min. 30°C Max. 45°C
 Surrounding Activity : Human & Vehicular & Plant Acti.
 Parameter Required : As Per Work Order

S No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	66.5	57.5
2	L min	IS: 9989-1981, IS 9876: 1981	42.4	39.2
3	Leq	IS: 9989-1981, IS 9876: 1981	54.44	41.50

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1. Day Time is from 6.00 AM to 10.00 PM
 2. Night Time is reckoned between 10.00 PM to 6.00 AM
 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
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End of Report


 (Checked By)



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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/N/2006280008
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2006280008
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Receipt Date : 28/06/2020
 Sampling Duration : 24 Hrs
 Sample Collected by : Vardan EnviroLab Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989; IS 9876
 Instrument Used : ULM

General Information

Sampling Location : Railway Entry Gate
 Instrument Code : VEL/SLM/03
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 26/06/2020 To 27/06/2020
 Time of Monitoring : 6.00 to 6.00 AM
 Ambient Temperature (°C) : Min. 30°C Max. 45°C
 Surrounding Activity : Human & Vehicular Acti.
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	63.7	68.2
2	L min	IS: 9989-1981, IS 9876: 1981	42.2	42.8
3	Leq	IS: 9989-1981, IS 9876: 1981	54.16	49.21

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1. Day Time is from 6.00 AM to 10.00 PM.
 2. Night Time is reckoned between 10.00 PM to 6.00 AM
 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
 Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

End of Report


 (Checked By)


 Approved By

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4.3 Ground water Quality Analysis



Figure No.5. Plan Showing Ground Water Quality Monitoring Location Map

Location Code: -

- GW1- Site Office
- GW2- PalsadaVillage
- GW3- Kathali Village
- GW4- Chote Bhandar Village
- GW5- Bade Bhandar Village



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/W/2006280001

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhoti Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist Raigarh 406100 (Chhattisgarh)

Report No. : VEL/W/2006280001

Format No : 7.8 F-01

Party Reference No : Nil

Reporting Date : 03/07/2020

Period of Analysis : 01/07/2020-03/07/2020

Receipt Date : 28/06/2020

Sampling Date : 26/06/2020

Sampling Quantity : 2.0 Ltr.

Sampling Type : Grab

Sample Description : Water Sample
 Location : Site Office
 Sample Collected by : Vardan EnviroLab Team
 Preservation : 25 DEGREE
 Sampling and Analysis Protocol : IS 10500 2012

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
1	pH (at 25°C)	IS 3026(P-11): 1983 Reaff. 2017	7.41		6.5 to 8.5	No Relaxation
2	#Colour	IS 3025: 1983 (P-4) Reaff. 2017	*BDL (**DL Nilapplicable)		5	10
3	Turbidity	IS 3025 (Part 10): 1984, Reaff. 2017	*BDL (**DL 0.1NTU)	NTU	1	5
4	#Odour	IS 3025 (P-5) : 2018	Agreeable	--	Agreeable	Agreeable
5	#Taste	IS 3025 (P-5) : 1984 Reaff. 2017	Agreeable	--	Agreeable	Agreeable
6	Total Hardness (as CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	193.64	mg/l	200	600
7	Calcium (as Ca)	IS: 3025 (Part 4U): 1991 Reaff. 2018	66.05	mg/l	75	200
8	Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	173.36	mg/l	200	600
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	68.94	mg/l	250	1000
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL (**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	7.00	mg/l	30	100
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	329.00	mg/l	500	2000
13	Sulphate (as SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019	24.59	mg/l	200	400
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.37	mg/l	1.0	1.5
15	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	0.64	mg/l	45.0	No Relaxation
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.21	mg/l	0.3	No Relaxation
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL (**DL-0.03 mg/L)	mg/l	0.03	0.2
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL (**DL-0.2 mg/L)	mg/l	0.5	1.0
19	Phenolic Compounds (C6H5OH)	APHA 23rd Edition 2017, 5530C	*BDL (**DL-0.001 mg/L)	mg/l	0.001	0.002
20	#Mineral Oil	IS 3025 (P-39)	*BDL (**DL-0.5 mg/L)	mg/l	0.5	No Relaxation
21	#Anionic Detergents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL (**DL-0.10 mg/L)	mg/l	0.2	1.0

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001


Test Report

Sample Number : VEL/W/2006280001

Report No. : VEL/W/2006280001

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.2 mg/L)	mg/l	5.0	15.0
23	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/l)	mg/l	0.05	1.5
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 D	*BDL(**DL-0.05 mg/L)	mg/l	0.1	0.3
25	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l	0.01	No Relaxation
26	Arsenic (as As)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l	0.01	0.05
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	--
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	-
29	Ammonia	IS-3025 (Part-34)- 1988, Reaff: 2019	*BDL(**DL-0.5 mg/L)	mg/l	0.5	No Relaxation
30	Sulphide	IS 3025 (P-29) :1986 Reaff 2019 Idometric	*BDL(**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l	4.0	No relaxation
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l	0.7	No relaxation
33	Residual Free Chlorine	APHA 4500 Cl-B	*BDL(**DL-0.2 mg/L)	mg/l	0.2	1.0
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100 ml	-	-

End of Report


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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/W/2006280002
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhole Bhandar, Post Office Dade Dandar
 Tehsil Pussora Dist-Rajgarh-303001 (Raj.)

Report No. : VEL/W/2006280002
 Format No : 7.8 F-01
 Party Reference No : Nil
 Reporting Date : 03/07/2020
 Period of Analysis : 01/07/2020-03/07/2020
 Receipt Date : 28/06/2020
 Sampling Date : 26/06/2020
 Sampling Quantity : 2.0 Ltr.
 Sampling Type : Grab

Sample Description : Water Sample
 Location : Village Palsada
 Sample Collected by : Vardan EnviroLab Team
 Preservation : 25 DEGREE
 Sampling and Analysis Protocol : IS 10500 2012

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
1	pH (at 25°C)	IS 3025(P-11): 1983 Reaff. 2017	7.48		6.5 to 8.5	No Relaxation
2	#Colour	IS 3025: 1983 (P-4) Reaff. 2017	*BDL(**DL 5Hazen)		5	15
3	Turbidity	IS 3025 (Part 10): 1984, Reaff. 2017	*BDL(**DL 0.1NTU)	NTU	1	5
4	#Odour	IS 3025 (P-5) : 2018	Agreeable	--	Agreeable	Agreeable
5	#Taste	IS 3025 (P-8): 1984 Reaff. 2017	Agreeable	--	Agreeable	Agreeable
6	Total Hardness (as CaCO ₃)	IS: 3025 (Part 21): 2009, Reaff. 2019	197.76	mg/l	200	600
7	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	69.35	mg/l	75	200
8	Alkalinity (as CaCO ₃)	IS: 3025 (Part 23): 1986, Reaff. 2019	212.76	mg/l	200	600
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	70.97	mg/l	250	1000
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	6.00	mg/l	30	100
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	344.00	mg/l	500	2000
13	Sulphate (as SO ₄)	IS: 3025 (Part 24): 1986, Reaff. 2019	27.86	mg/l	200	400
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.43	mg/l	1.0	1.5
15	Nitrate (as NO ₃)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	0.46	mg/l	45.0	No Relaxation
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.24	mg/l	0.3	No Relaxation
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/L)	mg/l	0.03	0.2
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/L)	mg/l	0.5	1.0
19	Phenolic Compounds (C ₆ H ₅ OH)	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.001 mg/L)	mg/l	0.001	0.002
20	#Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.5 mg/L)	mg/l	0.5	No Relaxation
21	#Anionic Detergents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.10 mg/L)	mg/l	0.2	1.0

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Test Report

Sample Number : VELW/2006280002

Report No. : VELW/2006280002

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.2 mg/L)	mg/l	5.0	15.0
23	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/L)	mg/l	0.05	1.5
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 B	*BDL(**DL-0.05 mg/L)	mg/l	0.1	0.3
25	Selenium (as Se)	APHA (23rd edition-2017), 3111C	*BDL(**DL-0.005 mg/L)	mg/l	0.01	No Relaxation
26	Arsenic (as As)	APHA (23rd edition-2017), 3111C	*BDL(**DL-0.005 mg/L)	mg/l	0.01	0.05
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	--
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	
29	Ammonia	IS-3025 (Part-34)- 1988, Reaff. 2019	*BDL(**DL-0.6 mg/L)	mg/l	0.6	No Relaxation
30	Sulphide	IS 3025 (P-29) :1986 Reaff 2019 Idometric	*BDL(**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l	4.0	No relaxation
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l	0.7	No relaxation
33	Residual Free Chlorine	APHA 4500 C1-B	*BDL(**DL-0.2 mg/L)	mg/l	0.2	1.0
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100 ml	-	-

End of Report

(Checked By)



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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised ISO 9001 | OHSAS 45001

Test Report

Sample Number : VELW/2006280003

Report No. : VELW/2006280003

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhole Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-498100 (Chhattisgarh)

Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Period of Analysis : 01/07/2020-03/07/2020

Sample Description : Water Sample
 Location : Village Kathli
 Sample Collected by : Vardan EnviroLab Team
 Preservation : 25 DEGREE
 Sampling and Analysis Protocol : IS 10500 2012

Receipt Date : 28/06/2020
 Sampling Date : 26/06/2020
 Sampling Quantity : 2.0 Ltr.
 Sampling Type : Grab

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
1	pH (at 25°C)	IS 3025(P-11): 1983 Reaff. 2017	7.41		6.5 to 8.5	No Relaxation
2	#Colour	IO 0025. 1000 (P-4) Reaff. 2017	*BDL(**DL 5Hazen)		5	15
3	Turbidity	IS 3025 (Part 10): 1984, Reaff: 2017	*BDL(**DL 0.1NTU)	NTU	1	5
4	#Odour	IS 3025 (P-5) : 2018	Agreeable	--	Agreeable	Agreeable
5	#Taste	IS 3025 (P-11): 1984 Reaff. 2017	Agreeable	--	Agreeable	Agreeable
6	Total Hardness (as CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	374.92	mg/l	200	600
7	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	110.63	mg/l	75	200
8	Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	330.96	mg/l	200	600
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	97.33	mg/l	250	1000
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	24.03	mg/l	30	100
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	574.00	mg/l	500	2000
13	Sulphate (as SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019	67.37	mg/l	200	400
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.59	mg/l	1.0	1.5
15	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	2.61	mg/l	45.0	No Relaxation
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.36	mg/l	0.3	No Relaxation
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/L)	mg/l	0.03	0.2
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/L)	mg/l	0.5	1.0
19	Phenolic Compounds (C6H5OH)	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.001 mg/L)	mg/l	0.001	0.002
20	#Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.5 mg/L)	mg/l	0.5	No Relaxation
21	#Anionic Detergents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.10 mg/L)	mg/l	0.2	1.0

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 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/W/2006280003

Report No. : VEL/W/2006280003

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.2 mg/L)	mg/l	5.0	15.0
23	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/L)	mg/l	0.05	1.5
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 B	*BDL (**DL -0.05 mg/L)	mg/l	0.1	0.3
25	Selenium (as Se)	APHA (23rd edition 2017), 3114C	*BDL (**DL 0.005 mg/L)	mg/l	0.01	No Relaxation
26	Arsenic (as As)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l	0.01	0.05
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	--
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	--
29	Ammonia	IS-3025 (Part-34)- 1988, Reaff: 2019	*BDL(**DL-0.5 mg/L)	mg/l	0.5	No Relaxation
30	Sulphide	IS 3025 (P-29) :1986 Reaff 2019 Iodometric	*BDL(**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l	4.0	No relaxation
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l	0.7	No relaxation
33	Residual Free Chlorine	APHA 4500 Cl-B	*BDL(**DL-0.2 mg/L)	mg/l	0.2	1.0
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100 ml	-	-

End of Report

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/W/2006280004
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhole Bhandar, Post Office Dade Dandar
 Tehsil Puraone, Dist-Rajgarh-495100 (Chhattisgarh)
 Sample Description : Water Sample
 Location : Village Chhole Bhandar
 Sample Collected by : Vardan EnviroLab Team
 Preservation : 25 DEGREE
 Sampling and Analysis Protocol : IS 10500 2012

Report No. : VEL/W/2006280004
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/07/2020
 Period of Analysis : 01/07/2020-03/07/2020
 Receipt Date : 28/06/2020
 Sampling Date : 26/06/2020
 Sampling Quantity : 2.0 Ltr.
 Sampling Type : Grab

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
1	pH (at 25°C)	IS 3025(P-11): 1983 Reaff. 2017	7.54		6.5 to 8.5	No Relaxation
2	#Colour	IS 3025: 1985 (P-4) Reaff. 2017	*BDL (**DL 1 Hazen)		5	5
3	Turbidity	IS 3025 (Part 10): 1984, Reaff: 2017	*BDL (**DL 0.1NTU)	NTU	1	5
4	#Odour	IS 3025 (P-5) : 2018	Agreeable	--	Agreeable	Agreeable
5	#Taste	IS 3025 (P-8): 1984 Reaff. 2017	Agreeable	--	Agreeable	Agreeable
6	Total Hardness (as CaCO ₃)	IS: 3025 (Part 21): 2009, Reaff. 2019	329.60	mg/l	200	600
7	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	108.98	mg/l	75	200
8	Alkalinity (as CaCO ₃)	IS: 3025 (Part 23): 1986, Reaff. 2019	236.40	mg/l	200	600
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	89.22	mg/l	250	1000
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL (**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	14.01	mg/l	30	100
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	484.00	mg/l	500	2000
13	Sulphate (as SO ₄)	IS: 3025 (Part 24): 1986, Reaff. 2019	49.18	mg/l	200	400
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.40	mg/l	1.0	1.5
15	Nitrate (as NO ₃)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	3.69	mg/l	45.0	No Relaxation
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.29	mg/l	0.3	No Relaxation
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL (**DL-0.03 mg/L)	mg/l	0.03	0.2
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL (**DL-0.2 mg/L)	mg/l	0.5	1.0
19	Phenolic Compounds (C ₆ H ₅ OH)	APHA 23rd Edition 2017, 5530C	*BDL (**DL-0.001 mg/L)	mg/l	0.001	0.002
20	#Mineral Oil	IS 3025 (P-39)	*BDL (**DL-0.5 mg/L)	mg/l	0.5	No Relaxation
21	#Anionic Detergents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL (**DL-0.10 mg/L)	mg/l	0.2	1.0

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 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VELW/2006280004

Report No. : VELW/2006280004

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.2 mg/L)	mg/l	5.0	16.0
23	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/L)	mg/l	0.05	1.5
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 B	*BDL(**DL-0.05 mg/L)	mg/l	0.1	0.3
25	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l	0.01	No Relaxation
26	Arsenic (as As)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/l)	mg/l	0.01	0.05
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	--
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	--
29	Ammonia	IS- 3026 (Part-34)- 1988. Reaff: 2019	*BDL(**DL-0.5 mg/L)	mg/l	0.6	No Relaxation
30	Sulphide	IS 3025 (P-29) :1986 Reaff 2019 Idometric	*BDL(**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l	4.0	No relaxation
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l	0.7	No relaxation
33	Residual Free Chlorine	APHA 4500 Cl-B	*BDL(**DL-0.2 mg/L)	mg/l	0.2	1.0
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100 ml	-	-

End of Report


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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/W/2006280005
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Rajgarh-496100 (Chhattisgarh)
 Sample Description : Water Sample
 Location : Village bade Bhandar
 Sample Collected by : Vardan EnviroLab Team
 Preservation : 25 DEGREE
 Sampling and Analysis Protocol : IS 10500 2012

Report No. : VEL/W/2006280005
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 04/07/2020
 Period of Analysis : 01/07/2020-04/07/2020
 Receipt Date : 28/06/2020
 Sampling Date : 26/06/2020
 Sampling Quantity : 20 Ltr
 Sampling Type : Grab

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
1	pH (at 25°C)	IS 3026(P-11): 1983 Reaff. 2017	7.48		6.5 to 8.5	No Relaxation
2	#Colour	IS 3026: 1983 (P-4) Reaff. 2017	*BDL(**DL 5Hazen)		5	15
3	Turbidity	IS 3025 (Part 10): 1984, Reaff: 2017	*BDL(**DL 0.1NTU)	NTU	1	5
4	#Odour	IS 3025 (P-5) . 2018	Agreeable	--	Agreeable	Agreeable
5	#Taste	IS 3025 (P-8): 1984 Reaff. 2017	Agreeable	--	Agreeable	Agreeable
6	Total Hardness (as CaCO3)	IS: 3025 (Part 21): 2008, Reaff. 2019	333.72	mg/l	200	600
7	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	107.33	mg/l	75	200
8	Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	315.20	mg/l	200	600
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	97.33	mg/l	250	1000
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	16.02	mg/l	30	100
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	494.50	mg/l	500	2000
13	Sulphate (as SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019	45.90	mg/l	200	400
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.33	mg/l	1.0	1.5
15	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	4.30	mg/l	45.0	No Relaxation
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.28	mg/l	0.3	No Relaxation
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/L)	mg/l	0.03	0.2
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/L)	mg/l	0.5	1.0
19	Phenolic Compounds (C6H5OH)	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.001 mg/L)	mg/l	0.001	0.002
20	#Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.5 mg/L)	mg/l	0.5	No Relaxation
21	#Anionic Detergents (as MBAS)	APHA 23rd Edition 2017, 5640C	*BDL(**DL-0.10 mg/L)	mg/l	0.2	1.0



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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/W/2006280005

Report No. : VEL/W/2006280005

S.No.	Test Parameters	Test Method	Results	Units	IS:10500-2012	
					Acceptable Limit	Permissible Limit
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.2 mg/L)	mg/l	5.0	15.0
23	Copper (as Cu)	APHA 23rd Edition 2017 Method No. 3111B	*BDL(**DL-0.02 mg/L)	mg/l	0.05	1.5
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 B	*BDL(**DL-0.05 mg/L)	mg/l	0.1	0.3
25	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l	0.01	No Relaxation
26	Arsenic (as As)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l	0.01	0.05
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	--
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml	Shall not be detectable in any 100 ml sample	--
29	Ammonia	IS-3025 (Part-34)- 1988, Reaff: 2019	*BDL(**DL-0.5 mg/L)	mg/l	0.5	No Relaxation
30	Sulphide	IS 3025 (P-29) :1986 Reaff 2019 Idometric	*BDL(**DL-0.05 mg/L)	mg/l	0.05	No Relaxation
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l	4.0	No relaxation
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l	0.7	No relaxation
33	Residual Free Chlorine	APHA 4500 Cl-B	*BDL(**DL-0.2 mg/L)	mg/l	0.2	1.0
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100 ml	-	-

End of Report


(Checked By)



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4.4 Surface water Quality Analysis



Figure. No. 6. Plan Showing Surface Water Quality Monitoring Location Map

Location Code: - 1. Mand Nadi River (Up Stream)

2. Mand Nadi River (Down Stream)



Vardan EnviroLab



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/W/2006280008
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tohail Puccora, Dist Raigarh 406100 (Chhattisgarh)
 Name of the Project : -

Report No. : VEL/W/2006280008
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 04/07/2020
 Period of Analysis : 01/07/2020-04/07/2020
 Receipt Date : 28/06/2020
 Sampling Date : 25/06/2020
 Sampling Quantity : 2.0
 Sampling Type : Grab
 Preservation : 25 DEGREE

Sample Description : SURFACE WATER
 Location : Mand River
 Sample Collected by : Vardan EnviroLab Team
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2296

S.No.	Test Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS 3025(P-11): 1983 Reaff. 2017	7.43	
2	#Colour	IS 3025: 1983 (P-4) Reaff. 2017	*BDL(**DL 5Hazen)	
3	Turbidity	IS 3025 (Part 10): 1984, Reaff. 2017	*BDL(**DL 0.1NTU)	NTU
4	#Odour	IS 3025 (P-5) : 2010	Agreeable	--
5	#Taste	IS 3025 (P-8): 1984 Reaff. 2017	Agreeable	--
6	Total Hardness (as CaCO ₃)	IS: 3025 (Part 21): 2009, Reaff. 2019	131.84	mg/l
7	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	34.67	mg/l
8	Alkalinity (as CaCO ₃)	IS: 3025 (Part 23): 1986, Reaff. 2019	118.20	mg/l
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	46.63	mg/l
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/L)	mg/l
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	9.80	mg/l
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	191.50	mg/l
13	Sulphate (as SO ₄)	IS: 3025 (Part 24): 1986, Reaff. 2019	34.42	mg/l
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.27	mg/l
15	Nitrate (as NO ₃)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	5.53	mg/l
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.25	mg/l
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/L)	mg/l
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/L)	mg/l
19	Phenolic Compounds (C ₆ H ₅ OH)	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.001 mg/L)	mg/l

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector-5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VELAW/2006280006

Report No. : VELAW/2006280006

S.No.	Test Parameters	Test Method	Results	Units
20	#Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.5 mg/L)	mg/l
21	#Anionic Detergents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.10 mg/L)	mg/l
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	0.22	mg/l
23	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/L)	mg/l
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 B	*BDL(**DL-0.05 mg/L)	mg/l
25	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l
26	Arsenic (as As)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml
29	Ammonia	IS-3025 (Part-34)- 1988, Reaff: 2019	*BDL(**DL-0.5 mg/L)	mg/l
30	Sulphide	IS 3026 (P-29) :1986 Reaff 2019 (ometric	*BDL(**DL-0.05 mg/L)	mg/l
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l
33	Residual Free Chlorine	APHA 4500 CI-B	*BDL(**DL-0.2 mg/L)	mg/l
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100ml

End of Report


 (Checked By)



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Vardan EnviroLab



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VELW/2006280007
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pissore, Dist-Raigarh-496100 (Chhattisgarh)

Name of the Project : -

Sample Description : SURFACE WATER
 Location : Mand River (Up Stream)
 Sample Collected by : Vardan EnviroLab Team
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2296

Report No. : VELW/2006280007
 Format No : 7.8 F-01
 Party Reference No : Nil
 Reporting Date : 04/07/2020
 Period of Analysis : 01/07/2020-04/07/2020
 Receipt Date : 28/06/2020
 Sampling Date : 25/06/2020
 Sampling Quantity : 2.0
 Sampling Type : Grab
 Preservation : 25 DEGREE

S.No.	Test Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS 3025(P-11): 1983 Reaff. 2017	7.51	
2	#Colour	IS 3025: 1983 (P-4) Reaff. 2017	*BDL(**DL 5Hazen)	
3	Turbidity	IS 3025 (Part 10): 1984 Reaff. 2017	*BDL (**DL 0. INTU)	NTU
4	#Odour	IS 3025 (P-5): 2018	Agreeable	-
5	#Taste	IS 3025 (P-0): 1984 Reaff. 2017	Agreeable	-
6	Total Hardness (as CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	107.12	mg/l
7	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	29.72	mg/l
8	Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	90.62	mg/l
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	38.52	mg/l
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/L)	mg/l
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	8.01	mg/l
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	137.50	mg/l
13	Sulphate (as SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019	24.59	mg/l
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.20	mg/l
15	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	5.23	mg/l
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.22	mg/l
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/L)	mg/l
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/L)	mg/l
19	Phenolic Compounds (C6H5OH)	APHA 23rd Edition 2017, 5630C	*BDL(**DL-0.001 mg/L)	mg/l

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | DHSAS 45001)

Test Report

Sample Number : VEL/W/2006280007

Report No. : VEL/W/2006280007

S.No.	Test Parameters	Test Method	Results	Units
20	#Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.6 mg/L)	mg/l
21	#Anionic Detergents (as MRAS)	APHA 23rd Edition 2017, 5040C	*BDL(**DL-0.10 mg/l)	mg/l
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	0.15	mg/l
23	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/L)	mg/l
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 B	*BDL(**DL-0.05 mg/L)	mg/l
25	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l
26	Arsenic (as As)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml
29	Ammonia	IS-3025 (Part 34)- 1988, Reaff 2019	*BDL(**DL 0.6 mg/L)	mg/l
30	Sulphide	IS 3025 (P-29) :1986 Reaff 2019 Idometric	*BDL(**DL-0.05 mg/L)	mg/l
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l
33	Residual Free Chlorine	APHA 4500 Cl-B	*BDL(**DL-0.2 mg/L)	mg/l
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100ml

End of Report


(Checked By)


(Approved By)

Note: a) The results listed refer only to the tested samples & applicable parameters
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Figure. No. 7. Plan Showing Surface Water Quality Monitoring Location Map



Location Code: - 1 Mahanadi River Up Stream
2 Mahanadi River down Stream



Vardan EnviroLab



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VELW/2006280008
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village: Oldole Dhandar, Post Office: Bado Dandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)
 Name of the Project : --
 Sample Description : SURFACE WATER
 Location : Mahanadi (Down Stream)
 Sample Collected by : Vardan EnviroLab Team
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2296

Report No. : VELW/2006280000
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 04/07/2020
 Period of Analysis : 01/07/2020-04/07/2020
 Receipt Date : 28/06/2020
 Sampling Date : 25/06/2020
 Sampling Quantity : 2.0
 Sampling Type : Grab
 Preservation : 25 DEGREE

S.No.	Test Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS 3025(P-11): 1983 Reaff. 2017	7.24	
2	#Colour	IS 3025: 1983 (P-4) Reaff. 2017	*BDL(**DL 5Hazen)	
3	Turbidity	IS 3025 (Part 10): 1984, Reaff. 2017	*BDL(**DL 0.1NTU)	NTU
4	#Odour	IS 3025 (P-5) : 2018	Agreeable	--
5	#Taste	IS 3025 (P-5). 1984 Reaff. 2017	Agreeable	--
6	Total Hardness (as CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	123.60	mg/l
7	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	46.23	mg/l
8	Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	141.84	mg/l
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	50.69	mg/l
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/L)	mg/l
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	2.00	mg/l
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	277.50	mg/l
13	Sulphate (as SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019	31.14	mg/l
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.33	mg/l
15	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	17.53	mg/l
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.32	mg/l
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/L)	mg/l
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/L)	mg/l
19	Phenolic Compounds (C6H5OH)	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.001 mg/L)	mg/l

Note: a) The results listed refer only to the tested samples & applicable parameters
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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised |ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/W/2006280008

Report No. : VEL/W/2006280008

S.No.	Test Parameters	Test Method	Results	Units
20	#Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.5 mg/L)	mg/l
21	#Anionic Detergents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(*DL-0.10 mg/L)	mg/l
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	0.30	mg/l
23	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(*DL-0.02 mg/L)	mg/l
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 B	*BDL(**DL-0.05 mg/L)	mg/l
25	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l
26	Arsenic (as As)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml
29	Ammonia	IS-3025 (Part-34)- 1988, Reaff: 2019	*BDL(**DL-0.5 mg/L)	mg/l
30	Sulphide	IS 3025 (P-29) :1986 Reaff 2019 (dometric)	*BDL(**DL-0.05 mg/L)	mg/l
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l
33	Residual Free Chlorine	APHA 4500 Cl-B	*BDL(**DL-0.2 mg/L)	mg/l
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100mi

End of Report


 (Checked By)



Note: a) The results listed refer only to the tested samples & applicable parameters
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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/W/2006280009

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Name of the Project : --

Sample Description : SURFACE WATER
 Location : Mahanadi (UP Stream)
 Sample Collected by : Vardan EnviroLab Team
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2296

Report No. : VEL/W/2006280009
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 04/07/2020
 Period of Analysis : 01/07/2020-04/07/2020
 Receipt Date : 28/06/2020
 Sampling Date : 25/06/2020
 Sampling Quantity : 2.0
 Sampling Type : Grab
 Preservation : 25 DEGREE

S.No.	Test Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS 3025(P-11): 1983 Reaff. 2017	7.28	
2	#Colour	IS 3025: 1983 (P-4) Reaff. 2017	*BDL(**DL 6Hazen)	
3	Turbidity	IS 3025 (Part 10): 1984, Reaff. 2017	*BDL(**DL 0.1NTU)	NTU
4	#Odour	IS 3025 (P-6): 2010	Agreeable	--
5	#Taste	IS 3025 (P-8): 1984 Reaff. 2017	Agreeable	--
6	Total Hardness (as CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	119.48	mg/l
7	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	37.97	mg/l
8	Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	122.14	mg/l
9	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	40.55	mg/l
10	#Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/L)	mg/l
11	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2019	6.01	mg/l
12	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff. 2017	219.50	mg/l
13	Sulphate (as SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019	29.50	mg/l
14	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.27	mg/l
15	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	10.15	mg/l
16	Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.25	mg/l
17	Aluminium (as Al)	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/L)	mg/l
18	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/L)	mg/l
19	Phenolic Compounds (C6H5OH)	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.01 mg/L)	mg/l

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised JISO 9001 | OHSAS 45001

Test Report

Sample Number : VELAW/2006280009

Report No.

: VELAW/2006280009

S.No.	Test Parameters	Test Method	Results	Units
20	#Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.5 mg/L)	mg/l
21	#Anionic Detergents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.10 mg/L)	mg/l
22	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	0.25	mg/l
23	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/L)	mg/l
24	Manganese (as Mn)	APHA 23rd edition-2017), 3030D, 3111 B	*BDL(**DL-0.05 mg/L)	mg/l
25	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l
26	Arsenic (as As)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.005 mg/L)	mg/l
27	#Total Coliform	IS 1622:2009	Absent	MPN/100 ml
28	#E.Coli	IS 1622:2009	Absent	MPN/100 ml
29	Ammonia	IS-3025 (Part-34)- 1988, Reaff: 2019	*BDL(**DL-0.5 mg/L)	mg/l
30	Sulphide	IS 3025 (P-29) :1988 Reaff 2019 Idometric	*BDL(**DL-0.05 mg/L)	mg/l
31	#Chloramines as CL2	APHA 4500G	*BDL(**DL-0.5 mg/L)	mg/l
32	#Barium as Ba	APHA 3111B	*BDL(**DL-0.01 mg/L)	mg/l
33	Residual Free Chlorine	APHA 4500 Cl-B	*BDL(**DL-0.2 mg/L)	mg/l
34	#Fecal Coliform	IS 1622,1981 (Ref.2003)	Absent	MPN/100ml

End of Report


(Checked By)



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4.5 Soil Quality Analysis

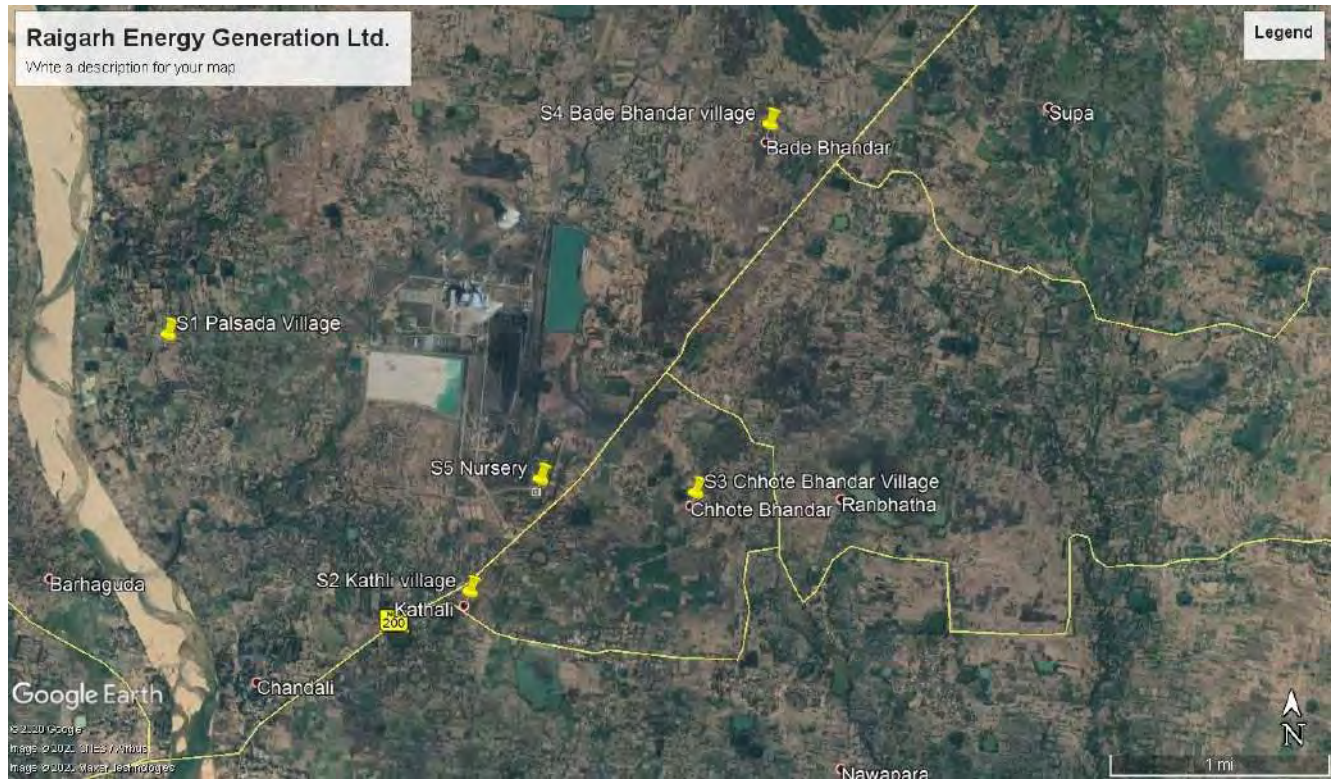


Figure No. 8. Plan Showing Soil Sample Monitoring Location Map

Location Code: -

- S1- PalsadaVillage
- S2- Kathli Village
- S3- Chote Bhandar Village
- S4- Bade Bhandar Village
- S5- Nursery



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 ISO 9001 & ILL Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number :	VEL/SO/2006280001	Report No. :	VEL/SO/2006280001
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd. Village Chhoti Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-498100 (Chhattisgarh)	Format No :	7 8 F-01
		Party Reference No :	NIL
		Reporting Date :	04/07/2020
		Period of Analysis :	28/06/2020-04/07/2020
		Receipt Date :	20/06/2020
Sample Description :	ECIL	Sampling Date :	26/06/2020
Location :	Village Palsada	Sampling Quantity :	2 Kg.
Sample Collected by :	Vardan EnviroLab Representative	Sampling Type :	Composite
Parameter Required :	As Per Work Order	Packing Status :	Temp. Seal
Sampling and Analysis Protocol :	IS 2720, APHA & USDA		

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS : 2720 (Part 26): 1987, Reaff. 2016	7.45	-
2	Electrical Conductivity	IS 14767: 2000 Ref. 2016	0.342	mS/cm
3	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
4	Water holding capacity	USDA:1954-Reaffirmed,2010	34.37	%
5	Bulk density	USDA:1954-Reaffirmed 2014 (Page-96)	1.28	gm/cc
6	Chloride	USDA:1954-Reaffirmed,2010 Method 13 (Page-98)	82.35	mg/kg
7	Calcium (as Ca)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	352.70	mg/kg
8	Sodium (as Na)	USDA:1954-Reaffirmed,2010 Method 10A (Page-96)	76.50	mg/kg
9	Potassium (as K)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	101.92	mg/kg
10	Organic Matter	IS 2720 (Part 22) 1972Ref. 2015	0.45	%
11	Magnesium (as Mg)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	73.15	mg/kg
12	Available Nitrogen (as N)	IS : 14684,1999 Reaff. 2015	218.38	kg./hec.
13	Phosphorus	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	21.4	kg./hec.
14	Total Zinc (as Zn)	USEPA 3050 B 1996	12.8	mg/kg
15	Total Manganese (as Mn)	USEPA 3050 B 1996	145.6	mg/kg
16	Total Chromium (as Cr)	USEPA 3050 B:1996	0.74	mg/kg
17	Total Lead (as Pb)	USEPA 3050 B 1996	4.4	mg/kg
18	Total Cadmium (as Cd)	USEPA 3050 B 1996	0.86	mg/kg

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/SO/2006280001

Report No

: VEL/SO/2006280001

S.No.	Parameters	Test Method	Results	Units
19	Total Copper (as Cu)	USEPA 3050 B 1996	12.2	mg/kg
20	Soil Texture	IS:2720 (P-4) RA:2006	Silty loam	-

End of Report


(Checked By)



Note: a) The results listed refer only to the tested samples & applicable parameters
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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number :	VEL/SO/2006280002	Report No. :	VEL/SO/2006280002
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd. Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7.8 F-01
		Party Reference No :	NII
		Reporting Date :	04/07/2020
Sample Description :	SOIL	Period of Analysis :	28/00/2020-04/07/2020
Location :	Village Kathli	Receipt Date :	28/06/2020
Sample Collected by :	Vardan EnviroLab Representative	Sampling Date :	24/06/2020
Parameter Required :	As Per Work Order	Sampling Quantity :	2 Kg.
Sampling and Analysis Protocol :	IS 2720, APHA & USDA	Sampling Type :	Composite
		Packing Status :	Temp. Seal

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS : 2720 (Part 26): 1987, Reaff. 2016	7.44	-
2	Electrical Conductivity	IS 14767: 2000 Ref. 2016	0.355	mS/cm
3	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
4	Water holding capacity	USDA:1954-Reaffirmed,2010	32.50	%
5	Bulk density	USDA:1954-Reaffirmed 2014 (Page-96)	1.24	gm/cc
6	Chloride	USDA:1954-Reaffirmed,2010 Method 13 (Page-98)	73.61	mg/kg
7	Calcium (as Ca)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	345.81	mg/kg
8	Sodium (as Na)	USDA:1954-Reaffirmed,2010 Method 10A (Page-96)	79.61	mg/kg
9	Potassium (as K)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	94.6	mg/kg
10	Organic Matter	IS 2720 (Part 22) 1972Ref. 2015	0.66	%
11	Magnesium (as Mg)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	87.45	mg/kg
12	Available Nitrogen (as N)	IS : 14684,1999 Reaff. 2015	288.59	kg./hec.
13	Phosphorus	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	38.70	kg./hec.
14	Total Zinc (as Zn)	USEPA 3050 B 1996	12.9	mg/kg
15	Total Manganese (as Mn)	USEPA 3050 B 1996	152.2	mg/kg
16	Total Chromium (as Cr)	USEPA 3050 B:1996	1.35	mg/kg
17	Total Lead (as Pb)	USEPA 3050 B 1996	4.1	mg/kg
18	Total Cadmium (as Cd)	USEPA 3050 B 1996	0.75	mg/kg

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Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/SO/2006280002

Report No. : VEL/SO/2006280002

S.No.	Parameters	Test Method	Results	Units
19	Total Copper (as Cu)	USEPA 3050 D 1996	12.7	mg/kg
20	Soil Texture	IS:2720 (P-4) RA:2006	Silty loam	-

End of Report


(Checked By)



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Test Report

Sample Number : VEL/SO/2006280003
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Dade Bandar
 Tehsil Pussore, Dist-Kalgarh-495100 (Jhhatitgarh)

Report No. : VEL/SO/2006280003
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 04/07/2020
 Period of Analysis : 28/06/2020-04/07/2020
 Receipt Date : 28/06/2020
 Sampling Date : 24/06/2020
 Sampling Quantity : 2 Kg.
 Sampling Type : Composite
 Packing Status : Temp Seal

Sample Description : SOIL
 Location : Village Chhote Bhandar
 Sample Collected by : Vardan EnviroLab Representative
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2720, APHA & USDA

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS : 2720 (Part 26): 1987, Reaff. 2016	7.43	-
2	Electrical Conductivity	IS 14767: 2000 Ref. 2016	0.345	mS/cm
3	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
4	Water holding capacity	USDA:1954-Reaffirmed,2010	33.19	%
5	Bulk density	USDA:1954-Reaffirmed 2014 (Page-96)	1.47	gm/cc
6	Chloride	USDA:1954-Reaffirmed,2010 Method 13 (Page-98)	83.06	mg/kg
7	Calcium (as Ca)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	347.97	mg/kg
8	Sodium (as Na)	USDA:1954-Reaffirmed,2010 Method 10A (Page-96)	69.94	mg/kg
9	Potassium (as K)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	97.22	mg/kg
10	Organic Matter	IS 2720 (Part 22) 1972Ref. 2015	0.63	%
11	Magnesium (as Mg)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	75.17	mg/kg
12	Available Nitrogen (as N)	IS : 14684,1999 Reaff. 2016	236.24	kg./hec.
13	Phosphorus	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	21.3	kg./hec.
14	Total Zinc (as Zn)	USEPA 3050 B 1996	14.4	mg/kg
15	Total Manganese (as Mn)	USEPA 3050 B 1996	148.7	mg/kg
16	Total Chromium (as Cr)	USEPA 3050 B:1996	1.1	mg/kg
17	Total Lead (as Pb)	USEPA 3050 B 1996	3.8	mg/kg
18	Total Cadmium (as Cd)	USEPA 3050 B 1996	0.72	mg/kg

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MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/SO/2006280003

Report No. : VEL/SO/2006280003

S.No.	Parameters	Test Method	Results	Units
19	Total Copper (as Cu)	USEPA 3050 B 1996	14.5	mg/kg
20	Soil Texture	IS:2720 (P-4) RA:2006	Silly loam	-

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 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number :	VEL/SO/2006280004	Report No. :	VEL/SO/2006280004
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd. Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7.8 F-01
		Party Reference No :	NIL
		Reporting Date :	04/07/2020
		Period of Analysis :	28/06/2020-04/07/2020
Sample Description :	SOIL	Receipt Date :	28/06/2020
Location :	Village Bade Bhandar	Sampling Date :	24/06/2020
Sample Collected by :	Vardan EnviroLab Representative	Sampling Quantity :	2 kg
Parameter Required :	As Per Work Order	Sampling Type :	Composite
Sampling and Analysis Protocol :	IS 2720, APHA & USDA	Packing Status :	Temp. Seal

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS - 2720 (Part 20), 1907, Reaff. 2016	7.87	-
2	Electrical Conductivity	IS 14767: 2000 Ref. 2016	0.342	mS/cm
3	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
4	Water holding capacity	USDA:1954-Reaffirmed,2010	36.35	%
5	Bulk density	USDA:1984 Reaffirmed 2014 (Page 06)	1.34	gm/cc
6	Oil/solids	USDA:1954-Reaffirmed,2010 Method 13 (Page-96)	14.40	mg/kg
7	Calcium (as Ca)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	111.02	mg/kg
8	Sodium (as Na)	USDA:1954-Reaffirmed,2010 Method 10A (Page-96)	67.41	mg/kg
9	Potassium (as K)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	127.58	mg/kg
10	Organic Matter	IS 2720 (Part 22) 1972Ref. 2015	0.72	%
11	Magnesium (as Mg)	Method manual of Soil Testing In India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	21.30	mg/kg
12	Available Nitrogen (as N)	IS : 14684,1999 Reaff. 2015	321.06	kg./hec.
13	Phosphorus	Method manual of Soil Testing In India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	30.6	kg./hec.
14	Total Zinc (as Zn)	USEPA 3050 B 1996	18.1	mg/kg
15	Total Manganese (as Mn)	USEPA 3050 B 1996	125.9	mg/kg
16	Total Chromium (as Cr)	USEPA 3050 B:1996	0.96	mg/kg
17	Total Lead (as Pb)	USEPA 3050 B 1996	3.1	mg/kg
18	Total Cadmium (as Cd)	USEPA 3050 B 1996	0.69	mg/kg

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MoEF & CC Recognised | ISO 9001 | OHSAS 45001


Test Report

Sample Number : VEL/S0/2006280004

Report No. : VEL/S0/2006280004

S.No.	Parameters	Test Method	Results	Units
19	Total Copper (as Cu)	USEPA 3060 B 1996	12.7	mg/kg
20	Soil Texture	IS:2720 (P-4) RA:2006	Silty loam	--

End of Report


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 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number :	VEL/S0/2006280005	Report No. :	VEL/S0/2006280005
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd. Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7.8 F-01
		Party Reference No :	NIL
		Reporting Date :	04/07/2020
Sample Description :	SOIL	Period of Analysis :	28/06/2020-04/07/2020
Location :	Nursery	Receipt Date :	28/06/2020
Sample Collected by :	Vardan EnviroLab Representative	Sampling Date :	24/06/2020
Parameter Required :	As Per Work Order	Sampling Quantity :	2 Kg
Sampling and Analysis Protocol :	IS 2720, APHA & USDA	Sampling Type :	Composite
		Packing Status :	Temp. Seal

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS : 2720 (Part 26): 1987, Reaff 2016	7.70	-
2	Electrical Conductivity	IS 14767: 2000 Ref. 2016	0.323	mS/cm
3	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
4	Water holding capacity	USDA:1954-Reaffirmed,2010	36.38	%
5	Bulk density	USDA:1954-Reaffirmed 2014 (Page-96)	1.39	gm/cc
6	Chloride	USDA:1954-Reaffirmed,2010 Method 13 (Page-98)	78.25	mg/kg
7	Calcium (as Ca)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	348.05	mg/kg
8	Sodium (as Na)	USDA:1954-Reaffirmed,2010 Method 10A (Page-96)	70.41	mg/kg
9	Potassium (as K)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	122.64	mg/kg
10	Organic Matter	IS 2720 (Part 22) 1972Ref. 2015	0.68	%
11	Magnesium (as Mg)	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	75.02	mg/kg
12	Available Nitrogen (as N)	IS : 14684,1999 Reaff. 2015	270.17	kg./hec.
13	Phosphorus	Method manual of Soil Testing in India, (Department of Ag., and Corporation Ministry of Ag. Govt. of	24.7	kg./hec.
14	Total Zinc (as Zn)	USEPA 3050 B 1996	23.3	mg/kg
15	Total Manganese (as Mn)	USEPA 3050 B 1996	132.5	mg/kg
16	Total Chromium (as Cr)	USEPA 3050 B:1996	3.8	mg/kg
17	Total Lead (as Pb)	USEPA 3050 B 1996	3.56	mg/kg
18	Total Cadmium (as Cd)	USEPA 3050 B 1996	0.62	mg/kg

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Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/S0/2006280005

Report No.

: VEL/S0/2006280005

S.No.	Parameters	Test Method	Results	Units
19	Total Copper (as Cu)	USEPA 3050 B 1996	14.9	mg/kg
20	Soil Texture	IS:2720 (P-4) RA:2006	Silty loam	--

*** End of Report ***

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4.6 Effluent Sample Analysis Report

Locations

1. STP Outlet
2. ETP Outlet



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VCL/WW/2006200001
Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VCL/WW/2006280001
Format No : 7.8 F-01
Party Reference No : NIL
Reporting Date : 03/07/2020
Period of Analysis : 28/06/2020-03/07/2020
Receipt Date : 28/06/2020
Sampling Date : 23/06/2020
Sampling Quantity : 2 Ltr.
Sampling Type : GRAB

Sample Description : Waste Water
Location : STP Outlet
Sample Collected by : Vardan EnviroLab Representative
Preservation : 23 DEGREE
Parameter Required : As Per Work Order
Analysis Protocol : IS 3025

S.No.	Test Parameters	Test Method	Result	Unit	Standards		
					*Limit	Public Sewers	Land for Irrigation
1	pH	IS 3025 (P-11): 1983 Reaff. 2017	7.42	-	5.5 - 9.0	5.5 - 9.0	5.5 - 9.0
2	Total Suspended Solids	IS: 3025 (Part 17): 1984, Reaff. 2017	22.00	mg/l	100.0	600.0	200.0
3	Oil & Grease	IS 3025(P-39):1991 RA 2019	0.80	mg/l	10.0	20.0	10.0
4	BOD (3 days @ 27°C)	IS: 3025 (Part-44): 1993, Ref: 2019	25.50	mg/l	30.0	350.0	100.0
5	COD	IS : 3025 (Part 58) : 2006 Ref: 2017	128.80	mg/l	250.0	-	-

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/WW/2006280002

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/WW/2006280002

Format No : 7.8 F-01

Party Reference No : NIL

Reporting Date : 03/07/2020

Period of Analysis : 28/06/2020-03/07/2020

Receipt Date : 28/06/2020

Sampling Date : 25/06/2020

Sampling Quantity : 2 Ltr.

Sampling Type : GRAB

Sample Description : Waste Water

Location : ETP Outlet

Sample Collected by : Vardan EnviroLab Representative

Preservation : 23 DEGREE

Parameter Required : As Per Work Order

Analysis Protocol : IS 3025

S.No.	Test Parameters	Test Method	Result	Unit	Standards		
					*Limit	Public Sewers	Land for Irrigation
1	pH	IS 3025 (P-11): 1983 Reaff. 2017	7.64	-	5.5 - 9.0	5.5 - 9.0	5.5 - 9.0
2	Total Suspended Solids	IS: 3025 (Part 17): 1984, Reaff. 2017	20.00	mg/l	100.0	600.0	200.0
3	Oil & Grease	IS 3025(P-39):1991 RA 2019	0.70	mg/l	10.0	20.0	10.0
4	BOD (3 days @ 27°C)	IS: 3025 (Part-44): 1993, Ref: 2019	21.00	mg/l	30.0	350.0	100.0
5	COD	IS : 3025 (Part 58) : 2008 Ref: 2017	99.06	mg/l	250.0	-	-

End of Report

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4.6 Stack Emission Analysis Report

Locations

1. TPP



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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 15001]

Test Report

Sample Number : VEL/S/2006280001
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhole Bhandar, Post Office Badi Bandar
 Tehsil Pussore, Dist-Raigarh-498100 (Chhattisgarh)

Report No. : VEL/S/2006280001
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 04/07/2020
 Period of Analysis : 28/06/2020-04/07/2020
 Receipt Date : 28/06/2020

Sample Description : Stack Emission Monitoring

General Information
 Sampling Location : TTP
 Sample Collected by : Vardan EnviroLab Team
 Date of Sampling : 24/06/2020
 Sampling duration (Minutes) : 26.0 Min.
 Stack attached to : TPP
 Make of stack : Iron
 Diameter of stack(m) : 7 cm
 Height of stack(m) : 275
 Instrument calibration status : Calibrated
 Meteorological Condition : Clear Sky
 Ambient Temperature - Ta (°C) : 34.0
 Temperature of Stack Gas - Ts (°C) : 127
 Velocity of Stack Gas (m/sec) : 17.4
 Flow rate of PM (LPM) : 32.0
 Flow rate of Gas (l PM) : 2.0
 Sampling condition : Isokinetic
 Protocol used : IS 11255 & EPA

S.No.	Parameters	Test Method	Results	Units	Limits as per CPCB
1	Particulate Matter (as PM)	IS: 11255 (Part1) : 1985, RA 2014	43.27	mg/Nm3	50
2	Sulphur Dioxide (as SO2)	IS: 11255(Part 2): 1986, Reaffirmed 2014	809.45	mg/Nm3	800
3	Oxide of Nitrogen as NO2	IS-11255 P-7, RA 2017	342.0	mg/Nm3	300
4	Mercury as Hg	APHA 3rd edition 2017, 303A (Page No. 365)	BDL(DL 0.1)	mg/Nm3	0.03

*BDL-Below Detection Limit. *DL -Detection Limit.

End of Report


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Chapter – 5.0 CONCLUSION

RAIGARH ENERGY GENERATION LTD., authorities have been taken successful steps in controlling environmental pollution in and around the project. This fact is clear from analytical results of different environmental parameters. A brief conclusion is as follows.

Sr. No.	Environmental Parameters	Conclusion
5.1	Air Environment	After analysis of the samples from five different locations it is observed that both the individuals and average concentration of air pollutants in respect of SO ₂ , NO ₂ , PM ₁₀ , PM _{2.5} , CO and Mercury are well within the prescribed limits of NAAQM standards. People of township and of surrounding villages do not have any problems regarding the air quality and have no grievances because of Thermal Power Plant activities.
5.2	Water Environment	The analytical result of the samples from the ground water of villages, surface water from river, and domestic & industrial effluent after treatment shows that the concentrations of different water parameters are well within prescribed limits and will not cause any adverse impact on human health and on surrounding area. People of surrounding areas express satisfaction about the water quality of That area.
5.3	Noise Environment	The observations taken at four village location during day and night time shows that the noise level are well within prescribed limits of CPCB. Hence there is no possibility of any adverse effect of noise generated due to Thermal Power Plant activities on peoples of Surrounding areas.

All the above details show that Thermal Power Plant of RAIGARH ENERGY GENERATION LTD. is not causing any adverse impact on the human health and ecological balance.

2nd Quarterly Environmental Monitoring Report



Submitted To:

**M/s Raigarh Energy Generation Ltd.
Village Chhote Bhandar, Post office Bade Bhandar,
Tehsil Pussore, Dist.-Raigarh -496100 (Chhattisgarh)**

Conducted by:

**M/s Vardan EnviroLab
Plot no. 82A, Sector-5, IMT Manesar, Gurugram (Haryana)**

(Recognized by MoEF & CC, NABL Government of India)

PREFACE

The growing concern for environmental protection and the passing of various environmental legislations have increased the responsibilities of Ministry of Environment, Forests & Climate Change, Pollution Control boards in many folds. Besides enforcing the various environmental legislations MoEF&CC, CPCB & SPCB strive to propagate the necessity awareness regarding the various legal provisions and environmental protection measures in the country.

Electric Power scenario has occupied a significant place in the development program of the country. Development and environment can neither be separated nor ignored. In fact, they are complimentary to each other. These issues have become a concern of the community, particularly the environment impact due to industries in the developing countries.

However, the prerequisite for sustainable development is judicious planning of environmental status, likely impacts of the approach adopted on the environment including inhabitants of the locality, availability of the eco-friendly technology, emerging waste disposal and waste utilization processes, techniques of land reclamation for the restoration of aesthetic beauty and soon.

M/s Raigarh Energy Generation Ltd., Village Chhote Bhandar, Post Office Bade Bhandar, Raigarh-496100, India, has engaged **M/S Vardan EnviroLab, Gurugram, (HR)** to provide Environmental Services in respect of ambient air quality monitoring, stack emission, noise level monitoring & Sampling and Analysis of ground water quality, surface water quality, treated effluent sewage, effluent water from ETP, and soil for **Raigarh Energy Generation Ltd., Raigarh district of Chhattisgarh**, as per guidelines of MoEF & CC and CPCB Gazette notification.

M/S Vardan EnviroLab, Gurugram, (HR) has deployed entirely its own personnel, facilities and expertise for doing this service. Sampling / Monitoring Stations were identified by the Environmental Officer of Raigarh Energy Generation Ltd., The samples were analyzed **partly at site** and partly at our MoEF Recognized laboratory situated at Gurugram (HR).

This report presents the data generated for the period from 19th September 2020 to 21st September 2020, i.e. **for Second quarter which** includes sampling locations, Methodology, testing procedure and compilation for the Environmental parameters i.e. Air, Water & Noise with a view to evaluate the impact due to the thermal power plant activities.

During the course of our operations for the above task, the staff and management of Raigarh Energy Generation Ltd., were extremely co-operative. We are grateful to them for their invaluable support and assistance rendered to us during the course of the sampling and monitoring.

Date : 30/9/2020


Authorized Signatory

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Chapter – 1.0

INTRODUCTION

M/s Raigarh Energy Generation Ltd., a subsidiary of Adani Power, is a power generation company based at Raigarh in the State of Chattisgarh. Raigarh Energy Generation Ltd., has recently commissioned its Thermal Power Plant first 600MW Unit at Village Chhote Bhandar, Post Office Bade Bhandar, Raigarh- 496100, India. The second unit of 600MW is under implementation.

Raigarh Energy Generation Ltd., is also committed towards the environment and the community it operates in. It has successfully implemented several community welfare schemes in the field of livelihood, infrastructure, community health and education which has so far benefited over 60,000 people from close to 75 villages.



Figure No.1. Raigarh Energy Generation Ltd.

Chapter – 2.0

PROJECT PROFILE

2.1 Topography & Drainage

Topography of this area is generally undulating. The area is drained by Mand River approximately 3 km. away from plant in North direction and Mahanadi River approximately 5 km. away from plant in South direction.

2.2 Location

Plant is bounded by Northern Latitudes of 21° 44' 00" to 21° 44' 42" and Eastern Longitude of 83° 16' 30" to 83° 17' 18". This area falls in the survey of India toposheet no. 64 O/1, 64 O/2, 64 O/5 and 64 O/6. The location of the mine area is shown in **Fig. No. 2**

2.3 Climate

The climate of the area is Sub-tropical type. It is in the zone of humid tropic climate where temperature and humidity of air are very high. The temperature varies from the minimum - maximum temperature range between 29.5°C - 49 °C in summer, and 8°C - 25 °C in winter. The humidity varies from 35% to 82%. The annual average rainfall in the area is about 1300 mm.

2.4 Communication

The nearest railway station is Kirodimal, which is at a distance of ~23 Km towards North direction. The area is well connected with N.H. No. 216. Nearest Airport is Raipur ~250 km in SW direction. Nearest village is Bade Bhandar ~ 1 km. in North direction and nearest town is Raigarh ~21 km. in North-East direction.

2.5 Location Map

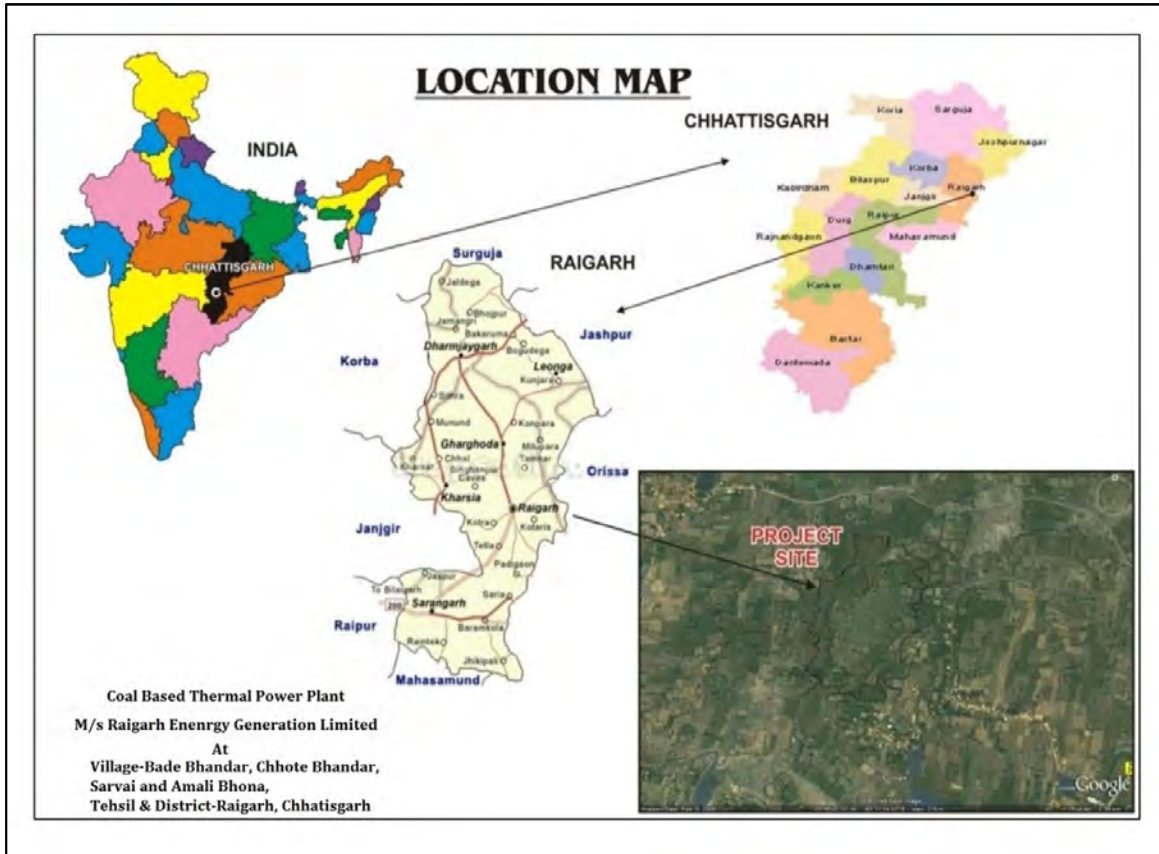


Figure No.2. Location Map

Chapter – 3.0

SCOPE OF STUDY AND METHODOLOGY

3.1 Scope of Study

The scope of study includes Environmental Services in respect of ambient air quality monitoring, noise level monitoring & Sampling and Analysis of ground water quality, surface water quality, treated effluent sewage, effluent water from ETP and soil.

3.2 Methodology

As mentioned in the scope of work covering the various Environmental components monitoring and sampling and its analysis was carried out on the basis of guidelines of Ministry of Environment Forest & Climate Control of Government of India & Chattisgarh State Pollution Control Board. Sampling procedure method reference and Analysis procedure method reference are mentioned in monitoring reports.

3.2.1 Ambient Air Quality Monitoring

The ambient air quality has been carried out at various sources of air pollution surrounding and in the Plant. The prime objective of the ambient air quality monitoring is to assess the existing air quality of the area.

The ambient air quality monitoring was carried out for 24 hours at each station. At all stations SO₂, NO₂, PM₁₀, PM_{2.5}, CO and Mercury were monitored. All the samples collected were analyzed for quantitative analysis of various pollutants.

The ambient air quality sampling locations were identified by the Environmental Officer of Raigarh Energy Generation Ltd.

3.2.2 Water Environment

The ground water samples, surface water samples were collected from selected locations in two liter sterilized plastic cans. These samples were analyzed as per IS 10500:2012. The domestic effluent and Industrial effluent samples were collected and analyzed for parameters: pH, Total suspended solids, Biochemical Oxygen Demand, Chemical Oxygen Demand and Oil & Grease.

3.2.3 Noise Environment

Sound level meter was used to know the sound levels generated due to plant activities at different locations. The measurements were taken for Equivalent sound level over a time period for day and night which is expressed in dB(A).

3.2.4 Soil

The Soil samples were collected from selected locations. These samples were analyzed for Physico-Chemical parameters including heavy metals.

Chapter – 4.0

SAMPLING LOCATION MAP AND ANALYSIS REPORTS

4.1 Ambient Air Quality Monitoring



Figure No.3. Plan Showing Ambient Air Quality Location Map

Location Code: -

- A1- Site Office
- A2- PalsadaVillage
- A3- Kathali Village
- A4- Chhote Bhandar Village
- A5- Bade Bhandar Village



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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AA/06

Report No. : VEL/A/2009230009/A

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-498100 (Chhattisgarh)

Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Site Office
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/12/FPS/11
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 09.30 TO 09.30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS :5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P- 23)-2006, RA. 2017	78.00	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS:5182 (P- 24)-2001, RA. 2017	41.98	µg/m ³	60
3	Nitrogen Dioxides (as NO2)	IS:5182 (P- 6)-2006 RA.2017	24.52	µg/m ³	80
4	Sulphur Dioxide (as SO2)	IS:5182 (P- 2)-2001, RA. 2017	14.68	µg/m ³	80

*BDL-Below Detection Limit, **DL-Detection Limit

End of Report

(Signature)

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AA/06

Report No. : VEL/A/2009230009/B

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7 B F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Site Office
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/12/FPS/11
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 09.30 TO 09.30 Hrs
 Ambient Temperature (°C) : Min, 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS :5182
 Sampling Duration : 24 Hrs
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Carbon Monoxide (as CO)	By Analyzer	0.37	mg/m ³	4.0
2	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (**DL 1.0 ng/m ³)	µg/m ³	--

*BDL-Below Detection Limit. **DL-Detection Limit

End of Report

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Test Report

Sample Number : VEL/RAIGARH/AA/07
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/A/2009230010/A
 Format No : 7 & F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village - Palsada
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/13/FPS/12
 Instrument Calibration Status : Calibrated
 Latitude : -
 Longitude : -
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 10.30 TO 10.30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS :5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P- 23)-2006, RA. 2017	72.88	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS:5182 (P- 24)-2001, RA. 2017	37.82	µg/m ³	60
3	Nitrogen Dioxides (as NO ₂)	IS:5182 (P- 6)-2006 RA.2017	22.56	µg/m ³	80
4	Sulphur Dioxide (as SO ₂)	IS:5182 (P- 2)-2001, RA. 2017	13.80	µg/m ³	80

BDL - Below Detection Limit ** DL Detection Limit

End of Report

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AA/07

Report No. : VEL/A/2009230010/B

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village - Palsada
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/13/FPS/12
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 10.30 TO 10.30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS :5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Carbon Monoxide (as CO)	By Analyzer	0.65	mg/m ³	4.0
2	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (**DL1.0 ng/m ³)	µg/m ³	--

BDL - Below Detection Limit ** DL Detection Limit

End of Report


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Test Report

Sample Number : VEL/RAIGARH/AA/08
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/A/2009230011/A
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village - Kathli
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/14/FPS/13
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 11:30 TO 11:30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS :5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P- 23)-2006, RA. 2017	72.59	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS:5182 (P- 24)-2001, RA. 2017	39.92	µg/m ³	60
3	Nitrogen Dioxides (as NO ₂)	IS:5182 (P- 6)-2006 RA.2017	23.35	µg/m ³	80
4	Sulphur Dioxide (as SO ₂)	IS:5182 (P- 2)-2001, RA. 2017	12.46	µg/m ³	80

BDL - Below Detection Limit ** DL Detection Limit

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised **ISO 9001 | OHSAS 45001**)

Test Report

Sample Number : VEL/RAIGARH/AA/08
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/A/2009230011/B
 Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village - Kathli
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/14/FPS/13
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 11.30 TO 11.30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS :5182
 Sampling Duration : 24 Hrs
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Carbon Monoxide (as CO)	By Analyzer	0.71	mg/m ³	4.0
2	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (*DL1.0 ng/m ³)	µg/m ³	--

BDL - Below Detection Limit ** DL Detection Limit

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AA/09
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No : VEL/A/2009230012/A
 Format No : 7.8 F 01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village - Chhote Bhandar
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/15/FPS/14
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 12.30 TO 12.30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS :5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P- 23)-2006, RA. 2017	75.94	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS:5182 (P- 24)-2001, RA. 2017	41.20	µg/m ³	60
3	Nitrogen Dioxides (as NO ₂)	IS:5182 (P- 6)-2006 RA.2017	25.79	µg/m ³	80
4	Sulphur Dioxide (as SO ₂)	IS:5182 (P- 2)-2001, RA. 2017	11.16	µg/m ³	80

BDL - Below Detection Limit ** DL Detection Limit

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AA/09

Report No. : VEL/A/2009230012/B

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7 B F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village - Chhote Bhandar
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/15/FPS/14
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 12.30 TO 12.30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS 5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Carbon Monoxide (as CO)	By Analyzer	0.81	mg/m ³	4.0
2	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (**DL 1.0 ng/m ³)	µg/m ³	--

BDL - Below Detection Limit ** DL Detection Limit

End of Report


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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AA/10
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/A/2009230013/A
 Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village - Bade Bhandar
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/16/FPS/15
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 13.30 TO 13.30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS :5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Particulate Matter (as PM -10)	IS:5182 (P- 23)-2006,RA. 2017	77.34	µg/m ³	100
2	Particulate Matter (as PM - 2.5)	IS:5182 (P- 24)-2001, RA. 2017	41.58	µg/m ³	60
3	Nitrogen Dioxides (as NO ₂)	IS:5182 (P- 6)-2006 RA.2017	23.78	µg/m ³	80
4	Sulphur Dioxide (as SO ₂)	IS:5182 (P- 2)-2001, RA. 2017	11.59	µg/m ³	80

BDL - Below Detection Limit ** DL Detection Limit

End of Report

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/RAIGARH/AA/10

Report No. : VEL/A/2009230013/B

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : AMBIENT AIR

General Information

Sampling Location : Village - Bade Bhandar
 Sample Collected by : VEL Team
 Sampling Equipment used : RDS/FPS
 Instrument Code : VEL/RDS/16/FPS/15
 Instrument Calibration Status : Calibrated
 Latitude : --
 Longitude : --
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 13.30 TO 13.30 Hrs.
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Scope of Monitoring : Regulatory Requirement
 Sampling & Analysis Protocol : IS 5182
 Sampling Duration : 24 Hrs.
 Parameter Required : As Per Work Order

S.No.	Parameters	Test Method	Results	Units	Limit as per CPCB
1	Carbon Monoxide (as CO)	By Analyzer	0.84	mg/m ³	4.0
2	Mercury (Hg)	Methods of air sampling and analysis, 3rd ed., 1988, Method No.317	BDL (*DL1.0 ng/m ³)	µg/m ³	--

BDL - Below Detection Limit ** DL Detection Limit

End of Report

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4.2 Noise Level Monitoring



Figure No.4. Plan Showing Noise Level Monitoring Location Map

Ambient Noise Level Monitoring Locations

- Location Code: -
- N1- Field Hostel
 - N2- Palsada Village
 - N3- Kathali Village
 - N4- Chote Bhandar Village
 - N5- Bade Bhandar Village

Work Zone Noise Level Monitoring Locations

- Location Code: -
- N6- Site Office
 - N7- Behind Switchyard
 - N8- Railway Entry Gate



TC-6652

Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/RAIGARH/AN/01 Report No. : VEL/N/2009230003/A
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh) Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Receipt Date : 23/09/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : VEL Team
 Instrument : Calibrated
 Calibration Status :
 Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989, IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Site Office
 Instrument Code : VEL/JA1/SLM/07
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 19/09/2020 To 20/09/2020
 Time of Monitoring : 06.00 TO 06.00 Hrs.
 Ambient Temperature (°C) : Min. 24° Max 31°
 Surrounding Activity : Human, Vehicular & Other Activity
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	63.7	51.2
2	L min	IS: 9989-1981, IS 9876: 1981	42.2	38.8
3	Leq	IS: 9989-1981, IS 9876: 1981	56.46	43.26

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1 Day Time is from 6 00 AM to 10.00 PM
 2 Night Time is reckoned between 10 00 PM to 6.00 AM
 3 SilenceZone is defined as an area up to 100m around premises of Hospitals Educational Institutions and Courts Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
 Note. Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

End of Report

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AN/02 Report No : VEL/N/2009230004/A
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)
 Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Receipt Date : 23/09/2020
 Sampling Duration : 24 Hrs
 Sample Collected by : VEL Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989, IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Village - Palsada
 Instrument Code : VEL/JAI/SLM/01
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 19/09/2020 To 20/09/2020
 Time of Monitoring : 06.00 TO 06.00 Hrs
 Ambient Temperature (°C) : Min. 24° Max 31°
 Surrounding Activity : Human, Vehicular & Other Activity
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	62.4	52.4
2	L min	IS: 9989-1981, IS 9876: 1981	41.8	38.1
3	Leq	IS: 9989-1981, IS 9876: 1981	54.47	42.27

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1 Day Time is from 6.00 AM to 10.00 PM
 2 Night Time is reckoned between 10 00 PM to 6.00 AM
 3 SilenceZone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
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Test Report

Sample Number : VEL/RAIGARH/AN/03 Report No. : VEL/N/2009230005/A
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Receipt Date : 23/09/2020
 Sampling Duration : 24 Hrs
 Sample Collected by : VEL Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989: IS 9876
 Instrument Used : SLM

General Information
 Sampling Location : Village - Kathli
 Instrument Code : VEL/JAI/SLM/03
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 19/09/2020 To 20/09/2020
 Time of Monitoring : 06:00 TO 06:00 Hrs.
 Ambient Temperature (°C) : Min. 24° Max 31°
 Surrounding Activity : Human, Vehicular & Other Activity
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	63.7	52.8
2	L min	IS: 9989-1981, IS 9876: 1981	42.2	37.1
3	Leq	IS: 9989-1981, IS 9876: 1981	53.14	41.24

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1. Day Time is from 6.00 AM to 10.00 PM
 2. Night Time is reckoned between 10.00 PM to 6.00 AM
 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones
 Note. Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

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 (Checked By)

(Approved By)
VARDAN ENVIROLAB
 JAIPUR
 Authorised Signatory

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/RAIGARH/AN/04 Report No. : VEL/N/2009230006/A
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar Format No : 7.8 F-01
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh) Party Reference No : NIL
 Reporting Date : 30/09/2020
 Receipt Date : 23/09/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : VEL Team
 Instrument : Calibrated
 Calibration Status :
 Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989, IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Village - Chhote Bhandar
 Instrument Code : VEL/JAI/SLM/04
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 19/09/2020 To 20/09/2020
 Time of Monitoring : 06:00 TO 06:00 Hrs
 Ambient Temperature (°C) : Min 23° Max 31°
 Surrounding Activity : Human, Vehicular & Other Activity
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	63.8	53.8
2	L min	IS: 9989-1981, IS 9876: 1981	42.1	38.8
3	Leq	IS: 9989-1981, IS 9876: 1981	51.93	43.64

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1. Day Time is from 6.00 AM to 10.00 PM.
 2. Night Time is reckoned between 10:00 PM to 6:00 AM
 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
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TC-6652

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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AN/05
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2009230007/A
 Format No : 7 B F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Receipt Date : 23/09/2020
 Sampling Duration : 24 Hrs.
 Sample Collected by : VEL Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989, IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Village - Bade Bhandar
 Instrument Code : VEL/JAI/SLM/07
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 06.00 TO 06.00 Hrs
 Ambient Temperature (°C) : Min 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	66.7	55.8
2	L min	IS: 9989-1981, IS 9876: 1981	42.9	38.6
3	Leq	IS: 9989-1981, IS 9876: 1981	52.71	44.21

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1 Day Time is from 6.00 AM to 10.00 PM.
 2: Night Time is reckoned between 10.00 PM to 6.00 AM
 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/RAIGARH/AN/06
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2009230008/A
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Receipt Date : 23/09/2020
 Sampling Duration : 24 Hrs
 Sample Collected by : VEL Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989; IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Field Hostel
 Instrument Code : VEL/JAI/SLM/01
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 06.00 TO 06.00 Hrs
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	65.7	55.8
2	L min	IS: 9989-1981, IS 9876: 1981	41.2	38.5
3	Leq	IS: 9989-1981, IS 9876: 1981	54.71	43.2

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

- Day Time is from 6.00 AM to 10.00 PM.
 - Night Time is reckoned between 10.00 PM to 6.00 AM
 - Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/RAIGARH/AN/07
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/N/2009230009/A
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Receipt Date : 23/09/2020
 Sampling Duration : 24 Hrs
 Sample Collected by : VEL Team
 Instrument : Calibrated
 Calibration Status

Sample Description : Ambient Noise
 Scope of Monitoring : Regulatory Requirement
 Protocol Used : IS 9989; IS 9876
 Instrument Used : SLM

General Information

Sampling Location : Behind Switch Yard
 Instrument Code : VEL/JAI/SLM/03
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 06 00 TO 06 00 Hrs
 Ambient Temperature (°C) : Min 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	64.7	54.2
2	L min	IS: 9989-1981, IS 9876: 1981	41.3	38.7
3	Leq	IS: 9989-1981, IS 9876: 1981	53.23	42.37

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1 Day Time is from 6.00 AM to 10.00 PM.
 2 Night Time is reckoned between 10.00 PM to 6.00 AM
 3 Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones.
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 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/RAIGARH/AN/08 Report No. : VEL/N/2009230010/A
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd. Format No : 7.8 F-01
 Village Chhote Bhandar, Post Office Bade Bandar Party Reference No : NIL
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh) Reporting Date : 30/09/2020
 Receipt Date : 23/09/2020
 Sample Description : Ambient Noise Sampling Duration : 24 Hrs.
 Scope of Monitoring : Regulatory Requirement Sample Collected by : VEL Team
 Protocol Used : IS 9989: IS 9876 Instrument : Calibrated
 Instrument Used : SLM Calibration Status

General Information

Sampling Location : Railway Entry Gate
 Instrument Code : VEL/JAI/SLM/04
 Meteorological condition during monitoring : Clear Sky
 Date of Monitoring : 20/09/2020 To 21/09/2020
 Time of Monitoring : 06.00 TO 06.00 Hrs
 Ambient Temperature (°C) : Min. 23° Max 30°
 Surrounding Activity : Human, Vehicular & Other Activity
 Parameter Required : As Per Work Order

S.No.	Test Parameters	Protocol	Test Result dB (A)	
			Day Time	Night Time
1	L max	IS: 9989-1981, IS 9876: 1981	62.8	54.8
2	L min	IS: 9989-1981, IS 9876: 1981	41.2	38.2
3	Leg	IS: 9989-1981, IS 9876: 1981	52.11	42.11

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

1 Day Time is from 6 00 AM to 10.00 PM.
 2: Night Time is reckoned between 10.00 PM to 6.00 AM
 3 SilenceZone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones
 Note. Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply

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4.3 Ground water Quality Analysis



Figure No.5. Plan Showing Ground Water Quality Monitoring Location Map

Location Code: -

- GW1- Site Office
- GW2- PalsadaVillage
- GW3- Kathali Village
- GW4- Chote Bhandar Village
- GW5- Bade Bhandar Village



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/GW/01

Report No. : VELW/2009230006/A

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7.8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr.

Sampling Type : Grab

Sample Description : GROUND WATER

Location : Site Office

Sample Collected by : VEL Team

Preservation : Suitable Preservation

Sampling and Analysis : IS 10500 -2012

Protocol

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	pH	IS 3025 (P-11): 1983 Reaff. 2017	7.38	--	6.5 to 8.5	No Relaxation
2	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	288.00	mg/l	500	2000
3	Total Alkalinity (as CaCO ₃)	IS: 3025 (Part 23): 1986, Reaff. 2019	152.88	mg/l	200	600
4	Total Hardness (as CaCO ₃)	IS: 3025 (Part 21): 2009, Reaff. 2019	170.28	mg/l	200	600
5	Nitrate (as NO ₃)	IS: 3025 (Part 34): 1988, Reaff. 2019	0.55	mg/l	45	No Relaxation
6	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	52.45	mg/l	250	1000
7	Sulphate (as SO ₄)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	21.11	mg/l	200	400
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	58.73	mg/l	75	200
9	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2009 (EDTA method)	6.73	mg/l	30	100
10	Fluorides (as F)	APHA 23rd Edition 2017, 4500 FD	0.34	mg/l	1.0	1.5
11	Total Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.22	mg/l	0.3	No Relaxation
12	Arsenic (as As)	APHA (23rd edition-2017), 3114 C	*BDL(**DL-0.005 mg/l)	mg/l	0.01	0.05
13	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/l)	mg/l	0.05	1.5
14	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.20 mg/l)	mg/l	5.0	15
15	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.05 mg/l)	mg/l	0.01	No Relaxation
16	Turbidity	IS 3025 (Part 10): 1984, Ref: 2017, (Nephelometric Method)	*BDL(**DL 1.0 NTU)	NTU	1	5
17	Aluminium	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/l)	mg/l	0.03	0.2
18	Manganese (as Mn)	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	*BDL(**DL-0.05 mg/l)	mg/l	0.1	0.3
19	Ammonia (as NH ₃)	IS-3025 (Part-34)- 1988, RA. 2019	*BDL(**DL-0.3 mg/l)	mg/l	0.5	No Relaxation

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/GW/01

Report No. : VEL/W/2009230006/A

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
20	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/l)	mg/l	0.5	1.0
21	Sulphide	IS: 3025 (Part 29): 1986, RA. 2009 Turbidity Method	*BDL(**DL-0.1 mg/l)	mg/l	200	400
22	Phenolic Compound	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l	0.001	0.002
23	Free Residual Chlorine	IS: 3025 (Part 26): 1986 RA 2019	*BDL(**DL-0.2 mg/l)	mg/l	0.2	1

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report


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- All disputes are subjected to Jaipur jurisdiction.



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/GW/01

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.

Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/W/2009230006/B

Format No : 7.8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr.

Sampling Type : Grab

Sample Description : GROUND WATER

Location : Site Office

Sample Collected by : VEL Team

Preservation : Suitable Preservation

Sampling and Analysis Protocol : IS 10500 -2012

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	Total Coliform (By MPN Method)	IS:1622	Absent	MPN/10 0 ml	Shall not be Detectable in any 100 ml sample	NA
2	E-Coli	IS:1622	Absent	per 100 ml	Absent/100 ml	Absent/100 ml
3	Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/l)	mg/l	0.05	No Relaxation
4	Colour	IS 3025: 1983 (P-4) RA.. 2017	*BDL(**DL 1.0 Hazen)	Hazen Unit	5	15
5	Odour	IS 3025 (P-5); RA. 2018	Agreeable	Qualitative	Agreeable	Agreeable
6	Taste	IS 3025(P-8):1984 RA. 2017	Agreeable	Qualitative	Agreeable	Agreeable
7	Anionic Surface Active Agent	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.05 mg/l)	mg/l	0.2	1.0
8	Mineral Oil	IS 3025(P-39)	*BDL(**DL-0.05 mg/l)	mg/l	0.5	No Relaxation
9	Barium as (Ba)	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l	0.7	No Relaxation
10	Faecal Caliform	IS:1622	Absent	MPN/10 0 ml	Shall not be Detectable in any 100 ml sample	



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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/01

Report No.

: VEL/W/2009230006/B

*BDL-Below Detection Limit, **DL-Detection Limit.

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/GW/02

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
Village Chhole Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VELW/2009230007/A

Format No : 7 8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr. +250 ml

Sampling Type : Grab

Sample Description : GROUND WATER

Location : Village - Palsada

Sample Collected by : VEL Team

Preservation : Suitable Preservation

Sampling and Analysis : IS 10500 -2012

Protocol

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	pH	IS 3025 (P-11): 1983 Reaff. 2017	7.38	--	6.5 to 8.5	No Relaxation
2	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	340.00	mg/l	500	2000
3	Total Alkalinity (as CaCO ₃)	IS: 3025 (Part 23): 1986, Reaff. 2019	219.52	mg/l	200	600
4	Total Hardness (as CaCO ₃)	IS: 3025 (Part 21): 2009, Reaff. 2019	209.88	mg/l	200	600
5	Nitrate (as NO ₃)	IS: 3025 (Part 34): 1988, Reaff. 2019	0.76	mg/l	45	No Relaxation
6	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	58.28	mg/l	250	1000
7	Sulphate (as SO ₄)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	24.49	mg/l	200	400
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	71.42	mg/l	75	200
9	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2009 (EDTA method)	7.70	mg/l	30	100
10	Fluorides (as F)	APHA 23rd Edition 2017, 4500 FD	0.39	mg/l	1.0	1.5
11	Total Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.24	mg/l	0.3	No Relaxation
12	Arsenic (as As)	APHA (23rd edition-2017), 3114 C	*BDL(**DL-0.005 mg/l)	mg/l	0.01	0.05
13	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/l)	mg/l	0.05	1.5
14	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.20 mg/l)	mg/l	5.0	15
15	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.05 mg/l)	mg/l	0.01	No Relaxation
16	Turbidity	IS 3025 (Part 10): 1984, Ref: 2017, (Nephelometric Method)	*BDL(**DL 1.0 NTU)	NTU	1	5
17	Aluminium	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/l)	mg/l	0.03	0.2
18	Manganese (as Mn)	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	*BDL(**DL-0.05 mg/l)	mg/l	0.1	0.3
19	Ammonia (as NH ₃)	IS-3025 (Part-34)- 1988, RA. 2019	*BDL(**DL-0.3 mg/l)	mg/l	0.5	No Relaxation

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/02

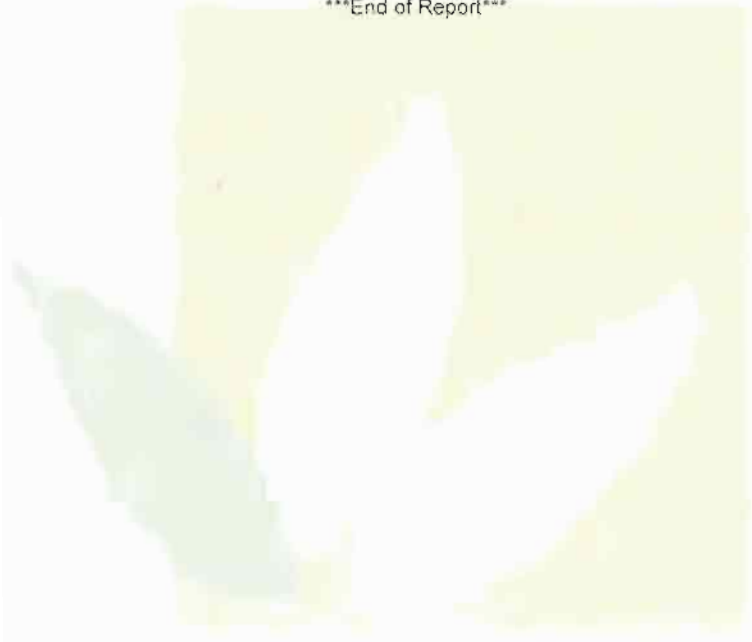
Report No. : VELW/2009230007/A

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
20	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/l)	mg/l	0.5	1.0
21	Sulphide	IS: 3025 (Part 29): 1986, RA. 2009 Turbidity Method	*BDL(**DL-0.1 mg/l)	mg/l	200	400
22	Phenolic Compound	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l	0.001	0.002
23	Free Residual Chlorine	IS: 3025 (Part 26): 1986 RA 2019	*BDL(**DL-0.2 mg/l)	mg/l	0.2	1

*BDL-Below Detection Limit,**DL-Detection Limit

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/GW/02

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VELW/2009230007/B
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/10/2020
 Period of Analysis : 23/09/2020-03/10/2020
 Receipt Date : 23/09/2020
 Sampling Date : 21/09/2020
 Sampling Quantity : 2 Ltr. +250 ml
 Sampling Type : Grab

Sample Description : GROUND WATER
 Location : Village - Palsada
 Sample Collected by : VEL Team
 Preservation : Suitable Preservation
 Sampling and Analysis Protocol : IS 10500 -2012

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	Total Coliform (By MPN Method)	IS:1622	Absent	MPN/100 ml	Shall not be Detectable in any 100 ml sample	NA
2	E-Coli	IS:1622	Absent	per 100 ml	Absent/100 ml	Absent/100 ml
3	Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/l)	mg/l	0.05	No Relaxation
4	Colour	IS 3025: 1983 (P-4) RA.. 2017	*BDL(**DL 1.0 Hazen)	Hazen Unit	5	15
5	Odour	IS 3025 (P-5): RA. 2018	Agreeable	Qualitative	Agreeable	Agreeable
6	Taste	IS 3025(P-8):1984 RA. 2017	Agreeable	Qualitative	Agreeable	Agreeable
7	Anionic Surface Active Agent	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.05 mg/l)	mg/l	0.2	1.0
8	Mineral Oil	IS 3025(P-39)	*BDL(**DL-0.05 mg/l)	mg/l	0.5	No Relaxation
9	Barium as (Ba)	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l	0.7	No Relaxation
10	Faecal Coliform	IS:1622	Absent	MPN/100 ml	Shall not be Detectable in any 100 ml sample	



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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/02

Report No.

: VEL/W/2009230007/B

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/GW/03

Name & Address of the Party : M/s Raigarh Energy Generation Ltd

Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/W/2009230008/A

Format No : 7.8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr. +250 ml

Sampling Type : Grab

Sample Description : GROUND WATER

Location : Village - Kathli

Sample Collected by : VEL Team

Preservation : Suitable Preservation

Sampling and Analysis Protocol : IS 10500 -2012

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	pH	IS 3025 (P-11): 1983 Reaff. 2017	7.45	--	6.5 to 8.5	No Relaxation
2	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	516.00	mg/l	500	2000
3	Total Alkalinity (as CaCO ₃)	IS: 3025 (Part 23): 1986, Reaff. 2019	290.08	mg/l	200	600
4	Total Hardness (as CaCO ₃)	IS: 3025 (Part 21): 2009, Reaff. 2019	332.64	mg/l	200	600
5	Nitrate (as NO ₃)	IS: 3025 (Part 34): 1988, Reaff. 2019	3.34	mg/l	45	No Relaxation
6	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	81.59	mg/l	250	1000
7	Sulphate (as SO ₄)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	41.39	mg/l	200	400
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	98.40	mg/l	75	200
9	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2009 (EDTA method)	21.17	mg/l	30	100
10	Fluorides (as F)	APHA 23rd Edition 2017, 4500 FD	0.51	mg/l	1.0	1.5
11	Total Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.29	mg/l	0.3	No Relaxation
12	Arsenic (as As)	APHA (23rd edition-2017), 3114 C	*BDL(**DL-0.005 mg/l)	mg/l	0.01	0.05
13	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/l)	mg/l	0.05	1.5
14	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.20 mg/l)	mg/l	5.0	15
15	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.05 mg/l)	mg/l	0.01	No Relaxation
16	Turbidity	IS 3025 (Part 10): 1984, Ref: 2017, (Nephelometric Method)	*BDL(**DL 1.0 NTU)	NTU	1	5
17	Aluminium	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/l)	mg/l	0.03	0.2
18	Manganese (as Mn)	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	*BDL(**DL-0.05 mg/l)	mg/l	0.1	0.3
19	Ammonia (as NH ₃)	IS-3025 (Part-34)- 1988, RA. 2019	*BDL(**DL-0.3 mg/l)	mg/l	0.5	No Relaxation

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/GW/03

Report No. : VEL/W/2009230008/A

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
20	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/l)	mg/l	0.5	1.0
21	Sulphide	IS: 3025 (Part 29): 1986, RA. 2009 Turbidity Method	*BDL(**DL-0.1 mg/l)	mg/l	200	400
22	Phenolic Compound	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l	0.001	0.002
23	Free Residual Chlorine	IS: 3025 (Part 26): 1986 RA 2019	*BDL(**DL-0.2 mg/l)	mg/l	0.2	1

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report


(Checked By)



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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/GW/03
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Sample Description : GROUND WATER
 Location : Village - Kathli
 Sample Collected by : VEL Team
 Preservation : Suitable Preservation
 Sampling and Analysis Protocol : IS 10500 -2012

Report No. : VEL/W/2009230008/B
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 03/10/2020
 Period of Analysis : 23/09/2020-03/10/2020
 Receipt Date : 23/09/2020
 Sampling Date : 21/09/2020
 Sampling Quantity : 2 Ltr +250 ml
 Sampling Type : Grab

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	Total Coliform (By MPN Method)	IS:1622	Absent	MPN/10 0 ml	Shall not be Detectable in any 100 ml sample	NA
2	E-Coli	IS:1622	Absent	per 100 ml	Absent/100 ml	Absent/100 ml
3	Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/l)	mg/l	0.05	No Relaxation
4	Colour	IS 3025: 1983 (P-4) RA.. 2017	*BDL(**DL 1.0 Hazen)	Hazen Unit	5	15
5	Odour	IS 3025 (P-5): RA, 2018	Agreeable	Qualitative	Agreeable	Agreeable
6	Taste	IS 3025(P-8):1984 RA, 2017	Agreeable	Qualitative	Agreeable	Agreeable
7	Anionic Surface Active Agent	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.05 mg/l)	mg/l	0.2	1.0
8	Mineral Oil	IS 3025(P-39)	*BDL(**DL-0.05 mg/l)	mg/l	0.5	No Relaxation
9	Barium as (Ba)	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l	0.7	No Relaxation
10	Faecal Caliform	IS:1622	Absent	MPN/10 0 ml	Shall not be Detectable in any 100 ml sample	



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- All disputes are subjected to Jaipur jurisdiction.



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/03

Report No. : VEL/W/2009230008/B

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report


(Checked By)



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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/GW/04

Report No. : VEL/W/2009230009/A

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Format No : 7.8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr +250 ml

Sampling Type : Grab

Sample Description : GROUND WATER

Location : Village - Chhote Bhandar

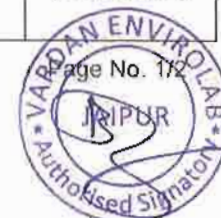
Sample Collected by : VEL Team

Preservation : Suitable Preservation

Sampling and Analysis Protocol : IS 10500 -2012

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	pH	IS 3025 (P-11): 1983 Reaff. 2017	7.63	--	6.5 to 8.5	No Relaxation
2	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	458.00	mg/l	500	2000
3	Total Alkalinity (as CaCO ₃)	IS: 3025 (Part 23): 1986, Reaff. 2019	243.04	mg/l	200	600
4	Total Hardness (as CaCO ₃)	IS: 3025 (Part 21): 2009, Reaff. 2019	297.00	mg/l	200	600
5	Nitrate (as NO ₃)	IS: 3025 (Part 34): 1988, Reaff. 2019	4.33	mg/l	45	No Relaxation
6	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	91.31	mg/l	250	1000
7	Sulphate (as SO ₄)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	45.44	mg/l	200	400
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	96.82	mg/l	75	200
9	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2009 (EDTA method)	13.47	mg/l	30	100
10	Fluorides (as F)	APHA 23rd Edition 2017, 4500 FD	0.40	mg/l	1.0	1.5
11	Total Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.25	mg/l	0.3	No Relaxation
12	Arsenic (as As)	APHA (23rd edition-2017), 3114 C	*BDL(**DL-0.005 mg/l)	mg/l	0.01	0.05
13	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/l)	mg/l	0.05	1.5
14	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.20 mg/l)	mg/l	5.0	15
15	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.05 mg/l)	mg/l	0.01	No Relaxation
16	Turbidity	IS 3025 (Part 10): 1984, Ref: 2017, (Nephelometric Method)	*BDL(**DL 1.0 NTU)	NTU	1	5
17	Aluminium	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/l)	mg/l	0.03	0.2
18	Manganese (as Mn)	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	*BDL(**DL-0.05 mg/l)	mg/l	0.1	0.3
19	Ammonia (as NH ₃)	IS-3025 (Part-34)- 1988, RA. 2019	*BDL(**DL-0.3 mg/l)	mg/l	0.5	No Relaxation

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/04

Report No. : VELW/2009230009/A

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
20	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/l)	mg/l	0.5	1.0
21	Sulphide	IS: 3025 (Part 29): 1986, RA, 2009 Turbidity Method	*BDL(**DL-0.1 mg/l)	mg/l	200	400
22	Phenolic Compound	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l	0.001	0.002
23	Free Residual Chlorine	IS: 3025 (Part 26): 1986 RA 2019	*BDL(**DL-0.2 mg/l)	mg/l	0.2	1

*BDL-Below Detection Limit,**DL-Detection Limit

End of Report


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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/04

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.

Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/W/2009230009/B

Format No : 7.8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr +250 ml

Sampling Type : Grab

Sample Description : GROUND WATER

Location : Village - Chhote Bhandar

Sample Collected by : VEL Team

Preservation : Suitable Preservation

Sampling and Analysis : IS 10500 -2012

Protocol

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	Total Coliform (By MPN Method)	IS:1622	Absent	MPN/100 ml	Shall not be Detectable in any 100 ml sample	NA
2	E-Coli	IS:1622	Absent	per 100 ml	Absent/100 ml	Absent/100 ml
3	Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/l)	mg/l	0.05	No Relaxation
4	Colour	IS 3025: 1983 (P-4) RA.. 2017	*BDL(**DL 1.0 Hazen)	Hazen Unit	5	15
5	Odour	IS 3025 (P-5): RA. 2018	Agreeable	Qualitative	Agreeable	Agreeable
6	Taste	IS 3025(P-8):1984 RA. 2017	Agreeable	Qualitative	Agreeable	Agreeable
7	Anionic Surface Active Agent	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.05 mg/l)	mg/l	0.2	1.0
8	Mineral Oil	IS 3025(P-39)	*BDL(**DL-0.05 mg/l)	mg/l	0.5	No Relaxation
9	Barium as (Ba)	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l	0.7	No Relaxation
10	Faecal Caliform	IS:1622	Absent	MPN/100 ml	Shall not be Detectable in any 100 ml sample	



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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/04

Report No. : VEL/W/2009230009/B

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/GW/05

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhole Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VELW/2009230010/A

Format No : 7 8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr. +250 ml

Sampling Type : Grab

Sample Description : GROUND WATER

Location : Village - Bade Bhandar

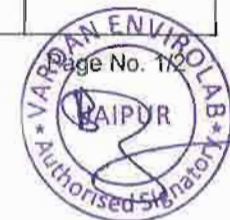
Sample Collected by : VEL Team

Preservation : Suitable Preservation

Sampling and Analysis Protocol : IS 10500 -2012

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	pH	IS 3025 (P-11): 1983 Reaff. 2017	7.47	--	6.5 to 8.5	No Relaxation
2	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	477.00	mg/l	500	2000
3	Total Alkalinity (as CaCO ₃)	IS: 3025 (Part 23): 1986, Reaff. 2019	290.08	mg/l	200	600
4	Total Hardness (as CaCO ₃)	IS: 3025 (Part 21): 2009, Reaff. 2019	304.92	mg/l	200	600
5	Nitrate (as NO ₃)	IS: 3025 (Part 34): 1988, Reaff. 2019	3.99	mg/l	45	No Relaxation
6	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	101.02	mg/l	250	1000
7	Sulphate (as SO ₄)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	42.40	mg/l	200	400
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019	93.64	mg/l	75	200
9	Magnesium (as Mg)	IS: 3025 (Part 46): 1994, Reaff. 2009 (EDTA method)	17.32	mg/l	30	100
10	Fluorides (as F)	APHA 23rd Edition 2017, 4500 FD	0.37	mg/l	1.0	1.5
11	Total Iron (as Fe)	IS 3025(P-53): 2003 Reaffirm 2019	0.27	mg/l	0.3	No Relaxation
12	Arsenic (as As)	APHA (23rd edition-2017), 3114 C	*BDL(**DL-0.005 mg/l)	mg/l	0.01	0.05
13	Copper (as Cu)	APHA 23rd Edition Year 2017 Method No. 3111B	*BDL(**DL-0.02 mg/l)	mg/l	0.05	1.5
14	Zinc (as Zn)	APHA (23rd edition-2017), 3030D, 3113 B	*BDL(**DL-0.20 mg/l)	mg/l	5.0	15
15	Selenium (as Se)	APHA (23rd edition-2017), 3114C	*BDL(**DL-0.05 mg/l)	mg/l	0.01	No Relaxation
16	Turbidity	IS 3025 (Part 10): 1984, Ref: 2017, (Nephelometric Method)	*BDL(**DL-1.0 NTU)	NTU	1	5
17	Aluminium	IS 3025 (Part-55): 2003, Reaff. 2019	*BDL(**DL-0.03 mg/l)	mg/l	0.03	0.2
18	Manganese (as Mn)	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	*BDL(**DL-0.05 mg/l)	mg/l	0.1	0.3
19	Ammonia (as NH ₃)	IS-3025 (Part-34)- 1988, RA. 2019	*BDL(**DL-0.3 mg/l)	mg/l	0.5	No Relaxation

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/05

Report No. : VEL/W/2009230010/A

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
20	Boron (as B)	APHA 23rd Edition Year 2017 Method No. 4500B	*BDL(**DL-0.2 mg/l)	mg/l	0.5	1.0
21	Sulphide	IS: 3025 (Part 29): 1986, RA. 2009 Turbidity Method	*BDL(**DL-0.1 mg/l)	mg/l	200	400
22	Phenolic Compound	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l	0.001	0.002
23	Free Residual Chlorine	IS: 3025 (Part 26): 1986 RA 2019	*BDL(**DL-0.2 mg/l)	mg/l	0.2	1

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report


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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/GW/05

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.

Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/W/2009230010/B

Format No : 7 8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr. +250 ml

Sampling Type : Grab

Sample Description : GROUND WATER

Location : Village - Bade Bhandar

Sample Collected by : VEL Team

Preservation : Suitable Preservation

Sampling and Analysis Protocol : IS 10500 -2012

S.No.	Parameters	Protocols	Results	Units	IS:10500-2012	
					Acceptable Limits	Permissible Limits
1	Total Coliform (By MPN Method)	IS:1622	Absent	MPN/10 0 ml	Shall not be Detectable in any 100 ml sample	NA
2	E-Coli	IS:1622	Absent	per 100 ml	Absent/100 ml	Absent/100 ml
3	Cyanide (as CN)	APHA 23rd Edition 2017, 4500CN D	*BDL(**DL-0.05 mg/l)	mg/l	0.05	No Relaxation
4	Colour	IS 3025: 1983 (P-4) RA.. 2017	*BDL(**DL 1.0 Hazen)	Hazen Unit	5	15
5	Odour	IS 3025 (P-5): RA. 2018	Agreeable	Qualitative	Agreeable	Agreeable
6	Taste	IS 3025(P-8):1984 RA. 2017	Agreeable	Qualitative	Agreeable	Agreeable
7	Anionic Surface Active Agent	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.05 mg/l)	mg/l	0.2	1.0
8	Mineral Oil	IS 3025(P-39)	*BDL(**DL-0.05 mg/l)	mg/l	0.5	No Relaxation
9	Barium as (Ba)	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l	0.7	No Relaxation
10	Faecal Caliform	IS:1622	Absent	MPN/10 0 ml	Shall not be Detectable in any 100 ml sample	

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/GW/05

Report No. : VELW/2009230010/B

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report

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4.4 Surface water Quality Analysis



Figure. No. 6. Plan Showing Surface Water Quality Monitoring Location Map

Location Code: - 1. Mand Nadi River (Up Stream)

2. Mand Nadi River (Down Stream)



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/SW/01
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)
 Name of the Project :
 Sample Description : SURFACE WATER
 Location : Mand River (Down Stream)
 Sample Collected by : VEL Team
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2296

Report No. : VELW/2009230002/A
 Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 03/10/2020
 Period of Analysis : 23/09/2020-03/10/2020
 Receipt Date : 23/09/2020
 Sampling Date : 21/09/2020
 Sampling Quantity : 2 Ltr + 250 ml
 Sampling Type : Grab
 Preservation : Suitable Preservation

S.No.	Test Parameters	Test Method	Results	Units
1	pH value	IS 3025 (P-11): 1983 Reaff. 2017	7.48	--
2	Turbidity	IS 3025 (Part 10): 1984, Reaff: 2017, (Nephelometric Method)	4.00	NTU
3	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	271.00	mg/l
4	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	66.05	mg/l
5	Sulphate as (SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	30.74	mg/l
6	Total Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	117.60	mg/l
7	Total Hardness (CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	138.60	mg/l
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019 (EDTA method)	44.44	mg/l
9	Magnesium	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	6.74	mg/l
10	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.25	mg/l
11	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	5.21	mg/l
12	Phenolic compounds	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l
13	Iron	IS:3025(P-53):2003,RA.2019:2003	0.24	mg/l
14	Zinc as (Zn)	APHA (23rd edition), 3030D,3113B	*BDL(**DL-0.20 mg/l)	mg/l
15	Copper (Cu)	APHA (23rd edition), 3111B	*BDL(**DL-0.02 mg/l)	mg/l
16	Manganese as Mn	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l
17	Arsenic as As	APHA (23rd edition), 3030D,3114C, 2017	*BDL(**DL-0.005 mg/l)	mg/l

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Test Report

Sample Number : VEL/SW/01

Report No. : VEL/W/2009230002/A

S.No.	Test Parameters	Test Method	Results	Units
17			mg/l)	
18	Boron	APHA (23rd edition) 4600B, 2017	*BDL(**DL-0.2 mg/l)	mg/l
19	Selenium as Se	APHA (23rd edition),3114C, 2017	*BDL(**DL-0.05 mg/l)	mg/l

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report


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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/SW/01

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Name of the Project :

Sample Description : SURFACE WATER
Location : Mand River (Down Stream)
Sample Collected by : VEL Team
Parameter Required : As Per Work Order
Sampling and Analysis Protocol : IS 2296

Report No. : VELAW/2009230002/B

Format No : 7 8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr. + 250 ml

Sampling Type : Grab

Preservation : Suitable Preservation

S.No.	Test Parameters	Test Method	Results	Units
1	Colour	IS 3025: 1987 (P-4) Reaff.2017	4.00	Hazen
2	Odour	IS 3025 (P-5) : 2018	Agreeable	--
3	Taste	IS 3025 (P-8):1984 Reaff. 2017	Agreeable	--
4	Anionic Surface active agents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.05 mg/l)	mg/l
5	Fecal Coliform	IS-1622:2009	46.00	MPN/100ml
6	Total Coliform	IS-1622:2009	70.00	MPN/100ml
7	Residual Free Chlorine	IS:3025(P-26):1986,RA:2019:1986	*BDL(**DL-0.2 mg/l)	mg/l
8	E Coli	IS 1622, 1981 (Ref. 2003)	Present	MPN/100ml
9	Cyanide as CN	APHA 4500 CN -D	*BDL(**DL-0.05 mg/l)	mg/l
10	Aluminium as Al	IS 3025 (P-55) 2003, RA 2019	*BDL(**DL-0.03 mg/l)	mg/l
11	Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.05 mg/l)	mg/l
12	Ammonia	IS-3025(P-34)-1988,Reaff:2019	2.74	mg/l
13	Sulphide	IS3025(P-29):1986 Reaff 2019	*BDL(**DL-0.1 mg/l)	mg/l
14	Barium (Ba)	APHA 3111B	*BDL(**DL-0.05 mg/l)	mg/l



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- All disputes are subjected to Jaipur jurisdiction.



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

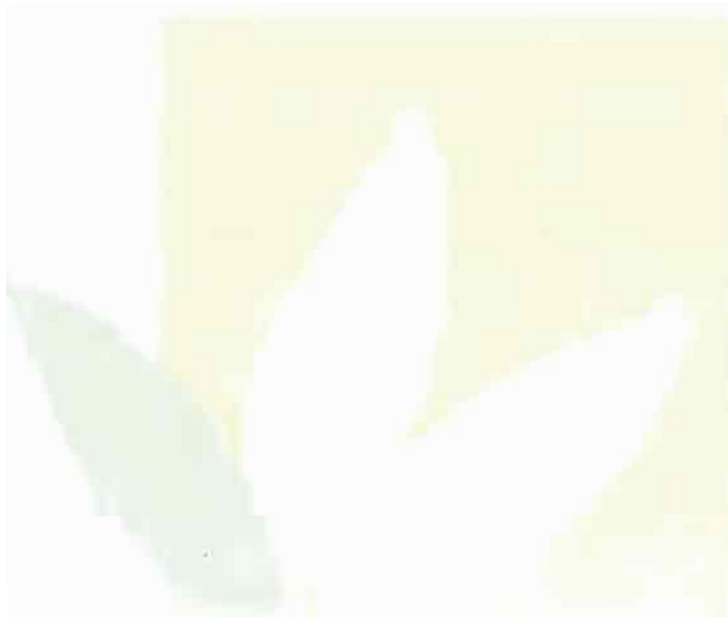
Sample Number : VEL/SW/01

Report No. : VELAW/2009230002/B

*BDL-Below Detection Limit,**DL-Detection Limit

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number :	VEL/SW/02	Report No. :	VELW/2009230003/A
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7 8 F-01
Name of the Project :		Party Reference No :	NIL
Sample Description :	SURFACE WATER	Reporting Date :	03/10/2020
Location :	Mand River (Up Stream)	Period of Analysis :	23/09/2020-03/10/2020
Sample Collected by :	VEL Team	Receipt Date :	23/09/2020
Parameter Required :	As Per Work Order	Sampling Date :	21/09/2020
Sampling and Analysis Protocol :	IS 2296	Sampling Quantity :	2 Ltr + 250 ml.
		Sampling Type :	Grab
		Preservation :	Suitable Preservation

S.No.	Test Parameters	Test Method	Results	Units
1	pH value	IS 3025 (P-11): 1983 Reaff. 2017	7.35	--
2	Turbidity	IS 3025 (Part 10): 1984, Reaff: 2017, (Nephelometric Method)	2.00	NTU
3	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	232.00	mg/l
4	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	54.39	mg/l
5	Sulphate as (SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	26.69	mg/l
6	Total Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	90.16	mg/l
7	Total Hardness (CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	118.80	mg/l
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019 (EDTA method)	39.68	mg/l
9	Magnesium	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	4.81	mg/l
10	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.30	mg/l
11	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	4.56	mg/l
12	Phenolic compounds	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l
13	Iron	IS:3025(P-53):2003,RA.2019:2003	0.23	mg/l
14	Zinc as (Zn)	APHA (23rd edition), 3030D,3113B	*BDL(**DL-0.20 mg/l)	mg/l
15	Copper (Cu)	APHA (23rd edition), 3111B	*BDL(**DL-0.02 mg/l)	mg/l
16	Manganese as Mn	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l
17	Arsenic as AS	APHA (23rd edition), 3030D,3114C, 2017	*BDL(**DL-0.005 mg/l)	mg/l

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/SW/02

Report No.

: VEL/W/2009230003/A

S.No.	Test Parameters	Test Method	Results	Units
17			mg/l)	
18	Boron	APHA (23rd edition) 4500B, 2017	*BDL(**DL-0.2 mg/l)	mg/l
19	Selenium as Se	APHA (23rd edition),3114C, 2017	*BDL(**DL-0.05 mg/l)	mg/l

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number :	VEL/SW/02	Report No. :	VEL/W/2009230003/B
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd. Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7 8 F-01
Name of the Project :		Party Reference No :	NIL
Sample Description :	SURFACE WATER	Reporting Date :	03/10/2020
Location :	Mand River (Up Stream)	Period of Analysis :	23/09/2020-03/10/2020
Sample Collected by :	VEL Team	Receipt Date :	23/09/2020
Parameter Required :	As Per Work Order	Sampling Date :	21/09/2020
Sampling and Analysis Protocol :	IS 2296	Sampling Quantity :	2 Ltr + 250 ml
		Sampling Type :	Grab
		Preservation :	Suitable Preservation

S.No.	Test Parameters	Test Method	Results	Units
1	Colour	IS 3025: 1987 (P-4) Reaff.2017	3.00	Hazen
2	Odour	IS 3025 (P-5) : 2018	Agreeable	--
3	Taste	IS 3025 (P-8):1984 Reaff. 2017	Agreeable	--
4	Anionic Surface active agents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.05 mg/l)	mg/l
5	Fecal Coliform	IS-1622:2009	33.00	MPN/100ml
6	Total Coliform	IS-1622:2009	46.00	MPN/100ml
7	Residual Free Chlorine	IS:3025(P-26):1986,RA:2019:1986	*BDL(**DL-0.2 mg/l)	mg/l
8	E Coli	IS 1622, 1981 (Ref. 2003)	Present	MPN/100ml
9	Cyanide as CN	APHA 4500 CN -D	*BDL(**DL-0.05 mg/l)	mg/l
10	Aluminium as Al	IS 3025 (P-55) 2003, RA 2019	*BDL(**DL-0.03 mg/l)	mg/l
11	Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.05 mg/l)	mg/l
12	Ammonia	IS-3025(P-34)-1988,Reaff:2019	2.52	mg/l
13	Sulphide	IS3025(P-29):1986 Reaff 2019	*BDL(**DL-0.1 mg/l)	mg/l
14	Barium (Ba)	APHA 3111B	*BDL(**DL-0.05 mg/l)	mg/l



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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/SW/02

Report No. : VEL/W/2009230003/B

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report

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Figure. No. 7. Plan Showing Surface Water Quality Monitoring Location Map



Location Code: - 1 Mahanadi River Up Stream
2 Mahanadi River down Stream



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/SW/03
 Name & Address of the Party : M/s Raigarh Energy Generation Ild
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)
 Name of the Project :
 Sample Description : SURFACE WATER
 Location : Mahanadi (Down Stream)
 Sample Collected by : VEL Team
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2296

Report No. : VEL/W/2009230004/A
 Formal No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 03/10/2020
 Period of Analysis : 23/09/2020-03/10/2020
 Receipt Date : 23/09/2020
 Sampling Date : 21/09/2020
 Sampling Quantity : 2 Ltr + 250 ml.
 Sampling Type : Grab
 Preservation : Suitable Preservation

S.No.	Test Parameters	Test Method	Results	Units
1	pH value	IS 3025 (P-11): 1983 Reaff. 2017	7.38	--
2	Turbidity	IS 3025 (Part 10): 1984, Reaff. 2017, (Nephelometric Method)	4.00	NTU
3	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	292.00	mg/l
4	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	50.51	mg/l
5	Sulphate as (SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	24.32	mg/l
6	Total Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	141.12	mg/l
7	Total Hardness (CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	134.64	mg/l
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019 (EDTA method)	49.20	mg/l
9	Magnesium	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	2.89	mg/l
10	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.33	mg/l
11	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	12.49	mg/l
12	Phenolic compounds	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l
13	Iron	IS:3025(P-53):2003,RA.2019:2003	0.29	mg/l
14	Zinc as (Zn)	APHA (23rd edition), 3030D,3113B	*BDL(**DL-0.20 mg/l)	mg/l
15	Copper (Cu)	APHA (23rd edition), 3111B	*BDL(**DL-0.02 mg/l)	mg/l
16	Manganese as Mn	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l
17	Arsenic as As	APHA (23rd edition), 3030D,3114C, 2017	*BDL(**DL-0.005 mg/l)	mg/l

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TC-6652

Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/SW/03

Report No. : VELW/2009230004/A

S.No.	Test Parameters	Test Method	Results	Units
17			mg/l)	
18	Boron	APHA (23rd edition) 4600B, 2017	*BDL(**DL-0.2 mg/l)	mg/l
19	Selenium as Se	APHA (23rd edition),3114C, 2017	*BDL(**DL-0.05 mg/l)	mg/l

*BDL-Below Detection Limit,**DL-Detection Limit

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/SW/03

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Name of the Project :

Sample Description : SURFACE WATER

Location : Mahanadi (Down Stream)

Sample Collected by : VEL Team

Parameter Required : As Per Work Order

Sampling and Analysis Protocol : IS 2296

Report No. : VELW/2009230004/B

Format No : 7 8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr. + 250 ml

Sampling Type : Grab

Preservation : Suitable Preservation

S.No.	Test Parameters	Test Method	Results	Units
1	Colour	IS 3025: 1987 (P-4) Reaff.2017	4.00	Hazen
2	Odour	IS 3025 (P-5) : 2018	Agreeable	--
3	Taste	IS 3025 (P-8):1984 Reaff. 2017	Agreeable	--
4	Anionic Surface active agents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.05 mg/l)	mg/l
5	Fecal Coliform	IS-1622:2009	63.00	MPN/100ml
6	Total Coliform	IS-1622:2009	79.00	MPN/100ml
7	Residual Free Chlorine	IS:3025(P-26):1986,RA:2019:1986	*BDL(**DL-0.2 mg/l)	mg/l
8	E Coli	IS 1622, 1981 (Ref. 2003)	Present	MPN/100ml
9	Cyanide as CN	APHA 4500 CN -D	*BDL(**DL-0.05 mg/l)	mg/l
10	Aluminium as Al	IS 3025 (P-55) 2003, RA 2019	*BDL(**DL-0.03 mg/l)	mg/l
11	Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.05 mg/l)	mg/l
12	Ammonia	IS-3025(P-34)-1988,Reaff:2019	3.84	mg/l
13	Sulphide	IS3025(P-29):1986 Reaff 2019	*BDL(**DL-0.1 mg/l)	mg/l
14	Barium (Ba)	APHA 3111B	*BDL(**DL-0.05 mg/l)	mg/l



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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/SW/03

Report No. : VEL/W/2009230004/B

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/SW/04

Name & Address of the Party : M/s Raigarh Energy Generation Ild
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Name of the Project :

Sample Description : SURFACE WATER
Location : Mahanadi (Up Stream)
Sample Collected by : VEL Team
Parameter Required : As Per Work Order
Sampling and Analysis Protocol : IS 2296

Report No. : VEL/W/2009230005/A
Format No : 7 8 F-01
Party Reference No : NIL
Reporting Date : 03/10/2020
Period of Analysis : 23/09/2020-03/10/2020
Receipt Date : 23/09/2020
Sampling Date : 21/09/2020
Sampling Quantity : 2 Ltr + 250 ml
Sampling Type : Grab
Preservation : Suitable Preservation

S.No.	Test Parameters	Test Method	Results	Units
1	pH value	IS 3025 (P-11): 1983 Reaff. 2017	7.32	--
2	Turbidity	IS 3025 (Part 10): 1984, Reaff: 2017, (Nephelometric Method)	2.00	NTU
3	Total Dissolved Solids	IS 3025 (P-16): 1984 Reaff 2017	262.00	mg/l
4	Chloride (as Cl)	IS: 3025 (Part 32): 1988, Reaff. 2019	56.34	mg/l
5	Sulphate as (SO4)	IS: 3025 (Part 24): 1986, Reaff. 2019 Turbidity Method	20.61	mg/l
6	Total Alkalinity (as CaCO3)	IS: 3025 (Part 23): 1986, Reaff. 2019	133.28	mg/l
7	Total Hardness (CaCO3)	IS: 3025 (Part 21): 2009, Reaff. 2019	130.68	mg/l
8	Calcium (as Ca)	IS: 3025 (Part 40): 1991 Reaff. 2019 (EDTA method)	42.85	mg/l
9	Magnesium	IS: 3025 (Part 46): 1994, Reaff. 2019 (EDTA method)	5.78	mg/l
10	Fluoride (as F)	APHA 23rd Edition 2017, 4500FD	0.26	mg/l
11	Nitrate (as NO3)	IS: 3025 (Part 34): 1988, Reaff. 2019 (Chromotropic Method)	8.64	mg/l
12	Phenolic compounds	APHA 23rd Edition 2017, 5530C	*BDL(**DL-0.1 mg/l)	mg/l
13	Iron	IS:3025(P-53):2003,RA.2019:2003	0.27	mg/l
14	Zinc as (Zn)	APHA (23rd edition), 3030D,3113B	*BDL(**DL-0.20 mg/l)	mg/l
15	Copper (Cu)	APHA (23rd edition), 3111B	*BDL(**DL-0.02 mg/l)	mg/l
16	Manganese as Mn	APHA3111B	*BDL(**DL-0.05 mg/l)	mg/l
17	Arsenic as As	APHA (23rd edition), 3030D,3114C, 2017	*BDL(**DL-0.005 mg/l)	mg/l

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/SW/04

Report No.

: VELW/2009230005/A

S.No.	Test Parameters	Test Method	Results	Units
17			mg/l)	
18	Boron	APHA (23rd edition) 4500B, 2017	*BDL(**DL-0.2 mg/l)	mg/l
19	Selenium as Se	APHA (23rd edition),3114C, 2017	*BDL(**DL-0.05 mg/l)	mg/l

*BDL-Below Detection Limit,**DL-Detection Limit.

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VEL/SW/04

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Name of the Project :

Sample Description : SURFACE WATER
Location : Mahanadi (Up Stream)
Sample Collected by : VEL Team
Parameter Required : As Per Work Order
Sampling and Analysis Protocol : IS 2296

Report No. : VEL/W/2009230005/B

Format No : 7 8 F-01

Party Reference No : NIL

Reporting Date : 03/10/2020

Period of Analysis : 23/09/2020-03/10/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020

Sampling Quantity : 2 Ltr. + 250 ml.

Sampling Type : Grab

Preservation : Suitable Preservation

S.No.	Test Parameters	Test Method	Results	Units
1	Colour	IS 3025: 1987 (P-4) Reaff.2017	3.00	Hazen
2	Odour	IS 3025 (P-5) : 2018	Agreeable	--
3	Taste	IS 3025 (P-8):1984 Reaff. 2017	Agreeable	--
4	Anionic Surface active agents (as MBAS)	APHA 23rd Edition 2017, 5540C	*BDL(**DL-0.1 mg/l)	mg/l
5	Fecal Coliform	IS-1622:2009	26.00	MPN/100ml
6	Total Coliform	IS-1622:2009	34.00	MPN/100ml
7	Residual Free Chlorine	IS:3025(P-26):1986,RA:2019:1986	*BDL(**DL-0.2 mg/l)	mg/l
8	E Coli	IS 1622, 1981 (Ref. 2003)	Present	MPN/100ml
9	Cyanide as CN	APHA 4500 CN -D	*BDL(**DL-0.05 mg/l)	mg/l
10	Aluminium as Al	IS 3025 (P-55) 2003, RA 2019	*BDL(**DL-0.03 mg/l)	mg/l
11	Mineral Oil	IS 3025 (P-39)	*BDL(**DL-0.05 mg/l)	mg/l
12	Ammonia	IS-3025(P-34)-1988,Reaff:2019	3.29	mg/l
13	Sulphide	IS3025(P-29):1986 Reaff 2019	*BDL(**DL-0.1 mg/l)	mg/l
14	Barium (Ba)	APHA 3111B	*BDL(**DL-0.05 mg/l)	mg/l



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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/SW/04

Report No. : VEL/W/2009230005/B

*BDL-Below Detection Limit,**DL-Detection Limit

End of Report

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4.5 Soil Quality Analysis



Figure No. 8. Plan Showing Soil Sample Monitoring Location Map

Location Code: -

- S1- PalsadaVillage
- S2- Kathli Village
- S3- Chote Bhandar Village
- S4- Bade Bhandar Village
- S5- Nursery



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number	: VEL/S/02	Report No.	: VEL/S0/2009230003/A
Name & Address of the Party	: M/s Raigarh Energy Generation Ltd Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No	: 7.8 F-01
Sample Description	: SOIL	Party Reference No	: NIL
Location	: Village - Palsada	Reporting Date	: 29/09/2020
Sample Collected by	: VEL Team	Period of Analysis	: 23/09/2020-29/09/2020
Parameter Required	: As Per Work Order	Receipt Date	: 23/09/2020
Sampling and Analysis Protocol	: IS 2720, APHA & USDA	Sampling Date	: 21/09/2020
		Sampling Quantity	: 2 Kg
		Sampling Type	: Composite
		Packing Status	: Temp. Sealed

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS : 2720 (P- 26): 1987,RA: 2016	7.58	-
2	Electrical Conductivity	IS 14767: 2000 RA:2016	0.332	mS/cm
3	Bulk density	USDA:1954 (Page-96) RA: 2014	1.30	gm/cc
4	Organic Matter	IS 2720 (P-22) 1972 RA:2015	0.51	%
5	Available Nitrogen (as N)	IS : 14684,1999 RA: 2015	233.4	kg./hec.
6	Available Phosphorus	Lab SOP no. VEL/STP/01: 2018	32.43	kg./hec.
7	Total Zinc (as Zn)	USEPA 3050 B: 1996	15.4	mg/kg
8	Total Manganese (as Mn)	USEPA 3050	135.6	mg/kg
9	Total Lead (as Pb)	USEPA 3050 B: 1996	4.4	mg/kg
10	Total Cadmium (as Cd)	USEPA 3050	0.71	mg/kg
11	Total Copper (as Cu)	USEPA 3050 B: 1996	11.8	mg/kg

End of Report

Mishra
 (Checked By)



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- All disputes are subjected to Jaipur jurisdiction.



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number :	VEL/S/02	Report No. :	VEL/S0/2009230003/B
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd. Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7.8 F-01
		Party Reference No :	NIL
		Reporting Date :	29/09/2020
Sample Description :	SOIL	Period of Analysis :	23/09/2020-29/09/2020
Location :	Village - Palsada	Receipt Date :	23/09/2020
Sample Collected by :	VEL Team	Sampling Date :	21/09/2020
Parameter Required :	As Per Work Order	Sampling Quantity :	2 Kg.
Sampling and Analysis Protocol :	IS 2720, APHA & USDA	Sampling Type :	Composite
		Packing Status :	Temp. Sealed

S.No.	Parameters	Test Method	Results	Units
1	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
2	Water holding capacity	USDA:1954-Reaffirmed,2010	33.64	%
3	Chloride	USDA:1954 Method 13 (Page-98) RA: 2010	77.64	mg/kg
4	Calcium (as Ca)	Lab SOP no. VEL/STP/01: 2018	345.21	mg/kg
5	Sodium (as Na)	USDA:1954 Method 10A (Page-96) RA: 2010	81.32	mg/kg
6	Potassium (as K)	Lab SOP no. VEL/STP/01: 2018	90.63	kg/hect.
7	Magnesium (as Mg)	Lab SOP no. VEL/STP/01: 2018	86.61	mg/kg
8	Total Chromium (as Cr)	USEPA 3050 B:1996	1.24	mg/kg
9	Soil Texture	IS:2720 (P-4) RA:2006	Silty Loam	--

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number :	VEL/S/03	Report No. :	VEL/S0/2009230004/A
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7 8 F-01
Sample Description :	SOIL	Party Reference No :	NIL
Location :	Village - Kathli	Reporting Date :	29/09/2020
Sample Collected by :	VEL Team	Period of Analysis :	23/09/2020-29/09/2020
Parameter Required :	As Per Work Order	Receipt Date :	23/09/2020
Sampling and Analysis Protocol :	IS 2720, APHA & USDA	Sampling Date :	21/09/2020
		Sampling Quantity :	2 Kg
		Sampling Type :	Composite
		Packing Status :	Temp Sealed

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS : 2720 (P- 26); 1987,RA: 2016	7.51	-
2	Electrical Conductivity	IS 14767: 2000 RA:2016	0.340	mS/cm
3	Bulk density	USDA:1954 (Page-96) RA: 2014	1.24	gm/cc
4	Organic Matter	IS 2720 (P-22) 1972 RA:2015	0.72	%
5	Available Nitrogen (as N)	IS : 14684,1999 RA: 2015	266.91	kg. /hec.
6	Available Phosphorus	Lab SOP no. VEL/STP/01: 2018	40.8	kg. /hec.
7	Total Zinc (as Zn)	USEPA 3050 B: 1996	12.61	mg/kg
8	Total Manganese (as Mn)	USEPA 3050	133.73	mg/kg
9	Total Lead (as Pb)	USEPA 3050 B: 1996	2.22	mg/kg
10	Total Cadmium (as Cd)	USEPA 3050	0.59	mg/kg
11	Total Copper (as Cu)	USEPA 3050 B: 1996	10.8	mg/kg

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number :	VEL/S/03	Report No. :	VEL/S0/2009230004/B
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7.8 F-01
		Party Reference No :	NIL
		Reporting Date :	29/09/2020
Sample Description :	SOIL	Period of Analysis :	23/09/2020-29/09/2020
Location :	Village - Kathli	Receipt Date :	23/09/2020
Sample Collected by :	VEL Team	Sampling Date :	21/09/2020
Parameter Required :	As Per Work Order	Sampling Quantity :	2 Kg
Sampling and Analysis Protocol :	IS 2720, APHA & USDA	Sampling Type :	Composite
		Packing Status :	Temp. Sealed

S.No.	Parameters	Test Method	Results	Units
1	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
2	Water holding capacity	USDA:1954-Reaffirmed,2010	30.21	%
3	Chloride	USDA:1954 Method 13 (Page-98) RA: 2010	96.82	mg/kg
4	Calcium (as Ca)	Lab SOP no. VEL/STP/01: 2018	353.14	mg/kg
5	Sodium (as Na)	USDA:1954 Method 10A (Page-96) RA: 2010	86.7	mg/kg
6	Potassium (as K)	Lab SOP no. VEL/STP/01: 2018	148.0	kg/hect.
7	Magnesium (as Mg)	Lab SOP no. VEL/STP/01: 2018	84.2	mg/kg
8	Total Chromium (as Cr)	USEPA 3050 B:1996	1.92	mg/kg
9	Soil Texture	IS:2720 (P-4) RA:2006	Silty Loam	--

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/S/04
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhatisgarh)

Sample Description : SOIL
 Location : Village - Chhote Bhandar
 Sample Collected by : VEL Team
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2720, APHA & USDA

Report No. : VEL/S0/2009230005/A
 Format No : 7 8 F-01
 Party Reference No : NIL
 Reporting Date : 29/09/2020
 Period of Analysis : 23/09/2020-29/09/2020
 Receipt Date : 23/09/2020
 Sampling Date : 21/09/2020
 Sampling Quantity : 2 Kg.
 Sampling Type : Composite
 Packing Status : Temp. Sealed

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS : 2720 (P- 26): 1987,RA: 2016	7.65	-
2	Electrical Conductivity	IS 14767: 2000 RA:2016	0.337	mS/cm
3	Bulk density	USDA:1954 (Page-96) RA: 2014	1.41	gm/cc
4	Organic Matter	IS 2720 (P-22) 1972 RA:2015	0.54	%
5	Available Nitrogen (as N)	IS : 14684,1999 RA: 2015	218.11	kg./hec.
6	Available Phosphorus	Lab SOP no. VEL/STP/01: 2018	35.0	kg./hec.
7	Total Zinc (as Zn)	USEPA 3050 B: 1996	10.62	mg/kg
8	Total Manganese (as Mn)	USEPA 3050	132.9	mg/kg
9	Total Lead (as Pb)	USEPA 3050 B: 1996	5.43	mg/kg
10	Total Cadmium (as Cd)	USEPA 3050	0.85	mg/kg
11	Total Copper (as Cu)	USEPA 3050 B: 1996	17.6	mg/kg

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number :	VEL/S/04	Report No :	VEL/S0/2009230005/B
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7 8 F-01
		Party Reference No :	NIL
		Reporting Date :	29/09/2020
		Period of Analysis :	23/09/2020-29/09/2020
Sample Description :	SOIL	Receipt Date :	23/09/2020
Location :	Village - Chhote Bhandar	Sampling Date :	21/09/2020
Sample Collected by :	VEL Team	Sampling Quantity :	2 Kg
Parameter Required :	As Per Work Order	Sampling Type :	Composite
Sampling and Analysis Protocol :	IS 2720, APHA & USDA	Packing Status :	Temp. Sealed

S.No.	Parameters	Test Method	Results	Units
1	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
2	Water holding capacity	USDA:1954-Reaffirmed,2010	36.0	%
3	Chloride	USDA:1954 Method 13 (Page-98) RA: 2010	77.0	mg/kg
4	Calcium (as Ca)	Lab SOP no. VEL/STP/01: 2018	337.3	mg/kg
5	Sodium (as Na)	USDA:1954 Method 10A (Page-96) RA: 2010	74.0	mg/kg
6	Potassium (as K)	Lab SOP no. VEL/STP/01: 2018	93.2	kg/hect.
7	Magnesium (as Mg)	Lab SOP no. VEL/STP/01: 2018	69.8	mg/kg
8	Total Chromium (as Cr)	USEPA 3050 B:1996	1.94	mg/kg
9	Soil Texture	IS:2720 (P-4) RA:2006	Silty Loam	--

End of Report


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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number : VFI/S/05
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Sample Description : SOIL
 Location : Village - Bade Bhandar
 Sample Collected by : VEL Team
 Parameter Required : As Per Work Order
 Sampling and Analysis Protocol : IS 2720, APHA & USDA

Report No. : VEL/S0/2009230006/A
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 29/09/2020
 Period of Analysis : 23/09/2020-29/09/2020
 Receipt Date : 23/09/2020
 Sampling Date : 21/09/2020
 Sampling Quantity : 2 Kg.
 Sampling Type : Composite
 Packing Status : Temp Sealed

S.No.	Parameters	Test Method	Results	Units
1	pH (at 25°C)	IS : 2720 (P- 26): 1987,RA: 2016	7.52	-
2	Electrical Conductivity	IS 14767: 2000 RA:2016	0.325	mS/cm
3	Bulk density	USDA:1954 (Page-96) RA: 2014	1.31	gm/cc
4	Organic Matter	IS 2720 (P-22) 1972 RA:2015	0.64	%
5	Available Nitrogen (as N)	IS : 14684,1999 RA: 2015	279.1	kg./hec.
6	Available Phosphorus	Lab SOP no. VEL/STP/01: 2018	33.2	kg./hec.
7	Total Zinc (as Zn)	USEPA 3050 B: 1996	19.71	mg/kg
8	Total Manganese (as Mn)	USEPA 3050	126.2	mg/kg
9	Total Lead (as Pb)	USEPA 3050 B: 1996	3.85	mg/kg
10	Total Cadmium (as Cd)	USEPA 3050	0.42	mg/kg
11	Total Copper (as Cu)	USEPA 3050 B: 1996	13.54	mg/kg

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number :	VEL/S/05	Report No. :	VEL/S0/2009230006/B
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd. Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7 & F-01
		Party Reference No :	NIL
		Reporting Date :	29/09/2020
		Period of Analysis :	23/09/2020-29/09/2020
Sample Description :	SOIL	Receipt Date :	23/09/2020
Location :	Village - Bade Bhandar	Sampling Date :	21/09/2020
Sample Collected by :	VEL Team	Sampling Quantity :	2 Kg
Parameter Required :	As Per Work Order	Sampling Type :	Composite
Sampling and Analysis Protocol :	IS 2720, APHA & USDA	Packing Status :	Temp Sealed

S.No.	Parameters	Test Method	Results	Units
1	Colour	USDA:1954-Reaffirmed,2010	Yellowish Red	-
2	Water holding capacity	USDA:1954-Reaffirmed,2010	32.03	%
3	Chloride	USDA:1954 Method 13 (Page-98) RA: 2010	96.63	mg/kg
4	Calcium (as Ca)	Lab SOP no. VEL/STP/01: 2018	388.9	mg/kg
5	Sodium (as Na)	USDA:1954 Method 10A (Page-96) RA: 2010	71.7	mg/kg
6	Potassium (as K)	Lab SOP no. VEL/STP/01: 2018	90.9	kg/hect.
7	Magnesium (as Mg)	Lab SOP no. VEL/STP/01: 2018	31.3	mg/kg
8	Total Chromium (as Cr)	USEPA 3050 B:1996	1.72	mg/kg
9	Soil Texture	IS:2720 (P-4) RA:2006	Silty Loam	-

End of Report


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4.6 Effluent Sample Analysis Report

Locations

1. STP Outlet
2. ETP Outlet



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/STP/01

Name & Address of the Party : M/s Raigarh Energy Generation Ltd.

Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Sample Description : Waste Water

Location : STP Outlet

Sample Collected by : VEL Team

Parameter Required : As Per Work Order

Sampling and Analysis Protocol : IS 3025

Report No. : VEL/WWW/2009230001/A

Format No : 7.8 F-01

Party Reference No : NIL

Reporting Date : 29/09/2020

Period of Analysis : 23/09/2020-29/09/2020

Receipt Date : 23/09/2020

Sampling Date : 21/09/2020


Sampling Quantity : 2 Ltr

Sampling Type : Grab

Packing Status : Temp Sealed

S.No.	Test Parameters	Test Method	Result	Unit	Prescribed Limit
1	pH	IS 3025 (P-11): 1983 RA2017	7.49	-	5.5 - 9.0
2	Total Suspended Solids	IS: 3025 (Part 17): 1984, RA2017	22.7	mg/l	100.0
3	Oil & Grease	IS 3025(P-39):1991 RA 2019	1.2	mg/l	10.0
4	BOD (3 days @ 27°C)	IS: 3025 (Part-44): 1993, RA: 2019	25.2	mg/l	30.0
5	COD	IS : 3025 (Part 58) : 2006 RA: 2017	129.0	mg/l	250.0

End of Report


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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised | ISO 9001 | OHSAS 45001

Test Report

Sample Number :	VEL/OUTLET/01	Report No :	VEL/WWW/2009230002/A
Name & Address of the Party :	M/s Raigarh Energy Generation Ltd. Village Chhote Bhandar, Post Office Bade Bandar Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)	Format No :	7.8 F-01
		Party Reference No :	NIL
		Reporting Date :	29/09/2020
		Period of Analysis :	23/09/2020-29/09/2020
Sample Description :	Waste Water	Receipt Date :	23/09/2020
Location :	ETP Outlet	Sampling Date :	21/09/2020
Sample Collected by :	VEL Team	Sampling Quantity :	2 Ltr.
Parameter Required :	As Per Work Order	Sampling Type :	Grab
Sampling and Analysis Protocol :	IS 3025	Packing Status :	Temp. Sealed

S.No.	Test Parameters	Test Method	Result	Unit	Prescribed Limit
1	pH	IS 3025 (P-11): 1983 RA2017	7.71	-	5.5 - 9.0
2	Total Suspended Solids	IS: 3025 (Part 17): 1984, RA2017	21.8	mg/l	100.0
3	Oil & Grease	IS 3025(P-39):1991 RA 2019	0.9	mg/l	10.0
4	BOD (3 days @ 27°C)	IS: 3025 (Part-44): 1993, RA: 2019	15.6	mg/l	30.0
5	COD	IS : 3025 (Part 58) : 2006 RA: 2017	89.3	mg/l	250.0

End of Report

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4.7 Stack Emission Analysis Report

Locations

1. TPP



Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035
 Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051
 MoEF & CC Recognised [ISO 9001 | OHSAS 45001]

Test Report

Sample Number : VEL/ST/01
 Name & Address of the Party : M/s Raigarh Energy Generation Ltd.
 Village Chhote Bhandar, Post Office Bade Bandar
 Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/S/2009230001/A
 Format No : 7.8 F-01
 Party Reference No : NIL
 Reporting Date : 30/09/2020
 Period of Analysis : 23/09/2020-30/09/2020
 Receipt Date : 23/09/2020

Sample Description : Stack Emission Monitoring

General Information

Sampling Location : TPP
 Sample Collected by : VEL Team
 Date of Sampling : 20/09/2020
 Sampling duration (Minutes) : 40 min. (11.00 to 11 40 hrs)
 Stack attached to : TPP
 Make of stack : Iron
 Diameter of stack(m) : 7.5m
 Height of stack(m) : 275 m
 Instrument calibration status : Calibrated
 Meteorological Condition : Clear Sky
 Ambient Temperature - Ta (°C) : 34
 Temperature of Stack Gases - Ts (°C) : 129
 Velocity of Stack Gases (m/sec.) : 17.65
 Flow rate of PM (LPM) : 25
 Flow rate of Gas (LPM) : 2.0
 Sampling condition : OK
 Protocol used : IS 11255 & EPA

S.No.	Parameters	Test Method	Results	Units	Limits
1	Particulate Matter (as PM)	IS: 11255 (Part1) : 1985, RA 2014	46.93	mg/Nm ³	50.0
2	Sulphur Dioxide (as SO ₂)	IS: 11255(P- 2): 1985, RA.2014	729.76	mg/Nm ³	600.0
3	Oxide of Nitrogen as NO ₂	IS-11255 P-7, RA 2017	267.11	mg/Nm ³	300.0

BDL - Below Detection Limit ** DL Detection Limit

End of Report

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Laboratory: Plot No. 24, 25, Narayan Vihar B Block, Jaipur (Raj.) 302035

Corp. Off.: Plot No. 82A, Sector- 5, IMT Manesar, Gurugram- 122051

MoEF & CC Recognised (ISO 9001 | OHSAS 45001)

Test Report

Sample Number : VEL/ST/01

Name & Address of the Party : M/s Raigarh Energy Generation Ltd
Village Chhote Bhandar, Post Office Bade Bandar
Tehsil Pussore, Dist-Raigarh-496100 (Chhattisgarh)

Report No. : VEL/S/2009230001/B

Format No : 7 8 F-01

Party Reference No : NIL

Reporting Date : 30/09/2020

Period of Analysis : 23/09/2020-30/09/2020

Receipt Date : 23/09/2020

Sample Description : Stack Emission Monitoring


General Information

Sampling Location : TPP
Sample Collected by : VEL Team
Date of Sampling : 20/09/2020
Sampling duration (Minutes) : 40 min (11 00 to 11 40 hrs)
Stack attached to : TPP
Make of stack : Iron
Diameter of stack(m) : 7.5m
Height of stack(m) : 275 m
Instrument calibration status : Calibrated
Meteorological Condition : Clear Sky
Ambient Temperature - Ta (°C) : 34
Temperature of Stack Gases - Ts (°C) : 129
Velocity of Stack Gases (m/sec.) : 17.65
Flow rate of PM (LPM) : 25
Flow rate of Gas (LPM) : 2.0
Sampling condition : OK
Protocol used : IS 11255 & EPA

S.No.	Parameters	Test Method	Results	Units	Limits
1	Mercury as Hg	APHA 3rd edition 2017, 303A (Page No. 365)	BDL (DL 0.1)	mg/Nm ³	0.03

BDL - Below Detection Limit ** DL Detection Limit

End of Report


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Chapter – 5.0 CONCLUSION

RAIGARH ENERGY GENERATION LTD., authorities have been taken successful steps in controlling environmental pollution in and around the project. This fact is clear from analytical results of different environmental parameters. A brief conclusion is as follows.

Sr. No.	Environmental Parameters	Conclusion
5.1	Air Environment	After analysis of the samples from five different locations it is observed that both the individuals and average concentration of air pollutants in respect of SO ₂ , NO ₂ , PM ₁₀ , PM _{2.5} , CO and Mercury are well within the prescribed limits of NAAQM standards. People of township and of surrounding villages do not have any problems regarding the air quality and have no grievances because of Thermal Power Plant activities.
5.2	Water Environment	The analytical result of the samples from the ground water of villages, surface water from river, and domestic & industrial effluent after treatment shows that the concentrations of different water parameters are well within prescribed limits and will not cause any adverse impact on human health and on surrounding area. People of surrounding areas express satisfaction about the water quality of That area.
5.3	Noise Environment	The observations taken at four village location during day and night time shows that the noise level are well within prescribed limits of CPCB. Hence there is no possibility of any adverse effect of noise generated due to Thermal Power Plant activities on peoples of Surrounding areas.

All the above details show that Thermal Power Plant of RAIGARH ENERGY GENERATION LTD. is not causing any adverse impact on the human health and ecological balance.

ANNEXURE -II

Name of Power Utility: Raigarh Energy Generation Limited

Name of Thermal Power Plant: Raigarh Energy Generation Limited

Installed Capacity (Total): 600 MW

PERIOD OF REPORT- April 2020 to September 2020

[All Quantities in Million Tonne]

Sl. No.	ASH GENERATION AND UTILIZATION				MODE OF ASH UTILIZATION AND UTILIZATION IN EACH MODE										
	Month	Fly Ash Generation	Fly Ash Utilization	% age Utilization	In making of Fly Ash based/ Bricks/ Blocks/ Tiles etc.	In manufacture of Portland Pozzolana Cement	In construction of Highways & Roads including Flyovers	Part replacement of cement in concrete	In Hydro Power Sector in RCC Dam Construction	In Ash dyke raising	In reclamation of low lying Area	In Mine filling	In Agriculture/ Waste land Development	Others	
(1)	(2)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	
1	April-2020	0.0175	0.0173	98.8%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0173	0.0000	0.0000	0.0000	
2	May-2020	0.0627	0.0304	48.5%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0304	0.0000	0.0000	0.0000	
3	June-2020	0.0645	0.0107	16.6%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0107	0.0000	0.0000	0.0000	
4	July-2020	0.0000	0.0044	#DIV/0!	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0044	0.0000	0.0000	0.0000	
5	August-2020	0.0259	0.0204	78.7%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0204	0.0000	0.0000	0.0000	
6	September-2020	0.0460	0.0341	74.1%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0341	0.0000	0.0000	0.0000	
TOTAL		0.2166	0.1174	54.19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1174	0.0000	0.0000	0.0000	

Abbreviations:-
 MW-Mega Watt
 MT- Million Tonne

ANNEXURE -III

Green Belt Development

Plantation on 33% land of 487 acres	163 acres
Density of plantation	2500 plants/Hectare
Area required per plant	4.0 SQM
Total No. of plantation completed	206474 No's
2011-12	30,000
2012-13	20,571
2013-14	37,139
2014-15	43,107
2015-16	40,278
2016-17	17,517
2017-18	7,348
2018-19	3,450
2019-20	2,600
April 2020 – Sept 2020	4426
Survival rate maintained	>70%

ANNEXURE – IV

HYDROGEOLOGICAL
INVESTIGATION
REPORT

**IN AND AROUND BADE BHANDAR & CHHOTE
BHANDAR VILLAGE,
BLOCK- PUSSORE
DISTRICT - RAIPUR (C.G.)**

M/S RAIGARH ENERGY GENERATION LIMITED



PREPARED BY

ENVIBA ENVIRONMENTAL SERVICES

**EW-19, INDRAPRASTHA COLONY, RAIPURA, RAIPUR,
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STUDY TEAM

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1. INTRODUCTION

Adani Power Limited (APL), India's largest private sector thermal power producer, Raigarh Energy Generation Limited is a Public incorporated on 15 March 1995. It is classified as Non-govt Company and is registered at Registrar of Companies, Gwalior. It is involved in Production, collection and distribution of electricity. Raigarh Energy Generation Limited's Corporate Identification Number is (CIN) U40102MP1995PLC009177 and its registration number is 9177. Directors of Raigarh Energy Generation Limited are Samir Kumar Mitra, Rambhav Vishwanathan Gattu, Jayadeb Nanda, The addition of 1,370 MW capacity, along with the recently concluded acquisition of the 600 MW Korba West Power Co. Ltd., solidifies APL's position as India's largest private sector thermal power producer, with aggregate operating capacities of 12,450 MW and gives it a strong presence in India's leading power generating as well as power consuming regions.

With these developments, APL is now uniquely poised to contribute to the forthcoming growth phase of India's electricity sector, driven by a robust economic growth, as well as an increase in the market size led by reforms under the Government's ambitious "Power For All" vision. APL now has a healthy mix of open capacities as well as capacities tied up in long term PPAs, which provide it long term visibility while allowing it to tap into real growth opportunities. The Adani Group, with its established Pit-to-Plug presence, is confident of leveraging its strengths to achieve its long term goals, and contributing significantly to nation building.

This pre-eminent position of APL will be further consolidated upon completion of the 1,600 MW (2 X 800 MW) Ultra-supercritical power project, which is being constructed in Godda District of Jharkhand for supply of power to Bangladesh, and take the aggregate generation capacity to 14,050 MW.

SBI Capital Markets Limited acted as the M & A advisor for the transaction and has played a pivotal role in concluding the deal. Cyril Amarchand Mangaldas was the legal advisor and Luthra & Luthra Law offices acted as the Lenders' Legal Counsel.

Raigarh Energy Generation Limited (formerly known as Korba West Power Company Limited) has set up a coal based Thermal Power Plant of capacity 1x600 MW at village Chote Bhandar, Bade Bhandar, Sarvani & Amali Bhona, in Tehsil Pussore of Raigarh District.

REGL has been granted Environmental Clearance by Hon'ble MoEF&CC vide letter No. J-13012/57/2008-IA.II (T), dated 20.05.2010 and Amendment of Environmental Clearance for Coal transportation by way of Road for an interim period of three years dated 16.04.2015. However, the

Railway project was not completed by KWPCCL and the company went under insolvency resolution process under the Insolvency and Bankruptcy code 16.

Hon'ble NCLT, Ahmedabad has approved the resolution plan submitted by Adani Power Ltd. for acquiring KWPCCL Vide order IA 236 of 2019 in C.P (I.B) No. 190/NCLT/AHM/2018 dated 24th June 2019 and subsequently Adani Power Ltd. Has taken over management of KWPCCL. Korba West Power Company Ltd. is 100% subsidiary of Adani Power Ltd. The name has been changed from Korba West Power Company Limited to Raigarh Energy Generation Limited.

MoEF&CC has already issued the letter for change in name of Environmental Clearance vide letter dated 22.10.2019.

The company has adopted four peripheral villages and executing most of the CSR works in those villages in the field of their livelihood, infrastructure development, cleanliness, community health and education. The Thermal Power Plant was not in operation since May'2017 due to major breakdown of generator earth failure, The unit was revived in the month of December 2019

1.1 OBJECTIVE AND SCOPE OF WORK

1.1.1 Objective and Scope

The broad objective of the present study is to establish the hydrogeological environment of the project area and study the impact on ground water and suggest strategies for mitigation.

The scope of work includes following points

1. Conducting comprehensive hydrogeological studies, pumping test, chemical analysis of ground and surface water samples from the buffer zone of 10 km radius and particularly downstream side of ash dyke and its impact on the water regime for REGL" for 1 x 600 MW coal based Thermal Power Plant, Raigarh Energy Generation Ltd, Raigarh, Chhattisgarh
2. Survey and hydrological data collection of 30 key wells of 10 km radius are from the boundary of plant (buffer zone) of existing open wells/bore wells/piezometers and determine and record for each location including extermination of coordinates of the points by GPS and its plotting on map and water levels, pre & post monsoon levels. Yields, use, aquifer tapped etc.
3. Comprehensive hydrogeological assessment studies of the buffer zone discussing its geomorphology, digitized elevation model, geology, nature of water bearing formation sand depth to water table, long term ground water recharge, present ground water exploitation and present status of ground water development.
4. Conducting a pump test any existing plant/private bore well along with recuperation test. The pump test is required to find out the aquifer parameters like K, T and S. Interpretation of pump test data by software is included conducting pump test on any open well and its recovery test to find out aquifer parameters.
5. Collection of samples of ground water and few surface samples from the buffer zone and more from the downstream side of ash dyke for determination of 23 constituents and parameters comprising pH, Color, EC, TDS, Chloride, Sulphate, Calcium, Magnesium, Fluoride, Nitrate, Bicarbonate, Carbonate, Total Hardness, Total alkalinity and all the heavy and toxic elements including Hg (which are generally present in bottom ash).
6. Preparation of ground water quality report of 10 km radius area of buffer zone based the results of chemical analysis and its different maps showing the different contour maps on important constituents.

7. Hydrological and drainage studies of buffer zone, delineation of micro watersheds, its catchment area, catchment yields, particularly of watershed covering the ash dyke.
8. Preparation of ground water contour map of 10 km radius area showing the Ground water flow direction and hydraulic gradient.
9. Submission of draft report covering the findings of the investigations, original data and recommendations for future monitoring.
10. Submission of final report after incorporation of user observations.

1.1.2 Approach and Methodology

To fulfill the above objectives, especially Hydrogeological study in the area, following approach has been adapted as given below:

A detailed Hydrogeological investigation was carried out in & around Plant within 10 km of radius for both Core & Buffer Zone for evaluating the impact of project activity on ground water storage in the area.

Collection and collation of supplementary data viz. soils, geology, geomorphology, drainage etc. for interpretation.

Establishment of observation stations for water level measurements in different seasons as well as water sample collection for determining the quality aspects.

Pumping test data & its interpretation for knowing the hydrogeological parameters, etc.

Ground water resources have been estimated based on the norms recommended by GEC'97.

Evaluation of present ground water scenario as well as future course of action for protecting the natural environment.

2. GENERAL DESCRIPTION OF THE AREA

2.1 LOCATION

Raigarh Energy Generation Limited (formerly known as Korba West Power Company Limited) has set up a coal based Thermal Power Plant of capacity 1x600 MW at village Chote Bhandar, Bade Bhandar, Sarvani & Amali Bhona, in Tehsil Pussore of Raigarh District.

REGL has been granted Environmental Clearance by Hon'ble MoEF&CC vide letter No. J-13012/57/2008-IA.II (T), dated 20.05.2010 and Amendment of Environmental Clearance for Coal transportation by way of Road for an interim period of three years dated 16.04.2015. However, the Railway project was not completed by KWPCCL and the company went under insolvency resolution process under the Insolvency and Bankruptcy code 16.

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The company has adopted four peripheral villages and executing most of the CSR works in those villages in the field of their livelihood, infrastructure development, cleanliness, community health and education. The Thermal Power Plant was not in operation since May'2017 due to major breakdown of generator earth failure, The unit was revived in the month of December 2019

The co-ordinates of the Plant are $21^{\circ}43'41.6''N$ - $21^{\circ}45'3.5''N$ latitudes and $83^{\circ}16'2.85''E$ to $83^{\circ}17'1.33''E$ longitudes. For the present study, an area of 10 km of radius has been demarcated which lies between $21^{\circ}39'11''N$ - $21^{\circ}49'57''N$ latitudes and $83^{\circ}10'46''E$ to $83^{\circ}22'22.41''E$ longitudes and falls under the Survey of India Top sheet No. 64 O/1,64 O/2,64 O/5 and 64 O/6 in parts (1:50000 scale).The location map of the project site and toposheet of study area is given in **Fig. 2.1, 2.2** and the Satellite image map of the area is given in **Fig. 2.3**.

Brief Description of the Project

S. No.	Particulars	Details
1.	Name of the project	600 MW Coal based Thermal power plant
2.	Total Project Area	240 ha.
3.	Greenbelt Area	80 ha.(33.33% of the total plot area)
4.	Locations	
	A. Village	Bade Bhandar, Chote bhandar, Sarvani & Amali Bhona
	B. Tehsil	Raigarh
	C. District	Raigarh
	D. State	Chhattisgarh
5.	Toposheet	64 O/1,2,5,6
6.	Type of land	Government Revenue Land & Un irrigated Private Land (No Forest Land)
7.	Topography	Gently sloping towards South
8.	Latitude	21°44' to 21°45' North
9.	Longitude	83°17' to 83°17' East
10.	Elevation	215 m above MSL
11.	Climatology (During summer Season-March to May 2008)	
	A. Temperature	28.2°C to 45.7°C
	B. Relative Humidity	24 % to 56%
	C. Mean Annual Rainfall	1500 mm
12.	Nearest National Highway	NH-216 / 153
13.	Nearest Railway Station	Kirodimal
14.	Nearest Airport	Raipur (250 km)
15.	Nearest Tourist Place	No Tourist place within 10 km radius of the project site.
16.	Reserve forest/Protected forest/ Wildlife Sanctuary/ Biosphere reserve.	Damka Protected Forest (8 km, South West)
17.	Historical & Archaeological Important Place	No Historical & Archaeological site within 10 km radius of the project site
18.	Nearest Village	Bade Bhandar (1 km, North East)
19.	Nearest Town	Raigarh (23 km, North East)

S. No.	Particulars	Details
20.	Nearest Water bodies	Mand River (3.0 km, SW) Mahanadi River (5.0 km, S)
21.	Seismic Zone	Zone II: as per IS 1893 - 1984

2.2 ACCESSIBILITY

The area is well connected by metaled and unmetalled road as well as Rail networks. Chandrapur Railway station, on Mumbai- Howrah Broad Gauge main line of the South-Eastern-Central Railway is situated around 7kmsSWdirection from plant site. Raipur is nearest Airport and is about 220 km from the study area which is also approachable by road and rail. The block head quarter is Pussore

2.3 DEMOGRAPHY

There are 107 villages within 10 kms radius of mining lease area. The population as per 2011 Census is 104237 (for10km radius buffer zone). Scheduled Caste population of the study area (10km) is **12395** and Scheduled Tribe is 25949, Percentage of literacy is 65%. The workers those actually engaged in occupation are 50450 Main workers are around 32923whilemarginalworkers are 17527 Rest of the total population, are considered as non-workers. Population details is presented in table 2.1

Table 2.1 Population details as per census 2011

Block	Name	NoHH	TOTP	TOTM	TOTF	PSC	MSC	FSC	PST	MST	FST
Janjgir-Champa District											
Dabhra	Amaldiha	121	422	210	212	3	1	2	17	7	10
Dabhra	Balpur	513	1775	921	854	21	8	13	943	497	446
Dabhra	Barhaguda	257	1148	594	554	54	29	25	918	472	446
Dabhra	Bhainsamuhan	107	420	206	214	133	66	67	214	104	110
Dabhra	Bilaigarh	149	551	279	272	48	25	23	0	0	0
Dabhra	Borsi	299	1046	533	513	91	44	47	239	119	120
Dabhra	Chandali	312	1171	586	585	103	50	53	70	34	36
Dabhra	Chandrapur	1658	7688	3852	3836	444	223	221	804	390	414
Dabhra	Domanpur	257	839	427	412	6	4	2	4	3	1
Dabhra	Gopalpur	258	1247	634	613	132	69	63	552	283	269
Dabhra	Govindpur	235	800	413	387	109	51	58	117	57	60
Dabhra	Hardi	157	683	343	340	145	69	76	74	39	35
Dabhra	Hirapur	68	282	144	138	0	0	0	138	73	65
Dabhra	Kalma	297	1180	590	590	66	32	34	601	303	298
Dabhra	Kanshidih	365	1325	661	664	153	81	72	340	171	169
Dabhra	Khorsiya	178	577	280	297	75	33	42	8	3	5
Dabhra	KundaruJhanjh	101	454	230	224	23	10	13	294	148	146

Block	Name	NoHH	TOTP	TOTM	TOTF	PSC	MSC	FSC	PST	MST	FST
Dabhra	Latesara	360	1138	583	555	163	88	75	330	157	173
Dabhra	Madwa	286	1044	511	533	433	217	216	402	195	207
Dabhra	Mahadeopali	70	259	130	129	4	2	2	144	71	73
Dabhra	Mauhapali	225	768	391	377	193	92	101	0	0	0
Dabhra	Mirauni	208	848	432	416	91	46	45	358	189	169
Dabhra	Nawapara	297	1109	545	564	76	38	38	213	100	113
Dabhra	Palsada	209	711	358	353	17	9	8	380	192	188
Dabhra	Parsapali	159	594	294	300	92	45	47	359	179	180
Dabhra	Pendruwa	549	1954	977	977	107	53	54	674	332	342
Dabhra	Radhapur	243	785	408	377	85	41	44	162	90	72
Dabhra	Sirauli	258	957	492	465	38	21	17	325	173	152
Raigarh District											
Baramkela	Bargaon	305	1175	574	601	178	77	101	222	107	115
Baramkela	Bijepur (Chintamani)	8	20	11	9	0	0	0	0	0	0
Baramkela	Bijepur (Girdhari)	160	621	323	298	15	9	6	25	13	12
Baramkela	Bilaigarh	321	1281	649	632	223	113	110	158	77	81
Baramkela	Chhuwaripali	222	729	355	374	66	31	35	252	119	133
Baramkela	Kudhargadi	93	356	187	169	80	41	39	106	56	50
Baramkela	Lipti	115	432	218	214	9	6	3	81	41	40
Baramkela	Manikpur	122	442	214	228	173	81	92	16	8	8
Baramkela	Naughata	322	1262	632	630	119	58	61	281	152	129
Baramkela	Pihara	379	1284	631	653	617	303	314	50	20	30
Baramkela	Salheona	499	1768	917	851	303	148	155	604	308	296
Baramkela	Vishvaspur	90	372	181	191	78	35	43	218	108	110
Pusaur	Amaldiha	215	683	320	363	48	23	25	162	71	91
Pusaur	Amalibhauna	149	577	290	287	0	0	0	532	265	267
Pusaur	Amalipali	85	282	143	139	154	80	74	0	0	0
Pusaur	Bade Bhandar	316	1198	603	595	116	58	58	329	169	160
Pusaur	Bandimal	139	564	281	283	20	11	9	189	93	96
Pusaur	Baradoli	167	637	311	326	52	27	25	57	29	28
Pusaur	Barpali	210	802	400	402	422	216	206	112	55	57
Pusaur	Basanpali	324	1098	536	562	164	80	84	370	180	190
Pusaur	Bonda (Junadih)	188	810	407	403	16	7	9	628	313	315
Pusaur	Bulaki	115	404	203	201	0	0	0	167	79	88
Pusaur	Bunga	695	2660	1336	1324	245	128	117	453	218	235
Pusaur	Changhori	158	540	279	261	50	25	25	20	11	9
Pusaur	ChhichhorUmaria	652	2392	1230	1162	289	139	150	189	93	96
Pusaur	Chhinch	212	806	403	403	3	1	2	202	99	103
Pusaur	ChhoteBhandar	166	565	304	261	58	29	29	28	14	14
Pusaur	Chikhali	220	933	479	454	320	159	161	101	50	51
Pusaur	Dhangaon	143	547	265	282	53	25	28	205	100	105
Pusaur	Ghughawa	229	797	416	381	62	36	26	86	45	41

Block	Name	NoHH	TOTP	TOTM	TOTF	PSC	MSC	FSC	PST	MST	FST
Pusaur	Gotama	305	1142	573	569	137	67	70	193	101	92
Pusaur	Jampali	188	720	353	367	90	38	52	357	175	182
Pusaur	Jatari	419	1493	728	765	163	83	80	331	160	171
Pusaur	Jewaridih	107	425	208	217	197	93	104	42	19	23
Pusaur	Jiladi	44	209	115	94	0	0	0	193	108	85
Pusaur	Karichhapar	99	391	190	201	70	35	35	169	82	87
Pusaur	Karrajor	159	590	297	293	0	0	0	138	67	71
Pusaur	Kathali	152	609	324	285	61	36	25	24	14	10
Pusaur	Kawrhiha	192	802	391	411	11	7	4	403	186	217
Pusaur	Kensara	402	1628	839	789	69	34	35	398	210	188
Pusaur	Kesapali	103	401	198	203	26	13	13	39	19	20
Pusaur	Khaprapali	110	399	206	193	11	5	6	28	15	13
Pusaur	Koanuwatal	234	964	486	478	52	28	24	252	129	123
Pusaur	Kotasura	447	1701	877	824	272	141	131	347	177	170
Pusaur	Kotmara	340	1133	554	579	41	18	23	411	205	206
Pusaur	Lankapali	140	512	261	251	161	80	81	0	0	0
Pusaur	Linjir	364	1244	627	617	6	3	3	247	129	118
Pusaur	Litaipali	187	714	369	345	6	3	3	184	94	90
Pusaur	Nawapara	225	970	490	480	69	33	36	405	197	208
Pusaur	Nawapara (Bade)	107	408	207	201	55	27	28	2	1	1
Pusaur	Parsapali	133	430	218	212	19	8	11	170	83	87
Pusaur	Pusalda	401	1601	803	798	80	42	38	155	83	72
Pusaur	Putkapuri	322	1320	662	658	93	44	49	161	82	79
Pusaur	Raibar	296	994	495	499	201	105	96	424	207	217
Pusaur	Raipali (Junadiah)	84	272	137	135	23	11	12	0	0	0
Pusaur	Raitarai	141	505	258	247	24	12	12	183	99	84
Pusaur	Ranbhatha	298	1221	612	609	206	109	97	373	186	187
Pusaur	RawanKhondra	135	472	241	231	31	15	16	129	70	59
Pusaur	Ruchida	396	1655	851	804	261	138	123	231	128	103
Pusaur	Sarasmal	103	364	179	185	97	46	51	96	45	51
Pusaur	Sarwani	133	460	227	233	25	9	16	384	195	189
Pusaur	Semara	288	986	500	486	111	50	61	138	76	62
Pusaur	Semibhanwar	98	383	194	189	26	14	12	33	19	14
Pusaur	Shankarpali	105	394	199	195	13	6	7	0	0	0
Pusaur	Siha	334	1325	643	682	52	25	27	113	53	60
Pusaur	Siladi	141	530	253	277	22	9	13	491	238	253
Pusaur	Singpuri	108	378	180	198	88	45	43	116	47	69
Pusaur	Suloni	96	383	199	184	78	36	42	85	47	38
Pusaur	Supa	465	1785	900	885	668	339	329	278	142	136
Pusaur	Surri	344	1298	660	638	303	161	142	138	73	65
Pusaur	Taparada	301	1009	494	515	440	215	225	90	47	43
Pusaur	Tetala	607	2181	1090	1091	132	69	63	542	261	281
Pusaur	Thakurpali	106	394	206	188	78	46	32	0	0	0
Pusaur	Thengagudi	120	484	253	231	11	6	5	173	96	77

Block	Name	NoHH	TOTP	TOTM	TOTF	PSC	MSC	FSC	PST	MST	FST
Pusaur	Tilagi	264	1095	553	542	172	86	86	451	235	216
Pusaur	Tinmini	444	1855	942	913	279	139	140	275	130	145
Pusaur	Torna	82	295	161	134	20	11	9	74	43	31
Pusaur	Tupakdhar	51	203	106	97	13	7	6	10	3	7
Raigarh	Kantahardi	385	1410	692	718	85	44	41	781	374	407
Raigarh	Sahasपुरi	331	1146	588	558	76	37	39	371	189	182
Sarangarh	Timarlaga	805	3142	1603	1539	333	166	167	798	404	394
Total		27456	104237	52514	51723	12395	6187	6208	25949	13017	12932

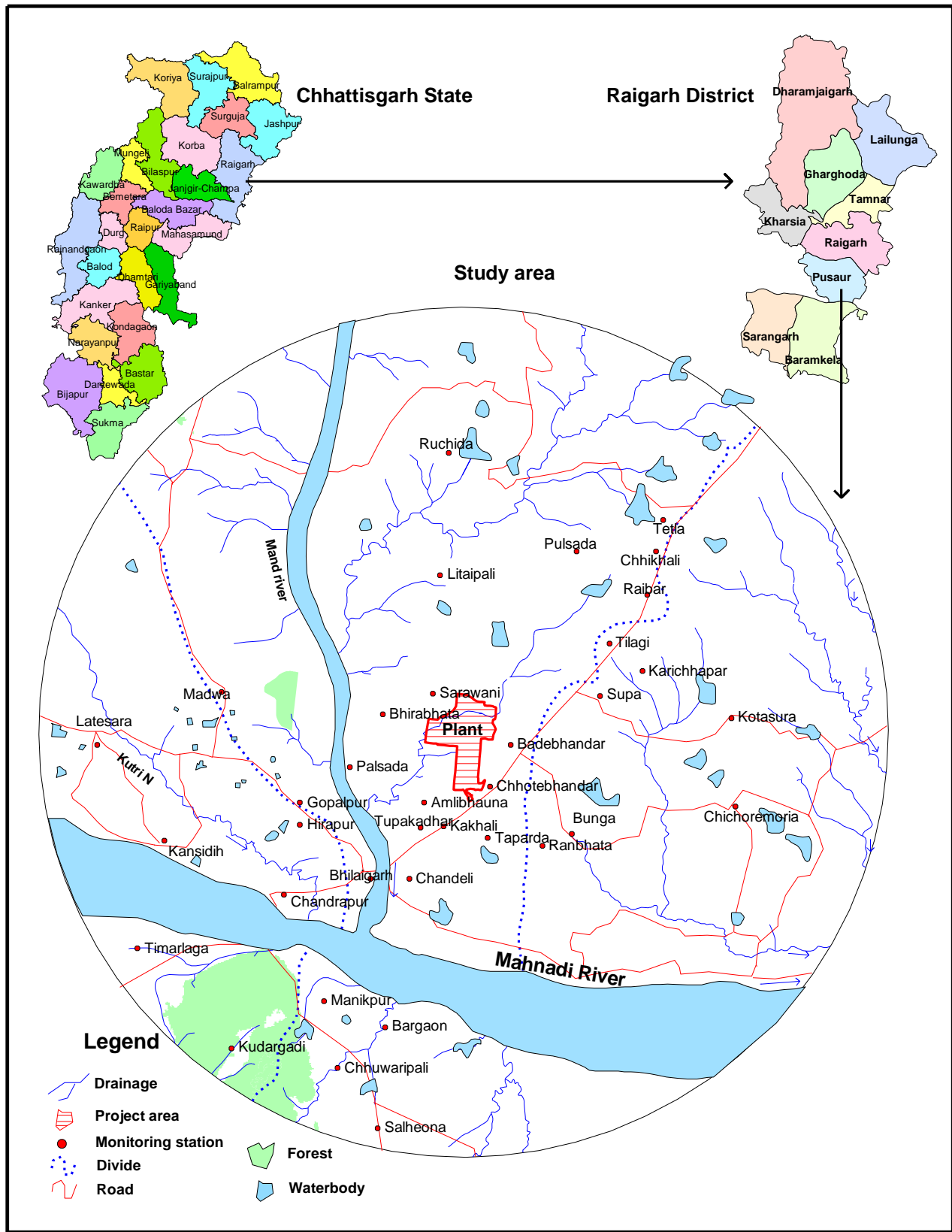


Fig 2.1: Location map the Study area

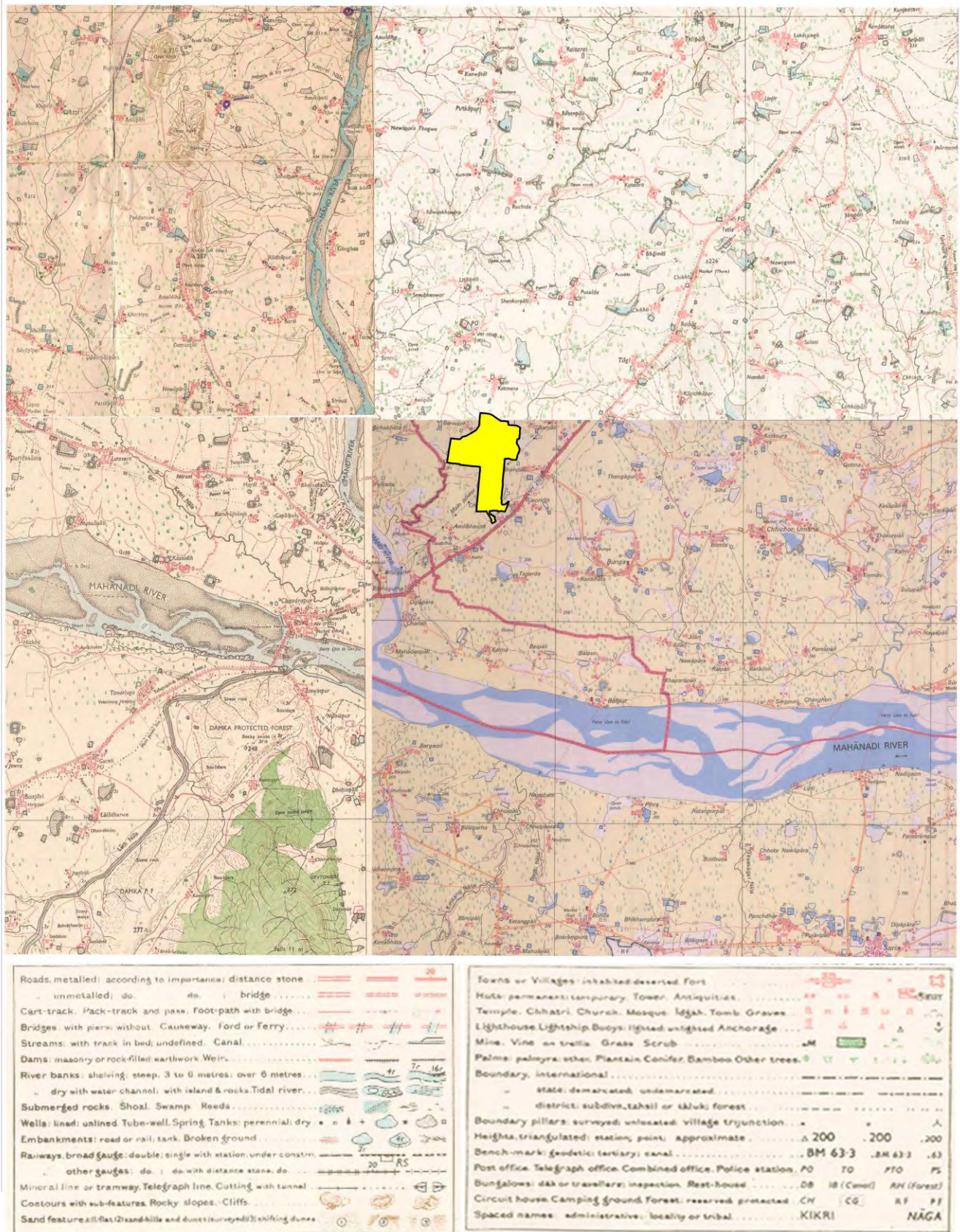


Fig 2.2: Toposheet (1:50000) of the Study area

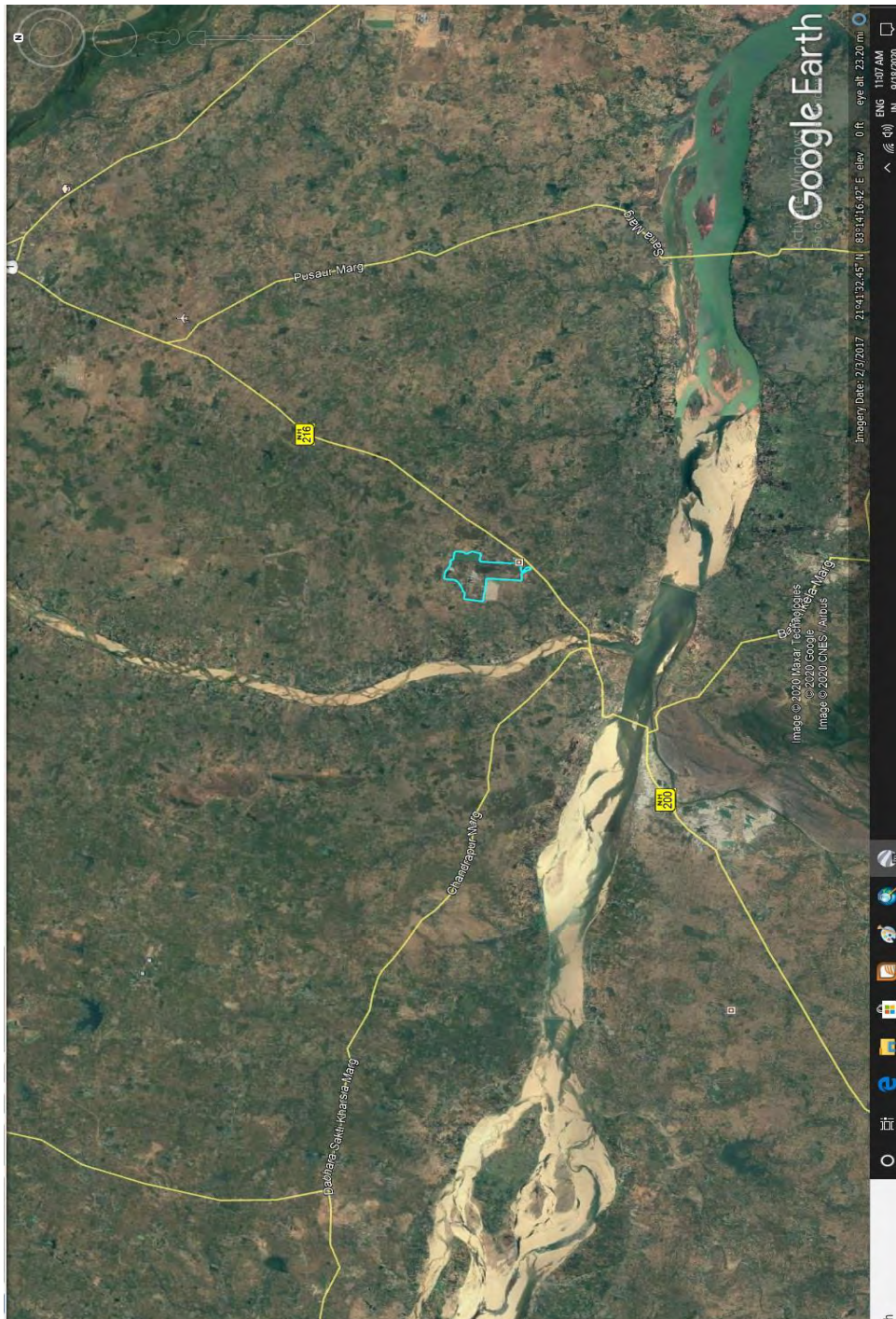


Fig 2.3: Satellite of the Study area

Fig 2.4: Plant Layout

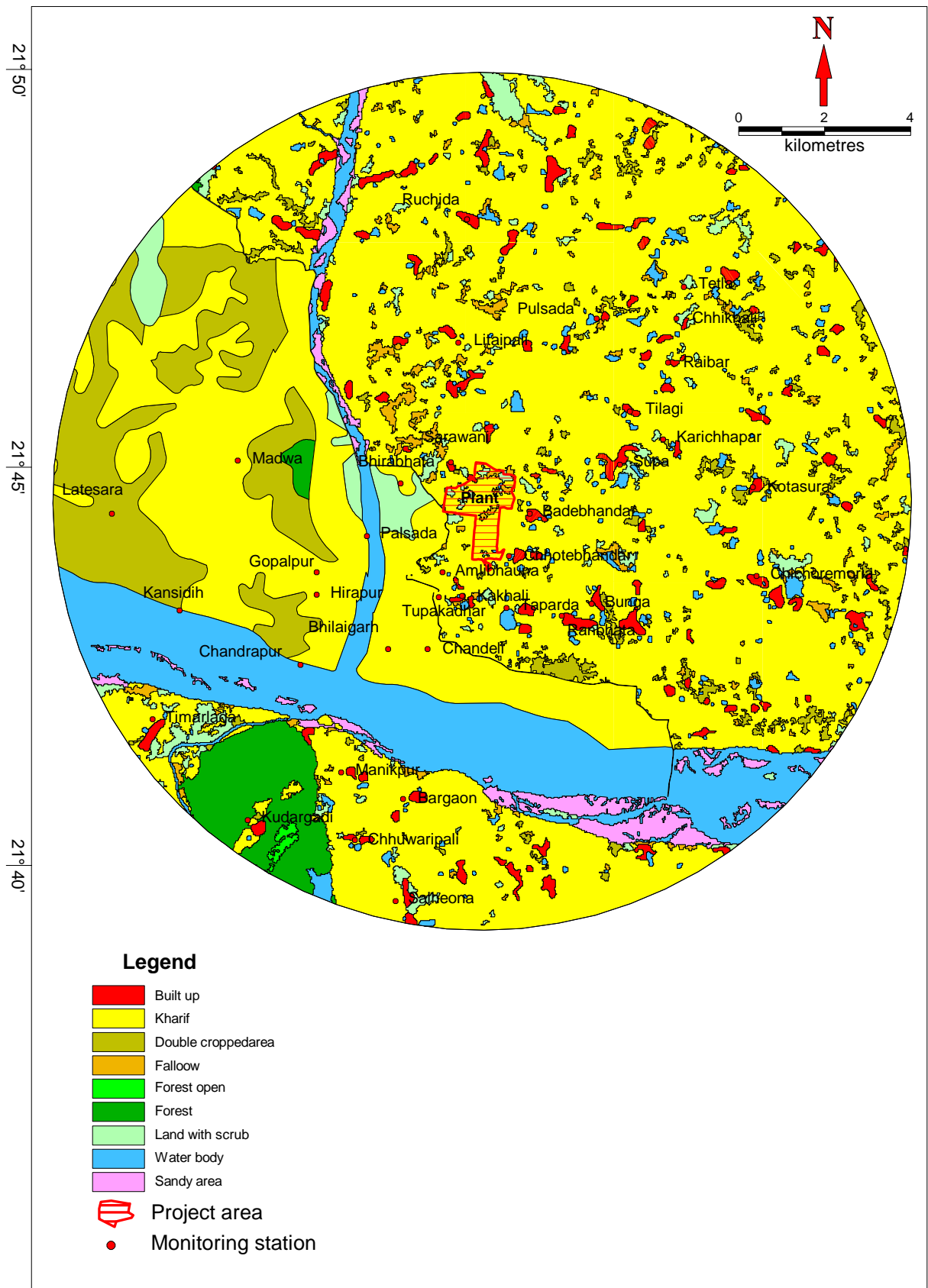
2.4 LAND USE

In the study area, nearly 314 ha,4800 ha is covered by irrigated land, area is covered by non-irrigated area. Culturable waste land area comes around 26600 ha while 45800 ha area is covered by area not available for cultivation. Details of land use pattern of the study area are presented in **Table 2.2** below and **Fig 2.5**.

Table 2.2: Land use Pattern of the Study Area (10 km radius from the Project site)

SN	Crop type	Code	Area in Sq km	Percentage to total area
1	Kharif	2010100	210.26	66.96
2	Double cropped area	2010300	28.92	9.21
3	Fallow	2020000	4.58	1.46
4	Land with scrub	4030000	10.47	3.33
5	Forest open	3020200	0.29	0.09
6	Forest	3020400	8.76	2.79
7	Sandy area	5010200	5.62	1.79
8	Built up	1000000	7.56	2.41
9	Water body	5000000	37.56	11.96
			314.00	100.00

Source: Satellite Imagery



Fig

2.5: Land use map the Study area

2.5 CROPPING PATTERN OF THE STUDY AREA

The study area represents agricultural plain land. Green fields and lot of agricultural activities in the surroundings of villages are noticed. Baseline data collected from Agriculture Department, Raipur and observed that majority of the area around the 10 Km. radius from the project site is distributed with following crops:

Kharif Crops: - Peddy, Cotton, Wheat, Maize, Jowar, Moong, Sunflower, Soyabean, Groundnut.

Rabi Crops: -Gram Wheat, Jow, Taramera, Sarson, Bhindi, Channa, Pea, Tomato, Palak, Raddish,.

Cropping pattern of the area depends upon the climatological conditions and need of the local population of the area. Sometimes cropping pattern may get changed during construction and operational phase because of particular requirement of specified anthropogenic activities.

The study area shows typical agro climatic conditions. In spite of the agriculture being dependent mainly on monsoon and underground water, cultivations the major occupation of this region. The land is monoculture in nature besides the above-mentioned crops, banana, papaya, bar, ginge, methi, tomato, carrots, soya beans etc. are also grown in the area. The growth season of major crops are as shown in table 2.3 given below:-

Table 2.3 Growth seasons of major crops

S.NO.	NAME OF CROP	PLANTATION MONTH	HARVEST SEASON
1.	PEDDY	JUNE-JULY	OCTOBER
2.	WHEAT	JAN.	MAY
3.	JOWAR	JULY	OCT.-NOV.
4.	COTTON	APRIL	JULY-AUGUST

Most of the crops are grown on small farms (located near the village wells) where generally he work is done manually. A very little mechanized (with tractor) cultivation is also seen a times inertia in areas.

2.6 CLIMATE AND SOILS

2.6.1 Climate:

The area enjoys tropical climate with hot summer followed by well-distributed rainfall through South-West monsoon season. The winter commences from December and last till the end of February. The period from March to the end of May is hot season. The monsoon season starts from the middle of June and last till the end of September. The average daily annual normal temperature for the area is 32° C. During the summer Season humidity is lowest i.e. about 32% and is highest during the South-West Monsoon period i.e. about 80%. The rainfall increases generally from the north-west to the south-east. About 94 percent of the annual rainfall is received during the period June to October, July and August being the rainiest months. The variation in annual rainfall from year to year is very large. On an average there are 50- 60 rainy days in a year. There is only one observatory located in Raipur which is about 65 km away from the study area maintained by Indian Meteorology Department. The monthly average of different parameters of weather for the period 1980 to 2018 is presented in **Table-2.4** below.

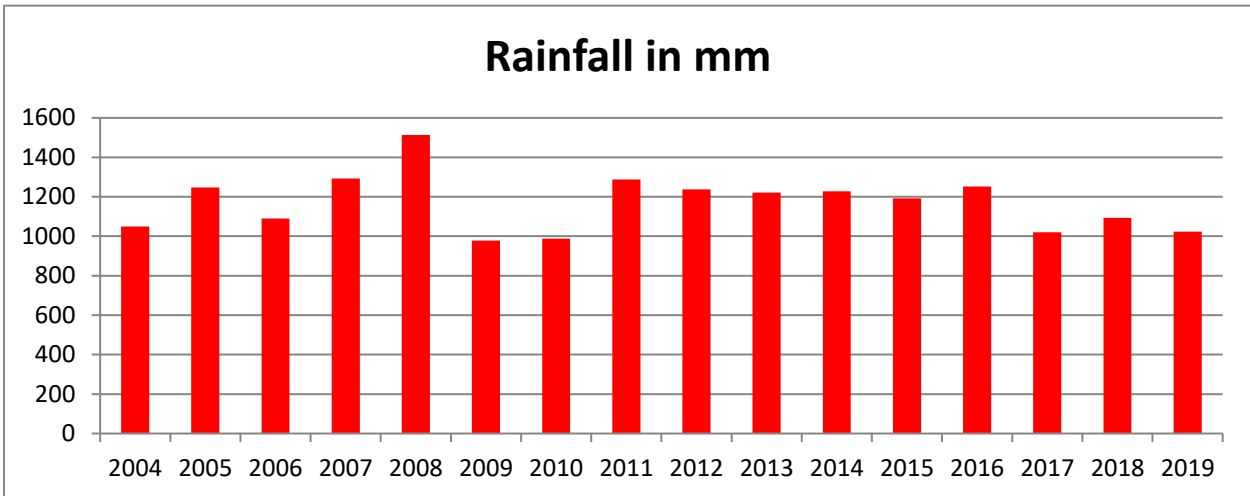
Table-2.4. Climatological data of Observatory station at Raigarh, IMD

Month	Mean Temp.(°C)		Relative Humidity (%)	Wind Velocity (Km/Hr)	Rainfall (mm)	EPT(mm)
	Max	Min				
January	25.5	13	50	5	17.8	102
February	28	16	39	3.8	12.4	132
March	33	20	36	4.1	11.7	175
April	36	24	36	3	11.9	221
May	46	25	37	4.4	28.8	223
June	38	22	58	15	188.5	195
July	31	23	86	16	335.2	124
August	30	23	82	10	308	122
September	27	23.8	75	12	198	125
October	26	23	64	5	35.4	137
November	25	16.1	53	4	9.6	114
December	23	13.1	52	4.1	10.3	105
Avg./Total	31	20	56	7	1169	148

2.6.2 Rainfall

During the Year 2004 to 2019 the maximum rainfall recorded 1513.9 mm in the year 2008 and minimum rainfall 978.2 mm had been recorded in the year 2009. Details are as shown in **Table 2.5**. In this year very low rainfall recorder, although ground water of this area falls under safe zone as well as forest is very dense, but precipitation was comparably too less. The average rainfall for last eleven year is average 1169 mm. Out of the total annual rainfall about 90% of the takes place during the South West Monsoon i.e. among the months June to September. Only 8% of the rainfall takes place during the Winter Season from October to February while only 2% of the rainfall takes place during summer Season.

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
2004	18.8	0	0	0	0	168.5	289.2	474.8	61.9	36.6	0	0	1049.8
2005	37.5	8.2	0	0	0	277.1	427.6	310.4	121.6	64.4	0	0	1246.8
2006	0	0	0	0	91.2	117.5	308.2	430.6	110.2	26.1	5.3	0	1089.1
2007	0	35.2	17.2	0	29.6	233.1	342.3	318.2	239.5	40.1	36.6	0	1291.8
2008	22.4	21.3	27.8	31.5	2.3	256.7	298.1	586.5	261.5	5.8	0	0	1513.9
2009	0	0	0	0	0	15.3	650.4	194.8	92.2	25.5	0	0	978.2
2010	0	0	0	0	0	117.1	319.5	251.4	251.2	21.3	7.3	20.5	988.3
2011	0	2.1	0	5.8	2.3	99.7	269	320.4	589.2	0	0	0	1288.5
2012	47.6	0	0	0	0	200.2	267.1	447.3	239.5	17.2	18.4	0	1237.3
2013	0	0	0	20.3	0	146.2	386.1	371.1	111.3	186.3	0	0	1221.3
2014	0	0	0	0	0	148.2	461	367.5	214.2	36.9	0	0	1227.8
2015	0	0	8.4	0	0	263.2	335.5	390.1	171.5	20.4	0	3	1192.1
2016	4	6.3	4.3	0.7	3.5	99.3	394	406.7	289.1	44.5	0	0	1252.4
2017	0	0	0	0	4.5	203.7	332.9	223.8	208.2	47.2	0.3	0	1020.6
2018	5	0	0	0	0	208.5	289.2	474.8	61.9	38.6	15	0.2	1093.2
2019	6	0	0	0	0	165.5	281.2	471.8	61.9	36.6	0.5	0	1023.5



2.7 SOILS

Three main soil categories are present in the study area namely Vertisols, Alfisols and Ultisols, Soil map of the study area is presented in **Fig 2.6**.

2.7.1 Ultisols

The Indian equivalent of this soil found in study area is Lateritic and red yellow soil. It is exposed in southern eastern part in the area. It is the ultimate product of continuous weathering of minerals in a humid climate. This is a highly weathered and leached acid soil with high levels of clay below top layer. They are characterized by a humus-rich surface horizon and by a layer of clay that has migrated below the surface horizon. This soil has variety of clay minerals but in many cases the dominant mineral is Kaolinite. This clay has good bearing capacity and no shrink-swell property. They are red to yellow in color and are quite acidic having pH less than 5. The red and yellow color results from the accumulation of iron oxide which is highly insoluble in water.

2.7.2 Vertisols

Indian equivalent of this soil is found in the area namely Medium black and deep black soil. They are exposed in major parts of the study area, north east to south western part of the study area. They are characterized by a high content of expanding and shrinking clay known as montmorillonite. They may also be characterized by salinity and well-defined layers of calcium carbonate or gypsum. Vertisols typically form from highly basic rocks such as basalts and are found typically on level or mildly sloping topography in climatic zones that have distinct wet and dry seasons. Depending on the parent material

and the climate, they can range from grey or red to the more familiar deep black. Vertisols contain high level of plant nutrients, but, owing to their high clay content, they are not well suited to cultivation without painstaking management. Vertisols are especially suitable for rice because they are almost impermeable when saturated. Rainfed farming is very difficult because vertisols can be worked only under a very narrow range of moisture conditions as they become very hard when dry and become very sticky when wet.

2.7.3 Alfisol

This is a fertile leached soil found in humid areas that is alkaline or basic and contains a clay-rich layer. They are less extensively leached of metal ions and develop in cooler climates than the Ultisols, a clay-rich soil of warmer regions. These soils formed where annually dropping leaves form a thick humus layer with the time, under which by decomposition processes the characteristic loam layer are formed, which usually refers to a high age of the soil. They are considered as very fertile soils and are accordingly frequently agriculturally used. Alfisols typically exhibit well-developed, contrasting soil horizons (layers) depleted in calcium carbonate but enriched in aluminum- and iron-bearing minerals. Below the surface horizon lies a region with significant accumulation of translocated (migrated) layer silicate clay. This region, called the argillic horizon, is characterized by a relatively high content of available calcium, magnesium, potassium, and sodium ions. Alfisols which are available in the state are red gravelly, red loamy and red sandy soils. These soils cover in southern part of the study area.

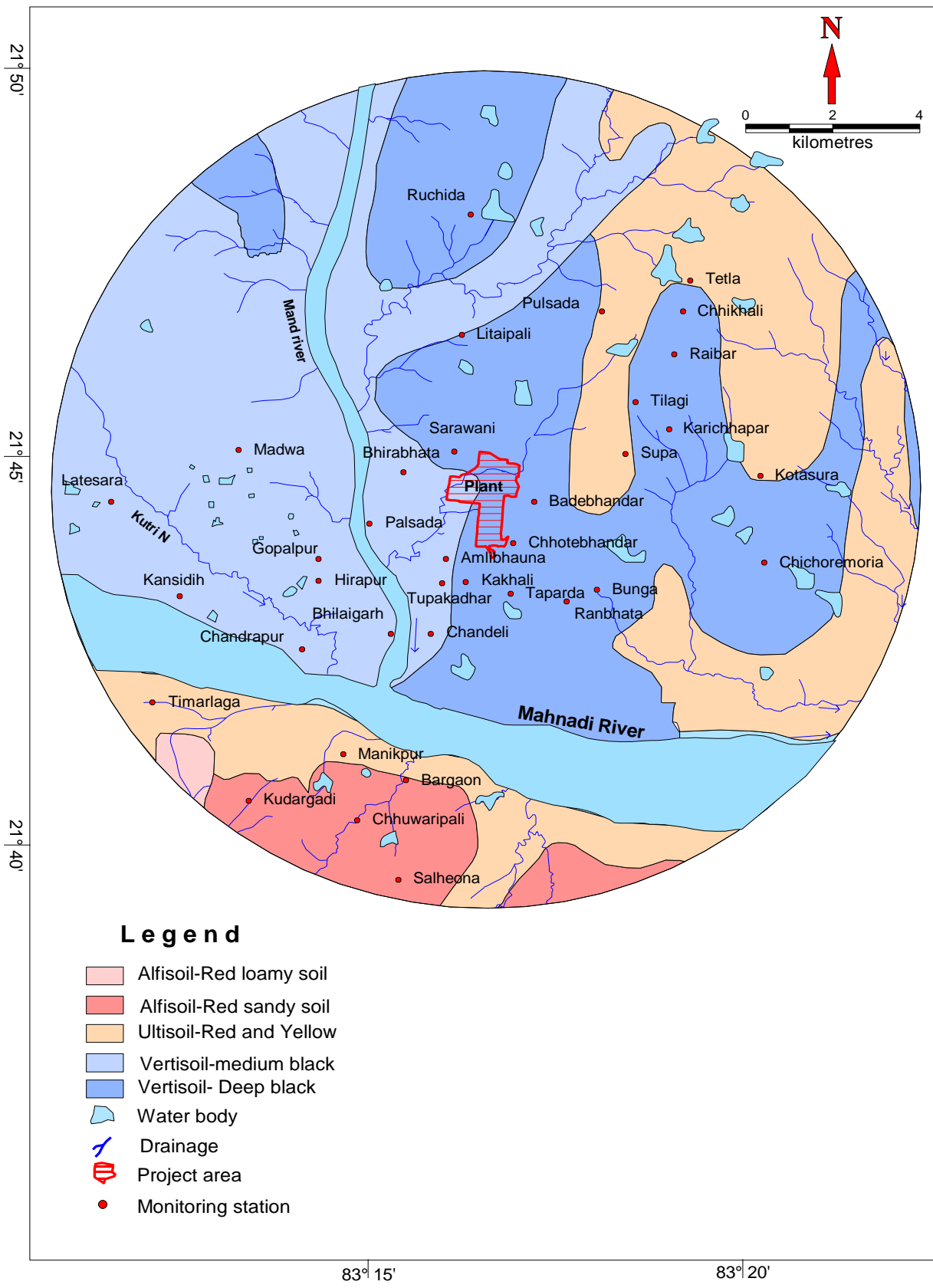


Fig 2.6: Soil map of the Study area

2.8. DRAINAGE AND GEOMORPHOLOGY

There are many factors controlling the occurrence and path flows of groundwater, like physiography, slope, drainage pattern, landforms and land use/land cover. Understanding the role of geomorphology, drainage and land cover is essential to accurately assess hydrogeological systems and groundwater resources.

2.8.1: Drainage

The area is drained mainly by Mand and Kelo River and its tributaries namely Kutri, Pajhar and Koledenga. River flows north to south direction in the Eastern part of the study area is drain by tributaries of Kelo River. Mand and Mahanadi is a perennial river while rest of the tributaries are ephemeral in nature. This tributary system comes under Mahanadi basin. The drainage pattern in the area is sub-parallel and dendritic in nature with high drainage density indicating the formations in the area are moderately porous and permeable in nature and are having high surface run-off. The drainage density is more or less same in the study area. The drainage map of the study area is presented in

Fig 2.7.

The study area is characterized by flat undulating terrain with regional slope in northern part is south towards Mahanadi and in south of Mahanadi the slope is towards north. The average elevation in the southern portion is around 210 m while in the Northeastern and north western parts are 230 m Amsl. The average land slope of the area is works out about 4m per km from top sheets (1:50000 scale), Survey of India.

Drainage network are universal feature of landscape on the earth. Various environmental factors such as climate, relief, lithology, and vegetation play a considerable role in the development of drainage basin. Watershed geomorphology helps in understanding the physical and hydrological behavior of the river regime.

2.8.2 Geomorphology:

The study area is characterized by more or less flat undulating terrain with regional slope to the south and North. It has gradual and very gentle rise and fall, elevation and depressions, repetitive in nature. As a whole the area has southwesterly downward gentle gradient. The highest RL is 287m due northwest and the lowest RL is 199 m, due south part near Mahanadi River. Thus, maximum surface relief is 88m only over an aerial distance of about 18 km. Geo-morphologically the study area represents old flood Plain, Structural plan, Hills and valley and Pedi plain. The Physiography of the area is controlled by

geological formations namely shale and sandstone, at places seen as surface outcrops. In response to lithology of rocks, their chemical composition, their relative deposition, tectonic set up, they were chiseled into various geomorphic and hydrogeomorphic surfaces; in this case flood Plain and Pediplain/pediment. The geomorphological map of the study area is given in **Fig 2.8**.

Flood Plain:

The flood Plain is exposed in south-central & northern part of study area along river courses of mahanadi and mond river. It consists of sand, siltstone and clay etc. This geomorphic unit is developed in patches, in northern and southern parts of the study area, mainly close to river courses. It is characterized by gently undulating and flat terrain. It is developed on Proterozoic rocks namely limestone & shale with extensive fractures and joints, having erosional surfaces is covered with detritus of rock and thin to moderate cover of soil.

Structural plain:

The development of this unit is resultant of polycyclic erosional and depositional processes. It is concealed and covered under thin soil cover. Major part of area is occupied Structural plain in the study area. It is identified at an elevation of 210 to 280 m. am.s.l.

Structural hills and valley: Structural hills are developed in the south-eastern part of the study area comparatively in small patch. This geomorphic unit is formed due to differential erosion and weathering, so that a more resistant formation or intrusion stands as hills and valleys are generally filled with loose boulder, cobbles, pebbles, gravels, sand and silt. The geomorphic features in the study area are shown in **Fig 2.8**.



Fig2.7: Drainage and watershed map of the Study area

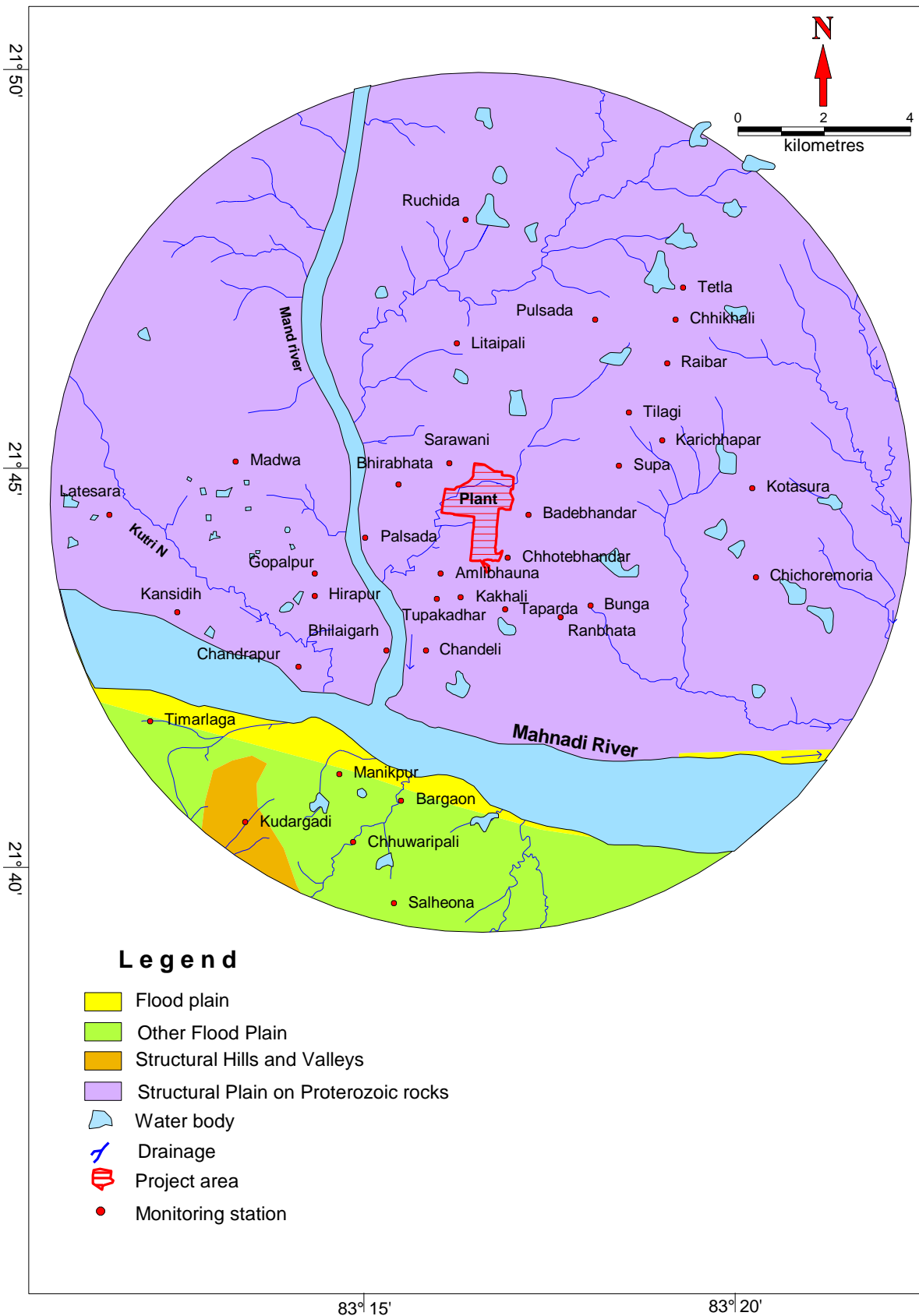


Fig 2.8: Geomorphological map the Study area

3. GEOLOGY

3.1 REGIONAL GEOLOGY:

The rocks of the Chhattisgarh super group represented by limestone and shale. A thin layer of alluvium/ laterite belonging to Quaternary period is found on the top surface. The generalized stratigraphic sequence of formation in and around the area is given in **Table 3.1** below.

Table-3.1 Generalized stratigraphic sequence of Raigarh District

Age	Supergroup	Group	Formation	Lithology
QUATERNARY	Recent to sub-recent		Alluvium and Laterite	Sand, Silt, Clay and lateritic Soil
PROTEROZOIC	Chhattisgarh Supergroup	Raipur Group	Maniyarifm	Gypsiferous Shale
			Hirrifm	Dolomitic limestone
			Tarengafm	Shale & Dolomite
			Chandifm	Limestone & Shale
			Gunderdehifm	Shale
			Raigarh	Shale, Limest., Arenite & Conglomerate
			Charmuriafm	Limestone & Shale
		Chandrapur Group	Kanspatharfm	Sandstone, Siltstone & Conglomerate
			Choparadihfm	
			Lohardifm	
				Bilari group Sonakhan gr Baya group
ARCHAEAN	Basement crystallines- Granite, gneisses, granulite and Amphibolite			

3.1.1 Basement Crystalline:

The basement crystallines belongs to Archaean age mainly consists of Granite, gneisses, granulite, phyllites and amphibolites. At places it is intruded by quartz veins. The overlying sedimentaries belongs to Chhattisgarh Super group of rocks. The contact between the Achaeans and the sedimentaries is faulted along the western margin of the basin.

3.1.2 Chhattisgarh Super group:

The crescent shaped Chhattisgarh basin within the Central Indian Craton can be subdivided into a small Baradwarproto-basin in the east and main Hirriproto -basin in the west. The entire succession of Chhattisgarh super group is divided into three groups. Lowermost Pairi group consists of sandstone, conglomerate, limestone and shale overlies unconformably on crystalline group and developed in the Baradwarproto-basin. The middle Chandrapur group un- conformably overlying the Singhora group or older basement and consists of arenite formations and third is Raipur group at the top, comprising argillite-carbonate suite of rock.

3.1.2.1 Chandrapur group:

The sequence of Chandrapur group shows a variable thickness ranging from 20 m to as much as 90 m. The maximum thickness is attained in SE part of the basin, thinning westward as well as NE side and directly overlying the crystalline basement.

3.1.2.2 Raipur group:

The Raipur group comprising of predominantly argillite sequence conformably overlies the Chandrapur group with a gradational contact. The group has been subdivided into six sub-division representing three cycles of carbonate-argillite sediments as follows

Charmuria formation- dominantly carbonate sequence and is conformably overlain by Gunderdehi formation.

Gunderdehi formation- dominantly a calcareous argillite purple coloured shale with intercalated limestone is dominant member.

Chandi formation- comprise a major stromatolytic limestone sequence developed around southern side of Hirri sub-basin as arcuate outcrop pattern and is medium to course grained dolomitic limestone.

Tarenga formation- conformably overlies the Chandi formation and comprise cherty shale, calcareous shale and argillaceous dolomite, green and white clay.

Hirri formation- conformably overlies the Tarenga formation in south and Pandaria formation(coalesce of Charmuria, Gunderdehi, Chandi and tarenga formation) in the north. At places intra-formational conglomerate, dolomite and black shale contained gypsum as layer parallel to bedding.

Maniyari formation- named after the river along which the rock is best developed. It represents the closing phase of deposition in Chhattisgarh basin and consists of lower gypsiferous grey siltstone and shale followed by reddish brown calcareous and non-calcareous shale with limestone and dolomite.

3.1.3 Recent to sub-recent:

3.1.3.1 Laterite:

In situ and rolled laterite occurs at many places in isolated patches. These are blanket deposits and few centimeters to few meters in thickness. The ferruginous rock formations of Chhattisgarh Supergroup are responsible for the formation of thin capping of laterite due to leaching and concentration of iron oxide from sandstone of Chandrapur group and also of shale of Raipur group.

3.1.3.2 Alluvium:

The alluvium consists of sand, silt and clay. The sands are fine to coarse grained and poorly sorted. The alluvial soils are mostly of residual in nature and are the weathered products of shale and limestone. The thickness of soil varies from few centimeters to over 10m in places.

3.2 LOCAL GEOLOGY:

The area is underlain by thin layer alluvial/laterite belonging to Quaternary period. Thick pile of rocks belonging to Raipur group of Younger Proterozoic period consisting of shale, underlie the alluvial sediments (**Fig 3.1**). The formation have general strike in NE-SW direction with very low dips of 2° to 3° due NW. Two sets of vertical joints trending in N50°E- S50°W and NE-SW direction are prominent in the area. The gap between joint plain is large from few centimeters to 5meters and are mostly interconnected. The lithological characters of various formations present in the study area are described as follows:

3.2.1 Chandrapur Group

In Baradwar sub-basin, the Chandrapur Formation does not show any major change from its western counterpart. Its composition, structure and lithologies are more or less same in both the sub-basins. However, the significant differences observed in-group as well as in formation level.

The Chandarpur Group attains a maximum thickness of about 200 m. along the southeastern margin and is unconformably overlying the Singhora Group. The unconformity is evidenced by the presence of conglomerate/ gritty arenite at basal part of Chandarpur, which overlaps the formations of Singhora Group as well as basement on either side of basin axis.

The Chandarpur Group developed in and around the area has been classified into three major formations viz. the lower arenite followed by middle argillite and the top arenite which are correlated with the Loharadih, Chaporadih and Kansapathar of Hirri sub-basin.

Lohardih Formation: The formation attains a maximum thickness of about 20 m. and comprises of clast as well as matix-supported conglomerate, arkose, sub-arkose, chert and fine-grained ferruginous arenite.

Chaporadih Formation: This formation is best developed in Singhora area where it attains a thickness of about 100 m. It comprises black, pink and light grey shale intercalated with arenite bands. Black shale is generally laminated with alternate fine silt-rich lamellae and is characterised by current ripple. Black shale varies laterally on either side to pink and light grey shale. The intercalated arenite is fine grained containing asymmetric ripple marks.

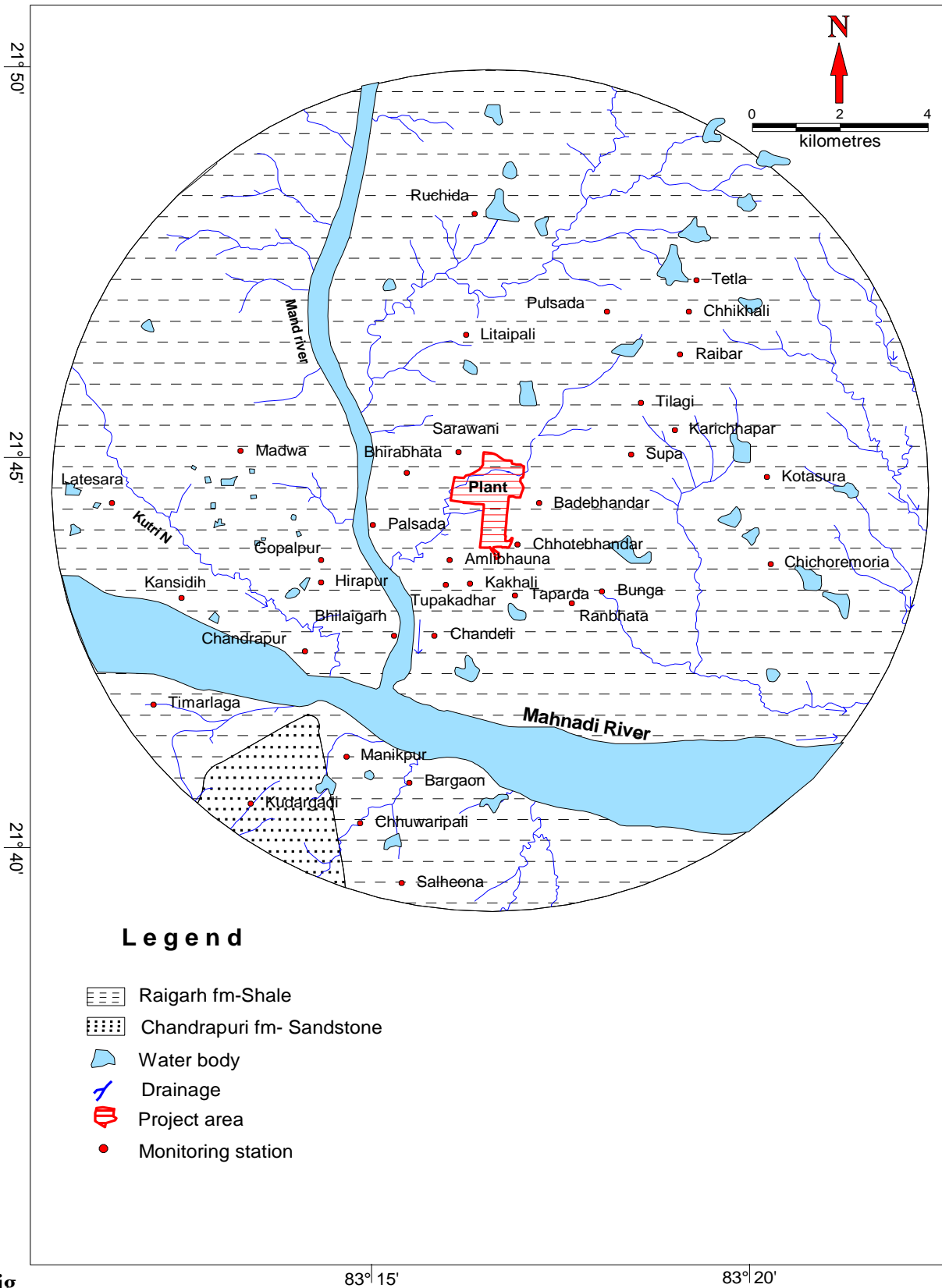
Kansapathar Formation: The formation attains a maximum thickness of about 50 m. at Singhora area and gradually thins out laterally as well as basinward to 20 m. The rock is mainly arenite showing similar character as discussed earlier.

3.2.2 Raigarh Formation: The formation is widely developed in Baradwar sub-basin, comprising dominantly friable calcareous purple shale with limestone intercalations. The formation can be classified into a lower shale flaggy carbonate-arenite member which is followed upward by a purple calcareous shale member. Unlike Hirri sub-basin, the bedded flaggy limestone gradually changes in its outcrop width and further east it pinches out occurring as pockets and lenses in the purple shale above the Chandarpur arenite. At places, arenite lenses and bands are also present in the member. The upper member is mainly purple calcareous shale with limestone as well as arenite lenses. Mud cracks and ripple marks are the common structures. One of the mappable arenite members is Dhurkotarenite occurring within the shale and comprises conglomerates and sandstone. Conglomerate consists of clasts of quartz, shale, jasper and chert embedded in siliceous matrix. This grades to a sandstone which is coarse to medium grained containing argillaceous and calcareous matrix. The dark grey dolomite in subsurface grades to light grey to cement limestone. A thin friable green sandstone unit occurs in SariaBorda area of Baramkela block. They also described presence of dolostone around Raigarh town. Some

Stromatolitic limestones within this formation in Raigarh district indicate extension of Bamandih Formation upto Raigarh district (Mukherjee, 2005).

3.2.3 Soil/Laterite:

Along Mahanadi course and in south of Mahanadi is underlain by alluvial residual soil covers which are loam and sandy loam. Laterites occur as capping associated with shale. The thickness of overburden varies from 2 to 6 m. In order to understand the geological sequence fully well in the project site geological map of study area, **Fig 3.1**.



Fig

3.1: Geological map of the Study area

4. HYDROGEOLOGY

4.1 INTRODUCTION

Ground water occurrence is highly influenced by underlying geological formations and their hydrogeological characteristic. Weathered and fractured zones present in the rocks or formation provides scope of ground water occurrence, storage and its movement. Hydrogeology of the area broadly describes the disposition of aquifers, occurrence of ground water its movement, yield potential of water bearing formations, groundwater regime conditions in space and time etc. Detailed hydro-geological investigation has been carried out in and around the project area for elucidating the hydrogeology and establishing the interrelationships between various hydraulic parameters.

4.2 GROUND WATER OCCURRENCE AND AQUIFER SYSTEMS

In the study area, ground water occurs under phreatic or unconfined condition in weathered portion of rocks and semi-confined to confined conditions in fractures/cavernous part of rocks i.e. limestone and shale at depths. The shallow aquifers occur within an average depth of 20m. The configuration of water table in the shallow aquifer follows the topography due to which the ground water movement is generally towards valleys or topographic low. The water bodies such as tanks, canals and streams also influence the occurrence and movement of ground water in shallow aquifers. The shallow aquifers of the area are mostly developed by way of dug wells in the area with depth ranges from 7 to 16 m. In general the yield of dug wells ranges from 25 to 40m³/day. Deeper aquifer in the area mainly formed of Raipur group of rocks constituted of Raigarh formation comprising shale and limestone. The deeper aquifers of the area are mostly developed by way of bore wells with depth range from 50 to 80 m. In general, the yield of bore wells ranges from 1 to 5 lps.

4.3 WATER TABLE CONFIGURATION AND FLOW DIRECTION

The flow direction is of two directions i.e. in north of Mahanadi, central and northern part of the study area it is towards south and in southern part of the study area it is in north direction indicating the Mahanadi River is flowing southern portion of the study area near to project area.

A local variation in flow direction is also observed which indicates the flow towards the Mond and Mahanadi river in all directions. The Mond and its tributaries flowing in north to south and Mahanadi

River flowing in southern part west to east of the study area are effluent in nature. The water table elevation in the study area ranges between 200 to 220mamsl indicating more or less the plain terrain. The southern part of the area is having low altitude of water table elevation i.e. 200mamsl while water table elevation increases to central & is maximum i.e. 220mamsl. The gradient of water table is variable. In the area the yield ranges between 1 to 5 lps in central & eastern indicating the area is covered by fractured shale while in major part of the area it is 1 to 3 lps which is covered with shale & sandstone. Hydrogeological map is given at **Fig.4.1 and 4.2.**

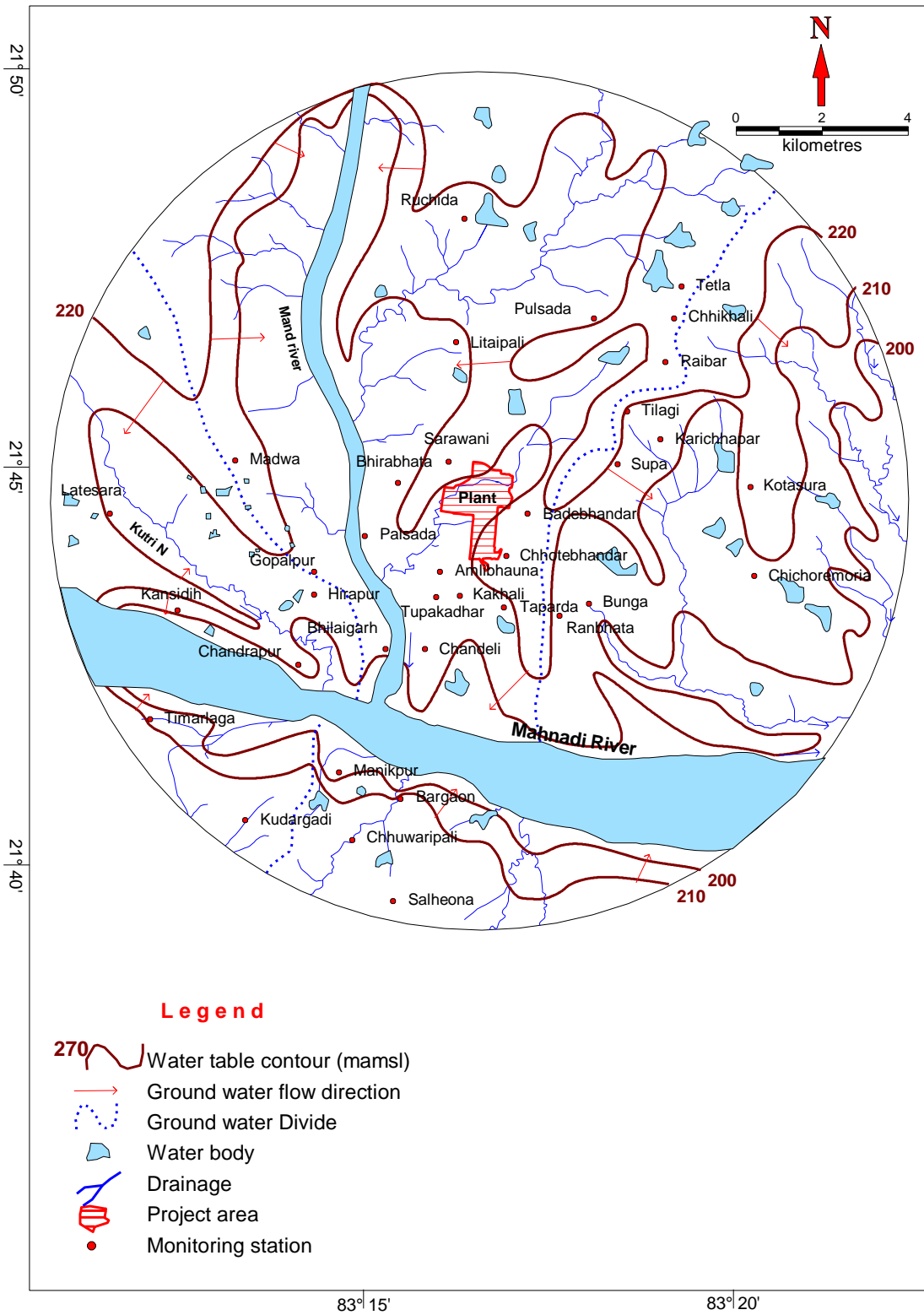


Fig 4.1 Water table contour and ground water flow direction

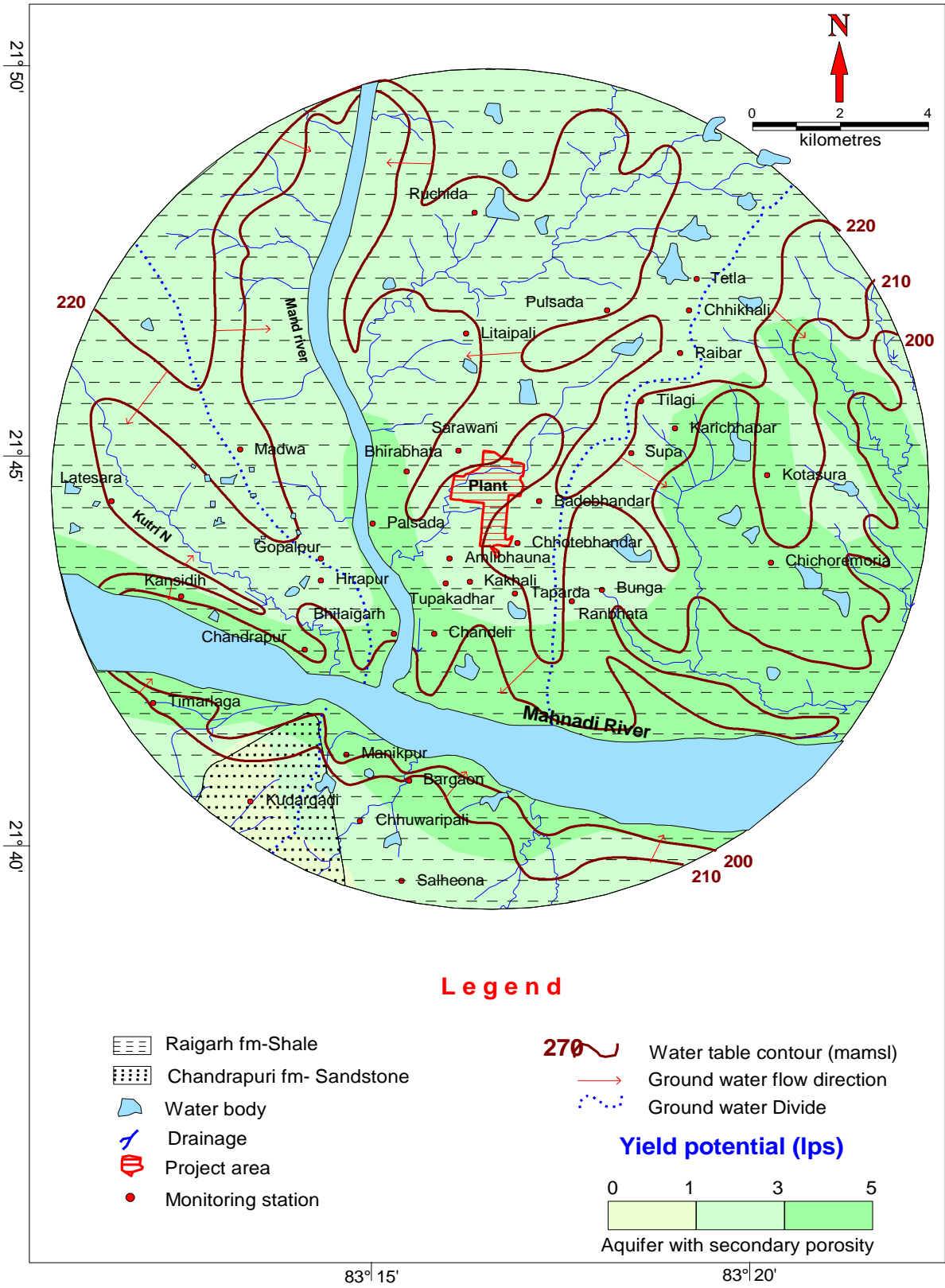


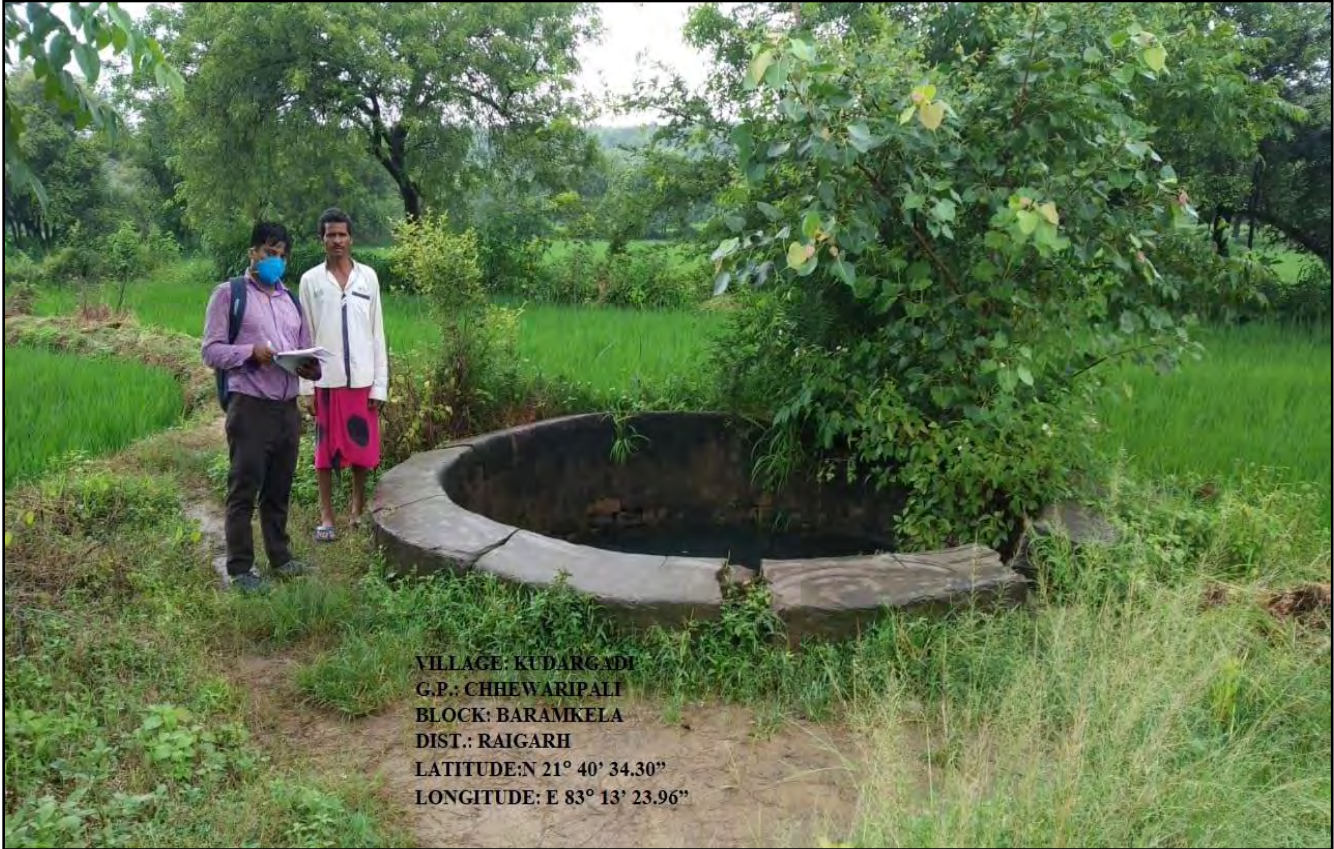
Fig 4.2: Hydrogeological map of the study area

4.4 GROUND WATER REGIME MONITORING

The monitoring of ground water regime is of immense help in management of the water resources as well as protecting the ground water storage. Such study envisages regular monitoring of water level at selected locations to observe the changes in ground water level and variation in ground water quality with respect to time and space. It is pertinent to say that any development of ground water resources in a particular area would bring changes in ground water regime if input to the ground water system is not balanced with output from the same system.

The study aims to observe the changes in ground water levels and quality with respect to the ground water development, which in turn would help in identifying the appropriate measures to be adopted for artificial recharge to ground water and neutralize the impact of the excessive ground water development. In the present report, the monitored data has been presented and the overall picture of ground water regime behaviour due to continuous abstraction of ground water has been analyzed for the year 2019-2020. Ground water regime monitoring was carried out four times in a year i.e. January May, August and November. The water level data of the month of May and November are taken as levels of pre-monsoon and post-monsoon respectively, Data presented and analyzed for pre and post monsoon water level data. The photographs of the some monitoring stations are indicated in **plate: I**, which was taken during the collection of water level of ground water in all four seasons.





VILLAGE: KUDARGADI
G.P.: CHHEWARIPALI
BLOCK: BARAMKELA
DIST.: RAIGARH
LATITUDE: N 21° 40' 34.30"
LONGITUDE: E 83° 13' 23.96"



VILLAGE: KANSIDIH
G.P.: KANSIDIH
BLOCK: DABHARA
DIST.: JANJIRI CHAMPA
LATITUDE: N 21° 43' 11.55"
LONGITUDE: E 83° 12' 29.25"



Village-HIRAPUR
G.P.-GOZALPUR
BLOCK-DABHARA
DIST.-JANJIR CHAMPA
LATITUDE N-21° 43' 24.18"
LONGITUDE E-83° 14' 20.54"



Village-Bunga
G.P.- Bunga
Block - Pusour
District - Raigarh
Latitude N - 21° 43' 31"
Longitude E - 83° 18' 03.04"



Village -Chhikholi
G.P. - Chhikholi
Block - Pusour
District - Raigarh
Latitude N - 21° 46' 47.61"
Longitude E - 83° 19' 08.73"



Village-Chichoremona
G.P. - Chichoremona
Block - Pusour
District - Raigarh
Latitude N - 21° 43' 34"
Longitude E - 83° 20' 13.18"



Village - Kotsara
 G.P. - Kotsara
 Block - Pusour
 District - Raigarh
 Latitude N - 21° 46' 33.94"
 Longitude E - 83° 16' 15.82"



Village - Litaipali
 G.P. - Litaipali
 Block - Pusour
 District - Raigarh
 Latitude N - 21° 46' 33.94"
 Longitude E - 83° 16' 15.82"



Village - Raibar
 G.P. - Raibar
 Block - Pusour
 District - Raigarh
 Latitude N - 21° 46' 18.74"
 Longitude E - 83° 19' 04.87"



Village - Ruchida
 G.P. - Ruchida
 Block - Pusour
 District - Raigarh
 Latitude N - 21° 48' 06.47"
 Longitude E - 83° 16' 21.99"

4.4.1 Distribution of monitoring stations

To study the change in ground water regime in and around study area, total of 36 monitoring wells were established at different locations for regular monitoring of ground water level. The basic details of these monitoring wells are presented in **Table 4.1** and their distribution is presented in **Fig 4.1**.

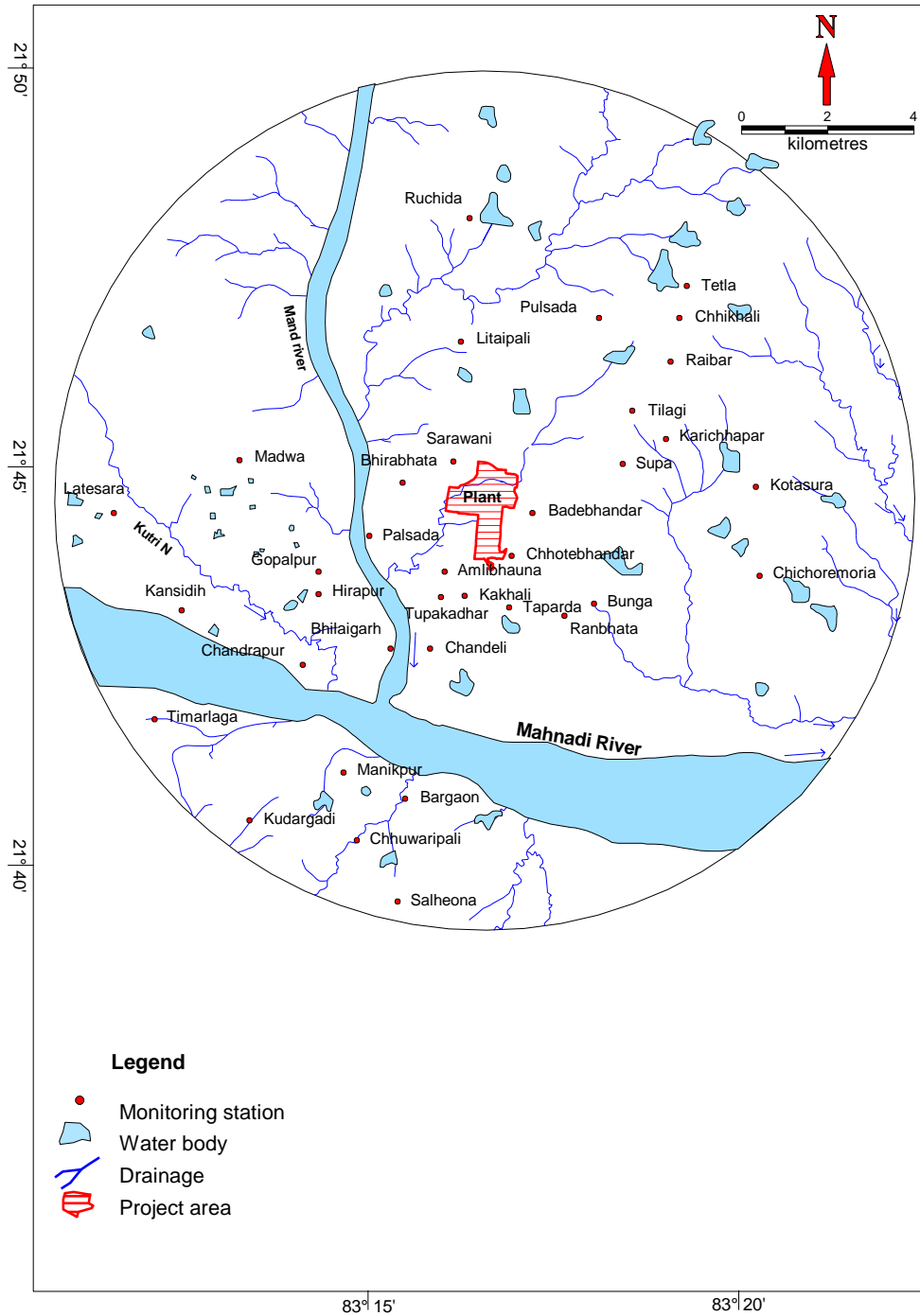


Fig 4.1: Location of monitoring wells of the Study area

Table 4.1 : Basic details of established monitoring wells

Sl no.	Village	G.p.	Block	District	Dia (m)	Elevation (mamsl)
1	Salheona	Salheona	Baramkela	Raigarh	3.5	218
2	Chhuwaripali	Chhuwaripali	Baramkela	Raigarh	0.152	219
3	Bargaon	Bargaon	Baramkela	Raigarh	0.152	219
4	Manikpur	Manikpur	Baramkela	Raigarh	0.152	211
5	Kudargadi	Chhuwaripali	Baramkela	Raigarh	3.5	215
6	Hirapur	Gopalpur	Dabhra	Janjgir-champa	2	212
7	Gopalpur	Gopalpur	Dabhra	Janjgir-champa	3.8	210
8	Madwa	Madwa	Dabhra	Janjgir-champa	0.152	224
9	Latesara	Latesara	Dabhra	Janjgir-champa	5.0	210
10	Kansidih	Kansidih	Dabhra	Janjgir-champa	3.1	211
11	Chandeli	Chandeli	Dabhra	Janjgir-champa	1.2	208
12	Bhilaigarh	Bilaigarh	Dabhra	Janjgir-champa	3.1	213
13	Palsada	Palsada	Dabhra	Janjgir-champa	0.152	213
14	Bhirabhata	Palsada	Dabhra	Janjgir-champa	0.152	198
15	Sarawani	Barpali	Dabhra	Janjgir-champa	0.152	221
16	Timarlaga	Timarlaga	Saranggarh	Raigarh	0.152	213
17	Tupakadhar	Taparda	Pussore	Raigarh	0.152	211
18	Amlibhauna	Chhote bhandar	Pussore	Raigarh	0.152	210
19	Kakhali	Taparda	Pussore	Raigarh	2.4	214
20	Taparda	Taparda	Pussore	Raigarh	0.152	209
21	Ranbhata	Ranbhata	Pussore	Raigarh	0.152	213
22	Bunga	Bunga	Pussore	Raigarh	0.152	208
23	Chichoremoria	Chichoremoria	Pussore	Raigarh	0.152	216
24	Badebhandar	Badebhandar	Pussore	Raigarh	0.152	221
25	Tetla	Tetala	Pussore	Raigarh	0.152	234
26	Pulsada	Pulsada	Pussore	Raigarh	4	225
27	Ruchida	Ruchida	Pussore	Raigarh	3.2	216
28	Litaipali	Litaipali	Pussore	Raigarh	0.152	210
29	Chhikhali	Chhikhali	Pussore	Raigarh	2.4	232
30	Raibar	Raibar	Pussore	Raigarh	4.4	237
31	Tilagi	Tilagi	Pussore	Raigarh	0.152	226

32	Karichhapar	Siha	Pussore	Raigarh	0.152	221
33	Kotasura	Kotasura	Pussore	Raigarh	0.152	224
34	Supa	Supa	Pussore	Raigarh	0.152	225
35	Chhotebhandar	Chhotebhandar	Pussore	Raigarh	0.152	226
36	Chandrapur	Chandrapur	Dabhra	Janjgir- champa	2.1	218

5. ANALYSIS OF WATER LEVELS

5.1 INTRODUCTION

Ground water levels or piezometric heads is resultant of all input and output to ground water system with defined boundaries. Ground water is a dynamic system. The parameters required to be monitored during ground water regime monitoring are ground water level or piezometric heads and chemical quality. These are subject to change due to natural and or anthropogenic causes with respect to time and space. Rainfall, natural recharge to ground water, ground water draft and seepage from surface water bodies plays important roles in changes in ground water level fluctuations. The quality of water is being recharge, nature of host rock and dilution/concentration of ground water impacts the changes in ground water quality. Monitoring of ground water quality and temperature are one of the essential components for ground water regime monitoring. The monitored data is analyzed in time and space to assess the changes and a relationship is established to determine the impact of ground water development and recharge to the system.

5.2 GROUND WATER LEVELS:

The configuration of the water table depends upon by topography, geology, climate, water yielding and water bearing properties of rocks in the zones of aeration and saturation, which control ground water recharge. The upper surface of the zone of saturation is the water table. In case of wells penetrating confined aquifers, the water level represents the pressure or piezometric head at that point. Ground water monitoring network planning is basic step for ground water regime monitoring and further, for assessment of groundwater resources and planning for development and management programs. The groundwater, being hidden resource can only be analyzed through its signatures in the form of water level fluctuations. The systematic and regular monitoring of groundwater levels can bring out the changes taking place in the regime. The data so generated are of immense help for regional groundwater flow modeling for planning and management of ground water resources and its sustainability. Modeling provides necessary information to the user agencies to frame contingency plans in case of unfavorable groundwater recharge situation.

The data have also immense utility in implementing the legal provisions of groundwater regulation, and to substantiate expert advice in legal issues arising out of conflicting interests of ground water users. Ground water regime data of different seasons have been collected for the year 2019, analyzed for every set of measurements and discussed with maps in following sections.

5.2.1 Analysis of water levels (2019-2020)

The water level data collected four times during the year 2019 from the observation wells in core zone as well as buffer zone is presented in **Table 5.1**.

Table 5.1: Depth to water levels monitored in the study area (during 2019 -2020)

Sl No.	Village	District	Latitude	Longitude	Nov 19 (mbgl)	May 20 (mbgl)	Fluctuation (m)	RL of water level May 20 (mamsl)
1	Salheona	Raigarh	21°39'33"	83°15'24"	1.5	6.1	4.6	211.9
2	Chhuwaripali	Raigarh	21°40'19"	83°14'51"	2.43	4.87	2.44	214.13
3	Bargaon	Raigarh	21°40'50"	83°15'30"	4	6.21	2.21	212.79
4	Manikpur	Raigarh	21°41'10"	83°14'40"	6.09	10.67	4.58	200.33
5	Kudargadi	Raigarh	21°40'34"	83°13'24"	1.7	5.32	3.62	209.68
6	Hirapur	Janjgir-Champa	21°43'24"	83°14'20"	1.8	5.18	3.38	206.82
7	Gopalpur	Janjgir-Champa	21°43'41"	83°14'20"	1.4	6.1	4.7	203.9
8	Madwa	Janjgir-Champa	21°45'05"	83°13'16"	3.5	7.43	3.93	216.57
9	Latesara	Janjgir-Champa	21°44'25"	83°11'34"	1.2	4.5	3.3	205.5
10	Kansidih	Janjgir-Champa	21°43'12"	83°12'29"	2.3	6.84	4.54	204.16
11	Chandeli	Janjgir-Champa	21°42'43"	83°15'50."	2	7.62	5.62	200.38
12	Bhilaigarh	Janjgir-Champa	21°42'43"	83°15'18."	1.8	4.32	2.52	208.68
13	Palsada	Janjgir-Champa	21°44'08"	83°15'01."	1.9	4.32	2.42	208.68
14	Bhirabhata	Janjgir-Champa	21°44'48"	83°15'28."	3.1	7.3	4.2	190.7
15	Sarawani	Janjgir-Champa	21°45'04"	83°16'09"	2.43	7.61	5.18	213.39
16	Timarlaga	Raigarh	21°41'50"	83°12'07"	1.5	4.3	2.8	208.7
17	Tupakadhar	Raigarh	21°43'22"	83°15'59"	2.2	6.3	4.1	204.7
18	Amlibhauna	Raigarh	21°43'41"	83°16'02"	1.8	5.31	3.51	204.69
19	Kakhali	Raigarh	21°43'23"	83°16'18"	2.1	7.5	5.4	206.5
20	Taparda	Raigarh	21°43'14"	83°16'54"	1.8	6.62	4.82	202.38
21	Ranbhata	Raigarh	21°43'08"	83°17'39"	4.7	7.6	2.9	205.4
22	Bunga	Raigarh	21°43'17"	83°18'03"	1.5	7.1	5.6	200.9
23	Chichoremoria	Raigarh	21°43'38"	83°20'17"	4.7	8.19	3.49	207.81
24	Badebhandar	Raigarh	21°44'25"	83°17'13"	1.05	8.3	7.25	212.7

25	Tetla	Raigarh	21°47'16"	83°19'18"	11.1	15.5	4.4	218.5
26	Pulsada	Raigarh	21°46'52"	83°18'07"	2.1	8.32	6.22	216.68
27	Ruchida	Raigarh	21°48'07"	83°16'22"	1.5	6	4.5	210
28	Litaipali	Raigarh	21°46'34"	83°16'15"	5.5	9.31	3.81	200.69
29	Chhikhali	Raigarh	21°46'52"	83°19'12"	2.1	7.3	5.2	224.7
30	Raibar	Raigarh	21°46'19"	83°19'05"	1.76	3.1	1.34	233.9
31	Tilagi	Raigarh	21°45'42"	83°18'34"	4.6	11.2	6.6	214.8
32	Karichhapar	Raigarh	21°45'21"	83°19'01"	2.1	7.12	5.02	213.88
33	Kotasura	Raigarh	21°44'45"	83°20'14"	6.1	11.68	5.58	212.32
34	Supa	Raigarh	21°45'02"	83°18'26"	2.7	6.14	3.44	218.86
35	Chhotebhandar	Raigarh	21°43'53"	83°16'56"	1.9	6.7	4.8	219.3
36	Chandrapur	Janjgir-Champa	21°42'31"	83°14'07"	2.5	7.31	4.81	210.69

5.2.1.1 Post-monsoon Depth to Water level (November' 2019)

The depth to water level map has been prepared based on ground water monitoring data of Nov 2019. On perusal of the data and map given at Fig.5.1, it is observed that the overall depth to water level remains between 1.05 and 11.1 meters below ground level. The post-monsoon depths to water level range of 3 to 5 mbgl are observed at Birabhata, Madwa, Bargaon ,Tilagi, Ranbhata and Chichore moria villages. Ground water levels more than 5 mbgl are observed in the villages litaipali, manikpur Kotasura and Tetla Water level less than 3 mbgl are observed in the 72 % of the villages and along river courses

5.2.1.1 Pre-monsoon Depth to Water level (May' 2020)

The depth to water level map has been prepared based on ground water monitoring data of May 2020. From the perusal of Table 5.2, it is observed that the overall depth to water level remains between 3.1 to 15.5 meters below ground level. The pre-monsoon depth to water levels ranges between 5 and 10 mbgl in 72.2% of the villages. Water levels more than 10 mbgl are observed in the villages namely Manikpur ,Toilagi, Kotasura and Tetla villages while in Raibor, Timarlaga, Bhilaigarh, palsada, latesara and Chhuwaripali showing water level less than 5 mbgl.as shown in Fig 5.1.

5.2.1.3 Seasonal water level fluctuation (Nov' 2019 VsMay' 2020).

Based on the pre-monsoon & post-monsoon data water level fluctuation in the study area is calculated & respective map (as shown in Fig 5.3) has also been prepared. It is observed that in the study area water level fluctuation varies from 1.34to7.25 meters. Lower range of water level fluctuation is also observed along the river course followed by >6. 0 to 2 to 4 & 4 to 6.

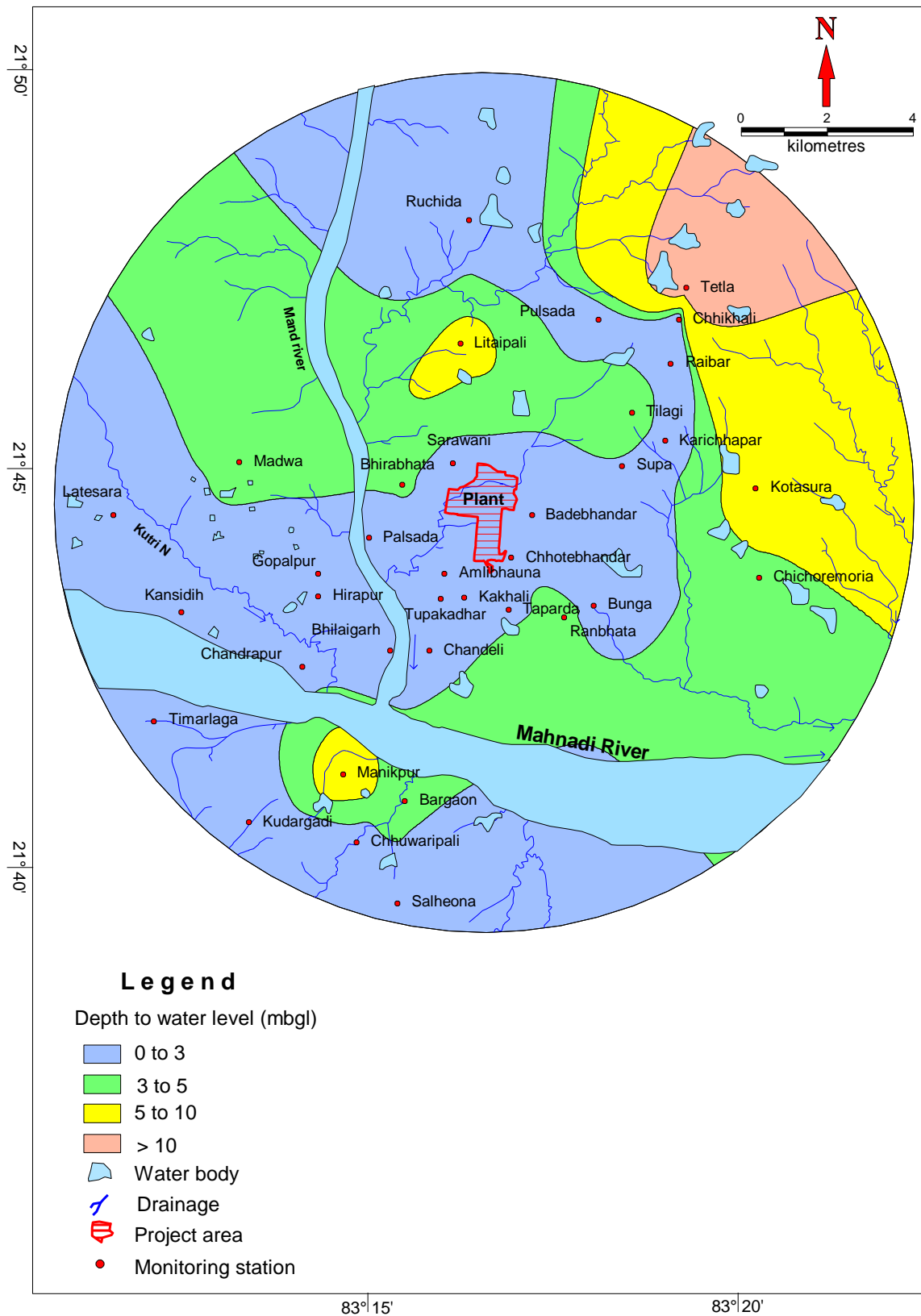


Fig.5.1: Post-monsoon Depth to Water level map (Nov.2019)

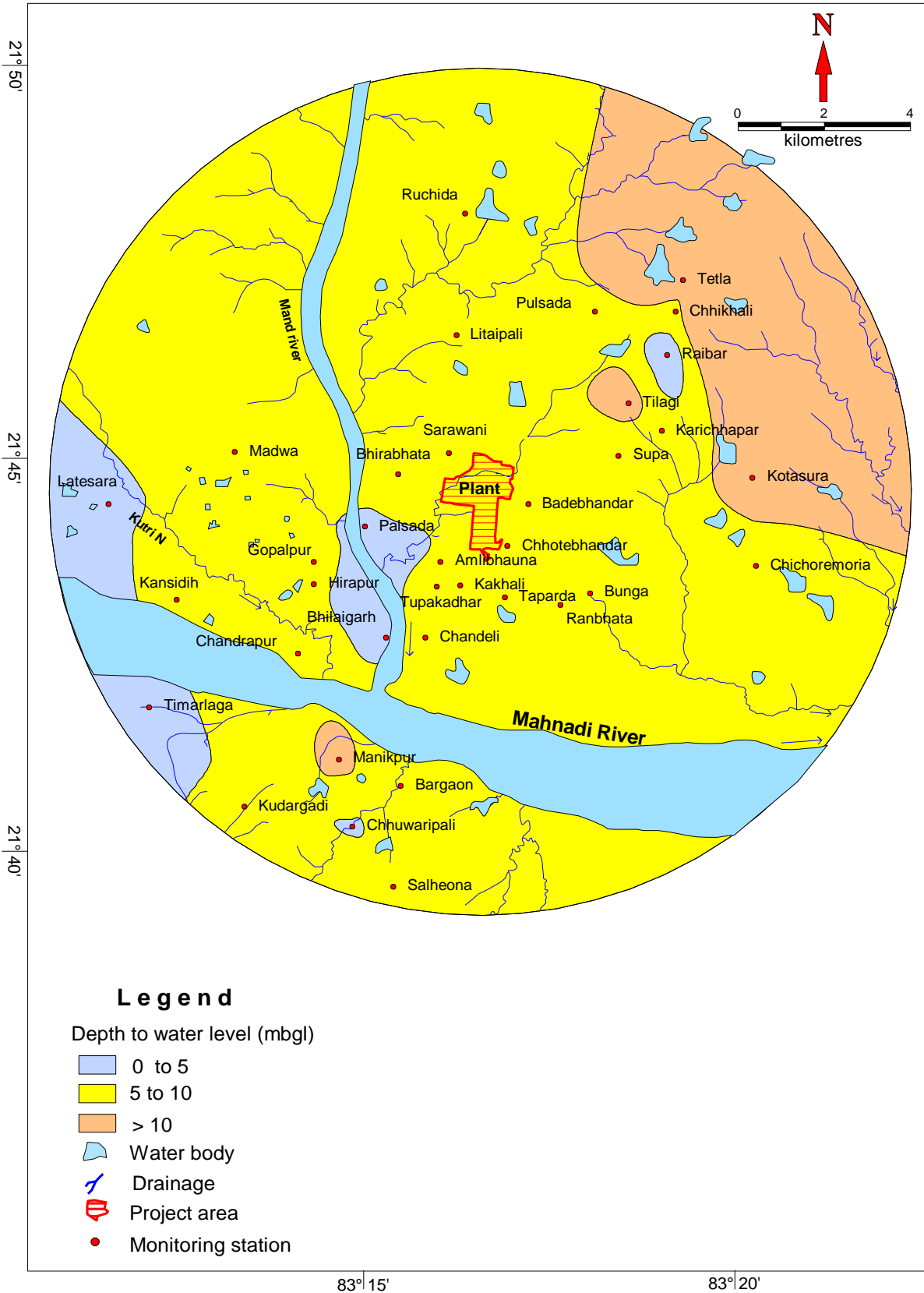


Fig.5.2: Pre-monsoon Depth to Water level map (May 2020)

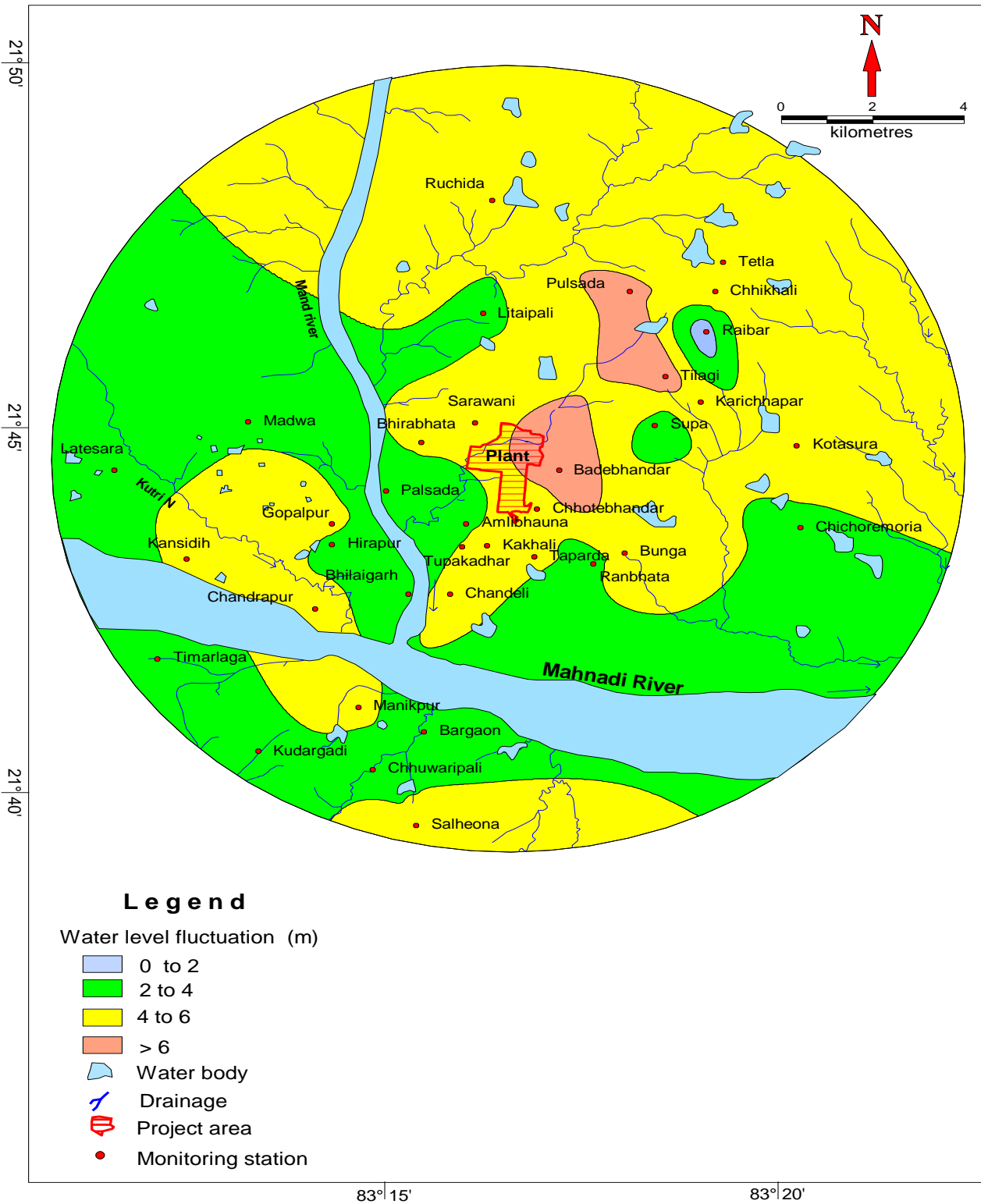


Fig 5.3: Seasonal Water Level Fluctuation map (Nov2019 VsMay'2020)

5.3 AQUIFER PARAMETERS:

The aquifer parameters are essentially required for the estimation of aquifer characteristic as well as planning the ground water withdrawal for required ground water. Accordingly, pumping test has been carried out for determination of aquifer parameters accurately. The aquifer parameters of study area covered by fractured shale are described below.

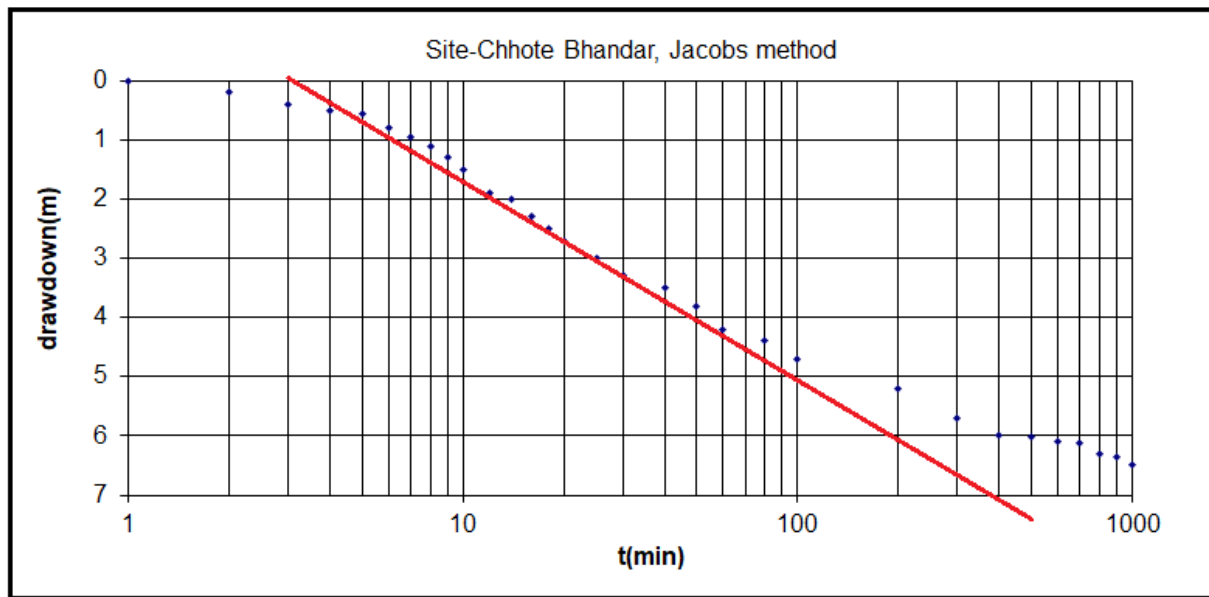
The transmissivity values of phreatic aquifer tapped in open well in general varies from 4 to 25 m²/day while specific capacity ranges from 15 to 40 lpm/m/day. However for deep aquifer the transmissivity ranges from 15-72 m²/day and at places it ranges up to 40 m²/day. The potential fractures for boreholes up to 100 mbgl depth in the area are recorded at various depths i.e. 40-45, 60-65, 75-80, 90-95 mbgl and are 4 to 5 in numbers.

To verify the aquifer parameters of the aquifer, present in the area pumping test has been carried out on a private /public bore well at Chhote Bhandar village (close to Project). The results and data interpretation is discussed below

Village	ChhoteBhandar
Block	Pussore
District	Raigarh
State	Chattisgarh
Date	28/8/2020
Duration of test	1000 minutes
Capacity of pump	3 hp
Distance of OW from pump well	45 m.
Thickness of the aquifer	10
MP(magl)	0.4
SWL(mbmp)	8.5
Discharge(lps)	4.5

Sl.no.	Time since pumping started (min)	Tape Reading (m)		DTW (mbmp)	Draw Down (m)	Remarks
		Hold	Cut			
1	1	20	11.50	8.50	0.00	
2	2	20	11.30	8.70	0.20	
3	3	20	11.10	8.90	0.40	
4	4	20	11.00	9.00	0.50	
5	5	20	10.95	9.05	0.55	
6	6	20	10.70	9.30	0.80	
7	7	20	10.55	9.45	0.95	
8	8	20	10.40	9.60	1.10	
9	9	20	10.20	9.80	1.30	
10	10	20	10.00	10.00	1.50	

11	12	20	9.60	10.40	1.90	
12	14	20	9.50	10.50	2.00	
13	16	20	9.20	10.80	2.30	
14	18	20	9.01	10.99	2.49	
15	20	20	8.80	11.20	2.70	
16	25	20	8.50	11.50	3.00	
17	30	20	8.20	11.80	3.30	
18	40	20	8.00	12.00	3.50	
19	50	20	7.68	12.32	3.82	
20	60	20	7.30	12.70	4.20	
21	80	20	7.10	12.90	4.40	
22	100	20	6.80	13.20	4.70	
23	200	20	6.30	13.70	5.20	
24	300	20	5.80	14.20	5.70	
25	400	20	5.50	14.50	6.00	
26	500	20	5.48	14.52	6.02	
27	600	20	5.41	14.59	6.09	
28	700	20	5.38	14.62	6.12	
29	800	20	5.20	14.80	6.30	
30	900	20	5.15	14.85	6.35	
31	1000	20	5.08	14.92	6.50	



The pumping test data has been analyzed by Jacob's straight line method of the pumping data of the observation well. The calculation is given below.

Formulae: $T = \frac{2.3Q}{4\pi\Delta s}$
 $K = \frac{T}{b}$ &
 $S = \frac{2.25 T t_0}{r^2}$

Where,

$T = kD =$ Transmissivity, m^2/day

$K =$ Permeability

$B =$ Thickness of aquifer

$Q =$ Discharge m^3/day

$r =$ Distance (m) between PW & OW

$\Delta s =$ Slope of straight line per log cycle of time

$S =$ Storage coefficient

$t_0 =$ time in days at zero drawdown

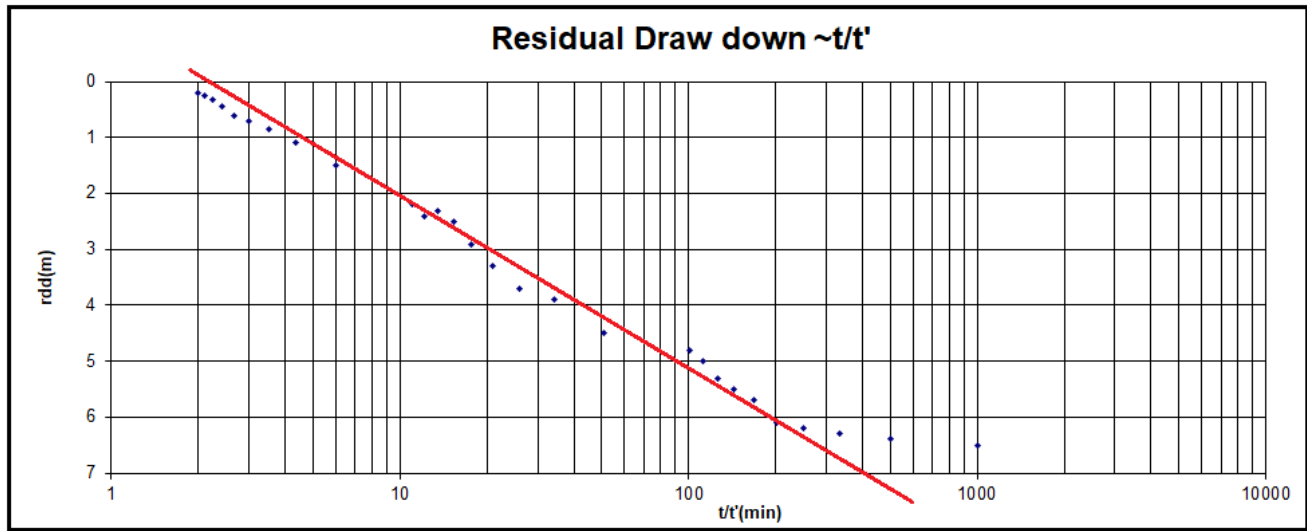
On the basis of above formulae, the calculated parameters are as follows.

$T = 22.24 m^2/day$, $K = 2.24 m/day$ &

$S = 3.4 \times 10^{-5}$

Table 5.3: Recouperation Data							
Time since pumping started in min(t)	Time since pumping stopped in min (t')	t/t'	Tape reading (m)		DTW (mbmp)	RDD (m)	Remarks
			Hold	Cut			
1001	1	1001.00	20	7	13	6.5	
1002	2	501.00	20	7.1	12.9	6.4	
1003	3	334.33	20	7.2	12.8	6.3	
1004	4	251.00	20	7.3	12.7	6.2	
1005	5	201.00	20	7.4	12.6	6.1	
1006	6	167.67	20	7.8	12.2	5.7	
1007	7	143.86	20	8	12	5.5	
1008	8	126.00	20	8.2	11.8	5.3	
1009	9	112.11	16	4.5	11.5	5	
1010	10	101.00	16	4.7	11.3	4.8	
1020	20	51.00	16	5	11	4.5	
1030	30	34.33	16	5.6	10.4	3.9	
1040	40	26.00	16	5.8	10.2	3.7	
1050	50	21.00	16	6.2	9.8	3.3	
1060	60	17.67	16	6.6	9.4	2.9	
1070	70	15.29	16	6.99	9.01	2.51	
1080	80	13.50	16	7.18	8.82	2.32	
1090	90	12.11	16	7.1	8.9	2.4	
1100	100	11.00	16	7.3	8.7	2.2	
1200	200	6.00	16	8	8	1.5	
1300	300	4.33	16	8.4	7.6	1.1	
1400	400	3.50	16	8.64	7.36	0.86	

1500	500	3.00	16	8.8	7.2	0.7
1600	600	2.67	16	8.9	7.1	0.6
1700	700	2.43	16	9.05	6.95	0.45
1800	800	2.25	16	9.18	6.82	0.32
1900	900	2.11	16	9.26	6.74	0.24
2000	1000	2.00	16	9.3	6.7	0.2



Formulae:

$$T = 2.3Q / 4\pi\Delta s, K = T/b$$

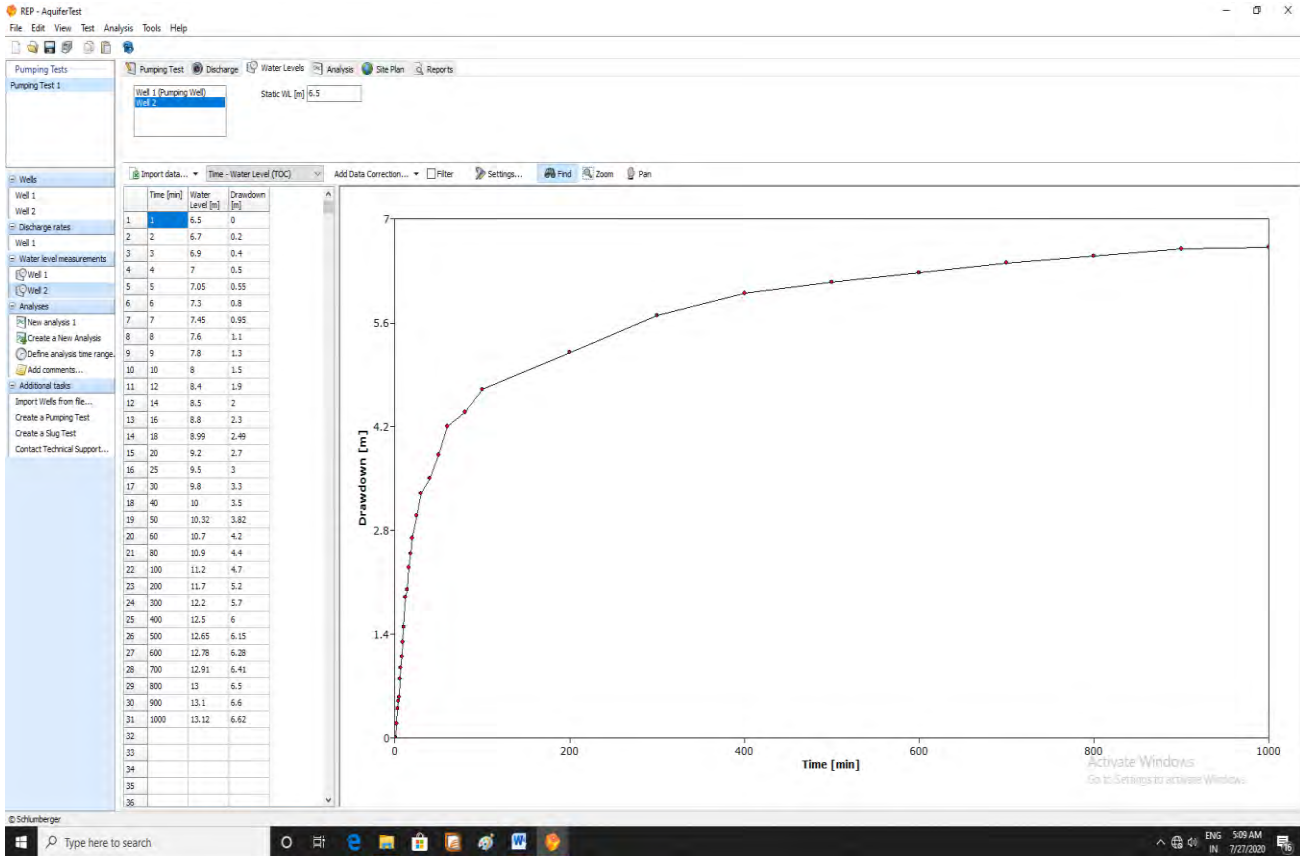
$$S = 2.25 T t_0 / r^2$$

On the basis of above formulae, the calculated parameters are as follows.

$$T = 22.24 \text{ m}^2/\text{day}, K = 2.24 \text{ m/day} \text{ \&}$$

$$S = 3.4 \times 10^{-5}$$

Pumping water level data plot in Aquifer test soft ware



1. Surface Geophysical Survey

Surface geophysical survey comprised of Six Vertical Electrical Sounding (VES) have been conducted at ten different locations after S1 during the period 25.08.2020 to 04.09.2020 to know the subsurface condition in and around Raigarh Energy Generation Limited, Village-Badebhandar and Chhotebhandar, Block- Pussore, district- Raigarh, Chhattisgarh. The VES locations are given in the location map Fig. 6.1 & 6.2.

6.1 RESISTIVITY SURVEY:

Using Ohm's law electrical resistivity of sub-surface geologic formation is determined through artificially energizing the subsurface and carrying measurements on the ground surface. Contrast in resistivity value of an individual layer with the surrounding or effective presence (dependent of its relative resistivity and thickness) makes it detectable.

In the electrical resistivity method, a known amount of electrical current (I) is sent into the ground through a pair of electrode (called current electrodes) and the potential (δV) developed because of the resistance offered by the subsurface due to the passage of this current is measured across another pair of electrodes (potential electrodes) planted into the ground. The ratio between the potential measured and the corresponding current sent into the ground yields the resistance 'R' of the ground to a depth depending upon the spacing between the two current electrodes. Through the multiplication of this value of 'R' by a geometric factor a parameter called the apparent resistivity " ρ_a " is computed. Both the parameters, apparent resistivity ' ρ_a ' and the resistance 'R' contain the information on the geo-electric characteristics of the subsurface. In practice, there exist several configurations but most commonly used are the Wenner and Schlumberger configurations.

In this survey microprocessor based resistivity meter CRM-500 was used. For the present study Vertical Electrical Sounding (VES) have been carried out using Schlumberger configuration. Maximum spreads were 200m (AB) for sounding.

6.2 Vertical Electrical Sounding (VES)

VES is a process by which the depth investigation is made. In this, the center is fixed and the measurements are made by successively increasing the electrode spacing. The apparent resistivity values obtained with increasing values of electrode separations are used to estimate the thickness and

resistivity's of the subsurface formations. In Schlumberger sounding arrangement (Figure-6), all the four electrodes are kept in a line symmetrically over a point '0', with inner (Potential) electrodes kept closer. For increasing the depth of investigation the current electrodes C_1 and C_2 are moved apart symmetrically from the center point '0' keeping the potential electrodes fixed. The separation between the potential electrodes is changed only when the potential between them drops to allow value during the course of sounding. The apparent resistivity for each electrode separation is calculated by multiplying the resistance 'R' with Schlumberger configuration factor 'K' (which is called as geometrical factor). We have

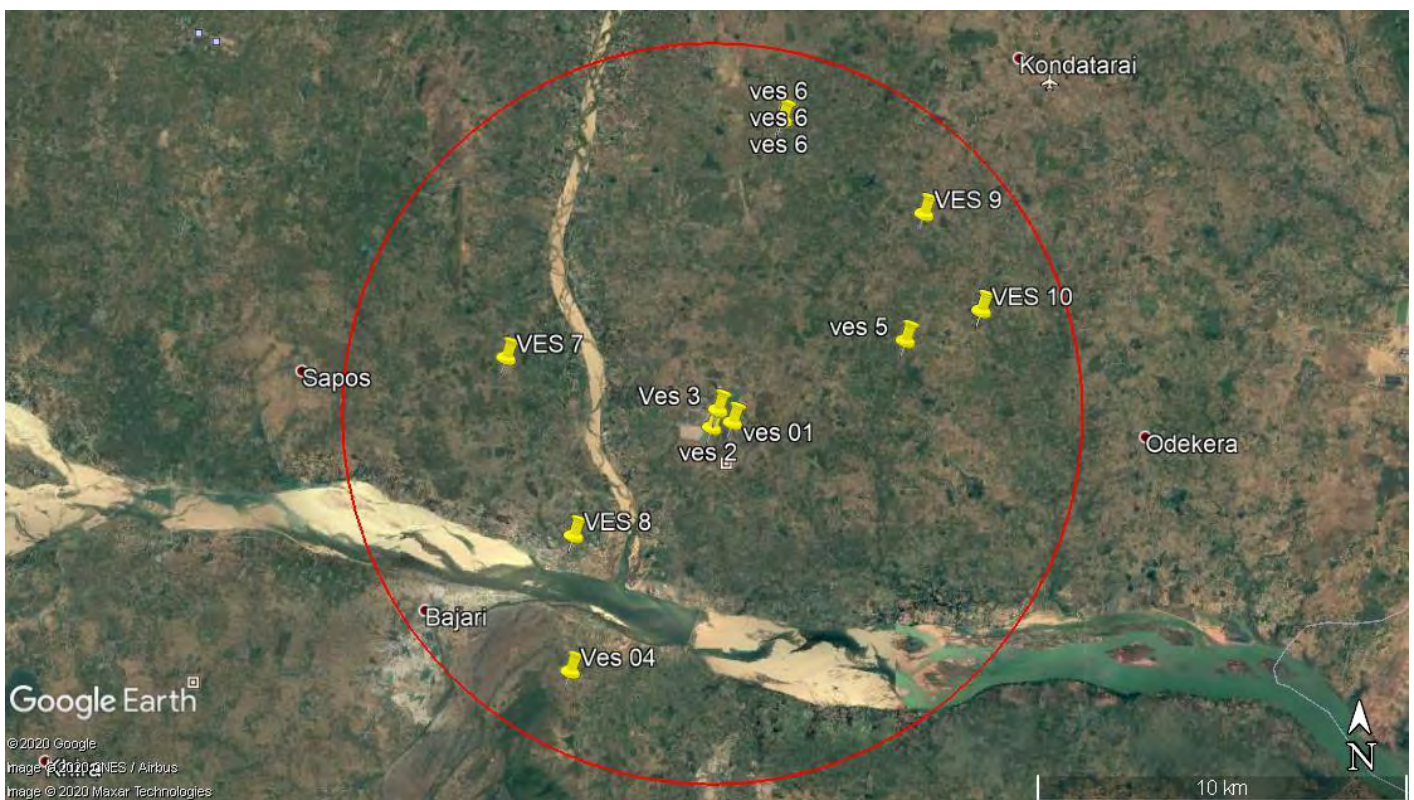


Fig 6.1: Location Map of Geophysical Survey

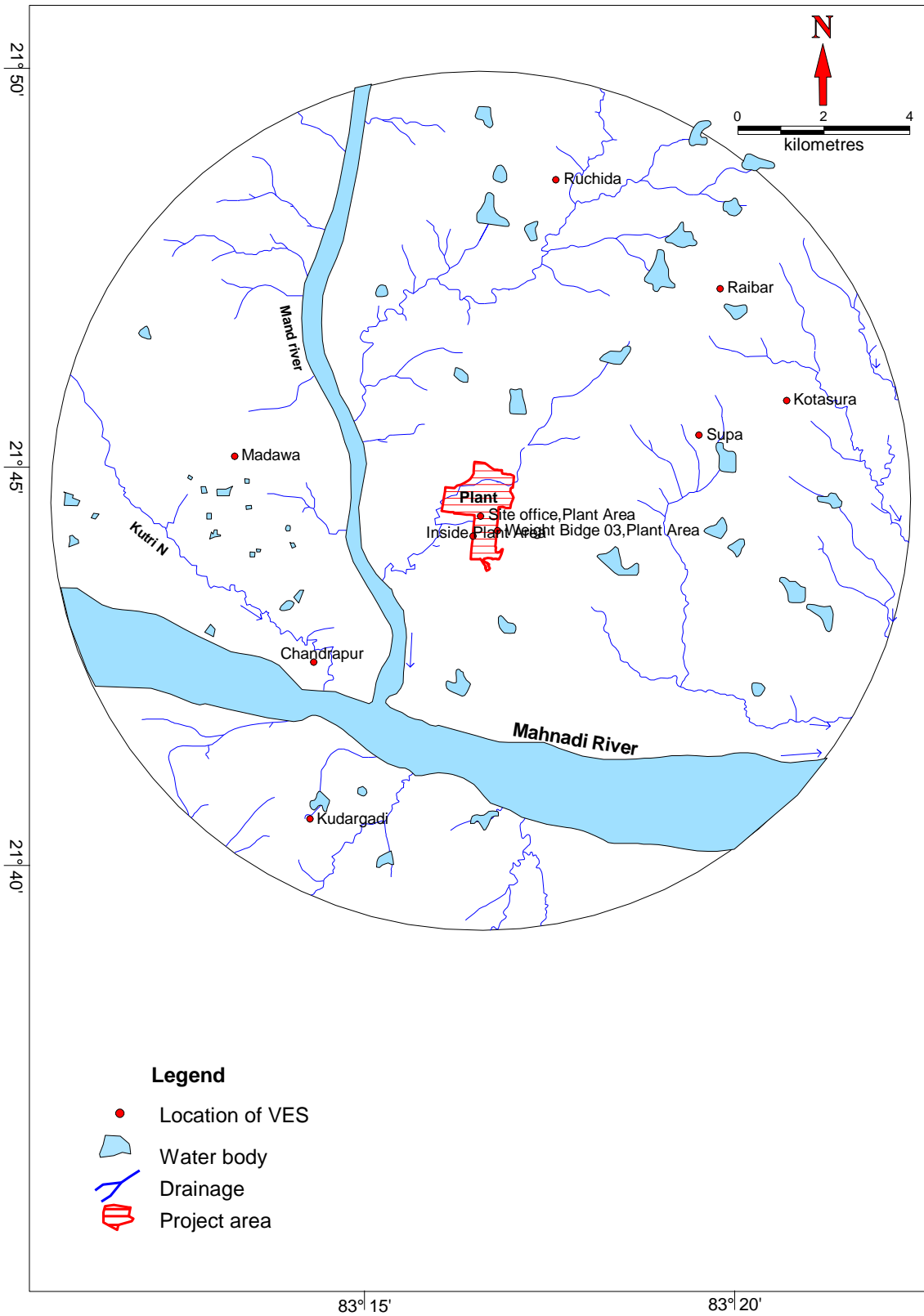


Fig 6.2 Location of VES

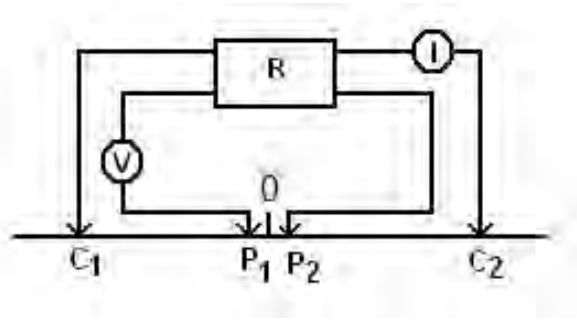


Fig 6.3: Schlumberger electrode configuration

The formula is

$$\rho_a = \pi R \left\{ \left(\frac{C_1 C_2}{2} \right)^2 - \left(\frac{P_1 P_2}{2} \right)^2 \right\} / P_1 P_2 \text{ or } \rho_a = KR$$

Where 'K' is the geometric factor for Schlumberger configuration,

$C_1 C_2$ is current electrode spacing

$P_1 P_2$ is potential electrode spacing

Equipment

The geophysical methods are useful in constructing a picture of the subsurface hydrogeological conditions in totally virgin areas. It is based upon measurement of earth electrical properties. In the present study the resistivity surveys have been carried out by using Aquameter CRM 500 an indigenous microprocessor based Resistivity Meter (Fig.-6.4).

Aquameter CRM 500 is a high power version (40 Watt) which is useful for any type of soil specially preferred for low resistivity soil of the coastal region. It can penetrate current down to 500 meters. It is a popular instrument, because of its single button operation deep penetration, accurate and reliable result, even in adverse field conditions. The instrument has a facility to measure self-potential (SP) which is useful in mineral prospecting and environmental studies.



Fig 6.4: Aquameter CRM 500

6.3 Data Analysis and Interpretation

Surface geophysical survey comprised of nine Vertical Electrical Sounding (VES) has been conducted at ten different locations during the period 25.08.2020 to 02.09.2020 to identify the subsurface condition of the study area. The observed resistance values from the instrument have been multiplied with geometric factor (K) to get the apparent resistivity values for each electrode spacing. The apparent resistivity values for different potential dipole were brought to single common potential dipole. The field apparent resistivity data were plotted on log-log graph paper against the half current electrode separation to get the VES curves (X axis- $C_1C_2/2$ value and Y axis apparent resistivity value).

These data of $C_1C_2/2$ and apparent resistivity were interpreted with the help of two layer master curve by curve matching technique and further checked with the help of IPI2WIN software. The final results were corroborated with the known hydrogeological conditions existing in the area. The geoelectric layer parameters (layer resistivity and layer thickness) were obtained for each VES. The interpreted results are given in the table 6.2. The field curves of VES are given in Fig 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 and the field data of VES is shown in Table 6.1.

Table-1: VES Data

VES 1		VES 2		VES 3		VES 4		VES 5		VES 6	
Location: Weight Bidge 03, Plant Area		Location: Inside Plant Area		Location: Site Office Chowk, Plant Area		Location: Kudargadi		Location: Supa		Location: Ruchida	
Latitude: N-210 44'12.62"		Latitude: N- 210 44'08.30"		Latitude: N-210 44'23.66"		Latitude: N- 21°40'35.41"		Latitude: N- 210 45'24.04"		Latitude: N- 210 48'36.95"	
Longitude: E- 830 16'48.41"		Longitude: E- 830 16'28.88"		Longitude: E-830 16'34.70"		Longitude: E-83°14'16.10"		Longitude: E- 830 19'31.01"		Longitude: E- 830 17'35.14"	
Date: 31.08.2020		Date: 31.08.2020		Date: 25.08.2020		Date: 01.09.2020		Date: 01.09.2020		Date: 02.09.2020	
AB/2	App. R	AB/2	App. R	AB/2	App. R	AB/2	App. R	AB/2	App. R	AB/2	App. R
2	32.16	2	27.33	2	33.43	2	19.60	2	27.89	2	22.59
3	23.37	3	24.35	3	25.88	3	15.30	3	23.06	3	18.06
4	17.57	4	21.69	4	20.05	4	13.00	4	19.46	4	14.93
5	14.33	5	19.39	5	16.00	5	11.50	5	16.76	5	12.80
6	12.77	6	16.79	6	13.96	6	10.78	6	14.43	6	11.50
8	11.07	8	14.73	8	11.38	8	9.86	8	12.51	8	10.85
10	11.30	10	13.48	10	10.56	10	10.00	10	12.43	10	10.78
12	12.43	12	13.20	12	11.00	12	10.10	12	13.21	12	11.61
14	13.76	14	13.67	14	12.09	14	10.80	14	14.14	14	12.51
16	15.24	16	14.24	16	13.12	16	11.90	16	15.24	16	13.31
18	16.42	18	15.34	18	14.14	18	12.80	18	16.76	18	14.43
20	18.18	20	16.31	20	14.83	20	13.50	20	17.93	20	15.66
25	22.14	25	19.19	25	17.10	25	16.50	25	21.25	25	17.93
30	25.53	30	21.69	30	19.46	30	19.00	30	24.18	30	20.83
35	28.27	35	24.18	35	21.99	35	21.74	35	27.33	35	23.69
40	31.09	40	26.59	40	24.51	40	23.92	40	30.26	40	26.59
45	33.05	45	29.25	45	27.14	45	26.31	45	33.28	45	28.66
50	35.86	50	31.73	50	30.05	50	28.17	50	36.10	50	30.67
60	39.70	60	36.35	60	34.19	60	32.28	60	41.35	60	34.66
70	43.66	70	39.97	70	38.12	70	36.99	70	46.10	70	38.90
80	48.35	80	43.96	80	41.35	80	41.25	80	50.02	80	42.21
90	52.45	90	47.05	90	43.66	90	43.56	90	53.90	90	45.79
100	55.40	100	49.34	100	45.48	100	45.37	100	57.69	100	47.69

VES7		VES 8		VES 9		VES 10	
Location: Weight Bidge 03, Plant Area		Location: Inside Plant Area		Location: Site Office Chowk, Plant Area		Location: Kudargadi	
Latitude: N-210 44'12.62"		Latitude: N- 210 44'08.30"		Latitude: N-210 44'23.66"		Latitude: N-21°40'35.41"	
Longitude: E- 830 16'48.41"		Longitude: E- 830 16'28.88"		Longitude: E-830 16'34.70"		Longitude: E-83°14'16.10"	
Date: 31.08.2020		Date: 31.08.2020		Date: 25.08.2020		Date: 01.09.2020	
AB/2	App. R	AB/2	App. R	AB/2	App. R	AB/2	App. R
2	24.12	2	27.09	2	31.23	2	31.23
3	19.06	3	23.18	3	24.12	3	23.12
4	15.98	4	20.21	4	18.23	4	19.65
5	13.78	5	18.23	5	15.25	5	15.78
6	12.34	6	16	6	13.54	6	13.66
8	11.93	8	14.21	8	12.22	8	11.09
10	11	10	13	10	11.54	10	10.47
12	12.78	12	13.25	12	12.56	12	10.98
14	13.97	14	14	14	14	14	11.76
16	15	16	14.99	16	16.23	16	12.76
18	16.9	18	16.21	18	18.23	18	14
20	18.45	20	17.09	20	20.13	20	14.76
25	20.23	25	20.43	25	23.12	25	16.95
30	22.09	30	22.12	30	27.56	30	19.23
35	24.89	35	25.09	35	30.44	35	21
40	28.76	40	27.43	40	33.09	40	23.65
45	30.78	45	30.45	45	35	45	27
50	33.89	50	32.89	50	37	50	29.65
60	37	60	38.12	60	41.2	60	33.67
70	41.78	70	42	70	45.9	70	38.01
80	44.89	80	45.78	80	51.22	80	42.12
90	47.98	90	49.09	90	55.23	90	46.23
100	51.78	100	51.27	100	58.09	100	49.87

2. Result And Discussions

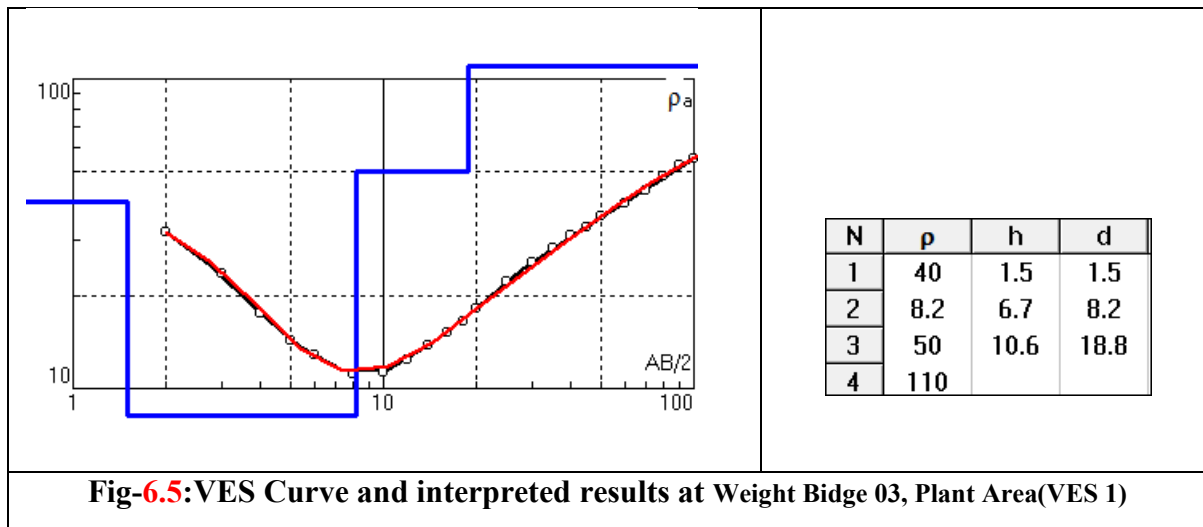
A total 10 numbers of VES has been carried out at 10 different points in plant area and its surroundings Villages, Block- Pussore, district-Raigarh, Chhattisgarh. - (Details of locations is given in fig.1& Fig.2). Aquameter CRM 500 Resistivity meter has been used for conducting the VES. Schlumberger and half Schlumberger configurations have been used for conducting the VES survey. The maximum Current electrode spread for conducting VES was 200m (AB).

The data is plotted on double logarithmic graph paper and matched with standard curves to know the true resistivity and thickness of various layers. The data is also interpreted by Computer using IPI2WIN software to verify the results of partial curve matching. From interpreted results of VES the resistivity and thickness of different layers are given in table 6.2.

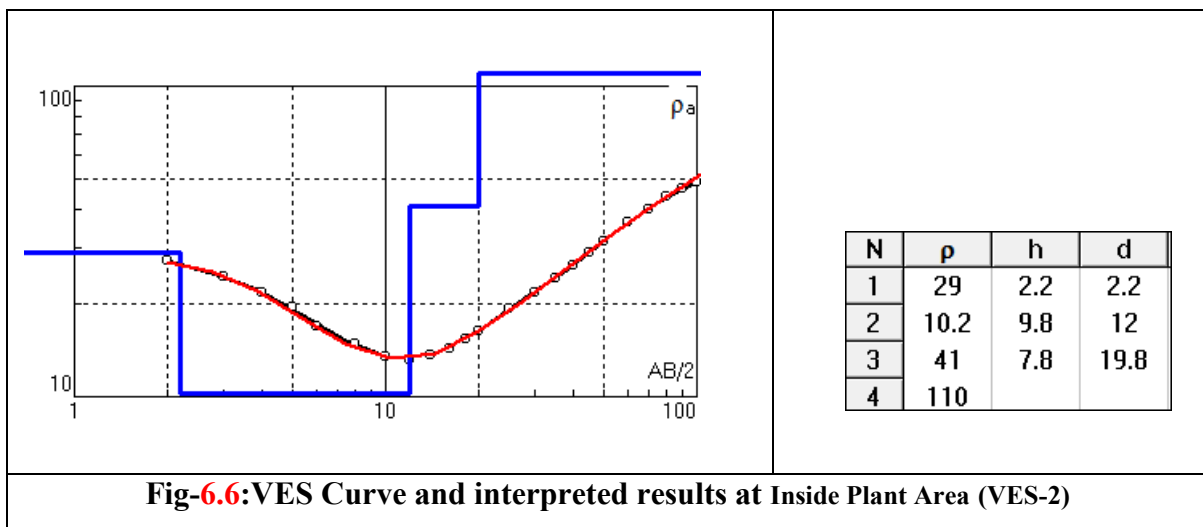
VES No	Layer Resistivity(in Ohm-m)				Layer Thickness(in m)		
	ρ_1	ρ_2	ρ_3	ρ_4	h_1	h_2	h_3
VES-1	40	8.2	50	110	1.5	6.7	10.6
VES-2	29	10.2	41	110	2.2	9.8	7.8
VES-3	38.5	8.4	33.2	100	1.7	8.5	9.0
VES-4	22.4	7.8	39	105	1.5	8.6	8.3
VES-5	30.5	8.8	42	116	1.9	7.0	10.3
VES-6	24.5	7.8	35	98	1.8	6.7	10.3
VES-7	27.6	8.53	61.6	98.2	1.65	7.75	9.97
VES-8	28.6	10.2	34.6	111	2.06	7.81	12.84
VES-9	41.2	10.1	67.2	116	1.35	7.71	18.8
VES-10	35	8.4	53.7	132	1.73	9.69	11.5

VES-1:

It is a HA type curve and it has four layer. The topmost layer having resistivity value of $40\Omega\text{-m}$ is top soil whereas the second layer is shale with resistivity of $8.2\Omega\text{-m}$. The third layer is fractured sandstone with resistivity of $50\Omega\text{-m}$, while the last layer is hard sandstone having resistivity of $110\Omega\text{-m}$. The thickness of topmost layer was 1.5 m and the second layer & third layer thickness are 6.7m and 10.6 m respectively.



VES-2:It is a HA type curve and it has four layer. The topmost layer having resistivity value of $29\Omega\text{-m}$ is top soil whereas the second layer is shale with resistivity of $10.2\Omega\text{-m}$. The third layer is fractured sandstone with resistivity of $41\Omega\text{-m}$, while the last layer is hard sandstone with resistivity of $110\Omega\text{-m}$. The thickness of topmost layer is 2.2m and the second layer & third layer thickness are 9.8m and 7.8m respectively.



VES-3:

It is a HA type curve and it has four layer. The topmost layer having resistivity value of 38.5 Ω-m may be top soil whereas the second layer is shale with resistivity of 8.4 Ω-m. The third layer is fractured sandstone with resistivity of 33.2Ω-m, while the last layer is hard sandstone having resistivity of 100 Ω-m. The thickness of topmost layer is 1.7m and the second layer & third layer thickness are 8.5m and 9.0m respectively.

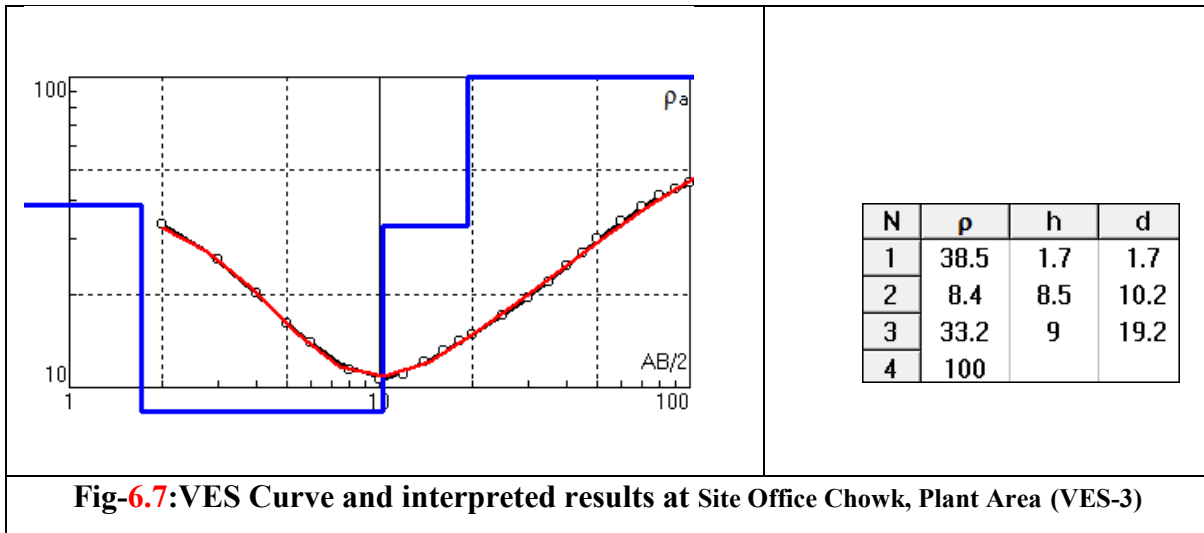


Fig-6.7:VES Curve and interpreted results at Site Office Chowk, Plant Area (VES-3)

VES-4:It is also a HA type curve and it has four layer. The topmost layer having resistivity value of 22.4Ω-m is top soil whereas the second layer is shale with resistivity of 8.4Ω-m. The third layer is fractured sandstone with resistivity of 39Ω-m, while the last layer is hard sandstone having resistivity of 105 Ω-m. The thickness of topmost layer was 1.5 m and the second layer & third layer thickness are 8.6m and 8.3m respectively.

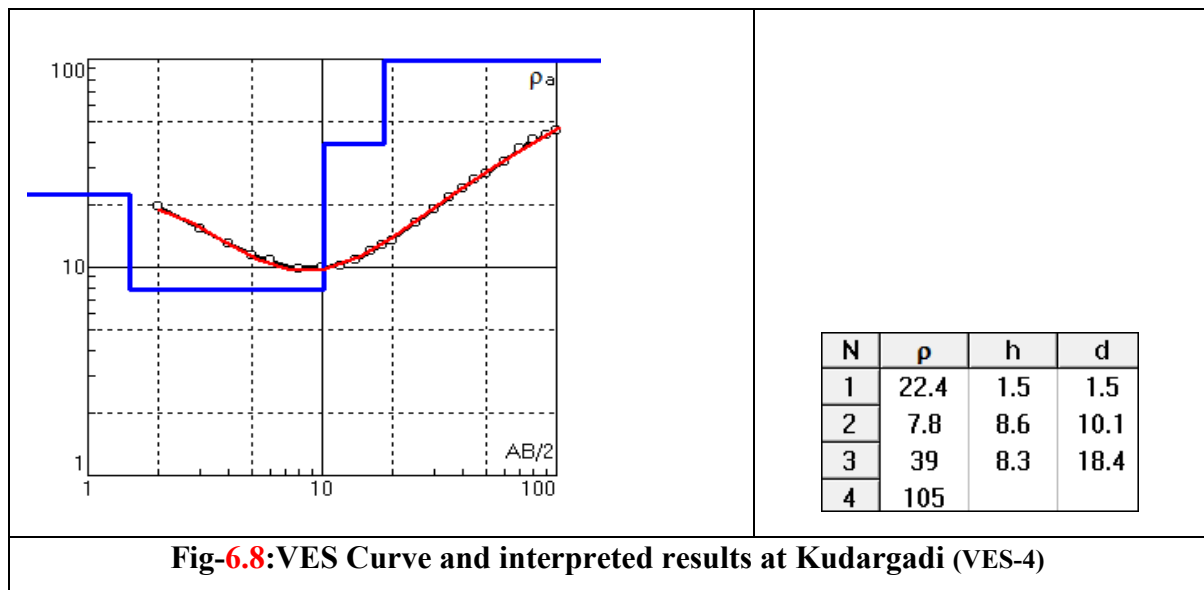
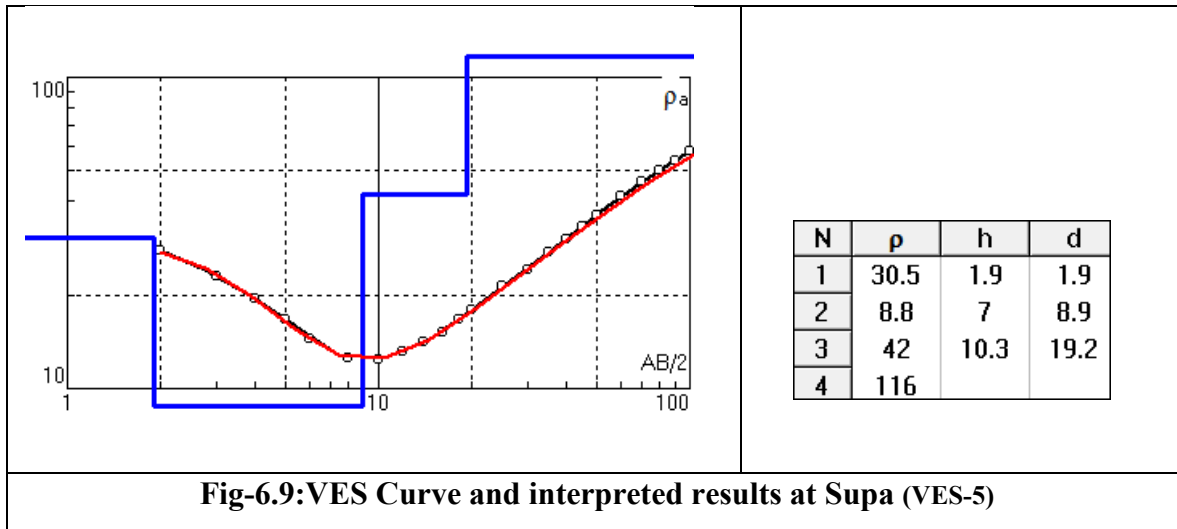


Fig-6.8:VES Curve and interpreted results at Kudargadi (VES-4)

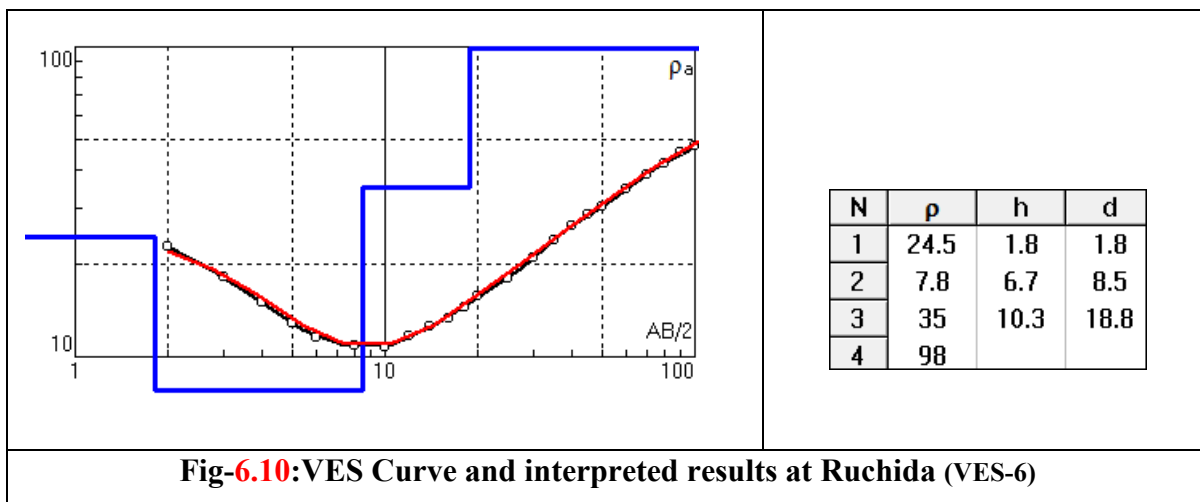
VES-5:

It is also a HA type curve and it has four layer. The topmost layer having resistivity value of $30.5\Omega\text{-m}$ is top soil whereas the second layer is shale with resistivity of $8.8\Omega\text{-m}$. The third layer is fractured sandstone with resistivity of $42\Omega\text{-m}$, while the last layer is hard sandstone having resistivity of $116\Omega\text{-m}$. The thickness of topmost layer was 1.9m and the second layer & third layer thickness are 7.0m and 10.3m respectively.



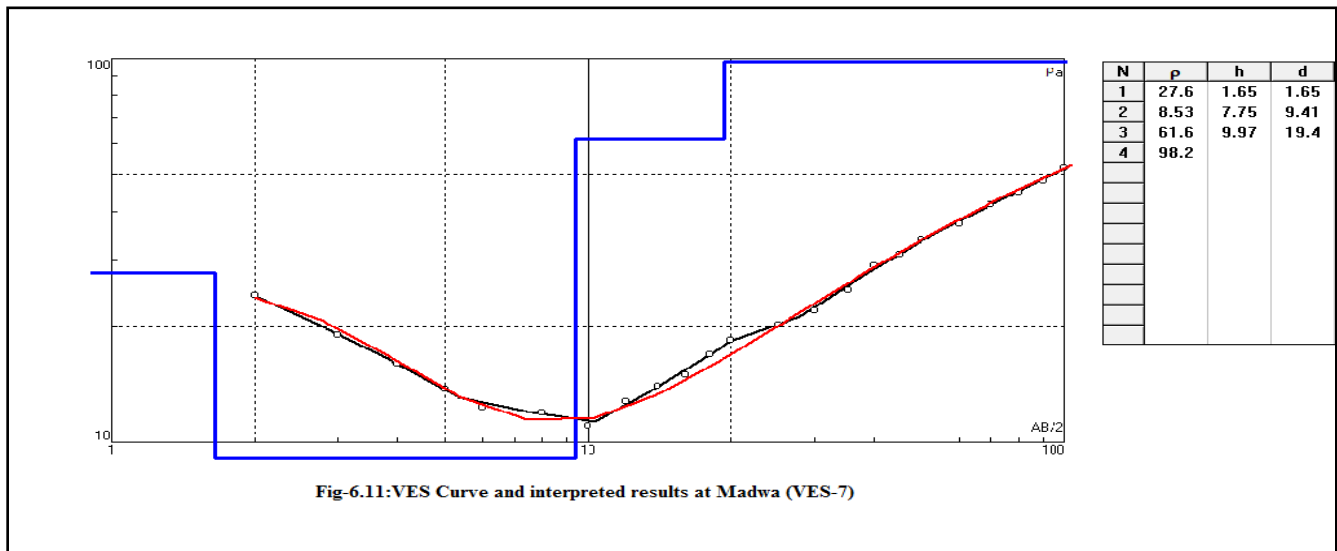
VES-6:

It is also a HA type curve and it has four layer. The topmost layer having resistivity value of $24.5\Omega\text{-m}$ is top soil whereas the second layer is shale with resistivity of $7.8\Omega\text{-m}$. The third layer is fractured sandstone with resistivity of $35\Omega\text{-m}$, while the last layer is hard sandstone having resistivity of $98\Omega\text{-m}$. The thickness of topmost layer was 1.8m and the second layer & third layer thickness are 6.7m and 10.3m respectively.



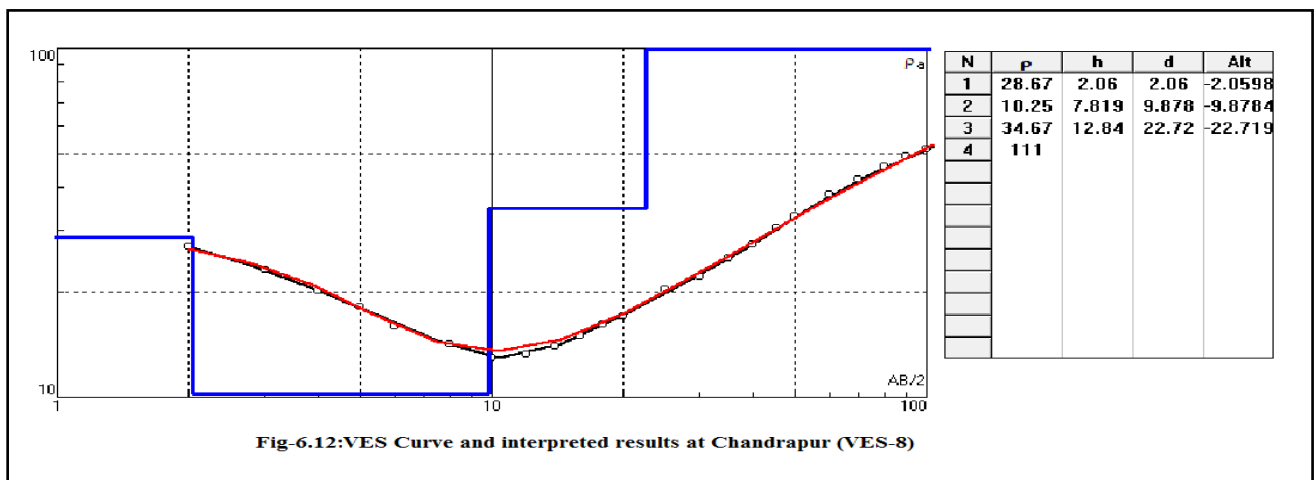
VES-7:

It is also a HA type curve and it has four layer. The topmost layer having resistivity value of 27.6Ω-m is top soil whereas the second layer is shale with resistivity of 8.53 Ω-m. The third layer is fractured sandstone with resistivity of 61.6Ω-m, while the last layer is hard sandstone having resistivity of 98.2Ω-m. The thickness of topmost layer was 1.65m and the second layer & third layer thickness are 7.75 m and 9.97 m respectively.



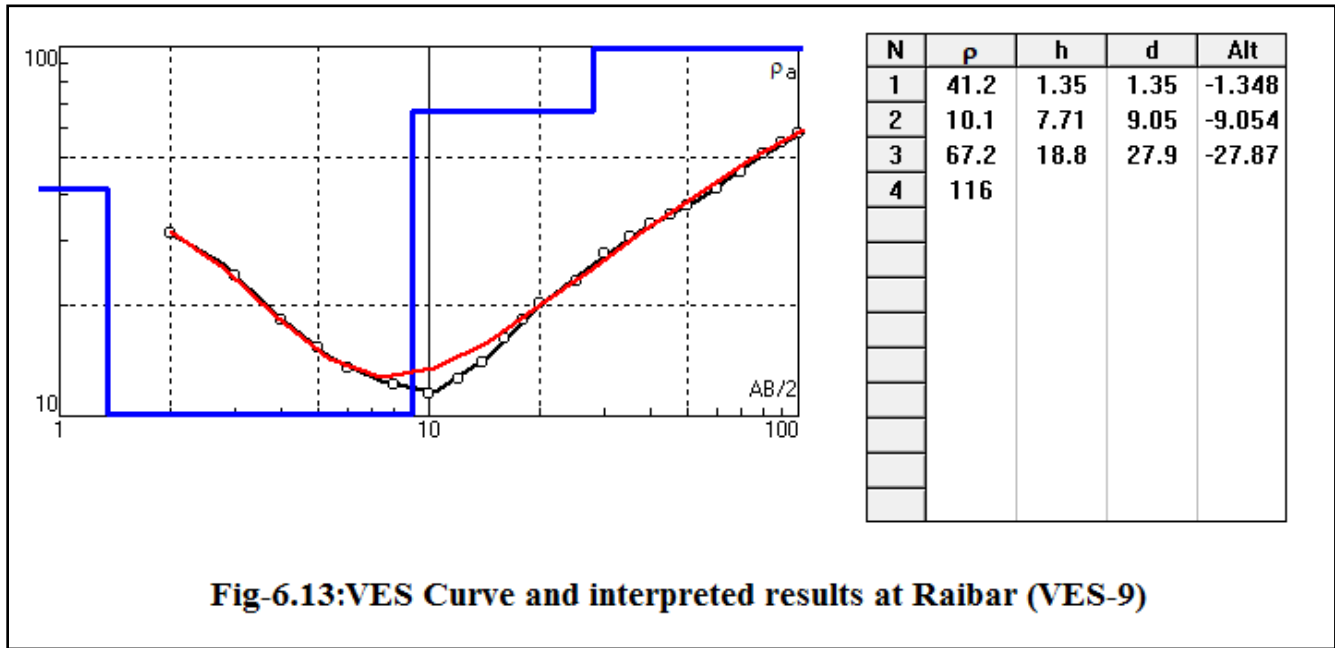
VES-8:

It is also a HA type curve and it has four layer. The topmost layer having resistivity value of 28.67 Ω-m is top soil whereas the second layer is shale with resistivity of 10.25 Ω-m. The third layer is fractured sandstone with resistivity of 34.67 Ω-m, while the last layer is hard sandstone having resistivity of 111 Ω-m. The thickness of topmost layer was 2.06 m and the second layer & third layer thickness are 7.81 m and 12.84 m respectively.



VES-9:

It is also a HA type curve and it has four layer. The topmost layer having resistivity value of 41.2 Ω -m is top soil whereas the second layer is shale with resistivity of 10.1 Ω -m. The third layer is fractured sandstone with resistivity of 67.2 Ω -m, while the last layer is hard sandstone having resistivity of 116 Ω -m. The thickness of topmost layer was 1.35 m and the second layer & third layer thickness are 7.71 m and 18.8 m respectively.



VES-10:

It is also a HA type curve and it has four layer. The topmost layer having resistivity value of 35 Ω -m is top soil whereas the second layer is shale with resistivity of 8.4 Ω -m. The third layer is fractured sandstone with resistivity of 53.7 Ω -m, while the last layer is hard sandstone having resistivity of 132 Ω -m. The thickness of topmost layer was 1.73 m and the second layer & third layer thickness are 9.69 m and 11.5 m respectively.

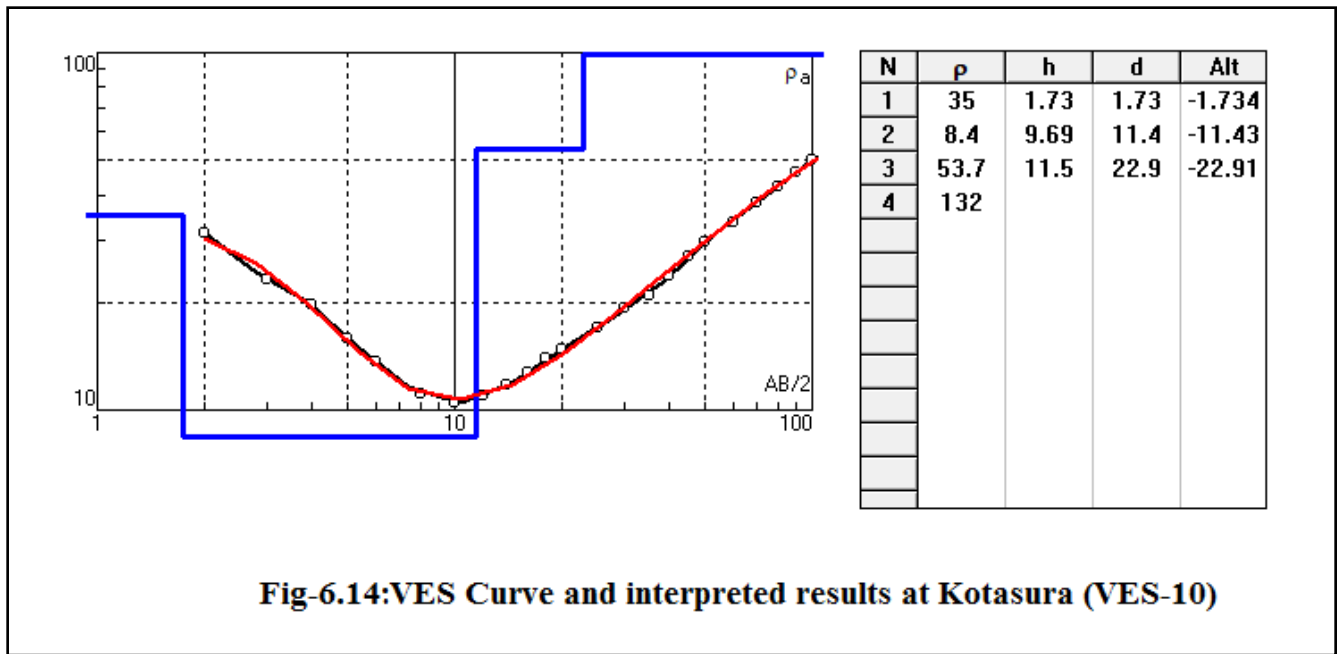


Fig-6.14:VES Curve and interpreted results at Kotasura (VES-10)

Factor analysis has been done and from the results it is observed that there are deeper fractures at different depths. The probable fractures are given in the following table-6.3.

Table-6.3: Probable Fracture Zone	
VES No	Probable Fracture Zone
VES-1	Between 50 to 60m and 70 to 80m.
VES-2	Between 40 to 45m and 60 to 80m.
VES-3	Between 45 to 50m and 60 to 80m.
VES-4	Between 40 to 45m and 70 to 80m.
VES-5	Between 35 to 40m and 60 to 70m.
VES-6	Between 35 to 40m and 60 to 70m.
VES-7	Between 30 to 35m and 80 to 90m.
VES-8	Between 20 to 25m and 90 to 100m.
VES-9	Between 45 to 50m and 55 to 65m.
VES-10	Between 25 to 30 m and 50 to 60m.

3. Conclusions & Recommendations

From the interpretation of resistivity survey we got the following outcome.

The thickness of topsoil varies from 1.5m to 2.2 m with resistivity range from 22.4 Ω -m to 41.2 Ω -m.

The thickness of second shale layer varies from 6.7m to 9.8m and the resistivity range is 7.8 Ω -m to 10.2 Ω -m.

Third layer is fracture sandstone and the thickness of this layer varies from 7.8m to 18.8m and resistivity range is 33.2 Ω -m to 67.2 Ω -m.

The last layer is hard sandstone which shows high electrical resistivity with the range of 98 Ω -m to 132 Ω -m.

Possibility of two deeper fractures zones are also there one is at at 30 to 50m depth and other one is at 60 to90 m depth.

Bore well may be drilled down to 100m at each point go get good amount of water. The depth of casing is maximum 20m.



Fig 6.15: Resistivity Survey in Plant Premises

7. Ground Water Resources

The ground water resources for the study area were assessed as per methodology recommended by ground water estimation committee'2015. The resources were calculated by Infiltration method due to non-availability of long-term water level data and fluctuation in the area. The rain fall recharge was calculated by Rainfall Infiltration method. Domestic water requirement has been estimated based on population as per Census 2011 by taking the average per capita consumption as 60 liter per day by considering 100% dependence of total population on ground water. The ground water draft for irrigation was calculated from number of ground water abstraction structure.

7.1 GROUND WATER RECHARGE:

- a) Total geographical area in ha. = 31400
- b) Area not suitable for ground recharge in ha. =Nil
- c) Area suitable for ground recharge in ha. =31400
- d) Average water level:
 - Pre-monsoon = 7.09mbgl.
 - Post-monsoon = 2.8mbgl.
- e) Normal annual rain fall = 1.169 m.
- f) Normal monsoon rain fall = 1.01 m.
- g) Normal non monsoon rain fall = 0.159 m
- h) Ground Water Recharge by rain fall infiltration method - The rain fall infiltration factors for different formations have been taken as those recommended by GEC 2015 .The equation used for computation of recharge is

$$R_{rf} = NAR \times A \times RFI$$

Where,

R_{rf} = Recharge from rainfall

NAR = Normal annual rain fall

A = Area of the unit in ha

RFI = Rain fall infiltration factor

$$\text{Recharge from rainfall} = 1.169 \times 31400 \times 0.06$$

= 2202.4 ham.

Return seepage from surface water irrigation

Crop type	Area irrigated (ha)	Average depth of water applied (m)	Irrigation water applied (ham)	Water delivered at 80% efficiency	Seepage factor	Seepage (ham)
Paddy	4800	0.4	1920.0	2400	0.4	960.0

i) Seepage from tanks/ ponds

No of tanks = 150

Total water spreaded area in ha = 1250

Seepage factor (m/year) = 0.6

Total non monsoon seepage (ham) = 750

j) Annual ground water recharge =

$$\begin{aligned} & \text{Rainfall recharge} + \text{Seepage from irrigation} + \text{Recharge from tanks/ponds} \\ & = 2202.4 + 960 + 750 \\ & = 3912.4 \text{ ham} \end{aligned}$$

K) Annual Extractable Ground Water Recharge

Annual Extractable Ground Water Recharge has been computed by deducting the unaccounted natural discharge from the total annual recharge as per the criteria recommended by GEC'2015. In the study area 10% of replenishable ground water is considered to deduct from total recharge as it goes as base flow.

$$\begin{aligned} \text{Annual Extractable Ground Water Recharge} &= \text{Total annual recharge} - \text{Base flow} \\ &= 3912.4 \text{ ham} - 391.2 \text{ ham} \\ &= 3521.2 \text{ ham} \end{aligned}$$

7.2 ANNUAL GROUND WATER EXTRACTION:

7.2.1 Domestic purposes –

Water draft has been estimated based on population. The average per capita consumption has been taken as 60 liters per day by considering 100% dependence on the ground water. The total annual demand is calculated as follows

$$\begin{aligned}\text{Total annual demand in ham} &= \text{Population} \times 60 \times 365 / 1000 \times 1000 \\ &= 104237 \times 60 \times 365 / 1000 \times 1000 \\ &= 228.28 \text{ ham}\end{aligned}$$

7.2.2 Ground water draft for irrigation:

Ground water draft for irrigation was calculated from number of ground water abstraction structures present in the area.

Ground water structure	No of G W structure	Unit draft in ham	Gross extraction in ham
Dug wells	475	1.0	475
Tube wells	1000	2.0	2000

7.3 Ground water balance (ham) :

$$\begin{aligned}&= \text{Annual Extractable Ground Water Recharge} - \text{Gross ground water extraction} \\ &= 3521.2 \text{ ham} - 2703.28 \text{ ham} \\ &= 817.92 \text{ ham}\end{aligned}$$

From the above it may be seen that the balance ground water resources in the area is of the order of 817.92 ham

7.4 Stage of ground water Extraction:

$$\begin{aligned}&= \text{Gross ground water extraction} \times 100 / \text{Annual extractable ground water recharge} \\ &= 2703.28 * 100 / 3521.2 \\ &= \mathbf{76.77 \%}\end{aligned}$$

According to recommended methodology stage of ground water extraction above 70% is considered Semi-critical. So the present study area is come in “SEMI-CRITICAL” category.

8. GROUND WATER QUALITY

The suitability of ground water for drinking/irrigation/industrial purposes is determined keeping in view the effects of various chemical constituents present in water on the growth of human being, animals, and various plants and also on industrial requirement. However, many ions are very essential for the growth of plants and human body but when present in excess, have an adverse effect on health and growth. For estimation of the quality of ground water, 15 ground water samples have been collected in study area. The ground water samples were analysed for major as well as heavy chemical constituents. The ranges of different chemical constituents present in ground water are given in **Table 8.1** and details are given in **Annexure I** and location of water sampling is given in **fig 8.1**.

Table 8.1: Aquifer wise ranges of chemical constituents

SN	Parameters	Prescribed limits as per IS 10500		Observed value
		Desirable limit	Permissible limit	
1	PH	6.5-8.5	No Relaxation	6.66-7.68
2	EC $\mu\text{S}/\text{cm}$ @ 25°C	750	2250	238-2503
3	Turbidity	1	5	0.28-34.5
4	Total Dissolved Solid (mg/l)	500	2000	152-1602
5	Calcium (Ca) (mg/l)	75	200	29-433
6	Fluride (as F) (mg/l)	1	1.5	0.51-2.99
7	chloride (As Cl) (mg/l)	250	1000	7.9-287
8	magnesium (As mg) (mg/l)	30	100	9.23-57.3
9	Nitrate (As No3) (mg/l)	45	No Relaxation	0.25-11.99
10	Sulphate (As So4) (mg/l)	200	400	9.77-277
11	Total Hardness (as Caco3) (mg/l)	200	600	23-1150
12	Barium (as Ba) (mg/l)	0.7	No Relaxation	N.D.
13	Boron (as B) (mg/l)	0.5	1	N.D.
14	Aluminium (as Al) (mg/l)	0.003	0.2	N.D.
15	Copper (as Cu) (mg/l)	0.05	1.5	N.D.
16	iron (as Fe) (mg/l)	0.3	No Relaxation	0.11-0.22
17	Manganese (as mn) (mg/l)	0.1	0.3	ND
18	Silver (as Ag) (mg/l)	0.1	No Relaxation	N.D.
19	Zinc (as zn) (mg/l)	5	15	N.D.
20	Mercury (as Hg) (mg/l)	0.001	No Relaxation	N.D.
21	cadmium (as cd) (mg/l)	0.003	No Relaxation	N.D.
22	Lead (as Pb) (mg/l)	0.01	No Relaxation	N.D.
23	Nickel (as Ni) (mg/l)	0.02	No Relaxation	N.D.
24	Arsenic (as As) (mg/l)		0.001	N.D.
25	Chromium (as Cr) (mg/l)	0.03	No Relaxation	N.D.

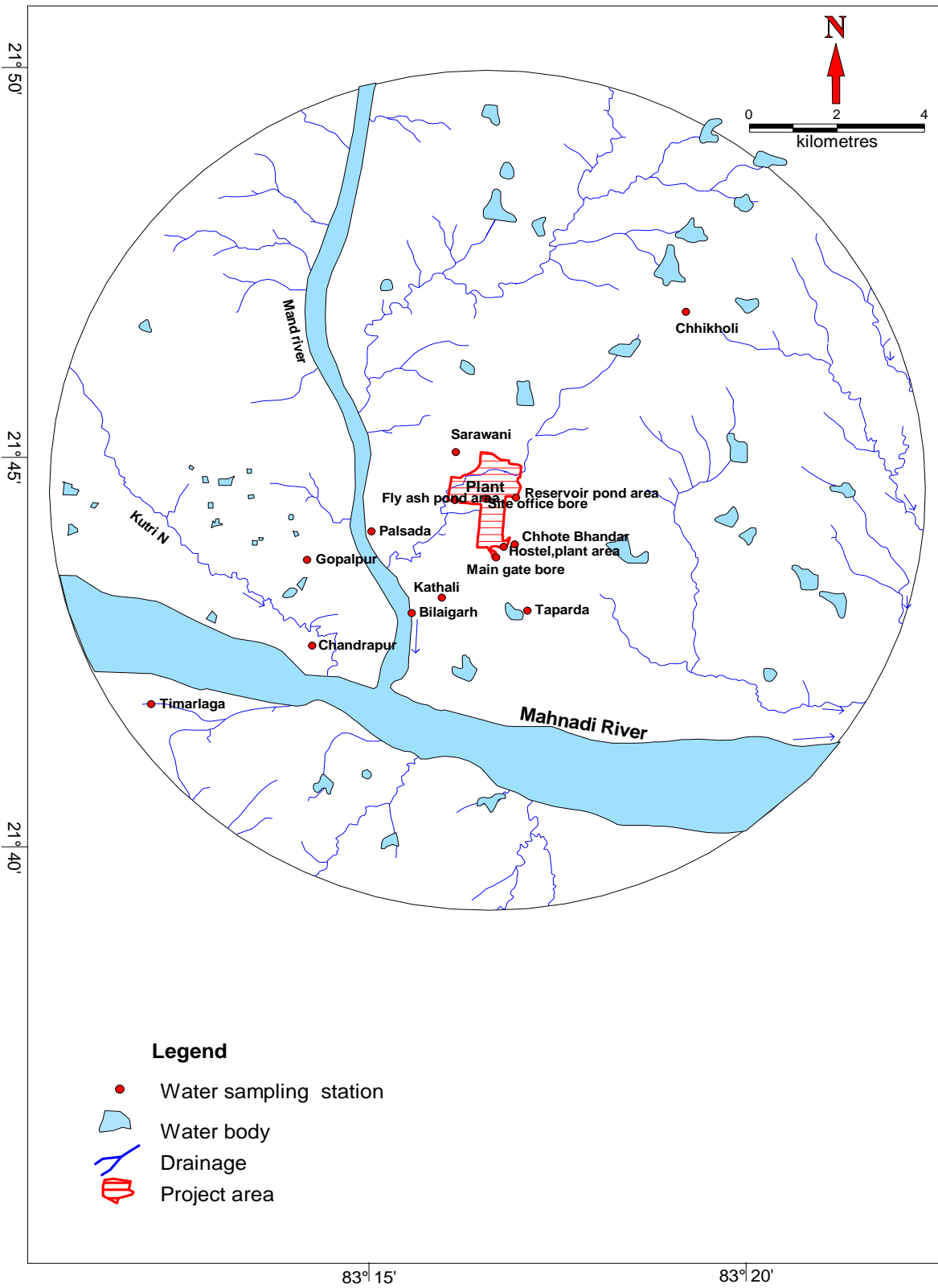


Fig-8.1: Location of water sampling

According to above table, majority of chemical constituent of all samples are within permissible limit and suitable for drinking, irrigation and industrial use, fluoride contamination is observed only at Ash Pond area and Main gate bore well, Plant Area may be due to ash, Higher concentration of EC observed at Mohrenga, Bilaigarh village and Ca contamination observed at Gopalpur, Bhilaigarh, Chhote Bhandar and Hostel well. Rest of the parameters is within permissible limit.

Geochemical Classification of Ground Water

The geochemical classification of ground water, of study area has been carried out by using Piper Diagrams the ground water is of Ca/Mg/Na-HCO₃ SO₄ type. The analysis of ground water samples collected from the area suggests that type of water in the major part is bicarbonate dominating type, The type of ground water found in each ground water sample collected is given in the **Table 9.2** . .

Table 8.2. The type of ground water

SN	Village	G.P.	Y coordinate	X coordinate	Watertype
1	Gopalpur	Gopalpur	21°43'41.88"	83°14'11.00"	Ca-HCO ₃ -SO ₄
2	Bilaigarh	Bilaigarh	21°43'00"	83°15'33.63"	Ca-HCO ₃ -Cl
3	Palsada	Palsada	21°44'03"	83°15'02.32"	Ca-Na-HCO ₃ -SO ₄
4	Sarawani	Barpali	21°45'04"	83°16'09.43"	Ca-Na-HCO ₃ -SO ₄
5	Timarlaga	Timarlaga	21°41'50"	83°12'06.80"	Na-Ca-HCO ₃ -Cl
6	Taparda	Taparda	21°43'02"	83°17'05.73"	Ca-Na-HCO ₃ -SO ₄
7	Chhikholi	Chhikholi	21°46'52"	83°19'11.65"	Ca-Na-HCO ₃ -SO ₄
8	ChhoteBhandar	ChhoteBhandar	21°43'52.69"	83°16'55.77"	Ca-Mg-HCO ₃ -SO ₄
9	Kathali	Tarpada	21°43'12.90"	83°15'58.54"	Ca-HCO ₃ -SO ₄ -Cl
10	Chandrapur	Chandrapur	21°42'34.62"	83°14'15.74"	Ca-HCO ₃
11	Fly ash pond area	Plant area	21°44'22.26"	83°16'07.35"	Ca-Cl-HCO ₃ -SO ₄
12	Field hostel, plant area	Plant area	21°43'50.68"	83°16'47.80"	Ca-HCO ₃ -SO ₄
13	Reservoir pond area	Plant area	21°44'29.21"	83°16'57.98"	Ca-Mg-HCO ₃ -SO ₄
14	Site office bore	Plant area	21°44'27.56"	83°16' 33.30"	Ca-HCO ₃ -SO ₄
15	Main gate bore well	Plant area	21°43'43.40"	83°16'41.53"	Ca-HCO ₃ -SO ₄

SUITABILITY OF GROUND WATER FOR DRINKING AND IRRIGATION PURPOSES

The suitability of ground water for drinking purpose:

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents present in water on the biological system of human being. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (BIS-2003, revised) were used to decide the suitability of ground water that occur in study area for drinking purpose. The classification of ground

water samples falling below desirable limit (DL), between desirable & maximum permissible limit (DL-MPL) and above maximum permissible limit (MPL) for drinking water purpose limit is shown in the following Table 8.3

Table 8.3: Classification of Ground Water Samples for Drinking Purposes.

Parameters	Drinking water Standards (IS-10500-91, Revised 2003)		Total No. of GW Samples	Samples (< DL)		Samples (DL-MPL)		Samples (>MPL)	
	Desirable Limit (DL)	Maximum Permissible Limit (MPL)		No.	%	No.	%	No.	%
PH	6.5-8.5	No relaxation	15	3	20	12	80		0
TDS (mg/L)	500	2000	15	8	53.33	7	46.67		0
TH (mg/L)	300	600	15	3	20	8	53.33	4	26.67
Ca (mg/L)	75	200	15	3	20	8	53.33	4	26.67
Mg (mg/L)	30	100	15	4	26.67	10	66.67	1	6.67
Cl (mg/L)	250	1000	15	14	93.33	1	6.67	0	0
SO ₄ (mg/L)	200	400	15	11	73.33	4	26.67	0	0
NO ₃ (mg/L)	45	-	15	15	100		0		0

It is observed from the above **table 8.3**, that than 74% of samples are suitable for drinking purposes. It is also observed that only 26% of samples show the TH, Ca and Mg concentration above the maximum permissible limit of BIS Standards. Therefore, it is concluded that the potability of ground water in major part of study area.

The suitability of ground water for Irrigation purpose

Water is one of the most important constituents, which is required for plant growth, which not only provides the liquid for food processing of the plants but also provides important nutrients for the growth of the plants. But when concentration of ions, are found in excess in the water, it affects the plant growth and reduces the plant yield. Therefore, it is necessary to know the quality of the water before applying in the field, so that the maximum crop yield can be obtained.

Sodium Adsorption Ratio (SAR)

SAR is an expression pertaining to cation makes up of water and soil solution and is used for characterizing the sodium hazard of irrigation water. The main problem with high sodium concentration is its effect on soil permeability & water irrigation. Sodium also contributes directly to the total salinity of the water and may be toxic to sensitive crops such as fruit trees. SAR is calculated from the following equation-

$$\text{SAR} = \frac{\text{Na}^+}{\sqrt{(\text{Ca}^{2+} + \text{Mg}^{2+})/2}}$$

Where the concentration of cations are expressed in meq/L.

Residual Sodium Carbonate (RSC)

Water containing carbon dioxide on way gets saturated with carbon dioxide and forms bicarbonates. The excess bicarbonates of Mg and Ca are precipitated out as carbonates. This produces impermeability to the top soil. Bicarbonate concentration of water has been suggested as additional criteria of suitability of irrigation water. Residual sodium carbonate is determined by using the following formula.

$$\text{RSC} = (\text{CO}_3 + \text{HCO}_3) - (\text{Ca} + \text{Mg})$$

The suitability of ground water of study area for irrigation purpose was considered on the basis of U. S Salinity diagram in which electrical conductivity value in $\mu\text{S}/\text{cm}$ at 25°C upto $5000 \mu\text{S}/\text{cm}$ at 25°C is plotted on one axis and the SAR values upto 10 on the other. The electrical conductivity and the corresponding SAR & RSC values of each ground water sample collected from the study area is given in the **Table 8.4**, and the EC and SAR values are plotted in **Wilcox Diagram (Fig 8.2)** and **Piper (Fig 8.3)**.

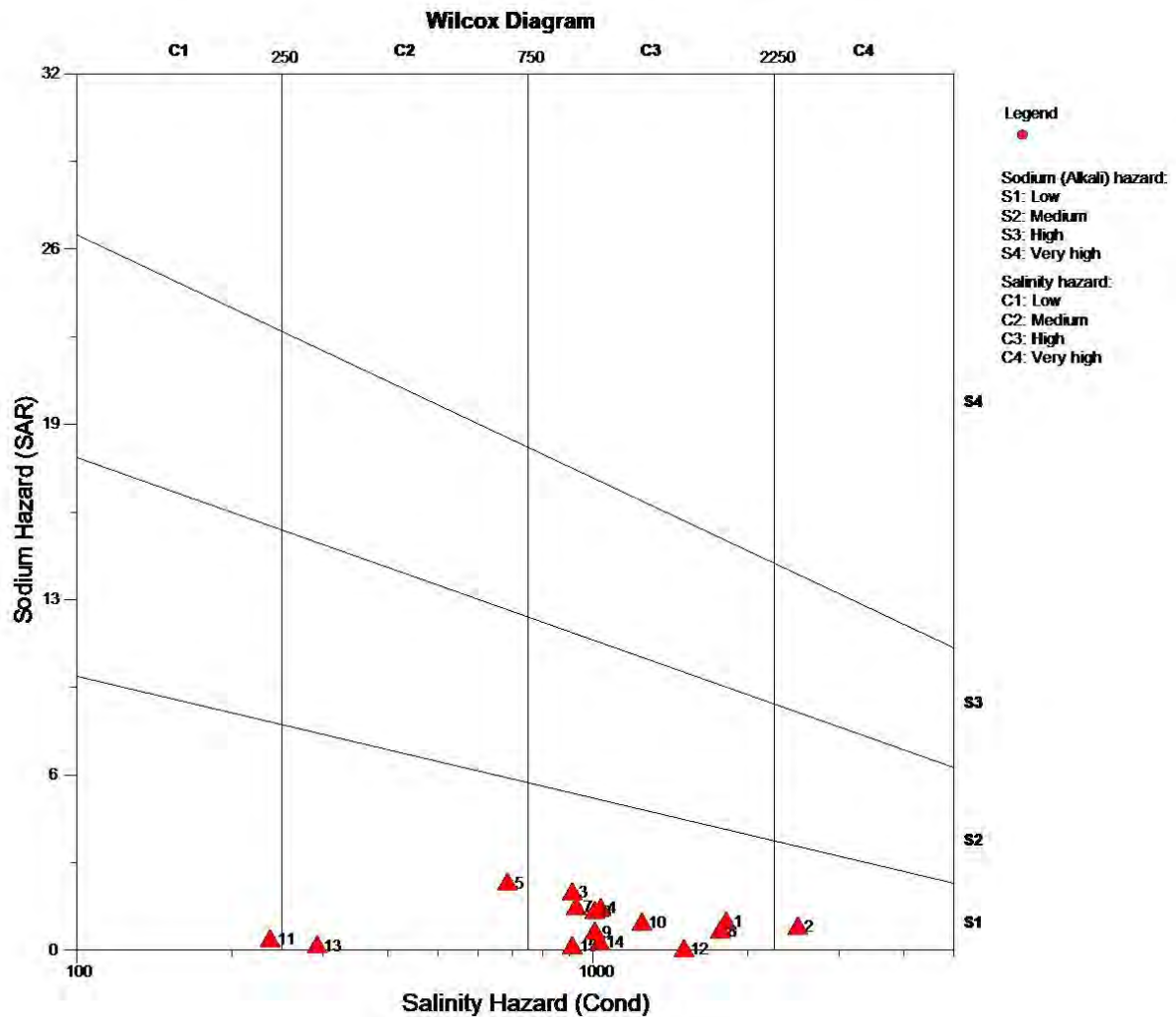


Fig 8.2: Wilcox Diagram

The number of ground water samples based on Sodium Absorption Ratio (SAR) characteristics falling under Good, Good to Permissible, Doubtful & Bad (Unsuitable) categories is shown in the following **Table 8.4**

Table 8.4: Classification of ground water for irrigation based on SAR values					
EC microsiemens/cm at 25°C		SAR Value			
		<10 (S1)	10-18 (S2)	18-26 (S3)	>26 (S4)
	Quality	Good	Good to Permissible	Doubtful	Bad (Unsuitable)
	Total No. of GW Samples	No. of samples	No. of samples	No. of samples	No. of samples

< 100	-	-	-	-	-
100-250 (C1)	1	1	-	-	-
250-750 (C2)	2	2	-	-	-
750-2250 (C3)	11	11		-	-
2250-5000 (C4)	1	1			
> 5000					
Total	15	15			
Overall Percentage		100%			

From the Table 8.4, it is observed that 100% of samples show SAR values below 10 and falling in the Low Sodium (alkali) Hazard Zone (S1). Such type of water can be used for irrigation on almost all soils with little danger of development of sodium exchangeable problem. Out of 15 samples collected from study area fourteen samples having EC above > 2250 $\mu\text{S}/\text{cm}$ at 25° and only one sample at Bhilaigarh showing EC 2503 $\mu\text{S}/\text{cm}$ at 25°.

The High Salinity Water (C3) cannot be used on soils with poor drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.

The Very High Salinity Water (C4) is not at all suitable for irrigation under ordinary conditions, but may be used occasionally if the soil is permeable by providing adequate drainage and irrigation water must be applied in excess to provide considerable leaching and very salt tolerant crops should be selected.

Based on above **table 8.4**, ground water samples are classified with respect to salinity and sodium hazard and are presented in **Table 8.5**.

Type of Classification	Characteristics	No. of samples falling	%
C1S1		1	6.67
C1S2			
C2S1	Medium salinity and low sodium water	2	13.33
C3S1	High salinity and low sodium water	11	73.33

C4S1	Very high salinity and low sodium water	1	6.67
Total		15	100

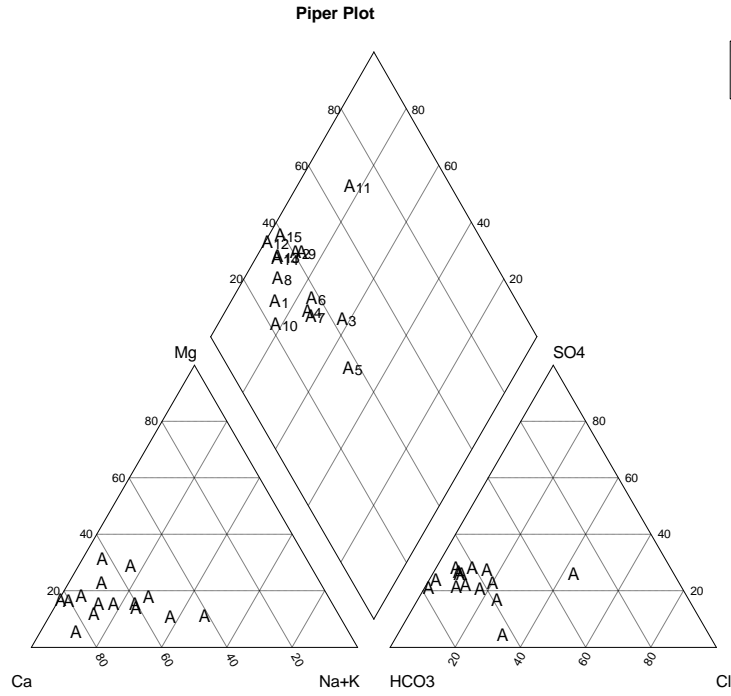


Fig 8.3: Trainer piper diagram







(Fig 8.4: Water Sampling in Plant premises and buffer Zone of the Study Area)

9. SUMMARY & CONCLUSIONS

Raigarh Energy Generation Limited (formerly known as Korba West Power Company Limited) has set up a coal based Thermal Power Plant of capacity 1x600 MW at village Chote Bhandar, Bade Bhandar, Sarvani & Amali Bhona, in Tehsil Pussore of Raigarh District.

REGL has been granted Environmental Clearance by Hon'ble MoEF&CC vide letter No. J-13012/57/2008-IA.II (T), dated 20.05.2010 and Amendment of Environmental Clearance for Coal transportation by way of Road for an interim period of three years dated 16.04.2015. However, the Railway project was not completed by KWPCCL and the company went under insolvency resolution process under the Insolvency and Bankruptcy code 16.

Hon'ble NCLT, Ahmedabad has approved the resolution plan submitted by Adani Power Ltd. for acquiring KWPCCL Vide order IA 236 of 2019 in C.P (I.B) No. 190/NCLT/AHM/2018 dated 24th June 2019 and subsequently Adani Power Ltd. Has taken over management of KWPCCL. Korba West Power Company Ltd. is 100% subsidiary of Adani Power Ltd. The name has been changed from Korba West Power Company Limited to Raigarh Energy Generation Limited.

MoEF&CC has already issued the letter for change in name of Environmental Clearance vide letter dated 22.10.2019.

The company has adopted four peripheral villages and executing most of the CSR works in those villages in the field of their livelihood, infrastructure development, cleanliness, community health and education. The Thermal Power Plant was not in operation since May'2017 due to major breakdown of generator earth failure, The unit was revived in the month of December 2019

There are 107 villages within 10 kms radius of mining lease area. The population as per 2011 Census is 104237. Scheduled Caste population of the study area (10 km) is **12395** and Scheduled Tribe is 25949, Percentage of literacy is 65%. The workers those actually engaged in occupation are 50450 Main workers are around 32923 while marginal workers are 17527 Rest of the total population, are considered as non-workers

The area is drained mainly by Mand Mahanadi and Kelo River and its tributaries namely Kutri, Pajhar and Koledenga. River flows north to south direction in the Eastern part of the study area is drain by tributaries of Kelo River. Mand and Mahanadi is a perennial river while rest of the tributaries are

ephemeral in nature. This tributary system comes under Mahanadi basin. The drainage pattern in the area is sub-parallel and dendritic in nature with high drainage density indicating the formations in the area are moderately porous and permeable in nature and are having high surface run-off. The drainage density is more or less same in the study area.

The study area is characterized by flat undulating terrain with regional slope in northern part is south towards Mahanadi and in south of Mahanadi the slope is towards north. The average elevation in the southern portion is around 210 m while in the Northeastern and northwestern parts is 230 m amsl. The average land slope of the area is works out about 4m per km from top sheets (1:50000 scale), Survey of India.

The study area is characterized by more or less flat undulating terrain with regional slope to the south and North. It has gradual and very gentle rise and fall, elevation and depressions, repetitive in nature. As a whole the area has southwesterly downward gentle gradient. The highest RL is 287m due northwest and the lowest RL is 199 m, due south part near Mahanadi River. Thus, maximum surface relief is 88m only over an aerial distance of about 18 km

In the area, ground water occurs under phreatic or unconfined condition in weathered portion of rocks and semi-confined to confined conditions in fractures/cavernous part of rocks i.e. shale and limestone at depths.

The depth to water level of Nov 2019 remains between 1.05 and 11.1 meters below ground level. The post-monsoon depths to water level range of 3 to 5 mbgl are observed at Birabhata, Madwa, Bargaon, Tilagi, Ranbhata and Chichore moria villages. Ground water levels more than 5 mbgl are observed in the villages Litaipali, Manikpur Kotasura and Tetla Water level less than 3 mbgl are observed in the 72 % of the villages and along river courses .

The depth to water level of May 2020 remains between 3.1 to 15.5 meters below ground level. The pre-monsoon depth to water levels ranges between 5 and 10 mbgl in 72.2% of the villages. Water levels more than 10 mbgl are observed in the villages namely Manikpur ,Toilagi, Kotasura and Tetla villages while in Raibor, Timarlaga, Bhilaigarh, palsada, latesara and Chhuwaripali showing water level less than 5 mbgl.

Based on the pre-monsoon & post-monsoon data water level fluctuation in the study area is calculated. It is observed that in the study area water level fluctuation varies from 1.34 to 7.25 meters. Lower range of water level fluctuation is also observed along the river course followed by > 6. 0 to 2 to 4&4 to 6.

The flow direction is of two directions i.e. in north of Mahanadi, central and northern part of the study area it is towards south and in southern part of the study area it is in north direction indicating the Mahanadi river is flowing southern portion of the study area

In the major portion of the area the yield ranges between 1 to 3 lps indicating the area is covered compact and shallow weathered shale while in rest of the area it is 1 to 5 lps covered with fractured shale.

In the study area both shallow and deep aquifer occurs. The shallow aquifers of the study area occur within an average depth of 20m. In general the yield of dug wells ranges from 40 to 60 m³/day. Deep aquifer system in the area mainly formed by the Raigarh formation which comprises of shale & limestone. The deep aquifers of the area are mostly developed by way of borewells in the area whose depth varies from 60 to 80m. Alluvium formation in the area are more productive & yield around 1 to 5 lps, while shale in the area along & nearby river courses yield 1 to 3 lps of water.

The aquifer parameters of the study area covered by shale for deep aquifer the transmissivity values of phreatic aquifer tapped in open well in general varies from 4 to 25 m²/day while specific capacity ranges from 15 to 40 lpm/m/day. However for deep aquifer the transmissivity ranges from 15-32 m²/day and at places it ranges up to 40 m²/day. The potential fractures for boreholes up to 100 mbgl depth in the area are recorded at various depths i.e. 40-45, 60-65, 75-80, 90-95 mbgl and are 4 to 5 in numbers.

The ground water sources within 10 km of radius estimated on the basis of norms as per GEC'2015 indicate that the total groundwater resource of the present study area is of the order of 3912.4 Ham while the total extractable ground water resources in the area are of the order of 3521.2 Ham. Gross ground water extraction in the area is around 2703.28 Ham while Balance groundwater resources are 817.92 Ham. The stage of ground water extraction in the area is around 76.77 % which comes in "SEMI-CRITICAL" category.

The detailed chemical analysis for water samples drawn at Five locations at plant area (Fly Ash ponds, reservoir pond) and 10 villages of buffer zone for non-metallic ingredients like pH, Turbidity, TDS, TSS, CaCO₃, Ca, Cl, Mg, SO₄ & SiO₂ and metallic ingredients like Pb, Hg, Ag, Mn, Zn, Fe, & Cr etc. were done in-2020. The data indicates that the ground water quality is improved in downstream for most of metallic and non-metallic ingredients and most of the ingredients are in permissible limit as per IS:10500-2012.

It is observed that 100% of samples show SAR values below 10 and falling in the Low Sodium (alkali) Hazard Zone (S1). Such type of water can be used for irrigation on almost all soils with little danger of development of sodium exchangeable problem. Out of 15 samples collected from study area fourteen

samples having EC above $> 2250 \mu\text{S}/\text{cm}$ at 25° and only one sample at Bhilaigarh showing EC $2503 \mu\text{S}/\text{cm}$ at 25° .

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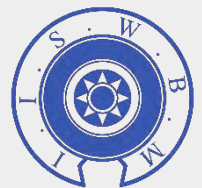
The Very High Salinity Water (C4) is not at all suitable for irrigation under ordinary conditions, but may be used occasionally if the soil is permeable by providing adequate drainage and irrigation water must be applied in excess to provide considerable leaching and very salt tolerant crops should be selected.

The present study reveals that there is no adverse impact of Fly Ash ponds on ground water regime of the area both on water levels as well as water quality.

ANNEXURE - V

**SOCIAL AUDIT & SOCIAL IMPACT EVALUATION OF
CSR ACTIVITIES OF
RAIGARH ENERGY GENERATION LIMITED**

Executed By



IISWBM

November 2020

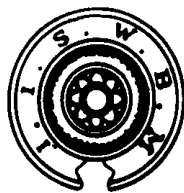
**SOCIAL AUDIT AND SOCIAL IMPACT EVALUATION
OF CSR ACTIVITIES OF RAIGARH ENERGY
GENERATION LIMITED**



**RAIGARH ENERGY GENERATION LIMITED
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Document No. IISWBM/IRP/SA-REGL/2020/01 Dated 20/11/2020 V1.1

Executed by



**Indian Institute of Social Welfare
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November, 2020

FOREWORD

The Adani Group has made foray into high growth sector like Power, Infrastructure, Global Trading, Logistics, and Energy. Adani Power Limited (APL) has recently acquired 1 x 600 MW Coal-based Super Critical Thermal Power Plant of Korba West Power Company Ltd (KWPC), Raigarh in the State of Chhattisgarh and changed name is Raipur Energy Generation Limited (REGL). With reference to the Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India (GoI), Environmental Clearance (EC) Social Audit for the CSR Schemes shall be carried out periodically as per the CSR guidelines of Government of India. Accordingly, they engaged Indian Institute of Social Welfare and Business Management (IISWBM), Kolkata to undertake Social Audit & Social Impact Evaluation of CSR activities undertaken during last five years i.e. 2015-16 to 2019-20.

The prime aims of the present study were to evaluate the social impact of CSR activities undertaken in and around the vicinity of the REGL's TPP area for upliftment of quality of life of local people of the neighboring villages.

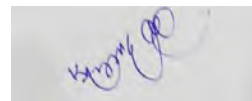
IISWBM was required to conduct field survey including public consultation, collect primary and secondary data on the basis of structured questionnaires to evaluate the social impact. This report presents the detail of CSR activities undertaken during the last five years and its impact on community development and improvement of quality of life of local people. The present social audit reveals that CSR Activities are being implemented with a result based approach and community is very satisfied.

The cooperation and guidance received from Shri Rambhav Gattu, Station Head, REGL&REL; Shri Samir Kumar Mitra, Plant Head, REGL; Shri Amit Kr. Soni, Head (Environment), REL; Shri Purnendu Kumar, REGL and other executives & officers of REGL in conducting this study are highly acknowledged.

This study would have not been possible without the constant support and guidance of Executives of Adani Power Limited. We are grateful to acknowledge the constant guidance and support extended by Shri Santosh Singh, Sr. VP, Corporate Environment Group and Shri R. N. Shukla, AGM, Corporate Environment Group, Adani Power Limited as well as their officers and staff.

We would also extend a warm thanks to the members of local village panchayats, anganbadi workers, village school teachers, students, parents, farmers and other beneficiaries from covered villages, all who contributed magnanimously to our study with their comments and insights.

Kolkata
November 20, 2020



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LIST OF ABBREVIATIONS

ABBREVIATION DESCRIPTION

APL	: Adani Power Limited
AF	: Adani Foundation
BDO	: Block Development Officer
BPL	: Below Poverty Line
CHC	: Community Health Centre
CPRs	: Common Property Resources
CSR	: Corporate Social Responsibility
EHS	: Environment, Health & Safety
FGDs	: Focus Group Discussions
GP	: Gram Panchayet
HSC	: Health Sub-Centre
ICDS	: Integrated Child Development Services
ITI	: Industrial Training Institute
Ha	: Hectare
HH	: Household
IISWBM	: Indian Institute of Social Welfare & Business Management
IMR	: Infant Mortality Rate
KWPCL	: Korba West Power Company Limited
MoEF&CC	: Ministry of Environment, Forests & Climate Change
MMR	: Maternal Mortality Rate
MTPA	: Metric Tonne per Annum
MW	: Megawatt
NFHS	: National Family Health Survey
NGOs	: Non-Governmental Organizations
O&M	: Operation & Maintenance
OBC	: Other Backward Class
PAPs	: Project Affected Persons
PAFs	: Project Affected Families
PAVs	: Project Affected Villages
PC	: Public Consultation
PHC	: Primary Health Centre
PRA	: Participatory Rural Appraisal
QoL	: Quality of Life
QoC	: Cumulative Quality of Life
R&R	: Resettlement & Rehabilitation

ABBREVIATION DESCRIPTION

RAP	: Resettlement Action Plan
REGL	: Raigarh Energy Generation Limited
RRA	: Rapid Rural Appraisal
SA	: Social Audit
SC	: Scheduled Caste
SES	: Socio-Economic Survey
SHG	: Self Help Group
SIA	: Social Impact Assessment
SIE	: Social Impact Evaluation
SPCB	: State Pollution Control Board
ST	: Scheduled Tribe
TFR	: Total Fertility Rate
TPP	: Thermal Power Plant
TSC	: Total Sanitation Campaign
TPP	: Thermal Power Plant
ULBs	: Urban Local Bodies
VDAC	: Village Development Advisory Committee
VFCs	: Value Function Curves
ZP	: Zila Parishad

EXECUTIVE SUMMARY

1.0 INTRODUCTION

The Adani Group (1988) has grown from being a trading house to a diversified business group with interests from infrastructural development to FMCGs. The Adani Group has made foray into high growth sector like Power, Infrastructure, Global Trading, Logistics and Energy.

Adani Power Limited has recently acquired 1 x 600 MW Thermal Power Plant of Korba West Power Company Ltd (KWPC), Raigarh in the State of Chhattisgarh and changed name is Raigarh Energy Generation Limited (REGL). With reference to the Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India (GoI), Environmental Clearance (EC) for 1x600 MW TPP Social Audit for the CSR Schemes shall be carried out periodically as per the CSR guidelines of Government of India. Accordingly, in compliance to the conditions of MoEF&CC's EC for TPP of REGL Social Audit & Social Impact Assessment Study have been carried out.

The salient features of 600 MW (1 × 600 MW) coal based super critical thermal power plant of Raigarh Energy Generation Limited (REGL), a wholly owned company of Adani Power Limited (APL) are presented in following table:

Item	Particulars
Location of the Plant	Village: Chote Bhandar, Bade Bhandar, Sarvani & Amali Bhona, Block: Pussore, District: Raigarh, State: Chhattisgarh
Net capacity	600 MW
No. of Units and configuration	1 x 600 MW
Date of Commercial Operation (COD)	2013
Technology	
Steam Generator	Super critical Pressure 255 kg /cm ² Temperature 571°C
Turbo Generator	Turbine -246 kg/cm ² (a), 563°C, 3000 rpm Generator - 685 MW (Each unit) Generator Transformer - 776 MVA
Major Auxiliary System	<ul style="list-style-type: none"> • Boiler & Turbine Auxiliaries • Pre-treatment Plant • Compressed Air System • Coal and Ash Handling System • CW System and Raw Water System



Item	Particulars
	<ul style="list-style-type: none"> • Fire-fighting System • Air conditioning System • Ventilation System
Stack Details	
No. of Stack	1
Stack Height (meter)	275 each
No. of flue	Single flue
Additional equipment	Electrostatic Precipitator
Coal	Indigenous Coal – 2.0 MTPA Transportation: Railways/Road
Land	
Plant Land Area	487.00 Acre
Water	
Cooling Technology	Natural draft cooling system
Total Water Requirement	15 MCM (withdraw 10 MCM)
Total Discharge	'Zero Discharge Norm' is being followed
General Information	
Manpower Requirement (Total)	Approx 150
Project Cost	Rs 3,600 crores

Objectives of Study

The aims of the proposed social audit are to evaluate social impact of CSR activities undertaken in and around the vicinity of the REGL's TPP area for upliftment of quality of life of local people of the neighbouring villages. The prime objectives of the study includes:

- To assess the baseline status of key social parameters around the REGL's TPP site;
- To evaluate the social impact of the TPP based on the available secondary data and information generated during the study/survey;
- To present all potential significant social impacts and local employable youth for training in skills, relevant to the project;
- To undertake detailed social audit of CSR Activities undertaken by REGL in last five years.



Scope of Study

The scope of study includes:

- 1) Social Audit & Social Impact Evaluation Survey/study.
- 2) Action plan for identification of local employable youth for training in skills, relevant to the project.
- 3) Evaluation of Socio-economic profile of the CSR villages.
- 4) Public consultation in selected Panchayat/villages to ascertain the public views on various social and local issues.
- 5) Gap analysis and comparison of last five years for local development as well as social upliftment of local society.

Detail of REGL-CSR Zone

The REGL's Thermal Power Plant (TPP) is located at Bade Bhandar Village under Pusore Block/Tehsil of Raigarh District, Chhattisgarh. The REGL-CSR zone primarily falls under Pusour and Barmakhela Blocks of Raigarh District as well as partially under Dabhra Block of Janjgir-Champa District under Chattisgarh State. The analysis of the CSR villages reveal that out of total 127 villages, 3.15% (4 villages) are falling under core zone and 21.25% (27 villages) are under Buffer Zone-I (i.e. 5 km radius of TPP) and remaining (i.e. 75.6%) in Buffer Zone-II (i.e. 5-10 km radius of TPP).

2.0 PRINCIPLES & GUIDELINES FOR SA & SIE

Social Impact Evaluation basically means the evaluation of qualitative and quantitative impact of the Community Development Programme carried out by the organization on the community. The evaluation includes assessment of the physical changes that have taken place during an identified span of time because of the activities undertaken as well as the awareness and perception of the people for whom the activities were aimed. The impact could be short term or / and long term. It could be on the economic aspect or the socio-cultural aspect or on both the aspects. This impact would vary depending upon the efficiency and effectiveness of the CD activities carried out and the social/physical infrastructure provided to the Community.

Adani Power Limited (APL) has always been committed to the cause of social service and has repeatedly channelized a part of its resources and activities, such that it positively affects the society socially, ethically and also environmentally. The company has taken up various CSR initiatives and enhanced values in the society.



With the advent of the Companies Act, 2013 constitution of a Corporate Social Responsibility Committee of the Board and formulation of a CSR policy became a mandatory requirement. Accordingly, the company has formulated a robust CSR policy which encompasses its philosophy and guides its sustained efforts for undertaking and supporting socially useful programmes for the welfare and sustainable development of the society. The CSR policy of APL was approved by the Board of Directors on 6th August, 2014.

Social auditing is a process that enables an organisation to assess and demonstrate its social, economic, and environmental benefits and limitations. It is a way of measuring the extent to which an organisation lives up to the shared values and objectives it has committed itself to. Social auditing also provides an assessment of the impact of an organisation's non-financial objectives through systematically and regularly monitoring its performance and the views of its stakeholders. Social auditing requires the involvement of stakeholders. This may include employees, clients, volunteers, funders, contractors, suppliers and local residents interested in the organisation. Stakeholders are defined as those persons or organisations who have an interest in, or who have invested resources in, the organisation.

3.0 METHODS & TOOLS FOR SA & SIE

The Social Audit (SA) & Social Impact Evaluation (SIE) has been conducted using primary data as well as secondary data available with the Districts & Blocks as well as APL and REGL. Interview with the local people and discussions with community, Government officials and community based organizations of the area were an important component of the study.

The sample villages were selected representing whole CSR region of the REGL's TPP for the present study. We have used both primary and secondary data for the study. The secondary data have been collected from the various source, namely, Census of India, Health Department, Education department, office of ICDS, Statistical department of the concerned district. The primary data have been collected from the beneficiaries of different programmes, Local community, Representatives of Gram Panchayets etc. from selected villages. The overall impact of CSR activities has been assessed for the last five years i.e. 2015-2016 to 2019-2020.

As discussed earlier the framework for Social Audit was evolved including Social Process Method clubbed with Activity Analysis Approach. This uses SA4P focus system that assesses an activity around 4Ps viz. Policy, People, Process, Programmes. The individual weightage against these factors shall sum up to gross assessment measurable figure on a pre framed scale. The impact assessment matrix was evolved considering following factors:

- Design Quality
- Measurable Quantitative Progress - Days/Coverage/Change in Income/Money saved /Mandays etc.



- Programme Approach
- Satisfaction of Stakeholders

A kick-off meeting was organised on 16th September, 2020 to discuss the modalities for initiating the social audit and social impact evaluation study and logistic support required for the same under the guidance of Shri R. N. Shukla, Corporate Environment Group, APL and Shri Amit Kr. Soni, Head (Environment), REGL and Shri Purnendu Kumar, CSR Head, REGL with IISWBM team members. The field survey and data collection was undertaken between September - October, 2020. The series of public consultation meeting conducted involving Sarpanch/ Upsarpanch/ member of Gram Panchayet along with the local people to evaluate the social impact of setting up and operation of REGL's TPP along with the evaluation of social impact of CSR activities undertaken by AF-REGL during the last five years i.e. 2015-16 to 2019-20 as well as their suggestions for improving the quality of life of local people in all the core as well as buffer zone villages falling within the 10 km radius of the REGL's Thermal Power Plant.

4.0 SOCIO-ECONOMIC PROFILE OF CSR ZONE

The Socio-economic profile of REGL's CSR zone have been assessed using primary as well as secondary available with the Districts & Blocks as well as APL and REGL. PRA/RRA techniques were also adopted for the purpose.

The analysis of demographic profile of villages falling within the REGL-CSR Zone reveals that total number of households i.e. 29,277 and population of i.e. 1,08,888 in CSR Zone only 764 household with population of 2800 in core zone villages. Gender wise distribution of population in CSR villages reveals that 50.38% of the population are male and remaining 49.62% are female in the REGL-CSR zone. Analysis of status of child population (0-6 years) in REGL-CSR zone reveals that 11.27% are children (0-6 years) of total population in CSR zone. The analysis further shows that the sex ratio among child population is comparatively higher i.e. 985 females per 1000 male as compared to overall sex ratio i.e. 913 females per 1000 male in CSR zone. The analysis of distribution of SC & ST population reveals that 13.5% is scheduled caste and 25.33% are scheduled tribe of total population in REGL CSR zone. Overall status of literacy in CSR zone is 76.01% .

The analysis of status of workers in villages falling under CSR zone shows that out of total working population, 62.48% are main workers and remaining 37.52% are marginal workers. It also reveals that 32.36% are cultivators, 49.75% are agricultural labours, 1.62% are engaged in household industries and remaining 16.27% of the total main workers are other workers in the CSR zone. Whereas majority (68.22%) are agricultural labours followed by cultivators (20.56%) of the total marginal workers in the CSR zone.

For assessing the existing status of basic amenities and infrastructure development viz., educational facilities, drinking water, health and sanitation facilities, road and communication



facilities, agricultural development facilities, skill development, etc., field survey was conducted in the 66 CSR villages falling under 3 Blocks, namely Pusour and Raigarh Blocks of Raigarh district and Dabhra Block of Jajgir-Champa district under Chattisgarh State.

5.0 DETAIL OF CSR ACTIVITIES UNDERTAKEN

Korba West Power Company Limited (KWPCCL) a 1X600 MW supercritical thermal Power plant has been acquired by Adani Power Limited in June 2019 and acknowledged as Raigarh Energy Generation Limited (REGL). KWPCCL had run CSR activities since from August 2008. Raigarh Energy Generation Limited-Adani Foundation (REGL-AF) a CSR arm of Adani Group, has taken over CSR activities of KWPCCL.

As per the APL CSR policy AF-REGL has undertaken various activities for providing sustainable livelihood and strengthening basic amenities & infrastructural facilities at villages of CSR zone REGL. The major emphasis is being given in rural infrastructure development, sustainable livelihood development and strengthening the educational facilities in terms of providing infrastructural supports at primary as well as the secondary schools of REGL CSR zone. Besides improving the infrastructural facilities at educational institutions, the study materials, scholarships, etc. were also provided. For undertaking the CSR activities at CSR zones, the emphasis were also given in improving drinking water and health, hygiene & sanitation facilities, etc. for villages of CSR zone.

CSR activities commenced in the REGL CSR Zone since 2008-2009. It may be pertinent to mention here that due to major breakdown of the generator plant was not in operation from May, 2017 to December 2019. There were no significant CSR activities during the FY 2018-19 and FY 2019-20 as all CSR activities suspended after breakdown of the generator as it was not possible to carry out the same due to adverse financial situation.

The REGL-AF follows the philanthropic scope of activities for sustainable community development. The CSR Programme matrix with sectors vis-à-vis the stakeholders covered under them are presented in subsequent table:



Sector	Strategic Focus	Interventions	Stakeholders
EDUCATION	Quality Improvement	Mobile library, Learn to read, Read to learn, cultural programs, activity based learning with primary school children, Science learning through Lab-in-box program, Promotion of sports and games for school children, placement of community teachers in government schools.	Children- Students , College going girls, Anganwadi Children and Staff, Parents, School Staff, School Management , Village Panchayat Representatives
	Infrastructure Supplementation	School Infrastructure Improvement, Drinking Water for School, Anganwadi Improvements.	
HEALTH, HYGIENE & SANITATION	Preventive Health and Diagnostics and Hygiene & Sanitation	Health Awareness Camps, Community Dispensaries, Organizing various activities in coordination with ICDS for service improvement at Aganwadi center- training to AWWs and helpers, updating growth monitoring chart, health education sessions, regularization of MangalDiwas, Godbharai etc., Strengthening of Mahtaripanchayat, Observed National Nutrition Week, World Breast Feeding Week, National Girl Child Day, Support (tricycles, etc) to physically challenged persons, General health camps, Fogging in CSR villages for mosquito control, Supply of Mason and helper for construction of individual household toilets.	Villagers , Children, Pregnant Women, School Children, Doctors, Mitanin, Victims of accidents, Patients, Village Panchayat Representatives



Sector	Strategic Focus	Interventions	Stakeholders
	Curative Health and Emergency Services	Extend services of OHC Ambulance in emergency for local community, Malnutrition Intervention	
SUSTAINABLE LIVELIHOODS	Alternate Livelihood & Empowerment	Formation and strengthening of SHGs, Capacity building of SHG members on Functions of SHGs, accounts and book keeping, leadership training, Training and exposure visits on income generating activities like poultry farming, mushroom cultivation, Extension of revolving fund for income generating activities like poultry farming, mushroom cultivation, vegetable cultivation etc., Formation of women's cooperative society (registered under cooperative society's act) to run income generating activities, Tailoring training to women and girls, Farmers training on "SRI" and improved agricultural practices, Promotion of "SRI" method for paddy cultivation. Skill training to youths on driving training, ITI training and construction skill training, Breed development of cattle through artificial insemination, Training to farmers on cattle management and feeding practices, Veterinary services in villages, Organization of	Women, Unemployed Youth (men & women), Farmers, Disabled Individuals



Sector	Strategic Focus	Interventions	Stakeholders
		veterinary camps for cattle, Promotion of nutritional supplements for cattle, Demonstration for fodder development in villages, Dairy development, Linkages with CG Milk Cooperative Federation for marketing of milk.	
Rural Infrastructure Development	Improving availability of basic amenities and infrastructure facilities	Deepening & renovation of Ponds in villages, Bore wells with pumps for drinking water, Construction of water tanks, Construction of cement concrete roads in villages, Construction of Community centres, Construction of Sanskritik manch, Construction of class rooms, boundary wall of schools and Aganwadi Centre, Levelling of school ground, Support for construction of Temple, Construction of police transit hall, Repair of tribal hostel, Repair of solar lights of tribal hostels.	Villagers community, School-College Students & Staff, Anganwadi Children and Staff, Parents, Tribal community Village Panchayat Representatives

The prime CSR activities undertaken includes:

- ❖ Since beginning of the project, app. Rs 21.60 Cr invested under Corporate Social Responsibility, spread in 76 villages of 43 panchayats covering app. 60 thousand population of Pussore block, Raigarh district and Dabhra block of Janjgir-Champa district,
- ❖ Rs. 6.52 Cr invested for community development in 17 tribal populated villages,
- ❖ 56 PAPs were trained in ITI fitter and electrician trade and given employment as operator in the plant,
- ❖ Three cooperative societies formed to engage villagers in alternate livelihood activities namely,



- Gram Vikas Kamgar Sahkari Samiti - 85 PAPs are engaged through this society, carrying out housekeeping and green belt development work in the plant premises,
 - Dairy Cooperative Society - group of 25 dairy farmers linked with CG state dairy society for collection and marketing of the milk, app. 200 litres of milk sold per day,
 - Mahanadi Bahudesiye Sahkari Samiti – it is a women run society for various income generating activities,
- ❖ Developing infrastructure is essential for sustaining and multiplying growth of the society. Having the need and immediate expectations of the community, various infrastructure development activities undertaken in the villages –
- 38 ponds were excavated in 29 peripheral villages enhancing the water catchment area of the existing pond,
 - Pond deepening and beautification were done for Jaisingh talab Raigarh, Turki talab, Sarangarh and Chandan talab, Pussore,
 - 63 bore wells with pumps were installed for safe drinking water in 44 villages and 36 water tanks constructed in 30 villages,
 - App. 32 km cement concrete road constructed in 48 villages to ease movement in the villages,
 - Construction of schools boundary wall, community sheds, table chairs in the school, repair of school hostels, etc. were executed in villages,
- ❖ Livelihood and Skill Enhancement –
- SHGs - 1078 women associated with 99 SHGs, formed cooperative society
 - Best Agricultural Practices – SRI, vegetable promotion, mushroom production
 - Livestock development – app. 900 farmers trained, >4000 cattle treated in 42 vet camps, breed dev. (240 Cross Breed calves born). dairy promotion (app.150 lit. milk collected and sold every day)
 - Skill development – ITI training(58nos.), Driving training(67nos.), construction skill training (20nos.), tailoring training (502), poultry farming(37nos.); Total 684 trained
 - Cooperative society (Gram Vikas) formed to engage PAPs – 93 persons engaged
- ❖ Education support program –
- Remedial Classes for primary school children – community sensitization program



- > 2500 school children from 20 Govt. Middle Schools benefitted from activity based science learning program
 - Sports and games with school children
 - Placement of community teachers in Govt. High Schools on district admin directives
- ❖ Community Health Care program –
- Impacted 5163 mothers, children and adolescent girls of 78 AWCs in 50 villages
 - > 1000 Patients received treatment in health check-up camps
 - Fogging – measures to control mosquito borne diseases in 4 villages
 - Financial support for critical illness to the most needy people on request
 - Extended services of Ambulance in emergencies for community
- ❖ Cultural and sports promotion –
- Sports and games promoted among local youths – organized Football, Volleyball, Kabbadi tournament
 - Community Connect – attended religious functions in the villages
 - Contributed to cultural programs organized by district administration

REGL received awards and accolades from Think India and India CSR for “Livelihood project” and “women’s empowerment”. District Administration also recognized REGL contribution towards its support to Chakradhar Samaroh and response to flood relief and activities.

During the year 2015-16 to 2017-18 REGL invested fund in diversified programme. The fund expended during this period in various CSR activities was INR 129.44 lakhs. Whereas as mentioned in earlier section that due to major breakdown of the generator plant was not in operation from May, 2017 to December 2019 therefore no significant fund was allocated for CSR activities during the FY 2018-19 and FY 2019-20 due to adverse financial situation. Out of that around 38% fund was invested for infrastructure development activities different villages within 10 km periphery of TPP. Considering the need of the local area as well as the community expectation the maximum emphasis was on construction of CC roads, deepening of ponds, construction of bore well, water tanks, school roads and support for temple construction etc. The expenditure incurred for strengthening education facilities accounts for about 39.88% of total CSR fund followed by sustainable livelihood development which accounted for 20 % of total CSR fund.



6.0 SOCIAL AUDIT OF CSR ACTIVITIES

APL has always endeavoured to be a leader in community development (CD) and corporate performance, which can be measured in terms of economic, social, and environmental impacts. Further, specifically on CD, APL is governed by the CSR policy formulated in August, 2014. APL CSR policy is primarily governed by Section 135 of the Companies Act, 2013.

The social audit of CSR activities have been undertaken for the last five years i.e. 2015-16 to 2019-20. The comprehensive profile of all CSR activities illustrate the following two types of programmes and target groups:

- i) Activities targeted to individual persons like students, physically challenged persons, women, unemployed youth, etc.; and
- ii) Activities targeted on whole community, namely, infrastructure works, support provided to resource-poor institution (school, colleges, Panchayets, etc.), entertainment, health and sanitation etc.

The AF-REGL undertook CSR activities under two heads, one being the individual beneficiary oriented programmes and other being community beneficiary oriented programmes. Under the individual beneficiary oriented schemes like providing scholarships, free education, skill development training, computer training, medical surgery, family planning, provision of tri-cycle, special shoes and hearing aids for handicapped were given. With the provision of scholarship, free education and aids for handicapped, there has been a rise in the sense of solidarity and self-dependence among the beneficiaries. Skill development training for women and girls has helped in capacitating them with skills and opened avenues for earning opportunities. Many of these women and girls have now opened up their business at home which is providing additional income to support their family besides economically empowering them. ASDC and other training has helped several beneficiaries to make self-reliant. The skill development training has made remarkable impact in terms of providing greater job opportunities especially to vulnerable group of people. The significant number of women in adjacent villages are motivated to scale up their business of mushroom cultivation, poultry farming, tailoring & garment manufacturing. The adoption of SRI technique for paddy cultivation along with livestock development and vermicomposting has increased crop yield significantly in the REGL-CSR zone. The beneficiaries of free surgery/operation support have now been able to resume their household responsibilities. The AF-REGL through promotion of female sterilization has been able to encourage small family potential benefits to local people.

Some of the benefits provided by the AF-REGL for any particular village were also availed directly or indirectly by other villagers. Deepening of pond and streams and bus shelters for passengers have proved to be useful not only for the residents of the particular village, but also



for all the other villagers who access these facilities. The problems of villagers with regard to water logging and swampy filthy areas have been solved with construction of drains at various villages. With construction of school buildings/classroom and better sanitation facilities including development of playground, the expected results have been achieved to enhance the learning ambience in the educational institutions. With building up of school boundaries, safety of children in the school has enhanced. With the commencement and subsequent strengthening of health services in almost all the CSR villages, the health status of local people has improved significantly. With maintenance and renovation of schools and cleaning of drains, there has been a positive impact on the atmosphere of the villages.

The AF-REGL has done commendable work in ensuring the provision of clean potable drinking water to villagers. In several adjoining villages, Bore wells and water tanks have been installed and being maintained by local people effectively. This has helped in solving the problem of shortage of water availability to great extent.

Besides the regular mobile health care unit services to various CSR villages, every year the AF-REGL also conducts various health camps in different villages where people from the nearby villages also come to get free medical check-up. In these camps medical check-ups and advice or consultation by specialized doctors is provided. Seasonal ailments are treated and free medicines are distributed. Patients suffering from serious ailments are either sent to REGL hospital or are referred to other hospitals. Such camps have had positive impact on the lives of the people who are now not only relieved of seasonal diseases but are also diagnosed for complicated ailments.

The live-stock development centres have been setup for improving the status of live-stock. From time to time health camps for livestock are also organized wherein villagers from the concerned villages as well as nearby villages come for free medical treatment and advice. Apart from free medical check-ups and medicines, other facilities like artificial insemination methods and vaccines are also provided. With these camps being organized from time to time, the livestock mortality rates have gone down.

Sports competitions are also conducted/sponsored by AF-REGL regularly at various villages/town. Football, Volleyball, Kabaddi, Cricket, race, high jump, short puts throw and several other games are organized. The AF-REGL bears the expenses of providing players uniforms, conveyance charges, food, etc. The winners are given medals and trophies. These tournaments have very positive impact on the local youths interested in games and sports. This not only enhances their interest in games and sports but also gives them recognition. Apart from this, AF-REGL has provided computer, chairs, tables, sittings mats and games and sports appliances for schools. All the activities conducted in the selected villages under CSR were need-based and have had positive impact on the lives of the people.



7.0 SOCIAL AUDIT IMPACT MATRIX

Social Audit team applied tools to gather first hand response from the stakeholders including the implementing staff from the REGL-AF. The findings are classified in the 4 thrust areas – Rural Infrastructure Development (Improvement of availability of basic amenities); Education (Quality Improvement, Infrastructure supplementation, HR Support); Community Health and Sanitation (Preventive and Curative measures); Sustainable Livelihoods Development (Youth, Farmers, Women and Groups). In each of the segments selected sample units were considered to study the programme design, implementation approach, reception and impact among the beneficiaries. These sample units are quantitatively and qualitatively assessed as per the scheme of social audit as elaborated in earlier chapters.

The present social audit conducted for CSR activities undertaken during 2015-16 to 2019-20 on the basis of above mentioned framework. The overall summary of impact assessment matrix is presented in subsequent table:

Sl. No.	Description	Total Score	Score Obtained	% of Score
1	CSR Policy, Process & Programme	3000	2531.51	84.38
2	CSR Activities Under Rural Infrastructure Programme	2000	1753.33	87.66
3	CSR Activities Under Education Programme	1500	1271.63	84.77
4	CSR Activities Under Health and Sanitation Programme	1500	1049.99	69.99
5	CSR Activities Under Sustainable Livelihood Programme	2000	1694.40	84.72
Grand Total		10000	8300.83	83.00

CSR Activities are being implemented with a result based approach. Good indicators are being maintained. Community is satisfied. Quantitative Indicators exhibit a healthy level at 8300 of 10000 scale. Qualitative indicators meet satisfaction of the beneficiaries in the grade of 80% and above.

Since the SA point weight 8300.83 is in band 7500-10000 it is termed as – Sustainably Excellent. This indicates that the current position has the potential to improve, however it has gained basic strength to deliver. More value addition strategies need to be implied with the core approach in time to come. There is an increase of about 8 % against social audit impact score of 2014-15.



1.0 INTRODUCTION

1.1 PROLOGUE

The Adani Group (1988) has grown from being a trading house to a diversified business group with interests from infrastructural development to FMCGs. The Adani Group has made foray into high growth sector like Power, Infrastructure, Global Trading, Logistics and Energy.

Adani Power Limited (APL), a member of the Adani Group, has taken up implementation of large Thermal Power Projects at various locations in India in view of the growing needs of power requirements in the country. APL is also actively planning to implement Thermal Power Stations at various locations in India, totaling to about 20,000 MW in the coming years.

Adani Power Limited has taken over Raigarh Energy Generation Limited (REGL) erstwhile Korba West Power Company Limited (KWPC) 1 x 600 MW Thermal Power Plant, through the insolvency proceedings by Hon'ble National Company Law Tribunal, Ahmedabad Bench vide order dt. 24.06.2019. Since commissioning of the unit, the erstwhile company Korba West Company Limited, in absence of PPA, was making recurring losses and facing severe financial constraint. During this critical juncture, unfortunately there was breakdown of generator on 22.05.2017 which further thrown serious challenges, with these reasons the erstwhile company underwent through Insolvency & Bankruptcy Code 2016 for insolvency proceedings by Hon'ble National Company Law Tribunal, Ahmedabad Bench. Currently, REGL is putting best efforts towards revival of the unit.

With reference to the Ministry of Environment & Forest (MoEF), Government of India (GoI), Environmental Clearance (EC) for 1x600 MW TPP Social Audit for the CSR Schemes shall be carried out periodically as per the CSR guidelines of Government of India and Details to be submitted to MoEF besides putting it on company's website. Accordingly, in compliance to the conditions of MoEF's EC for TPP of REGL Social Audit & Social Impact Assessment Study need to be carried out.

The proposed study would enable Raigarh Energy Generation Limited (REGL) to meet the requirement of MoEF's EC compliance besides meeting its mission of being socially responsible corporate entity with thrust on community development around its Thermal Power Plant at Bade Bhandar under Pussor Block of Raigarh District in Chhattisgarh.



1.2 PROJECT DETAIL

A 600 MW (1 × 600 MW) coal based super critical thermal power plant of Korba West Power Company Limited (KWPCCL) has been recently acquired by Raigarh Energy Generation Limited (REGL), a wholly owned company of Adani Power Limited (APL). The location of REGL's TPP is presented in Figure 1.1 and 1.2. The TPP is located at a distance of 21 km North of Raigarh town. The project sites (i.e. main plant as well as water intake well) are situated in the geographical coordinates between N 21°43'52.57" – 21°44'53.37" latitude, and E 83°15'55.52" – 83°16'45.37" longitude and covered by the Survey of India Toposheets No. 64 O/1, 64 O/2, 64O/5 & 64 O/6. The Project site is located in the vicinity of the rivers, Mand about 3 km towards west, and Mahanadi River about 5 km towards south, on their left banks.

The brief description of the plant is presented in Table 1.1. Figure 1.3 and 1.4 presents layout and configuration of REGL's TPP. In addition to coal, LDO and HFO are used as an auxiliary liquid fuel. Light Diesel Oil (LDO) is used for cold start up and HFO is used for flame stabilization at lower load. The main plant is arranged within the three interconnected structures, the boiler, turbine building & integrated control and electrical building.

TABLE 1.1: SALIENT FEATURES OF REGL's TPP

Item	Particulars
Location of the Plant	Village: Chote Bhandar, Bade Bhandar, Sarvani & Amali Bhona, Block: Pussore, District: Raigarh, State: Chhattisgarh
Net capacity	600 MW
No. of Units and configuration	1 x 600 MW
Date of Commercial Operation (COD)	2013
Technology	
Steam Generator	Super critical Pressure 255 kg /cm ² Temperature 571°C
Turbo Generator	Turbine -246 kg/cm ² (a), 563°C, 3000 rpm Generator - 685 MW (Each unit) Generator Transformer - 776 MVA
Major Auxiliary System	<ul style="list-style-type: none"> • Boiler & Turbine Auxiliaries • Pre-treatment Plant • Compressed Air System • Coal and Ash Handling System • CW System and Raw Water System



Item	Particulars
	<ul style="list-style-type: none"> • Fire-fighting System • Air conditioning System • Ventilation System
Stack Details	
No. of Stack	1
Stack Height (meter)	275 each
No. of flue	Single flue
Additional equipment	Electrostatic Precipitator
Coal	Indigenous Coal – 2.0 MTPA Transportation: Railways/Road
Land	
Plant Land Area	487.00 Acre
Water	
Cooling Technology	Natural draft cooling system
Total Water Requirement	15 MCM (withdraw 10 MCM)
Total Discharge	'Zero Discharge Norm' is being followed
General Information	
Manpower Requirement (Total)	Approx 150
Project Cost	Rs 3,600 crores

Advantages of Supercritical Thermal Cycle:

- The 600 MW units have super critical steam parameters to achieve higher efficiency and hence, lower cost of generation. The prime advantages of the Super-critical technology are:
 - Improvement in power plant efficiency is more than 2%.
 - Reduction in coal consumption.
 - Reduction in emission of Greenhouse gases.
 - Overall reduction in auxiliary Power Consumption,
 - Reduction in requirement of ash dike land and consumptive water.
 - Sliding pressure operation due to once through system.



- Uniform distribution of heat due to spiral wall arrangement leading to less Boiler tube failure, thereby improving system continuity and availability of the station.
- Low thermal stress in turbine.
- Less start up time of the boiler.
- Reduction in water requirement.
- The thermodynamic cycle for 600 MW units considers super-critical steam parameters. The unit comprises of boiler, steam turbine generator, condenser, condensate extraction and boiler feed system along with all other necessary equipment for single/double reheat-regenerative cycle. For purpose of the study, the MP/IP cylinders may be of single/double casing design as per manufacturers' standard. The exhaust from HP-IP turbine will further expand in the double flow LP Turbine.

Steam Generator:	Super critical Pressure 255 kg /cm ² Temperature 571°C
Turbo Generator:	Turbine - 246 kg/cm ² (a), 563°C, 3000 rpm Generator - 600 MW Generator Transformer - 776 MVA

- A total height of reinforced concrete chimney is 275 m having 7.4 m exit diameter.
- For air pollution control system, each steam-generating unit has been provided with electrostatic precipitators. Each precipitator has two parallel gas paths, any of which can be isolated for maintenance when required, keeping the other path in operation.

These units utilize main and hot reheat steam at a temperature of 566°C at the turbine inlet. The main steam inlet pressure is about 254 Ata and the reheat steam pressures are in the order of 40 bar.

The energy flow in the process of thermal power generation is in four stages - firstly, the chemical energy of the coal is transformed into heat energy, which is then converted into mechanical energy and finally into electric energy through generator. The main raw materials required for thermal power generation are coal, water, and air.

In the first stage, the coal moves from the coal handling plant to the coal bunker, from where it is fed into the pulverizing mills. This mill stacks, reclaims and crushes the coal into fine powder, which is then mixed with air and blow down into the boiler by a fan. In the boiler, the mixture



of coal dust and air burns like a gas and produces high temperature. The boiler walls are lined with tubes containing high quality de-mineralized water, better known as boiler water. The heat Released by the burning coal is absorbed by the boiler which in turn transfers the water into steam. The steam is then channelized through nozzles onto the turbine's blades, where it makes the turbine rotate. A generator is attached to the turbine, which produce electricity once the turbine starts to move. The electricity is then passed through a step-up transfer which increase the voltage so that it can be transmitted efficiently over the power line of the grid.

The ash is generated due to combustion of coal as residue. Ash is collected at the bottom of the furnace as bottom ash, Economizer hoppers as Eco ash, Air-preheater hoppers as APH ash, electrostatic precipitator (ESP) hoppers as Fly ash and stack hoppers as Stack ash. The quantum of ash generation would depend on the plant load factor and the quality of coal being fed.

This ash, known as bottom ash, is water quenched, and then conveyed for disposal. The rest is fly-ash, which is in form of fine powders and is taken out of the furnace to the Electrostatic Precipitators. The fly-ash trapped by the ESP is collected pneumatically operated dry ash storage silos for cement manufacturing.

As already mentioned earlier, the plant is using super-critical technology. The thermal efficiency of the power plant can be improved by using the steam at super critical condition. The improvement in overall efficiency of the plant compared to sub critical parameters is usually at least 2% if the super critical parameters are implemented. The importance of thermal efficiency of the thermodynamic cycle and the methods to improve the thermal efficiency of the cycle are also analyzed. The indirect costs such as reduction in maintenance cost, auxiliary power consumption, ash dike land and environmental benefits such as reduction in greenhouse gases; water requirements, etc. are additional to the above increase in efficiency.

Importance of Efficiency:

Since the time thermal power stations have been engineered, there is a quest for efficiency improvement. One such effort in that direction is supercritical parameters (i.e.) the pressure above 225 kg/cm^2 and temperature above 374.15°C . The supercritical parameters for Raipur 685 MW boiler are: 259 kg/cm^2 of pressure and 571°C of temperature.

Methods of Increasing Ranking Cycle Efficiency:

The steam power cycle efficiency can be improved by the following methods:



Raising supply temperature by super heating: Increasing the turbine inlet temperature of steam will raise the heat supply to the boiler more than the heat rejection.

Raising inlet pressure of steam: Increasing the pressure will mean increase in saturation temperature at which steam evaporates thus increasing the average inlet temperature (T_1).

Efficiency can be improved by dropping the final pressure (or temperature) at which heat is rejected.

Regenerative heating: Heating the feed water pumped to the boiler by bleeding steam from turbine.

Reheat cycle: Reheating of steam in boiler after it has already expanded in high pressure (HP) turbine will avoid moisture formation in low pressure (LP) Turbine. Also, more heat content of steam before LP turbine will improve efficiency.

At most elevated condition, the steam is supercritical. Thus, if water is at a supercritical pressure and is heated the temperature will increase continuously. At a particular value, the water will flash instantaneously into steam and super heating will commence. There is no change of specific volume from the liquid to the dry steam state.

Supercritical Boiler:

A Boiler operating at a pressure above critical point is called Supercritical Boiler. Supercritical Boiler has no drum and heat-absorbing surface being, in effect, one continuous tube hence called 'Once Through Supercritical Pressure Boilers'. Boiler Feed Pump pressurizes the water in boiler, sensible heat is added in feed heaters, economizer, and furnace tubes, until water attains saturation temperature and flashes instantaneously to dry saturated steam and super heating commences.

Steam Generator Set:

The steam generator for super-critical unit consists of a number of parallel circuits connected by inlet & outlet headers. Pressurized water enters the circuit at one end and leaves as supercritical steam at other end. Thus, boiler is of "Once-through type". Once-through boiler may be designed in both two-pass & tower type design. Since flow is once-through furnace wall tube. Temperature tends to increase at low load. Assisted circulation mode is super imposed to overcome this problem. The volume of the evaporator system is much smaller compared to a Natural circulation boiler. Due to smaller inventory of stored water & steam, theoretical rate of response is much faster than drum unit at base load. Super heater section has been divided in



convection and radiant zones and designed so as to maintain rated steam temperature of 571°C at the outlet. The units have been completed with coal preparations and firing system, fuel oil firing system, draft plants comprising FD, ID and PA fans, electrostatic precipitators with required number of fields in series and a multi-flue 275 m high chimney.

Light Diesel Oil (Calorific value around 10,300 K Cal/Kg) is being used as start-up and stabilization fuel. As per GOI norms, space provision for FGD unit has been incorporated in the plant layout.

Due to elevated pressure and temperature, cycle efficiency improves which results in reduction of fuel consumption per unit of electricity generated, which in turn reduces CO₂, NO_x & SO₂ emission. To limit the dust load at the inlet to the chimney to a value of 50 mg/Nm³, as per the norms prescribed by the Ministry of Environment and Forest, Govt. of India, adequately sized electrostatic-precipitators have been provided.

Turbine Generator Set:

The steam turbine set is with standard multi-stage, 3000 rpm, tandem compound, single/double reheat, regenerative, condensing, multi-cylinder unit with eight (8)/nine (9) uncontrolled extractions for regenerative feed water heating. The turbine has one single flow HP cylinder, one double flow IP turbine and two double flow LP casings. The LP turbine exhausts against a condenser pressure of 76 mm Hg (abs) and maximum cooling water temperature of 33°C. The unit has horizontally split double flow LP cylinder with the LP turbine exhausting steam directly into spring mounted surface type, two-pass condenser having divided water box. The turbo-generator sets are designed for a maximum throttle steam flow at turbine valve wide open (VWO) condition of 105% of turbine MCR flow. A quick acting "HP and LP Turbine Bypass Station" has been provided as a part of turbine package. The unit is equipped with all auxiliaries as per good engineering practice. The steam turbine is directly coupled to the horizontally mounted, three phases, two-pole, cylindrical rotor type electric generator terminal after meeting power requirement for excitation system. The generator is of 0.85 – plant load factor and thus the MVA rating works out to be about 776 MVA. The generators deliver power at the standard voltage of the manufacturer between 20-24 KV, 3 Phase, 50 Hz. The steam turbine is equipped with hydraulic/motorized turning gear for uniform heating/ cooling of the rotor during start up/shut down. Highly sensitive electronic-hydraulic governing system is provided with suitable hardware to ensure fast speed to operation & safety. The units are complete with twin flow, double-pass, horizontal, surface type, water cooled condensers, 2 x 100% vacuum pumps (1W + 1S), vertical/ horizontal shell and tube type high pressure feed water heaters with group bypass arrangement, 4-stage horizontal U-tube low pressure heaters, drain cooler, gland steam condenser, horizontal spray or spray-cum-tray type deaerator with integral vent condenser etc. The units are equipped with two (2) nos. 50% capacity turbine driven and one



(1) 30% capacity motor driven centrifugal, horizontal, boiler feed pumps of barrel casing construction.

FIGURE 1.1: LOCATION OF 1 X 600 MW THERMAL POWER PLANT OF REGL

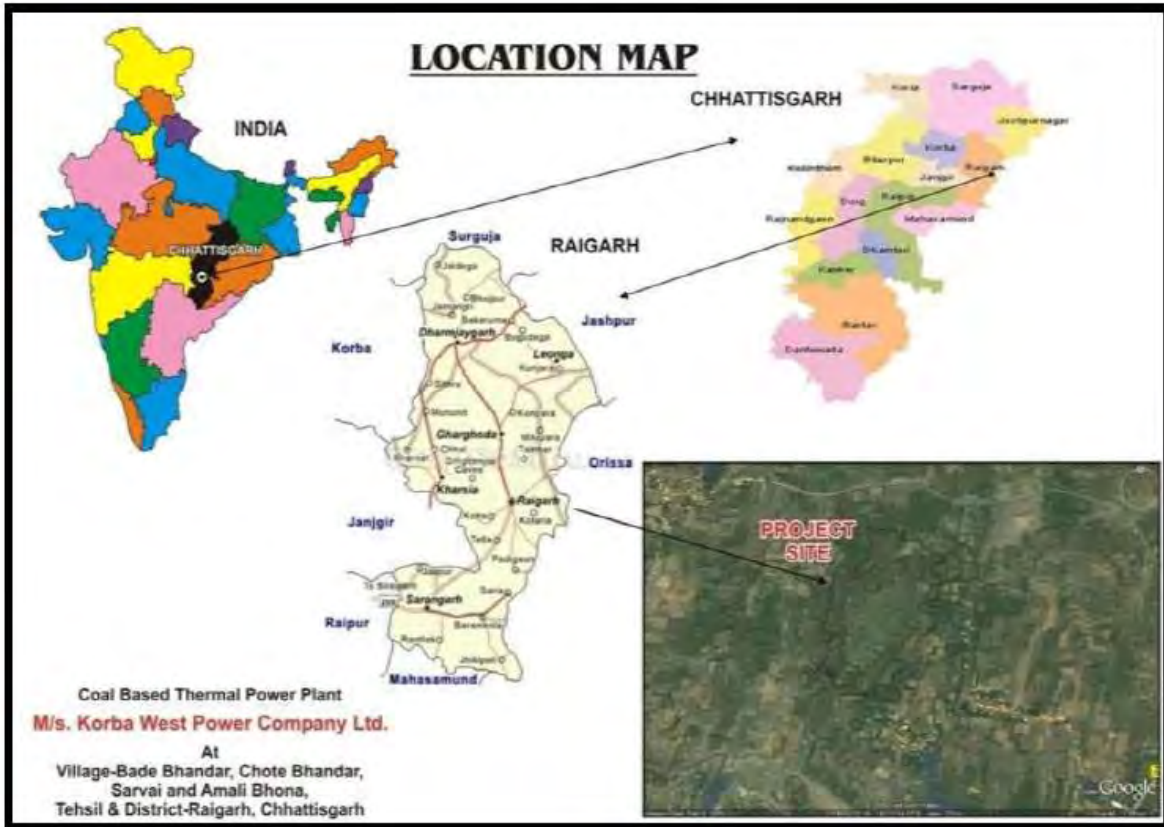


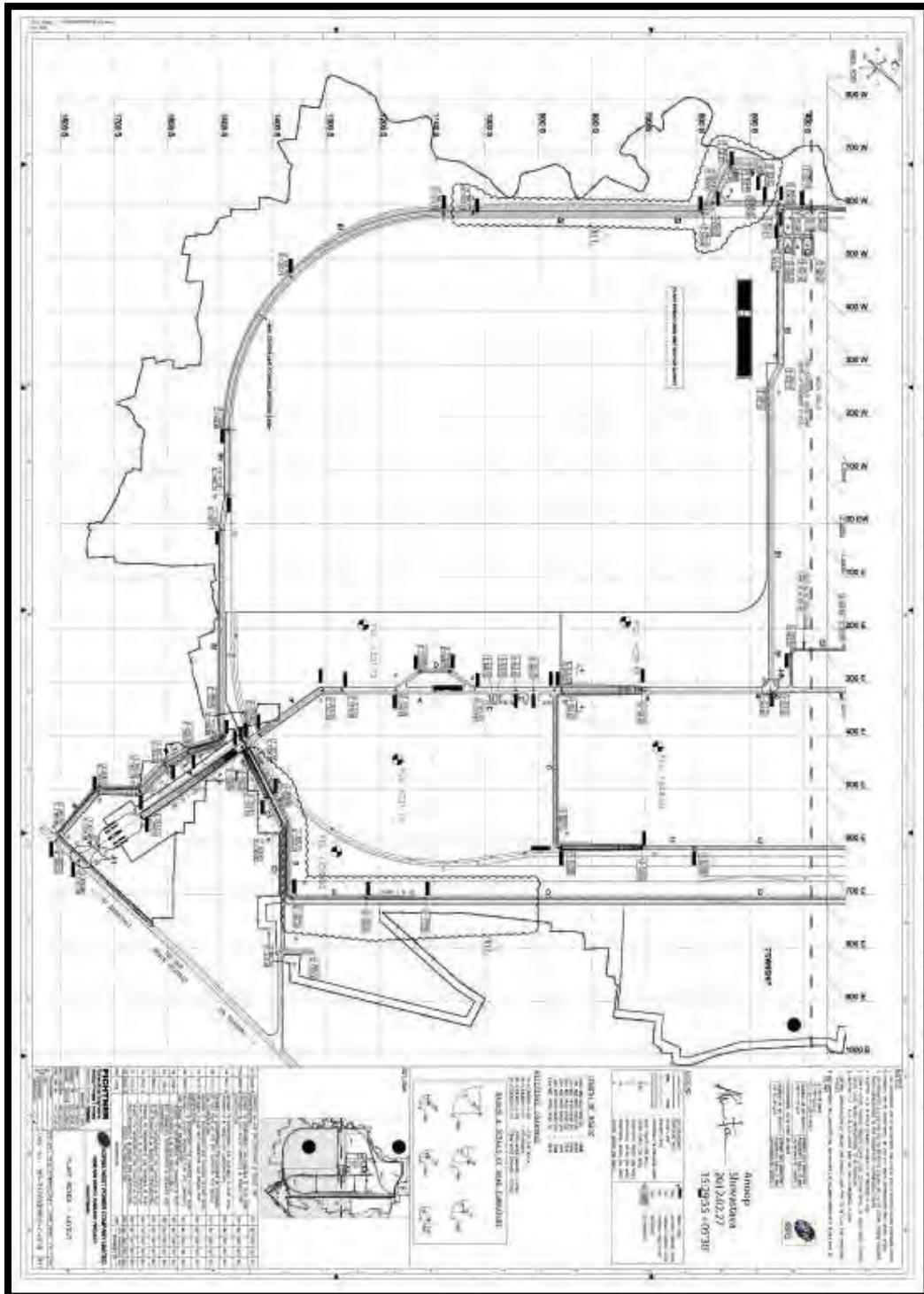
FIGURE 1.2: SATELLITE IMAGERY OF LOCATION OF REGL'S TPP SITE



FIGURE 1.3: LAYOUT MAP OF REGL's TPP



FIGURE 1.4: LAYOUT PLAN OF REGL's TPP



1.3 OBJECTIVES OF THE STUDY

The aims of the proposed social audit are to evaluate social impact of CSR activities undertaken in and around the vicinity of the REGL's TPP area for upliftment of quality of life of local people of the neighbouring villages. The prime objectives of the study includes:

- To assess the baseline status of key social parameters around the REGL's TPP site;
- To evaluate the social impact of the TPP based on the available secondary data and information generated during the study/survey;
- To present all potential significant social impacts and local employable youth for training in skills, relevant to the project;
- To undertake detailed social audit of CSR Activities undertaken by REGL in last five years.

1.4 SCOPE OF THE STUDY

The scope of the study includes the undertaking of a reconnaissance Social Audit & Social Impact Evaluation of CSR activities undertaken by REGL. On the basis of the survey, a framework for assessing social development in all the villages coming within 10 km radius of the project site would be evolved. The study shall be in line with National Legislation and in compliance with EC Conditions of MoEF & CC.

The scope of work includes:

- 1) Social Audit & Social Impact Evaluation Survey/study.
- 2) Action plan for identification of local employable youth for training in skills, relevant to the project.
- 3) Socio-economic profile of the villages and economic development profile of the villages.
- 4) Public consultation in all Panchayat/villages to ascertain the public views on various social and local issues.
- 5) Community engagement and social development plan.
- 6) Social Audit of 10 km radius and action plan for implementation.



- 7) Gap analysis and comparison of last three years for local development as well as social upliftment of local society.
- 8) Advantages of conducting Social Audit /Social Impact Evaluation.

1.5 DETAIL OF REGL-CSR ZONE

The REGL-CSR zone has been identified within 10 km radius considering the boundary of TPP. The identified CSR zone has been divided into three sub-zones i.e. Core Zone (CZ), Buffer Zone-I (BZ-I) and Buffer Zone-II (BZ-II). Core Zone includes the villages which are affected directly due to land acquisition for TPP. The Buffer Zone-I includes the villages falling within 5 km radius from boundary of TPP. The Buffer Zone-II includes villages falling within 5-10 km radius of TPP. The location of CSR villages of TPP is presented in Figure 1.5 and 1.6.



FIGURE 1.5: LOCATION OF CSR ZONE OF RAIGARH ENERGY GENERATION LIMITED

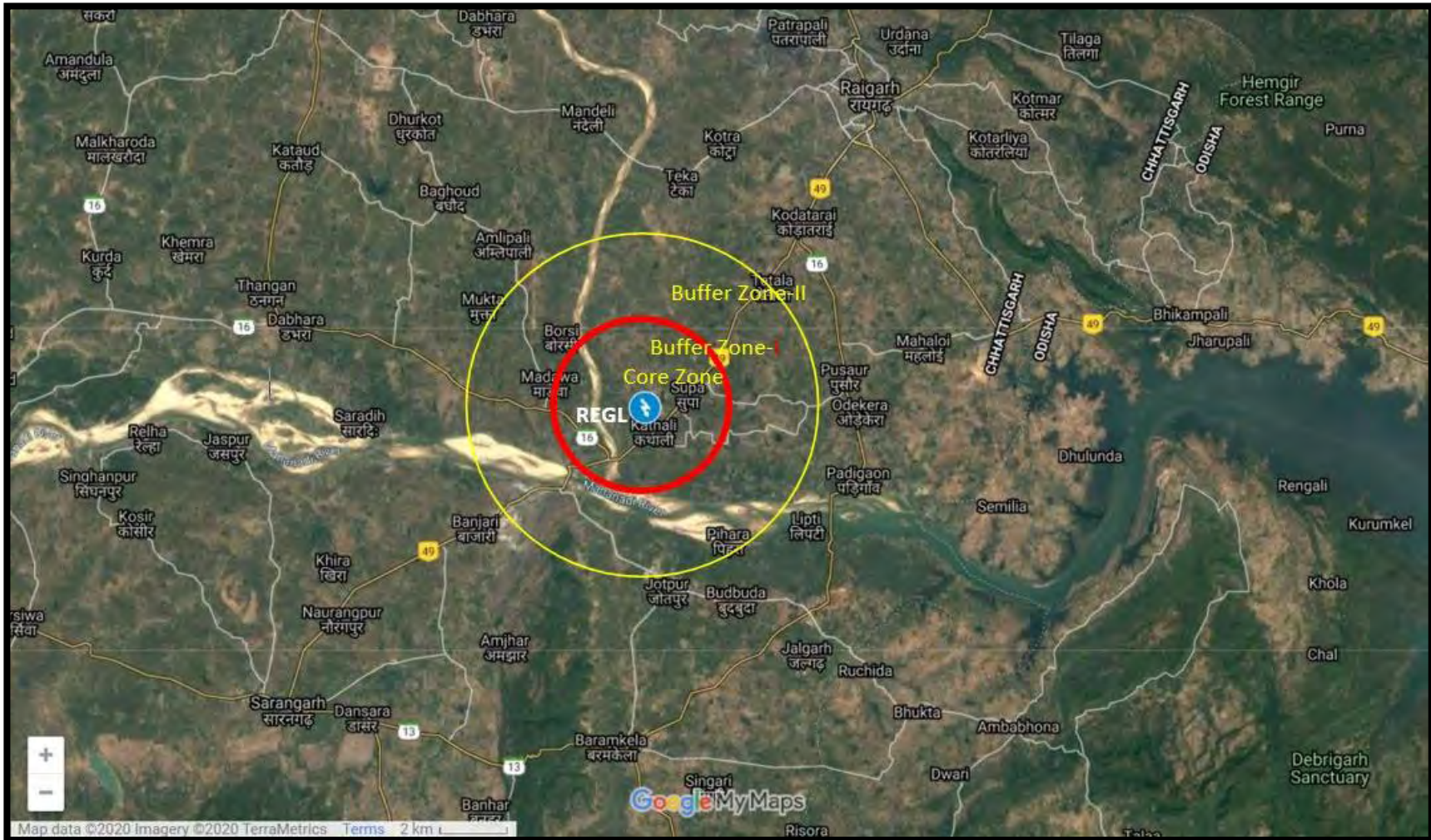
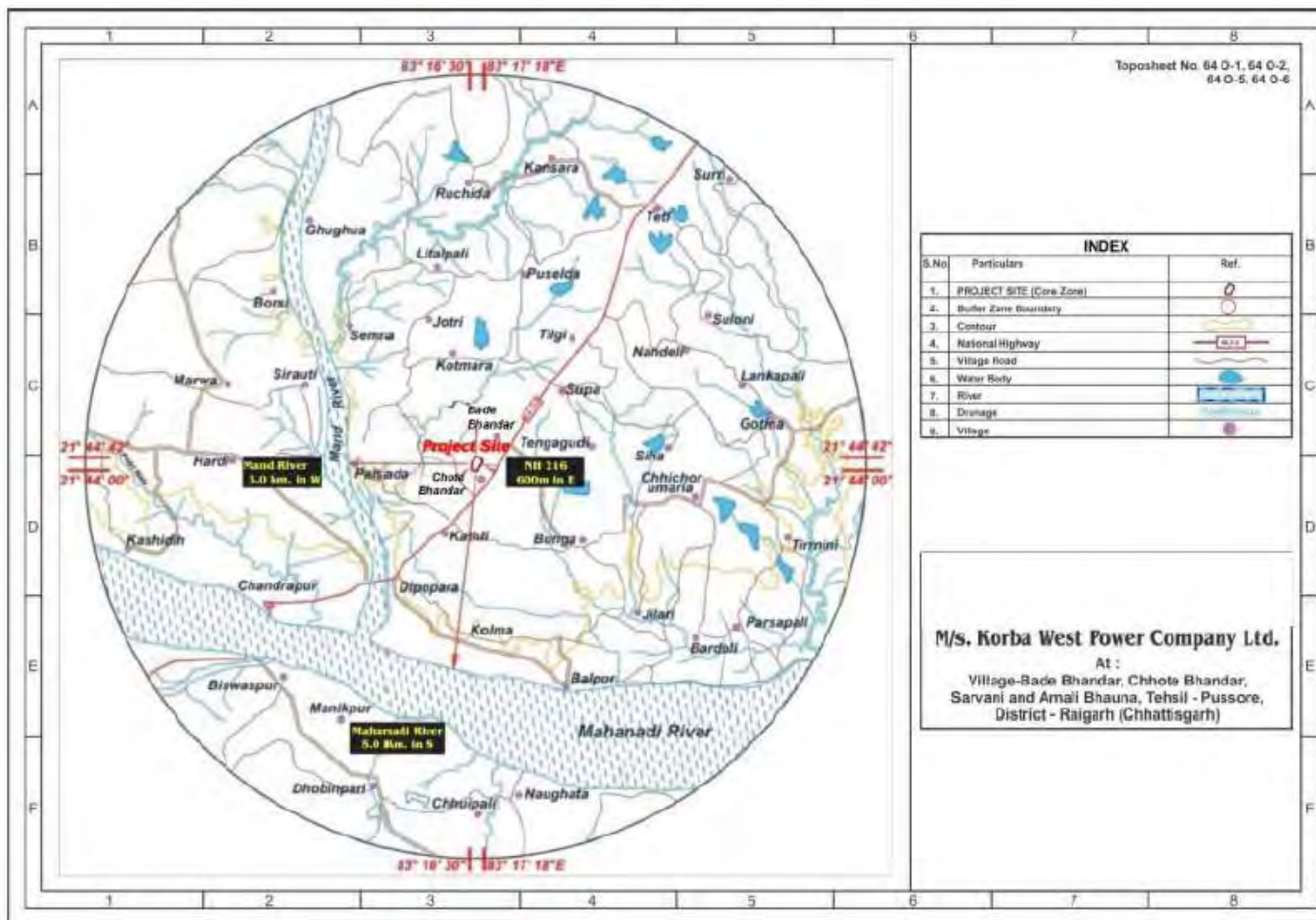


FIGURE 1.6: LOCATION OF CSR VILLAGES OF REGL



The REGL-CSR zone primarily falls under Pusour and Barmakhela Blocks of Raigarh District as well as partially under Dabhra Block of Janjgir-Champa District under Chattisgarh State. The geographical distribution of villages falling within 10 km radius of TPP i.e. CSR zone is presented in Table 1.2. The analysis reveals that out of total 127 villages falling within REGL-CSR zone, 126 are inhabited and only one is un-inhabited villages. The zone wise distribution of CSR villages is presented in Figure 1.7. The analysis of district wise distribution of villages reveals that out of total 127 villages falling within CSR zone 73.23% villages fall under Raigarh District and remaining 26.77% villages fall under Janjgir-Champa District of Chattisgarh State (Figure 1.8). Similarly the analysis of block wise distribution of villages falling under REGL zone reveals that 54.33% villages fall under Pusour Block, 14.96% villages falls under Barmakela Block and 3.93% villages under Raigarh Block of Raigarh District and remaining 26.77% villages fall under Dabhra Block of Janjgir-Champa District (Figure 1.9). The list of CSR villages is presented in Annexure 1.1.

TABLE 1.2: GEOGRAPHICAL DISTRIBUTION OF VILLAGES IN REGL-CSR ZONE

Block	District	State	No. of Villages		
			Inhabited Villages	Un-inhabited Villages	Total
Core Zone					
Pusour	Raigarh	Chattisgarh	4	-	4
Sub-Total			4	-	4
Buffer Zone-I					
Pusour	Raigarh	Chattisgarh	21	-	21
Dabhra	Janjgir-Champa	Chattisgarh	6	-	6
Sub-Total			27	-	27
Buffer Zone-II					
Pusour	Raigarh	Chattisgarh	44	-	44
Barmakhela	Raigarh	Chattisgarh	18	1	19
Raigarh	Raigarh	Chattisgarh	5	-	5
Dabhra	Janjgir-Champa	Chattisgarh	28	-	28
Sub-Total			95	1	96
Grand Total			126	1	127



Fig 1.7: ZONE-WISE DISTRIBUTION OF CSR VILLAGES OF REGL

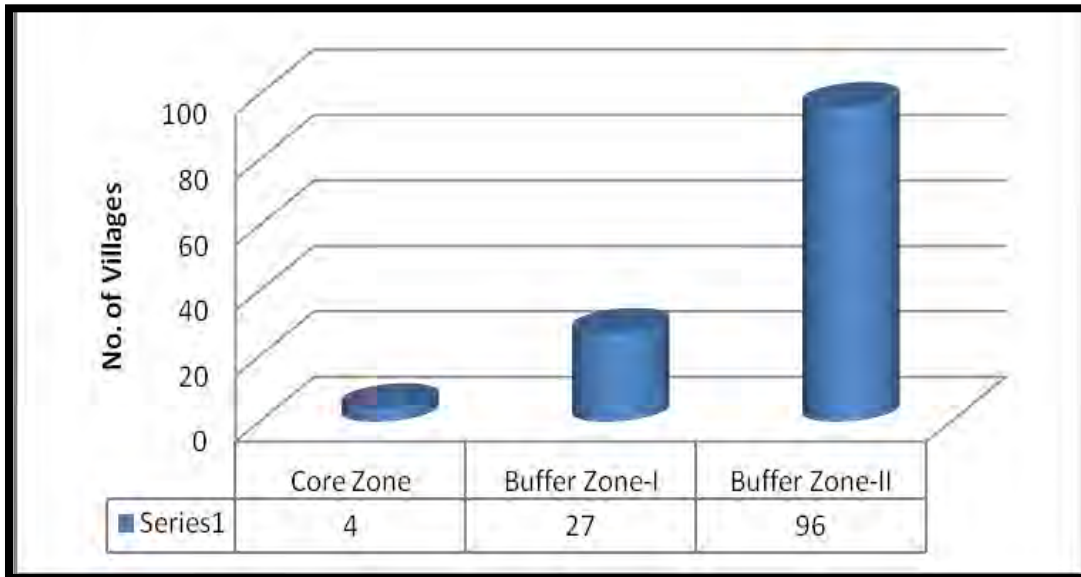


Fig 1.8: DISTRICT-WISE DISTRIBUTION OF CSR VILLAGES OF REGL

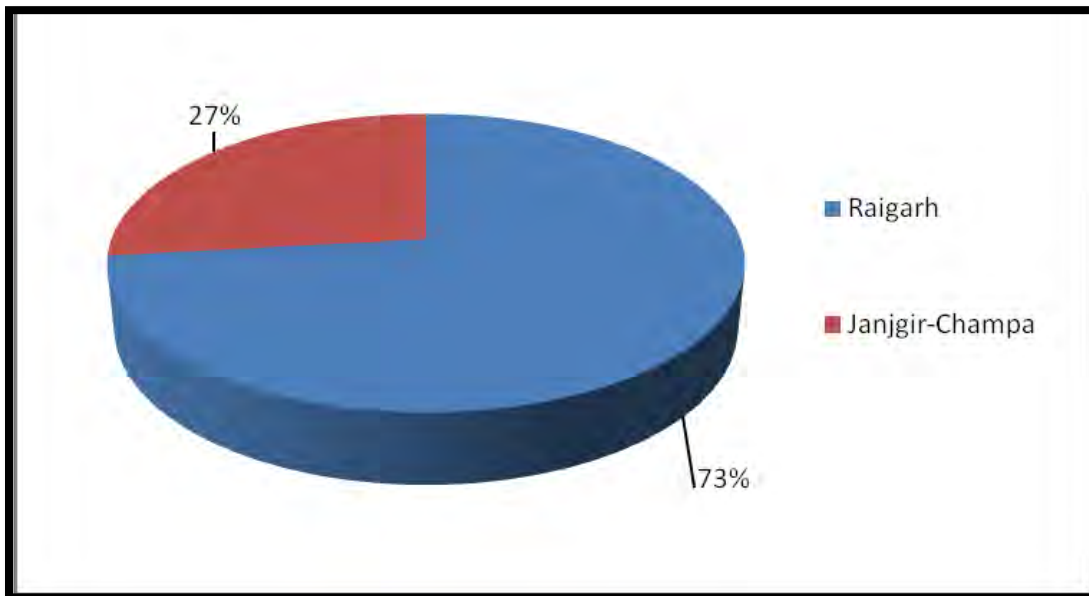
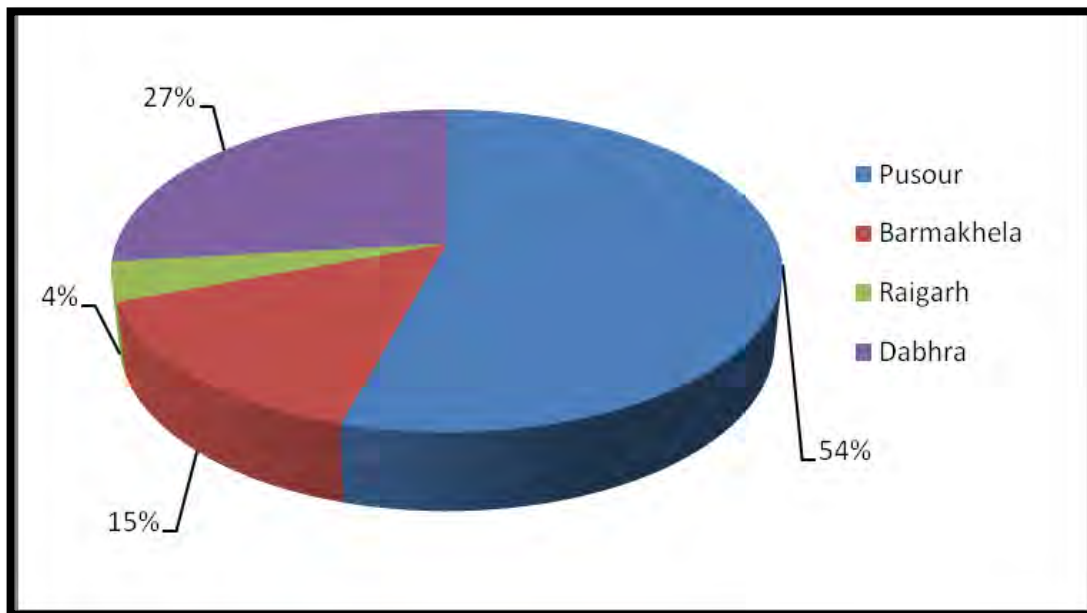


Fig 1.9: BLOCK-WISE DISTRIBUTION OF CSR VILLAGES OF REGL

2.0 PRINCIPLES AND GUIDELINES FOR SA & SIE

2.1 CORPORATE SOCIAL RESPONSIBILITY (CSR)

2.1.1 Concept of CSR

Corporate Social Responsibility (CSR) also called corporate responsibility, corporate citizenship, responsible business and corporate social opportunity is a concept whereby organizations consider the interests of society by taking responsibility for the impact of their activities on customers, suppliers, employees, shareholders, communities and other stakeholders, as well as the environment. This obligation is seen to extend beyond the statutory obligation to comply with legislation and sees organizations voluntarily taking further steps to improve the quality of life for employees and their families as well as for the local community and society at large. The practice of CSR is subject to much debate and criticism. Proponents argue that there is a strong business case for CSR, in that corporations benefit in multiple ways by operating with a perspective broader and longer than their own immediate, short-term profits. Critics argue that CSR distracts from the fundamental economic role of businesses; others argue that it is nothing more than superficial window-dressing; still others argue that it is an attempt to pre-empt the role of governments as a watchdog over powerful multinational corporations.

CSR in Global Context

While there may be no single universally accepted definition of CSR, each definition that currently exists underpins the impact that businesses have on society at large and the societal expectations of them. Although the roots of CSR lie in philanthropic activities (such as donations, charity, relief work, etc.) of corporations, globally, the concept of CSR has evolved and now encompasses all related concepts such as triple bottom line, corporate citizenship, philanthropy, strategic philanthropy, shared value, corporate sustainability and business responsibility. This is evident in some of the definitions presented below:

The European Commission defines CSR as “the responsibility of enterprises for their impacts on society”. To completely meet their social responsibility, enterprises “should have in place a process to integrate social, environmental, ethical human rights and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders”.

The World Business Council for Sustainable Development (WBCSD) defines CSR as “the continuing commitment by business to contribute to economic development while improving the quality of life of the workforce and their families as well as of the community and society at large.”



According to the United Nations International Development Organization (UNIDO), “Corporate social responsibility is a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders. CSR is generally understood as being the way through which a company achieves a balance of economic, environmental and social imperatives (Triple-Bottom-Line Approach), while at the same time addressing the expectations of shareholders and stakeholders. In this sense it is important to draw a distinction between CSR, which can be a strategic business management concept, and charity, sponsorships or philanthropy. Even though the latter can also make a valuable contribution to poverty reduction, will directly enhance the reputation of a company and strengthen its brand, the concept of CSR clearly goes beyond that.”

From the above definitions, it is clear that:

- The CSR approach is holistic and integrated with the core business strategy for addressing social and environmental impacts of businesses.
- CSR needs to address the well-being of all stakeholders and not just the company's shareholders.
- Philanthropic activities are only a part of CSR, which otherwise constitutes a much larger set of activities entailing strategic business benefits.

CSR in Indian Context

CSR in India has traditionally been seen as a philanthropic activity. And in keeping with the Indian tradition, it was an activity that was performed but not deliberated. As a result, there is limited documentation on specific activities related to this concept. However, what was clearly evident that much of this had a national character encapsulated within it, whether it was endowing institutions to actively participating in India's freedom movement, and embedded in the idea of trusteeship.

As some observers have pointed out, the practice of CSR in India still remains within the philanthropic space, but has moved from institutional building (educational, research and cultural) to community development through various projects. Also, with global influences and with communities becoming more active and demanding, there appears to be a discernible trend, that while CSR remains largely restricted to community development, it is getting more strategic in nature (that is, getting linked with business) than philanthropic, and a large number of companies are reporting the activities they are undertaking in this space in their official websites, annual reports, sustainability reports and even publishing CSR reports.



The Companies Act, 2013 has introduced the idea of CSR to the forefront and through its disclose-or-explain mandate, is promoting greater transparency and disclosure. Schedule VII of the Act, which lists out the CSR activities, suggests communities to be the focal point. On the other hand, by discussing a company's relationship to its stakeholders and integrating CSR into its core operations, the draft rules suggest that CSR needs to go beyond communities and beyond the concept of philanthropy. It will be interesting to observe the ways in which this will translate into action at the ground level, and how the understanding of CSR is set to undergo a change.

2.1.2 CSR and Sustainability

Sustainability (corporate sustainability) is derived from the concept of sustainable development which is defined by the Brundtland Commission as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Corporate sustainability essentially refers to the role that companies can play in meeting the agenda of sustainable development and entails a balanced approach to economic progress, social progress and environmental stewardship.

CSR in India tends to focus on what is done with profits after they are made. On the other hand, sustainability is about factoring the social and environmental impacts of conducting business, that is, how profits are made. Hence, much of the Indian practice of CSR is an important component of sustainability or responsible business, which is a larger idea, a fact that is evident from various sustainability frameworks. An interesting case in point is the NVGs for social, environmental and economic responsibilities of business issued by the Ministry of Corporate Affairs in June 2011. Principle eight relating to inclusive development encompasses most of the aspects covered by the CSR clause of the Companies Act, 2013. However, the remaining eight principles relate to other aspects of the business. The UN Global Compact, a widely used sustainability framework has 10 principles covering social, environmental, human rights and governance issues, and what is described as CSR is implicit rather than explicit in these principles.

Globally, the notion of CSR and sustainability seems to be converging, as is evident from the various definitions of CSR put forth by global organisations. The genesis of this convergence can be observed from the preamble to the recently released draft rules relating to the CSR clause within the Companies Act, 2013 which talks about stakeholders and integrating it with the social, environmental and economic objectives, all of which constitute the idea of a triple bottom line approach. It is also acknowledged in the Guidelines on Corporate Social Responsibility and Sustainability for Central Public Sector Enterprises issued by the Department of Public Enterprises (DPE), Ministry of Heavy Industries & Public Enterprises in April 2013. The



new guidelines, which have replaced two existing separate guidelines on CSR and sustainable development, issued in 2010 and 2011 respectively, mentions the following:

“Since corporate social responsibility and sustainability are so closely entwined, it can be said that corporate social responsibility and sustainability is a company’s commitment to its stakeholders to conduct business in an economically, socially and environmentally sustainable manner that is transparent and ethical.”

2.1.3 Functional Elements of CSR

Milton Friedman, Nobel Laureate in Economics and author of several books wrote in 1970 in the New York Times Magazine that "the social responsibility of business is to increase its profits" and "the business of business is business". This represented an extreme view that the only social responsibility a law-abiding business has is to maximize profits for the shareholders, which were considered the only stakeholders for the company. However, time has given the term 'stakeholder' wider connotations. Edward Freeman defines, 'a stakeholder in an organization is any group or individual who can affect or is affected by the achievement of the organization's objectives.' Thus, the term stakeholder includes (apart from shareholders), but not limited to, customers, employees, suppliers, community, environment and society at large.

These and a host of other such ideas have given rise to the concept of Corporate Social Responsibility (CSR). The concept of CSR goes beyond charity or philanthropy and requires the company to act beyond its legal obligations and to integrate social, environmental and ethical concerns into its business process. Business for Social Responsibility defines CSR as "achieving commercial success in ways that honour ethical values and respect people, communities, and the environment. It means addressing the legal, ethical, commercial and other expectations that society has for business and making decisions that fairly balance the claims of all key stakeholders. In its simplest terms it is: "what you do, how you do it, and when and what you say." A widely quoted definition by the World Business Council for Sustainable Development states that "Corporate social responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large".

Though, there is no universal definition of CSR but the common understanding amongst most of these definitions concern with how the profits are made and how they are used, keeping in mind the interests of all stakeholders. The concept of Corporate Social Responsibility is constantly evolving. The emerging concept of CSR goes beyond charity and requires the company to act beyond its legal obligations and to integrate social, environmental and ethical concerns into company's business process. What is generally understood by CSR is that the



business has a responsibility - towards its stakeholders and society at large - that extends beyond its legal and enforceable obligations. The triple bottom line approach to CSR emphasizes a company's commitment to operating in an economically, socially and environmentally sustainable manner. The emerging concept of CSR advocates moving away from a 'shareholder alone' focus to a 'multi-stakeholder' focus. This would include investors, employees, business partners, customers, regulators, supply chain, local communities, the environment and society at large. The key components of CSR would therefore include the following:

Corporate Governance: Within the ambit of corporate governance, major issues are the accountability, transparency and conduct in conformity with the laws. Good corporate governance policy would enable the company to realize its corporate objectives, protect shareholder rights, meet legal requirements and create transparency for all stakeholders.

Business Ethics: relates to value-based and ethical business practices. 'Business ethics defines how a company integrates core values - such as honesty, trust, respect, and fairness – into its policies, practices, and decision making. Business ethics also involves a company's compliance with legal standards and adherence to internal rules and regulations.

Workplace & Labour Relations: Human resources are most important and critical to a company. Good CSR practices relating to workplace and labour relations can help in improving the workplace in terms of health and safety, employee relations as well as result in a healthy balance between work and non-work aspects of employees' life. It can also make it easier to recruit employees and make them stay longer, thereby reducing the costs and disruption of recruitment and retraining.

Affirmative Action/Good Practices: Equal opportunity employer, diversity of workforce that includes people with disability, people from the local community etc., gender policy, code of conduct/guidelines on prevention of sexual harassment at workplace, prevention of HIV/AIDS at workplace, employee volunteering etc. are some of the good practices which reflect CSR practices of the company.

Supply Chain: The business process of the company is not just limited to the operations internal to the company but to the entire supply chain involved in goods and services. If anyone from the supply chain neglects social, environmental, human rights or other aspects, it may reflect badly on the company and may ultimately affect business heavily. Thus, company should use its strategic position to influence the entire supply chain to positively impact the stakeholders.

Customers: The products and services of a company are ultimately aimed at the customers. The cost and quality of products may be of greatest concern to the customers but these are not the only aspects that the customers are concerned with. With increased awareness and means of communication, customer satisfaction and loyalty would depend on how the company has



produced the goods and services, considering the social, environmental, supply-chain and other such aspects.

Environment: Merely meeting legal requirements in itself does not comprise CSR but it requires company to engage in such a way that goes beyond mandatory requirements and delivers environmental benefits. It would include, but not limited to, finding sustainable solutions for natural resources, reducing adverse impacts on environment, reducing environment-risky pollutants/emissions as well as producing environment-friendly goods.

Community: A major stakeholder to the business is the community in which the company operates. The involvement of a company with the community would depend upon its direct interaction with the community and assessment of issues/risks faced by those living in the company surrounding areas. This helps in delivering a community-focused CSR strategy - making positive changes to the lives of the people and improving the brand-image of the company. Involvement with the community could be both direct & indirect - through funding and other support for community projects implemented by local agencies.

2.1.4 Benefits of a CSR Programme

As the business environment gets increasingly complex and stakeholders become vocal about their expectations, good CSR practices can only bring in greater benefits, some of which are as follows:

- **Communities provide the licence to operate:** Apart from internal drivers such as values and ethos, some of the key stakeholders that influence corporate behaviour include governments (through laws and regulations), investors and customers. In India, a fourth and increasingly important stakeholder is the community, and many companies have started realizing that the 'licence to operate' is no longer given by governments alone, but communities that are impacted by a company's business operations. Thus, a robust CSR programme that meets the aspirations of these communities not only provides them with the licence to operate, but also to maintain the licence, thereby precluding the 'trust deficit'.
- **Attracting and retaining employees:** Several human resource studies have linked a company's ability to attract, retain and motivate employees with their CSR commitments. Interventions that encourage and enable employees to participate are shown to increase employee morale and a sense of belonging to the company.



- **Communities as suppliers:** There are certain innovative CSR initiatives emerging, wherein companies have invested in enhancing community livelihood by incorporating them into their supply chain. This has benefitted communities and increased their income levels, while providing these companies with an additional and secure supply chain.
- **Enhancing corporate reputation:** The traditional benefit of generating goodwill, creating a positive image and branding benefits continue to exist for companies that operate effective CSR programmes. This allows companies to position themselves as responsible corporate citizens.

2.1.5 Principles and Guidelines of CSR

National Voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business rolled-out by the Ministry of Corporate Affairs in India, were developed through an extensive consultative process with the objective of providing a distinctive India-centric approach for Indian businesses to understand the nuances of responsible business, applicable to large and small businesses alike. They are easy to comprehend and implement and encourage businesses to adopt the triple bottom line approach. These guidelines consist of nine principles which relate to ethics and transparency, product life cycle sustainability, employee well-being, stakeholder engagement, human rights, environmental stewardship, responsible policy advocacy, inclusive development and consumer well-being. Each principle consists of core elements that further articulate the purpose and sense of each principle. It also provides an approach for adopting these guidelines.

In India, the concept of CSR is governed by Section 135 of the Companies Act, 2013, which was passed by both Houses of the Parliament, and had received the assent of the President of India on 29 August 2013. The CSR provisions within the Act is applicable to companies with an annual turnover of 1,000 crore INR and more, or a net worth of 500 crore INR and more, or a net profit of five crore INR and more. The new rules, which are applicable from the fiscal year 2014-15 onwards, also require companies to set-up a CSR Committee consisting of their board members, including at least one independent director.

The Act encourages companies to spend at least 2% of their average net profit in the previous three years on CSR activities. The ministry's rules, that have been put up for public comment, define net profit as the profit before tax as per the books of accounts, excluding profits arising from branches outside India.

The Act lists out a set of activities eligible under CSR (Figure 2.1). Companies may implement these activities taking into account the local conditions after seeking board's approval. The



indicative activities which can be undertaken by a company under CSR have been specified under Schedule VII of the Act.

The Companies (Corporate Social Responsibility Policy) Rules, 2014 provide a number of clarifications, some the highlights are as follows:

- Surplus arising out of CSR activities will have to be reinvested into CSR initiatives, and this will be over and above the 2% figure.
- The company can implement its CSR activities through the following methods:
 - Directly on its own
 - Through its own non-profit foundation set-up so as to facilitate this initiative
 - Through independently registered non-profit organisations that have a record of at least three years in similar such related activities
 - Collaborating or pooling their resources with other companies

**FIGURE 2.1: LIST OF CSR ACTIVITIES
(AS PER COMPANIES ACT, 2013 SCHEDULE VII)**



- Only CSR activities undertaken in India will be taken into consideration.
- Activities meant exclusively for employees and their families will not qualify.
- A format for the board report on CSR has been provided which includes amongst others, activity-wise, reasons for spends under 2% of the average net profits of the previous three years and a responsibility statement that the CSR policy, implementation and monitoring process is in compliance with the CSR objectives, in letter and in spirit. This has to be signed by either the CEO, or the MD or a director of the company.

2.1.6 CSR Policy of APL

Adani Power Limited (APL) has always been committed to the cause of social service and has repeatedly channelized a part of its resources and activities, such that it positively affects the society socially, ethically and also environmentally. The company has taken up various CSR initiatives and enhanced values in the society.

With the advent of the Companies Act, 2013 constitution of a Corporate Social Responsibility Committee of the Board and formulation of a CSR policy became a mandatory requirement. Accordingly, the company has formulated a robust CSR policy which encompasses its philosophy and guides its sustained efforts for undertaking and supporting socially useful programmes for the welfare and sustainable development of the society. The CSR policy of APL was approved by the Board of Directors on 6th August, 2014. The detail of CSR Policy of APL, August, 2014 is presented in Annexure 2.1.

2.2 SOCIAL IMPACT EVALUATION (SIE)

REGL believes in growth with a human face, and pursuing people-centred development. REGL is a socially committed organization and a socially responsible corporate citizen. It attaches great importance to discharging its overall social responsibilities to the community and the society at large. In accordance with its mission of being socially responsible corporate entity with thrust on Community Development, REGL aims to focus on implementing all community development (CD) programmes in the affected/ neighbouring villages around its TPP based on the specific needs of the community assessed through the Need Assessment Survey. REGL has undertaken CSR activities as per the APL's CSR policy in approximately 77 Villages falling in CSR zone under Raigarh District of Chhattisgarh on the basis of NAS. To understand the effectiveness and utility of the CSR activities carried out, it is imperative to conduct an evaluation study to measure the

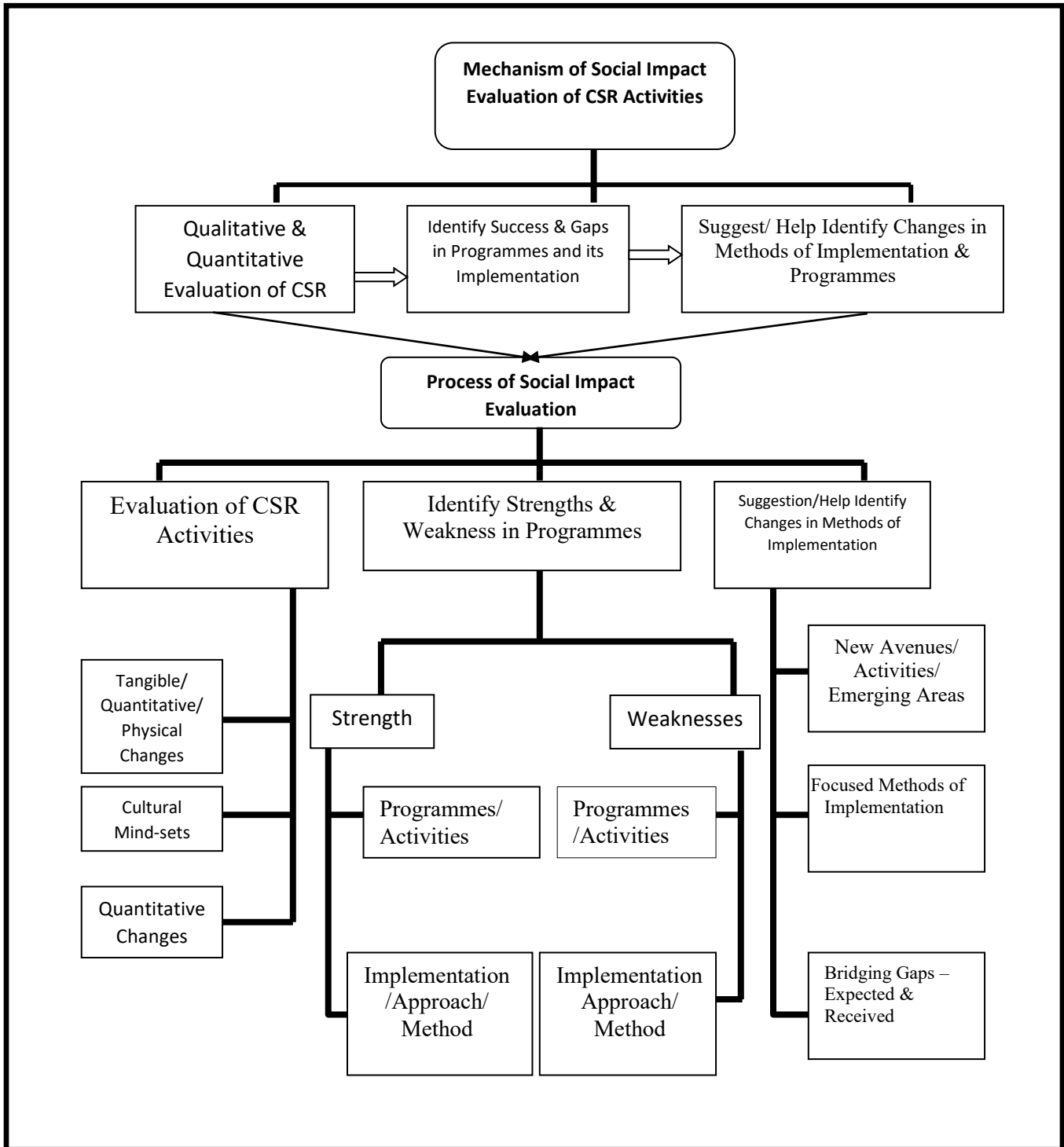


social, economic & cultural impacts of the programs/activities on the community. The whole exercise aims to set long-term CD priority, which could be achieved within the specified time frame. The evaluation process would also help REGL to create positive brand image and contribute to sustainable development. Very briefly, social impact evaluation is a way of assessing the impact of CSR activities on groups/community members. The results for evaluation then guide future actions.

Social Impact Evaluation basically means the evaluation of qualitative and quantitative impact of the Community Development Programme carried out by the organization on the community. The evaluation includes assessment of the physical changes that have taken place during an identified span of time because of the activities undertaken as well as the awareness and perception of the people for whom the activities were aimed. The impact could be short term or / and long term. It could be on the economic aspect or the socio-cultural aspect or on both the aspects. This impact would vary depending upon the efficiency and effectiveness of the CD activities carried out and the social/physical infrastructure provided to the Community. The mechanism of SIE of CSR activities is presented in Figure 2.2



FIGURE 2.2: MECHANISM OF SOCIAL IMPACT EVALUATION OF CSR ACTIVITIES



Social impact evaluation would help to determine the extent to which the community people have got benefited from the CSR activities implemented for them and whether CSR activities have been able to bring desired changes in the educational/ health / economic status of the communities, thereby providing an understanding of the effectiveness of the existing programs/ activities. SIE also proposes the changes that need to be undertaken in future implementation of CSR activities. SIE helps to understand the following aspects of community:

- The short term and long term social/ cultural / economic impacts of the CSR activities on the community people.
- The effectiveness of the existing programs / activities with respect to the needs of the community.
- The contribution of CSR activities in raising the living standard of people.
- The changing needs of the community people.

2.3 SOCIAL AUDIT (SA)

Social auditing is a process that enables an organisation to assess and demonstrate its social, economic, and environmental benefits and limitations. It is a way of measuring the extent to which an organisation lives up to the shared values and objectives it has committed itself to. Social auditing also provides an assessment of the impact of an organisation's non-financial objectives through systematically and regularly monitoring its performance and the views of its stakeholders. Social auditing requires the involvement of stakeholders. This may include employees, clients, volunteers, funders, contractors, suppliers and local residents interested in the organisation. Stakeholders are defined as those persons or organisations who have an interest in, or who have invested resources in, the organisation.

In other words, a social audit is a way of measuring, understanding, reporting and ultimately improving an organization's social and ethical performance. A social audit helps to narrow gaps between vision/goal and reality, between efficiency and effectiveness. It is a technique to understand, measure, verify, report on and to improve the social performance of the organization. Social auditing creates an impact upon governance. It values the voice of stakeholders, including marginalized/poor groups whose voices are rarely heard.

The key difference between development and social audit is that a social audit focuses on the neglected issue of social impacts, while a development audit has a broader focus including environment and economic issues, such as the efficiency of a project or programme.



2.3.1 Objectives of Social Audit

The prime objectives of social audit include:

- Increasing efficacy and effectiveness of community development programmes.
- Assessing the physical and financial gaps between needs and resources available for community development.
- Scrutiny of various policy decisions, keeping in view stakeholder interests and priorities, particularly of vulnerable & poor people.
- Creating awareness among beneficiaries and providers of local social and productive services.
- Estimation of the opportunity cost for stakeholders of not getting timely access to common property resources.

2.3.2 Advantages of Social Audit

A social audit can complement an organisation's annual financial audit by providing clear information on performance against social objectives. The results can be fed into the organisation's strategic review and planning processes to improve overall performance and social impact. It has been shown to increase accountability of the organisation to its stakeholders and to enhance democratic practice. In addition to serving as a management tool, social audits can be used for marketing, promotion and advocacy purposes. The prime advantages of social audit include:

- Encourages local democracy.
- Trains the community on participatory local planning.
- Encourages community participation.
- Benefits disadvantaged groups.
- Promotes collective decision making and sharing responsibilities.
- Develops human resources and social capital.



2.3.3 Process of Social Audit

CSR Audit is a formal strategic process that helps to measure company's actual social performance against the social objectives it has set for itself, and how decision making, mission statement, guiding principles, and business conduct are aligned with social responsibilities. The audit helps in discovering the interests and objectives of employees and stakeholders.

Recent research has indicated that integrating business strategy and corporate social responsibility contributes to:

- Improved community relations
- Reduced operating costs
- Increased employee satisfaction
- Corporate accountability
- Positive brand awareness

There are six key steps of Social Audit which are as follows:

1. Participatory activities

- Understanding key principle of social audit.
- List core values of the programmes
- List down social objectives of the programme
- Match activities with objectives
- List current practices and delivery system
- Fix the responsibility for doing social audit
- Budget for social audit

2. Defining audit boundaries and identifying stakeholders

- Elaborate key issues for social auditing based on the social objectives
- Prepare a statement of purpose, objectives, key issue and activities for social auditing.
- Identify key stakeholders for consultation (Government and civil society)
- Forge consensus on audit boundaries to identify stakeholders and formalize commitments.

3. Social accounting & bookkeeping

- Select performance indicator for social accounting
- Identify what additional with existing records can be used.



- Identify what additional data to be collected, who would collect this data and how
- When stakeholders would be consulted and about what?
- Prepare a social accounting plan timeline
- Plan for monitoring social accounting activities

4. Preparing and using accounts

- Prepare social accounts using existing information, data collection and views of stakeholders
- Identify key issues for action
- Take stock of objective, activities and core values
- Set targets for future

5. Social audit & dissemination

- Presenting social accounts to social auditors
- Social auditors verify data and comment on the quality of social accounting and reporting
- Social auditor has to collect information from the stakeholders regarding programme implementation and benefits accrued to them
- Disseminate social auditors consolidate report to the decision making committee
- Disseminate report to civil society
- Begin next cycle of social accounting

6. Feedback & institutionalization of social audit

- Feedback for fine tuning of policy legislation, administrative functioning and programming towards social objectives
- Follow up action
- Reviewing support to civil society for the participation
- Institutionalization of process

Following are key factors for successful Social Audit:

- Level of information shared with and involvement of stakeholders, particularly of the rural poor, women, and other marginalized sections.
- Commitment, seriousness and clear responsibilities for follow-up actions.
- Involvement of key facilitators in the process.



3.0 METHODS & TOOLS FOR SA & SIE

The Social Audit (SA) & Social Impact Evaluation (SIE) has been conducted using primary data as well as secondary data available with the Districts & Blocks as well as APL and REGL. Interview with the local people and discussions with community, Government officials and community based organizations of the area were an important component of the study.

Conducting SA & SIE involve the use of a broad array of data collection methods, quantitative and qualitative, common in social science research. Often, a combination of tools may be required to do SIE and SA. In addition to substantive analytical tools, SA&SIE use participatory methods that contribute to a better understanding of the social as well as cultural issues.

3.1 DATA COLLECTION PROCEDURE

There are several methods of collecting data for purposes of conducting SA and SIE. The methods generally in use include:

Quantitative Methods

- Sample survey
- Other administrative records

Qualitative Methods

- Key beneficiaries/informant interviews
- Focus Group Discussions (FGDs)
- Rapid Rural Appraisal (RRA)/Participatory Rural Appraisal (PRA)
- Public consultation

The sample villages were selected representing whole CSR region of the REGL's TPP for the present study. We have used both primary and secondary data for the study. The secondary data have been collected from the various source, namely, Census of India, Health Department, Education department, office of ICDS, Statistical department of the concerned district. The primary data have been collected from the beneficiaries of different programmes, Local community, Representatives of Gram Panchayets etc. from selected villages. The overall impact of CSR activities has been assessed for the last five years i.e. 2015-2016 to 2019-2020 as plant was under major break down from May, 2017 to December, 2019 therefore no significant CSR activities could be undertaken during 2018-19 to 2019-20. The data collection work has been executed in two phases; under Phase-I, we developed rapport with different local communities, representatives of Gram Panchayat and some key persons of the selected villages and also



approached different government officers of the concerned Blocks and District. Under Phase-II, we collected all relevant data from different sources. We recorded qualitative observations from Focus Group Discussion (FGDs), interviews with beneficiaries and Gram Panchayat members during our field survey. The field survey and data collection were initiated in September, 2020 and completed in October, 2020. All the collected data were coded for computerization and subsequent analysis. All the data were then fed into the software of Statistical Package for Social Sciences (SPSS) and rechecked before analysis. The study tools, sample size for different targeted activities and methodology are given below:

3.2 SAMPLING & ANALYTICAL TOOLS

3.2.1 Sampling Tools, Sample Size and Coverage

Depending on the nature of information required, we developed six types of schedules/questionnaires for different target groups, namely, Beneficiaries under different programme, Village schedule for Gram Panchayats, schedule for Focus Group Discussions (FGDs) of communities, profiling of the CSR activities through local people, questionnaires for concerned government officials and thematic points for field observations. The tools and coverage by respondents have been given in Table 3.1.

TABLE 3.1: SAMPLING TOOLS, SAMPLE SIZE AND COVERAGE

Sampling Tools	Respondent	Sample Size	Scope
Part-A: Individual Beneficiary-Oriented Activities			
Beneficiary Schedule	Beneficiaries of Different programmes	At least 5 beneficiaries from each programme in each village (if <5, then all)	Obtain information on socio-economic, educational and demographic features of the households, type of benefits and its impact and need of the household
Part-B: Community Beneficiary-Oriented Activities			
Schedule for profiling the CSR activities	A group comprised of representatives of local body, Prominent Local	One Schedule administered in each village	Profiling of all the activities executed under CSR in the village



Sampling Tools	Respondent	Sample Size	Scope
	People and Local communities		
Schedule for Focus Group Discussions (FGDs)	Representatives of Local body, Prominent people, Representatives of weaker sections and project affected persons, if any	One FGD organized in each village and discussion initiated with 8-10 members of the specified areas ensuring gender representation	Community needs, quality of work/services & impact of executed activities like Infrastructural, Socio-cultural, Awareness, Livestock and Programmes for changing the traditional agricultural production system or any other CSR activities.
Village Schedule	Representatives of Gram Panchayat & Prominent people	One Schedule administered in each village	Availability of basic amenities, Demographic, Socio-economic and educational characteristics etc.
Qualitative Information	Self Observation	All team members	Impact on socio-economic - cultural –political aspects and any specific fact beyond the purview of structured schedule.
Part-C: Collection of Secondary Data			
Questionnaires /Data Format for Education Department	BSA/Coordinator from concerned Block Resource Centre	One from each Block	Population of the school going (6-14 years) children, enrolment, dropout, never enrolled children by gender and caste, retention etc.
Questionnaires/Data Format for Health Department	CMO/Medical Officer from PHC/CHC	One from each Block	Health status of the people regarding no. of cases of Measles, TB, Polio, Malaria and birth & death rate of the concern areas.
Questionnaires/Data	DPO/CDPO of	One from each	Immunization, information



Sampling Tools	Respondent	Sample Size	Scope
Format for ICDS Department	concerned Block	Block	regarding mother and child care, IMR, MMR, U5MR

The sample copy of the questionnaires/formats developed for social impact evaluation of REGL's TPP along with social audit of CSR activities is presented in Annexure 3.1.

3.2.2 Method for Sampling and Administration of Tools

The method adopted for survey and selection of sample was simple random sampling and purposive sampling. The simple random method has been used for the selection of different types of beneficiaries and purposive method was used for the selection of persons for FGDs and profiling the executed activities in the villages. The details are given in Table 3.2.

TABLE 3.2: METHODS OF SAMPLING AND ADMINISTRATION OF TOOL

Particulars	Sample method	Method for Administration of Tools
For collection of basic information of the village	The member of the team approached the concerned representatives of Gram Panchayats and prominent people of the village.	Individual interviews were conducted with the representatives of gram Panchayat and prominent people of the village avoiding the crowd.
Profiling the Executed Activities	For this purpose, we purposively selected groups, consisting of representatives of local body, prominent local people and local communities in each CSR village.	Identified the target persons with the help of facilitators. Due care for ensuring gender representation was taken. The date, time and venue for profiling of activities were fixed with the prior consent of identified persons. A two-member team in which one was monitor and other was writer started the profiling in a pre-decided venue.
Beneficiary from Different Programmes	We have arranged the list of beneficiaries in alphabetical orders and then randomly selected the desired number. The additional	Trained members of the team approached the selected beneficiary with the help of facilitator and established rapport



Particulars	Sample method	Method for Administration of Tools
	sample has been taken to compensate the sample loss.	building. The individual interview was conducted in the house of the respondent avoiding the crowd.
Focus Group Discussions (FGDs)	For this exercise, we have purposively selected a group consisting of the representatives of local body, prominent people, representatives of weaker section and project affected person, if any, in each CSR village.	Identified the targeted persons with the help of facilitators ensuring gender representation. The date, time and venue for FGD fixed with the consent of the identified group. The two members of the team, in which one was monitor and the other was writer, started the FGD on pre-fixed venue. The monitor raised questions/issues and encouraged the members to discuss and explore the facts. The writer recorded the entire discussion in structured schedule and a voice recorder was also used for recording the matter of discussion.
Qualitative Information	In the above process each team member recorded his own observation on selected issues. The significant observation helped to understand the complicity of the data.	
Information from Secondary sources	The team members requested the District Magistrate, Raigarh, to provide his support and cooperation for collection of necessary data from different departments and for this purpose, the DM issued a letter to all concerned departments. The team members approached the concerned office and requested officers to provide the information on questionnaires. The concerned departments provided the available data.	



3.3 FRAMEWORK FOR SOCIAL AUDIT

As discussed earlier the framework for Social Audit was evolved including Social Process Method clubbed with Activity Analysis Approach. This uses SA4P focus system that assesses an activity around 4Ps viz. Policy, People, Process, Programmes. The individual weightage against these factors shall sum up to gross assessment measurable figure on a pre framed scale.

The social impact assessment of CSR activities was undertaken on following lines :

- Design Quality
- Measurable Quantitative Progress - Days/Coverage/Change in Income/Money saved / Mandays etc.
- Programme Approach
- Satisfaction of Stakeholders

The impact assessment matrix was evolved considering above mentioned factors as presented in subsequent sections:

Stage	Process	Output
Stage 1	Identification of SA Indicators	The SA team suggested 3 categories of 29 indicators : <ul style="list-style-type: none"> • Policy and Process -2 • Programme Factors –4 • Sample Activity/Observation type - 23
Stage 2	Identification of Social Audit Compliance factors	7 points identified to factor the procedural appropriateness of SA
Stage 3	Awarding points and then weight award by the SA team in consultation with the independent field observers	A set of 29 indicators + 1 SA factor for calculating the SA Point weight
Stage 4	Boxing the qualitative and few standard quantitative observations based on FGD and other interactions in scale of Good, Average and Bad.	A summary table delivering SA Point Weight, effectiveness checks and other quantitative details of coverage and expenditure along with brief comment by SA Team.
Stage 5	Sharing of SA findings with the stakeholders in REGL_AF and local villages.	SA is available to the community to catalyze the performance for better score during next assessment year.



Point Weightage for Selected Components

Such weightage was attributed by the SA team after analyzing the relative importance of the activities to the overall understanding of Social Audit objectives as per the ToR. The assessment scheme provides adequate approach to include following dimensions:

1. Direction (Positive to Negative that can lead to interpretation of Good and Poor)
2. Degree of Direction over a scale of -3 to +3 scale.

Each section focuses on certain aspect of assessment through a number of questions that the assessment team has placed against a 3 tail response pattern indicating – 1. The optimum side 2. The neutral point and -3. The Cause of concern point.

Once the gross point weight of each section is summed up it is available to reflect the overall health of CSR activities, policies and approach. But in order to be more rational we further multiply this with Social Audit procedural correctness factor which gives the final output value of SA score.

The list of SA Indicators as well as the weight attributed to each indicator are as follows:

S N	SA Indicator	Weightage
CSR POLICY & PROCESS:		
1	Overall Common Factors –I (POLICY)	5X
2	Overall Common Factors-II (PROCESS)	5X
Sub-total		10X
CSR PROGRAMME:		
3	Programme Common Factors (PROGRAMME)	4X
4	Programme Specific Factors (RURAL INFRASTRUCTURE)	4X
5	Programme Specific Factors (EDUCATION)	4X
6	Programme Specific Factors (COMMUNITY HEALTH AND SANITATION)	4X
7	Programme Specific Factors (SUSTAINABLE LIVELIHOODS)	4X
Sub-total		20X
CSR ACTIVITIES:		
8	Sample Activity Rural Infrastructure- Pond Deepening & Development	3X
9	Sample Activity Rural Infrastructure- Construction of Bore Well with Pump	4X
10	Sample Activity Rural Infrastructure- Construction of CC Road	4X
11	Sample Activity Rural Infrastructure- Construction of Community Center	3X
12	Sample Activity Rural Infrastructure- Development of School Infrastructure	3X



S N	SA Indicator	Weightage
13	Sample Activity Rural Infrastructure- Renovation of Religious Structure	3X
14	Sample Activity Education-Placement of Community Teachers	3X
15	Sample Activity Education-Activity Based Learning	3X
16	Sample Activity Education- Teaching Aids Support	3X
17	Sample Activity Education- Promotion of Sport & Games	3X
18	Sample Activity Education- Mobile Library	3X
19	Sample Activity Health: Mother & Child Health	3X
20	Sample Activity Health: Health Camp	3X
21	Sample Activity Health : Support to Physically Challenged People	3X
22	Sample Activity Health : Ambulance Service	3X
23	Sample Activity Health : Support for Construction of Household Toilet	3X
24	Sample Observation Sustainable Livelihoods : Skill Development Training	4X
25	Sample Observation Sustainable Livelihoods : Formation & Development of SHGs	4X
26	Sample Activity Sustainable Livelihoods : Promotion of SRI	3X
27	Sample Activity Sustainable Livelihoods : Development of Co-operative Society	3X
28	Sample Observation Sustainable Livelihoods : Live stock Development	3X
29	Sample Observation Sustainable Livelihoods : Tailoring, Poultry, Mushroom Production Centre	3X
Sub-total		70X
Grand total		100X

3.4 FIELD SURVEY & DATA COLLECTION

3.4.1 Reconnaissance Survey

A kick-off meeting was organised on 16th September, 2020 to discuss the modalities for initiating the social audit and social impact evaluation study and logistic support required for the same under the guidance of Shri R. N. Shukla, Corporate Environment Group, APL and Shri Amit Kr. Soni, Head (Environment), REGL with IISWBM team members.

During the introductory meeting with Shri R. N. Shukla, Corporate Environment Group, APL and Shri Amit Kr. Soni, Head (Environment), REGL along with Shri Purnendu Kumar, CSR Head, REGL and IISWBM team members, following issues were discussed & resolved to initiate the social audit & social impact evaluation study for REGL's TPP:



1. Initially Shri R. N. Shukla mentioned the objectives of proposed study as well as time period which need to be considered for the same. Shri Amit Kr Soni and Shri Purnendu Kumar explained the various CSR activities undertaken during last five years i.e. 2015-16 to 2019-20 and emphasised the recent CSR interventions of REGL and their salient features viz. Sustainable Livelihood Development, Water Conservation & Rain Water Harvesting, Strengthening of Health and Sanitation facilities, Live Stock Development, etc as well as various IG activities for women empowerment like mushroom cultivation, tailoring, Bio-manure, etc. Subsequently Shri Shukla highlighted the prime thrust area and coverage of proposed study to be undertaken by IISWBM and mentioned that the study should consider all the major social issues in line with the regulatory agency's requirement as well as needs of local people while assessing the impact of CSR activities on local community in particular and on region as a whole. Accordingly, various parameters included in the draft questionnaire submitted by IISWBM for social audit & social impact evaluation study have been discussed. Shri Soni & Shri Purnendu Kumar mentioned that the proposed questionnaire may be used for pilot survey and on the basis of pilot survey certain parameters to address the local people need may be included, if required. Accordingly, it was resolved that the suggestions made during discussion as well as the observation recorded during the pilot survey would be incorporated in the proposed questionnaire and the same would be subsequently used for the field survey and data collection.

2. Subsequently the detail meeting was held with Shri Amit Soni and Shri Purnendu Kumar, Unit CSR Head, Adani Foundation, REGL with IISWBM team members to understand the CSR activities of REGL being undertaken by Adani Foundation. Shri Kumar highlighted the new intervention initiated for skill development and income generation besides the other SLD, Education, Health and Infrastructure Development activities. The following information and documents were provided by CSR Cell of Adani Foundation, Bade Bhandar:
 - a. List of CSR villages along with name of Gram Panchayet and contact person;
 - b. Copy of Annual Report of CSR for 2015-16 and 2019-20 along with Budget and Expenditure.
 - c. Detail of CSR activities undertaken during last five years i.e. 2015-16 to 2019-20.

Dr. Agrawal requested to Shri Kumar to kindly provide village wise detail of CSR activities undertaken along with cost incurred for last five years i.e. 2015-2016 to 2019-2020. Shri Kuma ensured to provide all the information related to CSR activities of REGL



required for the present study. Accordingly, Dr. Agrawal submitted checklist of detailed information required in connection with CSR activities of REGL.

3. It was resolved that the formal letter to sarpanch of selected GPs may be given in advance (at least 1-2 days) mentioning the objectives and modus operandi of social audit and social impact evaluation study. The format for the same as well as social impact of various CSR activities undertaken and suggestions for improvement was evolved under the guidance of Shri R N Shukla and Shri Amit Soni.
4. The time schedule for initiating the field survey and data collection was discussed in view of prevailing pandemic (COVID-19) and technical as well as logistic support required for the same. Shri Shukla suggested to undertake field survey and data collection in consideration of prevailing norms and guidelines of Central and State Governments with proper protection of project team members as well as other stakeholders involved in the present study and the same was agreed by IISWBM project team.

3.4.2 Field Survey & Data Collection

As discussed in earlier section, the field survey and data collection was undertaken between September-October, 2020. The series of public consultation meeting conducted involving Sarpanch/ Upsarpanch/ member of Gram Panchayet along with the local people to evaluate the social impact of setting up and operation of REGL's TPP along with the evaluation of social impact of CSR activities undertaken by AF-REGL during the last five years i.e. 2015-16 to 2019-20 as well as their suggestions for improving the quality of life of local people in all the core as well as buffer zone villages falling within the 10 km radius of the REGL's Thermal Power Plant. The sample copy of FGD- public consultation intimation letter issued to Sarpanch/ Upsarpanch with request to organize public consultation on pre-decided date and time involving local people for the purpose along with endorsement regarding their presence during public consultation and the social issues identified along with their suggestions for the same is presented in Annexure 3.1.

Assessment of the existing basic amenities and infrastructural facilities along with the changes due to setting up and operation of REGL's TPP as well as need for strengthening the same in the concerned villages was also undertaken. The detail of surveyed CSR villages is presented in Table 3.3.



TABLE 3.3: DETAIL CSR VILLAGES SURVEYED FOR SIE AND SA FOR REGL'S TPP

Sl. No	Schedule No.	Village	GP	Block	District	CSR Zone
1	SA/REGL-01	Bade Bhandar	Bade Bhandar	Pusour	Raigarh	CZ
2	SA/REGL-02	Sarvani	Sarvani	Pusour	Raigarh	CZ
3	SA/REGL-03	Chhote Bhandar	Chote Bhandar	Pusour	Raigarh	CZ
4	SA/REGL-04	Aml Bhouna	Chote Bhandar	Pusour	Raigarh	CZ
5	SA/REGL-05	Jeveridih	Chote Bhandar	Pusour	Raigarh	BZ-I
6	SA/REGL-06	Kotmara	Kotmara	Pusour	Raigarh	BZ-I
7	SA/REGL-07	Barpali	Barpali	Pusour	Raigarh	BZ-I
8	SA/REGL-08	Amlipali	Kotmara	Pusour	Raigarh	BZ-I
9	SA/REGL-10	Tupakdhar	Taprda	Pusour	Raigarh	BZ-I
10	SA/REGL-11	Kathli	Taprda	Pusour	Raigarh	BZ-I
11	SA/REGL-12	Supa	Supa	Pusour	Raigarh	BZ-I
12	SA/REGL-13	Thengagudi	Supa	Pusour	Raigarh	BZ-I
13	SA/REGL-14	Jatri	Jatri	Pusour	Raigarh	BZ-I
14	SA/REGL-15	Bunga	Bunga	Pusour	Raigarh	BZ-I
15	SA/REGL-16	Ranbhatha	Ranbhatha	Pusour	Raigarh	BZ-I
16	SA/REGL-17	Semra	Semra	Pusour	Raigarh	BZ-I
17	SA/REGL-18	Semibhwar	Semra	Pusour	Raigarh	BZ-II
18	SA/REGL-19	Tilgi	Tilgi	Pusour	Raigarh	BZ-I
19	SA/REGL-20	Karichhapar	Siha	Pusour	Raigarh	BZ-I
20	SA/REGL-21	Pusalda	Pusalda	Pusour	Raigarh	BZ-II
21	SA/REGL-22	Sankarpali	Pusalda	Pusour	Raigarh	BZ-I
22	SA/REGL-23	Chikhli	Chikhli	Pusour	Raigarh	BZ-I
23	SA/REGL-24	Raibar	Raibar	Pusour	Raigarh	BZ-I
24	SA/REGL-25	Litaipali	Litaipali	Pusour	Raigarh	BZ-I
25	SA/REGL-26	Rawnkondhra	Litaipali	Pusour	Raigarh	BZ-II
26	SA/REGL-27	Siha	Siha	Pusour	Raigarh	BZ-I
27	SA/REGL-28	Bonda	Bonda	Pusour	Raigarh	BZ-I
28	SA/REGL-29	Siladi	Bonda	Pusour	Raigarh	BZ-II
29	SA/REGL-30	Jiladi	Bonda	Pusour	Raigarh	BZ-II
30	SA/REGL-31	Nawapara B	Nawapara B	Pusour	Raigarh	BZ-II
31	SA/REGL-32	Khaprapali	Nawapara B	Pusour	Raigarh	BZ-II
32	SA/REGL-33	Raipali	Nawapara B	Pusour	Raigarh	BZ-II
33	SA/REGL-34	Singpuri	Baradoli	Pusour	Raigarh	BZ-II



Sl. No.	Schedule No.	Village	GP	Block	District	CSR Zone
34	SA/REGL-35	Ruchida	Ruchida	Pusour	Raigarh	BZ-II
35	SA/REGL-36	Gotama	Gotama	Pusour	Raigarh	BZ-II
36	SA/REGL-39	Lankapali	Nandeli	Pusour	Raigarh	BZ-II
37	SA/REGL-40	Chichor Umariya	Chichor Umariya	Pusour	Raigarh	BZ-II
38	SA/REGL-41	Kensera	Kensara	Pusour	Raigarh	BZ-II
39	SA/REGL-42	Badimal	Kensara	Pusour	Raigarh	BZ-II
40	SA/REGL-43	Tetla	Tetla	Pusour	Raigarh	BZ-II
41	SA/REGL-46	Putkapuri	Putkapuri	Pusour	Raigarh	BZ-II
42	SA/REGL-47	Basanpali	Basanpali	Pusour	Raigarh	BZ-II
43	SA/REGL-48	Bulaki	Kwrika	Pusour	Raigarh	BZ-II
44	SA/REGL-51	Changhori	Pasapali	Pusour	Raigarh	BZ-II
45	SA/REGL-52	Salhepali	Bhatpur	Pusour	Raigarh	BZ-II
46	SA/REGL-53	Surri	Surri	Pusour	Raigarh	BZ-II
47	SA/REGL-54	Ghughwa	Ghughwa	Pusour	Raigarh	BZ-II
48	SA/REGL-55	Torna	Ghughwa	Pusour	Raigarh	BZ-II
49	SA/REGL-56	Chuhipali	Nansiya	Raigarh	Raigarh	BZ-II
50	SA/REGL-57	Kurmapali	Kurmapali	Pusour	Raigarh	BZ-II
51	SA/REGL-58	Thakurpali	Ourabhata	Raigarh	Raigarh	BZ-II
52	SA/REGL-59	Tekka	Pacheda	Pusour	Raigarh	BZ-II
53	SA/REGL-60	Amaldiha	Pacheda	Pusour	Raigarh	BZ-II
54	SA/REGL-61	Pacheda	Pacheda	Pusour	Raigarh	BZ-II
55	SA/REGL-63	Kouwantal	Kouwantal	Pusour	Raigarh	BZ-II
56	SA/REGL-64	Raitarai	Kouwantal	Pusour	Raigarh	BZ-II
57	SA/REGL-65	Jampali	Telipali	Pusour	Raigarh	BZ-II
58	SA/REGL-66	Gorra	Gorra	Pusour	Raigarh	BZ-II
59	SA/REGL-69	Linjir	Linjir	Pusour	Raigarh	BZ-II
60	SA/REGL-70	Bijna	Jogitari	Pusour	Raigarh	BZ-II
61	SA/REGL-71	Nandeli	Nandeli	Pusour	Raigarh	BZ-II
62	SA/REGL-72	Chandli	Chandli	Dabhra	Jajgir-Champa	BZ-I
63	SA/REGL-73	Kalma	Kalma	Dabhra	Jajgir-Champa	BZ-II
64	SA/REGL-74	Mahadevpali	Kalma	Dabhra	Jajgir-Champa	BZ-II



Sl. No.	Schedule No.	Village	GP	Block	District	CSR Zone
65	SA/REGL-75	Palsada	Palsada	Dabhra	Jajgir-Champa	BZ-I
66	SA/REGL-76	Bhirha Bhatha	Palsada	Dabhra	Jajgir-Champa	BZ-I

The impact/feedback of CSR activities undertaken by REGL at villages around TPP as well as railway track were undertaken during the field survey and data collection. The priorities of local people were also identified for undertaking CSR activities.

3.4.3 Focus Group Discussions

An exhaustive guideline for conducting public consultation through Focus Group Discussions (FGD) was also developed. For discussion with male groups, various thematic areas were selected which included village history and its natural resources, access to public services, employment, housing, farm and non-farm livelihood, landholding and poverty, access to institutional credit and transportation facilities. The thematic areas selected for discussion with women groups included PDS, Anganwadi, Primary Education, Women employment, drudgery and health issues.

The following Participatory Rural Appraisal (PLA) techniques were applied in the assessment process:

- Resource mapping
- Social mapping
- Input – Output tree
- Timeline analysis
- Health chart
- Institution mapping

The series of public consultation meeting conducted involving Sarpanch/ Upsarpanch/ member of Gram Panchayet along with the local people to identify the likely social issues as well as their suggestions for tackling the same in all the core as well as buffer zone villages falling within the 10 km radius of the REGL's TPP.

The public consultation intimation letters were issued to Sarpanch/ Upsarpanch with request to organize public consultation on pre-decided date and time involving local people. The local people participated in the public consultation were enlisted and their endorsement regarding



their presence during public consultation were taken. During the public consultation, various social issues were identified along with their suggestions for mitigating the same were documented. Assessment of the existing basic amenities and infrastructural facilities along with the need for strengthening the same in the concerned villages was also undertaken.





P1: Discussion With KWTPP Authority to Initiate SES and NAS



P2: Discussion With CSR Team of KWTPP to Evaluate CSR Activities Undertaken



P3: Secondary Data Collection from KWTPP Authority to Undertake SIA



P4: Sensitization of PAPs & Other Local People for Undertaking SES & NAS at Core Villages



P5: Sensitization of Local People for Undertaking SES & NAS at Buffer Zone Villages



P6: Sensitization of Local People for Undertaking SES & NAS at Buffer Zone Villages



P7: Socio-Economic Survey at Core Zone Villages



P8: Socio-Economic Survey at Buffer Zone Villages



P9: Socio-Economic Survey at Buffer Zone Villages



P10: Interaction for Preparation of Women Profile of Project Area



P11: Interaction for Preparation of Women Profile of Project Area



P12: Interaction for Preparation of Women Profile of Project Area



P13: Focus Group Discussion at CSR Zone Villages



P14: Focus Group Discussion at CSR Zone Villages



P15: Focus Group Discussion at CSR Zone Villages



P16: Priority Need Assessment for Community Development In CSR Villages



P17: Priority Need Assessment for Community Development In CSR Villages



P18: Priority Need Assessment for Community Development In CSR Villages