MAHARASHTRA STATE POWER GENERATION CO. LTD.

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.
CIN: U40100MH2005SGC153648

Office of **Chief Engineer**
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CE (E&S-GP II)/EE-1/GPII/EC Compliance/ 351 Date: 30 JUN 2025

To,
The Regional Officer,
Integrated Regional Office,
Ministry of Environment, Forest & Climate Change, Raipur
Aranya Bhawan, North Block,
Sector-19, Naya Raipur,
Atal Nagar, Chattisgarh
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Sub: - Six monthly compliance report (Period: October 2024- March 2025) of Environmental Clearance of Gare Palma Sector II Coal Mine Project of 23.6 MTPA capacity (Open Cast 22.0 MTPA + Under Ground- 1.6 MTPA) in mine lease area of 2583.48 ha of M/s Maharashtra State Power Generation Company Ltd (MSPGCL) located in District- Raigarh, Chhattisgarh.

Ref: -

EC letter (Identification No. - EC24A0605CG5972856N, File No. - J-11015/72/2016-IA.II(M), dated 13.08.2024.

Sir,

Gare Palma Sector II Coal Mine Project of Open Cast 22.0 MTPA + Under Ground- 1.6 MTPA capacity in mine lease area of 2583.48 ha of M/s Maharashtra State Power Generation Company Ltd (MSPGCL) located in District- Raigarh, Chhattisgarh has been granted Environment Clearance by MoEF & CC vide EC letter u/r.

As per the EC conditions, please find enclosed herewith Six-monthly compliance report (Period: October 2024- March 2025) of Environmental Clearance of Gare Palma Sector II Coal Mine Project.

Thanks & regards,

Yours truly,

SGL

Chief Engineer (E&S-GPII)

Copy to: (By E-mail)

1. The Director, MoEF & CC, New Delhi
2. The Member Secretary, CECB, Raipur (CG)
3. The Regional Officer, CECB, Raigarh

Six Monthly compliance report of GP-II Environment Clearance letter dated 13.08.2024 (File No.: J-11015/72/2016-IA.II(M)) for the period from October 2024 to March ,2025

Sl. No.	Specific Condition	Compliance Status
1.1	The project proponent shall obtain Consent to Establish/Operate from the State Pollution Control Boards for the proposed peak capacity of 23.60 MTPA (OC-22.0 MTPA+UG-1.6 MTPA) prior to the commencement.	Consent to Establish obtained vide letter No. 11887/11888 TS/CECB/2025 dated: 17/03/2025. Consent to Operate obtained vide letter No. 2427/TS/CECB/2025, Dated 27/05/2025. From Chhattisgarh Environment Conservation Board, Raipur.
1.2	NoC from Central Ground Water Authority (CGWA)/ concerned local authority, as the case may be, shall be obtained before drawing the groundwater for the project activities, state pollution control board/pollution control committees shall not issue the consent to operate (CTO) under Air (prevention and control of Pollution) Act and Water (Air (prevention and control of Pollution) Act till the project proponent shall obtain such permission.	Obtained permission from the Central ground water authority for the ground water abstraction/utilization vide NOC, Letter No. CGWA/NOC/MIN/REN/1/2025/11170, dated 18.03.2025 having approval of freshwater abstraction is 1239 m^3/d and dewatering (for internal use) is 398 m^3/d. Copy of the CGWA NOC is enclosed as **Annexure - 1**
1.3	The PP shall implement the following recommendations made in the Hydrogeology & Embankment Design report of IIT (ISM) Dhanbad. PP shall install water meters at all intake points and take specific measures for reduction in water consumption and generation of alternative sources of water through rainwater harvesting measures. PP shall monitor the water quality surface as well as groundwater for the presence of heavy metals. Immediate mitigation measures will be adopted if water quality deteriorates. Safe drinking water shall be supplied to all residents of the ML area. Water audit needs to be done every year by a reputed institute for further reduction of water consumption and PP shall implement its recommendations and submit a report to RO annually: - a) Provision of garland drains around pit, dump and backfilled area and embankment.	Water meter shall be installed at all inlet and outlet points. NABL/MoEF&CC accredited lab shall be engaged for the regular monitoring of Air and water. Safe drinking water will be supplied to all residents within ML area. Reputed institute will be engaged (as per CGWA empaneled audit agency) for water audit for reduction of water consumption and report will be submitted to RO, MoEF & CC & CECB. a. During Civil work before commencement of the mine, garland drain shall be prepared at site around pit, dump and backfilled area and embankment. b. Settling pond/reservoir shall be constructed within ML area, so that Garland drains to be connected with the same. c. Water seeping into mine shall be treated as per the mentioned

	b) Discharge from Garland drain shall be connected to settling pond/reservoir before discharging into Kelo river for controlling sediment load. c) The water seeping into the mine shall be collected in mine sump, pumped to surface reservoir where the sediments shall be separated through gravity separation technique. The surface overflow from these reservoirs after suitable treatment shall be recycled for various end uses i.e. drinking water for the community, irrigation and industrial requirements like sprinkling on haul roads, cleaning and washing of vehicles etc. d) During mining a statutory barrier of 100 m is required to be left between the mine workings and the Kelo riverbank. The embankment shall be constructed along the banks of the Kelo river, as per the detailed design and alignment given in the report. The height of the embankment shall vary from 2 m to 9 m on the right bank and from 4m to 9m on the left bank. e) It is further planned to strengthen the embankment on riverside by placing large boulders in wire net bags to prevent erosion and damage to the embankment by floods in river/nala besides grouting any weak portions of the embankment. The embankment will also be stabilized by road rollers and vibrators followed by plantation of grass and bushes all over to prevent soil erosion. f) The HDPE geomembrane lining in the embankment will provide puncture and tear resistance, resistance to acids, bases, salts, and organic chemicals, low permeability to water and gases and stability against environmental stress cracking. g) The apron provided at the base of the embankment will help in considerably reducing the seepage through the base of the embankment. In addition, the central core layer will have interlocking arrangement at the base to avoid seepage from the base specially during the occurrence of high flood events. h) The possibility of an AI/IOT based real-time water quality and flow monitoring system integrated with online sensor may be explored in Kelo river and Mine water reservoir to keep online track of mine water	condition. WTP shall be constructed at the site for treatment of mine water. d. Embankment shall be constructed along the banks of the Kelo river, as per the detailed design and alignment given in the report. e. Embankment shall be protected by the larger boulder in wire net bags. Plantation and bushes shall be developed on the surface of embankment. f. HDPE geomembrane lining in the embankment will be provided. g. The apron will be provided at the base of embankment. h. AI/IOT based real time water quality flow monitoring system shall be explored.

	quality and Kelo river along with the measurement of Kelo river flow, velocity and depth of water. AI inbuild system will help in providing early warning for any un-precedented flood (Flood alert system) & deterioration in water quality well in advance to adopt all proactive measures to minimize the risk.	
1.4	PP shall submit the study conducted by IIT Dhanbad to State Water Department and obtain permission before diversion of two nalas, one on the west side (Nala A) and one on the East side (Kamara nala) of Kelo river.	Hydrology report prepared by IIT Dhanbad will be submitted to State Water department for approval of Nala Diversion.
1.5	The total water requirement is 2785 KLD and the net water requirement is 1785 KLD. The total water requirement will be met by bore-wells at site during the initial 2-3 years after which the mine water will be used after appropriate treatment as required. The total industrial water demand (peak) in operation phase shall be met by utilizing treated mine discharge water. If required, necessary arrangement shall be made to reuse treated water from STP & ETP to nearby TPP or coal washery or future coal washery by entering suitable agreement. No wastewater (treated or untreated) shall be discharged into the river or any other water body.	STP and ETP with an adequate capacity of 5 KLD each already installed at mine site.
1.6	Water quality and Bioassay tests of kelo shall be monitored quarterly and submitted to the State Pollution Control Board. No waste shall be discharged into the river. Quarterly monitoring of the quality of water from bore wells used for drinking purposes shall be conducted and a report thereof shall be submitted to SPCB.	Water quality and Bioassay tests of Kelo will be monitored quarterly through MOEF& NABL approved environmental lab Post commencement of mine, Quarterly monitoring of the quality of water from bore wells used for drinking purposes shall be conducted by NABL& MOEF&CC approved environment lab.
1.7	All the villages coming under the zone of influence as in the hydrology study shall be provided with suitable water supply along with sanitation facilities.	Shall be complied.
1.8	PP shall implement the recommendations of NEERI Report within the lease area	Shall be complied.
1.9	The social fabric of the area needs to be kept intact, accordingly, the R&R plans should be made such that the Cultural and religious beliefs of the locals are protected. Further, PP shall prepare and implement a mitigative plan based on the guiding principles provided in the Socio-Economic Report prepared by the Entrepreneurship Development Institute of India, Ahmedabad (EDII) within six months. The budget proposed for addressing the issues of PH under CER as per the last EC was 45.35 Cr for 5 years. PP shall	Mitigative plan shall be prepared based on the guiding principles provided in the Socio-Economic Report prepared by the Entrepreneurship Development Institute of India, Ahmedabad (EDII). Sufficient funds for CER will be allocated within the next 10 years. Time bound action plan for CER activities will also be prepared.

	ensure that sufficient funds shall be allocated for the same keeping in mind that activities are to be carried out for at least 10 years. PP shall submit a time-bound, activity-wise plan with budgetary provisions to the Ministry. After preparation of the plan, PP shall submit the action taken with documentary proof viz. photographs, the amount spent etc. to the concerned RO in six monthly compliance reports. Separate audited accounts shall be maintained. All the recommendations made in the Socio-economic & Social Impact Assessment study shall be complied within a stringent timeframe. The timeline should be submitted to the District Collector for necessary action points.	
1.10	All the recommendations made in the Socio-economic & Social Impact Assessment study shall be complied within a stringent timeframe. The timeline should be submitted to the District Collector for necessary action points.	Shall be complied.
1.11	PP shall implement the following recommendations made in CSIR-CIMFR report "Advice on mitigation measures to be adopted for the villagers of the GPII coal block area in Tamnar, District Raigarh, Chhattisgarh.": a) Design and operate the mine with a focus on minimizing dust generation during coal and Overburden (OB) production processes. Employ advanced technologies and engineering solutions to mitigate dust emissions at the source. b) Implement transportation methods that prevent the exposure of dust to the ambient air. Utilize In-Pit Crushing and Conveying (IPCC) or High Angle Conveying (HAC) mechanisms for material handling and transport to minimize airborne dust. c) Aim to transform the mine into a seldom blast and preferably dumper-free opencast mining by adopting cutting edge technology for coal production, crushing and transport. This approach not only reduces dust emissions but also enhances workplace ergonomics, operational efficiency, health hygiene and safety. d) Implement a closed transportation system utilizing pipe conveyors or enclosed conveyors. This approach ensures that material transport is contained within a closed system, minimizing the dispersion of dust and pollutants into the surrounding environment.	• Air pollution control measures will be arranged at site to mitigate the dust emission. • IPCC and HAC mechanism for material handling and transport will be utilized. • Cutting edge technology will be adopted in the plant. • Closed transport system will be utilized. • Comprehensive greenbelt shall be developed along the mine boundary to reduce dust dispersion and noise pollution. • Regular medical examination including spirometry tests for all workers to monitor lung function and detect early signs of respiratory diseases shall be conducted. • Proximity detection systems on heavy machinery will be installed. • Designated walkways and traffic zones within the mine site shall be

	e) Implement a comprehensive green belt initiative, incorporating dense vegetation surrounding the mine site. This strategic green belt will act as a natural barrier, effectively reducing dust dispersion and minimizing noise pollution, thus mitigating the environmental impact on the surrounding community. f) Mandate regular medical examinations, including spirometry tests, for all workers to monitor lung function and detect early signs of respiratory diseases. Conduct training sessions on proper respiratory hygiene and cough etiquette to prevent the spread of respiratory infections among workers. g) Install proximity detection systems on heavy machinery to alert operators of nearby workers and prevent collisions and crush injuries. Establish designated walkways and traffic zones within the mining site to separate pedestrian and vehicle traffic and reduce the risk of accidents. Conduct ergonomic assessments of workstations and equipment to identify and mitigate ergonomic risk factors contributing to musculoskeletal injuries. h) Provide Personal Protective Equipment (PPE) to all employees to mitigate residual impacts effectively. Ensure that PPE kits are regularly refreshed and samples are periodically tested to maintain their effectiveness in safeguarding the health and safety of workers against any potential hazards encountered during mining operations. i) Implement a comprehensive hearing conservation program, including annual audiometric testing and noise exposure monitoring for all workers. Utilize advanced noise control technologies such as silencers, mufflers, and acoustic enclosures to reduce noise emissions from equipment and machinery. Provide regular training sessions on the proper use and maintenance of hearing protection devices to ensure maximum effectiveness and compliance. j) Substitute hazardous chemicals with environmentally friendly alternatives wherever feasible to minimize the risk of chemical exposure to workers and the surrounding environment. Implement a chemical management system to track the handling, storage, and disposal of hazardous substances and ensure compliance with safety regulations. Conduct regular inspections and audits of chemical storage areas to identify and address potential leaks,	provided before commencing work. • A refreshed PPE kit for workers shall be arranged at site. • Advanced noise control technologies such as silencers, mufflers, and acoustic enclosures must be arranged at site to reduce noise emissions from equipment and machinery. • A Vendor would be finalized for hazardous waste disposal. • An emergency response plan shall be prepared and developed on site. • Training for emergency response teams to effectively handle emergencies. • Water management practices include regular monitoring of water quality by NABL & MOEF&CC approved environment monitoring agency. • Water reservoir and sedimentation pond must be provided within the mine lease. • Land reclamation and rehabilitation plan shall be prepared annually. • Buffer zones and conservation areas shall be identified around the sensitive ecological habitats. • Soil sampling shall be conducted on regular basis by NABL & MOEF&CC approved environment monitoring agency. • Training and support to local farmers on safe agricultural practices

	spills, or contamination risks. k) Offer stress management workshops and resilience training programs to help worker scope with the demands and challenges of mining work. Establish a peer support network or buddy system to encourage social connections and provide emotional support among workers. Promote work-life balance initiatives, and recreational activities to enhance overall well-being and job satisfaction. l) Develop and regularly update emergency response plans and procedures to address potential mine accidents, including fires, explosions, and collapses. m) Conduct emergency response drills and simulations involving both onsite personnel and local emergency services to ensure readiness and coordination in the event of a crisis. n) Provide specialized training for designated emergency response teams to effectively handle emergency situations and assist with rescue and evacuation efforts. o) Implement robust water management practices, including regular monitoring of water quality parameters such as pH, turbidity, and heavy metal concentrations. Since there is a reported presence of arsenic in the area, this should be specifically monitored in the ML area and the residents provided with safe drinking water. p) Implement a zero-water discharge policy and establish water bodies within the vicinity to facilitate the treatment and provision of water for the local community. Install sedimentation ponds and filtration systems to capture and treat runoff from mining activities before it enters local water bodies. q) Collaborate with local communities and regulatory authorities to establish a comprehensive water monitoring program to detect and mitigate any signs of contamination promptly. r) Implement land reclamation and rehabilitation measures, to restore disturbed areas and minimize erosion and sedimentation s) Establish buffer zones and conservation areas around sensitive ecological habitats to preserve biodiversity and ecosystem services in the surrounding area. t) Conduct regular soil sampling and analysis to assess nutrient levels and soil	shall be provided.

	health parameters and guide appropriate remediation and restoration efforts. u) Collaborate with local agricultural extension services and farmers to promote sustainable land management practices and mitigate the impact of mining on agricultural productivity. v) Establish a systematic approach to managing Overburden Dumps, Coal Dumps, Spoil Heaps, Reject Dumps, and Tailings Dumps to ensure minimal impact on soil and land fertility. Adhere to industry best practices and regulatory guidelines when sitting and managing these dumps to safeguard soil quality and preserve land fertility throughout the mining operation's lifecycle. w) Provide training and support to local farmers on safe agricultural practices, including proper irrigation techniques and soil management strategies.	
1.12	PP shall review the outcome of the skill development programs whether it is providing any benefit or not, and whether it helps the community in getting job/business opportunities. PP shall align the activities as per the present-day needs. The skilled beneficiaries shall be aided in job placements and self-employment ventures by the PP and a record of this shall be maintained. A report in this regard shall be submitted to the concerned RO within 6 months.	Skill development program will be designed based on prior Training needs assessment done in line with scientific study conducted by EDII, Ahmedabad any other contemporary development evolving demographic profile of stakeholders/PAPs. Accordingly, Skill development program during operation phase shall be carried out.
1.13	PP shall carry out a survey of the impact of blasting in the nearby area/villages by involving a reputed institute and take remedial measures as proposed by the respective institute. Further, provide compensation if any for any damage caused.	Detailed survey will be carried out during operation phase to assess the impact of blasting in the nearby area/villages and the same shall be submitted to RO.
1.14	PP shall implement the following recommendations made in the report "Plan for the protection of the ecology and post-mining ecological restoration plan for the Gare Palma-II coal mine project, Tamnar, Raigarh, Chhattisgarh", prepared by ISM Dhanbad: a) It is important to emphasize that green belt development offers a solution to most of the environmental problem, including noise and air pollution and land deterioration. Thus, all important processes could be supported by plants as a barrier. b) Revegetation in ex-mining lands not only protects the mine soil from degradation due to erosion but also improves the quality of the mine soil	• Greenbelt will be developed at site as per the finalized surface plan for plantation. • Vegetation will be developed at OB dump area and the temp grass meting must be laid down on OB dump to protect the soil erosion. • Afforestation and reclamation shall be carried out as per the suggested list given in the Forest Conservation plan and Ecology restoration plan. • Restoration initiatives shall be designed for implementation at site.

	itself. Improving the quality of mine soil does not solely come from trees but also from the legume cover crops. c) From the environmental perspective, means putting the land impacted by the mining activity back to a sustainable usable condition, the post mine revegetation should be sustainable, in the long term, under normal land management practices. d) Afforestation and reclamation should be carried out in a way that promotes the growth of fruit-bearing trees, which will draw wildlife and preserve the region's biodiversity. In addition to fruit trees, various flowering plants should be planted to promote biodiversity and attract native and local creatures, including insects, birds, monkeys, and reptiles. Encouraging the growth of medicinal plants is also vital for the welfare of the surrounding villages. The vetiver plantations may also be encouraged because, in addition to their medicinal potential, the grass species has a high anchoring strength. e) Many restoration initiatives may be impacted by extreme weather events including storms, droughts, and heavy rain, thus it is important to plan ahead and prevent these effects. Future fire risk should be taken into account. f) Seasonality and water availability are essential to a species' ability to establish, thrive, and survive. Drought risk should be considered while selecting a restoration site or determining which ecological components to repair. g) In accordance with the guidelines outlined in the mine plan or scheme, the topsoil should only be held temporarily at the designated site(s) and should not be left unused for longer than three years. Reclamation of land and plantation should be the proper uses for the topsoil. It is important to design top layers of dumps and batters of depleted mine workings so that the slope allows water to drain naturally while also protecting against erosion from water. h) To stop silt and sediment flows from mine operations and OB dumps, suitable-sized catch drains and siltation ponds should be built. The green belt development can be irrigated with the water so gathered. The drains need to be adequately maintained and desilted on a regular basis,	• Water reservoirs shall be created in ecological area to enhance the water availability for species. • Topsoil will be stored at the designated site based on the guideline given in the ecological restoration plan. • Suitable-sized catch drains, and siltation ponds shall be built. • The drains shall be adequately maintained and desilted on a regular basis, especially after the monsoon. • Drain fertile soil-covered surfaces, drainage facilities (ditches) shall be built. • The biologically active layer of reclaimed soil shall be kept at least 80 - 120 cm thick, for trees, it should be 120 - 200 cm thick. • Native species shall be used in greenbelt plantation on OB dump area. • Annual status of afforestation and implementation of wildlife conservation plan to be received from local Forest department against the deposit amount for afforestation and WLCP.

	especially after the monsoon. When it's required to drain fertile soil-covered surfaces, drainage facilities (ditches) should be built such that the hazardous layers are completely covered. Use of appropriate protective materials is required to regulate the inflow and discharge of water. Wave movement must be prevented on the batter surfaces, particularly those that are close to and above sea level. i)The characteristics of the soil used for reclamation and the anticipated usage of the area after reclamation determine how thick the covering topsoil layer is. For farmed fields, the biologically active layer of reclaimed soil should be at least 80 - 120 cm thick; for trees, it should be 120 - 200 cm thick. j) The establishment of native species is aided by the replacement of fertile overburden material, such as carefully excavated forest floor and topsoil from the cleared opencast working face (fore field), or other biologically active organic materials. It is important to take into account that managing the rootstocks and seeds that are already in the soil is hastening the processes of soil development, particularly the intended humus formation. k) The status of the local flora and wildlife should be routinely observed throughout the year, taking note of variables such as the area covered by vegetation or plantations, the kind of plantations, the kinds of trees, grasses, and shrubs that are present, the spacing between plants, and the survival rate. It is important to make any changes occurring in the area evident. The State Forest and Wildlife Department should be consulted when conducting the study. The social impact perspective should be used to evaluate all reclamation plans. In order to keep an eye on any potential alterations, environmental control measures should also be taken	
1.15	Progressive backfilling of the mine and progressive reclamation of the OB dump shall be done as per the approved mine closure plan & as per the recommendation of the eco-restoration report.	Progressive backfilling of the mine and progressive reclamation of the OB dump shall be monitored.
1.16	The project proponent shall take all precautionary measures during mining operations for the conservation and protection of endangered fauna, if any, spotted in the study area. Wildlife Management Plan prepared and approved by PCCF, WL vide letter no. 494/12, dated 20.01.2021 shall be implemented in consultation with the State Forest and Wildlife Department. The budget	Annual status of afforestation and implementation of wildlife conservation plan shall be received from local Forest department against the deposit amount for afforestation and WLCP.

	earmarked for WLCP is Rs 344.40 Lakh. PP shall deposit the amount of WLCP in the Government account as approved by the concerned authority	
1.17	PP shall implement the following recommendations made in the Carrying Capacity Report undertaken by CECB, Chhattisgarh through IIT-Patna as applicable for the said mines which include: a) Coal and fly ash transportation is not permitted on any village road. All industrial roads need to be paved with concrete/asphaltand properly maintained with timely repairs. b) Regular water sprinkling work to be taken place on all industrial roads. c) Mine should have a wheel washing system at all entrance and exit points. d) Railway siding needs to adhere to CPCB regulations and should include rain guns, wind-breaking walls, sprinklers, parking lots, access roads, drainage facilities, settling pits, etc. e) If coal is being transported by road, transporters should be charged a surcharge based on their distance and time travelled for the purpose of road maintenance and repair. Plantation should be done along such roads. f) CAAQMS must be installed in almost every village of Tammar block and consistently connected to the state pollution control board according to CPCB guidelines.	• Wheel washing system must be deployed before commencement of the work. • All the facilities mentioned in the condition such as rain guns, wind-breaking walls, sprinklers, parking lots, access roads, drainage facilities, settling pits etc to be provided with mine area.
1.18	Third-party audit (by NEERI/CIMFR/IIT/NITs) for air & water quality shall be carried out annually to keep a check on the same. PP shall implement the recommendations of the audit and submit the outcome of the audit to the concerned RO of MoEF&CC.	Third party audit will be done annually for air and water quality.
1.19	As per NGT order dated 15.02. 2022 in Original Application No. 104'2018 in the matter of Shivpal Bhagat & Ors vs UIO, PP to i) comply with all the recommendation of Carrying Capacity Study being conducted by reputed institute by CPCB & SPCB, ii) Coal transportation is permitted for only one year through road from date of commissioning and subsequently. transport must be done by rail or closed conveyor belt only, iii) proper and free health care facilities with multispecialty treatment system shall be provided in coal mine buffer area,	• In adherence to the condition, suitable arrangement for transportation of coal by rail or conveyor shall be made. • Suitable health care facilities shall be provided.

	iv) when coal is sold to TPP there is the agreement to sell that at least 25% Fly Ash of the coal sold should be accepted by the coal company (seller) from TPP(Purchaser) failing which coal company shall be liable for civil action and other legal measures.	
1.20	PP shall ensure that all types of plastic waste generated from the mines shall be stored separately in isolated areas and disposed of strictly adhering to the Plastic Waste Management Rules 2016. In pursuant to the Ministry's OM dated 18/07/2022, PP shall also create awareness among the people working in the project area as well as in its surrounding area on the ban on Single Use Plastic (SUP) in order to ensure compliance of the Ministry's Notification published by the Ministry on 12/08/2021. A report along with the photographs of the measures taken shall also be included in the six-monthly compliance reports being submitted by PP.	Form-II for plastic waste management and generation shall be prepared and submitted to RO.
1.21	PP shall obtain a 5-star rating in terms of Environment Compliance from the Ministry of Coal as per the rating system implemented by the Ministry of Coal.	5-star rating in terms of Environment Compliance shall be obtained from MoC.
1.22	PP shall ensure that No OB dumping is done outside the lease area.	OB dump will not be done outside the mine lease area.
1.23	PP shall submit an action plan for using and developing Renewable Energy for its consumption in its utilities/machinery/equipment instead of using electricity from Grid/generated from Thermal Power Plants. PP shall Install additional solar power generation units	An action plan shall be prepared for using and developing Renewable energy for its consumption in utilities.
1.24	The Committee is of the view as the forest is at a distance of 100 meters PP shall create a natural wind barrier between the lease boundary and the forest area by developing a dense green belt. Impact on the forest land shall be studied/monitored at regular intervals and a report shall be submitted to RO.	A natural wind barrier between lease boundary and the forest area by developing a dense green belt. The report will be submitted to RO.
1.25	PP shall carry out plantation in an area of 2256.60 ha area and plant a minimum of 5641500 saplings. The density of the tree plantation shall be maintained at 2500 saplings/Ha. The budget proposed for the same is Rs 35.0 Lakh the same needs to be increased as per the actual plantation & maintenance cost. After completion of the tree plantation number of trees shall be duly endorsed by the District Forest Officer.	Greenbelt plantation will be developed as per prepared surface plan for plantation.
1.26	PP shall speed up concurrent Green Belt development so as to achieve the targets within the next 3 years. The green belt and plantation plan submitted in the EIA/EMP shall be implemented in a time-bound manner. A survival rate of at least 80% shall be maintained by carrying out gap plantation in case of	Greenbelt development shall be done as submitted. Annual audit will be carried out at site to prepare the detailed statement for expenditure along with proof of activities.

	mortality. The budget earmarked for the plantation shall be kept in a separate account. PP should annually submit the audited statement of expenditure along with proof of activities viz. photographs (before & after with geolocation date & time), details of expert agency engaged, details of species planted, number of species planted, survival rate, density of plantation etc. to the Regional Office of MoEF&CC and on PARIVESH Portal as the case may be for the activities carried out during previous year.	
1.27	The plantations done by the PP need to be adequately densified and audited by a third party preferably a forestry institution of MoEFCC (e.g. ICFRE) to assess their efficacy	For plantation, a third part audit will be conducted by forestry institution.
1.28	To control the production of dust at the source, the crusher and in-pit belt conveyors shall be provided with mist type sprinklers. Mitigating measures shall be undertaken to control dust and other fugitive emissions all along the roads by providing sufficient fixed-type water sprinklers. Adequate corrective measures shall be undertaken to control dust emissions, which would include mechanized sweeping, water sprinkling/mist spraying on haul roads and loading sites, long-range misting/fogging arrangement, wind barrier wall and vertical greenery system, green belt, dust suppression arrangement at loading and unloading points etc.	Crusher and In-pit conveyor with mist type sprinklers shall be provided at site. Fixed type water sprinkler with adequate no. shall be provided. Mechanized sweeping machine, water sprinkling/mist spraying for haul road and loading sites, fog canon system, wind barrier wall shall be provided at site.
1.29	The annual EMP budget is Rs 148453.76 Lakh (Table 10.2 of EIA Report) and shall be kept in a separate account and audited annually. If required, the same shall be increased. PP shall submit the proof (viz. photographs, reports etc.) of activities taken under EMP and the amount spent to the concerned RO in six monthly compliance reports.	An annual audit will be conducted to monitor the implementation of the EMP budget, and the details of the amount spent will be submitted to RO with six monthly report.
1.30	Continuous monitoring of occupational safety and other health hazards and corrective actions need to be ensured	Internal audits will be carried out to monitor occupational safety and health hazards.
1.31	PP shall obtain the permission of the State Public Works Department before the proposed for diversion Roads from Bajamura to Ghargoda (approx. 11.6 km) and Milupara to Tamnar (app 3 km).	Shall be complied.
1.32	Persons of nearby villages shall be given training on livelihood and skill development to make them employable.	Training will be provided to nearby people on livelihood and skill development.
1.33	Mining shall be carried out only by surface miners for the project and silo loading till railway siding through in-pit conveyor should be installed to avoid road transportation in 2 years.	Surface miners will be deployed at site. Silo loading through in-pit conveyor will be installed within 2 years.

1.34	Efforts shall be made for utilizing alternate sources of surface water, abandoned mines or else whatsoever and thus minimizing the dependability on a single source.	Noted.
1.35	Active OB Dump should not be kept barren/open and should be covered by temporary grass to avoid air born of particles	Temporary grass will be laid down on an active OB dump during operation phase.
1.36	PP shall conduct the stability study of OB dump by reputed agencies and necessary approval of DGMS.	Stability study of OB dump will be carried out by reputed agencies and necessary approval of DGMS shall be obtained.
1.37	Project Proponent shall obtain blasting permission from DGMS for conducting mining operation near villages and also explore deployment of rock breakers of suitable capacity in the project to avoid blasting very near to villages. There shall be no damages caused to habitation/structures due to blasting activity.	Blasting permission from DGMS will be obtained. Roack breakers to be deployed at site.
1.38	Proponent shall appoint an Occupational Health Specialist for Regular and Periodical medical examination of the workers engaged in the Project and maintain records; accordingly, also, Occupational health check-ups for workers having some ailments like BP, diabetes, habitual smoking, etc. shall be undertaken once in six months and necessary remedial/preventive measures taken accordingly. The recommendations of National Institute for ensuring good occupational environment for mine workers shall be implemented; The prevention measure for burns, malaria and provision of anti-snake venom including all other paramedical safeguards may be ensured before initiating the mining activities	Shall be complied suitably.
1.39	Project Proponent shall follow the mitigation measures provided in Office Memorandum No. Z-11013/57/2014- IA.II (M), dated 29th October, 2014. titled “Impact of mining activities on Habitations-Issues related to the mining Projects wherein Habitations and villages are the part of mine lease areas or Habitations and villages are surrounded by the mine lease area”.	Shall be complied.
1.40	The illumination and sound at night at project sites disturb the villages in respect of both human and animal populations. Consequent sleeping disorders and stress may affect the health in the villages located close to mining operations. Habitations have a right for darkness and minimal noise levels at night.	A monthly Illumination survey as per DGMS will be carried out and the report will be submitted to RO with half yearly compliances. Biological clock to be maintained.

	PP must ensure that the biological clock of the villages is not disturbed by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limits for day' light/night hours.	
1.41	PP shall obtain permission from DGMS and concerned railway authorities before diversion/re-alignment of railway line and comply with the conditions/recommendations of the approval so obtained.	Permission will be obtained from DGMS and the concerned railway authority before diversion of any railway line.
1.42	PP is advised to implement the 'Ek Ped Maa Ke Naam' Campaign which was launched on 5th June 2024 on the occasion of the World Environment Day to increase the forest cover across the Country. This plantation drive is other than Green belt development. The action in this regard shall be submitted concerned RO in six monthly reports	Shall be complied.
1.43	PP shall gradually shift to e-vehicles/ LNG/CNG transport for men and materials	Shall be complied.

Standard EC Conditions for (Mining of minerals)

1. Statutory Compliance

Sl. No.	EC Conditions	Compliance
1.1	The Environmental clearance shall be subject to orders of Hon'ble Supreme Court of India, Hon'ble High Courts, NGT and any other Court of Law, from time to time, and as applicable to the project	Agreed.
1.2	The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project.	MoEF&CC vide file no. 8-06/2022-FC and 8-06/2022-FC has granted Forest Clearance stage-I & stage-II respectively.
1.3	The project proponent shall obtain clearance from the National Board for Wildlife, if applicable.	Not applicable.
1.4	The project proponent shall prepare a Site-Specific Conservation Plan & Wildlife Management Plan and approved by the Chief Wildlife Warden. The recommendations of the approved Site-Specific Conservation Plan / Wildlife Management Plan shall be implemented in consultation with the State Forest Department. The implementation report shall be furnished along with the six-monthly compliance report (in case of the presence of schedule-I species in the study area).	Site specific conservation plan and Wildlife management plan have been prepared and the same has been approved by PCCF Wildlife. The cost of the plan has been deposited into the CAMPA account of the State for further implementation.

		Approval of wildlife conservation plan is enclosed herewith as **Annexure-2**
1.51	The project proponent shall obtain Consent to Establish / Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the concerned State pollution Control Board/ Committee.	Consent to Establish obtained vide letter No. 11887/11888 TS/CECB/2025 dated: 17/03/2025 & Consent to Operate obtained vide letter No. 2427/TS/CECB/2025, Dated 27/05/2025 from Chhattisgarh Environment Conservation Board, Raipur.
1.6	The project proponent shall obtain the necessary permission from the Central Ground Water Authority	Obtained permission from Central ground water authority for the ground water abstraction/utilization, vide NOC-No CGWA/NOC/MIN/REN/1/2025/11170 dated 18.03.2025
1.7	Solid/hazardous waste generated in the mines needs to addressed in accordance to the Solid Waste Management Rules, 2016/Hazardous & Other Waste Management Rules, 2016.	Post commencement of mine operation, Hazardous waste authorization shall be taken from respective Pollution control department.
1.8	Permission of power supply to be taken from the concerned authority for meeting power demand of the project site.	Permission for 70000 kW (Source: 11 kV overhead line from the existing grid at Tamnar) will be taken from the state electricity board.
1.9	The maximum production or peak production at any given time shall not exceed the limit as prescribed in the EC.	Agreed.
1.10	Validity of EC is as per life of the mine mentioned in EC letter or 30 years as per EIA Notification, 2006 and its amendments therein	Agreed
2. Air Quality Monitoring And Mitigation Measure		
2.1	Adequate ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely particulates, SO2 and NOx. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive receptors in consultation with the State Pollution Control Board. Online ambient air quality monitoring station/stations may also be installed in addition to the regular air monitoring stations as per the requirement and/or in consultation with the SPCB	Online ambient air quality monitoring station(s) will be installed as per consent conditions.

2.2	The Ambient Air Quality monitoring in the core zone shall be carried out to ensure the Coal Industry Standards notified vide GSR 742 (E) dated 25th September, 2000 and as amended from time to time by the Central Pollution Control Board. Data on ambient air quality and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly reported to the Ministry/Regional Office and to the CPCB/SPCB.	Data on heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly monitored through NABL/MoEF&CC accredited lab and the same will be reported to the Ministry/Regional Office and to the CPCB/SPCB.
2.3	Transportation of coal, to the extent if permitted by road, shall be carried out by covered trucks/conveyors. Effective control measures such as regular water sprinkling/rain gun/ Fog cannon /mist sprinkling etc., shall be carried out in critical areas prone to air pollution with higher level of particulate matter all through the coal transport roads, loading/unloading and transfer points. Fugitive dust emissions from all sources shall be controlled regularly. It shall be ensured that the ambient air quality parameters conform to the norms prescribed by the Central/State Pollution Control Board.	Effective control measures such as regular water sprinkling/rain gun/ Fog cannon /mist sprinkling etc., shall be arranged at site to mitigate the fugitive emission.
2.4	Major approach roads shall be black topped and properly maintained.	Agreed.
2.5	PP to install solar lights along the road used for transportation of coal to avoid the accidents at night and also seek its maintenance.	The same shall be complied.
2.6	The transportation of coal shall be carried out as per the provisions and route proposed in the approved mining plan. Transportation of the coal through the existing road passing through any village shall be avoided. In case, it is proposed to construct a 'bypass' road, it should be so constructed that the impact of sound, dust and accidents could be appropriately mitigated.	Agreed.
2.7	Vehicular emissions shall be kept under control and regularly monitored. All the vehicles engaged in mining and allied activities shall operate only after obtaining 'PUC' certificate from the authorized pollution testing centres.	Vehicular emissions shall be kept under control and regularly monitored.
2.8	Coal stock pile/crusher/feeder and breaker material transfer points shall invariably be provided with dust suppression system. Belt-conveyors shall be fully covered to avoid air borne dust. Side cladding all along the conveyor gantry should be made to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.	Agreed.
2.9	Coal handling plant shall be operated with effective control measures w.r.t. various environmental parameters. Environmental friendly sustainable technology should be implemented for mitigating such parameters.	Noted.
2.10	Adequate number of Fog canon (mist sprayer) shall be installed to reduce the impact of air pollution at dust generating sources with time bound action plan.	Fog canon (mist sprayer) shall be installed in sufficient nos to reduce the impact of air pollution at dust generating sources like haul roads, loading points, Coal stock yard point etc.

2.11	PP should Install Wind breaker/shield arrangement along the railway siding for reducing the dust propagation in upwind direction.	Noted.
2.12	Post environmental closure third party monitoring by reputed instituted in air quality, water, land & soil etc shall be carried out and analysed with EMP measures at regular interval. A suitable recommendation in this regard, shall be furnished to IRO, MoEF&CC for compliance. The data used for analysis shall be obtained from continuos AQMS, site specific water regime. Also third party shall analyses the implementation of river diversion, meeting to the requirement of project report.	Post environmental closure third party monitoring by reputed institute for air quality, water, land & soil etc shall be carried out as per approved mine plan.
3. Water Quality Monitoring And Mitigation Measures		
3.1	The effluent discharge (mine waste water, workshop effluent) shall be monitored in terms of the parameters notified under the Water Act, 1974 Coal Industry Standards vide GSR 742 (E) dated 25th September, 2000 and as amended from time to time by the Central Pollution Control Board.	Effluent discharge (mine waste water, workshop effluent) will be monitored through NABL/MoEF&CC accredited lab.
3.2	The monitoring data shall be uploaded on the company's website and displayed at the project site at a suitable location. The circular No.J-20012/1/2006-lA.11 (M) dated 27th May, 2009 issued by Ministry of Environment, Forest and Climate Change shall also be referred in this regard for its compliance.	Agreed.
3.3	Regular monitoring of ground water level and quality shall be carried out in and around the mine lease area by establishing a network of existing wells and constructing new piezometers during the mining operations. The monitoring of ground water levels shall be carried out four times a year i.e. pre-monsoon, monsoon, post-monsoon and winter. The ground water quality shall be monitored once a year, and the data thus collected shall be sent regularly to MOEFCC/RO.	Shall be complied.
3.4	Monitoring of water quality upstream and downstream of river including pons, lakes, tanks shall be carried out once in six months and record of monitoring data shall be maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office.	Agreed.
3.5	Ground water, excluding mine water, shall not be used for mining operations. Rainwater harvesting shall be implemented for conservation and augmentation of ground water resources.	Agreed.
3.6	The project proponent shall not alter major water channels around the site. Appropriate embankment shall be provided along the side of the river/nallah flowing near or adjacent to the mine. The embankment constructed along the river/nallah boundary shall be of suitable dimensions and critical patches shall be strengthened by stone pitching on the river front	Appropriate embankment will be provided along both side of the Kelo river as per the Hydrology report and the same will be strengthened by stone pitching

	side, stabilized with plantation so as to withstand the peak water pressure preventing any chance of mine inundation.	
3.7	Garland drains (of suitable size, gradient and length) around the critical areas i.e. mine shaft and low lying areas, shall be designed keeping at least 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine sites. The sump capacity shall also provide adequate retention period to allow proper settling of silt material of the surface runoff	Garland drains (of suitable size, gradient and length) around the critical areas i.e. mine shaft and low lying areas, will be designed as per Hydrology report.
3.8	The water pumped out from the mine, after siltation, shall be utilized for industrial purpose viz. watering the mine area, roads, green belt development etc. The drains shall be regularly desilted particularly after monsoon and maintained properly	Pumped out water will be used for dust suppression, greenbelt development and washing purposes. The Garland drains will be regularly desilted and maintained properly.
3.9	Industrial waste water from coal handling plant and mine water shall be properly collected and treated so as to conform to the standards prescribed under the Environment (Protection) Act, 1986 and the Rules made thereunder, and as amended from time to time. Oil and grease trap shall be installed before discharge of workshop effluent. Sewage treatment plant of adequate capacity shall be installed for treatment of domestic waste water.	Shall be complied.
3.10	Adequate groundwater recharge measures shall be taken up for augmentation of ground water. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mine.	Adequate groundwater recharge pit will be constructed to recharge the ground water table.
3.11	The surface drainage plan including surface water conservation plan for the area of influence affected by the said mining operations shall be prepared, considering the presence of any river/rivulet/pond/lake etc., with impact of mining activities on it, and implemented by the project proponent. The surface drainage plan and/or any diversion of natural water courses shall be as per the provisions of the approved Mining Plan/ EIA-EMP submitted to this Ministry and the same should be done with due approval of the concerned State/GoI Authority. The construction of embankment to prevent any danger against inrush of surface water into the mine should be as per the approved mining plan and as per the permission of DGMS.	Shall be complied.
3.12	The project proponent shall take all precautionary measures to ensure reverian/ riparian ecosystem in and around the coal mine upto a distance of 5 km. A revarian /riparian ecosystem conservation and management plan should be prepared and implemented in consultation with the irrigation / water resource department in the state government.	A revarian /riparian ecosystem conservation and management plan has been prepared by IIT (ISM) Dhanbad and the recommendation of IIT (ISM) Dhanbad shall be implemented at site. **Annexure: -3 (Chapter 5)**

3.13	Domestic water shall be providing to the residents/villages which are coming under the zone of influence of the project due to ground water extraction by installing a RO plant with proper supply line and Taps within 2 years	Noted.
3.14	No obselete technologies for sewage treatment shall be implemented. Construction of Sewage Treatment Plant with latest technology should be completed within 2 years and treated water shall be reused for plantation. CTE and CTO of STP shall be obtained as per the norms.	Shall be complied.
4. Noise And Vibration Monitoring And Prevention		
4.1	Adequate measures shall be taken for control of noise levels as per Noise Pollution Rules, 2016 in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with personal protective equipments (PPE) like ear plugs/muffs in conformity with the prescribed norms and guidelines in this regard. Adequate awareness programme for users to be conducted. Progress in usage of such accessories to be monitored.	Adequate measures will be taken for control of noise levels in the work environment.
4.2	The noise level survey shall be carried out as per the prescribed guidelines to assess noise exposure of the workmen at vulnerable points in the mine premises, and report in this regard shall be submitted to the Ministry/RO on six-monthly basis.	Noted. The same shall be submitted post commencement of mine operation.
5. Mining Plan		
5.1	5- Star Rating is mandatory to obtain certification as per guidelines of Mininstry of Coal	Noted.
5.2	Mining shall be carried out under strict adherence to provisions of the Mines Act 1952 and subordinate legislations made there-under as applicable.	Agreed.
5.3	No change in mining method i.e. UG to OC, calendar programme and scope of work shall be made without obtaining prior approval of the Ministry of Environment, Forests and Climate Change (MoEFCC).	Agreed.
5.4	Mining shall be carried out as per the approved mining plan (including Mine Closure Plan) abiding by mining laws related to coal mining and the relevant circulars issued by Directorate General Mines Safety (DGMS).	Agreed.
5.5	Underground work place environmental conditions shall be rendered ergonomic and air breathable with adequate illumination in conformance with DGMS standards.	Agreed.
5.6	No mining shall be carried out in forest land without obtaining Forestry Clearance as per Forest (Conservation) Act, 1980 and also adhering to The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 read with provisions of Indian Forest Act, 1927.	MoEF&CC vide file no. 8-06/2022-FC and 8-06/2022-FC has been granted Forest Clearance stage-I & stage-II respectively.

5.7	Efforts should be made to reduce energy and fuel consumption by conservation, efficiency improvements and use of renewable energy.	Agreed.
5.8	Transportation by Railway Siding shall be developed to avoid transportation by Road	Noted.
6. Land Reclamation		
6.1	Digital Survey of entire lease hold area/core zone using Satellite Remote Sensing survey shall be carried out at least once in three years for monitoring land use pattern and report in 1:50,000 scale or as notified by Ministry of Environment, Forest and Climate Change(MOEFCC) from time to time shall be submitted to MOEFCC/Regional Office (RO).	Noted. Will be complied post commencement of mine operation.
6.2	Post-mining land be rendered usable for agricultural/forestry purposes and shall be handed over to the respective State Government, as specified in the Guidelines for Preparation of Mine Closure Plan, issued by the Ministry of Coal dated 27th August, 2009 and subsequent amendments.	Will be complied during mine closure as per approved mine plan.
6.3	Regular monitoring of subsidence movement on the surface over and around the working areas and its impact on natural drainage pattern, water bodies, vegetation, structure, roads and surroundings shall be continued till movement ceases completely. In case of observation of any high rate of subsidence beyond the limit prescribed, appropriate effective mitigation measures shall be taken to avoid loss of life and materials. Cracks should be effectively plugged in with ballast and clay soil/suitable material.	Noted. Will be complied during underground mine operation.
6.4	Fly ash shall be used for external dump of overburden, backfilling or stowing of mine as per provisions contained in clause (i) and (ii) of subparagraph (8) of fly ash notification issued vide SO 2804 (E) dated 3rd November, 2009 as amended from time to time. Efforts shall be made to utilize gypsum generated from Flue Gas Desulfurization (FGD), if any, along with fly ash for external dump of overburden, backfilling of mines. Compliance report shall be submitted to Regional Office of MoEF&CC, CPCB and SPCB.	Noted.
6.5	A separate team for subsidence monitoring and surface mitigation measures shall be constituted and continuous monitoring & implementation of mitigation measures be carried out.	Agreed.
6.6	Thorough inspection of the mine lease area for any cracks developed at the surface due to mining activities below ground shall be carried out to prevent inrush of water in the mine.	Agreed.
6.7	Native tree species shall be selected and planted over areas affected by subsidence.	Agreed. Native species will be planted as per approved EIA/EMP report.
6.8	The project proponent shall make necessary alternative arrangements, if grazing land is involved in core zone, in consultation with the State government to provide alternate areas	Grazing land will be provided in the R&R colony in consultation with the State government.

	for livestock grazing, if any. In this context, the project proponent shall implement the directions of Hon'ble Supreme Court with regard to acquiring grazing land.	
7. Public Hearing and Human Health Issues		
7.1	Adequate illumination shall be ensured in all mine locations (as per DGMS standards) and monitored.	Shall be complied.
7.2	The project proponent shall undertake occupational health survey for initial and periodical medical examination of the personnel engaged in the project and maintain records accordingly as per the provisions of the Mines Rules, 1955 and DGMS circulars. Besides regular periodic health check-up, 20% of the personnel identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any, as amended time to time.	Shall be complied.
7.3	Personnel (including outsourced employees) working in core zone shall wear protective respiratory devices and shall also be provided with adequate training and information on safety and health aspects.	Agreed. PPE kit with an adequate training on safety and health aspects will be provided to all working employees.
7.4	Skill training as per safety norms specified by DGMS shall be provided to all workmen including the outsourcing employees to ensure high safety standards in mines.	Shall be complied.
7.5	Effective arrangement shall be made to provide and maintain at suitable points conveniently situated, a sufficient supply of drinking water for all the persons employed.	Noted.
7.6	implementation of the time bound action plan on the issues raised during the public hearing shall be ensured. The project proponent shall undertake all the tasks/measures as per the time bound action plan submitted with budgetary provisions during the public hearing. Land oustees shall be compensated as per the norms laid down in the R&R policy of the company/State Government/Central Government, as applicable.	Agreed. All the issues raised during Public hearing along with budgetary provisions has already been addressed in EIA report and the same will be implemented.
7.7	The project proponent shall follow the mitigation measures provided in this Ministry's OM No.Z- 11013/5712014-IA.I1 (M) dated 29th October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'.	Shall be complied.
7.8	PP to conduct need based assessment survey of the area to for in order to decide the activities to be carried under the CSR and to provide detail of the activity carried out with adequate budgetary provision and time bound action plan.	Shall be complied.
7.9	PP should conduct epidemiology study to (analysis of the distribution, patterns and determinants of health and disease conditions in defined populations).	Shall be complied.
7.10	Permanent Health care facilities of Hospital should be established within 5 km of project boundary for the local people.	Noted.

7.11	PP must ensure an emergency action plan during pandemic in order to provide assistance to the nearby villages located within the 10 km radius buffer zone (If required)	Noted.
7.12	PP is asked to also identify the rural areas for installation of solar light with its maintenance within the study area of 10 km radius buffer zone with time bound action plan	Shall be complied.
7.13	PP to take measure for installation of Renewable Energy sources in nearby area falling within 10 km radius	Noted.
8. Corporate Environment Responsibility		
8.1	The company shall have a well laid down environmental policy duly approve by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental/forest/wildlife norms/conditions. The company shall have defined system of reporting infringements/deviation/violation of the environmental/forest/wildlife norms/conditions and/or shareholders/stake holders.	Agreed. MAHAGENCO has prepared Environment Safeguard & Responsibility Framework (ESRF) Policy approved by Competent Authority.
8.2	A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly to the head of the organization.	Agreed.
8.3	Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.	Shall be complied.
8.4	Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.	Environmental audit will be carried out post commencement of mine operation.
8.5	PP should establish in house (at project site) environment laboratory for measurement of environment parameter with respect to air quality and water (surface and ground. A dedicated team to oversee environment management shall be setup which should comprise of Environment Engineers, Laboratory chemist and staff for monitoring of air, water quality parameters on routine basis. Any non- compliance or infringement should be reported to the concerned authority	Shall be complied.
9. Miscellaneous		
9.1	The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be	Complied. Notice was published in newspaper as per requirement on 17.08.2023. **Annexure-04**

	in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.	
9.2	The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.	Agreed. The same has already been communicated to Heads of local bodies, Panchayats.
9.3	The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.	Being Complied.
9.4	The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the ministry of Environment, Forest and Climate Change at environment clearance portal.	Noted.
9.5	The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.	The same shall be complied post commencement of mine operation.
9.6	The project authorities shall inform to the Regional Office of the MOEFCC regarding commencement of mining operations.	Agreed.
9.7	The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.	Agreed.
9.8	The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report, commitment made during Public Hearing and also that during their presentation to the Expert Appraisal Committee.	Agreed.
9.9	No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change (MoEF&CC).	Noted.
9.10	Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.	Noted.
9.11	The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.	Noted.
9.12	The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.	Noted.
9.13	The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.	Agreed.

9.14	The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.	Agreed.
9.15	The proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during presentation to the EAC. All the commitments made on the issues raised during public hearing shall also be implemented in letter and spirit.	Agreed.
9.16	Compensation of the land acquired for the project shall be settled as per the R&R Policy. Adequate facility of drinking water, plantation and other social amenities should be provided to established R&R villages.	Agreed. The same shall be done as per state government policy.
9.17	Persons of nearby villages shall be given training on livelihood and skill development to make them employable with its proper records.	Shall be complied.
9.18	The illumination and sound at night at project sites disturb the villages in respect of both human and animal population. Consequent sleeping disorders and stress may affect the health in the villages located close to mining operations. Habitations have a right for darkness and minimal noise levels at night. PPs must ensure that the biological clock of the villages is not disturbed; by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limits for day light/night hours	Agreed.

ANNEXURE-I

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल प्राधिकरण
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Authority

(भूजल निकासी हेतु अनापत्ति प्रमाण पत्र)
NO OBJECTION CERTIFICATE (NOC) FOR GROUND WATER ABSTRACTION

Project Name:	Gare Palma Sector- Ii Coal Block		
Project Address:	Annexure 1- Site Plan, Annexure-2 -approved Mining Plan, Annexure 3 -site On Toposheet		
Village:	Gare	Block:	Tamnar
District:	Raigarh	State:	Chhattisgarh
Pin Code:			
Communication Address:	M/s Maharashtra State Power Generation Company Ltd., (mspgcl), Vidyut Bhavan, Katol Road, Nagpur-440013, , Nagpur, Maharashtra - 440013		
Address of CGWB Regional Office :	Central Ground Water Board North Central Chhattisgarh, 2nd Floor, Lk Corporate And Logistic Park, Dhamtari Road, Nh-30, Dumartarai, Raipur, Chhattisgarh - 492015		

1.	**NOC No.:**	CGWA/NOC/MIN/REN/1/2025/11170	2.	**Date of Issuence**	18/03/2025
3.	Application No.:	21-4/600/CT/MIN/2017	4.	Category: (GWRE 2024)	Safe
5.	Project Status:	Existing With Additional Ground Water Requirment	6.	NOC Type:	Renewal
7.	**Valid from:**	05/05/2024	8.	**Valid up to:**	04/05/2026

9. Ground Water Abstraction Permitted:

Fresh Water		Saline Water		Dewatering		Total	
m³/day	m³/year	m³/day	m³/year	m³/day	m³/year	m³/day	m³/year
1239.00	452235.00			398.00	145270.00	1637.00	597505.00

10. Details of ground water abstraction /Dewatering structures

	Total Existing No						Total Proposed No					
	DW	DCB	BW	TW	MP	MPu	DW	DCB	BW	TW	MP	MPu
Abstraction Structure*	0	0	0	0	0	0	0	0	5	0	0	0
Dewatering Structure*	0	0	0	0	0	0	0	0	0	0	0	1

*DW- Dug Well; DCB-Dug-cum-Bore Well; BW-Bore Well; TW-Tube Well; MP-Mine Pit;MPu-Mine Pumps

11.	Ground Water Abstraction/Restoration Charges paid (Rs.):	3585030.00
12.	Environment Compensation (if applicable) paid (Rs.):	0.00

13.	Number of Piezometers(Observation wells) to be constructed/ monitored & Monitoring mechanism.	No. of Piezometers	Monitoring Mechanism		
			Manual	DWLR**	DWLR With Telemetry

18/11, जामनगर हाउस, मानसिंह रोड, नई दिल्ली - 110011 / 18/11, Jamnagar House, Mansingh Road, New Delhi-110011
Phone: (011) 23383561 Fax: 23382051, 23386743
Website: cgwa-noc.gov.in

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	**DWLR - Digital Water Level Recorder	2	0	1	1

(Compliance Conditions given overleaf)

This is an auto generated document & need not to be signed.

18/11, जामनगर हाउस, मानसिंह रोड, नई दिल्ली - 110011 / 18/11, Jamnagar House, Mansingh Road, New Delhi-110011
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Validity of this NOC shall be subject to compliance of the following conditions:

Mandatory conditions:

1) Installation of tamper proof digital water flow meter with telemetry on all the abstraction structure(s) shall be mandatory for all users seeking No Objection Certificate and intimation regarding their installation shall be communicated to the CGWA within 30 days of grant of No Objection Certificate.

2) Proponents shall mandatorily get water flow meter calibrated from an authorized agency once in a year.

3) Construction of purpose-built observation wells (piezometers) for ground water level monitoring shall be mandatory as per Section 14 of Guidelines. Water level data shall be made available to CGWA through web portal. Detailed guidelines for construction of piezometers are given in Annexure-II of the guidelines.

4) Proponents shall monitor quality of ground water from the abstraction structure(s) once in a year. Water samples from bore wells/ tube wells / dug wells shall be collected during April/May every year and analysed in NABL accredited laboratories for basic parameters (cations and anions), heavy metals, pesticides/ organic compounds etc. Water quality data shall be made available to CGWA through the web portal.

5) In case of mining projects, additional key wells shall be established in consultation with the Regional Director, CGWB for ground water level monitoring four (4) times a year (January, May, August and November) in core as well as buffer zones of the mine.

6) In case of mining project the firm shall submit water quality report of mine discharge/ seepage from Govt. approved/ NABL accredited lab.

7) The firm shall report compliance of the NOC conditions online in the website (www.cgwa-noc.gov.in) within one year from the date of issue of this NOC.

8) Industries abstracting ground water in excess of 100 m 3 /d shall undertake annual water audit through certified auditors and submit audit reports within three months of completion of the same to CGWA. All such industries shall be required to reduce their ground water use by at least 20% over the next three years through appropriate means.

9) Application for renewal can be submitted online from 90 days before the expiry of NOC. Ground water withdrawal, if any, after expiry of NOC shall be illegal & liable for legal action as per provisions of Environment (Protection) Act, 1986.

10) This NOC is subject to prevailing Central/State Government rules/laws/norms or Court orders related to construction of tube well/ground water abstraction structure / recharge or conservation structure/discharge of effluents or any such matter as applicable.

General conditions:

11) No additional ground water abstraction and/or de-watering structures shall be constructed for this purpose without prior approval of the Central Ground Water Authority (CGWA).

12) The proponent shall seek prior permission from CGWA for any increase in quantum of groundwater abstraction (more than that permitted in NOC for specific period).

13) Proponents shall install roof top rain water harvesting in the premise as per the existing building bye laws in the premise.

14) The project proponent shall take all necessary measures to prevent contamination of ground water in the premises failing which the firm shall be responsible for any consequences arising thereupon.

15) In case of industries that are likely to contaminate the ground water, no recharge measures shall be taken up by the firm inside the plant premises. The runoff generated from the rooftop shall be stored and put to beneficial use by the firm.

16) Wherever feasible, requirement of water for greenbelt (horticulture) shall be met from recycled / treated waste water.

17) Wherever the NOC is for abstraction of saline water and the existing wells (s) is /are yielding fresh water, the same shall be sealed and new tubewell(s) tapping saline water zone shall be constructed within 3 months of the issuance of NOC. The firm shall also ensure safe disposal of saline residue, if any.

18) Unexpected variations in inflow of ground water into the mine pit, if any, shall be reported to the concerned Regional Director, Central Ground Water Board.

19) In case of violation of any NOC conditions, the applicant shall be liable to pay the penalties as per Section 16 of Guidelines.

20) This NOC does not absolve the proponents of their obligation / requirement to obtain other statutory and administrative clearances from appropriate authorities.

21) The issue of this NOC does not imply that other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would consider the project on merits and take decisions independently of the NOC.

22) In case of change of ownership, new owner of the industry will have to apply for incorporation of necessary changes in the No Objection Certificate with documentary proof within 60 days of taking over possession of the premises.

23) This NOC is being issued without any prejudice to the directions of the Hon'ble NGT/court orders in cases related to ground water or any other related matters.

24) Proponents, who have installed/constructed artificial recharge structures in compliance of the NOC granted to them previously and have availed rebate of upto 50% (fifty percent) in the ground water abstraction charges/ground water restoration charges, shall continue to regularly maintain artificial recharge structures.

25) Industries which are likely to cause ground water pollution e.g. Tanning, Slaughter Houses, Dye, Chemical/ Petrochemical, Coal washeries, pharmaceutical, other hazardous units etc. (as per CPCB list) need to undertake necessary well head protection measures to ensure prevention of ground water pollution as per Annexure III of the guidelines.

26) In case of new infrastructure projects having ground water abstraction of more than 20 m3/day, the firm/entity shall ensure implementation of dual water supply system in the projects.

27) In case of infrastructure projects, paved/parking area must be covered with interlocking/perforated tiles or other suitable measures to ensure groundwater infiltration/harvesting.

28) In case of coal and other base metal mining projects, the project proponent shall use the advance dewatering technology (by construction of series of dewatering abstraction structures) to avoid contamination of surface water.

29) The NOC issued is conditional subject to the conditions mentioned in the Public notice dated 27.01.2021 failing which penalty/EC/cancellation of NOC shall be imposed as the case may be.
30) This NOC is issued subject to the clearance of Expert Appraisal Committee (EAC) (if applicable).
31) In the self-compliance report, the PP shall submit details of Drilling Agency/ Agencies, which has/ have constructed BW(s)/ TW(s) along with undertaking to the effect that all necessary measures have been taken as per directions of Hon'ble Supreme Court provided in Annexure-VII of guidelines dated 24.09.2020 in respect of abandoned/ failed BW(s)/ TW(s)/Piezometer(s), if any. The PP is advised to engage registered drilling agency/ agencies. In the event of any mishap/ unfortunate incident due to negligence in taking measures for prevention of accident due to falling in Bore Well, both PP and concerned drilling agency shall jointly be held responsible and penal action as per extant Government rules shall be taken.

(Non-compliance of the conditions mentioned above is likely to result in the cancellation of NOC and legal action against the proponent.)

CENTRAL GROUND WATER AUTHORITY

Department of Water Resources, River Development and Ganga Rejuvenation
Ministry of Jal Shakti, Govt. of India

Receipt

(As per the guideline Gazette Notification S.O. 3281(E) regarding the New Guidelines dated 24.09.2020 of CGWA, MoJS, Govt. of India)
https://cgwa-noc.gov.in

Application No,:	21-4/600/CT/MIN/2017	Date of Issuence:18/03/2025
Name of Firm:	GARE PALMA SECTOR- II COAL BLOCK	
AppType Category:	*Coal*	
Application Type:	*Mining*	
PAN/GSTIN No. of Firm/Individual:	/	

SN	Description	Amount (Rs.)
1.	Application Processing Fee	**5000.00**
2.	Ground Water Abstraction charges	**3585030.00**
3.	Ground Water Restoration charges	**0**
4.	Environmental Compensation Charges (ECRGW) *(Date From to) Days-*	
5.	Penalty for non-Compliance of NOC conditions *Condition to be mentioned*	
6.	Adjustment Charges	
7.	Rebate	
8.	Charges for correction/modification in the existing issued No Objection Certificate	

S.No.	Description	Rate
(i)	Change in User ID	Rs. 1000
(ii)	Change in firm Name	Rs. 5000
(iii)	Extension of No Objection Certificate	Rs. 5000
(iv)	Issuance of duplicate No Objection Certificate	Rs. 5000
(v)	Issuance of corrigendum to No Objection Certificate	Rs. 5000
(vi)	Any other items/correction etc.	Rs. 500

Rs. Rupees Thirty Five Lakh Ninty Thousand Thirty Only	**3590030.00**

This is an system generated invoice, hence, does not require ink signed.

18/11, जामनगर हाउस, मानसिंह रोड, नई दिल्ली - 110011 / 18/11, Jamnagar House, Mansingh Road, New Delhi-110011
Phone: (011) 23383561 Fax: 23382051, 23386743
Website: cgwa-noc.gov.in

Term and conditions:

i. All disputes are subject to Delhi Jurisdiction.
ii. Any complaint in regard to the rates will not be entertained.

Member-Secretary
CGWA, New Delhi

राज्य शासन से संबंधित अभिलेख

चेक लिस्ट क्रमांक:— 42

वन्यप्राणी परियोजना पर प्रधान मुख्य वन संरक्षक (वन्यप्राणी) का अभिमत

आदेश द्वारा पी.व्ही. नरसिंग राव, भा.व.से. प्रधान मुख्य वन संरक्षक, (वन्यप्राणी एवं जैव विविधता संरक्षण) सह मुख्य वन्यप्राणी अभिरक्षक, छत्तीसगढ़, नवा रायपुर

सेक्टर–19, नार्थ ब्लाक, अरण्य भवन, प्रथम तल (एफ.आर.) अटल नगर, नवा रायपुर

✉ cwlwcg@gmail.com (☎0771-2512880, 🖷0771-2512881)

//आदेश//

आदेश क्रमांक/व.प्रा./प्रबंध-494/12 नवा रायपुर, दिनांक–20.01.2021

मुख्य वन संरक्षक (वन्यप्राणी) एवं क्षेत्र संचालक, अचानकमार टायगर रिजर्व, बिलासपुर का पत्र क्रमांक/व.प्रा./मा.चि./2020/534 दिनांक 20.02.2020 द्वारा मेसर्स महाराष्ट्र स्टेट पावर जेनरेशन कंपनी लिमिटेड द्वारा तमनार परिक्षेत्र में रायगढ़ वनमंडल अंतर्गत गारे पेल्मा सेक्टर–2 कोल ब्लाक कुल रकबा 214.869 हे. के वनभूमि व्यपवर्तन हेतु भारत सरकार द्वारा जारी पत्र दिनांक 08.08.2016 के शर्त क्रमांक 4(iii) में अधिरोपित शर्त के पालनार्थ वन्यप्राणी संरक्षण योजना तैयार कर इस कार्यालय को प्रस्तुत किया गया है। मुख्य वन संरक्षक, बिलासपुर वृत्त, बिलासपुर के पत्र क्रमांक/19 दिनांक 07.01.2021 द्वारा प्रस्तावित वन्यप्राणी संरक्षण एवं संवर्धन योजना पर अनुशंसा व्यक्त की गई है।

प्रस्तुत वन्यप्राणी संरक्षण योजना का गहन परीक्षण किया गया। परीक्षण करने पर कुछ कमियां पायी गयी, जिसके पूर्ति हेतु इस कार्यालय के पत्र क्रमांक/व.प्रा./प्रबंध-494/2466 दिनांक 30.06.2020 प्रेषित करते हुये प्रस्ताव में आवश्यक संशोधन समाविष्ट करने हेतु आवेदक संस्था को लेख किया गया था। आवेदक संस्था द्वारा उक्त कमियों को दूर कर पुनरीक्षित वन्यप्राणी संरक्षण योजना मुख्य वन संरक्षक (वन्यप्राणी) एवं क्षेत्र संचालक, अचानकमार टायगर रिजर्व, बिलासपुर का पत्र क्रमांक/व.प्रा./मा.चि./2020/2348 दिनांक 21.09.2020 द्वारा इस कार्यालय को प्रस्तुत किया गया है।

आवेदक संस्थान द्वारा प्रस्तुत वन्यप्राणी संरक्षण योजना का अनुमोदन करते हुये योजना में प्रावधानित राशि का कुल 03 वर्षों में उपयोग करते हुये परिशिष्ट में वर्षवार आबंटन किया जाता है। अनुमोदित योजना में वन्यजीव रहवास सुधार, वन्यजीव संरक्षण, मृदा एवं जल संरक्षण कार्य, चारागाह विकास, तथा जन जागरूकता आदि से संबंधित राशि का विवरण परिशिष्ट-1 में दर्शित है (संलग्न)।

उक्त वन्यप्राणी संरक्षण योजना की लागत राशि रूपये 358.60 लाख वर्तमान दरों पर है। परियोजना में देरी होने से समय लागत बढ़ेगी, जिसमें प्राईस इन्डेक्स के हिसाब से वृद्धि होगी। परियोजना के क्रियान्वयन के समय जो भी लागत आयेगी वह प्रस्तावकों को वन विभाग में एकमुश्त जमा करानी होगी, जिससे मूल्य वृद्धि के प्रभाव को समाप्त किया जा सके। वन विभाग इस प्रकार जमा की गई राशि से वन्यप्राणी संरक्षण योजना में दर्शाये समय सारणी के अनुसार क्रियान्वित करेगा।

अनुमोदित वन्यप्राणी योजना में दर्शाये गये उपरोक्त घटकों के संगत फील्ड में किये जाने वाले कार्यों का कार्यवार/स्थलवार प्रोजेक्ट संबंधित वनमण्डलाधिकारी के द्वारा तत्समय प्रचलित मार्गदर्शी सिद्धांतों (व्यय नार्मस, कार्य की प्रकृति, वन्यप्राणी प्रबंधन के संबंध में लागू होने वाले अन्य तकनीकी तथ्यों व निर्देशों) के अनुरूप तैयार कर सक्षमतानुसार तकनीकी स्वीकृति/अनुमोदन हेतु अनुशंसा सहित संबंधित मुख्य वन संरक्षक को प्रेषित किया जावेगा। संबंधित मुख्य वन संरक्षक द्वारा प्रोजेक्ट की तकनीकी स्वीकृति/अनुमोदन की अनुशंसा के साथ मुख्य वन्यप्राणी अभिरक्षक छत्तीसगढ़ को प्रेषित किया जावेगा। प्रोजेक्ट का परीक्षण वन्यप्राणी प्रबंधन की उपयुक्तता की दृष्टि से किया जाकर मुख्य

FC- memo

वन्यप्राणी अभिरक्षक के द्वारा कार्य हेतु प्रशासकीय स्वीकृति जारी किये जाने की अनुशंसा के साथ प्रोजेक्ट, प्रशासकीय स्वीकृति/बजट आबंटन करने हेतु सक्षम अधिकारी को प्रेषित किया जावेगा। प्रशासकीय स्वीकृति आदेश जारी किये जाने के पश्चात ही कार्यों का कियान्वयन व.मं.अ. द्वारा किया जावेगा।

वन्यप्राणी प्रबंधन योजना के कार्यों की मॉनिटरिंग का कार्य संबंधित मुख्य वन संरक्षक व मुख्य वन्यप्राणी अभिरक्षक छ.ग. द्वारा किया जावेगा। किये जा रहे कार्यों की भौतिक व आर्थिक प्रगति से मुख्य वन्यप्राणी अभिरक्षक को प्रतिमाह व.मं.अ. द्वारा अवगत कराया जावेगा।

अनुमोदित वन्यप्राणी संरक्षण योजना की एक प्रति संलग्न प्रेषित है। कृपया वन्यप्राणी संरक्षण योजना में प्रावधानित राशि रूपये 358.60 लाख एकमुश्त जमा करने हेतु परियोजना प्रस्तावकों को आदेशित करें।

संलग्न— परिशिष्ट एवं प्रस्ताव की 01 प्रति।

प्रधान मुख्य वन संरक्षक (व.प्रा.) सह मुख्य वन्यप्राणी
अभिरक्षक, छ.ग., अटल नगर, रायपुर

पृ.क्रमांक/व.प्रा./प्रबंध—494/246 नवा रायपुर, दिनांक 20 01.2021

प्रतिलिपि सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित :—

1. अपर प्रधान मुख्य वन संरक्षक (भू-प्रबंध) नवा रायपुर।
2. मुख्य वन संरक्षक बिलासपुर वृत्त बिलासपुर।
3. मुख्य वन संरक्षक वन्यजीवन और क्षेत्रीय निदेशक, अचानकमार टायगर रिजर्व बिलासपुर।
4. वनमंडलाधिकारी रायगढ़ वनमंडल रायगढ़।
5. मुख्य अभियंता मेसर्स महाराष्ट्र स्टेट पावर जनरेशन कंपनी लिमिटेड।

प्रधान मुख्य वन संरक्षक (व.प्रा.) सह मुख्य वन्यप्राणी
अभिरक्षक, अटल नगर, रायपुर, छ.ग.

FC-memo

Annexure-1

Table No.-1

Expenditure on Soil and Water Conservation work

S.No.	Name of Nala	Catchment Area (Ha.)	Forest Area (Ha.)	Work Name	Quantity				Unit	Rate (in Lakh)	Amount in (in Lakh)
					Total	Y (1)	Y (2)	Y (3)			
1	GerwaniNala	2804	1357	BWCD	39	15	15	9	No.	0.040	1.56
2	GerwaniNala			LBCD	14	5	5	4	No.	0.100	1.40
3	GerwaniNala			GS	6	3	2	1	No.	1.250	7.50
	Total	**2804.00**	**1357.00**		**59**	**23**	**22**	**14**			**10.46**
4	BanjariNala	2556	1760	BWCD	132	50	50	32	No.	0.040	5.28
5	BanjariNala			LBCD	23	10	8	5	No.	0.100	2.30
6	BanjariNala			GS	7	3	2	2	No.	1.250	8.75
7	BanjariNala			TALAB	1	1	-	-	No.	25.000	25.00
8	BanjariNala			SCT	10000	4000	4000	2000	No.	0.003	30.00
	Total	**0.00**	**0.00**		**10163**	**4064**	**4060**	**2039**			**71.33**
9	GardharasiNala	859	378	BWCD	14	6	5	3	No.	0.040	0.56
10	GardharasiNala			LBCD	4	2	1	1	No.	0.100	0.40
11	GardharasiNala			GS	1	1	-	-	No.	1.250	1.25
12	GardharasiNala			SD	1	1	-	-	No.	35.000	35.00
	Total	**0.00**	**0.00**		**20**	**10**	**6**	**4**			**37.21**
13	JanjgirNala	1389	609	BWCD	15	7	5	3	No.	0.040	0.60
14	JanjgirNala			LBCD	10	5	3	2	No.	0.100	1.00
	Total	**1389.00**	**609.00**		**25**	**12**	**8**	**5**			**1.60**
15	ChirwaniNala	1113	862	LBCD	49	20	20	9	No.	0.100	4.90
16	ChirwaniNala			GS	6	3	2	1	No.	1.250	7.50
	Total	**2502.00**	**1471.00**		**55**	**23**	**22**	**10**			**12.40**
	Grand Total	**6695.00**	**3437.00**	Total	10322	4132	4118	2072			133.00

Table No.-2

EXPENDITURE ON WILDLIFECONSERVATION

S. No.	ITEM	Year (1)	Year (2)	Year (3)	TOTAL AMOUNT IN INR (LUMP SUM)
IMPROVEMENT OF FOOD					
1	Pasture Development including uprooting of lantana and other unwanted weeds	15,00,000	10,00,000	10,00,000	35,00,000
2	Control of Grazing	5,00,000	2,00,000	2,00,000	9,00,000
3	Weed Control	1,00,000	1,00,000	1,00,000	3,00,000
4	Burning regime, seeding and grass cutting.	1,00,000	1,00,000	1,00,000	3,00,000

5	Development of brows; fruit, seeds & mast.	4,00,000	4,00,000	4,00,000	12,00,000
IMPROVEMENT OF COVER					
1	Escape Cover	5,00,000	3,00,000	-	8,00,000
2	Ambush Cover	3,00,000	1,00,000	1,00,000	5,00,000
3	Reproductive Cover	3,00,000	1,00,000	1,00,000	5,00,000
4	Special Refuges	3,00,000	1,00,000	1,00,000	5,00,000
5	Shade and resting places	10,00,000	2,50,000	2,50,000	15,00,000
CREATION OF CONSERVATION AWARENESS					
1	Provision of salt licks	3,00,000	1,00,000	1,00,000	5,00,000
2	Development of cattle sheds	10,00,000	5,00,000	5,00,000	20,00,000
	TOTAL				**1,25,00,000**

Table No.-3

Proposed Budget for "*VULTURE*" Habitat Plan

S. N.	Components &Subcompo nents	Discription	Executio n periods (in Year)	Unit	Quan tity	Cost per Unit (in Lac)	Year wise cost estimate (in lac)			
							Y-1	Y-2	Y-3	Total
1	2	3	4	5	6	7	8	9	10	11
1.	Project Construction	DPR by Doing field Survey to Prepare	1	Forest Division	1	0.30	0.30	0.00	0.00	0.30
		TOTAL: -	**1**		**1**	**0.30**	**0.30**	**0.00**	**0.00**	**0.30**
2.	**Avifauna (Valture) Alternate Habitate Plan: -**									
2.1	Artificial Nesting	Artifical Nest Construction	2	No. of Nest	200	0.01	2.00	0.00	0.00	2.00
		TOTAL: -	**2**		**200**	**0.01**	**2.00**	**0.00**	**0.00**	**2.00**
3.	**Area Conservation and Promotion through Forest management committee: -**									
3.1	Capacity Development of joint Forest management committee members	To increase Awareness of committee members regarding bird enhance.	3	No. of Financial year	3	0.30	0.30	0.30	0.30	0.90
S.N.	Components & Sub Components	Discription	Execution periods (in Year)	Unit	Quant ity	Cost per Unit (in Lac)	Year wise cost estimate (in lac)			
							Y-1	Y-2	Y-3	Total
1	2	3	4	5	6	7	8	9	10	11
3.2	Field Protection and Promotion work	2 Area Conservation and augmentation through Valture protectors	3	No. of Financial year	2	1.20	0.80	0.80	0.80	2.40
		TOTAL: -	**6**		**5**	**1.50**	**1.10**	**1.10**	**1.10**	**3.30**

3.	**Area Conservation and Promotion through Forest management committee: -**									
3.1	Capacity Development of joint Forest management committee members	To increase Awarenes s of committe e members regarding bird enhance.	3	No. of Financial year	3	0.30	0.30	0.30	0.30	0.90
S.N .	**Components &Subcompone nts**	**Discriptio n**	**Executi on periods (in Year)**	**Unit**	**Qua ntity**	**Cost per Unit (in Lac)**	**Year wise cost estimate (in lac)**			
							Y-1	**Y-2**	**Y-3**	**Total**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
3.2	Field Protection and Promotion work	2 Area Conservati on and augmentati on through Peafowl protectors	3	No. of Financial year	2	1.20	0.80	0.80	0.80	2.40
		TOTAL: -	6		5	1.50	1.10	1.10	1.10	3.30
4.	**Bird Survey and Project impact Study: -**									
4.1	Project co-ordi nator Appoint-ment and esta-blishment Exp.	Project co-ordi nator Post creation	3	No. of Staff	1	1.50	0.50	0.50	0.50	1.50
4.2	Tranning of Project co-ordi nator and Staff etc.	Staff tranning and Field trip	1	No. of Financial year	1	0.50	0.50	0.00	0.00	0.50
4.3	Survey, Study work and report prepration	Establishm ent and Execution	3	No. of Financial year	3	0.25	0.25	0.25	0.25	0.75
		TOTAL: -	7		5	2.25	1.25	0.75	0.75	2.75
5	Research & Specialist services	Research, Field trip & Specialist services	1	No. of Financial year	3	0.35	0.25	0.50	0.30	1.05
6	Evaluation and Monitoring	-	3	No. of Financial year	3	0.15	0.15	0.15	0.15	0.45
7	Administrative Expense	Others Expense	3	No. of Financial year	3	0.15	0.15	0.15	0.15	0.45
		TOTAL: -	7		9	0.65	0.55	0.80	0.60	
		Grand TOTAL: -	23	-	220	4.71	5.20	2.65	2.45	10.30

4.	**Bird Survey and Project impact Study: -**									
4.1	Project co-ordi nator Appoint-ment and esta-blishment Exp.	Project co-ordi nator Post creation	3	No. of Staff	1	1.50	0.50	0.50	0.50	1.50
4.2	Tranning of Project co-ordi nator and Staff etc.	Staff tranning and Field trip	1	No. of Financial year	1	0.50	0.50	0.00	0.00	0.50
4.3	Survey, Study work and report prepration	Establishment and Execution	3	No. of Financial year	3	0.25	0.25	0.25	0.25	0.75
		TOTAL: -	7		5	2.25	1.25	0.75	0.75	2.75
5	Research & Specialist services	Research, Field trip & Specialist services	1	No. of Financial year	3	0.35	0.25	0.50	0.30	1.05
6	Evaluation and Monitoring	-	3	No. of Financial year	3	0.15	0.15	0.15	0.15	0.45
7	Administrative Expense	Others Expense	3	No. of Financial year	3	0.15	0.15	0.15	0.15	0.45
		TOTAL: -	7		9	0.65	0.55	0.80	0.60	1.95
		Grand TOTAL: -	23	-	22	4.71	5.20	2.65	2.45	10.30

Proposed Budget for "*PEAFOWL & PEACOCK*" Habitat Plan

S.N.	Components &Subcompo nents	Discripti on	Executi on periods (in Year)	Unit	Qua ntit y	Cost per Unit (in Lac)	Year wise cost estimate (in lac)			
							Y-1	Y-2	Y-3	Total
1	2	3	4	5	6	7	8	9	10	11
1.	Project Construction	DPR by Doing field Survey to Prepare	1	Forest Division	1	0.30	0.30	0.00	0.00	0.30
		TOTAL: -	1		1	0.30	0.30	0.00	0.00	0.30
2.	**Avifauna (Valture) Alternate Habitate Plan: -**									
2.1	Artificial Nesting	Artifical Nest Construct ion	2	No. of Nest	200	0.01	2.00	0.00	0.00	2.00
		TOTAL: -	2		200	0.01	2.00	0.00	0.00	2.00

Table No.-4

PROPOSED EXPENDITURE ON ELEPHANT CONSERVATION

S. No.	Item	Year (1)	Year (2)	Year (3)	Total Amount (Lakh Rs.)
1	Vehicle for movement of monitoring of Elephant's movement	15.00	-	-	15.00
2	Installation of Elephant Tracking System	5.00	-	-	5.00
3	Operationof Elephant Tracking System	4.00	3.00	3.00	10.00
4	FodderPlantation	10.00	2.50	2.50	15.00
5	BambooBrakes	3.00	1.00	1.00	5.00
6	PlantationofFruitTrees	6.00	2.00	2.00	10.00
7	Construction of Series of Tanks	5.00	-	-	5.00
8	BiodiversityConservation	3.00	1.00	1.00	5.00
9	MaintenanceofBiodiversityRecords	4.00	3.00	3.00	10.00
	Total	55.00	12.50	12.50	80.00

Summary of Expediture on Wildlife Conservation Plan

S.No.	Expenditure	Amount (in lakhs)
1	Soil and waterconservationwork	133.00
2	Forest conservationforwildlife	125.00
3	Vulture Habitate Plan	20.60
4	Elephant conservation	80.00
	Grand Total	**358.60**

Principal Chief Conservator of Forest, Cum
Chief Wildlife Warden
Chhattisgarh, Naya Raipur

Annexure: - 3

Report
on

Ecosystem Service Study of Tamnar Tehsil (Block), Raigarh, Chhattisgarh

Submitted to

Gare Palma-II coal mine
MAHAGENCO

Department of Environmental Science and Engineering
Center of Mining Environment
Indian School of Technology (Indian School of Mines)
Dhanbad, Jharkhand

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Executive Summary

The Tamnar block, which consists of the open cast (22.0 MTPA) and underground (1.6 MTPA) mines, is classified as an EIA notice Category A (500 Ha ML area for Coal Mining). The Tamnar Tehsil of Raigarh district of Chhattisgarh, an area of 516.89 Sq.km, is home to the entire project.

A study was carried out to analyze the ecosystem services in Tamnar block, Raigarh, Chhattisgarh. The detailed analysis was carried out following the scope of work, focusing on the environmental status close to the planned coal mine and the impact on ecological services. To project the current status in the study area, samples of surface water, groundwater, soil, air, noise, and biological material were gathered and assessed from representative locations in the core zone and buffer zone. In April 2024, during the pre-monsoon season, the samples were collected. The methods used for sample collection and preservation were done in compliance with accepted practices. The specific findings of the samples that were assessed are provided in the pertinent section of the report.

The report estimates and presents the impact on the ecological services of the surrounding ecosystem around the proposed mining. The area was sparsely populated. It was not regarded as a holiday spot Based on the findings of the above research, it is possible to conclude that the existing mine has not much of a substantial impact on nearby ecological components such as soil, water, air quality and resources.

Chapter – 1

1. Introduction

1.1. Project Description

The Tamnar block, which consists of the open cast (22.0 MTPA) and underground (1.6 MTPA) mines, is classified as an EIA notice Category A (500 Ha ML area for Coal Mining). The Tamnar Tehsil of Raigarh district of Chhattisgarh, an area of 516.89 Sq.km, is home to the entire project.

1.2 Location

The Tamnar Tehsil is located approximately 35 km north of Raigarh Township, which is also home to the closest train station on the SE Railway's Mumbai-Howrah main line. The longitude is between 83° 26' 21.85" and 83° 31' 19.1" E, and the latitude is between 22° 06' 22.33" and 22° 10' 48" N. The region under question is the Mandar Raigarh coal fields, also known as the Gare Palma section II coal mine. It is governed by the Tamnar Tehsil in the Raigarh district of Chhattisgarh, India. In Tehsil Tamnar, Raigarh, it includes a total of fourteen villages: Tihli, Rampur, Kunjemura, Gare, Saraitola, Murogaon, Radopali, Pata, Chitwahi, Dholnara, Jhinka Bahal, Dolesara, Bhalumura, Sarasmal, and Libra.

State Highway Punjipathara connects Raigarh to the mine via road. The main route that connects Raigarh and Ghargoda passes through Punjipathara hamlet. Roughly 40 kilometres separate Raigarh and Ghargoda. It is roughly 20 km by road from Raigarh to Punjipathara and 20 km by road from Punjipathara to Ghargoda in the north. The Punjipathara–Milupara road, which goes through the mine, is the route that travels from Punjipathara to the Gare Palma region via the Tamnar TPP area, which is 10 km away. Tamnar is located in sub-block "F" of the Gare Palma Sector I region, in the southwest. There are road networks inside the mine. The geography of the mine is uneven, with the Kelo River meandering through the southeast of the mine.

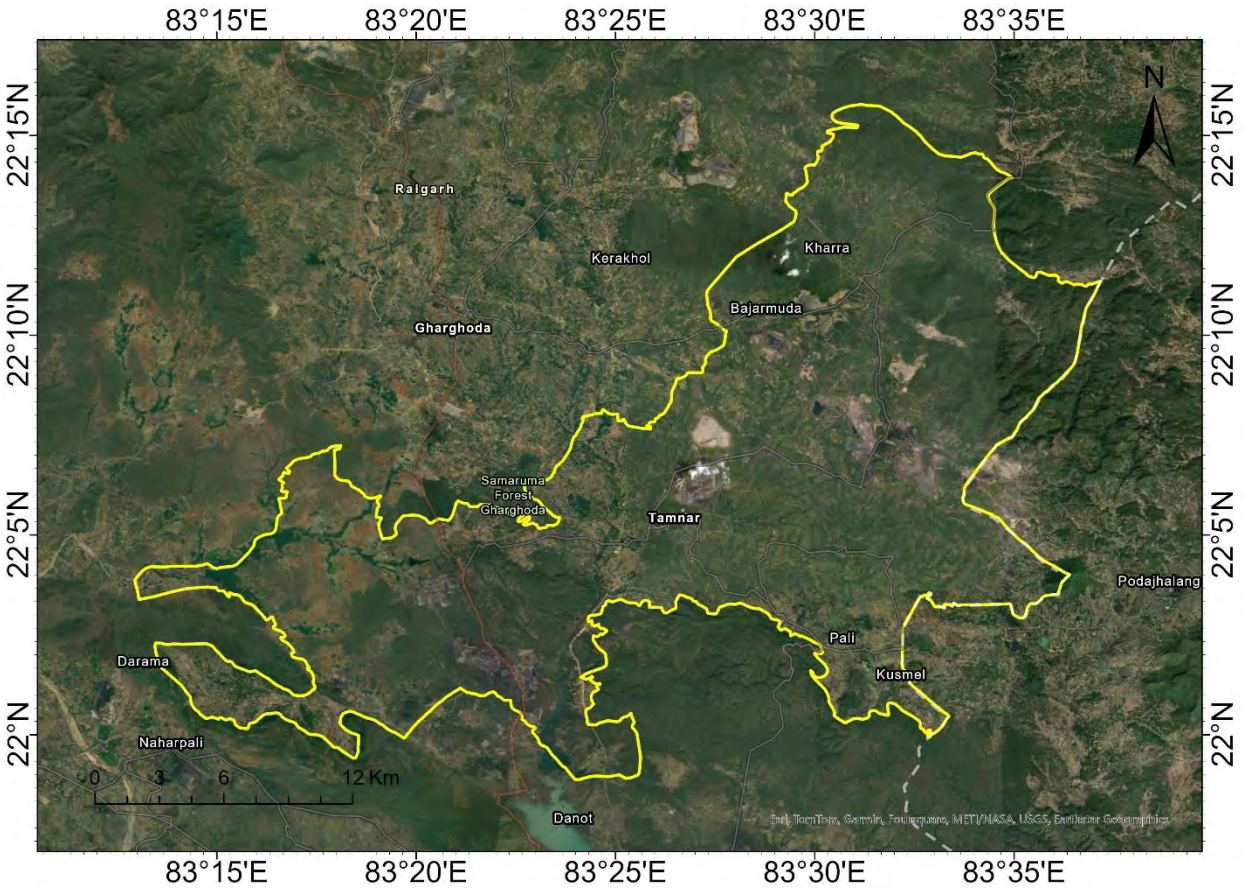

Fig -1.1 Map of the Tamnar tehsil, Raigarh, Chhattisgarh

1.3 Accessibility/Communication

State Highway No. 1 from Raigarh and National Highway No. 200 from Bilaspur provide excellent access to the Mand-Raigarh coalfield. The coalfield is also traversed by State Highway No. 23 between Dharamjaygarh and Kharsia. The district headquarters, Raigarh, is roughly 45 km southwest of Gare Sector III. An all-weathered road via Tamnar connects Gare Sector III to S.H. 1 at Punjipatra, which is roughly 23 km from Raigarh. Due to the existence of protected woods and nalas, the sub-blocks accessibility is limited during the monsoon. The closest railhead on the South East Central Railway's Howrah-Mumbai route is Raigarh.

1.4 Geology of the area

The southern portion of the Mahanadi Valley is made up of the Mand-Raigarh coalfields, which are primarily located in the Raigarh district with a tiny portion also located in the Karba district of Chhattisgarh State. In the foreseeable future, exploration in the extensive coalfield is anticipated to persist, primarily by MECL, GSI, and CMPDIL. Mand-Raigarh Coalfield is the vast deposits of Barakar and Supra-Barakar rocks among isolated Talchir outcrops that lie between latitudes N 21°45′ to 22°42′ and longitudes E 83°01′ to 83°44′. Its stratigraphic and tectonic setting are quite comparable, and it is positioned between the Ib-River Coalfield in the southeast and the Korba Coalfield in the west. The coal measures in the Mand-Raigarh basin are exposed in three well-defined patches due to erosion of the overlying Kamthi rocks along the drainage of the prominent rivers.

Table 1.1: Stratigraphic Succession of the area

Age	Formation	Thickness	Lithography
Recent	Soil Alluvium	3 m	Alluvial soil pebbly to bouldery bed with silty clay band, laterite, etc.
Cretaceous to Eocene	Deccan Traps	-	Basalt flows & dolerite dykes.
Lower to Middle Triassic	Kamthi	2851 m	Poorly sorted, frequently ferruginous, coarse to very coarse-grained, locally graded to pebbly, mega cross-bedded sandstone containing, brownish-grey to buff-colored clay clasts. A fossiliferous red claystone to siltstone bed occurs at the base.
Upper Permian to Lower Permian	Raniganj	180 m	Mostly fine to medium-grained, grayish white, micaceous sandstone and siltstone with claystone, shale, minor coarse-grained sandstone, and two coal seams of inferior grade
	Barren Measure	300 m	Dominantly grey claystone/grey shale with siltstone and iron stone bands; interbedded sequence of fine to medium-grained sandstone and shale.
	Barakar	425 – 800 m	Medium to coarse and very coarse-grained even gritty, sandstone at the lower part followed upward by fine to medium-grained assemblage with grey

			claystone/shale which becomes predominant towards the upper part, number of coal seams, and carbonaceous shale.
	Karharbari	23 m	Mottled at places carbonaceous sandstone, frequently associated with pebbles of quartzite granite, etc. of various shapes and sizes.
Upper Carboniferous to Lower Permian	Tachir	150+	Very fine to fine-grained sandstone with siltstone and shale, occasionally greenish, at places with matrix-based variegated polymictic conglomerate.
Precambrian			Granitic gneisses, mica-schists quartzites, intruded by pegmatites and quartz veins.

The geological formations of Mand-Raigarh Coalfield are briefly described below: (Bull. GSI, Ser-A, No.45, Vol.-III, 1983).

Precambrian: The Precambrian rocks comprising Granite Gneiss, mica schist, Phyllites and Quartzites along with Quartz veins & Pegmatites occur along the northern, northeastern periphery. The strike of the foliation varies from E-W to N70°W – S70°E with 50^{o} to 70^{o} dip towards the west.

Talchir formation: The Talchir sequence begins with tillite at the base and overlies the basement unconformably. It occurs as a continuous strip along the northern periphery of the basin. Along the southern boundary, Talchirs crop out as narrow, elongated discontinuous strips disrupted by faults. The Mand-Raigarh basin shows widespread development of basal tillite pointing to the advancement of ice from the surrounding Precambrian uplands.

Karharbari Formation: Karharbari formation is developed in a limited area. It consists of mottled, at places carbonaceous sandstone, frequently associated with pebbles of quartzite, granite, etc. of various shapes and sizes.

Barakar Formation: The Barakar Formation conformably overlies the Talchir sediments over the major part of the coalfield and covers a large tract within the coalfield. It is represented predominantly by multistoried cross-bedded feldspathic sandstones which are highly kaolinized and friable with subordinate shales, carbonaceous shales, and coal seams. The sandstones are mostly medium to very coarse-grained and milky white to greyish-white in color. The sandstones

are arkosic and often show pronounced kaolinisation. Exposures of fine-grained sandstone and grey to greyish-black shale are very limited.

Barren Measure Formation: Barren Measure formation overlies conformably over Barakar formation. Barren Measure formation can be traced in the southeastern part between Gharghoda and Gare, besides sporadic occurrence in the vicinity of Chhal and Kuremkela. This formation comprises predominantly grey claystone/grey shale with siltstone and iron stone bands and interbanded occurrence of fine to medium-grained sandstone & shale.

Kamthi Formation: The rocks of Kamthi Formation are well exposed at higher contours of the flat-topped hills. They not only occur in the intervening area between Mand Valley and Hasdo-Arand on the one side and the Raigarh Coalfield on the other but also occur as irregular patches along the axial region of the Mand Valley. It is represented dominantly by coarse, friable, porous, and brownish to red cross-bedded sandstone and argillaceous beds. The nature of the contact between Kamthis & Barakars is variable and is somewhat discordant and at places, the Kamthi strata overlap the older units.

Intrusives / Deccan Trap: Several basic dykes, sills, and flows have been observed in the Uprora-Porea area in the northern part of the coalfield. The basic rock comprises fine-grained Basalts to coarse-grained Gabbroid type. The flows at places have been altered to laterite. A dyke exposed north of Amaldih has been traced over a distance of 26.5 Km. in an east-west direction and another dyke exposed 0.8 Km. south Porea is over 6 km in length.

Coal seams: The regional exploration so far conducted & continuing till date in Mand-Raigarh Coalfield, especially in the western part along the eastern bank of Mand River and the northern part of Dharamjaygarh-Khargaon, Ongana-Potia as well as Chhal area, has revealed the presence of several coal seams. Coal of this coalfield is generally banded in nature and it is not devolatilised. In general, coal is low in rank, high in volatile matter, and non-coking type.

Regional structure: The Mand-Raigarh Coalfield is an asymmetrical basin with an approximately NW-SE axis. It is a part of the Ib-Mand-Korba master basin lying within the Mahanadi Graben. It displays a typical half-graben configuration, with the southern boundary marked by a major NW-SE zone of faulting coinciding with the trend of the Mahanadi Graben and the northern boundary not faulted over the major part. In the Mand Valley proper, the coal measures lying between Kharsia & Dharamjaygarh display a broad synclinal structure with its

axis running just south of Sithra. The northern limb of the Mand River basin is exposed to the north of the Sithra-Dharamjaygarh area where the Barakar beds are found to strike broadly in the NW-SE direction. The beds dip at a low angle of 5° to 7° towards the southwest. In the southern limb, the strike is approximately NW-SE with minor variations and the beds dip towards the northeast.

The other structural element in this basin belt comprises normal Gravity faults. The available surface and sub-surface data indicate that the area lying on both sides of Mand River is traversed by several sub-parallel faults of considerable linear extent, though the surface expressions of faults are very limited or entirely lacking. Two sets of faults trending WNW-ESE to NW-SE and N-S occur. The former generally has down throws against the dip i.e. towards the north while the latter has an easterly throw. The amount of throw varies from 10m to 150m.

Geology of Tamnar tehsil, Raigarh

Tamnar Block is located in the southeastern part of Mand-Raigarh Coalfield. The Geology of the block conforms to the regional set-up. The major part of the Tamnar Block is covered by the Barakar Formation.

Geological succession in Tamnar tehsil, Raigarh

The geological succession evolved based on exploration data generated in the block is given in the Table below. While calculating the thickness of different stratigraphic formations, all the data generated by the boreholes in the block are considered.

Table 1.2: Stratigraphy of the study area.

Age	Formation	Thickness	Lithography
Recent	Recent	0.50 m to 15.00 m	Soil, alluvium
Lower Permina	Barakar	203.00 m to 477.20 m	Fine, medium, and coarse-grained felspathic, grey sandstone, micaceous and laminated at places, Grey shale, fine clay, intercalation off shale and sandstone, and carbonaceous shale and coal seams.
Upper cambrial to Permean	Talchir	0.30 m to 45.90 m	Boulder bed, rhythmite, fine-grained greenish sandstone, greenish to purple shales, Khaker-colored siltstones.
- Unconformity -			

Archeans	Pre-cambrian	0.10 m to 12.50 m	Mica-schist, gnesis and quarzite.

Soil & Alluvium: A major part of the block is covered by a thin layer of soil and alluvium horizon. The weathering has affected all the strata below the soil to a varying extent. The thickness of soil ranges from 0.50 m (MMT-20) to 15.00 m (MMT -166). The depth of the weathered zone varies from 0.50 m (MMT-124 & MMT-176) to 30.32 m (MMT-33).

Intrusive: The block is free from any intrusive.

Structure of the block:

1. The structural interpretation is mainly based on the sub-surface data obtained during exploratory drilling.
2. The general strike of coal horizons is NW-SE in the major part of the block with minor swings. The dip of beds varies from 2o to 4o towards the southwest.
3. The block does not show major tectonic disturbances.

1.5 Soil characteristics

1.5.1 Grain size analysis of soil:

The grain size analysis of the soil in respect of the area in and around of study area is given in (Table). The average composition can be classified as Sandy Silt, as per the scheme of classification of the Unified Soil Classification System (USCS). The soil is fine-grained with significant silt content and a portion of sand. The organic fraction is also good possibly making it fertile for agriculture.

Table 1.3: Grain size Analysis of the area

Type of Grain	Notation	Bajaramunda	Mallupara	Khamariya	Karuwahi	Bhalumuda	Average %
		S1	S2	S3	S4	S5	
Sand	(SAN)	54.49	57.32	30.79	15.42	15.42	34.688
Silt	(SIL)	23	27.88	46.73	59.73	59.73	43.414
Clay	(CLN)	8.08	7.88	16.41	23.22	23.22	15.762
Organic	(C)	14.43	6.92	6.07	1.63	1.63	6.136
	%	**100**	**100**	**100**	**100**	**100**	**100**

1.5.2 Silt Yield Index:

The Silt Yield Index (SYI) is defined as the Yield per unit area and the SYI value for the hydrologic unit is obtained by taking the weighted arithmetic mean over the entire area of the hydrologic unit by using a suitable empirical equation. The Silt Yield Index (SYI) concerning micro watersheds has been estimated and given in the table below.

Table 1.4: Silt Yield Index (SYI) (EIA/Mine plan report)

S. No.	Nomenclature of Watershed	W1	Area in Hectare A1	Silt Yield Index
1	W-01	30	1946	1516
2	W-02	30	289	225
3	W-03	30	82	64
4	W-04	30	138	108
5	W-05	30	199	155
6	W-06	30	1072	835
7	W-07	30	125	97
8	Total		3851	3000

1.6 Topography Drainage and surface waterbodies

The terrain of the coalfield is rolling and undulating, with wide troughs strewn across the hills. The area's topography is primarily composed of a softer horizon and is generally undulating; more resistant sedimentary strata, which rise to heights of up to 600 metres above MSL (Morga Pahar) in the northeast and 580 metres above MSL (Silot Pahar) in the northwest, stand out as ridges. The surrounding area (up to 10 km) varies from 242 m to 640 m above MSL, whereas the overall elevation of the mining area is from 242 m to 303 m above MSL. The slope is oriented southward. The hills are 450 metres above MSL and are of the relict type. The area's primary drainage system is made up of the perennial Mand River, which flows southerly, and its tributaries. The eastern portion of the coalfield is drained by the Kelo River, a tributary of the Mahanadi that flows through the southeast portion of the mine. There are a few ponds in the mine.

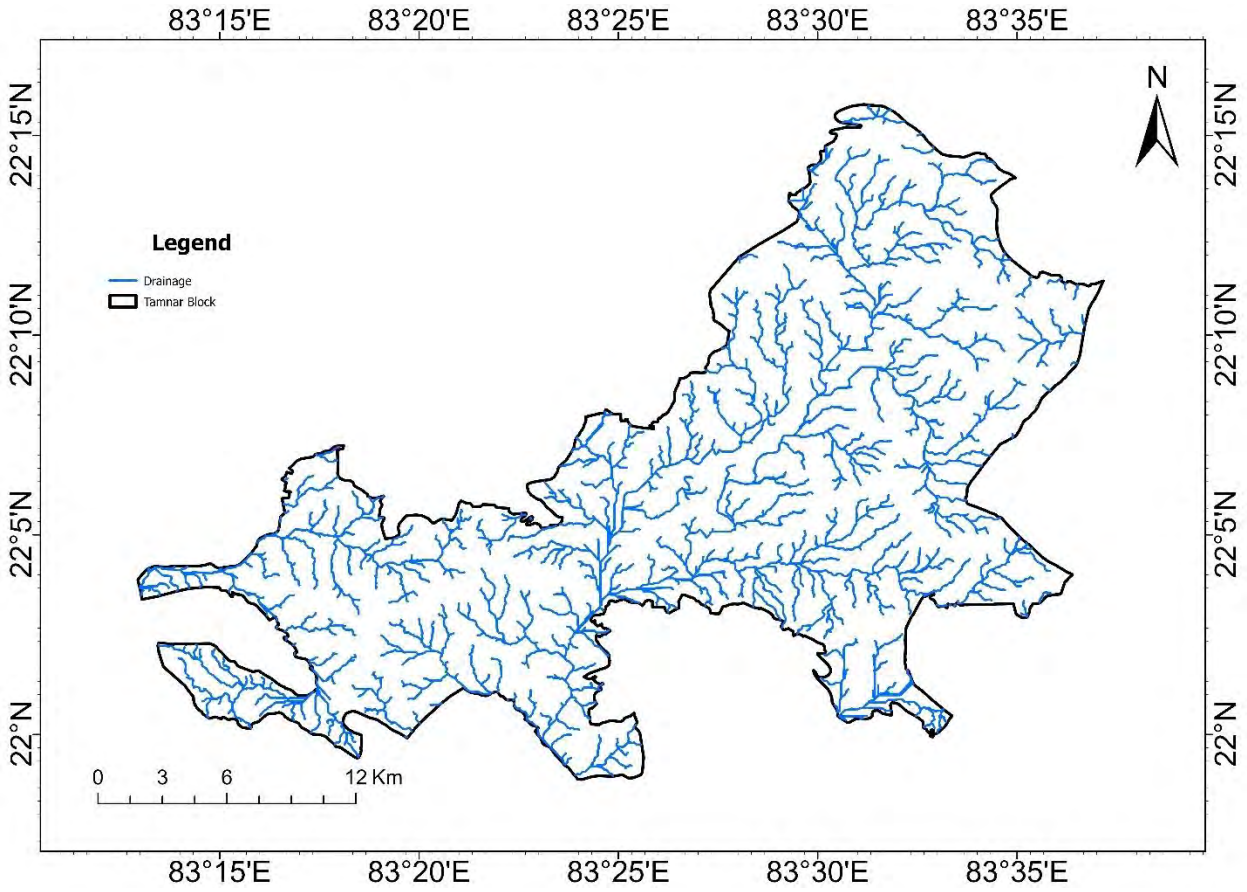

Fig - 1.2. Drainage map of the study area

1.7 Microclimate of the area

The study area has a subtropical climate, which is defined by a scorching summer, a moderate winter, and evenly spaced rainfall throughout the southwest monsoon season. There are four distinct seasons in a year. The southwest monsoon season runs from June to September, whereas the summer season spans from March to mid-June. The post-monsoon season lasts from October to November, whereas the cold season lasts from December to February. The IMD's closest weather station is located in Raigarh.

1.7.1 Annual rainfall for the area

The average annual rainfall based on the 30 years of IMD data, was observed to be 1394.7 mm. The monsoon sets in the month of June and continues till October. The maximum amount of

rainfall (403.5 mm) occurring in the month of July. Monthly variations in the rainfall for past 30 years is given in figure 5.

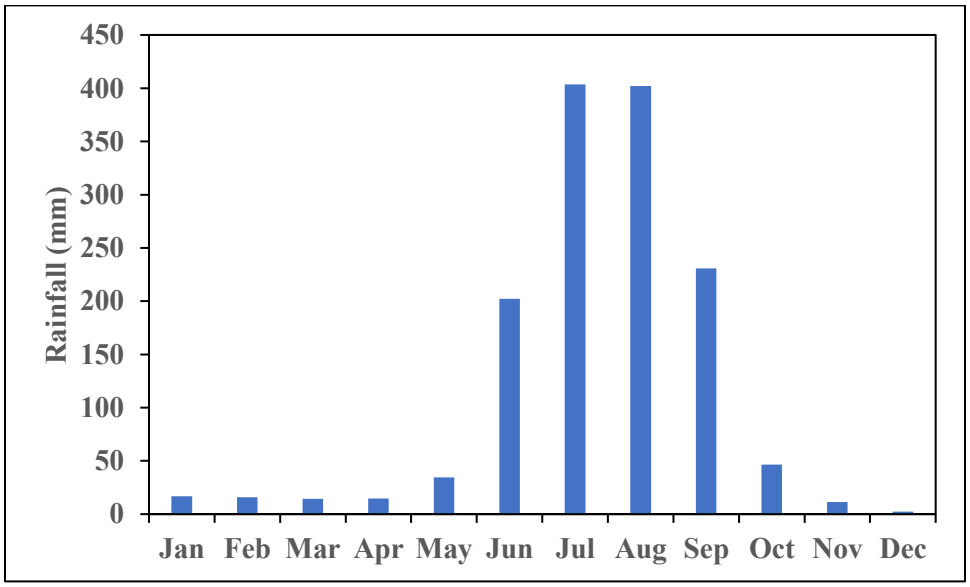

Fig- 1.3. Monthly variation in rainfall (IMD Climatological Normal 1981-2010)

1.7.2 Temperature ranges in the area

As per the monthly average of daily maximum and minimum temperatures collected from IMD Station, Raigarh, the monthly mean of minimum temperatures ranges from 9.32°C in January to 22.97°C in May. The monthly mean of maximum temperature ranges from 31.40°C in January to 44.62°C in May.

Summer is very hot & oppressive. The average rainfall of the district ranges from 1200 mm to 1300 mm. July is the rainiest month & may be the driest. Dec. and Jan. are the coldest months with a minimum temperature of 8°C, sometime. May is the hottest month with a 44.62°C maximum temperature. The summer season starts from middle of the March to the middle of June to September. Winter rain is scanty and only 91.56 mm of rain is recorded in the area with an average of 6 rainy days in the winter season from October to February. Winters are not very long. The difference in minimum temperature is high between Nov. to Feb. and the difference is lowest in the rainy season. The month-wise details of the average maximum and minimum temperature are given below.

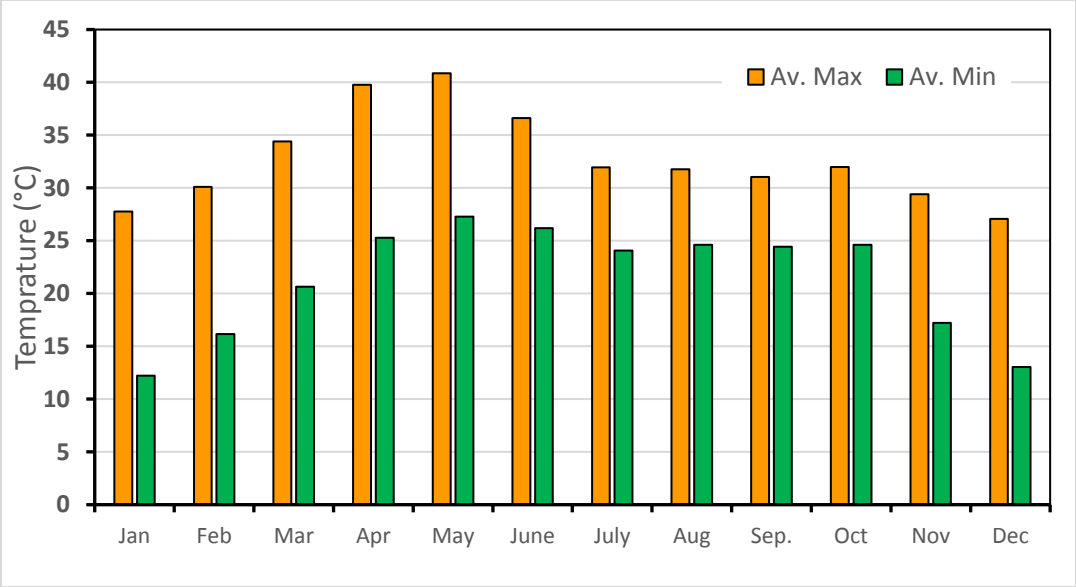

Fig- 1.4. Month-wise distribution of average maximum and average minimum temperature for the month over the past decade.

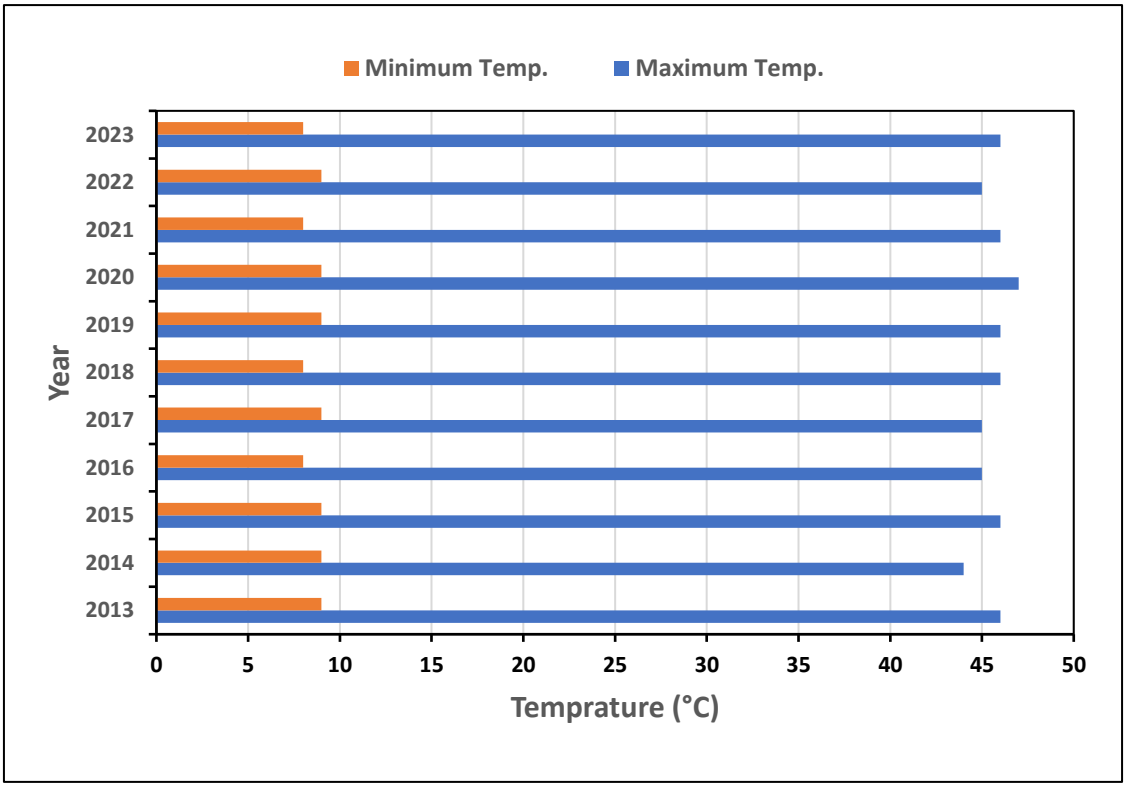

Fig- 1.5. The Comparative Status of Temperature for the last decade.

Site Survey: The site survey of the study area was conducted in the pre-monsoon season to know the existing environmental status and to understand the baseline environmental conditions in and around the proposed project.

1.8 Crop Land/ Agriculture Land

The majority of the 12,369.39 Ha of land is covered by agricultural land. That makes up roughly 25.62% of the entire region. The area is farmed using both single and double cropping techniques. Currently, a portion of the property is left fallow, with grass growing on it. Rain-fed agriculture may be to blame for this. Seasonal agriculture is practiced on these agricultural lands. It is mostly agricultural land. Plantation agriculture is also present across the research area. Cropping land accounts for 219.59 Ha, or 34.79% of the overall project site boundaries, of the project site area.

1.8.1 Open Scrub

The scrubland area makes up approximately 4,148.93 ha, or 8.59%, of the entire research area. This type of land cover describes an area of land where the predominant natural vegetation is made up of sparse grass growth and bushes and scrubs. This kind of land area, which has very little vegetation, is categorized as a wasteland since its soil is unfit for agriculture. In the earth, only little bushes and grasses survive. This kind of land cover is typically found scattered among agricultural land areas. This type of land cover is dispersed throughout the majority of the land area in the proposed study region as well. A total 73.53 Ha area comes under scrubland of the total project site boundary area, which is 11.65 % of the total project site boundary.

1.8.2 Waste Land

Wastelands are areas of land that have deteriorated soils and rocky topography, making them unsuitable for farming, grazing, or other commercial activities. This kind of land area, which has relatively little vegetation, has soil that is not appropriate for farming. This pattern of land use and cover makes up approximately 458.86 Ha, or 0.95% of the entire research area. The wasteland of the whole project site border area makes up 2.37 Ha, or 0.38 % of the total project site boundary.

Plate-1.1 Ecological survey team from IIT(ISM) Dhanbad along with officials from Tamnar block, Raigarh, Chhattisgarh

CHAPTER – 2

2. Existing Environmental Status

2.1 Existing Environment Quality

A comprehensive study of the environmental quality in and around of the Tamnar Tehsil area was performed which includes the assessment of Land use, water quality, air quality, level of noise, flora and fauna, hydrology, socio-economic scenario etc.

2.2 Environmental Impact Assessment

Environmental Impact Assessment (EIA) is a process that examines the environmental consequences of development actions in advance with an emphasis on environmental protection. The idealized EIA process is flexible, iterative, proactive and based on accurate, consistent, transparent and defensible methods. This is only achievable if the EIA forms a part of integrated systems of environmental regulation, based on strategic planning and regulation of environmental quality and operating standards to quality standards. Thus, the EIA can provide a basis for environmentally sound decision-making, the designing and planning of developmental projects, monitoring, management and audit, mitigation and application of EIA process.

Various baseline parameters *viz*. Air, Land, Surface water, Groundwater, Micro-meteorological, Flora, Fauna, Social aspects, etc. are included in the study of EIA. Based on baseline environmental status and proposed project activities potential impacts have been assessed and predicted.

The project area environmental status was based on detailed field survey investigations. Besides these components the impact on quality of life of the people living in the vicinity of the proposed project is important to arrive at the informed decision for the environment feasibility of the project. So, the Baseline data generation and its assessment is the backbone of any EIA Study. EIA is now a mandatory requirement and is to be carried out according to the terms of reference (ToR) defined by the Expert Appraisal Committee (EAC) of Ministry of Environment, Forests & Climate Change (MoEF & CC), Government of India for environmental clearance to start-up a new project.

Scope of work

The environmental status of the proposed area is monitored by the present study in respect of Group-I "Air, Water, Noise, Soil and Micro met data" by regular monitoring to understand the baseline environmental conditions in and around the proposed project. The monitoring was carried out for the pre-monsoon period, thus the data generated will be used to estimate the present trend in comparison with stipulated standards.

2.3. Land Use Land Cover of Tamnar block

Tamnar block is located in the Northeastern region of Chhattisgarh, which is 26 km north of Raigarh. The 10 km buffer zone of the proposed site shares its boundary with Orissa in the east. The land use map for the core and buffer zone was prepared using LISS-IV multispectral data with 5m spatial resolution downloaded from bhoonidhi.nrsc.gov.in dated 30th April 2024, which falls during the summer season in the Indian subcontinent. The land use map was prepared in ArcGIS 3.0 using a supervised classification technique and Support Vector Machine (SVM) classifier. Eight classes were prepared for the study's Land Use Land Cover (LULC) classification: Water, Dense Vegetation, Settlement, Open Scrub, Agricultural Land, Mining, industry and Ash Pond. Random Stratified Sampling with 421 sample points was done to assess the accuracy of the LULC of the study area. The accuracy of the LULC Map of the study area was found to be 0.93 with a Kappa Coefficient of 0.89 (Table 2.2).

Table 2.1. Details of the Satellite Data

Satellite Used	Liss-IV
Date of Acquisition	30-4-2024
Time	04:40:16.115722 GMT
Path	103
Row	056
Cloud Cover	0

Table 2.2. Accuracy Assessment of LULC of Tamnar block area

Class Name	Water	Dense Vegetation	Settlement	Open Scrub	Agricultural Land	Mining	Industry	Ash Pond	Total	User Accuracy	Kappa Coefficient
Water	8	0	0	0	2	0	0	0	10	0.8	
Dense Vegetation	0	77	0	1	2	0	0	0	80	0.96	
Settlement	2	0	16	3	3	0	0	0	24	0.67	
Open Scrub	0	1	0	38	3	0	0	0	42	0.90	
Agricultural Land	1	1	4	5	213	3	0	0	227	0.94	
Mining	0	0	0	0	0	18	0	0	18	1	
Industry	0	0	0	0	0	0	10	0	10	1	
Ash Pond	0	0	0	0	0	0	0	10	10	1	
Total	11	79	20	47	223	21	10	10	421		
Producer Accuracy	0.73	0.98	0.80	0.81	0.96	0.86	1	1		0.93	
Kappa Coefficient											0.89

Table 2.3. Area of Individual Classes of Tamnar block.

Zone	**Area (ha)**	**% Area**
Water	516.89	1.00
Dense Vegetation	20474.01	39.61
Settlement	1674.72	3.24
Agricultural	25389.63	49.12
Mining	1865.97	3.61
Industry	1235.36	2.39
others	516.89	1.00

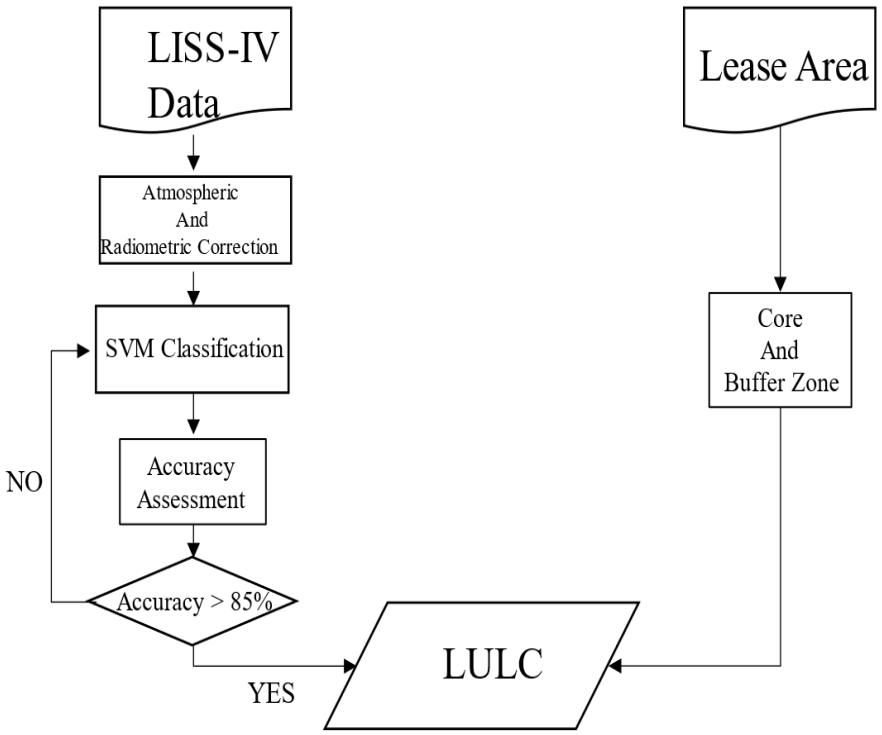

Fig 2.1. Flow chart of preparation of Land-use map

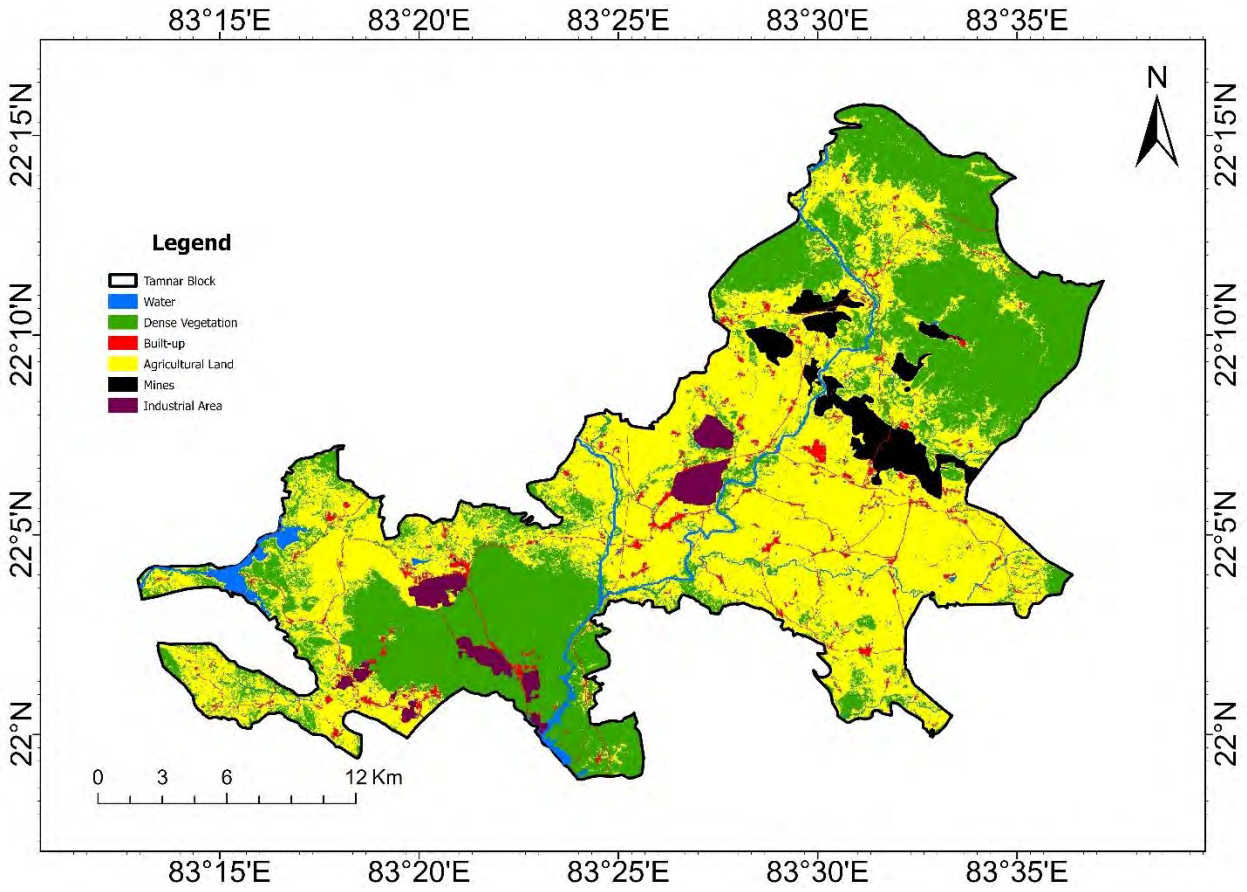

Fig 2.2. Land Use Land Cover map of the study area

2.4 Air Quality Status

2.4.1. Ambient Air quality in Tamnar Tehsil, Raigarh, Chhattisgarh

The monitoring of air was carried out in the pre- monsoon season of the year 2024 in core and buffer zone in the proposed site, and the data was utilized for preparation of this report as per the latest Gazette Notification of the Central Pollution Control Board (CPCB) (16th November 2009). On the basis of physiography of the area, predominant meteorological parameters like wind direction, wind speed etc. are monitored in various stations to assess the ambient air quality.

2.4.2. Micro Meteorological Condition

A micro meteorological station data was collected from the proponent which was installed in the GP-II Office area (22°10'15.03"N & 83°27'48.18"E) of the Tamnar Tehsil, Raigarh in the month of April, 2024. The details of the wind rose are as follows:

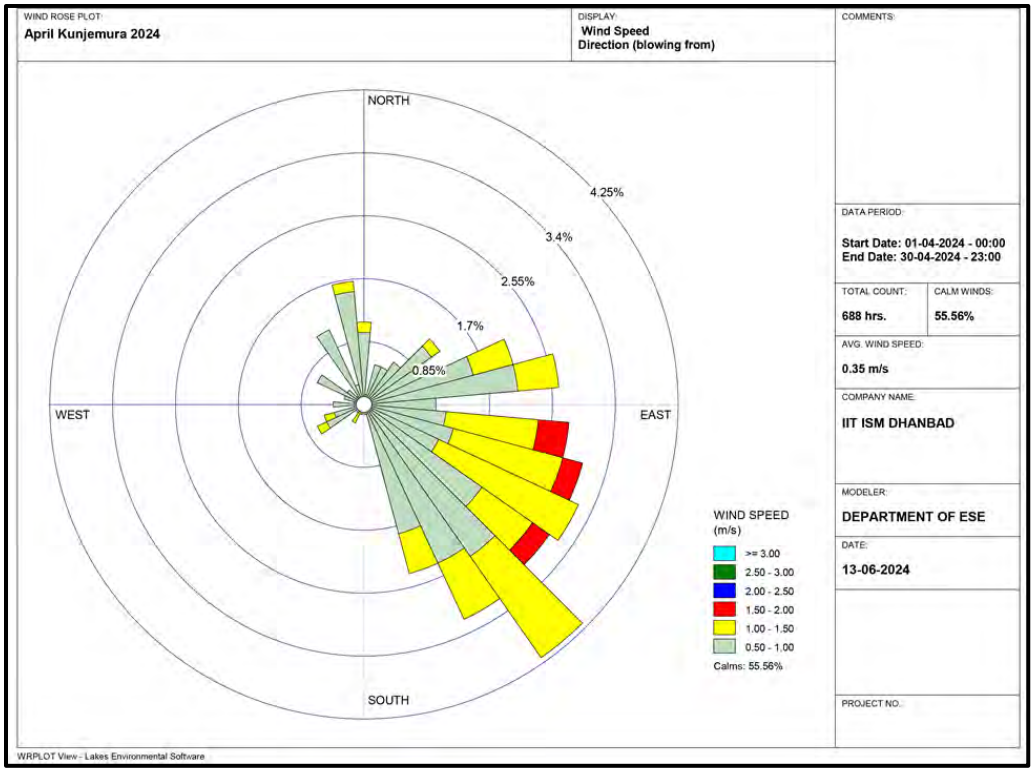

Fig 2.3. Wind Rose Diagram of Kunjemura

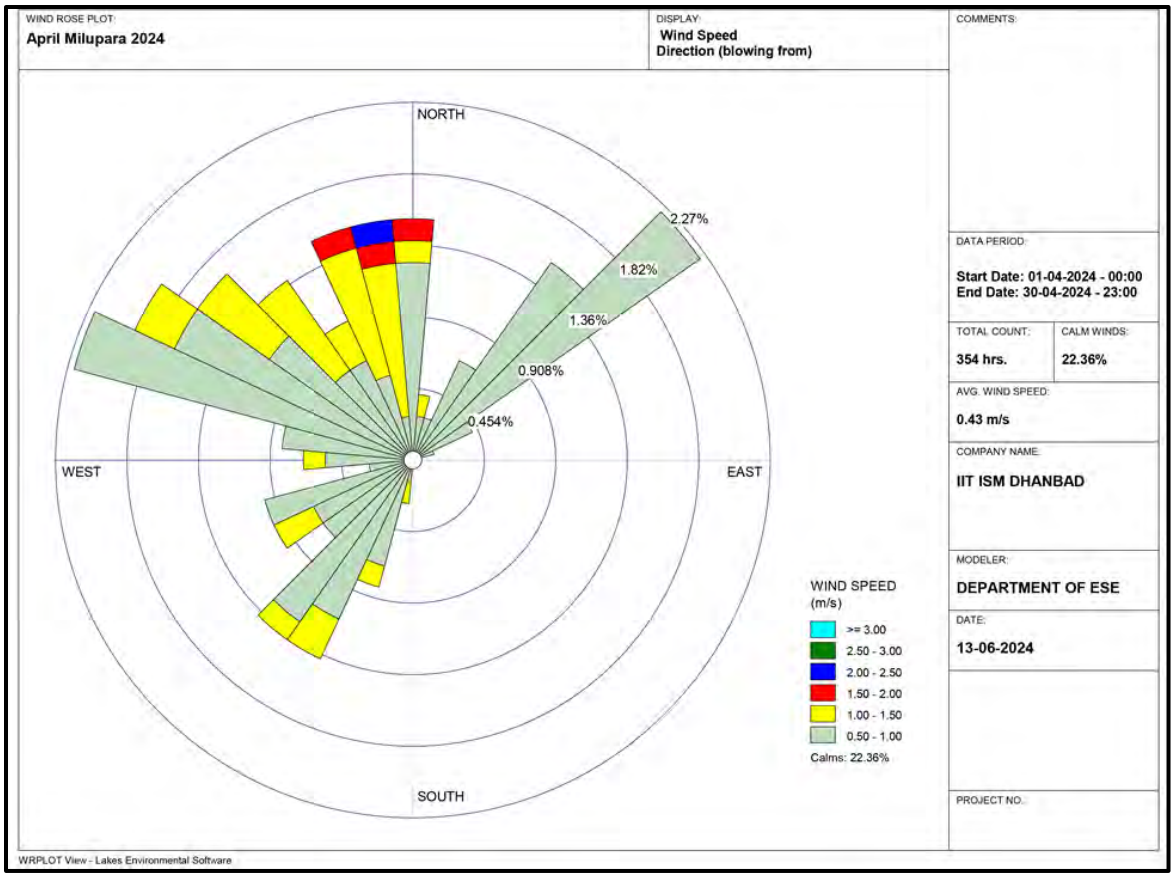

Fig - 2.4. Windrose Diagram of Milupara

2.4.3 Sample collection:

The Air quality monitoring was carried out in the Tamnar block area as per the latest Gazette Notification of the Central Pollution Control Board (CPCB) (16th November 2009). The samples were collected in the month of April, 2024 of the pre monsoon season. The duration of sampling of PM_{10}, $PM_{2.5}$, SO_2, and NO_2, Benzene etc. was each twenty-four hourly continuous sampling per day and CO and Ozone was sampled for 8 hours continuous thrice in 24-hour duration monitoring. The Air sampling location details are given below:

Table – 2.4. Sampling locations for Air quality monitoring of Tamnar Tehsil, Raigarh, Chhattisgarh

Sample Codes	Locations	Approximate Distance (km)	Direction	Environmental Setting
A-1	GP-II Office	0.00	--	Rural/Residential Area
A-2	Dhaurabhanta	3.0	SE	Rural/Residential Area
A-3	Rodopali Village	--	--	Rural/Residential Area
A-4	Bhalumura Village	0.15	N	Rural/Residential Area
A-5	Kondkel	6.8	E	Rural/Residential Area
A-6	Padigaon	8.2	S	Rural/Residential Area
A-7	Mahloi Village	8.5	S	Rural/Residential Area
A-8	Khamharia	4.8	E	Rural/Residential Area
A-9	Jharna Village	2.1	SE	Rural/Residential Area
A-10	Tamnar Village	6.3	SW	Rural/Residential Area
A-11	Gharghoda Town	3.1	W	Rural/Residential Area
A-12	Barkaspali Village	9.7	W	Rural/Residential Area
A-13	Libra	0.5	S	Rural/Residential Area
A-14	Tihili Rampur	--	--	Rural/Residential Area
A-15	Milupara	9.2	E	Rural/Residential Area

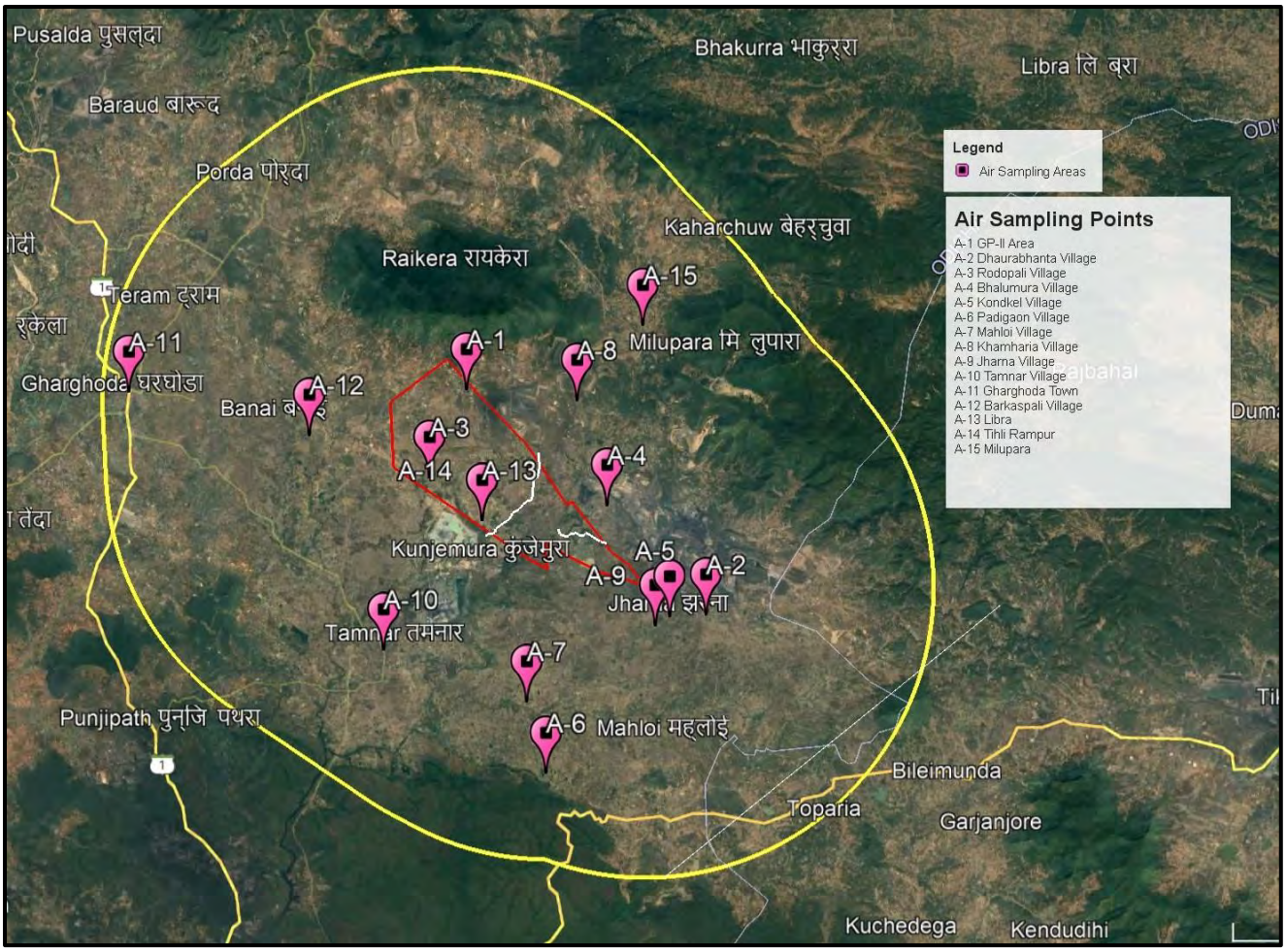

Fig - 2.5. Sampling location map of Air in the Tamnar Tehsil, Raigarh, Chhattisgarh.

Plate-2.1a.

Plate-2.1b

Plate-2.1c

Plate-2.1d.

Plate-2.1e.

Plate-2.1f.

Plate – 2.1a-f. Air sampling in the Tamnar Tehsil, Raigarh, Chhattisgarh.

2.4.4. Methodology

Table – 2.5. Techniques used for ambient air quality monitoring

Parameters	Test method
Particulate Matter (Size less than 10 μm), PM_{10}	Repairable dust sampling (Gravimetric)
Particulate Matter (Size less than 2.5 μm), $PM_{2.5}$	Low-volume sampling (Gravimetric)
Sulphur dioxide (SO_2)	Improved West and Gaeke Method
Nitrogen dioxide (NO_2)	Jacob & Hochheiser modified (NaOH - $NaAsO_2$) method
Carbon Monoxide (CO)	Non-dispersive Infrared (NDIR) Spectroscopy
Ozone (O_3)	Spectrophotometric method
Ammonia (NH_3)	Indophenol Blue Method
Benzene, C_6H_6	Adsorption and desorption followed by GC analysis
Benzo(a)pyrene(Bap) Particulate phase only	Solvent Extraction followed by GC analysis
Arsenic(As)	AAS method after sampling on EPM 2000 Filter paper
Nickel (Ni)	AAS method after sampling on EPM 2000 Filter paper
Lead (Pb)	AAS method after sampling on EPM 2000 Filter paper

The gaseous pollutants (SO_2, NO_2, O_3, NH_3 etc.) were monitored by using an attached gaseous kit with the respirable dust sampler (RDS) and analyzed through the wet chemistry method.

For SO_2, concentration in ambient air, a sample was collected by drawing air at a flow rate of 0.6 L min^{-1} through an absorbing solution of 0.04 M potassium tetra chloromercurate (K_2HgCl_4). A dichloro sulphitomercurate complex thus formed reacted with sulfamic acid (0.6%), pararosaniline and formaldehyde (0.2%) to form intensely coloured pararosaniline methyl sulphonic acid. The absorbance of the solution was measured at 560 nm using a UV-VIS spectrometer by following the improved method of west and Gaeke.

To determine the NO_2 sample was collected by drawing air at a flow rate of 0.3 L min^{-1} through absorbing solution, a mixture of 0.4% sodium hydroxide (NaOH) and 0.1% sodium arsenite ($NaAsO^{2-}$). The concentration of nitrite ion (NO^{2-}) produced during sampling was determined colorimetrically by reacting the nitrite ion with phosphoric acid, sulfanilamide, and N–(1–naphthyl) –ethylenediamine di–hydrochloride (NEDA) and measuring the absorbance of highly coloured azo–dye at 540 NM using a UV–VIS spectrophotometer by the method described and modified by Jacobs and Hochheiser.

O_3, the sample was collected by drawing air at a flow rate of 1.0 L min^{-1} through absorbing solution, a mixture of Absorbing Solution (1% KI in 0.1 m Phosphate Buffer) - Dissolve 13.6 g of potassium dihydrogen phosphate (KH_2PO_4), 14.2 g of disodium hydrogen phosphate (Na_2HPO_4) or 35.8 g of the dodecahydrate salt (Na_2HPO_2. $12H_2O$), and 10.0 g of potassium iodide in sequence. The absorbance of the solution was measured at 352 NM against a reference using a UV-VIS spectrometer by method 411, Air Sampling and Analysis 3rd Edition.
NH_3 was collected by drawing air at - a flow rate of 1.2 L min^{-1} through absorbing solution N Sulphuric Acid. The absorbance of the solution was measured at 630 NM using a UV–VIS spectrophotometer by Indophenol method.
The gaseous pollutant (CO) was monitored by a portable instrument KIMO (Model AQ200), which gives a direct concentration reading in digital format.

The particulate pollution PM_{10} and C_6H_6, BaP, As, Ni and Pb in the particulate phase in ambient air were monitored by using an instrument, a repairable dust sampler (RDS), $PM_{2.5}$ for fine particulate sampler (FPS).

For PM_{10} concentration in ambient air, air is drawn through a size-selective inlet and through a 20.3 X 25.4 cm (8" X 10") filter at a flow rate, which is typically 1132 L/min. The faceplate was removed by loosening the wing nut. The filter paper was placed in the centre (on the support screen) with the rough side of the filter facing upwards. Reading of the elapsed time meter was recorded. The specified length of sampling was 24 hours. After the required time of sampling, the flow meter reading was recorded, filter paper was collected from the sampler, and put in a container or envelope (IS5182 Part XXIII, 2006BIS). The filter papers were weighed under controlled conditions of humidity and temperature before and after sampling. Weights for the blank filters were also recorded. Before weighing, all filter paper (EPM 2000) was left to equilibrate their humidity (around 50%) temperature conditions (20 ± 1°C) or in an airtight desiccator for 24 hours. The collected particle mass was calculated by subtracting before and after sampling of the filter paper by Gravimetric Method.

For determination of the $PM_{2.5}$ concentration in ambient air, an electrically powered air sampler draws ambient air at a constant volumetric flow rate (16.7 lpm) maintained by a mass flow / volumetric flow controller coupled to a microprocessor into specially designed inertial particle-size separator (i.e. cyclones or impactors), where the suspended particulate matter in the $PM_{2.5}$ size ranges is separated for collection on a 47 mm polytetrafluoroethylene

(PTFE) filter over a specified sampling period. The flow control must be upgraded at least every 30 seconds and recorded (logged) every five minutes. Moisture content can affect filter weight. Filters must be equilibrated for a minimum of 24 hours in a controlled environment prior to pre- and post-weighing. The balance room's relative humidity must be maintained at a mean value range of 45 ± 5 % and its air temperature must be maintained at a mean value range of 25.0 ± ºC. The collected particle mass was determined before and after sample collection of filter paper by Gravimetric Method.

For determination of heavy metal required for acid digestion by an atomic absorption spectrophotometer (AAS, GBC, Avanta, Australia). Cut 1"x 8" strip the filter from the 8"x10" filter sample and place on its edge in a labelled centrifuge tube using vinyl gloves or plastic forceps and microwave extraction was performed as per standard protocol prescribed by CPCB 2009. The extracted solution was filtered through a Whatman Filter 42 and the final volume was adjusted to 50 ml with double distilled water and stored in inert glass until analyzed by using AAS. The trace metal concentrations in the samples were calculated by subtracting the blank value of the respective metal.

Benzo(a)Pyrene & other PAHs concentration in ambient air, air is drawn through a size-selective inlet and a 20.3 X 25.4 cm (8" X 10") filter at a flow rate, which is typically 1132 L/min by using repairable dust sampler. Samples were collected on a glass fibre filter (EPM 2000). The sample was extracted by standard protocol prescribed by CPCB and the concentration by HPLC.

As per CPCB norms, National Ambient Air Quality Standards (NAAQS) are given below.

Table 2.6. National Ambient Air Quality Standards (NAAQS)

Standards	Category		SPM ($\mu g/m^3$)	RPM/PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_X ($\mu g/m^3$)
NAAQS 2009	Industrial, Residential, Rural and Other Areas	Annual	-	60	40	50	40
		24 Hrs	-	100	60	80	80
	Ecologically Sensitive Areas (Notified by Central Government)	Annual	-	60	40	20	30
		24 Hrs	-	100	60	80	80
As per MOEF notification GSR 742(E), dated 25 Sep'2000	Existing Coal Mines (commenced prior to 25.09.2000)	Annual	430	215	-	80	80
		24 Hrs	600	300	-	120	120
	New Coal Mines (commenced after 25.09.2000)	Annual	360	180		80	80
		24 Hrs	500	250	-	120	120

Table – 2.7. Air Quality Index and Associated Health Impacts

Air Quality Index Values	Air Quality Index Categories	Associated Health Impacts
0-50	Good	Minimal Impact
51-100	Satisfactory	May cause minor breathing discomfort to sensitive people
101-200	Moderately Polluted	May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and older adults
201-300	Poor	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease
301-400	Very Poor	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases
401-500	Severe	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases

2.4.5. Results of Air quality

Table-2.8. Results of ambient air quality of Tamnar Tehsil, Raigarh, Chhattisgarh.

Parameters	Unit	Permissible Limit (NAAQS-2009)	Sampling Locations													
			AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6	AQ-7	AQ-8	AQ-9	AQ-10	A0-11	AQ-12	AQ-13	AQ-14	AQ-15
Sulphur Dioxide (SO_2)	µg/m^3	50* 80**	14.83	12.48	17.34	15.65	11.24	16.96	14.72	9.35	11.43	21.85	18.92	14.58	12.16	20.51	23.76
Nitrogen Dioxide (NO_2)	µg/m^3	40* 80**	31.45	24.72	36.19	33.68	25.18	21.82	35.37	19.81	16.42	30.86	27.34	21.51	18.42	37.37	32.67
PM_{10}	µg/m^3	60* 100**	58.47	42.53	68.64	60.82	51.48	43.26	54.52	46.44	41.28	59.71	63.38	52.40	43.85	71.36	66.73
$PM_{2.5}$	µg/m^3	40* 60**	43.74	39.65	54.26	28.13	35.41	31.74	46.94	27.32	34.73	45.22	52.65	43.94	38.91	49.62	47.58
Ozone (O_3)	µg/m^3	100** 180**	43.31	39.73	49.65	38.76	34.44	31.18	40.82	37.74	32.30	42.46	48.97	45.18	36.24	48.88	49.61
Lead (Pb)	µg/m^3	0.50* 1.0**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carbon Monoxide (CO)	mg/m^3	02** 04**	1.0	1.0	<1.0	1.0	1.0	1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	1.0
Ammonia (NH_3)	µg/m^3	100* 400**	22.84	25.46	20.53	26.25	17.62	20.18	24.95	23.66	19.71	27.47	26.38	22.49	21.83	24.53	28.45
Benzene (C_6H_6)	µg/m^3	05*	0.018	0.028	0.017	0.022	0.012	0.023	0.014	0.025	0.015	0.011	0.022	0.016	0.011	0.023	0.024
Benzo(a)Pyrene (BaP)	ng/m^3	01*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	ng/m^3	06*	0.014	0.017	0.011	0.019	0.015	0.012	0.014	0.020	0.016	0.013	0.012	0.014	0.011	0.012	0.015
Nickel (Ni)	ng/m^3	20*	0.023	0.019	0.014	0.024	0.016	0.012	0.017	0.013	0.018	0.014	0.011	0.018	0.014	0.021	0.022

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

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

Impression: All the analyzed parameters were found within the permissible limit as per CPCB guidelines, 2009.

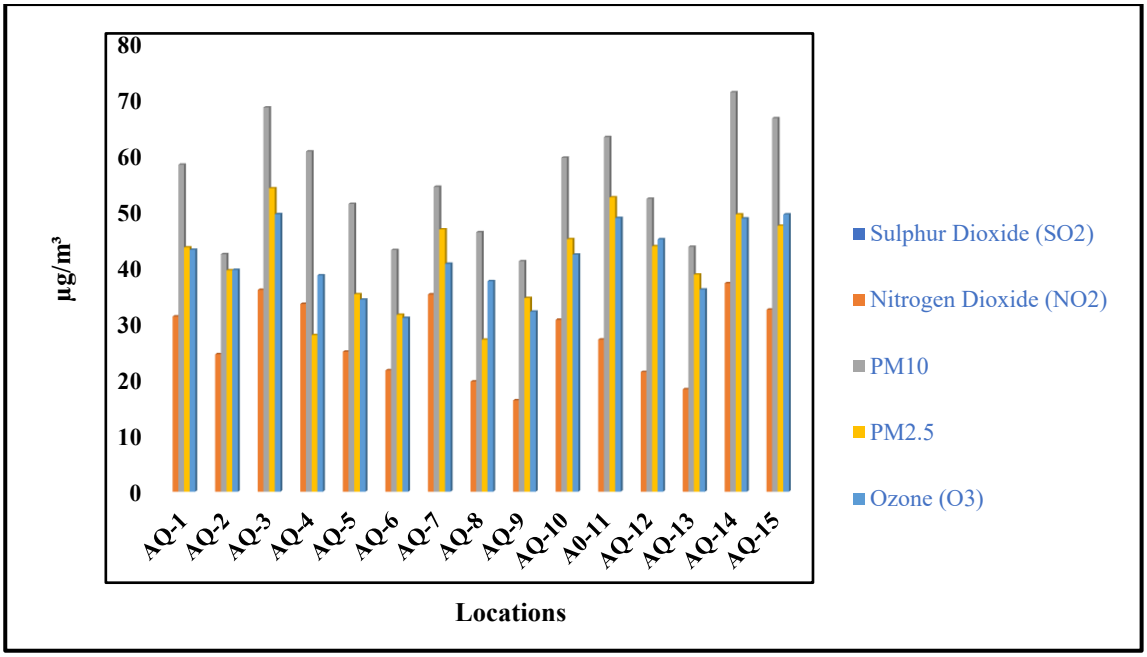

Fig – 2.6. Concentration of various air parameters

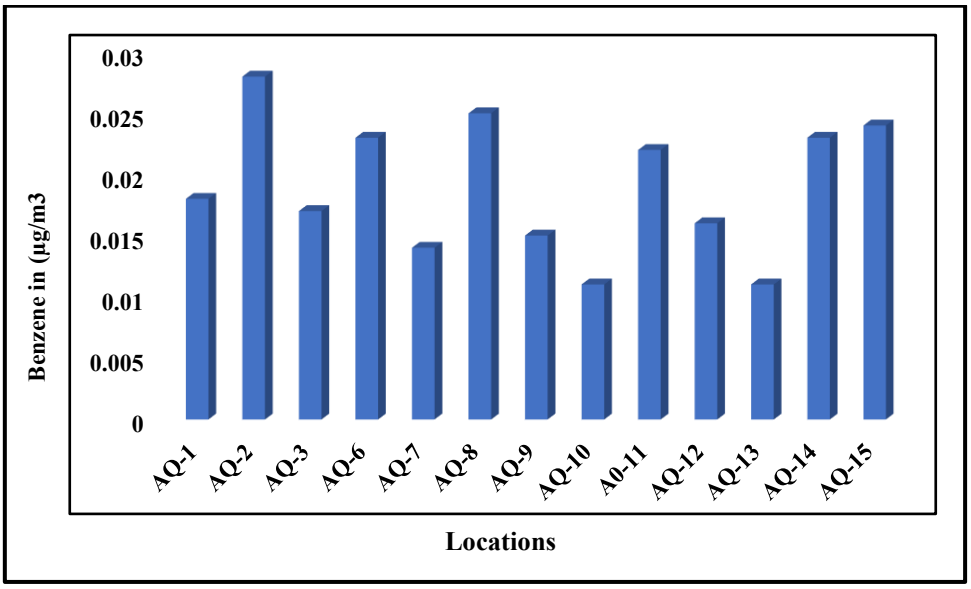

Fig – 2.7. Concentration of benzene air sample

2.5 Water Quality Status

Scope of the study

Water quality status in the Tamnar Tehsil, Raigarh, Chhattisgarh.

2.5.1 Sample collection

Surface water and groundwater sources in the Tamnar Tehsil, Raigarh area were collected and analyzed for projecting the existing water quality status in the study area. The samples were collected in the month of April 2024 of the pre monsoon season. The methodology for sample collection and preservation techniques was followed as per the standard procedures.

Surface water samples were collected from different sources such as streams, river and ponds adjacent to the study area. Groundwater samples were collected from different domestic drinking borewells, dug wells etc. located core and buffer zone to the study area. For each sample station, the water samples were collected in cleaned polypropylene bottles. Samples collected for heavy metal content were acidified with HNO_3. Samples for bacteriological analysis were collected in sterilized glass bottles. The water sampling location details are given below:

Table – 2.9. Sampling locations of water quality assessment of Tamnar Tehsil, Raigarh, Chhattisgarh.

Sample Code	Locations	Latitude	Longitude	Direction	Environmental Setting
Surface water					
SW - 1	Kelo River (Upstream) (Near Milupara)	22°11'20.02" N	83°31'9.72"E	E	Stream
SW - 2	Kelo River (Downstream)	22° 7'32.27"N	83°28'13.81" E	--	Stream
SW - 3	Kelo River (Mid-stream)	22° 7'36.05"N	83°29'31.20" E	--	Stream
SW - 4	Padigaon Village	22° 3'5.07"N	83°28'58.12" E	S	Pond
SW - 5	Mahloi Village	22° 4'23.28"N	83°28'40.29" E	S	Pond
SW – 6	Jharna Village	22° 5'46.51"N	83°31'31.39" E	SE	Pond
SW - 7	Mudhinar Village	22° 7'3.24"N	83°24'46.83" E	W	Pond

SW - 8	Devgarh Village	22° 7'59.60"N	83°23'45.09" E	W	Pond
SW - 9	Saraideepa Village	22° 9'53.32"N	83°26'30.04" E	N	Pond
SW - 10	Khamharia	22° 9'45.61"N	83°29'58.28" E	E	Pond
SW-11	Sarasmal	22° 7'55.38"N	83°30'11.94" E	--	Pond
SW-12	Kerakhol	22°11'55.18" N	83°25'3.49"E	NW	Pond
SW-13	Devgaon	22° 3'59.20"N	83°27'34.86" E	SW	Pond
SW-14	Ukaripali	22° 7'37.64"N	83°21'38.34" E	W	Pond
SW-15	Jhinka Bahal	22° 6'24.02"N	83°29'56.06" E	--	Pond
Groundwater					
GW - 1	GP-II Office	22°10'15.85" N	83°27'48.36" E	--	Borewell water used for drinking and domestic purposes
GW - 2	Dhaurabhanta	22° 5'50.62"N	83°32'24.53" E	SE	Borewell used for drinking and domestic purposes
GW - 3	Rodopali Village	22° 9'39.96"N	83°26'54.73" E	--	Borewell used for drinking and domestic purposes
GW - 4	Bhalumura Village	22°10'27.73" N	83°26'45.75" E	N	Borewell used for drinking and domestic purposes
GW - 5	Kondkel	22° 9'28.09"N	83°31'39.05" E	E	Borewell used for drinking and domestic purposes
GW - 6	Padigaon	22° 3'2.81"N	83°29'1.43"E	S	Dug well used for drinking and domestic purposes
GW - 7	Mahloi Village	22° 4'23.46"N	83°28'42.78" E	S	Borewell used for drinking and domestic purposes
GW - 8	Khamharia	22° 9'53.67"N	83°30'1.26"E	E	Borewell used for drinking and domestic purposes
GW - 9	Jharna Village	22° 5'41.08"N	83°31'22.38" E	SE	Borewell used for drinking and domestic purposes
GW - 10	Tamnar Village	22° 5'29.53"N	83°25'52.86" E	SW	Borewell used for drinking and domestic purposes
GW-11	Gharghoda Town	22°10'31.22" N	83°20'59.08" E	W	Borewell used for drinking and domestic purposes

GW-12	Barkaspali Village	22° 9'33.46"N	83°24'35.83" E	W	Borewell used for drinking and domestic purposes
GW-13	Libra	22° 6'19.05"N	83°30'32.58" E	S	Borewell used for drinking and domestic purposes
GW-14	Tihili Rampur	22° 7'10.50"N	83°29'48.67" E	--	Borewell used for drinking and domestic purposes
GW-15	Milupara	22°11'19.46" N	83°31'25.09" E	E	Borewell used for drinking and domestic purposes

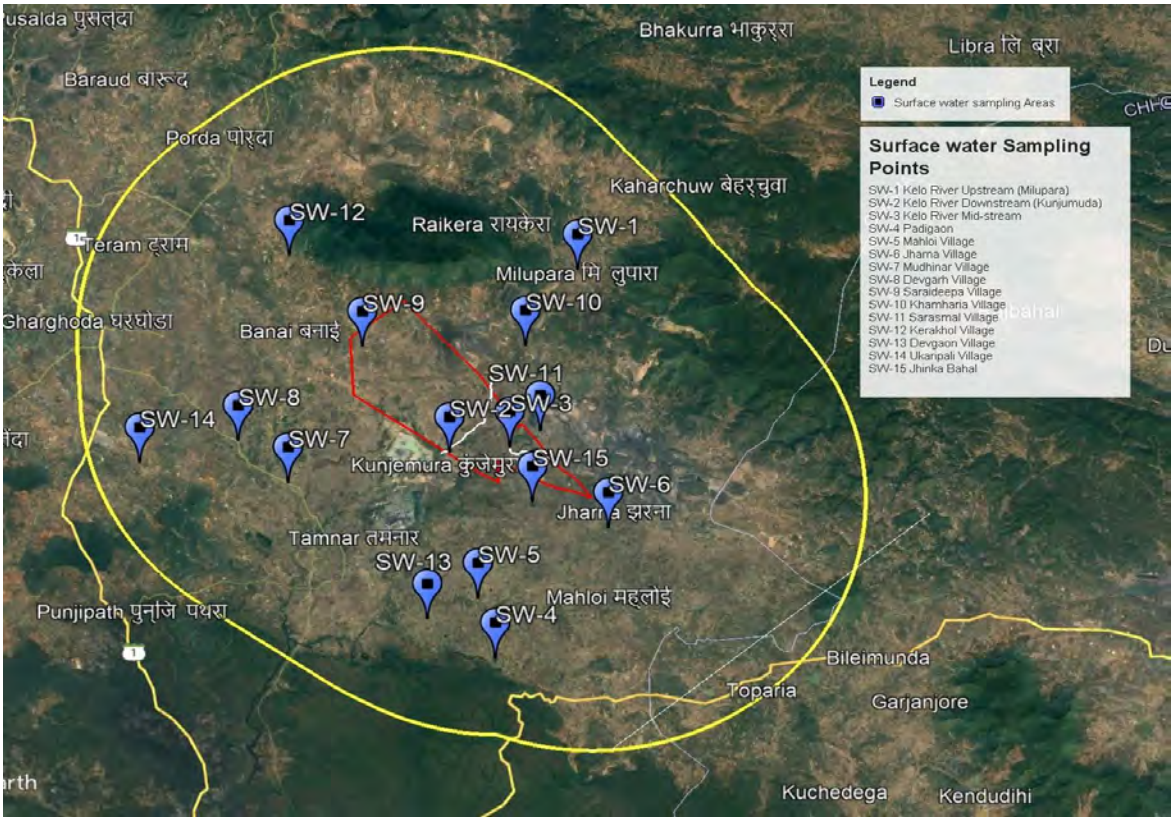

Fig. 2.8. Sampling location map of surface water in the Tamnar Tehsil, Raigarh, Chhattisgarh.

2.5.2. Methodology

The collected samples were analyzed for physico-chemical and bacteriological parameters as per the procedure specified in "standard methods for the examination of water and wastewater", American Public Health Association (APHA). Parameters such as pH, electrical conductivity, temperature, dissolved oxygen (DO) and total dissolved solids (TDS) were analyzed at the time of sample collection. The results of parameters analyzed were compared with the standard guidelines IS: 10500 for groundwater and IS 2296 for surface water. All sampling was done in 1L sampling bottle.

Plate – 2.2a. Surface water sampling of the stream in the study area

Plate – 2.2b. Surface water sampling of the pond in the study area

Plate – 2.2c. Surface water sampling of the stream in the study area

Plate – 2.2d. Surface water sampling of the Pond in the study area

Plate – 2.2e. Surface water sampling of the Pond in the study area

Plate – 2.2f. Surface water sampling of the Pond in the study area

Plate – 2.2g. Surface water sampling of the Pond in the study area

Plate – 2.2h. Surface water sampling of the Pond in the study area

Plate – 2.2i. Surface water sampling of the Pond in the study area

Results: 2.5.3

Table – 2.10. Physico-chemical characteristics of surface water samples at Tamnar Tehsil, Raigarh, Chhattisgarh.

Parameters	Unit	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10	SW-11	SW-12	SW-13	SW-14	SW-15
pH	--	8	7.96	7.18	7.88	7.73	7.55	7.76	7.26	7.68	7.35	7.8	7.52	7.24	7.77	7.61
EC	µS cm^{-1}	301	290	279	348	318	246	361	282	268	320	207	269	359	384	219
TDS	mg L^{-1}	196	167	185	226	204	178	235	219	161	254	153	180	241	268	135
TSS	mg L^{-1}	38	31	24	42	33	22	40	35	18	29	14	19	30	39	9
Turbidity	NTU	10.5	11.8	10.6	13.6	8.2	6.9	11.4	12.8	7.3	19.4	6.9	6.7	14.8	16.7	6.3
DO	mg L^{-1}	5.8	4.3	5.2	4.6	5.3	5.6	4.8	5.4	4.5	5.8	4.9	5.6	5.9	4.7	5.3
BOD (3-days)	mg L^{-1}	2.67	11.27	9.38	2.93	3.01	7.5	3.18	2.43	3.35	2.63	10.97	8.47	6.84	3.35	2.37
COD	mg L^{-1}	8.01	24.18	20.51	11.26	8.33	18.19	8.49	10.48	11.25	8.74	28.39	23.46	19.83	12.91	8.74
Total hardness	mg L^{-1}	285.2	257.1	273.5	329.8	301.2	276.3	357.6	325.3	271	419.8	247.5	263.2	437.4	415.8	208.6
Na^{+}	mg L^{-1}	13.4	11.8	10.2	14.5	12.8	13.2	16.7	15.3	12.6	18.2	11.8	14.7	16.1	15.7	11.4
Cl^{-}	mg L^{-1}	42.3	38.6	45.8	53.1	42.4	47.5	59.7	49.2	37.5	61.2	31.7	35.9	64.3	56.1	34.5
K^{+}	mg L^{-1}	5.6	5.2	6.3	7.5	6.1	4.9	8.1	6.8	5.4	8.6	4.9	5.2	7.9	6.6	4.4
Ca^{2+}	mg L^{-1}	73.5	68.1	71.3	88.3	83.9	76.6	85.4	79.5	64.7	92.6	59.3	62.2	86.4	78.8	61.3
Mg^{2+}	mg L^{-1}	20.4	18.6	19.3	23.7	20.8	17.2	22.3	19.4	16.7	26.6	21.3	23.8	28.4	20.6	14.2
$SO4^{2-}$	mg L^{-1}	68.6	62.5	65.3	79.4	72.6	66.5	75.2	70.6	58.9	81.5	68.4	52.7	78.8	61.4	52.8
$PO4^{3-}$	mg L^{-1}	2.6	1.8	2.2	3.5	3.2	2.8	3.3	3.1	1.4	4.6	2.9	1.6	4.1	2.5	1.8
NO^{3-}	mg L^{-1}	5.2	4.7	4.9	7.3	6.8	4.8	5.7	5.5	4.6	8.1	5.3	4.2	8.3	5.6	4.8
HCO^{3-}	mg L^{-1}	138.4	133.5	132.7	158.4	143.9	139.6	168.2	164.3	135.8	176.5	121.8	128.3	191.6	187.4	118.7
Co	mg L^{-1}	0.024	0.021	0.025	0.042	0.028	0.017	0.034	0.029	0.022	0.053	0.013	0.018	0.064	0.049	0.014
Cu	mg L^{-1}	0.035	0.028	0.047	0.056	0.048	0.026	0.065	0.055	0.038	0.072	0.026	0.029	0.068	0.051	0.027
Ni	mg L^{-1}	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fe	mg L^{-1}	0.25	0.18	0.22	0.28	0.04	0.32	0.39	0.17	0.08	0.25	0.04	0.12	0.43	0.31	0.06
Mn	mg L^{-1}	0.27	0.19	0.14	0.22	0.17	0.11	0.16	0.24	0.15	0.22	0.13	0.11	0.09	0.27	0.12
Zn	mg L^{-1}	0.57	0.41	0.52	0.39	0.64	0.52	0.47	0.76	0.51	0.63	0.35	0.41	0.54	0.29	0.38
Pb	mg L^{-1}	0.005	0.002	0.003	0.006	0.004	0.002	0.001	0.001	0.003	0.002	0.001	0.004	0.003	0.001	0.001
Total coliform	MPN/100 ml	350	334	386	418	496	553	598	471	366	595	337	429	538	341	462

Class A – Drinking water without conventional treatment, but after disinfection. Class B – Water for outdoor bathing. Class C – Drinking water with conventional treatment followed by disinfection. Class D – Water for fish culture and wildlife propagation. Class E – Water for irrigation, industrial cooling and controlled waste disposal.

Unobj – Unobjectionable; BOD (biochemical oxygen demand), COD (chemical oxygen demand), BDL – below detection limit.

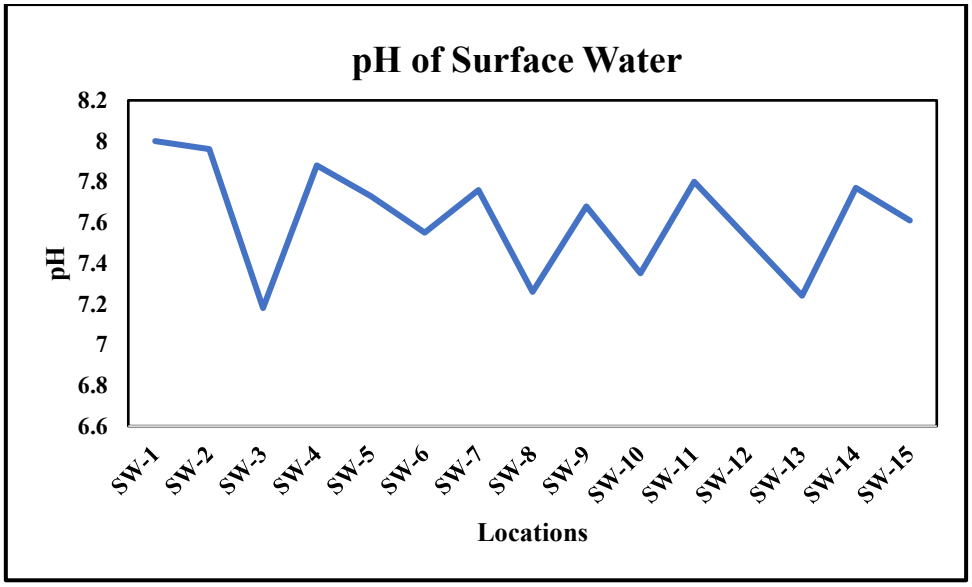

Fig. 2.9. Variation of pH in surface water sample

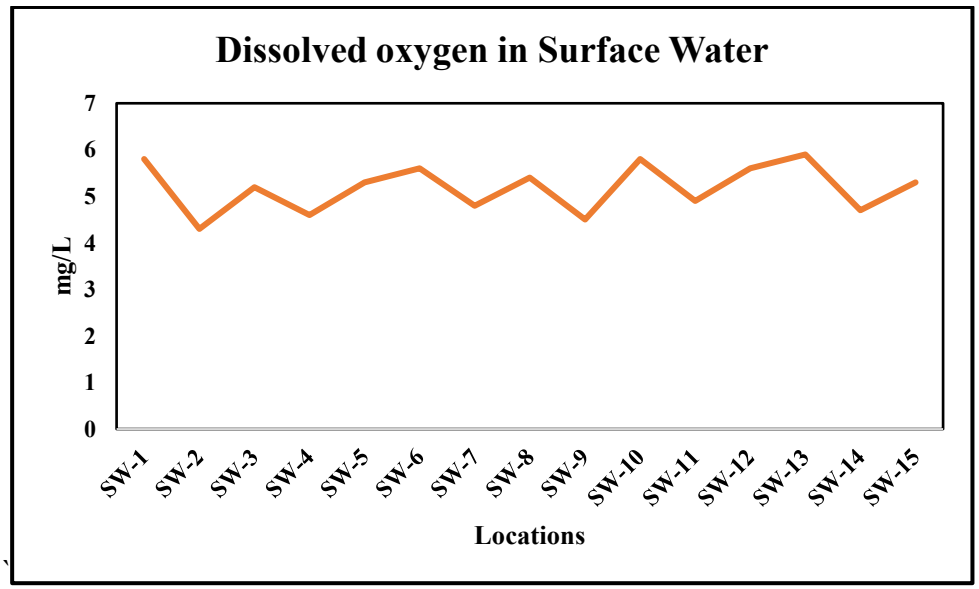

Fig. 2.10. Variation of Dissolved oxygen in surface water sample

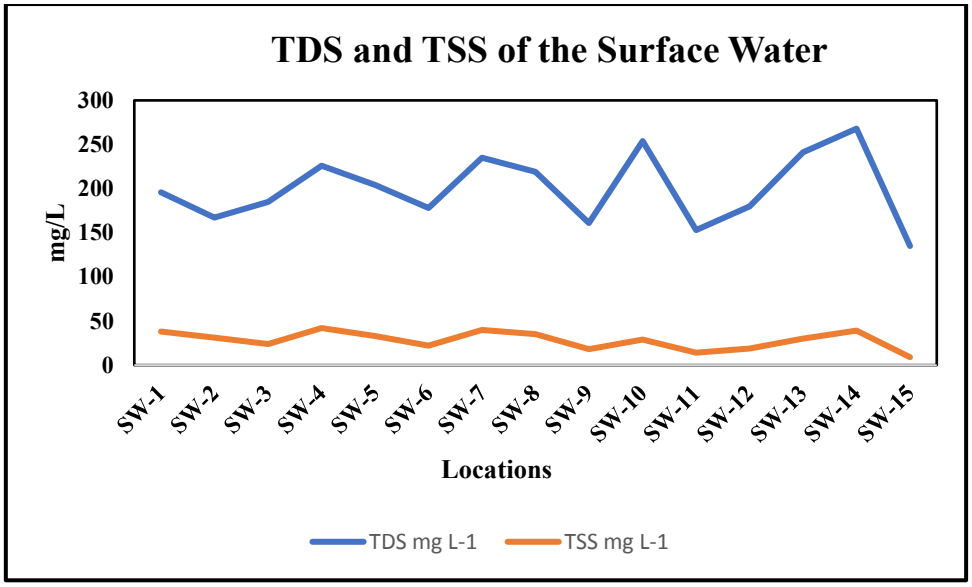

Fig. 2.11. Variation of TDS and TSS in surface water sample

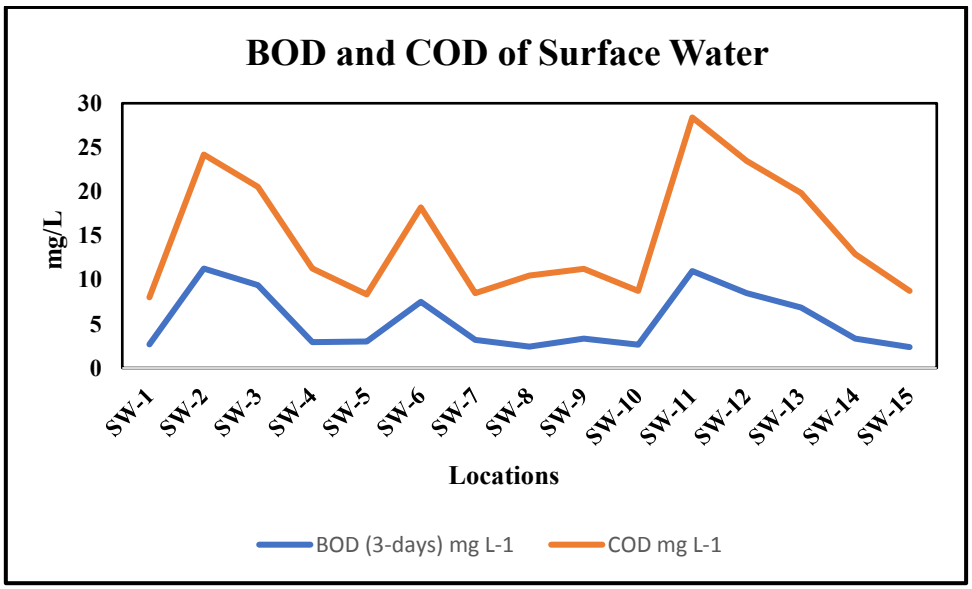

Fig. 2.12. Variation of BOD and COD in surface water sample

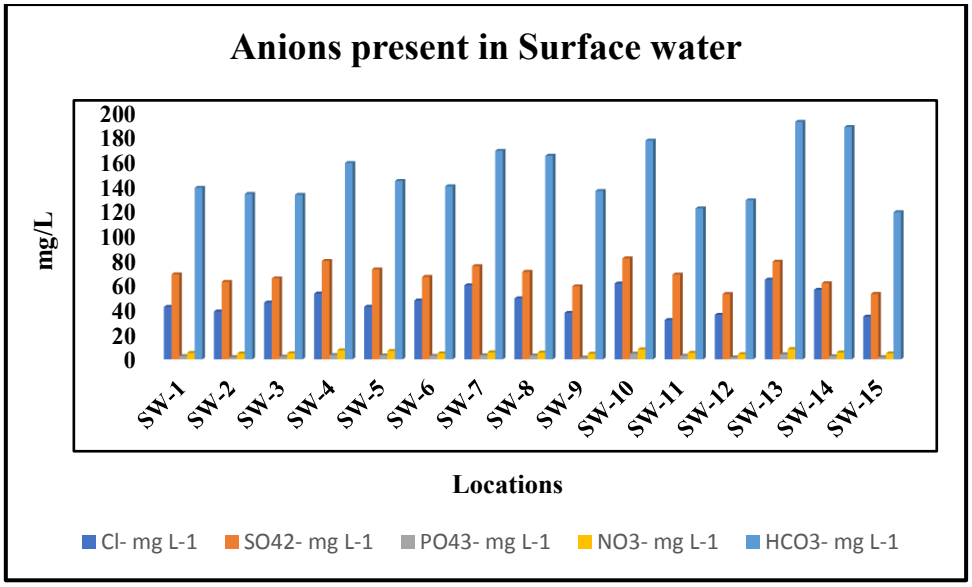

Fig. 2.13. Variation of anions in surface water sample

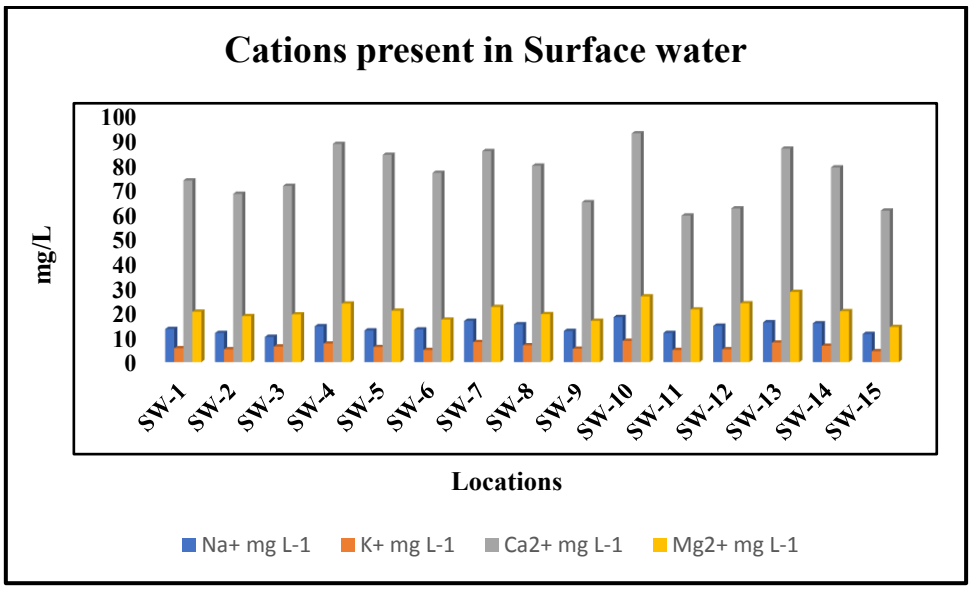

Fig. 2.14. Variation of cations in surface water sample

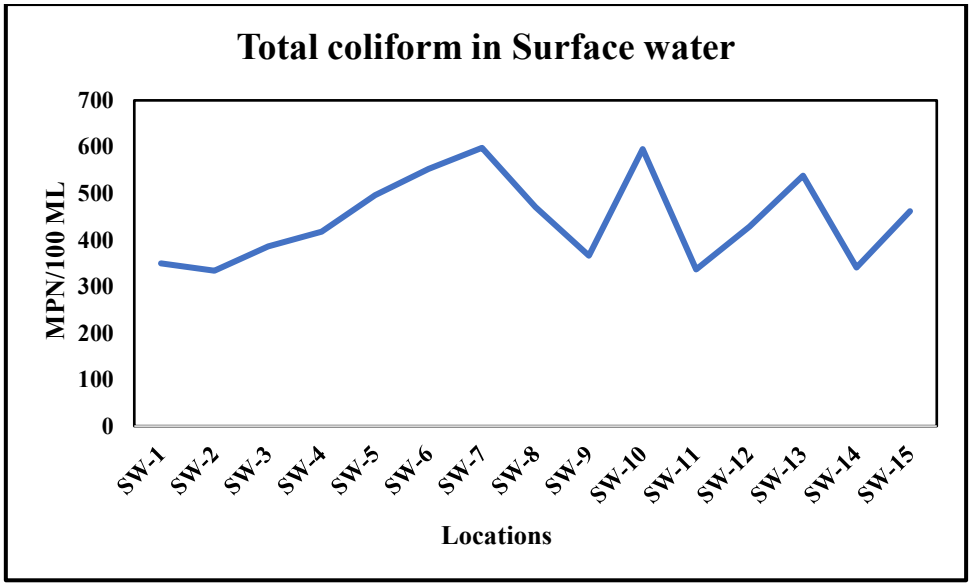

Fig. 2.15. Variation of coliforms in surface water sample

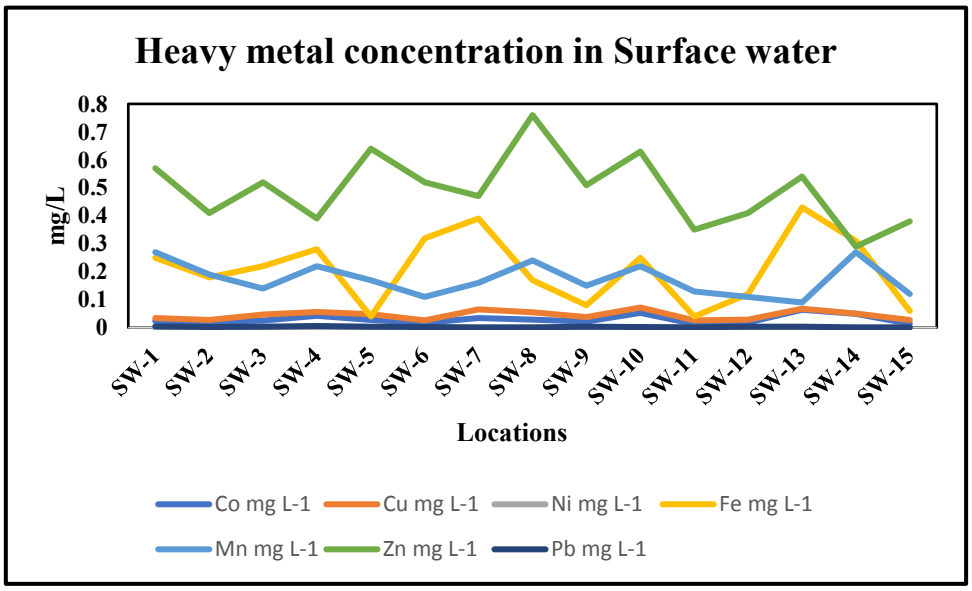

Fig. 2.16. Variation of heavy metals in surface water sample

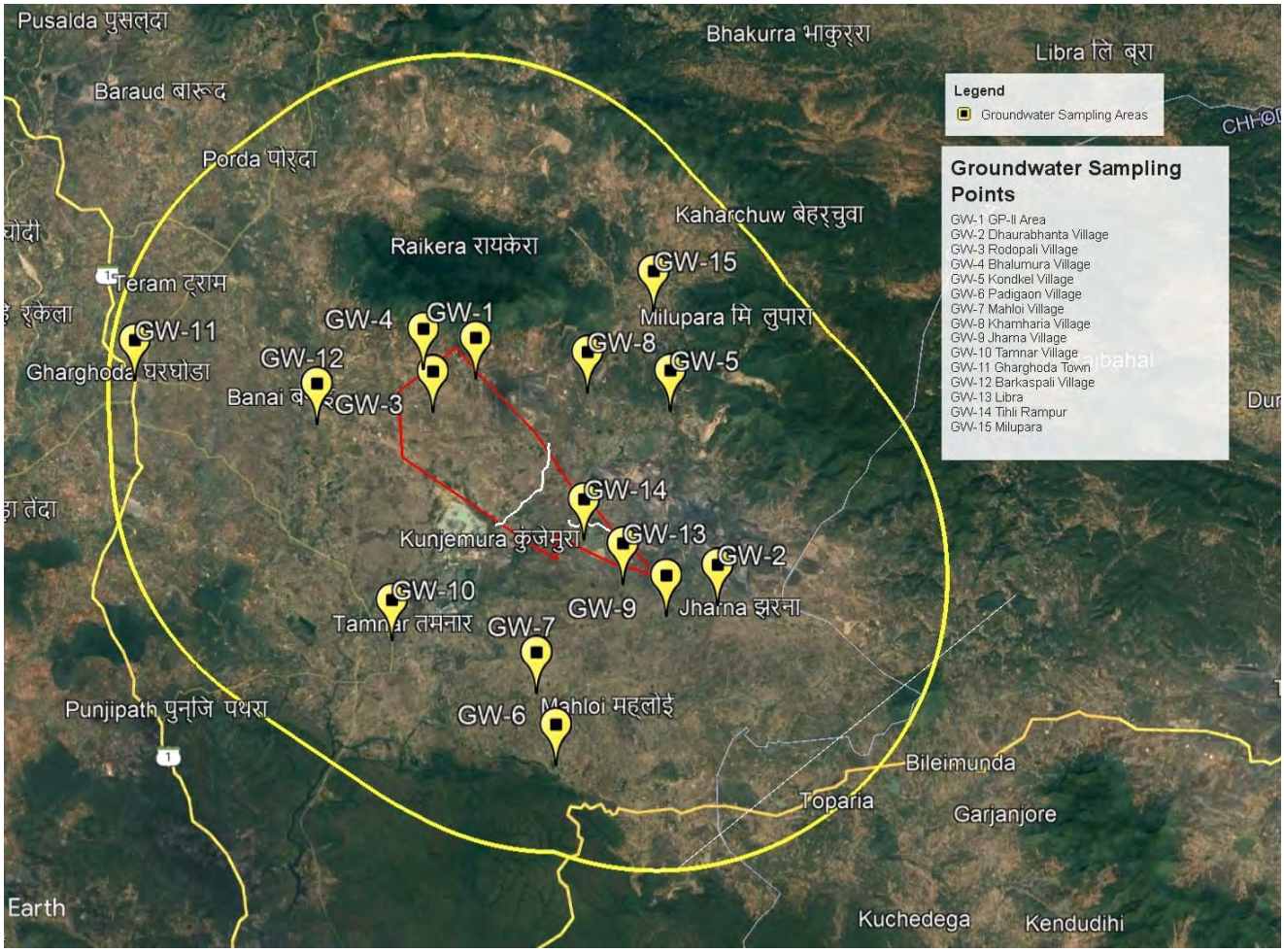

Fig. 2.17. Sampling location map of Groundwater in the Tamnar Tehsil, Raigarh, Chhattisgarh.

Plate – 2.3a. Groundwater sampling of the borewell in the study area

Plate – 2.3b. Groundwater sampling of the borewell in the study area

Plate – 2.3c. Groundwater sampling of the borewell in the study area

Plate – 2.3d. Groundwater sampling of the borewell in the study area

Plate – 2.3e. Groundwater sampling of the dug well in the study area

Plate – 2.3f. Groundwater sampling of the borewell in the study area

Plate – 2.3g. Groundwater sampling of the borewell in the study area

Plate – 2.3h. Groundwater sampling of the dugwell in the study area

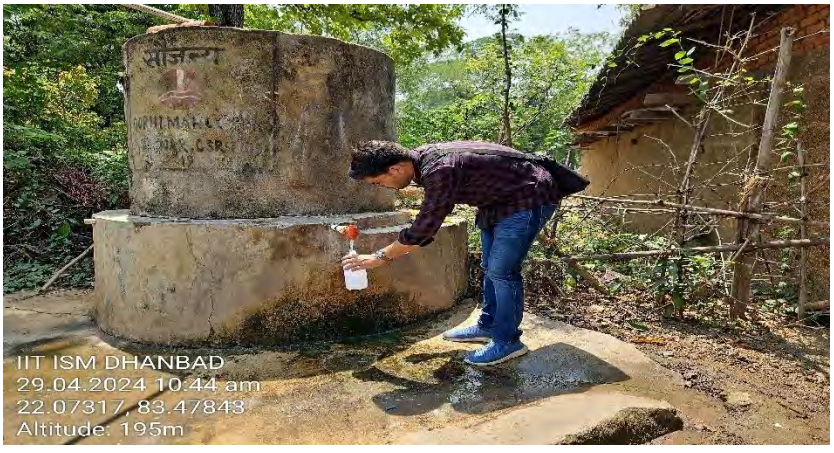

Plate – 2.3i. Groundwater sampling of the borewell in the study area

The quality of water of the project area plays an important role in evaluating the socio-economic parameters of the project. The assessment of the surface water quality was done from 15 different locations in the project area. The quality of surface water quality was compared with the IS 2296:1982 and found that the concentration of target analytes was within the prescribed limits. The pH of the water was neutral to slightly basic due to the surrounding rocky surface which might add carbonate, bicarbonate and hydroxide compounds to the water body. Total dissolved solids were found to be in the optimum range due to weathering of surrounding rocky areas. The optimum concentration of dissolved oxygen in the water body in the range of 4.3 mg/L to 5.8 mg/L indicates a healthy water body with minimum pollutants source. Due to the low concentration of Nitrate (NO_3^-) and Phosphate (PO_4^{-3}) which serve as nutrients to various biological organisms, the biological oxygen demand (BOD) is within the limits. Chemical Oxygen Demand (COD) maximum concentration of 28.39 mg/L indicates the discharge of industrial waste in the water body. The Na^+ and Cl^- ions concentration which mainly contributes to total dissolved solids found within the range. The concentration of metal such as Co, Cu, Ni, Zn was found to be in low concentration which indicates a suitable environment for aquatic ecosystems. The total coliform which is used as an indicator of the cleanliness of the water source was under the permissible limit.

Table – 2.11. Physico-chemical characteristics of groundwater samples of Tamnar Tehsil, Raigarh, Chhattisgarh.

Parameters	Unit	IS:10500 Acceptable limit	Permissible limit in the absence of alternate source	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	GW-10	GW-11	GW-12	GW-13	GW-14	GW-15
Odour	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Taste	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Turbidity	NTU	10	Agreeable	2.8	2.7	2.4	3.1	2.4	2.8	1	4.8	3.6	2.2	1.8	5.2	4	4.6	2.9
pH	--	6.5-8.5	NR	6.63	7.53	7.16	7.56	6.27	7.59	7.61	7.48	7.16	6.74	7.67	7.05	6.81	7.72	7.95
Electrical conductivity	$\mu S\ cm^{-1}$	NM	NM	561	528	546	484	436	602	584	511	559	634	518	612	466	409	594
Total dissolved solid	$mg\ L^{-1}$	500	2000	332	318	324	295	302	374	352	288	379	417	313	406	293	281	387
Total hardness as $CaCO_3$	$mg\ L^{-1}$	200	600	163	154	159	136	161	172	151	126	178	183	142	187	122	135	169
Total alkalinity	$mg\ L^{-1}$	200	600	144	128	135	117	148	124	113	142	157	160	119	166	106	121	146
Ca^{2+}	$mg\ L^{-1}$	75	200	34.7	28.3	31.2	25.8	41.4	33.5	26.4	39.7	48.6	52.4	30.1	58.3	27.2	35.8	43.6
Mg^{2+}	$mg\ L^{-1}$	30	100	19.4	16.7	20.6	11.5	28.1	22.4	13.8	25.2	27.8	29.4	14.5	26.7	12.4	20.1	23.8
Cl^{-}	$mg\ L^{-1}$	250	1000	43.6	35.8	44.1	27.3	56.2	49.7	31.3	58.6	54.9	64.2	34.5	57.3	27.2	41.9	59.4
Na^{+}	$mg\ L^{-1}$	NM	NM	23.9	24.7	25.5	26.3	27.2	28	28.8	29.6	30.4	31.2	32	32.8	33.7	34.5	35.3
Fluoride (as F)	$mg\ L^{-1}$	1.0	1.5	0.83	0.92	0.96	1.42	0.88	1.28	0.97	1.06	1.12	0.76	1.34	1.08	1.27	1.15	1.04
K^{+}	$mg\ L^{-1}$	NM	NM	2.1	2.6	1.7	2.3	2.8	2.2	3.2	2.8	2.1	3.6	2.3	1.9	3.4	2.6	3.1
SO_4^{2-}	$mg\ L^{-1}$	200	400	78.2	73.5	72.1	76.8	84.2	80.1	85.4	78.6	89.8	93.4	84.6	86.1	74.3	72.9	81.7
NO^{3-}	$mg\ L^{-1}$	45	NR	26.4	22.6	27.1	31.5	35.7	39.2	42.7	34.3	40.4	43.8	38.9	35.7	29.3	32.1	38.3
HCO^{3-}	$mg\ L^{-1}$	200	NR	147.2	136.9	141.3	128.6	152.2	134.8	125.3	146.5	152.8	155.7	126.1	167.3	117.8	123.4	145.5
Free residual chlorine	$mg\ L^{-1}$	0.2	1.0	0.05	0.02	0.14	0.08	0.18	0.08	0.04	0.02	0.03	0.12	0.06	0.02	0.11	0.04	0.16
Cobalt (Co)	$mg\ L^{-1}$	NM	NM	0.017	0.007	0.021	0.006	0.003	0.028	0.002	0.001	0.024	0.015	0.011	0.006	0.003	0.025	0.018
Copper (Cu)	$mg\ L^{-1}$	0.05	1.5	0.022	0.008	0.013	0.027	0.015	0.007	0.012	0.02	0.025	0.032	0.018	0.023	0.006	0.019	0.028
Nickel (Ni)	$mg\ L^{-1}$	0.02	NR	0.008	0.012	0.005	0.015	0.006	0.002	0.008	0.005	0.018	0.016	0.022	0.004	0.002	0.014	0.003
Boron (B)	$mg\ L^{-1}$	0.5	1.0	0.016	0.005	0.002	0.006	0.014	0.021	0.007	0.002	0.011	0.005	0.013	0.008	0.025	0.007	0.019
Iron (Fe)	$mg\ L^{-1}$	0.3	NR	0.28	0.54	0.63	0.35	0.21	0.72	0.48	0.16	0.33	0.51	0.34	0.25	0.46	0.21	0.36
Manganese (Mn)	$mg\ L^{-1}$	0.1	0.3	0.004	0.002	0.001	0.006	0.001	0.003	0.012	0.008	0.002	0.018	0.001	0.002	0.007	0.001	0.005
Zinc (Zn)	$mg\ L^{-1}$	5.0	15.0	1.191	0.852	0.934	0.428	1.614	0.726	1.357	0.584	0.381	1.736	0.824	0.253	0.682	1.953	0.993
Lead (Pb)	$mg\ L^{-1}$	0.01	NR	0.002	0.001	0.001	0.005	0.002	0.003	0.002	0.004	0.001	0.002	0.001	0.004	0.002	0.001	0.002
Aluminum (Al)	$mg\ L^{-1}$	0.03	0.2	0.002	0.001	0.004	0.002	0.002	0.001	0.003	0.002	0.001	0.002	0.004	0.002	0.001	0.001	0.002
Mercury (Hg)	$Mg\ L^{-1}$	0.001	NR	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium (Cd)	$mg\ L^{-1}$	0.003	NR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Arsenic (As)	$mg\ L^{-1}$	0.01	0.05	<0.001	0.001	0.001	0.002	0.001	<0.001	<0.001	0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	0.001
Chromium (Cr)	$mg\ L^{-1}$	0.05	NR	0.001	0.001	0.003	0.002	0.001	0.005	0.002	0.002	0.001	0.006	0.002	0.005	0.001	0.003	0.002
Selenium (Se)	$mg\ L^{-1}$	0.01	NR	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (CN)	$mg\ L^{-1}$	0.01	NR	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

*NM - Not mentioned, NR – No relaxable

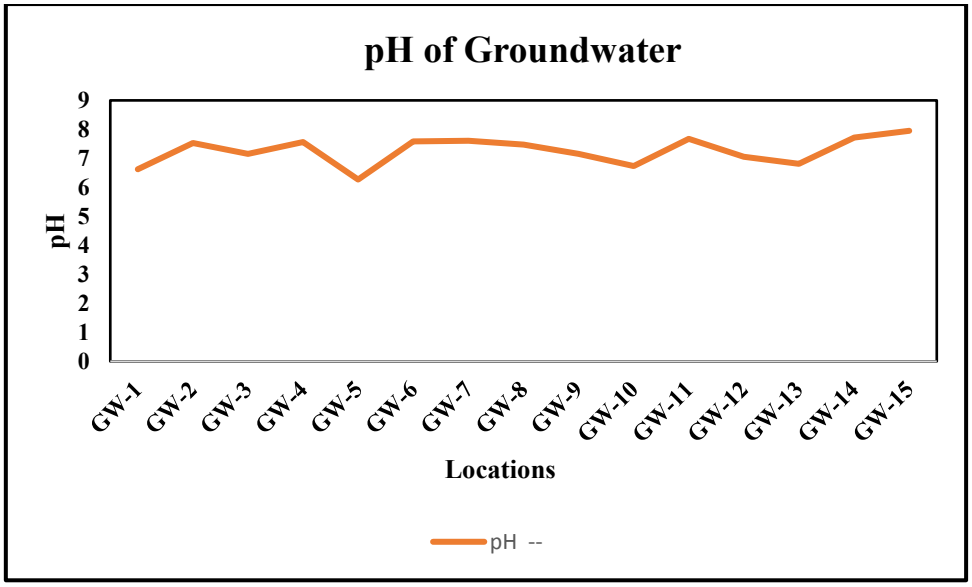

Fig. 2.18. Variation of pH in groundwater sample

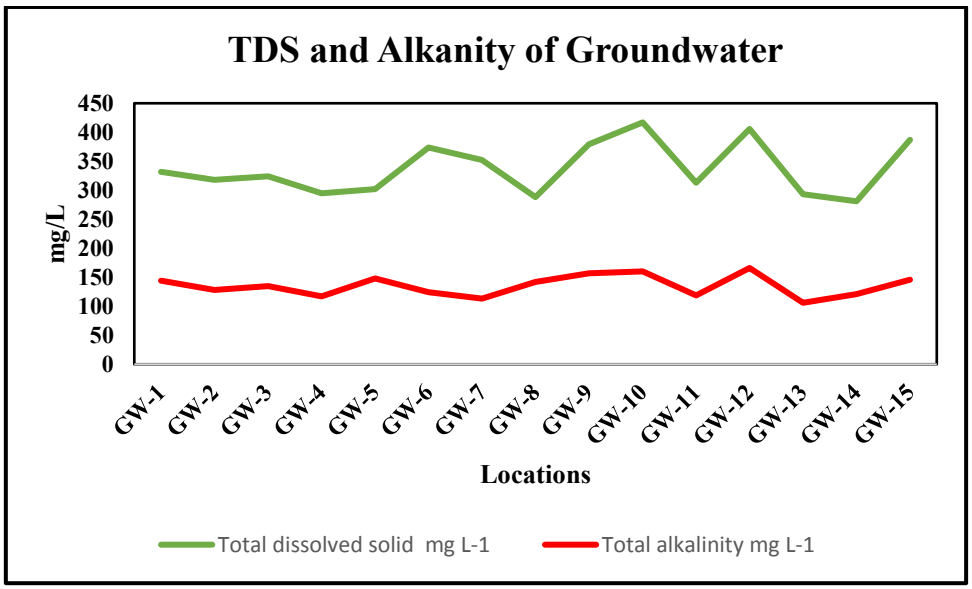

Fig. 2.19. Variation of TDS and alkanity in groundwater sample

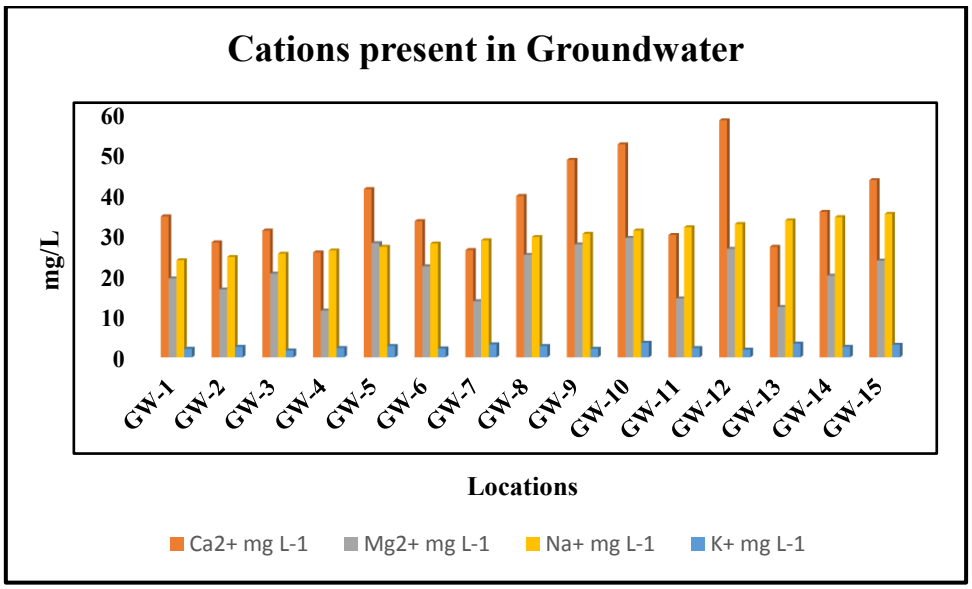

Fig. 2.20. Variation of cations present in groundwater sample

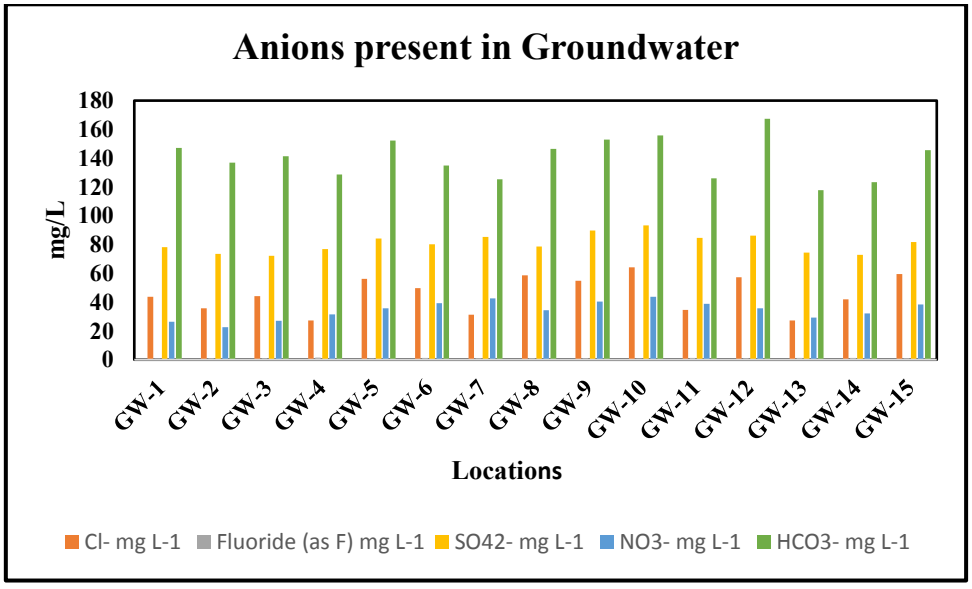

Fig. 2.21. Variation of anions present in groundwater sample

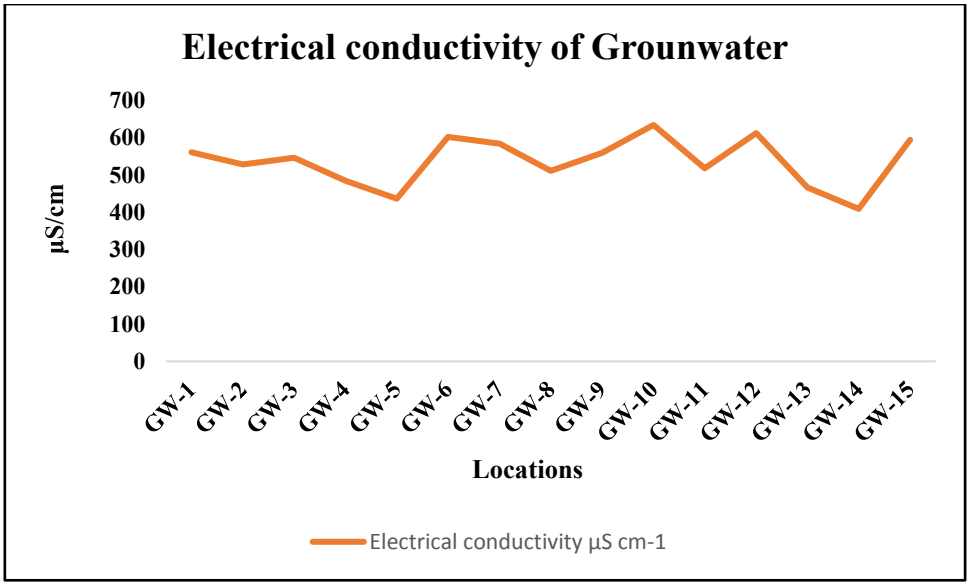

Fig. 2.22. Variation of EC in groundwater sample

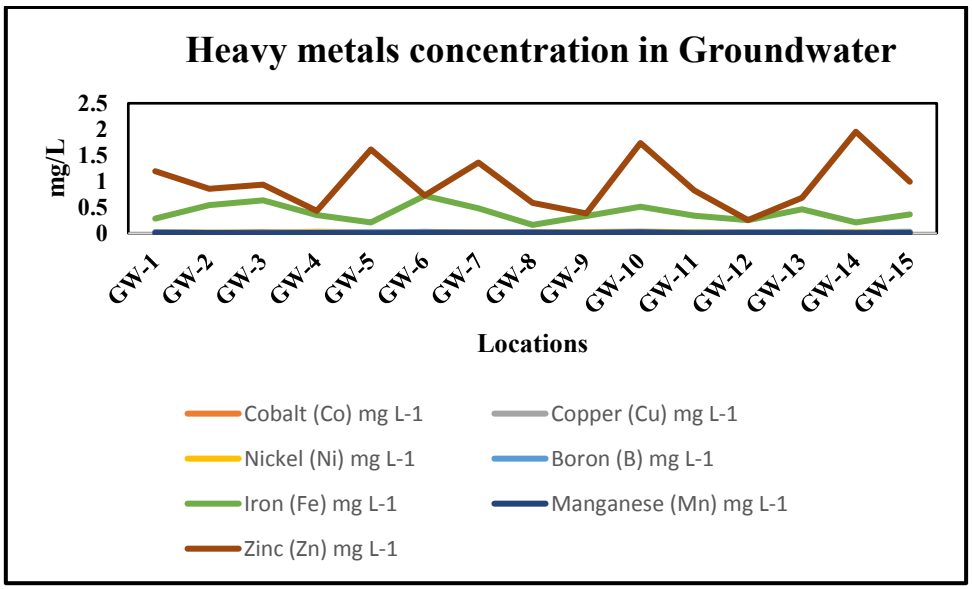

Fig. 2.23. Variation of heavy meals concentration in groundwater sample

The assessment of the groundwater of the project area was conducted from 15 different locations. The quality of groundwater was compared concerning IS 10500:2012 specification. All parameters for groundwater analysis were within the permissible limit. The physical parameters like odour, taste and colour were agreeable. Due to the availability of no industrial development activity except for coal mining, the impact on the quality of groundwater is insignificant. The pH of the water was slightly acidic to neutral due to the geo-climatic conditions of the region. The TDS and turbidity follow a proportional trend and are within the acceptable limit of 500 mg/L and 10 NTU, respectively. The concentrations of heavy metals like Cd, As, Cr, Hg were below the detection limit or were present in very low concentrations. This implies a positive sign on the health of people consuming the water without any toxicity. The total hardness which results due to carbonate, bicarbonate and hydroxide ions were in the range of 122 mg/L to 187 mg/L and in the permissible limit which is 200 mg/L. Fluoride which is responsible for fluorosis causing severe impact on bones and teeth in the population was above the limit. Due to the optimum concentration of dissolved ions, the electrical conductivity ranges in between 409 µs/cm to 634 µs/cm. Metals such as Co, Cu, Ni, N, Fe, Mn and Zn were present in very low concentrations.

Impression: As per the above water quality analysis, it is recommended that water is fit for drinking and bathing purposes in the current situation.

2.6. Soil Quality Status

Scope of the study

Soil quality status adjacent to the Tamnar Tehsil, Raigarh, Chhattisgarh.

2.6.1 Sample collection

Soil samples from the Tamnar Tehsil, Raigarh, Chhattisgarh were collected and analyzed for projecting the existing soil quality status in the study area. The samples were collected in April 2024 of the pre-monsoon season. The methodology for sample collection and preservation techniques was followed as per the standard procedures. The soil sampling location details are given below:

Table – 2.12. Sampling locations of Soil quality assessment of Tamnar Tehsil, Raigarh, Chhattisgarh.

Sample Code	Locations	Approximate Distance (km)	Direction	Environmental Setting
S-1	GP-II Area	--	--	Cultivated land
S-2	Kunjumuda Village	--	W	Cultivated land
S-3	Mahloi Village	8.1	S	Cultivated land
S-4	Kondkel	9.0	E	Cultivated land
S-5	Samkhera Village	7.6	S	Cultivated land
S-6	Jharna Village	2.0	SE	Cultivated land
S-7	Mudhinar Village	5.6	W	Cultivated land
S-8	Gharghoda Village	9.0	W	Cultivated land
S-9	Tamnar Village	7.1	SW	Cultivated land
S-10	Kerakhol	5.5	NW	Forest land
S-11	Rodapali	--	--	Cultivated land
S-12	Sarasmal	5.6	--	Barren land
S-13	Dhaurabhanta	2.9	SE	Cultivated land
S-14	Milupara	8.2	E	Cultivated land
S-15	Mudagaon	--	--	Cultivated land

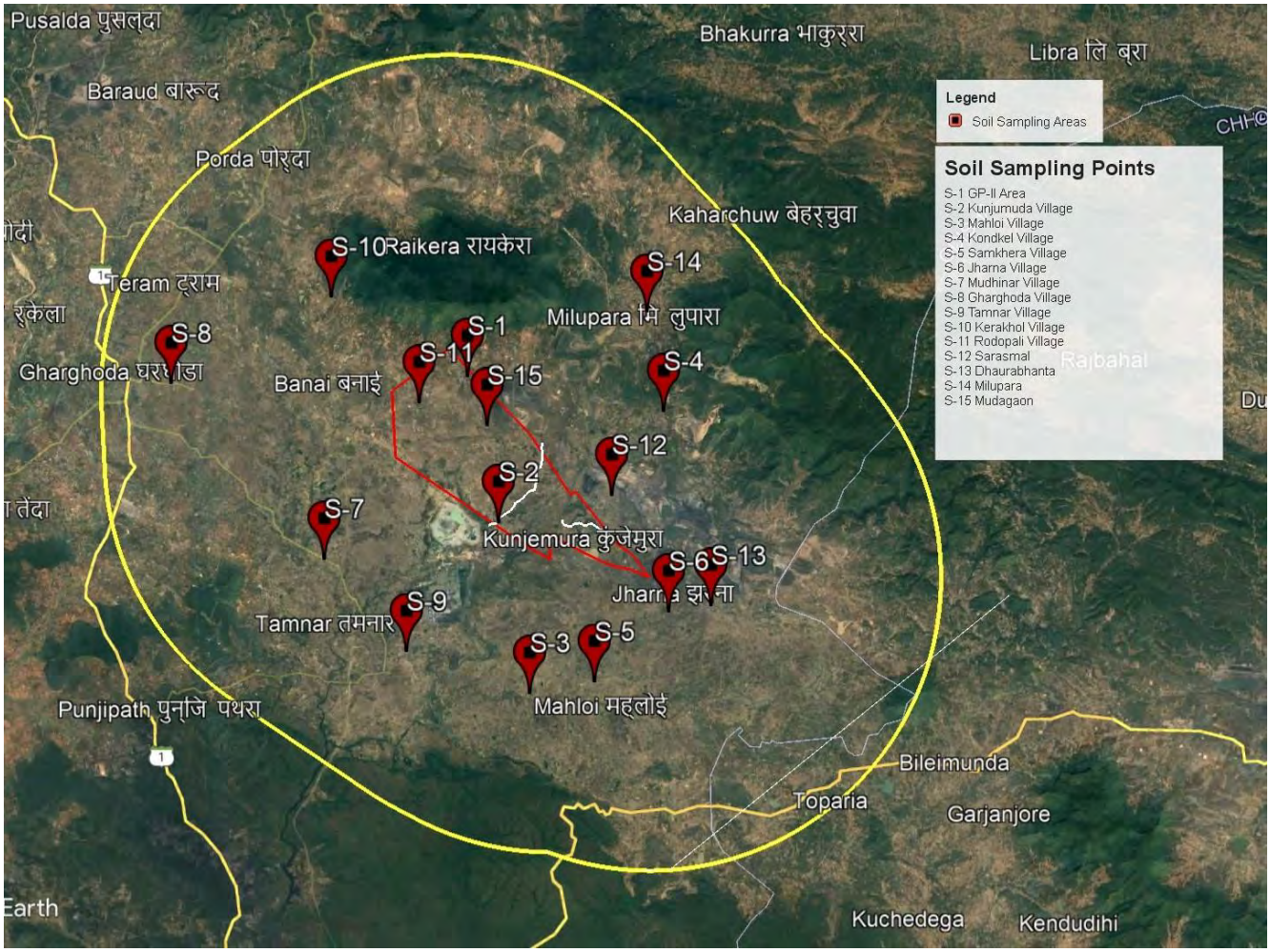

Fig. 2.24. Sampling location map of soil in the Tamnar Tehsil, Raigarh, Chhattisgarh

2.6.2. Methodology

Table – 2.13. Analytical Techniques for Soil Analysis

Parameters	**Methods**
Particle Size distribution	Sieve analysis
Texture	Chart developed by the public Road Administration
EC	Conductivity meter
pH	pH meter
Water holding capacity	Gravimetric method
Bulk Density	Sand replacement, core cutter
Porosity	Measurement of weight and volume
Moisture content	Gravimetric method
Organic carbon	Rapid Dichromate Oxidation Technique
Nitrogen	Kjeldahl distillation
Phosphorous	Olsen's Method
Potassium	Flame photometric
Chlorides	Argentometric
Fluorides	Argentometric
Sodium	Flame photometric
Calcium	Flame photometric
Magnesium	Flame photometric
Sodium Absorption ratio	Flame photometric
Heavy metals	Atomic Absorption Spectrophotometer (AAS)

Plate – 2.4a. Sampling of cultivated soil in the study area

Plate – 2.4b. Soil sampling of barren land in the study area

Plate – 2.4c. Soil sampling of cultivated land in the study area

Plate – 2.4d. Soil sampling of barren land in the study area

Plate – 2.4e. Soil sampling of agricultural land in the study area

Plate – 2.4f. Soil sampling of agricultural land in the study area

2.6.3. Results

Table- 2.14: Physico-chemical characteristics of soil samples of Tamnar Tehsil, Raigarh, Chhattisgarh.

SI No.	Parameters	Unit	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	S-12	S-13	S-14	S-15
1.	Particle Size distribution Clay Silt Sand	%	 12% 20% 68%	 13% 26% 61%	 15% 31% 54%	 16% 28% 56%	 11% 30% 59%	 12% 27% 61%	 21% 20% 59%	 20% 19% 61%	 14% 24% 62%	 15% 31% 54%	 11% 40% 49%	 18% 30% 52%	 14% 21% 65%	 11% 48% 41%	 16% 28% 56%
2.	Texture	--	Sandy loam	Sandy loam	Sandy loam	Sandy clay	Sandy clay	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy clay
3.	EC	dS/m	0.38	0.36	0.3	0.43	0.34	0.37	0.44	0.39	0.35	0.42	0.42	0.43	0.32	0.37	0.41
4.	pH	--	6.71	6.94	7.76	7.31	7.22	7.92	6.86	8.03	7.63	6.81	8.19	7.45	7.06	7.57	6.26
5.	Water holding capacity	%	39.88	36.27	40.53	42.64	38.48	41.62	44.26	40.95	36.18	42.93	38.17	45.04	42.31	39.83	37.62
6.	Bulk Density	g/cc	2.09	1.91	2.44	2.18	1.96	2.13	2.07	1.93	2.36	2.51	2.28	2.11	1.82	2.35	2.01
7.	Porosity	%	44.55	42.1	40.83	39.64	40.02	42.73	38.64	41.67	43.19	40.86	41.06	38.62	43.28	42.46	43.59
8.	Moisture content	%	6.28	5.81	8.29	7.46	8.4	6.84	5.63	7.29	7.95	8.66	6.42	6.14	8.82	7.88	6.93
9.	Organic carbon	%	0.85	1.42	1.06	1.24	0.91	1.39	1.12	1.57	1.02	0.96	1.35	1.29	0.86	1.43	1.22
10.	Nitrogen	kg/ha	201.46	192.21	186.72	214.08	196.59	181.61	219.58	209.14	203.17	221.44	195.28	219.49	223.85	189.37	220.61
11.	Phosphorous	kg/ha	6.34	6.57	5.42	7.06	6.62	6.29	7.38	7.13	6.86	7.24	6.46	6.92	7.05	5.83	7.34
12.	Potassium	kg/ha	214.3	208.7	195.2	211.4	189.3	184.5	221.9	212.7	196.4	219.3	190	215.6	194.7	181.9	219.5
13.	Chlorides	mg/kg	60.14	56.46	54.35	63.72	51.75	68.29	55.06	49.37	58.81	52.44	65.08	62.82	57.05	68.31	53.74
14.	Fluorides	mg/kg	3.71	4.43	4.18	3.86	4.14	4.25	3.98	4.32	3.81	4.08	2.72	3.47	3.68	4.15	4.26
15.	Sodium	mg/kg	22.49	28.76	19.63	31.85	22.06	16.43	25.61	16.25	33.43	22.19	18.52	20.67	24.35	31.42	28.27
16.	Calcium	mg/kg	48.44	32.88	29.54	51.37	42.62	35.93	44.37	26.6	30.65	41.72	34.29	38.84	46.06	52.58	45.43
17.	Magnesium	mg/kg	24.89	18.69	21.93	33.51	27.07	16.65	22.96	19.82	20.17	35.49	26.25	18.07	23.41	29.15	17.68

18.	Sodium Absorption ratio	meq/kg	2.35	1.64	1.35	1.06	0.77	0.48	0.19	0.35	1.06	0.77	0.67	0.28	0.51	0.8	1.25
19.	Copper	mg/kg	2.54	1.02	1.73	1.38	2.06	2.25	1.52	1.96	1.14	2.86	2.44	2.61	2.15	1.83	2.31
20.	Zinc	mg/kg	24.62	12.76	30.62	19.67	12.02	21.84	16.38	13.76	21.32	12.02	17.15	23.58	15.64	18.91	14.23
21.	Lead	mg/kg	6.94	2.06	8.75	5.63	1.43	0.92	3.82	4.51	9.88	5.18	2.86	4.72	3.51	7.6	1.34
22.	Cadmium	mg/kg	0.39	0.44	0.13	0.17	0.22	0.08	0.11	0.53	0.2	0.35	0.19	0.41	0.15	0.26	0.23
23.	Chromium	mg/kg	3.16	2.06	2.43	1.95	2.62	1.84	3.85	2.17	3.11	2.88	2.26	3.63	2.51	2.08	2.73
24.	Arsenic	mg/kg	0.015	0.024	0.008	0.026	0.014	0.006	0.013	0.021	0.018	0.011	0.028	0.017	0.036	0.004	0.013
25.	Mercury	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

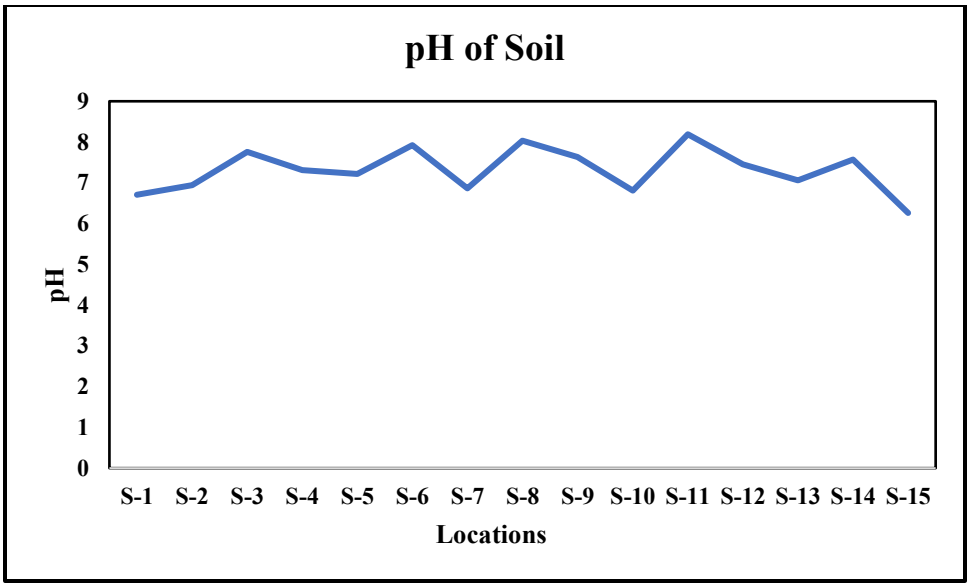

Fig. 2.25. Variation of pH in soil sample

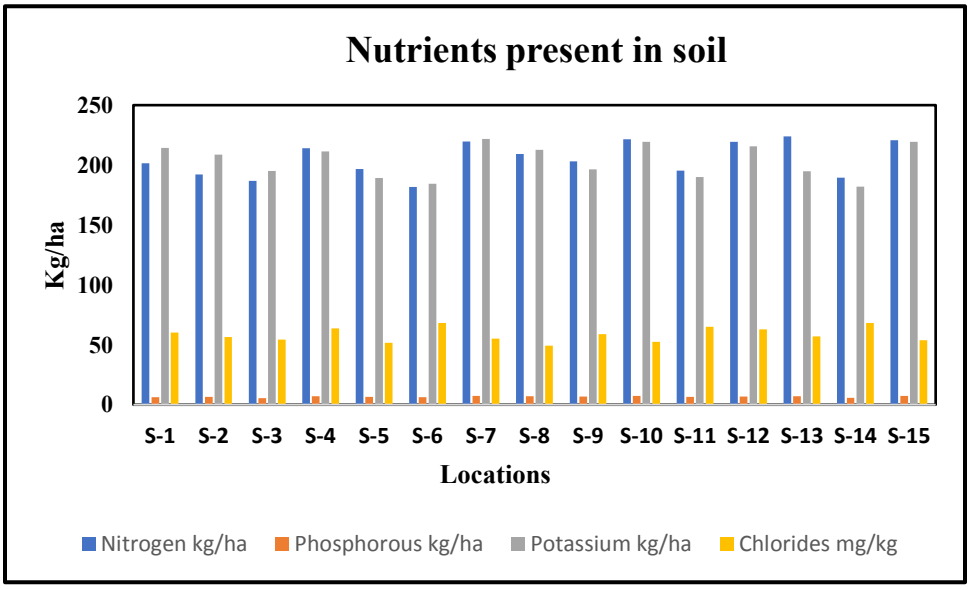

Fig. 2.26. Variation of nutrient concentration in soil sample

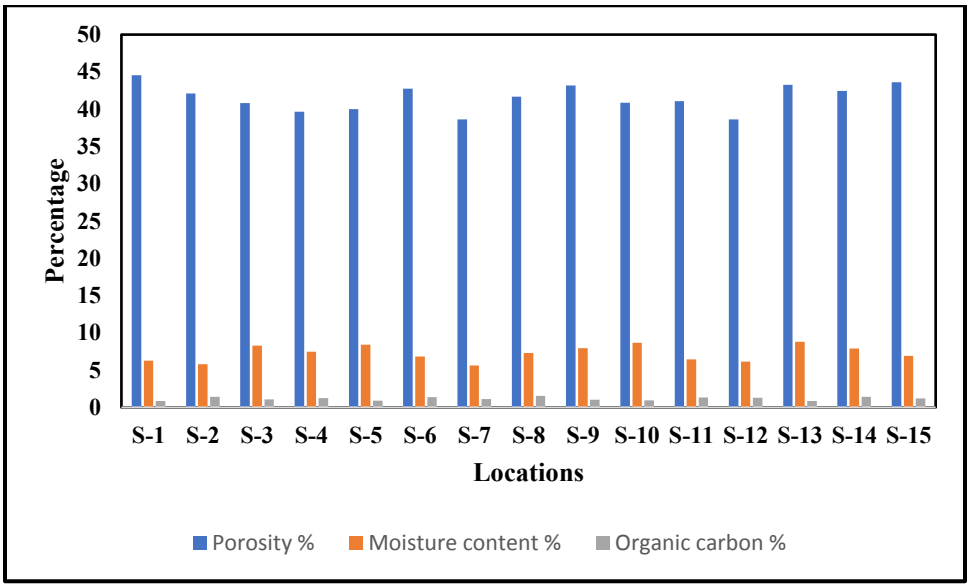

Fig. 2.27. Variation of % porosity, moisture content and organic carbon in soil sample

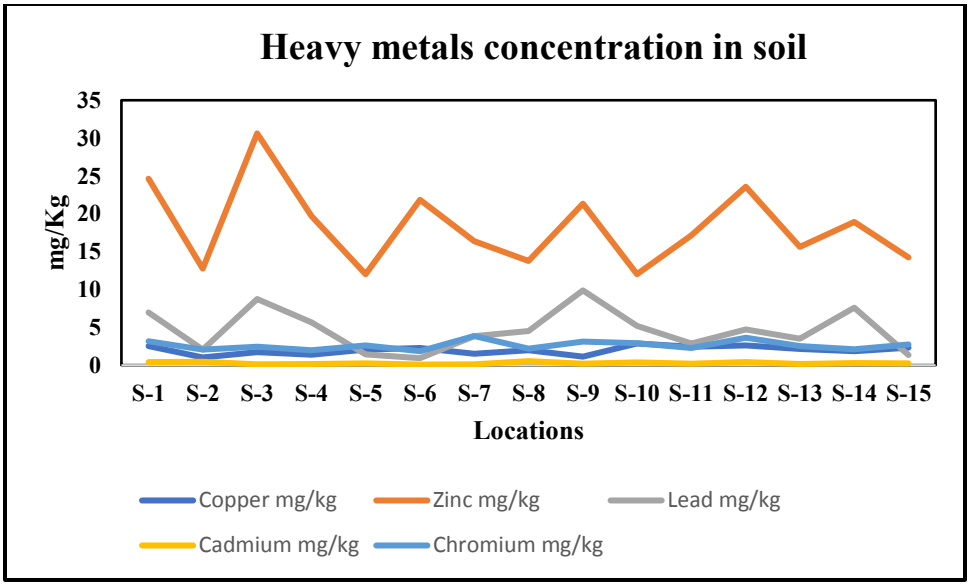

Fig. 2.28. Variation of heavy metals concentration in soil sample

The pH of the soil was in the range of slightly acidic to slightly basic due to the geo-climatic conditions of the region. The electrical conductivity ranged from 0.3 dS/m to 0.44 dS/m which is within the limits and there is no sign of in-situ weathering. The water holding capacity is low due to low porosity. Moisture content was low due to a lack of organic matter, combined with sandy soil structure. Due to low moisture content and high stone content, microbial activity is low in the soil. Nitrogen ranges from 181.61 kg/ha to 223.85 kg/ha which indicates its sufficiency. The phosphorus quantity was low. The range of different heavy metals such as Cd, Cr, As and Hg were within the limits. The sodium absorption ratio which is an indicator of the suitability of water for use in agricultural irrigation and the management of sodium-affected soils was in optimum concentration.

Impression: The study revealed that the soil of the study area was sandy loam and silty clay in texture, pH was slightly acidic. The soil samples analysed were not contaminated in terms of heavy metals. The concentration of heavy metals in soil samples was compared with standard guidelines (Soil critical range by Kabata Pendias and Pendias, 1984) and noticed that the calculated values fall well within the range. The soil can be used for cultivation purposes.

2.7. Noise Quality Status

Scope of the study

Noise level status in Tamnar Tehsil, Raigarh, Chhattisgarh.

2.7.1. Sample collection

The Noise monitoring was carried out in the Tamnar Tehsil, Raigarh, Chhattisgarh. As per the latest Gazette Notification of the Central Pollution Control Board (CPCB, 2000). The samples were collected in April 2024 of the post-monsoon season. The Noise sampling location details are given below:

Table – 2.15. Sampling locations for Noise monitoring of Tamnar Tehsil, Raigarh, Chhattisgarh.

Sample Code	Locations	Approximate Distance (km)	Direction	Environmental Setting
N - 1	GP-II Office	--	--	Industrial area
N - 2	Dhaurabhanta	3.0	SE	Rural/Residential area
N - 3	Rodapali Village	--	--	Rural/Residential area
N - 4	Bhalumura Village	0.15	N	Residential area
N - 5	Kondkel	6.8	E	Rural/Residential area
N - 6	Padigaon	8.2	S	Rural/Residential area
N - 7	Mahloi Village	8.5	S	Rural/Residential area
N - 8	Khamharia	4.8	E	Rural/Residential area
N - 9	Jharna Village	2.1	SE	Rural/Residential area
N-10	Tamnar Village	6.3	SW	Rural/Residential area
N-11	Gharghoda Town	3.1	W	Rural/Residential area
N-12	Barkaspali Village	9.7	W	Rural/Residential area
N-13	Libra	0.5	S	Rural/Residential area

N-14	Tihili Rampur	--	--	Rural/Residential area
N-15	Milupara	9.2	E	Rural/Residential area

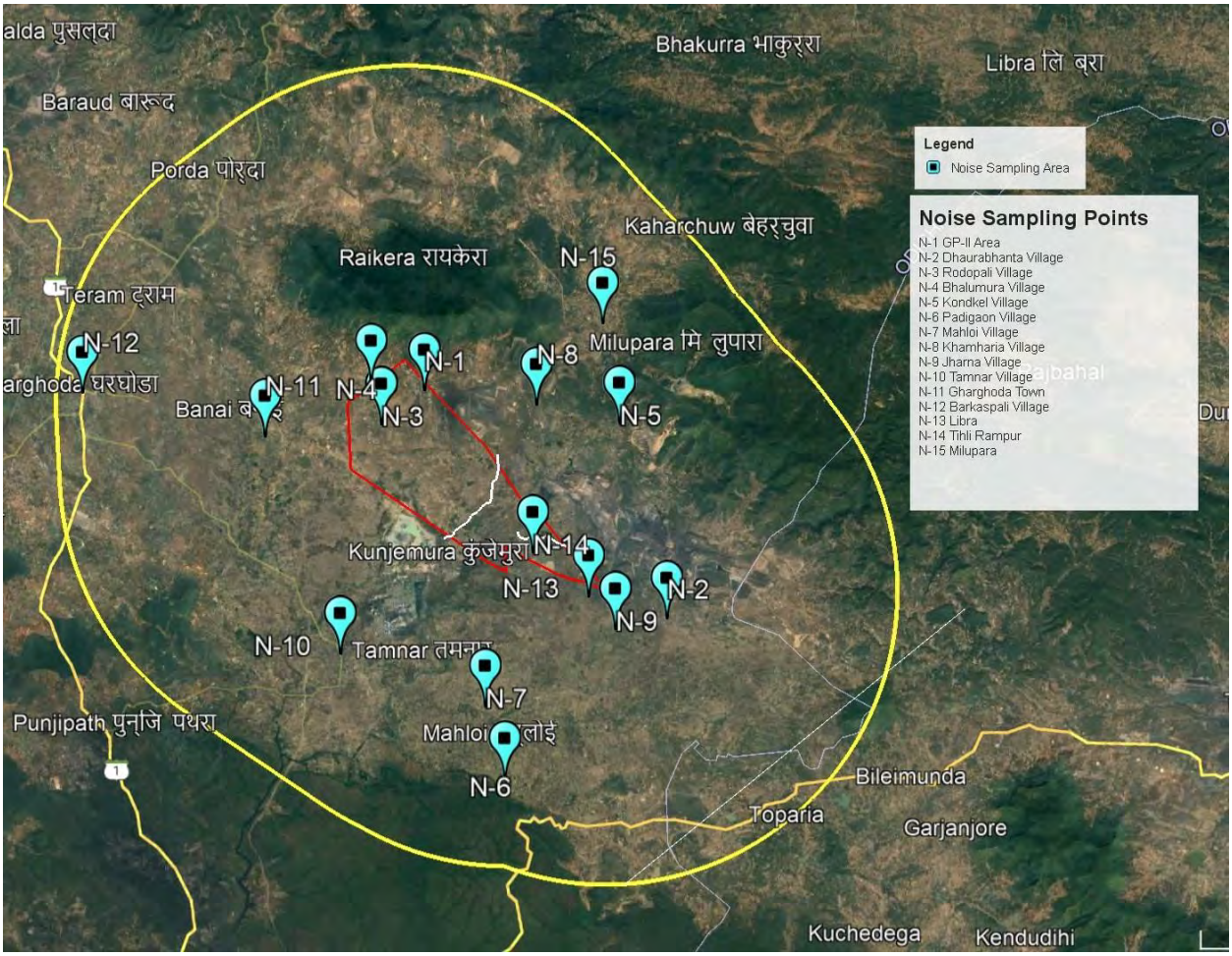

Fig: 2.29. Sampling location map of Noise in the study area

2.7.2. Methodology

Monitoring Instrument

Noise levels were measured using an integrated sound level meter (Bruel & Kjaer 2238). The integrating sound level meter is an integrating type with Octave filter attachment. This Sound level meters have many uses, ranging from the traditional uses in assessing environmental and workplace noise to industrial quality control and development. This instrument is capable of measuring the Sound Pressure Level (SPL), Leq and Octave band frequency analysis.

Method of monitoring

Noise level monitoring was carried out continuously for 24 hours with one-hour interval starting at 06:00 hrs to 06:00 hrs next day. LA_{eq} were directly computed by the instrument based on the sound pressure level. Lday (Ld), Lnight (Ln) and Ldn values were computed using corresponding hourly LA_{eq} of the day and night respectively. Monitoring was carried out 'A' response and fast mode.

Table: 2.16. Maximum permissible limits of ambient noise level

	Category of Area	**Limits in dB(A)**	
		Day time (6.00 am to 10.00 pm)	Night time (10.00 pm to 6.00 am)
Maximum permissible limits in Db(A) of Ambient noise level as per MOEF notification S>O123(E) dated 14 Feb 2000 and GSR 742 (E), dated 25 Sep 2000	Industrial Area	75	70
	Commercial Area	65	55
	Residential Area	55	45
	Silence zone	50	40

Parameter measured during monitoring

For noise levels measured over a given period of time, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the time certain noise levels are exceeding the time interval. The notation for the statistical quantities of noise levels are described below:

- L_{10} is the noise level exceeded 10 percent of the time;
- L_{50} is the noise level exceeded 50 percent of the time; and
- L_{90} is the noise level exceeded 90 percent of the time

Equivalent Sound Pressure Level (LA_{eq}):

The LA_{eq} is the equivalent continuous sound level, which is equivalent to the same sound energy as the actual fluctuating sound measured in the same period. This is necessary because sound from source often fluctuates widely during a given time.

2.7.3. Results

Table- 2.17. Results of ambient level of noise in the study area.

Category of Area / Zone	Limits in dB(A) Leq* (CPCB-2000)	Name of location														
		N - 1	N - 2	N - 3	N - 4	N - 5	N -6	N - 7	N - 8	N - 9	N-10	N-11	N-12	N-13	N-14	N-15
Industrial/ mining Area	75*	60.6														
	70**	50.4														
Residential /rural Area	55*		41.6	41.8	39.6	40.2	41.7	39.7	42.0	41.0	38.4	43.5	40.2	42.4	38.7	44.3
	45**		28.2	28.8	26.5	28.7	32.0	28.5	32.9	28.4	21.6	32.7	29.6	29.3	26.2	33.8

Note: - 1. *Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. **Night time shall mean from 10.00 p.m. to 6.00 a.m.
dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Various activities such as blasting, extraction of coal, movements of machinery, equipment and vehicles, as well as due to activities in the workshop, CHP etc are responsible for different levels of noises in the project area. The sound level assessment was done in the adjoining areas by recording the noise levels. As per Occupational Safety and Health Administration the noise levels were found to be less than 90 dB(A) for 8 hours exposure. The area was categorized in Industrial/mining area and Residential/rural area. The locations were within the Residential/rural

zone. As per the CPCB norms, the acceptable outdoor noise levels were found to be within the permissible limits.

Impression: All the analyzed parameters were found within the permissible limit as per CPCB guidelines, 2000.

2.8. Biological Environmental Status

Scope of the study

Impact studies on biological environment of Tamnar Tehsil, Raigarh, Chhattisgarh.

2.8.1. Methodology

To study the present status of flora and fauna in the region, a survey of the study area has been performed to get a general picture of the landscape and the vegetation. A field survey of the study site was conducted during the month of April, 2024. The numbers of surviving flora (trees, shrubs and grasses) and fauna were randomly collected and documented. The collected samples were identified after studying the relevant characteristics. The survey was also based on the consultation with the local community.

2.8.2. Identification of Flora and Fauna

For the study of ecological services, a detailed study of the present flora and fauna in the core and buffer zone was performed.

Several process for assessing different species of flora and fauna were performed through surveys, field sampling, and data from secondary sources were collected. The list of the important species of flora and fauna was prepared of the proposed area ecosystem. The risk factor for the available species of flora and fauna was not considered due to absence of any endemic and endangered species in the given area. The members of the proposed project were conduct the ecological environment upgradation and its preservation in stage wise manner.

2.8.3 Ecological Assessment of the area for Flora and Fauna

2.8.3.1 Ecology of the area

The state of Chhattisgarh is part of the Deccan Peninsular-Central Highlands region, which is distinguished by high plateaus and hills that support a unique array of flora and animals. Three separate ecological provinces make up the state, according to the categorization of Rodgers & Panwar (1988): 6D Chotanagpur

Plateau, 6C Eastern Highlands, and 6E Central Highlands. According to the biogeographical categorization, the Tamnar region is part of the Deccan Peninsular-Central Highlands region (6A).

The forest vegetation in the area is classified as Tropical Dry Deciduous Forest (Group 5) by Champion and Seth (1968), who developed the classification of Forest Types Zones of India. The two main categories of vegetation structure forest land and non-forest land can be used to define the leasehold area. Government-owned non-forest land is considered barren, whereas privately owned land is used for both agriculture and non-agriculture. There are 75.945 hectares of protected forest and 135.374 hectares of revenue forest. After receiving MoEF, the Indian government's forest clearance, the forest area shall be redirected. According to the Forest Survey of India, the area's forest is categorized as an Open Forest since its canopy cover ranges from 40% to 10%. According to the most recent classification of Indian Forest types, the research area's forest is classified as either Northern Tropical dry deciduous Sal Bearing Forest (sub-group 5B/C1) or Northern Tropical dry mixed deciduous Forest (sub-group 5B/C2). Sal (*Shorea robusta*), Mahua (*Madhuca latipolia*), Tendu (*Diospyros melanozylon*), Palas (*Butea monosperma*), Neem (*Azadiracta indica*), and other common plant species can be found in the forest. The area is also home to gram, maize, and paddy crops.

The region is classified as sal, mixed, and sub-humid to dry deciduous woods. Sal woodland is thought to be the sub-climax that leads to the establishment of the mixed forest at the climax. The region's native vegetation is a forest. Man-made elements, like as livestock grazing, have led to the development of savanna-like structures. These elements are contributing to the fast deterioration of the forests in the plains and, more significantly, in the hills. Timber trees such as Sal (*Shorea robusta*) and Bija (*Pterocarpus marsupium*) are the first to go from the local forests. After that, fuel wood is extracted, which causes forests to become scrubland and eventually grazing (grass) land. Most of the area's soil is sandy loam, or "matasi" as it is known locally. The region lies on the cusp of a dry to humid, tropical to subtropical climate. The winter months are temperate to cool, with a low of about 10 °C on occasion. The summer months can see highs of over 47 °C. The post-monsoon period is the most taxing on life, even with the sporadic rains that occur. This dry stretch lasts for almost eight months. With the searing sun, the dry summer months—especially March through mid-June—become very taxing. During this time, relative humidity could drop as low as 20%. Sal forest is typical of the region's climax vegetation. Champion and Seth report that there are

two distinct kinds of forests in the area. i. 3C/C2e. ii. The 3C/C3 Moist Mixed Deciduous Forest; and iii. The Moist Peninsular Sal Forest.

The mining lease area is gently undulating, but otherwise nearly flat. The land is classified as sal forest with mixed forests strewn throughout. Within the lease area, there are isolated plantations of sisal (*Agave americana*), kaju (*Anacardiun occidentale*), and teak (*Tectona grandis*). With optimal protection and minimal disturbance, sal reaches a maximum height of 15 to 20 meters. The region's forests range in quality from severely degraded to comparatively decent. During the wet months, the ground is covered until roughly the middle of January, when winter officially begins. Beginning in late winter (February), leaf fall lasts until around early summer (March). Certain plants begin to lose their leaves in November, while other species may not stop losing them until April. On the other hand, fresh leaves begin to emerge in early April and continue practically entirely until mid-June. The forest is nearly leafless in April and early May, which improves sight over long distances. Because these are the ideal months to see wildlife, poachers may target them as well. It is advisable to sit close to a water hole, of which there aren't many during these months, to get a better look at the fauna. Depending on the location, dominant tree sal loses its leaves for a shorter period, perhaps from a few days to around a month. In most cases, a species' leafless state lasts for a relatively brief period. On the other hand, a fire might burn the litter in both small and vast areas. On the other hand, not much is damaged by the fire. The majority of the seeds produced by herbaceous plants that have already shed have survived the slight surface fire. In a similar vein, the tubers are already deeply buried in the ground and are unaffected by surface fire. Since trees don't have leaves, the foliage is unaffected; nevertheless, certain trees—most notably the sal tree—have already begun to produce leaves.

True restoration and reclamation are only possible if baseline data on the area before the mining/ vegetation clearance are available. Thus, it is important to have an on-ground ecological study of the area before the business of interest begins. After the closure of mines, it is this baseline community of plants and animals, which becomes the objective of the revegetation and reclamation plan. Thus, a scientific study was done in the area for baseline data.

2.8.4 Assessment of native flora and fauna

2.8.4.1 Data collection methodology

There is a pre-planned format used for the data collection. To identify the many plant and animal species, a group of specialists in the domains of botany, ecology, and environment undertook the mission of visiting the area's major areas and coordinating with the local community and forest officials. For this particular initiative, local older residents were hired to assist with the direct and indirect identification of both flora and wildlife. Interviews with the inhabitants of the core and buffer zones were used to gather information about animals and birds.

Furthermore, secondary data on native and local flora and animals were gathered by utilizing information from important plantation journals, survey records, and the Botanical and Zoological Surveys of India. On the other hand, the community and local forest officials verified all the data gathered.

2.8.5 Native flora species

There is a wide variety of native plants, including trees, shrubs, and herbs. With the assistance of the cola officials of the Indian government's forest department and a field visit, the species was identified. Table 5 provides a list of the recognized plants.

Table 2.18: Major flora species in the Tamnar Tehsil, Raigarh, Chhattisgarh.

S. No.	Plant (Scientific Name)	Common name	Family
	Tree species		
1.	*Acacia catechu*	Khair	Fabaceae
2.	*Adina cordifolia*	Haldu	Rubiaceae
3.	*Aegle marmelos*	Bel	Rutaceae
4.	*Ailanthus excelsa*	Mahanimb	Simaroubaceae
5.	*Alangium salvifolium*	Ankol	Cornaceae
6.	*Albizzia procera*	Safed siras	Fabaceae
7.	*Annona squamosa*	Sitaphal, Sharifa	Annonaceae
8.	*Anogeissus latifolia*	Dhawra	Combretaceae
9.	*Antidesma diandrum*	Khatua, Dhakki	Phyllanthaceae
10.	*Azadirachta Indica*	Neem	Meliaceae
11.	*Balanites aegyptiaca*	Hingot	Balanitaceae
12.	*Bauhinia malabarica*	Amli	Fabaceae
13.	*Bauhinia purpurea*	Kaniar	Fabaceae
14.	*Bauhinia racemosa*	Katmauli	Fabaceae

S. No.	Plant (Scientific Name)	Common name	Family
15.	*Bauhinia variegata*	Kachanal	Fabaceae
16.	*Boswellia serrata*	Salai	Burseraceae
17.	*Bridelia retusa*	Kaji, khaja	Phyllanthaceae
18.	*Buchanania lanzan*	Chironji, piyal	Anacardiaceae
19.	*Butea monosperma*	Dhak, Palash	Fabaceae
20.	*Careya arborea*	Kumbhi	Lecythidaceae
21.	*Casearia graveolens*	Chilla, Pimpri	Salicaceae
22.	*Casearia tomentosa*	Chilla, Gotlu	Salicaceae
23.	*Cassia fistula*	Amaltas	Fabaceae
24.	*Clematis triloba*	Churahar	Ranunculaceae
25.	*Cochlospermum religiosum*	Galgal	Bixaceae
26.	*Cordia macleodii*	Dahiman	Boraginaceae
27.	*Cryptolepis buchananii*	Kalabel	Apocynaceae
28.	*Dalbergia latifolia*	Kala-shisham	Fabaceae
29.	*Dalbergia paniculata*	Dobin	Fabaceae
30.	*Dioscorea bulbifera*	Zimikand, Gethi	Dioscoreaceae
31.	*Diospyros melanoxylon*	Tendu	Ebenaceae
32.	*Elaeodendron glaucum*	Jamarasi	Celastraceae
33.	*Emblica officinalis*	Amla	Phyllanthaceae
34.	*Erythrina suberosa*	Dhaul dhak	Fabaceae
35.	*Eucalyptus camaldulensis*	Eucalyptus	Myrtaceae
36.	*Eugenia heyneana*	Kathjamun	Myrtaceae
37.	*Euphorbia neriifolia*	Danda-thor	Euphorbiaceae
38.	*Ficus bengalensis*	Barh	Moraceae
39.	*Ficus glomerata*	Gular	Moraceae
40.	*Ficus religiosa*	Aswattha	Moraceae
41.	*Flacourtia indica*	Katai, kukai	Salicaceae
42.	*Gardenia latifolia*	Papda	Rubiaceae
43.	*Gardenia latifolia*	Papda	Rubiaceae
44.	*Gardenia turgida*	Pheda, kharhar	Rubiaceae
45.	*Garuga pinnata*	Kharpat	Burseraceae
46.	*Gmelina arborea*	Gamhar	Lamiaceae
47.	*Grewia hirsute*	Kukurbicha	Malvaceae
48.	*Grewia tiliaefolia*	Dhamani	Malvaceae
49.	*Hardwickia binata*	Anjan	Fabaceae
50.	*Hemidesmus indicus*	Anantamul	Apocynaceae
51.	*Holarrhena antidysenterica*	Kutaj	Apocynaceae
52.	*Hymenodictyon excelsum*	Bhurkur	Rubiaceae

S. No.	Plant (Scientific Name)	Common name	Family
53.	*Jasminum arborescens*	Bara-kunda	Oleaceae
54.	*Kydia calycina*	Pula, Potari	Malvaceae
55.	*Lagerstroemia parviflora*	Sidi, lendia	Lythraceae
56.	*Madhuca indica*	Mahua	Sapotaceae
57.	*Mangifera indica*	Aam	Anacardiaceae
58.	*Miliusa tomentosa*	Kari, Hoom	Annonaceae
59.	*Millettia auriculata*	Gauj	Fabaceae
60.	*Mimusops hexandra*	Khimi	Sapotaceae
61.	*Mitragyna parvifolia*	Keim, Kadamb	Rubiaceae
62.	*Ougeinia oojeinensis*	Tinsa	Fabaceae
63.	*Phoenix acaulis*	Kuchachinda	Arecaceae
64.	*Pongamia pinnata*	Karanj	Fabaceae
65.	*Pterocarpus marsupium*	Beeja	Fabaceae
66.	*Salmalia malabarica*	Semal	Malvaceae
67.	*Sehleichera oleosa*	Kusum	Sapindaceae
68.	*Shorea robusta*	Sal	Dipterocarpaceae
69.	*Smilax macrophylla*	Kumarika	Smilacaceae
70.	*Syzygium cumini*	Jamun	Myrtaceae
71.	*Tamarindus indica*	Imli	Fabaceae
72.	*Tectona grandis*	Sagun	Lamiaceae
73.	*Tectona grandis*	Sagun	Lamiaceae
74.	*Terminalia arjuna*	Arjun	Combretaceae
75.	*Terminalia chebula*	Harra	Combretaceae
76.	*Terminalia tomentosa*	Asan	Combretaceae
77.	*Ventilago madraspatana*	Keonti	Rhamnaceae
78.	*Wrightia tinctoria*	Dudhi	Apocynaceae
79.	*Zizyphus mauritiana*	Ber	Rhamnaceae
Shrub Species			
80.	*Abrus precatorius*	Gunchi, Gaungchi	Leguminosae
81.	*Acacia caesia*	Chilati (large)	Fabaceae
82.	*Acacia pennata*	Biswal	Mimosaceae
83.	*Acacia rugata*	Shikakai	Leguminosae
84.	*Asparagus racemosus*	Shatamuli	Liliaceae
85.	*Celastrus paniculatus*	Mal-kangani	Celastraceae
86.	*Cissus quadrangularis*	Hadjod	Vitaceae
87.	*Clematis triloba*	Churahar	Ranunculaceae
88.	*Cryptolepis buchananii*	Kalabel	Asclepiadaceae
89.	*Dioscorea Bulbifera*	Zimikand, Gethi	Dioscoreaceae

S. No.	Plant (Scientific Name)	Common name	Family
90.	*Hemidesmus indicus*	Anantamul	Apocynaceae
91.	*Jasminum arborescens*	Bara-kunda	Oleaceae
92.	*Millettia auriculata*	Gauj	Leguminosae
93.	*Smilax macrophylla*	Kumarika	Smilacaceae
94.	*Ventilago madraspatana*	Keonti	Rhamnaceae
95.	*Zizyphus rugosa*	Churna, Suran	Rhamanaceae
Grasses & Bamboos			
96.	*Cymbopogon martini*	Gandhabel, Makora,	Poaceae
97.	*Cynodon dactylon*	Doob	Poaceae
98.	*Dendrocalamus strictus*	Bans	Poaceae
99.	*Eleusine coracana*	Mandua	Poaceae
100.	*Eragrostis tenella*	Bharbhusi	Poaceae
101.	*Imperata cylindrical*	Uloo, Sirhu	Poaceae
102.	*Iseilema laxum*	Musel, moshi	Poaceae
103.	*Themeda Quadrivalvis*	Gunther / Chhirra	Poaceae
104.	*Dicanthium annulatum*	Kail	Poaceae
105.	*Andropogon aciculatus*	Mothi marvel	Poaceae
106.	*Heteropogon contortus*	Kusal, Sukal, Lampa	Poaceae
107.	*Themeda quadrivalvis*	Gunner	Poaceae
108.	*Apluda varia*	Phuli	Poaceae
109.	*Apluda mutica*	Kunda-phuli	Poaceae
110.	*Thysanolaena maxima*	Phool bahari	Poaceae
111.	*Eulaliopsis binata*	Sabai, Bhabhar	Poaceae
112.	*Oplismenus burmanii*	Napier grass	Poaceae
113.	*Fimbristylis podocarpa*	fimbry or fimbristyle	Cyperaceae
114.	*Cyperus iria*	Nagarmotha	Cyperaceae
115.	*Cyperus pygmaeus*	Motha	Cyperaceae
116.	*Cyperus rotundus*	Motha	Cyperaceae
Climbers and Creepers			
117.	*Abrus precatorius*	Ghumchi	Fabaceae
118.	*Acacia pinnata*	Raona, Chotichilati	Mimosaceae
119.	*Asparagus racemosus*	Shataori	Liliaceae
120.	*Bauhinia vahlii*	Mahul	Caesalpiniaceae
121.	*Celastrus peniculata*	Malkangni	Celastreceae
122.	*Cryptolepis buchanani*	Nagbel	Asclepiadaceae
123.	*Dioscorea hispida*	Biachandi	Dioscoreaceae
124.	*Gymnema sylvestre*	Phulcat	Rhamnaceae
125.	*Ichnocarpus frutescens*	Dhimarbel	Apocynaceae

S. No.	Plant (Scientific Name)	Common name	Family
126.	*Marsdenia tenacissdima*	Dudhibel	Asclepiadaceae
127.	*Mucuna pruriens*	Kewanch	Fabaceae
128.	*Smilax marcrophylla*	Ramdaton	Liliaceae
129.	*Spatholobus roxburghi*	Palasbel	Fabaceae
130.	*Vallaris heynei*	Keoti	Apocynaceae
131.	*Ventilago calyculata*	Pararbel	Rhamnaceae
Epiphytes			
132.	*Vanda tessellata*	Blue Vanda Orchid	Orchidaceae
Parasites			
133.	*Dendrophthoe falcata*	Mistletoe	Loranthaceae
134.	*Viscum orientale*	Oriental Mistletoe,	Santalaceae
135.	*Cuscuta reflexa*	Dodder, Amarbel	Convolvulaceae

Fig 2.30: In discussion with members of forest department, Raigarh, Chhattisgarh.

Plate 2.5a. Field visit for identification of flora species

Plate 2.5b. Field visit for identification of flora species

Plate 2.5c. Field visit for identification of flora species

Plate 2.5d. Field visit for identification of flora species

Plate 2.5e. Field visit for identification of flora species

Plate 2.5f. Field visit for identification of flora species

Plate 2.5g. Field visit for identification of flora species

Plate 2.5h. Field visit for identification of flora species

Plate 2.5i. Field visit for identification of flora species

2.8.6 Fauna consideration

The area is rich in fauna life including mammals, reptiles, amphibians, and birds. The major mammals include spotted deer, mole-rat, Nilgai, Jackal, Bats, Jungle Cat, Squirrel, Rat, Hedgehog, Mongoose, Porcupine, Hare, Rhesus macaque, Bandicoot, Langur, Wild Boar, Four-horned Antelope, Mouse deer, and Indian fox. The avian diversity in the area is also significant along with reptiles including a variety of snakes like rustle viper, krait, saw-scaled viper, cobra, and rat snake along with toads, frogs, lizards, chameleons, freshwater turtles, and tortoises are present. It is also notable that are is rich in variety and population of butterflies, moths, and honeybees.

However, most of the species enumerated fall under the category of 'Least Concern' as per the IUCN classification of animal species. The list of species belonging to different categories as per the Wildlife (Protection) Amendment Act (2022) has been given below Table.

Animals in Schedule I are endangered species that need rigorous protection. Species under this Schedule are prohibited from being hunted throughout India. Violators of the act for Schedule 1 species are liable to the harshest penalties. Schedule II species are protected species, with a ban on trade and commerce. The Schedule III and IV animals are prohibited from hunting, but the penalty for any violation is less compared to the first two schedules. The Schedule V animals are considered vermin and can be hunted without any restriction.

The Schedule I species are Sloth bear, Jackal, Bengal fox, Peafowl and Monitor Lizard. The habitat of Schedule I and II species was observed in the forest regions of the buffer zone of the proposed mine site.

Table 2.19: List of fauna in the area and their classification as per the Wildlife (Protection) Amendment Act (2022)

S. No.	Common name	Zoological name	Schedule as per Wildlife (Protection) Amendment Act 2022
Mammals Species			
1.	Sloth bear	*Melursus ursinus*	I
2.	Jackal	*Canis aureus*	I
3.	Bengal fox	*Vulpus benghalensis*	I
4.	Common langur	*Semnopithecus entellus*	II
5.	Jungle cat	*Felis chaus*	II

6.	Monkey	*Macaca mulatta*	III
7.	Hyaena	*Hyaena hyaena*	III
8.	Wid boar	*Sus scrofa*	III
9.	Indian hare	*Lepus ruficaudatus*	IV
10.	Squirrel	*Funambulus pennanti*	IV
11.	Common house rat	*Rattus rattus*	V
12.	Fruit bat	*Cynopterus sphinx*	V
13.	Field rat	*Bandicota benghalensis*	V
		Bird Species	
1.	Peafowl	*Pavo cristatus*	I
2.	Comman myna	*Acridotheris tristis*	IV
3.	Brahminy myna	*Sturnus pagodarum*	IV
4.	Pied myna	*Sturnus contra*	IV
5.	Black drongo	*Dicrurus paradiseus*	IV
6.	Spotted dove	*Streptopelia chinensis*	IV
7.	Blue jay	*Coracias benghalensis*	IV
8.	Parakeet	*Psittacutla krameri*	IV
9.	Little Green Bee-Eater	*Merops orientalis*	IV
10.	Koel, Cuckoo	*Eudynamys scolopaicea*	IV
11.	Phakhta	*Streptopelia chinensis*	IV
12.	Jangali Tota	*Taccocua leschenaultia*	IV
13.	Tania Tota	*Psittacula cyanocephala*	IV
14.	Tota	*Psittacula krameri*	IV
15.	Neelkanth	*Coracias benghalensis*	IV
16.	Bater (Grey Quail)	*Coturnix coturnix*	IV
17.	Basanti (Indian cuckoo)	*Cuculus micropterus*	IV
18.	Kite	*Milvus migrans*	IV
19.	Redwhiskered bulbul	*Pycnonotus cafer*	IV
20.	Bater (Grey Quail)	*Coturnix coturnix*	IV
21.	Red jungle fowl	*Gallu gallus*	IV
22.	Grey jungle fowl	*Gallus sonneratii*	IV
23.	Jungle myna	*Acridotheres fuscus*	IV
24.	Grey heron	*Aredea ceineria*	IV
25.	Golden backed *woodpecker*	*Brachypternus benghalensis*	IV
26.	Owl	*Bubo bubo*	IV
27.	Cattle egret	*Bubucus ibis*	IV
28.	Blue rock pigeon	*Columba livia*	IV
29.	Common Hawk-cuckoo	*Cuculus varius*	IV
30.	Grey patridge	*Francolinus pondicerianus*	IV
31.	Grey waig tail	*Motacilla cinerea*	IV
32.	Grey quail	*Perdicula asiatica*	IV
33.	Roseringed parakeet	*Psittacula krameri*	IV
34.	Spotted dove	*Pycnonotus luteolus*	IV
35.	Common kingfisher	*Alcedo atthis*	IV

36.	Pond heron	*Ardeola grayii*	IV
37.	Large cormorant	*Phalacrocorax carbo*	IV
38.	Little cormorant	*Phalacrocorax niger*	IV
39.	Little green heron	*Ardeola striatus*	IV
40.	Little egret	*Egretta garzetta*	IV
41.	Phakta	*Streptopedia senegalensis*	IV
42.	Asian openbill	*Anastomus oscitans*	IV
43.	Black ibis	*Psedibis papillosa*	IV
44.	Greater caucal	*Centropus sinensis*	IV
45.	Indian Robin	*Saxicoloides fulicata*	IV
46.	Oriental Magpie Robin	*Copsychus saularis*	IV
47.	House crow	*Corvrus splendens*	V
48.	Jangali Kaua	*Corvus macrorhynchos*	V
49.	House sparrow	*Passer domesticus*	V
Reptiles			
1.	Monitor Lizard	*Varanus benghalensis*	I
2.	Dhaman/Indian Rat snake	*Ptyas mucosus*	IV
3.	Dhondwa/Water sanke	*Enhydris enhydris*	IV
4.	Nag/Cobra	*Naja naja*	IV
5.	Common Karait	*Bungarus caeruleus*	IV
6.	Banded Krait	*Bungarus fasciatus*	IV
7.	Russel viper	*Vipera ruselli*	IV
8.	Sita Ki Lath	*Amphiesma stolata*	IV
9.	Goh, Monitor lizard	*Varanus benghalensis*	IV
10.	Garden lizard	*Calotes versicolor*	IV
Amphibians and Fish			
1.	Bull frog	*Hoplobatrachus tigerinus*	IV
2.	Common toads	*Duttaphrynus melanostictus*	IV
3.	Skipper frog	*Euphlyctis cyanophlyctis*	IV
4.	Small Frog	*Microhyla ornata*	IV
5.	Tree frog	*Polypedates maculatus*	IV
6.	Kotri/Karwadi	*Puntius sophora*	-
7.	Karwadi	*Puntius ticto*	-
8.	Tengna	*Mystus cavasium*	-
9.	Bam	*Mastocembelus armatus*	-
10.	Padhan	*Wallago attu*	-
11.	Magur	*Clarius batrachus*	-
12.	Singi	*Heteropneustes fossilis*	-
13.	Maral	*Chana marulius*	-
14.	Bhunda	*Ophiocephalus striatus*	-
15.	Bhanga	*Labeo bata*	-
16.	Dandai	*Rasbora daniconius*	-
17.	Karwadi	*Barbus ticto*	-

18.	Catla	*Catla catla*	-
19.	Mrigal	*Cirrhina mrigala*	-
20.	Mongri rou	*Labeo fimbriatus*	-
21.	Dingra	*Mystus aor*	-
22.	Freshwater cat fish	*Mystus seenghala*	-
23.	Singhara	*Mystus vittatus*	-

2.9. Socio-economic Status

The area lies in the Milupara, Bhalumura, Tamnar, Mahloi, Padigaon and Jharna villages where Rodopali and Tihli Rampur villages lie in the core zone of an area. The main occupation of the majority of the population is agriculture labourers and many of them are unemployed. The consultation with the local community of all the surrounding villages was carried out.

Plate 2.6a. Consultation with local community

Plate 2.6b. Consultation with local community

Plate 2.6c. Consultation with local community

Plate 2.6d. Consultation with local community

Plate 2.6e. Consultation with local community

Plate 2.6f. Consultation with local community

Plate 2.6g. Consultation with local community

2.9.1. Findings

- The area was less populated, all the houses were temporarily constructed in both core and buffer zones, almost all the villages having primary facilities, tube wells/dug wells for drinking water. The peoples were happy for employment opportunity in the proposed coal mine.

Chapter - 3

3. Ecosystem Services

Ecosystem services are mainly the processes and conditions through which natural ecosystems and the species associated with them fulfil and sustain the life of human. Ecosystem goods production such as biomass fuel, timber, natural rubber, seafood, forage, industrial products and the biodiversity are maintained by them. According to (TEEB), it is considered as the direct and indirect contributions of ecosystems to human well-being. It plays an important part in human economy by providing trade of goods and harvest. Apart from production of goods, they function as actual life-support by cleansing, recycling and renewing. Cultural and aesthetic benefits are also provided by them. Ecosystem services must be considered as a contribution of the natural capital to human well-being.

3.1 Ecosystem Services Identification

People obtain varied benefits from the ecosystem in the form of ecosystem services. Ecosystem services are identified mainly into four categories.

- Provisioning services, such as food and water
- Regulating services, such as flood and disease control
- Supporting services, such as nutrient cycling
- Cultural services, such as cultural, spiritual and recreational benefits.

3.1.1 Provisioning Services

These ecosystem service provides the basic necessity to human beings. The products obtained from the ecosystems are: -

- **Food and fiber** – Food products of vast range derived from plants, animals and microbes, as well as materials such as wood, jute, silk and other products derived from ecosystem are included in this.
- **Fuel** – Wood, dung and other biological materials serve as source of energy.
- **Fresh water** – It is considered as a linkage between provisioning and regulating service. The quantity of water available locally is mainly influenced by availability of forests and vegetation.

- **Genetic resources** – This includes the genes and genetic information used for animal and plant breeding and biotechnology.
- **Medicinal resources** – Ecosystem is a source of medicinal resources which provides medicines, biocides and other biological matters.
- **Ornamental resources** – Resources such as different flower species, products of animals such as skin and shells are often used as ornaments and is also considered as important aspect in human economy.

3.1.2 Regulating Services

These are the services obtained from the regulation of ecosystem processes, including:

- **Maintenance of air quality** – Ecosystem serve as a dual purpose by contributing chemicals and also its extraction from the atmosphere, which influences the air quality in various aspects.
- **Regulation of climate** – Climate is influenced by the ecosystems both locally and globally. At local scale, temperature and precipitation may be affected by change in land cover pattern. On global scale, greenhouse gas emission or sequestration regulates the pattern of climate.
- **Regulation of water** – By changing the land cover pattern, for example, replacing forests with croplands or conversion of wetland to other commercial use strongly influence the aquifer recharge ability, flooding cycle and magnitude and timing of the water runoff.
- **Treatment of waste-water** – Ecosystem can be a source of impurities in fresh water and also act as a natural buffer by filtering and decomposing organic wastes introduced into inland waters, coastal and marine ecosystems. This reduces the concentration of pollutants and level of nutrients.
- **Regulation of human diseases** – The abundance of any pathogen population is directly related to the kind of ecosystem present and can also alter the abundance of disease vectors, such as mosquitoes.
- **Protection from natural hazards** – The damage caused by any cyclones or large waves could be reduced due to the presence mangroves and coral reef in the coastal ecosystem.

3.1.3 Cultural Services

These services are tightly bound to human values and behaviour and is considered as nonmaterial benefits which obtain from ecosystems in the form of spiritual enrichment, aesthetic experience and cognitive development. These includes:

- **Educational values and Knowledge systems** – In many societies, ecosystems and their components provide the basis for both formal and informal education. Different knowledge system developed by different cultures is influenced by ecosystems.
- **Spiritual values and cultural diversity** – Ecosystems and their components are associated by spiritual and religious values of different religions. The diversity in the nature of ecosystems is the result of diversity in the culture.
- **Aesthetic values** – Ecosystems in various aspects represent its aesthetic value or beauty in the form of scenic views, parks, beaches, mountainous hills etc.
- **Tourism and Cultural heritage values** – Tourism is considered as a prominent source of income for many countries. It helps people to understand the biodiversity and different unknown heritage places of a country. Ecotourism is a new concept which defines and elaborate the biological diversity of any country or place. Important historical places and species which are culturally significant are maintained by many societies, which place high value on the maintenance.
- **Social relations** – Social relations are mainly influenced by the ecosystems that are established in particular cultures. For example, fishing societies differ in many respects in their social relations from agricultural societies or nomadic herding.

3.1.4 Supporting Services

Supporting services act as a basis for the production of all other ecosystem services. Its impact on the people is either indirect or occur over a long time and it differ from other ecosystem services. These include:

- **Habitat** – Habitat is an essential element for survival of any species which includes food, water and shelter. Each species has its own habitat for their survival and existence. Different ecosystem is required by birds, mammals, insects, fish and migratory birds during their movement phase.
- **Genetic diversity maintenance** – Variety of genes present between and within the population of species is known as genetic diversity. Different races or breeds are distinguished on the basis of diversity of genes. High number of species present in specific region describes the diverse nature of genes and is termed as 'biodiversity hotspots.

3.2 Ecological Dimensions

The ecological dimension describes the relationship between people and the environment and the effect that they have on each other in turn. The environmental dimension deals with the fragility of ecological and biophysical systems, and their different functions, under a hazardous condition, to suffer damage and deterioration. This term usually comes when the concept of sustainability is mentioned. This is partly due to the fact that the original sustainability models were based mostly on the ecological aspect, but also because public understanding of sustainability is very closely linked to this dimension. It is argued that ecological sustainability is a function for the furthering of social and economic development, thereby indicating that the limits of growth are not set by the environment but rather by the state of scientific and technical knowledge and the social organization thereof.

3.3 Social Metabolism

Societies depend on a continuous throughput of materials and energy required to build up, maintain and operate their material stocks (e.g. buildings, infrastructures, machinery as well as humans and livestock). This "social metabolism" can be seen as a functional equivalent of biological metabolism. Socio-metabolic research links the use of biophysical resources to social organization, recognizing that the quantity, composition, sources and sinks of resources used, as well as the material stocks created in the process, reflect socio-economic production and consumption systems that are highly variable across time and space.

3.4 Ecological Footprint

Ecological footprint (EF), measure of the demands made by a person or group of people on global natural resources. Ecological Footprint adds up all the productive areas for which a population, a person or a product competes. It measures the ecological assets that a given population or product requires to produce the natural resources it consumes (including plant-based food and fiber products, livestock and fish products, timber and other forest products, space for urban infrastructure) and to absorb its waste, especially carbon emissions. One can estimate the EF, measured in "global hectares" (gha), at various scales—for individuals, regions, countries, and humanity as a whole. An area is considered unsustainable if a land's ecological footprint is greater than its biocapacity.

To calculate the ecological footprint of a nation, an equation was given by Tiezzi *et al.*

$$EF = \Sigma T_i/Y_w \times EQF_i$$

where T_i *i*s the annual number of tons of each product *i* that are consumed in the nation, Y_w is the yearly world-average yield for producing each product *i*, and EQF_i is the equivalence factor for each product *i.*

3.4.1. Ecological Footprint Analysis

Ecological footprint analysis is a quantitative tool that represents the ecological load imposed on the earth by humans in spatial terms. The ecological footprint of a defined population is the total area of land and water ecosystems required to produce the resources that the population consumes, and to assimilate the wastes that the population generates, wherever on earth the relevant land/ water is located.

The size of a mine's ecological footprint is usually determined by combining the consumption of requirements of land of all categories and discharge of waste. The land considered is made up of ecologically productive land and water in various classes which includes cropland, pasture, forest etc.

The shortage of accessible data is the main challenge in conducting the EFA. The impact on the environment by any organizations is clearly highlighted by the footprint resulted by them. The analysis involves in recognizing such actions by providing the platform and improving the workforce by educating them to improve their contribution in these operations. EFA includes several components which are as follow: -

- **Footprint of carbon** – The major estimation includes the activities which are mentioned in the Greenhouse gas Protocol (WRI & WBCSD, 2004). The total impact of the activities of different organizations could be assessed by converting total emission to the atmosphere to carbon dioxide equivalents (CO_2e).
- **Footprint of Air** – It is an important indicator in determining the ambient air quality of a mining area. The air quality present in the airshed of coal mining area can be measured easily.
- **Footprint of water** – This indicative measure was first introduced by Hoekstra in 2002. The resources of freshwater along with supply chains and water use assessment can be easily performed by using this tool.
- **Assessment of Life-cycle** – It is an important parameter for determining the possible impacts and environmental aspects of a product by coupling the potential impacts associated with it along with examining the life cycle of a product.
- **Footprint of biodiversity** – It is considered as an advance form of ecological footprint which involves specific biodiversity impact of CO_2 emission and specific biodiversity impacts of direct land use.
- **Analysis of materials flow** – It is a tool which assess the environmental impact of a flow of materials and energy which passes through an economy.

National Footprint and Bio-capacity Accounts (NFAs) provide the core data required for all Ecological Footprint analysis worldwide. The Accounts measure the ecological resource use and resource capacity of nations over time. Based on approximately 15,000 data points per country per year, the Accounts calculate the Footprints of more than 200 countries, territories, and regions from 1961 to the present.

3.4.2. Advantages of EFA

The main idea of EFA is to assess the footprint of companies and assign possible measures to reduce them. It acts as a baseline in mining companies to understand their consumption and emission. Other advantages include:

- the single index provides for ease of communication and understanding
- a variety of goods, activities and services can readily be assessed and compared.
- a link can easily be made between local and global consumption.

- the relationship between different impacts can be explored; and values are based on ecological realities rather than arbitrary weightings.
- Foot printing also provides a useful measurement system that can complement frameworks such as the Natural Step.

Ecological Footprint can be applied to good effect at the corporate level as an aggregated eco-efficiency indicator that links in with global carrying capacity and hence global sustainability. Although in itself, EFA does not integrate all aspects of sustainable development, it can be used with other indicators to drive integrated sustainability indicators. As with many sustainability measurements, Ecological Foot printing will benefit from lessons learned in wider usage and from further research into the methodology, supporting data and practical application.

3.5. Methodology for Ecosystem Services Study

3.5.1 Ecological Sampling Techniques

If we want to know what kind of plants and animals are in a particular habitat, and how many there are of each species, it is usually impossible to go and count each and every one present. It would be like trying to count different sizes and colours of grains of sand on the beach.

This problem is usually solved by taking a number of samples from around the habitat, making the necessary assumption that these samples are representative of the habitat in general. In order to be reasonably sure that the results from the samples do represent the habitat as closely as possible, careful planning beforehand is essential.

Samples are usually taken using a standard sampling unit of some kind. This ensures that all of the samples represent the same area or volume (water) of the habitat each time.

3.5.2 Sampling Site Descriptions

Ecological Sites provide a consistent framework for classifying and describing rangeland and forestland soils and vegetation; thereby delineating land units that share similar capabilities to respond to management

activities or disturbance. Ecological Site Descriptions (ESDs) are reports that provide detailed information about a particular kind of land - a distinctive Ecological Site.

ESDs provide land managers the information needed for evaluating the land as to suitability for various land-uses, capability to respond to different management activities or disturbance processes, and ability to sustain productivity over the long term.

3.5.3. Selection of Sampling Site

The perfect picture of a population can be obtained by conducting a sampling in random way such that the probability of a selection of each individual is equal. Random selection is where each member of the population has an equal chance of selection and is carried out by numbering each item of the population then using random number tables to choose which items to examine. In a sampling procedure, random numbers are considered as a series of number by which chance of selecting at any point is same. The best way of generating random numbers is by writing numbers from 0 to 9 on a piece of paper, mix them and then draw the slips out. Numbers are written down which appears on the slip and then the procedure should be repeated again.

Haphazard sampling is where we try to create a random sample by haphazardly choosing items in order to try and recreate true randomness. It doesn't usually work, because of selection bias: where we knowingly or unknowingly create unrepresentative samples. In order to create a true random selection, we need to use one of the tried and testing random selection methods, like simple random sampling. Even if we try to choose items without any bias or reason for including (or excluding) items, haphazard samples nearly always result in a sample that looks a lot different from a random sample. Therefore, the results from your test or experiment will have unpredictable errors and most likely, invalid results.

3.5.4 Common Sampling Method

There are generally three types of sampling methods to select individuals from a population situated in space:

Quadrat Method

Quadrats normally consist of a square frame, the most frequently used size being $1m^2$. The purpose of using a quadrat is to enable comparable samples to be obtained from areas of consistent size and shape. Rectangular quadrats and even circular quadrats have been used in some surveys. It does not really matter what shape of quadrat is used, provided it is a standard sampling unit and its shape and measurements are stated in any write-up. It may however be better to stick to the traditional square frame unless there are very good reasons not to, because this yields data that is more readily comparable to another published research. Choice of quadrat size depends to a large extent on the type of survey being conducted. For instance, it would be difficult to gain any meaningful results using a 0.5 m^2 quadrat in a study of a woodland canopy! Small quadrats are much quicker to survey, but are likely to yield somewhat less reliable data than large ones. However, larger quadrats require more time and effort to examine properly. A balance is therefore necessary between what is ideal and what is practical. As a general guideline, 0.5 - 1.0 m^2 quadrats would be suggested for short grassland or dwarf heath, taller grasslands and shrubby habitats might require 2 m quadrats, while quadrats of 20 m^2 or larger, would be needed for woodland habitats. At the other end of the scale, if you are sampling moss on a bank covered with a very diverse range of moss species, you might choose to use a 0.25 m^2 quadrat.

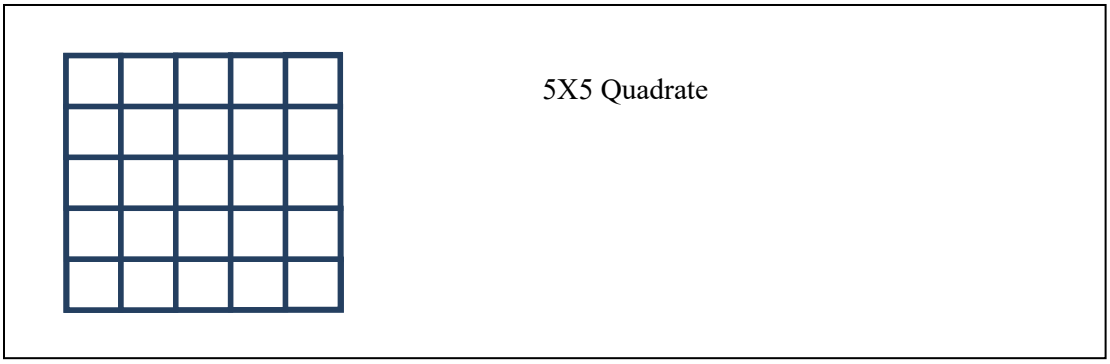

Fig. 3.1 Quadrat Method for determination of vegetation sample

100 * 100 m Quadrate Sampling

Quadrate sampling is a method used in ecology to study the distribution of organisms within a specified area. The method involves placing a square frame, known as a quadrate, at random or systematically across

a habitat to count and record the types and numbers of species within each quadrate. For a 100 * 100-meter quadrate sampling, the method was applied on a much larger scale than typical smaller quadrates, but the basic principles remained the same. Using a measuring tape, stakes, and string to mark the 100 * 100-meter quadrate within the selected coordinates. Within each 100 * 100-meter quadrate, systematically surveying and recording of the species present was done. This might involve walking transects within the quadrate and recording observations.

Transect method

It is considered as a distance sampling to estimate the density and or abundance of biological populations. In line transect sampling, a series of lines is distributed according to some design (usually a systematic grid of parallel lines and an observer travel along each line, searching for animals or animal clusters). For each animal or cluster detected, the observer measures or estimates the (perpendicular) distance x of the animal or cluster centre from the nearest part of the line.

The sampling design in a line transect study is the procedure by which the transect locations are selected. In line transects sampling, several sampling methods may be considered in selecting the line transects. Usually, single or multiple transect lines are randomly placed on the study region. Estimates of abundance from multiple transect lines are obtained by averaging the abundance from each transect line used.

Plate 3.1a. Quadrate sampling at the study area

Plate 3.1b. Quadrate sampling at the study area

Plate 3.1c. Quadrate sampling at the study area

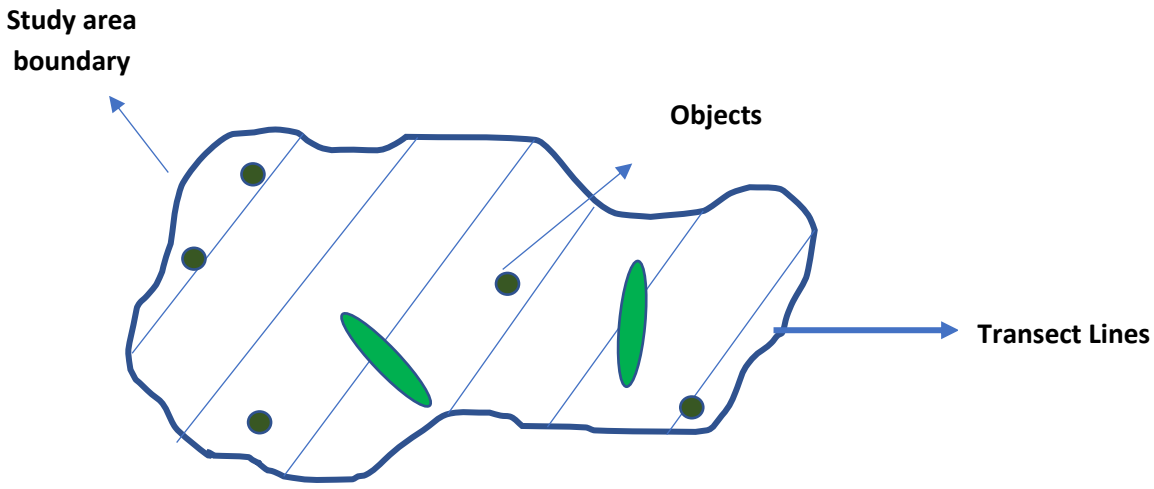

Fig. 3.2. Transect method for determination of vegetation sample

Plotless method

Plotless sampling is the sampling without the use of quadrats or transects. Individual pin-frame records may be regarded as plotless samples. Plotless sampling is most often used for surveys of forest vegetation, especially where a rapid inventory is required. Plotless sampling methods calculate the average area per tree by measuring distances between points and trees or between trees. These techniques have the advantage of not requiring plot boundaries and are generally fast, since inter-tree distances tend to be low in mangrove forests and therefore rapidly measured.

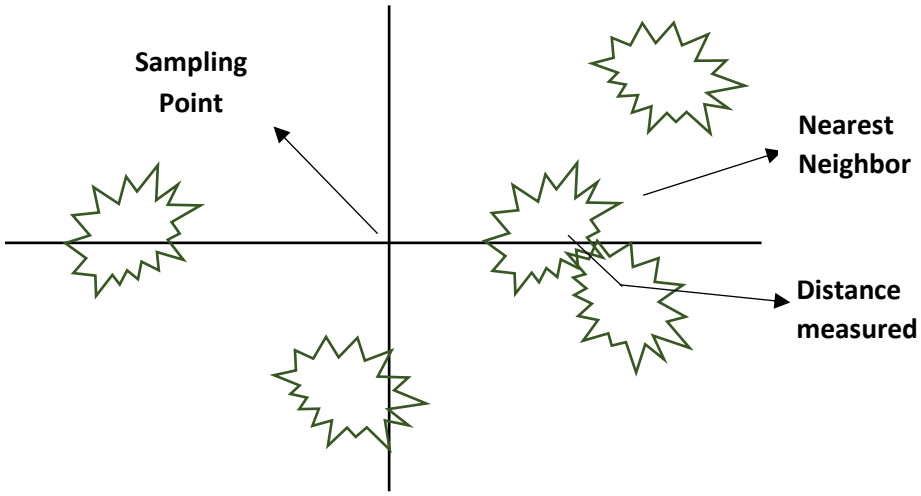

Fig. 3.3. Plotless method for determination of vegetation sample

This method is quite useful in determining the dispersion pattern of the organisms. Unlike the quadrat method, they are not used for density determination.

3.5.5. Density and Dispersion Patterns

Density and dispersion are two descriptors of populations that can provide insight into processes such as competition and territoriality. Their measurement is therefore fundamental to our understanding of biogeography. Density is the number of individuals per unit area or volume. Dispersion is the pattern of spacing of individuals within the area the population inhabits. The dispersion pattern of individuals in a population may conform to any one of several broad types, such as random, uniform, or contagious (clumped). Any pattern is relative to the space being examined; a population may appear clumped when a large area is considered but may prove to be distributed at random concerning a much smaller area.

1) **Random -** This implies that the individuals have been distributed by chance. In such a distribution, the probability of finding an individual at any point in the area is the same for all points. Random patterns will develop only if each individual has had an equal and independent opportunity to establish itself at any given point.
2) **Uniform** - This type of distribution implies a regularity of distance between and among the individuals of a population. Perfect uniformity exists when the distance from one individual to its

nearest neighbour is the same for all individuals. This is achieved, on a plane surface, only when the individuals are arranged in a hexagonal pattern. Patterns approaching uniformity are most obvious in the dispersion of orchard trees and in other artificial plantings, but the tendency to a regular distribution is also found in nature, as for example in the relatively even spacing of trees in forest canopies, the arrangement of shrubs in deserts, and the distribution of territorial animals.

3) **Contagious or clumped -** The most frequent type of distribution encountered is contagious or clumped indicating the existence of aggregations or groups in the population. Clusters and clones of plants, and families, flocks, and herds of animals are common phenomena. The degree of aggregation may range from loosely connected groups of two or three individuals to a large compact swarm composed of all the members of the local population. Furthermore, the formation of groups introduces a higher order of complexity in the dispersion pattern, since the several aggregations may themselves be distributed at random, evenly, or in clumps.

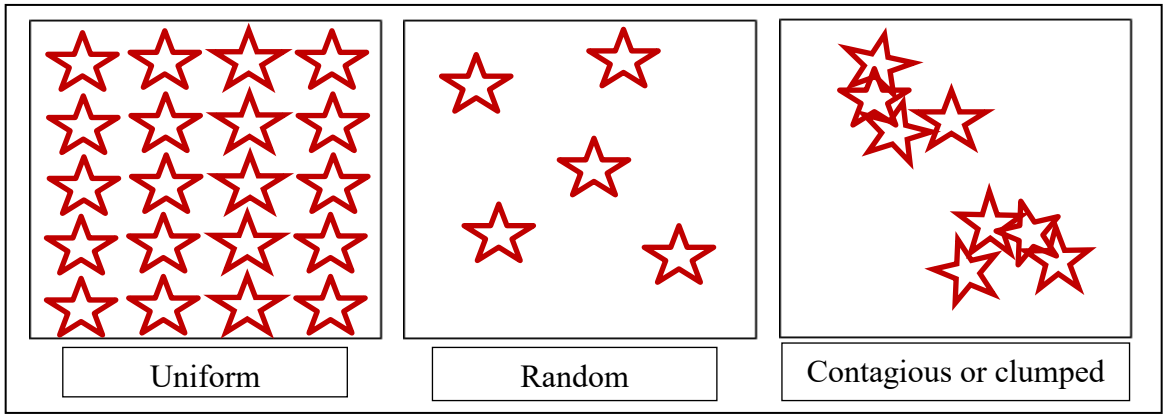

Fig. 3.4. Density and Dispersion Patterns

3.5.6. Dispersion Pattern Determination

The dispersion pattern detection with respect to quadrat methods is based on possible values series which involves Mean ratio and Variance

- $S^2 / \bar{X} < 1$ implies regular
- $S^2 / \bar{X} = 1$ implies random

- $S^2/\bar{X} > 1$ implies contagious.

Consider the expected value (E) to be the mean ($\bar{X}$) of all the observations, and the observed values to be the individual observations. Thus:

$$\chi 2 = \Sigma (O - E)2 /E = \Sigma (Xi - \bar{X}) 2 /X$$

With n-1 degrees of freedom, where n is the number of samples. You can then simply use a χ 2 table to determine the level of significance.

3.5.7. Nearest neighbor Method

Nearest-neighbour sampling method A method of plotless sampling in which the distance is measured from the first individual (the nearest to the random sampling point) to its nearest neighbour. This permits the calculation of the density of individuals, or of its reciprocal, the mean area per individual. The dispersion pattern and its corresponding statistical significance test is outlined here:

$$A = \Sigma(d1^2) / \Sigma (d2^2)$$

Where,

A > 1 implies contagious dispersion

A = 1 implies random dispersion

A < 1 implies regular dispersion

For random dispersions the parameter x = A/ (1+A) has a value of 0.5.

A more general method to estimate dispersion patterns from nearest neighbour data is from Clark and Evans (1954). Using their method, in a population of individuals with a density D, the distance from each individual to its nearest neighbour is measured. The mean distance is:

$$\bar{r}a = \Sigma d/n$$

If the population is distributed randomly, the expected value of the average distance would be re where:

$$\bar{r}e = 1/(2D)1/2$$

The ratio R (=¯ra / ¯re) is a measure of the departure from randomness. If R=1 the pattern is random, if aggregation is maximum, R=0. Can you figure out why this is so? If spacing is maximum R = 2.1491. A significance test for this value is given by c = (ra-re)/sD, where sD is the standard error of the mean distance to the nearest neighbour in a randomly dispersed population with density D. In this case

$$sD = 0.26126/ (n*D)1/2$$

3.5.8. Carbon Stock and Biomass Estimation in Trees

Estimation of carbon stocks and biomass of trees is calculated using the approved methodological tool AR-TOOL 14 version 3.0 of UNFCCC. The estimation of biomass and Expansion Factor (BEF). In this technique, volume tables or volume equations are used to convert tree dimensions to stem volume of trees. Stem volume of trees is converted to above-ground tree biomass using density and biomass expansion factors, and the above-ground tree biomass is expanded to total tree biomass using root-shoot ratios. Thus, biomass of trees of species j in sample plot p is estimated as:

$$B_{TREE,\,j,\,p,\,I,\,t} = V_{TREE,\,j,\,p,\,I,\,t} \times D_j \times BEF_{2,\,j}\, X\,(1 + R_j)$$

The details of the equation is mentioned and discussed in carrying capacity section.

3.6. Biodiversity Indexes Estimation

Diversity indices are statistics used to summarize the diversity of a population in which each member belongs to a unique group. For example, in ecology the groups are typically species. In ecology, species richness refers to number of species and species eveness refers to homogeneity of the species. That is, the more equal the proportions for each of the groups, the more homogeneous, or even, they are. Different fields of application may use different terminology for these concepts.

Given the large number of indices, it is often difficult to decide which the best method of measuring diversity is. One good way to get a feel for diversity measures is to test their performance with one's own data. A rather more scientific method of selecting a diversity index is on the basis of whether it fulfils certain function criteria- ability to discriminate between sites, dependence on sample size, what component of

diversity is being measured, and whether the index is widely used and understood. The various diversity measures are given below:

3.6.1. Species estimation Indices

3.6.1.1. Simpson's Index

Simpson gave the probability of any two individuals drawn at random from an infinitely large community belonging to different species. The Simpson index is therefore expressed as 1-D or 1/D. Simpson's index is heavily weighted towards the most abundant species in the sample while being less sensitive to species richness. It has been shown that once the number of species exceeds 10 the underlying species abundance distribution is important in determining whether the index has a high or low value. The D value which is standing for the dominance index is used in pollution monitoring studies. As D increases, diversity decreases. That way it is effectively used in Environment Impact Assessment to identify perturbation.

$$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$$

n = the total number of organisms of a particular species

N = the total number of organisms of all species

The value of Simpson's index D ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity.

3.6.1.2. Shannon's Index of diversity

The Shannon diversity index (the Shannon–Wiener diversity index) is a popular metric used in ecology. It's based on Claude Shannon's formula for entropy and estimates species diversity. The index takes into account the number of species living in a habitat (richness) and their relative abundance (evenness).

$$H = -\sum[(pi) * \log(pi)]$$

Where:

H - Shannon diversity index;

pi - Proportion of individuals of i-th species in a whole community:

n - individuals of a given type/species; and

N - total number of individuals in a community,

∑ - Sum symbol; and

log - Usually the natural logarithm, but the base of the logarithm is arbitrary (10 and 2 based logarithms are also used).

3.7. Outcome of Ecological services

A total of 271 tree species examined representing 79 species, 37 families from 15 Quadrants study were identified from the total area of 427.993 ha. *Cucurbitaceae* and *Solanaceae* was the dominant family in the forest. Family mainly present were *Cucurbitacea*e, *Solanacea*e, *Apiaceae*, *Rutaceae*, *Amaranthaceae*, *Malvaceae*, *Dioscoreaceae*, *Convolvulaceae*, *Poaceae*, *Leguminosae*, *Asteraceae*.

Table – 3.1. Details of selected tree species for calculation of biodiversity's Index

Family	37
Species	79
Total no. of trees	271
Total Quadrants	15

Table – 3.2. Summary of Biodiversity's Index

Quadrat No.	Stratification Area	H' (Shannon diversity index)	D (Simpson index)
1	Core	1.67749	0.722222
2	Core	1.37606	0.76923
3	Core	1.56496	0.666666
4	Core	1.47913	0.666666
5	Core	1.09337	0.846153
6	Core	1.52471	0.666667
7	Buffer	1.36543	0.85
8	Buffer	1.02392	0.866667

9	Buffer	1.19214	0.615384
10	Buffer	1.70651	0.821428
11	Buffer	1.28605	0.727272
12	Buffer	1.56812	0.851851
13	Buffer	1.59333	0.833333
14	Buffer	1.33979	0.785715
15	Buffer	1.55604	0.833334

Table: 3.3. Biodiversity Indexes Estimation of the study area

	n	N	pi	Pi^2	LnPi	-Pi*LnPi	H (Shannon diversity Index)	N(n-1)	N(N-1)	N(n-1) /N(N-1)	D (Simpson index)
Q1 Core	5	19	0.263158	0.0692521	-1.335	0.35132		76	342	0.222222	
	2	19	0.105263	0.0110803	-2.25129	0.23698		19	342	0.055556	
	1	19	0.052632	0.0027701	-2.94444	0.15497		0	342	0	
	3	19	0.157895	0.0249307	-1.84583	0.29145		38	342	0.111111	
	3	19	0.157895	0.0249307	-1.84583	0.29145		38	342	0.111111	
	5	19	0.263158	0.0692521	-1.335	0.35132		76	342	0.222222	
				0.5068		**1.67749**	**1.67749**				**0.722222**
Q2 Core	3	14	0.214286	0.0459184	-1.54045	0.3301	**1.37606**	28	182	0.153846	**0.76923**
	4	14	0.285714	0.0816327	-1.25276	0.35793		42	182	0.230769	
	4	14	0.285714	0.0816327	-1.25276	0.35793		42	182	0.230769	
	3	14	0.214286	0.0459184	-1.54045	0.3301		28	182	0.153846	
				0.2551022		**1.37606**					
Q3 Core	4	13	0.307692	0.0946746	-1.17865	0.36266	**1.56496**	39	156	0.25	**0.666666**
	2	13	0.153846	0.0236686	-1.8718	0.28797		13	156	0.083333	
	2	13	0.153846	0.0236686	-1.8718	0.28797		13	156	0.083333	
	3	13	0.230769	0.0532544	-1.46634	0.33839		26	156	0.166667	
	2	13	0.153846	0.0236686	-1.8718	0.28797		13	156	0.083333	
				0.2189348		**1.56496**					
Q4 Core	5	13	0.384615	0.147929	-0.95551	0.3675	**1.47913**	52	156	0.333333	**0.666666**
	2	13	0.153846	0.0236686	-1.8718	0.28797		13	156	0.083333	
	2	13	0.153846	0.0236686	-1.8718	0.28797		13	156	0.083333	
	1	13	0.076923	0.0059172	-2.56495	0.1973		0	156	0	
	3	13	0.230769	0.0532544	-1.46634	0.33839		26	156	0.166667	
				0.2544378		**1.47913**					
Q5 Core	4	14	0.285714	0.0816327	-1.25276	0.35793	**1.09337**	42	182	0.230769	**0.846153**
	5	14	0.357143	0.127551	-1.02962	0.36772		56	182	0.307692	
	5	14	0.357143	0.127551	-1.02962	0.36772		56	182	0.307692	
				0.3367347		**1.09337**					
Q6 Core	3	13	0.230769	0.0532544	-1.46634	0.33839	**1.52471**	26	156	0.166667	**0.666667**
	3	13	0.230769	0.0532544	-1.46634	0.33839		26	156	0.166667	
	1	13	0.076923	0.0059172	-2.56495	0.1973		0	156	0	
	2	13	0.153846	0.0236686	-1.8718	0.28797		13	156	0.083333	
	4	13	0.307692	0.0946746	-1.17865	0.36266		39	156	0.25	
				0.2307692		**1.52471**					
Q7 Buffer	7	21	0.333333	0.1111111	-1.09861	0.3662	**1.36543**	126	420	0.3	**0.85**
	5	21	0.238095	0.0566893	-1.43508	0.34169		84	420	0.2	

	5	21	0.238095	0.0566893	-1.43508	0.34169		84	420	0.2	
	4	21	0.190476	0.0362812	-1.65823	0.31585		63	420	0.15	
				0.2607709		**1.36543**					
Q8	5	16	0.3125	0.0976563	-1.16315	0.36348		64	240	0.266667	
Buffer	8	16	0.5	0.25	-0.69315	0.34657		112	240	0.466667	
	3	16	0.1875	0.0351563	-1.67398	0.31387		32	240	0.133333	
				0.3828126		**1.02392**	**1.02392**				**0.866667**
Q9	2	14	0.142857	0.0204082	-1.94591	0.27799		14	182	0.076923	
Buffer	1	14	0.071429	0.005102	-2.63906	0.1885		0	182	0	
	5	14	0.357143	0.127551	-1.02962	0.36772		56	182	0.307692	
	4	14	0.285714	0.0816327	-1.25276	0.35793		42	182	0.230769	
	2	14	0.142857	0.0204082	-1.94591	0.27799		14	182	0.076923	
				0.2346939		**1.19214**	**1.19214**				**0.615384**
Q 10	8	29	0.275862	0.0760999	-1.28785	0.35527		203	812	0.25	
Buffer	5	29	0.172414	0.0297265	-1.75786	0.30308		116	812	0.142857	
	6	29	0.206897	0.0428062	-1.57554	0.32597		145	812	0.178571	
	2	29	0.068966	0.0047562	-2.67415	0.18442		29	812	0.035714	
	5	29	0.172414	0.0297265	-1.75786	0.30308		116	812	0.142857	
	3	29	0.103448	0.0107015	-2.26868	0.23469		58	812	0.071429	
				0.1938168		**1.70651**	**1.70651**				**0.821428**
Q 11	4	12	0.333333	0.1111111	-1.09861	0.3662		36	132	0.272727	
Buffer	1	12	0.083333	0.0069444	-2.48491	0.20708		0	132	0	
	3	12	0.25	0.0625	-1.38629	0.34657		24	132	0.181818	
	4	12	0.333333	0.1111111	-1.09861	0.3662		36	132	0.272727	
				0.2916666		**1.28605**	**1.28605**				**0.727272**
Q 12	7	28	0.25	0.0625	-1.38629	0.34657		168	756	0.222222	
Buffer	4	28	0.142857	0.0204082	-1.94591	0.27799		84	756	0.111111	
	8	28	0.285714	0.0816327	-1.25276	0.35793		196	756	0.259259	
	5	28	0.178571	0.0318878	-1.72277	0.30764		112	756	0.148148	
	4	28	0.142857	0.0204082	-1.94591	0.27799		84	756	0.111111	
				0.2168369		**1.56812**	**1.56812**				**0.851851**
Q 13	6	25	0.24	0.0576	-1.42712	0.34251	**1.59333**	125	600	0.208333	**0.833333**
Buffer	4	25	0.16	0.0256	-1.83258	0.29321		75	600	0.125	
	4	25	0.16	0.0256	-1.83258	0.29321		75	600	0.125	
	5	25	0.2	0.04	-1.60944	0.32189		100	600	0.166667	
	6	25	0.24	0.0576	-1.42712	0.34251		125	600	0.208333	
				0.2064		**1.59333**					
Q 14	4	15	0.266667	0.0711111	-1.32176	0.35247	**1.33979**	45	210	0.214286	**0.785715**
Buffer	5	15	0.333333	0.1111111	-1.09861	0.3662		60	210	0.285714	
	2	15	0.133333	0.0177778	-2.0149	0.26865		15	210	0.071429	
	4	15	0.266667	0.0711111	-1.32176	0.35247		45	210	0.214286	
				0.2711111		**1.33979**					

Q 15 Buffer	3	25	0.12	0.0144	-2.12026	0.25443	**1.55604**	50	600	0.083333	**0.833334**
	8	25	0.32	0.1024	-1.13943	0.36462		175	600	0.291667	
	5	25	0.2	0.04	-1.60944	0.32189		100	600	0.166667	
	4	25	0.16	0.0256	-1.83258	0.29321		75	600	0.125	
	5	25	0.2	0.04	-1.60944	0.32189		100	600	0.166667	
				0.2224		**1.55604**					

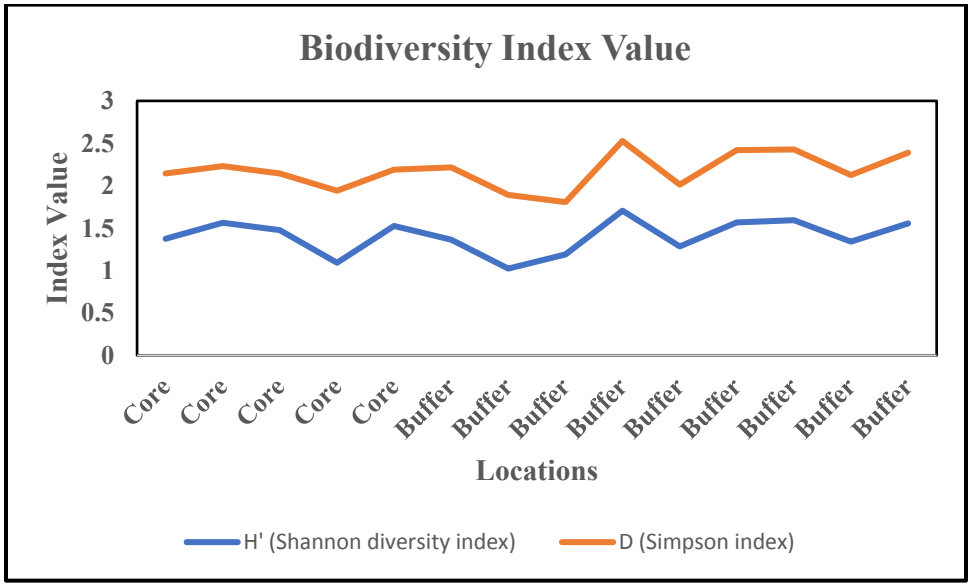

Fig. 3.5. Biodiversity index value

- A low Simpson's index of value 0.66 was observed in Quadrate 3 and 4 and a high value of 0.84 was observed in Quadrate 5. While in buffer zone, high value of Simpsons index was examined in Quadrate 7, 8, 10, 12, 13 and 15 of 0.8 and low value in Quadrate 9 of 0.6. The average biodiversity index in core zone was 0.71 and 0.79 in the buffer zone. As per the Importance Value Index (IVI), the most dominant species in both Core and Buffer zone are *Shorea robusta* Roth (Sal) and *Diospyros melanoxylon* Roxb (Black ebony). The Shannon diversity index was also calculated. The average value in the core zone was found to be 1.45, while in the buffer zone the value was 1.40.
- Efforts are therefore required to plan and implement reclamation of mined out areas, avenue and block plantations having diverse native plant species in order to improve the diversity index in the core zone and to bring them at par or even better than the one existing in the reserve forest area in the surrounding.

Chapter - 4

4. Environmental Impact and Mitigation Measures

4.1 In terms of Water Quality

4.1.1 Environmental Impact

Aquifer geometry: Changes in aquifer geometry leads to disturbance in the water level present in the vicinity of the mine and also disrupts the direction of ground water flow. These results in the creation of higher permeability zones and secondary fractures within the aquifer. After the completion of mining activity, original water level is restored by the aquifer and area mined out act as a good reservoir.

Topography & Drainage: Topography and drainage by developing micro basins

Water levels: As proposed mine is an opencast, the impact of mining on local water levels will be limited to few hundred meters.

Physico-Chemical and Bacteriological**:** No abnormality, Acceptable

4.1.2 Mitigation Measures for water quality

4.1.2.1 Management of Surface Water drainage

Water collected in the catchment area should be drained out into the sump by constructing the Garland drains around the periphery of the quarry. In this whole process, the accumulated water which is collected during the rainy season in the working face will be thrown out with the help of heavy-duty pumps by passing through the settling ponds to these garland drains which further will be sent to the reservoir.

4.1.2.2 Discharge of Mine Water

The assessment of the 10% probability of the water quantity on the floor of the mine sump should be done in different stages. The sump water should be pumped out and discharged into the settling tank where suspended solids will get settled. The recycling of the treated water should be done after the sedimentation and is used in various activities such as plantation and agriculture purposes, water sprinkling, recharging of

groundwater and domestic use by the local villagers. The discharging of collected water from the settling tank should be done to the surface drain which should be further transported to the reservoir. Oil and Grease trap and sedimentation tank should be used to recycle the effluents of the workshop.

4.1.2.3 Conservation of Water

Water conservation can be best performed by recycling the wastewater after the proper treatment. The treated water after the sedimentation should be reused for various purposes such as plantation and agriculture purposes, water sprinkling, recharging of groundwater and domestic use by the local villagers. Oil and Grease trap and sedimentation tank should be used to recycle the effluents of the workshop.

Regular monitoring of water should be done to maintain its quality whole year and be conserved in the mine pits. After the mine closure, the mined-out area should be treated as a water body. After the final closure of the mine, these water sources should serve as a considerable source of water.

4.2 In terms of Air Quality

4.2.1 Impact Assessment of Air Quality

Meteorological Condition

Due to the fire susceptibility of coal dumps, spontaneous combustion may occur, therefore, changes in the ambient temperature, speed of wind and direction are likely to change to some extent.

Ambient air quality

Direct: Transport vehicles emission in the form of noxious gases and dust slightly increases, Ambient SPM levels increase to some extent due to Blasting, coal and dump handling.

Indirect impact of surface coal transport, generation from workshop and dump handling occur in the long run.

A slight increase in the ambient SPM level occurs due to Blasting and Drilling activities.

Long-term impact upon the air quality due to transport of surface coal, generation from workshop and dump handling.

4.2.2 Mitigation Measures for Air Quality

Within the mining area including coal handling plants and railway siding, the following are the control measures for air pollution regulation which will be practiced.

- Dust generation should be minimized by regular spraying of water on approach roads which lie within the mining area.
- Coal loading points and discharging points should be equipped with fixed sprinklers.
- Along the haul road, plantation programs should be conducted in adequate quantity to minimize the pollutants generated by the transport.
- Adequate plantation should be conducted to cover the exposed overburden dumps.
- Dust arresting devices or wet drilling arrangements should be employed during the drill procedure.
- Ambient air quality of the project area should be regularly monitored.
- Dust emerging during blasting should be regulated by performing optimum blast-hole geometry.

4.3 In terms of Noise level

4.3.1. Impact Assessment of Noise

Increase in Noise levels at drilling and blasting, Operation of HEMMs, Operation of equipment etc.:

Noise levels above the permissible limit may have an impact on the workers and nearby habitats. It may lead to irritation and annoyance. Impaired hearing may cause mental and physical fatigue, interference with normal activities and health hazards. Interference with communication, task and sometimes cardio-vascular diseases occur in extreme cases.

4.3.2. Mitigation Measures for Noise

The levels of noise present were below the prescribed limits. Suitable measures should be adopted if the noise level is way more than the permissible limit because of mining operations in the working area to maintain the sound level. The following steps should be adopted and it should be continued:

- By making use of resilient mounting or altering structures, the noisy machines or other sources should be isolated or enclosed.
- Trees with thick foliage should be planted in rows along the roads which act as acoustic barriers against the noise generated by the machines.
- Vibration of machines should be reduced by proper alignment and balancing of machines.
- Regular maintenance schedules for HEMM and other machinery to eliminate noise as far as possible should be implemented.
- Workers should be provided with ear muffs/ear plugs to protect their ears when the noise level is above the permissible limits.
- Controlled blasting should be performed.
- The noise level of the project area should be monitored regularly.

4.4 In terms of Land Resource

4.4.1 Impact Assessment of Land Resource

Topography: There will be a marked change in the topography observed in the quarry area, mining equipment area and dump area.

Change in Landscape and Land use patterns in the pre-mining scenario such as visual impact-loss of aesthetic beauty, ugly scar on land, deforestation-loss of surface soil and vegetation cover: A huge change will be observed in the total scenario of the land use pattern.

Change in Surface Drainage: Surface drainage will have a stark change and a new pattern of drainage will be developed.

4.4.2 Mitigation Measures for Land Resource

The following measures should be taken for the suitable land resource management of the area.

- After the cessation of mining operation, the present land use should be converted into the internal dump, green belt, built-up area, surface infrastructure, final void/water body and other surface water bodies etc.
- The quantities of the OB should go to the external dumps during the initial years i.e., up to 3rd year. From 4th year onwards, internal dumping should get started.
- During the mining of the multi-seam zone, the parting OB of the older seam should be transported through the central haul road.
- Rehandling of temporary external dump to internal dump should be done from the 7th year to the 10th year.
- In the starting, the topsoil should be removed and stored separately which will be further spread over the levelled graded backfilled spoil directly for reclamation of the quarried-out land.
- Plantation of native species trees should be carried out around the mine infrastructure and nearby areas.

4.5 In terms of Flora and Fauna

4.5.1 Impact Assessment of Flora and Fauna

Vegetation Cover: Due to mining activities, no other area will be affected other than the area used for quarry excavation, erection and development of plants, service & allied structures, colony, roads, diversions, culverts etc. Hence, the impact on flora and fauna will not be of an appreciable level.

Forest Degradation: Due to mining activity some of the forest land is going to be affected. Against this, the significant area should be generated by way of reclamation of dump areas, plantation in other available areas etc. The process of photosynthesis and transpiration is affected by the pollution generated by coal and OB transportation. Necrosis disease occurs in plants due to SO_2 pollution. Hence, the Impact on flora and fauna is major.

Hydro-geological aspects: The effect on the water level is nominal concerning opencast mine. Flora and fauna which directly or indirectly depend upon the ground and surface water will not be affected due to no appreciable change in their concentration.

Ecological aspects: There is a minor change expected in ecological parameters on which the survival of flora and fauna depends directly or indirectly in an opencast mine. The expected impact on flora and fauna is not above the appreciable level.

Plantation work and forest & wildlife conservation in a scientific way by project authorities in the mine area will increase the aestheticism of the area.

4.5.2 Mitigation Measures for Flora and Fauna

The area of the Tamnar tehsil, Raigarh is thinly populated. It is not considered as a holiday resort. Due to disturbances caused by open-cast mining operations, the surface of the mine is devoid of any rare variety of flora and fauna. Deterioration caused by the activity of opencast mining operation on quality of life or loss of amenity is not further envisaged by anyone. The animals belonging to schedule I & II should have a proper conservation plan which should be prepared and implemented effectively.

Strengthening of safety zones and compensatory afforestation should be done. A habitat for the fauna should be developed by authority.

4.6 In terms of Socio-Economic

4.6.1 Impact on Socio-Economic Status

There are two villages i.e., Rodapali and Tihili Rampur located in the core zone. The population predominantly comprises agriculture labour and non-workers. The predominant population comprises agricultural labour and marginal workers in the proposed area. The probable impact on Socio-Economic status of the study area was assessed below:

- Population Growth & In-migration
- Transport & Communication

- Human Settlement & Resettlement / Rehabilitation
- Civic Amenities & Community development
- Income & Employment Social status growth
- Growth of Financial Revenues (State & Central)
- Educational facilities and Literacy
- Economic growth

4.6.2. Mitigation Measures for Socio-Economic

- Rehabilitation and Resettlement of the PAFs should be done. Through this, homesteads should be shifted to the rehabilitation site.

Chapter – 5

5. Riparian ecosystem conservation and management plan

5.1. Riverine ecosystem conservation

Riverine (or riparian) ecosystem conservation and management require a holistic strategy that takes human interactions and ecological health into account. An organized strategy for riverine ecosystem management and conservation is as follows:

i. Gaining Knowledge of the Ecosystem:

- Ecological Assessment: Evaluate the riverine ecosystem in its whole, taking into account habitats, connectivity, biodiversity, and water quality.
- Stakeholder Engagement: Involve scientists, NGOs, government organizations, and local communities to obtain a variety of viewpoints and knowledge.

ii. Threat Identification:

- Pollution: Take care of both non-point source (agricultural runoff) and point source (industrial discharge) pollution.
- Habitat Loss: Locate regions affected by erosion, the encroachment of exotic species, and alterations brought about by human activity (such as dams and urbanization).
- Overuse of Resources: Take sustainable measures to manage recreational activities, fishing, and water extraction.

iii. Conservation Goals:

- Conservation of Biodiversity: safeguard threatened species and maintain natural plants and animals.
- Improving Water Quality: Establish goals for lowering contaminants and raising water clarity.
- Habitat Restoration: Use erosion control techniques, reforestation, and wetland restoration to restore degraded ecosystems.

iv. Management Strategies:

- Regulatory Measures: Establish and uphold laws pertaining to fishing methods, pollution prevention, and land use
- Community Education: To increase knowledge of the value of riverine ecosystems, hold workshops, outreach initiatives, and educational campaigns.
- Sustainable Practices: Encourage methods of urban development, forestry, and agriculture that have the least negative effects on rivers and the areas around them.

v. Monitoring and Assessment:

- Data Gathering: Set up programs to monitor ecosystem health, biodiversity indicators, and water quality.
- Adaptive Management: Make use of gathered data to modify management tactics and guarantee their continued efficacy.

vi. Collaborative approach:

- Collaborative Initiatives: To coordinate conservation activities across watersheds, collaborate with nearby communities, governments, and organizations.
- Money: To support conservation initiatives and long-term management initiatives, look for money from international organizations, private donors, and government grants.

vii. Long-term Sustainability:

- Policy Advocacy: At the local, regional, and federal levels, promote legislation that safeguards riparian zones and water resources.
- Capacity Building: Provide technical support and training programs to increase local capacity for sustainable management.

viii. Emergency Response Planning:

- To reduce the effects on riverine ecosystems, create plans for reacting to both human-caused and natural disasters, such as chemical spills and floods.

ix. Recreation and Public Engagement:

- Balancing Use: Make sure that leisure pursuits (boating, hiking, and fishing) are controlled sustainably to keep ecosystems intact while permitting enjoyment by the general people.

x. Reporting and Documentation:

• Transparency: To maintain accountability and promote learning, keep track of actions, outcomes, and management decisions.

5.2. Riparian Habitat

Riparian areas in watersheds provide numerous ecological links between upland areas and their aquatic ecosystems, besides creating shade, cover and organic debris for fish and wildlife. Riparian zones with woody debris provide an extremely important structural component in aquatic ecosystems, often becoming the dominant element in the physical structure of streams while also providing an important nutritional substrate for the aquatic ecosystem.

A critical role of the riparian ecosystem is met when coarse, woody debris naturally falls into streams; debris (allochthonous) inputs that dominate small streams are their main source of energy. Riparian vegetation has been shown to exert significant control over fluvial processes, but also largely determines instream habitat by providing: (i) flow resistance; (ii) log jams that create flow interruptions; (iii) interception and storage of sediment; (iv) bank strengthening; and (v) concave bank bench deposition.

These types of flow disturbance regimes in stream ecosystems are vital to shaping the riparian zone and its vegetation. By establishing riparian flows that exceed channel capacity for the LORP, we are providing the fundamental disturbance regime to restore the Lower Owens River ecosystem.

The heart of an ecologically healthy watershed is the riparian habitat. Riparian habitat is shaped not only by channel geomorphology, hydrologic pattern, the spatial position of the channel in the drainage network, and the natural disturbance regimes but is also affected by habitat dynamics, water quality and the animal community. All of these factors interact to affect riparian habitat, but riparian habitat also affects each of these ecological processes as well.

5.3. Current status of Riverine Ecosystem

There is one prominent watercourse passing through the eastern part of the block i.e. Kelo River.

The major characteristics of the river include:

- Total Catchment Area of the Project Site: 319 sq. km
- Total length of the river within the watershed: 40 km
- Average Width of the River: 75 m
- Average Depth of River: 15 m
- Peak 24 hours Rainfall Taken as 100 mm
- The runoff co-efficient taken as: 0.7
- The volume of the River within the catchment area: 45 Mcum
- Runoff generated from catchment area: 22.3 Mcum
- Maximum seepage of the water available during mining: 5000 cum/day maximum

5.3.1. Characterization of Drainage Basin

To identify the length of streams, drainage density, drainage pattern, and stream order classification, including catchment shape, a thorough study of the drainage basin was conducted. This will assist in identifying flood-prone areas, designing embankments, and diverting the Nallah by providing information on the catchment area, surface runoff, and peak flood levels.

5.3.2. Stream Order classification

In geomorphology and hydrology, the term "stream order" or "waterbody order" refers to a positive whole number that represents the degree of branching within a river system. Order 1 is assigned to the smallest river tributary, and order 2 stream starts when two tributaries of order 1 merge. By combining lower order streams, a higher order stream also arises in the same way. In a given watershed, the trunk stream—through which all discharges pass—becomes the stream of highest order. The length and number of each order of stream has been worked out and given in Table. The analysis of data revealed that the study area consists of various stream of order ranging from 1-6.

5.3.3. Stream Order

Table 5.1 Length of stream in the study area

Stream Order	Length (km)
1	468
2	231
3	105
4	81
5	22
6	44

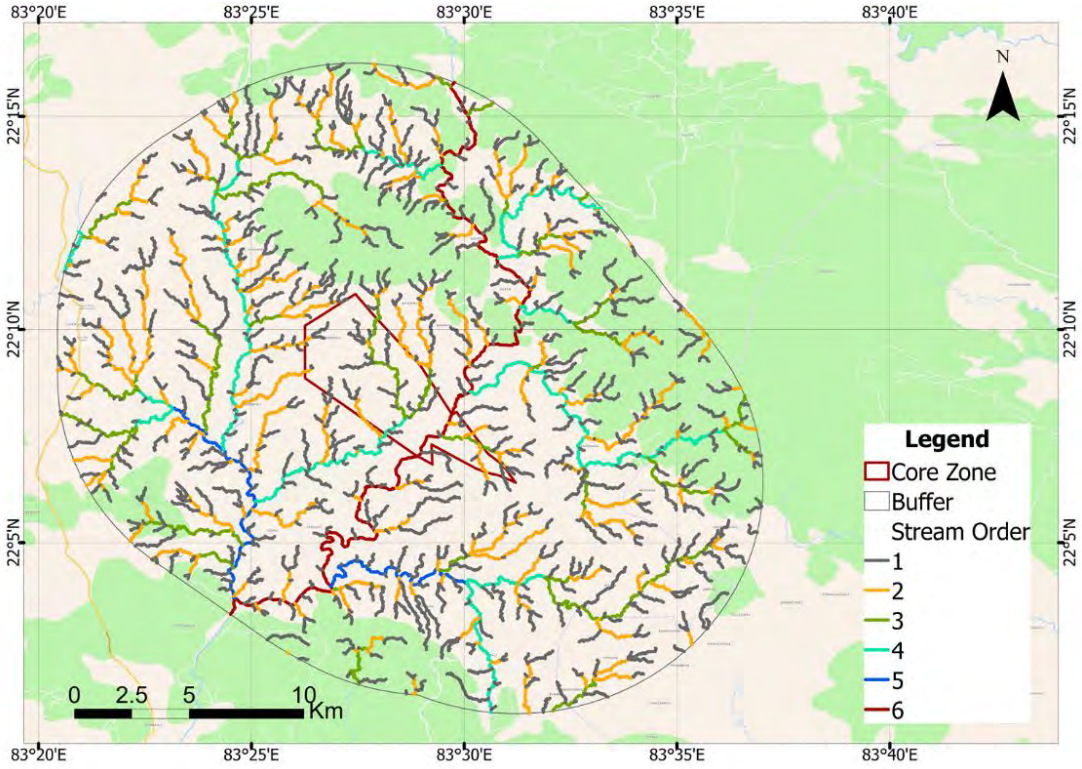

Fig - 5.1. Stream order in the study area

Fig - 5.2. Official meeting with irrigation departments at Raigarh, Chhattisgarh

Fig – 5.3. Near Upstream side of Kelo River

Fig – 5.4. River profile at the midtream

Fig - 5.5. River profile at the downstream

5.4. Conservation plan for River

5.4.1. Conservation plan for Watershed

- The mine working should be protected from the river inundation by providing embankments on either side of the river. The maximum elevation of the embankment of the right bank from N.S.L

should be 9 meters and a minimum elevation of 2 meters. For the left bank, the maximum elevation of the embankment should be 9 meters and minimum elevation is 4 meters.

- Adequate measures to protect the mine workings from surface water flow during the rains should be taken by way of providing garland drains around the mine excavations and also by providing suitable drainage gradients for mine benches. The embankments on the river will also protect the course of the river from overflow. The bank of the river will also be protected with a plantation of native flora. The green belt on the western bank should be 15 m wide, while the eastern bank should be 5 m.
- A 100-meter statutory buffer must be left between the Kelo River bank and the mine workings during mining. According to the comprehensive plan and alignment provided in the report, the embankment will be built alongside the banks of the Kelo River. The embankment's height should range from 2 to 9 metres on the right bank and from 4 to 9 metres on the left bank.

5.4.2. Conservation plan for riparian plant/phytoplankton communities

- Develop a lateral and longitudinal corridor of native riparian plant communities throughout the river by using annual seasonal habitat flows. Riparian habitat should be dominated by willow, cottonwood and wet meadow vegetation that exhibits healthy age structure developing toward late seral stages.
- Implement seasonal habitat flows after the initial phases of flow reintroduction. Flow magnitude is to be based upon the run-off year and will follow the nomograph. Seasonal habitat flows alone should not determine vegetation trends; therefore land management and grazing strategies should be used to enhance and influence riparian zones. Land and water management should be constantly coordinated through monitoring feedback to ensure that riparian habitat is developing a healthy age structure, diversity and trend toward late seral stages.
- Active interventions, such as planting of riparian and upland vegetation, can be employed if adaptive management indicates such actions should be beneficial. Specific areas of the river or uplands where planting and vegetating efforts could be performed will require time to identify and assess after first allowing water and land management efforts to show positive results before intervening in other ways.

5.4.3. Conservation plan for riparian fishes and other zooplankton communities

- Fish habitat management, which will include land use and stream flow management, should be performed as part of the overall riparian management. Fisheries management is the responsibility of the project proponent. Nevertheless, project proponent must collaborate to pool and analyze data during the monitoring years to implement effective and fair adaptive management strategies.
- Fisheries management should be establishing a healthy warm-water recreational fishery and to provide habitat for native species. Seasonal habitat and base flows are intended to enhance warm-water recreational fishery as well as benefit biodiversity and native species.
- In addition to instream channel flows, flows should also be managed to connect off channel fish habitats with the river channel. These connections will serve as corridors for fish migration, spawning and nursery areas, and rearing areas; corridors will also provide pathways for fish movement and create riparian habitat for a variety of birds, mammals, reptiles and amphibians.
- It has been suggested that the connecting the river directly to native fish sanctuaries should have barriers to prevent upstream fish movement from the river. However, since these corridors are not native fish sanctuaries, and native fish sanctuaries will not initially be connected to the river, screens and barriers will not be required.

5.5. Recommendations:

- **Integrated Watershed Management:** It is important to put into practice watershed-based management techniques that take into account the ecosystem's overall health, including impacts from upstream and downstream. To coordinate conservation activities across jurisdictions and sectors, it is important to foster partnerships among stakeholders, such as government agencies, local communities, non-governmental organizations, and so on.

- **Preserving Riparian Buffers:** In order to filter pollutants, lessen erosion, and create wildlife corridors, vegetated buffers around rivers and streams should be created and kept up. In order to reduce encroachment and ecological fragmentation, land use planning should take into account riparian setbacks and zoning requirements.

- **Restoration and Rehabilitation:** To improve biodiversity and link fragmented habitats, identify and priorities degraded or altered riparian habitats for restoration activities. In order to increase the adaptability of the habitat and its resilience to climate change, restoration initiatives should make use of native flora.
- **Water Quality Management:** The implementation of best management practices (BMPs) is recommended in order to mitigate the entry of chemical pollutants, fertilizer runoff, and sedimentation into rivers. The factors pertaining to water quality, such as dissolved oxygen, pH, and nutrient levels, must be consistently observed to evaluate the efficacy of management strategies and identify any new hazards.

- **Ecological Utilization of Land and Water:** In order to minimize habitat degradation and preserve the integrity of the ecosystem, laws pertaining to water abstraction, dredging, and land removal should be put into place. Education on sustainable agricultural methods, responsible recreation, and the significance of riparian conservation should be provided to landowners, farmers, and the general public, among others.

- **Climate Change Adaptation:** Techniques like restoring natural floodplains and increasing water retention capacity should be developed to lessen the effects of climate change on riparian ecosystems.

- **Community Involvement:** Through outreach programs, citizen science initiatives, and collaborative decision-making procedures, the local communities should be included in conservation efforts. To gain support and encourage stewardship, emphasize the advantages that healthy riparian habitats have for the environment, the economy, and culture.

- **Research and Innovation:** To help guide management choices, research on riparian ecology, hydrology, and ecosystem services should be encouraged. Additionally, creative conservation techniques should be supported. To successfully monitor and manage riparian ecosystems, more research should be done on the use of remote sensing, GIS (Geographic Information System), and other technologies.

- **Capacity Building:** To improve local stakeholders' abilities to manage riparian ecosystems efficiently, training and capacity building programs for resource managers and community leaders should be arranged.

- **Adaptive Management and Evaluation:** It is best to use adaptive management techniques that permit modifications in response to fresh data and evolving environmental circumstances. Additionally, provide precise benchmarks and indicators to evaluate the effectiveness of conservation efforts and update stakeholders on developments.

- Putting these suggestions into practice calls for a cooperative and flexible strategy that is adapted to the unique traits and difficulties of every riverine environment. We should safeguard the long-term resilience and health of riparian ecosystems for future generations by placing a high priority on conservation and sustainable management techniques.

Chapter – 6

Monetary evaluation of ecosystem services in Tamnar Tehsil, Raigarh

6.1 Introduction

Natural resources play a significant role in economic activities and contribute to economic value. These resources include non-renewable ones like oil and natural gas, as well as renewable resources such as land, water, and timber from forests. Part of this value is integrated into economic processes and reflected in national accounts. The value of non-renewable resources is especially apparent in markets, both for the materials extracted and for the remaining reserves. It is important to differentiate between ecosystem assets and ecosystem services when evaluating ecosystems. Ecosystem assets refer to ecosystems within a specific area, assessed based on the value they provide to people. The term "ecosystem assets" reflects an anthropocentric view used in accounting, focusing on the value ecosystems offer to humans. The goal is to determine the value of ecosystems, including, where possible, all ecosystem services produced by these assets. In this approach, accounting conventions are applied, meaning that individual ecosystem services are examined based on the specific ecosystems that supply them.

Valuation in ecosystem accounting aims to produce reliable statistical data on the economic value of ecosystem flows and assets, organized within an accounting framework. This information serves multiple purposes (Melman & Van der Heide, 2011; EU, 2015; DEFRA, 2007; SEEA EEA, 5.5). It highlights the dependence of economic sectors on ecosystems, both in physical and monetary terms. It also informs public policy decisions, such as determining appropriate taxation levels for sustainable ecosystem use, evaluating alternative policy options (e.g., land use decisions), and conducting cost-benefit analyses. This data is critical for political debates, offering tools to protect the natural environment, which is essential for human well-being. Additionally, it is needed for insurance purposes (e.g., assessing the value of environmental damage) and for private financing of climate change adaptation and mitigation efforts (e.g., calculating collateral).

6.2 SEEA ecosystem accounting

SEEA Ecosystem Accounting is a method for systematically measuring and monitoring ecosystem services and conditions over time to support decision-making and planning. The United Nations has developed the System of Environmental-Economic Accounting – Experimental Ecosystem Accounting (SEEA EEA) to guide the implementation of ecosystem accounting (UN et al., 2014b). A key objective of the SEEA EEA is to measure ecosystem services in alignment with the System of National Accounts (SNA) (UN et al., 2009). The SNA serves as the global standard for national accounts statistics, underpinning macroeconomic indicators like gross domestic product (GDP). In SEEA ecosystem accounting, monetary valuation primarily aims to integrate information on ecosystem conditions and services with standard national accounts (SEEA EEA TR, 1.12). This approach enables comparison between ecosystem services and the production and consumption of other goods and services, facilitating the inclusion of ecosystem data in economic models and productivity analyses.

6.3 Key principles for ecosystem valuation

Environmental economic accounting has emerged in response to the global call for integrated social, economic and environmental data and information that enables decision-making on sustainable development. In this chapter, we outline the key principles for valuation within the SEEA ecosystem accounting context. The focus is on defining what exactly will be valued and how this relates to the principles of the SNA. Understanding of value concepts is essential for the correct interpretation and application of the monetary ecosystem accounts.

6.3.1 What needs to be valued?

Monetary valuation concerns three specific components of the SEEA EEA framework: ecosystem assets, ecosystem services, and the associated benefits. These are shown in Figure 2.1.1 which represents a so-called logic chain that links the ecosystem services supplied by ecosystem assets to the benefits and their specific beneficiaries or economic users.

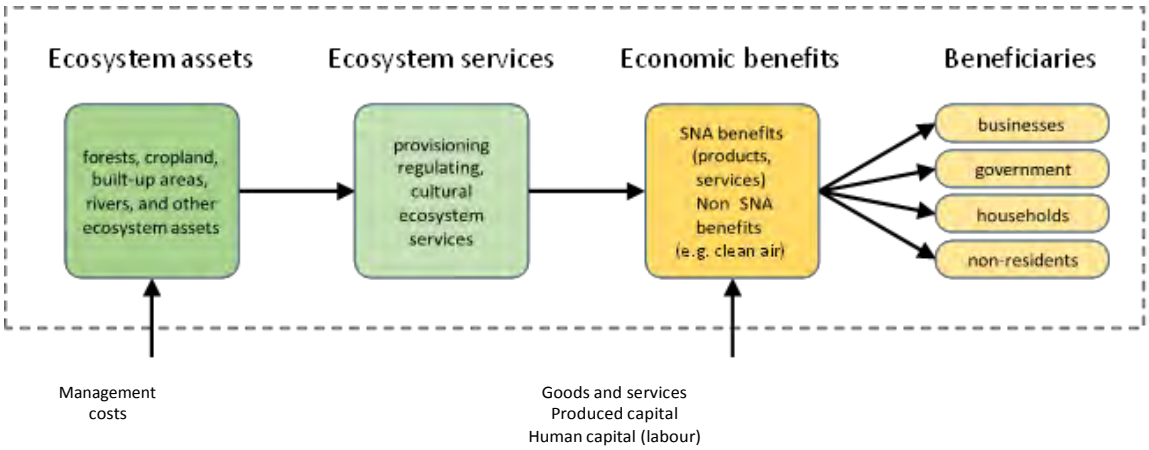

Figure 6.1 Key components for monetary valuation in the SEEA EEA

6.3.2 Which values matter?

The SEEA's valuation method can be compared to the Total Economic Value (TEV) framework, which organizes various types of value. TEV differentiates between use values (three types) and non-use values (three types), all of which are economic and depend on human preferences and perceptions. Use values are related to the benefits people receive from using ecosystem assets, either now or in the future. The three types of use values are:

1. **Direct use value** comes from the actual use of an ecosystem asset by humans to generate a benefit, such as timber, crops, fish, or recreational activities.
2. **Indirect use value** refers to the benefits humans receive from the natural functions of an ecosystem asset, like air filtration, pollination, or carbon storage.
3. **Option value** is a specific form of use value, representing the willingness to pay to preserve the option of using a resource in the future. The option value is relevant when future demand for an ecosystem service is uncertain or when the long-term effects of current decisions are unknown, such as the potential value of a forest for future medicinal plant discoveries.

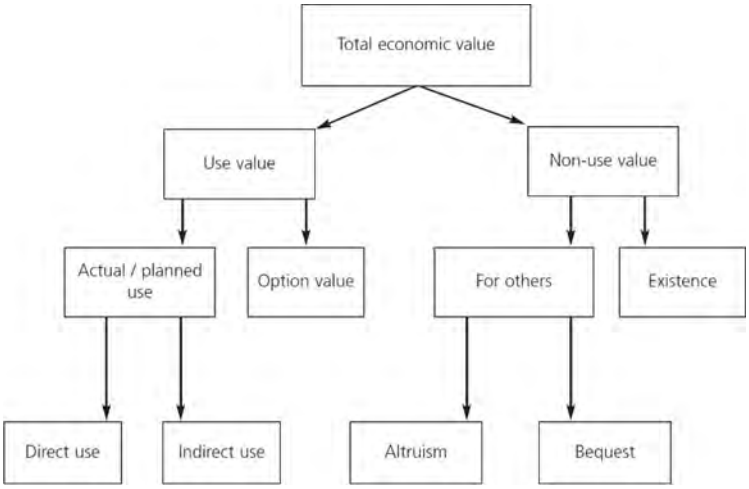

Figure 6.2 The Total Economic Value Framework

Non-use values stem from qualities intrinsic to the ecosystem. There are three types of non-use values:

4. **Existence value** is the satisfaction gained simply from knowing that something exists.
5. **Altruistic value** comes from the satisfaction of knowing that others benefit from the ecosystem.
6. **Bequest value** is the satisfaction derived from knowing that future generations will be able to use the ecosystem.

6.4 Valuation methods

6.4.1 Market-based methods: Resource Rent

Resource rent refers to the economic rent generated from environmental assets, including natural resources and ecosystems (SNA, 2008). It can be calculated using national accounts by subtracting the costs of labor, produced assets, and intermediate inputs from the market value of the outputs (benefits). This pricing method is typically used for provisioning services, such as those from agriculture, forestry, and fishing, especially in cases where land leases or prices are not viable indicators of the value of ecosystem services (SEEA EEA, 5.79).

6.4.2 Market-based methods: Rent prices

Rent is the income earned by the owner of a natural resource (the lessor or landlord) for allowing another entity (the lessee or tenant) to use the resource for production purposes (SNA, 7.109). In some cases, rental prices can serve as a proxy for valuing ecosystem services. For instance, the rent paid for agricultural land

reflects the ecosystem services provided by that land, as farmers rent land for activities like crop production or livestock farming, directly tying these payments to the services the land offers.

6.4.3 Cost-based methods: Replacement Costs

The replacement cost method estimates the value of an ecosystem service by considering the costs that would arise from taking mitigating actions if the service were lost (SEEA EEA, 5.84). This method is especially relevant for regulating services like flood protection and water filtration (SEEA EEA, 5.85). The key assumption behind the replacement cost method is that the service can be replaced by a man-made alternative. However, it can be challenging to find exact substitutes for ecosystem services, and some may be irreplaceable. In such cases, the replacement cost method is not applicable.

6.4.4 Cost-based methods: Avoided Damage

The avoided damage method estimates the value of ecosystem services by considering the costs of damages that would occur if these services were lost (Farber, Costanza, Wilson, 2002; De Groot et al., 2002). Similar to the replacement cost method, it focuses on services provided by ecosystems that are degraded due to human activities, especially through pollution. This method is particularly useful for assessing the value of regulating services like erosion control, flood protection, sedimentation control, air purification, and carbon sequestration. It assumes that individuals are willing to pay to prevent these damages (SEEA EEA TR, 5.101).

6.4.5 Revealed preference methods: Travel Costs

The Travel Cost Method is used to estimate the monetary value of recreational ecosystem services. Since accessing nature for recreation often involves travel, the expenses incurred by consumers to visit a site (e.g., transportation, fuel, parking fees, bike rentals) serve as a proxy for their willingness to pay for these services. Essentially, this method reassigns market-based transactions (travel expenses) to environmental services (ONS, 2014). Additionally, travel time and time spent at the site can also be valued, though these are typically considered welfare values (SEEA EEA, 5.103; ONS, 2014).

6.5 VALUATION OF ECOSYSTEM GOODS & SERVICES

6.5.1 Introduction

This report addresses the need for information on the economic value of ecosystem services and the potential loss of this value due to exploitation activities in the Area. Such data can be used to establish fees for damage to natural capital (i.e., internalizing the external costs of activities), determine compensation for beneficiaries losing ecosystem services, and optimize mitigation efforts in mining operations by prioritizing the protection of high-value ecosystem services. The valuation in this report focuses on biotic natural capital (ecosystems) rather than abiotic natural capital (minerals and fossil fuels).

6.5.2 Concept of Total Economic Value (TEV)

The concept of Total Economic Value (TEV) is one of the most widely used frameworks for identifying and categorizing forest benefits. It attempts to account comprehensively for all forest ecosystem services, categorizing these into direct, indirect, option, and existence values (Table 6.1).

Table 6.1: Total Economic value (TEV) framework

Total Economic Value	
Use Value	Non-Use Value
Direct Use Value Indirect Use Value Option Value	Existence value Altruistic value Bequest Value

6.5.3 Forest Classification of the present study

The classification of forest used currently for NPV rates is based on two parameters:

6 Eco-classes (as aggregated by Forest Type Groups according to Champion & Seth Classification)

3 Canopy Cover Density Classes which include Very Dense Forest (VDF), Moderately Dense Forest (MDF) and Open Forest (OF).

Eco-class III: Tropical Dry Deciduous Forests

Eco-class- IV: Tropical & Subtropical Dry Evergreen Forests

Grasses and bushes in these areas help in sequestration of carbon in significant quantity along with preventing release of soil carbon (FAO 2010). Many such areas are also critical habitats for biodiversity and hence are important. In the light of these facts, the forest canopy density class has been included as the second parameter for classification with four levels - namely Very Dense Forest (VDF), Moderately Dense Forest (MDF), Open Forest (OF) and Scrub.

6.6 Valuation of Ecosystem goods and services used in the study

The current study made significant efforts to identify objective parameters for capturing the economic value of biodiversity but was unable to find a scientific indicator for this purpose. Although some biodiversity benefits are reflected in ecosystem services like bioprospecting, pollination, seed dispersal, and soil conservation, the study acknowledges the considerable uncertainty involved in directly valuing biodiversity due to limitations in available datasets and valuation methodologies.

The methodology adopted for valuation of Ecosystem goods and services used in the study as per CESM Report (2013), updating the current value as per Ministry of Environment, Forest and Climate Change (Forest Conservation Division) Government of India, vide File No.5-3/2011-FC(Vol-I), dated: 6th January, 2022.

6.6.1 Timber/Wood production

Timber remains one of the most marketable benefits derived from forests. Although forests in India are not specifically managed for timber production following the National Forest Policies of 1952 and 1988, the economic value of timber from Indian forests remains significant. In the Net Present Value (NPV) calculations, the economic value of timber reflects the potential production that would have occurred if the land had continued to be used for forestry.

In this study, the following assumption was made:

For existing forests, the economic valuation of timber production was set at Rs **63032.94** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.2 Fodder production

Forests are crucial for providing fodder to individuals engaged in livestock-based livelihoods. A substantial portion of cattle used in livestock management graze in forests. It is assumed in this study that the economic value of fodder production is consistent across different forest canopy cover density classes, based on the ease of access to forests with varying canopy densities.

(a) For existing forests, the economic valuation of fodder production was set at Rs **19178.55** per hectare per year, according to the CESM Report (2013).

6.6.3 Bamboo production

The 2006 NPV Expert Committee Report did not include the value of bamboo production in its calculation of NPV for forest diversion. However, this study incorporates new, reliable data on bamboo production. Similar to timber, bamboo biomass data for different forest classifications is sourced from the Forest Survey of India's Forest Inventory Data. Using an average rotation period of 4 years, Von Mantel's formula is applied to estimate the mean annual bamboo production from these biomass estimates. A cost adjustment factor of 20% is applied to the market price of bamboo to account for factors such as high local community use and the opportunity costs associated with bamboo extraction and transportation.

(a) For existing forests, the economic valuation of bamboo production is set at Rs **6539.22** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.4 NTFPs (Non wood forest products)

The significance of Non-Timber Forest Products (NWFPs) for local forest communities cannot be overstated. NWFPs play a crucial role in the livelihoods of these communities. Although estimates of NWFPs' contribution to average family income can vary, research consistently shows that NWFPs often represent a substantial portion of the total income for forest-dependent families. The 2006 NPV Expert Committee calculated the value of NWFP production from forests using data from the 1999 Common Property Resources in India study.

For existing forests, the economic valuation of NWFPs is set at Rs **26123.22** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.5 Fuelwood

Fuelwood is essential for the rural population in India, serving as a primary source for cooking and other household and non-agricultural uses. The economic value of fuelwood production from forests is estimated for various states using adjusted consumption estimates and market prices. Data indicates that over half of the country's fuelwood needs are met from forests. While numerous surveys have been conducted to estimate fuelwood consumption, many fail to account for significant unauthorized removals that go unreported. The actual fuelwood consumption in the country is estimated to be only about 10% of what is officially reported.

As with fodder production, it is assumed that the economic value of fuelwood production is consistent across all forest canopy cover density classes, based on ease of access.

(a) For existing forests, the economic valuation of fuelwood production is set at Rs **8139.6** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.6 Carbon sequestration

Forests play a crucial role in sequestering large amounts of CO_2, helping to mitigate the severe impacts of climate change. When forests are diverted, their capacity to sequester CO_2 is significantly reduced. The social cost associated with the lost CO_2 sequestration due to forest diversion needs to be accounted for. Given the long-term impact of forest diversion, a low discount rate is applied. For India, the average social cost of CO_2, with low discount rates, is approximately US$ 10 per ton of CO_2, based on rates for 2015 (US$ 5.47), 2025 (US$ 10.12), and 2035 (US$ 14.47).

To estimate CO_2 sequestration for different forest classification units, biomass estimates from the Forest Survey of India's Forest Inventory (FSI 2013c) are used. These estimates, along with default IPCC values, help determine carbon sequestration rates. The average social cost of CO2 (US$ 10 per ton) is then used to calculate the economic value of carbon sequestration.

For existing forests, the economic valuation of carbon sequestration is set at Rs **3736.26** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.7 Bioprospecting and Gene-pool Protection

In light of rising species extinction rates globally, the importance of forests in conserving species with potential future economic value is increasingly acknowledged. This insurance value of forests is related to the option value within the Total Economic Value framework. Although this area is still developing in terms of research, state-wise estimates of the economic value of bioprospecting are available for India. The study provides the Net Present Value (NPV) of bioprospecting for various states based on three parameters: (i) the number of medicinal plants in each state, (ii) the number of species of conservation importance in each state, and (iii) all species in each state. This study uses estimates based on the total number of species in each state. Due to limited data on canopy cover density classes, the economic value of bioprospecting is assumed to be uniform across all forest canopy cover density classes.

(a) For existing forests, the economic value of bioprospecting and gene-pool protection is set at Rs **103813.56** per hectare over 20 years, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.8 Pollination and seed dispersal

The 2006 NPV Expert Committee did not include the value of pollination and seed dispersal services from forests in India. However, this study recognizes their significance, especially in a country like India, where a large portion of the workforce relies on agriculture for their livelihoods. The degradation of these services has been notably impactful in India, as seen in cases such as the decline in apple production in Himachal Pradesh due to forest shrinkage.

The economic value of pollination and seed dispersal services has been estimated based on the cost of natural forest regeneration and its replacement cost if done artificially, which is Rs 17,100 per hectare as recommended by the National Afforestation Programme Guidelines (NAP 2009). Estimates of natural forest regeneration across different forest types have been adjusted to account for regeneration in plantations. It

should be noted that this estimate reflects only the cost of artificially replacing natural forest regeneration and partially covers the economic value of forest succession.

Due to the lack of reliable estimates for India, it is conservatively assumed that only 50% of natural regeneration can be attributed to pollination and seed dispersal services provided by insects, birds, and other animals, with the remainder attributed to natural processes like water flow and wind. To account for the proximity of agricultural landscapes to scrub and open forests and the good habitat for pollinators in moderately dense and very dense forests, a uniform value is used across different canopy cover density classes.

(a) For existing forests, the economic value of pollination and seed dispersal is estimated at Rs **15555.51** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.9 Soil conservation

The ability of forests to prevent soil erosion largely depends on their canopy cover, which intercepts precipitation. To estimate their effectiveness in preventing soil erosion, relative weights for different canopy density classes have been calculated. The study considers the avoided nutrient loss of three major nutrients—nitrogen, phosphorus, and potassium—as a result of soil conservation by forests. The concentration of these nutrients in runoff is used to estimate nutrient loss through soil erosion. The avoided loss of nutrients is then valued based on the market price of fertilizers in India.

Using the quantity of nutrient loss prevented by forests through soil conservation and the cost of fertilizers needed to replace these nutrients, the total economic value of soil conservation by forests is estimated.

(a) For existing forests, the economic value of soil conservation is estimated at Rs **13806.72** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.10 Water recharge

The economic value of hydrological services, including soil conservation, is considered under the umbrella of "watershed services." This study estimates the economic value of water recharge using a simplified water balance equation:

$$P=E+R+F+GW$$

Where:

- P = precipitation
- E = evapotranspiration
- R = runoff
- F = moisture required to saturate the soil to field capacity
- GW = groundwater recharge

Assuming that precipitation, evapotranspiration, and moisture requirements remain constant even if forests are diverted, the contribution of forests to groundwater recharge is estimated by comparing runoff rates from forested areas to those from non-forested areas. Given that canopy cover significantly influences groundwater recharge, a linear relationship between runoff as a percentage of precipitation and vegetation cover is assumed. Estimates for extreme scenarios, such as runoff rates in Very Dense Forests (2% of precipitation) and bare soil (19.6% of precipitation), are used. Runoff rates for Medium Dense Forests (MDF), Open Forests (OF), and Scrub are interpolated based on average canopy covers of 0.55, 0.25, and 0.05, respectively. These estimated runoff rates are then used to calculate the additional groundwater recharge provided by forests compared to bare land. The economic value of this additional groundwater recharge is determined using the market value of water.

(a) For existing forests, the economic value of water recharge is estimated at Rs **1941.57** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF) (CESM, 2013).

6.6.11 Carbon storage

The carbon stored in forests has significant economic value as it prevents carbon from being released into the atmosphere and contributes to climate change. When forests are diverted, this carbon storage is lost, increasing the likelihood of carbon being emitted. The economic value of the carbon stored in forests is estimated based on the social cost of CO_2.

It is important to note that the carbon stock in Scrub, particularly below-ground biomass, can be substantial and comparable to that of Open Forest (OF). Consequently, the carbon stock for Scrub is treated as equivalent to that of Open Forest in each Forest Type Group. Additionally, while carbon release rates from

different forest carbon pools can vary, the study simplifies calculations by assuming that all stored carbon is released at once if forests are diverted.

(a) For existing forests, the economic value of carbon storage is estimated at Rs **413161.2** per hectare over 20 years, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.12 Water purification

Reliable data on the contribution of forests to water purification services is lacking both regionally and nationally in India. Forests naturally filter precipitation and purify water; however, when forests are removed, this natural purification process is severely disrupted. Consequently, artificial water purification systems must be installed, which come with high setup and ongoing maintenance costs to ensure a continuous supply of clean water.

Due to the absence of specific data for different forest type groups or canopy cover density classes, the study uses a uniform estimate of Rs. 2,950 per hectare per year for the economic value of water purification services across all forest types and canopy densities.

(a) For existing forests, the economic value of water purification is estimated at Rs **4513.5** per hectare per year, assuming the forest is classified as Medium Dense Forest (MDF).

6.6.13 Summary of Economic Value of Ecosystem Goods & Services

Table 6.2: Economic valuation of Ecosystem goods & services

(*As per CESM Report (2013), updated by MoEf&CC, Government of India, vide File No.5-3/2011-FC(Vol-I), dated: 6th January, 2022)*

Sl. No.	Ecosystem Goods & Services & their economic value	Market cost (maximum)
1.	Timber/ wood production	Rs. 63032.94/ha/year
2.	Bamboo production	Rs. 6539.22/ha/year

3.	Fodder Production	Rs. 19178.55/ha/year
4.	Non wood forest produces (NWFP)	Rs. 26123.22/ha/year
5.	Fuel woods	Rs. 8139.6/ha/year
6.	Carbon sequestration	Rs 3736.26/ ha/year
7.	Bio-prospection and gene pool protection	Rs. 103813.56/ha (after 20 years)
8.	Pollination & seed dispersal	Rs. 15555.51/ha/year
9.	Soil Conservation	Rs. 13806.72/ha/year
10.	Water Recharge	Rs. 1941.57/ha/year
11.	Carbon storage	Rs. 413161.2/ha (after 20 years)
12.	Water purification	Rs. 4513.5/ha/year

6.7 References

- Report by Indian Institute of Forest Management (IIFM) in collaboration with Forest Survey of India (FSI), Dehradun on Revision of rates of NPV applicable for Different class/category of forests, dated November 2014.

- Ministry of Environment, Forest and Climate Change (Forest Conservation Division) Government of India, vide File No.5-3/2011-FC(Vol-I), dated: 6th January 2022.

Chapter - 7

Conclusions and Recommendations

- The Tamnar Tehsil was sparsely populated. It is not regarded as a vacation spot. The surface of the mine should be devoid of any uncommon variety of flora and fauna due to disturbances created by open-cast mining activities. The impact of opencast mining activities on quality of life or loss of amenity should be considered in more details.
- During the site survey, most of the domestic animals were spotted. Comprehensive conservation plans that are effectively planned and implemented should be in place for Schedule I and II animals.
- The Biological Diversity Act (2002), the area's conservation importance, local customs, traditions, customary rights, and the region's fauna and flora profile were all considered in creating the biodiversity management and conservation plan.
- During the present study, the physico-chemical and biological characteristics of all the water bodies in the Tamnar Tehsil indicate their healthy and productive nature. Surface water at all the sampling sites located near the Tamnar tehsil is suitable for drinking, aquaculture practices, irrigation and other usage of domestic purposes.
- Kelo River and all its adjoining streams are a major source of water for the local inhabitants.
- An estimate was made of the planned area's net groundwater and surface water availability. The groundwater recharge is in a balanced condition after taking the local agricultural and residential needs into account. Because of this, it is predicted that, after providing for the buffer zone's future needs, there is excess water available annually from the groundwater recharge. All things considered, groundwater's assimilation capacity is durable and will be able to sustain local activity.
- The entire ecological status like water quality and biological components of the Kelo River and its adjoining streams should be protected against further deterioration by considering the following points:

- Public awareness campaigns should be arranged to raise awareness about the need to clean, conserve, and manage rivers and other aquatic environments.
- Regular scientific monitoring is necessary to determine the pollution levels at the source, allowing for the precise identification of the pollutants' impact on the catchment region in advance.
- It is recommended that appropriate siltation wetlands be built at the sewage entry points of each hamlet situated along the riverbank.
- Additionally, planting should be done in the river's riparian zone to lessen soil erosion along the riverbank, perhaps improving the natural habitat of nearby faunal species.

- Dense forests of a mixed kind and sal were prevalent in the vicinity of the planned project location. There have been observations of wild species of sal (*Shorea Robusta*) and sagon (*Tectona garndis*) in tropical dry deciduous forests. The woodland area also includes several grazing grass types, herbs with therapeutic properties, and beneficial shrubs like *Acacia nilotica* (Khair) that can be used as animal fodder.
- It should be mentioned that creating green belts is a solution to every environmental issue, including noise pollution and land deterioration. Thus, plantations could be used as a barrier to support all important operations.
- The main contributors to air and noise pollution are the movement of vehicles used for material handling and the state of the roads. As such, it is recommended that materials be transported in covered vehicles. Maintaining appropriate environmental conditions in the area will also be aided by routine upkeep of the haul roads and automobiles.
- The local population may receive benefits from social festivals or other programs of a similar nature, as well as participation in mining activities and other social measures implemented by the authority.
- Based on the aforementioned study, it can be said that the current mine has no appreciable effect on the surrounding ecological elements, primarily the soil, water, and air quality. There is a lot of greenery in the immediate vicinity, including roadside plantations, reserve forests, agriculture regions, village orchards, and nearby streams and river, such as the Kelo River, however, development of a safety zone and green belt area should be carried out in afforested areas.

- The trees in the green belt should be planted in three layers, have three distinct heights, and be wind-firm, broad-leaved, and evergreen. In the necessary area, a colony and infrastructure should be established. Raising a sufficiently wide green belt on both sides of the freight route is necessary. Moreover, a water body ought to be created in the last mining vacuum. There should be a suitable conservation plan for the creatures on schedules I and II.
- The environment is greatly impacted by mining operations, compromising ecosystem services that are essential to both ecological balance and human well-being. Comprehending these effects via an ecosystem services inventory is crucial for efficient environmental management and corporate social responsibility. However, because there are fewer people in the planned mine region, there will be less of an influence on the surrounding ecosystem.
- It is necessary to set up a monitoring system to keep tabs on how ecosystem services evolve over time. Additionally, use adaptive management techniques to improve ecosystem resilience and lessen adverse effects.
- It is important to make sure that reporting ecosystem service inventories complies with local and other environmental standards. Additionally, openness could be improved by updating corporate sustainability reports on a regular basis and publishing inventory findings.
- To track changes in ecosystem services over time and incorporate feedback loops for adaptive management, a comprehensive monitoring Programme should be implemented. Additionally, constant monitoring will offer insights into the resilience of ecosystem services and the efficacy of mitigation strategies, enabling prompt modifications to management techniques.

- To effectively communicate the results and consequences of the ecosystem services inventory, stakeholder engagement initiatives should be strengthened. In order to promote common understanding and support for sustainable mining practices, transparent communication is essential for building confidence and fostering collaboration with local people, regulatory agencies, and other stakeholders.
- Training and capacity-building programs ought to be planned for staff members engaged in sustainability and environmental management projects. Increasing internal

capacity will facilitate the application of ecosystem-focused solutions and guarantee adherence to best practices and environmental laws.

- To improve ecosystem services within and surrounding mining operations, the potential for implementing nature-based solutions (such as green infrastructure and the restoration of degraded ecosystems) should be investigated. Solutions rooted in nature can offer sustainable and affordable means of reducing environmental damage, boosting ecosystem resilience, and improving biodiversity.
- To make sure the ecosystem services inventory is kept up to date and useful, a schedule for routine review and updating should be set. To preserve the credibility and utility of the inventory over time, regular updates will take stakeholder expectations, environmental conditions, and mining operations into account.
- By putting these suggestions into practice sustainability measures will be strengthened, and the mining area's ecosystem services will be preserved and improved. The corporation can attain long-term environmental stewardship and make a beneficial impact on the communities and areas in which it operates by incorporating environmental issues into fundamental business procedures and cultivating partnerships with stakeholders.

जबरदस्त वापसी • सेंसेक्स ने साल की चौथी और अब तक की 18वीं बड़ी रैली देखी

सेंसेक्स फिर 80 हजारी, 1 दिन में मार्केट कैप करीब 7.30 लाख करोड़ रुपए चढ़ा

बिज़नेस संवाददाता | मुंबई

अमेरिका में मंदी की आशंका कम होने दुनिया के बाजारों में तेजी रही। सेंसेक्स शुक्रवार को 1,331 अंक (1.68%) की बढ़त के साथ करीब दो हफ्ते बाद 80 हजार के ऊपर 80,437 पर बंद हुआ। वहीं निफ्टी में 397 अंक (1.65%) की उछाल के साथ 24,541 पर बंद हुआ। यह सेंसेक्स की इस साल एक दिन की चौथी और अब तक की 18वीं बड़ी उछाल है। इस साल में सेंसेक्स 3 जून को 2,507 अंक, 5 जून को 2,303 अंक, 7 जून को 1,619 अंक की बढ़त दर्ज हुई थी।

स्वस्तिका इन्वेस्टमार्ट के रिसर्च हेड संतोष मीणा के अनुसार, शुक्रवार की तेजी में कई फैक्टर्स ने योगदान दिया। फेड की ब्याज दर में रिकॉल का डर कम हुआ है और मजबूत रिटेल बिक्री के आंकड़ों के साथ-साथ उम्मीद से बेहतर रोजगार के आंकड़ों ने संभावित अमेरिकी मंदी की चिंताओं को कम किया है।

एफपीआई जितने शेयर बेच रहे, उससे ज्यादा घरेलू निवेशक लगा रहे

सेंसेक्स रिकॉर्ड लेवल से 1,431 अंक नीचे यानी रिकवरी से 1.47% पीछे है

सेंसेक्स रिकॉर्ड लेवल से 1,431 अंक (1.75%) और निफ्टी 470 अंक (1.88%) नीचे है। इस माह 1 अगस्त को सेंसेक्स 81,868 और निफ्टी 25,011 के रिकॉर्ड स्तर पर बंद हुए थे। इसी दिन इन्होंने 82,129 और 25,078 का ऑल टाइम हाई बनाया था।

एफआईआई ने 29 हजार करोड़ निकाले, डीआईआई ने 31 हजार करोड़ लगाए

अगस्त माह में 1 से 14 तारीख के बीच विदेशी निवेशकों (एफआईआई) ने भारतीय बाजार में कैश सेगमेंट में 29,743.43 करोड़ रुपए निकाले हैं। वहीं, घरेलू फंड्स (डीआईआई) ने 31,453.91 करोड़ रुपए लगाए हैं। यानी मार्केट को रिटेल निवेशक और घरेलू संस्थान ड्राइव कर रहे।

451.60 लाख करोड़ पहुंचा मार्केट कैप, उच्चतम स्तर से 10.78 लाख करोड़ कम

बीएसई में लिस्टेड कंपनियों का कुल मार्केट कैप 7.30 लाख करोड़ रु. बढ़कर 451.60 लाख करोड़ हो गया। यह 31 जुलाई के रिकॉर्ड स्तर 462.38 लाख करोड़ रु. से 10.78 लाख करोड़ रु. (2.3%) कम है। 5 अगस्त को 441.84 लाख करोड़ के निचले स्तर पर था।

इस साल राइट्स इश्यू से जुटाई 2.4 गुना पूंजी कैप, 17 हजार करोड़ जुटाए

शेयर बाजार की तेजी कंपनियों के लिए राइट्स इश्यू से पूंजी धन जुटाने के लिहाज से भी बेहतर साबित हुई है। इस साल में अब तक 13 कंपनियां राइट्स इश्यू से 17,087 करोड़ रु. जुटा चुकी हैं। यह पिछले साल 2023 में 12 कंपनियों द्वारा राइट्स इश्यू से जुटाए 7,266 करोड़ रु. से 2.4 गुना अधिक है।

ओला इलेक्ट्रिक के शेयर 20% उछले, मार्केट कैप 58 हजार करोड़ रुपए पार

ओला इलेक्ट्रिक मोबिलिटी ने इलेक्ट्रिक मोटर साइकिल सेगमेंट में उतरने की घोषणा की। इससे कंपनी के शेयर 20% उछलकर 132.76 रुपए पर पहुंच गए। 9 अगस्त को 76 रुपए के बेस प्राइस पर आया यह शेयर निवेशकों का 75% रिटर्न दे चुका है। कंपनी का मार्केट कैप 58.55 हजार करोड़ रुपए पर पहुंचा।

डायरेक्ट टैक्स एरियर डिमांड 43 लाख करोड़

नई दिल्ली | 31 मार्च, 2024 तक डायरेक्ट टैक्स एरियर डिमांड की साल की तुलना में 75.44% बढ़कर 43 लाख करोड़ हो गई है। आयकर अधिकारियों के मुताबिक 43 लाख करोड़ रुपए से ज्यादा की एरियर डिमांड में से 60% टॉप 5,000 मामलों की है। यह बहुत तेज बढ़ोतरी है और इसके लिए तत्काल कार्रवाई की जरूरत है। इसलिए सीबीडीटी द्वारा पहचाने गए टॉप 5,000 में आने वाले मामलों का विश्लेषण करने के लिए सीबीडीटी एक विशेष टीम का गठन करेगी। चालू वित्त वर्ष में अप्रैल से 11 अगस्त के बीच प्रत्यक्ष कर संग्रह 22% बढ़कर 6.93 लाख करोड़ से अधिक हो गया।

आईपीओः जेएसडब्ल्यू स्टील ने पेपर जमा किए

मुंबई | जेएसडब्ल्यू ग्रुप की कंपनी जेएसडब्ल्यू सीमेंट ने 4,000 करोड़ रुपए का आईपीओ लाने के लिए सेबी के पास ड्राफ्ट पेपर दाखिल कर दिए हैं। घटनाक्रम से जुड़े अधिकारियों ने यह जानकारी दी। उन्होंने बताया कि आईपीओ में 2,000 करोड़ रुपए के नए शेयर किए जाएंगे और ऑफर फॉर सेल के तहत इतनी ही राशि शेयर पेश किए जाएंगे।

फूड प्रोसेसिंग सेक्टर में एफडीआई 30% घटा

नई दिल्ली | देश के फूड प्रोसेसिंग सेक्टर में प्रत्यक्ष विदेशी निवेश (एफडीआई) वित्त वर्ष 2023-24 में 30% घटकर 5,037.06 करोड़ रुपए रह गया। 2022-23 में 7,194.13 करोड़ रुपए का एफडीआई आया था।

सूचना

[illegible] ... (.../2019-IA.III) दिनांक ... अगस्त 2024 के द्वारा महानदी कोल फील्ड्स ... कंपनी लिमिटेड की ... मिलियन टन प्रति वर्ष ... के लिए पर्यावरणीय स्वीकृति प्रदान की है। ... पर्यावरणीय स्वीकृति पत्र की प्रतियां ... में उपलब्ध हैं। ... वेबसाइट http://environmentclearance.nic.in और https://www.mahagenco.in पर अवलोकन की जा सकती है।

[illegible]

सस्ती आम सूचना पड़ेगी बहुत महंगी !!!

स्टील कारोबारियों से मिला आईफा सस्टेनेबल स्टील मैन्यू. एसोसिएशन का प्रतिनिधिमंडल, 'ग्रीन स्टील शिखर सम्मेलन' के लिए किया आमंत्रित

रायपुर | आगामी महीने मुंबई में आयोजित होने वाले 'ग्रीन स्टील शिखर सम्मेलन-2024' में शामिल होने के लिए आईफा सस्टेनेबल स्टील मैन्युफैक्चरर्स एसोसिएशन ने प्रदेश के स्टील कारोबारियों को आमंत्रित किया है। इस संबंध में एसोसिएशन के प्रतिनिधिमंडल ने प्रदेश के छत्तीसगढ़ मिनी स्टील प्लांट, छत्तीसगढ़ स्पंज आयरन मैन्युफैक्चरर्स और छत्तीसगढ़ स्टील री-रोलर्स एसोसिएशन के पदाधिकारियों से मुलाकात की। स्थानीय होटल में आयोजित एक कार्यक्रम में प्रतिनिधिमंडल ने बताया कि 'ग्रीन स्टील शिखर सम्मेलन-2024' का आयोजन 18 व 19 सितंबर को बॉम्बे प्रदर्शनी केंद्र, गोरेगांव मुंबई में किया गया है। इस सम्मेलन में विशिष्ट अतिथि केंद्रीय मंत्री ... नितिन गडकरी, इस्पात मंत्री एचडी कुमारस्वामी सहित अन्य मंत्री व उच्च अधिकारी शामिल होंगे। छत्तीसगढ़ के मुख्यमंत्री विष्णुदेव साय को भी विशेष अतिथि के रूप में आमंत्रित किया गया है। छत्तीसगढ़ मिनी स्टील प्लांट एसोसिएशन के महासचिव मनीष धुप्पड़ के अनुसार प्रतिनिधिमंडल को प्रदेश के स्टील उद्योग से संबंधित विभिन्न समस्या एवं मांग से अवगत कराया गया है जिस पर उन्होंने सम्मेलन में चर्चा कर समाधान निकालने के प्रयास की बात कही है।

सीडीएसएल के शेयर 10 फीसदी तक उछले

मुंबई | सीडीएसएल के शेयर शुक्रवार को एनएसई पर 10 फीसदी तक उछल गए। 2,812 की ऊंचाई छूने के बाद अंत में 9 फीसदी बढ़त के साथ 2,788 रुपए पर बंद हुए। इस हफ्ते कुल 4 में से 3 कारोबारी सत्र में शेयर में बढ़त देखने को मिली है।

आम सूचना

[illegible]

ईश्तहार

[illegible]

आम सूचना

[illegible]

नोटिस

[illegible]

प्रतिभूति कागज कारखाना, नर्मदापुरम-461005 (म.प्र.)

(भारत प्रतिभूति मुद्रण तथा मुद्रा निर्माण निगम लिमिटेड की इकाई)

भारत सरकार के पूर्ण स्वामित्वाधीन

[illegible]

CIN U22213DL2006GOI144763, GSTIN: 23AAJCS0711J3ZE

Tel. No. 07574-286517-18, Fax No. 07574-255173, E-mail: [illegible], Website: http://spmnarmadapuram.spmcil.com

क्रमांक: एस.आर./1(33)/सुरक्षा/विज्ञा.क्र.-177 दिनांक : 17.08.2024

भर्ती

प्रतिभूति कागज कारखाना, नर्मदापुरम (म.प्र.) संविदा आधार पर "सुरक्षा अधिकारी" की नियुक्ति हेतु आवेदन आमंत्रित करता है, जिसका विवरण निम्नानुसार है :-

क्र.	पदनाम	पद	योग्यता	ग्रेड	वेतन/परिलब्धियां
1	सुरक्षा अधिकारी	एक (01)	सेना / पैरा मिलिट्री / राज्य पुलिस से सेवा-निवृत्त अधिकारी जो सेवा-निवृत्त के समय सातवें वेतन आयोग के पे मैट्रिक्स लेवल 10 के वेतनमान पर नियमित पद धारित किये हों।	ई-1 से ई-2	रु.58,000/- प्रतिमाह (अन्य परिलब्धियां सहित)
2	आयु सीमा : अधिकतम 62 वर्ष, तैनाती स्थान : प्रतिभूति कागज कारखाना, नर्मदापुरम (म.प्र.)				

विस्तृत विवरण हमारी वेबसाइट- http://spmnarmadapuram.spmcil.com (Careers) पर उपलब्ध है।

मानव संसाधन विभाग

GOVT. OF BIHAR

BIHAR COMBINED ENTRANCE COMPETITIVE EXAMINATION BOARD

I.A.S. Association Building, Near Patna Airport, Patna-14.

UNDER GRADUATE MEDICAL ADMISSION COUNSELLING (UGMAC)-2024 for MBBS/ BDS/ B.V.Sc. & A.H. in Govt. Medical / Dental / Veterinary Colleges and Private Medical / Dental Colleges of Bihar

Adv. No.- BCECEB(UGMAC)-2024/02 Dated 14.08.2024 bceceboard.bihar.gov.in

Important Notice

Online Application Form are invited from qualified, eligible & interested NEET(UG)-2024 candidates for appearing in the Under Graduate Medical Admission Counselling (UGMAC)-2024 in order to select candidates for admission to the first year UG Medical / Dental Courses (MBBS / BDS) in Government / Private Medical / Dental Colleges of Bihar state and B.V.Sc. & A.H. courses in Govt. Veterinary Colleges of Bihar based on the Merit-List / Rank-List of UGMAC-2024 prepared on the basis of merit list of NEET (UG)-2024 conducted by the National Testing Agency (NTA).

2. DQ candidates must note that they have to submit DQ certificate issued by only authorised Centres / Institutes on prescribed proforma as per para 3.6.3 (Annexure-5, 6, 7) of the prospectus of UGMAC-2024 at the time of counselling / document verification. For this, after filling and downloading the hard copy of [illegible]

पूर्व मध्य रेल

ई-निविदा सूचना

[illegible]

आम सूचना

[illegible]

आवेदिका

आम सूचना

[illegible]

Ladki Bahin grants start flowing, 80 lakh get ₹3000

Priyanka.Kakodkar
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Mumbai: Two days ahead of its launch, Maharashtra govt has already deposited Rs 3,000 into the accounts of 80 lakh women who are beneficiaries of Mukhya Mantri Majhi Ladki Bahin Yojana. The state expects over one crore beneficiaries to receive the stipend in the first phase, which will launch on Aug 17.

However, it's not clear how many of the 27 lakh accounts (from total 1.3 crore eligible applicants so far), which have been facing Aadhar linkage issues, have been rectified. "This issue is being worked on and will be resolved soon," said women and child welfare minister Aditi Tatkare.

So far, 1.6 crore women have applied for the scheme. The state started disbursing the stipend from Aug 14. The Rs 1,500 per month stipend for July and Aug, amounting to Rs 3,000, is being given at the same time. Tatkare has made it clear that the scheme will continue even after the application deadline of Aug 31.

"Initially, we were testing the accounts by transferring Rs 1. Then we decided to send the stipend of Rs 3,000 to side-step technical problems on the day of the launch," said Maharashtra CM Eknath Shinde on Thursday.

(With inputs from Manoj Badgeri and Pradeep Gupta)

Nitish hikes jobs creation target from 10L to 12L before '25 polls

Patna: Bihar govt has decided to provide jobs to 12 lakh youths, instead of 10 lakh announced earlier, before the assembly elections next year, chief minister **Nitish Kumar** announced in his Independence Day speech at Patna's Gandhi Maidan, reports **Madan Kumar**.

Asserting that his govt was continuously working towards fulfilling its commitment under 'Sat Nischay Part-2' programme, announced in

2020, to create 10 lakh jobs and another 10 lakh "opportunities of employment", Nitish said: "So far, a total of 5.16 lakh youths have already been provided govt jobs. Besides this, process of recruitment has already been completed for another 2 lakh posts...."

The state had surpassed its target of creating "opportunities of employment", with around 24 lakh people being provided such job opportunities in different sectors in the last four years, the CM added. "We have fixed a target of providing opportunities of employment to another 10 lakh people this year and the next year. Thus, a total of 34 lakh people would be provided employment opportunities by the next year, instead of 10 lakh announced earlier," he added.

Nitish also referred to the special financial package for Bihar announced recently by the Centre, and said he had continuously been pushing for granting special category status to the state or announcing a special package.

ED attaches ₹678 cr Avantha Group assets

Cos Routed ₹1,307Cr Of Loans To Related Entities Sans Nod

TIMES NEWS NETWORK

Avantha group is owned and controlled by industrialist Gautam Thapar

New Delhi: Enforcement Directorate on Thursday said it has attached properties worth over Rs 678 crore of the Avantha Group, owned and controlled by industrialist Gautam Thapar, in an alleged bank fraud and money-laundering case. The properties include land parcels located in Haryana, Maharashtra and Uttarakhand.

The agency said its investigation revealed that Avantha Group companies availed loans of more than Rs 2,400 crore from a consortium of banks led by SBI and later diverted over Rs 1,307 crore to related entities. These loans were availed without the due authorisation of the boards of these banks, ED said.

In Jan this year, ED had arrested Madhav Acharya, a senior official of Avantha Group in its money laundering case, which was based on a June 2021 FIR registered by CBI against Thapar, his CG Power and Industrial Solutions Ltd and other associates. Earlier, two attachments worth over Rs 14 crore were made, taking the total attachment to Rs 692 crore.

ED quoted a disclosure made by CG Power and Industrial Solutions Ltd before SEBI earlier which had "revealed that assets and liabilities of the company have been understated considerably and advances to related parties and unrelated parties have been understated".

It has found wrongful pledge of certain assets as collateral where the company was a co-borrower and guarantor for enabling financing of loans. These loans were later routed out of the company without due authorisation, the agency said.

The notice of the disclosure was taken by the lender banks led by SBI to lodge a complaint with CBI. The anti-corruption agency registered an FIR on June 22, 2021, which was the basis for the ED to initiate its money laundering probe.

In another money-laundering case related to Yes Bank, ED had arrested Gautam Thapar on Aug 4, 2021, after a series of day-long searches on his premises. ED's Yes Bank case revealed that Thapar and Avantha Realty Ltd, Oyster Buildwell Pvt Ltd and others were allegedly involved in criminal conspiracy and forgery for diversion of public money during 2017 to 2019, causing loss of Rs 466 crore to Yes Bank.

Guard against those trying to lead nation to anarchy: PM

New Delhi: In a veiled attack on the opposition over repeated protests and narratives like "threat to Constitution", PM Modi Thursday urged people of the country to be cautious about those trying to lead it to "anarchy and destruction" and those who are full of negativity and cannot see India's progress. He cautioned that the country must avoid these people, who are "mired in despair".

"When a handful of such individuals, consumed by their own negativity, spread this kind of toxicity it leads to anarchy, destruction, chaos, and setbacks that necessitate immense efforts to rectify," Modi said.

The PM, who was accused of conspiring to scrap quotas for SCs, made several references Dalits, tribals and the deprived and said that his focus on "saturation development" would be benficial particularly to these sections.

PM Modi said these "pessimistic elements are nurturing a negative mindset that dreams of destruction and seeks to undermine our progress". TNN

Remission for 1,160 prisoners: On the occasion of 78th Independence Day, director general of prisons, Delhi, Satish Golcha announced the grant of remission to 1,160 convicts. PTI

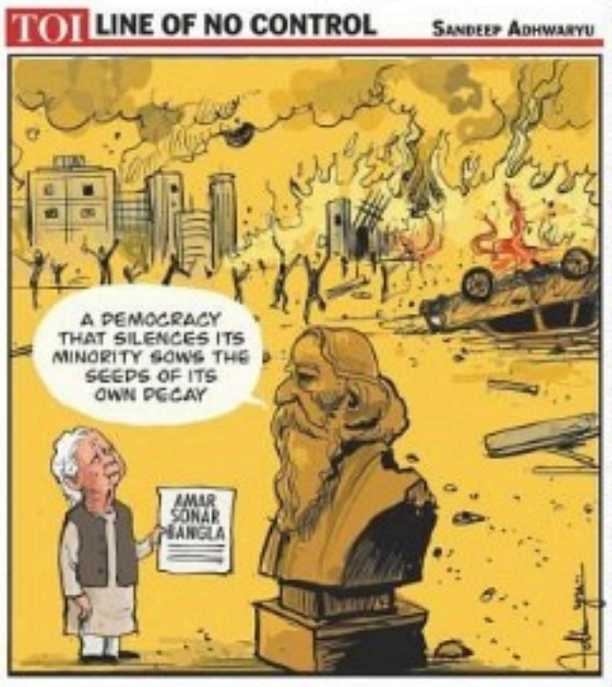
Govt to create 75k new med college seats in 5 years

TIMES NEWS NETWORK

New Delhi: Recognising the pressing need to provide more opportunities for medical professionals to receive quality education within the borders, PM Modi in his Independence Day address Thursday announced a significant initiative — the creation of 75,000 new medical seats across the country over the next five years.

The PM said his vision extended beyond merely increasing the number of medical seats, as he drew inspiration from the ancient Nalanda university to position India as a global education hub.

TOI LINE OF NO CONTROL — SANDEEP ADHWARYU



CJI: Emergency, B'desh remind us how valuable freedom is

AmitAnand.Choudhary
@timesofindia.com

New Delhi: Invoking the Emergency, when fundamental rights of citizens were suspended and people were subjected to various restrictions, and the present situation in Bangladesh, CJI D Y Chandrachud Thursday said people, who are taking freedom & liberty for granted, should dwell on stories of the past to know how precious freedom is.

The CJI emphasised the role played by lawyers and judges, as part of the judicial system, to protect the freedom and liberty of citizens.

"What is happening today ... years here today or most of them are of the post-independent generation and I myself of that generation. But many of you are of the post-Emergency generation, therefore it is very easy to take freedom for granted, it is simple to take liberty for granted. But it is important that we dwell on the stories of the past to remind us how precious freedom is," he said.

"As a judge for the past 24 years, I can keep my hand on my heart and say that the work of the courts reflect the struggles of ordinary Indians navigating the rough and tumble of their daily lives. The SC sees throngs of litigants seeking justice. The legal community allows the court to do justice to these citizens in no small measure," the CJI said.

Stalin changes mind, takes part in governor's 'at home reception'

Chennai: Tamil Nadu chief minister M K Stalin and his Cabinet colleagues took part in 'At Home Reception' hosted by governor RN Ravi at Raj Bhavan on Thursday.

Stalin's participation in the customary event assumes significance as DMK had already announced that there would be no representation from party side. DMK's allies, including Congress, also had made it clear that they would boycott the reception as the governor functioned against the 'state's interests'.

Staling presented a shawl and a book to the governor. Speaker M Appavu & state ministers including Durai murugan, Udhayanidhi Stalin and K Ponmudy took part in event. PTI

रायगढ़ । 15 अगस्त को
ी पावन बेला में सरदार
ल हाई स्कूल (आत्मानंद
क स्कूल) में आजादी दिवस
साथ मनाया गया। नव भवन
। यह स्कूल वर्तमान में पूर्व
ला प्रांगण में लग रही है और
भवन का कार्य चल रहा है।
ने रायगढ़ जिले के सभी विद्यालय में शिक्षा का स्तर सुधारने एवं विकास कार्य को बढ़ाने के मकसद से जिले में सभी विद्यालयों में शालेय विकास समिति का गठन किया है जो समय-समय पर स्कूल के कार्यो का समीक्षा करते रहेंगे और स्कूल के स्तर में क्या सुधार लाया जा सके जिससे स्कूलों का स्तर सुधार सके इसकी समीक्षा कर समिति के अध्यक्ष उनके अवगत कराते रहे। सरदार वल्लभ भाई पटेल हाई स्कूल (आत्मानंद स्कूल/नगर पालिक स्कूल) में तीन पाली में समिति के अध्यक्षों की नियुक्ति की गई है जिसमें हायर सेकेंडरी के लिए युवा नेता मंजूल दीक्षित, हाईस्कूल के लिए युवा नेता पवन शर्मा एवं मिडिल स्कूल के लिए पूर्व पार्षद संजय ज्ञानू मोदी को अध्यक्ष बनाया गया है, स्वत्रंता दिवस पर हाई स्कूल के अध्यक्ष पवन शर्मा एवं मिडिल स्कूल के अध्यक्ष संजय ज्ञानू मोदी के मुख्य आतिथ्य में ध्वजारोहण किया । उसी के साथ पिछले वर्ष के 10 वीं एवं 12 वीं के मेधावी छात्रों का स्कूल फैकल्टी एवं स्कूल की पूर्व प्राचार्य श्रीमती कल्याणी मुखर्जी की तरफ से सम्मान किया गया एवं स्कूल के बच्चों ने सांस्कृतिक कार्यक्रम का आयोजन भी किया । इस अवसर पर राष्ट्रपति पुरस्कार से सम्मानित राधेश्याम श्रीवास्तव , स्कूल के प्राचार्य मेहर पूर्व प्रभारी प्राचार्य नायक , सहायक निरीक्षक इंगेश्वर यादव, सौरभ चौधरी एवं अजय शर्मा सहित पूरी स्कूल शिक्षक एवं स्टाफ मौजूद रहे।

सरिया ।
दिवस के पावन
सरिया स्थित डेप
स्कूल में भव्य
आयोजन किया
मौके पर भाजपा
पंचायत सदस्य वै
ध्वजारोहण कर
शोभा बढ़ाई। नन्हे
साथ राष्ट्रगान की
फहराते हुए, उन्हो

सूचना

यह सूचित किया जाता है कि पर्यावरण वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार, नई दिल्ली ने अपने पत्रांक संख्या J-11015/72/2016-IA.II(M) दिनांक 13 अगस्त 2024 के द्वारा महाराष्ट्र राज्य विद्युत उत्पादन कंपनी लिमिटेड को ओपनकास्ट 22.0 एमटीपीए +भूमिगत 1.6 एमटीपीए क्षमता वाले गारे पाल्मा सेक्टर II कोयला खदान परियोजना के खनन के लिये 2583.48 हेक्टेयर के खदान क्षेत्र में जो कि लिबरा, डोलेसरा, टिहली रामपुर, पाता, ढोलनारा, मुड़ागांव, चितवाही, झिंकाबहाल, रोडोपाली, सारसमाल, कुंजेमुरा, भालुमुड़ा, गारे और सराईटोला तहसील तमनार, जिला-रायगढ़ छ.ग. में स्थित है, को पर्यावरणीय मंजूरी प्रदान की है। पर्यावरणीय मंजूरी पत्र की प्रतियां कार्यालय सदस्य सचिव, छत्तीसगढ़ पर्यावरण संरक्षण बोर्ड, पर्यावरण भवन, नार्थ ब्लाक सेक्टर-19, नया रायपुर, छत्तीसगढ़ मे उपलब्ध है। पर्यावरणीय मंजूरी पत्र पर्यावरण वन एवं जलवायु परिवर्तन मंत्रालय की वेबसाइट http://environmentclearance.nic.in और https://www.mahagenco.in की वेबसाईट पर भी उपलब्ध है।

वास्ते, महाराष्ट्र स्टेट
पावर जनरेशन कंपनी लिमिटेड
मुख्य अभियंता (कोयला)

कार्यालय नगर पालिक

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Phone no. 07762-222911

क्र. 14.22/रा.वि./ न.पा.नि./ 2024

-: ऑफर आमं

नगर पालिक निगम, रायगढ़ निम्नांकित स्थलों पर वाहन पंजीकृत डाक / स्पीड पोस्ट के माध्यम से ऑफर आमंत्रित समूह/एन.जी.ओ. कार्यालयीन समयावधि में निर्धारित तिथि त में जमा कर प्राप्त कर सकते हैं अथवा नगर निगम की वेबसाईट करना होगा।

पार्किंग ठेका का विवरण निम्नानुसार है -

क्र	स्थल का नाम	वाहन का प्र
1.	गांधी गंज मैदार	चार पहिया एवं
2.	नगर पालिक निगम, कार्यालय प्रांगण	चार पहिया एवं

ऑफर प्रपत्र प्राप्त करने एवं जमा करने की अंतिम तिथि
ऑफर प्रपत्र खोले जाने की तिथि 06.09.2024 समय
अन्य नियम/शर्ते ऑफर प्रपत्र कार्यालय से कार्यालय
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