SIX-MONTHLY COMPLIANCE REPORT

of

ENVIRONMENT CLEARANCE

(No. J-12011/26/2012-IA-I dated 4th September, 2019 and

EC amendment date 03.01.2024)

for

LOWER KOPILI HYDRO ELECTRIC PROJECT (120 MW), ASSAM

TO

MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE,

IA.I Division, Indira Paryavaran Bhawan, 3rd Floor, Vayu Wing, JorBagh Road,
New Delhi - 110 003

SUBMITTED BY

ASSAM POWER GENERATION CORPORATION LIMITED

December, 2024

Compliance of stipulated conditions of Environmental Clearance

Sl. No.	EC conditions	Status of Compliance
	Specific Conditions	
I	The Environmental Management Plan (EMP) shall be strictly adhered to and a sum of Rs.26147.5077 lakhs (Capital cost: 15427.689 lakhs & Recurring cost: Rs. l0l17.8l7 lakhs), the budgetary provisions for implementation of EMP, shall be fully utilized and not to be diverted to any other purpose. In case of revision of the project cost or due to price level change, the cost of EMP shall also updated proportionately.	Agreed.
II	The project proponent shall comply with the provisions contained in this Ministry's OM vide F. No.22-6512017-IA.III dated 1st May 2018 regarding Corporate Environment Responsibility. Project proponent shall require to invest Rs 5.81 crore for CER activities as submitted to the Ministry. A total budget of Rs. 5.81 crore shall be spent for upgradation of education facilities in existing schools (Rs. 66.0 lakhs), construction of community toilets (Rs.380.0 lakhs), upgradation of Health care facilities (Rs. 115.0 lakhs) and awareness generation (Rs 20.0 lakhs). The entire activities under CER shall be treated as project and shall be monitored. The monitoring report shall be submitted to the regional office as a part of half-yearly compliance report and to a District Collector.	Year wise CER and LAD plan are being prepared under the guidance of three committees through consultations with local people, Govt. line departments, etc. As soon as the plan is finalised it will be shared with MoEF&CC. Annexure 1 : LAD coordination Committee Annexure 2: Facilitation Committee Annexure 3 : CER, LAD committee
III	The environmental clearance is valid for period of 10 years from the date of issue of this letter for commissioning of the project.	Agreed
IV	After 5 years of the commissioning of the project, a study shall be undertaken regarding impact of the project on the environment and downstream ecology. The study shall be undertaken by an independent agency, decided in consultation with the Ministry.	Agreed
V	Any other clearances/permissions/approvals from any other organization/department, as applicable to the project shall be taken.	Agreed and obtained all the required clearances from other organization / department. As per the approved MOC from CEA on 9.11.22, Amendment in EC accorded on 03.01.20 by MoEF&CC, GOI. Annexure 4.
VI	PP shall procure construction material only from those Govt./Pvt. Agencies/Corporations/etc. that are having all applicable legal/statutory clearances/permissions or necessary permission to be obtained for quarrying construction materials for the project as per the EIA Notification, 2006 and subsequent amendments thereof.	Minor minerals are taken from the Govt. approved agencies. For extraction of aggregates, quarry area of 4.61 Ha has been identified and necessary clearances and permissions from North Cachar Hills Autonomous Council, Directorate of Geology and Mines, Forest Department has already been taken. EC accorded for the Quarry. Mostly the aggregates are being taken from the excavated materials only.
VII	Based on the recommendation of Cumulative Impact Assessment and Carrying capacity study of river basin or as per the ToR conditions or minimum 15% of the average flow of four consecutive leanest months or as submitted in the EIA/EMP report, whichever value is higher, shall be	Agreed

Sl. No.	EC conditions	Status of Compliance
	released as environmental flow.	
	Specific condition as per Amendment of EC dated 03.01.2024	
1.1	Aquatic study specially migratory aquatic species concerning occurrence of fishes/ habitat impact study shall be carried out from recognized Government Institute and prepare mitigation measures, with provision of financial budget revised in the EMP. The outcome of the said study shall be implemented,	APGCL has already entrusted the College of Fisheries, Raha, under Assam Agricultural University to carry out the study. Work order issued on 14.02.2024. The study was initiated from February 2024. 1st report submitted. (Annexure 5).
1.2	Submit undertaking that R&R scenario / habitat of flora and fauna of project are not changed due to modification of the project component.	Agreed and submitted to MoEF&CC on 21.11.2023. Annexure 6
	Standard conditions of Environmental Clearance	
I.	**Statutory compliance:**	
i	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.	• Stage-I Forest Clearance accorded by MoEF & CC, New Delhi on 5th February, 2019. • Stage-II Forest Clearance accorded by MoEF & CC, New Delhi on 04th December, 2020.
ii	The project proponent shall obtain clearance from the National Board for Wildlife, if applicable.	Not Applicable. There is no Wildlife Sanctuary or National Parks within 10 km radius of the project site.
iii	The project proponent shall prepare a Site-Specific Conservation Plan & Wildlife Management Plan and approved by the Chief Wildlife Warden, if applicable. 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 submitted to Chief Wildlife Warden, Assam on 25.6. 19. Biodiversity Management Committee has been constituted for implementation of the Wildlife Management Plan on 12.10.2022. First Biodiversity Management Committee meeting was organized on 21.12.2022. 2nd BMC meeting held on 21.06.2023 in the Divisional Forest Office, Dima Hasao West Division, Haflong and the 3rd BMC meeting held on 12.12.23. As per the agreed conservation strategy 10 camera traps wilh assesories were handed over to DFO, Dima Hasao on 13.06.24 for monitoring the terrestrial wildlife in Kruming RF.
iv	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.	Agreed. Package 2 Contractor has obtained the CTE and CTO for Crusher, 4 nos of DG sets; Batching Plant near power house along with 4 nos of DG sets and CTO for Batching Plant near Dam & 4 DG sets. CTO for crusher and DG sets obtained on 7/12.2021 vide Ref no. WB/SLC/T-1184/21-22/09/1152.

Sl. No.	EC conditions	Status of Compliance
		CTO for batching plant near Dam and DG sets obtained on 03.01.2023 vide Reference No. WB/SLC/T-1191/21-22/39. CTO for batching plant near Power House and DG sets obtained on 31.10.2023 vide Reference No. WB/SLC/T-1191/21-22/31. CTE will be obtained before construction of the 120 MW power generating plant. All the CTOs were submitted in the last six monthly compliance report to MoEF&CC. Package 2 Contractor has also obtained the following CTOs. CTO for 15 KLD Water Treatment Plant CTO for 15 KLD Water Treatment Plant Package 3 Contractor has obtained CTO for the RO plants from PCBA on 25.10.24 (Annexure -7). Hot mix plant is not installed for the project. Roads were blacktopped by engaging an approved third party who was doing road improvement works from Lanka to Umrangso.
v	NOC shall be obtained from National Commission of Seismic Design Parameters (NCSDS) of CWC.	Obtained and already submitted.
vi	Necessary approval of CEA shall be obtained for those projects having the project cost more than Rs. 1,000 crore.	Obtained and already submitted.
II. Air quality monitoring and preservation		
i	Regular monitoring of various environmental parameters viz., Water Quality, Ambient Air Quality and Noise levels as per the CPCB guidelines at designated locations shall be carried out on monthly basis and a detailed database of the same shall be prepared and recorded. This shall be used as a baseline data for post construction EIA / Monitoring purposes.	Regular monitoring done at project site at various sampling stations as mentioned in the EMoP (Environmental Monitoring Reports are enclosed in Annexure-8. The monitoring were carried out by MoEF&CC recognized Lab).
ii	Appropriate Air Pollution Control (APC) system shall be provided for all the dust generating points including fugitive dust from all vulnerable sources, so as to comply prescribed standards.	Regular monitoring done at project site. Adequate spraying of water in roads and dust control measures has already been installed in respective dust generation site.
iii	Necessary control measures such as water sprinkling arrangements, etc. bet taken up to arrest fugitive dust at all the construction sites.	Regular monitoring done at project site and water sprinkling done.

Sl. No.	EC conditions	Status of Compliance
		 
III. Water quality monitoring and preservation		
i	Before impounding of the water, Cofferdams for both at the upstream and downstream are to be decommissioned as per EIA/EMP report so that once the project is commissioned; cofferdam should not create any adverse impact on water environment including the rock mass and muck used for the Cofferdam.	Agreed.
ii	Water depth sensors shall be installed at suitable locations to monitor e-flow. Hourly data to be collected and converted to discharge data. The Gauge and Discharge data in the form of Excel Sheet is submitted to the Regional Office, MoEF & CC and to the CWC on weekly basis.	Regular recording of discharge data were taken from Kopili river. Automatic real-time sensor to collect data on water inflow and out flows from the hydropower dam is under process. 
IV. Noise monitoring and prevention		
i	All the equipment likely to generate high noise shall be appropriately enclosed or inbuilt noise enclosures be provided so as to meet the ambient noise standards as notified under the Noise Pollution (Regulation and Control) Rules, 2000, as amended in 2010 under the Environment Protection Act (EPA), 1986.	Agreed. All the DG sets are with acoustic enclosures.

Sl. No.	EC conditions	Status of Compliance
		
ii	The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.	Monitoring reports are enclosed in Annexure 8 and complied the Ambient Noise level standards.
V. Catchment Area Treatment Plan		
i	Catchment Area Treatment (CAT) Plan as proposed in the EIA/EMP report shall be implemented in consultation with the State Forest Department and shall be implemented in synchronization with the construction of the project.	An Amount of Rs. 28, 29, 67,000.00 (Rupees Twenty Eight Crore Twenty Nine Lakh Sixty Seven Thousand) only already paid to Forest Department for implementation of Catchment Area Treatment Plan (CATP). APGCL is pursuing with Forest Department for implementation. Implementation report from the State Forest Department not yet received. As per CAT Plan the land bank map was prepared (Annexure 9). As per the letter from CEO, CAMP, Govt of Assam the preparation of the action plan and implementation of CAT Plan will be initiated in the AOP 2024-2025. Letter dated 11.10.23.
VI. Waste management		
i	Muck disposal be carried out only in the approved and earmarked sites. The dumping sites shall be located sufficiently away from the HFL of the river. Efforts be made to reuse the muck for construction and other filling purposes and balanced be disposed of at the designated disposal sites. Once the muck disposal sites are inactive, proper treatment measures like both engineering and biological measures be carried out so that sites are stabilized quickly.	At present dumping of excavated earth in 4 locations in Revenue land are going on. Once the muck disposal sites are inactive, proper treatment measures like both engineering and biological measures will be carried out so that sites are stabilized quickly. Copy of the approved Muck Management Plan already shared in the earlier Compliance reports. The plan was updated based on the site conditions and asper the approved design by CEA. Subsequently it was approved by APGCL and PMC and submitted to ADB.
ii	Solid waste management should be planned in details. Land filling of plastic waste shall be avoided and instead be used for various purposes as envisaged in the EIA/EMP reports. Efforts be made to avoid one time use of plastics.	Agreed. SWM plan submitted to APGCL by package 2 contractor. At present segregation is going on at source and composting process is undertaken at site. Recyclable wastes are taken by vendors.

Sl. No.	EC conditions	Status of Compliance
		Package 1, 2, 3 contractors has an agreement with the Umrangso Municipality Board for disposal of Solid wastes.
VII. Green Belt, EMP Cost, Fisheries and Wildlife Management		
i	Detailed information on species composition particular to fish species from previous study/literature be inventoried and proper management plan shall be prepared for in situ conservation in the streams, tributaries of river and the main river itself for which adequate budget provision be made and followed strictly.	Agreed. As per EIA there was no fish species due to acidic nature of water. Hence no provisions were proposed for fish conservation in the EMP. 1st report by the College of Fisheries, Raha enclosed in Annexure 5. However, as per EC condition Downstream river ecology study will be conducted after 5 years of commissioning of the project as per the stipulation 7.(IV) to update the baseline information and plan will be updated accordingly. Moreover, as per the addendum to EC Aquatic study specially migratory aquatic species concerning occurrence of fishes/ habitat impact study shall be carried out from recognized Government Institute and prepare mitigation measures, with provision of financial budget revised in the EMP. Complying to the stipulation, APGCL has engaged the College of Fisheries Raha for Aquatic study. 1st report by the College of Fisheries, Raha enclosed in Annexure 5.
ii	Wildlife Conservation Plan prepared for both core and buffer zones shall be implemented in consultation with the local State Forest Department, if applicable.	Wildlife conservation and management plan was prepared during the EIA and it was submitted to CWLW, Assam. In the last three Biodiversity Management Committee meeting it was discussed and DFO's of the respective divisions were requested to prepare a year wise action plan for its implementation. APGCL has handed over 10 camera traps with accessories to the DFO, Dima Hasao for the terrestrial monitoring of wildlife.
iii	To enrich the habitat of the project site, plantation shall be raised as envisaged in the EIA/EMP report. Plantation to be developed along the periphery of the reservoir in multi-layers with local indigenous species in consultation with the local State Forest Department.	Agreed. Plantation already initiated.

Sl. No.	EC conditions	Status of Compliance
		   Plantation in the periphery of the reservoir will start soon.
iv	Compensatory Afforestation programme shall be implemented as per the plan approved.	Agreed. An amount of Rs. 15, 94, 23,850.00 (Rupees Fifteen Crore Ninety Four Lakh Twenty Three Thousand Eight Hundred Fifty) plus overhead only already paid to Forest Department for Compensatory Afforestation (CA) in CAMPA head. The 8 patches of Revenue land has already been notified as Reserved Forest by Govt. of Assam. Nursery has been raised under Dima Hasao West Forest Division. Seedling of different sizes in the newly established nursery nearby the village Tortelangsu

Sl. No.	EC conditions	Status of Compliance
		 Seedling of different sizes ready for plantation, Longku near the highway around the Forest office.
v	Fish ladder/pass as envisaged in the EIA/EMP report shall be maintained for migration of fishes. Regular monitoring of this facility be carried out to ensure its effectiveness.	As the river water is acidic in nature, during the EIA study no fish ladder / pass was proposed. Hence Fish ladder/pass is not considered in this project. However as per the condition of MoEF&CC, APGCL requested College of Fisheries, Raha, under Assam Agricultural University to carry out a study on the availability of migratory aquatic species in the river Kopili within the project impact area. The study has been initiated in the month of February, 2024. Final report after one year study will be ready by March, 2025.
VIII. Public hearing and Human health issues		
i	Resettlement & Rehabilitation plan be implemented in consultation with the State Govt. as approved by the State Govt., if any.	Agreed. Implementation is going on. 1. Copy of the Combined Resettlement and Tribal Development Plan (CRTDP) and the approval letters from the GOI and the autonomous district councils were already submitted in the earlier compliance report to MoEF&CC. 2. R&R Plan has been fully implemented baring few whose documents lacks authenticity. 3. Copy of fund utilization so far is presented in Annexure 10.
ii	Budget provisions made for the community and social development plan including community welfare schemes shall be implemented in to.	Agreed. Local Area Development Plan will be implemented as per plan. Facilitation Committee for implementation of Local Area Development Plan is constituted and accordingly meetings are conducted. APGCL has already taken up Community development work through the respective contractors as the contract is awarded under EPC mode.

Sl. No.	EC conditions	Status of Compliance
		As the requirements evolves during the progress of the project, instead of a firm plan-based implementation program, APGCL has decided to go for Need Based Community Requirement, which is more aligned to the requirement of the community. Moreover, APGCL will also support community development works under LAD and CER.
iii	Preventive measures viz. fuming and spraying of mosquito control shall be done in and around the labour colonies, affected villages, stagnated pools, etc. Provisions be made to not to create any stagnated pools to avoid creation of breeding grounds of the vector borne diseases.	Agreed.  Package 2 contractor has already taken up appropriate measures to control mosquitos. CP-2 (03.08.2024)-Dengue Awareness Program was organized in the Workmen Camp in collaboration with Umrangsu Community Health Center. 
iv	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	Agreed. Package 2, 3, 4 contractor has already constructed labour camps with he following facilities like - common kitchen, Sanitary and mobile toilets, safe drinking water, medical health care, etc. 

Sl. No.	EC conditions	Status of Compliance
		 RO Plant under CP-2
v	Labour force to be engaged for construction works shall be examined thoroughly and adequately treated before issuing them work permit. Medical facilities shall be provided at the construction sites.	Medical facility (First Aid Center) provided by the contractor at site.  Health and AIDS awareness camp at First Aid centre.
vi	Early Warning Telemetric system shall be installed in the upper catchment area of the project for advance intimation of flood forecast.	At present Early warning is given by district administration Disaster Management Cell and discharge data is shared by NEEPCO project authority located upstream. Project specific Early Warning Telemetric system is under installation before impounding of water. It will be completed soon. 
vii	Emergency preparedness plan be made for any eventuality of the dam failure and shall be implemented as per the Dam Break Analysis	Agreed. The Dam Break Analysis and Emergency Action Plan is prepared by IIT, Roorkee.
IX. Corporate Environment Responsibility		
i	The project proponent shall comply with the provisions contained in this Ministry's OM vide F.No. 22-65/2017-IA.III dated 01.05.2018, as applicable, regarding Corporate Environment Responsibility.	Agreed. It will be covered under EMP as per OM of MoEF&CC. Moreover, there is also similar provisions in Local Area Development

Sl. No.	EC conditions	Status of Compliance
		Fund under CRTDP. Activities will be carried out in phase manner. Year wise CER and LAD plan are being prepared under the guidance of three committees through consultations with local people, Govt. line departments, etc. As soon as the plan is finalized it will be shared with MoEF&CC. Annexure 1 : LAD coordination Committee Annexure 2: Facilitation Committee Annexure 3 : CER, LAD committee
ii	Skill mapping be undertaken for the youths of the affected project area and based on the skill mapping, necessary trainings to the youths be provided for their long time livelihood generation	1. Skill mapping and assessment already done under R&R Plan by NGO (Already submitted to MoEF&CC the previous compliance report). 2. Tender for engagement of an agency for Livelihood Training Program has been completed. Skill development will be done through M/s Arthy for the affected families under 120 MW LKHEP. 1st batch of the training will be initiated from December 2024.
iii	The PP 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. The copy of the board resolution in this regard shall be submitted to the MoEF&CC as a part of six-monthly report.	Agreed. 1. APGCL has an environmental policy in place. (Annexure 11) 2. Standard Operating Procedure (SOP) is under review.
iv	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.	A separate Environmental Cell both at the project and company head quarter level, with qualified personnel are in place.
v	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.	Agreed and initiated.
vi	Post EIA and SIA be prepared for the project through a third party and evaluation report be submitted to the Ministry after five years of commissioning of the project.	Agreed. Will be carried out after 5 years of commissioning of the project.
vii	Multi-Disciplinary Committee (MDC) be constituted with experts from Ecology, Forestry, Wildlife, Sociology, Soil	Agreed and is in place. 1st MDC meeting was convened on 6th May,

Sl. No.	EC conditions	Status of Compliance
	Conservation, Fisheries, NGO, etc. to oversee implementation of various environmental safeguards proposed in EIA/EMP report during construction of the project. The monitoring report of the Committee shall be uploaded in the website of the Company.	2022. Minutes of the meeting of 2nd MDC held on 20.06.2023 and 3rd MDC held on 11.12.2023 already shared in the previous Six monthly compliance reports.
X. Miscellaneous		
i	The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by 5 prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.	Already done. Copy of EC in the APGCL site : https://www.apgcl.org/lkhep.php
ii	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.	Already done.
iii	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.	Agreed and posted in Parivesh portal of MOEF&CC. Displayed in the APGCL site : https://www.apgcl.org/lkhep.php
iv	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.	Agreed and submitted every six months in the Parivesh portal as well as hard copy submitted to IRO.
v	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.	Agreed and submitted. Forn V for the Period April 2023 to March 2024 submitted on 10.05.2024 (Annexure 12.)
vi	The project proponent shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.	Agreed.
vii	The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.	Agreed
viii	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.
ix	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).	Agreed. During the detail designing and execution of the EPC contract minor adjustments were made with the approval from Central Electricity Authority, Central Water

Sl. No.	EC conditions	Status of Compliance
		Commission, Geological Survey of India, Central Soil and Material Research Station, GOI keeping the power generation capacity of 120 MW, location of the Dam Axis, FRL of 226m, alignment of HRT remaining same as mentioned in the EC. For the above changes APGCL has sought the approval from MPEF&CC and accordingly on 14.11.23 Amendment of EC was accorded on 3.1.24 by MoEF&CC. (Annexure 4)
x	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.	Agreed.
xi	The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.	Agreed.
xii	The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.	Agreed.
xiii	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.
xiv	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.
xv	Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	Agreed.

ANNEXURES : 1 - 12

Annexure 1 : LAD coordination Committee

ASSAM POWER GENERATION CORPORATION LIMITED
Registered Office: Bijulee Bhawan, 3rd floor, Paltanbazar, Guwahati-781 001, Assam

Mridul saikia
Chief General Manager (PP&I)
Project Director (PMU)
E-mail :mridul.saikia@apgcl.org

No: APGCL/LKHEP/PD/2017-18/21/Part-I/Part file-1/126 Dated: 11.11.2022

OFFICE ORDER

A Co-ordination Committee is hereby constituted for Lower Kopili Hydro Electric Project to facilitate consultation between Affected Peoples (APs), APGCL, District Council and NGO for discussion of APs problem regarding Land Acquisition, Rehabilitation & Resettlement and other aspects relating to Livelihood restoration and hence smooth implementation of CRTDP with the following members:

1. CGM (PP&I) APGCL- **Chairman**
2. GM LKHEP APGCL- **Member Convener**
3. GM (PP&I) APGCL- **Member**
4. DGM (Civil) LKHEP APGCL- **Member**
5. Social Safeguard Expert APGCL- **Member**
6. Environment Expert APGCL- **Member**
7. Social & Resettlement Expert PMC- **Member**
8. NGO CRADLE & GUS representative- **Member**
9. District Council Authority representative from Dima Hasao- **Member**
10. District Council Authority representative from Karbi Anglong- **Member**
11. Affected Peoples Representative- **Member**

NGO will facilitate consultation between the APs, APGCL and District Councils at the field offices and with the APs as and when required to discuss the implementation of CRTDP.

Chief General Manager (PP&I)
APGCL

Memo No: APGCL/LKHEP/PD/2017-18/21/Part-I/Part file-1/126(a) Dated: 11.11.2022

Copy to:

1) The OSD to the Chairman, APGCL - for kind information of Hon'ble Chairman, APGCL
2) The OSD to the MD, APGCL- for kind information of MD, APGCL
3) Members concerned.
4) Relevant file.

Chief General Manager (PP&I)
APGCL

Date: - 25/11/2022

ASSAM POWER GENERATION CORPORATION LIMITED
LOWER KOPILI HYDRO ELECTRIC PROJECT

A review meeting was held on 11/10/2022 in the 3rd floor Chairman's conference hall, Bijulee Bhawan, Paltan Bazar, Guwahati-01 to discuss the CRTDP, JFPR & External monitoring works under 120MW Lower Kopili Hydro Electric Project. The meeting decided that a facilitation committee at site should be formed as per the contract agreement comprising officials of APGCL, NGO & PMC

A Facilitation Committee is hereby constituted to facilitate the implementation of CRTDP (Combined Resettlement and Tribal Development Plan) for the 120 MW Lower Kopili Hydro Electric Project funded by ADB and Govt. of Assam.

The committee shall facilitate all the works related to Resettlement and Rehabilitation (R&R) plan in accordance with the contract Agreement and liaison closely with the Project affected Families (PAF) and Project Affected Persons (PAP) in matters pertaining to other than land and property related i.e. R&R.

The following members of the committee are mentioned below:

1. **Sri Dilip Kr Das, GM, LKHEP, APGCL----------Chairman**
2. **Sri Jonardan Rongpi, DGM(C), LKHEP, APGCL----------Convener**
3. **Sri Pankaj Hazarika, Social Expert, APGCL----------Member Secretary**
4. **Sri Victor Paul Choudhury, AGM (C), LKHEP, APGCL----------Member**
5. **Sri Sangram Singh, Social & Resettlement Expert, PMC, AFRY-------Member**
6. **Sri LP Singh, Social Development Expert, NGO GUS----------Member**
7. **Sri Mukut Deka, Training cum Livelihood Specialist, NGO Cradle-----Member**

Chairman
GM, LKHEP
APGCL

Convenor
DGM (C), LKHEP
APGCL

Member Secretary
Social Expert,
APGCL

Member
AGM (C), LKHEP
APGCL

Member
Social & Resettlement Expert,
PMC, AFRY

Member
Social Development Expert,
(NGO Cradle & GUS)

Member
Training cum Livelihood Specialist,
(NGO Cradle & GUS)

ASSAM POWER GENERATION CORPORATION LIMITED
Registered Office: Bijulee Bhawan, 3rd floor, Paltanbazar, Guwahati-781 001, Assam
Sri. Mridul Saikia
Project Director (PMU)
LOWER KOPILI HYDRO ELECTRIC PROJECT
E-mail: projectdirector@apgcl.com

No: APGCL/CGM(H)/W/2007/140/Pt-VI/43 Dated: 07/02/2022

OFFICE ORDER

In the interest of works, a committee is hereby constituted to supervise the works and determine the fund source for executing the works related to Corporate Environment Responsibility (CER), Conservation Plan for Schedule I Species under Environment Management Plan (EMP) and Local Area Development under Combined Resettlement and Tribal Development Plan (CRTDP) w.r.t Lower Kopili H.E. Project. The committee shall execute the works as per the regulations of Ministry of Environment, Forest & Climate Change (MoEF&CC) Govt. of India, Ministry of Tribal Affairs (MoTA) Govt. of India and Asian Development Bank (ADB). The committee shall comprise of the following members:

SL. No:	Members	Designation
1.	Th S. Singha, GM (PP&I), O/o the CGM (PP&I), APGCL	Head of the Committee
2.	Sri Saurav Saikia, GM (Civil) i/c, O/o the CGM (H&C), APGCL	Member
3.	Ph A. Singha, DGM (Civil), O/o the CGM (PP&I), APGCL	Member, Convenor
4.	Sri. A. Talukdar, DGM, O/o the CGM (PP&I), APGCL	Member
5.	Sri. M.J Pandit, AGM (Civil), O/o the CGM (PP&I), APGCL	Member
6.	Sri. P.J. Ligira, DM (ECE), O/o the GM, LKHEP, APGCL,	Member
7.	Sri. Gunjan Kr. Nath, JM (Civil), O/o the CGM (H&C), APGCL	Member
8.	Sri. A.J Pathak, AM (F&A), O/o the CGM (F&A), APGCL	Member
9.	Sri. Pankaj Hazarika, Social Safeguard Expert, APGCL	Member
10.	Dr. Deepak Baruah, Environmental Expert, APGCL	Member

The committee will be assisted by the PMC for LKHEP in the execution of the works.

Project Director (PMU)
APGCL

Copy to:

1. The OSD to the Chairman, APGCL, for kind information of Hon'ble Chairman.
2. The P.S. to Managing Director, APGCL, for kind information of Hon'ble MD.
3. The General Manager, Lower Kopili H.E. Project, Longku, for information.
4. The Team Leader, LKHEP, AFRY Ltd. for information and necessary action.
5. The Officers concerned.
6. Relevant file.

सत्यमेव जयते

File No.: J-12011/26/2012-IA.I
Government of India
Ministry of Environment, Forest and Climate Change
IA Division
****

Dated **03/01/2024**

To,

The Chief General Manager (Hydro)
M/s Assam Power Generation Corporation Ltd
2nd Floor, Bijulee Bhawan, Paltanbazar, Guwahati , Guwahati, KAMRUP METRO, ASSAM, Paltanbazar, 781001
cgmh2010@yahoo.in

Subject: **Lower Kopili HEP (120 MW) in Karbi Anglong & Dima Hasao, Assam by M/s Assam Power Generation Corporation Ltd- Amendment in Environmental Clearance- reg**

Sir/Madam,

This is in reference to your application submitted to MoEF&CC vide proposal number IA/AS/RIV/441844/2023 dated 23/10/2023 for grant of an amendment in prior Environmental Clearance (EC) to the project under the provision of the EIA Notification 2006-and as amended thereof.

2. The particulars of the proposal are as below :

(i) EC Identification No.	EC23A0505AS5877865A
(ii) File No.	J-12011/26/2012-IA.I
(iii) Clearance Type	Amendment in EC
(iv) Category	A
(v) Schedule No./ Project Activity	1(c) River Valley/Irrigation projects
(vi) Sector	River Valley and Hydroelectric Projects
(vii) Name of Project	Lower Kopili HEP (120MW) in Karbi Anglong & Dima Hasao, Assam, by M/s Assam Power Generation Corporation Ltd.
(viii) Location of Project (District, State)	DIMA HASAO, ASSAM
(ix) Issuing Authority	MoEF&CC
(x) EC Date	04/09/2019
(xi) Applicability of General Conditions	NO
(xiii) Status of implementation of the project	

1. In view of the particulars given in the Para 1 above, the project proposal interalia including Form-1(Part A, B and C) were submitted to the MoEF&CC for an appraisal by the Expert Appraisal Committee EAC under the provision of EIA notification 2006 and its subsequent amendments.
2. The above-mentioned proposal has been considered by Expert Appraisal Committee (EAC) in the meeting held on 26/10/2023. The minutes of the meeting and all the project documents are available on PARIVESH portal which can be accessed from the PARIVESH portal by scanning the QR Code above.
3. The brief about the reasons for an amendment requested along with comparison table illustrating the details of amendments are annexed to this letter as **Annexure (2)**.
4. The EAC, in its meeting held on 26.10.2023, based on information & clarifications provided by the project proponent and after detailed deliberations recommended the proposal for grant of amendment in Environment Clearance under the provision of EIA Notification, 2006 and as amended thereof.
5. The MoEF&CC has examined the proposal in accordance with the extant provisions of the Environment Impact Assessment (EIA) Notification, 2006 & further amendments thereto and based on the recommendations of the Expert Appraisal Committee hereby accords amendment in Environment Clearance dated 4.09.2019 for the instant proposal to **M/s Assam Power Generation Corporation Ltd** under the provisions of EIA Notification, 2006 and as amended thereof subject to compliance of EC conditions, general instructions issued vide EC letter dated and EC identification number IA/AS/RIV/441844/2023 and following certain additional specific conditions.
6. The details of amendment sought is at Annexure (2).
7. This issues with the approval of the Competent Authority

Copy To

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi - 110 001.
2. The Chairman, Central Electricity Authority, Sewa Bhawan, R. K. Puram, New Delhi - 110 066.
3. Deputy Director General of Forests (C), Ministry of Environment, Forest and Climate Change,Integrated Regional Office Law-U-Sib, Lumbatngen, Near MTC Workshop, Shillong
4. The Principal Chief Conservator of Forests, Head of Forest Force, Aranya Bhawan, Panjabari, Guwahati, 781037, Assam.
5. The Member Secretary, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi - 110 032.
6. The Member Secretary, Assam Pollution Control Board, Bamunimaidam, Guwahati – 21
7. Guard file/Monitoring file
8. Website of MoEF&CC.

Annexure 1

Specific EC Conditions for (River Valley/irrigation Projects)

1. Additional Condition

S. No	EC Conditions
1.1	Aquatic study specially, migratory aquatic species concerning occurrence of fishes /habitat impact studies shall be carried out from recognised govt. Institutes and prepared mitigation measures, with provision of financial budget revised in the EMP. The outcome of the said study shall be

S. No	EC Conditions
	implemented.
1.2	Submit undertaking that R&R scenario /habitat of flora and fauna of project are not change due to modification of the project components.
1.3	All the conditions mentioned in the EC dated 4.09.2019 shall remain unchanged.

Annexure (2)

The details of amendment sought

The Project Proponent and the accredited Consultant made a detailed presentation on the salient features of the project and informed that:

i. The Lower Kopili HEP (120 MW) is downstream development of existing Kopili HEP stage I and is located in east of Karbi Anglong and west of Dima Hasao districts of Assam.
ii. The project is situated in the West Karbi Anglong and Dima Hasao (also known as North Cachar Hills) Autonomous District Council (ADC) areas of Central Assam. The Project location (dam site) is defined by 25°39'57.39"N latitude and 92°46'53.62"E longitude
iii. The dam structure is located on Kopili River (a major tributary of the Brahmaputra River) and the main powerhouse and auxiliary power house structures are located on right bank of Kopili River.
iv. The project envisages utilization of the regulated discharge from Kopili HEP, spills of Khandong and Umrong Dam and the discharge from the intermediate catchment by creation of a reservoir and utilizing a gross head of about 114m.
v. This is a run-of-the-river scheme.
vi. The scheme has been conceived to run at full potential in monsoon season and operate as a peaking station in non-monsoon season.
vii. **Land requirement**: The total land requirement of the project is **1577** ha. The forest land to be acquired for the project is 523 ha. The private land to be acquired for the project is 1054 ha.
viii. **Forest Clearance**: In principle approval of Stage 1 Forest Clearance for the diversion of 523.046 ha of forest land was accorded on 27 .03.2019.
ix. **Environment clearance** for the project was accorded **on 04.09.2019**
x. **E flow** will be maintained as per stipulation of EC.
xi. **Salient features of the project:**

a. Land Area: 1577 Ha (Forest land 523.0 Ha, Revenue land 1054.0 Ha)
b. Power generation capacity: 120 MW (MPH – 2 X 55 MW; APH – 2 X 2.5 + 1 X 5 MW)
c. Location of Dam Axis: 25°39'57.39"N; 92°46'53.62"E
d. Location of MPH: 25°41'5 4.02"N; 92°48'15.98"E
e. Concrete Gravity Dam: Across the river Kopili at Longku
f. Dam Height 66.5 m
g. water conductor system comprising of an intake structure, head race tunnel along with surge shaft and pen stock.
h. **Project cost: 1031.58 Cr excluding the R&R land cost 84.33 Cr.**
i. **EMP cost: 26147.5077 lakh**
j. **CER cost: 5.81 Cr**

xii. **The details of amendment sought is as under: -**

S. No.	Para/ details of EC issued by MoEF&CC	Details as per EC	To be revised/ read as	Justification/ reasons

1	Dam Height (m)	70.13	66.5	El. 228.00 m – El. 162.50 m = 66.50m. Change in dam design alters consumption of construction materials (e.g., concrete) and the volume of muck generated for disposal on-site.
2	Length of the Dam (m) Total width of dam structure including overflow & non overflow blocks	345.05	335.0	As per revised arrangement of NOF and OF section.
3	No of Spillways	8	6	10 m x 12.50 m. The discharging capacity of proposed spillway arrangement is verified on the physical hydraulic model study carried out in IRI, Roorkee and gate opening was found adequate to pass the PMF at N-1 condition. Same is approved by CEA
4	HRT Diameter (m)	6.65	7.0	Diameter of HRT is increased to ensure CEA approved head losses of 6m.
5	HRT length (m)	3619.62	3641.22	As per revised arrangement.
6	Tail Race Channel width (m)	26.3	26.0	Arrangement is revised to provide better hydraulic condition at the outlet of tail race.
7	Tail Race Channel length (m)	52.0	40.0	
8	Submergence area with the Reservoir spread (Ha)	552 submergence area	552 submergence area with reservoir spread of 620 Ha	Submergence area remains same i.e. 552 Ha within the reservoir spread of 620 Ha to accommodate plantation area as per EC and FC stipulation, Reservoir rim treatment, safety area for human and wildlife, within the existing land area of 1577 ha.

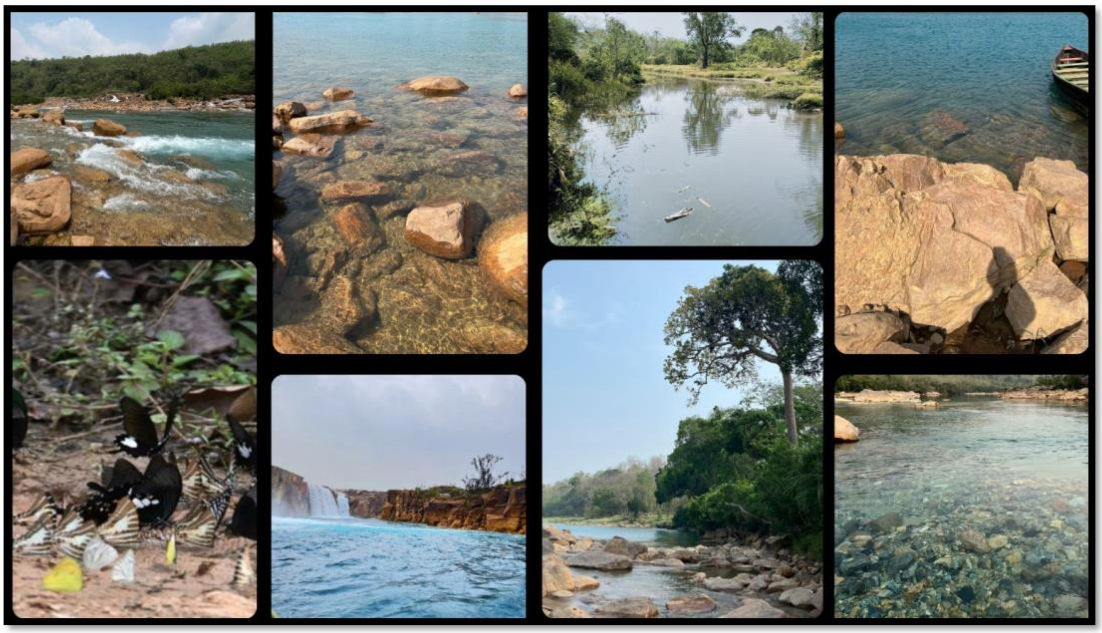
***

Digitally Signed by : Mr Munna Kumar Shah
Member Secretary, MoEFCC (EC)

Date: 03/01/2024

Final Technical Report

Aquatic Study especially migratory aquatic species in the River Kopili in relation to the 120 MW Lower Kopili Hydro Electrical Project (LKHEP) at Longku , Karbi Anglong and Dima Hasao



Submitted to:
Assam Power Generation Corporation Limited
Bijulee Bhaban , Paltan Bazar
Guwahati-01

Submitted by:
Department of Aquatic Environment Management
College of Fisheries,
Assam Agricultural University
Raha: Nagaon:Assam

Dated: 31st May 2024

Disclaimer

The present study was carried out from February, 2024 to May, 2024. All the results, inferences and interpretations presented in this report are strictly based on the findings of the study period.

Contents

List of Tables

List of Figures

1.0 Introduction

1.1. Study Details:

1.Title	:	Aquatic study especially migratory aquatic species in the River Kopili in relation to the 120 MW Lower Kopili Hydro Electrical Project (LKHEP) at Longku, Karbi Anglong & Dima Hasao
2.Duration	:	From February, 2024 to May, 2024
3. Implementation agency	:	Department of Aquatic Environment Management, College of Fisheries, Assam Agricultural University, Raha, Nagaon, Assam, India.
4. Total budget	:	Rs.19,12,000.00

1.2. Project Description:

Back ground:

Kopili is an inter-state river of North-East India that flows through the states of Meghalaya and Assam. The river originates in the Saipong Reserve Forest situated in south east of Meghalaya and passes through the borders of Meghalaya, Dima Hasao, Karbi Anglong and enters the plains in Nagaon district of Assam before its confluence with the mighty River Brahmaputra. The geographical coordinates range of the Kopili basin extends from longitude 91-93^0 E and latitude 25-27^0 N. The basin covers a total geographical area of 13,55,600 hectares. The river basin is bounded by Jayanti Hills in the West and South Cacher and Mikir Hills in the East. Kharkor, Myntriang, Dinar, Longsom, Amring, Umrong, Longku and Langkri are its major tributaries in its upper reaches. Diyung, Jamuna, Umkhen-Borapani, Killing and Kolong are its major tributaries in the lower stretch. The river flows for a total length of 290 kilometers and has a catchment area of 16,420 square kilometers (6,340 sq. miles). The river is very rich in terms of its ichthyofaunal diversity and other biotic components. As per the earlier records (Nath, 2023), 108 fish species belonging to 12 orders, 31 families and 63 genera were reported from the river. A total 46 genera of plankton were also recorded from the river. The present study is planned to investigate the probable impacts of the under construction 120 MW Lower Kopili Hydro Electrical Project (LKHEP) by Assam Public Generation Corporation Limited (APGCL) on the migratory aquatic species of the river with the following objectives.

1.3. Objectives

1. To document aquatic species with special reference to migratory species in the project impact zone.
2. To characterise habitat of aquatic species in the project impact zone.
3. To suggest & prepare mitigation measures.

2.0 Materials and Methods

2.1. Sampling of Water (Surface and Ground), sediment , fish (special emphasis on migratory species), plankton, periphyton , benthos and riparian vegetation

A. Study area:

The following stations (Fig.1) were selected for the investigation covering approximately 33 Km pathlength of the river based on a preliminary visit for collection of water, sediment, fish, plankton, periphyton, benthos & riparian vegetation samples to collect information on various study parameters.

Station 1: Located at 29 Kilo (Latitude $25^0$35.885/ N; Longitude $92^0$44.929/; Elevation 269m) approximately 5 Km upstream of the LKHEP. (Dam to Station 1=11.9 km)

Station 2: Located at approximately 1 Km upstream of the LKHEP (Latitude $25^0$39.329/ N; Longitude $92^0$47.325/; Elevation 190m) (Station 1 to 2 distance 10 km). (Dam to Station 2=1.60 km)

Station 3: Located just outside LKHEP project diversion tunnel outlet (Latitude $25^0$40.064/ N; Longitude $92^0$46.828/; Elevation 161m) (Station 1 to 3 distance 12 km, Station 2 to 3 distance 2 km).

Station 4: Located at downstream powerhouse of the LKHEP (Latitude $25^0$41.934/ N; Longitude $92^0$48.250/; Elevation 99m) (Station 1 to 4 distance 17 km, Station 3 to 4 distance 5 km). (Dam to Station 4=5.41 km)

Station 5: Located at a distance of 6 km from the tail race of LKHEP (Latitude $25^0$43.389/ N; Longitude $92^0$49.366/; Elevation 98m) (Station 1 to 5 distance 20 km, Station 4 to 5 distance 3 km), (Dam to Station 5=8.40 km)

Station 6: Located at a distance of one kilometer from confluence point of River Amreng & River Kopili (Latitude $25^0$45.070/ N; Longitude $92^0$51.295/; Elevation 77m) (Station 1 to 6 distance 27 km, Station 5 to 6 distance 7 km). (Dam to Station 6=16 km)

Station 7: Located at the confluence point of River Kopili & River Diyung (Latitude $25^0$40/1N; Longitude $92^0$47/45; Elevation 60m) (Station 1 to 7 distance 34km, Station 6 to 7 distance 7 km). (Dam to Station 7=27 km)

Station 8: Catchment area pond

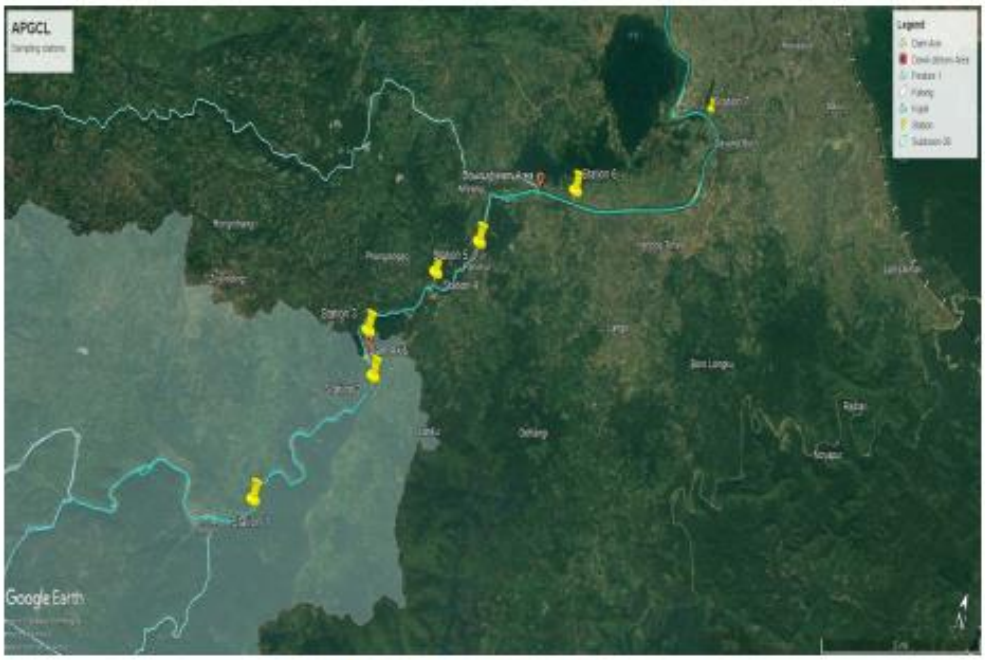


Fig.1 Map of the study area

Dates of sampling:

28/02/2024 & 29/02/2024- 1st Sampling
14/03/2024 & 15/03/2024 -2nd Sampling
28/03/2024 & 29/03/2024 -3rd Sampling
07/04/2024 & 08/04/2024-4th Sampling
26/04/2024 & 27/04/2024-5th Sampling
17/05/2024 & 18/05/2024-6th Sampling

B. Materials used during sampling

The sampling was carried out during February, 2024 and May, 2024 in morning period (from 8 am to 12 pm) from the selected sampling sites (Annexure 2). The following materials were used during the sampling:

- **Sampling Bottles:** Plastic bottles of 1000 ml capacity were used for the collection of water samples.

- **Pipettes:** All pipettes used during the study period were of borosil glass certified grade. Different capacity pipettes were used e.g., 1 ml, 2 ml, 5 ml and 10 ml. For biotechnology works micro-pipettes of different capacities (0.2-2 µL, 0.5-1.0 µL, 2-20 µL and 100-1000 µL) were used.
- **Reagents and Glasswares:** Glasswares namely conical flask, beaker, burettes, volumetric flask, test tubes were used for the preparation of chemicals and during conducting research. Glasswares were washed with chromic acid and rinsed with tap water.
- **Reagent Bottles:** Both plastic and glass reagent bottles were used to store reagents. Big cans were used to collect fish specimens from the river site.
- **Thermometer:** Mercury thermometer was used for measuring temperature.
- **Soil and Water Testing Kit:** Digital soil and water testing kit were used for estimating pH, TDS, electrical conductivity etc.
- **Plankton Net:** 28 mm mesh size nylobolt plankton net was used for the collection of plankton.
- **Sedgwick Rafter Cell:** It was used for counting plankton.

2.2. Habitat evaluation in terms of :

a) Water Quality Analysis

A. Physical Parameters of Water:

Different physical parameters like air and surface water temperature, water velocity were recorded monthly by using different methods described below:

- ***Water Velocity (msec^{-1}):*** The velocity of the river water was measured by using a float, a stopped clock and a measuring tape. A float was released from a fixed point and allowed to flow along with the water current for 30 seconds. The distance covered within 30 seconds from the fixed point was measured by using a measuring tape. The velocity of river water (msec-1) was calculated by using the following formula:

  Calculation:

  Water Velocity (mSec^{-1})=d/(T)

  Where, T = Time and d = Distance cover within 30 sec.
- **Air and Surface Water Temperature (^{0}C):** Mercury filled centigrade thermometer was used to record air and surface water temperature (Adoni, 1985). Surface water temperature was recorded by dipping the thermometer 12 inches into the water.

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- **Transparency:** Transparency was measured with the help of a simple instrument called a Secchi disc, which consist of a black and white disc of about 20 cm diameter. The disc is lowered on the graduated line into the water and the depth (d_1) at which it disappears is noted. Now the disc is lifted slowly and the depth (d_2) at which the disc reappears is noted. The reading $d_1 + d_2 / 2$ in cm provides the measure of light penetration or Secchi disc transparency.

B. Chemical Parameters of Water:

- **Water pH:** The pH of water samples was measured by a digital pH meter (Make ELICO LI 120) following the potentiometric method (Adoni, 1985).
- **Dissolved Oxygen (mgL^{-1}):** Dissolved oxygen was determined by standard Winkler's method (APHA, 2019).
- **Total Alkalinity (mgL^{-1}):** Total Alkalinity was calculated by the titration method (APHA, 2019).
- **Total Hardness (mgL^{-1}):**Total hardness was also determined by following the standard protocol of APHA (2019).
- **Electrical Conductivity (μScm^{-1}):** Systronics digital conductivity meter 306 was used to measure conductivity. Conductivity is reported in mmho or µmhoscm-1 or as μScm^{-1}. The electrode of the conductivity meter was immersed directly in the water collected in a wide-mouthed sampling bottle at the sampling site immediately for a period of time sufficient to permit constant readings (APHA, 2019).
- **Total Dissolved Solids (mgL^{-1}):** Systronics digital conductivity meter 306 was used to measure conductivity. Conductivity is reported in mgL-1. The electrode of the Systronic meter was immersed directly in the water collected in a wide-mouthed sampling bottle at the sampling site immediately for a period of time sufficient to permit constant readings (APHA, 2019).
- **Biological Oxygen Demand (BOD_3) (mgL^{-1}):** The biological oxygen demand (BOD3) at of the river water sample was determined following the standard procedure of the Central Pollution Control Board (CPCB, 2011).
- **Chemical Oxygen Demand (COD) (mgL^{-1}):** The chemical oxygen demand (COD) of the river water samples was determined following the standard procedures of the Central Pollution Control Board (CPCB, 2011).
- **Nitrate-Nitrogen (NO_3-N) (mgL^{-1}):** The nitrate-nitrogen content of water was measured using a visible Spectrophotometer at 543 nm and expressed in mgL^{-1} by following the standard methodology of APHA (2019).
- **Nitrite-Nitrogen (NO2-N) (μgL^{-1}):** The nitrite-nitrogen content of water was measured using a visible spectrophotometer at 543 nm and expressed in µgL-1 by following the standard methodology of APHA (2019).

- **Soluble Inorganic Phosphate (mgL^{-1}):** The soluble inorganic phosphate of water was determined using a visible Spectrophotometer and expressed in mgL^{-1} by following the standard methodology of APHA (2019).
- **Na ,K and K Content of the river water was estimated with the help of Flame Photometer (Systronics)**
- **Sulphate and chloride:** Sulphate and chloride was determined through Turbidimetry and Argentometry respectively (APHA, 2019)

C. Bacteriological parameters of water

- **Test for coliform Bacteria:** Coliform test plays a significant role in food processing industries. Standard techniques were followed for the collection and bacteriological analysis of water samples (APHA, 2019).

D. Heavy Metal Analysis:

Pb and As was analysed using Atomic Absorption Spectrophotometric analysis (ZEEnit 700P) using Lead Cal method by Flame technique.

E. Biological:

a) Plankton:

Plankton samples were collected in duplicate by filtering 100 Liters of river water using a 28 mm mesh nylobolt plankton net as described by Santhanam *et al*. (1987). The collected plankton samples were preserved in 3-4 % formalin in separate plankton tubes. In the laboratory, from the known volume plankton sample counting was done by using the Sedgwick Rafter Plankton counting cell (Sharma and Saini, 2005). Plankton was identified at genera level using the identifying keys of Edmondson (1959), Needham & Needham (1966) and the ICAR monograph series on algae (Ramanathan, 1964; Philipose, 1967). Plankton biomass in terms of density was determined using plankton density (UL^{-1}) a Sedgwick Rafter Cell as per the methodology of Sharma and Saini (2005) using the following equation:

$$U\,L^{-1} = N \times n \times L$$

Where ,

N= Number of plankton/ml

n= Volume of plankton sample

L= Total volume of water filtered in litres

b) Periphyton:

Periphyton samples were collected by scrapping 2 square centimeter surface areas of stone/boulders, wood and old logs that were submerged in the water. The collected samples were preserved in 5% formalin in separate tubes. In the laboratory from the known volume of the sample, counting was done using Sedgwick rafter cell (Sharma & Saini, 2005). The periphytic forms were identified up to generic level with the help of standard books like Edmondson (1959), Needham & Needham (1966) and ICAR monograph series of algae (Ramnathan, 1964; Philipose, 1967).

The periphyton ucm^{-2} was obtained using the equation

$U\ cm^{-1} = N \times n \times a$

Where ,

N= Number of periphyton/ml

n= Volume of periphyton sample

a= Area of the collected periphyton sample.

C) **Benthos :** For collection of benthos, a metallic tube of 50 cm length and 3 cm diameter was used in every station during sampling.

D) **Fish Diversity:**

Collection and Identification of Fish Species:

Fish specimens were collected from 7 selected stations of Kopili river & one catchment area pond during the study using gill nets of mesh size 2cm. A total number of 30 hauls per station was performed during every sampling programme for catching fish specimens. Proper care was taken after the collection of fish specimens to avoid damage. Fish samples were collected based on the guidelines of the National Biodiversity Authority, Govt. of India. Each collected sample was photographed and preserved in 10% formalin and deposited in the laboratory of the Department of Aquatic Environment Management, College of Fisheries, Assam Agriculture University, Raha, where each species was given a unique code number after identification. Identification was carried out based on their morphometric and meristic counts using standard keys (Talwar & Jhingran, 1991; Jayaram, 1999; Viswanath, 2002 & Kottelat, 2013). Measurements were taken on the left side of the specimen with the help of a digital caliper and meristic counts were recorded under a PC-based stereo-zoom microscope. The present conservation status of each

identified species was obtained using the website: www.iucnredlist.org (IUCN, 2021). Valid scientific names were confirmed from Eschmeyer's Catalogue of Fishes and Fish Base (Froese & Pauly, 2019).

E. Measures of Biodiversity:

Species Richness (S): The total number of different organisms present. It does not take into account the proportion and distribution of each subspecies within a zone. Species richness is calculated for plankton, periphyton samples.

Simpson's index (D): Simpson's index (D) of plankton, periphyton samples was calculated using the formula of Simpson (1949).

$$D = \sum (n/N)^2$$

Where n = the total number of organisms of a particular species
N = the total number of organisms of all the species
D measures the probability that two individuals randomly selected from a sample will belong to the same species (or same category other than species).

Shannon-Weiner Index (H'): Shannon- Weiner index (H') of plankton, periphyton samples was calculated using the formula of Shanon (1948)

$$H' = -\sum_{i=1}^{S} (p_i \ln p_i)$$

where S is the total number of species and p_i is the frequency of the ith species (the probability that any given individual belongs to the species, hence p.

2.3. Soil sampling or sediment characteristics

A) Sediment sample:

Soil samples were collected quarterly by Ekman's dredge separately from three sampling stations for the estimation of different soil parameters (Jackson, 1973). Then the samples were dried at room temperature and pulverized to a fine size and sieved through a standard sieve and it was used for estimation of pH, organic carbon, organic matter and available soil N, P and K in the laboratory. Sediment parameters like sediment pH, sediment organic carbon, sediment organic matter, and sediment N, P and K were estimated quarterly adopting standard procedures.

- **Sediment pH:** Sediment pH was determined using a standard method (Tan, 1996).
- **Sediment Organic Carbon (%):** Soil organic carbon was estimated by the redox titration method (Walkley and Black, 1943).
- **Sediment Organic Matter (%):** % of Organic Matter was estimated from Organic carbon (%) using the following equation:
- Organic Matter (%) =Organic carbon (%) X 1.724
- **Available Sediment Nitrogen (Kgha^{-1}):** Available nitrogen was estimated by the alkaline potassium paramagnet method (Olsen *et al*., 1954).
- **Available Sediment Phosphorus (Kgha^{-1}):** Available sediment phosphorus was measured in a spectrophotometer at 660 nm (Olsen *et al*., 1954).
- **Available Sediment Potassium(kgha^{-1}):** The available potassium was estimated by flame photometer.

2.4 Food Web diagram

The Food Web diagram was prepared as per Lombardo et al., 2015 with modifications based on the current research findings. Trophic Level Data was taken from fishbase.org.

3.0 Results and Discussion

3.1 Habitat evaluation in terms of :

i) Water Quality Analysis

A. Physical Parameters of Water:

a) Air Temperature (°C)

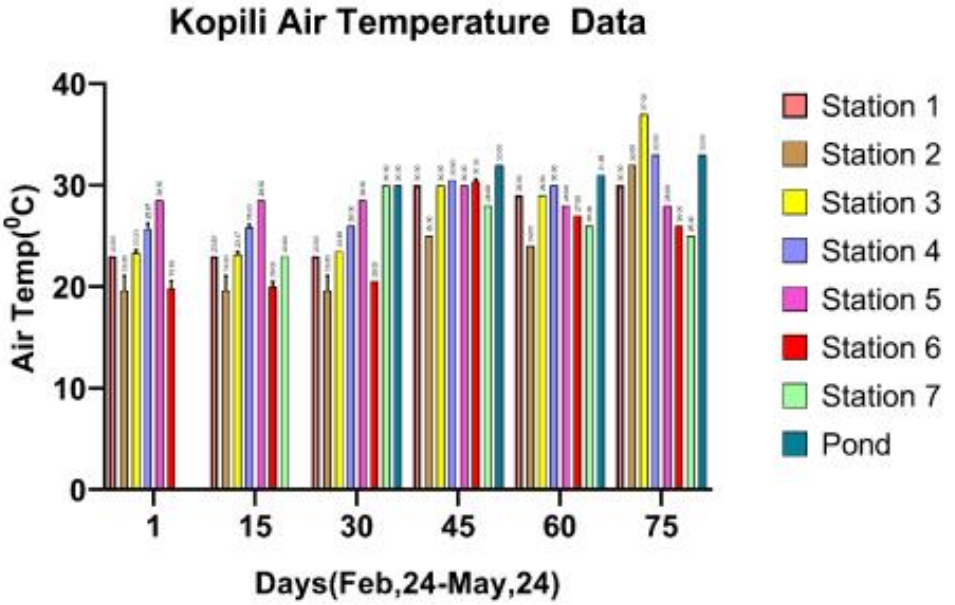

Fig 3.1: Variation of Air Temperature across different study stations

Atmospheric temperature of the study area displayed notable variation during the period of investigation. The mean temperature for Station 1 was 26.83°±3.43°C, indicating moderate variability. Station 2 showed a different pattern, starting at a lower range of 18°C to 20.8°C in the initial sampling periods, jumping to 25°C by mid-April, then slightly dropping to 24°C at the end of April, before spiking to 32°C by May. The mean temperature for Station 2 is 23.33± 4.89°C, reflecting notable variability.

Stations 3, 4, 5, 6, and the catchment area pond also exhibited distinctive trends. Station 3 maintained temperatures around 23.5°C initially, increased to 30°C by mid-April, then experienced a notable rise to 37°C in May. The mean temperature for Station 3 was 30.25± 5.54°C. Station 4 remained stable around 26°C initially, increased to approximately 30.5°C by mid-April, and then rose slightly to 33°C by May. The mean temperature for Station 4 is 29.75± 2.88°C. Station 5 consistently recorded temperatures around 28.5°C until a slight drop to 28°C starting mid-April and remained stable through May. The mean temperature for Station 5 is 28.42± 0.22°C, indicating high stability. Station 6 showed a gradual increase from approximately 20.5°C initially to 30.5°C by mid-April, before decreasing to 26°C in May. The mean temperature for Station 6 was 24.83± 4.30°C. Finally, the catchment area pond exhibited

stable temperatures around 30°C from mid-March, increasing slightly to 32°C in mid-April, and reaching 33°C by May. The mean temperature for the pond is 31.83± 1.17°C. These observations indicate varying degrees of temperature stability and increase across different stations, reflecting diverse local environmental conditions in Kopili.

b) Surface Water Temperature (°C)

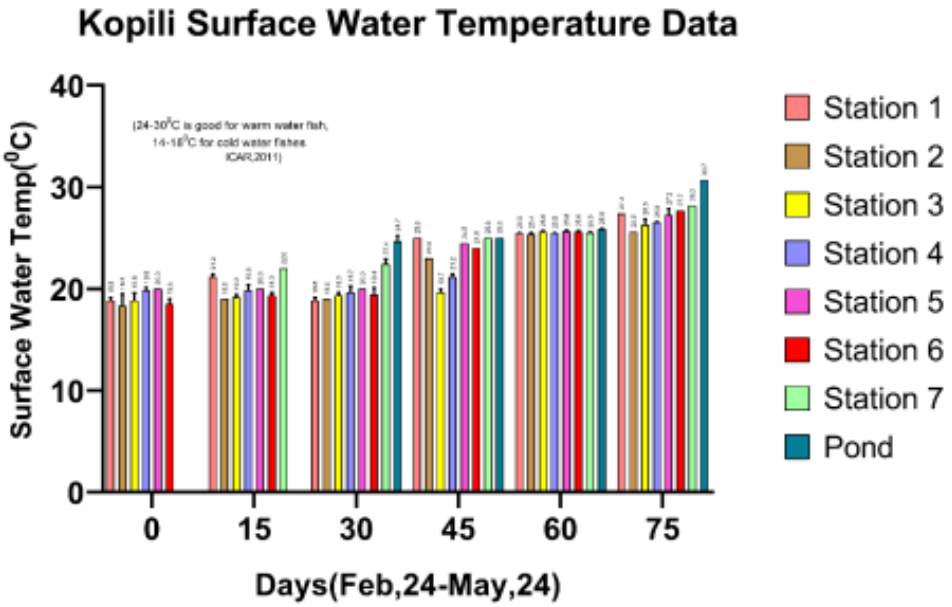

Fig 3.2: Variation of Water Temperature across different study stations

The surface water temperature (°C) data of the study stretch of River Kopili, recorded between February and May 2024, showed notable trends and variability across different stations. At Station 1, temperatures ranged from 18.5°C to 27.4°C, starting at an average of 19°C in February and steadily increasing to 27.4°C by May. The mean temperature for Station 1 over the entire period was 23.25± 3.43°C, indicating moderate variability. Station 2 exhibited a similar increasing trend, with temperatures ranging from 17°C to 25.6°C. Starting at an average of 18.33°C in February, Station 2's temperature rose to 25.6°C by May. The mean temperature for Station 2 was 21.65± 3.05°C, reflecting consistent but notable changes over time.

Stations 3, 4, 5, 6, and the catchment area pond also showed distinctive trends. Station 3's surface water temperature ranged from 18°C to 26.6°C, with an initial average of 19°C and a peak of 26.6°C during May. The mean temperature for Station 3 was 21.78± 3.25°C. Station 4 temperatures varied from 19°C to 26.6°C, starting at an average of 19.67°C in February and increasing to 26.6°C during May. The mean temperature for Station 4 was 22.1± 2.71°C.

Station 5 showed less variability with temperatures ranging from 20°C to 27.6°C. The mean temperature for Station 5 was 22.9± 2.97°C. Station 6 had temperatures ranging from 18°C to 27.7°C, with a mean of 22.38°C and a standard deviation of 3.73°C, indicating higher variability. The catchment area pond showed a notable rise from 24°C to 30.7°C, with the mean temperature at 26.23°C ± 2.87°C. These observations indicated varying degrees of temperature stability and increase across different stations, reflecting diverse local environmental conditions in Kopili. The congenial range of temperature for warm water fishers is 24-30°C and cold water fishes is 14-18°C (ICAR 2011).

c) Water Velocity

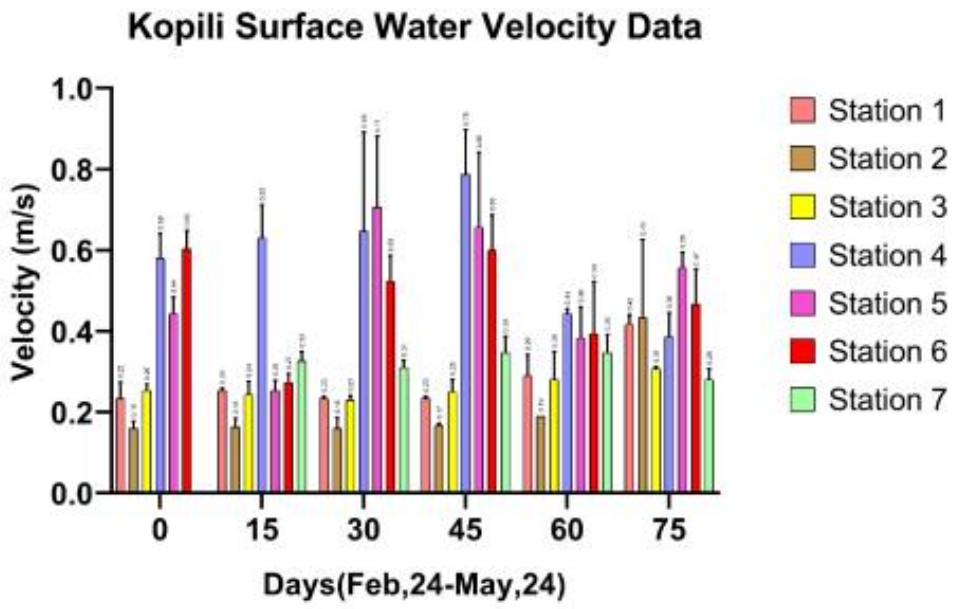

Fig 3.3: Variation of Water Velocity across different study stations

The water velocity measurements in meters per second (m/s) were recorded across various stations from February 2024 to May 2024. During the first sampling in February, Station 1 recorded water velocities ranging from 0.21 m/s to 0.28 m/s. Station 2 showed lower velocities, ranging from 0.15 m/s to 0.18 m/s. Station 3 had values between 0.24 m/s and 0.27 m/s. Station 4 recorded notably higher velocities, with values between 0.54 m/s and 0.65 m/s. Station 5 recorded velocities ranging from 0.4 m/s to 0.48 m/s. Station 6 had even higher velocities, between 0.56 m/s and 0.65 m/s. Over the subsequent sampling periods, water velocities showed notable variation. By the sixth sampling in May 2024, Station 1 had velocities ranging from 0.39 m/s to 0.43 m/s. Station 2 recorded a wider range of velocities, from 0.28 m/s to 0.65 m/s. Station 3 had velocities between 0.3 m/s and 0.31 m/s. Station 4 showed a slight decrease with velocities ranging from 0.32 m/s to 0.43 m/s. Station 5 had a range from 0.53 m/s to 0.6 m/s, showing an increase over time. Station 6 also saw a range from 0.39 m/s to 0.56 m/s. Station 7 had velocities between 0.25 m/s and 0.3 m/s. The mean water velocity across all stations and times was approximately 0.36 ±0.17 m/s, indicating substantial variation in water velocities over time and across different stations.

d) Secchi disc Turbidity

Table 3.1: Secchi disc Turbidity across all stations and months

time period in days	1st sampling (0 days, Feb 2024)	2nd sampling (15 days, March 2024)	3rd sampling (30 day, March 2024)	4th Sampling (45 days, April 2024)	5th sampling (60 days, April 2024)	6th sampling (75 days, May 2024)
Station 1	BV	BV	BV	BV	BV	BV
Station 1	BV	BV	BV	BV	BV	BV
Station 1	BV	BV	BV	BV	BV	BV
station2	BV	BV	BV	BV	BV	BV
station2	BV	BV	BV	BV	BV	BV
station2	BV	BV	BV	BV	BV	BV
station3	BV	BV	BV	BV	BV	BV
station3	BV	BV	BV	BV	BV	BV
station3	BV	BV	BV	BV	BV	BV
station 4	BV	BV	BV	BV	BV	BV
station 4	BV	BV	BV	BV	BV	BV
station 4	BV	BV	BV	BV	BV	BV
station 5	BV	BV	BV	BV	BV	BV
station 5	BV	BV	BV	BV	BV	BV
station 5	BV	BV	BV	BV	BV	BV
station 6	BV	BV	BV	BV	BV	BV
station 6	BV	BV	BV	BV	BV	BV
station 6	BV	BV	BV	BV	BV	BV
station 7		BV	BV	BV	15	11
station 7		BV	BV	BV	15	11
station 7		BV	BV	BV	16	11
pond			BV	BV	BV	BV
pond			BV	BV	BV	BV
pond			BV	BV	BV	BV

Note : BV -Bottom Visible

The Sacchi disc turbidity measurements were recorded at seven different stations and one pond over six sampling periods from February to May 2024. The results show that most stations maintained a constant turbidity level, labelled as "BV" (Bottom Visible), indicating the water was clear enough to see the bottom. However, Station 7 showed variations in turbidity levels during the later sampling periods.

The Sacchi disc turbidity results show that the water clarity remained generally high across most stations and the pond, with clear visibility to the bottom. Station 7 experienced a decrease in water clarity during the last two sampling periods, with turbidity values of 15 cm dropping to 11 cm, indicating some variability in water conditions at this location.

B. Chemical Parameters of Water:

a) Water pH

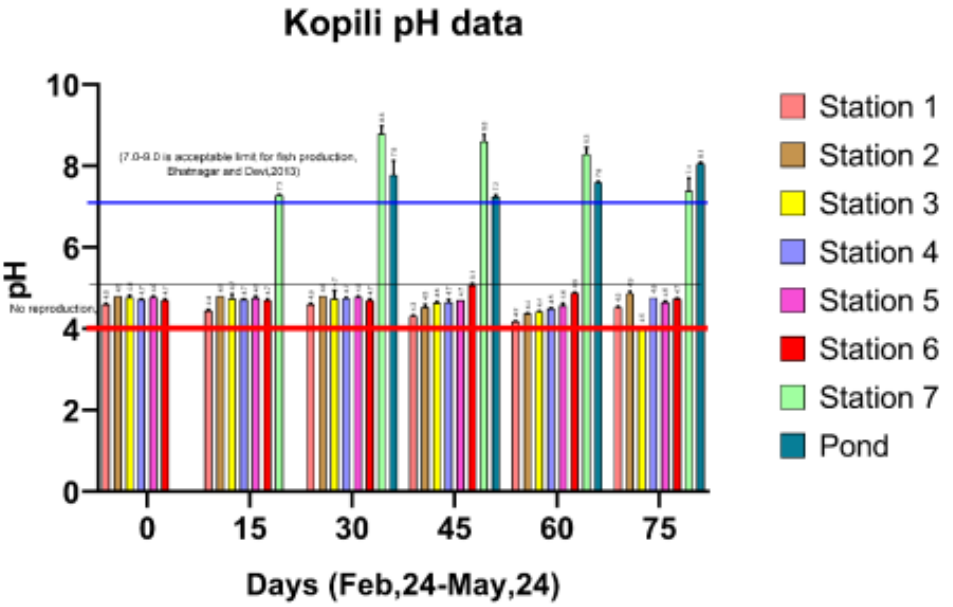

Fig 3.4: Variation of pH across different study stations

The pH values of water samples from various stations over a 75-day period from February to May 2024 exhibited noticeable time variability and differences across stations. At Station 1, the pH values remained relatively stable, ranging from 4.16 to 4.62, with an overall mean of approximately 4.41 and a standard deviation indicating minor fluctuations over time. The initial pH started at 4.56, dropped slightly in mid-March to 4.3, and then stabilized around 4.5 by May. Station 2 showed consistently higher pH levels, ranging from 4.35 to 4.9, with a mean of around 4.63. The pH here remained steady through March and April, with slight variations observed towards the end of the sampling period. Station 3 exhibited wider variability, with pH values from 3.9 to 4.9 and a mean of 4.47. The pH at Station 3 initially remained stable, showed a slight dip in April, and then decreased more significantly by May.

Station 4 had relatively higher and stable pH values, ranging from 4.5 to 4.76, averaging 4.66. The pH remained consistent across the sampling period with minor fluctuations. Station 5 showed slight fluctuations, with pH values from 4.5 to 4.8, and a mean of 4.71. The pH levels dropped slightly in March and April but returned to initial levels by May. Station 6 showed more significant time variability, with pH ranging from 4.65 to 5.1, and a mean of 4.79, indicating an increase in pH levels during the later sampling periods, especially noticeable in May. Station 7 had the highest and most variable pH values, ranging from 7.26 to 8.7, with a

mean of 8.07. Initial pH values were high in March, increased slightly in April, and then showed some decrease by May. The catchment area pond exhibited a narrower range, from 7.2 to 8.08, with a mean of 7.64. Its pH values were relatively stable but showed a slight increase towards the end of the sampling period.The data reveals that while some stations maintained consistent pH levels over time, others, particularly Stations 6 and 7, experienced significant changes, possibly due to environmental or anthropogenic influences. The standard deviations for each station highlight the degree of fluctuation, with Stations 6 and 7 showing higher variability compared to the relatively stable pH levels observed at other stations. This indicates that certain areas are more susceptible to factors that influence pH, emphasizing the importance of continuous monitoring and analysis to understand the underlying causes of these variations.

Maintaining an optimal pH range is crucial for the health and productivity of aquatic ecosystems. For most fish and aquatic organisms, a pH between 7.0 and 8.5 is ideal, supporting maximum biological productivity and well-being. When the pH of the water falls between 4.0 and 6.5 or rises between 9.0 and 11.0, fish experience significant stress, which can affect their growth, reproduction, and overall health. Extreme pH levels, specifically those below 4.0 or above 11.0, are typically lethal to fish, leading to almost certain death due to the inability of their physiological systems to cope with such harsh conditions (Bhatnagar & Devi 2013).

b) Conductivity

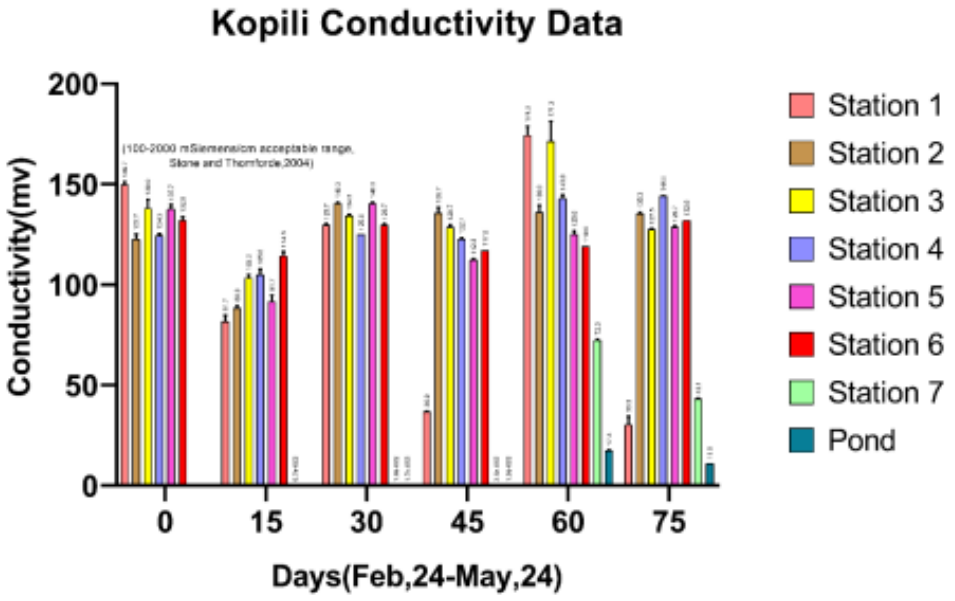

Fig 3.5: Variation of Conductivity across different study stations

The conductivity measurements (in mV) across various stations from February to May 2024 exhibit considerable variation. At Station 1, the values ranged from 27 mV to 151 mV, with an average of approximately 110.5±53.18 mV. Conductivity decreased notablely after the first

sampling, but then slightly fluctuated. For example, in February, conductivity was between 148 mV and 151 mV, while by May, it had dropped to between 27 mV and 35 mV.

Station 2 showed more consistent values, ranging from 87 mV to 141 mV, with an average of about 129.75 mV ±15.37 mV. The values remained relatively stable across the sampling periods. Similarly, Station 3 displayed conductivity values ranging from 102 mV to 179 mV, with an average of approximately 144.75 ±21.92 mV, maintaining stability over time. Station 4 showed slightly less variability with values ranging from 102 mV to 145 mV, averaging about 126.5 ±.87 mV.

In contrast, Station 5 had a range of 89 mV to 141 mV, with an average conductivity of about 122.17 ±17.06 mV. Station 6 exhibited minor fluctuations, with values from 112 mV to 133 mV, averaging 123.83 ±7.46 mV. Station 7 and the pond exhibited markedly different patterns. Station 7 started with negligible readings, around 0.02 mV, until the fourth sampling period, then increased sharply to 72 mV to 73 mV by May. The pond had minimal values initially, around 0.002 mV, before rising to between 11 mV and 17.7 mV by May.

The conductivity data reveals diverse trends across the different stations. While Stations 1 and 7 showed notable changes over time, with Station 7 starting from almost zero and rising sharply, other stations like Station 2, Station 3, and Station 6 remained relatively stable. The observed variations suggest distinct environmental conditions and influences at each station affecting the conductivity measurements.

Stone and Thomforde (2004) recommended a desirable conductivity range of 100 to 2,000 microSiemens per centimeter (µS/cm) for fish. This range ensures an optimal environment for fish health and productivity, balancing essential mineral content without reaching levels that might stress or harm aquatic life.

c) Dissolved oxygen

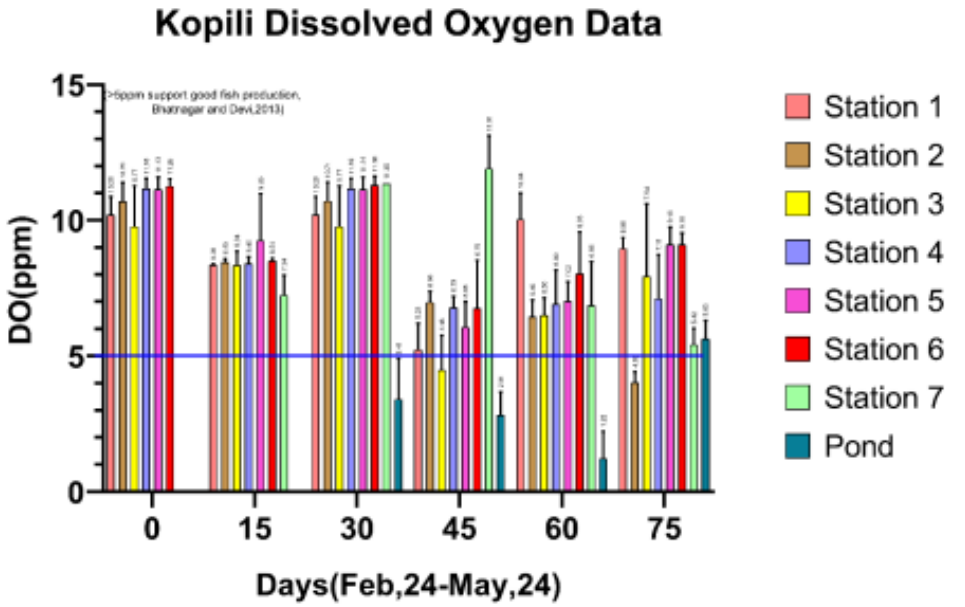

Fig 3.6 : Variation of Dissolve Oxygen across different study stations

The dissolved oxygen (DO) measurements (in ppm) across various stations from February to May 2024 show noticeable variation. At Station 1, the values ranged from 4.186 ppm to 11.028 ppm, with an average of approximately 8.99 ±1.96 ppm. The highest DO concentration was recorded in the initial sampling period, with a gradual decrease over time, hitting the lowest in the fourth sampling period before rising again in the final two samplings. Station 2 exhibited a broader range of DO values, from 3.62 ppm to 11.1895 ppm, averaging about 7.83 ±2.59 ppm. The DO levels at this station also showed a decreasing trend over time, with notable fluctuations.

Station 3 had a DO range of 3.622 ppm to 10.865 ppm, with an average of 7.93 ±2.38 ppm. The values at Station 3 indicated a notable dip during the second sampling, followed by a mixed trend. Station 4 showed DO levels ranging from 5.456 ppm to 11.592 ppm, with an average of 8.56 ±1.96 ppm. This station had relatively stable readings, with slight fluctuations. Station 5 exhibited DO levels from 4.99 ppm to 11.5115 ppm, with an average of 8.22 ±1.92 ppm, showing a slight decrease over time.

Station 6 had a range of DO values from 4.991 ppm to 11.6725 ppm, averaging 9.07 ±2.00 ppm. This station showed a notable drop in the fourth sampling period but maintained higher readings in other periods. Station 7 presented a wider variation in DO values, from 4.99 ppm to 13.28 ppm, with an average of 8.16 ± 2.79 ppm. The catchment area pond had the lowest DO values, ranging from 0.2415 ppm to 6.35 ppm, with an average of 3.84 ±1.89 ppm, indicating much lower oxygen levels compared to the stations. The data reveal distinct variations in DO levels across different sampling periods and stations, with some locations exhibiting more stability than others.

25

Dissolved oxygen (DO) levels greater than 5 parts per million (ppm) are essential to support good fish production. Adequate DO levels are crucial for the respiration of fish and other aquatic organisms. When DO levels fall below this threshold, fish can become stressed, their growth and reproductive rates can decline, and their susceptibility to diseases can increase. Consistently maintaining DO levels above 5 ppm ensures a healthy and productive aquatic environment (Bhatnagar & Devi 2013).

d) Total Dissolve solids

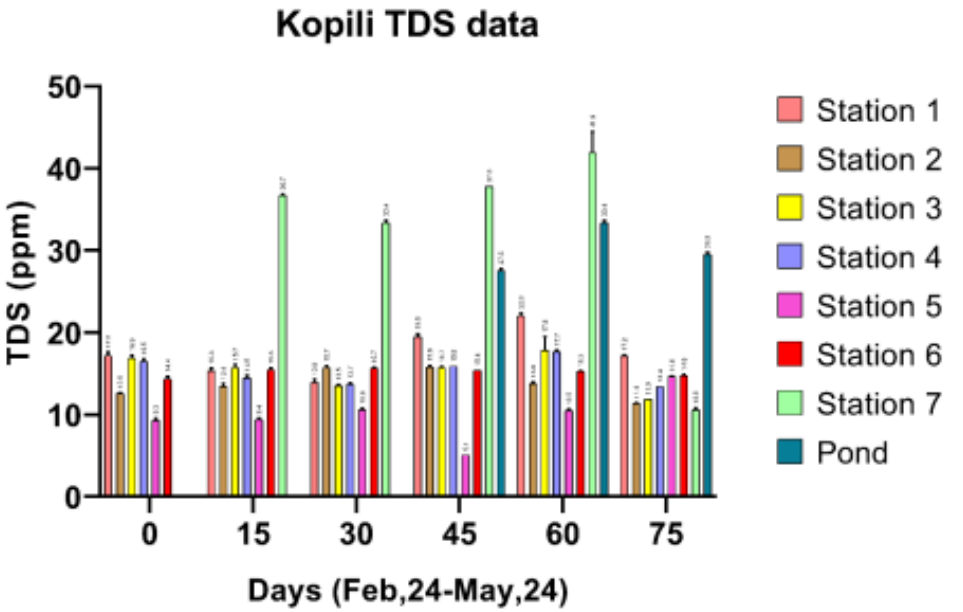

Fig 3.7 : Variation of TDS across different study stations

The Total Dissolved Solids (TDS) measurements in ppm were recorded at various stations over a period from February 2024 to May 2024. During the first sampling in February 2024, TDS levels at Station 1 ranged from 16.7 to 17.5 ppm, while Station 2 had lower values, ranging from 12.5 to 12.7 ppm. Station 3 and Station 4 showed similar TDS levels, around 16.2 to 17.2 ppm and 16.2 to 16.7 ppm, respectively. Station 5 had the lowest TDS levels at around 9.1 to 9.6 ppm. Station 6 displayed values between 14.2 and 14.7 ppm. Station 7 and the pond did not have data for the first sampling.

By the sixth sampling in May 2024, TDS levels showed notable variations. Station 1 recorded TDS levels ranging from 17.1 to 17.3 ppm. Station 2 saw a decrease in TDS levels, ranging from 11.3 to 11.4 ppm. Station 3 had a notable drop to around 11.9 ppm. Station 4's TDS levels stabilized around 13.4 ppm. In contrast, Station 5 saw a notable increase, with values around 14.6 to 14.7 ppm. Station 6 had slightly higher TDS levels, ranging from 14.7 to 14.9 ppm. Station 7 showed a dramatic drop to around 10.3 to 10.7 ppm from earlier higher values. The pond maintained consistent TDS levels between 29.4 and 29.8 ppm. The mean TDS level across all stations and times was approximately 18.4 ±9.2 ppm, indicating substantial variation across different stations and over time. TDS levels varied considerably, with Stations 5 and 7 showing the most notable changes over the sampling period.

e) Total Suspended Solids

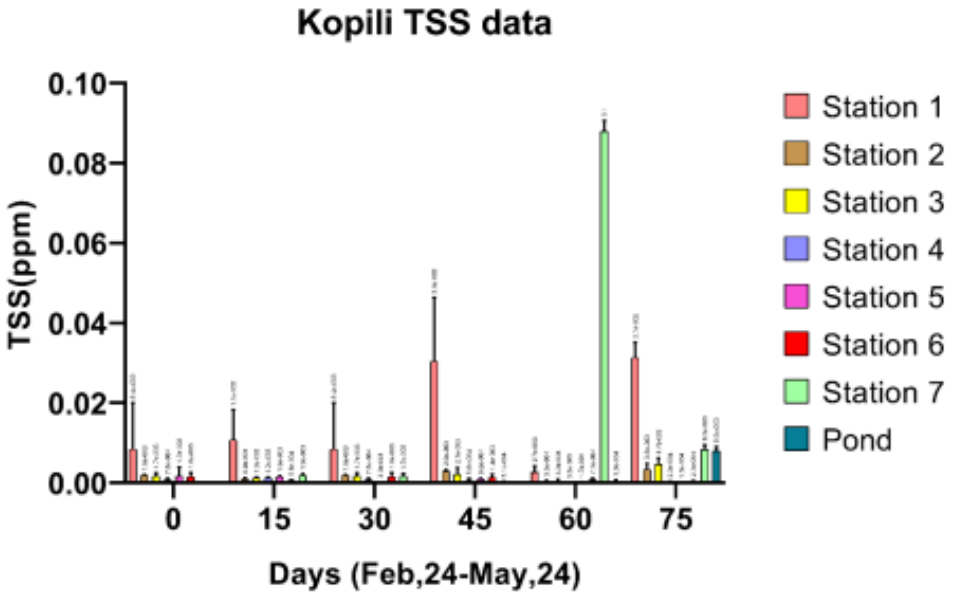

Fig 3.8: Variation of TSS across different study stations

The Total Suspended Solids (TSS) measurements in ppm were taken across various stations from February 2024 to May 2024. During the initial sampling in February 2024, the TSS levels at Station 1 varied from 0.000333 ppm to 0.021667 ppm. Station 2 showed relatively lower levels, ranging from 0.001667 ppm to 0.002 ppm, while Station 3 had values between 0.001 ppm and 0.002667 ppm. Station 4 and Station 5 recorded TSS levels between 0.000333 ppm and 0.001 ppm, and 0.000333 ppm to 0.004333 ppm, respectively. Station 6 had TSS levels ranging from 0.000667 ppm to 0.002667 ppm. There was no data recorded for Station 7 and the pond for the first sampling.

As the sampling continued, the TSS levels varied notably over time. By the sixth sampling in May 2024, Station 1 recorded higher levels ranging from 0.027 ppm to 0.034 ppm. Station 2 saw TSS levels ranging from 0.002 ppm to 0.005 ppm. Station 3 also had an increase with values between 0.003 ppm and 0.006 ppm. Station 4 maintained relatively low levels, around 0.0001 ppm to 0.0003 ppm. Station 5 showed a decrease, with values between 0.0001 ppm and 0.0002 ppm. Station 6 had TSS levels ranging from 0.0001 ppm to 0.0006 ppm. Notably, Station 7 exhibited a notable increase in TSS levels, particularly in the later stages, ranging from 0.007 ppm to 0.09 ppm. The pond also showed measurable TSS levels between 0.007 ppm and 0.009 ppm towards the end of the sampling period. The mean TSS level across all stations and times was approximately 0.007 ±0.015 ppm, indicating substantial variation in TSS concentrations over time and across different stations.The TSS levels generally increased over the sampling period, with Station 7 showing the most dramatic rise in TSS levels.

f) `Total Hardness

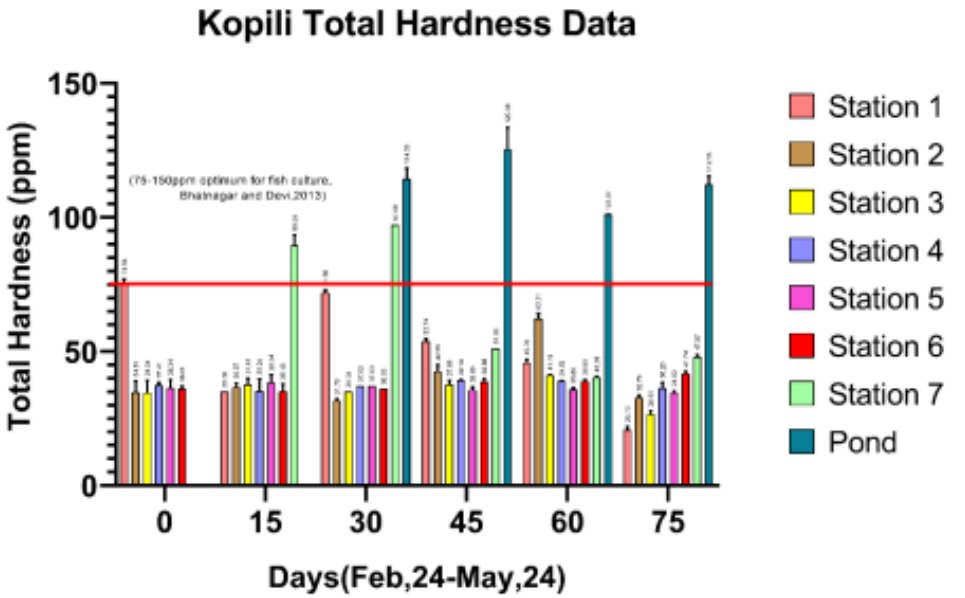

Fig 3.9: Variation of Total Hardness across different study stations

The total hardness (ppm) results across various stations from February to May 2024 revealed notable variations both across stations and over time. At Station 1, the total hardness values ranged from 19.4 ppm to 77.2 ppm, with an average of 48.73 ±22.91 ppm. These values show a clear decreasing trend over time, particularly notable in the last sampling period. Station 2 exhibited a range from 30.03 ppm to 63.63 ppm, averaging about 39.74 ±12.50 ppm. Station 2 experienced fluctuations in hardness levels, but overall, the values were relatively stable with slight increases towards the later sampling periods.

Station 3's hardness levels ranged from 25.88 ppm to 41.41 ppm, with an average of 35.11 ppm and a standard deviation of 4.83 ppm. This station demonstrated the most stable hardness values over time. Station 4 had hardness levels from 30.03 ppm to 39.5 ppm, averaging 37. ±2.79 ppm, indicating minimal variation. Station 5 showed values ranging from 33 ppm to 41.44 ppm, with an average of 36. ±2.60 ppm, which also remained fairly consistent over time.

Station 6 had hardness levels between 32.03 ppm and 42.56 ppm, with an average of 38.53 ±3.59 ppm, showing a slight increase towards the later sampling periods. Station 7 displayed a much broader range from 40 ppm to 97.097 ppm, averaging 68.57 ppm with a notable standard deviation of 25.78 ppm, indicating considerable variability. The pond had the highest and most consistent hardness levels, ranging from 101 ppm to 134.13 ppm, with an average of 116.34 ±10.32 ppm. The pond's consistently high values indicate a different water quality profile compared to the other stations, likely due to its stagnant nature. The data illustrate diverse trends in water hardness, with some stations showing marked changes over time, while others remained stable. Bhatnagar et al. (2004) indicated that hardness values less than 20 ppm cause stress to fish, while 75-150 ppm is considered optimal for fish culture. Hardness levels

exceeding 300 ppm are lethal to fish, as they increase pH levels, leading to the non-availability of essential nutrients.

g) **Total Alkalinity**

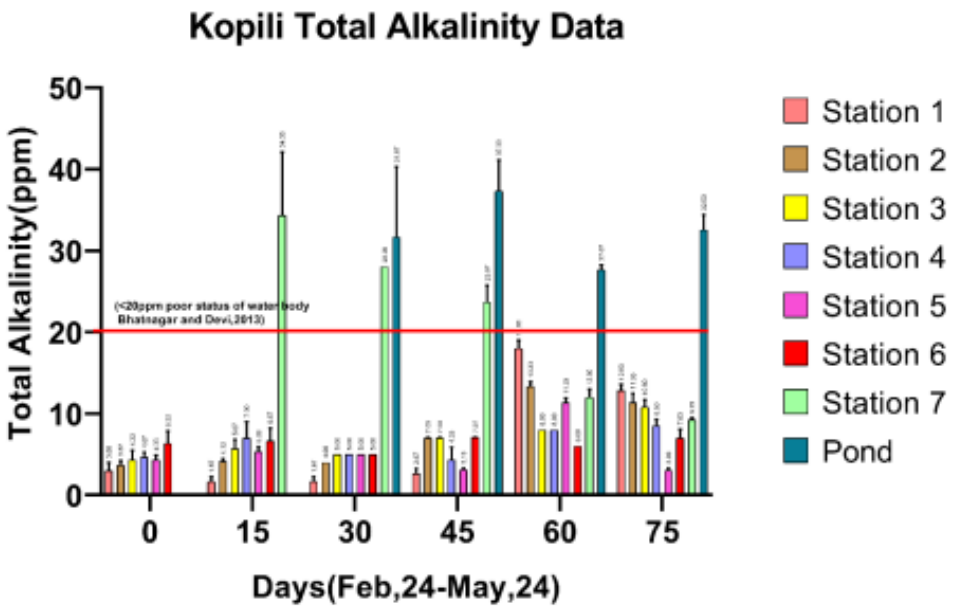

Fig 3.10 : Variation of Total Alkalinity across different study stations

The total alkalinity (ppm) data collected over six samplings from February to May 2024 at various stations indicated noticeable time-based variations. In the first sampling period (0 days, February 2024), Station 1 recorded alkalinity values of 2, 3, and 4 ppm. By the second sampling period (15 days, March 2024), the values slightly varied to 2, 1, and 2 ppm, reflecting a consistent low range. However, a marked increase was observed in the fifth sampling period (60 days, April 2024) with values rising to 17, 18, and 19 ppm. This increase continued into the sixth sampling period (75 days, May 2024), with values stabilizing around 12 to 13.5 ppm. The mean alkalinity at Station 1 over this period was 8.08 ±7.01 ppm, indicating a notable increase and variation over time.

Similar trends were observed at other stations. At Station 2, initial alkalinity values ranged from 3 to 4 ppm in February 2024, remained relatively stable in March 2024, and increased to around 7 ppm by the fourth sampling period (45 days, April 2024). In the fifth and sixth sampling periods, values ranged from 10 to 14 ppm, with a mean of 8. ±4.02 ppm. Station 3 followed a similar pattern, starting with values around 5 ppm, increasing slightly to 7 ppm in March and April, and then stabilizing at 9 to 11.6 ppm by May. The mean value for Station 3 was 7.08 ±2.74 ppm. At Station 7, there was a dramatic increase from 28 ppm in April to 43 ppm by the third sampling period, before settling between 9 and 13 ppm in May, showing a mean of 22.17 ±11.37 ppm. The pond also exhibited notable fluctuations, starting at 30 ppm in April and reaching up to 41 ppm by May, with a mean of 32.67 ±5.55 ppm. These data reflect substantial time-based variability in total alkalinity across different stations, with general trends

of increasing alkalinity levels from February to May 2024. Very low alkalinity values of Staation 1 to 6, indicated low buffering capacity of the Kopili river water in the study stretch.

Bhatnagar et al. (2004) suggested that total Alkalinity levels in water with less than 20 ppm indicating a poor status unsuitable for fish and prawn culture. Levels between 20-50 ppm denote low to medium quality, which may be marginally acceptable but not ideal. The desirable range for optimal fish and prawn health and productivity is between 80-200 ppm, as it ensures an adequate supply of essential minerals.

h) Nitrate

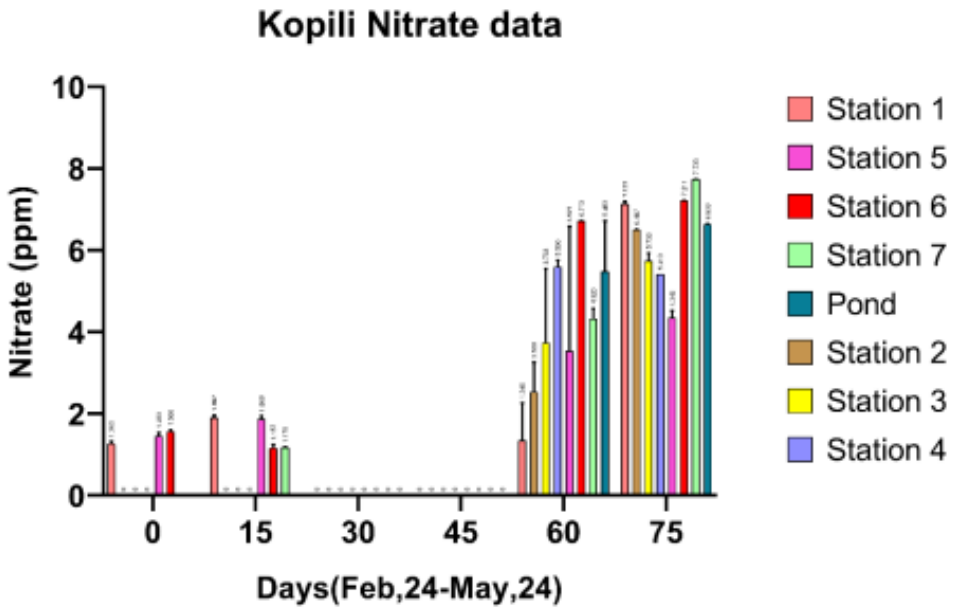

Fig 3.11 : Variation of Nitrate across different study stations

The nitrate (ppm) results from February to May 2024 exhibit considerable variation across different stations and sampling periods. Station 1 shows an initial nitrate concentration around 1.26 ppm, which then drops to 0 ppm during the third and fourth sampling periods before rising notably to an average of approximately 1.34 ppm by the fifth sampling, and peaking at 7.12 ppm by the sixth sampling. The mean nitrate concentration for Station 1 over this period is 2.04 ±2.96 ppm, indicating notable fluctuations, especially in the later periods.

Station 2 consistently recorded 0 ppm nitrate for the first four sampling periods. In the fifth and sixth sampling periods, the nitrate levels increased to an average of 2.53 ppm and 6.50 ppm respectively. The overall mean for Station 2 is 1.84 ±3.06 ppm. Similarly, Station 3 showed 0 ppm nitrate for the first four sampling periods, with an increase to an average of 3.07 ppm in the fifth sampling and 5.73 ppm in the sixth sampling. The mean for Station 3 is 1.47 ±2.75 ppm.

Station 4 consistently recorded 0 ppm nitrate for the first four sampling periods, followed by a notable increase to an average of 5.59 ppm in the fifth sampling period and a consistent 5.41 ppm in the sixth sampling period. The mean for Station 4 is 2.23 ppm with a standard deviation of 2.87 ppm. Station 5 also shows initial nitrate levels around 1.45 ppm, dropping to 0 ppm in the third and fourth sampling periods, then increasing notably to an average of 3.53 ppm in the fifth sampling and 4.34 ppm in the sixth sampling. The mean for Station 5 is 1.90 ±1.91 ppm.

Station 6 recorded an average of 1.56 ppm in the first two sampling periods, followed by 0 ppm in the third and fourth periods, and a notable increase to around 6.71 ppm by the fifth and sixth periods. The mean nitrate concentration for Station 6 is 2.79 ±2.96 ppm. Station 7 had no data for the first period, recorded an average of 1.17 ppm in the second sampling, and then 0 ppm in the third and fourth periods, followed by an increase to an average of 4.32 ppm and 7.73 ppm in the fifth and sixth periods, respectively. The mean for Station 7 is 3.35 ±3.48 ppm.

Finally, the pond showed 0 ppm nitrate in the first four sampling periods and an increase to an average of 5.48 ppm by the fifth and sixth sampling periods. The mean nitrate concentration for the pond is 2.04 ±2.73 ppm.The nitrate levels across all stations indicate notable temporal variations, with generally low levels in the initial periods and marked increases in the later periods, particularly the fifth and sixth sampling periods.

i) Nitrite

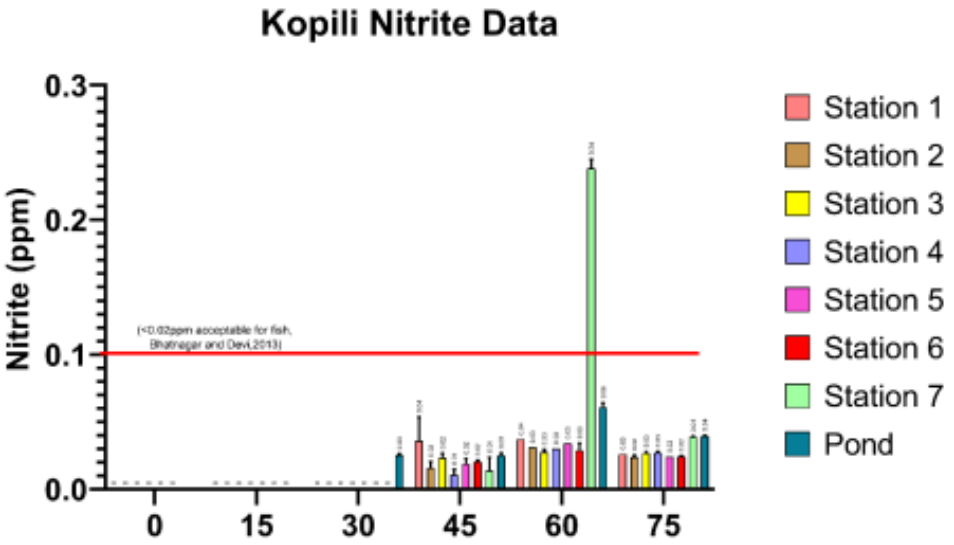

Fig 3.12: Variation of Nitrite across different study stations

The nitrite (ppm) results from February to May 2024 demonstrate a range of variations across different stations and sampling periods. Initially, all stations recorded 0 ppm nitrite levels in

the first three sampling periods. From the fourth sampling period onwards, the nitrite levels began to increase slightly. Station 1 showed a gradual increase from 0.015 ppm in the fourth sampling to an average of 0.037 ppm in the fifth sampling and then a slight decrease to 0.026 ppm by the sixth sampling. The mean nitrite concentration for Station 1 over the entire period was 0.019 ±0.017 ppm, indicating a slight but consistent increase in nitrite levels over time.

Station 2 recorded a similar trend, with nitrite levels remaining at 0 ppm for the first three periods, then increasing to an average of 0.016 ppm in the fourth sampling, and peaking at 0.031 ppm in the fifth sampling before slightly decreasing to 0.024 ppm in the sixth sampling. The mean nitrite concentration for Station 2 was 0.015 ±0.014 ppm. Station 3 also recorded 0 ppm nitrite initially, followed by a gradual increase to an average of 0.023 ppm in the fourth sampling and stabilizing at around 0.027 ppm by the sixth sampling. The mean for Station 3 was 0.017 ppm, with a standard deviation of 0.014 ppm.

Stations 4, 5, and 6 exhibited similar trends, with initial 0 ppm readings, followed by slight increases in the fourth sampling period. Station 4 had a mean of 0.014 ±0.013 ppm, while Station 5 showed a mean of 0.014 ±0.012 ppm. Station 6 recorded a mean of 0.013 ±0.012 ppm. Station 7 showed a notable difference, with no initial data and subsequent increases to 0.244 ppm in the fifth sampling, followed by a decrease to 0.039 ppm in the sixth sampling. The mean for Station 7 was 0.098 ±0.107 ppm, indicating notable fluctuations.

The pond showed slight variations with nitrite levels initially at 0.024 ppm, peaking at 0.064 ppm in the fifth sampling, and slightly decreasing to 0.039 ppm by the sixth sampling. The mean nitrite concentration for the pond was 0.042 ppm, with a standard deviation of 0.018 ppm.The nitrite levels across all stations indicate a general trend of initially low or non-existent levels, with slight increases observed from the fourth sampling period onwards, and some stations showing more notable fluctuations than others.

Stone and Thomforde (2004) suggested that the desirable range for nitrite (NO_2) in water is 0-1 mg/L, with levels less than 4 mg/L being acceptable. According to Bhatnagar et al. (2004), nitrite levels between 0.02-1.0 ppm are lethal to many fish species, levels above 1.0 ppm are lethal for many warm water fishes, and levels below 0.02 ppm are acceptable.

j) Soluble inorganic phosphate

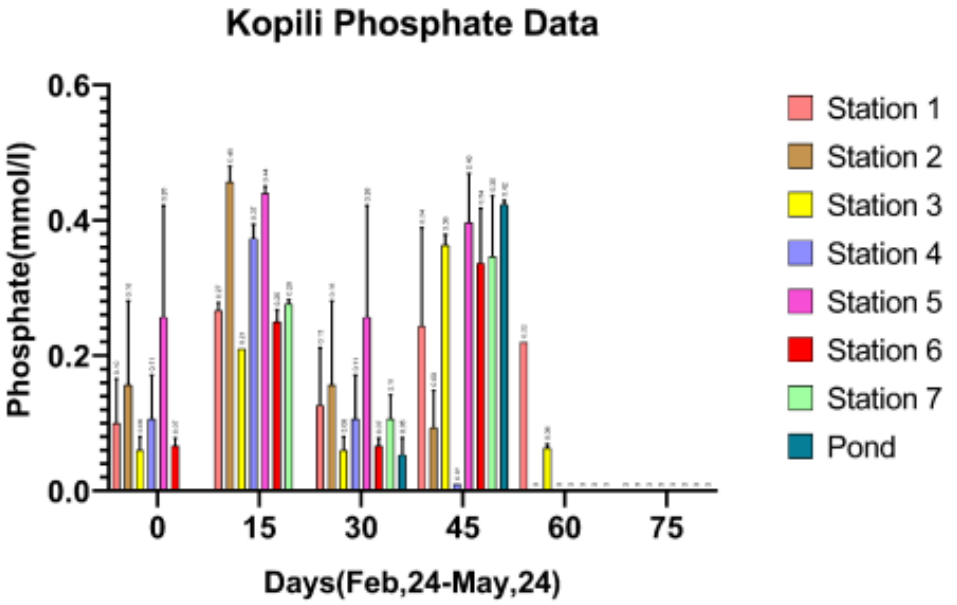

Fig 3.13: Variation of Phosphate across different study stations

The Soluble Inorganic Phosphate (ppm) results from February to May 2024 across various stations and sampling periods reveal notable fluctuations. Initially, phosphate levels varied notably among stations. Station 1 showed phosphate concentrations starting at 0.03 ppm and fluctuating across the sampling periods, peaking at 0.38 ppm in the second sampling before dropping to 0 ppm in the sixth sampling. The mean phosphate level for Station 1 over the entire period was approximately 0.18 ±0.14 ppm, indicating moderate variability in phosphate levels over time.

Stations 2 and 3 also exhibited fluctuations, with initial phosphate levels around 0.30 ppm and 0.04 ppm respectively. Station 2 showed a notable drop to 0 ppm by the fifth and sixth samplings, with a mean of approximately 0.20 ± 0.19 ppm. Station 3 had a peak at 0.38 ppm in the fourth sampling, followed by a drop to 0 ppm by the sixth sampling, with a mean of around 0. ±0.12 ppm. Stations 4 and 5 followed similar trends, with initial phosphate levels dropping to 0 ppm in later samplings. Station 4 had a mean phosphate level of about 0.14 ppm (standard deviation 0.15 ppm), while Station 5 showed higher initial levels with a mean of 0.27 ±0.19 ppm. Station 6 demonstrated lower variability, starting at 0.06 ppm and peaking at 0.43 ppm in the fourth sampling, but consistently dropping to 0 ppm by the sixth sampling. The mean phosphate concentration for Station 6 was approximately 0.17 ±0.12 ppm. Station 7 recorded high initial phosphate levels of around 0.28 ppm in the second sampling, with a mean of 0.21 ±0.12 ppm. The pond samples showed low phosphate levels overall, peaking at 0.43 ppm in the sixth sampling, with a mean of about 0.23 ±0.16 ppm.

In summary, phosphate levels across all stations showed notable initial variations, with a general trend of reduction to 0 ppm by the later sampling periods. The mean phosphate levels ranged from 0.14 ppm to 0.27 ppm across stations indicating moderate to high variability. This

suggests that phosphate concentrations in the sampled water bodies were influenced by temporal factors and possibly external environmental conditions, leading to initial spikes followed by a decline to minimal levels.

After analysis of the nutrient data of station 2, there is no evident sign of eutrophication in station 2 which will ultimately serve as the reservoir of LKHEP after commission. Further due to acidic water pH during the entire study period no fish and plankton were recorded from this station .

k) Biological Oxygen Demand (BOD_3)

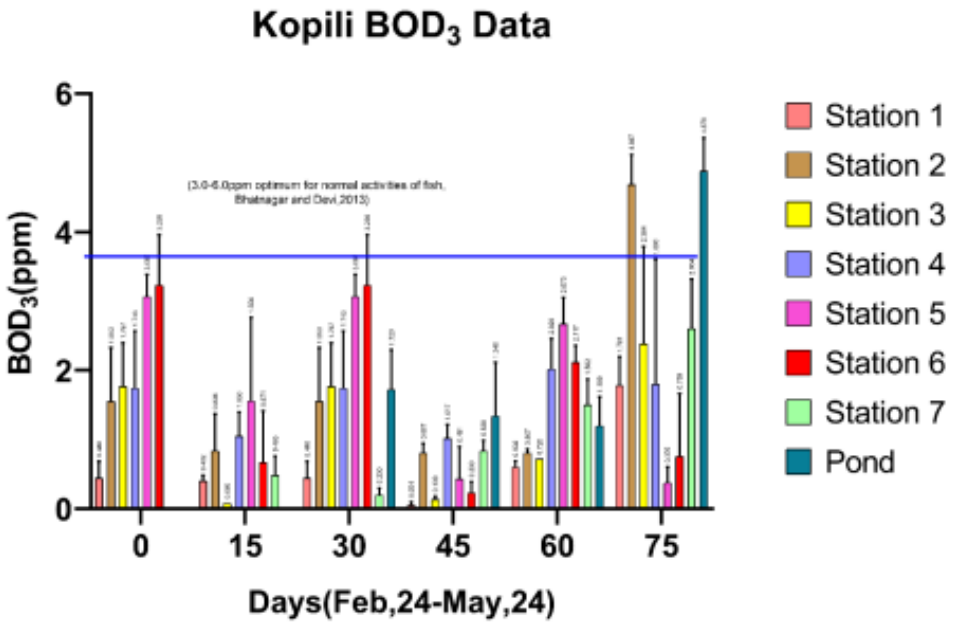

Fig 3.14 : Variation of BOD3 across different study station

The Biochemical Oxygen Demand (BOD_3) (ppm) data collected across six sampling periods from February to May 2024 show distinct variations over time and among different stations. For Station 1, BOD3 (ppm) started low, ranging from 0.178 to 0.66 ppm in February, and slightly fluctuated in March, then increased notably to a range of 0.498 to 2.246 ppm by May. The mean BOD_3 (ppm) for Station 1 across the six periods was 0.877 ±0.739 ppm, indicating a moderate increase over time with some variability.

Station 2 showed a wider range of initial BOD_3 (ppm) values, from 0.572 to 2.25 ppm in February. This range saw more fluctuations in March, stabilizing somewhat in April, and then spiking to values between 4.193 and 4.993 ppm by May. The mean alkalinity for Station 2 was 1.99 ±1.83 ppm, indicating a higher degree of variability and a notable overall increase. Similarly, Station 3 exhibited a mean of 1.47 ±1.24 ppm, with initial values from 0.08 to 2.17 ppm in February and peaking at 3.999 ppm by May. Station 4 started with values between 0.8 and 2.34 ppm and showed an increase to between 0.564 and 3.869 ppm, resulting in a mean of

1.57 ±0.90 ppm. Station 5 showed the highest variability, starting from 0.08 to 3.39 ppm and later ranging from 0.112 to 3.09 ppm, with a mean of 1.83 ±1.13 ppm.

Station 6 exhibited a notable range and variability, from 0.241 to 3.94 ppm in February to values between 0.088 and 1.792 ppm by May, with a mean BOD_3 (ppm) of 1.52 ±1.47 ppm. Station 7 presented substantial increases from February to May, with initial values ranging from 0.1 to 0.644 ppm, later reaching 0.676 to 3.06 ppm by May. The mean for Station 7 was 0.918 ±0.752 ppm. The catchment area pond displayed the highest mean BOD_3 (ppm) overall, with initial values from 0.49 to 2.09 ppm in February rising between 4.427 and 5.384 ppm by May. The mean BOD_3 (ppm) for the pond was 2.96 ±1.64 ppm.

The data reflect temporal and spatial variability in total BOD_3 (ppm) across the sampling periods and stations, with a general trend of increasing BOD_3 (ppm) levels from February to May 2024. The pond showed the highest BOD_3 (ppm) levels and variability, whereas the stations exhibited varied trends with increases over time.

According to Bhatnagar et al. (2004), a Biological Oxygen Demand (BOD) level between 3.0-6.0 ppm is optimal for the normal activities of fish. Levels between 6.0-12.0 ppm are sublethal, causing stress to fish, while levels above 12.0 ppm can typically result in fish kills due to suffocation.

l) Chemical Oxygen Demand (COD)

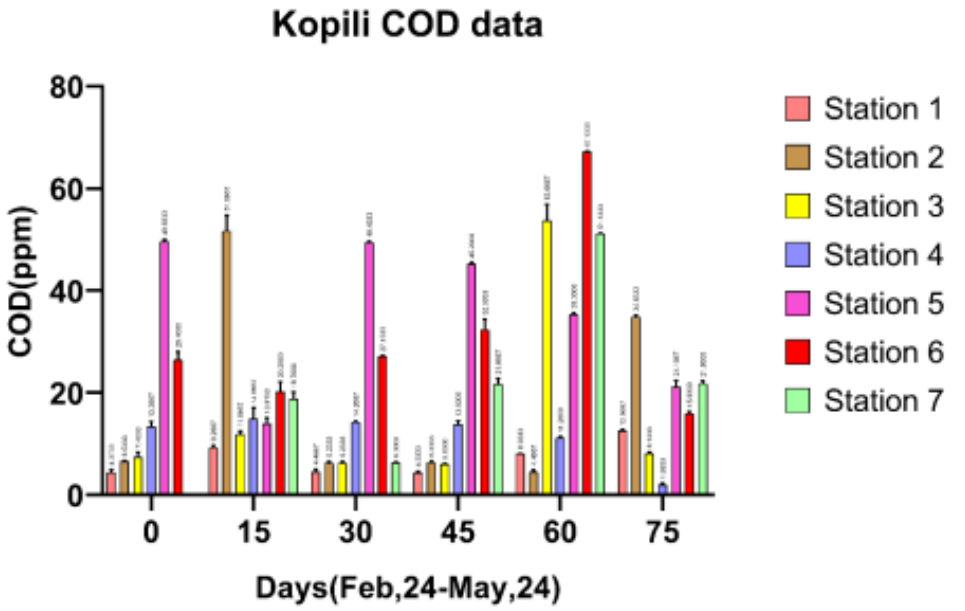

Fig 3.15: Variation of COD across different study station

The Chemical Oxygen Demand (COD) of the study stations from February to May 2024 showed notable variation both over time and across different stations. At Station 1, COD levels ranged from 3.73 ppm to 4.8 ppm in February, increasing consistently to between 12.4 ppm and 12.8 ppm by May. The mean COD concentration for Station 1 across all sampling periods was 7.75 ppm ±3.32 ppm, indicating a notable increase over time with moderate variability.

Station 2 exhibited a stark contrast, with initial COD levels between 6.4 ppm and 6.7 ppm in February, peaking dramatically to between 34.6 ppm and 35.2 ppm by May. The mean COD concentration for Station 2 was notably higher at 23.28 ±19.23 ppm, reflecting substantial temporal and spatial variation. Similarly, Station 3 showed initial COD levels ranging from 6.4 ppm to 8.2 ppm in February, which surged to values between 8 ppm and 8.4 ppm in May. The mean for Station 3 was 12.5 ±16.97 ppm, indicating large fluctuations over the sampling period.

Station 4 demonstrated consistently high initial COD levels, ranging from 12.4 ppm to 14.4 ppm in February, and showed a decrease to between 1.6 ppm and 2.3 ppm by May. The mean for Station 4 was 11.62 ±5.71 ppm, indicating a reduction over time. Station 5 had the highest initial COD levels among all stations, with values ranging from 49.3 ppm to 50 ppm in February, which decreased to between 19.9 ppm and 22.4 ppm by May. The mean COD concentration for Station 5 was 34.93 ±.38 ppm, reflecting high initial values that decreased over time.

Station 6 displayed COD levels ranging from 24.5 ppm to 27.5 ppm in February, reaching between 15.5 ppm and 16.3 ppm by May. The mean COD concentration for Station 6 was 29.8 ±18.38 ppm, indicating high and somewhat stable levels with a slight decrease. Station 7 presented varying initial COD levels, and by May, the range was 21 ppm to 22.4 ppm. The mean for Station 7 was 22.03 ±12.96 ppm, showing stable levels with moderate variability. The COD data indicates diverse trends over time across different stations. Some stations, like Stations 1, 2, and 3, showed increasing trends, while others like Stations 4 and 5 displayed decreasing trends over the sampling period. The variation among stations reflects differences in local environmental factors affecting COD levels.

m) Calcium

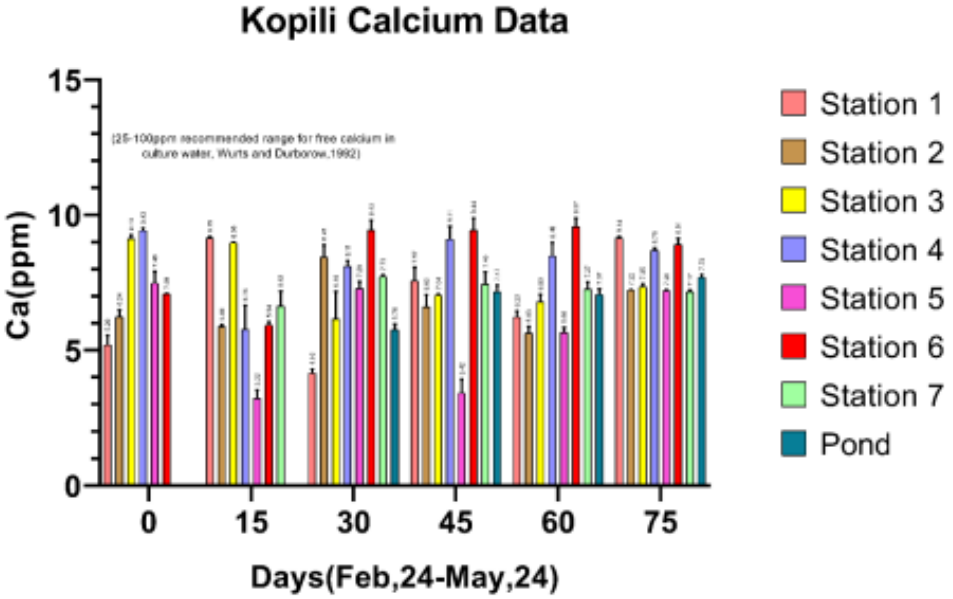

Fig 3.16: Variation of Calcium across different study station

The calcium concentration (ppm) data collected from February to May 2024 demonstrates variation over time and among different stations. In the initial sampling in February, calcium levels at Station 1 ranged from 5.0 to 5.6 ppm, while by May, they had increased to a range of 9.08 to 9.2 ppm. The mean calcium concentration for Station 1 across all sampling periods was 6.65 ±1.87 ppm, indicating a notable increase over time with consistent upward trends.

Station 2 showed initial calcium levels ranging from 5.8 to 6.5 ppm in February, which fluctuated and generally increased to a range of 7.21 to 7.24 ppm by May. The mean calcium concentration for Station 2 was 6.88 ±1.03 ppm, reflecting a steady increase over the sampling period. Station 3 had the highest initial calcium levels among all stations, with values between 9.0 and 9.27 ppm in February, decreasing slightly to a range of 7.24 to 7.44 ppm by May. The mean for Station 3 was 7.82 ±1.19 ppm, showing a decreasing trend.

Station 4 exhibited high initial calcium levels, ranging from 9.334 to 9.48 ppm, and maintained high levels throughout the sampling period, ending with values between 8.65 and 8.79 ppm in May. The mean for Station 4 was 8.58 ±0.79 ppm, indicating relatively stable high calcium levels. Station 5 displayed initial calcium levels ranging from 7.0 to 7.8 ppm in February, fluctuating more than other stations, with levels in May ranging from 7.17 to 7.231 ppm. The mean for Station 5 was 5.94 ±1.68 ppm, indicating variability.

Station 6 showed high calcium levels consistently, starting at 7.08 to 7.1 ppm in February and reaching between 8.67 to 9.43 ppm by May. The mean calcium concentration for Station 6 was 8.63 ±1.23 ppm, reflecting high and stable levels. Station 7 had varying initial calcium levels, and by May, the range was 7.11 to 7.21 ppm, with a mean of 7.23 ±0.25 ppm, indicating stable levels. The pond showed initial calcium levels ranging from 5.64 to 6.0 ppm, increasing to 7.0 to 7.8 ppm by May, with a mean of 6.95 ±0.66 ppm, reflecting a moderate increase over time.The data indicates an upward trend in calcium concentration over time for most stations, with Station 3 showing a slight decrease. Wurts and Durborow (1992) recommended that the range for free calcium in culture waters should be 25 to 100 mg/L, which corresponds to a calcium carbonate ($CaCO_3$) hardness of 63 to 250 mg/L.

n) Chloride

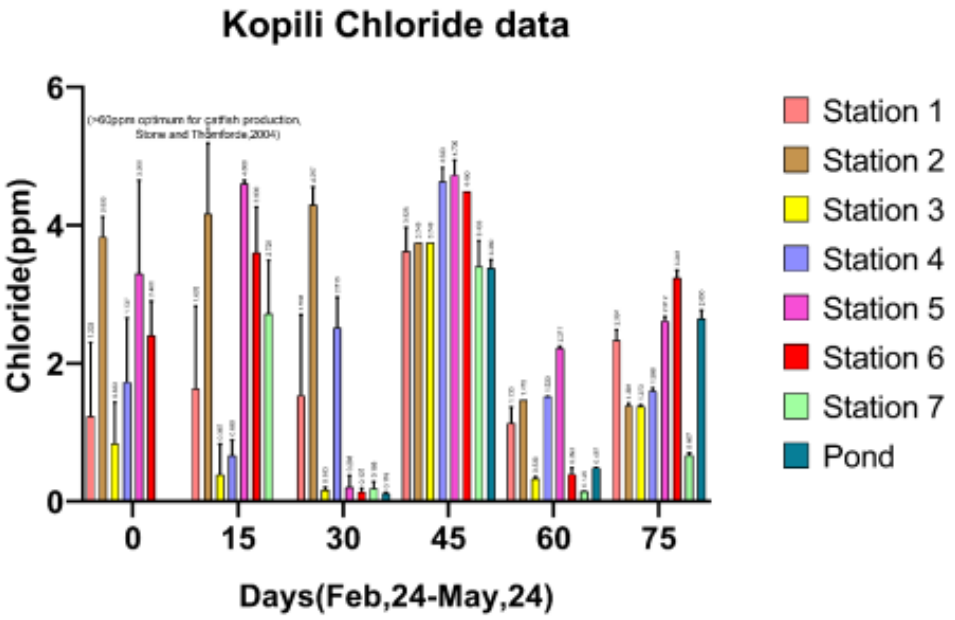

Fig3.17 : Variation of Chloride across different study station

The chloride concentration (ppm) data collected from February to May 2024 reveals variation both over time and across different stations. In the initial sampling in February, chloride levels at Station 1 ranged from 0.3 to 2.4 ppm. By May, these levels increased to a range of 2.165 to 2.468 ppm. The mean chloride concentration for Station 1 across all sampling periods was 1.96 ±0.99 ppm, indicating a moderate increase over time with some variability.

Station 2 showed initial chloride levels ranging from 3.5 to 4 ppm in February, which decreased to a range of 1.346 to 1.424 ppm by May. The mean chloride concentration for Station 2 was 3.35 ±1.23 ppm, reflecting a decrease over the sampling period. Station 3 had lower initial chloride levels, with values between 0.2 and 1.4 ppm in February, increasing to a range of 1.346 to 1.399 ppm by May. The mean for Station 3 was 1.31 ± 0.42 ppm, showing a slight increase over time.

Station 4 exhibited initial chloride levels ranging from 1.12 to 2.8 ppm, and these levels increased to a range of 1.519 to 1.624 ppm in May. The mean for Station 4 was 2.32 ±1.30 ppm, indicating a relatively stable trend with slight increases. Station 5 displayed higher initial chloride levels, ranging from 1.948 to 4.652 ppm in February, and fluctuated with levels in May ranging from 2.541 to 2.672 ppm. The mean for Station 5 was 3.10 ±1.13 ppm, indicating variability.

Station 6 showed an increase in chloride levels consistently, starting at 1.9 to 2.9 ppm in February and reaching between 3.124 to 3.332 ppm by May. The mean chloride concentration for Station 6 was 3.01 ±0.78 ppm, reflecting high and increasing levels. Station 7 had varying initial chloride levels, and by May, the range was 0.624 to 0.689 ppm, with a mean of 1.51 ±1.17 ppm, indicating stable low levels. The pond showed initial chloride levels ranging from 0.1 to 0.124 ppm, increasing to 2.546 to 2.781 ppm by May, with a mean of 1.76 ±1.43 ppm, reflecting a moderate increase over time.

The data indicates different trends in chloride concentration over time for various stations, with some showing increasing trends and others decreasing. The variation among stations reflects differences in local environmental factors affecting chloride levels. According to Stone and Thomforde (2004), the desirable range of chlorides for commercial catfish production is above 60 mg/L.

o) Iron

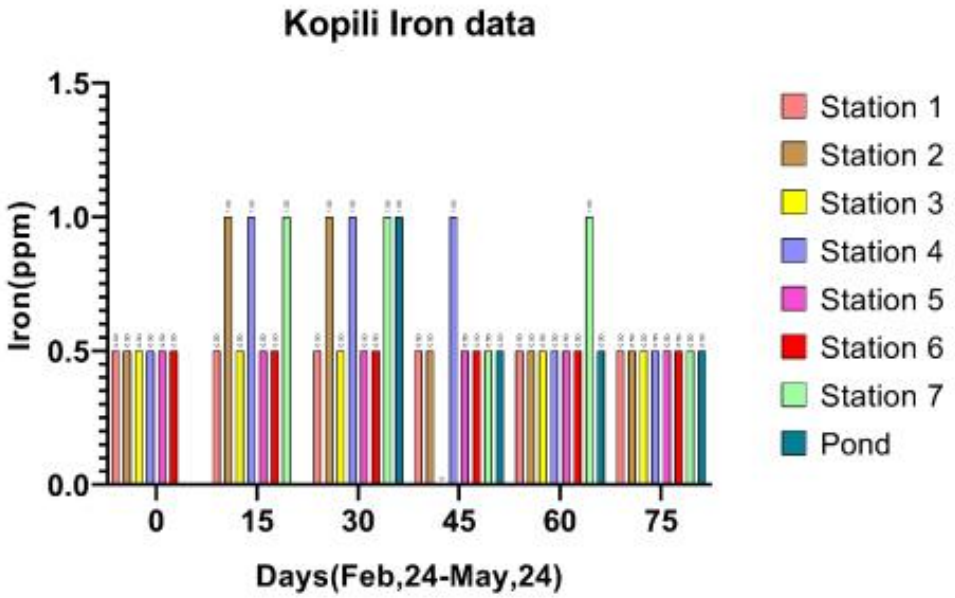

Fig 3.18: Variation of Iron across different study station

The iron (ppm) results from February to May 2024 across various stations show some variation, although the majority of the values are consistent. Station 1 consistently recorded an iron concentration of 0.5 ppm across all six sampling periods, resulting in an average of 0.5 ppm. This stability in Station 1 indicates a low but consistent presence of iron in the water, without much fluctuations over time.

Station 2 showed slightly more variability, with iron levels alternating between 0.5 ppm and 1 ppm. The average iron concentration for Station 2 was approximately 0.67 ±0.25 ppm. This suggests occasional increases in iron concentration at this station. Station 3 also maintained a generally stable iron concentration of 0.5 ppm, except for the fourth sampling period when the level dropped to 0 ppm. The average for Station 3 was around 0.42 ±0.22 ppm, indicating a slight fluctuation during the fourth sampling.

Station 4 exhibited a pattern similar to Station 2, with iron levels alternating between 0.5 ppm and 1 ppm. The average for Station 4 was 0.75 ±0.25 ppm. This station showed more pronounced fluctuations, particularly during the mid-sampling periods. Station 5 recorded a consistent 0.5 ppm across all sampling periods, mirroring the stability seen in Station 1, with an average of 0.5 ppm.

Station 6 also consistently recorded 0.5 ppm of iron, resulting in an average of 0.5 ppm. Station 7 showed variability similar to Stations 2 and 4, with iron levels alternating between 0.5 ppm

and 1 ppm. The average for Station 7 was 0.75 ± 0.25 ppm, indicating some periodic increases in iron concentration. Lastly, the pond showed a decrease from 1 ppm to 0.5 ppm after the first sampling, resulting in an average of 0.67 ±0.25 ppm, reflecting the initial higher concentration and subsequent stabilization.

The iron concentrations were generally stable at 0.5 ppm across most stations, with some stations like Stations 2, 4, 7, and the pond showing occasional increases to 1 ppm. The standard deviations were low, indicating minor fluctuations in iron levels across the different sampling periods.

p) **Potassium**

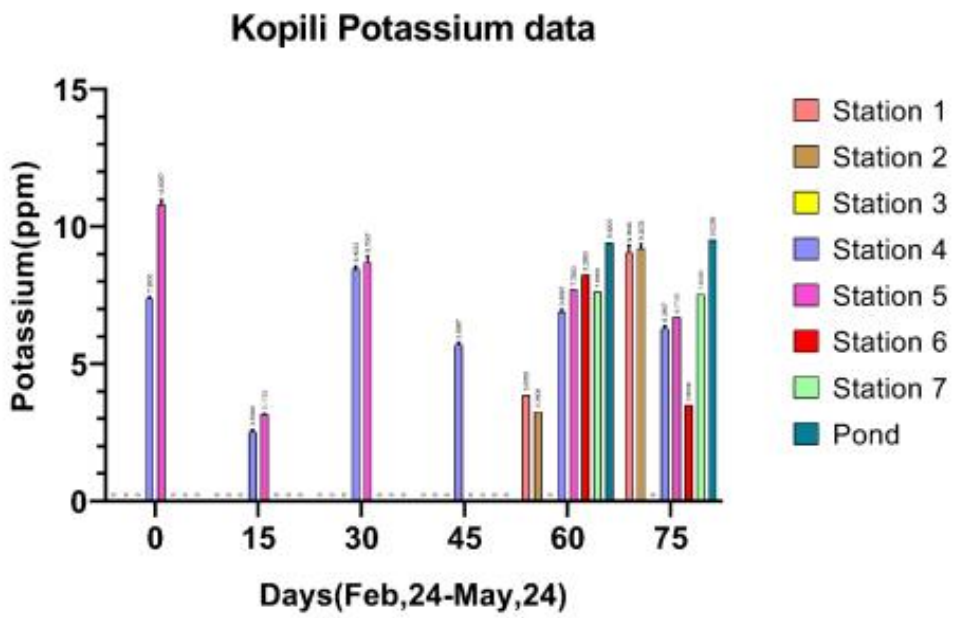

Fig 3.19 : Variation of Potassium across different study station

The Potassium (ppm) results were measured at different stations and times from February 2024 to May 2024. During the initial sampling in February, no Potassium was detected at any of the stations or the pond. By the second sampling in March, only Station 4 and Station 5 showed detectable levels of Potassium, ranging from 2.45 ppm to 3.18 ppm. As time progressed, the Potassium levels increased. By the third sampling, levels at Station 4 and Station 5 had increased notably, with Station 4 ranging from 8.34 ppm to 8.56 ppm, and Station 5 from 8.45 ppm to 8.84 ppm.

In April and May, Potassium levels continued to rise across more stations. The fifth sampling in April saw Potassium levels in Station 1 at 3.87 ppm, and stations 4, 5, 6, and 7 had notable levels ranging from 5.62 ppm to 8.25 ppm. By the final sampling in May, Potassium levels at Station 1 peaked at 9.36 ppm, with the pond reaching a high of 9.52 ppm. The mean Potassium levels across all stations and times were approximately 6.12 ±2.94 ppm, indicating higher

variation in Potassium concentrations over time and across different stations. The results suggest a clear temporal increase in Potassium levels, with the highest variability observed towards the later sampling periods.

q) Sodium

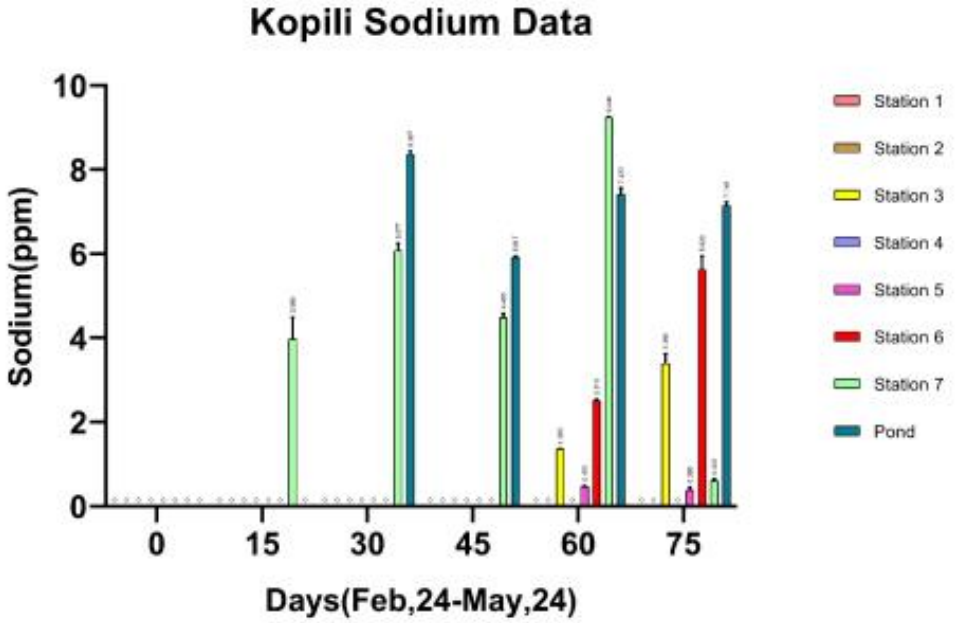

Fig 3.20 : Variation of Sodium across different study station

The Sodium (ppm) results indicated varying levels of Sodium across different stations and times from February 2024 to May 2024. Initially, no Sodium was detected at any station during the first sampling in February 2024. By the second sampling in March 2024, Sodium was detected only at Station 7, with levels ranging from 3.47 ppm to 4.49 ppm. As time progressed, the third sampling in late March showed an increase in Sodium levels at Station 7 to between 5.92 ppm and 6.26 ppm. Additionally, the pond showed notable Sodium levels, all around 8.33 ppm to 8.45 ppm.

In April and May, more stations exhibited detectable Sodium levels. By the fourth sampling, Station 3 showed Sodium levels around 1.36 ppm to 1.37 ppm, while Station 7 had levels ranging from 4.42 ppm to 4.59 ppm. The pond continued to show high Sodium levels, around 5.89 ppm to 5.94 ppm. By the fifth sampling in April, Station 6 showed notable Sodium levels, ranging from 2.48 ppm to 2.54 ppm, and Station 7 exhibited a peak of 9.23 ppm to 9.26 ppm. The pond remained high, with levels around 7.26 ppm to 7.54 ppm. In the final sampling in May, Station 3's Sodium levels ranged from 3.21 ppm to 3.65 ppm, and Station 6 showed levels from 5.33 ppm to 5.97 ppm. The mean Sodium level across all stations and times was approximately 3.83 ±3.22 ppm, indicating substantial variation over time and across different stations. The Sodium levels increased drastically over the sampling period, with Station 7 and the pond showing the highest concentrations.

r) Sulphate

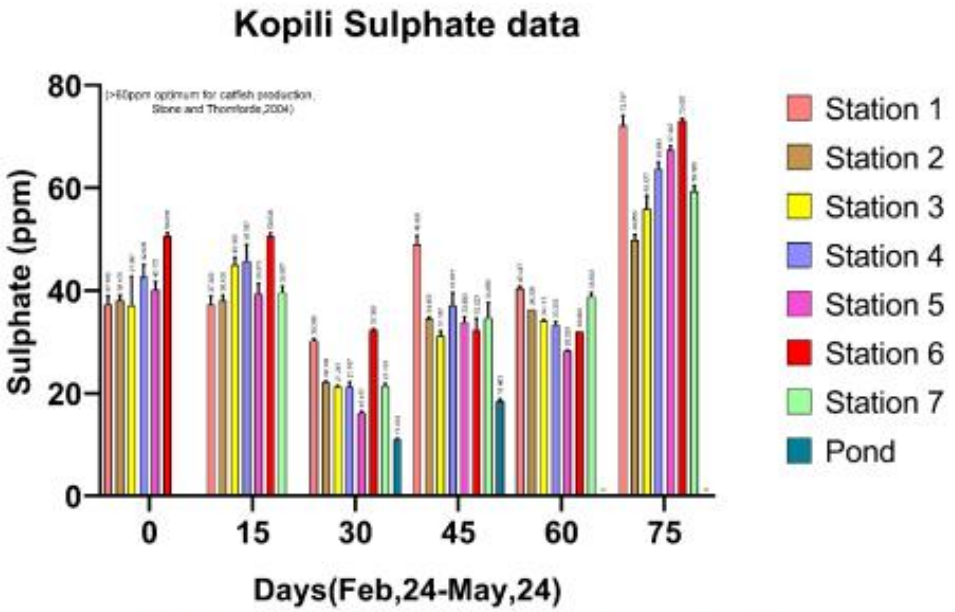

Fig 3.21: Variation of Sulphate across different study station

The Sulphate (ppm) results were measured at various stations from February 2024 to May 2024. In the first sampling in February 2024, the Sulphate levels ranged from 33 ppm to 51.3 ppm across all stations, with the pond showing no detectable Sulphate. The second sampling in March 2024 showed Sulphate levels remaining relatively consistent at each station, with slight variations. For example, Station 1 maintained levels around 37.4 to 38.9 ppm, while Station 4 stayed around 43.1 to 44.8 ppm. The pond also showed consistent results, ranging from 10.9 to 11.2 ppm.

As time progressed, the third sampling in late March 2024 saw a drop in Sulphate levels at most stations, with Station 5 and the pond showing the lowest values at around 16 ppm and 18.67 ppm, respectively. By the fourth sampling in April 2024, there was a slight increase in Sulphate levels, with Stations 1, 2, and 3 ranging between 30 ppm to 50 ppm. By the fifth sampling, Sulphate levels had increased across all stations, peaking at around 40.67 ppm to 40.67 ppm at Station 1, while the pond showed no detectable Sulphate. The final sampling in May 2024 recorded the highest Sulphate levels, especially at Station 1, ranging from 70.33 ppm to 74.23 ppm. The mean Sulphate level across all stations and times was approximately 38.2 ±18.9 ppm, indicating considerable variation in Sulphate concentrations over time and across different stations. The Sulphate levels showed an initial decrease followed by a notable increase, with Station 1 and Station 6 showing the highest levels towards the end of the sampling period. .

s) **Heavy metals (Pb & As):** Heavy metals (Pb & As) was not detected from water of River Kopili as well as groundwater samples collected during the entire study period.

C.Bacteriological parameters of water

MPN

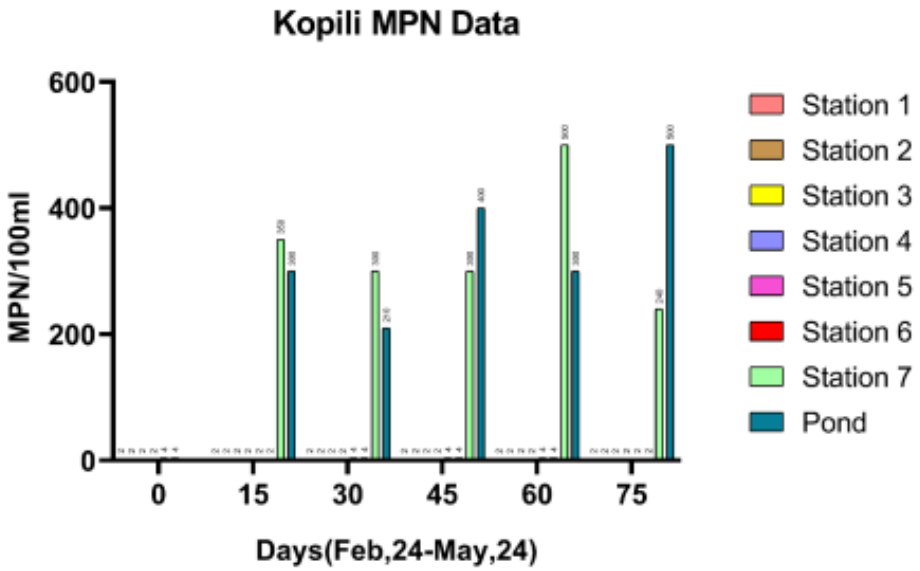

Fig 3.22 : Variation of MPN across different study station

The Most Probable Number (MPN) per 100 milliliters (ml) measurements were recorded across various stations from February 2024 to May 2024. For most stations (Stations 1 through 4), the MPN/100ml remained consistently low and unchanged at a value of 2 throughout all sampling periods. This suggests a relatively stable and low level of microbial presence in these locations.

However, more variability was observed in other stations and the pond. Station 5 and Station 6 both recorded an MPN/100ml of 4 during the first sampling in February, then dropped to 2 in subsequent samplings, with fluctuations between 2 and 4 across the sampling periods. Station 7 showed a dramatic increase in MPN/100ml starting from the second sampling in March, with values reaching 350. The readings then varied between 300 and 500, suggesting a high microbial presence and considerable variation over time. The pond also exhibited high MPN/100ml values, starting at 300 in the second sampling and fluctuating between 210 and 500 in subsequent samplings.

The mean MPN/100ml for Stations 1 through 4 was consistently 2, with a standard deviation of 0, indicating no variation. For Station 5 and Station 6, the mean MPN/100ml was 3, , reflecting some variability. Station 7 and the pond had much higher means of approximately 338 and 342, respectively, , indicating fluctuations in microbial presence. These variations highlight the differences in microbial activity across different sampling locations and time periods, suggesting that some areas are more prone to changes in microbial populations than others.

D. Biological

i) Plankton density Cells/NosL^{-1}

Table 3.2 : Plankton density across different study stations

	Plankton Genus	Station 1	station2	station3	station 4	station 5	station 6	Station 7	Pond
Phytoplankton	*Scenedesmus sp*	-	-	-	-	-	-	1.7	0.6
	Microcystis sp	-	-	-	-	-	-	1.2	0.9
	Euglena sp	-	-	-	-	-	-	3.5	3.7
	Asterionella sp	-	-	-	-	-	-	3.1	4.6
	Desmidium sp	-	-	-	-	-	-	1.4	1.1
	Cosmerium sp	-	-	-	-	-	-	0.7	0.2
	Frustulia sp	-	-	-	-	-	-	2.8	1.7
	Mougetia sp	-	-	-	-	-	-	2.1	4
	Cymbella sp	-	-	-	-	-	-	1.6	2
	Cyclotella sp	-	-	-	-	-	-	0.9	0.4
	Spryogyra sp	-	-	-	-	-	-	1.5	3.3
	Closterium sp	-	-	-	-	-	-	0.3	0.1
	Zygnema sp	-	-	-	-	-	-	2.4	2.8
	Phacus sp	-	-	-	-	-	-	4.1	2.9
	Nostoc sp	-	-	-	-	-	-	0.7	1.5
	Navicula sp	-	-	-	-	-	-	3.5	5.1
	Pediastrum sp	-	-	-	-	-	-	0.6	0.8
	Nitzchia sp	-	-	-	-	-	-		0.8
Zooplankton	*Diaptomus sp*	-	-	-	-	-	-	0.9	0.4
	Bosmina sp	-	-	-	-	-	-	0.3	0.2
	Alona sp	-	-	-	-	-	-	0.2	

	Cyclops sp	-	-	-	-	-	-	1.1	2.4
	Copepod Nauplii	-	-	-	-	-	-	1.4	3.1

During the study period no phytoplankton and zooplankton were recorded from station 1 to 6 , we have recorded 17 genera of phytoplankton and 5 forms of zooplankton from station 7. In addition,18 genera of phytoplankton and 4 forms of zooplankton were recorded from catch man area pond.

Biodiversity Indices : Shannon-Wiener Index and Simpson Diversity Index

The Shannon-Wiener Index is a measure of biodiversity that takes into account both the richness (number of different species) and evenness (distribution of individuals among those species) of a community ranges from 0-5. A higher Shannon-Wiener Index value indicates greater diversity within the community.In present study, the Shannon-Wiener Index of plankton at station 7 is 2.8587, while the pond has a Shannon-Wiener Index of 2.76899. This suggests that the plankton community at station 7 has slightly higher diversity compared to the pond.

The Simpson Diversity Index ranges from 0 to 1, with 0 indicating infinite diversity (infinite number of equally abundant species) and 1 indicating no diversity (only one species present).In the provided example, the Simpson Index of plankton at station 7 is 0.039984, and in the pond, it is 0.050774. Both values are close to 0, indicating relatively high diversity in both locations.Comparatively, the Simpson Index of the pond (0.050774) suggests slightly lower diversity than that of station 7 (0.039984), although both values still fall within the range close to 0, signifying diverse plankton communities.

Therefore, despite the slight difference between the two locations, both exhibit relatively high diversity of plankton species.

Periphyton

Table 3.3: Periphyton Diversity across different Station

Genus	Station 1	station2	station3	station 4	station 5	station 6	Station 7
Scenedesmus sp	-	-	-	-	-	-	+
Microcystis sp	-	-	-	-	-	-	+
Euglena sp	-	-	-	-	-	-	+
Asterionella sp	-	-	-	-	-	-	+
Desmidium sp	-	-	-	-	-	-	+
Cosmerium sp	-	-	-	-	-	-	+
Frustulia sp	-	-	-	-	-	-	+

Mougetia sp	-	-	-	-	-	-	+
Cymbella sp	-	-	-	-	-	-	+
Cyclotella sp	-	-	-	-	-	-	+
Spryogyra sp	-	-	-	-	-	-	+
Closterium sp	-	-	-	-	-	-	+
Zygnema sp	-	-	-	-	-	-	+
Phacus sp	-	-	-	-	-	-	+
Nostoc sp	-	-	-	-	-	-	+
Navicula sp	-	-	-	-	-	-	+
Pediastrum sp	-	-	-	-	-	-	+
Nitzchia sp	-	-	-	-	-	-	+

During the study period no periphyton were recorded from station 1 to 6 . We have recorded 18 forms of periphyton from station 7 .

Benthos : No benthos species were found in all the stations during study period.

Fish : During the present study, no fish species was recorded from stations 1,2,3,4 & 5. During the present investigation, 18 fish species belonging to 3 orders, 4 families, 15 genera were recorded from the study stretch. During the study, 2 fish species were recoded from station 6 while 16 fish species were recorded. One fish species was recorded from the catchment area pond. (Annexure I)

Table 3.4 : Station Wise Identification of Fish Species with Tropic Level status

Sl. no	Name of the Fish species & IUCN (2021) conservation status	Trophic Level	Station 1	Station 2	Station 3	Station 4		Station 5	Station 6	Station 7	Pond
1	*Puntius Sophore* (LC)	2.6 ±0.10	-	-	-	-		-	-	+	-
2	*Labeo rohita* (LC)	2.2 ±0.12	-	-	-	-		-	-	+	-
3	*Clupisoma garua* (LC)	3.7 ±0.59	-	-	-	-		-	-	+	-
4	*Cabdio morar* (LC)	3.3 ±0.4	-	-	-	-		-	-	+	-
5	*Opsarius bendelisis* (LC)	3.5 ±0.5	-	-	-	-		-	-	+	-
6	*Cirrhinus reba* (LC)	2.5 ±0.2	-	-	-	-		-	+	+	-
7	*Glossogbius giuris* (LC)	2.5 ±0.2	-	-	-	-		-	-	+	-
8	*Opsarius tileo* (LC)	3.6 ±0.5	-	-	-	-		-	-	+	-
9	*Osteobrama cotia* (LC)	2.9 ±0.3	-	-	-	-		-	-	+	-
10	*Labeo pangusia* (NT)	2.0 ±0.00	-	-	-	-		-	-	+	-
11	*Bangana dero* (LC)	2.0 ±0.00	-	-	-	-		-	-	+	-
12	*Sperta aor* (LC)	3.6 ±0.53	-	-	-	-		-	-	+	-

13	*Mystus cavasius* (LC)	3.4 ±0.4	-	-	-	-		-	-	+	-
14	*Mystus bleekeri* (LC)	3.3 ±0.4	-	-	-	-		-	-	+	-
15	*Botia rostrata* (VU)	3.2 ±0.4	-	-	-	-		-	-	+	-
16	*Pethia conchonius* (LC)	2.9 ±0.33	-	-	-	-		-	-	+	-
17	*Barilius barila* (LC)	3.2 ±0.4	-	-	-	-		-	+	–	-
18	*Danio rerio* (LC)	3.1 ±0.1	-	-	-	-		-	-	-	+

Note: + Present; - Absent

According to available literature (Hora, 1922; Das & Hasan, 2008), Cyprinid fishes display potamodrmous migration. They migrate upstream during monsoon for reproduction. They live in upper reaches for a period and then return to the lower reaches (foothills) for food and shelter. Based on the present study some of the potamodramous migratory fish species available in the study stretch of River Kopili are : *Labeo* spp., *Barilius* spp. and *Opsarius* spp.

Table 3.5: Length and Weight of Collected Fish species

Sl. no	Name of the Fish species & IUCN (2021) conservation status	Trophic Level	No of iNdviduals	Length (Cm)	Weight(gm)
1	*Puntius Sophore* (LC)	2.6 ±0.1 ()	7	10.1 11 13.86 10.1 9.8 9.4 11	15.57 20.502 10.5 16.315 17.90 13.142 27.71
2	*Labeo rohita* (LC)	2.2 ±0.12	4	20.6 15.2 19.5 18.2	108.81 43.005 79.186 71.512
3	*Clupisoma garua* (LC)	3.7 ±0.59	1	12.8	15.86
4	*Cabdio morar* (LC)	3.3 ±0.4	61	13.2 13.2 9.3 9.6 7.5 7.7 8 7 6.1 7.2 10.4 7.2 8.7 6.5 6.9 7.4 8 8.5 6.5 7.5 7.7 5.6 5.6 7 7.1 7.6 8.2 7.4 9.1	21.804 24.519 12.651 7.61 3.58 3.75 4.66 3.57 2.57 3.44 6.04 3.76 5.88 2.89 2.81 3.97 3.83 4.62 2.5 3.13 4.04 1.35 1.59 3.28 3.18 3.34 4.42 3.01 5.94

				6.8 8.3 7.5 6 8 7.3 9 7.1 8.1 8.3 8.6 7.4 8.1 6.5 7 7 8.3 8.2 7.4 7.1 7.2 7 6.2 7.5 8.2 7 7 7.2 6.6 7 6.6 6.8	2.95 4.24 3.89 2.08 3.77 3.45 7.24 3.49 5.07 4.57 5.11 3.02 3.92 2.45 3.84 3.57 4.79 4.58 3.27 3.47 3.17 2.33 2.68 3.85 4.74 2.95 3.26 3.87 3.12 3.07 3.20 2.93
5	*Opsarius bendelisis* (LC)	3.5 ±0.5		6.5 5.9	4.3 3.9
6	*Cirrhinus reba* (LC)	2.5 ±0.2	3	13.4 12.5 14.46	20.730 17.785 42.773
7	*Glossogbius giuris* (LC)	2.5 ±0.2	5	14.5 15.3 13 13.4 11.3	28.582 27.45 20.154 18.668 13.299
8	*Opsarius tileo* (LC)	3.6 ±0.5	1	7.5	20
9	*Osteobrama cotia* (LC)	2.9 ±0.3	22	8 8.6 8.2	7.25 7.703 7.509

				8.6 8.7 8.1 8.2 8.9 9.3 7.8 8.6 8.8 8.6 9.4 7.6 8.7 8.8 8.5 7.9 8.4 7.8 8.3	6.609 7.066 7.633 5.437 8.521 8.446 5.183 8.493 8.21 7.131 9.45 5.716 7.6 8.252 6.95 5.34 6.66 8.843 6.571
10	*Labeo pangusia* (NT)	2.0 ±0.00	2	21.7 18	123.6 68
11	*Bangana dero* (LC)	2.0 ±0.00	11	16.8 16.1 16.5 15 16 17 14.1 14.8 16.2 14.6 16.3	53.49 52.441 46.295 33.45 43.55 47.565 28.08 29.226 50.601 31.04 39.391
12	*Sperta aor* (LC)	3.6 ±0.53	1	25	100
13	*Mystus cavasius* (LC)	3.4 ±0.4	9	25.6 14.7 15.2 15 18.1 15.3 14.4 15.2 15.7	83.523 26.954 24.196 23.96 44.09 26.358 26.088 29.275 30.144
14	*Mystus bleekeri* (LC)	3.3 ±0.4	4	26.1 24.6 13.6 15.4	100 80.804 24.609 28.04

15	*Botia rostrata* (LC)	3.2 ±0.4	1	10.1	13.91
16	*Pethia conchonius* (LC)	2.9 ±0.33	3	5 4.8 5.1	3 2.88 3
17	*Barilus barila* (LC)	3.2 ±0.4	4	6.5 6.5 8.7 6.5	3.205 2.68 7.78 2.68
18	*Danio rerio* (LC)	3.1 ±0.1	2	4.5 4.3	4 3.2

Table 3.6: Fish fauna recorded during the study with their Order, Family, Common name, migratory nature and Conservation status

Sl. No.	Order	Family	Species	Common name	IUCN 2021	Migratory nature
1.	Cypriniformes	Cyprinidae	*Puntius sophore*	Soft fin swamp barb	LC	Reports available
2.			*Pethia conchonius*	Rosy barb	LC	
3.			*Labeo rohita*	Rohu labeo	LC	
4.			*Labeo pangusia*	Pangusia labeo	NT	
5.			*Bangana dero*	Kalabans	LC	
6.			*Cabdio morar*	Morar	LC	
7.			*Opsarius bendelisis*	Hamilton's barila	LC	
8.			*Opsarius tileo*	Tileo baril	LC	
9.			*Barilus barila*	Bared trout	LC	
10.			*Cirrhinus reba*	Reba carp	LC	
11.			*Danio rerio*	Zebra fish	LC	
12.			*Osteobrama cotio*	Hafo	LC	
13.			*Botia rostrata*	Gangetic loach	VU	
14.	Siluriformes	Bagridae	*Mystus cavasius*	Gangetic Mystus	LC	No reports
15.			*Mystus bleekeri*	Day's mystus	LC	-do-
16.			*Sperata aor*	Long-whiskered catfish	LC	-do-
17.		Sisoridae	*Clupeisoma garua*	Bachcha	LC	-do-
18.	Perciformes	Gobiidae	*Glossogobius giuris*	Tank goby/Bare eye goby	LC	-do-

Conservation Status

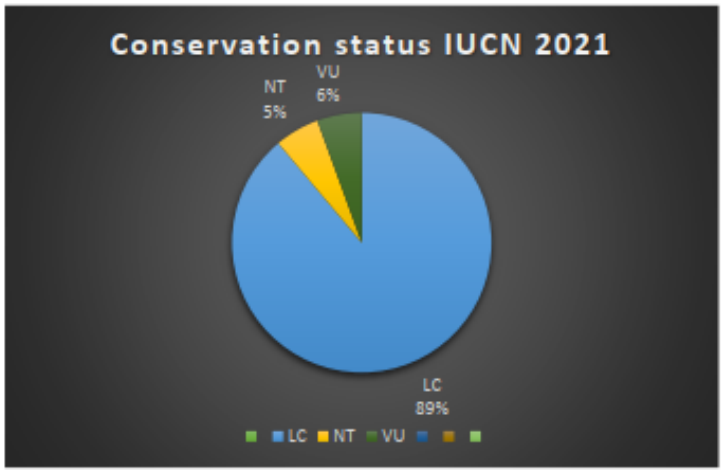

Fig 3.23 : Graphical representation showing conservation status of collected fish species from River Kopili as per IUCN 2021

Based on the previous study by Nath, 2023 and the current investigation 89% fish species recorded from the river were in Least Concern Category (LC) while 19 % were in near threatened category (NT), 6% Vulnerable category (VU) as per IUCN 2021

iii) Riparian Vegetation:

During the study period, no variation was observed in the riparian vegetation of the study stations. 106 different species of plants were identified from the study stations. As per the observation, the overall vegetation seems to be the tropical moist deciduous forest.

Table 3.7 : Riparian vegetation in different study stations

Sl. no	Name of the flora	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7
1	*Melia azedarachta,*	+	+	+	-	+	+	+
2	*Dillenia indica*	+	+	-	+	+	+	+
3	*Albizzia* sp	+	+	-	-	+	+	+
4	*Samanea saman*	+	+	-	-	+	+	+
5	*Crateva religiosa*	+	+	-	+	+	+	+
6	*Ficus benghalensis*	+	+	-	-	+	+	+
7	*Ficus hispida*	+	+	-	-	+	+	+
8	*Ficus religiosa*	+	+	-	-	+	+	+
9	*Tamarix dioica*	+	+	-	-	+	+	+
10	*Delonix regia*	+	+	-	-	+	+	+
11	*Alstonia scholaris*	+	+	-	+	+	+	+
12	*Mallotus* sp	+	+	-	-	+	+	+
13	*Artocarpus heterophyllus*	+	+	-	-	+	+	+
14	*Aegle marmelos*	+	+	+	-	+	+	+
15	*Syzygium* sp.	+	+	-	+	+	+	+
16	*Mangifera indica*	+	+	-	-	+	+	+
17	*Mengifera sylvatica*	+	+	-	-	+	+	+
18	*Terminalia cebula*	+	+	+	-	+	+	+
19	*Elaeocarpus* sp	+	+	+	-	+	+	+
20	*Musa paradisiaca*	+	+	-	-	+	+	+
21	*Musa acuminata*	+	+	-	-	+	+	+
22	*Morus alba*	+	+	-	-	+	+	+
23	*Ziziphus mauritiana*	+	+	-	-	+	+	+

24	*Spondius mengifera*	+	+	-	+	+	+	+
25	*Annoa squamosa*	+	+	-	-	+	+	+
26	*Citrus maxima*	+	+	+	-	+	+	+
27	*Phoenix sylvestris*	+	+	-	-	+	+	+
28	*Averrhoa* sp.	+	+	-	-	+	+	+
29	*Treminalia belerica*	+	+	-	-	+	+	+
30	*Randia* sp.	+	+	-	-	+	+	+
31	*Melastoma* spp.	+	+	-	-	+	+	+
32	*Tamarindus indica*	+	+	-	-	+	+	+
33	*Moringa oleifera*	+	+	-	-	+	+	+
34	*Mesua ferrea*	+	+	-	-	+	+	+
35	*Calamus* spp.	+	+	-	-	+	+	+
36	*Neolamarckia cadamba*	+	+	-	-	+	+	+
37	*Bambusa vulgaris*	+	+	-	+	+	+	+
38	*Bambusa tulda*	+	+	-	-	+	+	+
39	*Bambusa pallida*	+	+	+	-	+	+	+
40	*Bambusa nutans*	+	+	-	-	+	+	+
41	*Dendrocalamus hamiltonii*	+	+	-	-	+	+	+
42	*Acorus calamus*	+	+	-	-	+	+	+
43	*Aegle mermelos*	+	+	-	-	+	+	+
44	*Hydnocarpas kurzii*	+	+	-	-	+	+	+
45	*Diospyros peniculata*	+	+	-	+	+	+	+
46	*Saraca asoca*	+	+	-	-	+	+	+
47	*Alpinia galanga*	+	+	-	-	+	+	+
48	*Rauvolfia serpentina*	+	+	-	-	+	+	+
49	*Terminalia arjuna*	+	+	+	-	+	+	+
50	*Spondias* sp.	+	+	-	-	+	+	+
51	*Baccuria sepida*	+	+	-	-	+	+	+
52	*Garcinia pedunculata*	+	+	-	-	+	+	+

53	*Bombax ceiba*	+	+	-	+	+	+	+
54	*Premna benghalensis*	+	+	-	-	+	+	+
55	*Lagerstromia speciosa*	+	+	+	-	+	+	+
56	*Ageratum conyzoides L.*	-	-	-	-	-	+	-
57	*Alstonia scholaris (L.) Rr. Br.*	-	-	-	-	+	-	-
58	*Arundo donax L.*	-	-	-	-	-	+	-
59	*Balakata baccata (Roxb.) Esser*	-	-	+	+	-	-	-
60	*Bombax ceiba L.*	-	-	+	-	-	-	-
61	*Capparis acutifolia Sweet*	-	-		-	+	-	-
62	*Carallia brachiata (Lour.) Merr.*	-	-	-	+	-	-	-
63	*Carissa kopilii Barbhuiya, J. Sarma & S. Dey*	-	-	-	-	-	+	-
64	*Colocasia sp.*	-	-	-	-	-	+	-
65	*Colona floribunda (kurz) Craib*	-	-	+	-	-	+	-
66	*Cuphea sp.*	-	-	-		-	+	-
67	*Dalbergia sp.*	-	-	-	+	-		-
68	*Dalhousiea bracteata (Roxb.) Graham ex Benth.*	-	-	+	-	-	-	+
69	*Dendrocnide sinuate (Blume) Chew*	-	-	-	-	+	-	-
70	*Derris sp.*	-	+	-	-	-	-	-
71	*Duabanga grandiflora (Roxb. ex DC.) Walp.*	-	-	-	-	-	+	-
72	*Eriobotyra angustissima Hook.f.*	-	-	-	+	+	-	-
73	*Eugenia bracteata (Willd.) Roxb. ex DC.*	-	-	+	-	-	-	-
74	*Ficus hispida L.*	-	-	-	-	-	+	-
75	*Ficus racemosa L.*	-	-	-	-	+	-	-
76	*Ficus semicordata*	-	-	-	+	-	-	-

	Buch. – Ham. Sm.							
77	*Flueggea virosa (Roxb. ex Willd.) Royle*	-	-	-	-	-	+	-
78	*Hellenia speciosa(J. Koenig) S.R. Dutta*	-	-	-	+	-	-	-
79	*Hiptage benghalensis (L.) Kurz*	-	-	-		+	-	-
80	*Homonoia riparia Lour.*	-	-	-	+	-	-	-
81	*Jasminum laurifolium Roxb. ex. Hornem.*	-	+	-	-	-	-	-
82	*Litsea monopetala (Roxb.) Pers.*	-	-	-	-	-	+	-
83	*Microcos paniculata L.*	-	+	-	-	-		-
84	*Mimosa pudica L.*	-		-	-	-	+	-
85	*Monoon simiarum (Buch. – Ham. ex Hook. f. & Thomson) B. Xue & R.M.K. Saunders*	-	+	-	-	-	-	-
86	*Munronia sp.*	-	+	-	-	-	-	-
87	*Musa balbisiana Colla*	-		+		-	-	-
88	*Olax acuminata Wall. ex. Benth.*	-	+	-	+	-	-	-
89	*Pavetta pufii Barbhuiya, J. Sarma & S. Dey*	-	-	-	+	-	-	-
90	*Phoebe sp.*	-	-	+	-	-	-	-
91	*Pterospermum acerifolium (L.) Willd.*	-	-	+	-	-	-	-
92	*Ricinus communis L.*	-	-	-	-	-	+	-
93	*Schefflera sp.*	-	-	-	+	-		-
94	*Senegalia tamarindifolia (L.) Britton & Rose*	-	-	-		-	+	-
95	*Sterculia villosa Roxb. ex. Sm.*	-	-	+	-	+	-	-

96	*Syzygium cumini (L.) Skeels*	-	-	+	-	-	-	-
97	*Syzygium cyanophyllum (P.C. Kanjilal & D. Das) Raizada*	-	-	+	-	-	-	-
98	*Syzygium polypetalum (Wall.) Merr. & L. M. Perry*	-	+		+	+	-	-
99	*Tarenna pumila (Hook. f.) Merr.*		+	+	-	-	-	-
100	*Tetrameles nudiflora R. Br.*	-	-	+	-	-	-	-
101	*Thunbergia grandiflora Roxb.*	-	-	-	-	+	-	-
102	*Thyzanolaena latifolia (Roxb.ex Hornem) Honda*	-	-	-	-	-	-	-
103	*Trema orientale (L.) Blume*	-	-	-	+	-	-	-
104	*Ulmus lanceifolia Roxb.*	-	-	+	-	+	-	-
105	*Urena lobata L.*	-	-		-	-	+	-
106	*Wallichia oblongifolia Griff.*	-	-	+	-	-	-	-

3.2 Ground Water Analysis

Table 3.8 : Physical , Chemical and Biological parameters of Ground Water

	1st sampling (0 days, Feb 2024)	2nd sampling (15 days, March 2024)	3rd sampling (30 day, March 2024)	4th Sampling (45 days, April 2024)	5th sampling (60 days, April 2024)	6th sampling (75 days, May 2024)
pH	7.4	7.2	6.9	7.4	7.4	7.1
Conductivity(mV)	11	17	9	16	9	12
Dissolve oxygen (ppm)	3.4	4.5	3.7	4.1	4.2	4.2
Total Dissolve solid (ppm)	ND	ND	ND	ND	ND	ND
Total Suspended Solids (ppm)	ND	ND	ND	ND	ND	ND
Total Hardness (ppm)	134	151	152	127	125	143
Total Alkalinity (ppm)	45	51	53	48	59	62
Nitrate (ppm)	ND	ND	ND	ND	ND	ND
Nitrite (ppm)	ND	ND	ND	ND	ND	ND
BOD3 (ppm)	ND	ND	ND	ND	ND	ND
COD (ppm)	ND	ND	ND	ND	ND	ND
Calcium (ppm)	3	2	3	2	4	3
Chloride (ppm)	2	2	3	3	2	3
Iron (ppm)	0.5	0.5	0.5	0.5	0.5	0.5
Potassium (ppm)	ND	ND	ND	ND	ND	ND
Sodium (ppm)	ND	ND	ND	ND	ND	ND
Sulphate (ppm)	ND	ND	ND	ND	ND	ND
MPN'/100ml	2	2	4	4	2	2

The groundwater quality parameters measured over six sampling periods from February to May 2024 show that most variables were stable or showed minor fluctuations. The pH levels ranged from 6.9 to 7.4, with a mean of 7.23, indicating neutral water throughout the period. Conductivity varied from 9 to 17 mV, averaging 12.33 mV, and showed fluctuations, peaking in the second sampling. Dissolved oxygen ranged from 3.4 to 4.5 ppm, with a mean of 4.02 ppm, remaining stable towards the end of the sampling period. Total hardness ranged from 125 to 152 ppm, averaging 138.67 ppm, while total alkalinity increased gradually, peaking at 62 ppm during the final sampling. Calcium levels oscillated between 2 and 4 ppm, with a mean of 2.83 ppm, and chloride levels were stable at 2 to 3 ppm. Iron levels were constant at 0.5 ppm throughout.

Microbial content (MPN/100ml) fluctuated, with values ranging from 2 to 4, indicating periodic contamination. Parameters such as Total Dissolved Solids (TDS), Total Suspended

Solids (TSS), Nitrate, Nitrite, BOD3, COD, Potassium, Sodium, and Sulphate were not detected in any of the sampling periods, suggesting their negligible presence in the groundwater. The groundwater quality remained relatively consistent with occasional variations, indicating a stable water quality with some minor fluctuations over the sampling period.

3.3 Sediment characterization:

Texture , pH , nutrient Level: Texture of the sediment of all study stations were found to be sandy in the table below. The chemical characteristics of the sediment is shown in table below. The sediment organic carbon content of the study stations was found to be medium to low while the sediment nitrogen & phosphate content was found to be low. The sediment phosphorus values of the study stations were found to be high.

Table 3.9: Sediment Ph and nutrients

Stations	pH	Organic Carbon (%)	Av. N_2 (Kg/ha)	Av. P_2O_5 (Kg/ha)	Av. K_2O (Kg/ha)
1	6.3	0.12	39.82	117.98	80.64
2	6.2	0.48	159.31	84.63	60.48
3	5.1	0.75	252.24	135.93	87.36
4	6.3	0.16	53.10	89.76	43.68
5	6.1	0.43	146.03	79.50	40.32
6	6.0	0.52	172.58	67.96	50.40
7	7.1	0.40	132.76	84.63	70.56

Table 3.10 : Sediment Texture within stations

Stations	Sand (%)	Silt (%)	Clay (%)	Texture
1	89.60	1.42	8.98	Sandy
2	89.62	1.50	8.88	Sandy
3	89.64	1.28	9.08	Sandy
4	89.74	1.28	8.98	Sandy
5	89.86	0.96	9.18	Sandy
6	89.66	1.06	9.28	Sandy
7	89.62	1.30	9.08	Sandy

3.4 Impact and non-Impact zone

Fig 3.24: Impact (Red Line) and Non-Impact Zone of the study stretch of River Kopili

Fig 3.25: Impact and Non-Impact Zone of River Kopili with Graphical Illustration

Based on the 4 months data (Physical, chemical and biological parameters) of the present investigation . Station 7 i.e post confluence of River Diyung and Kopili , can be regarded as non-impact zone.In the impact zone of the study stretch of river Kopili i.e from station 1 to 6, (Fig :) many of the critical water quality parameters (pH ,Total Hardness and Total Alkalinity) were found

to be not congenial for aquatic life as a result of which no fishes, plankton and periphyton were recorded in this zone .However, in the station 7 after dilution of Kopili River water by River Diyung , the parameters were found to be suitable for aquatic organisms. During the present study in the non-impact zone we have recorded 16 fish species, 19 phytoplankton Genera and 5 zooplanktonic forms.

3.5 Breeding, nesting and feeding ground

Based on the 4 months data of the present investigation. Station 1 to 6 do not provide optimum conditions for breeding, nesting and feeding of fishes. However , since in station 7 we have recorded 16 fish species . Thus, this station may serve as a breeding, nesting and feeding ground of ichthyofauna. Further studies may bring out a detailed picture in this regard.

3.6 Gangetic Dolphin occurrence

Based on the present study and after consultation of previous literature (Nath et al., 2023) there is no record of occurrence of Gangetic Dolphin (*Platanista gangetica) i*n the River Kopili .

3.7 Habitat Restoration

Analysis of the water quality data generated during the current study clearly indicated that the habitat of River Kopili from Station 1 to 6 in not congenial for aquatic organisms specially fishes. After confluence of the River Diyung with Kopili at Station 7, the water quality parameters found to be restored towards congenial range for fishes. This restored habitat from Station 7 onwards should be managed and conserved by APGCL in consultation with professionals.

3.8 Food Web Diagram

Food web diagram could not be generated from station 1 to 6 due to absence of primary producer , secondary producer and consumers which are indispensable for a food chain leading to a food web. Based on the findings of our 4 months study , we have generated the following foodweb diagram for station 7.

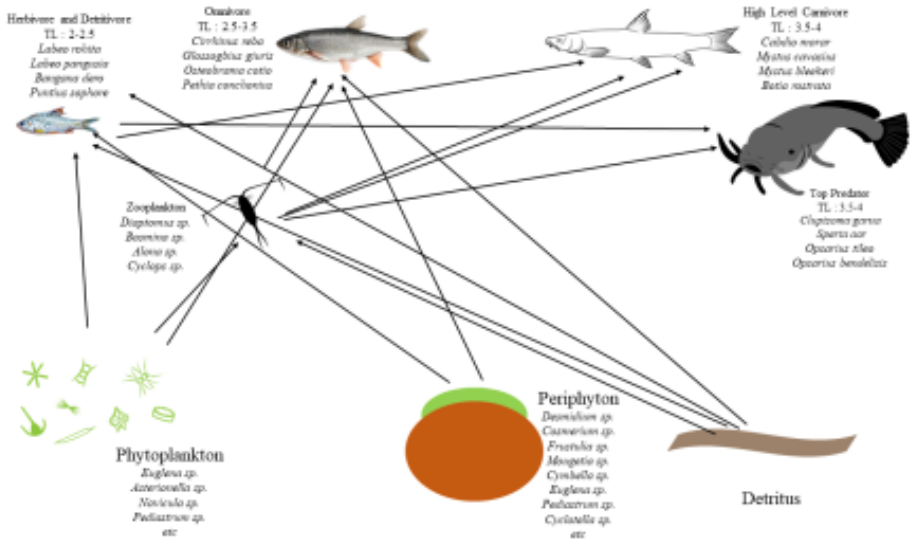

Fig 3.26: River Kopili Food Web in station 7

4.0 Acknowledgement

We would like to acknowledge Assam Power Generation Corporation Limited (APGCL) for providing us the opportunity to carry out this study, titled "Aquatic Study with a Focus on Migratory Aquatic Species in the River Kopili in Relation to the 120 MW Lower Kopili Hydro Electrical Project (LKHEP)." We also express our gratitude for the financial assistance provided by APGCL.

We would like to offer our heartfelt thanks to Dr. Bidyut Chandra Deka, Vice Chancellor of Assam Agricultural University, for providing us with the necessary facilities to carry out this research.

Next, we would like to extend our sincere gratitude to Dr. Pradip Chandra Bhuyan, Dean , College of Fisheries, Assam Agricultural University. His unwavering motivation and insightful guidance were invaluable throughout the duration of this project. Dr. Bhuyan's expertise and support played a crucial role in the successful completion of our research, and we are deeply appreciative of his contributions.

We would like to thank all the faculty members of the Department of Aquatic Environment Management for their constant support. We also extend our gratitude to the research scholars, Miss Newmei Tachangliu, Miss Papia Debnath, Miss Silpisikha Deka, and Miss Deepali Gupta, as well as the laboratory assistant, Miss Jyoti Gogoi, for their efforts and hard work. Their dedication and contributions were instrumental in the successful completion of this study.

Finally, we would like to extend our thanks to Mr. Sanayaima Singha, Miss Darshana Sharma, Mr. Lakhya Jyoti Das, Mr. Trinayan Bora, and Mr. Daibabani Baruah for their invaluable help and expertise in completing this study. Their assistance and knowledge significantly contributed to the success of our research.

5.0 Reference

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(Raktim Sarmah)
Young Professional -II
Department of Aquatic Environment
Management
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Assam Agricultural University
Raha , Nagaon

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Annexure I

Fish Photographs

Puntius sophore

Labeo rohita

Clupeisoma garua

Cabdio morar

Opsarius bendelisis

Cirrhinus reba

Glossogobius giuris

Opsarius tileo

Osteobrama cotio

Labeo pangusia

Bangana dero

Mystus cavasius

Mystus bleekeri

Sperta aor

Botia rostrata

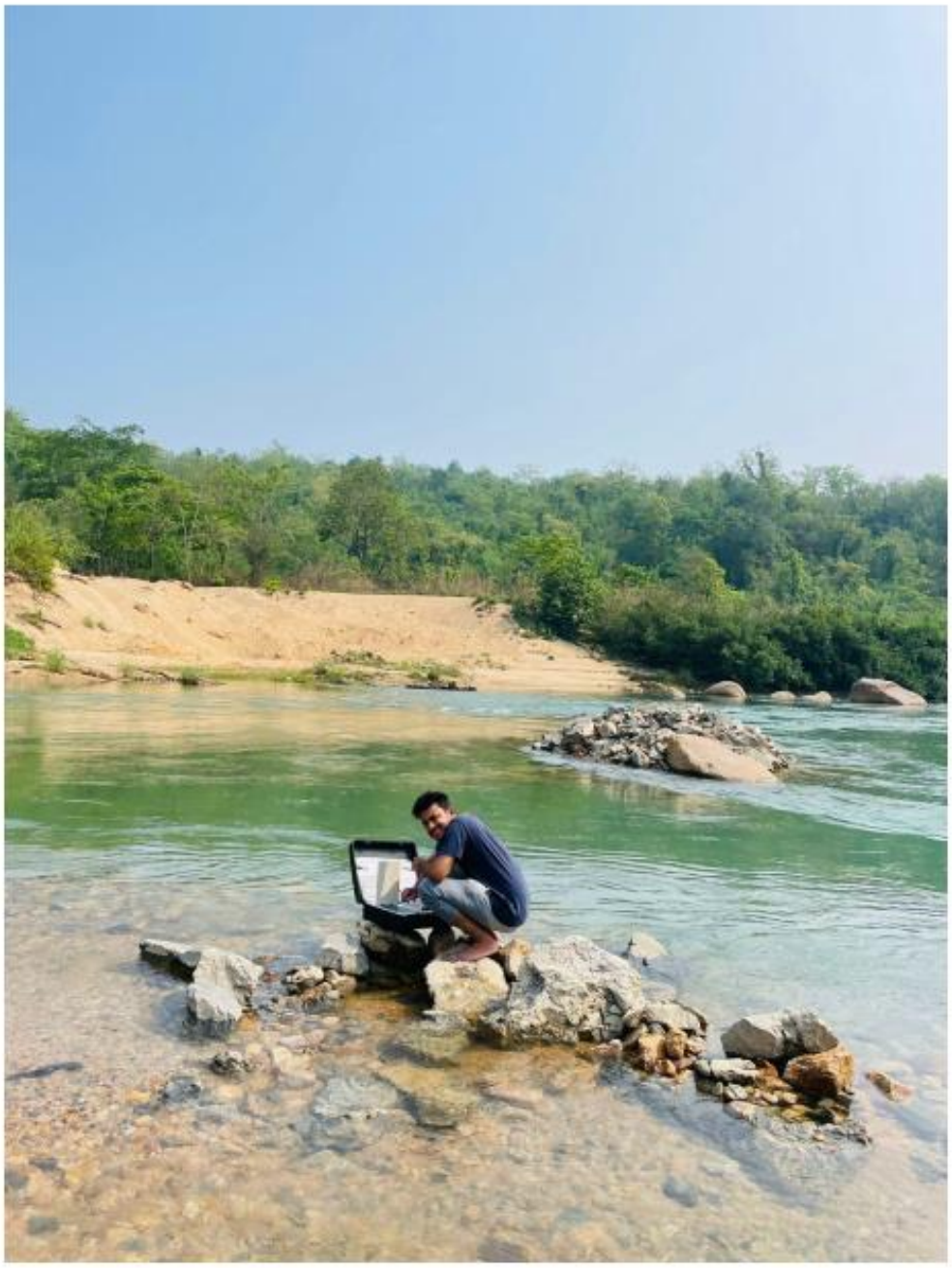
Danio rerio

Pethia conconius

Barilius barila

Annexure II

Sampling Photographs



ASSAM POWER GENERATION CORPORATION LIMITED
Registered Office: Bijulee Bhawan, 3rd floor, Paltanbazar, Guwahati-781 001, Assam

Shri Saurav Saikia
Chief General Manager (Hydro & Civil)
E-mail: cgmh2010@yahoo.in

Letter No: APGCL/CGM (H)/W/2007/140/Part-VII/114 Date: 21/11/2023

To,

The Director,
cum Member Secretary of EAC
IA-I Division
Ministry of Environment, Forest and Climate Change
New Delhi-11003

Sub: Submission of Undertaking that R&R scenario / habitat of flora and fauna of project are not change due to modification of the project components under Lower Kopili HEP, 120 MW

Ref: Minute of the EAC meeting of MoEF&CC held on 26.10.2023, proposal No. IA/AS/RIV/441844/2023

Sir,

With reference to the above, and in response to the minute of the EAC meeting, it is to mention herewith that the R&R scenario / habitat of flora and fauna of project will not be changed due to modification of the project components. As the changes are made due to detail engineering design which will not create any additional impact on the biotic community within the long-term leased area of 1577 Ha under Lower Kopili HEP, 120 MW. Moreover, necessary protective and conservative measures will be adhered as per norms.

This is for favour of your kind compliance of your stipulation as per reference cited above.

Your Sincerely,

21/11/2023

Chief General Manager (Hydro & Civil) i/c.
APGCL, Bijulee Bhawan

Copy to:

1. The OSD to Chairman, APGCL-for kind information to the Hon'ble Chairman
2. The OSD to Managing Director, APGCL-for kind information to the MD, APGCL
3. Relevant file

Annexure 7 : CTO for the RO Plant from PCBA under Package 3.

Pollution Control Board, Assam

(Department of Environment & Forests, Government of Assam)

অসম প্রদূষণ নিয়ন্ত্রণ পৰিষদ

(অসম চৰকাৰৰ বন আৰু পৰিবেশ বিভাগ)

NABL Accredited Testing Laboratory : Certificate No. TC-11384

No. PCBA/SLC/T-1409/24-25/14 Dated Guwahati, the 25th October, 2024

CONSENT TO OPERATE

'CONSENT TO OPERATE' (CTO) under Section 25 of Water (Prevention and Control of Pollution) Act, 1974 as amended and Rules framed there under, is granted to-

i) Name of Unit : M/s. Andritz Hydro Private Limited

ii) Name of the Occupier / Applicant and Designation : R Ram Kumar, Assistant General Manager

iii) Address of Unit : Longku Village,PR-7, Near PMC Colony, Dist: Dima Hasao, Assam-782448

iv) Cost of the project : Rs. 3.00 Lakh

v) Type of Project/Category : RO water treatment plant (Green Category)

vi) Details of Products :

Sl No.	Product	Quantity
1	Drinking Water	1000 Litres/Day

TERMS AND CONDITIONS:

1. The Consent to Operate (CTO) has been accorded based on the particulars furnished by the applicant vide Application **ID- 2883128** and subject to addition of further or more conditions if so warranted by subsequent developments. The Consent will automatically become invalid if any change or alteration or deviation is made in actual practice.
2. The CTO is valid for a period up to **31.03.2027**.
3. The CTO may be modified, suspended in whole or in part or withdrawn by the Board during its term for cause including, but not limited to the following:-
   a) Violation of any Terms and Conditions of this CTO;
   b) Obtaining the CTO by misrepresentation or failure to disclose fully all relevant facts & figures;
   c) If any genuine complaint received.
4. The unit shall obtain prior Consent to Establish from the Board, for any further expansion, alteration, modification or modernization of the project.
5. The project proponent shall develop a greenbelt/plantation area with native trees covering at least 33% of the total plot area.
6. Proper housekeeping shall be maintained. The unit shall not burn any wastes inside the premises.
7. The project authority shall install a Display Board as per the Board's notification No. PCBA/LGL-95/2021/Notification/01 dtd.11.11.2021 **(Appendix-A)**.

Contd....p/2

8. As per the provisions of the Water (Prevention and Control of Pollution) Act, 1974 as amended and the Air (Prevention and Control of Pollution) Act, 1981 as amended, any Officer empowered by the Board on its behalf shall have without interruption, the right at any reasonable time to enter the unit for inspection, collection of sample for analysis and may call for any information as deemed necessary. Denial of this right will cause withdrawal of the Consent Order.
9. The unit shall apply for renewal of this CTO before expiry. The Board has decided to renew the CTO for validity of five (5) years after receiving due fees for the entire period.

Specific Conditions:

A. Air Aspect:-

1. The unit shall comply with noise pollution control standard, as notified by **MoEF & CC vide GSR 7, dated Dec.22, 1998**, as mentioned herein under;

Limit in dB (A) Leq	
Day Time (6:00am-10:00pm)	**Night Time (10:00pm-6:00am)**
75	70

B. Water Aspect:

1. The discharge from Effluent Treatment system, and/or R.O. rejects shall meet the specific discharge standard as mentioned herein under:

Sl. No.	Parameters	Tolerance Limit
i)	pH	6.0 to 8.5
ii)	Total Suspended Solids	20 mg/l (max.)
iii)	Bio-chemical Oxygen Demand	30 mg/l (max.)
iv)	Chemical Oxygen Demand	250 mg/l (max.)
v)	Oil & Grease	5.0 mg/l (max.)
vi)	Other parameters	As per schedule-VI inserted by Rule 2(d) of the Environment (Protection) Second Amendment Rules, 1993 notified vide **G.S.R.422(E) dated 19.05.1993**

2. Source of Water : Ground Water
3. Details of water consumption and effluent generation:-

SL NO.	NAME	QUANTITY
1	Raw water Consumption	1.5 KLD
2	R.O. reject water	0.5 KLD
3	Permission From CGWA	Not Obtained

4. The unit shall install an Effluent Treatment system to treat the RO rejects. The possibility of utilization of rejected water from R.O. system shall be worked out to distribute water to nearby needy population at free of cost. Besides, R.O. rejects could also be sold to nearby industries, if required water quality criteria is fulfilled.
5. i) Storm water shall not be allowed to mix with any effluent and/or floor washings.
   ii) Storm water within the battery limit shall be channelized through separate drain/pipe passing through an Oil and Grease Trap.

Contd....p/3

iii) For storm water discharge, the unit shall comply with general effluent discharge parameters standard, notified by **MoEF & CC, GOI vide G.S.R.422 (E), dated 31.12.1993 (Appendix-B).**

Rain water harvesting facility shall be installed and maintained.

C. Solid Waste Aspect:

1. Adequate facility should be created for collection, storage, transportation, treatment and disposal of the non-hazardous solid waste generated from the unit.
2. Adequate system should be adopted on reduction of waste generation and enhancement of re-utilization and recycling of waste materials.
3. Solid waste generated in the unit shall be disposed of as per the provisions of the Solid Waste Management Rules, 2016.

D. Plastic Waste Aspect:

1. The unit shall not use any **Single Use Plastic (SUP)** items, the use of which has been banned by the **MoEF & CC, Govt. of India vide notification no.GSR 571(E) dated 12.08.2021.**
2. Plastic Waste generated in the unit shall be disposed of in accordance of the provisions under the Plastic Waste Management Rules, 2016.
3. The unit shall submit a report on generation and disposal of plastic waste within 30th June every year.

E. E- Waste Aspect:

The unit shall comply with the provisions of E-Waste Management Rules, 2022.

The unit shall submit compliance report of the mandated conditions by April 15th, every year to Member Secretary, PCBA as well as Regional Laboratory cum Office, Silchar, PCBA. The Board will have the liberty to withdraw the CTO, if adequate pollution control and safety measures are not implemented by the unit.

(Er. K. Talukdar)
Senior Environmental Engineer

Memo No.PCBA/SLC/T-1409/24-25/14-A 2760 Dated Guwahati, the 25th October, 2024

Copy to:

1. M/s. Andritz Hydro Private Limited, Longku Village, PR-7, Near PMC Colony, Dist: Dima Hasao, Assam-782448
2. The Member Secretary, Pollution Control Board, Assam, for information and compliance of conditions.

(Er. K. Talukdar)
Senior Environmental Engineer

Ambient Noise Monitoring Results CP-1

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TC-7669
NABL ACCREDITED

Recognized by Pollution Control Board, Assam

TEST REPORT

AMBIENT NOISE LEVEL MEASUREMENT REPORT

Rep.No. ANLMR_.1503282_01_669(B) Date: 13/05/2024
Sample ID: EETNE/MAY/09_A/23 ULR NO.: TC766923000000160(A)F

Issued to : M/s. BVG India Ltd. Midas Tower 4th Floor, Rajiv Gandhi Infotech Park, Phase 1-Hinjawani,Pune-411057

SL. NO.	DATE OF SAMPLING	LOCATION /SOURCE (Latitude and Longitude)	NOISE LEVEL in dB(A)Leq	
			Day (6:00 am to 10:00 pm)	Night (10:00 pm to 6:00 am)
i)	07/05/24	Package 1 Lat N 25°88'03.52" Long E 92°80'49.47"	58	43.6

Remarks: Noise level is carried out during 75% of the Day Time & Night Time.
Method of analysis : IS 9989 : 1981 RA : 2014
Sampling Instrument Used : SLM100 SLNO484-I-22, SLM 100 (213 DTC-2013)

Area Code	Category of area	Limits in dB(A) Leq	
		Day (6:00 am to 10:00 pm)	Night (10:00 pm to 6:00 am)
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Ambient Noise Standards:

FOR ENVISION ENVIRO TECHNOLOGIES NORTH EAST, GUWAHATI

Khairul Islam Sheikh
(Environmental Chemist)

Utpal Bezbaruah
(Technical Manager)
Authorized Signatory /Reviewed by

Note: i) The results relate only to the parameters tested.
ii) The test report shall not be reproduced except in full, without written approval of laboratory.
iii) Monitoring is performed twice a week in each location.

----------END OF REPORT----------

Page 1 of 1

House No. 6, 1st Floor, Sankardev Path, Pub-Sarania, Chandmari, Guwahati-781003, Assam.
Mobile : +91 98592 32126 / 94350 47496 ♦ e-mail : envisionghy@gmail.com

Ambient Air Monitoring Results CP-1

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TC 7669

NABL ACCREDITED

TESTREPORT

AMBIENT AIR ANALYSIS REPORT

Rep.No. AAAR_1503282_01_669(A) Date: 13/05/2024
Sample ID: EETNE/MAY/09_A/24 ULR NO.: TC766923000000160(A)F
Issued to : M/s. BVG India Ltd. Midas Tower 4th Floor, Rajiv Gandhi Infotech Park, Phase 1-Hinjawani,Pune-411057

Sample Drawn By	: UTPAL BEZBARUAH
Sampling Plan & Procedure	: EETNE/SOP/01
Analysis Duration	: 07/05/24 TO 13/05/24
Sampling Instrument Used	: AMBIENT AIR SAMPLER/RDS
Pollution Control Device, if any	: NO

SL. NO.	DATE OF SAMPLING	LOCATION/ SOURCE (Latitude & Longitude)	WEATHER	PARAMETERS					
				PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	HC (mg/m^3)	CO (mg/m^3)	SO_2 ($\mu g/m^3$)
i)	07/05/24	Package 1 Lat N 25°88'03.52" Long E 92°80'49.47"	Clear	42.1	32.4	19.6	BDL	BDL	10.9

Remarks: - Sampling were done within the 24hrs

NATIONAL AMBIENT AIR QUALITY STANDARDS:

Sl. No.	Pollutant	Test Method	Time Weighted Average	Concentration in Ambient Air Industrial, Residential, Rural and Other Area
1	Particulate Matter (PM_{10}), $\mu g/m^3$	IS:5182 Part-XXIII/ CPCB	Annual	60
			24 hours	100
2	Particulate Matter ($PM_{2.5}$), $\mu g/m^3$	EETNE/SOP/01/2017	Annual	40
			24 hours	60
3	Nitrogen Dioxide (NO_2), $\mu g/m^3$	IS:5182 Part-VI/ CPCB	Annual	40
			24 hours	80
4	Carbon Monoxide (CO), mg/m^3		8 Hours	2.0
5	Sulphur Dioxide (SO_2), $\mu g/m^3$	IS:5182 Part-II/ CPCB	Annual	50
			24 hours	80

For Envision Enviro Technologies North East, Guwahati

Khairul Islam Sheikh
(Environmental Chemist)

Utpal Bezbaruah
(Technical Manager)
Authorized Signatory /Reviewed by

Note: i) The results relate to the tested parameters & items sample.
ii) The test report shall not be reproduced except in full, without written approval of laboratory.

----------END OF REPORT----------

Page 1 of 1

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Soil Monitoring Results CP-1

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SOIL ANALYSIS REPORT

Rep.No: 240513_1502010_0

Date: 13/05/24

Name & Address of Client	**M/s. BVG India Ltd, Midas Tower, 4th Floor, Rajiv Gandhi Infotech Park, Phase-1, Hinjwani**
Sample Description	**Soil collected from Project site(Package 1)**
Date of Sampling	**07.05.24**
Sample collected by	**M/s. En-vision Enviro Technologies North East**

Sl No.	Soil Parameters	Unit	Result	Reference Method
1	p^H	---	7.33	Potentiometric
2	Soil type	----	Loamy Sand	Hydrometer
	Sand	%	65.41	Hydrometer
	Clay	%	14.77	Hydrometer
	Silt	%	11.6	Hydrometer
3	Nitrogen	kg/ha	118.9	Alkaline $KMnO_4$
4	Phosphorus	mg/kg	41.87	Olsen method
5	Potassium	mg/kg	50.23	NH_4-acetate extraction
6	Electrical conductivity	mS/cm	2.2	Conductivity meter
7	Water holding capacity	%	39.56	Standard method

House No. 6, 1st Floor, Sankardev Path, Pub-Sarania, Chandmari, Guwahati-781003, Assam.

Phone : +91 98592 32126, 88110 96201 ♦ e-mail : envisionghy@gmail.com

Sl No.	Parameters	Unit	Result	Reference Method
8	Organic matter	%	1.69	Titrimetric
9	Salinity	mS/cm	1.97	Conductometric
10	Iron	g/kg	40.5	Flame AAS (mg/kg)
11	Copper	mg/kg	13.72	Flame AAS
12	Nickel	mg/kg	5.66	Flame AAS
13	Manganese	g/kg	16.78	Flame AAS (mg/kg)
14	Zinc	mg/kg	24.3	Flame AAS
15	Chlorides	mg/kg	128.9	Argentometric

For En-vision Enviro Technologies North East, Guwahati

UTPAL BEZBARUAH
(Technical Manager)
Authorized signatory

Note: i) The results relate only to the parameter tested.
ii) The test report shall not be reproduced except in full, without written approval of laboratory.

END OF REPORT

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Phone : +91 98592 32126, 88110 96201 ♦ e-mail : envisionghy@gmail.com

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TEST REPORT

AMBIENT NOISE LEVEL MEASUREMENT REPORT
Rep.No. ANLMR_1503163_06A_572 Date: 08/03/2024
Sample ID: EETNE/MAR/04/24 ULR NO.: TC766924000000134F

Issued to : M/s. Andritz Hydro Pvt. Ltd., LKHEP Project, village – Longku, Dist. Dima Hasao, Pin - 788931

SL. NO.	DATE OF SAMPLING	LOCATION /SOURCE (Latitude and Longitude)	NOISE LEVEL in dB(A)Leq	
			Day (6:00 am to 10:00 pm)	Night (10:00 pm to 6:00 am)
i)	03/03/24	Near Service Bay	61.7	46.1
ii)	04/03/24	Near Valve House	57.6	44.9
iii)	05/03/24	Near Project Camp	59.8	47.8

Remarks: Noise level is carried out during 75% of the Day Time & Night Time.
Method of analysis : CPCB July 2015 guideline.
Sampling Instrument Used : SLM100 SLNO484-I-22, SLM 100 (213 DTC-2013)

Ambient Noise Standards:

Area Code	Category of area	Limits in dB(A) Leq	
		Day (6:00 am to 10:00 pm)	Night (10:00 pm to 6:00 am)
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Khairul Islam Sheikh
(Environmental Chemist)

(Technical Manager)
Authorized Signatory / Reviewed by

Note: i) The results relate to the tested parameters & items sample.
ii) The test report shall not be reproduced except in full, without written approval of laboratory.

----------END OF REPORT----------

Page 1 of 1

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TC-7669

TESTREPORT

AMBIENT AIR ANALYSIS REPORT
Rep.No. AAAR_1503163_01_571 **Date: 08/03/2024**
Sample ID: EETNE/MAR/04/24 **ULR NO.: TC766924000000134F**

Issued to : M/s. Andritz Hydro Pvt. Ltd., LKHEP Project, village – Longku, Dist. Dima Hasao, Pin - 788931

Sample Drawn By : UTPAL BEZBARUAH
Sampling Plan & Procedure : EETNE/SOP/01
Analysis Duration : 02/03/24 TO 06/03/24, 03/03/24 TO 07/03/24, 04/03/24 TO 08/03/24
Sampling Instrument Used : AMBIENT AIR SAMPLER/RDS
Pollution Control Device, if any : NO

SL. NO.	DATE OF SAMPLING	LOCATION/ SOURCE (Latitude & Longitude)	WEATHER	PARAMETERS					
				PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	HC (mg/m^3)	CO (mg/m^3)	SO_2 ($\mu g/m^3$)
i)	02/03/24	Near Service Bay	Clear	40.2	22.9	12.9	BDL	BDL	9.6
ii)	03/03/24	Near valve house		38.9	27.7	13.9	BDL	BDL	10.1
iii)	04/03/24	Near project Camp		38.6	27.8	14.5	BDL	BDL	10.6

Remarks: - Sampling were done within the annual based.
NATIONAL AMBIENT AIR QUALITY STANDARDS:

Sl. No.	Pollutant	Test Method	Time Weighted Average	Concentration in Ambient Air: Industrial, Residential, Rural and Other Area
1	Particulate Matter (PM_{10}), $\mu g/m^3$	IS:5182 Part-XXIII/ CPCB	Annual	60
			24 hours	100
2	Particulate Matter ($PM_{2.5}$), $\mu g/m^3$	EETNE/SOP/01/2017	Annual	40
			24 hours	60
3	Nitrogen Dioxide (NO_2), $\mu g/m^3$	IS:5182 Part-VI/ CPCB	Annual	40
			24 hours	80
4	Carbon Monoxide (CO), mg/m^3		8 Hours	2.0
5	Sulphur Dioxide (SO_2), $\mu g/m^3$	IS:5182 Part-II/ CPCB	Annual	50
			24 hours	80

For Envision Enviro Technologies North East, Guwahati

Khairul Islam Sheikh
(Environmental Chemist)

Utpal Bezbaruah
(Technical Manager)
Authorized Signatory / Reviewed by

Note: i) The results relate to the tested parameters & items sample.
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----------**END OF REPORT**----------

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Surface water Monitoring Results

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TEST REPORT:
Report No: 240311_1503164_01
ULR No: TC766924000000252P
Sample ID No: EETNE/MARCH/02/24
Test Starting Date: 04/03/2024

Date of Report: 11/03/24
Date of sample receipt: 04/03/2024
Test completion Date: 11/09/23

Name & Address of Client	M/s. ANDRITZ HYDRO PVT. LTD., LKHEP PrOJECT,, village- longku, Dist- Dima Hasao, Pin-788931					
Sample Description	Type: Surface Water (Service Bay)				Source: Kopili River	
Sample collected by	M/s. En-vision Enviro Technologies North East					
Sample Collection Particulars	Date 02/03/2024	Time 11:15 A.M	Temperature 31°C	pH 6.95	Quantity Drawn:2L	Sampling Method: EETNE/SOP/02

Sl No.	Parameters	Unit	Result	Reference Method	IS 10500:2012 Permissible Limit
1	pH	---	6.83	APHA 23rd Edition,4500 H+,Page:4-95	6.5-8.5
2	Turbidity	NTU	1.23	APHA 23rd Edition,2130,Page:2-13	5
3	TDS	mg/L	19.5	APHA 23rd Edition,2540 C, Page :2-69	2000
4	TSS	mg/L	82.3	APHA 23rd Edition,2540,Page:2-70	------
5	Oil and Grease	mg/L	<5	APHA 23rd Edition,5520 B,Page:5-42	------
6	Dissolved Oxygen	mg/L	4.8	APHA 23rd Edition,4500-O C,Page:4-146	6
7	Total hardness	mg/L	57	APHA 23rd Edition,2340 B,Page:2-48	600
8	Calcium	mg/L	23	APHA 23rd Edition,3500-Ca B,Page:3-69	200
9	Magnesium	mg/L	12	APHA 23rd Edition 3500-Mg B,Page:3-86	100
10	Total Alkalinity	mg/L	24.2	APHA 23rd Edition,2320,Page:2-37	600
11	Sulphate	mg/L	18.4	APHA 23rd Edition,4500-SO_4^{2-}E,Page:4-199	400
12	Nitrates	mg/L	6	APHA 23rd Edition,4500-NO_3B,Page:4-127	------
13	Phosphate	mg/L	<0.02	APHA 23rd Edition,4500-P,Page:4-163	------
14	Salinity	%	0.2	APHA 23rd Edition,2520B,Page:2-60	------
15	Conductivity	µS/cm	94	APHA 23rd Edition,2520B,Page:2-60	2500

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TC-7669

Sample ID No: EETNE/MARCH/02/24 **Date of sample receipt: 04/03/2024**
Test Starting Date: 04/03/2024 **Test completion Date: 11/03/2024**

Sl No.	Parameters	Unit	Result	Reference Method	IS 10500:2012 Permissible Limit
16	Arsenic	mg/L	BDL	APHA 23rd Edition,3114A,Page:3-36	------ -----
17	Iron(as Fe)	mg/L	0.95	APHA 23rd Edition,3500-Fe B,Page:3-80	------ -----
18	Total Coliform	MPN/100	2	APHA 23rd Edition,9222B,Page:9-81	Shall not be detectable in any 100 ml Sample
19	Fecal Coliform	MPN/100	Nil	APHA 23rd Edition,9222 D,Page:9-89	Shall not be detectable in any 100 ml Sample
20	BOD	mg/L	6	APHA 23rd Edition,5210B,Page:5-6	------ -----
21	COD	mg/L	47	APHA 23rd Edition,5220 b,Page:5-18	------ -----

NOTE: (BOD) Biochemical Oxygen Demand, (COD) Chemical Oxygen Demand,(TSS)Total Suspended Solids, (TDS) Total Dissolved Solids.

For Envision Enviro Technologies North East, Guwahati

ENVISION ENVIRO TECHNOLOGIES NORTH EAST Guwahati-3

KHAIRUL ISLAM SHEIKH
Environmental Chemist
Test Done By

UTPAL BEZBARUAH
Technical Manager
Authorized Signatory/Reviewed by

Note: i) The results relate only to the parameters tested.
ii) The test report shall not be reproduced except in full, without written approval of laboratory

End of report

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TC-7669

TEST REPORT:
Report No: 240311_1503163_2
ULR No: TC766924000000254P
Sample ID No: EETNE/MARCH/04/2024
Test Starting Date: 04/03/2024

Date of Report: 11/03/2024
Date of sample receipt: 04/03/2024
Test completion Date: 11/03/2024

Name & Address of Client	**M/s. ANDRITZ HYDRO PVT. LTD., LKHEP Project ,village- Longku ,Dist- Dima Hasao, Pin- 788931.**					
Sample Description	**Type: Raw water**				**Source: borewell**	
Sample collected by	**M/s. En-vision Enviro Technologies North East**					
Sample Collection Particulars	**Date 02/03/2024**	**Time 12:50 P.M**	**Temperature 32°C**	**pH 6.82**	**Quantity Drawn:4L**	**Sampling Method: EETNE/SOP/02**

Sl No.	Parameters	Unit	Result	Reference Method	IS 10500:2012 Permissible Limit
1	pH	---	6.74	APHA 23rd Edition,4500 H^+,Page:4-95	6.5-8.5
2	Turbidity	NTU	4.5	APHA 23rd Edition,2130,Page:2-13	5
3	TDS	mg/L	59.2	APHA 23rd Edition,2540 C, Page :2-69	2000
4	TSS	mg/L	72.5	APHA 23rd Edition,2540,Page:2-70	----
5	Oil and Grease	mg/L	<5	APHA 23rd Edition,5520 B,Page:5-42	----
6	Dissolved Oxygen	mg/L	5.1	APHA 23rd Edition,4500-O C,Page:4-146	6
7	Total hardness	mg/L	137.5	APHA 23rd Edition,2340 B,Page:2-48	600
8	Calcium	mg/L	28.4	APHA 23rd Edition,3500-Ca B,Page:3-69	200
9	Magnesium	mg/L	18.5	APHA 23rd Edition,3500-Mg B,Page:3-86	100
10	Total Alkalinity	mg/L	32.5	APHA 23rd Edition,2320,Page:2-37	600
11	Sulphate	mg/L	21.3	APHA 23rd Edition,4500-SO_4^{2-}E,Page:4-199	400
12	Nitrates	mg/L	45	APHA 23rd Edition,4500-NO_3^-B,Page:4-127	20
13	Phosphate	mg/L	<0.02	APHA 23rd Edition,4500-P,Page:4-163	----------
14	Salinity	%	0.2	APHA 23rd Edition,2520B,Page:2-60	----------
15	Conductivity	µS/cm	102.3	APHA 23rd Edition,2520B,Page:2-60	2500

Page 1 of 2

Sample ID No: EETNE/MARCH/04/24 **Date of sample receipt: 04/03/2024**
Test Starting Date: 04/03/2024 **Test completion Date: 11/03/2024**

Sl No.	Parameters	Unit	Result	Reference Method	IS 10500:2012 Permissible Limit
16	Arsenic	mg/L	BDL	APHA 23rd Edition,3114A,Page:3-36	-------
17	Iron(as Fe)	mg/L	0.52	APHA 23rd Edition,3500-Fe B,Page:3-80	------
18	Total Coliform	MPN/100	2	APHA 23rd Edition,9222B,Page:9-81	Shall not be detectable in any 100 ml Sample
19	Fecal Coliform	MPN/100	Nil	APHA 23rd Edition,9222 D,Page:9-89	Shall not be detectable in any 100 ml Sample
20	BOD	mg/L	5	APHA 23rd Edition,5210B,Page:5-6	-------
21	COD	mg/L	48	APHA 23rd Edition,5220 b,Page:5-18	-------

NOTE: (BOD) Biochemical Oxygen Demand, (COD) Chemical Oxygen Demand,(TSS)Total Suspended Solids, (TDS) Total Dissolved Solids.

For Envision Enviro Technologies North East, Guwahati

KHAIRUL ISLAM SHEIKH
Environmental Chemist
Test Done By

UTPAL BEZBARUAH
Technical Manager
Authorized Signatory/ Reviewed by

Note: i) The results relate only to the parameters tested.
ii) The test report shall not be reproduced except in full, without written approval of laboratory

End of report

Ground water monitoring Results (Borewell 1)

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TC-7669
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TEST REPORT:
ULR No: TC766924000000281
Report No: 240416_14080047_0
Sample ID No:EETNE/APRIL/12/24/D
Test Starting Date: 09/04/24

Date of Report: 16/04/24
Date of sample receipt: 08/04/24
Test completion Date: 16/04/24

Name & Address of Client	**BVG India Ltd. Midas Tower, 4th Floor, Phase-I, Rajiv Gandhi Infotech Park, Hinjawadi, Pune 411057 Maharastra,India.**				
Sample Description	**Type: Ground Water**	**Source : Borewell 1 Location:(At the back side of Type 1 Building) Depth:740 feet**			
Sample collected by	**M/s. En-vision Enviro Technologies North East**				
Sample Collection Particulars	**Date 08/04/2024**	**Time 11:20 A.M**	**Temperature 28°C**	**Quantity Drawn:4L**	**Sampling Method: EETNE/SOP/02**

Sl No.	Parameters	Unit	Result	Reference Method	IS 10500: 2012	
					Acceptable limit	Permissible limit
1	pH	---	7.40	APHA 23rd Edition 2017,4500 H^+ B, Page:4-95 / IS 3025 (Part 11) Electrometric Method	6.5-8.5	No relaxation
2	Turbidity	NTU	2.3	IS 3025 (Part 10) Nephelometric Method	1.0	5.0
3	TDS	mg/L	187	IS 3025 (Part 16)	500	2000
4	Total hardness	mg/L	180	IS 3025 (Part 21)	200	600
5	Calcium	mg/L	54.5	IS 3025 (Part 40) EDTA Titrimetric Method	75	200
6	Magnesium	mg/L	10.6	IS 3025 (Part 46)	30	100
7	Total Alkalinity	mg/L	220	IS 3025 (Part 23)	200	600
8	Chloride	mg/L	21.7	APHA 23rd Edition 2017,4500-Cl^- B,Page:4-75	250	1000
9	Sulphate	mg/L	17.5	APHA 23rd Edition 2017,4500-SO_4^{2-} E,Page:4-199	200	400
10	Nitrates	mg/L	4.3	APHA 23rd Edition 2017,4500-NO_3^-B,Page:4-127	45	No relaxation
11	Residual Chlorine	mg/L	BDL	APHA 23rd Edition 2017,4500-Cl B,Page:4-63	0.2	1.0

Page 1 of 2

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Report No: 240416_14080047_0
Sample ID No: EETNE/APRIL/12/24

Date of Report: 16/04/24
Date of sample receipt: 08/04/24

Sl No	Parameters	Unit	Result	Reference Method	IS 10500:2012	
					Acceptable limit	Permissible limit
12	Fluoride	mg/L	0.36	APHA 23rd Edition 2017,4500-F D,Page:4-90	1.0	1.5
13	Copper	mg/L	0.038	APHA 23rd Edition 2017,3111 B,Page:3-20	0.05	1.5
14	Iron(as Fe)	mg/L	0.165	APHA 23rd Edition 2017,3500-Fe B,Page:3-80	0.3	No relaxation
15	Cadmium	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.003	No relaxation
16	Lead	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.01	No relaxation
17	Zinc	mg/L	0.192	APHA 23rd Edition 2017, 3111 B,Page:3-20	5	15
18	Total Chromium	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.05	No relaxation
19	Manganese	mg/L	0.042	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.1	0.3
20	Selenium	mg/L	BDL	APHA 23rd Edition 2017, 3114 B,Page:3-36	0.01	No relaxation
21	BOD	mg/L	<2	APHA 23rd Edition 2017,5210B,Page:5-6 / IS 3025 (Part 44)	---	---
22	COD	mg/L	<5	APHA 23rd Edition 2017, 5220-B, Page No: 5-18	---	---

NOTE: (BOD) Biochemical Oxygen Demand, (COD) Chemical Oxygen Demand, (TDS) Total Dissolved Solids, (BDL) Below Detection Limit.

For Envision Enviro Technologies North East

KHAIRUL ISLAM SHEIKH
Environmental Chemist
Test Done By

UTPAL BEZBARUAH
Technical Manager
Authorized Signatory/Reviewed By

Note: i) The results relate only to the parameters tested and item sampled.
ii) The test report shall not be reproduced except in full, without written approval of laborator

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Page 1 of 1

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CP-1- Ground water monitoring Results (Borewell 2)

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TEST REPORT:
ULR No: TC766924000000282
Report No: 240416_14080047_1
Sample ID No:EETNE/APRIL/13/24/D
Test Starting Date: 09/04/24

Date of Report: 16/04/24
Date of sample receipt: 08/04/24
Test completion Date: 16/04/24

Name & Address of Client	**BVG India Ltd. Midas Tower, 4th Floor, Phase-I, Rajiv Gandhi Infotech Park, Hinjawadi, Pune 411057 Maharastra,India.**				
Sample Description	**Type: Ground Water**	**Source : Borewell-2 Location:(At the back side of Type 2 Building) Depth:530 feet**			
Sample collected by	**M/s. En-vision Enviro Technologies North East**				
Sample Collection Particulars	**Date 08/04/2024**	**Time 11:50 A.M**	**Temperature 28°C**	**Quantity Drawn:4L**	**Sampling Method: EETNE/SOP/02**

Sl No.	Parameters	Unit	Result	Reference Method	IS 10500: 2012	
					Acceptable limit	Permissible limit
1	pH	---	6.58	APHA 23rd Edition 2017,4500 H^+ B, Page:4-95 / IS 3025 (Part 11) Electrometric Method	6.5-8.5	No relaxation
2	Turbidity	NTU	4.1	IS 3025 (Part 10) Nephelometric Method	1.0	5.0
3	TDS	mg/L	28	IS 3025 (Part 16)	500	2000
4	Total hardness	mg/L	24	IS 3025 (Part 21)	200	600
5	Calcium	mg/L	6.4	IS 3025 (Part 40) EDTA Titrimetric Method	75	200
6	Magnesium	mg/L	1.9	IS 3025 (Part 46)	30	100
7	Total Alkalinity	mg/L	27.5	IS 3025 (Part 23)	200	600
8	Chloride	mg/L	14.6	APHA 23rd Edition 2017,4500-Cl^- B,Page:4-75	250	1000
9	Sulphate	mg/L	8.3	APHA 23rd Edition 2017,4500-SO_4^{2-} E,Page:4-199	200	400
10	Nitrates	mg/L	3.4	APHA 23rd Edition 2017,4500-NO_3^- B,Page:4-127	45	No relaxation
11	Residual Chlorine	mg/L	BDL	APHA 23rd Edition 2017,4500-Cl B,Page:4-63	0.2	1.0

Page 1 of 2

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Report No: 240416_14080047_0
Sample ID No:EETNE/APRIL/13/24

Date of Report: 16/04/24
Date of sample receipt: 08/04/24

Sl No	Parameters	Unit	Result	Reference Method	IS 10500:2012	
					Acceptable limit	Permissible limit
12	Fluoride	mg/L	0.32	APHA 23rd Edition 2017,4500-F D,Page:4-90	1.0	1.5
13	Copper	mg/L	0.031	APHA 23rd Edition 2017,3111 B,Page:3-20	0.05	1.5
14	Iron(as Fe)	mg/L	0.141	APHA 23rd Edition 2017,3500-Fe B,Page:3-80	0.3	No relaxation
15	Cadmium	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.003	No relaxation
16	Lead	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.01	No relaxation
17	Zinc	mg/L	0.163	APHA 23rd Edition 2017, 3111 B,Page:3-20	5	15
18	Total Chromium	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.05	No relaxation
19	Manganese	mg/L	0.028	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.1	0.3
20	Selenium	mg/L	BDL	APHA 23rd Edition 2017, 3114 B,Page:3-36	0.01	No relaxation
21	BOD	mg/L	<2	APHA 23rd Edition 2017,5210B,Page:5-6 / IS 3025 (Part 44)	---	---
22	COD	mg/L	<5	APHA 23rd Edition 2017, 5220-B, Page No: 5-18	---	---

NOTE: (BOD) Biochemical Oxygen Demand, (COD) Chemical Oxygen Demand, (TDS) Total Dissolved Solids, (BDL) Below Detection Limit.

For Envision Enviro Technologies North East

ENVISION ENVIRO TECHNOLOGIES (NORTH EAST) Guwahati -3

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Environmental Chemist
Test Done By

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CP-2 Water Treatment Plant

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TEST REPORT:
Report No: 240117_1503163_0
ULR No: TC766923000000212P
Sample ID No: EETNE/JAN/02/24
Test Starting Date: 10/01/24

Date of Report: 17/01/24
Date of sample receipt: 10/01/24
Test completion Date: 17/01/24

Name & Address of Client	M/s. Lower Kopili HEP Project, Lanku, District – Dima Hasao, Assam				
Sample Description	Source: Water Treatment Plant Dam Top				
Sample collected by	M/s. L&T Staff of Kopili project				
Sample Collection Particulars	Date 09/01/2024	Time 12:20 P.M	Temperature 30°C	Quantity Drawn:4L	Sampling Method: EETNE/SOP/02

Sl No.	Parameters	Unit	Result	Reference Method	IS 10500: 2012	
					Acceptable limit	Permissible limit
1	pH	---	7.72	APHA 23rd Edition 2017,4500 H^+ B Page:4-95 / IS 3025 (Part 11) Electrometric Method	6.5-8.5	No relaxation
2	Turbidity	NTU	<1	IS 3025 (Part 4) Nephelometric Method	1.0	5.0
3	TDS	mg/L	45.2	IS 3025 (Part 16)	500	2000
4	Total hardness	mg/L	35.7	IS 3025 (Part 21)	200	600
5	Calcium	mg/L	10.8	IS 3025 (Part 40) EDTA Titrimetric Method	75	200
6	Magnesium	mg/L	2.3	IS 3025 (Part 46)	30	100
7	Total Alkalinity	mg/L	24.6	IS 3025 (Part 23)	200	600
8	Chloride	mg/L	25.1	APHA 23rd Edition 2017,4500-Cl^- B,Page:4-75	250	1000
9	Sulphate	mg/L	12.4	APHA 23rd Edition 2017,4500-SO_4^{2-} E,Page:4-199	200	400
10	Nitrate	mg/L	4.9	APHA 23rd Edition 2017,4500-NO_3^- B,Page:4-127	45	No relaxation

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Test Starting Date: 10/01/24
Sample ID No: EETNE/JAN/02/24

Date of report: 17/01/24
Date of sample receipt: 10/01/24

Sl No.	Parameters	Unit	Result	Reference Method	IS 10500: 2012	
					Acceptable limit	Permissible limit
11	Fluoride	mg/L	0.34	APHA 23rd Edition 2017,4500-F D,Page:4-90	1.0	1.5
12	Copper	mg/L	0.038	APHA 23rd Edition 2017,3111 B,Page:3-20	0.05	1.5
13	Iron(as Fe)	mg/L	0.156	APHA 23rd Edition 2017,3500-Fe B,Page:3-80	0.3	No relaxation
14	Cadmium	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.003	No relaxation
15	Lead	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.01	No relaxation
16	Zinc	mg/L	0.198	APHA 23rd Edition 2017, 3111 B,Page:3-20	5	15
17	Total Chromium	mg/L	BDL	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.05	No relaxation
18	Manganese	mg/L	0.047	APHA 23rd Edition 2017, 3111 B,Page:3-20	0.1	0.3
19	Selenium	mg/L	BDL	APHA 23rd Edition 2017, 3114 B,Page:3-36	0.01	No relaxation
20	Arsenic	mg/L	BDL	APHA 23rd Edition 2017, 3114 B,Page:3-36	0.01	No relaxation
21	BOD	mg/L	<2	APHA 23rd Edition 2017,5210B,Page:5-6 / IS 3025 (Part 44)	--	--
22	COD	mg/L	<5	APHA 23rd Edition 2017, 5220-B, Page No: 5-18	--	--

NOTE: BDL (Below Detection Limit), BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand)

For En-vision Enviro Technologies North East, Guwahati

ENVIRO TECHNOLOGIES NORTH EAST Guwahati -3

KHAIRUL ISLAM SHEIKH
Environmental Chemist
Test done by

UTPAL BEZBARUAH
Technical Manager
Authorized Signatory/Reviewed By

Note: i) The results relate only to the parameters tested.
ii) The test report shall not be reproduced except in full, without written approval of laboratory.
iii) Parameter no. 8 to 20 are analyzed by Department of Chemistry, B.Borooah College as per our MOU.

End of report

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Enviro Technologies North East

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SOIL ANALYSIS REPORT

Rep.No: 240311_1503164_1 **Date: 11/03/24**

Name & Address of Client	**M/s. ANDRITZ HYDRO PVT. LTD., LKHEP Project ,village-Longku ,Dist- Dima Hasao, Pin- 788931.**
Sample Description	**NEAR SERVICE BAY**
Date of Sampling	**02/03/24**
Sample collected by	**M/s. En-vision Enviro Technologies North East**

Sl No.	Soil Parameters	Unit	Result	Reference Method
1	p^H	---	6.24	Potentiometric
2	Soil type	---	Silt highly organic clay	Hydrometer
	Permeability of soil	Cm/sec	1.1×10^{-6}	Constant head test method
	Sand	%	63.5	Hydrometer
	Clay	%	13.6	Hydrometer
	Silt	%	22.9	Hydrometer
3	Nitrogen	kg/ha	0.068	Alkaline $KMnO_4$
4	Phosphorus	mg/kg	9.6	Olsen method
5	Potassium	mg/Kg	12.2	NH_4-acetate extraction
6	Electrical conductivity	mS/cm	10	Conductivity Meter
7	Water holding capacity	%	13.5	Standard method
8	Organic matter	%	0.58	Titrimetric

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Sl No.	Parameters	Unit	Result	Reference Method
9	Organic Carbon	%	4.08	Rapid Dichromate Oxidation Technique
10	Iron	g/kg	81.5	Flame AAS(mg/kg)
11	Copper	mg/kg	3.12	Flame AAS
12	Nickel	mg/kg	3.08	Flame AAS
13	Manganese	g/kg	63.4	Flame AAS(mg/kg)
14	Zinc	mg/kg	8.3	Flame AAS
15	Arsenic	mg/kg	4.8	HG- AAS
16	Cadmium	mg/kg	0.02	Flame AAS
17	Lead	mg/kg	0.002	Flame AAS
18	Chromium	mg/kg	<0.02	Flameless AAS
19	Aluminum	mg/kg	BDL	Flameless AAS

For En-vision Enviro Technologies North East, Guwahati

UTPAL BARUAH
(Technical Manager)
Authorised Signatory/ Reviewed by

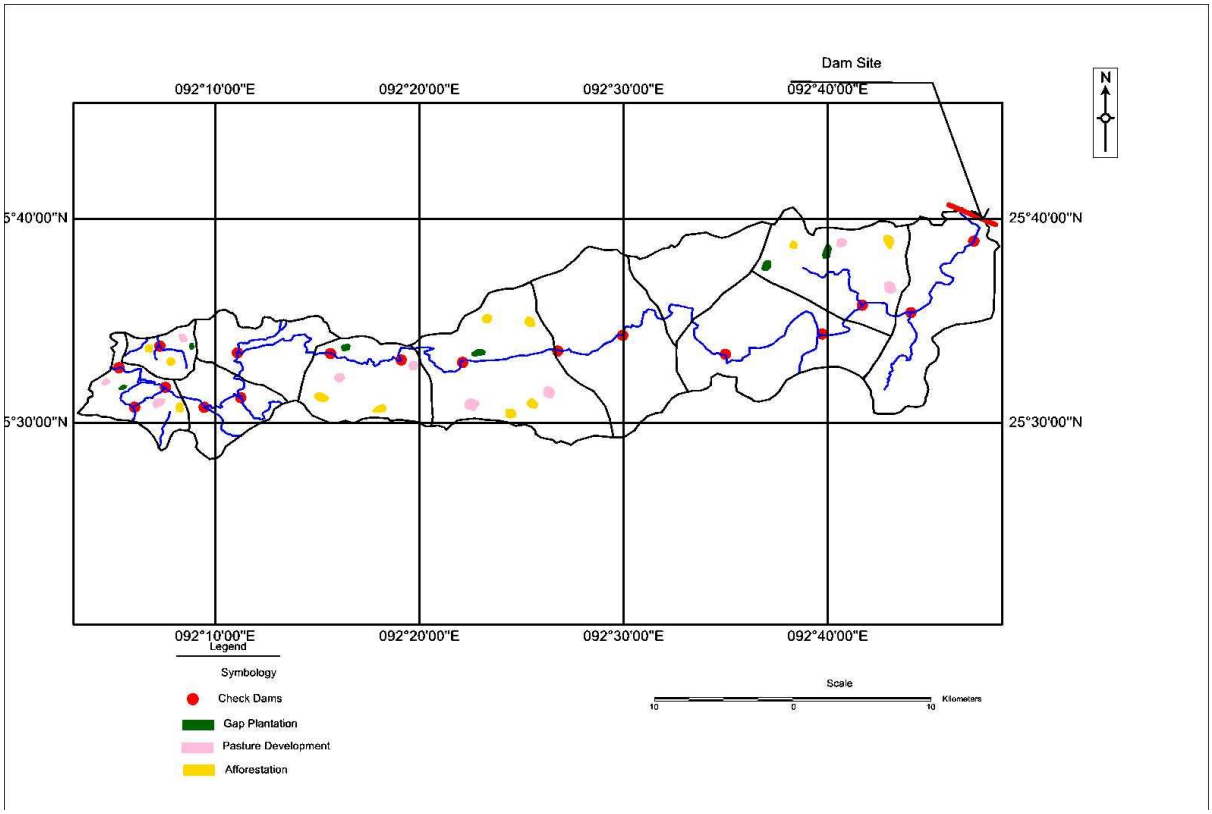
Note: i) The results relate only to the parameter tested.
ii) The test report shall not be reproduced except in full, without written approval of laboratory.

End of Report

Page 2 of 2

Annexure 9 : Land Bank Map of CAT Plan

Catchment Area Treatment Measures for Lower Kopili Catchment



Annexure 10 : Copy of fund utilization under R&R

ASSAM POWER GENERATION CORPORATION LIMITED
Registered Office: Bijulee Bhawan, 3rd floor, Paltanbazar, Guwahati-781001, Assam

Status of R&R implementation

Statement on implementation of Resettlement & Rehabilitation (R&R) plan under Combined Resettlement and Tribal Development Plan (CRTDP) for Lower Kopili Hydro Electric Project, Longku, APGCL as on 10th December 2024 is furnished below

1. Land compensation
   a) Dima Hasao = Rs 44.58 Crore (completed)
   b) Karbi Anglong = Rs 7.05 Crore (completed)

2. R&R assistances & allowances
   a) Dima Hasao = Rs 52.51 Crore (completed)
   b) Karbi Anglong = Rs 11.38 Crore (completed)

Total amount of Rs. 115.52 Crore (Rupees One Hundred Fifteen Crore Fifty-Two Lakh) has been disbursed so far under the plan covering both district of Dima Hasao & Karbi Anglong of Assam.

13.12.24
Deputy General Manager (F&A)
O/o the M.D., APGCL
Bijulee Bhawan, Ghy-01

ASSAM POWER GENERATION CORPORATION LIMITED
Registered Office: Bijulee Bhawan, Paltanbazar, Guwahati-781 001, Assam.
CIN:U40101AS2003SGC007239
Tele: 0361-2739 502; FAX: 0361-2739 546/22
E-mail: apgcl_md@yahoo.com; Website: www.apgcl.org

QUALITY, ENVIRONMENTAL, OCCUPATIONAL HEALTH & SAFETY POLICY

OUR AIM

- *To meet the ever increasing demand for electrical power by generating reliable power at competitive cost.*
- *To minimize the impact on environment while generating power.*
- *To minimize the occupational health and safety risk of all people involved in operation and maintenance of the power plants.*

OUR COMMITMENTS

- *To comply with various quality parameters specified by electricity authorities related to power generation.*
- *To comply with all environmental, occupational health & safety related legal and other requirements enacted by the Central and the State Governments.*
- *To continually improve the effectiveness of quality, environmental, occupational health & safety management system to enhance stakeholder satisfaction.*

OUR ENDEAVOUR

- *To continually improve productivity through planned operations and preventive maintenance.*
- *To adopt proactive measures for preservation of nature and reduction of work related risks.*
- *To motivate employees and all other personnel working under us to continually enhance quality, productivity, environmental, safety & occupational health performance through training and other relevant activities.*

Guwahati
Date: 30.09.2015

30/9.
(Managing Director)

ASSAM POWER GENERATION CORPORATION LIMITED
Registered Office: Bijulee Bhawan, 3rd floor, Paltanbazar, Guwahati-781 001, Assam

Akshay Talukdar
Project Director (PMU)
Email: akshay.talukdar@apgcl.org

No: APGCL/CGM(H)/W/2007/140/Pt-VII/159 Dated:10.05.2024

To,

The Member Secretary,
Pollution Control Board Assam.
Bamunimaidam,
Guwahati-21

Sub: Environmental Statement for 120 MW Lower Kopili Hydro Electric Project for the period ending March 2024

Ref: 1. CTE for the 120 MW Lower Kopili Hydro Electric Project's power plant at Longku, Dima Hasao vide No. WB/SLC/T-1267/22-23/7 dated 28th Feb, 2023.
2. EC accorded by MoEF&CC, New Delhi, vide No. J- 1211/26/2012-IA-I dated 4th September, 2019.

Sir,

This is to inform you that the Lower Kopili Hydro Electric Project is under construction stage. As per the compliance of the Standard EC Conditions for River Valley and Hydroelectric projects vide stipulation No. X.v. now, Assam Power Generation Corporation Limited (Project Proponent) is submitting the Environmental Statement for the year ending March, 2024.

This is for your kind information and necessary action.

Enclo: As stated

Yours sincerely,

Project Director, (PMU)
APGCL, Bijulee Bhawan, Ghy-1

Memo no: APGCL/CGM(H)/W/2007/140/Pt-VII/159(a) Dated:10.05.2024

Copy to:

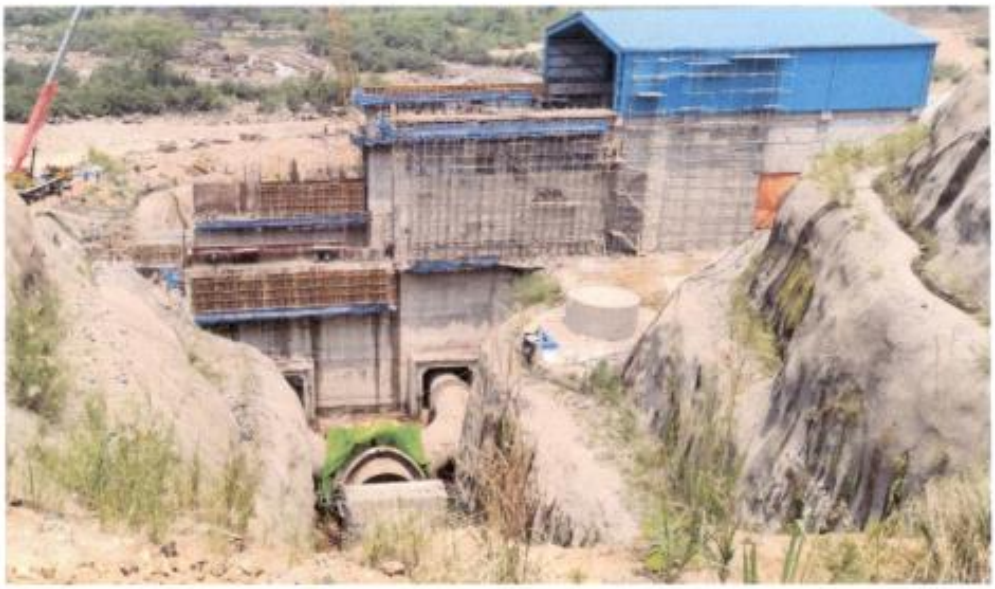
1. Reference file

Assam Power Generation Corporation Limited

Environmental Statement

Form V

For 120 MW Lower Kopili Hydro Electric Project, Longku, Dima Hasao, Assam



Address

Corporate Office:
Assam Power Generation Corporation Limited,
3rd Floor Bijulee Bhawan, Paltan Bazar, Guwahati-781001, Assam

Site Office:
Assam Power Generation Corporation Limited, Longku, Dima Hasao, Assam

FORM V

(See Rule 14)

The Ministry of Environment & Forest vide its notification dated 13 March, 1992 directed all industries which need to have consent under Water (Prevention & Control of Pollution) 1974 and Air (Prevention & Control of Pollution) 1981 to file the environmental statement every year. Environmental Statement for the financial year ending on 31st March on or before 30th of September every year.

Assam Power Generation Corporation Limited obtained CTE from PCBA for the 120 MW Lower Kopili Hydro Electric Project's power plant at Longku, Dima Hasao vide No. WB/SLC/T-1267/22-23/7 dated 28th Feb, 2023.

The format for the same is as follows: Environmental Statement for the financial year ending the 2024.

PART A

I	Name and address of the owner/ occupier of the industry operation or process.	Corporate Office: Assam Power Generation Corporation Limited, 3rd Floor Bijulee Bhawan, Paltan Bazar, Guwahati-781001, Assam. Site Office: Assam Power Generation Corporation Limited, Longku, Dima Hasao, Assam
II	Industry category Primary-(STC Code) Secondary-(STC Code).	Power generation plant (Hydro Power 120 MW) – RED
III	Production capacity- Units	120 MW (Under Construction)
IV	Year of establishment	Under construction
V	Date of the last environmental statement submitted	This is the first environmental statement for the period ending March 2024.

PART B

Water and Raw Material Consumption

1 Water consumption m3/ d - The power plant is under construction and expected date of dry commission of the power plant is April 2025

Process

Cooling

Domestic

Name of products	Process water consumption per unit of product output	
	During the previous financial year	During the current financial year
	(1)	(2)
(1) Power generation from MPH	-	NIL
(2) Power generation from APH	-	NIL
(3) Cooling	-	NIL

(2) Raw material consumption

*Name of raw unit materials	Name of products	Consumption of raw material per	
		During the previous financial year	During the current financial year
NIL			

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

PART C

Pollution discharged to environment/ unit of output.

(Parameter as specified in the consent issued)

Pollution	Quantity of pollutants Discharged (mass/ day)	Concentration ofpollutants in discharges (mass/ volume)	Percentage of variation from prescribed standards with reasons
(a) Water (b) Air		NIL as the plant is under construction	

PART D

Hazardous Wastes

(as specified under Hazardous Wastes (Management and Handling) Rules, 1989)

Hazardous Wastes	Total Quantity (Kg)	
	During the previous currentfinancial year	During the financial year
(a) From process	NIL as the plant is under construction.	
(b) From pollution control facilities.		

PART E

Solid Wastes

	Total Quantity	
	During the previous financial year	During the current financial year
(a) From process (b) From pollution control facility (c) (1) Quantity recycled or re-utilised within the unit (2) Sold (3) Disposed	NIL as the plant is under construction.	

PART F

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

PART G

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

MoEF&CC approved Environment Management Plan exists for the operation phase of the Hydro Power Plant.

PART-H

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

- Water Spraying on haulage road, dumping site etc. for dust suppression during construction.
- Plantation proposed & will be done within the diverted forest land in consultation with the Forest Department
- 198 Ha area kept as Green Belt in the Diverted Forest Land as per the MoEF&CC 's recommendation.
- For domestic waste water septic tank & soak pit proposed in the power plant.
- Solid wastes after segregation are taken by Umrangso Municipality for disposal in their designated site.

PART-I

Any other particular for improving the quality of the environment: Yes

- Compensatory Afforestation through CAMPA
- Implementation of CAT plan Soil and Moisture Conservation Plan through CAMPA
- Slope protection measures – engineering and bioengineering measures.
- Restoration of the construction sites will be carried out as per the approved plan.
- Mixed Plantation will be carried out in the restored lands as per the guideline of the working plan of the Forest Department in consultation with the Department.
- Installation of Bird flight divertors in the transmission line for conservation of migratory and resident birds.

Project Director (PMU),
Lower Kopili Hydro Electric Project 120 MW
Assam Power Generation Corporation Limited