Bangladesh – India Friendship Power Company (Pvt.) Limited

(A Joint Venture of NTPC Ltd. and BPDB)

Monitoring of Environment Parameter and Implementation of Environmental Management Plan during Construction Period along with Engineering Activities for 2X660 MW Maitree Super Thermal Power Project at Rampal in Bagerhat District

33rd Quarter Monitoring Report

Monitoring Period: May – July 2022

December 2022

Center for Environmental and Geographic Information Services

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Acknowledgements

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Last but not the least, the study team appreciates and acknowledges the concerns and perceptions of local people regarding the project and their active participations during field visits.

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Abbreviations and Acronyms

AAS	Atomic Absorption Spectrophotometer
AECL	Adroit Environment Consultants Ltd
As, Pb, Hg	Arsenic, Lead and Mercury
BCSIR	Bangldesh Council of Scientific and Industrial Research
BDS	Business Development Studies
BIFPCL	Bangladesh-India Friendship Power Company (Pvt.) Limited
BOD	Biochemical Oxygen Demand
BPDB	Bangladesh Power Development Board
BUET-BRTC	Bangladesh University of Engineering and Technology - Bureau of Research, Testing and Consultation
CDM	Clean Development Mechanism
CEGIS	Center for Environmental and Geographic Information Services
COD	Chemical Oxygen Demand
CPUE	Catch per Unit Effort
CSR	Corporate Social Responsibility
dBH	Diameter at Breast Height
DCR	Duplicate Carbon Receipt
DO	Dissolved Oxygen
DoE	Department of Environment
DPHE	Department of Public Health Engineering
EC	Electrical Conductivity
ECR	Environment Conservation Rules
EHS	Environmental Health Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering Procurement Construction
ESP	Exchangeable sodium percentage
FGD	Focus Group Discussion
FGD	Flue Gas Desulfurization
FSR	Fisheries Species Richness
GIS	Geographic Information System
GoB	Government of Bangladesh
GPS	Global Positioning System

GW	Groundwater
HS	Household Survey
IFC	International Finance Corporation
IGA	Income Generation Activities
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
Kg	Kilogram
KII	Key Informants Interview
MoPEMR	Ministry of Power, Energy and Mineral Resources
MW	Mega Watt
MSDS	Materials Safety Data Sheet
NTPC	National Thermal Power Corporation
OHSAS	Occupational Health and Safety Management Systems
PCU	Passenger Car Unit
PGCB	Power Grid Company of Bangladesh Ltd
PMU	Project Management Unit
PRA	Participatory Rural Appraisal
PWD	Public Works Department
QMR	Quarterly Monitoring Report
RRA	Rapid Rural Appraisal
RS	Remote Sensing
SAR	Sodium absorption ratio
SRDI	Soil Resources Development Institute
SRF	Sundarbans Reserve Forest
TDS	Total Dissolved Solid
TH	Total Hardness
ToR	Terms of References
TSS	Total Suspended Solid
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

Units

dB	Decibel
hr	Hour
Kg	Kilogram
Km	Kilometre
KV	Kilo Volt
KW	Killo Watt
m	Meter
mg	Milligram
MW	Mega Watt
Nm	Normal Meter
ppm	parts per million
ppt	parts per trillion
ton/year	Ton Per Year
s	Seconds

Units Conversion Table

General Units

1°C = 274.15 K=33.8° F

1 hectare = 10-2 km2 = 2.471 acres

1 kilogram = 2.20 pound

1 kilometre = 0.62137 mile

1 liter = 0.001 cubic meter

1 meter = 3.2808 feet

1 metric ton = 1000 kg

1 mg/L ≈1 g/m3≈1 ppm (w/w)

1 mg/m3 = 1 μg /L

1 pascal = 1 N/m2= 0.01 millibar

1 square mile = 640 acre = 2.590 km2

Energy Units

1 GWyr = 8.76 x 109 kW

1 horsepower = 746 W

1 KWh = 3412 Btu

1 kWh = 859.85 kcal

1 KWh = 3.6 x 106 J

1MW=1000KW=106W

Glossary

Aman:	Group of rice varieties grown in the monsoon season and harvested in the post-monsoon season. This is generally transplanted at the beginning of monsoon from July-August and harvested in November-Dec. Mostly rain-fed, supplemental irrigation needed in places during dry spell.
Aus:	Group of rice varieties sown in the pre-monsoon season and harvested in the monsoon season. These are broadcasted/transplanted during March-April and harvested during June-July. Generally, rain-fed, irrigation needed for HYVT. (High yield variety) Aus.
B Aus:	Broadcast Aus
Bazar:	Market
Beel:	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
Boro:	A group of rice varieties sown and transplanted in winter and harvested at the end of the pre-monsoon season. These are mostly HYV and fully irrigated, planted in December-January and harvested before the onset of monsoon in April- May.
Haat:	Market place where market exchanges are carried out either once, twice or thrice a week, however not every day.
Gear/Jaal:	Different types of fishing net to catch fish from the water bodies.
Kutcha:	A house made of locally available materials with earthen floor, commonly used in the rural areas.
Khal:	A drainage channel usually small, sometimes man-made through which the water flows. These may or may not be perennial.
Kharif:	Pre-monsoon and monsoon growing season. Cropping season linked to monsoon between March-October, often divided into kharif-1 (March-June) and kharif-2 (July-October).
Perennial Khal:	Water available in the khal all the year round.
Pacca:	Well-constructed building using modern masonry materials.
Rabi:	Dry agricultural crop growing season; mainly used for the cool winter season between November and February.
Seasonal Khal:	Water not available in the khal all the year round.
T. *Aman*:	Transplanted Aman
Upazila:	Upazila is an administrative subdivision of a District.

Executive Summary

This 33rd quarterly monitoring report covers the status of EMP (Environmental Management Plan) implementation for the concurrent period (during construction stage) as recommended in the EIA (Environmental Impact Assessment) study of power plant vide Memo No: DoE/Clearance/5062/2011 dt. 05/08/2013 as well as EIA report of Coal Transportation vide Memo No: DoE/Clearance/5532/2016 dtd.31/01/2018. During the month of July, 2022 CEGIS team carried out the monitoring activities covering every monitoring aspects as assigned in the ToR (Terms of Reference) and approval conditions of DoE along with valuable suggestions and recommendations from different national and international organizations. In other words, the aspects can briefly be addressed as monitoring of the Environmental Compliances and monitoring of the selected environmental parameters such as ambient air quality, noise level, water quality, land resource, traffic management status, water resources management status, agricultural resources monitoring, fisheries resources, Socio-economic monitoring, aquatic & terrestrial ecosystem monitoring and the Sundarbans Reserve Forest (SRF) health monitoring.

However, the The present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews/discussion to the proponents, project officials, relevant authorities and overall staffs of the entire plant. A comprehensive and detailed checklist was prepared to cover environmental compliance of different components e.g. Environmental and Social Management System and Action Plan; Labour and Working Condition; Community Health, Safety and Security; Biodiversity and Sustainable Management of Living Natural Resources, waste management and other relevant issues. Unlike the 32nd environmental compliance monitoring report this quarterly report will focus again on waste generation and its management in and around of the main plant and labour shed. It is noted that during 32nd field visit we identified a set of anomalies regarding waste generation and its proper management and requested to the respective authorities to look after this issue urgently. During 33rd visit we had a quick look on those issues again and found that all waste related issues are still unsolved. CEGIS raised this issue in the meeting to consider this issue as urgent and project management has assured us to take immediate step to resolve the issue.

In course of air quality monitoring it was observed that the concentration of criteria pollutants was found to be much higher at Mongla ghat area than the other locations whereas lowest concentration was observed at the Gaurambha area. On the other hand, according to the observed data it can be concluded that the concentration of major air pollutants was found comparatively lower in the Sundarbans area than that of the other monitoring locations. But due to the seasonal effect the concentration of the particulate matters (PM2.5, PM10 and SPM) was found to be slightly higher at Khan Jahan Ali Bridge area comparing to the standards set by DOE (Air pollution control rules, 2022). On the contrary, the concentration of SO2, & NOx which found to be higher in monsoon periods and CO concentration was found higher in post monsoon seasons. Nevertheless, the concentration as averaged for the corresponding locations were found to be lower than the standards (air pollution control Rules, 2022). However, major sources of criteria pollutants generation in and around the project site as observed were the piling activities, digging, tunneling and burrowing works, jetty erection activities, major construction works, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads and river Passur etc. Other sources of pollutants which may contribute to the existing pollution load are the small industries like cement works and refinery industries etc., diffuse sources like wood stoves, fires and wind generated dust etc.

Observed noise level at Chalna, a commercial area located at a distance of 4 km to the north-west direction of the proposed chimney location was recorded as 52.88 dB whereas it's standard level is 70 dB (Table: 2.4). Levels of noise at Kaigar Daskati (45.60 dB) situated at the Gucchha Gram, a residential area located at north-west corner of the project area; Chunkuri-2 (47.12 dB) located at 4km south-west direction from the chimney location; Maidara Khal (49.38 dB), south-west corner of the project area and a residential area and; Shapmari (44.58 dB), proposed township area didn't cross their corresponding standard limits (55 dB) of noise level (Table: 2.4). The level of noise at Barni (Gaurambha) was found to be 47.46 dB which was 12.54 dB lower than that of standard limit (60 dB) of noise level for this location (Table: 2.4). Harbaria (40.77 dB) and Akram Point (41.49 dB), the two ecologically silent zones were also not found to exceed the Bangladesh standard limit (50 dB) of their corresponding standard values (Table: 2.4).

On the other hand, observed noise levels at Khan Jahan Ali Bridge (55.75 dB), a commercial zone, and Mongla Port (55.08 dB), an industrial zone, were also not found to exceed the Bangladesh standard limit of noise at their corresponding values (Table: 2.4). The standard noise limits for Khan Jahan Ali Bridge and Mongla Port during the day are 70 dB and 75 dB, respectively.

The physico-chemical properties of Passur iver changes with the tidal intrusion in different seasons. During 32nd quarterly monitoring, pH was found slightly basic in nature. Salinity, Temperature and Dissolved oxygen level was found in fair and favourable for the aquatic life forms. During the 31st quarter (post-monsoon, 2021), TDS and TH has been relatively same with respect to the same seasons of last consecutive years. Nitrate (NO3-) level remained relatively lower. The phosphate (PO43-) was found within the safe limit of aquatic organisms. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and even no issues as well. Oil & grease concentration was found less than 2.0 mg/L at all sites which is less than the recommended concentration (10 mg/L) for Inland Surface Water. On the othert hand, the physical characteristics of groundwater quality is still in good condition with slight variation in pH and salinity. The reason being saline water intrusion and infiltration due to excessive withdrawn of groundwater by the surrounding communities during the dry season. During the monitoring tier As concentration breached the national water quality standard. However, the owner of the tube well will be informed to and monitoring will be continued in order to understand the facts. In addition, evaporation also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes in salinity. Chemical characteristics of the groundwater quality are also found relatively good.

33rd monitoring soil analysis report represents the samples collected in 32nd monitoring which is considered as dry season. Salinity of the monitoring plots are increasing. Mono valent cations concentration (Specially Na) is found to be increased in most of the cases. pH is also found to be increased. Organic matter concentration is found to decreased in four locations and increased in two (Baranpara and Basherhula). Lead concentration is increased in all locations while cadmium concentration is also increased in all locations except (Basherhula). But both of the element's concentration remains within the maximum permissible limit.

Agricultural and livestock data was not collected during this monitoring field visit as per TOR obligation. Next survey will be conducted in October, 2022 and report will be incorporated accordingly.

Similar to the earlier months monitoring report, vehicular movements were observed during the surveys were mostly for the regular construction activities of the Power Plant as the construction activities of the Power Plant are progressing heavily. Khulna Mongla Road at Khudir Bottola received the highest traffic volume compared to the other two locations namely Khulna Mongla Road at Gonai Bridge and Power Plant access road at Gonabelai Bridge. It is to be mentioned here that, during the afternoon time traffic volume at Khulna Mongla Road at Gonai Bridge and during morning and afternoon time Power Plant access road at Gonabelai Bridge were found to be lower whereas, during the other monitoring time at all the three locations, traffic volume has been found to be higher compared to the previous monitoring period.

Monitoring of 33-quarter for fisheries resources have been conducted at 13 sampling sites which were set at the inception stage. Out of these sites, effective samplings were done at 07 sites as fishing in other sites in the river were not observed. Amongst the effective sites, four (04) were in the river and three (03) were in the country side (shrimp farms). The followings are the key findings of the 33rd quarter monitoring in the fiscal year of 2022-23. Changes in habitat uses were observed in every past fiscal year along with the current one (as compared to the fiscal year of 2014-2015, 2015-2016, 2017-2018, 2018-2019, 2019-20 and 2020-21), caused mainly due to biophysical changes like tidal effect, forest erosion and vegetation coverage, seasonal variability, food availability and also fisheries management practices.

Moreover, through analyzing the type of habitat uses by different age group of fish species (based on the length-based community structure model) two types of habitats were found i.e. i) spawning and nursery ground and ii) feeding and maturation ground. Shannon-Weiner diversity index has also been observed to vary between 33-quarter with that of all previous quarters. Highest Shannon-Weiner index was found at Chandpai (0.91) indicating high evenly distributed fish species. On the contrary, lowest evenness was found at the Mongla Point (0.36). However, maximum FSR was obtained in the Chalna Point (n=13), while very low FSR was recorded at the Chandpai (n=06). Fries of fin fish dominant at Maidara, juveniles were at Chandpai and Chalna Point but adult age group were dominant at Mongla and Maidara Point of the Passur River system. Fish species like Chapila, Harina and Chela attain the maximum abundance among the migratory fish species observed in 33-quarter of monitoring. Moreover, among migratory species, Harina was observed to migrate long distances. In this monitoring, the highest productivity was found at Chalna point followed by Maidara point. The present study revealed that the highest catch susceptibility was also found in case of Ber Jal (2.75 kg/haul).

Vegetation composition, plant diversity, vegetation canopy status, plant health, bird habitat status, dolphin occurrence, benthos and plankton in aquatic ecosystems have been monitored for this monitoring season. A total of 47 tree species were recorded from all the monitoring sites with Shanon-Winner diversity index of 2.52 which shows the diversity has been improved than previous monitoring tier. Canopy status and plant health also revealed improvement comparing the same seasonal monitoring in last year. No bird nest of resident avifauna was sighted at any of the studied homestead.

Occurrences of dolphin has been recorded low in Passur River, Maidara River, Dhangmari Khal, Shella Gang and Bhadra Khal than the previous monitoring tier.

In comparison to other mangrove forests throughout the world, the Sundarbans is the most significant natural mangrove forest in Bangladesh and has a diverse range of plants. This ecosystem of the forest is dynamic and intricate. The local population has depended on the resources and services provided by the forest for many years. Ecological Critical Areas have been designated in a buffer zone 10 km from the Sundarbans' border (ECA) (Hossain, M. 2015). We know that Bangladesh has an impressive track record of growth and development. It has been among the fastest growing economies in the world over the past decade, supported by a demographic dividend, strong ready-made garment (RMG) exports, remittances, and stable macroeconomic conditions. So, Bangladesh requires more electricity to achieve the vision to provide impetus to the development dream of the nation. The energy demand is increasing in proportion to the pace of industrialization and population growth. For this reason, a 2x660 MW Maitree Super Thermal Power Project at Rampal, Bagerhat is established outside the Ecologically Critical Area of the Sundarbans, Bangladesh. Among all other coal-based power projects, the Rampal plant touched off an unprecedented uproar among green campaigners at home and abroad, as it is being constructed close to the Sundarbans, the largest mangrove forest in the world. The Center for Environmental and Geographic Information Services (CEGIS) team has been periodically monitoring (33rd) the Sundarbans Reserve Forest's health to oversee the probable impacts of the Rampal Thermal Coal Power Plant Project under implementation. Various bio-indicators such as tree growth, species diversity, seedling regeneration capacity, pneumatophore occurrence, carbon stock, crab hole density, canopy cover changes, Leaf Area Index, leaf phenology, pest, and diseases were observed in the permanent sample plots (PSPs) along the Passur River over time.

Moreover, the Socio-economic monitoring was conducted to explore project impacts on livelihoods, working environment, community health and safety, and activities under the Corporate Social Responsibility (CSR). For the study, physical observation, consultation and informal interviews collected information from the PMU and local communities. It is found that presently, about 10-15% of local labourers work at the project site Now a days, the engagement of local labors is decreasing because of conducting more technical activities in the project site and relevant technicians are unavailable or rarely found in the study area. However, the scope of employment is increased in the study area because of fully operating widen and well-designed access road, bazaar at the zero point and other newly development initiatives (i.e. LPG industries, cement factories, solar power plant etc.) near to the project area. In addition, local people are trying to make some scope of developing small business opportunities which become possible especially due to the project intervention.

Most of the labor sheds were not found clean but found with adequate toilet facilities, drinking water facilities. Drainage system and waste management facilities were not found satisfactory. A number of mangroves, fruits, coconut, and herbal plants were planted in the project area and the program is still ongoing, though the survival rate of the plants (except mangrove trees) are not satisfactory. In this regard, a caretaker from the Forest Department is engaged for supervising the maintenance of the plants. At present mangrove plants are found in the project area which changes canopy coverage in the project area and creates living environments of life.

1. Introduction

1.1 Background

The scope of works as assigned has provisioned to monitor the environmental components, social indicators and the implementation status of EMP (Environmental Management Plan) during the construction phase of 2x660 MW Maitree Super Thermal Power Plant. As an independent environmental monitoring agency, CEGIS was engaged for conducting the said activities in accordance with the Power Plant EIA approval condition no. 32 and Coal Transportation EIA approval condition no.17.

The location of 2x660 MW MSTPP project encompasses Sapmari, Katakhali and Kaigar Daskati Mauza of Rajnagar Union under Rampal Upazila of Bagerhat District (**Figure 1.1**). The Power Plant lies in between latitude 22˚ 37’ 0’’ N and 22˚ 34’ 30’’ N and longitude 89˚ 32’ 0’’ E and 89˚ 34’ 5’’ E. The Plant site is located at about 23 km south from the Khulna City and near about 14 km from the north-west direction of nearest tip of the Sundarbans (considering the proposed chimney location). Location of the study area along with the distance from World heritage sites are presented in **Figure 1.1**.

The study area includes: i) Area covering 10 km radius from the Plant location, ii) Area within 5 km strip from both banks of the Passur river starting from the Plant site to Hiron point (**Figure 1.2**). As per the contract, the findings of the previously formulated quarterly monitoring reports have been submitted to BIFPCL.

Monitoring of Environmental parameters and associated data collection is being continued considering the spatial as well seasonal variations. However, in July, 2022 CEGIS team has carried out the 33rd quarterly monitoring activities covering all the preselected monitoring parameters.

1.2 Objectives

The prime objectives of the study are:

- To monitor the important environment and social parameters during construction phase of the Power Plant and
- To monitor, the environmental compliances regarding EMP implementation during Power Plant’s construction works and associated activities.

1.3 Criteria for Selection of Monitoring Sites/Locations

The monitoring sites have been selected considering the sensitivity and the ambience of the surroundings likely to be impacted from the Project related activities which includes-

- Wind speed and direction, sensitive receptors in and around the vicinity of the project site were considered for monitoring the ambient air quality. Potential areas were also identified and selected for noise level monitoring likely to be impacted by the project activities. Similarly, sites for water quality monitoring were selected considering the water resources (Maidara and other nearer water bodies, Passur River from Chalna to Hiron Point) likely to be impacted by the project activities.
- Potential locations for fisheries resources monitoring were selected considering the fish habitats, biodiversity, migration and production zones likely to be impacted by the project activities.

- Monitoring locations for ecosystem and biodiversity, Soil and land resources were selected considering the induced impacts of the Project related activities on the project surrounding areas.
- Monitoring of socio-economic conditions of the PAPs (Project Affected Peoples) and project surrounding communities were being carried out on the basis of their circumstances likely to be transformed and /or altered by the project activities.
- Locations for Sundarbans Reserve Forest (SRF) Health Monitoring were selected considering the potential access routes of coal transportation through Sundarbans Forest area and associated activities for different phases of the power plant development and operation which might have significant effects on Sundarbans's flora and fauna.
- Monitoring aspects for Environmental compliances regarding EMP implementation status in and around the project area has been set as per suggestions made in the EIA reports and approval conditions from DoE of both the Power Plant and Coal transportation studies respectively for ensuring environmental sustainability and social acceptability.

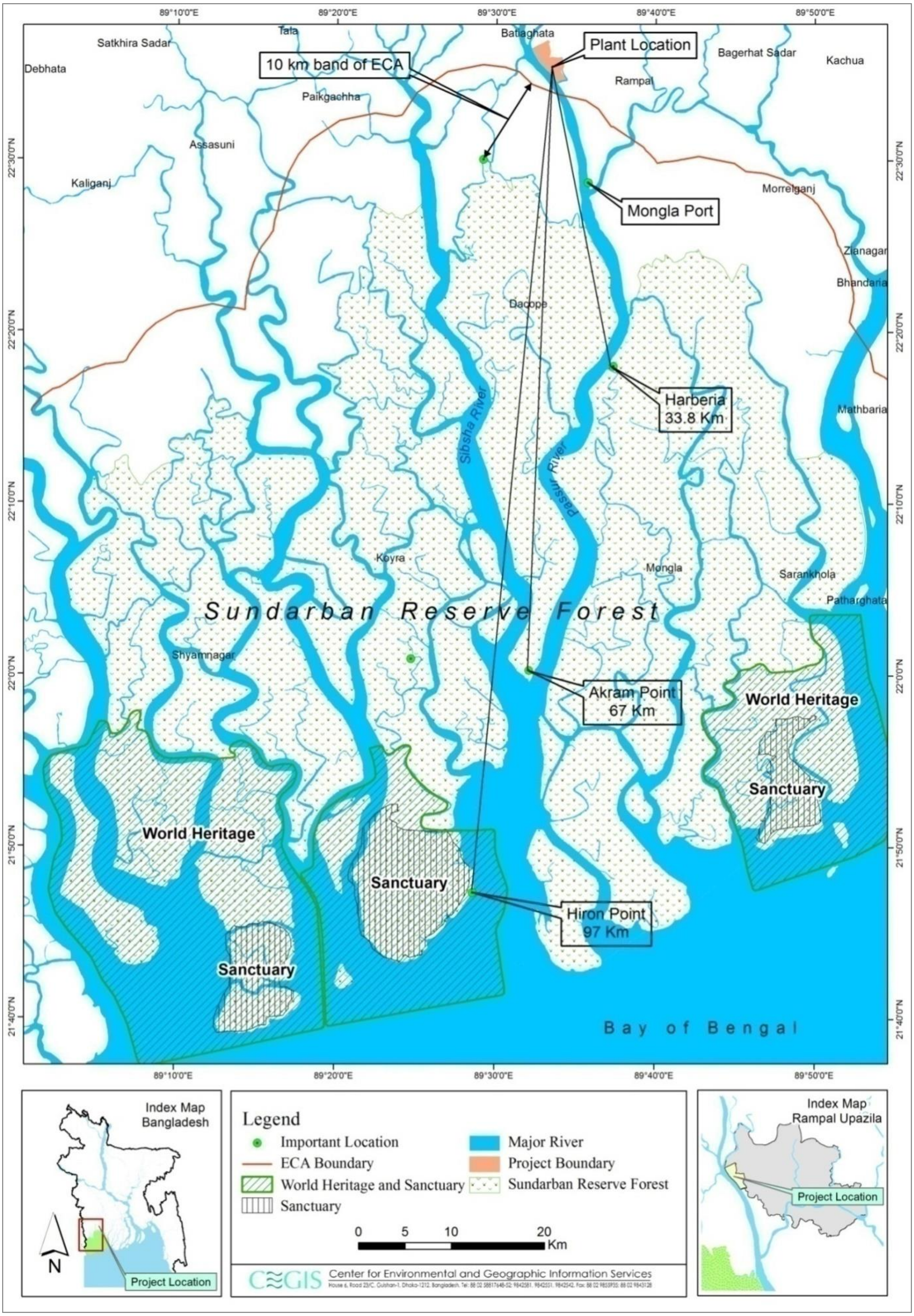


Figure 1.1: Location Map of the Study Area

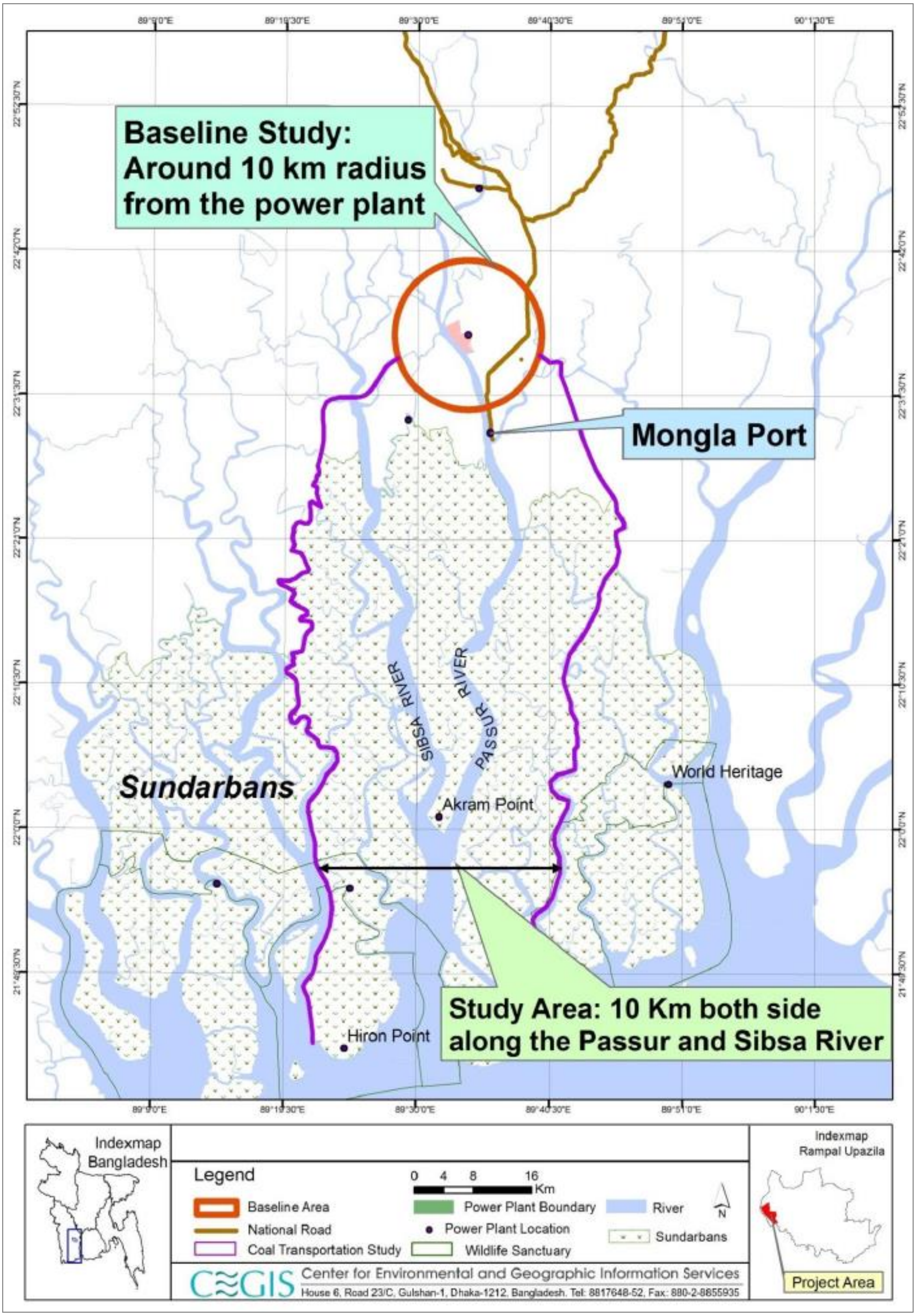


Figure 1.2: AOI of Environmental and Socio-economic Monitoring

1.4 Main Stakeholders

1.4.1 Forest Department

Monitoring of the Sundarbans Reserve Forest area need to be addressed as the conditions set out by the DoE. Hence, permission from the Forest Department is essential to carry out the said activities. The Forest Department has been providing the permission under certain conditions i.e. keeping close communication with the Forest Department, submission of the monitoring reports to the Forest Department along with the following activities:

- Inclusion of a Soil Scientist and a Botanist in the monitoring team,
- Monitoring of regeneration, in growths (seedlings), diseases and pests (if necessary, to carry out laboratory analysis),
- Monitoring of soil nutrients (macro, micro) and heavy metals,
- Monitoring of floral diversity, species richness and dominancy,
- Measurement of carbon content both above and below the ground level,
- Assessment of impact on canopy cover, leaves phenology, flowers behaviour, pneumatophore and crab hole conditions.

However, BIFPCL forwards each copy of the earlier quarterly monitoring reports to the Chief Conservator of Forest, Bangladesh Forest Department, Agargaon, Dhaka and Conservator of Forest, Khulna Circle, Boyra, Khulna. Similarly, the report of 33rd quarterly monitoring will also be forwarded to the same officials of the corresponding Departments.

1.4.2 Department of Environment (DoE)

The monitoring plans, indicators, parameters, location have been selected and arranged by incorporating the suggestion(s) and approval condition(s) from both the Power Plant EIA study and Coal Transportation EIA study. The BIFPCL forwards the monitoring reports and data to DoE on a regular basis (Monthly and Quarterly). The monitoring reports are also presented to the Environmental Clearance Committee of the DoE during renewal of the site clearance. In addition, one representative from the local DoE office is involved in each monitoring visit to accompany the monitoring team.

1.4.3 Bangladesh India Friendship Power Company (Pvt.) Limited (BIFPCL)

Bangladesh India Friendship Power Company (Pvt.) Limited (BIFPCL) is the Project Proponent of the proposed Power Project. The official(s) of BIFPCL has been assisting the study team from the beginning of the study. In addition, BIFPCL is thus far implementing the Environmental Management Plan (EMP) for ensuring environmental and social safeguarding of the Project surroundings including the Sundarbans Reserve Forest.

1.4.4 Local Community

The Project Affected Peoples (PAPs) has been included in each of the social environment-monitoring program. The changes in important socio-economic indicators were examined through Focus Group Discussions (FGDs), Key informant interview(s) and other informal discussions with the local people in different locations of the project influenced area.

1.4.5 Major Component of Monitoring Study

The Physical, Biological and Social aspects are monitored on regular basis and this quarterly monitoring report is furnished with the following subsequent chapters-

- Physical Environment covers monitoring of air quality, noise level, water quality, Soil and land resources, traffic management and the morphological study;
- Biological environment covers monitoring of fisheries resources, ecological resources and the Sundarbans Reserve Forest (SRF) health conditions;
- Socio-economic environment covers compensation, resettlement/rehabilitation, project related employment generation, labour and working condition, community health, security and safety, along with corporate social responsibilities.
- Environmental compliances monitoring includes Monitoring of Environmental and Social Management System Action Plan Implementation; Labour and working conditions; Community health, safety & security and Monitoring of biodiversity and sustainable management of living natural resources in and around the project area.

2. Physical Environment

2.1 Air Quality

Air is considered one of the major environmental components and in this connection, the parameters and monitoring locations of air quality were selected considering the major effects to be exerted by the power project activities during the pre-construction, construction, and operation stages as depicted in the EIA study. However, during the recent visit, all the preselected parameters and locations were monitored except the Hiron Point of Sundarbans (prevailing bad weather condition during the month of July) to observe major changes in air quality due to concurrent construction and supporting erection activities of the project.

2.1.1 Methodology

During the EIA study the criteria pollutants i.e. Particulate Matters (i.e., $PM_{2.5}$, PM_{10}, and SPM), SOx, NOx, CO and O_3 were expected to be generated from different phases i.e. pre-construction, construction, and operation activities of the Power Plant. However, the monitoring locations as well as the indicators for this study were also selected during the EIA study based on a number of criteria e.g., the sensitivity of the receptors, project activities like movement of coal-carrying vessels, coal trans-shipment point; wind speed, wind direction, atmospheric deposition (Wet and Dry) and atmospheric stability classes etc.

2.1.2 Method of Sampling and Laboratory Testing

In order to collect the air samples from the selected sites, Respirable Dust Sampler (Model-Envirotech India APM-460 BL) and Fine Particulate Sampler (Model-Envirotech India APM-550) were used. On the other hand, the $PM_{2.5}$, PM_{10}, and SPM were tested by gravimetric method and the concentration was analysed by West-Gaeke method. Likewise, the concentration of NO_2 was tested by Jacob and Hochheiser method. Moreover the concentration of Carbon Monoxide (CO) and Ozone (O_3) were measured by Metravi CO-10 meter and Tongdy O_3 Monitor respectively.

2.1.3 Pollution Sources in the Sundarbans

The key sources of air pollution around the Mongla Port area and project site can be considered as cement factories, LPG bottling plant, non-regulated mechanized boats, cargo vessels and ships plying to Mongla Port area and other commercial activities. The non-regulated ships, mechanized boats, cargo vessels plying through the Sundarbans Reserve Forest (SRF) in connection with the Mongla Port operation; fishing activities; honey, Golpata and timber collection; tourism etc. could be big contributing sources of air pollutants i.e., Particulate matters ($PM_{2.5}$, PM_{10} and SPM), Oxides of Sulphur (SOx), Oxides of Nitrogen (NOx) and Green House Gases (GHGs) in the study area as well as across the Passur channel. However, an inventory of the existing emission types and sources for the study area has been provided in **Table A2** of **Appendix IV**.

2.1.4 Monitoring Locations

Air quality is assessed monitored at the fixed locations for each of the monitoring quarters. As per the recommendations of DoE and experts' panel, two additional locations were included along with the existing monitoring locations. The air quality monitoring activities are shown in **Figure 2.1** and monitoring locations are shown in **Figure 2.2**. Details of the monitoring plan are attributed in **Table 2.1**.


Figure 2.1: Acquisition of Air Quality Monitoring data

Table 2.1: Air Quality Monitoring Plan

Sl. No.	Monitoring Indicators	Locations	GPS Points	Frequency	Methods/Tools/ Techniques
1	Particulate Matter ($PM_{2.5}$, PM_{10} and SPM) SO_X, NO_X, CO and O_3.	South West corner of the Project boundary	89°33'34.5"E; 22°34'33.8"N	Each Quarter of the year	Method of testing $PM_{2.5}$: Gravimetric
2		Proposed township area near Chimney location, Mauza: Sapmari Katakhali.	89°32'3.8"E; 22°36'32.5"N		Method of testing PM_{10}: USEPA (1997) Method 201 or 201A (as appropriate)
3		North West corner of the Project boundary (Kaigar Daskati)	89°33'51.8"E; 22°36'1.06"N		Method of testing SO_X: USEPA (2000) Method 6 or 6A or 6B or ISO (1998)
4		Barni, Gaurambha Union (4km North East from the chimney location)	89°34'37.7"E; 22°38'51.8"N		Method 11632 (as appropriate)
5		Chunkuri-2, Bajua Union (4km South West from the chimney location)	89°34'01.1"E; 22°32'3.3"N		Method of testing NOX: USEPA (2000) Method 7, 7A, 7B, 7C, 7D, or ISO (1993) Method 10396 (as appropriate).
6		Pankhali, Dacope, (4km North West from the Chimney location)	89°31'24.2"E; 22°36'6.7"N		
7		Mongla Port Area	89°35'50.4"E; 22°28'24.8"N		
8		Harbaria, Sundarbans	89°35'34.2"E 22°17'43.1"N		
9		Akram point, Sundarbans	89°30'54.1"E 22° '23.50"N		
10		Hiron Point, Sundarbans	89°27'53.2"E; 21°46'27.60"N		
11		Khulna city near Khan Jahan Ali Bridge	89°35'35.5"E; 22°46'36.8"N		
12		Project site-1 (Proposed Township area)	89º 33´ 13.7"E 22º35´43"N		
13		Access road bridge area	89°35'16.49" 22°34'37.11"N		

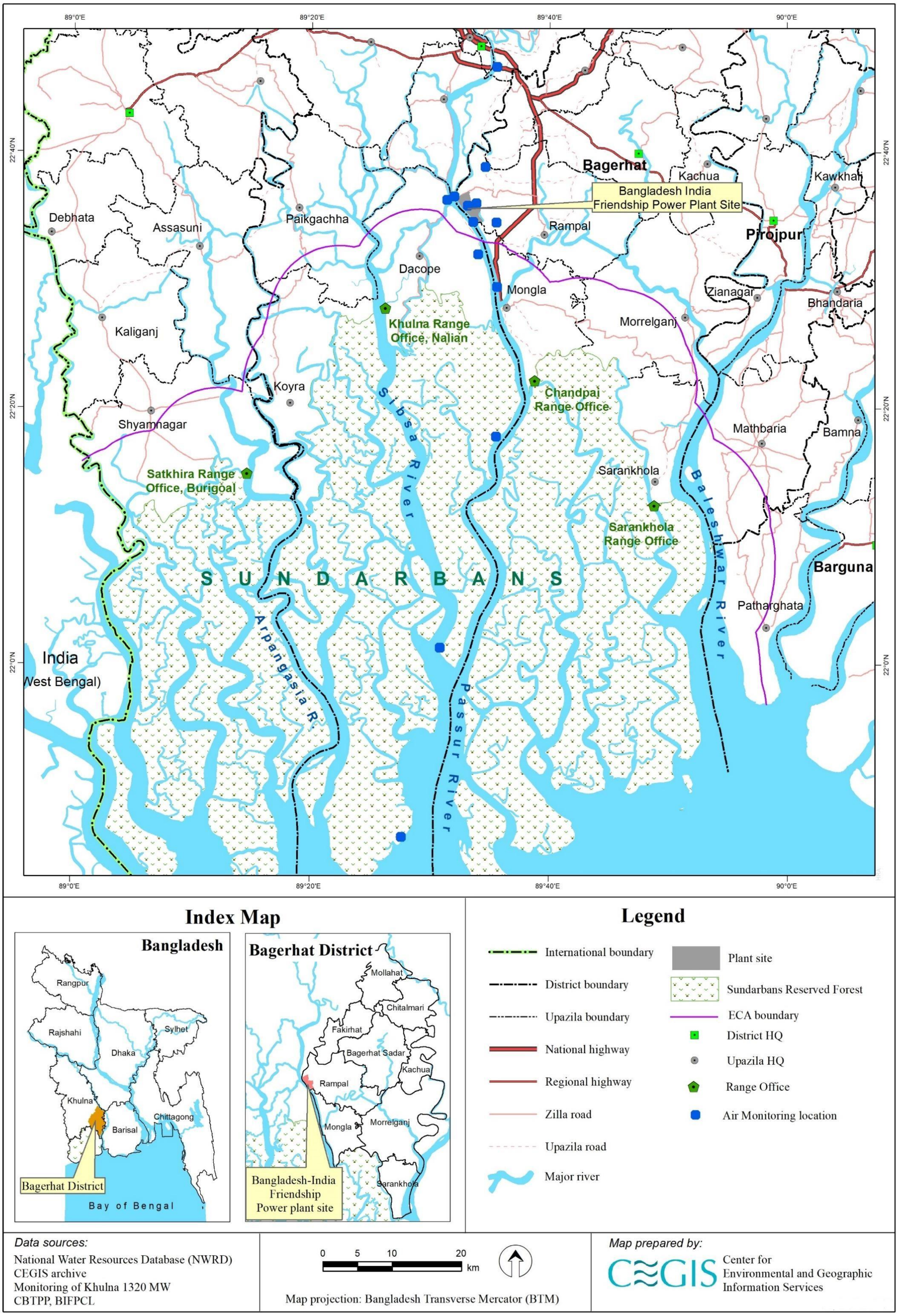


Figure 2.2: Air Quality Monitoring Locations

2.1.5 Status of Air Quality

During this monitoring tier, the maximum value (69.28μg/m^3) of $PM_{2.5}$ was found at Khan Jahan Ali toll plaza area whereas the minimum value (27.55 μg/m^3) was recorded at Gaurambha area. Likewise, PM_{10} concentration was found also highest (100.28 μg/m^3) at Khan Jahan Ali toll plaza area the and lowest (51.98 μg/m^3) at the Gaurambha area. Similarly, the concentration of SPM was also found highest (189.38 μg/m^3) at the Khan Jahan Ali toll plaza area.

The concentration of Sulphur dioxide (SO_2) in ambient air was found lower than the Bangladesh standard limit of (80μg/m^3) at all the sampling locations. However, among those, the maximum concentration (23.66 μg/m^3) was found at Khan Jahan Ali toll plaza area while the minimum concentration (10.57 μg/m^3) was recorded at Gaurambha area. Similarly, the values of NOx were also observed well below than the Bangladesh standard value of 80 μg/m^3. During this monitoring period maximum concentration (39.12 μg/m^3) of NOx was also found at Khan Jahan Ali toll plaza area whereas the lowest concentration (16.4 μg/m^3) was recorded at Gaurambha area. The contributor of such NOx emission may be from local human hauler, car, bus etc. Furthermore, during the monitoring period it was observed that the maximum values of CO (2.1 mg/m^3) and O_3 (66 μg/m^3) were found at Khan Jahan Ali toll plaza area though the results were found much lower than the standard value (5 mg/m^3 and 100 μg/m^3) set in Air pollution control Rules, 2022 respectively. From the measured values, it can be concluded that effect of seasonal variations on the surrounding environment may be the prominent reason for increasing or decreasing of the concentrations of the criteria pollutants for the corresponding air sheds.

Only $PM_{2.5}$ concentrations have been observed to be slightly exceeded at Khan Jahan Ali toll plaza area than the Standard as set in Air pollution control Rules, 2022. Similarly, concentration of all other the criteria pollutants were also seen higher at Khan Jahan Ali toll plaza area than the other locations during the monitoring period. Though the concentration were found to be within the standard limit but specially to minimize the particulate matter as well as the other criteria pollutant's concentration inside the power plant, the authority may take the necessary initiatives as suggested in the EMP of the EIA study e.g. continuous or periodic water spraying on the connected road networks inside the power plant area, install water sprinkler system at the prominent infrastructures like office areas, township area etc. and the major construction area, strictly maintain the vehicular speed at the sensitive areas and properly maintain the EMPs as stated in the EIA study of the power plant. The monitoring results of 32nd monitoring program has been shown in **Table 2.2** and all the monitoring results across the monitoring periods are attached in **Table A1** of **Appendix IV.** The baseline emissions scenarios are appended in **Table A2** of **Appendix IV**.

Seasonal variations among the air quality parameters

The values of all the criteria pollutants as averaged for the corresponding locations for the corresponding seasons were found to be higher in Khan Jahan Ali Bridge area than the project influence area followed by the Sundarbans reserve Forest (SRF) area. On the other hand, the concentration of the measured parameters was found to be higher in winter seasons of the monitoring periods except for SOx, & NOx which found to be higher in monsoon periods and CO concentration was found higher in post monsoon seasons. It can be mentioned here that the concentration was always observed to be much lower in SRF area than the other areas and never exceeded comparing to the standards set by DoE (ECR, 1997) (**Figure 2.3**).

Table 2.2: Air Quality Monitoring Results (33rd Quarterly Program)

Sl. No.	Location	Parameters (Concentration in µg/m3)						
		$PM_{2.5}$	PM_{10}	SPM	SO_2	NOx	CO	O_3
1	South-West corner of the project Boundary, Moidara	34.84	56.18	106.28	11.04	23.18	0.3	12
2	Propose Township area near Chimney location, Mouza-Sapmari Katakhali	41.2	64.29	118.62	12.58	18.4	1	16
3	North west corner of the project boundary (Koigardas Kathir Char)	39.36	58.03	108.2	13.29	20.63	0.4	11
4	Barni, Gaurambha Union 4 KM North-West from the Chimney location	27.55	51.98	93.44	10.57	16.4	0.8	14
5	Bauja Union 4km south west from the chimney location	38.48	53.19	103.72	11.08	21.94	0.2	29
6	Chalna Bazar Area, Dacope	43.8	62.53	120.3	14.55	22.3	0.1	29
7	Mongla Port area	49.15	74.7	141.48	14.9	20.82	0.4	31
8	Harbaria, Sundarban	30.22	60.21	103.5	12.59	19.69	0.9	24
9	Akram Point (Sibsa River)	42.85	69.02	127.39	12.71	23.16	0.4	37
10	Hiron Point, Sundarban	NM	NM	NM	NM	NM	NM	NM
11	Khulna Khan Jahan Ali Bridge near toll plaza area	69.28	100.28	189.38	23.66	39.32	2.1	66
12	Township area	51.29	69.28	134.27	14.56	20.23	1.3	38
	Taltola Bazar/BIFPCL (Project)	28.43	53.42	89.45	11.39	20.47	02	23
Standard (Air Pollution Control Rules, 2022)		**65**	**150**	**200 (ECR'97)**	**80**	**80**	**5000**	**100**

Source: CEGIS field survey, May, 2022; STD-Standard.*

Figure 2.3: Seasonal Variation of the Air Quality Parameters

Cluster analysis was performed to identify the grouping pattern of the criteria pollutants along with their corresponding locations. Euclidean distances were observed to measure the distances among the objects using as variables (annual average concentrations of the seven studied variables for every station). According to the dendogram (**Figure 2.4.**) Hiron point (L10), Akram Point (L9) and Harbaria (L8) represents the locations of minimum pollution level situated inside the Sundarbans Forest area and are away from the nuclei of Mongla industrial zone and the project site. On the other hand, Chalna (L6), Mongla Ghat (L7) and Khan Jahan Ali Bridge in Khulna (L11) are subjected to higher in population density and increased industrial activities among all sites whereas Maidara (L1), Shapmari (L2), Koigardashkatir char (3), Gaurambha (L4) and Bajua (L5) represent lower or moderate commercial activities **(Figure 2.4).**

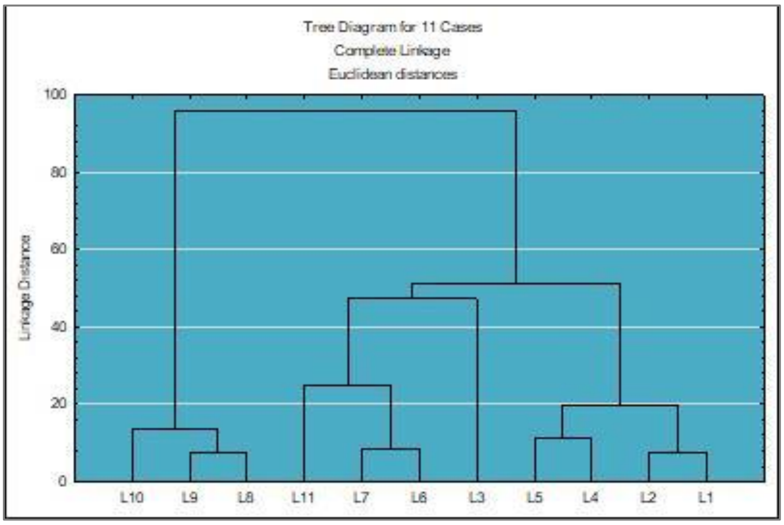


Figure 2.4: Dendogram of the Monitoring Stations using Euclidean Distance

2.1.6 Findings

During the monitoring period, it was observed that the concentration of criteria pollutants was found to be much higher at Mongla ghat area than the other locations whereas lowest concentration was observed at the Gaurambha area. On the other hand, according to the observed data it can be concluded that the concentration of major air pollutants was found comparatively lower in the Sundarbans area than that of the other monitoring locations. But due to the seasonal effect the concentration of the particulate matters ($PM_{2.5}$, PM_{10} and SPM) was found to be slightly higher at Khan Jahan Ali Bridge area comparing to the standards set by DOE (Air pollution control rules, 2022). On the contrary, the concentration of SO_2, & NOx which found to be higher in monsoon periods and CO concentration was found higher in post monsoon seasons. Nevertheless, the concentration as averaged for the corresponding locations were found to be lower than the standards (air pollution control Rules, 2022). However, major sources of criteria pollutants generation in and around the project site as observed were the piling activities, digging, tunneling and burrowing works, jetty erection activities, major construction works, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads and river Passur etc. Other sources of pollutants which may contribute to the existing pollution load are the small industries like cement works and refinery industries etc., diffuse sources like wood stoves, fires and wind generated dust etc.

2.2 Noise Quality

Noise is described by a weighted sound intensity (or level), which represents sound heard by the human ear and is measured in units called decibels (dBA). However, engine boats, trawlers, small barges, ships plying over the waterways, birds' chirping, stormy wind, falling of leaves from the trees and the wave breaking sound were the main source of noise generation in and around the Sundarbans. On the other hand, construction activities, the urban and rural vehicles i.e. buses, trucks, local human haulers, auto-rickshaws, motorized vans, motorbikes etc. were much noticeable in the outside of Sundarbans area.

2.2.1 Methodology

Noise levels were measured thrice in a day (morning, afternoon and evening) at seven locations and twice (morning & noon and noon & evening) at four locations around the project and study area. Each time, noise levels were recorded using sound level meter for five minutes of time span with an interval period of 30 second and the noise meter was properly set up and calibrated following the instruction manual. On the other hand, the monitoring locations were selected considering the sensitivity of the nearest receptors and accordingly, 6 (six) sites were selected in and around the Project area, 3 (three) sites were designated inside the Sundarbans Reserve Forest Area, 1 (one) at Mongla port area and the remaining one was selected at the Khan Jahan Ali Bridge toll plaza area near Khulna City (**Figure 2.5**).

Figure 2.5: Ambient Noise Acquisition

2.2.2 Sources of Noise in the study area

Among the sources of noise generation engine boats, trawlers, small barges, ships plying over the waterways, birds' chirping, stormy wind, falling of leaves from the trees and the wave breaking sound were the main source of noise generation in and around the Sundarbans. On the other hand, construction activities, the urban and rural vehicles i.e. buses, trucks, local human haulers, auto-rickshaws, motorized vans, motorbikes etc. were much noticeable around the project area.

2.2.3 Status of Noise

In order to provide an overview of the observed noise data set, the average values for the respective locations have been appended in Table 2.4 for ready reference; but the detailed noise level data have been attached in **Table C1, C2, C3, C4, C5, C6, C7** and **C8** respectively in the **Appendix IV**.

However, the Department of Environment of the People's Republic of Bangladesh, an agency under the Ministry of Environment and Forests has set up the standard of permissible limits of noise level at day time for different classified areas. According to Bangladesh Noise Pollution Control Rules (2006), the eleven monitored locations fall under different classified area like residential, commercial, mixed, silent and industrial class.

Observed noise level at Chalna, a commercial area located at a distance of 4 km to the north-west direction of the proposed chimney location was recorded as 52.88 dB whereas it's standard level is 70 dB (**Table: 2.4**). Levels of noise at Kaigar Daskati (45.60 dB) situated at the Gucchha Gram, a residential area located at north-west corner of the project area; Chunkuri-2 (47.12 dB) located at 4km south-west direction from the chimney location; Maidara Khal (49.38 dB), south-west corner of the project area and a residential area and; Shapmari (44.58 dB), proposed township area didn't cross their corresponding standard limits (55 dB) of noise level (**Table: 2.4**). The level of noise at Barni (Gaurambha) was found to be 47.46 dB which was 12.54 dB lower than that of standard limit (60 dB) of noise level for this location (**Table: 2.4**). Harbaria (40.77 dB) and Akram Point (41.49 dB), the two ecologically silent zones were also not found to exceed the Bangladesh standard limit (50 dB) of their corresponding standard values (**Table: 2.4**).

On the other hand, observed noise levels at Khan Jahan Ali Bridge (55.75 dB), a commercial zone, and Mongla Port (55.08 dB), an industrial zone, were also not found to exceed the Bangladesh standard limit of noise at their corresponding values (**Table: 2.4**). The standard noise limits for Khan Jahan Ali Bridge and Mongla Port during the day are 70 dB and 75 dB, respectively.

2.2.4 Locations of Noise Level Monitoring

Out of (11) locations, three (03) locations were inside the Sundarbans, six (06) locations were in and around the Project site, one at Khan Jahan Ali Bridge and the remaining one was at Mongla Ghat area (**Figure 2.6** and **Table 2.3**).

Table 2.3: Noise Monitoring Plan

SL. No.	Monitoring locations	GPS points	Time of noise monitoring
1	South West corner of the Project boundary	89°33'34.5"E; 22°34'33.8"N	Morning, Noon and evening
2	Proposed township area near Chimney location, Mauza: Sapmari Katakhali	89°32'3.8"E; 22°36'32.5"N	Morning, Noon and evening
3	North West corner of the Project boundary (Kaigar Daskati)	89°33'51.8"E; 22°36'1.06"N	Morning, Noon and evening
4	Barni, Gaurambha union (4km North East from the chimney location)	89°34'37.7"E; 22°38'51.8"N	Morning, Noon and evening
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	89°34'01.1"E; 22°32'3.3"N	Morning, Noon and evening
6	Pankhali, Dacope, (4km North West from the Chimney location)	89°31'24.2"E; 22°36'6.7"N	Morning, Noon and evening
7	Mongla Port Area	89°35'50.4"E; 22°28'24.8"N	Morning, Noon and evening
8	Harbaria, Sundarbans	89°35'34.2"E; 22°17'43.1"N	Morning and Noon
9	Akram point, Sundarbans	89°30'54.1"E; 22°"23.50"N	Morning and Noon
10	Hiron Point, Sundarbans	89°27'53.2"E21°46'27.60"N	Not monitored
11	Khulna city near Khan Jahan Ali Bridge	89°35'35.5"E; 22°46'36.8"N	Morning, Noon and evening

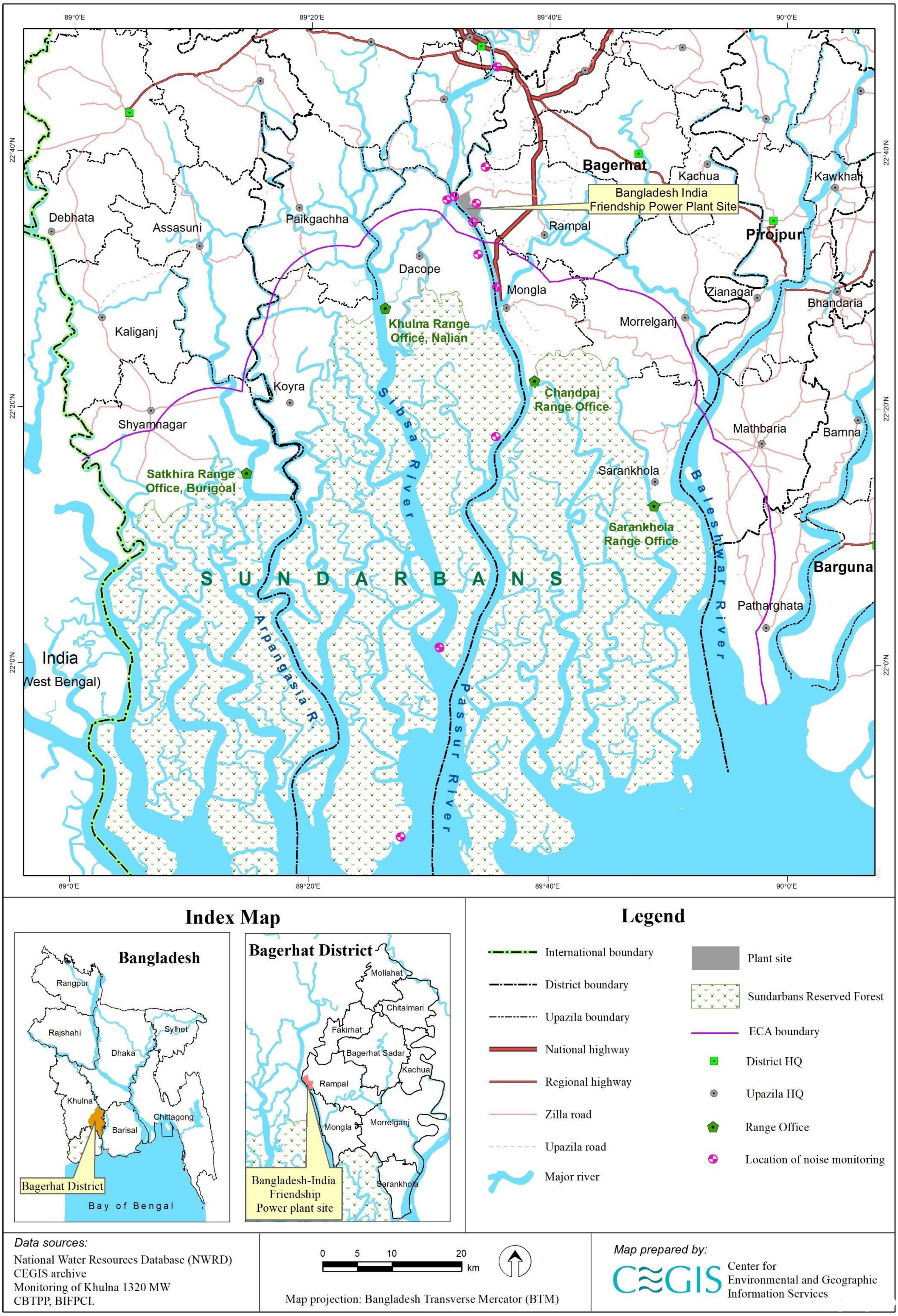


Figure 2.6: Noise Level Monitoring Locations

Table 2.4: Summary of the Ambient Noise Levels Recorded in Consecutive Monitoring Periods

Sl.	Location	QM-33 (Jul-22)	QM-32 (May-22)	QM-31 (Feb-22)	QM-30 (Nov-21)	QM-29 (Aug-21)	QM-28 (Apr-21)	QM-27 (Jan-21)	QM-26 (Nov-20)	QM-25 (Jul-20)	QM-24 (Apr-20)	QM-23 (Feb-20)	QM-22 (Nov-19)	QM-21 (Jul-19)	QM-20 (Apr-19)	QM-19 (Feb-19)	QM-18 (Nov-18)	QM-17 (Jul-18)	Std* (dB)
1	*Chalna, Dacope*	52.88	59.08	59.71	58.21	51.21	61.44	60.50	58.15	51.28	NM	54.59	58.60	59.34	61.67	56.45	58.23	57.54	70
2	*NW Corner of the Project area (Kaigar daskati)*	45.60	48.60	48.82	48.81	50.11	49.50	51.42	48.48	43.37	NM	45.42	51.11	55.18	56.85	50.75	58.82	45.63	55
3	*Chunkuri-2, Bajua*	47.12	48.91	49.02	46.58	50.36	51.31	47.05	45.91	48.75	NM	55.44	55.27	59.36	51.68	50.18	48.69	47.54	55
4	*SW corner of the project area (Moidara)*	49.38	50.53	54.65	48.36	51.90	55.24	52.36	49.18	50.18	NM	55.60	46.57	63.66	56.05	*55.79*	61.78	52.63	55
5	*Proposed Township area (Shapmari)*	44.58	49.76	50.03	44.78	53.84	52.05	49.09	44.45	53.72	NM	48.95	54.88	54.53	58.83	*58.13*	50.68	44.25	55
6	*Barni, Gaurambha*	47.46	47.23	48.89	55.58	51.00	52.34	53.09	58.33	48.80	NM	61.97	50.53	54.67	53.18	52.57	53.03	45.52	60
7	*Khan Jahan Ali Bridge, Khulna*	55.75	58.60	62.33	79.64	52.38	54.65	61.94	81.81	66.31	NM	62.20	66.05	63.46	66.95	66.93	62.15	63.36	70
8	*Mongla Port area*	55.08	57.38	55.95	75.37	55.49	53.63	56.52	76.92	64.41	NM	61.06	57.25	62.01	63.99	66.18	55.97	60.97	75
9	*Harbaria, Sundarbans*	40.77	49.37	47.31	55.43	NM	48.04	44.40	54.54	49.97	NM	43.94	44.10	44.90	48.43	49.67	48.80	50.28	50
10	*Akram Point, Sundarbans*	41.49	43.08	37.41	43.78	44.62	43.42	37.85	42.23	51.04	NM	36.59	44.86	44.84	42.33	46.45	41.00	45.20	50
11	*Hiron Point, Sundarbans*	NM	NM	36.29	50.79	50.94	NM	38.85	50.70	NM	NM	40.34	40.28	NM	NM	39.21	39.4	NM	50

		Monitoring periods (Cont.)															
Sl.	Location	QM-16 (Apr-18)	QM-15 (Jan-18)	QM-14 (Oct-17)	QM-13 (Apr-17)	QM-12 (Jan-17)	QM 11 (Oct-16)	QM 10 (Jul-16)	QM 9 (Apr-16)	QM 8 (Jan-16)	QM 7 (Oct-15)	QM 6 (Jul-15)	QM 5 (Apr-15)	QM 4 (Jan-15)	QM 3 (Oct-14)	QM 2 (Jul-14)	QM 1 (Apr-14)	Std* (dB)
1	*Chalna, Dacope*	59.63	60.1	58.64	61.62	59.29	65.51	52.42	65.08	66.07	65.12	49.77	57.08	53.28	54.63	52.87	68.13	70
2	*NW Corner of the Project area (Kaigar Daskati)*	47.90	49.3	46.95	47.19	44.52	55.48	52.65	50.79	50.96	41.94	41.56	44.67	35.25	41.92	NM	51.89	55
3	*Chunkuri-2, Bajua*	52.93	51.4	50.44	50.44	55.31	51.55	53.4	44.49	53.62	47.43	40.66	47.05	49.29	51.39	52.55	57.76	55
4	*SW corner of the project area (Moidara)*	47.55	44.5	43.26	43.25	45.19	48.51	65.37	54.50	60.44	42.7	43.75	43.58	36.03	45.95	47.6	49.2	55

Monitoring periods (Cont.)																		
Sl.	**Location**	**QM-16 (Apr-18)**	**QM-15 (Jan-18)**	**QM-14 (Oct-17)**	**QM-13 (Apr-17)**	**QM-12 (Jan-17)**	**QM 11 (Oct-16)**	**QM 10 (Jul-16)**	**QM 9 (Apr-16)**	**QM 8 (Jan-16)**	**QM 7 (Oct-15)**	**QM 6 (Jul-15)**	**QM 5 (Apr-15)**	**QM 4 (Jan-15)**	**QM 3 (Oct-14)**	**QM 2 (Jul-14)**	**QM 1 (Apr-14)**	**Std* (dB)**
5	*Proposed Township area (Shapmari)*	50.81	53.3	43.93	42.65	42.62	43.69	55.79	53.37	53.77	50.52	46.75	41.47	41.47	41.92	46.68	48.75	55
6	*Barni, Gaurambha*	56.14	55.6	45.52	44.83	49.05	54.91	56.75	53.97	59.16	55.16	46.18	54.17	43.6	49.78	49.95	58.84	60
7	*Khan Jahan Ali Bridge, Khulna*	64.87	61.7	62.47	56.72	55.57	60.95	63.77	65.85	68.45	64.25	52.82	73.45	61.72	66.28	60.8	71.7	70
8	*Mongla Port area*	62.95	59.8	49.66	47.61	48.95	49.86	52.86	49.88	52.7	47.01	39.61	48.15	38.69	60.5	53.84	61.24	75
9	*Harbaria, Sundarbans*	47.93	44.4	46.48	54.10	41.18	55.33	52.9	44.55	45.2	50.75	35.03	65.37	34.38	55.3	56.13	40.88	50
10	*Akram Point, Sundarbans*	45.39	40.1	42.38	44.30	38.08	41.77	47.96	42.95	42.95	49.6	NM	54.86	34.32	43.98	47.9	40.94	50
11	*Hiron Point, Sundarbans*	NM	38.8	39.79	NM	42.29	44.38	NM	43.11	NM	46.06	NM	47.84	37.37	47.98	51.29	38.63	50

*Note: All values are in decibels (dBA), QM- Quarter Monitoring, NM – Not Monitored, *Std- Standard as defined in National Noise Control Rules 2006; Note: All values are in decibels (dBA), QM- Quarter Monitoring, NM – Not Monitored, *Std- Standard as defined in National Noise Control Rules, 2006*

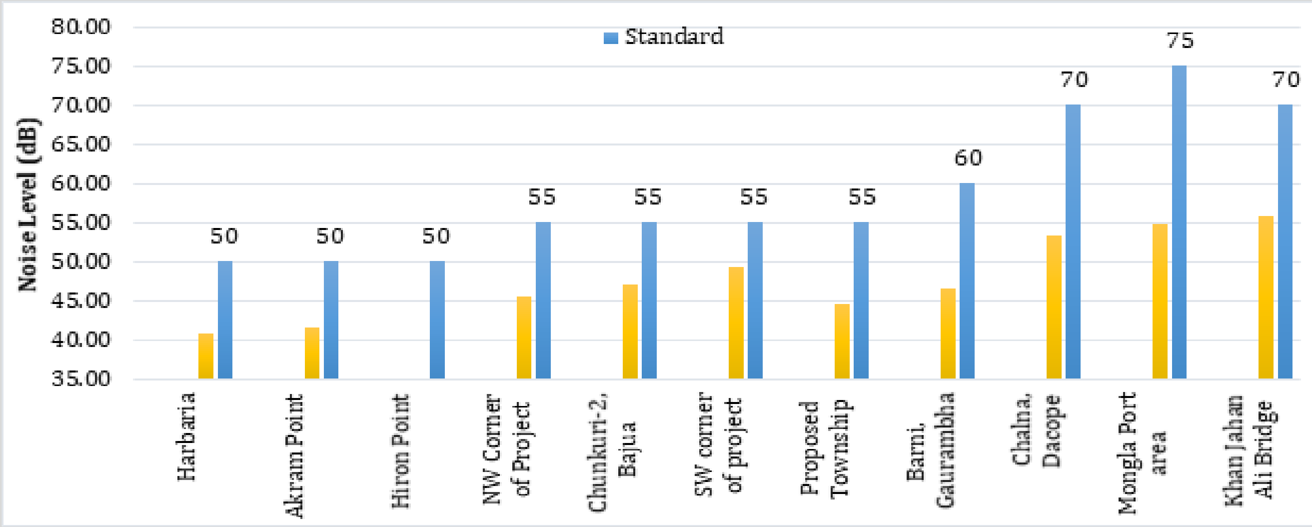


Figure 2.7: Status of Noise Level of 33rd monitoring season at different locatons

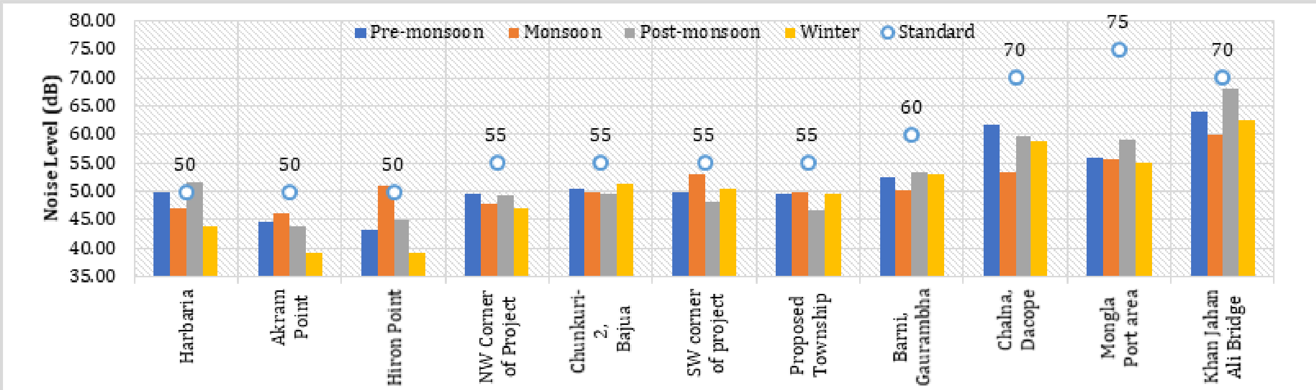


Figure 2.8: Status of average seasonal variations of noise level at different monitoring locations

2.2.5 Findings

The noise generation sources in the study area can mainly be divided into two types; one is natural and the other one is anthropogenic. Natural sources of noise generation were birds' chirping, stormy wind, wave breaking on the shoreline, howling of leaves and so on. On the other hand, traffic mobilization, industrial activities, vessels movement within the rivers and local vehicles were the anthropogenic sources of noise. However, the observed noise level was not found to exceed the Bangladesh standard limit of noise level.

2.3 Water Quality

An updated water quality status of the Passur-Sibsa River system and adjacent water bodies have been depicted in this section. Both the national and international guidelines were followed and adopted for sample collection as well as for analysis. This report includes physical water quality parameters collected during 33rd quarterly monitoring tier (July, 2022) and the tested results obtained from the laboratory up to May, 2022 (32nd quarterly monitoring). A number of identical parameters as well for the selected locations to understand the effect of power plant activities on the surface and groundwater quality which may affect the aquatic life of the adjacent river, the Sundarbans Forest ecosystem and community health in and around the power plant area. Due to the rough weather condition the team could not reach to Hiron point of Sundarbans and hence the water quality of Hiron Point was not assessed for the said monitoring tier.

2.3.1 Methodology

The procedure for water quality monitoring covers selection of water quality parameters, identification of sampling locations, determination of sampling frequency and evaluation criteria of the monitoring parameters etc. Standard approaches and methodologies were followed for the above-mentioned events. Both the surface and groundwater quality status of the water bodies in and around the Power Plant and the Sundarbans area were examined. The monitoring results are presented and compared with the national standards (ECR, 1997 and all available amendments). The samples were collected from eighteen (17) pre-selected locations (14 locations for surface water along the Passur River from Chalna to Sibsa River near Akram Point, Maidhara River near the project area and 3 locations for groundwater i.e. project area, Kapashdanga and Rajnagar). However, the standard sampling procedure was followed for both surface and groundwater sampling to reduce the possibility of any error. Each sample was labelled at the time of sampling. The selected monitoring locations for the monitoring program are shown in **Figure 2.9**. The details of the monitoring plan covering sampling locations, geographical locations, frequency and analysis techniques of sampling for surface and groundwater are given in **Table 2.5** and **Table 2.6** respectively.

Table 2.5: Groundwater Quality Monitoring Parameters, Locations and Plan

Sl. No.	Locations	GPS (Decimal Degree)		Frequency	Methods/Monitoring indicators/ Techniques
		Easting	Northing		
1	Near Proposed Township Area	89.566139˚E	22.594167˚N	Quarterly	In-situ testing of physical water quality parameters was done by Horiba U-50 multi-meter. Preservation of samples and Laboratory analysis were carried out at DPHE Central Laboratory and BCSIR
2	Rajnagar	89.576056˚E	22.612528˚N		
3	Kapasdanga	89.563000˚E	22.622528˚N		

Table 2.6: Surface Water Quality Monitoring Parameters, Locations and Plan

Sl No	Monitoring Indicators	Locations	GPS (Decimal Degree)		Frequency	Methods/Tools/ Techniques
			Easting	Northing		
1	pH, Temperature, Salinity, DO, BOD_5, TDS, TH, TSS, COD, Nitrate, Sulphate, Phosphate, Arsenic, Lead, Mercury, Oil & Grease, PAH, TOC, TC	Left Bank of Passur River at 100m u/s of North West corner of the Project boundary	22.604167°N	89.527222°E	Quarterly	In-situ testing of physical water quality parameters was done by Horiba U-50 multi-meter. Preservation of samples and Laboratory analysis were carried out at DPHE Central Laboratory and BCSIR
2		Middle of Passur River at 100m u/s of North West corner of the Project boundary	22.607222°N	89.528889°E		
3		Right Bank of Passur River at 100m u/s of North West corner of the Project boundary	22.609361°N	89.531417°E		
4		Left Bank of Passur River at Project Site-Jetty	22.584833°N	89.543583°E		
5		Middle of Passur River at Project Site-Jetty	22.587667°N	89.546472°E		
6		Right Bank of Passur River at Project Site-Jetty	22.589333°N	89.548222°E		
7		Left Bank of Passur River at South West corner of the Project boundary	22.572889°N	89.552583°E		
8		Middle of Passur River at South West corner of the Project boundary	22.574611°N	89.557500°E		
9		Right Bank of Passur River at South West corner of the Project boundary	22.575667°N	89.559861°E		
10		Maidara river at the South East corner of the project boundary at Ichamoti-Maidara confluence	22.600639°N	89.565611°E		
11		Maidara river near proposed Township area	22.577472°N	89.569250°E		
12		Passur river at Passur – Ghasiakhali confluence	22.473861°N	89.602361°E		
13		Passur river at Harbaria of the Sundarbans Reserve Forest area	22.295250°N	89.593139°E		
14		Passur river at Akram Point of the Sundarbans Reserve Forest Area	22.024120° N	89.514220°E		
15		Passur river at Hiron point of the Sundarbans Reserve Forest Area	21.774183°N	89.464778°E		

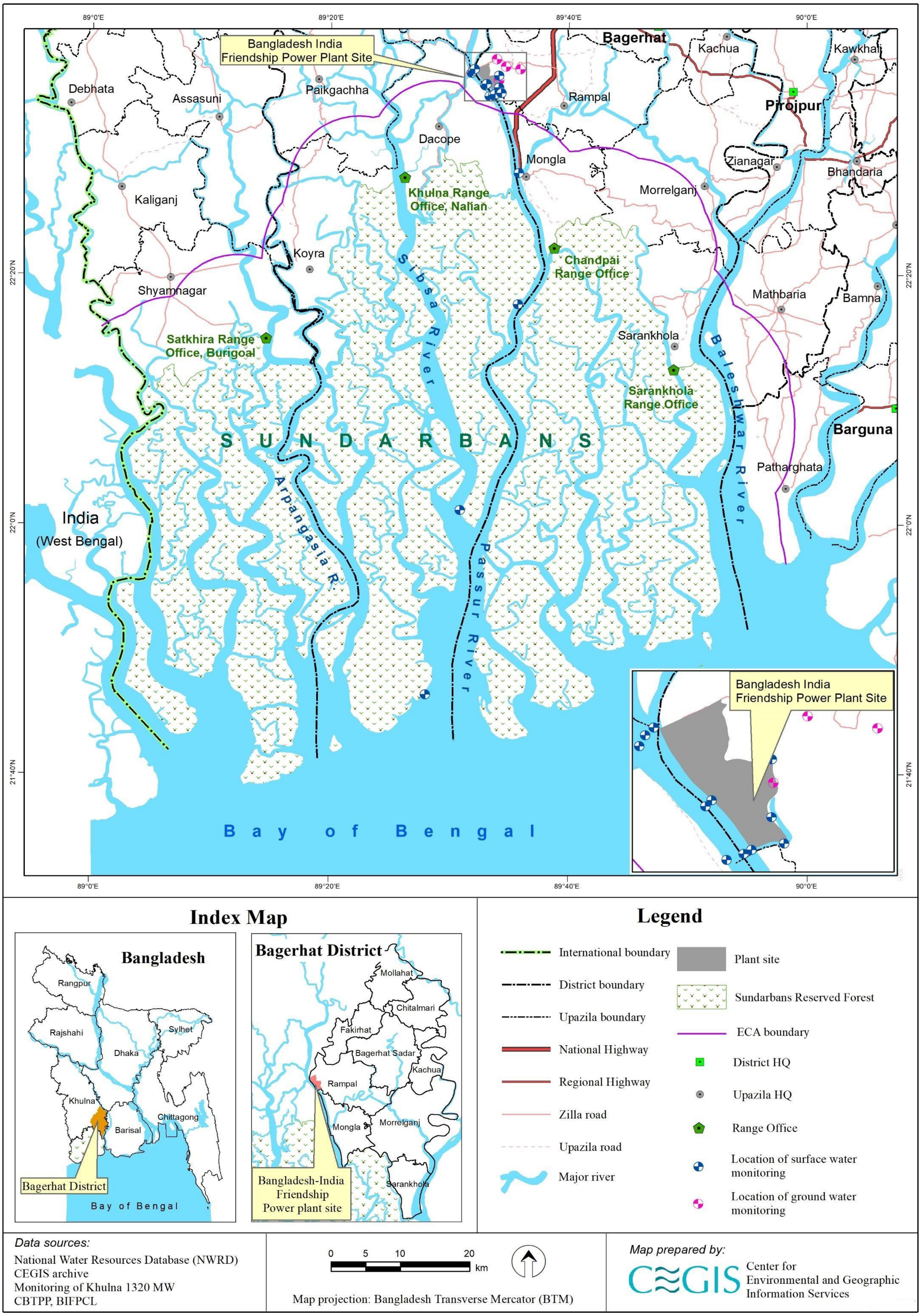


Figure 2.9: Surface Water and Groundwater Quality Monitoring Location

2.3.2 Selection of Parameters

The selected parameters for Ground water quality monitoring include pH, Temperature, Dissolved Oxygen (DO), Total Dissolve Solids (TDS), Total Hardness (TH), Chemical Oxygen Demand (COD), Salinity, Nitrate (NO_3^-), Phosphate (PO_4^{3-}), Sulphate (SO_4^{2-}), and Heavy Metals (As, Pb, Hg) etc.

Water Quality Parameters

The selected parameters for surface water and groundwater quality include Temperature, pH, Dissolved Oxygen (DO), Total Dissolve Solids (TDS), Total Suspended Solids (TSS), Total Hardness (TH), Turbidity, Chemical Oxygen Demand (COD), Salinity, Nitrate (NO_3^-), Phosphate (PO_4^{3-}), Sulphate (SO_4^{2-}), Heavy Metals (As, Pb, Hg), and Oil and Grease (for surface water). The parameters were categorized into 4 groups:

- Physical and aggregate properties i.e. pH, Temperature, Salinity, Hardness, TDS, TSS, Turbidity, Oil & Grease (for surface water);
- Inorganic non-metallic constituents i.e., DO, NO_3^-, PO_4^{3-} and SO_4^{2-};
- Aggregate organic constituents i.e. COD and
- Heavy metals i.e. As, Pb and Hg;

However, some additional parameters i.e., PAH (Polycyclic Aromatic Hydrocarbons), TOC (Total Organic Carbon) and TC (Total Carbon) were included in connection with the surface water quality monitoring study (3 locations as per recommendation of the DoE approved coal transportation study monitoring framework as well as approval condition no. 26 and accordingly the analysed data of the additional parameters are recorded and submitted to the DoE and other concerned authorities periodically.

2.3.3 Surface Water Sampling Procedure

The study area is highly influenced by tidal variation. Hence, temporal and spatial variations of tides were considered in sampling procedure. Surface water samples were collected at a distance of 50-100m away from the river bank and at a depth of 6cm below the water surface during low tides or relative slag period after the low tide for all parameters except oil and grease. The non-acidified sampling bottles were rinsed with respective water samples before sampling. Acidified sampling bottles were used for heavy metal (As, Pb, Hg) sample collection. The in-situ testing of the selected water quality parameters is shown in **Figure 2.10** and **Figure 2.11**.

On the other hand, the groundwater samples were collected from hand operated tube wells after 5-7 minutes of water extraction. Each sampling bottle was rinsed with respective water samples before sample collection and storing. Acidified sampling bottles were used for heavy metals (As, Pb, Hg) sample collection and were preserved following standard procedure.


Figure 2.10: Collection and Insitu testing of Groundwater


Figure 2.11: Water sample collection and Insitu Testing of Water Parameters

2.3.4 Water Quality Parameter Analysis Techniques/Methods

Water quality parameters were analysed as per the procedure of American Public Health Association (APHA) standard. The analysis procedures of different parameters along with the standards are given in **Table 2.7**.

Table 2.7: Testing Methodology of Water Quality Parameter

Parameters	Methods/Measuring Tools	Unit	BD Standard (ECR 1997)
Temperature	Horiba U-50 multimeter	^0C	20 - 30
pH	Horiba U-50 multimeter	-	6.5-8.5
TDS	Horiba U-50 multimeter	ppm or mg/L	2100 (SW), 1000 (GW)
TSS	Horiba U-50 multimeter	ppm or mg/L	150 (SW), 10 (GW)
Salinity	Horiba U-50 multimeter	ppt	-
DO	Horiba U-50 multimeter	ppm or mg/L	6
BOD_5	5-Day BOD Test at 20^0C	ppm or mg/L	50 (SW)
COD	Closed Reflux Method	ppm or mg/L	200 (SW), 4.0 (GW)
Total Hardness(as $CaCO_3$)	Titrimetric	ppm or mg/L	200-500
Ortho-Phosphate (PO_4^{3-})	UV-VIS Spectrophotometers	ppm or mg/L	6

Parameters	Methods/Measuring Tools	Unit	BD Standard (ECR 1997)
Nitrate (NO_3^-)	UV-VIS Spectrophotometers	ppm or mg/L	10
Sulphate (SO_4^{2-})	UV-VIS Spectrophotometers	ppm or mg/L	400
Oil and Grease	Liquid-liquid extraction with hexane, treatment with silica gel and gravimetric determination	ppm or mg/L	10 (SW)
Arsenic (As)	Atomic Absorption Spectrophotometers–Hydride Vapor Generating (AAS-HVG)	ppm or mg/L	0.05
Lead (Pb)	Atomic Absorption Spectrophotometers–Graphite Furnace (AAS-GF)	ppm or mg/L	0.05
Mercury (Hg)	Mercury Analyzer	ppm or mg/L	0.001
PAH	APHA 5310.B	mg/L	N/A
TOC and TC	APHA 5310.B	mg/L	N/A

2.3.5 Water Quality Reporting Arrangement

Water quality status of the adjacent water bodies of power plants and the Sundarbans Reserve Forest (SRF) are being observed since April, 2014. The 33rd quarterly report covers yearly variations of winter (May, 2022) for chemical water quality status and yearly variations for Pre-monsoon in physical water quality status (July, 2022) and are presented and compared with the ECR' 1997 Standards. To do so, all sampling points are clustered in five different sampling sites considering homogenous characteristics of the sampling points as well as the type of ecosystem touching the sample points. The clustered sample monitoring sites and the logical explanation of the clusters are presented in the following **Table 2.8.**

Table 2.8: Monitoring Sites and Characteristics

SL	Monitoring sites	Site Characteristics
(a)	**Power plant & adjacent areas**	Total 11 sampling points were selected and the values were averaged to represent the water quality status of power plant adjacent surface water bodies. These 11 sampling points are situated in the same river system or network and embedded within 1km radius of power plant area. Therefore, this study makes the clusters to represent the water quality status of the areas in a more explainable and understandable way.
(b)	**Mongla-Passur confluence**	This monitoring site is situated at least 13km downstream of the power plant. This point is a confluence area of Passur river and Mongla-Ghasiakhali channel. Around this point, the terrestrial ecosystem is mostly dominated by agricultural lands followed by rural settlements.
(c)	**Harbaria**	Harbaria site is situated around 15 km downstream of the Mongla/Ghasiakhali and Passur confluence. This site is dominated by Sundarbans Forest and heavily influenced by the activities of mother vessels unloading and small cargo movement for carrying of clinker, coal and LPG gas. It is to be noted here that the tidal effects of Bay of Bengal is very prominent here.
(d)	**Akram point**	Akram point is located around 35 km downstream of the Harbaria point. This site is situated at the confluence point of Passur and Sibsa river. This site is completely dominated by deep forests ecosystems. Influenced by tidal effects of Bay of Bengal.

SL	Monitoring sites	Site Characteristics
(e)	**Hiron Point**	Hiron point is the furthest point of this surface water-monitoring scheme. This point is at 25 km downstream of the Akram point. Deep forests and marine habitats are the main characteristics of the site. This site is completely exposed to the Bay of Bengal.

Status of Surface Water Quality

<u>*In-situ tested parameters*</u>

The in-situ tested results obtained up to 33rd monitoring period (July, 2022: monsoon season) are described below:

pH

During the visit, pH values in the monitoring sites were ranged between 8.5 and 7.58. The pH values of surface water monitoring data were found within the standard limit of ECR, 1997 Standard (6.5-8.5). The highest value (8.5) was found at Maidara River of the South East corner of the Project at Ichamoti-Maidara confluence and lowest (7.58) was observed at Left Bank of Passur River at Project Site-Jetty area. However, the values indicated slightly basic in nature during this pre-monsoon.

However, the pH values of monsoon and post-monsoon seasons were found to be comparatively lower than those of the pre-monsoon and winter seasons (**Table B.1: Appendix-IV**) which might be due to the decreased river water level during pre-monsoon and winter season triggered by inadequate rainfall and insufficient inflow from U/S (upstream) of Passur-Sibsa RS (River System) which has also been reported by others (*Rahman et al., 2013*). Fluctuations in pH values during different season of the year can be attributed to factors like removal of CO_2 by photosynthesis through bicarbonate degradation, dilution of waste with freshwater, reduction in salinity and temperature, and decomposition of organic matter (*Rajasegar, 2003*). Seasonal variations in pH concentrations among the selected monitoring sites during the quarterly monitoring programs of the previous years of Passur-Sibsa RS are presented in **Figure 2.12** and the observed dataset are attached in **Table B.1** of **Appendix- IV**.

Temperature

During the monitoring period the temperature varied from 32.51^{0}C -30.81^{0}C among the monitored sites. The maximum water temperature (32.51^{0}C) was recorded at Passur River at Akram point of Sundarbans. According to the ECR' 1997, 30^{0}C water temperature is still be tolerable by the aquatic organisms in tropical environment. However, the surface water temperature largely depends on daily weather condition (*Bartram. J. et. al., 1996*). According to the seasonal weather pattern of Bangladesh the temperature drops to a minimum level during winter and reach to the maximum level which is also applicable for the water temperature. Recorded temperatures indicated that there was spatial variation among the monitoring sites even in the same seasons. Seasonal variations in surface water temperature in the selected sites during the quarterly monitoring of previous years are presented in **Figure 2.13** and all the observed dataset are attached in **Table B.2 of Appendix- IV**.

Salinity

The observed salinity concentration ranged between 3.2 ppt. and 0.1 ppt. during the last monitoring season. The maximum salinity (3.2 ppt.) was observed at Akram point of the Sundarbans while minimum value was near the Power plant area. Sufficient fresh water flow from upstream section of the river system decrease the salinity concentrations during monsoon and post- monsoon seasons. In general, high salinity from sea water increased water salinity in the direction of downstream to upstream. In the monitored river systems, the highest salinity was observed in pre-monsoon season followed by winter season where monsoon reflects the lowest. Freshwater flow from upstream and the dominated towards the sea water are the main reason of low salinity concentration in monsoon. However, the water salinity data in the selected sampling stations of Passur-Sibsa RS of the previously monitoring periods are presented in **Figure: 2.14** and all the observed dataset are attached in **Table B.3 of Appendix- IV**.

Dissolved Oxygen

The standard DO level for the fisheries in aquatic environment is more than 5.0 mg/L (ECR'1997). During the last monsoon season, DO values ranged from 8.8 mg/L to 7.1 mg/L which was found within the permissible limit recommended by DoE. In general, higher DO levels are observed in monsoon and post-monsoon season basically for heavy rainfall and freshwater availability & upstream flow. Seasonal variations of DO at the monitoring sites of Passur-Sibsa RS for the monitoring periods are shown in **Figure: 2.15** and all the observed dataset are attached in **Table B.4** of **Appendix- IV.**

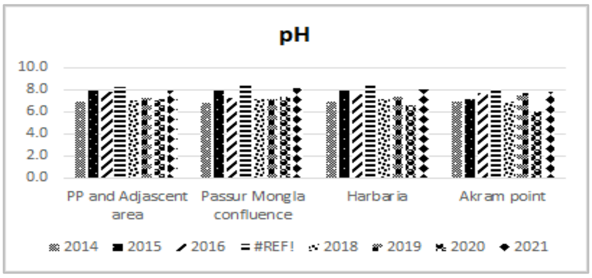


Figure 2.12: Variations in pH values in different monitoring sites

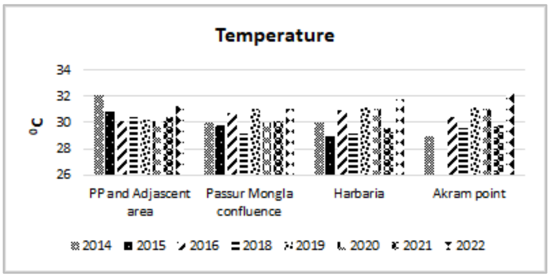


Figure 2.13: Variations in Temperature values in different monitoring sites

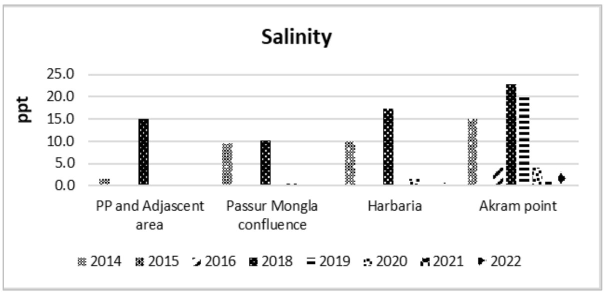


Figure 2.14: Variations in Salinity values in different monitoring sites

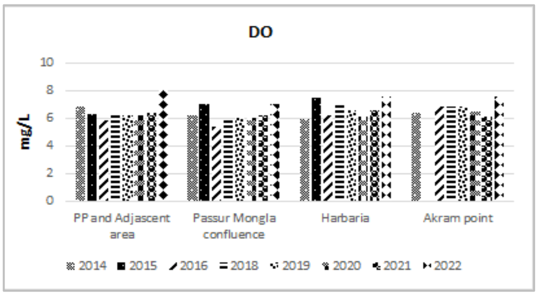


Figure 2.15: Variations in DO values in different monitoring sites

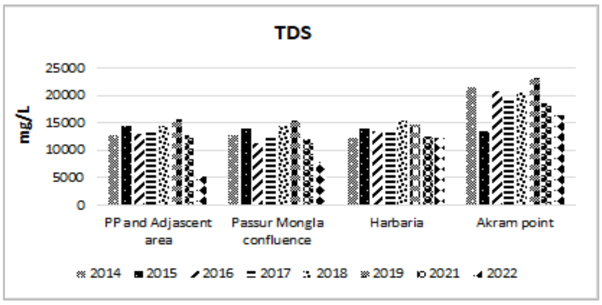


Figure 2.16: Variations in TDS values in different monitoring sites

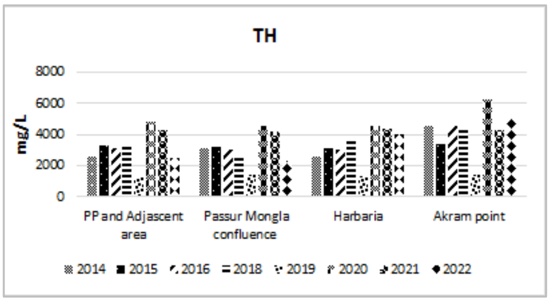


Figure 2.17: Variations in TH values in different monitoring sites

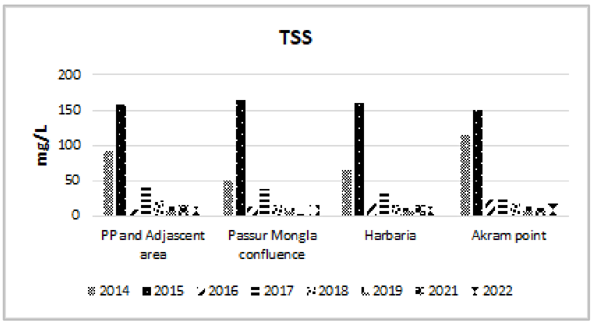


Figure 2.18: Variations in TSS values in different monitoring sites

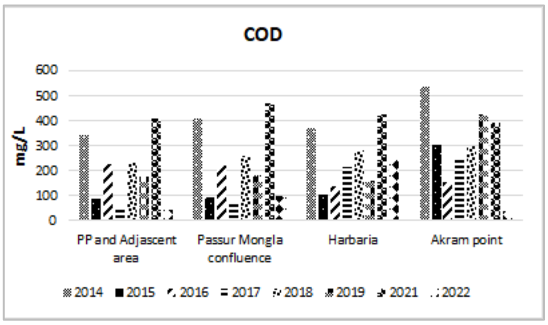


Figure 2.19: Variations in COD values in different monitoring sites

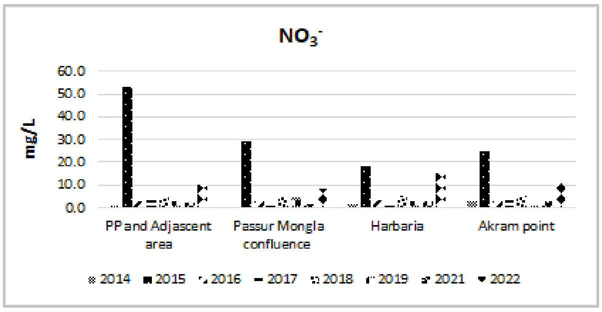


Figure 2.20: Variations in Nitrate values in different monitoring sites

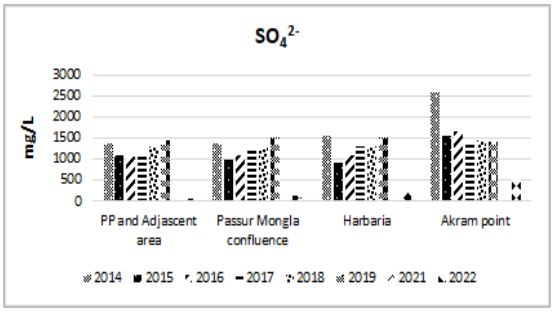


Figure 2.21: Variations in Sulphate values in different monitoring sites

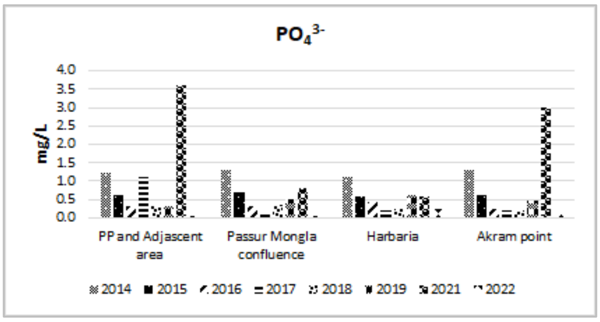


Figure 2.22: Variations in Phosphate values in different monitoring sites

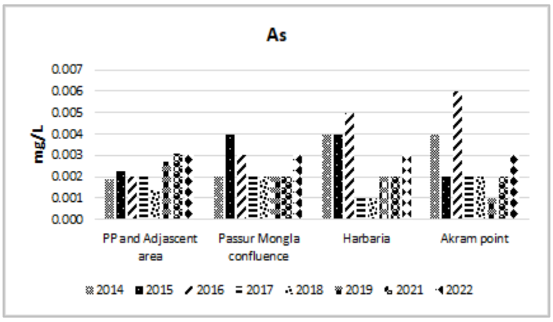


Figure 2.23: Variations in Arsenic values in different monitoring sites

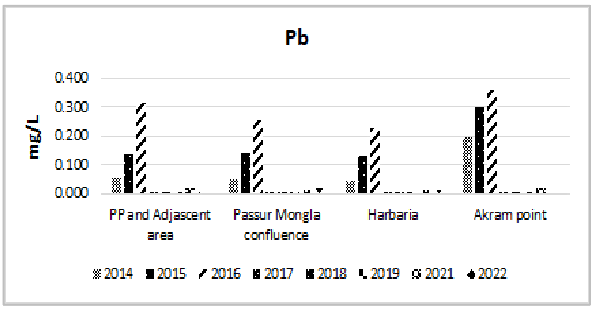


Figure 2.24: Variations in Lead values in different monitoring sites

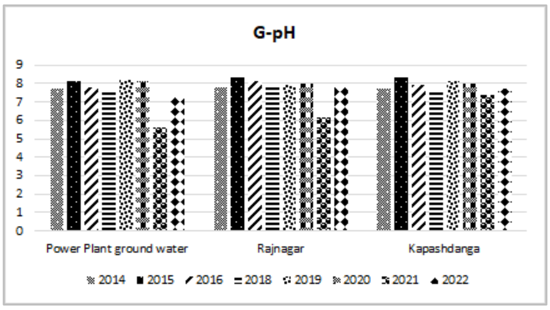


Figure 2.25: Variations in G-pH values in different monitoring sites

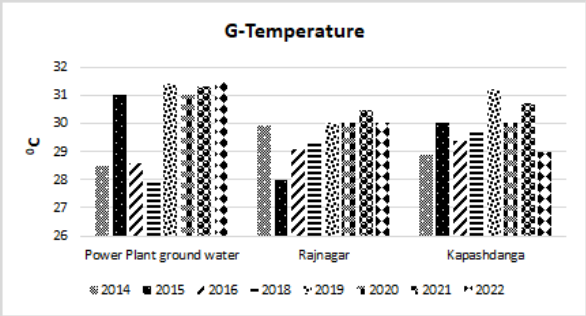


Figure 2.26: Variations in G-Temperature values in different monitoring sites

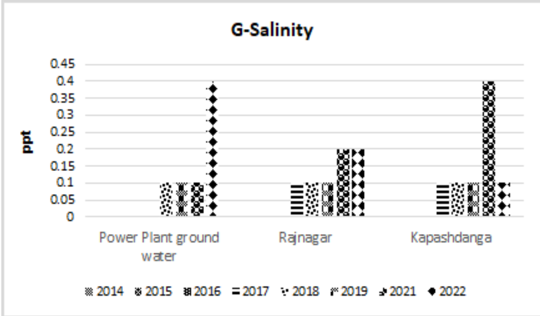


Figure 2.27: Variations in G-Salinity values in different monitoring sites

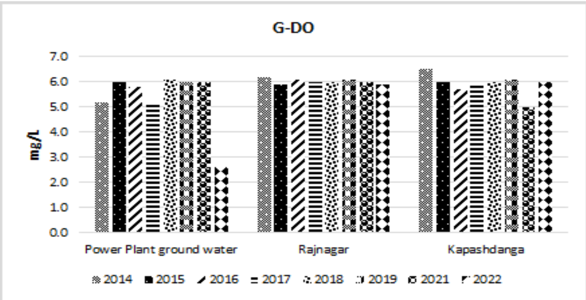


Figure 2.28: Variations in G-DO values in different monitoring sites

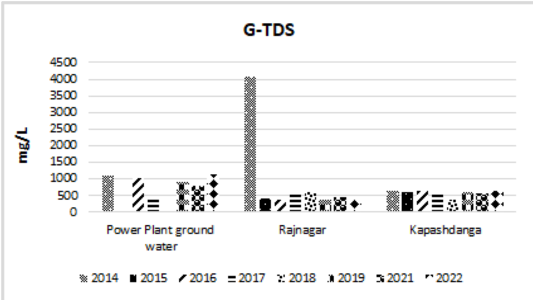


Figure 2.29: Variations in G-TDS values in different monitoring sites

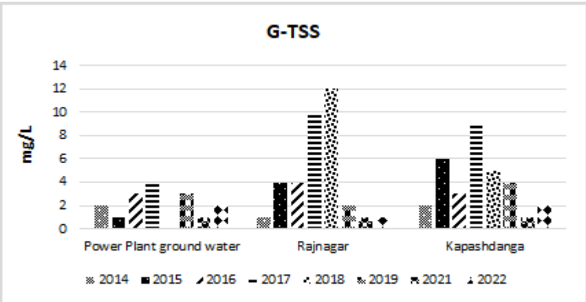


Figure 2.30: Variations in monsoon G-TSS values in different monitoring sites

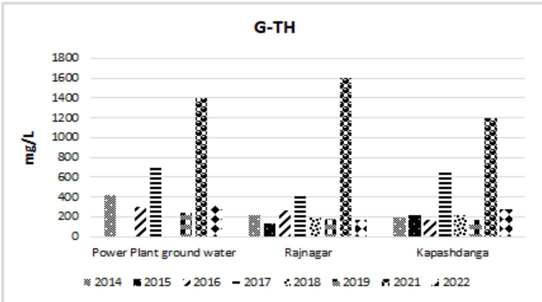


Figure 2.31: Variations in monsoon G-TH values in different monitoring sites

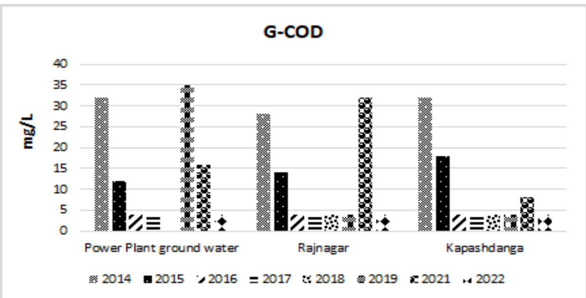


Figure 2.32: Variations in G-COD values in different monitoring sites

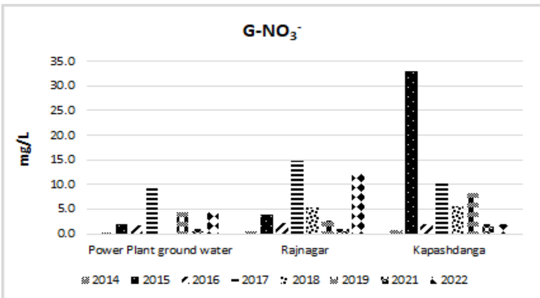


Figure 2.33: Variations in G-Nitrate values in different monitoring sites

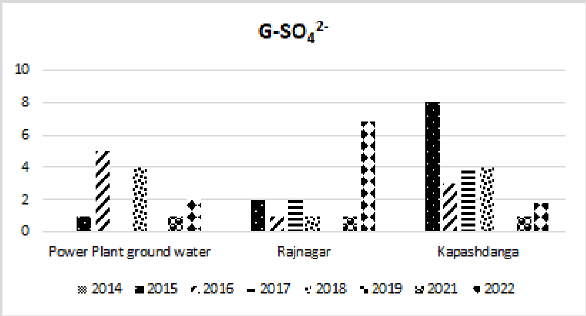


Figure 2.34: Variations in monsoon G-Sulphate values in different monitoring sites

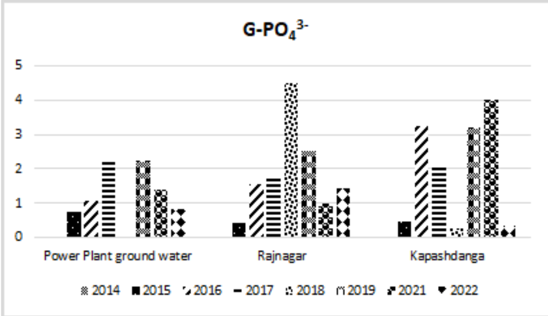


Figure 2.35: Variations in monsoon G-Phosphate values in different monitoring sites

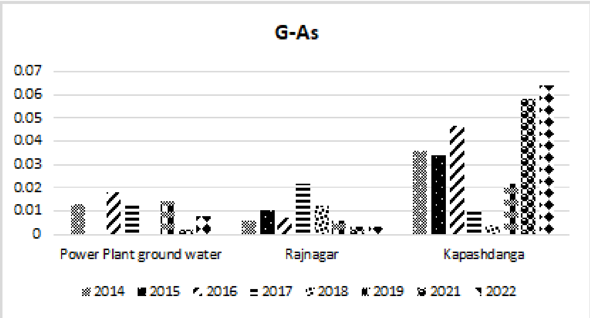


Figure 2.36: Variations in monsoon G-Arsenic values in different monitoring sites

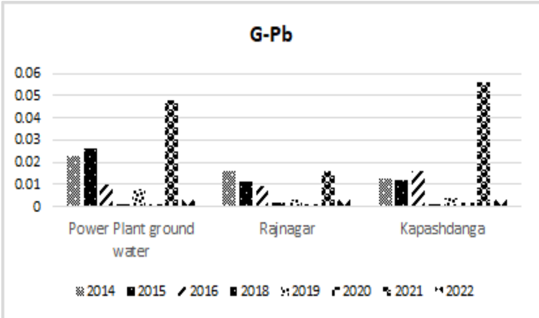


Figure 2.37: Variations in monsoon G-Lead values in different monitoring sites

Laboratory tested parameters

The laboratory tested results obtained up to 32nd monitoring period (May, 2022: Pre Monsoon season) are described below:

Total Dissolved Solids (TDS), Total Hardness (TH) and Total Suspended Solids (TSS)

TDS mainly indicates the presence of various kinds of minerals like ammonia, nitrate, phosphate, alkalis, some acids, sulphates and metallic ions etc., in water which comprise both colloidal and dissolved solids in water (Tareq. M. S. *et al.,* 2013). During the last visit, the TDS values were found to be ranged between 4060-16400 mg/L (**Figure 2.16**). Among the monitoring sites highest TDS was observed at Akram point (16400 mg/L) and lowest was found at Right Bank of Passur River at Project site-Jetty (4060 mg/L). In general, the TDS values increase in Pre-monsoon and winter seasons than in monsoon and post-monsoon periods which could be the contribution of less rainfall and decreased upstream flow to its dilution in the rainy season (Izonfuo and Bariweni, 2001)[1]. TDS values in Passur River increased as it progressed towards the Sea. Therefore, Akram point of Sundarbans showed the highest TDS with respect to remaining sampling point. **Table B.8**: **Appendix IV**). Regarding spatial variation, towards downstream of the River System, usually high TDS concentrations due to tidal influence of the Bay of Bengal that contains lots of salts and other nutrients.

[1] Izonfuo W. A and. L Bariweni 2001.The effect of urban runoff water and human activities on some physicochemical parameters of the Epie creek in the Niger Delta. J. Appl. Sci. & Enviro. Mgt, **5(1)**: 4755.

Total Hardness (TH) follows similar pattern as that of TDS e.g., high TH was found during pre-monsoon and winter season as of the TDS. The higher the nutrients the higher the occurrence of Total Hardness (TH). Insufficient freshwater supply due to low rainfall during winter and pre-monsoon period and seawater contains huge quantity of minerals including calcium and magnesium, which make the water hard. During the monitoring period the TH values were found to be ranged between 2100 mg/L to 5000 mg/L. In the deep Sundarbans hardness always found to be comparatively higher than the standard value of surface water (**Figure 2.17**). Generally, water hardness is found to be higher in monsoon season but in Passur River, it is found to be higher in pre-monsoon and winter season due to the saline water intrusion toward upstream (Rahman et al., 2013).

Total Suspended Solids (TSS) include solid materials of organic and inorganic in origins, which are normally suspended in water. In the Passur-Sibsa RS, the suspended matters generally contain sand, clay, silt and loam. TSS concentrations among the monitoring sites varied from 7 mg/L to 19 mg/L. TSS values recorded during the last pre-monsoon period found to be within the permissible limit of 150 mg/L (ECR, 1997). In 2014, TSS reached more than 150 mg/L at Mongla-Passur Confluence due to the oil spillage incident occurred at *9th December, 2014* (**Figure 2.18**). After that, the issue was not found any more, and the water bodies reinstated its properties naturally. Above all, in the Passur-Sibsa RS, TSS showed consistency in the concentrations of suspended matters.

Generally, in the Passur-Sibsa RS, TSS was found to be higher in Pre-monsoon and winter seasons than those of monsoon and post-monsoon seasons which may be due to relatively low precipitation and less upstream freshwater flow, urban runoff, industrial wastes, bank erosion, bottom feeders (such as carp), algae growth or wastewater discharges.

The status of TDS, TH and TSS of Passur River in the observed Monsoon seasons at different monitoring sites are presented in **Figure 2.15, 2.16** and **2.17** respectively and all the observed dataset are attached in **Table B.7**, **Table B.8** and **Table B.9** of **Appendix- IV.**

Chemical Oxygen Demand (COD)

COD is an indicator of organic pollution, which is caused by the inflow of natural organic loads, domestic, livestock and industrial wastes, which contain elevated levels of organic pollutants (Ayati, 2003). In fact, the higher the organic matter, the higher will be the decomposition and hence there will be a higher demand of O_2 in the water body.

COD concentrations varied from 20 mg/L to 240 mg/L during the last monsoon season (**Figure 2.19)**. The highest value was found at Harbaria while the lowest value was found in Right Bank of Passur River at Jetty site. The higher values of COD indicate high level of organic matter in the river water (Sivasubramanium, 1999). **Figure 2.19** indicates that, organic loads are higher in the deep forests of Sundarbans than the upstream areas especially the power plant and its adjacent areas. Deep forests supply many organic loads in the river while upstream loads as well increase the organic materials concentrations in huge at the downstream of the RS.

Over the year, COD concentration was found to be higher in pre-monsoon followed by winter as these seasons had insignificant rainfall comparing to those of other seasons and which actually increased the density of organic matter. In monsoon, higher discharge diluted the COD load of the river water, which in turn reduced COD concentration in post monsoon. The status of the monsoon season variation of COD is shown in **Figure 2.18** and the completely monitored dataset are provided in **Table B.5** of **Appendix- IV.**

Nitrate, Sulphate and Phosphate

During monsoon the highest nitrate value was found to be 15.35 mg/L at Harbaria of Sundarbans and lowest value was found to be 6.41 mg/L at Maidara River near proposed township area. The concentration of such Nitrate during the monsoon period could be the result of surface run-off, agricultural run-off, atmospheric deposition and domestic wastes dumping together with industrial pollution from upstream.

On the other hand, during the monitoring tier sulphate concentration was found to be higher in Harbaria (517.86 mg/L) and lowest (22.28 mg/L) at Middle Passur River at Project Site-Jetty site. In general, sulphate (SO_4^{2-}) concentration is higher in seawater as well as in coastal river due to the tidal influence. The monitored dataset substantiates this fact i.e., SO_4^{2-} concentration of Passur-Sibsa RS increases in the direction of upstream to downstream.

on the contrary, PO_4^{3-} concentrations was found highest (0.228 mg/L) during the last monsoon period at Harbaria of Sundarbans and lowest value (.0003 mg/L) was found at Maidara river near proposed township area. However, the recorded low phosphates value during wet seasons might be attributed to the limited flow of upstream freshwater, high salinity and utilization of phosphate by phytoplankton, stated by Senthilkumar et al., 2002; Rajasegar, 2003 (**Table B.11**).

The status of NO_3^-, SO_4^{2-} and PO_4^{3-} concentrations at different monitoring sites are shown in **Figure 2.20**, **Figure 2.21** and **Figure 2.22** and all the observed dataset are given in **Table B.10**, **Table B.11** and **Table B.12** of **Appendix- IV**.

Heavy Metals

Arsenic (As) concentrations varied between .003 mg/L to 0.004 mg/L during the last monsoon period. Though as concentration remains very low yet the seasonal variations in arsenic might be due to seasonal differences in riverine input and the intrusion of water masses (Yuan, et al., 2021). On the other hand, Higher As concentration at Hiron point in 2020 might be due to the less rainfall and higher seawater intrusion. On the other hand, the concentration of Pb ranged from 0.003 to 0.017 mg/L (**Figure 2.23**). Dissolved Pb is very harmful to aquatic organisms due to bioaccumulation, it increases in body tissue of organisms (Rompas, 2010). On the contrary, the values of Mercury (Hg) revealed consistency among all the monitoring points in all the seasons in all monitoring quarters. The values never exceeded 0.001 mg/L. In the last winter period, the concentrations also remain same. All the observed data are found to be within the permissible limit (0.05 mg/L) as per ECR, 1997.

The average value of As and Pb concentrations at different monitoring sites of the consecutive monitoring quarters for monsoon seasons are presented in **Figure 2.23** and **Figure 2.24** and all the observed dataset of As, Pb and Hg are given in **Table B.13**, **Table B.14** and **Table B.15** of **Appendix-IV**.

Oil and Grease

In order to measure the concentration of oil and grease in Passur-Sibsa River, samples were collected at five locations during low tide from the surface layer and analysed following the standard testing method of APHA. The concentration of oil and grease are presented in **Table-B.6** of **Appendix-IV.** During monsoon and post monsoon periods, the concentration of Oil and Grease were found to be lower than that of winter and pre-monsoon season. It appears from the data that Passur and Sibsa river system recorded high concentration of oil and grease in winter period in 2014, which might be due to accidental oil spillage occurred on December 9, 2014. An amount of 350,000 litres (Philips, 2014) of furnace oil had spilled in the river and spread over an area of 350 km^2 (Welle, 2014). During the monitoring period, Oil and grease was found <2.0- mg/L for all the monitoring sites. Plying of motorized boats, launches and other tourist boats, Navy boats and fishing boat at Dublar char could be the reasons of Oil and Grease in that areas. Moreover, for the seasonal fishing at sea, the engine boats and other fishing boats contributes huge amount of oil and grease in the river water. .

Findings

Passur River is highly influenced by tidal effects. Tidal penetration in the Passur River depends on seasonal change, upstream flow and catchment water discharge. However, the physico-chemical properties of Passur iver changes with the tidal intrusion in different seasons. During 32nd quarterly monitoring, pH was found slightly basic in nature. Salinity, Temperature and Dissolved oxygen level was found in fair and favourable for the aquatic life forms. During the 31st quarter (post-monsoon, 2021), TDS and TH has been relatively same with respect to the same seasons of last consecutive years. Nitrate (NO_3^-) level remained relatively lower. The phosphate (PO_4^{3-}) was found within the safe limit of aquatic organisms. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and even no issues as well. Oil & grease concentration was found less than 2.0 mg/L at all sites which is less than the recommended concentration (10 mg/L) for Inland Surface Water.

2.3.6 Status of the Groundwater quality

In-situ tested parameters

The in-situ tested results obtained up to 33rd monitoring period (July, 2022: Monsoon season) are described below:

pH and Temperature

The values of pH and temperature of groundwater in the monitored sites complied with the drinking water quality standards as specified in ECR, 1997 (7.8-7.26 and 32-29^{0}C respectively). When it comes to increasing drinking water alkalinity, various chemicals and pollutants are known to cause high pH levels. If the soil or bedrock around groundwater sources includes carbonate, bicarbonate, or hydroxide compounds, those materials get dissolved and travel with the water. These mineral deposits also increase the alkalinity of the water. On the other hand, no significant differences were observed against the previously monitored periods of the same season's results. Temperature were found more or less consistent with the previously respective season's data. However, the monitoring results of pH and temperatures (monsoon) of selected sites are presented in **Figure 2.25** and **Figure 2.26** the observed dataset of pH and Temperature are attached in **Table B.16** of **Appendix- IV**.

Salinity and Dissolved Oxygen (DO)

Groundwater salinity concentration at all the monitoring sites were found to be increasing trend with respect to previous years during monsoon period. High ground water extraction, ground water salinity intrusion or surface saline water percolation may be the key reason for increasing the level of salinity into ground water over the years at all the monitoring sites. (**Table B.17: Appendix- IV**). However, during the monitoring period, highest salinity was found at Power plant area (0.4 ppt.) and lowest at Kapashdanga area (0.1 ppt.).

DO values ranged between 6.0-2.6 mg/L during this monitoring season. DO concentrations were found to be within the permissible limit of ECR, 1997 (6.0 mg/L) in power plant groundwater and other monitoring sites. A slight low DO concentration in drinking water might only reduce the taste of water. Higher DO level makes water tastier but causes corrosion to the supply pipe.

All monitoring results of salinity and DO of the selected monitoring sites are presented in **Figure 2.27** and **Figure 2.28** and all the observed dataset of DO and Salinity are attached in **Table B.17** of **Appendix- IV** respectively**.**

Laboratory tested parameters

The laboratory tested results obtained up to 32nd monitoring period (May, 2022: Pre-monsoon season) are described as follows:

<u>TDS, TSS and TH</u>

The highest TDS value of 1150 mg/L was recorded in Power Plant tube well and slightly exceeded the ECR' 1997 (1,000 mg/L) (**Figure 2.29: TDS**). High ground water extraction, salinity intrusion or percolation may be the key reason for increasing the level of TDS. TSS also known as non-filterable residue, are the solids (minerals and organic material) which remain trapped on a 1.2μm filter (U.S.EPA, 1998). During the 33rd monitoring period, maximum TSS concentrations (2 mg/L) was recorded at Power plant and Kapashdanga area and minimum (1mg/L) at Rajnagar sites, which complied within the Standard for Drinking Water, Bangladesh (TSS: 10mg/L, ECR, 1997) (**Figure 2.30: TSS**). However, TSS was found much higher than the drinking standard quality particularly at Rajnagar during the pre-monsoon of 2017 and 2018.

On the other hand, TH concentrations of the three monitored spots varied from 165mg/L to 320mg/L during the last pre-monsoon period. The maximum value was found at Power Plant site and lowest at Rajnagar area. The drinking water collected from the monitoring sites complied with standard limit (200-500 mg/L) of water hardness set by the ECR' 1997 during the monitoring tier.

Groundwater TDS, TSS and TH values of the consecutive winter periods are presented in **Figure: 2.29, Figure 2.30** and **Figure 2.31** and all the observed dataset are attached in **Table B.18** and **B.19** of **Appendix- IV**.

<u>Chemical Oxygen Demand</u>

The Bangladesh standard for COD in drinking water is 4.0 mg/L. Monitoring results completely complied with the Bangladesh Standard for COD concentrations for every site during the last pre-monsoon period as like the year 2014 and 2015. Organic or inorganic compounds or ion in the ground water may be the major cause for increasing COD in the ground water during the winter which may also be triggered by the decreased groundwater recharge. The COD concentrations of all the pre-monsoon period monitoring sites are given in **Figure 2.32** and all the observed dataset are attached in **Table B.20** of **Appendix- IV**.

<u>Nitrate, Sulphate and Phosphate</u>

Natural nitrate levels in groundwater are generally very low (typically less than 10 mg/l NO_3^-), but nitrate concentrations increase due to human activities, such as agriculture, industry, domestic effluents. The sources of nitrates pollution in groundwater are cultivation in areas where the soil layer is relatively thin, or has poor nutrient buffering capacity, or where there are changes in land use; over fertilization of crop for intensification of agricultural activity; spread cultivation of crops which require high fertilizes doses and which leave the soil bare over long periods (maize, tobacco and vegetables); drainage systems which lead to drainage of fertilizers; intensive agricultural rotation cycles involving frequent ploughing and extensive areas of bare soils during winters; organic fertilizers form animal husbandry and increased urbanization. Among the monitoring tiers, the NO_3^- values were found to be highest during the monsoon of 2018 though it was found to be within the standard limit set by ECR'97. However, during last winter period, the nitrate values were found to be highest (12.30 mg/L) at Rajnagar area and lowest at Rajnagar (4.02 mg/L).

On the other hand, Sulphate (SO_4^{2-}) results were found complying with the Bangladesh Standard for Drinking Water Quality (400 mg/L) from the beginning of the monitoring study. During the last winter period, highest (6.8 mg/L) values was found in Rajnagar area and lowest (1.7 mg/L) in Kapashdanga area.

In addition, the concentrations of PO_4^{3-} were ranged between 0.3mg/L and 1.4mg/L, which was within the standard limit of 6.0mg/L (ECR'1997). PO_4^{3-} concentrations actually have both spatial and temporal variations but which is minor in the interest of this monitoring objectives as well as drinking purpose by the community resides there. The observed pre-monsoon seasons NO_3^-, SO_4^{2-} and PO_4^{3-} concentrations of groundwater are presented in **Figure 2.33, Figure 2.34** and **Figure 2.35** and all the observed dataset are attached in **Table B.21, B.22,** and **B.23** of **Appendix- IV.**

Arsenic (As), Lead (Pb) and Mercury (Hg)

According to Bangladesh Standard (ECR, 1997), the maximum acceptable concentration of Arsenic (As) in groundwater is 0.05 mg/L. The As concentrations among all the monitoring locations ranged between 0.003 mg/L and 0.064 mg/L. During the monitoring tier As concentration breached the national water quality standard. The prominent sources of arsenic contamination in groundwater of Bangladesh is still a matter of debate as no single cause can interpret the contamination processes (Islam et al., 2010)[2]. The most widely discovered two theories for the backgrounds of arsenic contamination of groundwater in Bangladesh may be the pyrite oxidation and iron oxyhydroxide reduction (Saha and Rahman, 2020)[3]. Higher arsenic concentration in groundwater could be (i) the presence of suitable arsenic bearing source material (i.e., rocks, minerals, soils, sediments); (ii) efficient mobilization and/or transport processes (i.e., oxidation of arsenic bearing sulphides); and (iii) lack of rapid arsenic removal processes (Polya and Middleton, 2017)[4]. However the owner of the tube well will be informed to and monitoring will be continued in order to understand the facts.

On the other hand, during the last pre-monsoon period Pb concentration was found to be slightly exceeded the permissible limit as specified in the (0.001 mg/L for Pb) in Power plant ground water (0.002 mg/L). The permissible limit is less than 0.001 mg/L for Hg. The concentration of Pb showed only spatial variation to some extent in some seasons (**Figure 2.37: Lead**). However, the water of the tube-wells was found suitable for drinking purpose in terms of metal pollution status. The observed values of As and Pb in all the winter seasons are presented in **Figure: 2.36** and **Figure 2.37** and all the observed dataset of As, Pb and Hg are presented in **Table B.24, B.25 and B.26** of **Appendix-IV**.

Remarks

This concluding remark represent that the physical characteristics of groundwater quality is still in good condition with slight variation in pH and salinity. The reason being saline water intrusion and infiltration due to excessive withdrawn of groundwater by the surrounding communities during the dry season. During the monitoring tier As concentration breached the national water quality standard.

[2] M.S. Islam, F. Islam, W.W. IWA., **Arsenic contamination in groundwater in Bangladesh: an environmental and social disaster,** IWA Water Wiki (2010).

[3] N. Saha, M.S. Rahman., **Groundwater hydrogeochemistry and probabilistic health risk assessment through exposure to arsenic-contaminated groundwater of Meghna floodplain, central-east Bangladesh,** Ecotoxicol. Environ. Saf., 206 (2020), Article 111349,

[4] D.A. Polya, D.R.S. Middleton., **Arsenic in drinking water: sources & human exposure,** Best Pract. Guid. Control Arsen. Drink. Water., 15 (2017)

However, the owner of the tube well will be informed to and monitoring will be continued in order to understand the facts. In addition, evaporation also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes in salinity. Chemical characteristics of the groundwater quality are also found relatively good. cons.

2.4 Land and Agricultural Resources Monitoring

2.4.1 Methodology of land resources monitoring

Monitoring of selected indicators is very crucial for better management of land resources in the study area. Plot/land use, soil fertility/nutrient status, soil contamination with heavy metals and soil salinity have been considered as the major indicators for land resources monitoring. It is also assumed that during the operation phase of the power plant, fly ash and other air borne pollutants may get deposited on the surrounding agriculture land, which ultimately will pollute the study area soil. Before that (during pre-construction and construction stage), only natural phenomena are responsible to alter soil parameters.

Sampling Frequency

The frequency of monitoring for land resources data collection has been considered twice in a year. Accordingly, the soil samples were collected during 32^{nd} monitoring field visit and sent immediately to laboratory for analysis. The analysis data has been incorporated with this monitoring report.

Monitoring Indicators

The continuous monitoring has given an opportunity to observe seasonal change along with spatial change of selected indicators of sampling plots. The selected indicators are soil reaction (pH), soil salinity (EC), Organic matter (OM), base cations-Ca, Mg, K and Na, status of macro nutrients (N, P and S), status of micro nutrients (B, Fe, Mn and Zn) and presence of heavy metals (Pb and Cd). Sodium absorption ratio (SAR), exchangeable sodium percentage (ESP) can be calculated from the analysed data. It can also be mentioned that the structural change of soils in the sampling plots may also be identified from these data.

The formula to calculate SAR is given below, with concentration expressed in milli equivalents per liter (meq/L) analysed from a saturated paste soil extract.

$$SAR = \frac{[Na^+]}{\sqrt{\frac{1}{2}([Ca^+] + [Mg^+])}}$$

ESP is the sodium adsorbed on soil particles as a percentage of the Cation Exchange Capacity (CEC). It is calculated as:

$$ESP = \frac{[Na]^+}{CEC} X100$$

CEC is often estimated as the major exchangeable cations, including hydrogen. Both cation and CEC are expressed as meq/100g. ESP can also be calculated as:

$$ESP = \frac{[Na]^+}{[Ca^{2+} + Mg^{2+} + Na^+ + K^+]}$$

ESP is used to characterise the sodicity of soils only, whereas SAR is applicable to both soil and soil solution or irrigation water.

Location

The selected mauzas for monitoring are Baranpara (E-89°30′59.1″, N-22°37′57.0″) of Batiaghata Upazila, Chunkuri-2 (E-89°32′20.0″, N-22°34′51.0″) of Dacope Upazila, Kapalirmet (E-89°36′8.8″, N-22°32′18.9″) of Mongla Upazila, Chakgona (E-89°34′25.3″,N-22°34′18.3″) of Rampal Upazila and Basherhula (E-89°34′25.0″, N-22°36′14.0″) of Rampal Upazila under Khulna and Bagerhat Districts. However, a new sampling location (Bidyarbon- E-89°34′40.0″, N-22°33′42.0″) of Mongla Upazila was included with the previous ones for monitoring as per ToR. The sampling locations with their corresponding coordinates are stated in **Table 2.9**. Locations of collected soil samples are presented in **Figure 2.38**.

Table 2.9: Land Resources Monitoring Plan

Site No.	Monitoring indicators	Location	GPS(Decimal Degree)		Sampling Frequency	Methods/Tools/ Techniques
			Northing	Easting		
1	Plot use, Soil fertility and nutrient, Chemical properties of soil (pH, Pb, Cd), Crop production and damage	Mouza: Baranpara, Union: Gangarampur Upazila: Batiaghata, District: Khulna	N-22°37′57.0″	E-89°30′59.1″	Bi-yearly (April and October)	In situ field sampling and Laboratory Testing in SRDI
2		Mauza:Chunkuri-2,Union:Bajua Upazila: Dacope, District :Khulna	N-22°34′51.0″	E-89°32′20.0″		
3		Mouza: Kapalirmet/Buridmial Union: Burirdanga, Upazila: Mongla District: Bagerhat	N-22°32′18.9″	E-89°36′8.8″		
4		Mouza: Chakgona, Union: Rajnagar Upazila: Rampal, District: Bagerhat	N-22°34′18.3″	E-89°34′25.3″		
5		Mouza: Basherhula, Union: Rajnagar Upazila: Rampal, District: Bagerhat	N-22°36′14.0″	E-89°34′25.0″		
6		Mouza: Bidyarbon, Union: Burirdanaga Upazila: Mongla, District: Bagerhat	N-22° 33′ 42.0″	E-89° 34′ 40.0″		

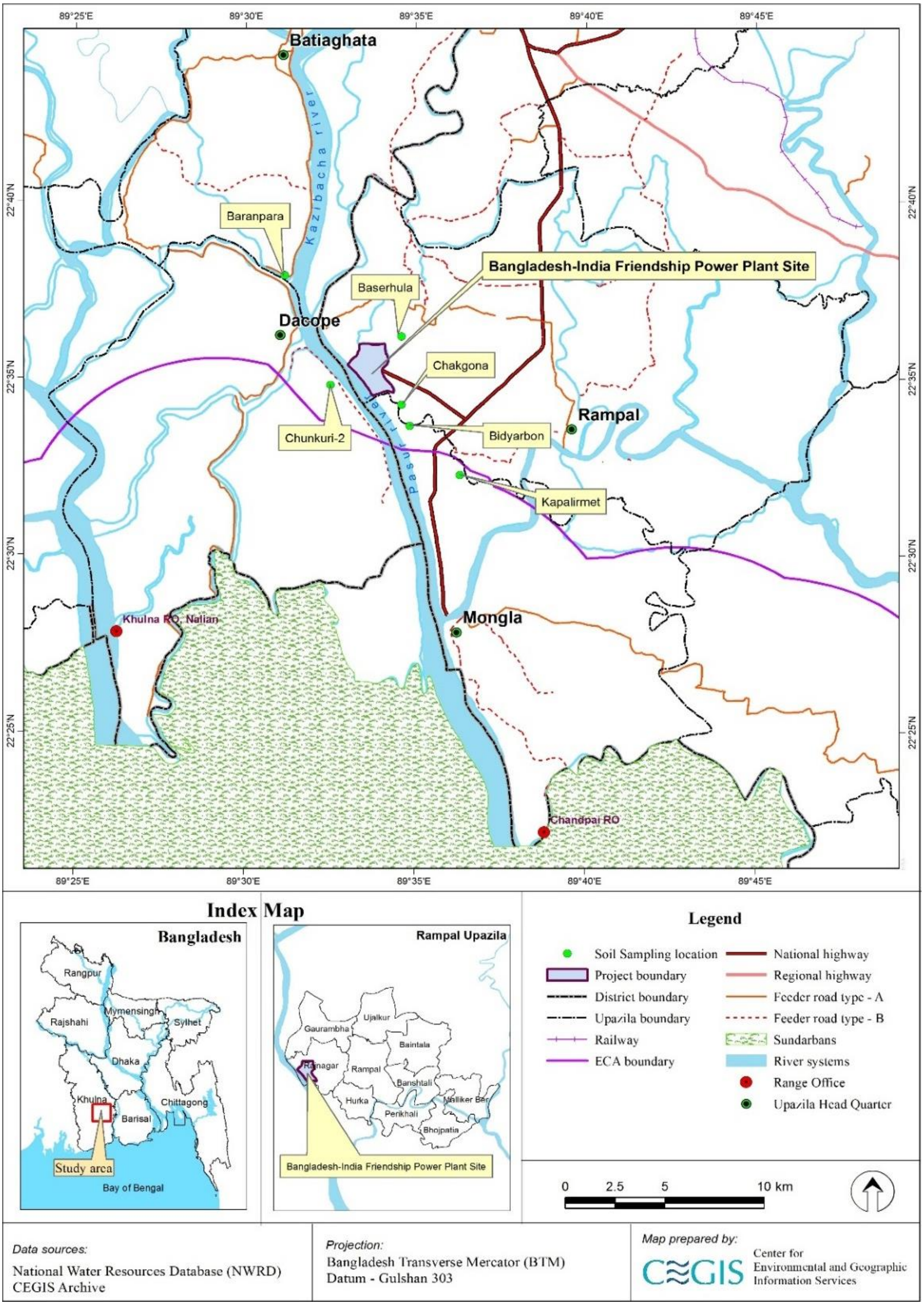


Figure 2.38: Land and Agricultural Resource Monitoring Locations

2.4.2 Process of Soil Samples Collection

Plot Selection

Monitoring plots were selected at the very beginning of this study. Expert's judgement along with plot owner's opinion was taken into consideration for this selection. Upazila Agriculture Officers of Batiaghata and Dacope of Khulna, Rampal and Mongla of Bagerhat District and Senior Scientific Officer of Soil Resource Development Institute (SRDI) of Khulna were contacted for collecting expert's judgement. Wind speed and wind direction were considered as potential local factor for the monitoring purpose. All the selected plots were characterized as medium high land (F_1), which are normally flooded in the range of 30-90 cm and remain inundated for more than two weeks to few months during the flood period.

Soil sample collection

Standard procedure was maintained during the collection of soil samples. In every plot, minimum three pits were dug through augur to collect composite sample. Each plot had three composite samples, top soil (0-15 cm), sub soil (15-30 cm) and sub stratum (30-45 cm). Soil samples were preserved in an air-tight plastic bag for laboratory analysis.

Laboratory Analysis

Collected soil samples have been handed over to the SRDI, Dhaka for laboratory analysis. The analysis data and report are incorporated with this monitoring (33rd monitoring) report

2.4.3 Status of soil quality of monitoring plots

Soil quality (wet season) of the monitoring plots are given below:

Monitoring Plot-1 (Baranpara)

Soil fertility and health is largely depending on salinity of the study area. According to the last soil chemical analysis, SAR and ESP value increases than last dry season while EC decreases. This might be due to the increase of mono-valent cation (Na) instead of divalent (Ca and Mg). Increase of monovalent cations isn't good for soil health and fertility. pH is also increasing. Top soil organic matter increases significantly compared to last dry season. Nitrogen and Phosphorus follows the similar trend. This might be an effect of good agricultural practice. Only Sulphur concentration decrease this year which might be impact of salinity increase.

Iron concentration is increased than the previous year. The rest of the elements (Boron, Zinc and Manganese) showed a decreasing pattern than the previous year. Most of the elements are not available in higher pH. This might be an impact of pH and salinity increase. Lead and Cadmium concentration increased after two consecutive years' decrement in this year. But both of the element's concentration remains within the maximum permissible limit in soil.

Monitoring Plot-2 (Chunkuri-2)

Good agricultural practice was found in this monitoring plot. As a result, soil condition has improved from the previous monitoring. But during this monitoring, organic matter, Nitrogen and Sulphur concentration decrease while phosphorus concentration is increased than last dry season monitoring. The decrease of major nutrients are the aftereffect of increasing salinity and erosion. Increase of Na, Ca and K concentration triggers up SAR and ESP values. pH is also increasing.

Among the micro elements, only Fe showed increasing trend while remaining showed decreasing trend during the monitoring period. Macro elements have tendency to become unavailable in high pH and salinity. Increasing trend of salinity was also observed during this monitoring period. This might be cause of decrease of macro elements concentration in this monitoring plot. Lead and cadmium concentration have increased but remains within the maximum permissible limit.

Monitoring Plot-3 (Kapalirmet)

This monitoring plot was used for fish cultivation during pre-monsoon and post monsoon period. Decreasing salinity was a common scenario of this monitoring plot due to leaching and continues lentic ecosystem. This situation also prevails this year. All salinity related parameters (EC, SAR and ESP) decreases while pH increases. Due to submerged condition, all essential elements (Organic matter, N and S) concentration is decreasing except P. Micro elements (Mn and Zn) concentration decreases except iron and Boron. This might be another impact of submergence. Lead and cadmium presence are found within the permissible limit. During this monitoring period.

Monitoring Plot-4 (Chakgona)

Overall salinity of this area increases after last year drop. Na and Ca concentration is increased while K and Mg concentration is decreased this might be an after impact of tropical cyclone. pH is also increased. Organic matter has decreased, so is Nitrogen and Sulphur. This might be an impact of increase soil salinity and erosion. But Phosphorus concentration is increased which might be due to effect of higher pH concentration.

Increasing trend of B and Fe concentration might be an over application of fertilizer. But decrease of Mn and Zn might be the impact of increasing leaching. Lead and Cadmium concentration is increased in this year but remains within the permissible limit.

Monitoring Plot-5 (Basherhula)

Overall salinity increased in this area. All salinity related parameters follow the similar trend. This might be due to increment of base cations concentration (Na, K and Ca) with except Mg. pH is also increasing. Organic matter concentration has increased. Only nitrogen concentration follows the trend while Phosphorus and Sulphur concentration reduces in this monito0ring year. All micro nutrients show (Fe, Zn, B) decreasing trend except Fe. While increment of lead is observed in this monitoring period. No presence of cadmium is found during this monitoring.

Monitoring Plot-6 (Bidyarbon)

One part of this monitoring plot is exposed to river. So, there is a good possibility of quick wash out and soil erosion during monsoon period. This scenario also indicates vulnerability to storm surge and salinity intrusion from riverside during extreme events. Overall SAR and ESP is increased in this area where base cations (Na, K, Ca) are also increased except Mg. pH is also increased.

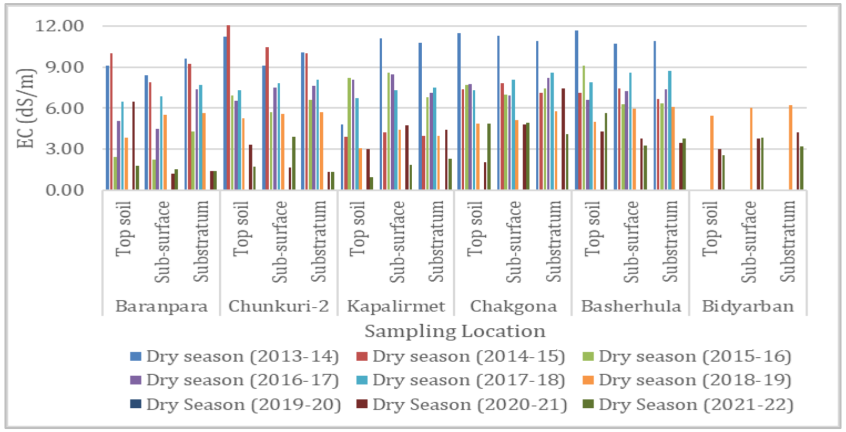
All the essential elements concentration (organic matter, Nitrogen, Phosphorus and Sulphur) has been decreased in this monitoring which might be due to the impact erosion. Fe concentration has increased during this monitoring while Mn, Zn and B concentration has decreased. Increasing salinity might reduce the presence of these elements. Lead and cadmium concentration have increased but remains within the maximum permissible limit.

2.5 Agriculture Resources Monitoring

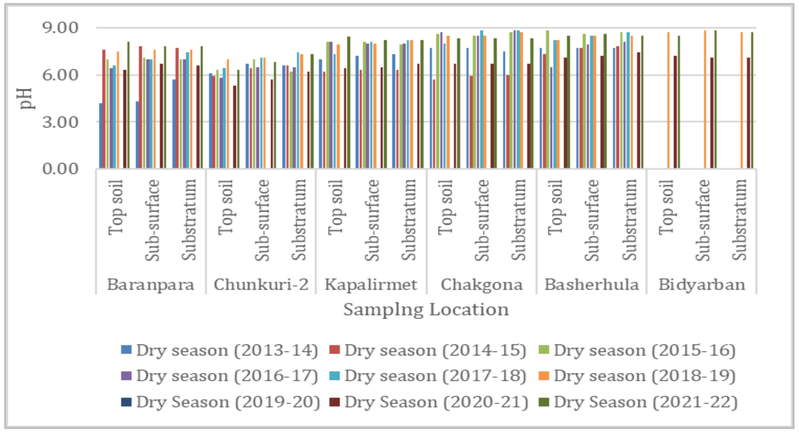
Monitoring of agriculture resources has been scheduled twice (April and October) a year as per the monitoring plan of the ToR. Next survey will be conducted in 34th Monitoring (October, 2022) and report will be incorporated accordingly.

2.6 Livestock Resources Monitoring

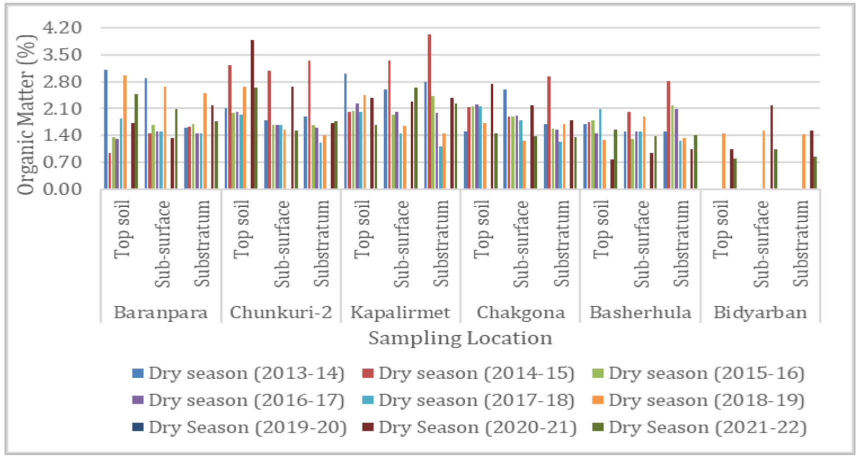
The frequency of monitoring for livestock resources data collection is considered twice in a year (April and October). Next survey will be conducted in 34th Monitoring (October, 2022) and report will be incorporated accordingly.



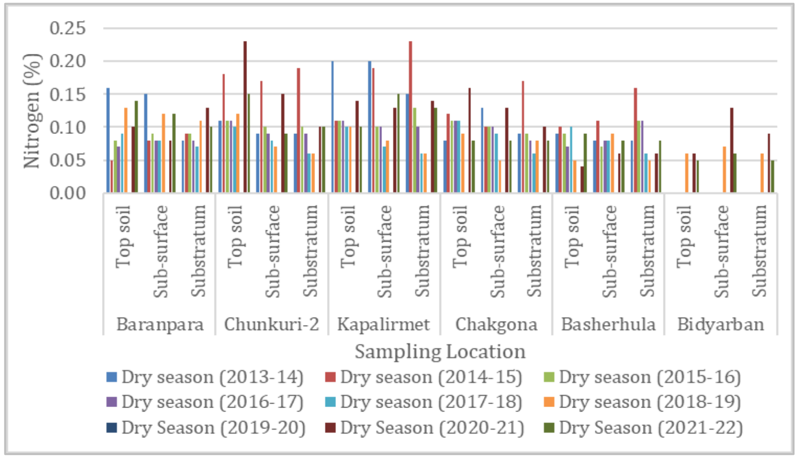
Changes of EC (dS/m) in dry seasons in sampling locations throughout the monitoring period



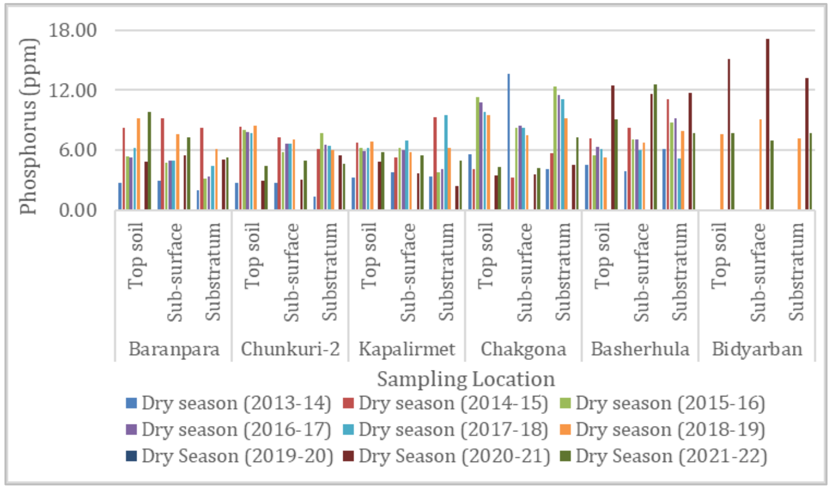
Changes of pH in dry seasons in sampling locations throughout the monitoring period



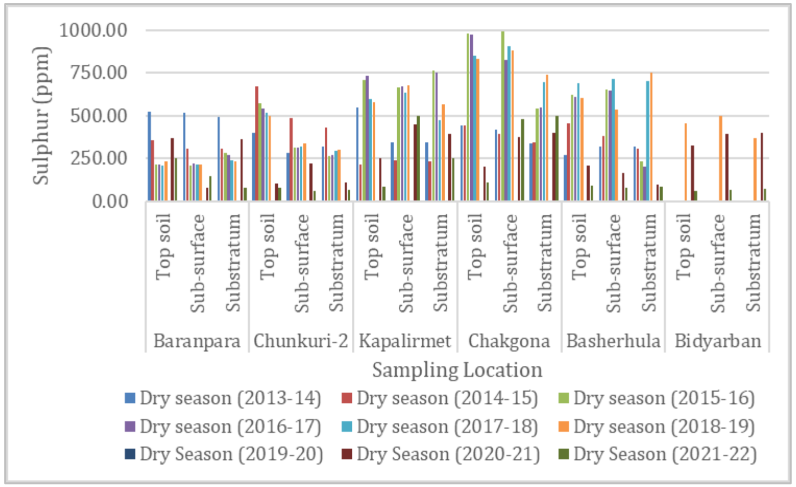
Changes of Organic matter (%) in dry seasons in sampling locations throughout the monitoring period



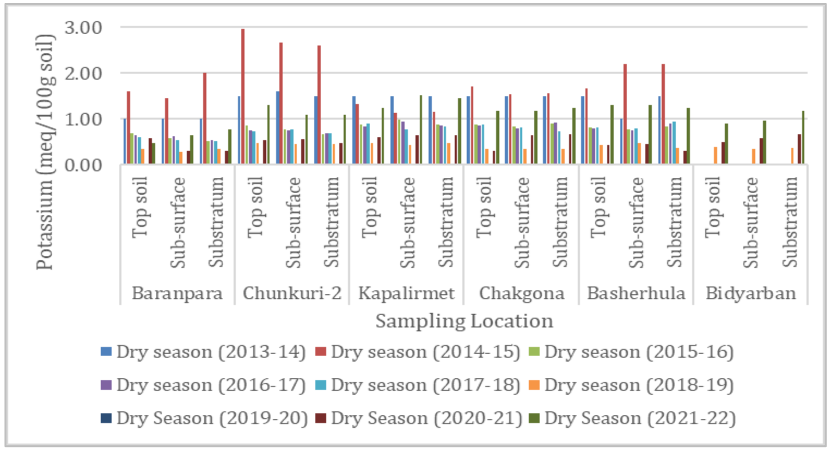
Changes of Nitrogen (%) in dry seasons in sampling locations throughout the monitoring period



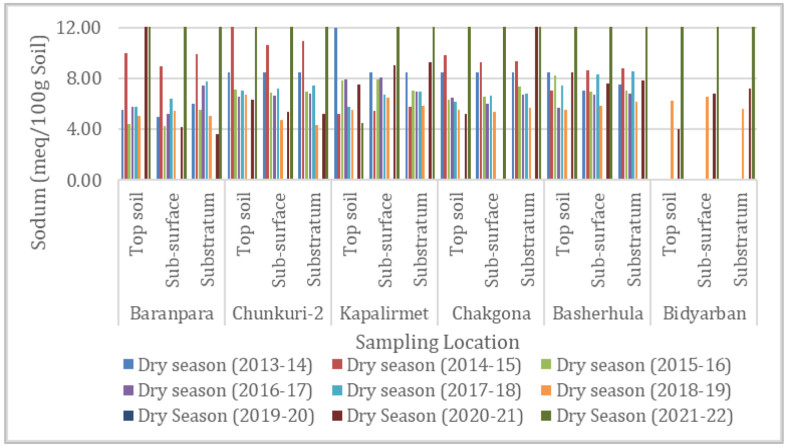
Changes of Phosphorus (ppm) in dry seasons in sampling locations throughout the monitoring period



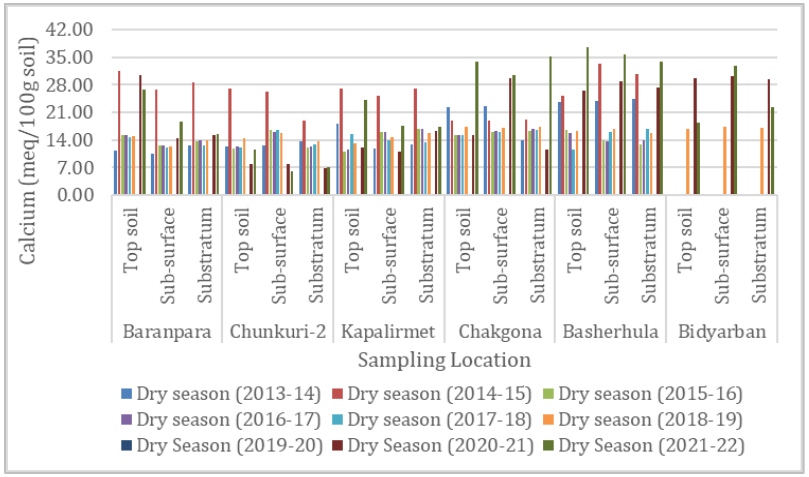
Changes of Sulfur (ppm) in dry seasons in sampling locations throughout the monitoring period



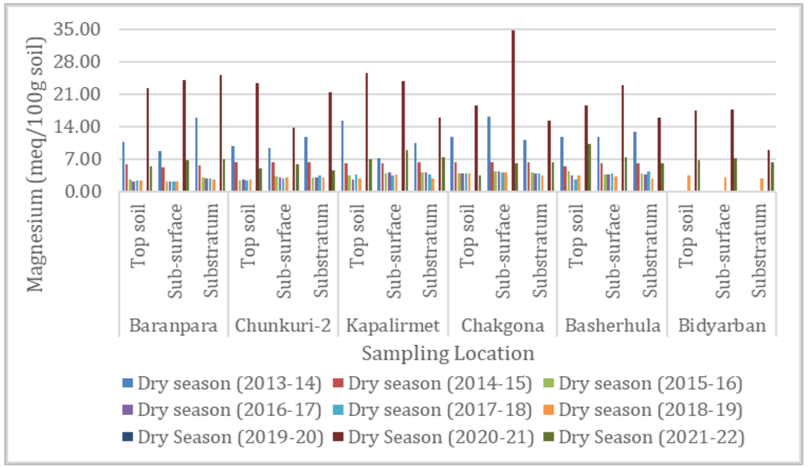
Changes of Potassium (meq/100g) in dry seasons in sampling locations throughout the monitoring period



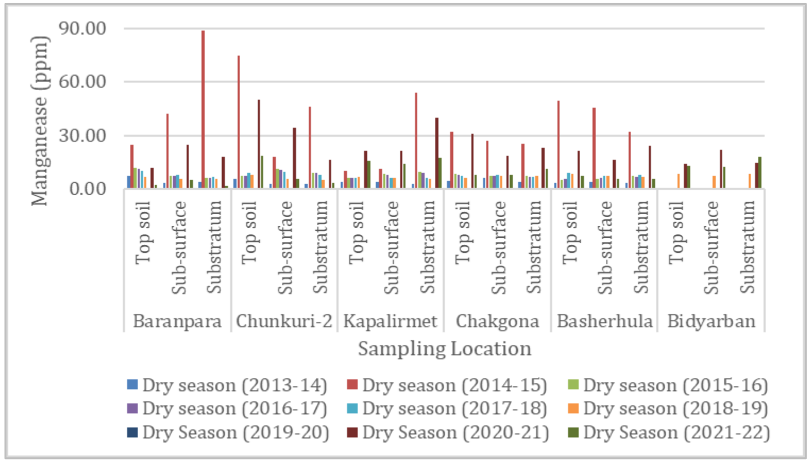
Changes of Sodium (meq/100g) in dry seasons in sampling locations throughout the monitoring period



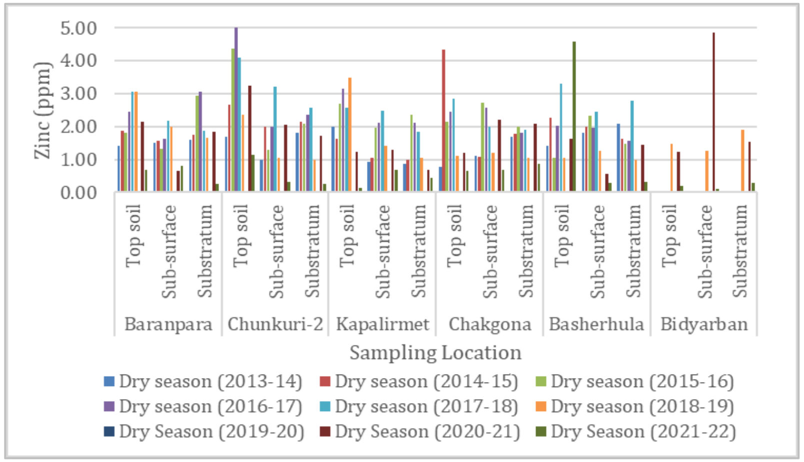
Changes of Calcium (meq/100g) in dry seasons in sampling locations throughout the monitoring period



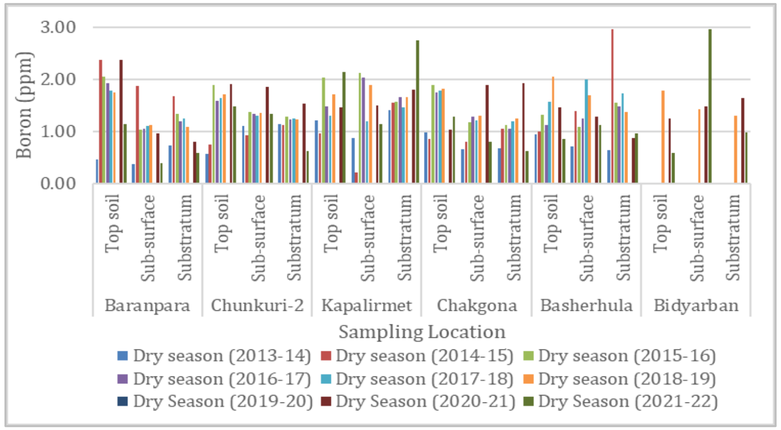
Changes of Magnesium (meq/100g) in dry seasons in sampling locations throughout the monitoring period



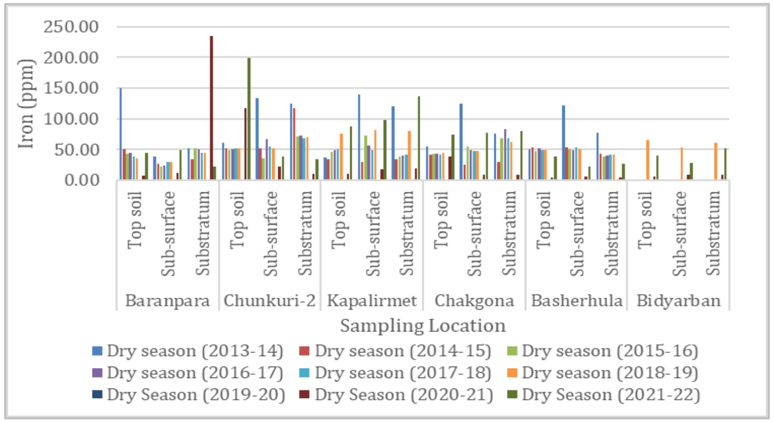
Changes of Manganese (ppm) in dry seasons in sampling locations throughout the monitoring period



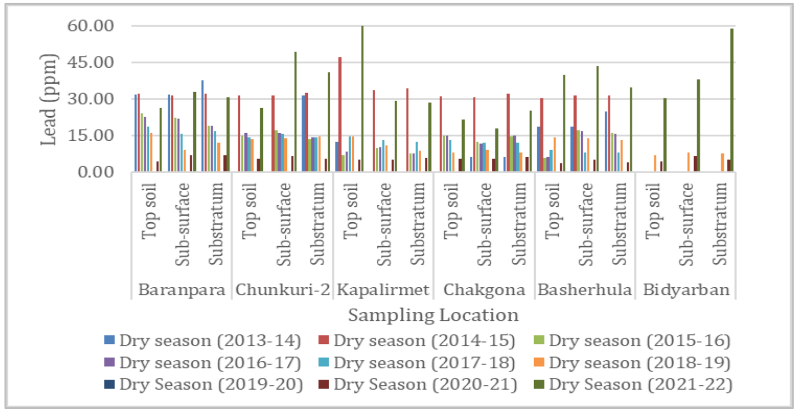
Changes of Zinc (ppm) in dry seasons in sampling locations throughout the monitoring period



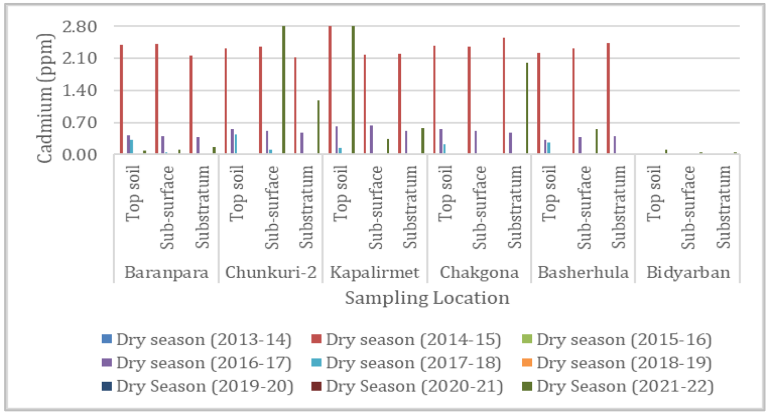
Changes of Boron (ppm) in dry seasons in sampling locations throughout the monitoring period



Changes of Iron (ppm) in dry seasons in sampling locations throughout the monitoring period



Changes of Lead (ppm) in dry seasons in sampling locations throughout the monitoring period



Changes of Cadmium (ppm) in dry seasons in sampling locations throughout the monitoring period

Figure 2.39: Changes in Chemical paramers in sampling locations throughout the monitoring period

2.7 Water resources monitoring

For monitoring the erosion and accretion at the project site, Mongla, Harbaria and Akram point areas, banklines of the Passur River were superimposed with each other.

2.7.1 River Morphology

Bangladesh is a riverine country. Rivers in different hydrological regions have different characteristics. Rivers in the northern part have fluvial characteristics while it is tidal in the south. The Passur River is one of the dynamic and major rivers in the southern part of Bangladesh. The Rampal power plant is being constructed along the left bank of the Passur River (**Figure 2.40**). It is always important to monitor the morphological characteristics of the river at regular intervals to assess the dynamics of the river in case of any development works. Monitoring river dynamics like erosion, accretion, and shifting of the bankline of the Passur River on a quarterly or half-yearly basis may facilitate the proper planning and management of the development work.

2.7.2 Methods to Assess the Riverbank Erosion and Accretion of the Passur River

For the assessment of the riverbank erosion and accretion, time-series satellite images were used. Then images were processed and analyzed before the assessment. After that, the locations of erosion and accretion as well as the shifting of bankline were identified. The steps of image processing and analysis are briefly explained below.

Collection and Processing of Images

Sentinel-1 Radarsat satellite images having 10m resolution covering the Passur River from Chalna to Hiron Point for the period from March 2022 to July 2022 were collected. After that, satellite images were geo-referenced to have the same projection system. Then, it was found that one image differs from another image. Under these circumstances, images were co-registered to avoid distortion with each image.

Delineation of Banklines

After the collection and processing of images, banklines were delineated for the mentioned period using the Arc-GIS tool. Then, banklines were analyzed and superimposed to assess the erosion-accretion and shifting of the river during the period from March 2022 to July 2022.

2.7.3 Monitoring of Erosion & Accretion and Shifting of the Banklines

For monitoring the erosion and accretion at the project site (Rampal Power Plant), Mongla, Harbaria, and Akram Point areas, banklines of the Passur River were superimposed on each other. It was found that the river is stable and there is no riverbank erosion or accretion as the river has not shifted from March 2022 to July 2022 (Figure 1). Although tiny line of red color (represents erosion) can be seen in few locations along both banks of the river but it may be considered as insignificant.

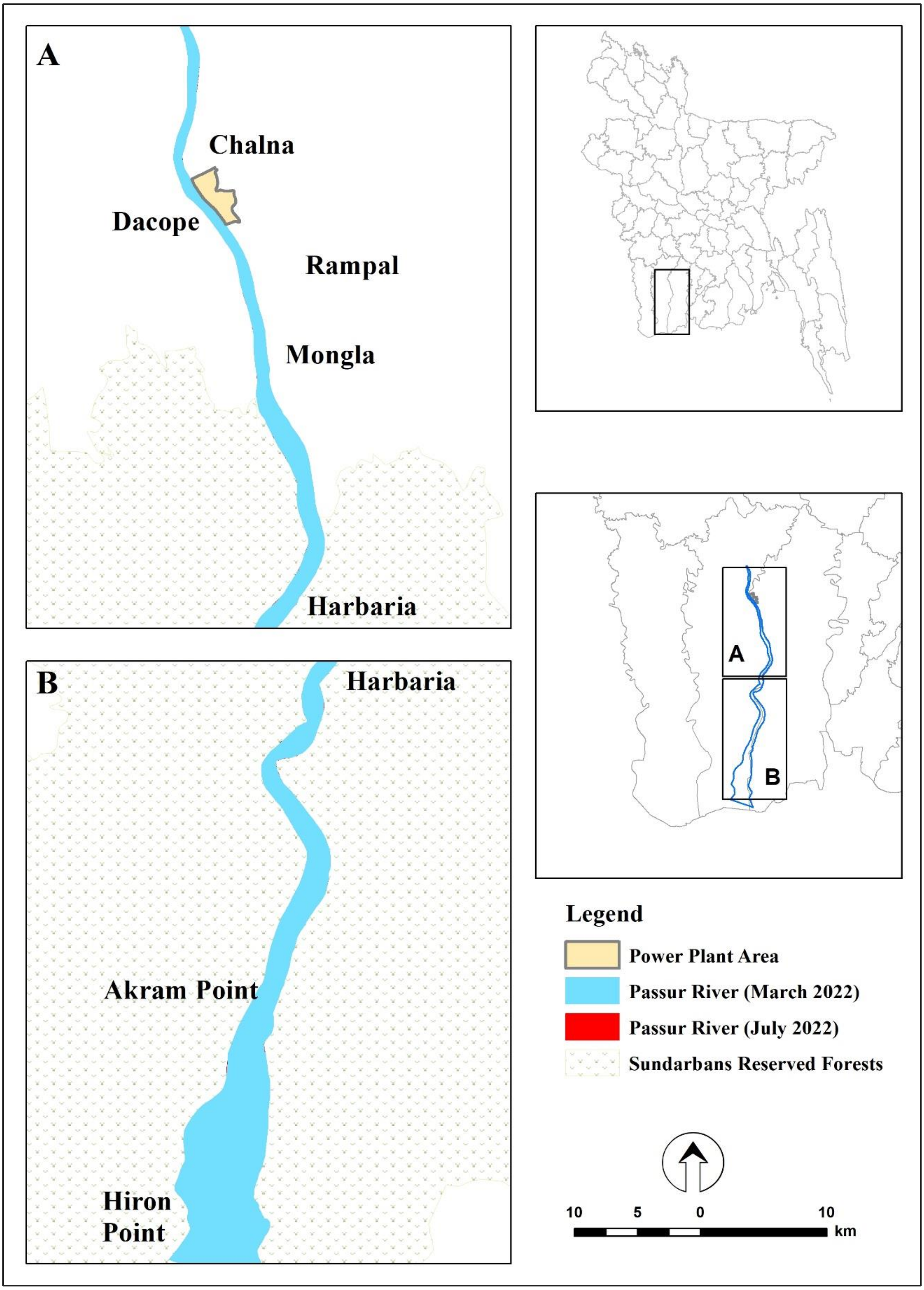


Figure 2.40: Riverbank erosion and accretion of the Passur River from March 2022 to July 2022

2.7.4 Tidal Water Level Data Analysis

For the monitoring of the tidal water level of the Hiron Point, Mongla Port and Rampal Jetty area, daily tidal water level data at Hiron Point and Mongla Port were collected from Bangladesh Inland Transport Authority (BIWTA) for the period from January 2022 to June 2022. Based on the relationship of the water level between Mongla Port and Hiron Point, the lag time and peak attenuation from Mongla Port to Rampal Jetty area were extrapolated.

Relation between Hiron Point and Mongla Port

For the assessment of lag time and peak attenuation between Hiron Point and Mongla Port, daily peak tidal water level was taken into consideration for the period from January to June 2022. After that, peak tidal water level data were plotted in the same graph both for Hiron Point and Mongla Port which is presented in **Figure 2.41**.

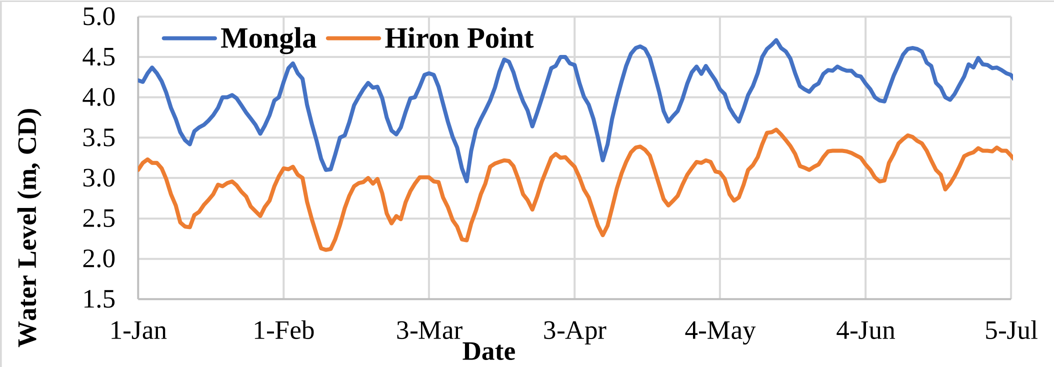


Figure 2.41: Peak water level at Hiron Point and Mongla Port for the period from January to June 2022

Moreover, maximum water level and corresponding time during full moon and no-moon were assessed to find out the lag time and peak attenuation between two stations (Mongla and Hiron Point) considering the distance between stations. For the assessment of the lag time and peak attenuation between two stations for two different quarters for the first half of the year 2022, tidal water level data from January to March 2022 as well as April to June 2022 were analyzed respectively. It was found that during no-moon period, peak water level of 3.14 m at Hiron Point at the beginning of the month of February 2022 travels through tide to the upstream at Mongla Port where its peak water level become 4.42 m on the same day (**Figure 2.42**). The peak attenuation between these two stations is 1.28 m. It was also found that the travelling time or lag time to reach this peak is around 1 hour 30 minutes.

Additionally, peak attenuation for the month of January 2022 and March 2022 are 1.18 and 1.27 respectively. While the lag time are 1 hour 0 minutes and 1 hour 30 minutes correspondingly for the month of January and March 2022 (**Figure 2.42**). The methodology is shown in **Figure 2.42**. It was measured that the distance between Hiron Point and Mongla Port is approximately 80 km. The average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from January to March 2022 is about 1 hour 20 minutes while the peak attenuation is nearly 1.24 m.

Furthermore, analysis was done for the period of April to June 2022 (**Figure 2.43**). It was found that the peak attenuation during the month of April and May are 1.25 and 1.01 respectively while it is only 1.10 for the month of June 2022. On the other hand, the lag time is same to reach peak water level from Hiron Point to Mongla Port for the month of April and May 2022 which is 1 hour 30 minutes. While it is 1 hour 20 minutes for the month of June 2022 (**Figure 2.43**).

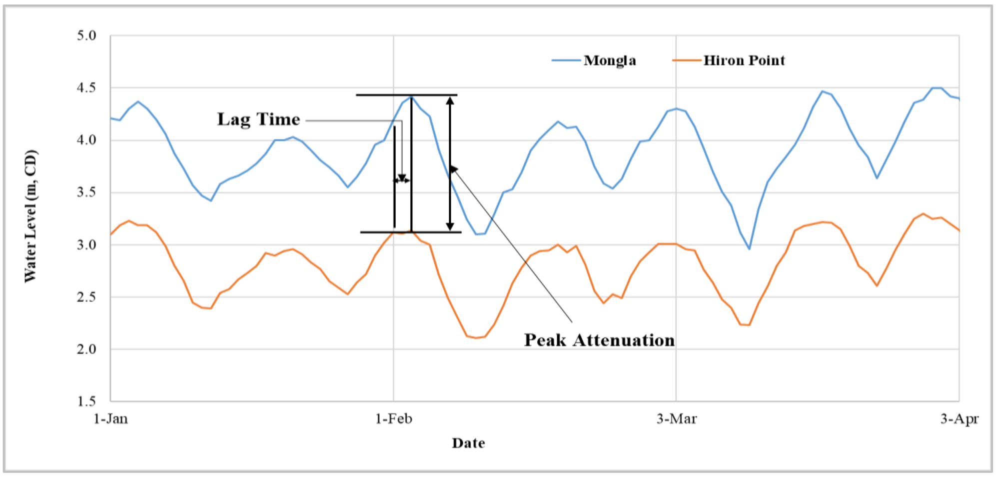


Figure 2.42: Process of calculation of lag time & peak attenuation during the period January-March 2022

In addition, average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from April to June 2022 is about 1 hour 27 minutes while the peak attenuation is nearly 1.12 m.

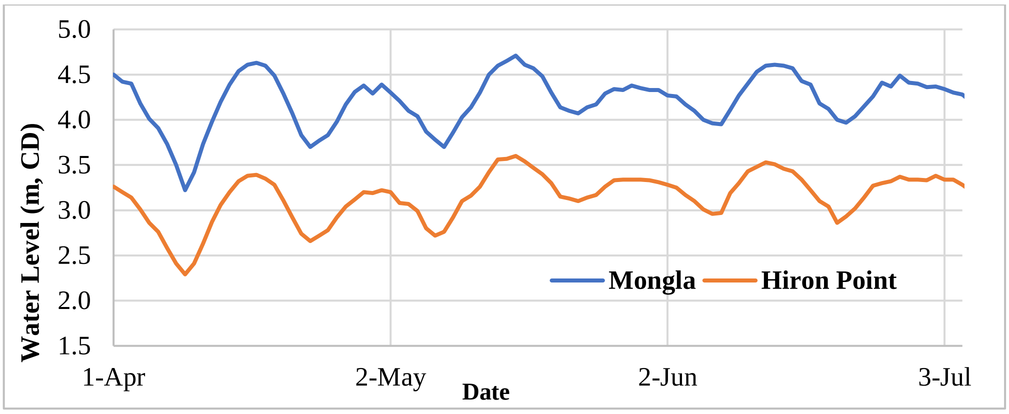


Figure 2.43: Peak water level at Hiron Point and Mongla Port for the period from April 2022 to June 2022

In summary, it was found that average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from January to June 2022 is about 1 hour 24 minutes while the peak attenuation is nearly 1.18 m. Relation between Hiron Point and Mongla Port was used to extrapolate the lag time and peak attenuation at Rampal Jetty area. The travelling distance from Mongla Port to Rampal Jetty area is 15 km. Based on the relation, it was estimated water level at certain peak at Hiron Point needs 1 hour 40 minutes to reach at Rampal Jetty area where peak attenuation is nearby 1.39 m.

2.7.5 Monitoring of Chemical properties of riverbed sediment

Sediment have been considered as an important environmental indicator for metal pollution in any natural ecosystem. The investigation of heavy metals in water and sediments could be used to assess the anthropogenic impacts and risks posed by waste discharges to the riverine ecosystems.

Therefore, sediment quality assessment is done during environmental issues monitoring of this project.

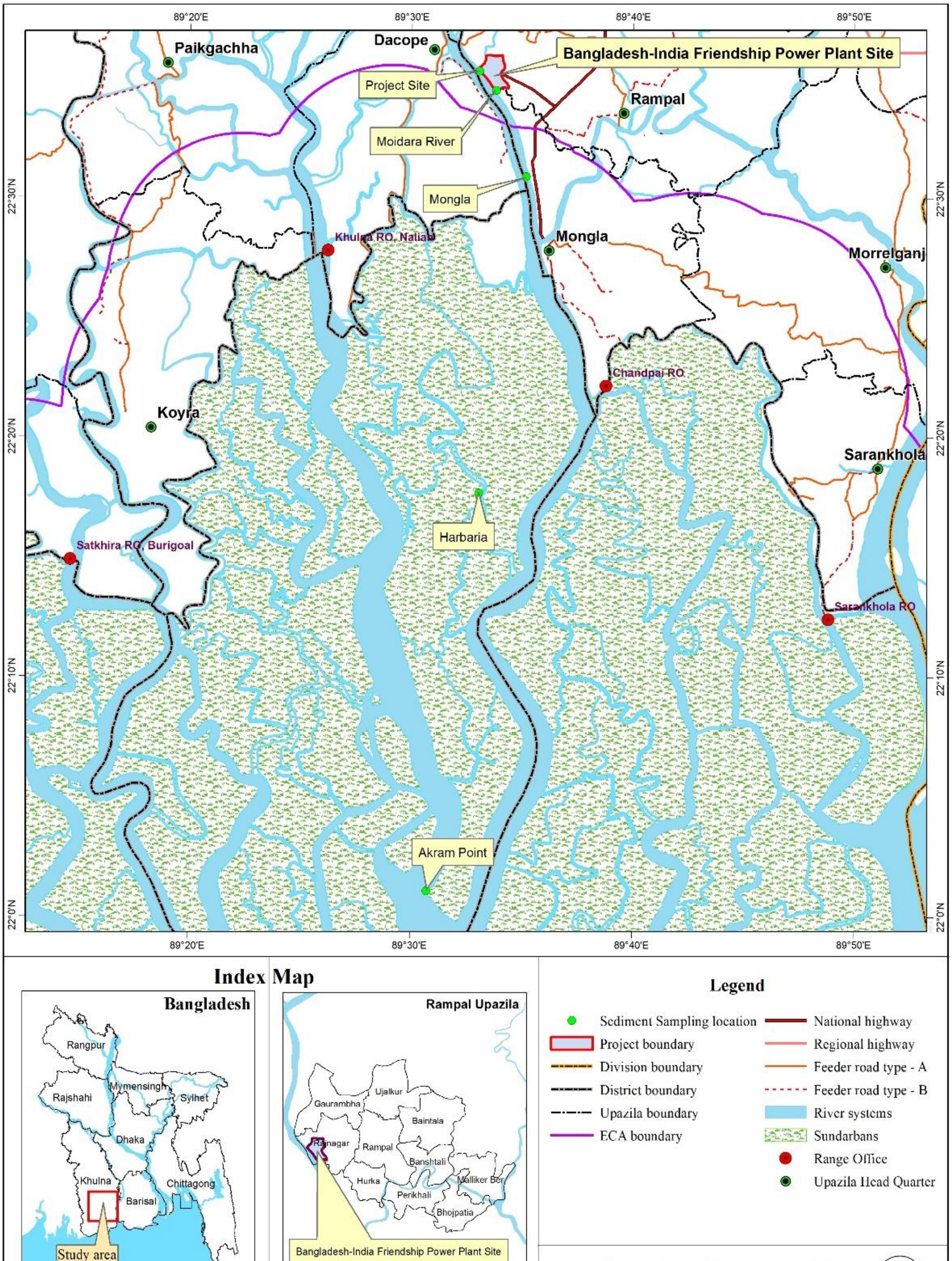


Figure 2.44: Locations of Sediment Sampling

2.7.6 Methodology

Sampling frequency

The frequency of monitoring for sediment quality is considered twice in a year (January and July). Accordingly, sediment sampling was done in 31st monitoring (January, 2022; considered as dry season). Data analysis of that sampling is incorporated in this report.

Monitoring indicators

The main objective of sediment quality monitoring is to find out the heavy metal accumulation in sediments due to anthropogenic activities (e.g. power plant activity and coal transportation). To find out the answers a biannual sediment monitoring is done in different sampling points. The major indicators for monitoring are heavy metals (As, Pb and Hg), pH and Sulfate. The selected heavy metals are mainly found in coal and assumed to pollute the sediment and water system during operation stage of power plant.

Location

The sampling locations are selected in both near places of project area and inside the Sundarbans. The sampling locations are stated in **Table 2.10**. Locations of collected samples are presented in **Figure 2.44**.

Table 2.10: Location of Sediment Monitoring Plan

Site No	Monitoring Indicators	Location	GPS (Decimal Degree)		Sampling Frequency	Methods/Tools /Techniques
			Northing	Easting		
1	Heavy metals (Arsenic-As, Mercury-Hg, Lead-Pb); pH and Sulfate (SO_4)	Project Site	N-22°35′21.2″	E-89°32′53.4″	Bi-yearly (January and July)	In situ field sampling and Laboratory Testing at BCSIR
2		Moidara River	N-22°34′33.4″	E-89°33′38.8″		
3		Mongla Port	N-22°30′57.1″	E-89°35′0.3″		
4		Harbaria	N-22°17′44.2″	E-89°32′53.4″		
5		Akram Point	N-22°01′07.6″	E-89°30′34.4″		

2.7.7 Process of Sediment Samples Collection

The sampling locations are selected on the basis of potential route of coal transhipment and assumed major polluted area. Project site and Moidara River is beside the power plant, while Harbaria and Akram point is inside the Sundarbans area where the coal transportation will take place. The sampling points were selected on the basis of TOR. Expert's judgement was also taken to validate the sampling points.

Sediment Samples Collection

Standard procedure was maintained during the collection of sediment samples. At least three replications were taken to ensure composite samples. Sediment samples were preserved in air-tight plastic bag for laboratory analysis.

Laboratory Analysis

Collected sediment samples have been handed over to BCSIR, Dhaka for laboratory analysis immediate after 33rd monitoring. After the analysis the data will be incorporated in 34th monitoring report.

2.8 Transportation Monitoring

2.8.1 Location of Traffic Survey

The traffic survey for this monitoring during the construction phase was conducted from January 29th to January 31st, 2022 on two weekdays and one weekend at three pre-selected locations around the project site. Weather was sunny on all the three days when the survey was conducted**.** The selected sites were Khudir Bottola and Gonai Bridge at Khulna Mongla Road and Gonabelai Bridge at Power Plant access road presented in the **Figure 2.45.**

2.8.2 Methodology

Traffic surveys were carried out at three distinct periods (morning - 7:00 AM to 10:00AM; noon-12:00 PM to 2:00PM and evening- 17:00 PM to 19:00PM) to understand the nature of traffic flow and traffic load on the preselected locations during different phase of the day. Vehicles were categorized based on the available vehicle types around the project area.

2.8.3 Traffic Volume Calculation

The survey results were used in computing the traffic volume of these roads in Passenger Car Unit (PCU). PCU is a matrix used in Transportation Engineering, to assess traffic-flow rate on roadways. A PCU is essentially the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car. While calculating the traffic volume in PCU, vehicle conversion factors suggested by the Roads and Highway department of Bangladesh were used as mentioned in **Table 2.11.**

Table 2.11: Vehicle Conversion Factors

Vehicle type	Factor
Bus	2.5
Minibus/Truck	2
Car/Microbus/Zeep	1
CNG	0.5
Rickshaw/Auto Rickshaw	0.8
Tempo/Human hauler	0.6
Motorcycle	0.3
Bicycle	0.2
Push Chart	4

2.8.4 Results of Monitoring

The summary results of vehicular movements at three different locations presented in **Table 2.12** shows that, according to the Passenger Car Unit (PCU) per hour, the Khulna-Mongla Highway receives the largest number of vehicles, compared to other surveyed roads.

Table 2.12: Calculated PCU in Three Locations at Three Different Time Period

Location	7:00 AM to 10:00AM	12:00 PM to 2:00PM	17:00 PM to 19:00PM
Khulna Mongla Road at Khudir Bottola	2760	2372	2056
Khulna Mongla Road at Gonai Bridge	720	688	943
Power Plant access road at Gonabelai Bridge	374	223	350

Source: Field Survey, May, 2022.

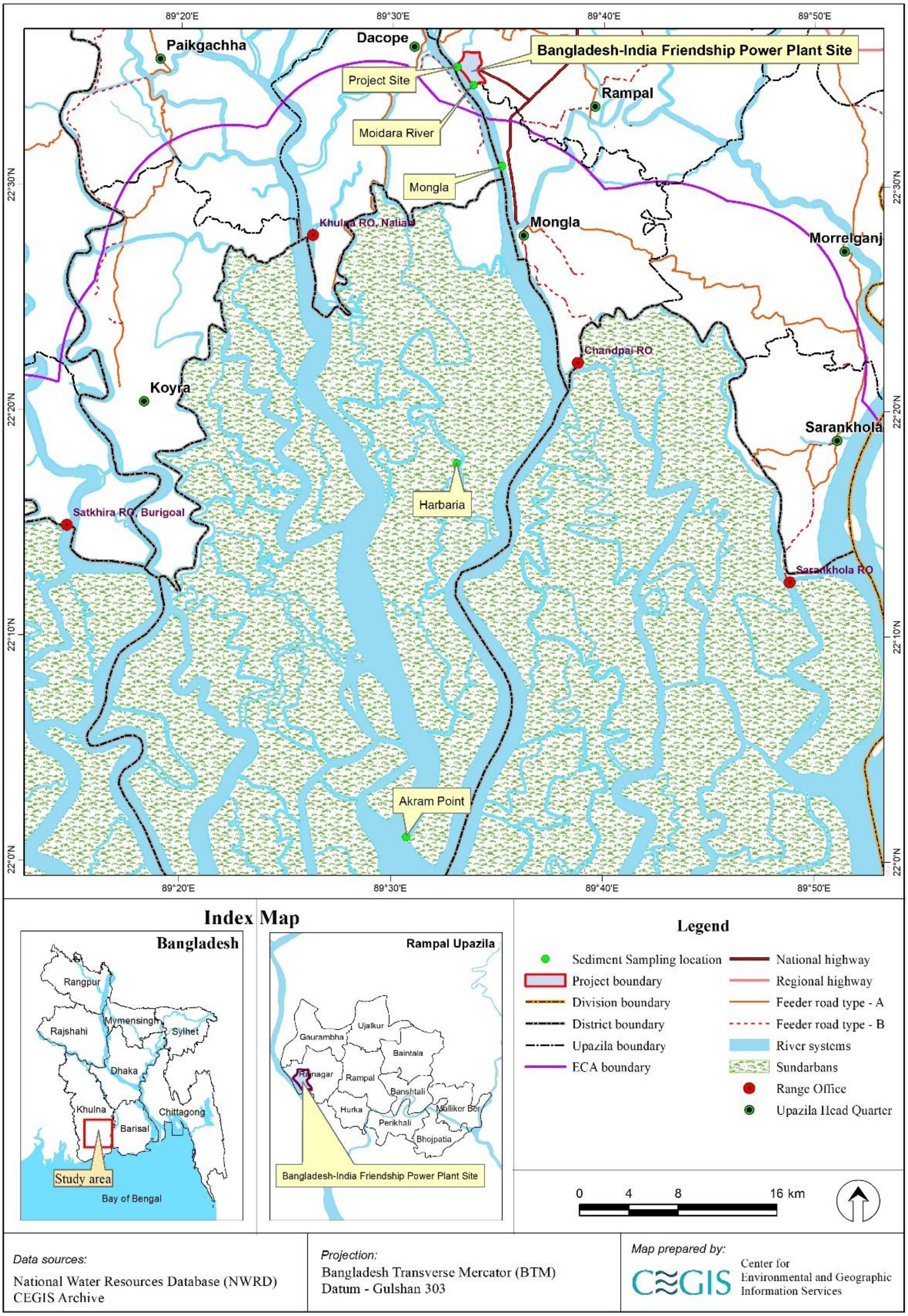


Figure 2.45: Locations of Traffic Survey

Similar to the earlier months monitoring report, vehicular movements were observed during the surveys were mostly for the regular construction activities of the Power Plant as the construction activities of the Power Plant are progressing heavily. Khulna Mongla Road at Khudir Bottola received the highest traffic volume compared to the other two locations namely Khulna Mongla Road at Gonai Bridge and Power Plant access road at Gonabelai Bridge. It is to be mentioned here that, during the afternoon time traffic volume at Khulna Mongla Road at Gonai Bridge and during morning and afternoon time Power Plant access road at Gonabelai Bridge were found to be lower whereas, during the other monitoring time at all the three locations, traffic volume has been found to be higher compared to the previous monitoring period. The detail survey findings regarding the traffic volume surveys as well as the detail calculations are attached in Table E1, E2 and E3 of Appendix-IV.

3. Biological Environment

Biological resources include all living organisms within an ecosystem which interact with one another as well as with the concerned physical environment. The biological resources around the project site were categorized into three major groups and monitored quarterly with the aim to establish baseline conditions to compare with the probable impact of proposed project in place. These groups include fisheries resources, ecological resources and Sundarbans Reserve Forest (SRF).

3.1 Fisheries Resources

The monitoring of 32 quarters for the session of 2014-15, 2015-16, 2016-17, 2017-18, 2018-2019, 2019-20, 2020-21 as well as of 2021-22 was completed and reported earlier. This chapter contains the findings of 33 quarters and a comparison with the earlier 32 quarters.

3.1.1 Methodology

Location of Monitoring Sites

In this phase, the monitoring activities were carried out in 13 pre-selected locations of which 10 locations were for capture fish habitat and three (03) were for shrimp/fish farms (culture fish habitat). Sampling sites for capture fishery were selected based on the available fishing grounds at upstream, midstream and downstream of the Passur River system. Sampling sites for culture fishery (shrimp/fish farms) were selected considering the project influence area. The fisheries resources monitoring locations are provided in **Table 3.1** and also shown in **Figure 3.1**.

Table 3.1: The Sampling Locations for Monitoring of Fisheries Resources

Site	Capture Habitat Location	Site	Capture Habitat Location
A	Akram Point	F	Chandpai
B	Haldikhali	G	Jongra
C	Charaputia	H	Mongla Port
D	Bhodra	I	Maidara
E	Harbaria	J	Chalna Point, Batiaghata
Site	**Culture Habitat Location**	**Site**	**Culture Habitat Location**
1	Bhekatkhali Khal, Rajnagar	3	Chunkuri-2
2	Kapasdanga-Muralia		

Selection of Parameters

According to ToR, five major components were selected for fisheries monitoring, such as fish habitat status, fish migration, fish diversity, shrimp/fish farm practices and fish production. Fish habitat status was monitored through investigating habitat suitability index in view of habitat classification based on length frequencies of different fish species, sensitivity of fish diversity and survival success of different life stages of fish to abiotic factors (water quality, bed material, morphological aspects and biotic factors (food cover). Fish migration status was monitored through assessing migratory fish species diversity, migration pattern, migration purpose, period and extent of migration etc. Species evenness, species richness and community structure were investigated for monitoring fish diversity. Shrimp/fish farm practice was monitored by viewing stocking pattern, growth rate and mortality rate. Fish production monitoring was divided into capture and shrimp/fish farm production.

Fish Habitat Status

Fish habitat status was monitored through determination of Habitat Suitability Index (HSI) by applying numerical habitat model based on the habitat classification and sensitivity of fish diversity and survival success of different life stages of fish to abiotic and biotic factors. Fish habitat classification was analyzed by calculating Euclidean Distance among sampling sties. Moreover, the similarities in species composition among the sites were analyzed using the Jaccard Index (JI) for estimating the extent of similarity between pairs of data sets.

Fish Migration

Migratory species were identified from the sampling sites by analyzing the common species found in the catch assessment survey and based on IUCN list.

Fish Diversity

Fish diversity was surveyed by Catch Per Unit Effort (CPUE) method. The fish individuals were counted according to the length of each species from the samples. Diversity was estimated by analyzing Shannon-Weiner Index ranges from 0 to 1. Fish species richness (FSR) was analyzed using the Simpson's Index that generates two types of values. The first one includes values from 0 to 1 expressing normalization scores for species richness status and the second one includes values from one (01) to values equal to the total number of species found in the sample which suggests that how many species are dominant in this fish community. Fish community structure has also been analyzed through counting the length-wise fish individuals.

Fish-Shrimp Culture Practice

For monitoring shrimp/fish farm, three farms within the direct impact zone of the proposed Power Plant were surveyed. Stocking pattern of the shrimp/fish farm is the major issue for successful production, because of having natural genetic resources from the wild source of the Passur River System. Moreover, mortality rate should be minimized for getting more economical output from the farms. So, stocking pattern and mortality rate and its causes were surveyed intensively.

Fish Production

Fish production for riverine fish was surveyed through CPUE. The information on the species-wise production of shrimp/fish farm was collected from the selected farms for the last catch.

3.1.2 Status of Monitoring

Followed by the quarter monitoring of the 2014-15, 2015-16, 2016-17, 2017-18, 2018-19, 2019-20 and 2020-21 (up to 31st quarter monitoring), 32nd quarter monitoring of session 2021-22 was conducted during the period from 24 may -01 June, 2022. No fishing activities were observed at Akram Point (A), Haldikhali (B), Charaputia (C), Bhodra Khal (D), Harbaria (E) and Jongra (G)) during the field visit in this quarter monitoring as this time was the government-imposed fishing ban period.

Fish Habitat Status

Fish habitat status has also varied in the view of habitat classification and habitat use pattern of different life stages of different fish species (**Table 3.2**).

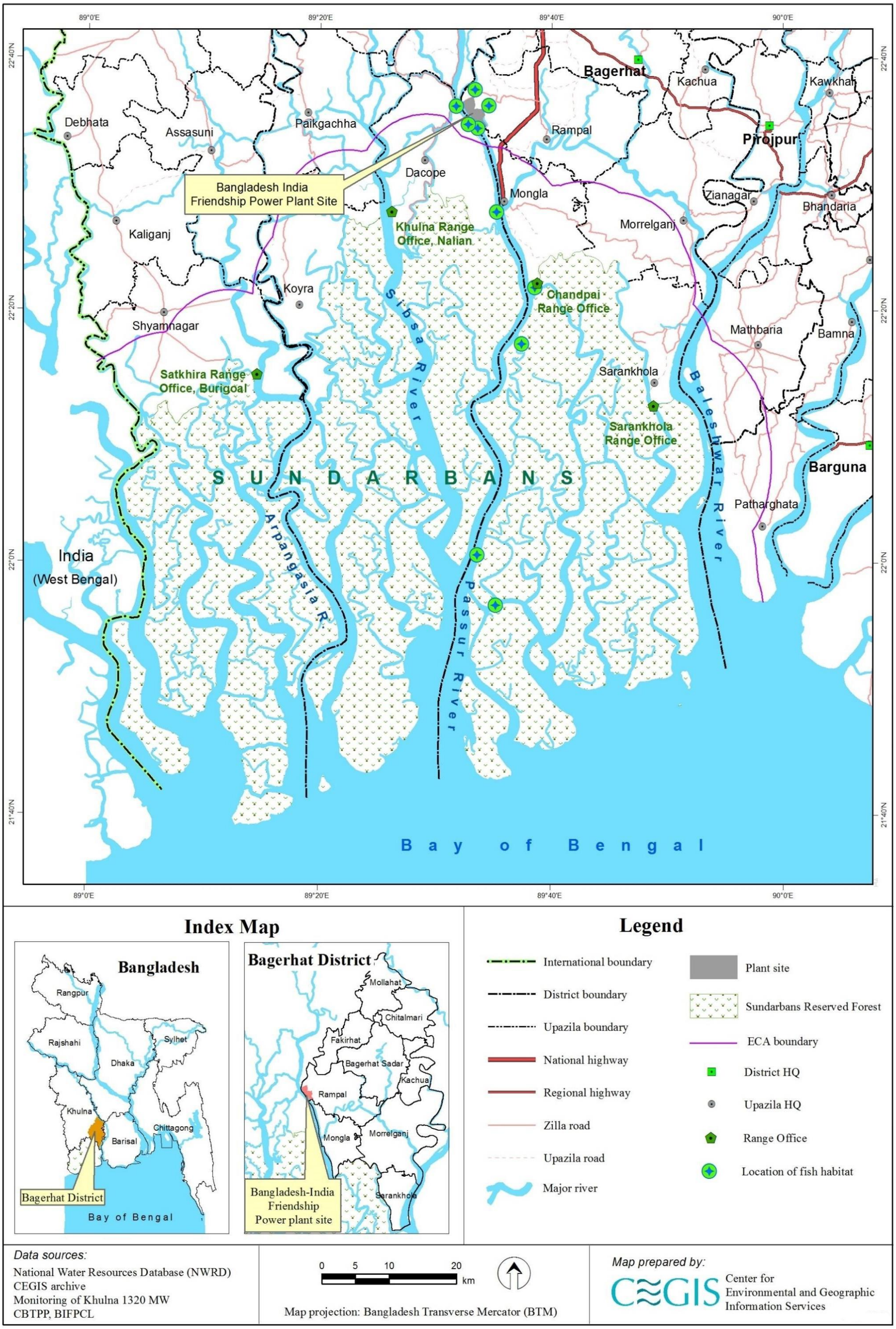


Figure 3.1: Fisheries Resources Monitoring Locations

Table 3.2: Classification of habitat use of 10 sampling sites

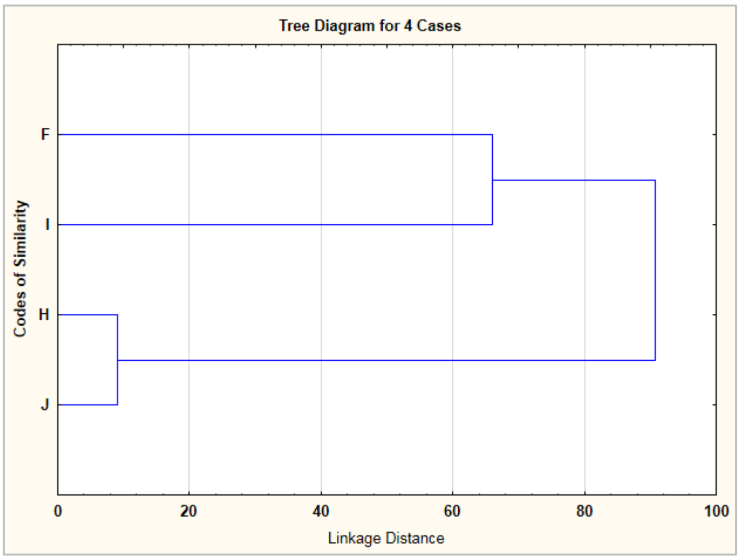
Monitoring Quarter	Type of Habitat Use
1st (April, 2014)	• Grazing Ground • Grazing and Breeding Ground
2nd (July, 2014)	• Grazing Ground • Spawning and Nursery Ground
3rd (October, 2014)	• Grazing Ground • Grazing and Breeding Ground • Spawning, Nursery and Grazing Ground
4th (January, 2015)	• Grazing Ground • Grazing and Breeding Ground • Spawning, Nursery and Grazing Ground
5th (April, 2015)	• Grazing Ground • Nursery Ground • Spawning and Nursery
6th (August, 2015)	• Grazing, Breeding Ground • Spawning, and Nursery Ground
7th (October, 2015)	• Grazing Ground, • Nursery Ground and • Growing and Feeding
8th (January, 2016)	• Nursery and Feeding Ground • Growing and Feeding
9th (April, 2016)	• Spawning and Nursery Ground • Feeding and Growing Ground
10th (July, 2016)	• Nursery Ground • Feeding and Breeding Ground
11th (October, 2016)	• Breeding and Spawning Ground • Feeding and Grazing Ground
12th (January, 2017)	• Grazing and Spawning Ground • Nursing Ground
13th (April, 2017)	• Grazing and Feeding Ground • Nursing Ground
14th (October, 2017)	• Grazing and Feeding Ground • Nursing Ground
15th (January, 2018)	• Grazing and Feeding Ground • Nursing Ground
16th (April, 2018)	• Feeding ground • Growing ground • Nursing ground
17th (July, 2018)	• Spawning and Nursery Ground • Nursery Ground with Feeding and Growing Capacity • Growing and Feeding Ground • Omni-ground
18th (November, 2018)	• Ground for Maturation • Omni-Ground: Nursery and Feeding Ground/Migratory Route; Ground for Maturation; Growing and Maturation Ground; Maturation Ground for Juveniles
19th (February, 2019)	• Ground for Feeding

Monitoring Quarter	Type of Habitat Use
	• Omni-Ground including Nursery Ground and Ground for Maturation
20th (April, 2019)	• Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
21st (July, 2019)	• Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
22nd (November, 2019)	• Spawning and Nursery Ground • Omni-Ground including Feeding and Maturation Ground
23rd (February, 2020)	• Nursery Ground • Spawning ground • Ground for maturation and feeding
25th (July, 2020)	• Nursery Ground • Ground for maturation and feeding
26th (November, 2020)	• Nursery Ground • Omni-Ground including Spawning and Nursery Ground, and Maturation Ground
27th (January, 2021)	• Nursery Ground • Omni-Ground including Spawning and Nursery Ground, and Maturation Ground
28th (April, 2021)	• Spawning and Nursery Ground • Ground for Maturation and Feeding
29th (September, 2021)	• Nursery Ground • Ground for Maturation and feeding
30th (November, 2021)	• Feeding Ground • Omni Ground including Nursery ground, and Maturation and Feeding Ground
31st (February, 2022)	• Nursery Ground • Maturation and Feeding Ground
32nd (May, 2022)	Spawning and Nursery Ground Maturation Ground

During the 32nd quarterly monitoring conducted in May of 2021-22 Session, the sampling sites were divided into two major classes as shown in **Figure-3.2**.

1. Spawning and Nursery Ground: The sampling sites, Chandpai (F) and Maidara Point (I) were found to support mostly length groups of 2-3cm, 3-5cm and 5-10cm of available fish species. Field findings revealed that the mentioned sampling sites were found to be used as spawning and nursery grounds of observed fish species.

2. Feeding and Maturation Ground: The sampling sites, Mongla (H) and Chalna Point (J) were found to support mostly length groups of 3-5cm and 5-10cm of available fish species. Field findings revealed that the mentioned sampling sites were found to be used as feeding and maturation ground of observed fish species.

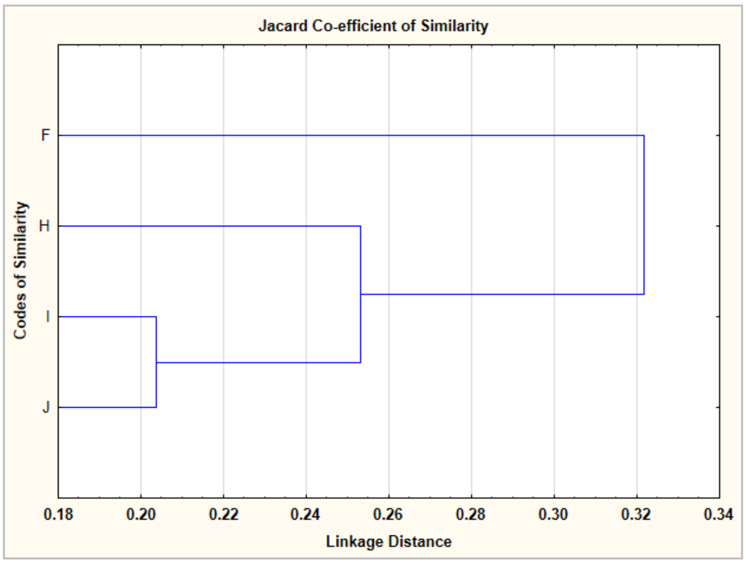


33rd Monitoring, July 2022

(Note: Life stages are identified through length measurement of the fish individuals)

Figure 3.2: Habitat classification on the basis of different life stages of fish species

The dendogram indicated the distances among the JI (Jaccard Coefficient Index) indices which are opposite to the JI values. It was found that the length-wise distribution relationship varied not only with the seasons but also with the year to year. In this quarterly monitoring in 2022-23, the JI value between the Chandpai (F) and Mongla (H) sampling sites were the highest (**Figure 3.3**) which indicates the maximum similarity in species occurrence between the two sites out of 04 sampling sites of available fishing.



33rd Monitoring (July, 2022)

Figure 3.3: Dendogram showing similarity in binary species composition in three sampling sites

Fish Diversity

Shannon-Weiner Index

In this monitoring year of 2022-23, species evenness also varies among the sampling sites. Highest Shannon-Weiner index was found at Chandpai (0.91) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at Mongla Point (0.36) (shown in **Table 3.3** and **Table 3.4**). It has also been found that both the number of fish species found in in-situ catch and the evenness of their distribution within the sampling sites show high variation with the changing seasonal and yearly bio-physical conditions.

Fish Species Richness (FSR)

Fish species richness was identified through Simpson's Index[5]. Considerable difference is noticed in the fish species richness (FSR) in different habitat classes (**Table 3. 5** and **Table 3. 6** and **Figure-3.5**).

In this monitoring phase, species richness varies with the sampling sites. Maximum FSR was obtained at Chalna Point (n=13), while very low FSR was recorded at Chandpai (n=06). Different scenarios of richness were found in this quarter in comparison to the previous monitoring years. Among habitats in the up-stream of the Passur River system, Chandpai was home to rich assemblage of *Chamua Chingri, Harina Chingri* and *Goda Kathali*, Mongla was rich of *Harina Chingri, Chela* and *Dogri,* Maidara was rich assemblage of *Harina, Golda, Chaka Chingri* and *Chela,* Chalna Point *was rich of Paissa, Chapila, Poa and Harinai Chingri.*

[5]Simpson's index is a method to calculate the community characteristics of fish in a particular habitat. It is mainly used to know about the species richness of a particular habitat to tell how many species are rich in their abundance. The value of this index ranges from 0 to 1. There is other kind of value which is described in the methodology section. The second value is mainly used to measure the species richness in the sampling sites.

Table 3.3: Site Wise Species Diversity using Shannon–Weiner Index (1st to 13th QM)

Site	Species Number													Shannon-Weiner Index*												
	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th QM	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th QM
A	33	0	13	7	3	0	10	15	0	0	1	2	2	0.5	0	0.7	0.6	1	-	0.6	0.4	0	0	0	0.9	0.74
B	12	0	24	14	0	0	11	3	0	0	1	0	5	0.9	0	0.6	0.4	0	-	0.6	0.6	0	0	0	0	0.37
C	2	12	9	0	11	26	18	24	17	0	23	10	18	0.3	0.77	0.4	0	0.8	0.6	0.5	0.7	0.6	0	0.6	0.6	0.79
D	12	22	15	26	27	24	20	25	8	19	32	27	15	0.3	0.78	0.7	0.5	0.7	0.7	0.5	0.7	0.6	0.6	0.6	0.8	0.76
E	7	13	10	11	6	16	9	9	15	12	5	4	4	0.4	0.6	0.8	0.8	0.2	0.7	0.9	0.4	0.7	0.5	0.7	0.7	0.51
F	3	13	6	4	10	8	14	6	7	5	7	12	9	0.8	0.77	0.5	0.6	0.7	0.4	0.8	0.7	0.8	0.7	0.9	0.9	0.53
G	6	3	5	7	18	3	8	6	6	4	12	3	15	0.7	0.82	0.7	0.7	0.2	1	0.7	0.8	0.6	0.9	0.2	0.7	0.67

Table 3.4: Site Wise Species Diversity using Shannon–Weiner Index (14th to 33rd QM)

Site	Species Number																			Shannon-Weiner Index																		
	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33 QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33 QM
A	0	0	3	0	8	0	2	0	0	0	0	7	18	0	6	20	25	0	0	0	0	0.92	0	0.16	0	0.65	0	0	0	0	0.64	0.59	0	0.49	0.61	0.50	0	0
B	0	0	0	0	2	0	-	0	0	0	0	0	0	0	0	7	25	0	0	0	0	0	0	0.92	0	-	0	0	0	0	0	0	0	0	0.73	0.52	0	0
C	0	0	12	0	0	24	11	0	0	10	0	4	28	4	10	34	33	0	0	0	0	0.69	0	0	1.69	0.86	0	0	0.78	0	0.82	0.53	0.88	0.82	0.83	0.54	0	0
D	0	0	0	0	0	0	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	17	12	0	2	0	0	2	0	9	0	3	13	25	12	0	0	0	0	0	0.31	0.73	0	0.99	0	0	0.72	0	0.29	0	0.74	0.79	0.73	0.71	0	0
F	6	17	0	0	0	13	22	19	11	11	0	12	7	20	0	10	13	19	6	0.85	0.81	0	0	0	1.44	0.74	0.5	0.81	0.56	0	0.70	0.18	0.37	0	0.68	0.59	0.84	0.91
G	81	29	21	16	19	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0.62	0.74	0.78	0.85	0.34	0	0.58	0	0	0	0	0	0	0	0	0	0	0	0
H	112	13	3	18	2	13	-	5	11	10	11	0	3	0	9	1	11	13	8	0.54	0.21	0.55	0.49	0	1.44	-	0.14	0.76	0.40	0.55	0	0.12	0	0.85	0	0.06	0.31	0.36
I	3	13	12	10	17	11	8	9	11	12	6	16	0	18	1	1	12	4	11	0.88	0.33	0.21	0.65	0.85	1.46	0.14	0.52	0.80	0.54	0.45	0.41	0	0.52	0	0	0.67	0.69	0.79
J	4	5	10	14	11	21	12	14	9	8	15	11	12	4	0	8	0	10	13	0.78	0.32	0.54	0.52	0.52	0.98	0.50	0.71	0.50	0.64	0.46	0.53	0.19	0.96	0	0.58	0	0.37	0.83

**According to Shannon-Weiner Index, 0-0.30: Low diversity/equally distribution (VH); 0.31-0.50: Moderate Diversity (M); 0.51-0.80: High Diversity (HD) and 0.80-1.0: Very High Diversity (VHD)*

Table 3.5: Site wise Rich Species Number (1st to 12th QM)

Site	Location	No. of Rich Species											
		2014-2015				2015-2016				2016-2017			
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
A	Akram Point	4	0	4	3	3	-	3	2	0	0	1	2
B	Haldikhali	7	0	4	2	0	-	3	2	0	0	1	0
C	Harbaria	1	5	2	0	4	4	3	6	4	0	4	2
D	Chandpai	2	2	5	4	5	8	3	7	4	6	3	7
E	Mongla Point	1	10	4	5	3	6	4	2	4	7	3	2
F	Maidara	3	6	2	2	4	2	4	2	3	2	3	3
G	Chalna Point	3	3	2	3	1	3	3	4	2	4	1	2

Table 3.6: Site wise Rich Species Number (13th to 33rd QM)

Location	No. of Rich Species																			
	2017-18			2018-19				2019-20				2020-21				2021-22				2022-23
	13th	14th	15th	16th	17th	18th	19th	20th	21th	22th	23th	25th	26th	27th	28th	29th	30th	31th	32nd	33rd
Akram Point	2	0	0	4	0	1	0	2	0	0	0	0	2	4	0	1	3	5	0	0
Haldikhali	1	0	0	0	0	3	0	-	0	0	0	0	0	0	0	0	4	4	0	0
Charaputia	0	0	0	4	0	0	4	7	0	0	5	0	3	3	2	2	6	4	0	0
Bhodra	0	0	0	0	0	0	0	-	0	0	1	0	0	0	0	0	-	-	0	0
Harbaria	7	6	6	0	2	4	0	2	0	0	2	0	1	0	2	4	4	4	0	0
Chandpai	6	5	7	11	9	2	3	7	4	6	2	0	4	1	2	0	3	5	9	5
Jongra	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	-	-	0	0
MonglaPoint	2	2	1	2	3	0	3	-	1	5	2	3	0	1	0	3	-	3	1	2
Maidara	1	3	2	1	3	9	3	1	1	6	3	2	3	0	3	1	1	4	2	4
ChalnaPoint	4	2	1	2	3	2	2	2	3	2	3	2	3	1	2	0	2	-	2	5

Source: CEGIS Field Survey, April 2014 - May 2022

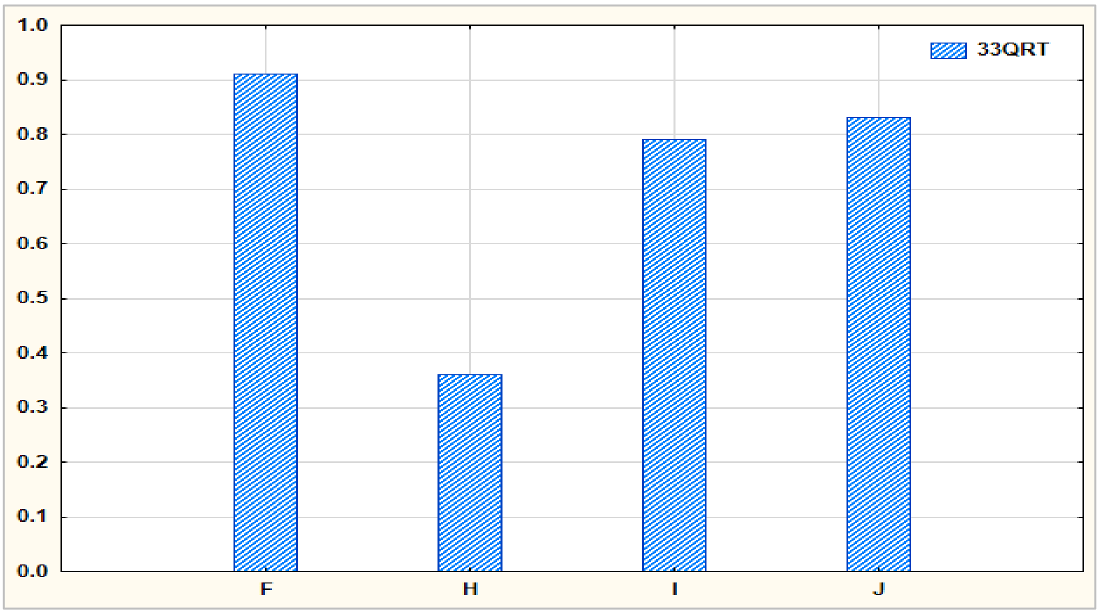
Ilish (*Tenualosa ilisa*)

Poa (*Johnius coitor*)

Bagda Chingri (*Penaeus monodon*)

Paissa (*Liza persia*)

Figure 3.4: Different available observed fish species in 31st quarterly monitoring tier



(FSR is identified though Simpson's Index)

Figure 3.5: Site-wise fish species richness (FSR) in the Passur River System

<u>*Fish Community Structure*</u>

Fish community structure was analyzed through counting the length-wise fish individuals (**Figure 3.6**). The following Table **D.3** of **Appendix IV** and **Figure 3.6** for 33rd quarter of monitoring shows that fry were dominant at Maidara Point. Juvenile were at Chandpai and Chalna Point but adult age group were dominant at Mongla and Maidara Point.

Note: N.B.: Colour ranges from deepest green to deepest red. 0-4.99% Occurrence signifies Deepest Green; 5-9.99%-Shaded Green; 11-14.99%-Normal Green; 15-19.99%-Light Green; 20-24.99%; 25-29.99%-Lightest Green; 30-34.99%; 35-39.99%; 40-44.99; 45-49.99; 50-54.99-Light Magenta; 55-59.99-Deep Magenta; 60-64.99%; 65-69.99%; 70-74.99%; 75-79.99%-Light Red; 80-84.99%-Deep Red; 85-89.99%; 90-94.99%; 95-100%-Deepest Red

Figure 3.6: Habitat Distribution of Different Life Stages of Fish Species

Fish Migration

Migratory Species Diversity

Migratory species were identified by analyzing the common species available in the regular catch from the sampling sites. Fish species like Chapila, Harina and Poa attain the maximum abundance among the migratory fish species observed in the 33rd quarter of monitoring. The relative abundance of the migratory species is given below in the **Figure 3.7**.

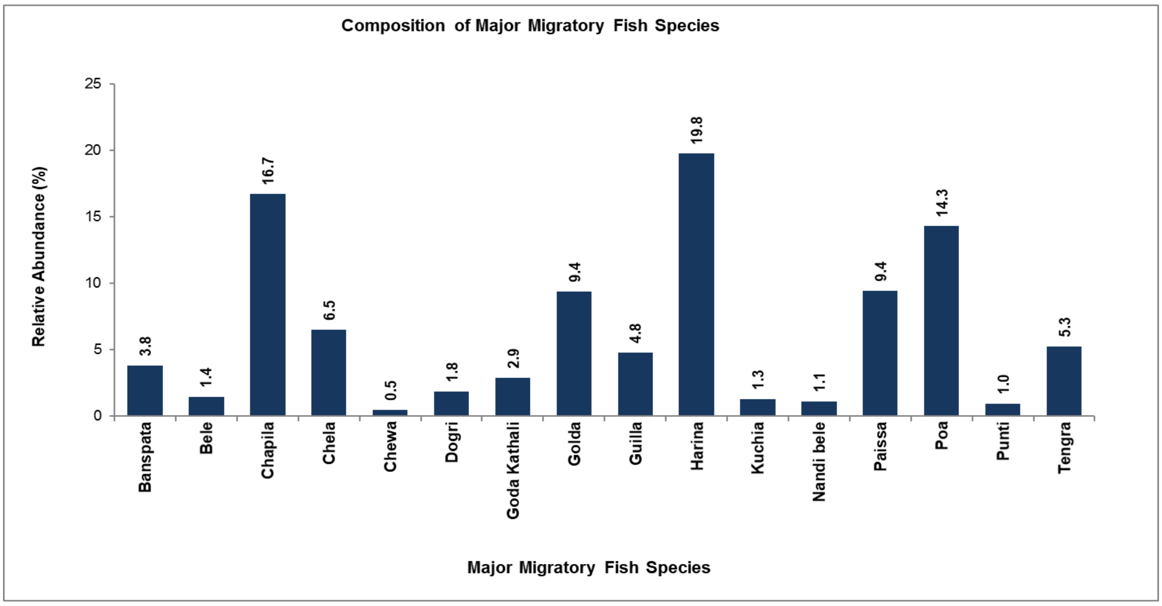


Figure 3.7: Relative abundance of major migratory fish species in sampling sites

Migration Extent, Time and Purpose

Major fish species showed interesting pattern in distribution for exploiting different purposes mentioned in the following table all along the sampling sites. Among migratory species, Harina was observed to migrate long distance (**Figure 3.8 and Table D.4 of Appendix-IV**).

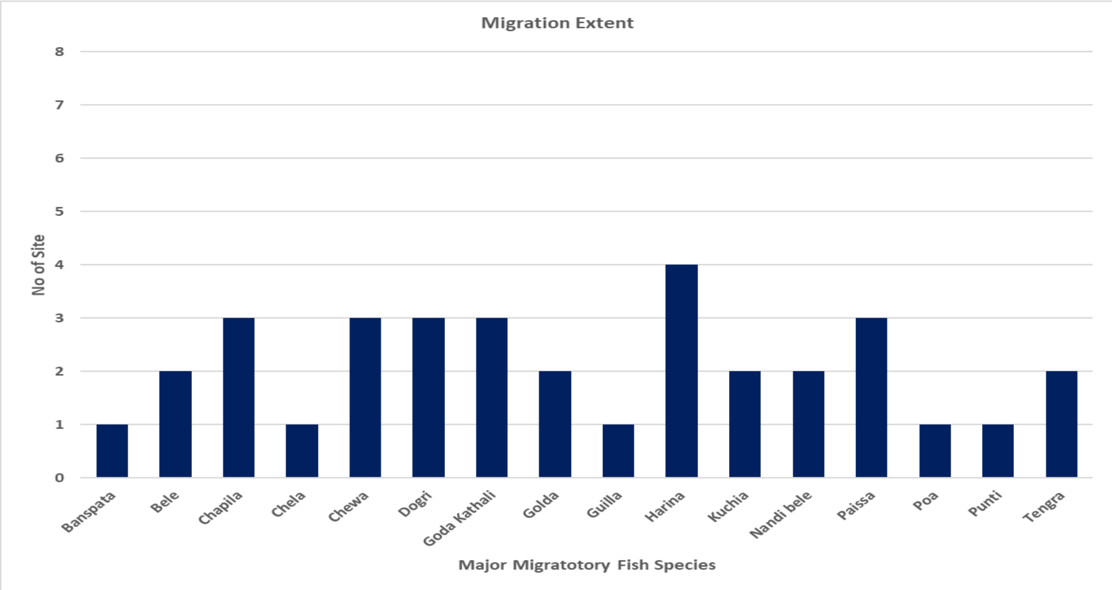


Figure 3.8: Migration extent of major migratory fish species in sampling sites

Shrimp/Fish Farm

Three farms situated in the direct impact zone of Power Plant were surveyed for monitoring shrimp/fish. Stocking pattern of the shrimp/fish farm is one of the major issues for successful production because of having natural genetic resources from the wild source of the Passur River System. Moreover, maximization of growth rate and minimization of mortality rate should be ensured for getting more economical output from the farms. So, stocking pattern, growth rate and mortality rate and its causes were surveyed intensively.

Stocking Pattern

It is reported by the farmers of the shrimp farms that maximum stocking in case of Bagda Chingri was found at Rajnagar Gher followed by Chunkuri-2 and Kapashdanga Gher. On the other hand, stocking density in respect of Paissa was highest at Chunkuri-2 followed by Kapashdanga gher (**Table 3. 7).**

Table 3.7: Stocking Pattern of Fish/Shrimp Farm

Name of shrimp farm	Name of species	Stocking Density (No/ha)	Stocking date
Rajnagar *(42.09 ha)*	Bagda	14,255	June, 2022
Kapashdanga-Muralia*(115.7ha)*	Bagda	3,989	June, 2022
	Paissa	1296	July, 2022
Chunkuri-2 *(6.07ha)*	Kharolla	1647	June, 2022
	Paissa	3295	June, 2022
	Bagda	6590	June, 2022
	Patari	329	July, 2022

Shrimp/Fish Growth Rate and Mortality

During the 33rd quarter of monitoring, the highest growth rate was observed in Kapashdanga Gher. (**Table 3.8** and **Table 3.9)**.

Table 3.8: Growth Rate and Mortality of Fish/Shrimp (1st to 13th QM)

Gher No.	1st QM (Apr 2014)		2nd QM (Jul 2014)		3rd QM (Oct 2014)		4th QM (Jan 2015)		5th QM (Apr 2015)		6th QM (Aug2015)		7th QM (Oct 2015)		8th QM (Jan 2016)		9th QM		10th QM		11th QM		12th QM		13th QM		14th QM		15th QM		16th QM	
	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)
1	0.3	15-20	0.2	40	0.25	50	-	-	-	30	0.18	25	0.20	60	-	-	-	-	0.2	20	0.20	60	-	-	-	30	0.03	50	-	-	0.28	0.28
2	0.3	30-35	0.3	94	0.25	10	-	-	-	-	0.14	20	0.15	100	-	-	0.21	15	0.3	40	0.25	50	-	-	-	10	0.38	35	-	-	0.42	0.42
3	0.2	25-30	0.2	25	0.20	65	-	-	-	10	0.15	50	0.25	20	-	-	0.17	30	0.15	30	0.20	30	-	-	-	25	0.02	25	-	-	0.4	0.4

Table 3.9: Growth Rate and Mortality of Fish/Shrimp (15th to 32nd QM)

Gher No.	17th QM		18th QM		19th QM		20th QM		21th QM		22st QM		23nd QM		25rd QM		26th QM		27th QM		28th QM		29th QM		30th QM		31st QM		32st QM		33 QM	
	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)
1	0.38	80	-	-	-	-	0.35	50	0.38	-	0.35		-	-	0.38	-	0.42	35	-	-	0.41	20	0.38		0.36	-	-	-	0.36	-	0.39	20
2	0.30	70	0.30	80	-	-	0.45	80	0.44	-	0.45		-	-	0.48	-	0.45	30	-	-	0.35	90	0.42		0.44	-	-	-	0.43	-	0.42	25
3	0.20	50	-	-	-	-	0.34	40	0.36	-	0.37		-	-	0.32	-	0.38	90	-	-	0.39	30	0.4		0.37	-	-	-	0.33	-	0.37	60

Source: CEGIS Field Survey, 2014-202

Fish Production

Capture Fish Production

The present study revealed that the highest catch susceptibility was also found in case of Ber Jal (2.75 kg/haul) shown in **Table 3.10**. In 33rd quarter monitoring, the highest productivity was found at Chalna Point followed by Maidara (**Table 3.11**). It is to be noted that fries found in catch were not considered in the productivity assessment.

Table 3.10: Total Catch in Different Gears in the Sampling Sites

Site	Habitat	Gear Name/Type	Haul Duration (hr)	No of Haul	kg/haul
F	Passur River	Khepla Jal	0.08	10	0.06
H	Passur River	Thela Jal	0.08	10	0.03
		Thela Jal	0.08	12	0.04
I	Passur River	Khepla Jal	0.05	10	0.04
		Box Net	0.25	15	0.01
		Net Jal	0.08	5	0.13
J	Passur River	Ber Jal	1	1	2.75
		Khepla Jal	0.05	5	0.07

*Source: Catch assessment survey, CEGIS, July 2022; ** Weight of Fry is not considered for catch assessment*

Table 3.11: Total Catch in the Sampling Sites

Sampling Site	Total Catch (kg)												
	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th QM
A	28	0	3	28.7	6	0	20	276.2	0	0	10	2	2
B	65	0	1	3.3	0	0	10	12.8	0	0	4	0	0.25
C	1,559	0.5	8	8.7	1.05	0.33	19.5	173.6	2.8	0	2.6	10	8.13
D	0	12	3	30	10.5	5.08	10.75	189	0	12	18	56	77.5
E	0	0.6	5	0	0.5	0.4	0.6	7.8	5	7.5	2.6	0	0
F	0	1.2	13	3.7	1.5	0.7	0.8	0	1.5	0.8	0.5	0	0.3
G	0	1.6	4	0.7	2.9	0.83	0.825	70	1	0.8	0.1	0	0.12

Sampling Site	Total Catch (kg)																		
	14 QM	15 QM	16 QM	17 QM	18 QM	19 QM	20 QM	21 QM	22 QM	23 QM	25 QM	26 QM	27 QM	28 QM	29 QM	30 QM	31 QM	32 QM	33 QM
A	0	0	17	0	16	0	0.40	0	0	0	0	30.5	3.5	-	1.1	27	30	-	-
B	0	0	0	0	1	0	0.00	0	0	0	0	-	-	-	0	13	14.5	-	-
C	0	0	1.50	0	0	93	17.50	0	0	4.6	0	18.9	33	12.7	5.85	23	20	-	-
D	0	0	0	0	0	0	0.00	0	0	1.35	0	-	-	-	0	-	-	-	-
E	1.5	2.56	0	0.1	2	0	0.50	0	0	1.17	0	2.07	-	47.5	11.34	52	4	-	-
F	0	0	0	0	0	0	0.00	0	0	0	0	0.6	-	2.3	0	-	-		0.6
G	10.5	37.67	3	4	27	0	0.00	0	0	0	0	-	-	-	0	-	-	-	-
H	0	0	0.33	22	0	5	0.00	11.5	0.2	20	10.5	-	4	-	6.1	0.25	1	-	0.8
I	0.4	0.67	0.13	3	5	1.2	0.00	0.5	1.7	0.4	3.0	5	-	3.5	7.75	2.5	0.1	1.2	1.25
J	0.3	0	1	0.25	1.2	0.6	0.17	1.6	0.8	0	6.3	7.5	-	0.3	0	3.25	-	1.3	3.1

**Average Weight 0.15kg/mud crab and average weight 0.6 kg/mud eel*

*** Weight of Fry is not considered for catch assessment*

Figure 3.9: Fishing gears observed during 33rd quarter monitoring

<u>*Culture Fish Production*</u>

The present study on shrimp/fish farm in the 33rd quarter monitoring phase showed that the highest production was observed in the Gher of Kapashdanga (Table D-5, Appendix-1).

3.2 Monitoring of Ecosystem and Bio-diversity

3.2.1 Indicators Selection

Indicators for terrestrial and aquatic ecosystems have been selected by prior anticipation of probable impacts on ecological resources in different phases of the proposed project. Composition and diversity of flora is important for vegetation study which indicates vegetation structure of an area. Plant health is directly related with biomass productivity. Plant health of an area may change for changing of different environmental parameters like temperature, composition of gaseous components, soil salinity, humidity and nutrients, air particulate dust etc. Plant diseases and proportion of healthy/ unhealthy plant is needed to observe for ensuring plant health condition.

Canopy status of terrestrial vegetation indicates plant health and biomass properties of an area. Vegetation canopy structure may be change for change of plant growth rate due to soil properties change, plant physiological disorders due to change of climatic parameters or even for different human interventions. To monitor vegetation canopy status of the study area, canopy cover has been followed in different time intervals.

Among the terrestrial faunal community, Bird is an important class that is sensitive to their habitat condition. Changes of environmental parameters, landuse and vegetation composition directly impact on bird's habitat of a locality. Broadly, two types of bird are found in an area; local and migratory. To observe local bird habitat suitability, number of bird nest and nesting bird species can be a good indicator. Numbers of wetlands where migratory birds come in each migration season have also been considered to observing migratory bird habitat suitability of the area.

In the respects of aquatic ecosystems, dolphin is an ecological indicator which indicates water quality as well as aquatic habitat suitability. This aquatic mammal is still present all the river systems of the study area. Any changes of water quality and river bed siltation may change dolphin occurrence in a river system. So, dolphin occurrence is needed to monitor for this study.

3.2.2 Rationales for Selection of Locations

4 homesteads have been selected for monitoring terrestrial ecosystem's indicators of the study area. Locations of the homesteads have been selected considering wind direction and spatial distribution from the project boundary. All the selected locations for terrestrial ecosystem monitoring is at northern sites as maximum time of the wind rose south to north direction and anticipated impacts will be take part according to this area. Beside this, Sundarban Reserve Forest is located sum of 14 km south from the project and various indicators of different locations of this forest is also observing for forest health monitoring. So, no site has been selected at south site of the proposed project.

3.2.3 Terrestrial Ecosystem

Terrestrial ecosystem supports most of the floral and faunal communities which are directly related to the environmental parameters like temperatures, air quality, sunlight, soil nutrients etc. In the study area, homesteads occupy maximum portions of terrestrial ecosystems. As such, observation on different indicators of selected homestead vegetation and dweller wildlife will be helpful to know the ecological impacts for the proposed project.

Description of the selected homestead

The homestead in Rajnagar is located at 2.5 km. east from upper North-east boundary of the project site. This is situated inside the damp area as numerous small swamps exist inside and surround the homesteads. Water retention capacity of surface soil of this homestead is very low and for this reason very little number of grasses and other herbs are present. Land elevation of selected homestead at Kalekarber village is comparatively flood free. This is located at about 1.8 km. east from Middle-east boundary of the project. Chalkghona village is located about 0.5 km south from south-east boundary of the project. The selected homestead of this village is close to Maidara River to it's north side and saline water shrimp farms to its south periphery. Presence of shallow ditches and peripheral waterbodies support to grow staple coverage of saline tolerant plant species. Borni village is located at about 3.0 km north from north-east boundary. Sampled homestead at Borni is situated at the middle part of the village. This homestead is also dominated by planted tree species and soil condition is similar to Rajnagar site. Vegetation of this homestead have been severely been damaged by past Cyclone Aila.

Species Composition of selected homestead vegetation

<u>*Homestead at Rajnagar*</u>

Once, this homestead was dominated with Gewa *(Excoecaria agallocha)* among all the trees due to its height population which get favor from soil's salinity for luxurious succession. But at ending of the year 2020, the homestead owner re-developed the homestead platform by filling sand extracted from nearer canal beds. Due to this activities, a staple portion of the *Gewa* coverage has been damaged along with other tree species. As a result, it is difficult to indicate the dominated tree species of this site. However, monocots fruits including Narikel *(Cocos nucifera)* and Khejur *(Phoenix sylvestris)* occupied the top canopy of the vegetation. Beside this, Safeda *(Manilkara zapota)* and Boroi *(Zizyphus sp)* are the two species of fruit yielding trees. In addition, a number of Bola *(Hibiscus tiliaceus),* Kewra *(Sonneratia apetala)* and one Sundari (*Heritiera fomes)* also found to exist. The homestead was cover very few grasses or undergrowth vegetation which also have been scarce after the land re-development.

Homestead at Kalekarber dighi

Two species like Narikel *(Cocos nucifera)* and Khejur *(Phoenix sylvestris)* occupies the top canopy. The homestead has many Mahagoni *(Swietenia mahagoni*) saplings which population is also high. Aam *(Mangifera indica)*, Safeda *(Manilkara zapota)*, Peyara *(Psidium guajava)* and Boroi (Zizyphus sp) are common trees height not more than 7 m. Mahagoni *(Swietenia mahagoni),* Rendi Koroi *(Albizia saman)* and Raj Koroi *(A. richardiana)* are timber trees those are occupied top canopy height more than 10m. Beside this, Neem *(Azadirachta indica),* Bakul (*Mimusops elengii)* and few numbers of Kola (Musa sp) are found on these homestead platforms.

Homestead at Chalkghona

Vegetation of this homestead also got rich population of mangrove plant species like Gewa *(Excoecaria agallocha)*, Gol *(Nipa fruticans),* Kewra *(Sonneratia apetala), and* Ora *(Sonneratia caseolaris).* Narikel is the dominating tree species as well as occupying the top canopy. As the homestead is near the periphery of river and shrimp ghers, soil salinity could have support luxurious growth of mangrove plant. This homestead got two shallow ditches which contained brackish water throughout the year. A number of ornamental plants were also observed on this homestead platform.

Homestead at Barni

A total of 38 tree species were recorded through quadrate sample survey of this homestead. Among them, Rendi Koroi *(Albizia saman)*, Mahagoni *(Swietenia mahagoni*), Taal *(Borassus flabellifer)*, Narikel *(Cocos nucifera),* Khejur *(Phoenix sylvestris)* are referable. The home owner planted many fruit yielding trees which now in growing stage. Among this, Kotbel *(Limonia acidissima)*, Aam *(Mangifera indica)* and Safeda *(Manilkara zapota)* are common. Gewa *(Excoecaria agallocha)* was dominated at western part of this homestead now being less populated due to fell by the house owner. Tiger Fern *(Acrostichum aureum)* is a mangrove herb which presence at here also referable. Random quadrate vegetation survey has been conducted at selected homesteads during recent monitoring tier. A total of 47 plant species (excluding undergrowths) has been recorded from 16 number of surveyed sample quadrates which Shanon-Winner Diversity Index were 2.52. Details of the survey result is presented in **Table 3.12**. Plant species diversity followed more than the previous monitoring.

Plant Health

Structure of vegetation community of this area is tree dominant. Random saline water shrimp farming is a big threat to plant health of this area. Hence, Plant health of this area is not satisfactory. Expansion of shrimp farming in this area triggered incretion of salinity of soils. For this reason, overall plant succession, growth and productivity have changed day by day.

Plant Diseases and symptoms in homestead vegetation

Plant diseases observation of an area is needed to evaluate plant health and productivity. During initial field survey, some tree species were selected for regular observation of plant disease. In this regards, a number of common tree species have been observed in each homestead. Leaf blast, Leaf spot, lethal yellowing, nut fall, Mite damage on nut fruit are common diseases of the plants in the study area. A brief discussion was held with home owners about diseases of selected economic plants which exist in their homesteads. Most symptoms for plant diseases are descriptive. Although, all plant diseases symptoms are not visible in a same time of the year, but it was tried to observe the existing disease symptoms. Leaf spot and mite damage on fruits is the common symptoms of *Cocos nucifera.* In addition, bud/trunk rot (Heart Rot), lethal yellowing and diameter loss at top portion of this monocot is also common symptom of this plant in all location. Infection of fungal/bacterial is not remarkable all the homesteads. But Leaf Anthracnose on *Mangifera indica* and Bacteriosis on *Psidium guajava* is commonly found most of the trees. *Phoenix sylvestris* also found unhealthy due to leaf yellowing from manganese deficiency.

Number of diseases affected trees

Plant health has been improved at all the sites and showed alive than previous tier (May 2022). Comparing to same season monitoring in previous year (July, 2021), the present year shows remarkable improving trend. Following table (**Table 3.13**) represents the time series data on unhealthy plants in studied homesteads.

Table 3.12: Plant species composition of the sampled homesteads

Sl. No.	Species Name	Local Name	Family	Rajnagar				Borni				Kalekarber				Chalkghona				Tot. No. of individuals	Biodiversity Index
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16		
1	*Acrostichum aureum*	Tiger Fern	Pteridaceae		2	2		4	2		5				2			2	1	20	**2.52**
2	*Justicia adhatoda*	Bashok	Acanthaceae						1		2			1						4	
3	*Albizia richardiana*	Chambol	Fabaceae					1				1				1				3	
4	*Albizia saman*	Rendi Koroi	Fabaceae	1				5		2		1				1	2			12	
5	*Areca catechu*	Supari	Arecaceae					1	12		5		1							19	
6	*Azadirachta indica*	Neem	Meliaceae				1	2	1	1										5	
7	*Borassus flabellifer*	Taal	Arecaceae							2		4	1	4				2		13	
8	*Carica papaya*	Pepey	Caricaceae								2									2	
9	*Citrus medica*	Lebu	Rutaceae									1								1	
10	*Cocos nucifera*	Narikel	Arecaceae	3	2	2	4	2	1	2	1		2	5	4	2	1	1	2	34	
11	*Cordia dichotoma*	Bohal	Boraginaceae										1				1			2	
12	*Dentella repens*	Danton	Rubiaceae					2	10		2		1		5					20	
13	*Diospyros pregrina*	Gaab	Ebenaceae					4								1	3			8	
14	*Erythrina ovalifolia*	Mandar	Fabaceae													1				1	
15	*Euphorbia tirucalli*	Pencil Tree	Euphorbiaceae						15											15	
16	*Excoecaria agallocha*	Gewa	Euphorbiaceae	2	3		5	3	1	2	3						3	7	5	34	
17	*Ficus benjamina*	Lokkho Pakur	Moraceae	1																1	
18	*Ficus hispida*	Dumur	Moraceae			1		1		2	1					1	1			7	
19	*Heritiera fomes*	Sundari	Sterculiaceae	2					1											3	
20	*Heritiera fomes*	Sundari	Sterculiaceae	2																2	
21	*Hibiscus tiliaceus*	Bola	Malvaceae		1			1					1		5					8	
22	*Ipomoea fistulosa*	Kolmilata	Convolvulaceae						30	50										80	
23	*Lannea coromandelica*	Jigar	Anacardiaceae						5				2	1		10				18	
24	*Lawsonia inermis*	Mehedi	Lythraceae			1					1									2	
25	*Lepisanthes rubiginosa*	Amjum	Sapindaceae			1														1	
26	*Limonia acidissima*	Kotbel	Rutaceae			1				1						1				3	

Sl. No.	Species Name	Local Name	Family	Rajnagar				Borni				Kalekarber				Chalkghona				Tot. No. of individuals	Biodiversity Index
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16		
27	*Mangifera indica*	Aam	Anacardiaceae						2			1				5	3			11	
28	*Manilkara zapota*	Safeda	Sapotaceae							1		1								2	
29	*Mimusops elengi*	Bokul	Sapotaceae										1							1	
30	*Moringa oleifera*	Sazna	Moringaceae					1							2	1				4	
31	*Musa sp*	Kola	Musaceae		2			5	10	3	5	8	10			7		3	1	54	
32	*Ocimum sanctum*	Tulshi	Lamiaceae		2			1			2					2	2		5	14	
33	*Phoenix sylvestris*	Khejur	Arecaceae	2				2					1		2		3	1	11	22	
34	*Phyllanthus reticulatus*	Sitki	Phyllanthaceae						1						3					4	
35	*Phyllanthus acidus*	Orboroi	Phyllanthaceae								1	1					2			4	
36	*Psidium guajava*	Peyara	Myrtaceae						1		1	1				1				4	
37	*Sonneratia apetala*	Kewra	Lythraceae				1													1	
38	*Spondias mombin*	Amra	Anacardiaceae					1	2											3	
39	*Streblus asper*	Shewra	Moraceae										1							1	
40	*Swietenia mahagoni*	Mahagoni	Meliaceae					3	2	5	1	20	10	4	25	2	3		5	80	
41	*Syzygium cumini*	Jaam	Myrtaceae													3				3	
42	*Tagetes erecta*	Ganda Fhul	Asteraceae														1			1	
43	*Tamarindus indica*	Tentul	Fabaceae				1				1					1				3	
44	*Terminalia arjuna*	Arjun	Combretaceae													1				1	
45	*Terminalia catapa*	Kathbadam	Combretaceae														2			2	
46	*Vachellia nilotica*	Babla	Fabaceae															1	1	2	
47	*Ziziphus mauritiana*	Kul boroi	Rhamnaceae					1	1							3				5	

Table 3.13: Proportion of healthy and unhealthy plants in studied homesteads

Location	Plant Name	Total No. of Plant	No. of Unhealthy Plant																										
			Apr, 2014	Jun, 2014	Oct 2014	Jan 2015	Apr 2015	Aug, 2015	Oct, 2015	Jan, 2015	Oct, 2016	Jan, 2017	Jan, 2018	Apr, 2018	Jul, 2018	Nov, 2018	Feb-19	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021	July, 2021	Nov, 2021	Feb, 2022	May, 2022
Rajnagar	*Cocos nucifera*	17*	NS	10	5	5	15	4	5	NS	3	4	6	6	9	4	4	3	2	3	10	3	7	11	10	10	10	3	1
	Phoenix sylvestris	25	NS	15	4	4	22	9	13	NS	10	2	5	4	7	6	8	9	5	3	4	4	5	2	12	2	3	2	2
	Manilkara zapota	1	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
	Albizia saman	2	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2
	Excoecaria agallocha	55*	NS	-	1	1	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	10	-	-	-
	Mangifera indica	3	NS	1	-	-	2	-	-	NS	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	2	2	-	-
	Psidium guajava	2	NS	2	-	-	2	-	-	NS	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Borni	*Cocos nucifera*	10	7	3	-	-	3	1	2	NS	1	2	3	1	2		1	1	1	2	1	-	-	-	-	-	-	1	-
	Phoenix sylvestris	12	-	5	4	4	3	1	4	NS	4	3	4	2	1		-	1	1	-	-	-	-	-	-	-	-	-	-
	Borassus flabellifer	6	3	1	-	-	-	-	-	NS	-	-	-	-	-	1	1	-	-	-	-	1	-	-	-	-	-	-	-
	Mangifera indica	6	3	3	1	1	4	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
	Excoecaria agallocha	18	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	3	-		3
	Swietenia mehogani	11	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Areca catechu	10	-	6	2	2	8	2	2	NS	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Manilkara zapota	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Psidium guajava	2	2	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kalekarber Dighi	*Cocos nucifera*	56	35	5	1	1	2	2	3	NS	1	1	-	6	3	-	1	3	1	7	4	2	-	-	-	2	-	-	-
	Phoenix sylvestris	10	-	3	-	-	1	-	1	NS	3	-	3	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
	Mangifera indica	5	1	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Manilkara zapota	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Borassus flabellifer	8	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Zizyphus sp	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
	Psidium guajava	8	-	-	-	-	-	-	-	NS	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tamarindus indica	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chalkghona	*Cocos nucifera*	39	25	19	5	5	34	20	-	NS	2	2	4	5	3	-	3	4	2	4	3	5	-	-	-	-	-	-	-
	Phoenix sylvestris	24	-	10	1	1	6	5	1	NS	1	-	5	2	3	-	-	1	2	2	1	3	-	1	3	2	1	1	-
	Albizia saman	3	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
	Excoecaria agallocha	36	-	-	1	1	-	-	-	NS	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-	-	1
	Manilkara zapota	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Psidium guajava	17	1	7	-	-	-	-	-	NS	-	-	-	-	-	1	3	-	-	1	-	-	-	-	-	-	-	-	-
	Mangifera indica	7	2	1	-	-	-	-	-	NS	-	1	-	1	-		-	-	-	-	-	-	-	-	-	-	-	-	-
	Borassus flabellifer	2	-	-	-	-	-	-	-	NS	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-

*Note: NS = Not Surveyed *=1 Cocos and 45 Excoecaria have been cut.*

Vegetation canopy status

Species representation in different canopy layers of homestead vegetation

Coconut (*Cocos nucifera)* occupied top canopy of all the studied homestead vegetation. Date Palm (*Phoenix sylvestris)* is prevalent as second top layer followed by Gewa (*Excoecharia agallocha)*. Most of the fruit yielding trees like Sofeda (*Manilkara zapota),* Mango (*Mangifera indica)* possess upper bole of canopy layer. Lower bole are occupied by small fruit yielding trees like Guava (*Psidium guajava)*, Musa sp. Very few grass species and undergrowth vegetation were followed at studied homesteads.

Estimated Canopy cover in homestead vegetation of sampling sites

Canopy cover has been slightly improved at three sites. Canopy has significantly improved at Borni as the planted saplings has been matured and expand their canopy in this rainy season. Overall canopy coverage in all the sites are revealed improvement comparing the same seasonal monitoring in last year. Canopy coverage of the studied homesteads has been represented in following **Table 3.14**.

Table 3.14: Vegetation Canopy Cover in different studied homesteads

Location	% of canopy Coverage													
	Apr 2014	Jun 2014	Oct 2014	Jan 2015	Apr 2015	Aug 2015	Oct 2015	Jan 2016	Jul 2016	Oct 2016	Jan 2017	Jan 2018	Apr 2018	Jul 2018
Rajnagar	NS	19	19	17	20	20	20	20	21	23	19	15	18	14
Borni	NS	26	18	18	12	14	20	20	25	25	23	21	21	23
Kalekarber	NS	20	24	25	23	24	24	22	24	26	25	23	24	24
Chalkghona	NS	13	24	22	17	21	21	20	21	27	26	25	16	18

Note: NS = Not Surveyed

Location	% of canopy Coverage														
	Nov, 2018	Feb, 2019	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021	Jul, 2021	Nov, 2021	Feb, 2022	May, 2022	July, 2022
Rajnagar	11	22	19	18	16	14	11	8	8	8	10	14	11	15	**16**
Borni	20	21	21	20	18	20	17	22	19	23	24	22	20	20	**26**
Kalekarber	25	24	25	25	24	24	22	22	24	19	21	24	24	24	**25**
Chalkghona	21	22	22	22	20	23	17	21	18	21	24	23	20	23	**24**

Bird Habitat

Local birds and their nesting behaviour

Numerous local bird species are occurred in the study area. Homestead vegetation are the prime habitat for local birds. Existence of vast shrimp farms as well as canals and rivers also favor good number of water dependent bird species in this area. Most of the birds are nesting on tall trees of homesteads. Small bird like Tailor bird, prefer small bushy shrubs. Although, birds do not follow any local boundaries, a clear conception on available bird species have been gathered through discussions with studied homestead owners as well as physical observation.

<u>*Bird species and number of Bird nests in sampling sites*</u>

No bird nest has been observed in this monitoring tier. However, **Table 3.15** represent the bird nest monitoring datasheet over the monitoring periods.

Table 3.15: Bird Nest Monitoring Datasheet

Monitoring Tier	Location	Name of nesting Bird						
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove	Black R. Flameback
Apr 2014	R	NS	NS	NS	NS	NS	-	-
	B	-	-	1	-		-	-
	K	NS	NS	NS	NS	NS	-	-
	C	-	1	-	1	-	-	-
Jun 2014	R	12	4	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C			11		-	-	-
Sep 2014	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Dec 2014	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Apr 2014	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Aug 2015	R	1	5	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Jan 2016	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Jun 2016	R	10	5	-	-	3	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	1	1	-	-	-	-	-
Oct 2016	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Jan 2017	R	-	-	-	-	-	-	-

Monitoring Tier	Location	Name of nesting Bird						
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove	Black R. Flameback
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Jan 2018	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	1	-	-	-	-	-
Nov 2018	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Feb 2019	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	1	-	-	-
Apr 2019	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Jul 2019	R	-	-	-	1	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Nov 2019	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Feb 2020	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Jul 2020	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Nov 2020	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Jan 2021	R	-	-	1	1	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-

Monitoring Tier	Location	Name of nesting Bird						
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove	Black R. Flameback
	C	-	-	-	-	-	-	-
Apr 2021	R	-	-	1	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	1	-
Jul 2021	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Nov 2021	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Feb 2022	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
May, 2022	R	-	-	-	-	-	-	1
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	1
	C	-	-	-	-	-	-	-
July, 2022	R	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-
Note: Location R=Rajnagar, B=Borni, K=Kalekarber, C=Chalkghona								

3.2.4 Aquatic Ecosystem Monitoring

Passur is the only external river beside the project area which maintains connectivity with all flowing water systems of the study area. On the other hand, Maidara River including two branches (Sailtakhali and Ichamoti) exists as an internal river system. Both of the river systems are support River Dolphin whole of the year. Hence, status of aquatic mammals (Dolphin) in these river systems has been monitored.

Dolphin Occurrence

<u>Dolphin migration route in study area</u>

Two dolphin species (Ganges River Dolphin and Irrawaddi Dolphin) travel throughout the Passur River for whole of the year. The Ganges River dolphin migrates from estuary regions to upstream connected rivers like Rupsha and Madhumoti. Though Irrawardi Dolphin is mostly habituated in estuary regions of Bangladesh, but this aquatic mammal is also occasionally sighted in Passur River. Ganges Dolphins also roam through Maidara River mainly during high tide. Siltation and narrowing of upstream branches are limiting the length of migration area of this river day by day.

Dolphin occurrence in Passur and Midara River

A total of 8.5 km river reach was surveyed have been surveyed within the Passur and Maidara River surround the project area (From Digraz Kheyaghat to Chunkuri to Digraz Kheyaghat) through boat transact during full tide and mid tide. A total of 2 dolphins have been recorded within the Maidara River in this survey. The encounter rate is 0.15 individual/km/hr which is lower than previous monitoring tier. **Figure 3.10** represents the survey transact and location of dolphin occurrence within the river channel.

Dolphin occurrence in Shella Gang and Bhadra Khal

Dolphin occurrence has monitored within 6.91 km length of Dhanmari Khal and recorded 5 dolphins. The transect length was 13.5 km which duration was 120 mins. The encounter rate was 0.56 individual/km/hour which is significantly lower than previous monitoring. The distribution of dolphin occurrence at Dhangmari Khal is presented in **Figure 3.11**.

Three Dolphins were also sighted in Shella Gang while 7.8 km transact survey conducted from Chandpai to Joymonirgol Thota to Food Silo to Joymonirgol Thota (**Figure 3.12**). The occurrence rate was 0.48 individual/km/hour.

Three dolphins have been recorded at Bhadra Khal during 49 min survey time and the 3.13 km inner reach from Bhadra Patrol Post. The encounter rate was 1.51 individuals/km/hr. The encounter rate was lower than the previous monitoring and this may be due invisibility of river surface for rainfall and waves. The distribution of dolphin occurrence at Bhadra Khal is presented in **Figure 3.13**.

Another short survey was conducted Karomjal, Harbaria and Akram Point while passing the river. Dolphin has been notified at Karamjal and Harbaria while travelling on boat. However, the survey result is included in **Table 3.16**.

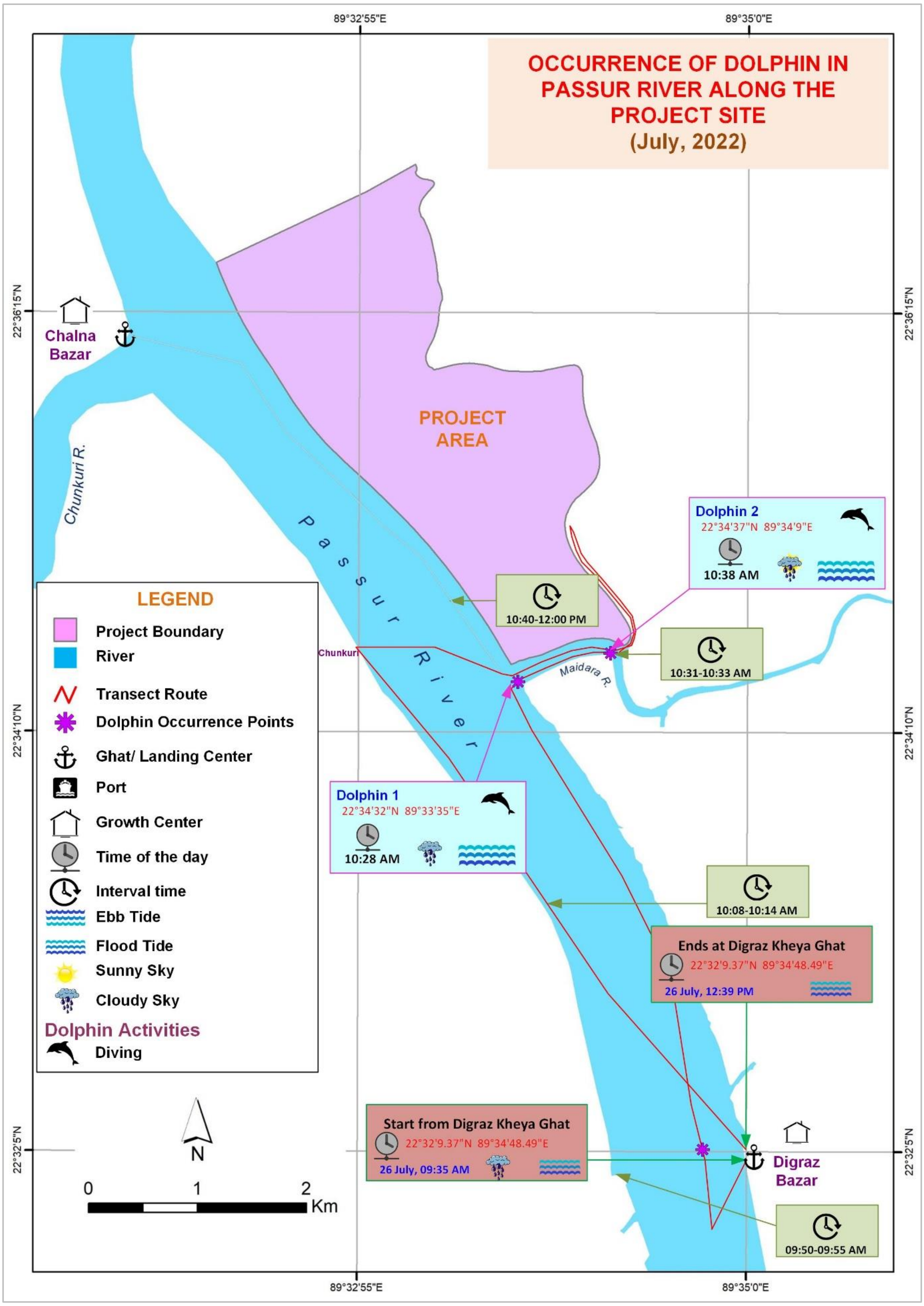


Figure 3.10: Occurrence of dolphins in Passur and Maidara River along the project site

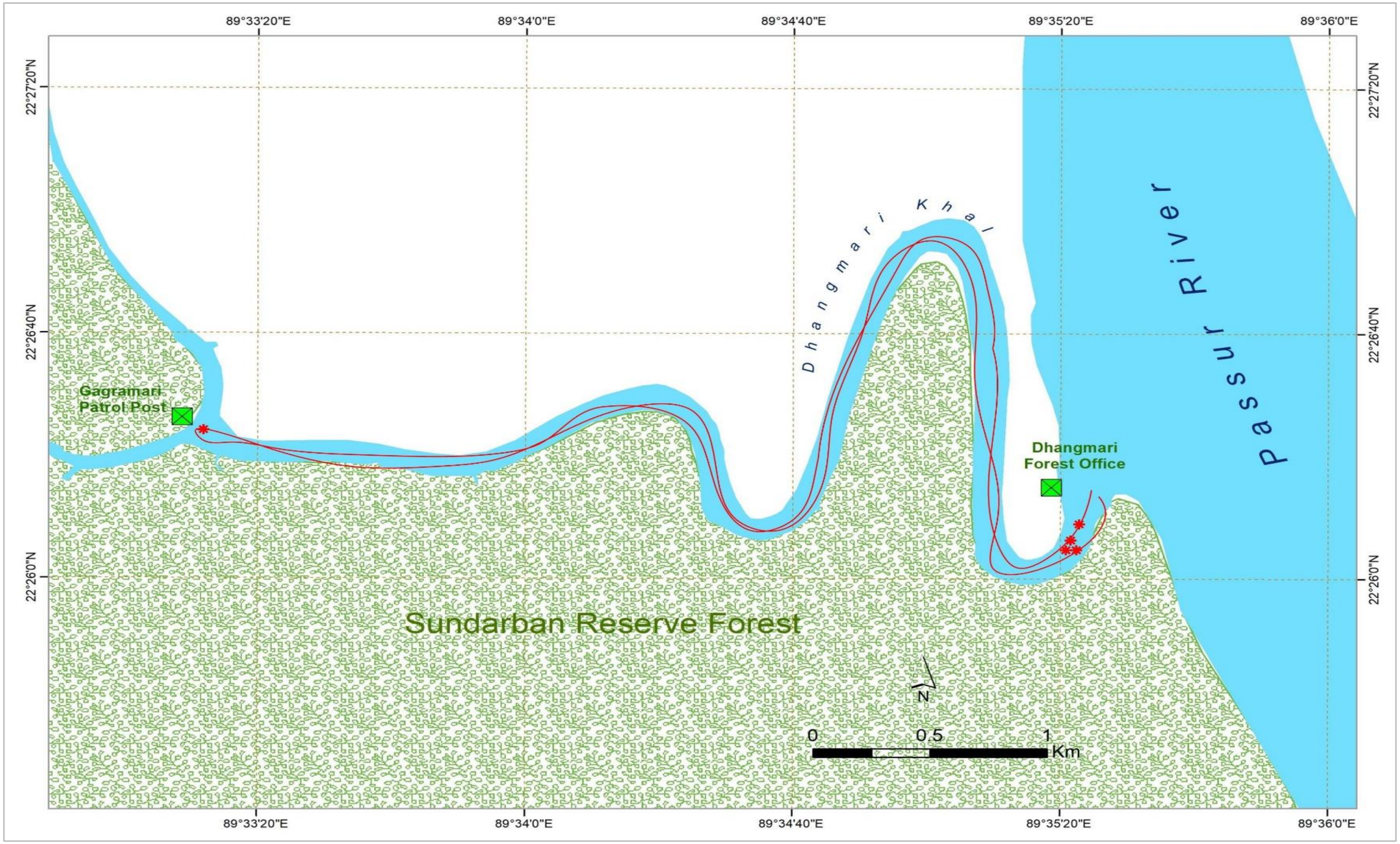


Figure 3.11: Location of dolphin occurrences in Dhangmari Khal

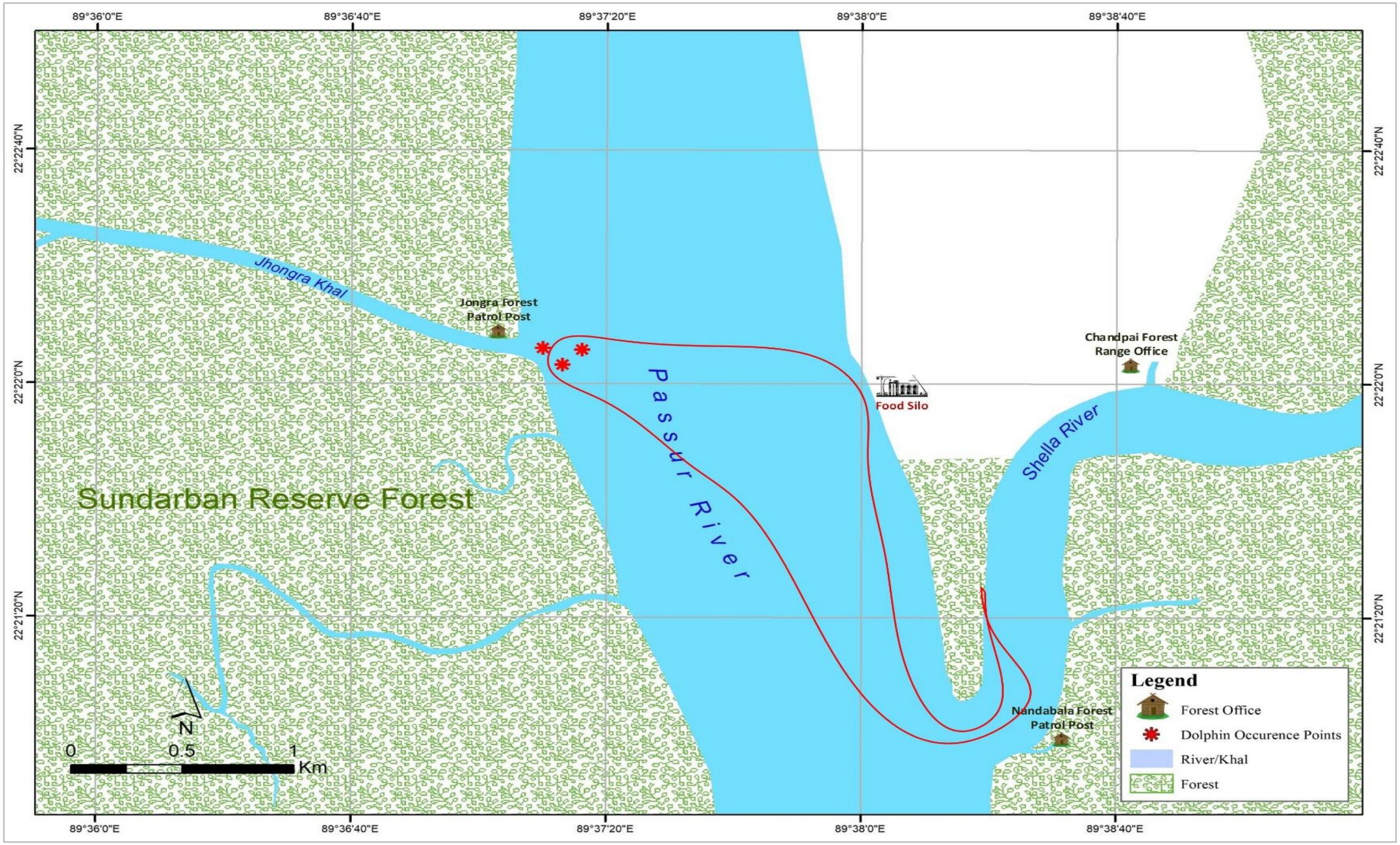


Figure 3.12: Location of dolphin occurrences in Chandpai

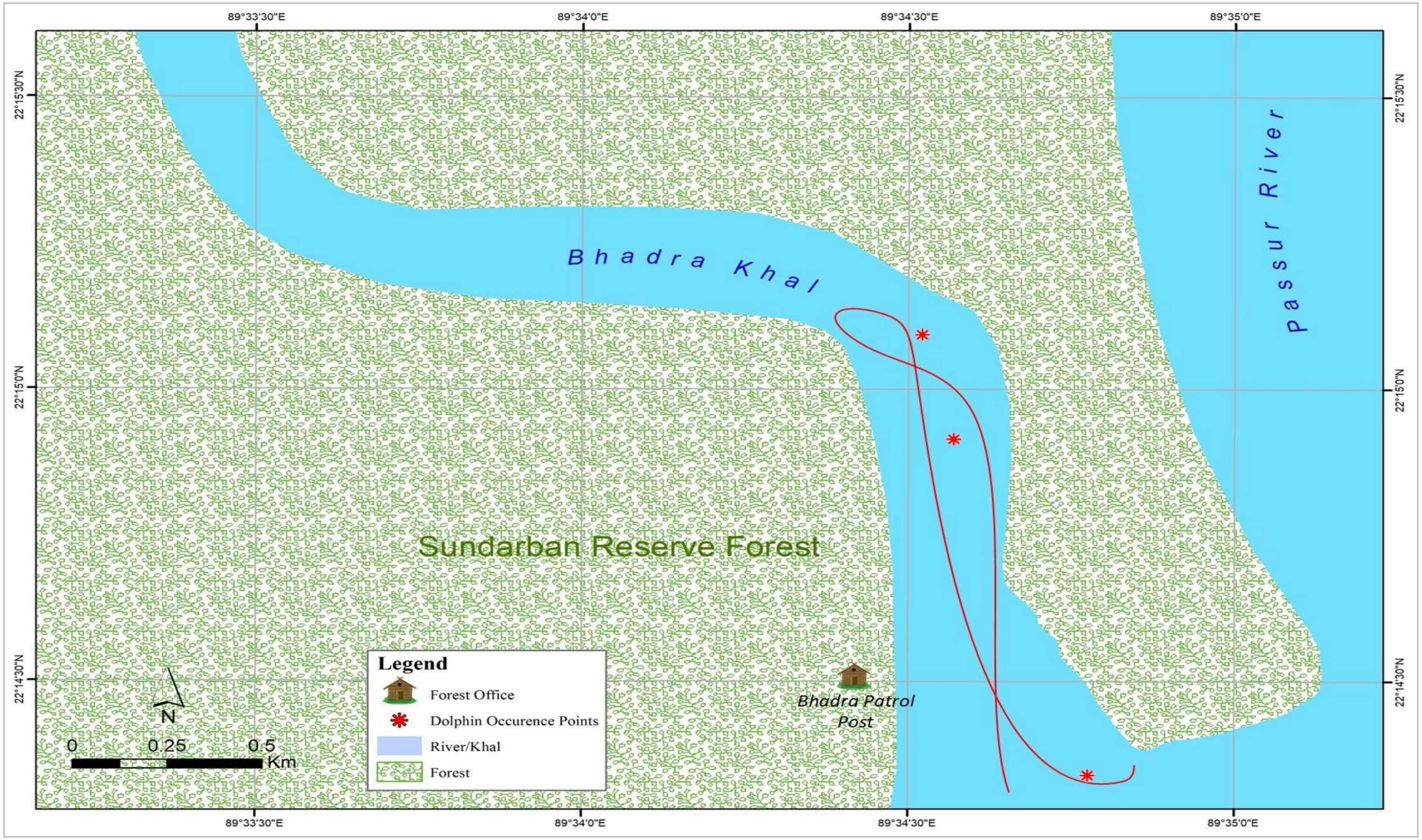


Figure 3.13: Location of dolphin occurrence in Bhadra Khal

Table 3.16: Dolphin observation Datasheet

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Maidara River	Shella River at Chandpai
Apr-2014	FT	Y	NS	NS	NS	Y	NS
	NT	Y	NS	NS	NS	N	NS
Jun-2014	FT	Y	NS	NS	NS	N	NS
	NT	Y	N	N	N	N	NS
Oct-2014	FT	Y	NS	NS	NS	Y	NS
	NT	Y	Y	Y	N	Y	NS
Jan-2015	FT	Y	Y	Y	NS	Y	NS
	NT	Y	Y	N	Y	N	NS
Apr-2015	FT	Y	N	N	Y	Y	NS
	NT	Y	N	N	Y	N	NS
Aug-2015	FT	Y	NS	N	NS	Y	NS
	NT	Y	Y	N	NS	N	NS
Oct-2015	FT	NS	NS	Y	N	NS	NS
	NT	Y	Y	NS	Y	Y	NS
Oct-2015	FT	Y	Y	Y	Y	N	NS
	NT	Y	N	N	NS	Y	NS
Jul-2016	FT	Y	Y	Y	NS	Y	NS
	NT	Y	NS	Y	NS	NS	NS
Oct-2016	FT	N	Y	Y	N	NS	NS
	NT	Y	Y	NS	N	Y	NS
Jan-2017	FT	Y	Y	N	NS	N	NS
	NT	Y	Y	N	NS	Y	NS
Jan-2018	FT	Y	NS	Y	N	NS	NS
	NT	Y	Y	N	N	Y	N
Jun-2018	FT	Y	N	N	N	Y	Y
	NT	Y	NS	N	Y	Y	NS
Nov-2018	FT	NS	N	N	N	NS	NS
	NT	Y	N	N	N	Y	Y
Feb-2019	FT	NS	Y	Y	N	NS	Y
	NT	Y	N	N	Y	N	NS
Apr-2019	FT	NS	Y	N	N	NS	NS
	NT	N	N	Y	N	N	Y
Jul-2019	FT	Y	Y	N	N	Y	Y
	NT	Y	NS	N	N	N	NS
Nov-2019	FT	NS	Y	Y	N	NS	Y
	NT	Y	Y	N	Y	Y	Y
Feb-2020	FT	Y	Y	Y	Y	Y	Y
	NT	Y	N	NS	NS	Y	Y
Jul-2020	FT	Y	N	N	N	Y	Y
	NT	Ns	Y	N	N	NS	Y
Nov-2020	FT	NS	NS	NS	NS	NS	Y

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Maidara River	Shella River at Chandpai
	NT	Y	NS	NS	NS	Y	NS
Jan-2021	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
Apr-2021	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
Jul-2021	FT	y	NS	Y	Y	Y	Y
	NT	NS	Y	N	N	NS	NS
Nov-2021	FT	Y	NS	N	N	Y	NS
	NT	N	N	Y	N	NS	NS
Feb-22	FT	y	Y	Y	N	Y	Y
	NT	N	NS	Y	N	NS	NS
May-22	FT	y	Y	N	N	Y	NS
	NT	NS	Y	Y	N	NS	Y
July-22	FT	N	NS	N	N	Y	Y
	NT	NS	Y	N	N	NS	NS
Note: FT=Flood Tide, NT=Neap Tide, NS=Not Surveyed; Occurrence Status: Y = Occurred, N = Not occurred							

3.3 Sundarbans Forest Health monitoring

3.3.1 Background

Forest health monitoring (FHM) is concerned with the ecosystem's health. Monitoring forest cover and functions provide data that can be used to influence policies and decisions on how to conserve, protect, and manage forests sustainably. Forests are an important aspect of our country's landscape. The Forest Health Monitoring program is designed to determine the status, changes, and trends in indicators of forest condition on a certain time interval basis. The Forest Health Monitoring program analyzes data from a variety of sources, including ground plots (i.e. long-term monitoring plots), aerial surveys, and other biotic and abiotic data sources, to address forest health issues that threaten forest ecosystem sustainability. One of the widely used forest healthy monitoring Bio-indicators is the growth trend over time and its relation to leaf area index (Beets and Whitehead 1996). Stands with a high leaf area index will accumulate more biomass and total volume per ha than stands with a low leaf area, other things being equal (Beets et al. 2008). Lichen abundance is another good indicator of forest health. Lichens often grow on trees and shrubs, absorbing nutrients from the atmosphere. Because lichens are very sensitive to air pollution—particularly to sulfur dioxide, fluoride, and ammonia—their presence or absence is an indicator of forest health. Mangrove trees can adapt to anaerobic and water-logged conditions by increasing their number of pneumatophores, hence providing greater surface area for gas exchange. Crab has a significant contribution to forming the ecological stability of the mangrove forest ecosystem. Crab burrows can effectively remove nitrogen from the aquatic ecosystem in the form of gaseous nitrogen (N2) and nitrous oxide (N2O) (Lee, 1989), and can improve oxygen content in the soil layer (Amarasinghe, 2009). The quality of the soil in a forest is another important indicator of forest health (USDA Forest Service. 2007). An evaluation of soil quality usually involves measuring the soil's physical, chemical, and biological makeup at different depths. Plant species diversity is another Bio-indicator of a healthy forest. One way to assess this diversity is to determine whether there is a mix of plant species of different sizes and ages, thus creating forest "layers" that provide habitat for many species (Greenleaf Forestry and Wood Products Inc. 2010). A healthy forest has a good regeneration capacity, which is also a bio-indicator of forest health monitoring. These bio-indicators will be investigated in Sundarbans Reserve Forest (SRF) in light of the Rampal Power Plant Installation.

3.3.2 Methodology

Permanent Sample Plot (PSP) Establishment and Layout

To set up permanent sample plots five sites have been selected on the basis of the preliminary survey (**Figure 3.14**). Among those, four sites are along the Passur River at Karamjal, Harbaria, Akram point and Hiron point, and the fifth one is near Sutarkhali forest office (**Table 3.17**). The sites have been selected considering the distance from the proposed Project site, wind directions, coal transportation route, river systems and vegetation types. Forest health at Hiron Point site have not monitored in this visit for not reach there due to unfavourable weather.

Bio-Indicators for Forest Health Monitoring

Monitoring of frequency for different indicators has been determined considering efficiency in time, cost and applicability. The indicators observed in this tier are as follows:

- Seedling Regeneration
- Pneumatophores
- Crab hole density
- Canopy cover
- Species composition & diversity
- Above ground and below ground carbon estimation
- Leaf phenology and phonological behaviour

Sampling Design of Permanent Sample Plots (PSPs)

At each site, a transect line was laid out perpendicular to the river or canal bank. Along the transect line, three circular nested subplots of a 12.62m radius have been laid out at 100m intervals to capture the maximum tree species (**Figure 3.15**). Because of the variation in species composition in SRF, observation plots were laid out from the coast, river, or canal-side to the upper slope zone where the forest area is denser. The location of the first subplot was 40m away from the ecotone zone to save the subplot from riverbank erosion. Each subplot was again subdivided into four quadrates (**Figure 3.16)**.

Table 3.17: General Description of Permanent Sampling Plots (PSPs)

Transect	Plot	Range	Compartment No.	GPS ± (m) Latitude (N)	GPS ± (m) Longitude (E)	Soil Description	Plot Location Notes
Sutar khali	1	Khulna	32	22.4981	89.4875	Hard Clay	Just opposite from Sutar Khali Forest Station and 40m SW from Sutar Khali Canal
	2	Khulna	32	22.4973	89.4871	Hard Clay	Just opposite from Sutar Khali Forest Station and 140m SW from Sutar Khali Canal
	3	Khulna	32	22.4965	89.4866	Hard Clay	Just opposite from Sutar Khali Forest Station and 240m SW from Sutar Khali Canal
Karamjal	1	Chandpai	31	22.4253	89.5943	Hard Clay	Plot center 40m west from Passur River
	2	Chandpai	31	22.4252	89.5934	Hard Clay	Plot center 140m west from Passur River
	3	Chandpai	31	22.4226	89.5925	Hard Clay	Plot center 240m west from Passur River
Harbaria	1	Chandpai	29	22.2061	89.5924	Hard Clay	40m west from Passur River
	2	Chandpai	29	22.2962	89.5917	Hard Clay	140m west from Passur River
	3	Chandpai	29	22.2962	89.5908	Muddy	240m west from Passur River
Akram Point	1	Khulna	17	22.0195	89.5129	Hard Clay	40m east from Shibsha River
	2	Khulna	17	22.0187	89.5134	Clay	140m east from Shibsha River
	3	Khulna	17	22.0180	89.5140	Hard Clay	240m east from Shibsha River
Hiron Point	1	Khulna	44	22.7753	89.4610	Sandy	350m east from Gogari Canal
	2	Khulna	44	21.9166	89.2333	Sandy	40m north from Bay of Bengal
	3	Khulna	44	22.1833	89.5000	Hard Clay	648m south east from Shibsha River

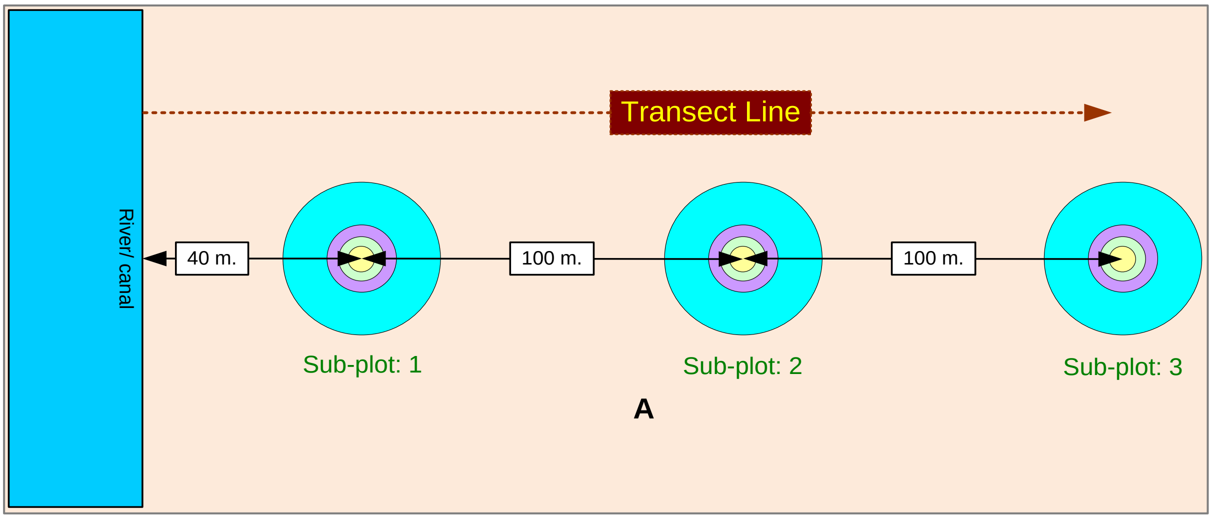


Figure 3.14: Layout of the Subplots and Transect Line Perpendicular from Ecotone (river or canal bank)

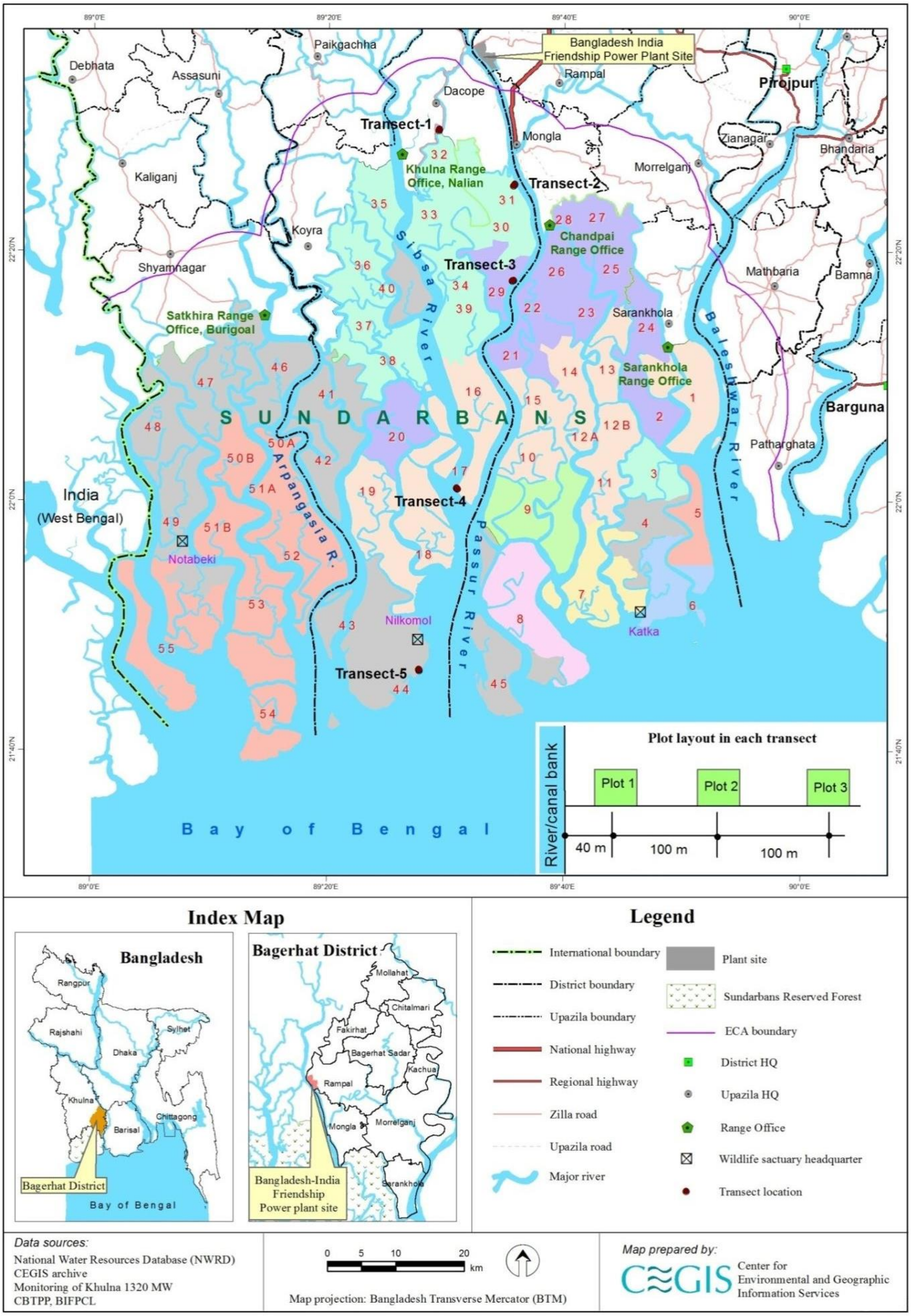


Figure 3.15: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)

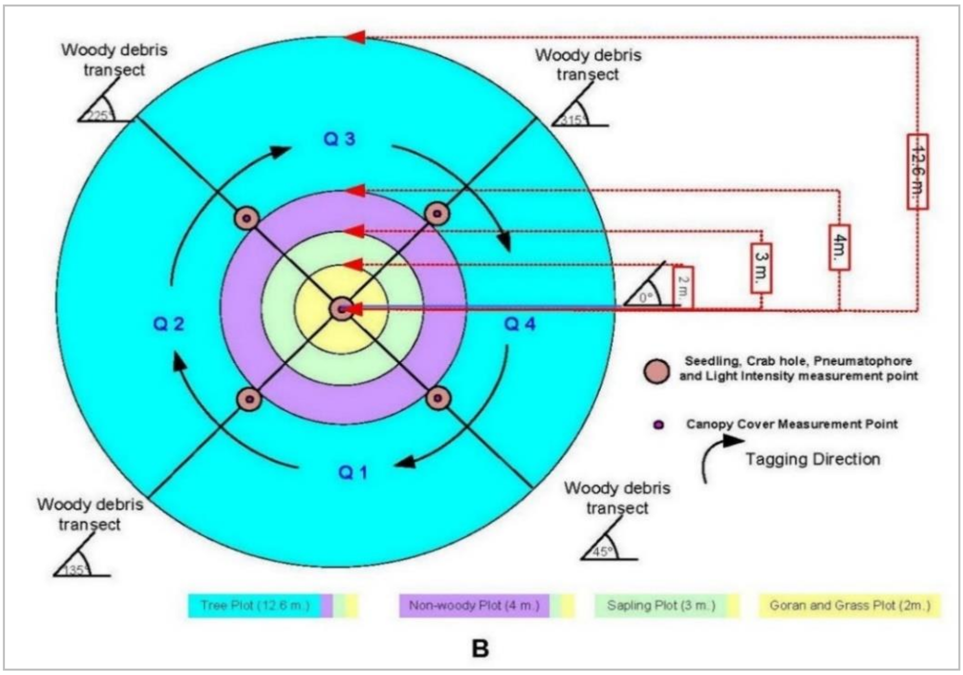


Figure 3.16: Layout of the Survey Activities in each Subplot

Tree Growth

The tag number of trees (DBH ≥ 5cm and lean angle greater than 45º) is monitored and rewritten if any new tree is found within 12.62 m radius circle of the Permanent Sample Plot (PSP). The tree height and diameter are also taken by the surveyor (**Figure 3.17**).

Figure 3.17: Team members measuring DBH and Height of trees

Biomass and carbon stock estimation

Aboveground biomass of tree and sapling was estimated by using Chave, et al., (2005) allomatric equation. Komiyama et al., (2008) equation was used to estimate belowground biomass.

- AGB (kg) = $\rho \times \exp(-1.349 + 1.980 \ln(dbh) + 0.207 \times (\ln(dbh))^2 - 0.0281(\ln(dbh))^3$
- BGB (kg) = $0.199 \times (\rho)^{0.899} \times (dbh)^{2.22}$

Where, ABG = above ground biomass; BGD = belowground biomass; DBH = diameter at breast height.

After calculating biomass, carbon content was calculated based on the assumption that carbon content is 50 percent of the dry woody biomass (Brown 1997).

Pneumatophores

The total number of living pneumatophores has been recorded within a circular area of 2 m radius centering each of the five points of all the subplots. The first point has been laid out in the centre of each subplot and other four have been in the midpoint of the four woody debris transects that are facing at 45°, 135°, 225° and 315° (**Figure 3.18**).

Crab Hole

Crab plays an important role in mangrove ecosystems such as decomposing litter fall thereby increasing fertility. In order to work out the crab density, usually crab hole abundance is monitored. For this purpose, the crab holes have been counted within an area of 2 m radius circle in each subplot's centre and in the midpoint of four woody debris transect (**Figure 3.18**).

Figure 3.18: Surveyor counting Pneumatophores & crab holes in PSPs

Figure 3.19: Team member taking canopy cover and light intensity using Densiometer and Lux meter

Canopy Cover

Canopy cover percentage was estimated by a spherical densitometer (i.e. densitometer a gridded convex mirror that provides a simple and inexpensive approach to measuring canopy cover). The densitometer was held at a distance of 30–40 cm from the body and at an elbow height so that head has not become visible in the mirror (**Figure 3.19**). After leveling the instrument using the level bubble, the dots which had not been occupied by the canopy were systematically counted. In each subplot, the meter readings have been taken at four points facing north, south, east, and west direction in each subplot. The canopy cover was calculated by taking the average of these readings.

Basal area, relative density, relative dominance, relative frequency tree diversity species

For describing floristic composition of species of the study area the basal area, relative density, relative dominance, relative frequency and Importance Value Index (IVI) were calculated (Moore and Chapman, 1986 and Shukla and Chandel 1980).

The basal area/ha is calculated according to the formula (Shukla and Chandel, 1980).

$$\text{Ba/ha} = \frac{\sum \frac{\Pi}{4} D^2}{\sum area \quad of \quad all \quad quadrats} \text{X} \quad 10000$$

Basal area = Π D²/4.

Where, Ba = Basal area in m^2

D = Diameter at breast height in meter

Π = 3.14

Following the formulas of Moore and Chapman (1986) and Shukla and Chandel (1980) quantitative structure parameters of investigated trees was calculated.

$$Density\ (stem/ha) = \frac{\text{Total no. of individuals of one species in all the plots}}{\text{Plot area } \times \text{ Total no. of plots studied}}$$

$$Relative\ density\ (\%) = \frac{\text{Total no. of individuals of one species in all the plots}}{\text{Total no. of plots studied}} x100$$

$$Frequency\ (\%) = \frac{\text{Total no. of plots in which the species occurs}}{\text{Total no. of plots studied}} x100$$

$$Basal\ area\ (m2/ha) = \frac{\text{Total basal area of individual species (m2)}}{\text{Sample plot area (ha) } \times \text{ Total no. of plots studied}}$$

$$Relative\ basal\ area\ (\%) = \frac{\text{Total basal area of one species in all plots}}{\text{Total basal area of all species in all plots}} x100$$

Importance Value Index (%) = (Relative density + Relative frequency + Relative dominance)/3

Species Diversity and evenness

Tree species data were collected from all the PSPs to identify diversity. Individual tree DBH ≥5cm was considered. Saplings (DBH<5cm and height 1.37m) and seedlings (height<1.37m) were assessed within a 3m and 2m radius circle respectively in each PSP. Seedlings were counted as species wise and their status was also recorded. For saplings, species name and DBH were recorded along with the living status. Any vegetation not meeting the requirements of the tree or sapling/seedling survey was treated as non-tree vegetation. The Non-woody palms (e.g., Nypa), Pandanus and Woody shrubs were measured within 4 m radius circle. Goran and herbaceous vegetation was measured within 2 m radius circle. The diameter was measured at the collar zone (Hossain, et al., 2012). Herbaceous vegetation was visually estimated and recorded as percent ground cover of herbs and grasses separately.

The following two indices of the Shannon's index (MacArthur and MacArthur 1961) H' and Pielou's (1969) index J' was used to measure woody species diversity or equitability (evenness.

$$H' = \sum_{i=1}^{s} \frac{n_i}{N} \log_2 \frac{N}{n_i}$$

$$J' = \frac{H'}{H'_{\max}} \quad (H'_{\max} = \log_2 S)$$

Where N is the total number of individuals and the unit of H' is bit, or the unit of entropy (Goldman, 2005)

Species richness

Species richness index was measured by Margalef (1958): R= (S-1)/ Ln (N) Where, S= total species found and N= total number of Individuals

Statistical analysis

Different statistical analyzes were performed for different indicators. A one-way ANOVA analysis was tested for canopy cover, pneumatophores and seedling density in order to find out whether any difference was made. For crab hole change, we performed paired sample t test in order to find out the difference.

3.3.3 Monitoring Result and discussion of SRF Health

Pneumatophore

The mean number of pneumatophores increased in Sutarkhali and Harbaria but decreased in Karamjol and Akram point from the baseline assessment. These trends occurred due to variation of floristic composition as from the observation it has been found that some species have numerous pnematophores *(Heritiera fomes)* and some have few pneumatophore such as Bruguiera spp, Ceriops decandra. The number of pneumatophores may also vary due to the elevation of the forest floor from the mean sea level (MSL). The Akram point is situated at the confluence of Shibsa and Passur River. Therefore, It can assume that, the forest will experiencing retrogression process where the climax species *(Heritiera fomes)* are started decaying. The major function of pneumatophores is to exchange gas into the atmosphere during tidal inundation. Hence, the highly elevated plot with less effect of inundation may have lesser number of pneumatophores.

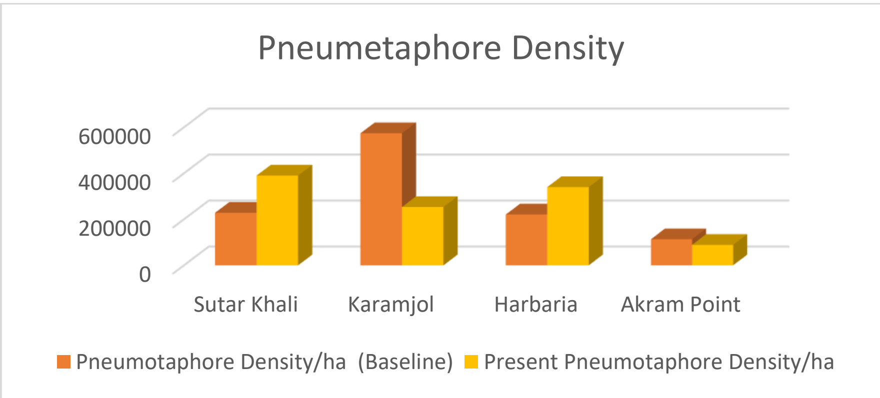


Figure 3.20: Pneumetaphore density among the four plots between two different time periods

Crab hole Density

The mean number of crab hole observed within plots during this monitoring survey showed a substantial increase at all sites compared with baseline. Crab hole density significantly increased in Sutarkhali and Akram point by 53% and 40% respectively (**Figure: 3.21**). This may be due to sandy forest floor at Akram point because they love to drag hole on that particular habitat and nature of mangrove (evergreen forest) forest floor in Sutarkhali. It is difficult to predict the relationship of crab hole with seasonal variability. Although mangroves are marshy land, there are differences in terms of area in dry period (winter) and wet period (monsoon) which shows some influences on crab hole abundance.

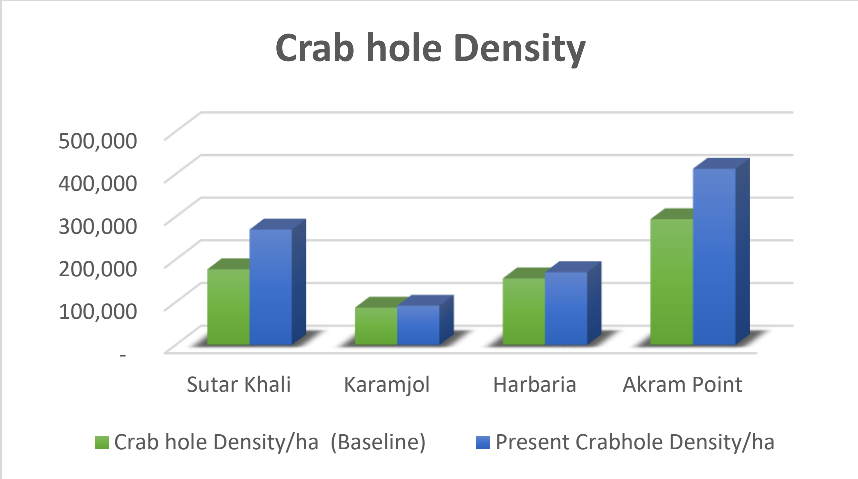


Figure 3.21: Crab hole density among the four plots between two different time periods

Seedling Density

The mean number of seedlings observed within the plots during this monitoring survey showed a substantial increase at Sutarkhali and Akram point but significant decrease at Karamjol and herbaria compared with baseline. On average, the mean number of seedling has decreased by 68% and 62% in Karamjol and Harbaria between the baseline and 33rd monitoring survey (**Figure 3.22**). A substantial increase 39% and 144% was seen for Sutarkhali and Akram point respectively. The recruitment of new seedlings depends on regeneration and survival rate. These indicators also depend on canopy cover, soil chemistry (pH, salinity, organic matter etc.). Seedlings usually die at an early stage in natural forest due to competition for nutrients as well as light intensity. Other than the silvicultural competition, the seedlings at Karamjol and Harbaria also face anthropogenic stresses due to their location being very much closer to the locality and considered tourist hotspots. Besides this, huge illicit feeling of trees is seen, which has created large open space. However, the monitoring result of this period has shown comparatively higher number of seedlings at Akram point than baseline period. This may be due to higher light intensity may favor for shade-intolerant species to grow at the early stage.

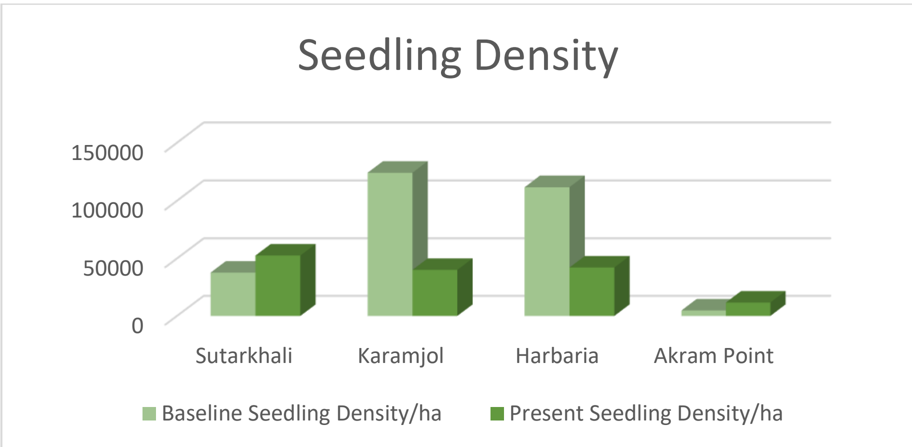


Figure 3.22: Seedling density among the four plots between two different time periods

Canopy Coverage

All the plot sites showed a mean increase in canopy coverage compared with the baseline survey. The highest percentage of canopy coverage increase in Karamjol (**Figure 3.23**). This may be due to the good foliage condition and less insect damage. Since greater than 60% of the canopy coverage in a site is treated as healthy, all the locations of the monitoring sites are in good shape.

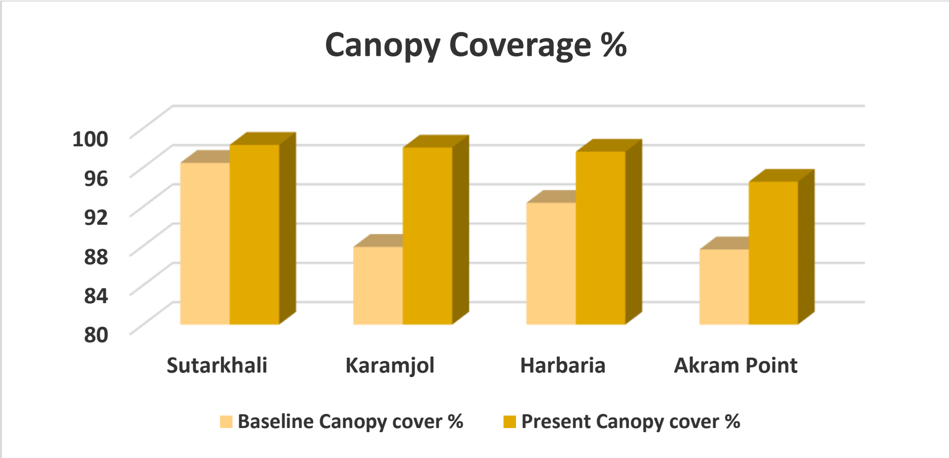


Figure 3.23: Canopy coverage among the four plots between two different time periods

<u>Mean DBH, Basal Area and stem density</u>

Mean DBH (Diameter at breast height; 1.37 m), Basal area (Sum of cross sectional area measured at breast height of all tree species in a plot) and stem density are three important stand structural properties in mangrove forest that are related to timber stand volume and growth. These three structural properties are inter-linked. For an example, if a stand has higher stem density but lower basal area indicating that the mean DBH of tree of that stand is also lower and vice-versa. However, it is also varied by other adapic and climatic factors. The average DBH increase in all plots except Harbaria as the stem density in herbaria decrease about 27% due to illicit filling and top dying of Sundri. Basal Area (m^2/ha) increased in all plots from the baseline period. Greater basal area equals greater tree canopy cover; thus, as both increase, less sunlight reaches the ground. Change in basal area over time is an important indicator of forest recovery during succession. In Akram point stem density of trees per hecter also reduced due to increasing mortality rate of sundri because of top dying. The mean DBH, basal area and stem density are shown in **Figure 3.24, Figure 3.25 and Figure 3.26**.

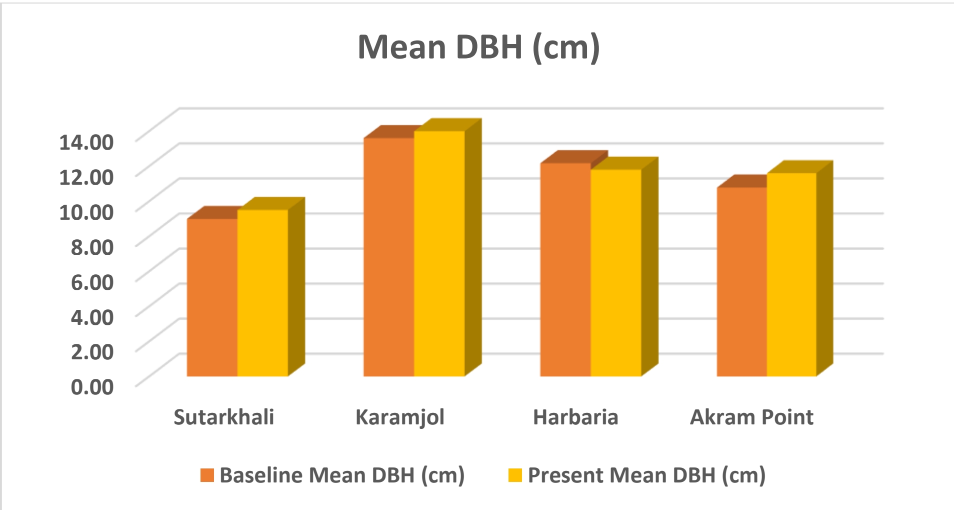


Figure 3.24: Mean DBH in four study plots in SRF

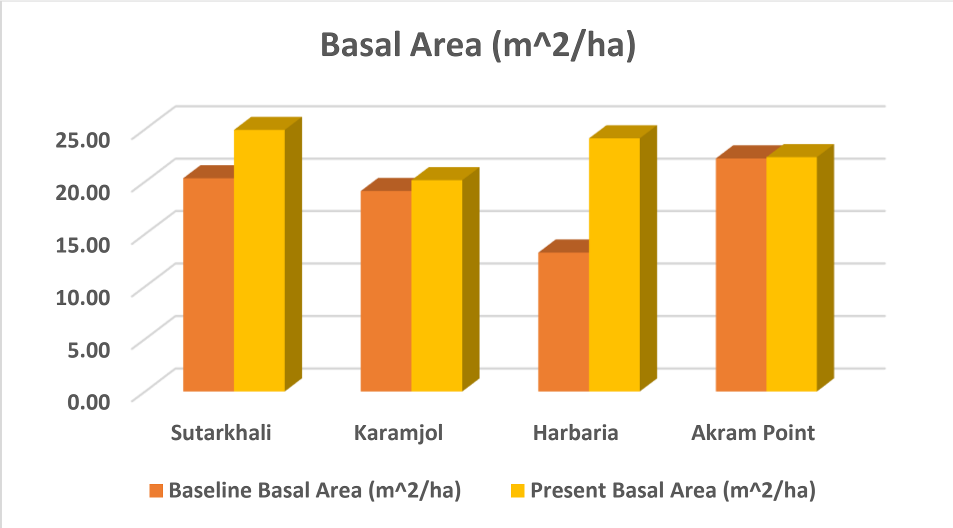


Figure 3.25: Mean basal area (m2ha-1) in four study plots in SRF

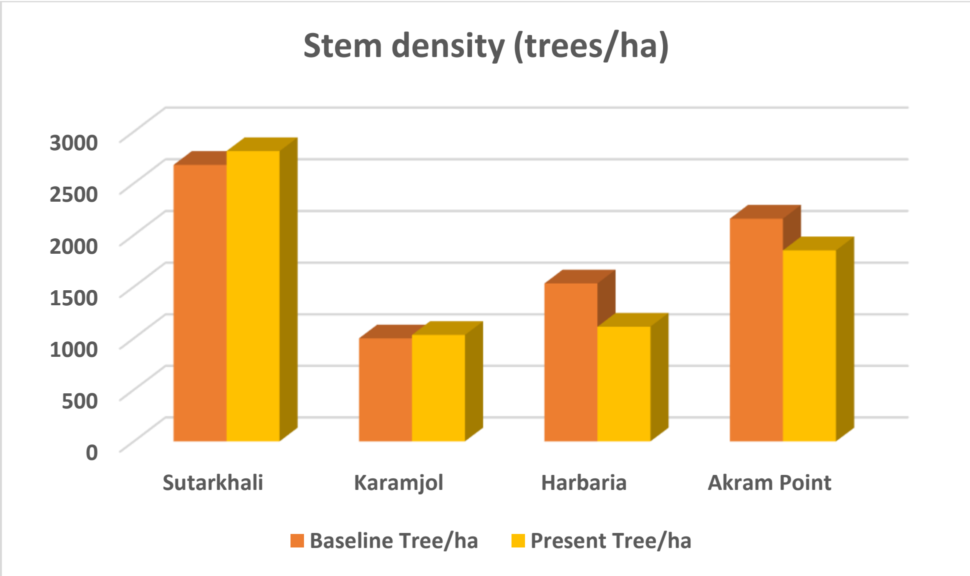


Figure 3.26: Mean Stem density (trees (DBH≥ 5)/ha-1) in four study plots in SRF

<u>*Floristic composition and important value index*</u>

The floral (excluding bacteria, fungi, and algae) composition of the four monitoring sites was also investigated (Table). In Sutar Khali, 1446 individuals of flora were encountered. The family, composition of Karamjol (917 individual's flora) and Harbaria (1097 individual's flora) respectively. A total of 516 individual of flora were found in Akram point (Table).

The IVI index describes the complete picture of phytosociological character of a species in a community. It is an aggregated index that summaries the density, abundance and distribution of species in particular area. Based on the higher value of IVI the importance of a particular species in a community can find out. Compared to the baseline condition the dominant species based on IVI remains the same in all plots except for sapling in Akram point which is replaced by *Excoecaria agallocha* (previously occupied by *Ceriops decandra*) Species ranking based on the IVI value and thereby the dominant species in a site of the four categories (Tree, sapling, seedling and nontree (Climber and herbs) are given in **Table 3.18**.

Table 3.18: Tree, sapling, seedling and nontree (Climber and herbs)

Plot No.	Category	Species Name	RF	RA	RC	IVI (Largest to smallest)	Dominant species (Largest IVI one)
1	Tree	Heritiera fomes (Sundri)	30	84.6	59.7	58.1	Heritiera fomes (Sundri)
		Excoecaria agallocha (Gewa)	30	8.29	15.26	17.85	
		Amoora cucullata (Amur)	10	0.24	0.09	3.44	
		Xylocarpus mekongensis (Passur)	30	6.87	24.95	20.61	
	Sapling (SP)	Excoecaria agallocha (Gewa)	33.33	11.76	7.02	17.37	Heritiera fomes (Sundri)
		Amoora cucullata (Amur)	16.67	5.88	5.16	9.24	
		Heritiera fomes (Sundri)	33.33	79.41	83.99	65.58	
		Xylocarpus mekongensis (Passur)	16.67	2.94	3.84	7.82	
	Seedling (S)	Heritiera fomes (Sundri)	20	73.29	N	46.64	Heritiera fomes (Sundri)
		Bruguiera sexangula	13.33	2.5	N	7.92	
		Xylocarpus mekongensis (Passur)	20	3.16	N	11.58	
		Amoora cucullata (Amur)	13.33	1.45	N	7.39	
		Acanthus ilicifolius-Hargoja	13.33	8.55	N	10.94	
		Excoecaria agallocha (Gewa)	13.33	10.66	N	12	
		Avicennia officinalis	6.67	0.39	N	3.53	
	Non Tree	(Brownlowia tersa) Sunduri lata	100	100	N	100	(Brownlowia tersa) Sunduri lata
2	Tree	Heritiera fomes (Sundri)	18.75	19.35	11.65	16.59	Bruguiera sexangula
		Excoecaria agallocha (Gewa)	18.75	29.68	12.98	20.47	
		Amoora cucullata (Amur)	6.25	0.65	0.13	2.34	
		Xylocarpus mekongensis (Passur)	18.75	7.74	9.32	11.94	
		Avicennia officinalis	12.5	8.39	33.95	18.28	
		Bruguiera sexangula	18.75	32.26	31.29	27.43	
		Intsia bijuga (Bhaila)	6.25	1.94	0.67	2.95	
	Sapling (SP)	Excoecaria agallocha (Gewa)	50	42.86	45.1	45.99	Heritiera fomes (Sundri)
		Heritiera fomes (Sundri)	50	57.14	54.9	54.01	
	Seedling (S)	Amoora cucullata (Amur)	20	1.21	N	10.61	Heritiera fomes (Sundri)
		Excoecaria agallocha (Gewa)	20	1.75	N	10.88	
		Bruguiera sexangula	30	2.16	N	16.08	
		Heritiera fomes (Sundri)	30	94.88	N	62.44	
	Non Tree	Phoenix paludosa (Hental)	33.33	15.38	N	24.36	Derris trifoliate (Kalia Lata)
		Derris trifoliate (Kalia lata)	33.33	69.23	N	51.28	
		(Brownlowia tersa)Sundri Lata	33.33	15.38	N	24.36	
3	Tree	Heritiera fomes (Sundri)	27.27	48.69	51.54	42.5	Heritiera fomes (Sundri)
		Excoecaria agallocha (Gewa)	27.27	45.69	42.29	38.42	
		Amoora cucullata (Amur)	9.09	2.62	0.75	4.15	
		Xylocarpus mekongensis (Passur)	18.18	1.87	5.04	8.36	
		Dahur	9.09	0.37	0.11	3.19	
		Urmui	9.09	0.75	0.28	3.37	
	Sapling (SP)	Heritiera fomes (Sundri)	40	80.56	70.78	63.78	Heritiera fomes (Sundri)
		Excoecaria agallocha (Gewa)	20	5.56	7.49	11.02	
		Amoora cucullata (Amur)	40	13.89	21.73	25.2	

<table>
<tr><th>Plot No.</th><th>Category</th><th>Species Name</th><th>RF</th><th>RA</th><th>RC</th><th>IVI (Largest to smallest)</th><th>Dominant species (Largest IVI one)</th></tr>
<tr><td rowspan="5"></td><td rowspan="4">Seedling (S)</td><td>Amoora cucullata (Amur)</td><td>33.33</td><td>8.69</td><td>N</td><td>21.01</td><td rowspan="4">Heritiera fomes (Sundri)</td></tr>
<tr><td>Excoecaria agallocha (Gewa)</td><td>22.22</td><td>4.79</td><td>N</td><td>13.5</td></tr>
<tr><td>Ceriops decandra</td><td>11.11</td><td>0.38</td><td>N</td><td>5.74</td></tr>
<tr><td>Heritiera fomes (Sundri)</td><td>33.33</td><td>86.15</td><td>N</td><td>59.74</td></tr>
<tr><td>Non Tree</td><td colspan="6">Not Present</td></tr>
<tr><td rowspan="10">4</td><td rowspan="3">Tree</td><td>Heritiera fomes (Sundri)</td><td>37.5</td><td>26.26</td><td>38.11</td><td>33.95</td><td rowspan="3">Excoecaria agallocha (Gewa)</td></tr>
<tr><td>Excoecaria agallocha (Gewa)</td><td>37.5</td><td>69.06</td><td>60.16</td><td>55.58</td></tr>
<tr><td>Ceriops decandra</td><td>25</td><td>4.68</td><td>1.73</td><td>10.47</td></tr>
<tr><td rowspan="2">Sapling (SP)</td><td>Excoecaria agallocha (Gewa)</td><td>33.33</td><td>5.56</td><td>2.74</td><td>13.88</td><td rowspan="2">Ceriops decandra</td></tr>
<tr><td>Ceriops decandra</td><td>66.67</td><td>94.44</td><td>97.26</td><td>86.12</td></tr>
<tr><td rowspan="4">Seedling (S)</td><td>Amoora cucullata (Amur)</td><td>10</td><td>1.36</td><td>N</td><td>5.68</td><td rowspan="4">Excoecaria agallocha (Gewa)</td></tr>
<tr><td>Excoecaria agallocha (Gewa)</td><td>30</td><td>67.73</td><td>N</td><td>48.86</td></tr>
<tr><td>Ceriops decandra</td><td>30</td><td>25.45</td><td>N</td><td>27.73</td></tr>
<tr><td>Heritiera fomes (Sundri)</td><td>30</td><td>5.45</td><td>N</td><td>17.73</td></tr>
<tr><td>Non Tree</td><td colspan="6">Not Present</td></tr>
<tr><td>5</td><td colspan="7">Not monitored during the monitoring period</td></tr>
</table>

3.4 Floral diversity, species richness and species evenness

Floral diversity and species richness is the major driver of ecosystem productivity, stability, nutrient dynamics and invisibility. Species evenness indicates the degree of homogeneity in a community. The floral diversity and species richness are higher in Karamjol followed by Harbaria, Akram Point and Sutar Khali (**Table.3.19**). From the diversity index, it has been seen that except for Karamjol species diversity and species richness decreased in all plots from the baseline condition. The lower species richness in Akram point indicate that it is ecologically less stable than other sites. This is because Akram point face natural stresses due to their location being very much closer to the sea.

Table 3.19: Species diversity index, evenness index and richness index of the monitoring site in SRF

Baseline status

Monitoring site	H'	J'	R'
Sutar Khali	1.02	0.32	1.24
Karamjol	1.57	0.40	2.11
Harbaria	1.41	0.41	1.50
Akram Point	1.03	0.65	0.34

Present status

Monitoring site	H'	J'	R'
Sutar Khali	0.55	0.39	0.50
Karamjol	2	0.80	1.19
Harbaria	0.94	0.52	0.89
Akram Point	0.75	0.68	0.36

Carbon density

Sundarbans Reserved Forest (SRF) is now dedicated for environmental purpose; all sort of timber harvest is completely banned. Only some Non Timber Forest products are allowed for extraction. In the environmental context, global warming and its possible mitigation option is a major concern among policy makers. Forest play an important role in mitigating global worming through sequestering atmospheric carbon. Concerning this issue, the biomass carbon and soil carbon was given highest priority in SRF health monitoring. The mean carbon (excluding soil) density in the four monitoring sites is shown in the **Table 3.20**. In Satarkhali, have the highest carbon (137.74) density per ha though it diversity, species richness is low which indicates that carbon content is not relatated to species diversity or richness rather it is determined by other factors such as function character of dominant species (tree dize e.g. diameter, density of mature species; table). Basal area and stem density of trees per ha are higher in Sutarkhali. Among the other monitoring sites, the mean carbon density of Karamjol and Akram point is lower than that of baseline carbon density but the other two sites have comparatively higher carbon density than from the baseline condition.

Table 3.20: Mean carbon density in Baseline and Present condition of the four monitoring sites

Baseline Status

Carbon density	Sutar Khali	Karamjol	Harbaria	Akram Pont
ABC Mg/ha per plot	70.51	79.47	45.95	82.10
BGC Mg/ha per plot	41.21	38.62	25.49	41.26
Total carbon	**111.72**	**118.09**	**71.44**	**123.36**

Present Status

Carbon density	Sutar Khali	Karamjol	Harbaria	Akram Pont
ABC Mg/ha per plot	87.25	68.83	82.29	63.52
BGC Mg/ha per plot	50.49	36.80	45.37	36.55
Total carbon	**137.74**	**105.63**	**127.66**	**100.07**

4. Social Environment

4.1 Introduction

Social safeguards refer to the policies, procedures, and measures intended to mitigate unintended negative impacts of the projects implemented or under implementation stage. Social safeguard monitoring helps to mitigate negative impacts and suggest measures and pathway for successful implementation following national and international standard. This safeguard monitoring is a follow-up study that occurred following the guidelines of DoE and Environmental Management Plan (EMP), suggested in the Environmental Impact Assessment (EIA) Report and conditions set by the DoE during the phase of implementation. This monitoring has examined the compliance status of the working environment, project implementations impact on local livelihoods, community health and safety and activities of Corporate Social Responsibility (CSR) done by the Project Management Unit (PMU). Additionally, the Corrective Action Plan (CAP) suggested addressing the non-compliance issues based on the findings of the safeguard monitoring.

4.1.1 Methodology

This monitoring was conducted based on the physical observation, interpersonal interview and group discussion at the project site and community level adjacent to the MSTTP. Interpersonal interview and group discussion were carried out at Zero Point, Kapasdanga, Rajnagar, Gaurambha, Foylarhat, Borodurgapur, Rajnagar and labor sheds area located within the project site.

Findings of Social Safeguard Monitoring

Impact on Livelihoods

It was estimated that the construction of MSTPP provided both technical and non-technical job as temporary aspect. However, local people are not technically sound in getting these kinds of jobs. Because of that local people could manage non-technical works from the MSTPP. During this phase of monitoring it was observed that activities related to the non-technical aspects were reducing. Apart from that about 20% local people from different unions of Rampal Upazila working as labor force with the different companies under the BHEL.

According to the local people of Gaurambha union, about 150 to 200 laborers were working at the project site. Besides, there were scopes of employment due newly developed access and paved road, bazaar at the zero point and other newly development initiatives (i.e. LPG industries, cement factories, solar power plant etc.) near to the project area. It was found that an easy bike-stand developed close to Gurudaskathi School (Gaurambha union) due to newly paved way. In this way, people tried to choose new livelihood options. Additionally, about 280 people were registered (under the motor vehicle federation) to run motor vehicles (i.e. easy bike, auto rickshaw and Van) at the approach road to carry both goods and passengers. As a result, it helps people to involve more earning opportunities than the previous time. Furthermore, local people started thinking to be skilled and also started learning wielding, machinery works, electrical works to catch the future jobs related to the project as well as other scopes that will be developed in the future in this area.

It was observed that local people of near villages are engaged in food, beverages, vegetable, mobile banking services and other service providing business/employment at the project adjacent area i.e. at the approach road side and within the labor sheds area which is found as the main earning sources of those households. The project authority organized training programs related to the ICT and sewing to learn people to be engaged new area of livelihoods options. Local people stated that this project has brought about a change in which they are thinking to be skilled for getting new opportunities. Because of that youth group are trying to be more skilled top avail new opportunity.

Working Environment

A work environment refers to the condition of the workplace whereas professionals and workers spend time to conduct different works. A healthy working is very important to add value and benefits for the work place. However, the MSTTP is in construction phase, the workplace that requires to ensure safety and friendly environment for the construction of the project activities. In this phase, there is a lot of chances to expose different risks elements and health hazard, obviously, required to protect safe environment considering all aspects of Occupational Health and Safety (OHS). The OHS risks include exposures to physical hazards due to the use of heavy equipment, dust, noise, vibrations, falling objects and the use of electrical and machinery equipment. The best planning to implement a safe working environment, procedures and culture during the construction phase provide better occupational health and safety issues. The Department of Environment (DoE) and EIA report on MSTTP provided guideline in which the BIFPCL authority took initiative keeping a good and friendly working environment. In this regard, laborers got training about safety, working at heights and use of PPE. The tri-party coordination meeting was held with all safety officers from BIFPCL, BHEL, and other construction companies to ensure compliance with the working environment. Regular toolbox training is held every day before starting the construction activities. The PMU was monitoring the all safety related issue if found during the ongoing activities.

Most of the labor sheds were found clean with adequate toilet facilities, drinking water, proper drain out and waste management facilities. At the same time, it was also observed that waste management wasn't satisfactory, and the laborers were dumping waste here and there. The dustbin provided by the third party was not adequate and clean to manage the kitchen and solid waste.

Community Health and Safety

Many community health and safety impacted during the construction of thermal power plant projects. There is a General guideline of IFC (section 1.1) which was considering during the construction of the MSTTP. In this consideration, the PMU used to check the community health and safety issues (i.e. dust and noise pollution, road safety, green belt preparation other community safeguards). In this regard, the EA maintaining the protocol to avoid noise and dust pollution. Considering the road safety, speed limit sign provided at the project site and it was monitored by the PMU. In addition, the EA have the additional risks management plan to overcome the situation occurred due to any accidental cases.

According to the field findings, the local communities at Gaurambha and Rajnagar unions are not encountered noise problems due to the construction activities of MSTPP. According to the PMU, noise generating construction activities are almost ending up and they try to maintain DoE standard for conducting noise generating construction activities. A green belt developed in the peripheral area of the power plant area following the conditions of DoE.

Local people of Rajnagar and Gaurambha union stated that they are encountering sound because of construction activities. This issue has already been raised to the MSTTP authority they have taken it as serious issue to solve this problem.

Besides, a number of mangrove, fruits, coconut, and herbal plants were planted in the project area and the program is still ongoing, though the survival rate of the plants (except mangrove trees) are not satisfactory. In this regard, a caretaker from the Forest Department is engaged for supervising the maintenance of the plants. Formalized process by which grievances couldn't raise by the local community and staff during construction phase of the project.

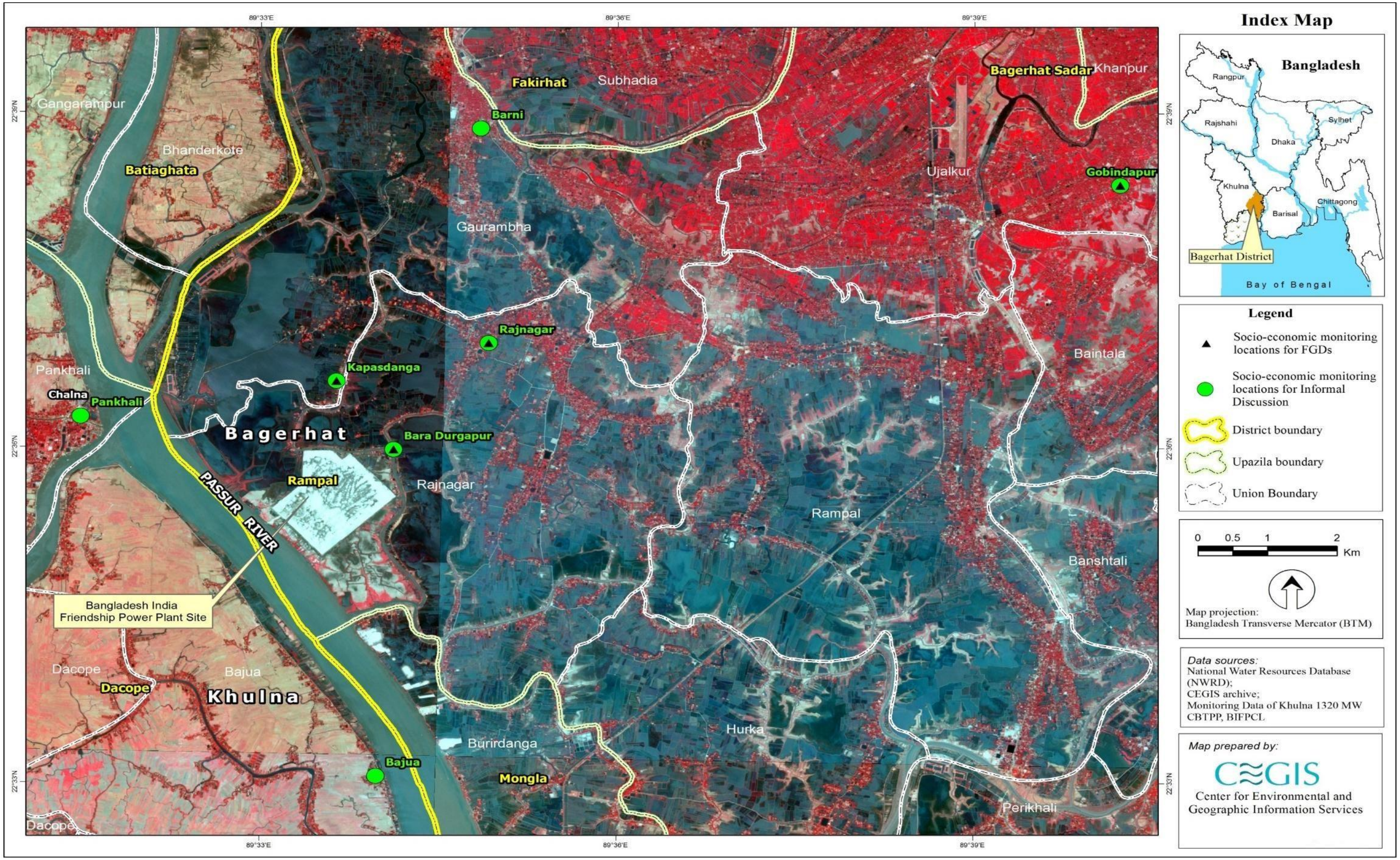


Figure 4.1: Socio-Economic Environment Monitoring Location

Corporate Social Responsibility (CSR)

The BIFPCL is committed to continue supporting/development activities under the CSR. It made a significant impact to the community in which community people get better interaction with the project. However, the CSR was the part of operation phase but it was observed that the BIFPCL committed to organize different programs, logistic and infrastructural support during the phase of construction.

The BIFPCL have conducting medical campaigns along with different socially demand-based programs. In consequence, they allocated vaccination program under the CSR in which officials and labor force got vaccinated. Also, constructed water treatment and filtering RO systems at 4 locations in Rajnagar and Gaurambha Unions for ensuring safe water for the community under the CSR activity. Previously, sewing and ICT training were introduced for the livelihood development of the local community in the study area.

RO System Installation

Four (4) RO system has been installed in the Rajnagar and Gaurambha Unions as 2 in each union where one in each union is operated successfully while remaining 2 are under process for operation. Each of these ROs are operated by a local committee formed by the guidance of respective union chairman.

Medical Campaign

Medical campaign is one of the major program under the CSR of MSTPP. According to BIFPCL, it was found that following services provided under the medical facilities provided by the CSR program till now. On the other hand, two (2) mobile medical campaigns organized at Hurka and Buridanga union. In this medical campaign a total of 434 patients received free treatment that became very beneficial for them. Local people appreciated this initiative very much and stated that the coverage of this free medical is required to be extended as more people can be benefitted accordingly.

Health Care Services- 61,925
Medical Support at Project Site -54,605
Office Medical Center- 8,247
Weekly Camp (Saturday & Tuesday)- 42,565
Labor colony camps- 3,187
Pathology test -298
Physiotherapy -308
Specialty Monthly Mobile Medical Camp at Different Union Parishad's Premises -5949

Recommendations

a. Waste Management at the Labor Shed should organized properly; If required, awareness raising workshop can be organized to convince people for maintaining waste management protocol;

b. Local people are becoming aware about the new entrepreneurship development in this area; in this regard, training on entrepreneurship development should be arranged under the CSR activities;

c. Rehabilitees should be given preference in implementing CSR program as they are under serious threat of another shifting;

d. Precautionary measures should be taken to avoid sound pollution;

e. Dust suppression by spraying water should be continued on construction sites, and other places where necessary to suppress dust and minimize air pollution; Special monitoring team required to monitor the dust pollution;

f. River water should be used for dust suppression activities and ground water use should be avoided completely;

g. Local work forces should be trained on masonry, carpentering, electrician & electronics, welding, driving, safety worker, rod binding and machineries operation to prepare them as the semi-skilled working force for this project;

h. It is required to establish a grievance redress team to monitor and solve the problem (especially during selecting beneficiaries for providing any services from the MSTTP) of localities regarding the aspect of construction activities of MSTTP;

i. A gender action plan regarding the women employment is required for the local communities;

j. Previously sewing and computer training were introduced for the skill development of local people. Outcomes of those trainings should be monitored as a lesson learnt, before initiating further such types of training;

k. Some ROs are installed in different location of the study area to ensure safe drinking water for the local people. Few of those are not properly operated due to malfunctioning of the Operational Local Committee. It is essential, to solve the issues immediately through discussion with those committees and related officials including LGIs representative;

l. Regular plantation is to be continued for making the desired and committed greenery effectively as per conditions of DoE;

m. Continuing regular health checkup and disease monitoring for the daily laborer at work place as well as for the laborer staying at labor colony;

n. Close monitoring should be continued for maintaining Covid-19 protocol and for handling any syndrome related to the COVID 19;

o. Ensure masks and other PPEs for everyone who are working at the Project site;

p. All officials and workers should be included under the Covid-19 vaccination program and project authority should maintain record and close monitor the issue;

q. CSR activities should be performed primarily among the PAPs on equitable manner. This should be audited by a third party monitoring team;

r. Special attention should be taken care for assessing the needs to local schools and colleges for implementing different programs under the CSR;

s. The PMU should be active and efficient in maintaining vehicle speed limits in the Project site;

t. Mindset of local people have been changed and people are more positive about the project. To increase more awareness, it is required to arrange some consciousness program in which they can be more aware how this power plant will be operated and how this project will be beneficial for the local people;

u. Digital Billboard about the MSTPP work progress status, and operation system would be placed on the approach road at main road connecting side to create more awareness about the construction and operation of the MSTPP;

v. It is required to arrange program at local schools, colleges and UP offices about the operation and impact of the power plant to disseminate the progress of the project and create more awareness about the MSTPP;

5. Environmental Compliance

5.1 Introduction

This environmental compliance report aims to highlight any actual or potential breach of compliance with the measures and requirements set forth in the EMP measures in the EIA report at Bangladesh-India Friendship Power Company Ltd (BIFPC). Providing an operational translation of local laws, international standards and company codes, the report will demonstrate the actions required to ensure that all operations along the supply chain, from the production of the raw material to the production of the electricity that are consistent and comply with DoE conditions and also Environmental Management Plan (EMP) requirements stated in the EIA report.

An E&S team from CEGIS recently visited to the plant on 27th July, 2022 for a routine inspection and to acquire information intrinsically considering the bio-physical and other related parameters through a rigorous walk-in visit, meeting with plant officials, general laborers and overall the close observation of the ongoing work at the plant.

The present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews/discussion to the proponents, project officials, relevant authorities and overall staffs of the entire plant. A comprehensive and detailed checklist was prepared to cover environmental compliance of different components e.g. Environmental and Social Management System and Action Plan; Labour and Working Condition; Community Health, Safety and Security; Biodiversity and Sustainable Management of Living Natural Resources, waste management and other relevant issues. Unlike the 32nd environmental compliance monitoring report this quarterly report will focus again on waste generation and its management in and around of the main plant and labour shed. It is noted that during 32nd field visit we identified a set of anomalies regarding waste generation and its proper management and requested to the respective authorities to look after this issue urgently. During 33rd visit we had a quick look on those issues again and found that all waste related issues are still unsolved. CEGIS raised this issue in the meeting to consider this issue as urgent and project management has assured us to take immediate step to resolve the issue.

<u>Highlighted issues during 32nd visit:</u>

1. *During the visit inside the labour shed plenty of household waste were found on the road in a messed-up condition.*
2. *Lack of waste bin and lack of proper initiative of source segregation of the organic waste has made the labour shed unhygienic*
3. *Unused bath-tub with dirty water was noticed where waste garbage and polybags were being floated.*
4. *Lack of adequate drainage and sewerage facilities, lavatory/toilet waste is being accumulated inside the labour shed that has been causing malodorous stench and health deterioration.*
5. *Stock-pile of construction and household waste were found by the side of the Maidara river bank that may washed away and deteriorate the adjacent river water during heavy rainfall.*
6. *Heap of Sand and other loose material were found uncovered at the labour shed and inside the plant premises.*
7. *Though there are 657 coloured waste bin there is no written labelling on the bin that is very important for source segregation and easily understandable for the general workers.*
8. *Keeping record about the amount of waste generation per day or per week is very important that was absent.*

In general, the aim of this compliance checklists are to check the implementation and effectiveness of mitigation measures as stated in EIA. The checklists are produced as Compliance Data Sheet that contains both quantitative and qualitative data. The summary of findings of the environmental compliance monitoring are presented in the following **Table no. 5.1, 5.2, 5.3** and **5.4** respectively.

Table 5.1: Monitoring of Environmental and Social Management System Action Plan Implementation

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
1	Generation of Noise within the BIFPCL's Plant construction premises.	• Switch off / throttle down all site machinery, vehicles, water vessels, and generator when not in use • No construction activities at night Use noise damper within the project boundary, Limit vehicle speed and monitor it at every suitable point.	• Noise data are being monitored monthly and quarterly basis both night and day time at different potentially sensitive areas (Labor colony, township) and compared with the ECR-1997 Standard which are being documented.by EPC contractor. • No noticeable noise detected except some gentle sound during the walk-in visit inside the project boundaries. • Workers at heavy noise generating activities (i.e. piling, rod cutting etc.) have been provided PPE (ear plug and ear muff) and its usage are being ensured through safety audit. • Idle machines / equipment / generators are switched off / throttled down. • Generators with acoustic enclosures are only being used as and when required. Signboards regarding noise permits were not observed at site.	Complied	• Schedule the Heavy noise related work if required and that should be disseminated to the workers and nearby communities before • CEGIS team has suggested to attach precautionary signboard regarding noise management. • Noise silencer should be imposed if any plan to run the work at night
2	Dust generation from construction works	• Limiting activities for producing fugitive dust particle within project area • Vegetation clearance and base stripping should be minimized. • Vehicle speed restriction must be enforced to control dust generation. • Earthen roads and undeveloped roads should be avoided to minimize dust generation	• Monthly and quarterly air quality monitoring in and around the project sites is being conducted and checked with ECR, 2005 standard. • Mixing of cement and concrete may generate some unavoidable dust but the crushed material was well covered and also noticed the water spraying at those areas.	Mostly Complied	• It is strongly recommended to cover all the Stockpiles of sand or any type of loose materials inside the plant premises and at the labour shed/camp.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Construction materials must be covered to protect from wind action • Spray water regularly for suppressing fugitive dust • Dust particle generated from access road must be controlled by spraying water during dry season. • Stock piles of construction materials must be covered in order to protect from wind action. An appropriate freeboard must be maintained in trucks hauling construction materials.	• Continuous water spraying on the dusty road was noticed. BHEL has contracted a company for 3 years for this job. • Like the 32st monitoring visit still some stockpiles of sand and other loose material were noticed uncovered. • Now-a days, earthen stock piles are covered by natural green of tiny grasses. These are acting as shield cover for fugitive dust • No black smoke observed because of plant and equipment are well maintained. Visual monitoring of dust is also being conducted.		• Dust suppression activities should be monitored on a regular basis for maintaining the air quality within standard limit. • Face musk should be use wear throughout the workplace. • Cleaning the Mud on the Inside roads has recommended.
3	Water Quality	• Surface water must be saved from any harmful effluent emission and waste dumping from project site • Provide closed system facilities and wastewater treatment plant to minimize discharge of effluents from worker's colony. • Good housekeeping at workshop and construction site • Appropriate equipment with safety measures should be used for storage and handling of lubricant • Provide training and awareness building program to the workers during construction. The training and awareness programs are: a) Arrange weekly consultation session among the workers through plant site managers. The	• Surface water is regularly monitored. The discharge water quality has been recorded within the standard limit (ECR, 1997) • Ground water is not used for construction purpose. • Construction waste water discharge is minimum and need based only. They are also meeting effluent norms. • Rainfall, runoff and other construction water are being drained out though permanent drainage system. And also, two nos. of runoff settling ponds are being made to settle the silt before discharge in to river. • Waste water is being discharging in to the Maidara River without any further treatment. • Temporary chemical lab has been established where turbidity, PH, alkalinity,	Mostly Complied at present	• Good housekeeping at workshop and construction site is strongly recommended • Waste water must have to be treated properly before final discharge into the river.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		duration of consultation is one hour according to ISO-14001 standard, Arrange monthly environmental meeting among the mid-level officers through top management when those issues will be discussed under guidance of ECR 1997.	conductivity, chlorine, iron (Fe) parameter are being tested and monitored. • RO1 and RO2 tank establishment has completed to remove the dissolved solids (less than 400 TDS at RO1 and less than 10 TDS at RO2) • ETP plant is still under construction where the effluent will be further treated before final discharge. • BIFPCL authority has established a silt trap at the North-East corner of the project site to control sediment running out from the projects with rainfall runoff. Training and awareness program staged regularly through PEP talks, lectures, one to one talk etc.		
4	Waste Generation	• Limiting site clearance and base stripping activities within the project boundary. • Gathering and stocking of construction materials and machinery must be within a limited area in the project boundary. • The project area has to be fenced prior to initiation of construction activities. • Stock piles of construction materials requiring cover up in order to protect them from wind and weathering action. • The existing right of way have to be used for material transportation without creating any block • Location of spoil stock pile ought to be located in safe area and protected from wind and rain action.	• During the visit CEGIS team found most of the construction waste are compiled at the demarcated place but more attention need to manage this properly as some waste were scattered here and there. • Most of the Labour shed/camp area were found very dirty. Organic and inorganic waste were found on the roads/lanes inside the camp which are spreading the stench around the community. • Stockpile of construction and household waste were noticed along with the bank of the nearby river which may pollute the river water during rainy season. (Pic attached)	Partially Complied with many lacking	• Strongly advised to keep the footpath of the labour shed clean and waste free. • Riverbank must be waste free and keep clean to save the river water deterioration. • Proper and immediate step need to be taken for the lavatory sewerage waste management at labour shed • Special care and training need to be

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• No spoil store on River bank/slope • Construction wastes must be reused or recycled as and where possible • Burning of waste material should be restricted • Quality housekeeping practice must be maintained by regular inspection and checking. • Keep onsite waste collection and disposal facilities • Keep provision of different colored waste bin for dumping biodegradable, reusable and recyclable wastes. Keep provision of awareness building meeting and training for employees	• Lack of proper drainage facilities of the lavatory waste has worsened the ambient environment. • Though requested waste quantity is not being yet to be measured. • No chemical or gaseous waste noticed during the visit as Chemical wastes are properly stored and labelled • Limited but Onsite waste collection and disposal facility has been observed. • Source segregation method were absent and not kept in separate labelled container. • Though there are 657 different colored waste container (EMP report) but not labeled by Bengali or English written sticker that is very important for source segregation of the waste. • Burning of waste materials is strictly banned inside the plant premises. • BHEL has engaged a company name Rahman Brothers in collaboration with the KCC for collection of waste from the disposal. • Waste management training has been included in induction training of the labor. There is a provision of development of solid waste management system which is given at clause no B12, Part no 9 of book no -2, page no 147-161 but that is still under construction.		conducted regarding source segregation of the waste • Awareness raising programs regarding waste recycle and reuse should be introduced. • Team advised again to label the waste container in written by both Bengali and English so that one can easily understand which container is for which type of waste. But still there is no progress in this issue.
5	Compensation and Resettlement	• Proper resettlement action plan and compensation plan if the Project needs any land acquisition addressing compensation, restoration, livelihood, living standards	• Compensation has been given to the rightful owners of the land as per the laws of Bangladesh e.g., ‘Acquisition and Requisition	In the process of Compliance	• The CSR activities should be oriented towards the affected people or household;

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		etc. based on proper socio-economic studies. • Resettlement of the PAPs • Cash for compensation of land (CCL) before resettlement formal agreement with the affected people prior to migration/resettlement • Sufficient standing crop compensation • Compensation for movable structures • Retention of salvageable materials • Compensation for loss of trading income one-time moving assistance grant to cover loss of regular wage income • Has a resettlement plan been developed which includes compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies? • Human provide/ take extra care/caution for the disadvantaged/ vulnerable group/s (i.e. women, children, ethnic minorities, indigenous people etc.) Provision of monitoring the compensation and resettlement process	of Immovable Property Ordinance, 1982 started in 2011 • Compensation was paid by the local DC office as per law of the land. • Local DC office facilitates to obtain house of the PAPs (settlers of the project area) in cluster villages provided by the GoB. • Almost 32 affected families are now having their houses at Foyla cluster villages. • BIFPCL is giving priority to affected people in project employment or trained them as much possible. • 136 indirectly affected people were given compensation by the DC Office, Bagerhat. • The project authority has given training on computer and swing to the nearby villagers including PAPs which is stopped at present due to COVID-19. • BIFPCL have also plan to initiate skill development trainings on electronics, driving, health and hazard safety, fittings, welding etc. • 17 families got their residence who have shifted their houses from project area to Kapashdanga.		CEGIS team advised several times to collect the original copy of compensation disbursement to the affected peoples from local DC office but this is not done yet.
6	Livelihood and living condition	• The labor recruitment policy must be formulated in such a way that the local laborers can easily get the chance of employment in the project work force.	• BIFPCL are recruiting the local people especially PAPs with the help of local government (UP Chairman and members). • Recruitments for labours are continual process. Locals are being given preferences. In August, 2022 Total manpower at site was	Partially complied	• Drainage and sewerage facility must be improved for proper lavatory waste management.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Govt./NGOs need to provide support the skill development program and income generation activities to local people; • For the increased movement of people and heavy vehicles, the road networks must be developed. Keep provision of sanitary toilet, one toilet for 10 persons.	5700 nos. Out of this, Bangladeshi manpower was 4200 nos. • An NGO "SAMAHAR" was engaged by BPDB to give livelihood training for the affected people. • Accidental log sheet or injury log book are being maintained. • Provisions has been kept for health facilities to the labors as well as for the communities. • Proponent has taken numbers of potential measures for COVID protection which is continued • The wage of the labor was found compatible with the national standard. • Labour accommodation is clean but plenty of waste were found on the camp road that is polluting the camp environment. • Some water reservoirs inside the labour camp were found very dirty where plenty of polybags and other garbage waste were floating. • Inadequate drainage facility of lavatory waste made the whole workers camp very unhygienic. Available drinking water, sanitation facilities, prayer room are provided at site.		• Dirty water reservoirs must be cleaned immediately. • 1 toilet for 10 people should be ensured Health and financial support should be available for the labour in case of COVID and other health effects.
7	Green House Gas Controlling Measures	• Restriction of any kind of solid waste disposal • Approved pollution control devices to be fitted in equipment and machinery.	• Fitness certification of vehicles and equipment are lacking for the construction works	Partially Complied	• GHGs inventory checklist should be prepared as soon as possible

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Transport vehicles must not be overloaded. • Avoid queuing of vehicles in areas adjacent to site, particularly near sensitive receptors including housing. • Switch off/throttle down all site vehicles, water vessels, generator and machinery when not in use. Regular maintenance of water vessels, vehicles, generator and machinery in accordance with manufacturer's	• The EPC Contractor is using relatively new equipment and vehicles to reduce the GHGs emission. • Equipment, generators and vehicles were observed switched off during non-operation period. • Green waste is not being segregated from others that can be a major concern for GHG emission. • No GHG inventories were prepared yet. From the discussion meeting CEGIS came to know that Authority will appoint third party to develop the GHG inventory including its management plan.		Segregation of the green and food waste must be the top priority for the waste management team.

Table 5.2: Monitoring of Labor and Working Condition

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
1	Working Conditions and Management of Worker Relationship	• Preparation of Human Resources Policies and Procedures for Direct workers; • Defined Working condition and Terms of Employment for direct worker; • Sustainably equivalent terms and condition for migrant workers; • Compliance to national law of forming workers' organization; • No discrimination and equal opportunity for all; Grievance Redress Mechanism.	• BIFPCL is running through the HR polices and switching their professionals as per demand of the project. • Based on the conversation with HR manager CEGIS team found all the agreement for the direct workers are well maintained. • Accidents, incidents, near miss, corrective actions, preventive measures, are reviewed and recorded. • O2 level measurement and other precautionary measures followed properly if there is any work need to be done in a confined space or any other closed premises. • The EHS department is also monitoring the occupational health safety issues carefully under this COVID situation. • No discrimination was recorded among at labor level between local or migrating labor in Bangladesh • BIFPCL has ensured minimum wage and working hours for the labor as per GoB rules and regulation. • Routine medical checkup and emergency medical care has been ensured Continued in association with COVID management guideline. GRM procedure is available for the project workers and officials but Community GRM is absent.	Mostly Complied	• OHAS must be monitored for construction workers • Requested to develop labour association protecting labour interest but still not done. • Create fund to support the labour and his families in case of any fatalities CEGIS team strongly and repeatedly recommended to the authority for Community GRM but still not done. The grievance box may be fixed just at the outside of the main entrance.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
2	Protecting Work Force	• The client will not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child health or physical, mental, spiritual, moral, or social development. No Forced Labor	• CEGIS tem visited all part of the construction area and pleased to see there is no child involved in the construction and any other works. • No forced labor has been recorded during the project tenure. • Proper documentation of contract with the worker is being maintained which includes working hour, wage and benefit. • Awareness about Covid-19 is being monitored. Team observed the workers are maintaining a physical distancing as well as using the proper precaution against COVID-19. • Workers must get the safety clearance before initiating any work like – routine checkup of the work places and administrative clearance is being Implemented • Sanitization is being done at regular intervals at Offices and labor sheds First Aid support is readily available for the labors as required.	Complied	• Complied but this should be continued strictly till the end of the pandemic. Awareness work should be continued regarding the local cultural values, STD, redressing of workers grievances, insurance policy related facilities and also contract clauses of the job to get maximum benefit.
3	Safety at site	• Installation/Construction of Safety Fence around the Project area • Use of Personnel Protective Equipment's (i.e. safety vest, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.);	• BIFPCL has demarcated the specific construction site with appropriate warning sign. • It was impressive to see that all Labors and Project personnel are using appropriate PPEs like reflecting vest, helmet, and safety shoes and face masks. • 33 no of Foam type, DCP type-261 no of DCP type and 218 no of CO2 type Fire	Complied	Satisfied but this process must be continued through the entire construction and operational phage.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		• Safety trainings for workers (i.e. fire control, working at height, working in heat, first aid etc.); • Practice of Tool box meeting, safety talks • Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.); • Maintaining Material Safety Data Sheet (MSDS); • Provision of Health care facilities such as doctor, hospital etc. available at/nearby the Plant construction site; • Availability of First Aid at work place; • Preparation and Follow of Emergency Response Plan (ERP); • Adequate fire precautions in place (e. g., fire extinguishers, escape routes etc.); • Documentation and reporting of occupational accidents, diseases, and incidents; Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS	extinguishers have been kept at different places of sites. In addition to this, two no fire fighting vehicle, two no ambulance with doctors are also available at sites. • BIFPCL has employed one Manager & Assistant Manager in Fire & Safety department. Approximately 93 safety officers/supervisor have been employed by the EPC contractor and Sub-contractors under the supervision of BIFPCL Fire & Safety department. During duty time, • Induction trainings and awareness program were given to **1531 no's** of participant work force during month of August,2022 and 816 no's of participants of July,2022 • The OHAS Company named Cholamandalam has been looking into the occupational safety system of this project. • Safety walk-down at a regular interval by the OHS officer has been strengthening the HIRA process. • Emergency contact address was found on the board at the site for any kind of sudden incident. Different type of awareness posters was also observed at the site premises (Pic attached) • The existing temporary hospital are fully running with doctors and 24hr availability of ICU supporting ambulance at the Project site; • EPC has made a contract with the Gazi Medical of Khulna city for emergency medical support.		

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			During COVID situation all the necessary precautionary measures including physical distancing is maintained properly. Vaccination program was arranged and basic health checkup including body temperature is monitored at regular basis while enter into the working site.		
4	Occupational Health and Safety procedure	• Provision of complete EHS division in the Human Resources Planning/ Organogram Preparation of Safety Policy to be adopted during Plant operation	• Adequate number of safety officers have been employed by the EPC contractor and Sub-contractors. • The OHAS Company named Cholamandalam has been looking into the occupational safety system of this project. • One safety park has been established for continual training as well as training during induction level. • Zero major accident/ incident happened from 21st April 2021 till now except some minor injuries. • Total Recordable Injury Frequency Rate (TRIFR) and Lost Time Injury Frequency Rate (LTIFR) are being followed. • Medical aid, fire extinguishers, PPEs are being provided adequately. • Regular Safety talk, safety meetings are being organized at site and also in class rooms. Photo are being attached. Adequate safety bill-boards etc. have been displaced all over the construction area.	Being Complied	• OHS should be a Continuous process regarding awareness build-up and strict to the safety issues, • Continued the safety training, buildup the awareness and make the labour habituated with the safety procedure

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
5	Workers Well Being	• Provision of Welfare facilities for Worker/Labor such as, timely bonuses, wage, overtime, sick leaves, vacations etc.; • Routine medical check-up and emergency medical care for the sick and injured; Appointment of a leader amongst the labor group, who will look into workers' well- being.	• Workers are satisfied with the residence facilities provided by BIFPCL. No dissatisfaction among the workers observed. • BIFPCL has developed apps https://bifpcl.com/safety.aspx for stepping up the safety issues well. • BIFPCL has ensured the benevolent grant developed by the contractor for the victim's family as per Government' rule. • Basic amenities like food, medicines, hygiene etc. are being ensured in labor colony • Workers get lemon or water during work period • Basic Medical care with free medicine and counseling is being provided to workers on regular basis. • Vitamin-C rich fruits, ORS distribution being done to contract workers occasionally. • Grievance mechanism available for the workers that usually address the safety issues. No labour association identified yet to look after workers 'well-being issues	Mostly Complied	• Establish and Freedom of Association, Rights & scope of bargaining should be open for the workers. Take care about the ultimate payment of the labors from the sub-contractor or local contractor. It should not be lower than the national standard fixed by the PWD for the labors.

Table 5.3: Monitoring of Community Health, Safety and Security

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
1	Disturbance to nearby community due to dust from developed land and Noise from construction activities	• Construction of boundary wall around the Project area; • Installed water spraying system to control dusts; • Conducting dust monitoring and visual inspection around the site boundary; Adopted noise management plan.	• Boundary wall construction is almost completed except some part from Bridge area to Jetty area. • Some sand pile and other loose material were found uncovered that could be a concern for the local communities. • Water is also being sprayed regularly on the stockpiles and registered. • Environmental Monitoring tem from CEGIS is routinely communicating with the nearby communities for assessing impacts and related complaints on dust generation issue. • Regular communication and consultation are taken places with the local government and local administration officials except this COVID situation • CEGIS team regularly monitors the noise level in the ambient area of the project site like Bajua, Mongla, koigordashkathi and it meets the standard nose level. Community GRM system was absent that is considered as an important tool to identify communities' complain	Mostly complied	• Uncovered sand and other flyable material should be covered and watered regularly. • Any complaint regarding noise and dust from local people must be addressed immediately and recorded accordingly in the register. The grievance register box should be placed at the gate of MSTPP so that the communities could easily put their written complain there.
2	Grievance of local people	• Availability and operation of Grievance Redress Mechanism; Maintaining open communication channel with the local community.	• Social liaison officer is working for maintaining relation with local communities especially the CSR activities. • Office medical centers of BIFPCL Total 196 patients have taken treatment in April,	Mostly complied	Recommend and advise in each quarterly meeting to initiate the community GRM procedure so that the

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			2022. Pathology test has done on 26 and Physiotherapy has given to 45 patients • BIFPCL regularly display the progress of the development through their website (https://www.bifpcl.com/) and disclosure meeting at the local government Though BIFPCL is receiving grievance from local community through local government like Union Chairman or Local Administration, Community Grievance Redress Mechanism (CGRM) has yet to be in action. It should be started as soon as possible.		local community could easily state any grievance properly. But this issue has yet to be done.
3	Risk of breaching Community Safety	• Construction of boundary wall/safety fence around the Project area; • Practicing Risk Assessment and Evaluation Process; • Practicing safe management for hazardous materials which may pose threat to the community; • Availability and operation of Emergency Response Plan; • Maintaining open communication channel with the local community; • Training and instruction to the security personnel about their behavior and communication with the local people;	• Boundary wall construction is almost completed except some part from Bridge area to Jetty area. • Initiated numbers of pollution mitigating system for protecting the dust and other pollution outside to the project area. • Strictly prohibited to enter outsider to the project site or labor camp and if required entry pass is required to enter the project site area. • No conflict has been noticed between local communities and project authorities or workers. • Project Security personnel is well trained and instructed by the authority to demonstrate a decent behavior and attitude to the local communities. • Though BIFPCL is receiving grievance from local community through local government	Complied	• Advise to Maintain and limit the frequent access of the project workers to the local community during this COVID pandemic Keep on tack about the communicable diseases transmission between the labors and nearby communities

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		Aware the security personnel about the right of the community people.	like Union Chairman or Local Administration, Community Grievance Redress Mechanism (CGRM) has yet to be in action. It should be started as soon as possible. • Routine medical camp has been conducted each month. Distribution of essential food items, soaps to nearby villages and contract workers are ongoing at a regular interval		
4	Community Health and Risk	• Provision of providing health service facilities to community if the Project poses any health risk like sexually transmitted disease, contract disease, vector-borne diseases; Implement all pollution mitigation measures to ensure safeguarding to community.	• Continued the medical facilities (consisting medical officer, medical assistant, office assistant) at Plant site for checkup the communicable diseases of the workers and staffs; • Total 269 patients have taken treatment, Pathology test has done 75 and Physiotherapy has given 64 patients in August, 2022. Also in July 2022, about 275 patients have taken treatment, Pathology test has done 24 and Physiotherapy has given 40 patients • Monthly Medical Camp at labour colony conducted on 27.08.2022 around 272 patients have been taken treatment. • Distribution of essential food items, soaps to nearby villages and contract workers during this COVID situation • BIFPCL arrange regular weekly health service program (medical consultation and	Complied	BIFPCL may introduce awareness program for STD and other transmitted diseases from workers to the community.

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			free medicine) for the local community considering the COVID situation. • Medical facilities for the local people has been running amid the COVID situation • Local people are coming to the office medical center for health issues where they are supported with health check-up and common medicine. EPC contractor is educating to the labors about protective action taken to avoid vector borne diseases and HIV positives and COVID pandemic		
5	Youth Employment (Local)	Providing training/awareness program for the local youth to let them aware about the required qualification to get involved in the Project related activities Emphasis to recruit local labors according to their skills and capacities.	• Regular communication is being maintained with the local government and community representatives for labor recruitment • An NGO "SAMAHAR" was engaged by BPDB to give livelihood training for the affected people • The proponent took a number of initiatives to encourage local students through awarding them scholarships before the COVID situation. They will work again on this field after reducing the COVID cases significantly. BIFPCL took initiatives and started to give computer training for generating ICT skill among local people. Besides, BIFPCL have also plan to initiate skill development trainings on electronics, driving, health and hazard safety, fittings, welding etc.	Being Complied	Training related to skilled construction work i.e. masonry, rod binding, plumbing, carpenter, electrician, lineman, elevator mechanic, glazier, iron worker, driving, heavy equipment operator or laborer etc. should be introduced immediately.

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
6	Public Communication, Consultation and Awareness	• Arranging public communication/consultation meeting; • Sharing of Project information with local people; Organizing environmental and social awareness programs/meetings.	• One social liaison officer is working (24x7) continuously for developing relation with local communities. • Regular consultation meetings are carried out with the local government and administration • Regular consultation meetings are carried out with the local government and administration. • Environmental and social awareness programs are organized and conducted by proponent on a regular basis except during the COVID situation. • BIFPCL regularly display the progress (thru Video) of the development through their website (https://www.bifpcl.com/) and also disclosure meeting at the local government. The local people are aware regarding the project activities from multiple sources like consultation, display board, website etc.	Mostly Complied	• BIFPCL may use print media, social media, digital media might be used for spreading the project right information The proponent should aware and clarify about the project the local people to stopover any rumor.

Table 5.4: Monitoring of Biodiversity and Sustainable Management of Living Natural Resources

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/Measures already Implemented	Compliance Status	Recommended Action
1	Rainfall runoff from the construction site would cause deterioration of aquatic ecosystem.	• Installation of proper runoff drains; Use of sediment fences, traps and basins for trapping the sediment, if required.	• Permanent drainage system (Under BHEL) to discharge waste water from the project area is still under construction. • EPC Contractor is monitoring the water quality on monthly basis at every outlet of the project site and comply with the ECR 1997 standard • Though there are two settling pond to settle the silt from Rainfall, runoff and other construction water but the waste water is being discharged to the Maidara river body without any proper treatment. This is very concerning in terms of aquatic biodiversity and water quality. Runoff/ wash away of the sediment is comparatively low to zero during this dry season.	Being complied	• Take immediate measures to maintain the roads and basin for trapping the sediment as monsoon season has started. • BHEL need to complete their drainage facilities for the better waste water management. • Operation of ETP should be quick to treat the waste water and other effluent before discharging in the nearby river.
2	Disturbance to nearby ecosystem due to different construction activities	• No cutting/ felling of trees along the river bank; • Implementation of onsite waste and air quality management plan; • Limiting soil extraction activities within the defined area; • Limiting the vegetation clearance and base stripping process within the Project boundary; • Safety fence around the construction site; • Limiting the use of night light;	• Most of the civil works has already completed. Now only the mechanical (instrumental and machine fitting) and electrical works are under-way. Thus the risk of deforestation and disturbance to the nearby ecosystem are minimal in this quarter. • Limiting the vegetation clearance within the Project boundary especially around the ash impoundment. • An MoU signed with Forest Dept., Bangladesh on 24.02.2015 for implementation of	Being Complied	• Advised to finish the unfinished plantation ASAP. • Regular monitoring of the planted trees. • Reduce the rate of mortality at the sapling stages.

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/Measures already Implemented	Compliance Status	Recommended Action
		• Using shade (directed downwards) around the outdoor lights; • Provision of cut-off time to switch off unnecessary lights at night; • Initiate Green plantation; • No plantation of non-native species; • Retaining top soil for future habitat restoration; No degradation of sensitive habitat.	Afforestation Program. Initial target was to plant 2 lac saplings in 3 years. During the visit we came to know that about 80,000 plantations have already done. • Another 30000 to 50000 trees were supposed to be planted by April to May 2022. But during 33rd site visit CEGIS came to know that this plantation will be done by Bagerhat Social Forest Division alongside of Ansar camp and residential area. • They are maintaining the EMP measures in a desired way for protecting the adjacent ecosystem. • No alien species has been recorded • Wild species like avifauna and mammals are now recorded in the greenery areas of the project site Employees are aware about the rescues of species and no harm to wild species		
3	Disturbance to river, inter-tidal areas and wet lands	• No encroachment of inter-tidal flood plain area; • No disturbance to Dolphin community; • Monitoring of Ecosystem Health and Monitoring of Sundarbans Forest Health; • If required, embankment should be constructed considering a setback distance from river/canal bank; • Slope protection work along the Maidara River should be completed	• Monitoring of ecosystem health of Sundarbans, and around the Project site is being continued. • The project is not obstructing the surface water flow. • BIFPCL has started maintenance of the slope protection works • Bank protection works of western bank of Maidhara river has finished • EPC Contractor is monitoring the discharged water quality at each of the outlet from this project on a monthly basis.	Complied	• Initiatives should be taken for excavation of silted reach of Maidara River to protect the rainfall runoff washout.

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/Measures already Implemented	Compliance Status	Recommended Action
		on an urgent basis before rainy season come, and; BIFPCL may take initiatives of excavating of silted reach of Maidara river near proposed township area to facilitate proper functioning of River for maintaining tidal flow dynamics	• The project authority has constructed the permanent jetty as per approved layout. • The Maidara River is showing its natural phenomena without any negative impact due to the construction interventions. Selected coal suppliers ensured the appropriate vessels with minimum sound for the coal transportation to avoid the disturbance to Dolphin community.		

Table 5.5: Status of Compliance to the Conditions of DoE

Sl. No	Condition of DoE	Compliance Status	Remarks
1	This EIA Report is approved only for 1320 MW Khulna Coal Based Power Plant. Any expansion or extension of this Power Plant will require obtaining further Environmental Clearance with additional EIA Study.	BIFPCL has not yet initiated any plan for expansion or extension of the 2x660 MW Maitree Super Thermal Power Plant.	BIFPCL will comply with the condition prior to initiation of any expansion or extension of the Power Plant.
2	The Coal Specification and Power Plant technology should be maintained as per EIA report. In case any change in design the proponent must obtain consent from DoE.	The Coal Specification and Power Plant technology are being maintained as per EIA report so far. In case of any change in Plant design and coal specification, the proponent shall have to obtain early consent from DoE.	Suggested to comply as and when required.
3	Project Proponent may undertake activities for land development and infrastructural development of the Project.	BIFPCL has already completed land development and Infrastructure development activities mostly for the Block–A area. Now the mechanical and electrical works are in progress.	Being Complied.
4	Project Proponent may open L/C (Letter of Credit) for importing machineries for the Project, which shall also include machineries relating to waste treatment plant and other pollution control devices.	The appointed EPC contractor has already imported maximum Equipment & machineries relating to waste treatment plant and other pollution control devices through opening the L/C.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
5	The activity under Proposed Khulna 1320 MW Coal based Thermal Power Plant Construction and operation shall not release any pollutant that affect human health or will have damaging impact on the environment or natural resources.	BIFPCL engaged CEGIS as an independent entity for monitoring the construction activities for examining environmental impacts on quarterly basis before the construction works started and accordingly the environmental and social impacts are being monitored as per EMP since 2014. No significant impact of Power Plant activities on the surrounding environment or on the natural resources has been recorded and reported (by the community) yet. Moreover, to control the emission and pollution an Effluent Treatment Plant, ESP, and FGD etc. have already been incorporated in the technical specification of main Plant as per DoE stipulations. The progress is as follow: • **Effluent Treatment Plant (ETP):** Civil works of ETP has completed and now the mechanical and instrumental works are under way. • **Electro Static Precipitator (ESP):** Completed and ready for operation • **Flue Gas Desulfurization (FGD):** FGD for Unit-1 is ready for operation. • **Desalinization plant:** Completed • **Low NOx burner:** Completed • **Online air and water quality monitoring system:** Steam and water quality analysis system has already been developed. Air monitoring system in under developing stage. Along with those measures, environmental compliance monitoring is also being continued in the project site in order to assess the impact on project ambient air quality, discharge water quality and noise level around the project site, working and labor conditions, occupational safety procedures community grievances etc. as per the monitoring plan stated in the EIA.	Being Complied.
6	Proper and adequate mitigation measures shall be ensured throughout preparation, construction and operation period of the proposed Khulna 1320 MW Coal based Thermal Power Plant Project activities.	• BIFPCL has taken appropriate mitigation measures conforming EMP and technical specification of main Plant at each of the stages of Project Development. Proper safeguard measures for the safety of the workers was very satisfactory. Proper PPE and scaffolding structures was observed during the site visit.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
7	Any heritage sight, ecologically critical area, and other environmentally, religious and archaeologically sensitive places shall be kept protected during Project construction phase.	There is no Religious and Archaeological place in and around the Project site. As a third party, CEGIS is continuously monitoring the potential locations and indicators which are sensitive to coal transportation in the Sundarbans ECA, Sundarbans Reserve Forest and Sundarbans World Heritage Site as per the guidance of DOE and Bangladesh Forest Department (BFD).	Being Complied and suggested to continue this compliance till and during the operation stage.
8	Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.	All the construction activities along with the coal transportation system are being followed and will be followed through best practices and according to the EMPs of EIA Report. Since, the environmental monitoring survey are not observed any anomalies, it can be concluded that the construction work is progressing in environment friendly procedure yet now.	Being Complied.
9	Construction works shall be restricted to daytime hours so as to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.	Construction related activities are restricted to daytime and sometimes extends to the late evening. The community responses towards construction works of Power Plant are being monitored and recorded regularly. Moreover, BIFPCL has appointed one social liaison officer who is working (24x7) for developing relation with local communities. Regular consultation meetings are carried out with the local government and administration in order to receive and realize the grievances and accordingly to redress those. There are no grievances related to the noise effects registered yet from the nearby communities.	Being Complied.
10	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed Project period.	EPC contractor and sub-contractor are providing adequate sanitation facilities for the workers. Sanitation facilities for health safety from COVID are supplied by the Contractor at the labor camps as well as in the work areas. The ambient environment of the labour camp seems unhygienic in terms of waste management.	Being Complied Waste management around the labour shed must be ensured as soon as possible.
11	In order to control noise pollution, vehicles & equipment shall undergo regular maintenance; working during sensitive hours and locating	All vehicle & equipment used at site are under regular maintenance and registration process. Working during sensitive hours like night time and locating machinery close to sensitive receptor like near the labor camps	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	machinery close to sensitive receptor shall be avoided.	are being avoided or managed through appropriate measures as observed during the monitoring span.	
12	No solid waste can be burnt in the Project area. An environment friendly solid waste management should be in place during the whole period of the Project in the field.	• Burning of waste materials is strictly prohibited inside the project boundary. • BHEL has engaged a solid waste management company who is now collecting the solid waste from the project area and dump it to the Khulna City Corporation (KCC) designated places. • Development of environment friendly waste collection and disposal system like Solid Waste Management, STP etc. are being developed at the demarcated place in plant premises. In addition, waste management training has been conducted in a regular basis among the labor.	Being complied
13	Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be endangered or destructed.	Quarterly monitoring activities are being carried out to examine the potential impacts on habitat of flora and fauna. No significant changes are yet recorded. Moreover, monthly environmental monitoring has been performed for noticing any harmful air pollutant emission or waste discharge form the project area.	Being Complied
14	All the required mitigation measures suggested in the EIA report along with the emergency response plan are to be strictly implemented and kept operative / functioning on a continuous basis.	The proponent is giving top priorities to occupational health and safety issues. To keep the workers and the plant safe, plenty of precautionary measures has identified during the physical visit of the plant. • An ICU rich hospital with an experienced medical team and ambulance has kept ready to provide the instant services • In case of emergency situation for both BIFPCL and EPC contractor, a contract has been signed with a private hospital (GAZI medical, Khulna) for medical services. • Emergency fire exit, the fire extinguisher, fire alarm has observed available and well-functioning. • As a part of emergency response plan emergency contact numbers contained laminated poster has noticed beside the construction site. • Proper PPE and scaffolding has observed during the field visit.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		BIFPCL working hard to build awareness about Covid-19 among workers and office support staff. Thermal scanning of workers is being done at regular frequency for checking COVID symptom.	
15	To control dust, spraying of water over the earthen materials should be carried out from time to time.	Periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. Monthly air quality monitoring at three locations inside the project boundary are being carried out. Based on the air quality monitoring findings and seasonal aspects, site specific water spraying is scheduled. BHEL has contracted with an external company for three years (renewable) who are spraying water as per schedule by three (03) water tankers to suppress fugitive dust.	Being Complied
16	Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.	• BIFPCL authority has selected designated areas for safe storage of construction materials. In addition, the maximum stock piles are sprinkling. They have established a silt trap at the North-east corner of the project site to control sediment running out from the projects with rainfall runoff. • During 33rd field visit piles of sand and other construction material were noticed uncovered. Plenty of construction residuals has been kept by the side of the Maidara river bank.	Partially complied It was strongly advised to cover up the sand pile and other loose material and the wastage should be placed at the demarcated place. Maidara River bank should be cleaned immediately.
17	Adequate considerations should be given to facilitate drainage system for runoff water from rain/tidal surge.	Adequate attempt has been adopted to facilitate drainage system for runoff water from rain/tidal surge as BIFPCL has already constructed the permanent drainage system for discharging water from the project area. Construction of permanent drainage system under BHEL scope of work is still behind	Being Complied.
18	Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies	Silt trap has been developed at the north-east corner of the project site. It is used to depositing the sediments coming with the storm water and finally discharge relatively sediment free storm water through the drainage line.	Being Complied.
19	The entire coal handling system should be designed as an enclosed (and not only covered) conveyor system. There should be integrated dust	Entire coal handling system is designed and constructed as an enclosed conveyor system as per DoE requirement. Integrated dust control system with dust extraction system/bag filter and dust suppression system at	Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	control system with dust extraction and bag filters at unloading areas and at each transfer points on the conveyor system.	crusher house, unloading points, transfer points has been specified in the technical specification of Main Plant EPC contract package. Refer Section (V), B4 of Technical Specification. During the 33rd field visit by CEGIS team it is observed that about 100% installation of the closed system coal conveyor belt from jetty to the coal shed has completed.	
20	Coal Plant should have high-efficiency bag filter for arresting dust emissions.	Integrated dust control system with dust extraction system/bag filter and dust suppression system at crusher house, unloading points, transfer points has been specified in the technical specification of EPC contract. Refer Section (V), B4 of Technical Specification (Clause no B4.3.1.4). High-efficient ESP is now completed that will control the dust emission.	Compliance action initiated.
21	Coal should be stored in a covered storage yard.	All these stipulations have been included in the technical specification of Main Plant EPC contract package, Section (V), B4 of Technical Specification (Clause No B4.3.1.6). The coal shed construction has already finished and the sheeting work is at finishing stage.	Being complied
22	The entire coal stockyard should be covered with water sprinkler provided with automated moisture sensor to control self-combustion.	All these stipulations have been included in the technical specification of Main Plant EPC contract package, Section V, B4 of Technical Specification. The covered Coal stockyard is now at the final stages.	Being complied
23	100% utilization of fly ash and bottom ash should be planned and implemented throughout the operation of the Plant. There should only be a provision of small ash dyke that will not exceed 25 (twenty-five) acres of land to store residual ash.	100% utilization of fly ash has been planned and shall be implemented throughout the operation of this Plant. EOI has been received in this regard from nearby Cement Industries. 25 acres' area has been allocated to store residual ash in case of emergencies. The ash dyke is now under construction stage.	Compliance action initiated.
24	Integrated dry ash handling, loading, unloading and transportation system should be established.	Integrated dry ash handling, loading, unloading and transportation system will be established during the operation stage of the power plant. Provisions in line with this has been included in Technical Specification of main Plant EPC contract package (Section V, Chapter B4). Erection of Ash silo structures has done beside the jetties in order to transport the dry ash with ships/cargo.	Compliance action initiated.

Sl. No	Condition of DoE	Compliance Status	Remarks
25	There should be adequate and properly sized and designed dry ash silo with appropriate conveyor system.	Adequate and properly sized dry ash silo with appropriate conveying system have been specified in Technical Specification of main Plant EPC contract package (Section V, Chapter B4). The construction work of ash silos is under construction.	Compliance action continued
26	Bottom ash should be extracted, crashed and stored in silos for utilization with proper collection and conveyor system.	Bottom ash shall be extracted, crushed and stored in silos for utilization with proper collection and conveying system during the operation stage of the power plant. The procedures have been included in the technical Specification of EPC contract package. (Section V, Chapter B4). The construction of silo is almost finished.	Compliance action initiated
27	Resettlement and rehabilitation of the displaced population (including those who do not own land) should be done properly.	Land has been acquired as per the legal procedure of GoB. However, BPDB wrote to Ministry for suitable resettlement and rehabilitation as per DoE requirement. BPDB prepared an assessment (Livelihood Restoration Plan) regarding the rehabilitees (including those who do not own land) for this Power Plant. As per the recommendation of the LRP, a NGO “SAMAHAR” completed Their tasks. This monitoring has recorded that DC office has rehabilitated around 32 families at Foyla and 17 families at Koigardaskati.	Compliance action continued
28	Resettlement plan should be properly implemented and people should be adequately compensated.	Resettlement and rehabilitation action had been taken as per the law of the land, Bangladesh. However, BPDB conducted an assessment (Livelihood Restoration Plan) regarding the rehabilitees (including those who do not own land) for this Power Plant. Based on the recommendation of the LRP, local NGO conducted the training and other tasks to the PAPs. DC office is trying to resettle the PAPs at their selected sites according to the LRP.	Compliance action continued
29	Construction material should be properly disposed-off after construction work is over.	Most of the civil works has already finished and now the mechanical and electrical works are going at full phase. During the field visit we found all the mechanical and construction residual are being kept at demarcated places. For the solid waste management, BHEL has engaged a company named Rahman & brothers in association with Khulna City Corporation (KCC) for collecting and safe disposal of waste materials form site. Further development of environment friendly waste collection and disposal system like Solid Waste Management, STP etc. are being developed at the demarcated place in plant premises.	Compliance action initiated Establishment of WMC is behind

Sl. No	Condition of DoE	Compliance Status	Remarks
		There is a provision of development of solid waste management system which is given at clause no B12, Part no 9 of book no -2, page no 147-161.In which there is development of WMC which has waste collection, waste segregation at source, recycling, treatment and disposal of waste will be done. This is not done yet. For this purpose, the Induction training has been provided but not sufficient.	
30	As described in the report environmental monitoring should be strictly followed and monitoring report should be shared with DoE to ensure the environmental management properly.	BIFPCL has engaged CEGIS as a third party independent entity for conducting environmental monitoring on a quarterly basis in February 2014. Accordingly, each quarterly monitoring report has been prepared, submitted and shared with DoE, which are also available at BIFPCL web site.	Being Complied.
31	All activities (pre-construction, construction and post-construction stage) should be implemented according to EMP clearly listed in the EIA report.	BIFPCL has adopted the EMP suggestions applicable at construction stages. BIFPCL is taking appropriate actions based on EMP monitoring report. BIFPCL regularly updates the EMP and OHAS which assist to reduce the risk of accidental events further. From the preconstruction stage till now BIFPCL has been following the guideline of EMP listed in the EIA report and we have suggested to follow the EMP strictly for the rest of the work.	Being Complied
32	A third party/independent monitoring bodies excluding JVC/BPDB should be engaged immediately for monitoring of all activities during pre-construction, construction and operation phases as per monitoring plan of EIA report and monitoring report must be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	CEGIS has been engaged by BIFPCL as an independent monitoring entity for conducting environmental monitoring on a quarterly basis since February 2014. Since the contract, CEGIS has been conducting the monitoring programs quarterly and producing monitoring reports on quarterly basis which are submitted by CEGIS to BIFPCL for onward submission to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment as directed by DoE.	Being Complied
33	Regular monitoring of the susceptible places of Sundarbans for protecting ecosystem, biodiversity and forest coverage should be made using latest high-resolution image for keeping ambient environment.	The Monitoring activities of CEGIS includes monitoring of the susceptible places of Sundarbans. The monitoring report contains analysis of biodiversity and forest coverage. However, in addition to this, Forest Department has also suggested some survey & analysis which have also	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		been monitored and reported by CEGIS through the quarterly monitoring report.	
34	Air, water, soil, biological and social data should be monitored regularly with a network monitoring system with a view to assess the natural quality of the Sundarbans and other fragile ecosystem and report of monitoring results should be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	The network monitoring system will be installed as a part of the project construction and it will be run as online monitoring system during the operation of the Power Plant. All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5). However, air, water, soil and biological components are regularly monitored as per recommendation of EMP. Each of the monitored environmental data has been incorporated in the Monitoring report and displayed on the BIFPCL website at present.	Compliance action initiated.
35	There should be regularly disclosure of the report through workshops and websites and responses should be taken care accordingly.	CEGIS has been regularly carrying out public consultation at different levels. All the monitoring reports are being kept available on website of BIFPCL (www.bifpcl.com)	Being Complied.
36	Online air and water quality monitoring system should be made functional throughout the life of the Plant.	The online monitoring system usually install when the Plant will be in operation phase. This will be continued throughout the life time of the Power Plant. Steam and water quality analysis system has already been developed. Air monitoring system in under developing stage. All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5).	Compliance action initiated
37	Management Information System (MIS) is to be developed for this coal-based Power Plant. The scope of MIS services will obviously include representing the real time monitored data especially environmental parameters displaying at Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment, BPDB and other concerned agencies/Ministries. The MIS should be web based	The MIS will be prepared before commissioning of the Power Plant. For developing MIS, consultant will be engaged earlier. Specifications of MIS system is already included in EPC contract document. Technical Specification like DDCMIS, DDCS, PADO System, HART system, Plant MMS, Information management security system etc. have been included. Moreover, the EPC contractor is going to initiate this activity.	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
	for accessing every individual to show the real time monitored records.		
38	JVC should provide all sort of logistics support to DoE and other relevant agencies for monitoring environment related items/events.	BIFPCL is ready and being provided all sort of logistic support as and when required by DoE and other relevant agencies for monitoring of Plant construction activities and environmental items/events maintain the health and safety protocol of the construction site.	Being complied
39	No ground water should be allowed to use for plant purposes.	The Power Plant has been designed considering use of surface water only during all stages of project development and operation. The authority has already installed Reverse Osmosis (RO) Water Treatment Plant (ABM Water) for use ground water for potable and domestic purposes. A second unit of RO plant is now in operation fulfilling fresh water from both domestic and construction requirements. However, a 1200ft deep tube well has been recorded near the ABM water plant for backup during emergencies. Proponent informed that some time it is used to supply the drinking water.	Ground water is being withdrawn only for supplying the drinking water.
40	Conduct stakeholder meetings on regular basis for better performance of the Project as a whole.	BIFPCL has appointed a social liaison officers who regularly visits nearby community to consult with the local people. Besides CEGIS, appointed by the Project authority, is also carrying out consultation with the local people with interviews on regular basis for better performance of the Project as a whole.	Being Complied
41	Additional Environmental baseline data to be collected as suggested in the EIA report and conveyed to DoE and other concern authorities.	All quarterly monitoring reports containing latest baseline data are being collected as suggested in the EIA study and are disseminating to DoE and other concerned authorities as instructed.	Being Complied
42	The Environmental Management Plan under the EIA study shall strictly be implemented and kept functioning on a continuous basis.	BIFPCL has been implementing all the EMP measures realistically phase by phase as suggested in EIA report and approval condition of DoE. The status of EMP implementation are also regularly monitored. Based on the monitoring, BIFPCL continuously updated the site specific EMP for better management of the potential impacts.	Being Complied
43	The Project authority shall submit a detail work plan with time schedule of development activities at least 7 (seven) days ahead of the work	The construction works is now about to finish. BIFPCL practiced the submission the detailed work plan seven (7) days before start of any	Being complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	commences in the field to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	construction activities to the suggested offices of DOE. This practice will be continued till the end of the project.	
44	Environmental Monitoring Reports according to specific format specified in the EIA Report shall be made available simultaneously to DoE Bagerhat District Office, Khulna Divisional Office and Headquarters on a monthly basis during the construction period of the Project.	Environmental Monitoring Reports as per specific format provided in the EIA Report made available by BIFPCL and submitted to DoE Bagerhat District Office, Khulna Divisional Office and Headquarters accordingly.	Being Complied
45	The following records must be kept in respect if any samples required to be collected for the purpose of environmental monitoring activities: • The date(s) on which the sample was taken; • The time(s) at which the sample was collected; • The point at which the sample was taken; and The name of the person who collected the sample.	The Monitoring report keeps all the records as suggested.	Being Complied
46	The results of any monitoring, required to be conducted under this EIA report must be recorded.	BIFPCL has been collecting all the monitoring data and submitting with proper documentation and accordingly sharing with DoE on regular basis.	Being Complied
47	In case of any emergency, the following information shall be immediately reported to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DoE) simultaneously. Nature of incident (oil spill, fire, accident. Collision, land slide, etc.). Personnel affected (injured, missing, fatalities, etc.). Emergency support available and its location (standby transport, medical facilities, etc.). Weather conditions Current operations (abandoning the site, firefighting, etc.)	No single emergency incident has occurred since April, 2021. The COVID restriction has been withdrawal by Gov. with the decreasing infection which also implemented for the MSTPP construction site. At present, the labors are working fully to this project with proper COVID safety measures. BIFPCL has given top priority on safety issues as like environment for this project after the bitter experience of two incidents. They have instructed the EPC contractor to establish best practices on OHAS and keep all records for avoiding any incident as like earlier. However, taking numbers of initiatives by the EPC and proponent significantly improve the safety	Complied at present

Sl. No	Condition of DoE	Compliance Status	Remarks
		system of the project. No environmental, accidental, anthropogenic incident has been not recorded since April 2021.	
48	The Project authority or its employees must notify the department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.	BIFPCL has established a proper mechanism for recording such incident as suggested and notify the department of Environment regarding incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident. EPC have already revised the health and safety management manual to continue the work amid the COVID pandemic. Moreover, CEGIS is monitoring the EMP implementation as a whole.	Complied at present.
49	All pollution incidents shall be reported immediately and simultaneously to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DoE) in Dhaka.	BIFPCL has established a proper mechanism for recording such incident as suggested in the ERP	Being complied
50	Appropriate permission would require to be obtained from the Forest Department in favor of cutting/felling on any plant/tree/sapling forested by any individual or government before doing such type of activity.	There is no need of cutting/felling down of any trees outside the project boundary. However, in future, if any such case arises, BIFPCL is committed to obtain appropriate permission from the Bangladesh Forest Department (BFD).	Being complied
51	Re-vegetation and re-plantation under green belt activities shall be undertaken in consultation with the Forest Department according to those mentioned in the EIA report.	• Limiting the vegetation clearance within the Project boundary especially around the ash impoundment. • An MoU signed with Forest Dept., Bangladesh on 24.02.2015 for implementation of Afforestation Program. Initial target was to plant 2 lac saplings in 3 years. • Under these plantation program initiated by Bangladesh Forest De4partment (BFD) about 80,000 trees of fruits and medicinal species has already planted. • Another 30000 to 50000 trees were supposed to be planted by April to May 2022. But during 33rd site visit CEGIS came to know that this plantation program will be done by Bagerhat Social Forest Division alongside of Ansar camp and residential area.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		However, it is expected to fulfill the target before commissioning of the power plant.	
52	Climate Change impacts and maximum storm surge height shall have to consider at the design and construction phase.	The design level (elevation) of the land and earthen embankment has designed and constructed considering the climate change impact and maximum storm surge height.	Being Complied
53	A separate EIA/morphological study shall have to be conducted for coal transportation and river dredging to develop sound environmental management plan towards conservation of ecosystem and biodiversity.	Coal transportation will be done through the existing maritime route, which is Mongla Port Authority (MPA) controlled waterways. M/s. Institute of Water Modelling (IWM) has already completed the EIA study for the dredging activity and submitted the report to MPA. A separate EIA study for Coal Transportation was conducted by M/s. Center for Environment and Geographic Information Services (CEGIS) which has been approved by DoE.	Being Complied.
54	A full-fledged institutional setup for EHS and CSR must be put in place before operation of the Power Plant.	A full-fledged institutional setup for EHS activities have been operated. After the consecutive accidents, the EHS process has been drastically re-arranged and reshaped. As a result, no major incident has been occurred since April, 2021. Safety walk-down by the EHS team inside the plant premises help to identify and register all kind of accident and incidental hazards if occurred and take immediate remedy measures. Meanwhile, a number of CSR activities like free medical camp, Boat Medical camp and medicines, free potable water supply to the local people, medical campaign, blanket distribution to the local people, EHS training, infrastructure development etc. are being conducted by the BIFPCL authority as a continuous process at the plant site. As a part of CSR around 272 patients have been taken treatment till 27.08.2022	In the process of compliance
55	The Project authority shall extend active cooperation to DoE officials to facilitate their visit to the site as and when necessary.	BIFPCL is extending its all-out cooperation to DoE.	Being Complied
56	Violation of any of the above conditions shall render this approval void.	Noted by BIFPCL	

Sl. No	Condition of DoE	Compliance Status	Remarks
57	Any injunction on this Project from the Honorable Supreme Court/High Court Division shall render this approval void.	Noted by BIFPCL	
58	Without installation of 275 Meter Height Chimney, Effluent Treatment Plant (ETP), Waste Water Treatment Plant (WWTP), Settling Pond, Desalinization Plant, API Oil Water Separator, High Efficiency Electro Static Precipitator (ESP), 'closed-loop' Flue Gas Desulfurization (FGD), Low NOx Burner, online air and water quality monitoring system and other pollution control equipment and obtaining Environmental Clearance Certificate, the proponent shall not start operation of the Project.	At present, the Plant is in construction phase. Some of the required parameter from DoE are ready, some are under ready and some will be ready before operation phage. **<u>Current status:</u>** • **Chimney:** Shell construction completed in Apr'21 (270 Meter). Flue liner erection completed and ready for Boiler light up (pic attached). • **DM water plant:** DM water plant has completed. • **Effluent Treatment Plant (ETP):** Civil works of ETP has completed and now the mechanical and instrumental works are under way. • **Electro Static Precipitator (ESP):** Completed and ready for operation • **Flue Gas Desulfurization (FGD):** FGD for Unit-1 is ready for operation. • **Desalinization plant:** Completed • **Low NOx burner:** Completed • **Online air and water quality monitoring system:** Steam and water quality analysis system has already been developed. Air monitoring system in under developing stage. • **Settling pond:** 02 no rain off settling ponds are being constructed to settle the silt before discharge in to river. Moreover, BIFPCL has got the Environmental Renewal Certificate each of the year through maintaining the conditions of DOE.	Compliance action initiated
59	This EIA Approval has been issued with the approval of the appropriate authority.	BPDB and BIFPCL are thankful to DoE.	

5.2 Compliance to the Conditions of DoE (EIA study of Coal Transportation)

Compliance to the conditions of DoE (EIA study of Coal Transportation)

However, with reference to the approval of EIA study of coal transportation for 2x660 MWMSTPP having (Memo no: DoE/ clearance/ 5532 / 2016/50, dated 31/01/2018), Department of Environment has set some specific conditions to be followed as a fulfillment of the condition no.53 of the EIA approval letter of 2x660 MWMSTPP. The conditions and compliance status have been listed as follows-

Table 5.6: Compliance conditions of DoE (EIA study of Coal transportation)

Sl. No.	Conditions	Compliance status	Remarks
1	This EIA Report is approved only for Coal Transportation for the Proposed 2x660 MW Maitree Super Thermal Power Plant Project. Any modification of this project as well as Coal Transportation will require further EIA approval with additional EIA Study.	The power plant is now in construction stage. BIFPCL will notify to DOE prior to initiation of any modification, expansion or extension of the Power Plant.	Suggested to comply as and when required.
2	The route of coal Transportation should be maintained as per EIA Report. In case of any changes the proponent must obtain consent from DoE.	The route of coal Transportation will be maintained as stated in the EIA report. In case of any changes in the transportation route, the proponent shall obtain consent from DoE.	Suggested to comply as and when required.
3	Project Proponent may open L/C (Letter of Credit) for importing machineries for the project which shall also include machineries relating to waste treatment plant and plant and other pollution control devices.	EPC contractor has been appointed for this Project. They are importing all the Power Plant machineries complying with the national laws and regulations.	Being Complied.
4	The activity under Coal Transportation for the Proposed 2x660 MW Maitree Super Thermal Power Plant Project shall not release any pollutant that affect human health or will have damaging impact on the environment or natural resources.	So far, no activity under Coal Transportation for the Proposed 2x660 MW Maitree Super Thermal Power Plant Project has been commenced. So, there is no issue for impact on the surrounding environment or natural resources from the coal transportation activities. BIFPCL engaged CEGIS for monitoring and examining status of the environment or natural resources. A strong baseline has been prepared throughout the coal transportation route for assessing the impact in future.	Suggested to comply as and when required.
5	Proper and adequate mitigation measures shall be ensured throughout the operation period of the Project	The project proponent has included all the mitigation measures in their BID document of Coal Transportation. However, BIFPCL is monitoring the implementation of mitigation measures	Suggested to comply at operation stage.

Sl. No.	Conditions	Compliance status	Remarks
		for the entire jetty construction period. They have developed a skilled manpower and system for ensuring the EMP during operation stage as well.	
6	Any heritage site, ecologically critical areas, and other environmentally, religious and archeologically sensitive places shall be kept protected during project operation.	There is no Religious and Archaeological place in and around the Project site. As a third party, CEGIS is now monitoring the potentially vulnerable locations and indicators which are sensitive to coal transportation in the Sundarbans ECA, Sundarbans Reserve Forest and Sundarbans World Heritage Site. Those information and data assist to protect the ecological critical areas in future during the operation of coal transportation.	Suggested to comply at operation phase.
7	Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding and nursery sites.	Development of coal transportation system will be followed through best practices, EMPs of EIA of Coal Transportation Report, national and international rules and guideline. Since, the environmental monitoring indicators are not observed any anomalies, it can be concluded that the construction work is progressing in environment friendly procedure till now.	Being Complied
8	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.	BIFPCL, EPC contractor and sub-contractors should ensure the sanitation facilities for the labour camps. During 32nd field visit the following anomalies were identified: • During the visit inside the labour shed plenty of household waste were found on the road in an unmanaged situation. • Lack of waste bin and lack of proper initiative of source segregation of the organic waste has made the labour shed unhygienic • Unused bath-tub with dirty water has noticed where waste garbage and polybags were floating. • Lack of lavatory/toilet waste drainage and sewerage facilities that has been causing waste accumulation and malodorous stench. CEGIS advised to take immediate step to clean the labour camp and other waste related issues to make the environment healthy. But during 33rd field visit the team observed the same situation as before.	Partially Complied Waste management issue needs to take as top priority.

Sl. No.	Conditions	Compliance status	Remarks
		But Authority has been providing sufficient training, instruction and facilities for managing COVID-19 to improve hygienic condition at labor camps and workplaces. Adequate no. of toilets has been made at every location at sites & labour colony	
9	Proper and adequate on-site precautionary Measures and safety measures shall be ensured so that no habitat of any flora and fauna would be endangered or destructed.	All the finished construction works so far including the Jetty has been followed in accordance with the EMP guidelines sated in the EIA report. Moreover, regular monitoring activities will be carried out to assess the significant changes (if any) for the rest of the unfinished works. The quarterly monitoring reports do not reflect any significant changes of the habitat of flora and fauna of the project influenced Passur river and Sundarbans ecosystem.	Being Complied
10	All the required mitigation measures Suggested in the EIA report along with the emergency response plan are to be Strictly implemented and kept operative/functioning on a continuous basis.	The proponent is giving top priorities to occupational health and safety issues. To keep the workers and the plant safe, plenty of precautionary measures has identified during the physical visit of the plant. • An ICU rich hospital with an experienced medical team and ambulance has kept ready to provide the instant services • In case of emergency situation for both BIFPCL and EPC contractor, a contract has been signed with a private hospital (GAZI medical, Khulna) for medical services. • Emergency fire exit, the fire extinguisher, fire alarm has observed available and well-functioning. • As a part of emergency response plan emergency contact numbers contained laminated poster has noticed beside the construction site. EHS team of BIFPCL, BHEL and Cholamandalam are compelling to ensure the safety mitigation measures as per EIA and EHS guideline. Moreover, Periodic training has been made as mandatory for the workers. BIFPCL has been working hard to build awareness about Covid-19 among workers and office support staff. Thermal scanning of workers is being done at	Being complied

Sl. No.	Conditions	Compliance status	Remarks
		regular frequency for checking COVID symptom.	
11	To control dust, spraying of water over the earthen materials should be carried out from time to time	Periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. BHEL has contracted with an external company for three years (renewable) who are continuously spraying water as per schedule by three (03) water tankers to suppress fugitive dust.	Being Complied
12	The entire coal handling system should be designed as an enclosed (and not only covered) conveyor system. There should be integrated dust control system with dust extraction and bag filters at unloading areas and at each transfer points on the conveyor system.	In the BID document, the coal handling system has been mentioned as closed system with the integration of dust control measures. Moreover, continuous monitoring system has been instructed in the EIA monitoring section. During the field visit, team observed the installation of the closed system conveyor has completed.	Compliance action initiated
13	Coal should be stored in a covered storage yard.	All these stipulations have been included in the technical specification of Main Plant EPC contract package, Section V, B4 of Technical Specification (Clause No B4.3.1.6). The coal stockyard construction has already finished. Now the sheeting work is underway.	Compliance Action initiated.
14	The entire coal stockyard should be Covered with water sprinkler provided with automated moisture sensor to control self-combustion.	EIA study of the Power Plant suggested to install water sprinkler in coal stockyard which has been repeated in EIA study of Coal transportation. However, all these stipulations have been included in the technical specification of Main Plant EPC contract package. Functionality of sprinkler system with automated moisture sensor will be checked during the operational stage.	Compliance Action initiated.
15	Construction material should be properly disposed of after the construction work is over.	Most of the residual has been disposed in a demarcated place but during the field visit it was observed plenty of construction waste was scattered and dumped by the bank side of the Maidara river. Sand pile and other loose materials were found uncovered. There is a provision of development of solid waste management system which is given at clause no B12, Part no 9 of book no -2, page no 147-161.**In which development of WMC will** ensure waste	Partially complied Intensive care should be taken in waste management issue specially the source segregation of the waste

Sl. No.	Conditions	Compliance status	Remarks
		collection, waste segregation at source, recycling, treatment and disposal of waste. The progress of this facility is behind.	
16	As described in the report environmental monitoring should be strictly followed and monitoring report should be shared with DOE to ensure the environmental management properly.	BIFPCL has engaged CEGIS for environmental monitoring the environmental management plan in February 2014. Accordingly, each quarterly monitoring report has been submitted and shared with DoE, which are also available at BIFPCL web site.	Being Complied.
17	A third party/independent monitoring bodies excluding BIFPCL should be engaged immediately for monitoring of all the activities during pre-construction, construction and operation phases as per monitoring plan of EIA report and monitoring report must be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	CEGIS, as an independent monitoring body has been engaged by BIFPCL since February 2014 and still continued. From then on, CEGIS has been conducting the monitoring programs quarterly and producing monitoring reports on regular basis which are submitted by CEGIS to BIFPCL for onward submission to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment as directed by DoE.	Being Complied
18	Regular monitoring of the susceptible places of the Sundarbans for protecting ecosystem, biodiversity and forest coverage should be made using latest high-resolution image for keeping ambient environment.	The Monitoring activities have been carried out by CEGIS as third-party independent entity. The study includes all of recommended issues vastly. The monitoring report contains analysis of ecosystem, habitat, and biodiversity and forest coverage at susceptible sites of Sundarbans. In addition to this, Forest Department has also suggested some survey & analysis of Sundarbans ecosystem along with the quarterly compliance monitoring report.	Being Complied.
19	Air, water, soil, biological and social data should be monitored regularly with a network monitoring system with a view to assess the natural quality of the Sundarbans and other fragile ecosystem and report of monitoring results should be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	The network monitoring system will be installed as a part of the project construction for online monitoring and it will run at the time in operation phase. All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5). Steam and water quality analysis system has already been developed. Air monitoring system in under developing stage.	Being Complied.

Sl. No.	Conditions	Compliance status	Remarks
		All the environmental monitoring reports are available on the BIFPCL website at present.	
20	There should be regular disclosure of the report through workshops and websites and responses should be taken care accordingly.	All of the environmental monitoring reports and other relevant reports are available on website of BIFPCL (www.bifpcl.com). BIFPCL as well as CEGIS is regularly carrying out public consultation at local level to get the responses from the community.	Being Complied.
21	BIFPCL should provide all sort of logistics support to DOE and other relevant agencies for monitoring environment related items/events.	BIFPCL is ready and provide all sort of logistic support as and when required by DoE and other relevant agencies for monitoring of Plant construction activities and environmental items/events.	Suggested to Comply as and when required.
22	In order to control noise pollution, vessels and equipment shall undergo regular maintenance; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.	54,560 tons of coal has been transported by 43 barges for the commissioning and initially it has been planned to bring a total of 3.0 Lac MT coal. Proponent confirmed that the vessel was covered and most of the work conducted during day time. No spillage and ship breakage incident happened. Noise level was within the control level.	Being complied and suggested to follow this up throughout the project cycle.
23	Vessels of this project should follow the MPA guidelines and protocol to ensure no hindrance to other vessels.	All the coal transportation process was under MPA guidelines and protocol and no other vessels were hindered by the coal barge as reported by the proponent.	Being complied and suggested to follow this throughout the project cycle.
24	The vessels used for this project should maintain IMO criteria to enable identification of substances harmful to the marine environment.	No anomalies were identified during the coal transportation so far as reported by the proponent. This should be strictly monitored by the project authority.	Being complied and suggested to follow this throughout the project cycle.
25	All the vessels should follow applicable MARPOL Convention, Appendix V on the prevention of pollution by garbage from ships.	Proponent is strictly following this issue and informed us that all the barge are following rules of MARPOL convention and no garbage was dumped in the water body from the ship.	Being complied and suggested to follow this throughout the project cycle.
26	Additional Environmental baseline data to be collected as suggested in the EIA report and conveyed to DOE and other concern authorities.	Environmental baseline data has been collected by third party *i.e.* CEGIS. CEGIS has submitted reports of quarterly monitoring containing latest baseline data to BIFPCL for further dissemination to DoE and other concerned authorities.	Being Complied
27	The Environmental Management Plan under the EIA study shall· strictly be implemented and kept	BIFPCL has so far been implementing the EMP measures phase by phase as suggested in EIA report and approved conditions of DoE. The status of EMP	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
	functioning on a continuous basis.	implementation are also regularly monitored by CEGIS.	
28	The project authority shall submit a detail work plan with time schedule of development activities at least 7 (seven) days ahead of the work commences in the field to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	Most of the development activities including jetty construction works are now completed. Beforehand, BIFPCL submitted the detailed work plan seven (7) days prior to starting of the construction activities to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously. It must be maintained in future.	Being complied
29	Environmental Monitoring Reports According to specific format specified in the EIA Report shall be made available simultaneously to DOE Bagerhat District Office, Khulna Divisional Office and Headquarters on a quarterly basis during the project period.	Environmental Monitoring Reports are being produced as per specific format provided in the EIA from the beginning till now. Report's content are disclosed by BIFPCL and submitted to DoE Bagerhat District Office, Khulna Divisional Office and Headquarters on monthly basis since April, 2018.	Being Complied
30	The following records must be kept in respect of any samples required to be collected for the purposes of environmental monitoring activities: a) the date(s) on which the sample was taken; b) the time(s) at which the sample was collected; c) the point at which the sample was taken; and d) The name of the person who collected the sample.	The Monitoring report of CEGIS are maintaining all the records as suggested.	Being Complied
31	The results of any monitoring required to be conducted under this EIA report must be recorded.	CEGIS is maintaining database fort all monitoring data analysis result and submitting to BIFPCL through proper documentation. The report is being shared with DoE on regular basis through monitoring reports.	Being Complied
32	In case of any emergency, the following information shall immediately be reported to Bagerhat District Office, Khulna Divisional office and Headquarters of the Department of Environment (DOE) simultaneously:	Emergency Reporting/ Emergency response Plan has been prepared and maintained for the Jetty construction (already finished) and will be followed for the coal transportation issues in future. As Coal transportation and its management is very sensitive to Environment and human body, Health and safety management manual have	Compliance Action initiated.

Sl. No.	Conditions	Compliance status	Remarks
	a. Nature of incident (oil spill, fire, accident, collision, land slide etc.) b. Personnel affected (injured, missing, fatalities, etc.) c. Emergency support available and its location (standby transport, medical facilities, etc.) d. Weather conditions e. Current operations (abandoning the site, firefighting, etc.)	been revised for better and precautious implementation of OHAS. Though BIFPCL has already put a top priority on OHAS issue, extra care will be ensured for this coal related issues. BIFPCL will adopt the ERP suggested on the EIA study of coal transportation in association with the NOSCOP and NPDM for any future incidents as suggested.	
33	National Oil Spill Contingency Plan (NOSCOP) should be followed to establish an organizational structure to combat marine pollution	Proponent is strictly following this issue and informed us that all the barge are following rules of National Oil Spill Contingency Plan (NOSCOP).	Being complied and suggested to follow this throughout the project cycle.
34	The project authority or its employees must notify the Department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.	BIFPCL has strengthened the mechanism for the incident as suggested that is notify to DoE regarding incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident. The institutional arrangement for managing the incident during coal transportation will be set up before operation stage based on the EIA and DoE recommendations. Moreover, monitoring activities is continued for checking any significant changes in natural ecosystem.	Complied at Present.
35	All pollution incidents shall be reported immediately and simultaneously to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DOE) in Dhaka.	BIFPCL has established a proper mechanism for recording such incidents as suggested in the ERP. CEGIS has been engaged to monitor the social and environmental compliance monitoring on a regular interval.	Complied at Present.
36	Climate Change impacts and maximum storm surge height shall have to consider at the design and construction phase of the jetty.	The design level (elevation) of the land and earthen embankment has been fixed and constructed considering the climate change impact and maximum storm surge height.	Being Complied
37	The transshipment point Faraway Buoy at the Bay should be used from November to	Not applicable in this stage	Suggested to comply as and when required.

Sl. No.	Conditions	Compliance status	Remarks
	March, and Mazhar point should be used from April to October every year for transporting coal which has been mentioned in the EIA Report.		
38	Violation of any of the above conditions shall render this approval void.	Noted by BIFPCL	-
39	Any injunction on this project from the Honorable Supreme Court/High Court Division shall render this approval void.	Noted by BIFPCL	-
40	This EIA approval is valid for one year from the date of issuance and the project authority shall apply for renewal to the Bagerhat District Office of DoE at Bagerhat with a copy to Head Office of DOE in Dhaka.	The authority is maintaining the renewal process as suggested. As like previous years, BIFPCL has got the renewal for this year.	Being complied

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Appendices

Appendix I: Checklist of Monitoring Environmental Compliances

Table A: Checklist of Monitoring for ESMP Implementation (During Construction Phase)

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Generation of Noise within the BIFPCL's Plant premises	• Conduct noise survey around and inside the site boundary • Reducing Noise and Vibrations to country's ambient standards, and occupational health and safety standards • Introducing vehicle speed limit and speed limit monitoring system • Green Plantation around the Project boundary • Switching off/ throttling down of machines/equipment's/generators which are not in use			
2	Dust Generation from Land development activities and other construction works	• Conducting dust monitoring and visual inspection around the site boundary • No use of earthen and undeveloped roads by vehicles related to the Project use • Installation of water spraying system to control fugitive dusts • Introducing vehicle speed limit and speed limit monitoring system • If yes, do they monitor vehicle speed regularly?			
3	Water Quality	• Fencing the construction site by drum sheet or Tarjja of any other fencing • Arrangement of runoff drainage for reducing any water logging • Location of backfilling stockpile in safe area and protected from wind and rain action • No storing of backfilling materials/spoil stored on river bank/slope • No disposal of waste and wastewater to river or canal.			
4	Waste Management System	• Provision of onsite waste management system			
5	Compensation and Resettlement	• Prepare Proper resettlement action plant and compensation plan if the Project needs any land acquisition addressing compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies • Resettlement of the PAPs • cash for compensation of land (CCL) before resettlement			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• formal agreement with the affected people prior to migration/resettlement • Sufficient standing crop compensation • Compensation for shift able structures? • Retention of salvageable materials? • Compensation for loss of trading income? • one-time moving assistance • grant to cover loss of regular wage income • Has a resettlement plan been developed which includes compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies? • Provide/take extra care/caution for the disadvantaged/vulnerable group(s) (i.e., women, children, ethnic minorities, indigenous people etc.) • Provision of monitoring the compensation and resettlement process			
6	Livelihood and living	• Does the Project pose any threat to the livelihood/living standards of the local people? • If yes, are adequate steps taken to reduce the impacts? • Has the company developed any policy which prioritizes the local laborers in employment opportunities? • Is there any possibility that large vehicle related to the Project will cause traffic induced disturbance/s to the local dwellers? • If yes, are there any mitigative steps taken to decrease the disturbance/s? • Has the road network been developed after the Project being proposed and during the construction phase? • Are there separate water and sanitation facilities for the construction workers in the Project area?			
7	Green House Gas Controlling Measures	• Use of efficient generator in the construction activities • Regular maintenance of vehicles, generator and machinery in accordance with manufacturer's specifications • Use of approved pollution control devices fitted in the equipment's and machineries • Switching off and throttling down the machines/equipment's/generators which are not in use			

Table B: Checklist of Monitoring ESMP Implementation (During Construction Phase)

(Labor and Working Condition)

Basic Data

Sl No	Description	Values
1	Direct Workers	
2	Contracted Workers	
3	Supply Chain Workers	
4	Child labor	
5	0 - 12	
6	13 - 14	
7	14 - 18	

Checklist for Labor and Working Condition

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Working Conditions and Management of Worker Relationship	• Preparation of Human Resources Policies and Procedures for Direct workers • Defined Working condition and Terms of Employment for direct worker • Sustainably equivalent terms and condition for migrant workers • Compliance to national law of forming workers' organization • No discrimination and equal opportunity for all • Measures for diminishing past discrimination • Grievance Mechanism			
	Protecting Workforce	• The client will not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. • No Force Labor			
2	Safety at site	• Installation/Construction of Safety Fence around the Project area			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• Use of Personnel Protective Equipment (i.e. safety suit, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.) • Safety trainings for workers (i.e. fire control, working at height, working in heat, first aid etc.) • Practice of Tool box meeting, safety talks, • Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.) • Maintaining Material Safety Data Sheet (MSDS) • Provision of Health care facilities such as doctor, hospital etc. available at/nearby the plant construction site • Availability of First Aid at work place • Preparation and Follow of Emergency Response Plan • Adequate fire precautions in place (for example, fire extinguishers, escape routes etc.) • Documentation and reporting of occupational accidents, diseases, and incidents • Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS			
3	Occupational Health and Safety Procedure	• Provision of complete EHS division in the Human Resources Planning/Organogram • Preparation of Safety Policy to be adopted during plant operation			
4	Worker's Well Being	• Establishment Grievance Mechanisms • Ensuring fair treatment, non-discrimination and equal opportunity • Compliance of Project's labor policy with the national labor law • No Child Labor • No incident of forced labor • Provision of Welfare facilities for Worker/Labor			

Table C: Checklist of Monitoring ESMP Implementation (During Construction phase)

(Community Health, Safety and Security)

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Disturbance to nearby community due to dust from newly developed land and Noise from construction activities	• Construction of boundary wall around the Project are • Installation of water spraying system to control dusts • Conducting dust monitoring and visual inspection around the site boundary • Adoption of Noise management plan			
2	Grievance of local people	• Availability and operation of Grievance Redress Mechanism • Maintaining open communication channel with the local community			
3	Risk of breaching Community Safety	• Construction of boundary wall/safety fence around the Project area • Practicing Risk Assessment and Evaluation Process • Practicing safe management for hazardous materials which may pose threat to the community • Availability and operation of Emergency Response Plan • Maintaining open communication channel with the local community • Training and instruction to the security personnel about their behaviour and communication with the local people • Aware the security personnel about the right of the community people			
4	Community Health Risk	• Provision of providing health service facilities to community if the Project possess any health risk like sexually transmitted disease, communicable disease, vector-borne diseases • Implement all pollution mitigation measures to ensure safeguarding to community			***(Continued)***
5	Youth Employment	• Providing training/awareness program for the local youth to let them aware about the required qualification to get involved in the Project related activities			
6	Public Communication, Consultation and Awareness	• Arranging public communication/consultation meeting • Sharing of Project information with local people • Organizing environmental and social awareness programs/meetings			

Table D: Checklist of Monitoring ESMP Implementation (During Construction phase)

(Biodiversity and Sustainable Management of Living Natural Resources)

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Runoff (contain mostly sediment load) from newly developed land falls into nearby river and channel.	• Installation of proper run on/runoff drains • Use of sediment fences, traps and basins for trapping the sediment, if required			
2	Disturbance to nearby ecosystem due to different construction activities	• No cutting/ felling of trees along the river bank • Implementation of on-site waste and air quality management plan • Limiting soil extraction activities limited within the defined area • Limiting the vegetation clearance and base stripping process within the Project boundary • Safety fence around the construction site • Limiting the use of night light • Using shade (directed downwards) around the outdoor lights • Provision of cut-off time to switch off unnecessary lights at night • Initiate Green plantation • No plantation of non-native species • Retaining top soil for future habitat restoration • No degradation of critical habitat?			
3	Occupation of river, inter-tidal areas and wetlands	• No encroachment of inter-tidal flood plain area • No disturbance to Dolphin community • Monitoring of Ecosystem Health and Monitoring of Sundarbans Forest Health • If required, embankment should be constructed considering a setback distance from river/canal bank • Slope protection work along the Maidara River should be completed on an urgent basis before rainy season come and • BIFPCL may take initiatives of excavating of silted reach of Maidara river near proposed township area to facilitate proper functioning of River for maintaining tidal dynamics			

Appendix II: Photo Album

Environmental and Socio-economic Monitoring of Khulna 2×660 MW Power Plant for 33rd monitoring program (J uly, 2022)

Monitoring team

Collectimg Data

Acquisition of ambient noise level

Measuring the Sapling DBH

Insitu testing of water quality parameters

Counting Pneumetaphore and Crab hole

Measuring Tree DBH

Observing Fisheries resources

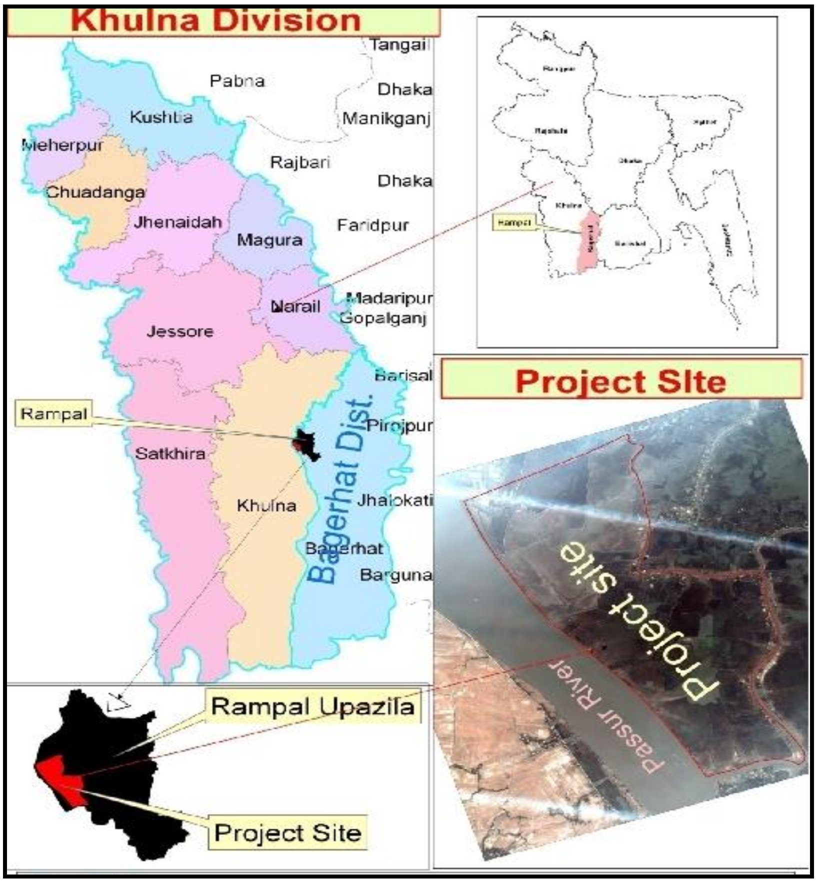
Appendix III: Terms of References (ToR)

Background

Bangladesh-India friendship Power Company (Pvt.) Ltd. (BIFPCL), a 50:50 Joint Venture Company of Bangladesh Power Development Board (BPDB) of Bangladesh & NTPC Limited of India is implementing a coal based thermal power plant named 2X660 MW Maitree Super Thermal Power Project at Rampal in Bagerghat District of Khulna Division of Bangladesh. The plant is envisaged to be based on super critical technology and is to be operated as Base Load Plant. The fuel envisaged is imported coal.

General Description of 2X660 MW Maitree Super Thermal Power Plant Project

Project Location: Upazila: Rampal, District: Bagerhat
Site is located at 23 kms Southward of Khulna City and 14 kms.
North-Eastward from Mongla Port.



Project Capacity: 1320 MW (2x660 MW), based on Ultra Super-critical Technology

Mode of Operation: Base Load

Fuel: Imported Coal

Fuel Transportation:	It is envisaged that imported coal from countries like Indonesia, Australia shall be transported through bigger ships, up to trans-shipment point, from where the coal shall be transported through barges to the coal unloading jetty at the plant end. From jetty to the power plant coal shall be transported through coal conveyor system.
Land& Land Development:	Based on the layout in the FR, it is estimated that approx. 575 acres of land will be required for the project. (375 Acres for Main Plant, 50 Acres for Township, 50 Acres for Jetty).
Evacuation of power:	Provision of line bays in generation switchyard for one no. 400 kV Double Circuit line and one no. 230 kV Double Circuit line have been kept. The Power evacuation (transmission line) system from the Project shall be at 400 kV level and will be outside the scope of the Project. 400 kV is being introduced for the first time in Bangladesh.
Expected Timeline for project implementation	The first unit of capacity 660 MW is scheduled to be synchronised in 41 months from the date of NTP to the EPC contractor for the Power project. Commissioning of the first unit of capacity 660 MW is envisaged at an interval of 5 months thereafter.

Broad Scope of Works

The study covers quarterly monitoring of different environmental and social parameters, and implementation of EMP (Environment Management Plan) during implementation phases as per DoE approval/requirement. The monitoring locations were selected based on physical activities, wind direction, sensitive receptors, etc. and were finalized through the consultation with DoE, Department of Fisheries (DoF), MPA and Forest Department (FD).

The Broad objectives of independent monitoring covers the following activities

- Monitoring implementation of EMP and environmental compliance;
- Monitoring of ambient air quality, noise level and water quality;
- Monitoring of cropping pattern and soil quality;
- Monitoring of fisheries resources covering fish habitats, biodiversity, migration and production;
- Monitoring of ecosystem and biodiversity;
- Monitoring of the Sundarbans Forest Health; and
- Monitoring of socio-economic condition and livelihoods.
- To evaluate the project environmental performance as due to construction activities.

The main objectives of this works are

- Monitoring of Social and Environmental parameters to update the baseline.
- Monitoring of Social and Environmental parameters during Implementation of the Project.
- Assistance to BIFPCL for implementation of Environmental Management Plan (EMP) during construction period.
- The scope of work of the Independent Monitoring will include the following specific tasks
- Develop specific monitoring indicators, checklists, and questionnaires to undertake independent monitoring (a preliminary list of monitoring indicators has been given in the EMP) in consultation with BIFPCL, DoE, Forest Department and the Financer;
- Review and verify the implementation progress of various EMP elements, particularly, mitigation plan, compliance monitoring, environmental trainings, documentation, and grievance redress mechanism;
- Physical aspects would cover air quality, noise level, water quality and land resources;
- Biological environment includes fisheries resources, ecological resources, Sundarbans Reserve Forest (SRF) health conditions including WHS;
- Environmental compliance monitoring includes Monitoring of Environmental and Social Management System Action Plan Implementation, monitoring of labour and working conditions, monitoring of community health, safety and security and monitoring of biodiversity and sustainable management of living natural resources.
- To establish baseline environmental conditions;
- Provide and monitor the environmental parameter during construction activities.
- To detect adverse environmental impacts for river dredging and other activities of site development;
- Provide technical assistance to the client for implementation of the EMP during the power plant construction at different sector of construction activities.
- To demonstrate whether the environmental control measures are operating as per designed;
- To provide data for emission inventories;
- To provide data at regular intervals for dissemination to the stakeholders
- To provide data for improvement and updating of the monitoring program;
- To assist in investigating the event of a trigger level or emission limit value being crossed.
- Update baseline data as per monitoring schedule and location.
- Provide technical assistance to the client for implementation of the EMP during power plant construction.
- Review the EIA document to evaluate the EMP measures incorporated in the contract to mitigate different social and environmental hazards and risks during construction of the Project
- Submit progress reports to the client.

- Physical observation to assess that all mitigation measures mentioned in EMP are carried out in all place.
- Sampling and carrying out necessary analysis of Environmental parameter such as surface & ground water quality, air quality, noise, Biological Environment, Socio-economic environment, Sundarbans Forest health etc. according to the monitoring framework in construction phase.
- Morphological changes of the adjacent river of the project will be influenced by the constructional activities. River bank erosion-accretion, drainage system, tidal inundation etc. will be investigate after regular intervals in the study area as per monitoring location of the EIA. The procedure of investigation and methodologies of analysis will be the same as pre-construction phases. River bed pollution will be identified though this study during construction of the power plant.
- Monitoring of floral resources will be performed quarterly. The indicators and procedures of flora monitoring will be relatively same as earlier studies of this projects. Plant composition, canopy coverage, indigenous and exotic species, plant intensities will be the main monitoring indicators during construction phases.
- Monitoring of faunal resources will be performed quarterly at the construction period. Faunal resources survey will coincide with floral resources survey as it will provide more insight about the inter-dependency between flora and fauna in an ecosystem.
- Render any other related services as and when requested.
- Conduct community level consultation in a regular interval and disclose project level information.
- Keep liaison with different organization like Govt department, NGOs, and relevant stakeholders.

The Monitoring parameter & associated indicator are given below

Monitoring Parameter	Indicators
Socio-economy	Livelihood and Occupation
	Income and expenditure
	Displacement and Migration
	Cultural and heritage
	Health and sanitation
	Risks and accidental assessment
	Transportation and communication
	Public and private Infrastructure development
Ecology and Biodiversity	Bio-indicator Assessment
	Movement of indigenous/ native species
	Envision of exotic species and regime dominance
	Species composition (Flora and Fauna)
	Assessment the services of dependent ecosystem
Agriculture	Land use and canopy coverage

Monitoring Parameter	Indicators
	Soil quality (Salinity, pH, OM,)
	Cropping pattern and crop intensities
	Irrigation and crop production
	Farmers survey result
Fisheries	Fish diversity and specification
	Fish production and availability
	Fisher survey result
Noise level	Sound level at the sensitive zone
Water resources	DO, BOD, COD, Salinity, TDS, TS, pH, Hg, Pb
	Total Hardness, Hg, NO_3 and PO_4
	River Morphology,
	Tidal inundation
	Drainage Network
	Erosion and Accretion
	Ground water quality
Air quality	SOx
	NOx
	SPM (PM_{10} and $PM_{2.5}$)
	CO

Air quality monitoring progress

The most commonly used method for automatically monitoring air pollutant such as those above are:

- SOx: measured by Fluorescent signal generated by exiting SO_2 with UV light
- NOx: measured by Chemilumiscent reaction between NOx & O_3
- O_3: measured by ultra violet absorption analyzer, this determines the Ozone concentration by the attenuation of 254 nm UV light along this signal fixed path cell
- Particulate matter (SPM, PM_{10}, $PM_{2.5}$): measured by gravimetric methods including true micro weighing technology for automatic monitoring & instrument named 'Tapered element oscillating micro balance (TOEM)' has been most frequently used. Measurement on filter tape using the principles of beta attenuation for estimating 30 mnt or 1 hr average concentrations of PM_{10} or $PM_{2.5}$ has also been used.
- CO: In urban air pollution studies, a non-disruptive infrared photo meter utilizing a gas filter co relation technology & state of the art optical & electronic technology is used to measure low concentration of CO accurately & reliably.

Expected Output

A breach of a trigger level or emission limit values may indicate a significant increase of a contaminate concentration in an environmental medium.

Baseline Monitoring is monitoring in and around the location of a proposed site so as to establish background environmental conditions prior to any development of the proposed site. In case of existing facilities, baseline-monitoring serves as a reference point to which later monitoring results are compared. The information will be used to evaluate in future compliance monitoring.

Compliance monitoring is periodic monitoring and is to determine whether there is any release of contaminants to the environment and to demonstrate compliance within the project area. It includes measurements of process conditions, process emissions and levels in receiving environments and the reporting of the results of such measurements to demonstrate compliance with limits specified in the legislation.

The information provided by compliance monitoring is also valuable for other environmental and management activities (e.g. for optimizing process, protecting sensitive ecosystems and informing the public of the effectiveness of environmental protection measures).

Assessment monitoring is investigative monitoring which is initiated after detection of the impacts to the environment or on attaining a trigger level. The assessment monitoring will:

- Identify the source of release materials;
- Characterize the nature, extent and rate of releases;
- Evaluate the risk to the environment and to human health;
- Evaluate measures to prevent or minimize future releases;
- Provide information for the design and implementation of corrective measures and
- Express the residual environmental impacts for proper compensation.

Reporting Requirements

As it is proposed to carry out the monitoring program for two quarters and the proposed deliverables are scheduled below:

SL	Name	No. of copies
1	Monitoring Report after each monitoring mission (each in one quarter) with complete data, analysis, lab. Results, discussion etc. as intended in the scope of work.	12
2	CD-ROM in respect of documents/datasheets	2

Appendix IV: Monitoring Data

(A) Air Quality Data

Table A1: Ambient Air Quality Monitoring Results

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	28th QM, April, 2021	29th QM, Aug, 2021	30th QM, Nov, 2021	31st QM, Jan, 2022	32nd QM, May, 2022	33rd QM, July, 2022	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
Weather		Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Rainy/Cloudy	Sunny/Rainy	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	Sunny	Sunny/Cloudy	Sunny	Sunny	Sunny/Cloudy	Rainy/Cloudy	Sunny/Cloudy	Sunny	Sunny	Sunny/Cloudy	Sunny/Cloudy	Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	
Concentrations are in µg/m³																																		
SW Corner of the PP area	$PM_{2.5}$	33	37	25	33	47	25	22	34	19	5	9	24.8	8.12	28.2	32.9	28.4	15.2	31.1	27.3	21.7	37.76	51.32	27.12	18.71	44.18	55.35	49.13	38.25	56.83	46.83	41.78	34.84	65^{24hr}
	PM_{10}	78	77	53	79	83	35	52	135	117	32	22	79	43.8	73.6	133	70	15.8	106	105.4	98.2	67.15	127.6	68.1	80.28	107.16	106.13	103.88	59.17	83.46	91.25	74.32	56.18	150^{24hr}
	SPM	207	239	190	200	177	42	91	175	332	51	53	115.7	122.4	169.4	145.6	121.5	12.9	137.4	151.6	128.6	109.25	183.56	108.4	98.26	149.73	163.48	155.14	99.44	144.48	159.45	139.42	106.28	200^{8hr} (ECR, 1997)
	SO_2	21	24	19	23	15	52	35	14	18	9	8	9.5	9.0	7.2	14.3	11.4	11.9	12.7	11.6	13.9	56.5	31.53	18.35	19.91	26.63	14.74	16.26	14.49	16.28	21.54	15.22	11.04	80^{24hr}
	NOx	26	29	27	31	29	35	29	18	18	12	10	11.3	10.7	7.5	17.7	12.8	10.2	14.8	12.4	16	55.08	24.97	12.12	8.82	16.62	37.16	22.31	19.87	21.64	39.5	22.49	23.18	80^{24hr}
	CO	120	188	140	190	144	146	88	74	57	35	119	59	91	73	61	32	11.1	28	15	18	4	16	28	0	2	0	0	1	0	1	1	0.3	$(5000)^{8hr}$
	O_3	27	26	19	22	26	12	5	4	1	1	1	5	03	10	03	9	13.2	7	9	6	25	10	8	8	8	9	16	42	11	12	18	12	100^{8hr}
Shapmari area	$PM_{2.5}$	39	48	48	39	34	18	17	35	25	3	8	25	14.6	8.5	31.5	26.7	15.8	35.7	30.6	18.9	50.24	19.34	19.14	20.35	29.17	52.74	48.64	41.2	44.65	39.86	36.71	41.2	65^{24hr}
	PM_{10}	814.6	90	74	102	97	31	48	116	44	11	11	99.5	56.9	40.4	147.8	52	64.4	109.9	126.3	106.1	63.94	82.27	83.22	71.06	84.3	112.04	83.1	64.28	71.35	58.29	68.79	64.29	150^{24hr}
	SPM	2156.3	263	217	274	266	47	79	192	187	27	23	154.2	136.7	45.3	181.4	138.7	113.4	143.9	168	150.8	123.56	120.45	106.3	95.24	119.22	170.33	139.26	116.48	118.49	128.34	158.14	118.62	200^{8hr} (ECR, 1997)
	SO_2	19	28	22	21	22	58	27	13	11	4	6	12.9	10	4.3	15	9.6	10.8	12.2	12.3	12.1	31.53	60.26	27.41	17.44	14.15	18.32	14.06	11.77	14.55	14.48	13.96	12.58	80^{24hr}
	NOx	29	39	27	26	24	46	25	16	22	6	8	15.7	11.8	6	18.6	10.2	13.1	13.6	13.8	13.9	24.97	58.39	18.77	10.17	14.18	29.9	21.65	21.394	20.85	20.44	20.47	18.4	80^{24hr}
	CO	165	210	230	164	136	127	102	77	22	31	108	66	78	79	69	27	25	30	21	20	4	11	44	4	0.013	0	0	1	1.1	1	1	1	$(5000)^{8hr}$
	O_3	33	26	26	23	21	16	1	1	1	0	0	1	08	25	04	4	8	6	4	1	34	22	9	6	2	6	9	28	41	49	8	16	100^{8hr}
NW Corner of the PP area	$PM_{2.5}$	37	44	19	42	59	28	19	24	11	3	10	29	10.3	15.2	40.7	27.7	12.9	32.3	20.3	14.2	37.27	33.2	21.61	21.93	46.73	68.26	58.81	22.66	41.98	42.81	54.16	39.36	65^{24hr}
	PM_{10}	67	78	56	98	91	96	29	125	29	24	14	108.7	31.3	49.9	136.3	100.1	44.3	117.4	93.6	58.7	42.99	1119.34	77.69	76.76	110.43	131.84	97.61	48.19	61.48	73.42	63.26	58.03	150^{24hr}
	SPM	234	217	157	310	244	321	66	187	115	31	35	168	91.7	63.9	161.7	116.2	76.3	156.2	125.5	119.2	60.45	175.13	100.04	101.33	160.3	180.43	161.8	77.149	104.73	123.76	132.77	108.2	200^{8hr} (ECR, 1997)
	SO_2	19	22	18	27	21	56	32	13	17	4	8	12.2	5.8	7.5	9.6	13.2	5.8	13.4	10.7	11.6	60.26	54.02	19.68	16.21	25.82	16.19	16.58	13.58	12.19	11.79	10.47	13.29	80^{24hr}
	NOx	23	28	22	32	39	43	21	18	16	5	11	14.7	7.1	9.2	11.7	14.3	5.9	15	11.3	13.5	58.39	43.45	17.53	10.55	18.91	34.1	27.42	20.49	18.39	20.25	23.96	20.63	80^{24hr}
	CO	110	178	110	210	140	133	87	77	38	47	127	31	74	80	45	43	21	32	20	16	7	0	30	2	0.012	0	0.2	1	1.4	1	0.6	0.4	$(5000)^{8hr}$
	O_3	25	19	17	36	44	11	8	2	0	1	1	3	05	10	05	7	6	8	1	5	18	2	9	8	8	12	14	17	34	12	8	11	100^{8hr}
Barni, Gaurambha	$PM_{2.5}$	39	47	57	39	41	34	11	29	23	9	10	21.7	7.9	13.8	52.3	18	11.9	15.4	19.3	19.7	57.51	31.28	26.66	18.04	38.69	61.29	62.29	21.8	58.34	29.22	31.43	27.55	65^{24hr}

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	28th QM, April, 2021	29th QM, Aug, 2021	30th QM, Nov, 2021	31st QM, Jan, 2022	32nd QM, May, 2022	33rd QM, July, 2022	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
Weather		Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Rainy/Cloudy	Sunny/Rainy	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	Sunny	Sunny/Cloudy	Sunny	Sunny	Sunny/Cloudy	Rainy/Cloudy	Sunny/Cloudy	Sunny	Sunny	Sunny/Cloudy	Sunny/Cloudy	Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	
Concentrations are in µg/m³																																		
	PM_{10}	103	122	67	97	82	65	26	97	82	45	13	105.4	30.5	30.2	140	30.5	20.5	50.1	102	69.9	33.25	69.32	61.11	59.02	91.79	93.36	103.42	50.26	73.17	43.88	46.29	51.98	150^{24hr}
	SPM	233	244	183	277	236	79	112	176	268	69	30	167.8	95.6	57.2	171.9	90.6	5.2	113.5	127.5	92.2	75.13	102.17	98.74	82.02	128.48	159.8	154.35	83.2	134.6	92.38	98.15	93.44	200^{8hr} (ECR, 1997)
	SO_2	21	23	17	22	25	41	31	16	20	10	7	12.2	5.5	4.1	13.8	6.1	6.1	9.5	11.5	12.6	54.02	59.33	18.88	24.29	20.17	16.47	13.52	14.44	21.39	14.36	18.42	10.57	80^{24hr}
	NOx	25	28	22	26	27	44	32	21	16	12	9	19.3	9.8	5.0	16.7	7.3	7.4	10.7	13.8	13.8	43.45	57.02	11.58	10.62	14.47	21.18	19.371	19.48	38.46	21.92	40.28	16.4	80^{24hr}
	CO	175	210	190	150	196	96	96	81	73	41	98	63	85	77	59	24	20	20	17	18	6	0	32	0	0	0	0	0	0	0.1	1	0.8	$(5000)^{8hr}$
	O_3	26	29	22	19	15	9	6	4	0	0	3	5	08	6	04	6	6	2	3	4	7	52	12	8	0	6	2	19	28	6	10	14	100^{8hr}
Chunkuri-2, Bajua Dacope	$PM_{2.5}$	35	39	46	37	33	35	28	31	25	7	5	25.2	8.7	17.3	33.4	11.4	10.2	26.8	22.8	15	19.46	33.74	39.44	18.22	43.91	59.18	53.36	33.27	29.61	45.3	48.94	38.48	65^{24hr}
	PM_{10}	77	86	69	68	61	109	49	98	60	23	20	74.4	44.4	100.2	157.1	40.6	30.6	105.9	126.7	72.7	46.37	78.27	100.08	59.91	88.93	117.42	86.44	61.9	44.28	66.54	86.48	53.19	150^{24hr}
	SPM	117	113	162	183	188	175	94	167	167	31	48	162	110.6	127.8	200	108	78.6	128.5	146.6	117.6	80.31	100.95	146.72	146.72	139.04	188.27	128.36	104.29	77.88	134.71	165.58	103.72	200^{8hr} (ECR, 1997)
	SO_2	19	24	21	18	11	55	33	21	13	7	9	18.9	8.2	7.9	19	10.4	7.5	12.1	12.4	11.2	45.81	35.42	36.14	18.74	29.94	16.45	19.66	15.98	10.59	12.84	14.82	11.08	80^{24hr}
	NOx	23	26	27	24	18	49	23	16	25	10	8	18	11.2	8.4	20.7	11.6	8.4	14	13.8	13.7	44.92	40.09	20.04	10.19	18.32	26.14	24.21	18.66	17.21	16.73	26.42	21.94	80^{24hr}
	CO	190	205	170	170	33	133	75	70	33	38	79	36	94	69	58	42	23	27	25	20	10	0	18	10	0	0.1	0.1	0.8	1	1	1	0.2	$(5000)^{8hr}$
	O_3	27	24	18	22	41	21	2	1	1	0	2	2	03	5	05	2	4	5	9	8	2	38	22	8	0	23	28	11	9	8	13	29	100^{8hr}
Pankhali, Dacope	$PM_{2.5}$	47	49	57	41	39	34	25	47	15	8	10	38.7	15.8	17	72.3	15.9	11.1	24.8	28.6	15.8	24.03	24.03	33.26	16.63	33.32	66.31	42.62	32.45	42.59	47.51	42.57	42.85	65^{24hr}
	PM_{10}	119	127	139	101	105	144	62	128	46	42	18	141.6	105	63.4	208.9	74.3	58.4	92	125.8	92.7	56.56	119.28	127.52	55.78	74.83	102.73	73.29	74.89	64.71	81.84	71.22	69.02	150^{24hr}
	SPM	297	266	254	208	299	339	183	198	114	78	34	194.6	179	87.5	223.9	154.1	98.4	139	178.2	141.1	93.5	100.95	160.02	70.23	111.95	156.56	116.73	118.4	107.31	148.93	128.98	127.39	200^{8hr} (ECR, 1997)
	SO_2	28	31	31	24	30	58	36	18	9	8	8	16.1	12.9	8	16.3	12.2	9.4	10.4	13.3	10.4	59.41	44.29	30.89	16.73	21.39	16.16	13.1	14.61	12.8	21.4	19.71	12.71	80^{24hr}
	NOx	41	39	36	26	27	47	23	15	19	9	9	19	18.7	10.2	17.7	13.7	12.1	13.4	14.9	11.7	51.09	17.72	19.02	10.52	12.12	28.54	17.18	20.27	19.33	38.27	29.44	23.16	80^{24hr}
	CO	230	217	250	188	177	125	105	101	55	29	112	48	83	87	49	34	29	30	14	14	9	0	11	0	0	1	0	1	1.1	2.8	2	0.4	$(5000)^{8hr}$
	O_3	49	38	36	27	11	13	5	2	2	0	0	3	06	0	06	6	8	8	8	3	22	26	2	2	4	20	2	10	19	48	39	37	100^{8hr}
Mongla Port area	$PM_{2.5}$	47	55	39	41	26	33	19	34	21	9	11	25.7	22.6	33.2	70.1	23.2	13.2	30.3	26.6	35	56.67	39.69	38.92	41.33	40.75	74.19	65.37	22.54	51.83	26.39	28.19	43.8	65^{24hr}
	PM_{10}	139	174	77	82	35	52	33	132	45	29	15	119.3	93.6	97	209.1	89.9	47.5	103.7	109.3	131	119	64.12	119.61	126.13	114.61	118.67	129.71	64.44	72.4	61.63	51.66	62.53	150^{24hr}
	SPM	288	303	197	217	214	118	65	189	144	50	6	172.3	196	187.2	242	144.7	73.7	161.9	157.1	183.1	192.17	83.9	173.36	166.16	152.76	201.16	180.22	85.2	128.3	100.53	92	120.3	200^{8hr} (ECR, 1997)
	SO_2	27	28	26	24	14	45	36	16	10	8	7	16.8	10.5	8.2	15.5	11.8	6.5	12	10.8	16.8	59.33	57.24	31.33	22.04	20.06	12.26	18.91	10.28	17.44	12.54	20.33	14.55	80^{24hr}
	NOx	44	39	33	27	17	40	20	13	14	10	8	15.3	15.1	10.7	18.4	13.2	7.2	16.8	12.6	17.8	57.02	46.58	13.34	11.29	9.69	19.25	30.2	19.73	29.16	18.43	31.63	22.3	80^{24hr}
	CO	230	320	220	211	24	110	84	71	29	31	97	44	72	79	52	29	20	33	28	17	15	48	29	24	0	2	0.9	2	2.4	2	0.2	0.1	$(5000)^{8hr}$
	O_3	57	52	37	26	09	15	8	3	1	2	1	4	04	9	02	3	1	9	7	3	5	40	4	2	1	66	91	23	43	20	13	29	100^{8hr}
Harbaria,	$PM_{2.5}$	19	22	33	27	24	27	24	26	13	6	10	19.2	10.5	28.3	43.5	11.6	11.4	20.6	15.4	14.2	28.03	39.69	17.81	20.11	34.42	53.28	46.13	34.94	31.2	41.58	43.27	49.15	65^{24hr}

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	28th QM, April, 2021	29th QM, Aug, 2021	30th QM, Nov, 2021	31st QM, Jan, 2022	32nd QM, May, 2022	33rd QM, July, 2022	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
Weather		Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Rainy/Cloudy	Sunny/Rainy	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	Sunny	Sunny/Cloudy	Sunny	Sunny	Sunny/Cloudy	Rainy/Cloudy	Sunny/Cloudy	Sunny	Sunny	Sunny/Cloudy	Sunny/Cloudy	Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	
Concentrations are in µg/m³																																		
Sundarbans	**PM_{10}**	41	39	59	56	49	42	50	82	42	20	14	85.2	36.7	89.9	152.4	29.1	24.3	80.5	92.6	63.9	21.85	64.12	63.27	62.24	79.38	100.11	82.83	61.53	49.07	58.92	51.04	74.7	150^{24hr}
	SPM	111	117	129	139	109	70	73	159	91	43	44	93.5	103.7	107	189.9	72.4	47.6	90.3	118.3	90.9	48.09	83.9	87.51	87.71	122.94	146.2	133.1	108.74	83.16	118.83	110.28	141.48	200^{8hr} (ECR, 1997)
	SO_2	9	10	14	12	16	51	34	15	11	6	7	11.9	5.7	7.6	13.2	7.9	4.9	11.6	9.5	11.6	49.72	57.24	16.47	13.31	19.74	14.66	16.58	14.75	12.68	22	13.76	14.9	80^{24hr}
	NOx	19	22	27	18	22	34	22	14	16	8	10	13	7.7	9.3	15.2	8.3	5.4	13	10.1	13	41.91	46.58	9.9	8.13	10.16	21.44	0	23.28	22.27	27.2	39.23	20.82	80^{24hr}
	CO	65	58	70	64	56	112	81	62	47	32	110	67	73	84	57	31	20	20	25	16	16	48	30	8	0	0	3	1	1	1	1	0.4	$(5000)^{8hr}$
	O_3	13	12	13	11	14	12	4	2	2	0	1	4	08	0	02	2	6	4	3	5	8	40	12	22	3	6	46.13	9	11	41	24	31	100^{8hr}
Akram Point, Sundarbans	**$PM_{2.5}$**	17	19	23	18	49	NO	25	18	9	4	4	14.3	13.2	7.5	35.4	13.7	14	29.1	16.2	13	19.68	36.67	23.04	13.16	22.74	48.2	41.33	39.16	23.6	29.65	58.43	30.22	65^{24hr}
	PM_{10}	39	44	32	39	77	NO	32	77	31	15	14	85.5	96.0	37.8	150.6	36.4	41.6	100.2	93.2	51.9	43	87.15	82.91	58.82	56.74	90.12	84.16	76.18	51.88	53.69	77.69	60.21	150^{24hr}
	SPM	114	133	97	88	102	NO	51	128	46	23	27	90.9	137.0	41.8	175.1	90.3	58	121.4	117.8	71.1	83.9	122.62	121.68	78.8	80.31	144.95	131.46	123.59	79.47	98.47	141.37	103.5	200^{8hr} (ECR, 1997)
	SO_2	7	9	12	13	21	NO	27	14	9	4	6	8.4	6	5.8	14	8.3	6.3	10.8	10.1	8.9	57.24	35.23	24.21	15.06	12.74	15.05	17.44	16.55	15.89	15.53	21.81	12.59	80^{24hr}
	NOx	17	19	22	17	27	NO	19	15	10	5	6	12.7	10.1	5.9	15.1	9.9	9.3	11.7	11.3	9.4	46.58	31.26	16.74	10.47	6.64	20.6	23.5	21.28	21.39	19.38	38.3	19.69	80^{24hr}
	CO	49	60	50	46	163	NO	92	64	21	37	101	58	79	69	52	21	25	28	17	14	38	24	20	14	0	0.2	0	2	1	1.4	0.3	0.9	$(5000)^{8hr}$
	O_3	11	14	9	10	27	NO	8	1	0	0	2	3	0	0	03	3	4	5	3	1	9	90	2	4	6	8	8	11	8	16	41	24	100^{8hr}
Hiron Point, Sundarbans	**$PM_{2.5}$**	15	23	19	17	28	NO	27	NO	17	NO	9	21.7	No	17.0	40.5	NO	NO	23.4	18.2	NO	NO	27.76	17.39	NO	28.15	55.71	NO	25.3	38.51	36.88	39.62	NO	65^{24hr}
	PM_{10}	44	38	34	41	60	NO	45	NO	40	NO	14	104.5	NO	92.1	149.8	NO	NO	86.7	96.1	NO	NO	67.89	72.45	NO	59.31	99.64	NO	59.7	49.27	58.45	48.81	NO	150^{24hr}
	SPM	101	119	107	97	110	NO	88	NO	132	NO	26	111.4	NO	102	173.7	NO	NO	107.9	127.8	NO	NO	90.31	94.28	NO	91.06	155.39	NO	94.7	89.36	106.93	96.23	NO	200^{8hr} (ECR, 1997)
	SO_2	8	7	13	14	15	NO	28	NO	15	NO	9	13.5	NO	6	15.8	NO	NO	10.6	10.7	NO	NO	45.81	13.33	NO	11.36	16.2	NO	13.92	14.33	12.76	15.38	NO	80^{24hr}
	NOx	18	18	19	22	20	NO	23	NO	19	NO	9	15.9	NO	7.8	18.1	NO	NO	12.5	10.9	NO	NO	44.92	8.65	NO	9.74	23.53	NO	20.06	16.27	19.66	39.72	NO	80^{24hr}
	CO	52	62	65	60	60	NO	93	NO	40	NO	121	43	NO	72	71	NO	NO	22	21	NO	NO	2	36	NO	0	0	NO	0	0	0.3	0.7	NO	$(5000)^{8hr}$
	O_3	14	13	11	9	23	NO	2	NO	0	NO	0	4	NO	0	04	NO	NO	6	6	NO	NO	16	7	NO	1	11	NO	14	22	22	38	NO	100^{8hr}
	$PM_{2.5}$	54	39	52	42	55	46	19	35	11	16	9	34.6	23.1	19.5	78.7	12.4	12.5	21.3	20.8	33	38.59	18.65	40.22	46.73	48.32	88.71	71.2	29.47	65.66	61.57	67.33	69.28	65^{24hr}

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	28th QM, April, 2021	29th QM, Aug, 2021	30th QM, Nov, 2021	31st QM, Jan, 2022	32nd QM, May, 2022	33rd QM, July, 2022	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
Weather		Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Rainy/Cloudy	Sunny/Rainy	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	Sunny	Sunny/Cloudy	Sunny	Sunny	Sunny/Cloudy	Rainy/Cloudy	Sunny/Cloudy	Sunny	Sunny	Sunny/Cloudy	Sunny/Cloudy	Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	
Concentrations are in µg/m³																																		
Khulna City, near Khan Jahan Ali Bridge	PM_{10}	139	117	91	84	75	89	49	112	69	68	24	145.9	99.5	39.6	213.9	38.8	45.4	57.9	91.3	125.9	47.05	59.19	116.16	119.11	109.63	159.22	120.38	64.44	124.55	100.3	92.36	100.28	150^{24hr}
	SPM	301	287	239	219	222	181	101	181	112	107	64	189.7	187.2	127.9	243.4	78.9	69.9	102.9	158	173.4	100.95	78.09	157.28	167.18	157.35	240.18	193.61	101.85	195.17	198.24	178.26	189.38	200^{8hr} (ECR, 1997)
	SO_2	33	29	33	28	31	59	28	16	11	10	10	17.1	7.2	7.1	21	7.5	7.5	8.7	10.4	15.3	35.42	49.72	28.31	30.73	29.58	18.8	20.64	12.73	26.18	28.52	19.29	23.66	80^{24hr}
	NOx	49	41	39	36	33	38	26	16	15	15	14	18.6	11.7	8.8	25	8.4	11.1	9.7	11.1	17.1	40.09	41.91	24.14	24.24	20.44	34.2	28.35	20.45	38.58	41.59	37.91	39.12	80^{24hr}
	CO	330	370	330	296	101	89	94	98	68	36	104	66	79	81	69	36	28	121	19	23	11	24	32	18	0.7	2	3	4	4.9	1.4	0.2	2.1	$(5000)^{8hr}$
	O_3	59	67	57	39	21	7	4	2	1	0	2	3	07	07	09	9	7	4	5	6	6	18	10	4	0	80	63	21	59	53	36	66	100^{8hr}
Township area	$PM_{2.5}$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	29.1	13.7	28.6	21.2	17.2	21.24	29.64	44.26	22.08	41.29	166.72	67.82	59.2	79.64	56.26	69.23	51.29	65^{24hr}
	PM_{10}	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	70.3	60.8	111.7	88.7	61.6	96.71	98.15	122.73	86.26	97.16	234.41	108.16	94.6	102.33	104.73	94.28	69.28	150^{24hr}
	SPM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	120.6	98.1	144.6	129.4	102.5	127.79	127.79	171.29	111.73	142.36	347.39	170.37	158	193.43	178.63	181.85	134.27	200^{8hr} (ECR, 1997)
	SO_2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	13.1	8.4	10.2	11.3	7.9	9.32	19.32	34.12	20.61	21.73	18.61	23.72	19.7	16.92	38.36	27.45	14.56	80^{24hr}
	NOx	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	14	9	11.6	12.1	11.9	15.63	15.63	21.72	11.17	13.36	33.48	34.49	27.3	48.41	44.77	39.56	20.23	80^{24hr}
	CO	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	46	32	30	18	21	9	0	18	2	0	3	1	1	1	3.3	4	1.3	$(5000)^{8hr}$
	O_3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	9	4	9	1	5	19	11	4	2	0	212	108	92	68	93	59	38	100^{8hr}
Access road bridge	$PM_{2.5}$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	33.1	20.9	40.9	26.9	36.1	39.65	14.65	26.26	20.16	38.72	94.23	64.73	52.2	55.31	57.29	31.28	28.43	65^{24hr}
	PM_{10}	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	118.1	83.7	128.3	112.9	137	142.84	79.92	91.39	78.69	93.48	188.64	119.73	96.1	69.4	69.89	59.15	53.42	150^{24hr}
	SPM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	142.5	106.2	177.8	168.2	163.2	171.2	109.25	126.13	102.03	136.66	269.3	173.92	151	129.45	137.46	98.74	89.45	200^{8hr} (ECR, 1997)
	SO_2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	12.2	10.9	13.4	12.5	15.7	17.37	56.5	16.16	18.82	18.11	20.23	19.16	13.3	20.76	16.93	19.3	11.39	80^{24hr}
	NOx	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	14.8	13.4	15	13	17.6	21.32	55.08	9.04	9.22	9.92	26.3	23.74	20.1	31.69	21.62	33.62	20.47	80^{24hr}
	CO	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	38	34	32	23	21	8	0	22	0	0	0.8	0.2	2	1	1	1	2	$(5000)^{8hr}$
	O_3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	5	7	9	6	7	6	6	6	8	2	68	46	16	29	72	31	23	100^{8hr}

Note(s): Concentrations are in µg/m³

- DoE- Department of Environment, NF- Not found; NO-Not observed; x-not measured at pre-construction stage.
- Fine Particulate Matter ($PM_{2.5}$), Respirable Dust Content (PM_{10}), Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO_X). Sulfur dioxide (SO_2), Carbone Monoxide (CO) & Ozone (O_3);
- Standards for 1hr, 24hr or Annual are indicated using superscript;

  This monitoring was carried out by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model-Envirotech India APM-550).; All data presented here are 8 hrs. Monitoring data.

Table A.2: Baseline conditions of emission of different infrastructures and sources

Sampling Locations	Criteria Pollutant	Cement Industry	Condensate Fractionating Plant	LPG Bottling Plant	Brick Field	Road Traffic	Small vessels, engine boat	Inland Water Cargo vessel	Sea going Mother Vessel (MV)	Fly ash Carrier	Clinkers Carrier	Clinker, Fly Ash Handling	Coal Carrier (MV)	Coal Ash Carrier (MV)	Coal Carrier (Lighter Vessel)	Coal Ash Carrier (Lighter Vessel)	Coal Loading and Unloading	Coal Handling (Stock Yard, Conveyor belt, etc)	BIF Power Plant (PP)	Other Coal Based PP	Other Fuel Based PP	Dredging and Land Filling	Earth excavation	Other Construction Activities	Residential sources
SW Corner of the PP area	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	√	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Proposed Township area of the PP	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
NW Corner of the PP area	PM	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Barni, Gaurambha	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√
	SOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Chunkuri-2, Dacope	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Pankhali, Dacope	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Mongla Port area	PM	√	√	√	X	√	√	√	√	√	√	√	X	X	X	X	X	X	X	X	√	X	X	X	√
	SOx	X	√	X	X	√	√	√	√	√	√	X	X	X	X	X	X	X	X	X	√	X	X	√	√
	NOx	X	√	X	X	√	√	√	√	√	√	X	X	X	X	X	X	X	X	X	√	X	X	X	√
	GHGs	X	√	X	X	√	√	√	√	√	√	X	X	X	X	X	X	X	X	X	√	X	X	X	√
Harbaria, Sundarbans	PM	X	X	X	X	X	√	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X

Sampling Locations	Criteria Pollutant	Cement Industry	Condensate Fractionating Plant	LPG Bottling Plant	Brick Field	Road Traffic	Small vessels, engine boat	Inland Water Cargo vessel	Sea going Mother Vessel (MV)	Fly ash Carrier	Clinkers Carrier	Clinker, Fly Ash Handling	Coal Carrier (MV)	Coal Ash Carrier (MV)	Coal Carrier (Lighter Vessel)	Coal Ash Carrier (Lighter Vessel)	Coal Loading and Unloading	Coal Handling (Stock Yard, Conveyor belt, etc)	BIF Power Plant (PP)	Other Coal Based PP	Other Fuel Based PP	Dredging and Land Filling	Earth excavation	Other Construction Activities	Residential sources
	SOx	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Akram Point Sundarbans	PM	X	X	X	X	X	√	√	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hiron Point Sundarbans	PM	X	X	X	X	X	√	√	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Khulna City, near Khan Jahan Ali Bridge	PM	√	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	√	√
	SOx	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
Township area	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√	√	√
	SOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√	√	√
Access road bridge area	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√	√	√
	SOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	X	X	X	X
	NOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	X	X	X	X
	GHGs	√	√	X	√	√	X	X	X	X	X	√	X	X	X	X	X	X	√	X	X	√	√	√	√

Legend X-Absence of source or no emission

√-Presence of source, emission of pollutant

(B) Water Quality Data

Surface Water Quality Monitoring Data

Table B.1: pH Values of Passur River Water

Sl	Sampling Locations	Monitoring periods																																Std*
		Apr	July	Oct	Jan	Apr	July	Oct	Jan	Apr	July	Oct	Jan	Apr	Oct	Jan	Apr	July	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	Jan	May	July	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM	33QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	7.2	7.0	8.1	7.9	7.6	7.8	7.6	7.1	7.5	7.27	6.9	7.6	7.2	7.1	8.28	8.1	8.4	7.9	8.18	9.0	6.8	7.9	8.4	6.9	6.9	8.5	8.3	5.5	7.8	8.0	7.77	8.02	
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	7.2	7.0	8.2	8.0	7.7	7.9	7.58	7.3	7.8	7.3	7	7.5	7.3	6.9	8.25	8.1	8.4	6.04	8.03	9.9	6.8	7.8	8.3	7.0	6.66	7.8	8.1	6.5	7.5	7.6	7.8	8.0	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	7.2	6.9	8.0	8.1	7.8	7.8	7.64	7.3	7.2	7.93	7.2	7.8	7.3	6.9	8.17	8.1	8.4	8.09	8.06	8.7	7.1	7.8	8.8	7.1	6.59	8.0	8.0	8.5	6.5	7.7	7.7	7.94	
4	Left Bank of Passur River at Project Site-Jetty	7.9	7.1	8.1	7.9	7.5	7.9	7.6	7.1	7.4	7.56	7.3	8.2	7.2	6.9	8.2	8.1	8.3	7.65	7.78	8.9	7.5	7.5	8.3	7.0	6.6	7.7	8.6	7.4	6.8	8.1	7.63	7.58	
5	Middle Passur River at Project Site-Jetty	7.1	6.9	8.1	7.9	7.6	8	7.58	7.5	7.8	7.6	7	8.5	7.8	7.2	8.21	8.1	8.3	8.20	7.97	8.4	7.2	7.4	8.3	7.2	6.77	7.7	8.0	8.4	7.6	7.7	7.72	7.95	
6	Right Bank of Passur River at Project Site-Jetty	7.1	6.9	8.2	7.9	7.7	8	7.62	7.6	7.4	7.9	6.9	8.7	7.4	7.2	8.2	8.1	8.2	7.87	8.04	8.5	6.7	7.4	8.0	7.2	6.88	7.8	8.9	5.8	7.6	7.8	7.81	7.98	
7	Left Bank of Passur River at South West corner from the Project boundary	7.4	7.0	8.1	7.6	7.5	8.1	7.78	8.1	7.6	7.94	7.2	8.1	6.9	7.2	8.39	8.0	8.4	8.11	7.89	9.3	7.4	7.3	8.6	7.4	7.13	7.8	8.2	6.7	8.2	7.9	7.63	7.99	
8	Middle of Passur River at South West corner from the Project boundary	7.4	6.9	8.0	7.5	7.2	8	7.6	8	7.1	8.04	7.5	8.6	6.8	7.1	8.15	8.1	8.5	7.44	7.85	8.7	6.5	7.2	8.2	7.6	6.82	8.0	8.4	8.6	8.2	7.8	7.64	7.99	6.5–8.5
9	Right Bank of Passur River at South West corner from the Project boundary	7.3	6.8	8.0	7.8	7.3	8.1	7.64	7.9	7.2	8.2	7.3	8.9	7.1	7	8.16	8.1	8.5	7.07	8.06	8.4	7.3	7.2	8.3	7.8	6.8	7.8	8.3	8.5	7.9	7.7	7.8	8.03	
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	7.4	6.9	8.1	7.7	7.5	8.1	7.3	7.3	7.1	8.1	6.8	8.1	7.2	7.1	8.4	8.1	8.6	7.94	8.05	9.3	7.2	7.4	8.0	7.1	6.85	7.4	8.0	5.9	7.8	8.0	7.61	8.5	
11	Maidara river near proposed township area	7.4	6.8	8.1	7.3	7.6	6.9	7.56	7.1	7.4	7.8	7.1	7.6	7.4	7	7.92	7.6	7.3	7.631	7.8	8.2	7.0	7.3	7.9	6.9	6.83	7.5	8.3	6.9	8.5	7.7	7.5	7.74	
12	Passur river at Passur-Ghasiakhali confluence	7.3	6.8	7.4	8.2	7.5	7.9	7.1	7.4	7.3	7.3	6.9	7.2	6.9	6.8	7.48	7.3	8.3	7.02	8.65	8.1	7.0	8.0	8.3	7.1	7.06	7.8	8.6	7.3	8.1	7.9	7.9	8.1	
13	Passur river at Harbaria of Sundarbans	7.9	6.9	8.0	8.1	7.7	7.9	7.8	8.2	7.3	7.63	7.4	7.8	6.9	7.1	8.19	8.1	8.4	7.19	7.71	8.2	7.2	8.0	8.4	7.4	6.1	8.2	7.8	6.6	7.3	7.7	7.7	8.07	
14	Passur river at Akram point of Sundarbans	7.2	6.9	7.9	8.1	7.7	NS	7.63	8	7.9	7.67	7.1	8.2	7.2	7.1	8.22	8.2	8```.2	8	7.77	7.9	7.1	7.8	8.2	7.7	6.6	7.7	8.2	6.0	6.9	7.6	7.69	7.83	
15	Passur river at Hiron po.000int of Sundarbans	7.2	7.0	7.0	8.1	7.7	NS	7.39	NS	7.8	NS	7.6	8.5	NS	6.8	8.2	NS	NS	7.18	7.79	NS	NS	7.8	8.2	NS	6.7	7.6	NS	8.0	6.7	7.5	NS	NS	

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring, NS – Not Surveyed

Table B.2: Surface Water Temperature (^0C) in Passur River

Sl. No.	Sampling Locations	Monitoring periods																																
		Apr	Jul	Oct	Apr	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	Jan	May	Jul	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM	33QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	31	33	31	19	30	31.8	31.2	22.0	31.2	29.6	30.1	22.8	30	29.8	19.7	30	30	28	22.02	31	30	27	25	30	27.67	20	31	30.26	26	22	29.99	31.17	
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	31	33	31	20	30	30.5	31.8	21.0	31.1	29.1	30.8	22.5	30	30.1	19.8	30	30	26.85	21.96	31	30	27	25	30	27.68	20	30	30.46	26	22	30.18	30.9	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	31	33	30	20	30	30.5	30.9	21.0	30.8	29.4	30.4	22.1	29.8	30.2	20.2	31	30	27.49	21.82	31	30	27	24	31	27.7	20	30	30.46	26	22	30.15	30.81	
4	Left Bank of Passur River at Project Site-Jetty	31	33	31	19	31	30.8	31.3	22.0	31.4	30.1	30.1	22.8	31.3	30.1	20.3	28	30	28.38	22.62	31	30	28	24	30	27.82	20	30	30.55	28	21	30.14	30.93	
5	Middle Passur River at Project Site-Jetty	30	32	31	19	30	30.6	31.6	22.0	30.9	30.5	31.0	21.8	30.0	29.8	20.3	29	30	27.97	22.55	31	31	28	24	30	27.76	20	30	30.44	27	22	30.28	31.04	
6	Right Left Bank of Passur River at Project Site-Jetty	30	32	31	19	30	30.4	31.1	21.0	31.0	30.5	31.1	21.9	30.0	29.9	20.3	28	31	28.05	22.35	31	30	28	24	30	27.67	20	30	30.54	30	22	30.24	31.14	
7	Left Bank of Passur River at South West corner from the Project boundary	31	32	30	20	31	30.5	30.3	23.0	30.7	30.7	30.4	22.1	29.9	30.0	20.6	28	31	27.85	22.17	33	30	27	25	30	28.42	21	30	30.44	27	23	30.14	31.19	
8	Middle of Passur River at South West corner from the Project boundary	31	31	29	19	30	30.8	30.5	22.0	30.4	29.8	30.2	22.0	29.8	30.1	20.2	28	31	28	22.27	31	30	27	25	30	27.9	20	30	30.5	27	22	30.24	30.98	20°C – 30°C
9	Right Bank of Passur River at South West corner from the Project boundary	31	31	29	19	31	30.6	30.8	21.0	30.1	29.8	31.1	22.1	30.1	30.1	20.3	28	31	28	22.54	32	30	27	25	30	27.83	21	30	30.46	27	22	30.21	31.08	
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	30	31	28	19	30	30.8	31.8	22.0	31.2	30.4	31.1	21.9	30.3	29.9	19.1	28	31	27.62	22.06	33	30	27	25	30	28.67	22	31	30.39	27	23	30.45	31.77	
11	Maidara river near proposed township area	30	32	27	20	30	31.6	31.2	23.0	30.6	30.7	31.2	21.8	30.1	30.0	21.1	31	31	30.2	21	32	30	27	23	30	28	21	31	30.54	29	22	29.21	32.51	
12	Passur river at Passur-Ghasiakhali confluence	29	30	32	19	30	29.8	30.7	21	31.3	30.7	30.38	22.1	30.2	30	20.8	30	29	26.82	21.89	31	30	28	22	30	28.07	21	29	30.15	27	22	31.63	31.05	
13	Passur river at Harbaria of Sundarbans	30	30	27	22	30	29.0	30.8	22.0	31.5	30.9	29.9	23.1	30.2	29.8	21	30	29	27.62	21.81	31	31	30	24	31	28.35	21	30	29.6	27	24	30.13	31.76	
14	Passur river at Akram point of Sundarbans	29	29	30	21	30	NS	30.2	21.0	30.8	30.4	30.4	22.5	30.8	29.9	21.2	32	30	27.21	22.42	31	31	29	24	31	29.48	22	30	29.75	28	21	31.36	32.34	
15	Passur river at Hiron point of Sundarbans	29	30	29	21	30	NS	30.4	NS	31.4	NS	31.3	21.4	NS	29.4	21.2	NS	NS	28.66	23.78	NS	NS	31	23	NS	29.02	22	NS	30.66	28	22	NS	NS	

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring, NS – Not Surveyed

Table B.3: Salinity (ppt) in Passur River

Sl. No	Sampling Locations	Monitoring periods																																	
		Apr	Jul	Oct	jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	Jan	May	Jul	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30th	31QM	32QM	33QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	11.5	2.5	0.0	4.5	13	0	0	4.1	8	0	0	3.7	6.3	0	2	11.5	0.2	0.9	11.1	16.6	0.5	0.4	3.8	0.2	0.1	2.4	7.1	0.1	0.1	0.8	2.6	0.1	No Specific standard for salinity has Been mention-ed in the ECR'1997
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	11.5	0.3	0.0	4.1	15	0	0	4.3	7.4	0	0	3.8	5.9	0	2	11.5	0.2	0.1	11.1	16.2	0.2	0.3	3.9	0.3	0.1	2.7	7.5	0.1	0.1	0.7	2.5	0.1	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	11.5	0.2	0.0	4.5	16	0	0	4.3	7	0	0	3.6	6.2	0	2	11.5	0.4	0.8	10.6	16.5	0.3	0.3	4.0	0.2	0.1	2.7	7.2	0.1	0.1	0.7	2.3	0.1	
4	Left Bank of Passur River at Project Site-Jetty	12.0	2.2	0.0	4.7	9	0	0	4.4	6	0	0	4	6.8	0	2.6	12.0	0.3	0.9	10.8	16.6	0.2	0.5	3.8	0.1	0.1	2.5	7.2	0.1	0.1	0.7	2.6	0.1	
5	Middle Passur River at Project Site-Jetty	12.0	0.3	0.0	5.1	13	0	0	5.1	6.2	0	0	3.9	6.9	0	2.6	12.0	0.2	0.8	10.8	16.9	0.2	0.3	3.9	0.2	0.1	2.7	7.3	0.1	0.1	0.8	2.3	0.1	
6	Right Left Bank of Passur River at Project Site-Jetty	12.0	0.5	0.0	5.0	14	0	0	5	9	0	0	4.2	6.1	0	2.7	12.0	0.2	0.8	11	16.9	1.2	0.3	3.9	0.1	0.1	2.4	7.3	0.1	0.1	0.8	2.1	0.1	
7	Left Bank of Passur River at South West corner from the Project boundary	9.5	4.0	0.0	5.2	14	0	0	5.2	8	0	0	4.2	6.5	0	2.8	9.5	0.2	1	9.9	12.0	0.3	2.1	3.7	0.2	0.2	2.6	7.0	0.1	0.1	1.0	2.6	0.1	
8	Middle of Passur River at South West corner from the Project boundary	9.0	0.0	0.0	5.2	13	0	0	4.9	7	0	0	4.1	7.1	0	2.8	9.0	0.3	0.2	11.5	16.7	0.2	0.1	0.1	0.2	0.1	2.5	7.3	0.1	0.1	0.9	2.7	0.1	
9	Right Bank of Passur River at South West corner from the Project boundary	10.0	2.5	0.0	5.1	12	0	0	5.5	6.8	0	0	4.1	7	0	2.8	10.0	0.3	0.3	11.1	16.9	0.3	0.4	3.5	0.3	0.1	2.7	7.4	0.1	0.1	0.9	2.4	0.1	
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	10.0	0.5	0.0	5.2	10	0	0	3.8	7.1	0	0	3.9	7	0	2.6	10.0	0.3	0.9	11.3	16.5	0.3	0.3	4.0	0.3	0.2	2.5	7.0	0.1	0.1	0.9	2.7	0.1	
11	Maidara river near proposed township area	9.0	4.5	0.0	4.5	9	0	0	2.5	6.3	0	0	3.8	6.9	0	2.52	9.0	0.2	0.02	9.9	8.0	1.0	0.3	4.0	0.5	2.	2.5	6.5	0.8	0.5	0.2	2.5	1.6	
12	Passur river at Passur-Ghasiakhali confluence	10.0	9.5	0.0	5.0	14	0	0	4.8	6	0	0	6.7	10.4	1.2	10.8	10.0	0.6	1	7.9	14.9	0.4	0.5	3.6	0.4	0.2	1.8	6.9	0.1	0.1	0.9	4.0	0.3	
13	Passur river at Harbaria of Sundarbans	12.0	10.0	0.0	6.0	15	0	0	5.3	8.9	0	0	8.9	10.4	2.3	2.8	12.0	2.2	1.8	11.9	15.6	0.3	0.7	3.7	1.5	0.2	2.6	7.0	0.1	0.2	2.1	6.3	0.6	
14	Passur river at Akram point of Sundarbans	19.0	15.0	1.0	16.0	20	NS	5	11.3	9.4	4	3	16.3	16	3.6	13.1	19.0	2.8	9.1	16.7	22.9	0.9	6.6	8.9	4.0	1.6	7.1	10.9	1.0	2.2	6.4	8.3	3.2	
15	Passur river at Hiron point of Sundarbans	23.0	19.5	2.0	23.0	25	NS	6.2	NS	14	NS	5.8	21.4	NS	5.1	16.45	23.0	NS	13.9	22.7	NS	NS	9.2	11.0	NS	2.6	8.2	NS	0.9	2.6	8.0	NS	NS	

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring,

NS – Not Surveyed

Table B.4: Dissolve Oxygen (DO) in Passur River

SL	Sampling Locations	Monitoring periods																																	
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	Jan	May	Jul	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM	33QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	5.9	6.1	5.6	5.5	6.2	5.3	6.8	5.1	7.1	6.2	6	6.1	7.1	6.3	5.19	6.575	6.0	6.4	8.7	5.9	6.0	7.7	8.4	6.1	6.4	9.2	6.5	**5.8**	7.8	6.5	7.3	8.1	5 or more (standard for sustaining fisheries)
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	4.9	6.8	7.7	6.6	6.4	5	6.4	5.1	6.4	5.7	6.1	5.9	7.2	6.4	5.03	6.225	6.2	6.2	7.9	6.5	6.0	7.8	8.6	6.1	7.64	9.6	6.0	**6.0**	7.5	6.7	7.8	8.5	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	5.2	6.7	7.7	6.7	6.2	5	7.1	6.2	6.9	5.6	6	6.1	6.8	6.5	5.06	6.275	6.1	6.3	7.3	6.3	6.1	7.8	7.6	6.0	6.3	7.8	6.8	**6.3**	6.5	6.5	7.5	7.8	
4	Left Bank of Passur River at Project Site-Jetty	5.7	6.8	7.6	5.8	6.2	6.7	6.8	5.9	5.8	6.1	6.3	6.2	6.9	6.3	5.1	6.15	5.5	6	8.7	6.1	6.5	8.6	8.1	6.0	8.2	9.0	8.4	**6.6**	6.7	7.1	7.5	7.5	
5	Middle of Passur River at Project Site-Jetty	5.9	6.9	7.2	5.9	6.6	6.6	7.2	5.3	6.1	6.3	5.9	5.9	7.4	6.3	5.03	6.5	6.0	6.2	7.3	6.5	6.3	8.0	8.2	6.4	8.89	8.9	8.0	**6.2**	5.6	5.5	6.0	8.8	
6	Right Bank of Passur River at Project Site-Jetty	5.8	6.6	8.0	6.8	6.4	6	7.6	5.4	6.6	5.8	6.1	5.9	7.5	6.5	4.9	6.575	6.5	6	7.4	6.0	6.4	8.2	7.0	6.2	7.8	9.3	8.5	**6.8**	6.5	6.7	5.0	8.1	
7	Left Bank of Passur River at South West corner from the Project boundary	6.6	7.3	5.6	6.1	6.3	7.5	6.4	6	6.9	6.3	5.9	6.3	6.4	6.5	5	6.55	6.8	6.1	7.8	6.1	6.2	9.9	6.9	6.6	9.7	9.6	5.4	**7.2**	6.7	6.4	6.2	7.5	
8	Middle of Passur River at South West corner from the Project boundary	6.5	7.1	5.6	6.9	6.5	7.4	6.1	6.1	7.1	6.4	6	6.4	7.2	7.1	4.98	6.825	6.2	6.3	7.1	6.5	6.2	10.0	7.2	6.5	9.76	7.0	6.3	**6.2**	6.5	6.6	7.2	8.0	
9	Right Bank of Passur River at South West corner from the Project boundary	6.5	7.2	5.8	6.6	6.4	7.3	6.3	5.8	6.8	5.6	6	6.4	6.8	6.5	5.11	6.625	6.0	6.2	6.9	6.1	6.3	10.5	7.8	6.3	9.76	6.4	5.9	**6.7**	6.1	6.5	6.7	8.1	
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	6.0	6.5	8.0	6.0	6.2	6	7.1	4.1	6.4	5.2	6.1	6.7	6.8	6.3	5.17	6.35	6.7	5.8	7.5	6.3	6.4	7.1	9.7	6.4	9.7	8.1	7.5	**6.8**	6.7	6.5	6.1	8.5	
11	Maidara river near proposed township area	6.7	6.8	8.0	6.2	6.5	6.4	7.1	5.2	5.9	5.4	6.4	6.7	7.1	6.2	5.11	6.7	6.3	6	6.0	6.2	6.0	7.7	7.5	6.1		8.0	7.0	**5.5**	6.2	6.5	7	7.6	
12	Passur river at Passur-Ghasiakhali confluence	5.3	6.2	7.0	6.5	6.3	7	6.6	5.4	5.8	5.4	5.6	5.9	6.4	6.4	5.23	5.95	5.8	6	6.9	6.5	6.2	7.9	8.6	6.0	8.14	9.2	5.9	**6.2**	5.8	6.9	6.8	7.1	
13	Passur river at Harbaria of Sundarbans	5.4	5.9	7.0	6.6	5.8	7.5	7.1	5.2	6.4	5.4	5.8	6.1	6.4	6.2	5.03	5.8	6.9	8.21	7.5	6.9	6.0	8.4	6.9	6.1	7.65	7.6	5.5	**6.6**	6.8	5.9	7.8	7.6	
14	Passur river at Akram point of Sundarbans	7.9	6.4	7.7	6.7	6	NS	7.3	6.2	6.1	6.2	6.7	6.5	7.2	6.8	5.4	6	6.8	6.9	7.7	7.0	6.6	7.7	9.7	6.5	6.61	7.2	6.8	**6.1**	6.5	6.2	7.1	7.6	
15	Passur river at Hiron point of Sundarbans	7.5	6.5	7.8	6.5	5.8	NS	7	NS	7.1	6.8	6.9	6.8	NS	7.3	5.4	NS	NS	7.2	8.0	NS	NS	8.6	6.7	NS	8.2	9.0	NS	**6.2**	6.9	6.2	NS	NS	

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring (April, 2014), 2QM = Second Quarterly Monitoring (July, 2014), 3QM = Third Quarterly Monitoring (October, 2014), 4QM = Fourth Quarterly Monitoring (January 2015)

NS – Not Surveyed

Table B.5: COD (mg/L) of Passur River System

Sl	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	April	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	288	24	6	128	87	42	32	124	220	8	12	56	52	24	48	276	20	56	72	188	36	56	24	32	16	56	508	4	44	24	24
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	284	20	30	68	58	43	36	100	240	8	8	40	48	8	28	240	24	44	60	180	24	40	28	36	12	32	404	4	52	12	28
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	328	56	14	92	132	18	28	96	280	8	8	44	56	40	40	230	12	48	48	176	32	26	32	28	8	20	400	4	40	8	48
4	Left Bank of Passur River at Project Site-Jetty	376	28	18	84	102	26	36	100	280	8	12	48	40	32	36	232	30	60	44	192	20	40	24	24	28	48	304	4	20	40	36
5	Middle Passur River at Project Site-Jetty	400	60	14	116	110	21	36	108	240	12	16	52	36	40	32	254	16	36	56	180	28	28	40	36	16	20	412	4	40	32	24
6	Right Bank of Passur River at Project Site-Jetty	364	496	18	108	88	24	40	80	260	8	12	42	48	16	28	252	12	42	64	172	24	24	24	40	20	56	390	12	4	12	20
7	Left Bank of Passur River at South West corner from the Project boundary	364	108	10	104	96	32	42	100	240	12	8	56	42	48	40	212	10	48	88	200	28	20	26	48	8	48	408	8	4	16	24
8	Middle of Passur River at South West corner from the Project boundary	400	40	22	16	18	25	28	100	180	8	8	52	36	8	44	218	24	32	36	160	20	32	20	36	12	56	424	8	24	36	48
9	Right Bank of Passur River at South West corner from the Project boundary	408	120	10	100	106	25	48	124	200	12	12	44	52	4	36	230	16	28	68	180	32	20	28	42	20	8	448	12	4	12	52
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	276	32	10	116	88	51	40	100	160	8	8	36	44	16	40	180	40	36	72	160	24	24	44	32	12	12	400	16	48	12	56
11	Maidara river near proposed township area	284	96	26	84	94	36	42	108	210	30	8	48	40	32	32	252	20	42	68	172	20	36	36	48	28	24	380	48	4	32	96
12	Passur river at Passur - Ghasiakhali confluence	408	172	14	96	92	30	46	88	220	12	16	40	64	**40**	48	260	10	20	32	178	24	40	36	72	56	32	472	32	12	16	96
13	Passur river at Harbaria of Sundarbans	372	216	14	96	102	26	36	100	140	16	12	**40**	216	32	40	280	16	58	56	184	32	32	40	80	76	12	424	16	4	60	240
14	Passur river at Akram point of Sundarbans	536	520	54	316	302	NS	84	96	156	4	68	56	240	**16**	72	296	110	44	**180**	160	220	92	56	108	60	28	392	80	192	36	36
15	Passur river at Hiron point of Sundarbans	540	416	122	472	470	NS	96	NS	160	NS	56	196	NS	4	88	NS	NS	76	140	NS	NS	72	64	NS	40	NS	NS	32	180	40	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.6: Oil and grease (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																															
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	April	Aug	Oct	Jan	May	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22 QM	23QM	25QM	26QM	27QM	28QM	29 QM	30QM	31QM	32QM	
1	Left Bank of Passur River at South West corner from the Project boundary	<5	<5	<5	>15	16.9	9	<5	39	61	5	<5	9.2	*5.73*	<5	16.6	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	**<2.0**	2.93	**<2.0**	<2.0	<2.0	**<2.0**	<2.0	
2	Passur-Ghasiakhali Confluence	<5	<5	<5	>15	13	7.63	9.87	21	30.3	13.5	<5	15.6	<5	<5	<5	<5	<5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**<2.0**	<2.0	**<2.0**	<2.0	<2.0	**<2.0**	<2.0	
3	Passur river at Harbaria of Sundarbans	<5	6.3	<5	>20	39.1	10.1	<5	14	26	5.73	<5	<5	<5	<5	<5	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**<2.0**	<2.0	**<2.0**	<2.0	<2.0	**<2.0**	<2.0	10
4	Akram Point of Sundarbans	<5	<5	<5	>20	<5	NS	10.8	ND	31	NS	10.1	13.8	7.71	<5	<5	<5	NS	<2.0	<2.0	<2.0	<2.0	<2.0	4.4	<2.0	**<2.0**	<2.0	**<2.0**	<2.0	<2.0	**<2.0**	<2.0	
5	Passur river at Hiron point of Sundarbans	<5	<5	<5	>20	<5	NS	9.73	36	82	5.87	<5	14.2	ND	<5	<5	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	**<2.0**	NS	**3.2**	<2.0	<2.0	**<2.0**	<2.0	

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.7: TDS (mg/L) of Passur River System

SL	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	13060	251	176	4360	14400	937	158	5570	13400	179	138	3100	13400	496	1913	14500	315	855	9940	15800	290	480	6800	134	122	3770	12500	58	160	1380	4870
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	12630	246	162	3950	14700	941	169	5910	13280	112	106	3140	13480	122	1919	14420	224	733	9950	15600	150	175	6950	114	96	4410	12700	105	150	1300	4800
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	12900	383	153	4330	14900	127	152	5490	13560	125	108	3330	13400	123	1915	14650	232	722	9730	15500	152	170	7300	116	94	4390	12300	106	147	1210	4350
4	Left Bank of Passur River at Project Site-Jetty	13190	445	169	4750	14600	175	172	5720	12830	162	147	3630	13560	172	2500	14300	328	824	9860	15700	205	190	6760	221	102	4150	12800	74	158	1230	5250
5	Middle Passur River at Project Site-Jetty	13330	353	156	4920	14500	132	162	5850	13100	185	110	3600	13490	125	2520	14450	235	716	9980	16000	142	175	6760	125	179	4170	13100	97	150	1510	4920
6	Right Bank of Passur River at Project Site-Jetty	13380	402	152	4870	14200	156	160	5480	13460	143	112	3520	13330	125	2500	14540	208	732	9800	16100	150	174	6900	132	105	4060	13200	110	153	1380	4060
7	Left Bank of Passur River at South West corner from the Project boundary	13180	655	162	5040	14500	336	192	5650	12820	205	113	3470	13640	160	2840	14400	205	945	10190	15640	208	325	6740	195	181	4100	13100	158	155	1850	5150
8	Middle of Passur River at South West corner from the Project boundary	13390	587	153	5050	14600	158	164	5740	12960	195	108	3790	13680	126	2710	14500	286	784	10280	16000	145	180	6450	128	98	4210	13300	110	153	1680	5070
9	Right Bank of Passur River at South West corner from the Project boundary	13240	916	154	5130	14250	160	164	5650	13590	140	146	3770	13360	127	2720	14610	296	786	10080	15800	154	172	6700	114	92	4450	13200	100	156	1650	4750
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	12400	455	214	5050	14000	2320	183	5450	13340	165	196	2920	13490	1616	2500	14160	265	992	10040	15700	940	1405	7250	229	206	4170	12500	216	160	1540	5100
11	Maidara river near proposed Township area	10970	2510	257	4390	13900	355	176	4420	11700	5170	238	3960	13110	1200	2970	14450	340	827	8860	15100	365	875	5800	2893	164	2320	11800	1270	780	1350	8900
12	Passur river at Passur - Mongla confluence	12800	6410	209	5130	14050	298	227	4540	11330	893	162	3370	12340	204	2570	14500	580	940	8350	15722	172	350	6240	740	148	3010	12100	180	203	1580	7820
13	Passur river at Harbaria of Sundarbans	12280	9360	285	4780	13900	683	205	4940	13580	1321	301	3370	13600	245	2690	15350	2190	1715	10950	15400	560	474	6430	489	2260	4060	12400	240	275	3850	12200
14	Passur river at Akram point of Sundarbans	21500	15960	3400	12350	13600	NS	4220	13330	20720	7330	2550	3580	19370	3270	11390	20600	7680	8100	17200	14800	12500	3950	16300	4188	1472	11400	18500	1700	3850	11600	16400
15	Passur river at Hiron point of Sundarbans	21500	14050	5720	17900	25300	NS	5830	NS	25500	NS	4120	12210	NS	4450	14190	NS	NS	12500	21110	NS	NS	5750	20400	NS	490	14600	NS	1610	6300	15500	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.8: TH (mg/L) Passur River System

SL	Sampling Locations	Monitoring periods																													
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	2900	250	216	930	3000	245	250	1270	3130	240	255	1090	3640	200	430	3100	210	335	2050	3000	2100	215	1540	205	272	2800	4500	140	145	370	2500
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	2500	180	218	870	3050	110	330	1380	3090	205	250	980	3420	150	510	1040	205	310	3900	5000	1950	125	1485	200	195	2700	4200	200	125	385	2400
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	2650	170	335	870	3250	105	360	1240	3140	205	190	1030	3300	155	498	1030	185	313	4100	5000	1900	190	1530	187	225	2750	4300	180	130	310	2250
4	Left Bank of Passur River at Project site-Jetty	2550	175	390	940	3450	118	365	1220	3010	220	265	1020	3400	160	570	1060	200	285	4600	5200	1850	175	1580	217	210	3000	4100	200	175	375	2500
5	Middle Passur River at Project Site-Jetty	2600	275	340	990	3250	103	355	1300	3070	232	237	915	3440	145	590	1040	210	255	4200	5000	2500	178	1560	215	235	3100	4500	175	140	325	2350
6	Right Bank of Passur River at Project site-Jetty	2625	350	355	970	3200	105	350	1260	3100	218	242	1070	3380	140	480	1085	215	275	4400	4800	2550	155	1490	202	200	2500	4000	175	145	340	2100
7	Left Bank of Passur River at South West corner from the Project boundary	2550	325	330	1045	3600	153	345	1370	3060	235	205	935	3540	150	505	1080	205	295	4400	4400	1700	175	1530	195	240	2550	4400	140	160	375	2550
8	Middle of Passur River at South West corner from the Project boundary	2800	350	345	1125	3670	105	390	1340	3130	242	217	1100	3480	155	530	1110	212	265	4300	5100	1850	150	1560	210	235	3200	4100	130	170	420	2400
9	Right Bank of Passur River at South West corner from the Project boundary	2500	475	325	975	3540	165	445	1270	3110	224	238	1110	3600	175	512	1100	205	325	4600	4900	2000	115	1485	207	243	2800	4400	100	155	430	2460
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	2500	450	350	980	3260	470	183	950	3180	220	250	1040	1960	165	505	1300	210	295	4000	5200	2000	350	1460	310	198	1400	4200	145	165	380	2450
11	Maidara river near proposed township area	2400	725	330	970	3190	130	340	1075	3080	875	240	1170	2300	320	478	1120	220	315	4100	5000	2200	285	1440	742	217	1200	4100	400	265	435	3100
12	Passur river at Passur - Mongla confluence	3150	1400	377	1000	3210	135	410	1090	3060	405	245	1070	2450	220	1070	1410	245	325	4000	4782	1800	200	1510	250	265	2850	4200	150	190	500	2300
13	Passur river at Harbaria of Sundarbans	2625	2150	345	970	3080	200	430	1100	3050	415	282	1070	3560	200	610	1330	530	2550	4500	4500	1400	185	1390	280	225	2870	4400	160	170	680	4000
14	Passur river at Akram point of Sundarbans	4500	3625	980	2380	3420	NS	1090	2850	4520	1750	670	1130	4300	640	1475	1440	2030	2750	5900	4500	4300	830	3470	1000	210	5050	4300	480	1000	6500	5000
15	Passur river at Hiron point of Sundarbans	4850	3050	1440	2690	3640	NS	1460	NS	5050	NS	810	2870	NS	905	1740	NS	NS	4200	6900	NS	NS	1225	3850	NS	230	5600	NS	470	1450	5300	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring:

NS – Not Surveyed.

Table B.9: TSS (mg/L) Passur River System

SL	Sampling Locations	Monitoring periods																													
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	598	126	234	180	160	26	76	14	8	61	20	46	51	18	14	18	17	14	15	12	14	8	11	14	7	11	15	12	13	15	7
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	45	92	193	210	167	25	80	12	7	48	18	52	42	15	15	17	16	11	12	14	11	7	8	6	11	6	23	14	12	14	10
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	53	112	174	230	170	127	65	14	10	56	16	48	48	22	14	22	15	15	14	13	13	6	7	11	8	7	20	9	10	17	11
4	Left Bank of Passur River at Project Site-Jetty	54	99	227	450	160	30	92	17	10	62	20	42	52	16	13	20	18	11	12	11	12	8	8	12	7	7	13	12	14	12	12
5	Middle Passur River at Project Site-Jetty	60	100	232	250	165	27	85	18	8	45	24	54	43	20	13	19	16	13	13	12	13	7	9	9	6	6	12	11	9	13	9
6	Right Bank of Passur River at Project Site-Jetty	55	105	186	200	155	40	97	22	7	49	19	46	38	17	14	21	15	12	15	15	14	6	6	12	9	8	16	8	13	11	11
7	Left Bank of Passur River at South West corner from the Project boundary	24	116	185	300	150	32	104	20	12	51	20	61	32	15	15	17	16	14	16	12	13	7	7	14	15	7	14	12	17	14	18
8	Middle of Passur River at South West corner from the Project boundary	27	112	536	530	147	40	90	7	10	43	18	58	44	16	17	19	14	13	13	11	12	6	8	13	8	6	15	9	4	12	13
9	Right Bank of Passur River at South West corner from the Project boundary	67	37	459	450	155	44	82	18	11	39	16	63	40	14	12	18	20	15	14	13	13	5	6	8	6	6	13	15	15	15	12
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	7	65	798	280	148	36	96	11	7	42	24	55	37	26	14	23	13	11	14	14	15	9	13	11	8	7	17	13	11	13	19
11	Maidara river near proposed township area	9	24	389	206	160	28	92	10	6	11	30	66	49	30	15	32	12	42	8	12	12	7	12	5	7	8	12	3	8	13	16
12	Passur river at Passur - Mongla confluence	50	310	203	280	165	24	60	15	13	47	27	61	38	**25**	13	14	17	27	15	13	13	15	14	9	8	6	3	7	13	14	15
13	Passur river at Harbaria of Sundarbans	65	90	869	400	160	42	74	22	18	31	18	**61**	33	27	17	15	13	22	12	11	12	11	11	17	5	8	14	9	15	15	13
14	Passur river at Akram point of Sundarbans	115	99	28	103	150	NS	110	16	23	16	41	34	28	22	14	18	14	15	11	10	7	7	10	18	8	11	11	16	12	16	17
15	Passur river at Hiron point of Sundarbans	91	72	267	200	180	NS	144	NS	15	NS	33	49	NS	16	13	NS	NS	6	9	NS	NS	5	10	NS	6	6	NS	13	13	13	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.10: Nitrate (NO_3^{2-}) (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																													
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.9	2.89	0.32	3	33	9.1	4	6.3	3	3.9	0.25	3.62	4.35	5.8	3	6.8	0.8	2.8	3.5	0.3	0.1	3.5	1.3	3	3.2	4.3	3.3	2.1	3.5	2.06	8.41
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	0.7	2.4	1.57	1.5	13	7.5	7.1	4.3	2.9	6.2	0.39	2.89	5.05	6.8	4.2	4.9	1.7	0.1	2.6	0.3	1.1	2.7	1.7	3.3	1.3	2.2	2.1	2.2	3.8	1.43	13.52
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.1	3.2	1.84	4.3	39	6.2	5	3.9	2.5	4.3	0.42	1.87	4.55	4.5	3.6	5.1	2.1	0.11	1.9	3.7	1.2	3.4	3.2	9.5	4.7	1.2	1.3	1.3	6.7	2.0	12.75
4	Left Bank of Passur River at Project Site-Jetty	1.3	0.76	1.64	3.1	48	6.6	5.7	3.1	2	5.1	0.76	2.25	6.11	7.1	3	2.8	2.8	1.7	2.1	3.0	1.5	3.0	4.5	2.9	2.5	0.7	2.1	1.4	12.6	15.9	10.8
5	Middle Passur River at Project Site-Jetty	1.4	2.69	1.42	2.2	69	6.1	3.3	5.2	3.1	2.7	0.52	2.46	3.4	3.1	4.7	5.2	1.8	0.9	2.2	1.2	1.5	1.7	2.7	1.9	2.6	3.1	3.0	1.6	0.3	1.5	8.71

Sl	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
6	Right Bank of Passur River at Project Site-Jetty	1.1	2.98	1.33	8.5	8	6.6	4.7	4.1	3.6	3.9	0.31	3.01	3.16	5	7.6	5.5	3.2	0.1	3.5	4.8	2.1	2.1	5.1	1.8	1.0	2.7	1.5	1.4	7.4	6.8	9.39
7	Left Bank of Passur River at South West corner from the Project boundary	0.75	2.13	1.85	2.7	87	14.9	4.4	4.9	2.6	3.6	0.2	3.64	3.14	4.1	8.8	2.6	4	0.1	4.2	0.5	1.5	2.0	7.4	1	0.5	1.8	1.7	1.9	0.7	1.1	11.15
8	Middle of Passur River at South West corner from the Project boundary	1.1	2.43	2.09	1.8	48	4	6.2	3.7	2.9	5.1	0.41	1.93	3.34	3.4	8.5	4.5	3.7	3.4	3.0	3.4	1.7	1.3	3.9	1.5	2.1	3.0	2.0	2.1	9.2	ND	8.5
9	Right Bank of Passur River at South West corner from the Project boundary	1.2	2.05	2.21	1.9	128	4.9	4.4	4.4	2.6	4.9	0.63	2.17	2.00	3.1	2.8	5.3	3.8	0.7	3.1	4.1	0.5	2.2	4.1	1.3	3.0	1.9	2.3	2.5	1.7	1.5	11
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.3	2.18	2.26	6	62	7	4.9	5.6	2.7	5.2	0.4	2.46	3.61	2.3	1.6	5.9	4.4	2.3	2.1	5.0	3.1	2.9	4.7	3.9	1.5	3.0	4.2	3.1	0.5	16.2	14.42
11	Maidara river near proposed township area	0.5	0.88	1.98	4	48	3.1	2.9	3.9	3.1	5.3	0.32	3.1	1.60	3.2	3.4	3.9	3.1	0.12	1.3	2.9	2.5	1.6	4.9	2.1	1.3	4.9	1.0	2.1	0.1	5.7	6.41
12	Passur river at Passur - Mongla confluence	0.6	1.52	1.64	4.5	29	7.8	3.1	3.7	3	5.2	0.27	2.78	2.49	3.5	4.5	4.7	2.4	1.6	3.7	2.7	1.8	2.0	3.3	1.5	2.6	0.5	1.7	3.8	0.4	9.4	8.05
13	Passur river at Harbaria of Sundarbans	1.4	1.75	1.67	2.7	18	4.4	4.4	5.1	3.4	5.1	0.39	2.78	2.46	4.2	4.6	5.2	2.7	0.1	4.7	4.4	1.7	2.1	3.2	5.7	2.6	0.5	2.6	3.9	1.0	4.06	15.35
14	Passur river at Akram point of Sundarbans	2.7	3.32	0.59	1.5	25	NS	3.2	4.9	2.9	5.4	0.25	3.08	3.69	2.2	1.8	5.5	4.2	0.1	1.8	2.7	1.3	1.6	2.6	4	2.6	2.9	2.8	4.1	0.0	24.7	10.85
15	Passur river at Hiron point of Sundarbans	0.8	2.84	0.4	2	28	NS	11.5	NS	3.5	NS	0.38	2.28	NS	2.6	6.1	NS	NS	0.9	2.6	NS	NS	2.5	4.1	NS	2.6	3.9	NS	3.2	0.5	1.8	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.11: Sulphate (SO_4^{2-}) (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	1840	20	26	580	1360	67	7	570	1080	18	5	230	422	29	630	1400	24	51	760	1460	23	37.0	490	4	3	270	1	21	99.4	**185.5**	36.32
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	1320	23	28	450	1260	11	8	590	1040	10	3	210	460	3	370	1320	18	49	756	1380	19	6.0	510	3	6	420	5	20	90.3	**188.57**	33.65
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	1280	36	34	480	1240	9	11	560	1020	13	4	200	1340	5	410	1440	20	46	764	1420	21	6.0	560	5	11	460	2	24	92.6	**197.77**	46.92
4	Left Bank of Passur River at Project Site-Jetty	1360	45	33	550	1240	26	10	550	1060	15	4	230	1380	2	310	1260	22	52	748	1410	16	5.0	530	8	5	410	1	18	89.3	**198.12**	41.55
5	Middle Passur River at Project Site-Jetty	1040	32	30	520	1120	6	8	580	980	17	6	280	1280	1	310	1200	21	38	760	1440	17	4.0	640	10	3	420	3	15	108.4	**186.22**	22.28
6	Right Bank of Passur River at Project Site-Jetty	1320	20	27	540	820	8	9	565	1100	14	5	230	1400	2	490	1400	16	42	762	1400	19	8.0	490	13	8	430	2	18	98.0	**180.76**	29.53
7	Left Bank of Passur River at South West corner from the Project boundary	1640	60	40	630	880	9	12	640	1060	15	6	230	880	2	700	1300	10	56	768	1500	15	25.0	520	16	6	450	3	19	118.7	**191.27**	37.16
8	Middle of Passur River at South West corner from the Project boundary	1520	40	35	560	1180	19	8	560	1020	18	5	231	1440	1	340	1380	24	52	760	1450	16	9.0	470	8	4	440	1	13	118.0	**189.35**	45.68
9	Right Bank of Passur River at South West corner from the Project boundary	1280	80	64	620	900	12	6	550	1080	12	8	250	1340	3	340	1240	22	39	770	1460	14	6.0	510	16	12	450	2	14	118.7	**185.03**	52.04
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	1120	20	63	570	1220	72	11	96	1040	11	14	160	1220	120	270	1200	21	65	758	1500	18	71.0	490	16	31	420	3	17	115.0	**199.7**	36.65
11	Maidara river near proposed township area	1320	210	63	460	840	27	9	480	1020	480	14	200	1340	76	350	1250	18	46	760	1490	12	55.0	565	21	26	190	15	39	91.1	**217.98**	158.91
12	Passur river at Passur - Mongla confluence	1360	620	44	630	980	39	13	482	1100	42	14	220	1220	**5**	280	1260	28	30	765	1446	14	33.0	580	12	21	260	13	39	106.8	**212.37**	111.28
13	Passur river at Harbaria of Sundarbans	1560	860	69	590	900	51	7	500	1080	60	19	220	1300	13	220	1300	35	20	756	1500	16	38.0	470	34	540	410	5	41	243.8	**227.53**	200.6
14	Passur river at Akram point of Sundarbans	2600	1400	1390	850	1540	NS	84	760	1650	620	190	230	1420	30	760	1460	620	250	764	1500	980	370.0	410	60	430	580	5	410	183.3	**245.62**	517.86
15	Passur river at Hiron point of Sundarbans	2080	1160	2360	1500	1920	NS	97	NS	2100	NS	320	1090	NS	2	510	NS	NS	780	769	NS	NS	540.0	445	NS	30	1240	NS	598	230.8	**985**	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.12: Phosphate (PO_4^{3-}) (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.52	2.23	0.67	0.32	0.86	10	1.27	0.269	0.22	1.14	3.39	0.67	1.31	0.49	0.21	0.38	1.03	0.25	0.25	0.25	10.1	0.3	0.2	0.25	0.5	5.3	4.9	4.2	1.5	0.19	0.0481
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.5	1.99	1.12	0.61	0.53	0.23	1.97	0.269	0.36	1.76	4.11	0.31	1.72	2.5	0.16	0.25	0.83	0.3	0.30	0.32	0.6	0.3	0.2	0.27	0.5	3.5	2	0.6	0.9	0.33	0.025
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	1.1	2.55	0.95	0.7	0.72	0.67	1.94	0.179	0.27	1.77	4.58	0.09	2.73	2.8	0.3	0.29	0.76	0.22	0.17	0.40	0.5	0.4	0.3	0.3	0.5	3.2	1.9	0.54	1.3	0.13	0.069
4	Left Bank of Passur River at Project Site-Jetty	2.1	0.45	0.92	0.43	0.49	0.27	2.53	0.357	0.31	2.31	2.76	0.07	2.77	3.3	0.19	0.38	0.88	0.24	0.20	0.30	0.6	0.2	0.3	0.35	0.7	2.9	2.3	4.5	0.0	0.46	0.051
5	Middle Passur River at Project Site-Jetty	2.2	2.13	1.11	0.41	0.68	0.59	1.3	0.536	0.3	0.98	3.2	0.12	0.66	3.9	0.17	0.34	1.07	0.4	0.35	0.27	0.6	0.3	0.2	0.29	0.5	3.0	5.7	2.1	0.0	0.10	0.02
6	Right Bank of Passur River at Project Site-Jetty	2	2.42	0.99	0.55	0.61	0.13	1.32	0.269	0.43	1.01	2.48	0.16	0.62	3.9	0.47	0.27	0.67	0.53	0.27	0.25	0.9	0.4	0.3	0.36	0.8	5.4	4	3.4	0.0	0.40	0.021
7	Left Bank of Passur River at South West corner from the Project boundary	0.57	1.25	1.18	0.76	0.65	0.1	0.99	0.536	0.63	0.87	4.16	0.09	0.65	4.6	1.31	0.29	1.16	0.32	0.20	0.41	11.1	0.5	0.4	0.4	0.7	3.0	1.2	5.4	0.3	0.04	0.02
8	Middle of Passur River at South West corner from the Project boundary	1.2	1.51	1.25	0.85	0.53	0.18	1.02	0.625	0.21	0.96	2.76	0.04	0.37	0.41	0.39	0.29	0.86	0.43	0.20	0.35	0.8	0.7	0.4	0.43	0.4	2.5	2.4	3.7	0.4	0.03	0.061
9	Right Bank of Passur River at South West corner from the Project boundary	1.5	1.1	1	0.53	0.6	0.1	1.39	0.536	0.33	1.123	2.71	0.07	0.45	0.63	0.62	0.42	1.03	0.57	0.37	0.27	0.8	0.5	0.4	0.52	1.3	3.2	6.3	2.7	0.1	0.14	0.008
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.55	2.1	1.27	0.59	0.7	0.5	1.27	0.351	0.19	1.06	2.836	0.07	0.61	0.51	0.38	0.24	0.83	0.27	0.40	0.28	0.5	0.6	0.5	0.25	1.2	13.1	8	3.4	0.2	0.59	0.006
11	Maidara river near proposed township area	1.1	0.53	1.04	0.64	0.55	0.29	1.28	0.269	0.13	1	5.23	0.2	0.47	15.3	0.71	0.28	1.2	0.22	0.28	0.30	0.8	0.4	0.3	0.56	0.7	4.1	0.76	0.2	0.4	0.35	0.003

Sl	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
12	Passur river at Passur - Mongla confluence	1.3	0.35	0.86	0.42	0.71	0.59	0.95	0.179	0.31	0.78	4.01	0.09	0.18	1.3	0.63	0.37	0.86	0.33	0.29	0.31	0.6	0.6	0.4	0.53	0.8	9.6	0.79	0.27	0.2	0.3	0.0572
13	Passur river at Harbaria of Sundarbans	1.1	0.56	1.22	0.61	0.59	0.89	0.35	0.269	0.42	0.53	1.16	**0.09**	0.21	3.15	0.81	0.26	0.5	0.25	0.30	0.52	0.6	0.7	0.2	0.4	0.3	2.6	0.6	1.9	0.7	0.48	0.228
14	Passur river at Akram point of Sundarbans	1.3	0.29	0.8	0.42	0.61	NS	0.43	0.357	0.26	0.47	9.08	0.1	0.19	0.36	0.97	0.20	0.67	0.5	0.19	0.63	0.5	0.3	0.1	0.37	0.4	7.1	3	0.87	0.4	0.45	0.125
15	Passur river at Hiron point of Sundarbans	7.51	0.29	1.09	0.44	0.47	NS	0.45	NS	0.36	NS	5.9	0.23	NS	0.55	1.45	NS	NS	0.61	0.18	NS	NS	0.3	0.2	NS	0.4	1.1	NS	0.5	0.2	1.03	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.13: Arsenic (As) (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.002	0.003	0.004	0.003	0.002	0.002	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.004	0.003	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.003
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.002	0.003	0.004	0.003	0.002	0.002	0.001	0.001	0.003	0.003	0.003	0.001	0.002	0.001	0.002	0.001	0.005	0.002	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.002	0.004	0.002	0.002	0.003	0.003
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.001	0.003	0.004	0.003	0.003	0.002	0.001	0.001	0.003	0.005	0.002	0.001	0.001	0.002	0.003	0.001	0.004	0.002	0.003	0.003	0.002	0.002	0.002	0.003	0.003	0.002	0.003	0.003	0.002	0.003	0.003
4	Left Bank of Passur River at Project Site-Jetty	0.002	0.004	0.004	0.004	0.002	0.002	0.001	0.002	0.002	0.004	0.002	0.002	0.001	0.002	0.002	0.002	0.005	0.002	0.001	0.003	0.002	0.003	0.003	0.002	0.003	0.002	0.002	0.003	0.002	0.002	0.003
5	Middle Passur River at Project Site-Jetty	0.002	0.004	0.004	0.003	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.003	0.002	0.001	0.003	0.002	0.003	0.002	0.002	0.004	0.003	0.002	0.002	0.002	0.002	0.003
6	Right Bank of Passur River at Project Site-Jetty	0.002	0.003	0.003	0.003	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.003	0.002	0.002	0.003
7	Left Bank of Passur River at South West corner from the Project boundary	<0.001	0.003	0.006	0.003	0.002	0.002	0.001	0.002	0.001	0.003	0.002	0.002	0.002	0.003	0.001	0.002	0.005	0.002	0.003	0.003	0.003	0.003	0.002	0.005	0.004	0.002	0.003	0.003	0.002	0.003	0.004
8	Middle of Passur River at South West corner from the Project boundary	<0.002	0.004	0.004	0.003	0.002	0.002	0.001	0.001	0.002	0.003	0.003	0.001	0.002	0.002	0.001	0.001	0.003	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.003	0.002	0.002	0.002	0.003
9	Right Bank of Passur River at South West corner from the Project boundary	0.002	0.003	0.006	0.003	0.002	0.003	0.001	0.001	0.002	0.004	0.002	0.002	0.003	0.002	0.001	0.001	0.004	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.003	0.002	0.002	0.002	0.003
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	<0.001	0.003	0.006	0.004	0.003	0.002	0.001	0.002	0.002	0.005	0.002	0.001	0.003	0.003	0.002	0.002	0.004	0.001	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.003	0.003	0.002	0.002	0.003	0.004
11	Maidara river near proposed township area	0.002	0.002	0.003	0.003	0.003	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.003	0.001	0.001	0.001	0.003	0.001	0.005	0.003	0.004	0.004	0.003	0.002	0.004	0.002	0.004	0.002	0.003	0.003	0.003
12	Passur river at Passur - Mongla confluence	0.002	0.004	0.003	0.003	0.004	0.002	0.001	0.002	0.003	0.004	0.003	0.002	0.002	0.002	0.001	0.002	0.003	0.001	0.007	0.003	0.002	0.004	0.003	0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.003
13	Passur river at Harbaria of Sundarbans	0.004	0.003	0.004	0.004	0.004	0.002	0.001	0.002	0.005	0.002	0.003	0.002	0.001	0.003	0.002	0.001	0.003	0.002	0.001	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.003
14	Passur river at Akram point of Sundarbans	0.004	0.002	0.002	0.003	0.002	NS	0.001	0.002	0.006	0.001	0.003	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.002	0.003
15	Passur river at Hiron point of Sundarbans	0.003	0.002	0.003	0.002	0.002	NS	0.001	NS	0.004	NS	0.002	0.002	NS	0.002	0.001	NS	NS	0.001	0.001	NS	NS	0.002	0.002	NS	0.009	0.002	NS	0.003	0.002	0.002	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed

Table B.14: Pb (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.053	0.004	0.002	0.104	0.098	0.0059	0.007	0.168	0.203	0.01	0.009	0.024	0.002	0.003	0.001	0.002	0.002	0.003	0.004	0.003	0.001	0.001	**0.008**	0.006	**0.002**	0.016	0.029	0.017	0.009	0.013	0.009
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.055	0.002	0.003	0.104	0.102	0.0038	0.006	0.092	0.302	0.009	0.007	0.034	0.001	0.003	0.001	0.001	0.001	0.007	0.005	0.002	0.003	0.002	**0.007**	0.004	**0.005**	0.017	0.029	0.019	0.019	0.01	0.009
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.055	0.005	0.002	0.111	0.138	0.0058	0.008	0.176	0.347	0.017	0.01	0.03	0.003	0.003	0.002	0.004	0.02	0.017	0.007	0.004	0.002	0.001	**0.009**	0.007	**0.006**	0.018	0.036	0.019	0.002	0.011	0.01
4	Left Bank of Passur River at Project Site-Jetty	0.057	0.002	0.003	0.154	0.142	0.011	0.01	0.115	0.336	0.014	0.007	0.036	0.001	0.002	0.002	0.001	0.018	0.013	0.005	0.003	0.009	0.001	**0.008**	0.005	**0.008**	0.015	0.016	0.012	0.003	0.009	0.008
5	Middle Passur River at Project Site-Jetty	0.06	0.002	0.002	0.139	0.135	0.002	0.009	0.148	0.317	0.006	0.006	0.046	0.003	0.002	0.001	0.003	0.008	0.01	0.003	0.003	0.003	0.001	**0.006**	0.007	**0.006**	0.017	0.014	0.012	0.002	0.007	0.003
6	Right Bank of Passur River at Project Site-Jetty	0.058	0.002	0.002	0.138	0.156	0.0021	0.007	0.112	0.298	0.01	0.005	0.041	0.002	0.001	0.001	0.001	0.041	0.012	0.007	0.002	0.009	0.003	**0.004**	0.008	**0.005**	0.019	0.012	0.016	0.002	0.011	0.008
7	Left Bank of Passur River at South West corner from the Project boundary	0.053	0.002	0.003	0.16	0.142	0.0076	0.01	0.134	0.396	0.007	0.006	0.048	0.003	0.001	0.001	0.007	0.012	0.011	0.003	0.002	0.120	0.001	**0.006**	0.019	**0.018**	0.019	0.0140.	0.022	0.003	0.014	0.004
8	Middle of Passur River at South West corner from the Project boundary	0.054	0.003	0.004	0.153	0.148	0.002	0.011	0.099	0.323	0.006	0.007	0.044	0.009	0.002	0.001	0.003	0.015	0.014	0.004	0.003	0.006	0.002	**0.008**	0.009	**0.008**	0.017	0.003	0.015	0.004	0.006	0.007
9	Right Bank of Passur River at South West corner from the Project boundary	0.056	0.005	0.004	0.139	0.163	0.002	0.009	0.093	0.331	0.012	0.007	0.056	0.003	0.002	0.002	0.005	0.03	0.019	0.006	0.002	0.004	0.001	**0.007**	0.01	**0.004**	0.022	0.014	0.016	0.005	0.007	0.009
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.053	0.004	0.004	0.143	0.135	0.002	0.07	0.023	0.35	0.008	0.008	0.038	<LOQ	0.003	0.002	0.002	0.01	0.008	0.004	0.002	0.003	0.002	**0.008**	0.013	**0.003**	0.019	0.013	0.022	0.004	0.008	0.01
11	Maidara river near proposed township area	0.048	0.004	<0.002	0.133	0.14	0.002	0.008	0.067	0.275	0.015	0.007	0.056	0.001	0.011	0.001	0.003	0.016	0.017	0.005	0.003	0.004	0.003	**0.006**	0.005	**0.006**	0.007	0.015	0.002	0.005	0.01	0.012
12	Passur river at Passur - Mongla confluence	0.05	0.032	<0.002	0.141	0.14	0.002	0.009	0.078	0.258	0.098	0.011	0.05	0.0001	0.011	0.001	0.002	0.015	0.009	0.007	0.003	0.002	0.002	**0.005**	0.003	**0.007**	0.015	0.014	0.023	0.008	0.013	0.017
13	Passur river at Harbaria of Sundarbans	0.043	0.044	0.004	0.137	0.13	0.002	0.012	0.135	0.228	0.02	0.01	0.05	0.001	0.005	0.003	0.003	0.017	0.009	0.015	0.002	0.006	0.014	**0.007**	0.009	**0.004**	0.002	0.014	0.011	0.019	0.01	0.01
14	Passur river at Akram point of Sundarbans	0.194	0.071	0.032	0.309	0.297	NS	0.084	0.302	0.359	0.142	0.126	0.033	0.009	0.004	0.169	0.001	0..062	0.018	0.013	0.002	0.001	0.019	**0.043**	0.011	**0.020**	0.001	0.018	0.005	0.004	0.011	0.009
15	Passur river at Hiron point of Sundarbans	0.224	0.05	0.07	0.309	0.291	NS	0.073	NS	0.607	NS	0.151	0.129	NS	0.019	0.175	NS	NS	0.014	0.017	NS	NS	0.008	**0.056**	NS	**0.013**	0.001	NS	0.5	0.005	0.009	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.15: Hg (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.004	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4	Left Bank of Passur River at Project Site-Jetty	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
5	Middle Passur River at Project Site-Jetty	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
6	Right Bank of Passur River at Project Site-Jetty	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
7	Left Bank of Passur River at South West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
8	Middle of Passur River at South West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
9	Right Bank of Passur River at South West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
11	Maidara river near proposed township area	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Passur river at Passur - Mongla confluence	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
13	Passur river at Harbaria of Sundarbans	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
14	Passur river at Akram point of Sundarbans	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
15	Passur river at Hiron point of Sundarbans	< 0.00015	NS	< 0.00015	< 0.00015	< 0.00015	< 0.00015	NS	NS	< 0.00015	NS	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	NS	NS	< 0.001	< 0.001	NS	< 0.001	< 0.001	< 0.001	NS	<0.001	<0.001	NS	<0.001	<0.001	<0.001	<0.001

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Parameters for ground water quality monitoring

Table B.16: pH and Temperature (0C) of Ground Water

Sl	Locations	Tube Well Type	Monitoring periods																															
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	Jan	May	Jul
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM	33QM
1	Near Proposed Township	Deep (>600 ft)	7.6	7.7	7.9	8	TC	8.1	7.49	7.6	7.8	7.8	8.4	8.1	7.4	8.2	6.9	NF	NF	NF	7.1	8.3	8.2	7.2	7.8	**8.1**	7.4	**7.2**	8.0	5.6	8.0	7.7	7.7	7.26
2	Rajnagar	Deep (>600 ft)	7.6	7.8	8	8.2	7.8	8.3	7.93	8.1	8.3	8.1	7.9	7.5	7.8	8.1	7.4	6.9	7.9	7.3	6.9	8.4	7.9	7.6	7.3	**8.0**	8	**7.5**	8.3	6.2	8.6	8.1	7.4	7.8
3	Kapasdanga	Deep (>600 ft)	7.6	7.7	8	8.1	7.9	8.3	7.7	7.9	8.2	7.9	7.9	7.6	7.4	7.8	7.2	7.2	7.6	7.6	6.5	8.9	8.1	7.4	7.5	**8.0**	8	**7.5**	8.2	7.4	9.1	8.1	8.2	7.7
4	Kalekharber	Shallow (<250 ft)	6.3	6.5	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF-Not Func tional.

Locations	Tube Well Type	Monitoring periods																															
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	Jan	May	Jul
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM	33QM
Near Proposed Township	Deep (>600 ft)	27.3	28.5	26	24.5	TC	31	30	24	29.8	28.6	29.1	25.1	28.7	27.2	22.9	NF	NF	NF	23.8	29	31.4	27	24	31	27	**22**	**23**	31.3	28.89	23	29	32
Rajnagar	Deep (>600 ft)	29.6	29.9	28	22.5	28.6	28	27.8	23	29.6	29.1	30.4	24.3	27.7	26.5	23.8	30.3	29.3	30	23.7	30	30.0	27	23	30	28	**25**	**23**	30.45	27.7	24	31.48	30
Kapasdanga	Deep (>600 ft)	29.2	28.9	28	25.1	28.8	30	28.7	25	30.1	29.4	29.8	24	28.4	26.4	23.6	30.1	29.7	29	23.2	30	31.2	26	23	30	27	**25**	**24**	30.72	28.04	25	29.37	29
Kalekharber	Shallow (<250 ft)	27.5	28.7	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

*Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF-Not Functional.; *Drinking water quality standards, The Environment Conservation Rules, 1997*

Table B.17: Salinity (ppt) and DO (mg/L) in Groundwater

Sl	Locations	Tube Well Type	Monitoring periods																															
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	Jan	May	Jul
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM	33QM
1	Near Proposed Township	Deep (>600 ft)	0	0	0	1	TC	0	0	0	0	0	0	0	0	0	0	NF	NF	NF	0.1	0.1	0.1	0.0	0.1	0.1	0.18	**0.1**	0.1	0.1	0	0.1	0.3	0.4
2	Rajnagar	Deep (>600 ft)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.3	0.1	0.1	0.1	0.5	0.1	0.0	0.1	0.1	0.1	**0.2**	0.3	0.2	0	0.2	0.2	0.2
3	Kapashdanga	Deep (>600 ft)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.2	0.1	0.1	0.1	0.7	0.1	0.0	0.1	0.1	0.1	**0.4**	0.3	0.4	0	0.4	0.4	0.1
4	Kalekharber	Shallow (<250 ft)	0	0	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF-Not Functional.

Sl	Locations	Tube Well Type	Monitoring periods																															
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	Jan	May	Jul
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM	33QM
1	Near Proposed Township	Deep (>600 ft)	4.4	5.2	6.5	6.7	TC	6	5.4	4.9	6.1	5.8	6.3	4.5	5.1	6.2	5.2	NF	NF	NF	6.0	6.0	6.1	6.0	6.0	6.0	6	**6.4**	6.4	6.0	6.5	6.2	4.0	2.6
2	Rajnagar	Deep (>600 ft)	6	6.2	7.7	6.3	6	5.9	6.1	5.2	5.8	6.1	5.8	4.8	5.3	5.8	4.47	6.0	6	5.9	6.1	6.5	6.0	6.2	6.1	6.1	6.2	**6.7**	6.3	6	7.7	4.7	2.99	5.9
3	Kapasdanga	Deep (>600 ft)	6.4	6.5	6.1	6.5	6.6	6	5.6	4.8	5.6	5.7	6.1	4.6	5.7	6.2	4.26	5.4	5.9	6.1	6.2	6.2	6.0	6.0	6.0	6.1	6	**4.9**	6.3	5	6.1	3.5	3.8	6.0
4	Kalekharber	Shallow (<250 ft)	4.4	6	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

*Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring; NF=Non-functional *Drinking water quality standards, The Environment Conservation Rules, 1997*

Table B.18: TDS (mg/L) and TSS (mg/L) concentrations in Groundwater

SL	Locations	Type of tube wells	Monitoring periods																													
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	Deep (>600 ft)	1113	999	-	1021	NO	881	377	447	1025	1000	617	623	395	602	405	NF	NF	NF	1315	915	25	900	3080	1196	139	200	810	890	350	0.86	1150
2	Rajnagar	Deep (>600 ft)	4090	371	-	378	390	574	1007	491	384	408	382	401	617	996	602	615	390	365	376	380	602	385	660	701	335	350	450	360	615	350	360
3	Kapasdanga	Deep (>600 ft)	643	635	-	600	600	328	611	284	645	607	636	998	558	390	994	370	608	610	927	610	360	603	370	316	202	610	570	610	860	620	620
4	Kalekharber	Shallow (<250 ft)	1055	970	-	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

SL	Locations	Type of tube wells	Monitoring periods																													
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	Deep (>600 ft)	-	6	19	40	NF**	23	4	31	3	5	7	32	4	8	12	NF	NF	NF	3	3	2	4	2	1	**3**	**1**	**1**	1	1	1	2
2	Rajnagar	Deep (>600 ft)	-	6	2	28	4	16	5	46	4	4	4	28	10	10	6	12	2	6	3	2	1	3	3	3	**5**	**2**	**1**	1	4	1	1
3	Kapasdanga	Deep (>600 ft)	-	8	6	32	6	14	4	41	3	4	5	25	9	9	7	5	3	8	4	4	4	4	2	1	**2**	**5**	**1**	2	3	1	2
4	Kalekharber	Shallow (<250 ft)	-	48	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	Nf	NF	NF	NF	NF	NF	NF	NF	NF	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional;

Table B.19: TH (mg/L) concentrations in Groundwater

Sl No	Locations	Type of tubewell	Monitoring periods																													
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	Deep (>600 ft)	425	250	300	235	NO	225	325	295	305	320	175	550	720	145	NF	NF	NF	NF	355	235	97	145	137	625	**232**	160	1400	160	70	180	320
2	Rajnagar	Deep (>600 ft)	220	175	180	110	138	125	450	195	263	248	295	510	420	240	265	195	235	178	215	182	167	245	118	210	**185**	145	1600	195	243	200	165
3	Kapasdanga	Deep (>600 ft)	190	140	180	125	216	115	480	225	163	28	183	620	654	215	305	215	170	138	270	167	212	137	145	237	**207**	130	1200	140	155	210	275
4	Kalekarber	Shallow (<250 ft)	780	450	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

*Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF=Non-functional; *Drinking water quality standards, The Environment Conservation Rules, 1997.*

Table B.20: COD (mg/L) concentrations of monitored ground water locations

Sl	Locations	Tube-well Type	Monitoring periods																													
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	Deep (>600 ft)	32	32	34	20	NO	12	4	4	4	4	4	4	4	8	NF	NF	NF	NF	4	352	4	4	4	4	4	4	16	32	4	12	32
2	Rajnagar	Deep (>600 ft)	28	28	18	16	14	10	8	4	4	4	4	4	4	8	4	4	4	4	3	4	4	4	4	4	4	4	32	28	20	8	28
3	Kapasdanga	Deep (>600 ft)	48	32	34	20	18	14	4	4	4	2	4	4	4	16	4	4	4	4	4	4	4	4	4	4	4	4	8	36	28	28	32
4	Kalekarber	Shallow (<250 ft)	32	36	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

*Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional; N/A=Not Availability; *Drinking water quality standards, The Environment Conservation Rules, 1997*

Table B.21: NO_3^- (mg/L) Concentrations in Ground Water

Sl	Locations	Type of tube well	Monitoring periods *BD Standard (10 mg/L)																													
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	Deep (>600 ft)	0.20	0.48	<0.10	28	-	7.6	4.3	2.1	1.7	3.8	6.1	4.65	9.32	3.3	5.9	NF	NF	NF	1.7	4.4	1.4	1.8	1.9	1.7	0.5	2.4	1	1.5	3.7	12.09	4.331
2	Rajnagar	Deep (>600 ft)	0.60	0.68	0.31	26	-	2.2	4.2	1.9	2.3	3.3	7.51	7.02	14.7	2.5	7.2	5.3	8.6	0.9	4.4	2.7	2.7	3.1	1.4	7.5	3.8	2.2	1	2.1	4.1	4.02	12.304
3	Kapasdanga	Deep (>600 ft)	0.80	0.40	0.80	13	-	4.7	3.8	2.8	1.9	3.7	10.16	4.65	10.2	4.6	1.7	5.7	7.8	1.4	2.1	8.3	1.7	1.6	2.7	1.7	3.1	4.9	2	2.1	2.6	8.83	1.9372
4	Kalekarber	Shallow (<250 ft)	0.40	0.56	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

*Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF=Nonfunctional; *Drinking water quality standards, The Environment Conservation Rules, 1997;*

Table B.22: SO_4^{2-} (mg/L) Concentrations in Ground Water

Sl	Location	Typeof Tubewell	Monitoring periods *BD Standard (400 mg/L)																														
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	Deep (>600 ft)	-	3	-	-	-	-	1	5	1	1	1	1	5	1	8	NF	NF	NF	1	4	1	2	2	4	**9**	1	1	1	2.2	14.94	2.1054
2	Rajnagar	Deep (>600 ft)	-	2	-	-	-	-	2	6	2	1	1	1	1	1	2	2	4	1	2	1	2	2	3	3	**3**	1	1	4	6.3	4.22	6.83
3	Kapasdanga	Deep (>600 ft)	-	10	-	-	-	-	2	2	8	1	1		3	2	6	4	6	1	1	4	1	1	2	4	**3**	7	1	3	2.6	9.51	1.76
4	Kalekarber	Shallow (<250 ft)	NF	3	NF	-	-	-	-	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

*Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF=Non-functional; *Drinking water quality standards, The Environment Conservation Rules, 1997*

Table B.23: PO_4^{3-} (mg/L) Concentrations in Ground Water

Sl	Location	Typeof Tubewell	Monitoring periods *BD Standard (6.0 mg/L)																														
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	Deep (>600 ft)	NF	2.2	-	0.74	NO	1.4	0.31	0.267	1.08	0.17	0.167	1.18	2.18	1.68	0.13	NF	NF	NF	2.1	2.3	0.3	1	1.1	0.3	0.7	2.0	1.4	1.7	0.9	1.0	0.8
2	Rajnagar	Deep (>600 ft)	-	2.5	-	0.44	1.98	1.6	0.27	0.179	1.53	0.29	0.67	1.21	1.8	3.5	0.17	4..5	2.9	0.15	1.3	2.5	4.0	0.5	0.4	1.5	6.3	1.8	0.98	1.2	1.4	0.6	1.4
3	Kapasdanga	Deep (>600 ft)	-	6.2	-	0.48	4.54	4.1	0.48	0.179	3.26	0.31	0.6	1.18	2.1	4.7	0.18	0.27	4.8	0.26	3.6	3.2	2.0	1.5	0.9	1.7	2.3	2.3	4	5	0.6	1.4	0.3
4	Kalekarber	Shallow (<250 ft)	NF	1.2	NF	NF	NF	NF	NF	NF	NF	NF	NF	1.23	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

*Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF=Nonfunctional; *Drinking water quality standards, The Environment Conservation Rules, 1997*

Table B.24: As concentrations (mg/L) of monitored ground water locations

Sl	Locations	Monitoring periods																															
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	0.013	0.020	0.012	0.014	NO	0.015	0.002	0.008	0.018	0.012	0.033	0.028	0.012	0.014	0.002	0.001	NF	NF	0.014	0.012	0.014	0.001	0.018	0.020	0.022	0.003	0.002	0.002	0.012	0.003	0.016	
2	Rajnagar	0.006	0.009	0.006	0.008	0.01	0.014	0.012	0.002	0.007	0.018	0.011	0.005	0.022	0.004	0.012	0.022	0.012	0.007	0.003	0.012	0.006	0.027	0.006	0.068	0.045	0.053	0.004	0.003	0.003	0.063	0.003	
3	Kapasdanga	0.036	0.033	0.020	0.017	0.034	0.024	0.011	0.002	0.047	0.005	0.016	0.028	0.010	0.027	0.002	0.001	0.004	0.050	0.004	0.012	0.022	0.001	0.033	0.003	0.004	0.006	0.049	0.008	0.061	0.014	0.048	
4	Kalekarber	0.376	0.407	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional; N/A=Not Availability; TC=temporarily closed, D=Damaged

**Drinking water quality standards, The Environment Conservation Rules, 1997.*

Table B.25: Pb concentrations (mg/L) of monitored ground water locations

Sl	Locations	Monitoring periods																															
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	22QM	23 QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	0.002	<0.002	0.004	0.023	NO	0.002	0.006	0.026	0.019	0.002	0.001	0.01	0.001	0.003	0.001	0.001	0.001	NF	NF	0.008	0.004	0.018	0.002	0.001	0.001	0.004	0.048	0.003	0.009	0.001	0.003	0.8
2	Rajnagar	<0.002	<0.002	<0.002	0.016	0.013	0.0027	0.021	0.011	0.007	0.002	0.001	0.009	0.001	0.007	0.002	0.001	0.001	0.001	0.004	0.003	0.004	0.002	0.008	0.001	0.001	0.006	0.016	0.008	0.002	0.001	0.004	1.4
3	Kapasdanga	<0.002	0.004	<0.002	0.013	0.017	0.002	0.005	0.012	0.008	0.002	0.001	0.016	0.001	0.002	0.001	0.001	0.001	0.001	0.056	0.004	0.006	0.001	0.001	0.002	0.001	0.002	0.056	0.002	0.001	0.001	0.003	0.3
4	Kalekarber	0.002	0.008	NF	NF	D	D	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NS

Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional; N/A=Not Availability; TC=temporarily closed, D=Damaged

**Drinking water quality standards, The Environment Conservation Rules, 1997*

Table B.26: Hg concentrations (mg/L) of monitored ground water locations

Sl	Locations	Monitoring periods*BD Standard (0.001 mg/L)																															
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	Oct	Jan	May
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	21QM	22QM	23^{r}QM	25QM	26QM	27QM	28QM	29QM	30QM	31QM	32QM
1	Township near project site	<0.00015	<0.00015	<0.0005	<0.0005	<0.0005	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	**<0.001**	**<0.001**	**<0.001**	**<0.001**	<0.001	<0.001	<0.001	<0.001	0.008
2	Rajnagar	<0.00015	<0.00015	<0.0005	<0.0005	<0.00015	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	**<0.001**	**<0.001**	**<0.001**	**<0.001**	<0.001	<0.001	<0.001	<0.001	0.003
3	Kapasdanga	<0.00015	<0.00015	<0.0005	<0.0005	<0.00015	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001		<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	**<0.001**	**NF**	**<0.001**	**<0.001**	<0.001	<0.001	<0.001	<0.001	0.064
4	Kalekarber	<0.00015	<0.00015	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	**NF**	**NF**	**NF**	**NF**	NF	NF	NF	NF	NF

*Source: CEGIS Field Survey; Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional; N/A=Not Availability; TC=temporarily closed, D=Damaged; *Drinking water quality standards, The Environment Conservation Rules, 1997.*

Table B.27: PAH (mg/L) concentrations of monitored locations

PAH	July, 2018			January, 2019			July, 2019			February, 2020			July, 2020			January, 2021			August, 2021			January, 2022		
	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point
Acenapthylene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzlol (A) Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzlol (A) Pyrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzlol (B) Fluoranthene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzol (G, H, I) Perilene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzol (K) Fluoranthene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzol (A, H) Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Source: CEGIS Field Survey; may 2022

Table B.28: TOC (mg/L) and TC (mg/L) concentrations of monitored locations

Monitoring sites	July, 2018		January, 2019		July, 2019		February, 2020		July, 2020		January, 2021		August, 2021		January, 2022	
	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon
Project jetty site	26.4	19.5	20.7	14.3	17.2	13.6	37.5	26.4	152	9.17	1302	<5	250	<5	218	21.2
Majhar point or Harbaria area	21.9	25.1	24.8	18.8	21.7	18.1	21.7	18.1	200	9.48	1568	<5	200	20.2	686	19.7
Hiron point	NM	NM	6.8	5.7	NM	NM	8.1	6.7	NM	NM	9241	<5	544	<5	2901	15.2

Source: CEGIS Field Survey, May, 2022

(C) Noise Level monitoring data

Table C.1: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM1 (Noise Level in dB (A)) Mar-14				QM2 (Noise Level in dB (A)) Jul-14				QM3 (Noise Level in dB (A)) Oct-14				QM4 (Noise Level in dB (A)) Jan-15				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	80.32	60.86	63.22	68.13	52.71	55.62	50.27	52.87	53.37	53.52	57	54.63	51.92	53.7	54.21	53.28	70
2	NW Corner of the Project area	55.23	53	47.43	51.89	NM	NM	NM	NM	42.67	41.73	41.37	41.92	33.87	36.42	35.46	35.25	50
3	Chunkuri-2, Bajua	62.69	57.19	53.39	57.76	54.61	51.14	51.9	52.55	52.26	51.14	50.76	51.39	55.08	46.29	46.49	49.29	50
4	SW corner of the Project area	49.2	NM	NM	49.2	44.55	48.94	49.33	47.6	45.56	45.1	47.18	45.95	36.57	34.24	37.27	36.03	50
5	Proposed Township area, Project site	47.8	49.7	NM	48.75	46.15	47.21	NM	46.68	42.67	41.73	41.37	41.92	41.49	39.55	43.37	41.47	50
6	Barni, Gaurambha	64.95	50.93	60.65	58.84	48.73	50.37	50.75	49.95	50.18	50.89	48.27	49.78	43.36	38.56	48.86	43.6	50
7	Khan Jahan Ali Bridge, Khulna	76.12	66.72	72.25	71.7	55.97	64.68	61.75	60.8	72.24	58.3	68.3	66.28	61.34	63.4	60.41	61.72	70
8	Mongla Port area	69.38	54.55	59.79	61.24	54.75	54.2	52.58	53.84	66.8	55.2	59.5	60.5	40.26	35.04	40.76	38.69	75
9	Harbaria, Sundarbans	39.24	NM	42.51	40.88	59.25	60.52	48.62	56.13	54.08	56.51	NM	55.3	36.36	32.4	NM	34.38	45
10	Akram Point, Sundarbans	40.95	41.98	39.9	40.94	48.95	46.86	NM	47.9	45.27	42.69	NM	43.98	37.9	30.75	NM	34.32	45
11	Hiron Point, Sundarbans	35.99	40.75	39.16	38.63	51.29	NM	NM	51.29	47.98	39.42	NM	47.98	42.82	31.93	NM	37.37	45

*Note(s): NM – Not Monitored, *Std- Standard as defined in National Noise Control Rules 2006*

Table C.2: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 5(Noise Level in dB (A)) Apr-15				QM 6 (Noise Level in dB (A)) Jul-15				QM 7 (Noise Level in dB (A)) Oct-15				QM 8 (Noise Level in dB (A)) Jan-16				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	57.27	54.31	59.65	57.08	43.52	54.23	51.56	49.77	68.32	66.09	60.96	65.12	67.84	61.25	66.31	66.07	70
2	NW Corner of the Project area	45.05	42.15	46.8	44.67	37.58	40.91	46.18	41.56	41.51	39.58	44.74	41.94	53.91	49.02	49.95	50.96	50
3	Chunkuri-2, Bajua	45.9	48.19	NM	47.05	40.57	42.23	39.17	40.66	47.53	45.48	49.28	47.43	56.84	48.12	55.90	53.62	50
4	SW corner of the Project area	40.6	43.25	46.89	43.58	44.57	44.30	42.36	43.75	36.15	48.26	43.68	42.70	60.32	55.30	63.70	60.44	50
5	Proposed Township area, Project site	41.49	39.55	43.37	41.47	43.41	50.86	45.99	46.75	46.89	49.47	55.20	50.52	54.79	52.22	54.29	53.77	50
6	Barni, Gaurambha	58.23	50.11	NM	54.17	46.76	44.83	46.95	46.18	56.40	54.19	54.88	55.16	60.62	60.00	56.86	59.16	50
7	Khan Jahan Ali Bridge, Khulna	75.2	72.75	72.42	73.45	52.95	52.18	53.34	52.82	64.43	61.65	66.65	64.25	69.96	64.81	70.56	68.45	70
8	Mongla Port area	46.02	49.29	49.15	48.15	36.72	38.56	43.54	39.61	45.39	NM	48.63	47.01	54.15	51.82	52.14	52.70	75
9	Harbaria, Sundarbans	67.06	64.05	64.99	65.37	39.33	30.74	NM	35.03	54.97	46.54	NM	50.75	45.72	44.69	*NM*	45.20	45
10	Akram Point, Sundarbans	53.35	56.37	NM	54.86	NM	NM	NM	NM	45.28	53.92	NM	49.60	45.60	40.29	*NM*	42.95	45
11	Hiron Point, Sundarbans	47.48	48.2	NM	47.84	NM	NM	NM	NM	54.44	37.69	NM	46.06	NM	NM	NM	NM	45

*Note(s): NM – Not Monitored, *Std- Standard as defined in National Noise Control Rules 2006.*

Table C.3: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM9 (Noise Level in dB (A)) Apr-16				QM 10 (Noise Level in dB (A)) Jul-16				QM 11 (Noise Level in dB (A)) Oct-16				QM 12 (Noise Level in dB (A)) Jan-17				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	67.71	61.23	66.31	65.08	50.92	50.04	52.3	51.42	60.1	68.6	67.8	65.5	54.4	61	61.46	58.95	70
2	NW Corner of the Project area	53.81	48.66	49.90	50.79	54.40	53.19	50.36	52.65	54.7	54.8	57.0	55.5	44.52	44.52	NM	44.52	50
3	Chunkuri-2, Bajua	43.30	43.35	46.84	44.49	56.29	49.4	54.51	53.4	50.4	47.7	56.6	51.6	55.73	56.2	NM	55.31	50
4	SW corner of the Project area	56.81	54.73	51.97	54.50	67.38	74.12	54.61	65.37	47.8	49.0	50.8	49.2	44.41	45.96	NM	45.19	50
5	Proposed Township area, Project site	55.02	52.41	52.69	53.37	62.71	52.98	51.67	55.79	45.8	41.6	48.7	45.4	NM	43.4	41.85	42.63	50
6	Barni, Gaurambha	50.63	54.19	57.09	53.97	51.2	59.54	59.53	56.75	52.4	57.3	55.0	54.9	49.75	48.35	NM	49.05	50
7	Khan Jahan Ali Bridge, Khulna	66.40	64.82	66.34	65.85	63.52	62.15	65.73	63.80	61.9	59.6	61.3	60.9	51.69	60.05	54.97	55.57	70
8	Mongla Port area	49.89	48.67	51.07	49.88	53.87	52.04	52.7	52.87	49.5	50.0	50.2	49.9	47.82	48.67	50.33	48.94	75
9	Harbaria, Sundarbans	44.40	44.69	NM	44.55	53.87	53.04	52.79	52.9	57.2	53.5	49.3	53.3	41.13	38.4	37.98	39.17	45
10	Akram Point, Sundarbans	45.60	40.29	NM	42.95	47.16	46.48	50.24	47.96	40.5	43.0	42.5	42.0	38.74	38.45	37.06	38.08	45
11	Hiron Point, Sundarbans	48.53	37.69	NM	43.11	NM	NM	NM	NM	46.1	42,08	41.9	44.0	43.62	40.96	42.29	42.29	45

*Note(s): NM – Not Monitored, *Std- Standard as defined in National Noise Control Rules 2006.*

Table C.4: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM13 (Noise Level in dB (A)) Apr-17				QM 14 (Noise Level in dB (A)) Oct-17				QM 15 (Noise Level in dB (A)) Jan-18				QM 16 (Noise Level in dB (A)) April-18				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	58.21	59.00	66.57	61.62	47.65	51.06	50.27	49.66	60.2	60.2	60.5	60.3	64.09	59.30	65.43	62.94	70
2	NW Corner of the Project area	44.97	49.30	47.31	47.19	47.65	45.12	46.65	46.47	47.8	48.1	49.2	48.37	47.92	54.32	61.14	54.46	55
3	Chunkuri-2, Bajua	45.60	52.29	53.42	50.44	39.82	45.60	41.73	42.38	51.1	51.2	52.1	51.47	44.77	46	63.14	51.30333	55
4	SW corner of the Project area	39.62	42.64	47.48	43.25	60.80	64.08	62.52	62.47	43.5	43.5	45.7	44.23	64.45	63.49	66.63	64.85667	55
5	Project site near Shapmari area	41.40	43.09	43.45	42.65	43.05	48.52	45.01	45.53	53.2	54	52.82	53.34	51.95	59.66	56.8	56.13667	55
6	Barni, Gaurambha	43.05	46.45	45.01	44.83	45.60	52.29	53.42	50.44	56.5	54.2	56.1	55.6	55.6	51.80	51.39	52.93	60
7	Khan Jahan Ali Bridge, Khulna	54.01	57.50	58.66	56.72	40.60	42.64	46.55	43.26	60.2	62.1	62.2	61.5	49.4	45.25	47.98	47.54333	70
8	Mongla Port area	47.78	47.45	45.25	47.61	41.40	44.68	45.71	43.93	60.2	60.2	58.4	59.6	50.84	48.33	53.25	50.80667	75
9	Harbaria, Sundarbans	50.79	53.67	57.84	54.10	44.25	46.67	47.31	46.08	45.8	44.7	43.8	44.7	50.23	45.55	65.43	53.73667	50
10	Akram Point, Sundarbans	43.41	45.60	43.89	44.30	58.21	58.59	58.70	58.50	39.4	40.5	41.1	40.3	58.31	60.93	64.87	61.37	50
11	Hiron Point, Sundarbans	NM	NM	NM	NM	39.92	39.79	33.5	37.74	37.2	39	38.4	38.2					50

*Source: CEGIS field Survey; NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

Table C.5: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 17 (Noise Level in dB (A)) July-18				QM 18 (Noise Level in dB (A)) Nov-18				QM 19 (Noise Level in dB (A)) Feb-19				QM 20 (Noise Level in dB (A)) Apr-19				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	57.64	56.94	58.03	57.54	61.3	56.3	57.1	70	56.14	59.28	53.95	56.45	62.02	61.91	61.08	61.67	70
2	NW Corner of the Project area	42.80	47.51	46.57	45.63	56.5	60.1	59.85	55	45.15	54.11	53	50.75	53.70	58.92	57.92	56.85	55
3	Chunkuri-2, Bajua	46.23	49.02	47.34	47.53	45.8	48.9	51.3	55	50.19	49.35	51	50.18	49.66	54.02	51.35	51.68	55
4	SW corner of the Project area	58.84	48.00	51.03	52.63	64.5	60.6	60.2	55	53.50	58.01	55.88	55.79	58.08	54.79	55.27	56.05	55
5	Project site near Shapmari area	42.66	45.82	48.78	45.75	45.1	51.2	55.8	55	58.48	61.21	54.70	58.13	61.35	58.97	56.16	58.83	55
6	Barni, Gaurambha	42.67	47.95	45.90	45.51	58.3	50.6	50.2	60	54.32	57.65	45.75	52.57	58.58	51.05	49.92	53.18	60
7	Khan Jahan Ali Bridge, Khulna	64.1	64.06	61.90	63.35	64.6	60.9	60.9	70	65.72	69.04	66.03	66.93	67.95	63.09	69.82	66.95	70
8	Mongla Port area	63.12	59.00	60.77	60.96	55.8	53.1	59.0	75	64.33	63.37	70.85	66.18	64.12	62.41	65.45	63.99	75
9	Harbaria, Sundarbans	51.98	48.58	50.28	50.28	49.9	47.6	NM	50	51.43	47.90	NM	49.67	49.42	47.45	NM	48.43	50
10	Akram Point, Sundarbans	46.52	43.88	45.2	45.20	41.9	40.1	NM	50	47.35	45.55	NM	46.45	46.16	38.49	NM	42.33	50
11	Hiron Point, Sundarbans	NM	NM	NM	57.54	39.7	39.1	NM	50	33.8	44.62	NM	39.21	NM	NM	NM	-	50

*Source: CEGIS field SurveyNote: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

Table C.6: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 21 (Noise Level in dB (A)) July-19				QM 22 (Noise Level in dB (A)) November-19				QM 23 (Noise Level in dB (A)) February 20				QM 25 (Noise Level in dB (A)) July, 20				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	55.92	60.88	61.23	59.34	70	61.03	55.78	58.60	56.24	54.09	53.45	54.59	52.00	51.11	50.56	51.28	70
2	NW Corner of the Project area	56.44	53.21	55.88	55.18	55	53.45	50.97	51.11	40.96	43.33	51.98	45.42	43.9	42.95	43.26	43.37	55
3	Chunkuri-2, Bajua	56.15	63.34	58.60	59.36	55	52.92	54.51	55.27	59.78	51.59	54.96	55.44	49.42	48.52	48.32	48.75	55
4	SW corner of the Project area	66.94	58.41	65.65	63.66	55	49.98	42.05	46.57	56.35	54.05	56.40	55.60	49.91	49.78	50.85	50.18	55
5	Project site near Shapmari area	53.14	55.40	55.05	54.53	55	55.80	54.77	54.86	51.02	47.91	47.93	48.95	54.55	53.21	52.88	53.72	55
6	Barni, Gaurambha	51.36	57.98	NM	54.67	60	49.37	48.53	50.53	57.37	60.48	68.05	61.97	56.53	40.65	49.21	48.80	60
7	Khan Jahan Ali Bridge, Khulna	63.38	60.55	66.44	63.46	70	67.65	65.32	66.05	60.75	62.81	63.05	62.20	65.55	66.86	66.52	66.31	70
8	Mongla Port area	60.49	62.10	63.43	62.01	75	55.66	55.85	57.25	59.74	62.38	61.07	61.06	64.92	67.90	63.71	66.41	75
9	Harbaria, Sundarbans	47.62	42.18	NM	44.90	50	44.71	NM	44.10	45.59	42.29	41.35	43.94	47.80	52.15	41.2	49.97	50
10	Akram Point, Sundarbans	44.05	45.62	NM	44.84	50	42.60	NM	44.86	NM	36.59	40.46	36.59	51.04	45.11	43.1	51.04	50
11	Hiron Point, Sundarbans	NM	NM	NM	NM	50	41.34	NM	40.28	41.3	39.41	NM	40.34	NM	NM	NM	NM	50

*Source: CEGIS field Survey; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

Table C.7: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 26 (Noise Level in dB (A)) Oct, 2020				QM 27 (Noise Level in dB (A)) Jan, 2021				QM 28 (Noise Level in dB (A)) Apr, 2021				QM 29 (Noise Level in dB (A) Jul, 2021				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	65.91	51.62	56.93	58.15	58.33	NM	62.68	60.50	61.35	61.74	61.22	61.44	50.96	51.08	51.57	51.21	70
2	NW Corner of the Project area	47.82	50.15	47.45	48.48	45.00	52.75	56.51	51.42	50.65	48.34	NM	49.50	49.60	51.64	49.09	50.11	55
3	Chunkuri-2, Bajua	43.58	47.68	46.45	45.91	48.75	45.45	46.96	47.05	50.22	52.90	50.81	51.31	49.93	51.65	49.52	50.36	55
4	SW corner of the Project area	49.50	48.83	49.22	49.18	NM	50.88	53.84	52.36	55.41	54.85	55.45	55.24	49.82	54.82	51.07	51.90	55
5	Project site near Shapmari area	50.23	41.71	41.43	44.45	49.19	47.07	51.00	49.09	52.23	51.24	52.67	52.05	53.45	54.35	53.71	53.84	55
6	Barni, Gaurambha	67.71	51.76	55.51	58.33	51.69	51.99	55.60	53.09	54.16	51.69	51.15	52.34	52.73	NM	49.28	51.00	60
7	Khan Jahan Ali Bridge, Khulna	81.72	81.45	82.25	81.81	61.95	NM	61.93	61.94	56.08	54.09	53.79	54.65	52.78	51.29	53.05	52.38	70
8	Mongla Port area	74.72	75.67	80.37	76.92	55.16	56.85	57.53	56.52	54.01	52.41	54.48	53.63	55.26	55.54	55.68	54.49	75
9	Harbaria, Sundarbans	59.01	NM	50.06	54.54	46.98	41.82	NM	44.40	48.54	47.54	NM	48.04	NM	NM	NM	NM	50
10	Akram Point, Sundarbans	NM	42.23	NM	42.23	40.34	35.35	NM	37.85	45.95	40.89	NM	43.42	46.31	42.94	NM	44.62	50
11	Hiron Point, Sundarbans	52.40	49.01	NM	50.70	42.50	35.23	NM	38.85	NM	NM	NM	NM	49.70	51.2	NM	50.94	50

*Source: CEGIS field Survey; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

Table C.8: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 30 (Noise Level in dB (A)) Oct, 2021				QM 31 (Noise Level in dB (A)) Jan, 2022				Std*
		Morni	A. noon	Evening	Dayti	Morn	A. no	Even	Dayt	Dayti
1	Chalna, Dacope	68.9	52.08	58.3	64.57	56	59.05	64.08	59.71	70
2	NW Corner of the Project area	47.99	51.61	48.17	49.59	49	48.90	48.56	48.82	55
3	Chunkuri-2, Bajua	45.31	48.07	46.8	46.87	49.85	47.48	49.70	49.01	55
4	SW corner of the Project area	49.66	49.49	48.95	49.37	63.74	49.95	50.25	54.65	55
5	Project site near Shapmari area	50.94	42.29	41.88	47.17	50.05	50.57	49.45	50.03	55
6	Barni, Gaurambha	68.37	51.5	56.61	63.96	47.60	49.57	49.51	48.89	60
7	Khan Jahan Ali Bridge, Khulna	77.75	80.58	81.43	80.18	61.04	63.52	62.44	62.33	70
8	Mongla Port area	73.94	75.15	79.45	76.86	NM	53.89	58.02	55.95	75
9	Harbaria, Sundarbans	59.51	50.62	NM	57.02	49.85	44.77	NM	47.31	50
10	Akram Point, Sundarbans	44.22	42.12	NM	43.29	38.66	36.15	NM	37.41	50
11	Hiron Point, Sundarbans	53.99	49.41	NM	52.27	39.5	33.08	NM	36.29	50

*Source: CEGIS field Survey; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

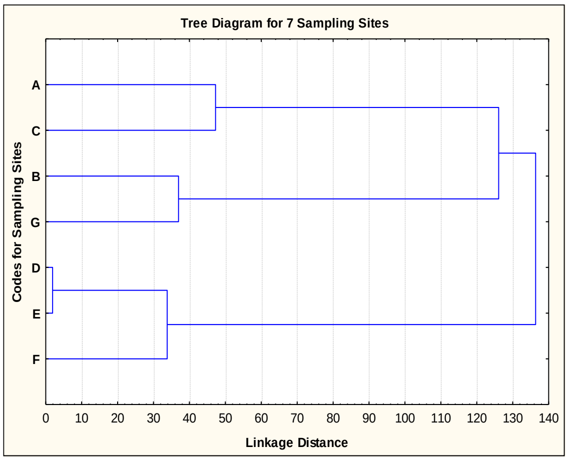
Table C.9: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 32(Noise Level in dB (A)) May, 2022				Std*	QM 33(Noise Level in dB (A)) Jul, 2022				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	56	61.25	59.97	59.08	70	52.71	52.62	53.30	52.88	70
2	NW Corner of the Project area	48.63	48.64	48.64	48.60	55	46.55	44.82	45.44	45.60	55
3	Chunkuri-2, Bajua	48.32	48.72	49.70	48.91	55	48.00	45.61	47.75	47.12	55
4	SW corner of the Project area	50.31	50.05	51.24	50.53	55	54.00	48.07	46.06	49.38	55
5	Project site near Shapmari area	49.70	49.34	50.24	49.76	55	44.50	45.75	43.49	44.58	55
6	Barni, Gaurambha	47.60	45.05	49.04	47.23	60	50.06	45.93	46.40	47.46	60
7	Khan Jahan Ali Bridge, Khulna	56.46	56.93	62.42	58.60	70	55.75	NM	NM	55.75	70
8	Mongla Port area	55.95	56.99	59.19	57.38	75	55.41	55.09	54.75	55.08	75
9	Harbaria, Sundarbans	52.31	46.44	NM	49.37	50	42.95	38.59	NM	40.77	50
10	Akram Point, Sundarbans	46.22	39.94	NM	43.08	50	41.97	NM	41.01	41.49	50
11	Hiron Point, Sundarbans	NM	NM	NM	NM	50	NM	NM	NM	NM	50

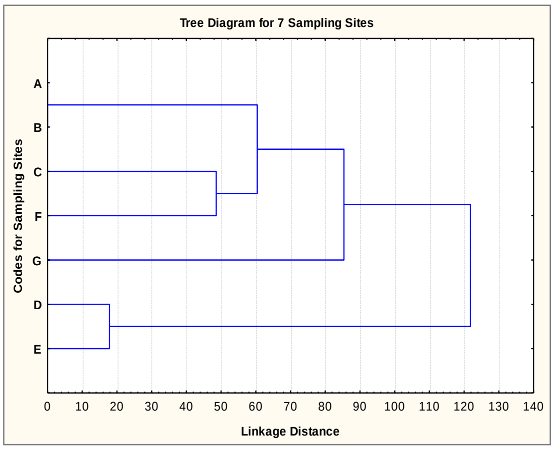
*Source: CEGIS field Survey; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

(D) Fisheries resources monitoring data

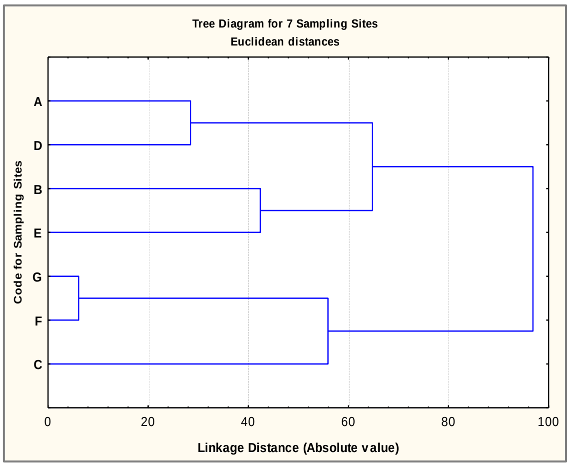
D1: Classification of functional habitat



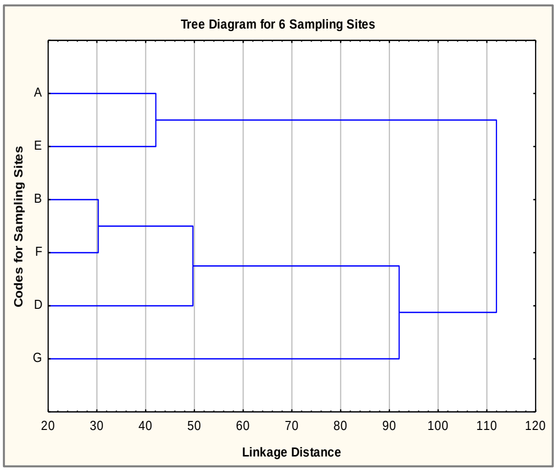
1st Monitoring, April, 2014



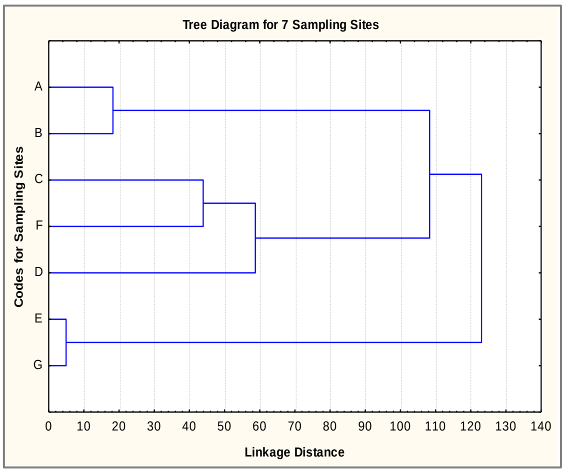
2nd Monitoring, July 2014



3rd Monitoring, October, 2014



4th Monitoring, January 2015



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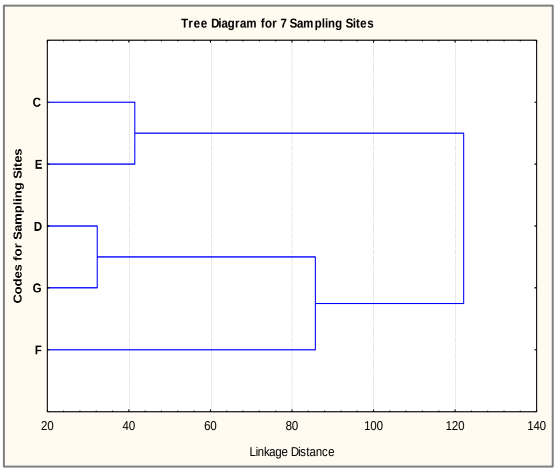
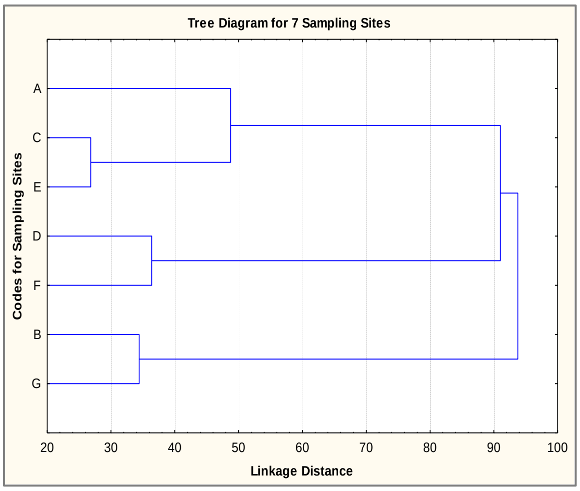
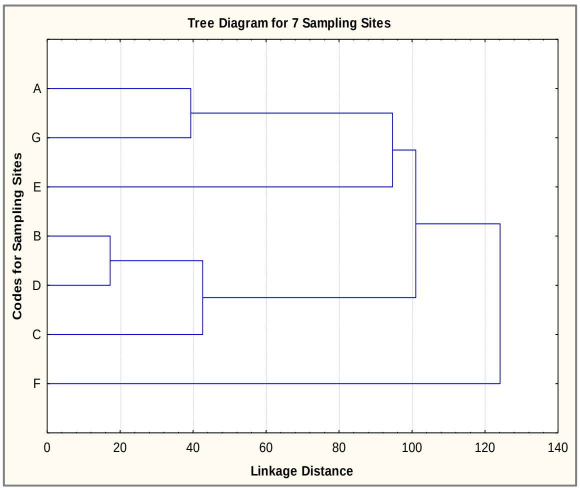


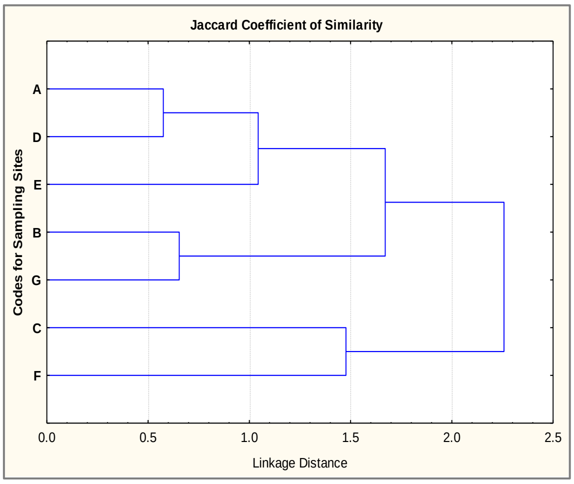
6th Monitoring, August, 2015

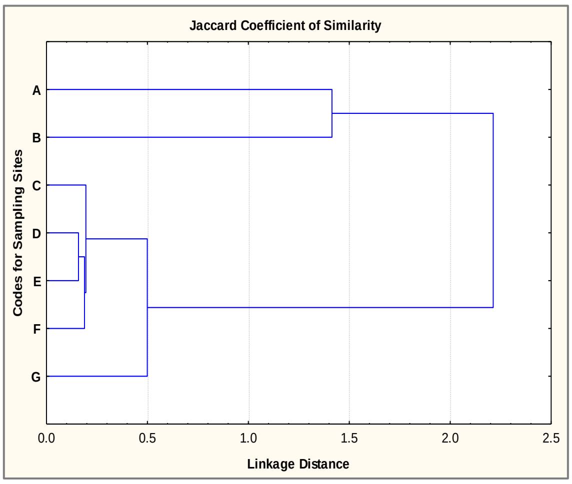


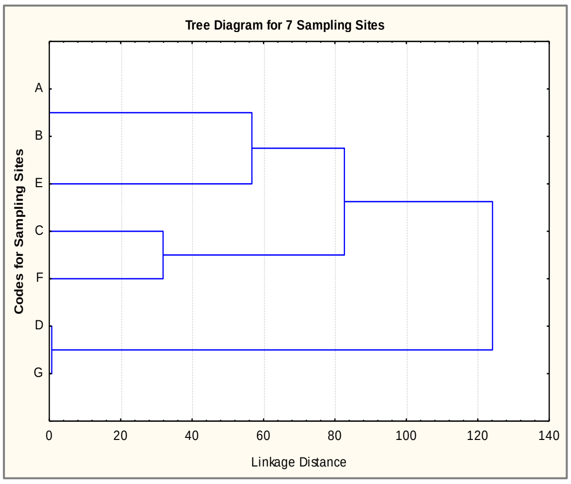


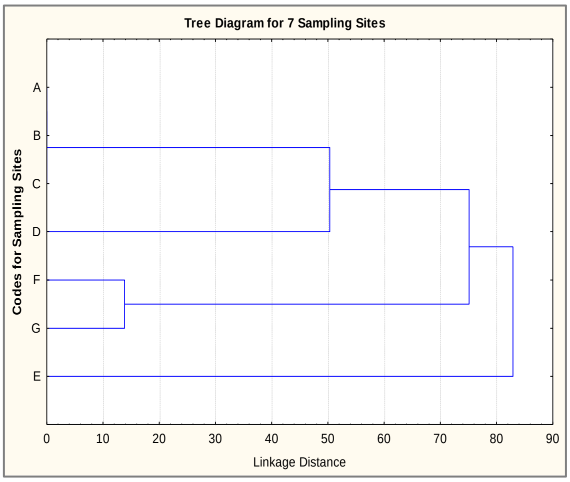
7th Monitoring, October, 2015

8th Monitoring, January, 2016



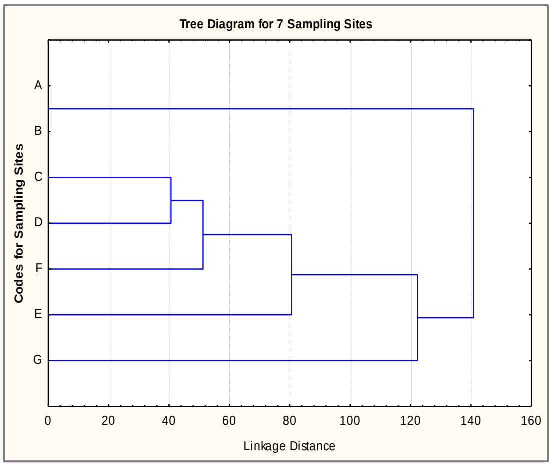




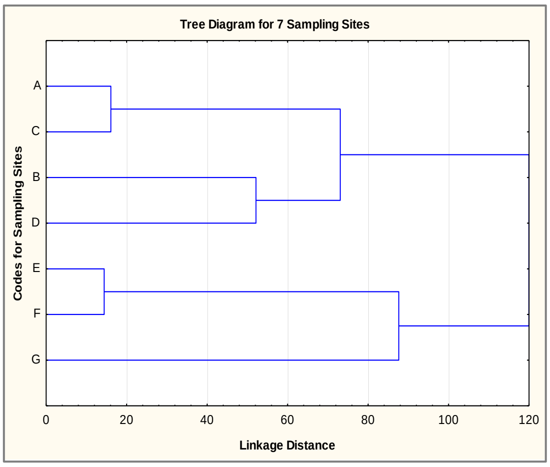


9th Monitoring, April, 2016

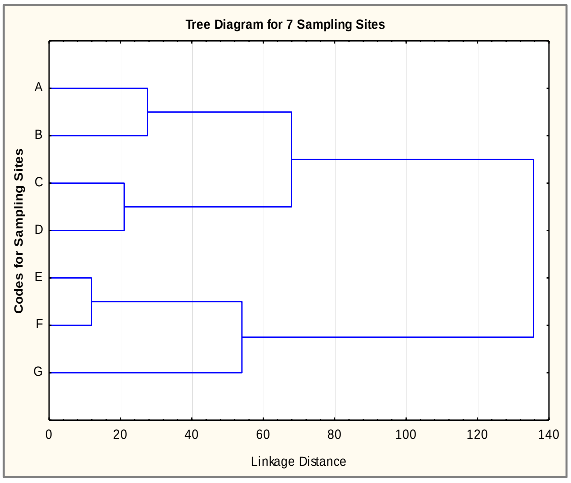
10th Monitoring, July, 2016



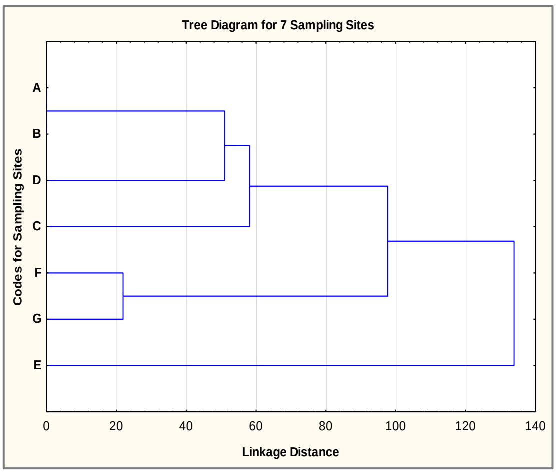
11th Monitoring, October, 2016



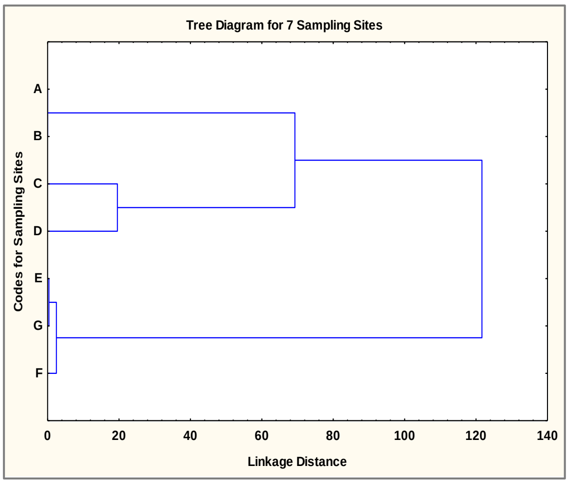
12th Monitoring, January, 2017



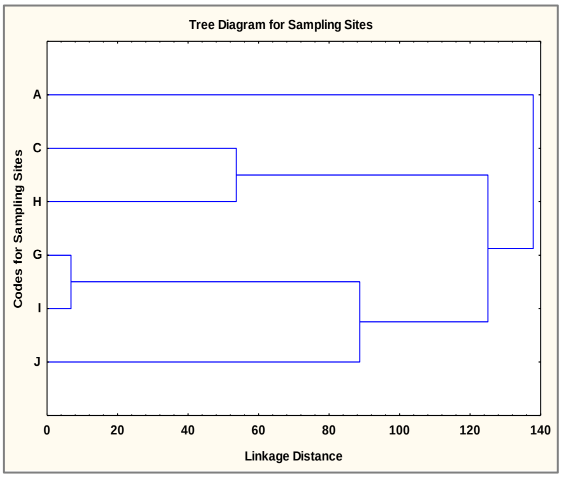
13th Monitoring, April, 2017



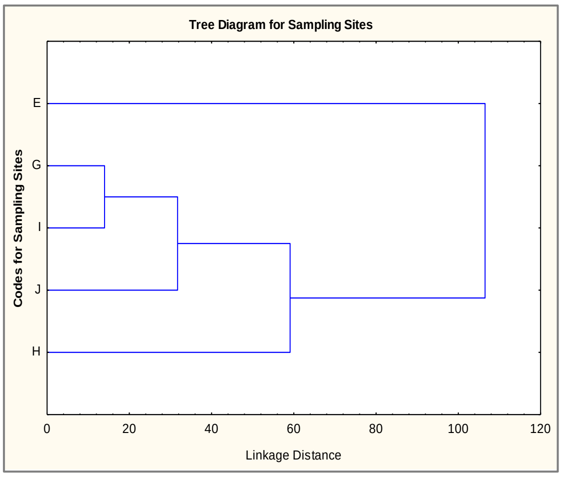
14th Monitoring, October, 2017



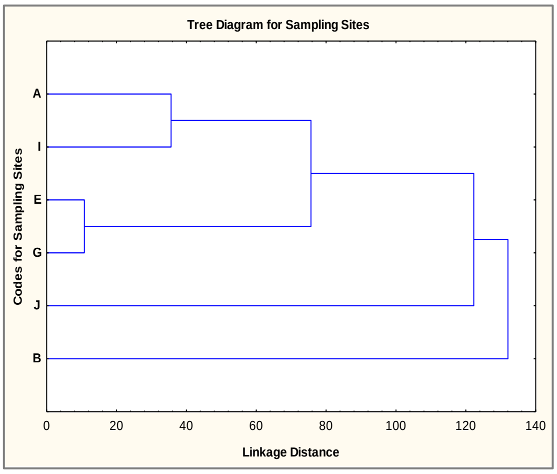
15th Monitoring, January, 2018



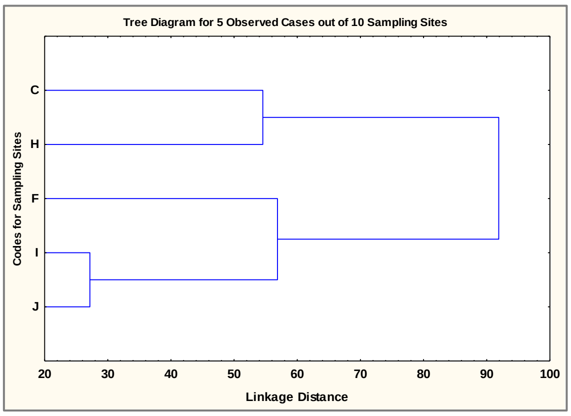
16th Monitoring, April, 2018



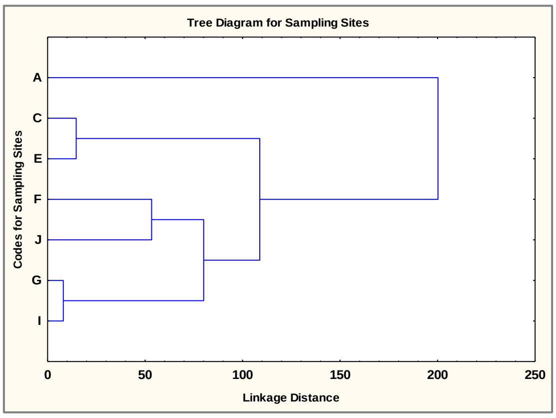
17th Monitoring, July, 2018



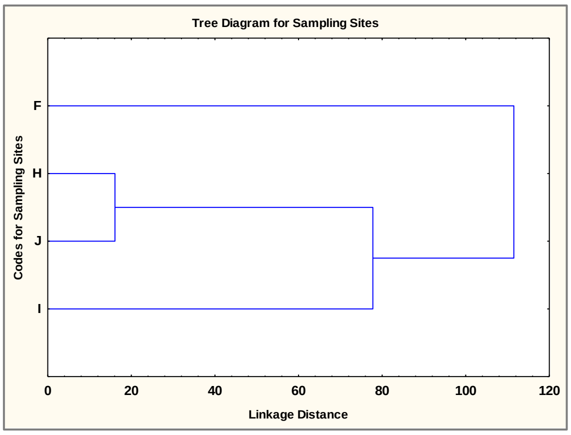
18th Monitoring, November, 2018



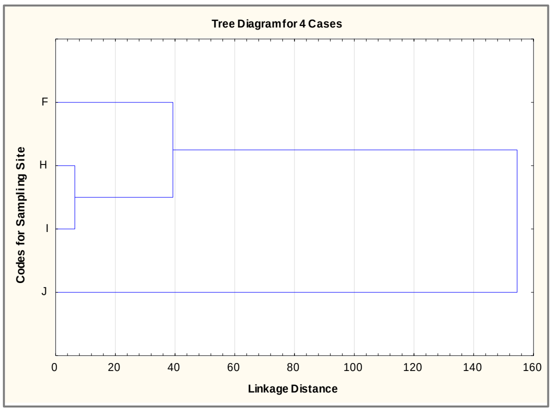
19th Monitoring, February, 2019



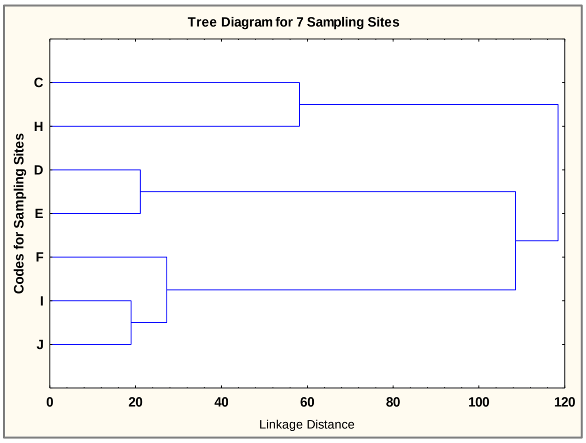
20th Monitoring, April, 2019



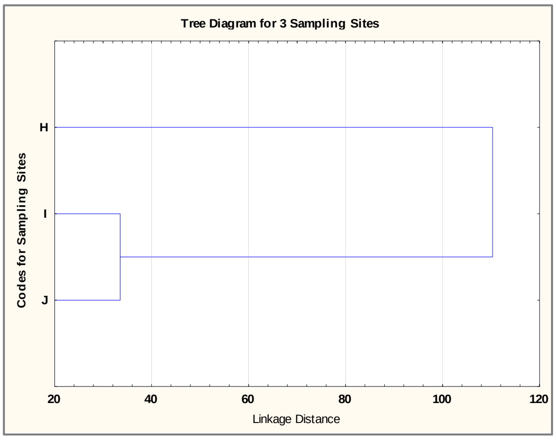
21st Monitoring, July 2019



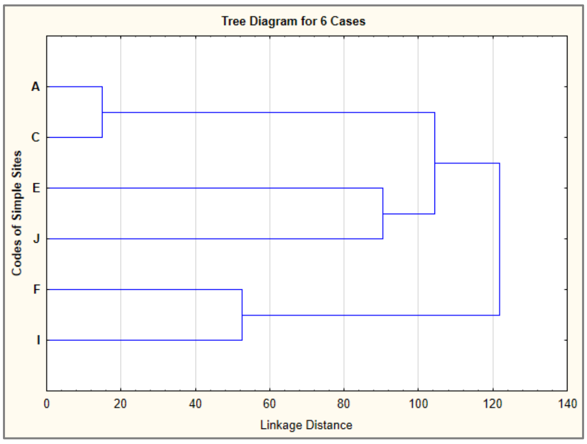
22nd Monitoring, November, 2019



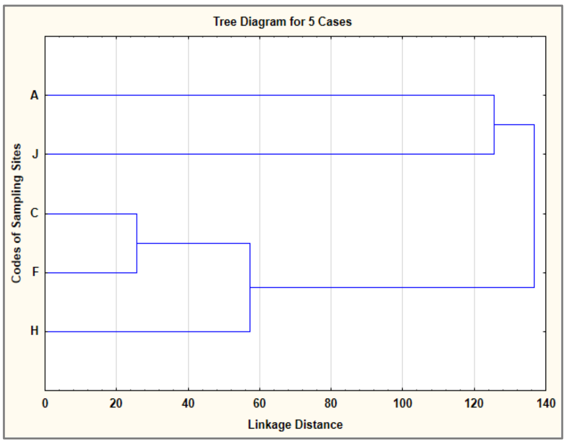
23rd Monitoring, February 2020



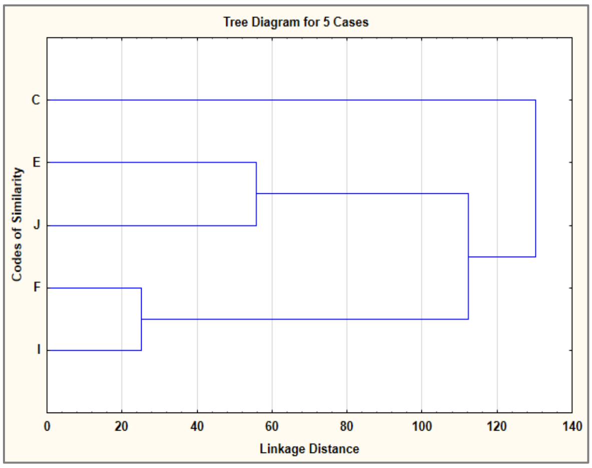
25th Monitoring, July 2020



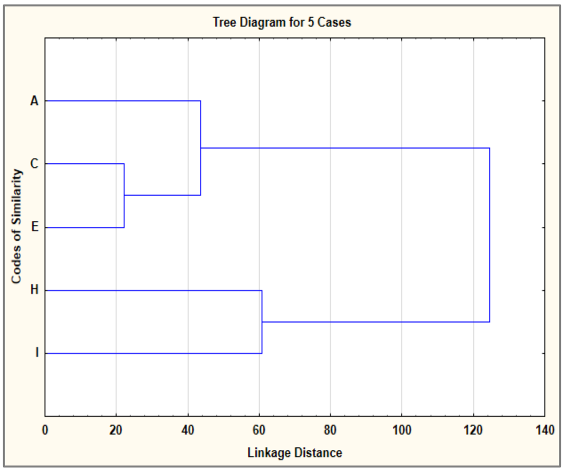
26th Monitoring, November 2020



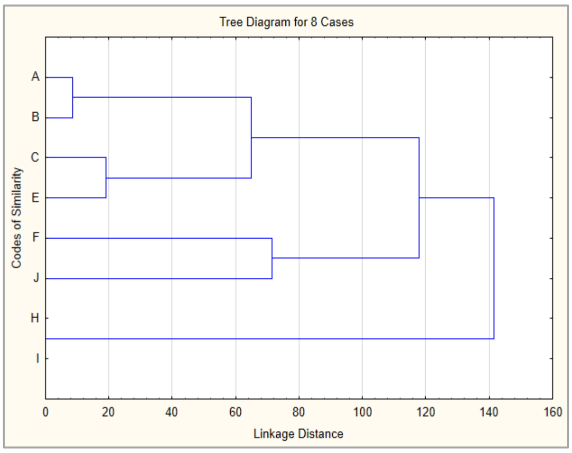
27th Monitoring, January 2021



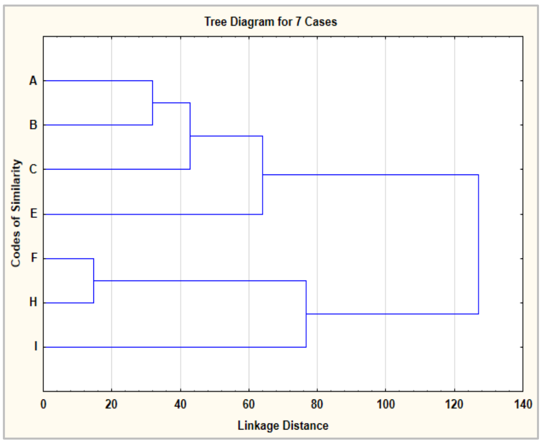
28th monitoring, April 2021



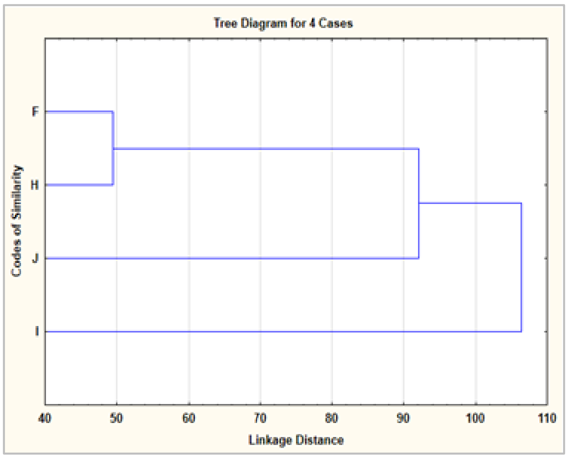
29th Monitoring, August 2021



30th Monitoring, November 2021

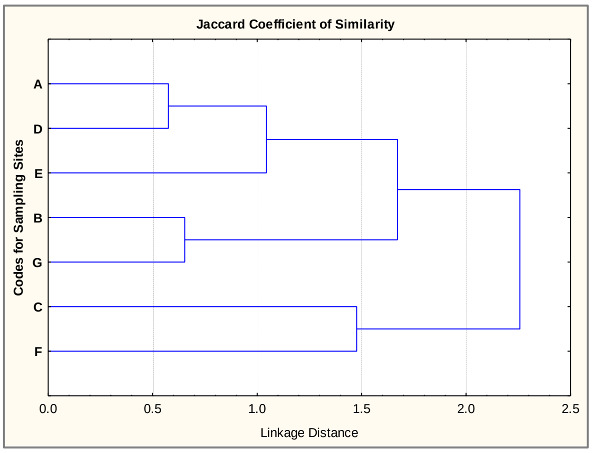


31st Monitoring, February, 2022

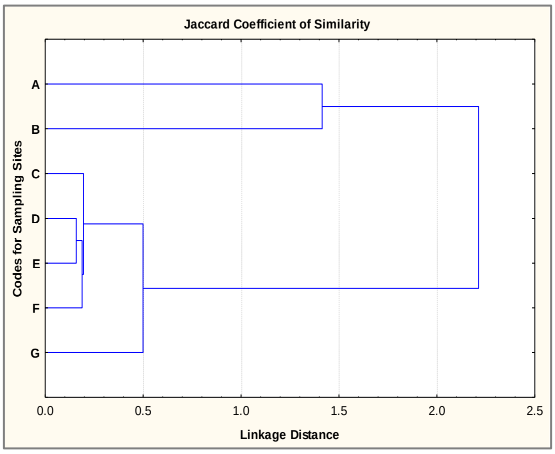


32nd Monitoring, May 2022

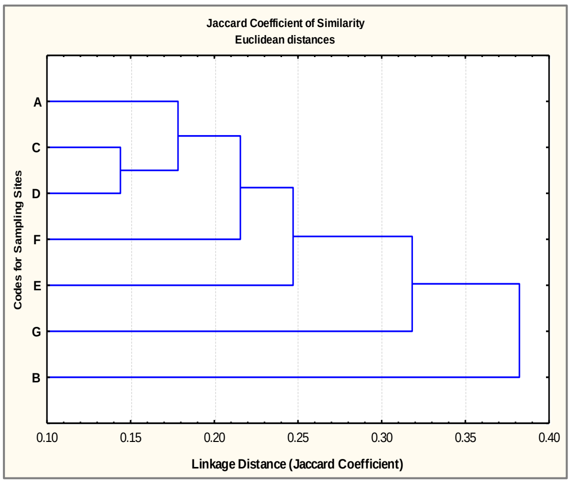
D2: Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence



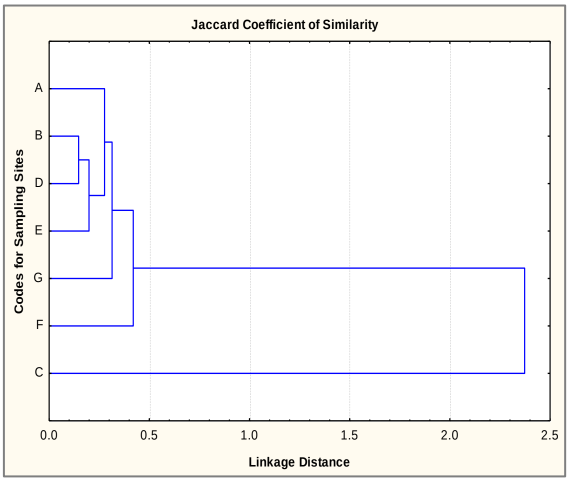
1st Monitoring, April, 2014



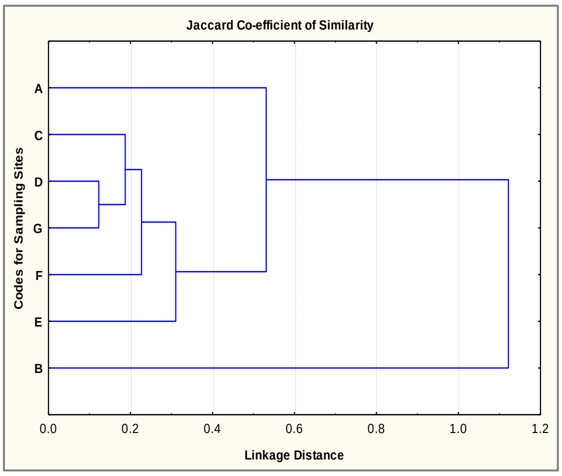
2nd Monitoring, July 2014



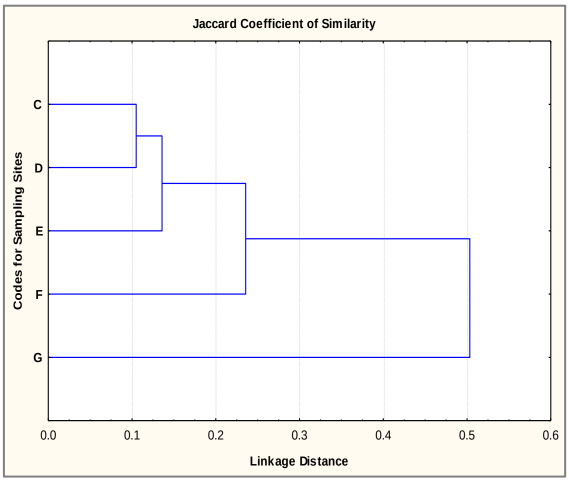
3rd Monitoring, October, 2014



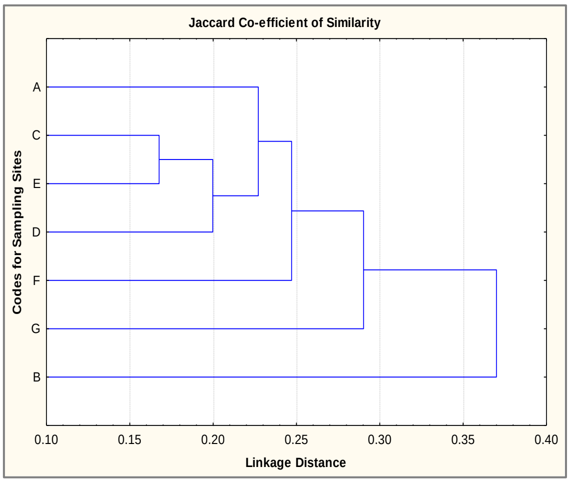
4th Monitoring, January 2015



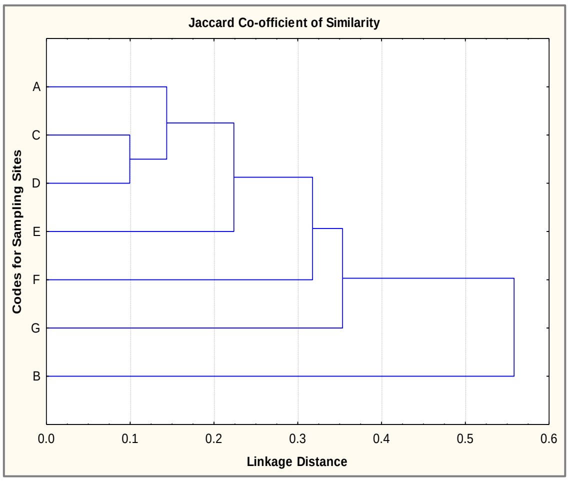
5th Monitoring, April, 2015



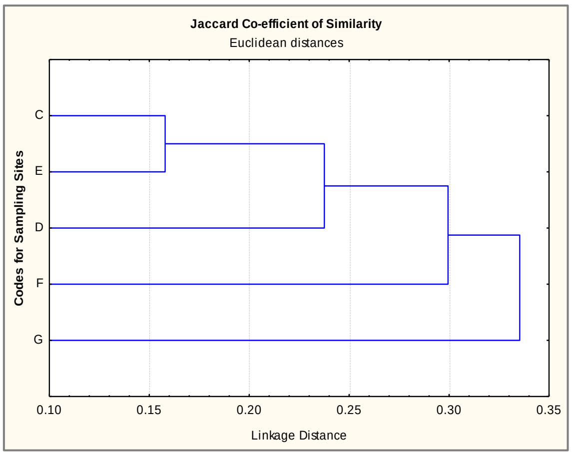
6th Monitoring, August, 2015



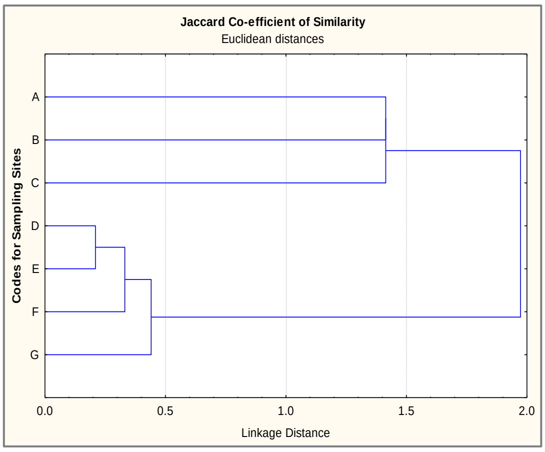
7th Monitoring, October, 2015



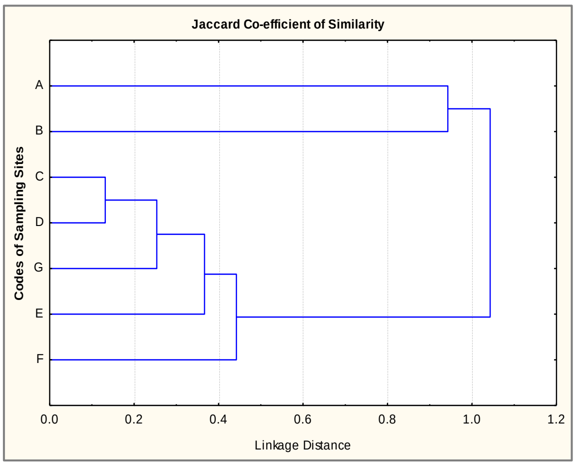
8th Monitoring, January, 2016



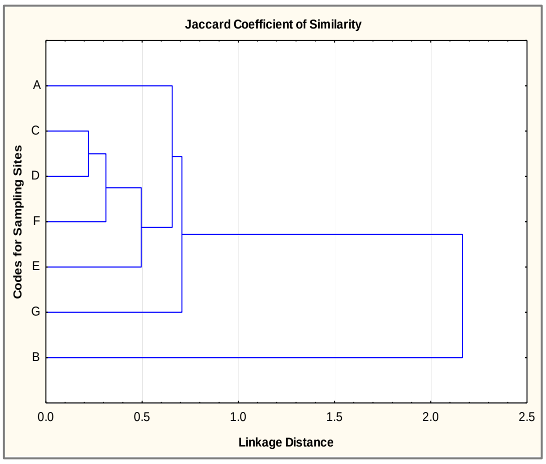
9th Monitoring, April, 2016



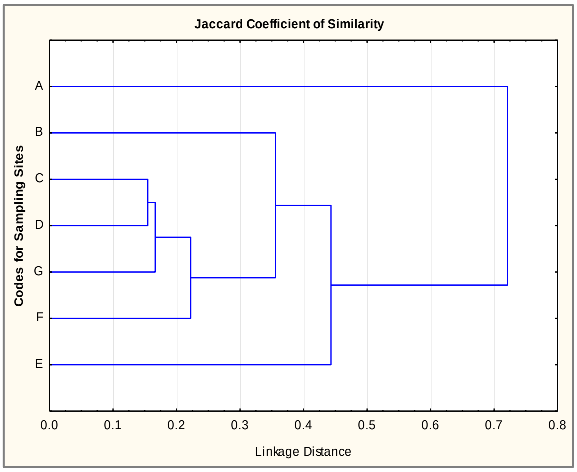
10th Monitoring, July, 2016



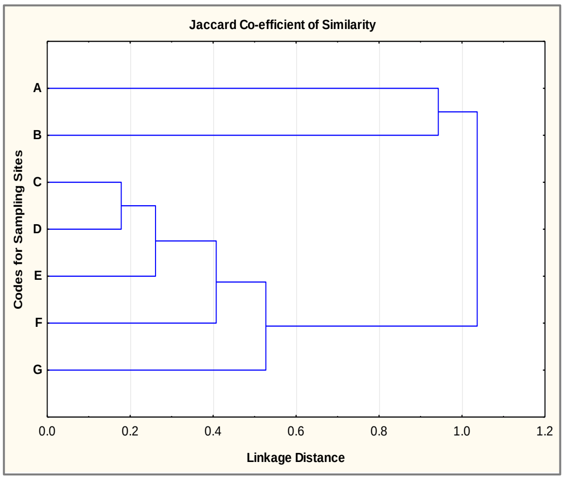
11th Monitoring, October, 2016



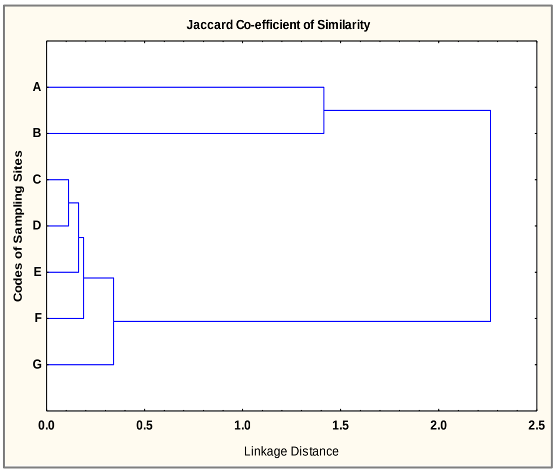
12th Monitoring, January, 2017



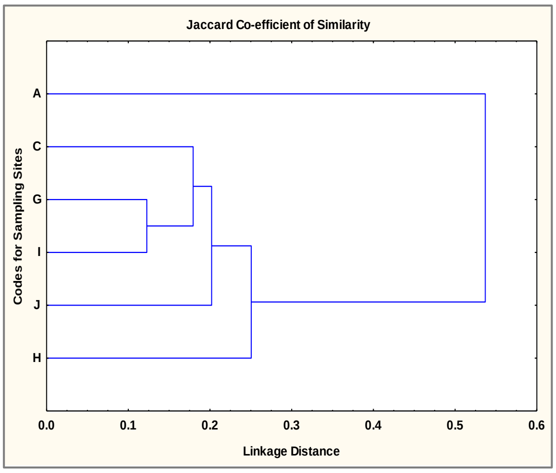
13th Monitoring, April, 2017



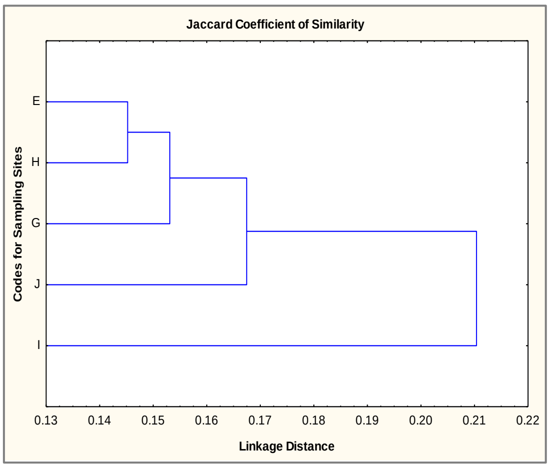
14th Monitoring, October, 2017



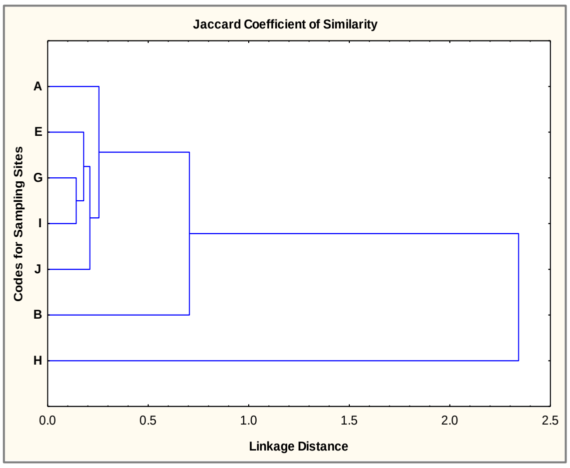
15th Monitoring, January, 2018



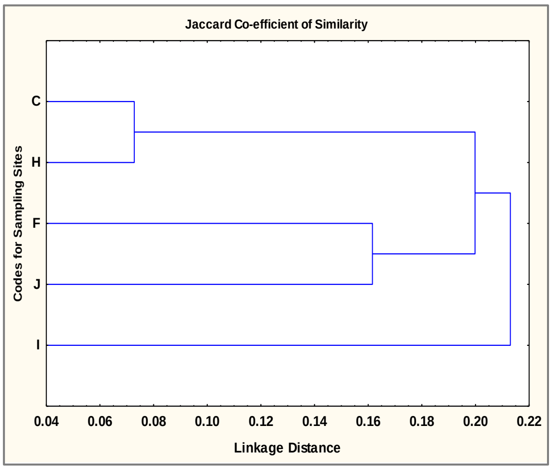
16th Monitoring, April, 2018



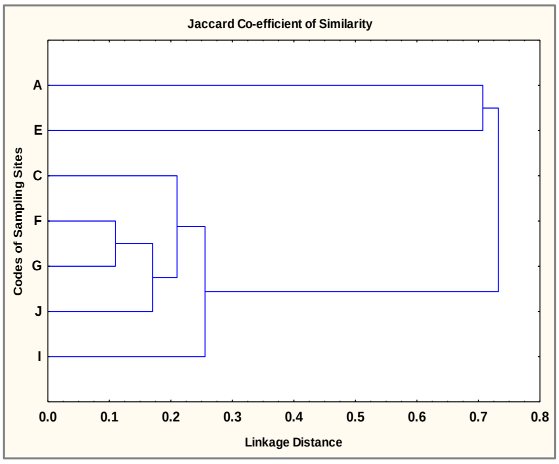
17th Monitoring, July, 2018



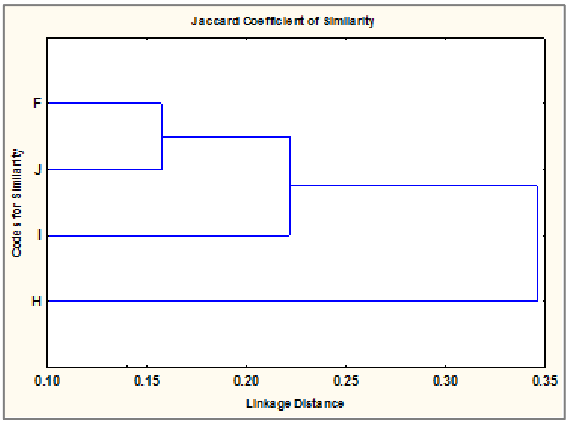
18th Monitoring, November, 2018



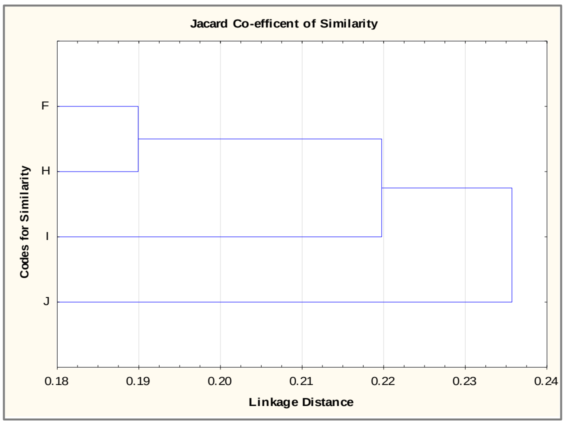
19th Monitoring, February, 2019



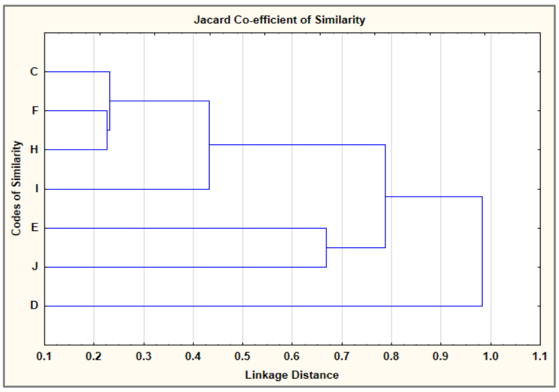
20th Monitoring, April, 2019



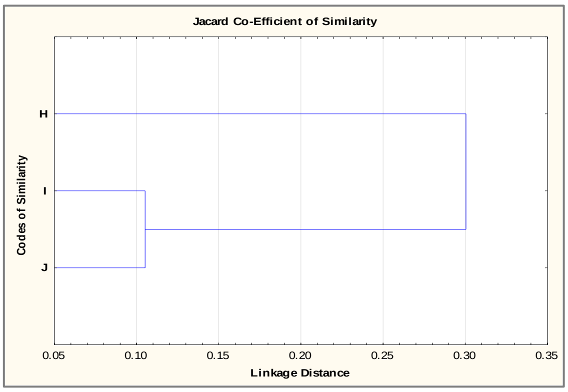
21st Monitoring, July 2019



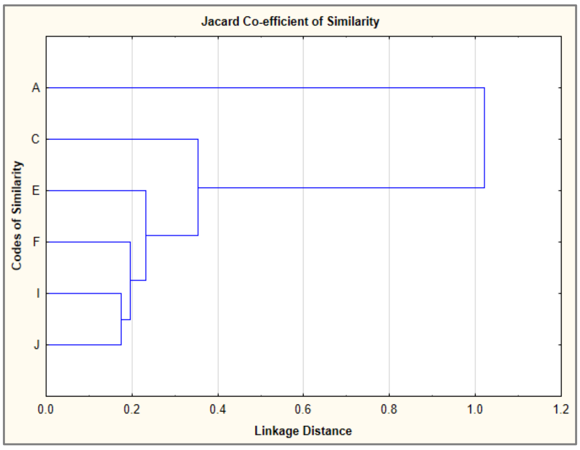
22nd Monitoring, November 2019



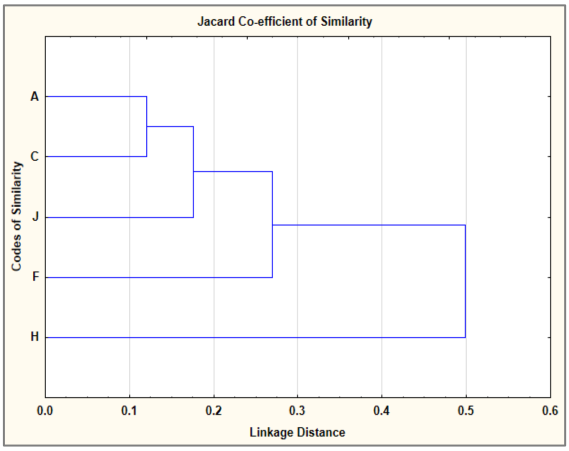
23rd Monitoring, February 2020



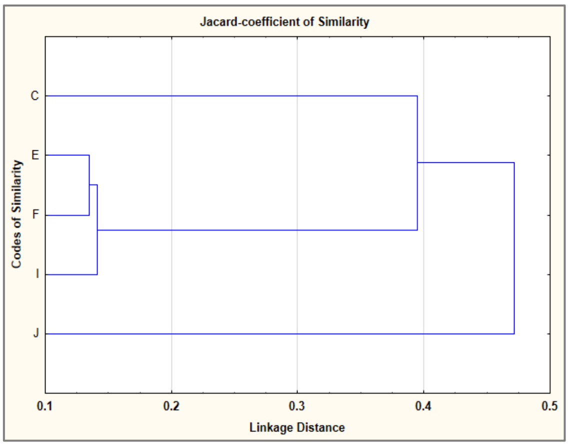
25th Monitoring, July 2020



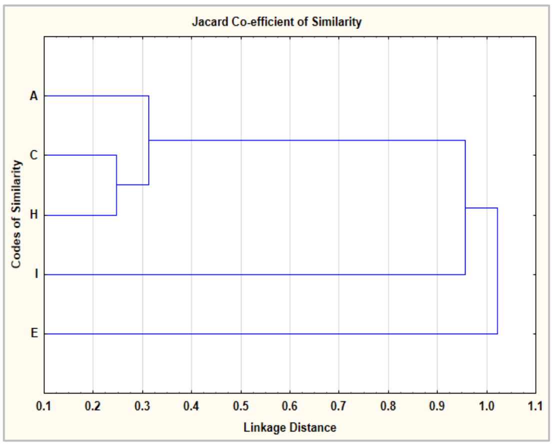
26th Monitoring, November, 2020



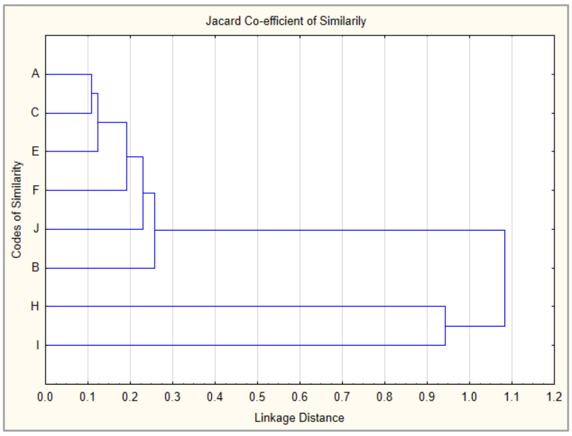
27th Monitoring, January, 2021



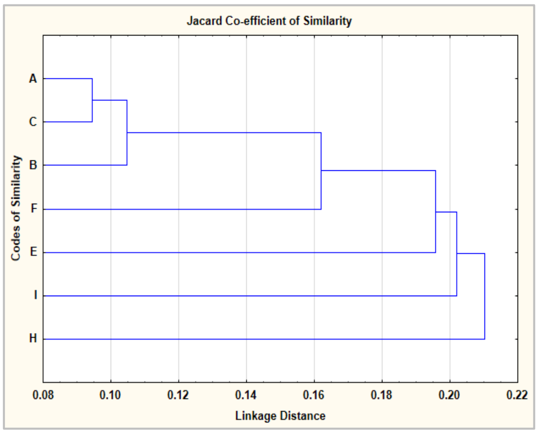
28th monitoring, April, 2021



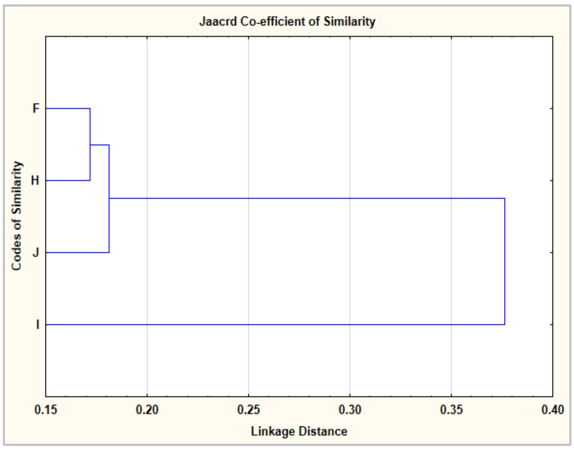
29th monitoring, August, 2021



30th Monitoring, November 2021

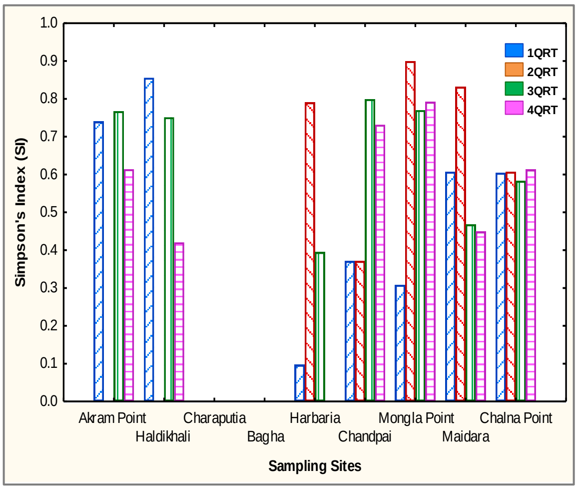


31st Monitoring, February, 2022

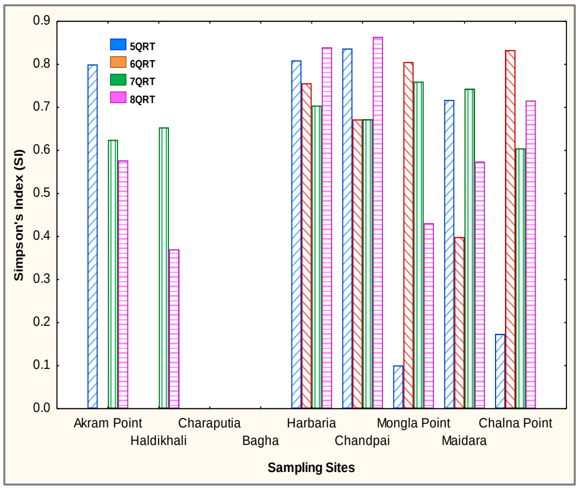


32nd Monitoring, May 2022

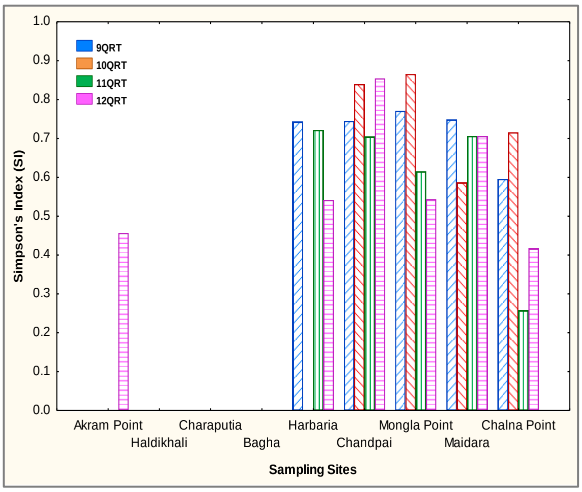
D.3: Site-wise fish species richness (FSR) in the Passur River System



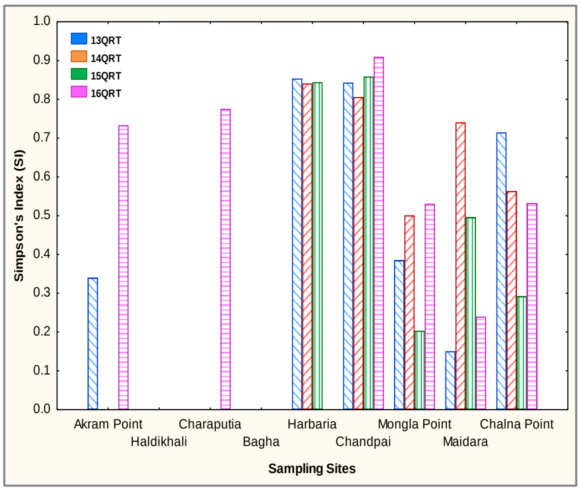
2014-2015



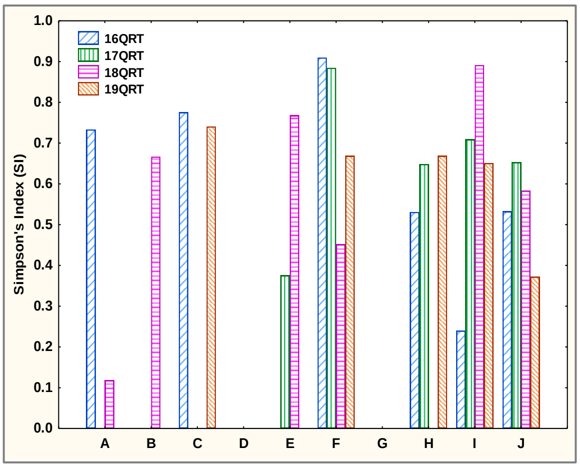
2015-2016



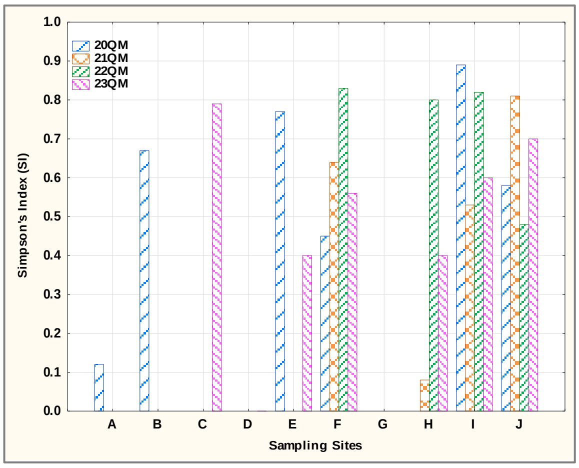
2016-2017



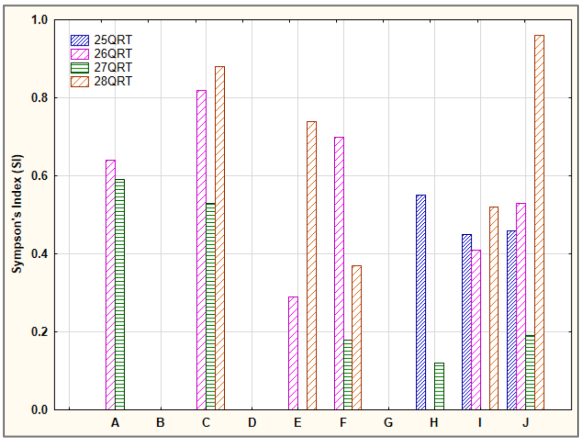
2017-18



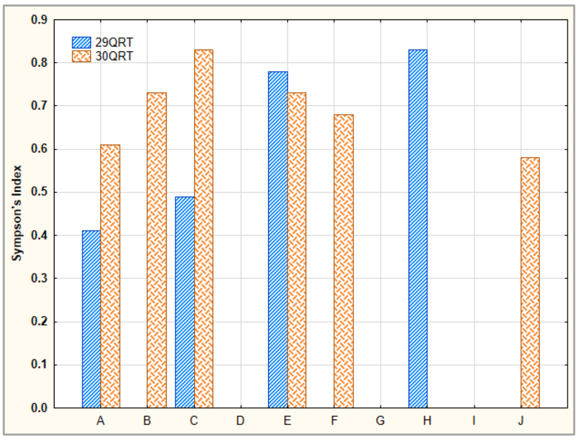
2018-19



2019-20

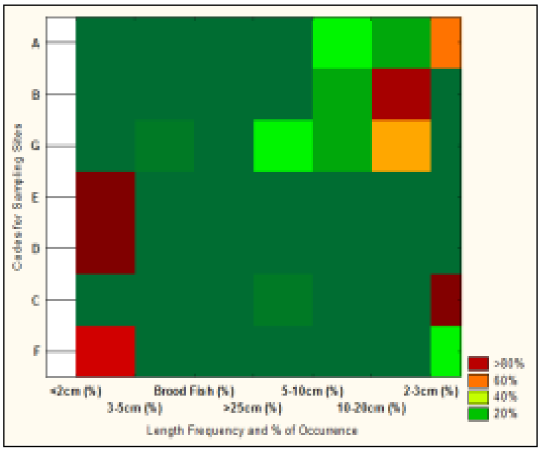


2020-21

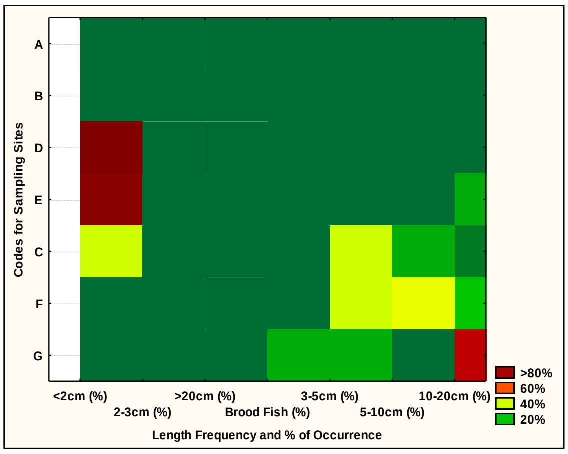


2021-2022

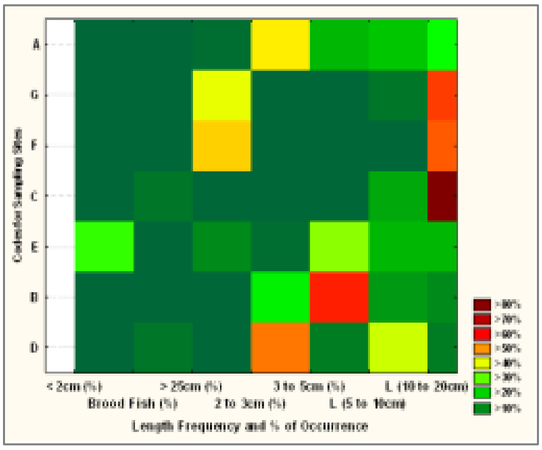
D4: Fish Community Structure



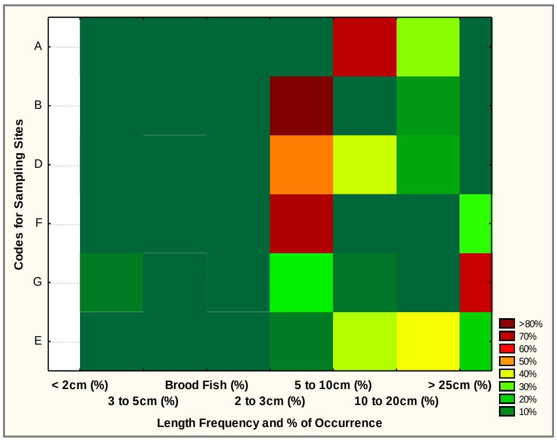
1st Monitoring, April, 2014



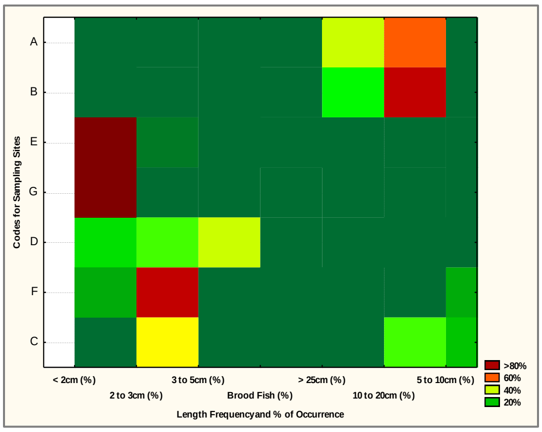
2nd Monitoring, July 2014



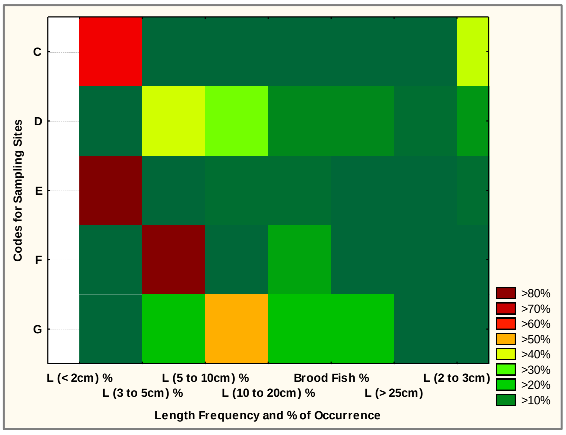
3rd Monitoring, October, 2014



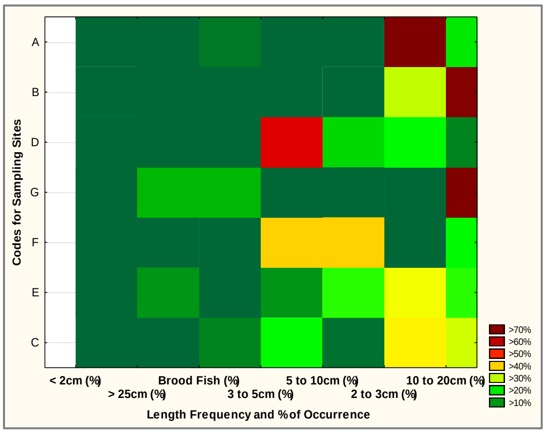
4th Monitoring, January 2015



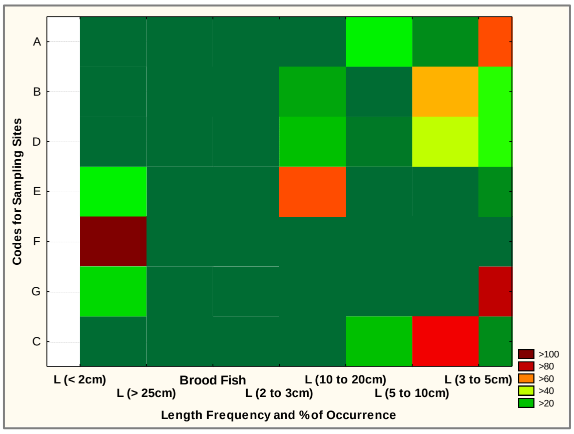
5th Monitoring, April, 2015



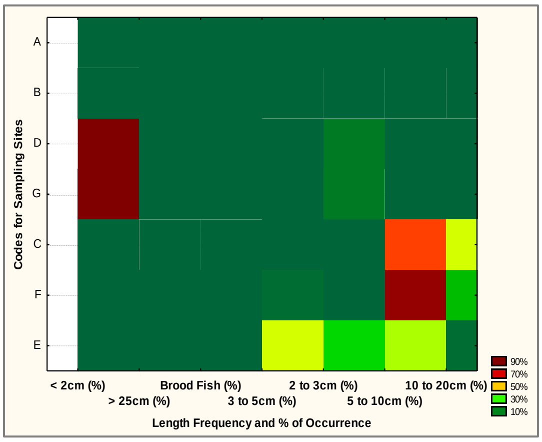
6th Monitoring, August, 2015



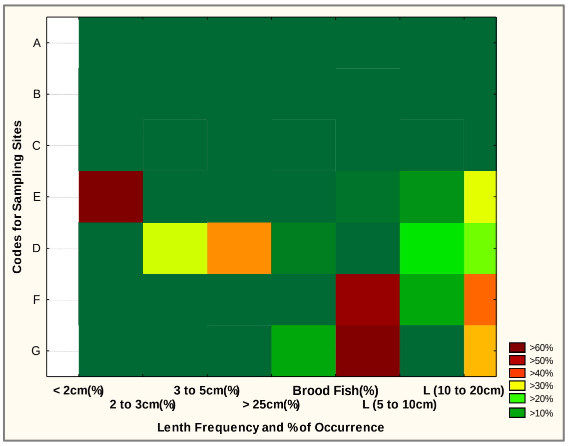
7th Monitoring, October, 2015



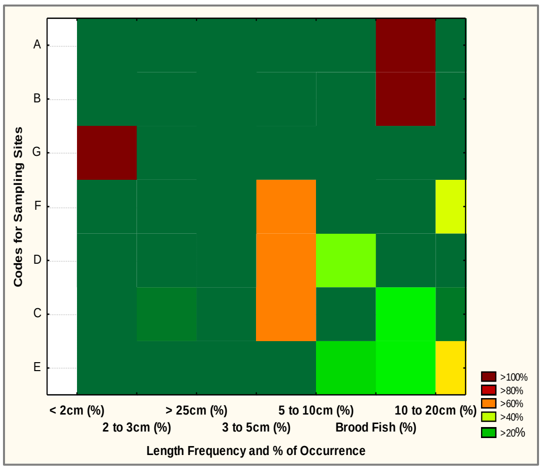
8th Monitoring, January, 2016



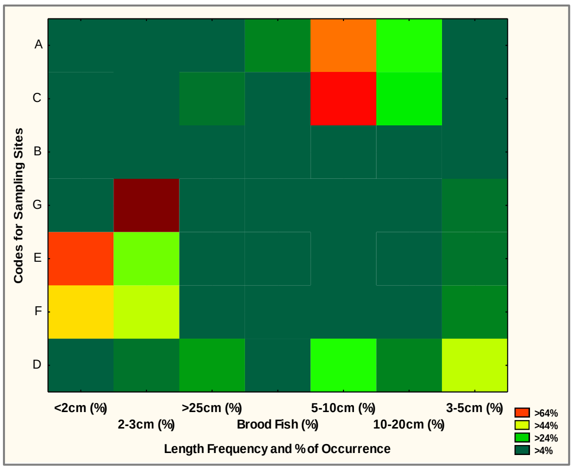
9th Monitoring, April, 2016



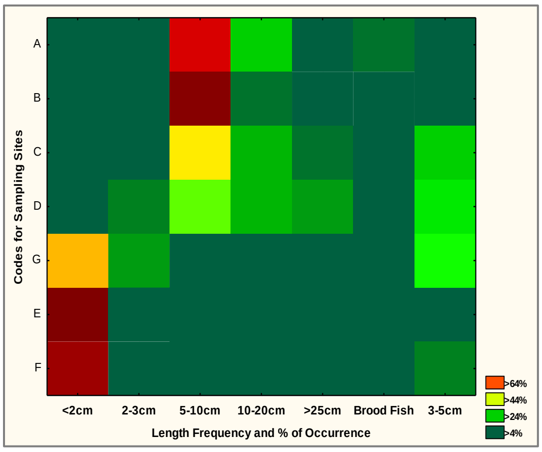
10th Monitoring, July, 2016



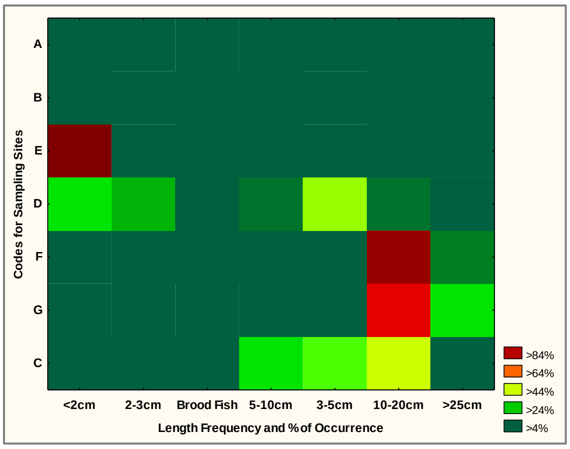
11th Monitoring, October, 2016



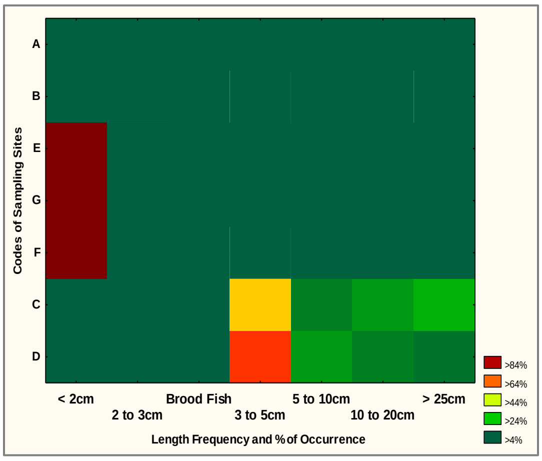
12th Monitoring, January, 2017



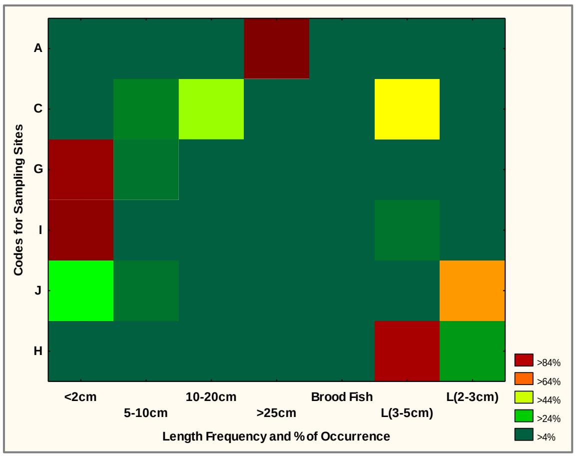
13th Monitoring, April, 2017



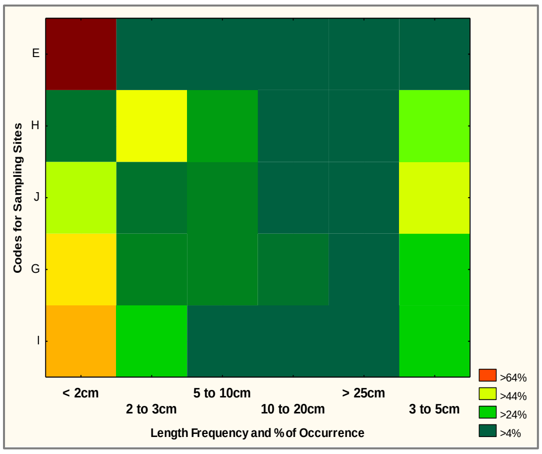
14th Monitoring, October, 2017



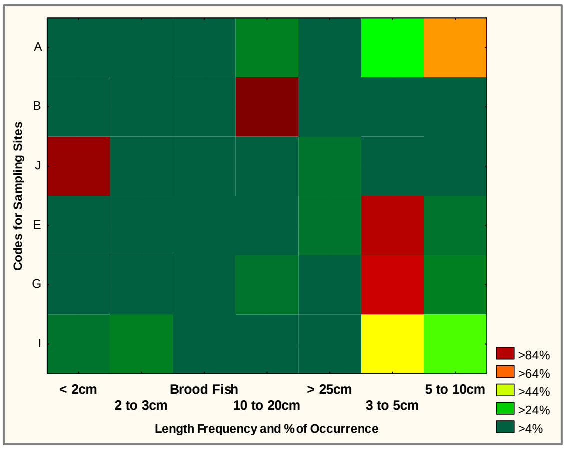
15th Monitoring, January, 2018



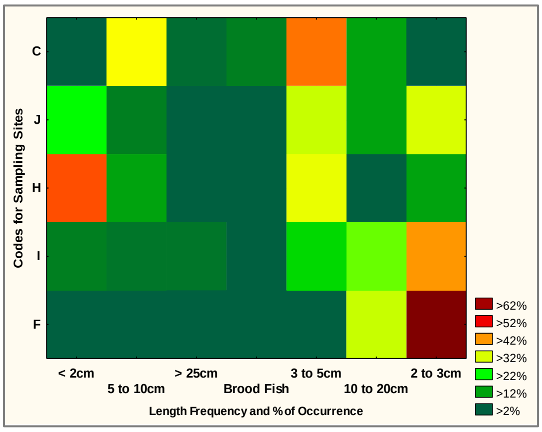
16th Monitoring, April, 2018



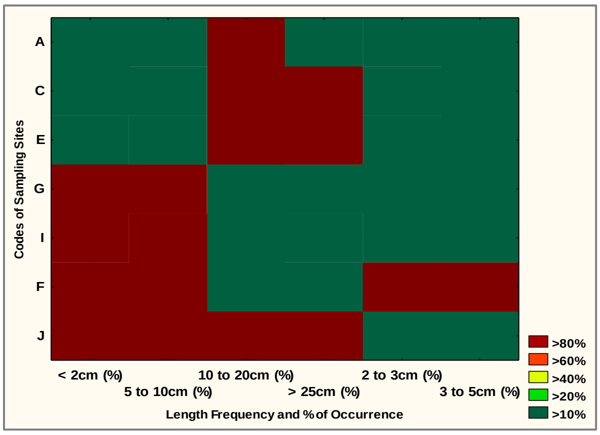
17th Monitoring, July, 2018



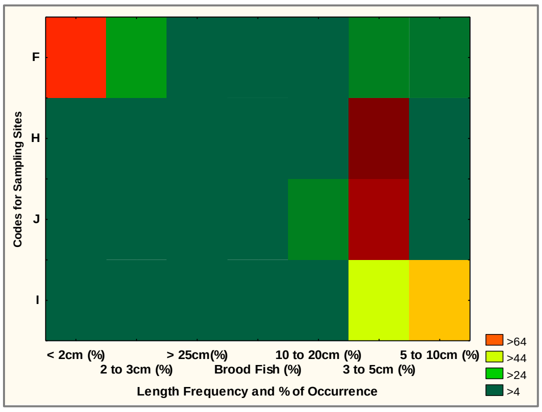
18th Monitoring, November, 2018



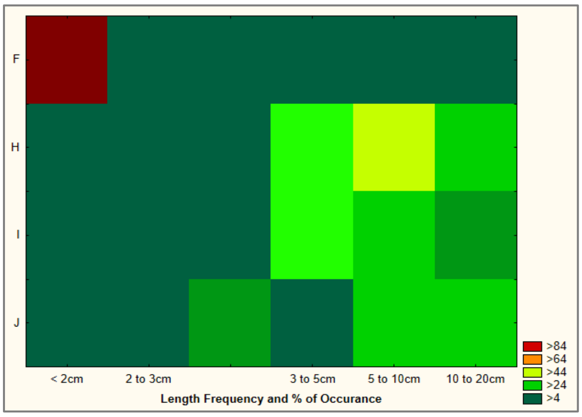
19th Monitoring, February, 2019



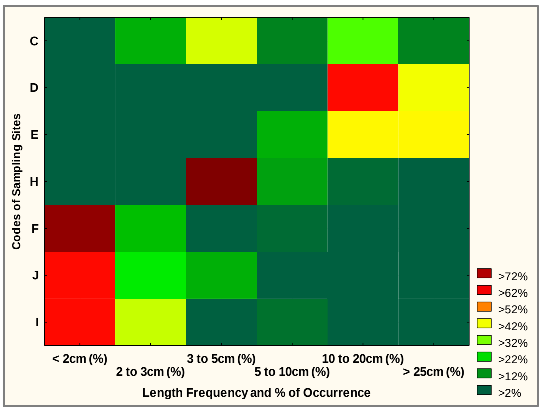
20th Monitoring, April, 2019



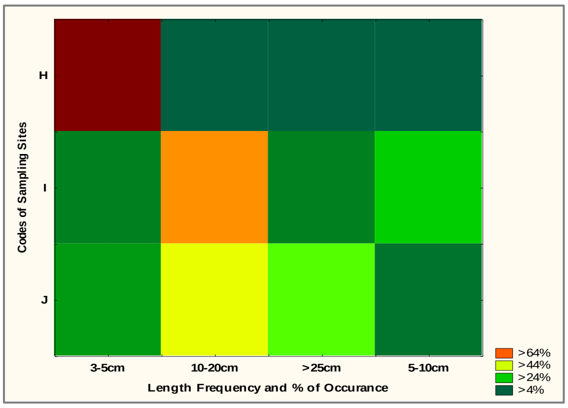
21st Monitoring, July 2019



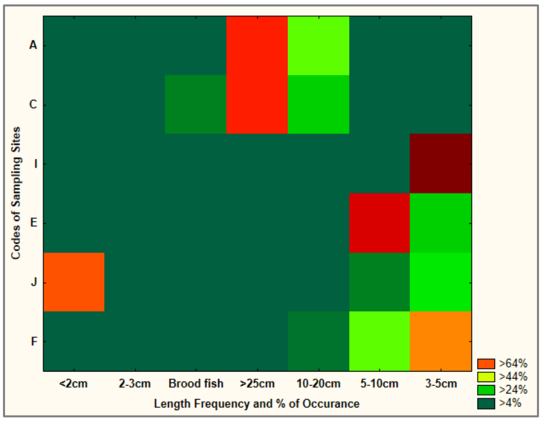
22nd Monitoring, November 2019



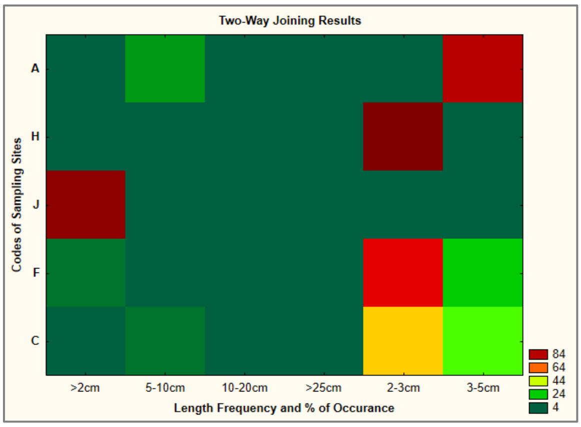
23rd Monitoring, February 2020



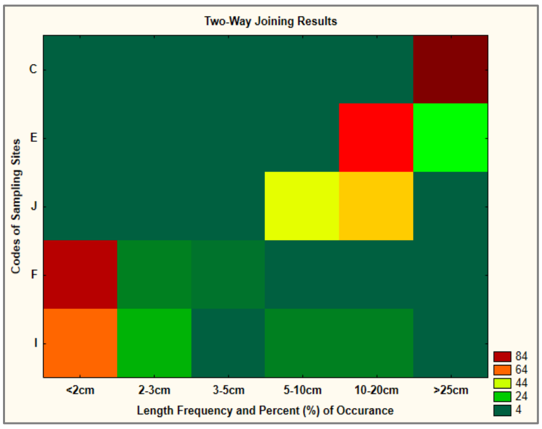
25th Monitoring, July 2020



26th Monitoring, November 2021

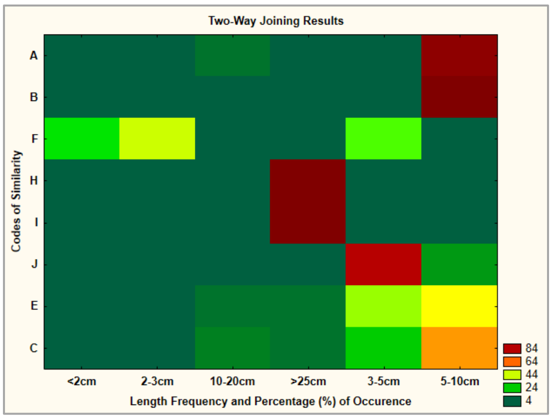


27th Monitoring, January, 2021

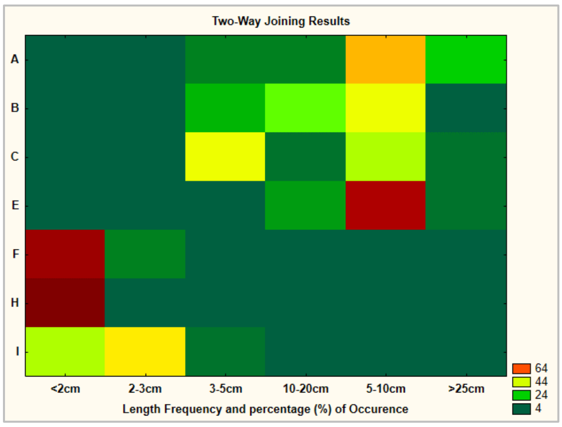


28th monitoring, April, 2021

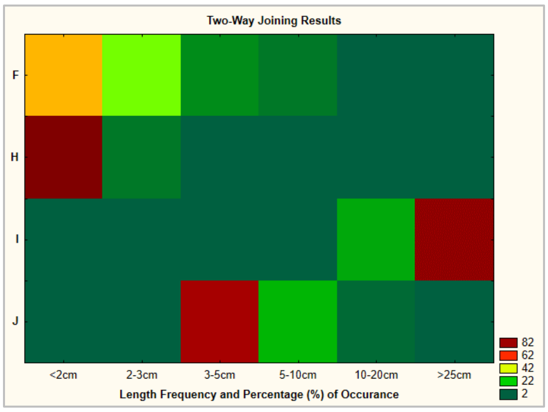
29th monitoring, August, 2021



30th Monitoring, November, 2021



31st Monitoring, February, 2022



32nd Monitoring, May 2022

D.4: Occurrence of Species

Local Name	Scientific Name	Local Status*	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
			‘-‘ = No; ‘+’ = Occurrence											
Hilsa	*Tenualosa ilisha*	NO	-	-	+	-	-	+	+	-	-	-	+	-
Sagor Baim	*Anguilla bengalensis*	NT	+	-	-	-	-	+	-	-	-	-	-	-
Bacha	*Eutropiichthys vacha*	CR	+	-	-	-	-	-	-	-	-	+	-	-
Bagda Chingri	*Penaeus monodon*	DD	+	+	+	+	+	+	+	+	+	+	-	+
Banspata	*Brachypleura novae-zeelandiae*	NO	+	+	+	+	-	+	+	+	+	-	+	+
Kukurjib	*Cynoglossus lingua*	NO	+	-	-	-	-	-	-	+	+	+	-	+
Bele	*Glossogobius giuris*	NO	+	+	+	+	+	+	+	+	+	-	+	+
Aswine Bele	*Butis butis*	NO	-	-	-	-	-	-	+	+	+	+	+	+
Bairagi	*Coilia dussumieri*	NO	+	+	+	+	+	+	-	+	-	-	-	+
Boishakhi Chingri	*Macrobrachium* sp.	NO	-	+	-	-	+	+	+	+	+	-	-	-
Chammu Chingri	*Metapenaeus brevicornis*	DD	+	+	+	-	+	+	+	+	+	+	+	-
Chaka Chingri	*Penaeus indicus*	DD	+	+	-	+	+	+	+	+	+	-	+	-
Ghora Chela	*Securicula gora*	-	+	-	-	-	-	-	-	-	-	-	-	-
Chanda Chela	*Securicula* sp.	-	-	+	+	-	-	-	-	-	+	+	-	-
Sada Chewa	*Trepauchen vagina*	NO	+	-	+	-	-	+	-	-	-	+	-	-
Lal Chewa	*Taenioides cirratus*	NO	+	+	+	+	+	+	+	+	+	-	-	-
Chhuri	*Trichiurus muticus*	NO	+	-	+	-	-	-	-	-	-	-	-	-
Sagor Chela	*Megalops cyprinoids*	NO	+	-	-	-	-	-	-	-	-	-	-	-
Purabi Chela	*Thryssa purava*	NO	+	-	-	-	-	-	-	-	-	-	-	-
Kabashi Tengra	*Mystus cavasius*	DD	+	-	-	-	-	-	-	-	-	-	-	-
Gagra Tengra	*Nemapteryx nenga*	DD	-	+	+	-	+	-	+	-	+	+	+	+
Gulsha Tengra	*Mystus bleekery*	DD	+	+	-	+	-	+	+	+	+	+	+	+
Harina Chingri	*Metapenaeus ensis*	DD	+	+	+	+	+	+	+	+	+	-	+	-
Ekthuto	*Hyporhampus limbatus*	NO	+	-	+	+	-	-	-	+	+	-	+	-
Kakila	*Xenentodon cancila*	NO	+	-	-	-	-	-	-	-	-	-	+	-
Chapila	*Gudusia chapra*	NO	+	+	-	-	-	-	-	-	-	+	-	-
Kuchia	*Monopterus cuchia*	DD	+	+	-	+	+	+	+	+	+	+	+	+
Loitta	*Harpodon nehereus*	NO	+	+	+	-	+	-	-	-	+	+	-	-
Motka Chingri	*Macrobrachium villosimanusless*	DD	+	+	+	+	+	+	+	+	+	+	+	-

Local Name	Scientific Name	Local Status*	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
			'-' = No; '+' = Occurrence											
Mud Crab	*Scylla serrata*	NO	+	-	+	+	+	+	+	+	+	-	+	+
Tular Dandi	*Sillaginopsis panijus*	NO	+	-	+	-	+	-	+	-	-	-	+	-
Paira Chanda	*Scatophagus argus*	DD	+	-	-	-	-	-	-	-	-	+	-	-
Paissa	*Liza parsia*	NO	+	+	+	+	+	+	+	+	+	+	+	+
Pangas	*Pangasius pangasius*	CR	+	-	+	-	-	-	-	+	-	-	-	+
Tak Chanda	*Leiognathus equulus*	NO	+	-	-	-	-	-	+	-	-	+	-	-
Phessa	*Setipinna phasa*	NO	+	+	+	+	+	+	+	+	+	-	+	-
Teli Phessa	*Setipinna phasa*	DD	-	-	+	-	-	-	-	-	-	+	-	-
Poma	*Poma poma*	NO	+	+	+	+	+	+	+	+	+	+	+	+
Potka	*Chelonodon patoca*	NO	+	+	-	+	+	+	-	+	+	-	+	+
Shilong	*Silonia silondia*	EN	+	-	+	-	-	-	-	-	-	-	+	-
Tailla	*Eleutheronema tetradactylum*	DD	+	-	-	-	-	-	-	-	-	+	-	-
Tapse	*Polynemus paradiseus*	DD	+	+	+	-	-	+	+	+	-	-	+	+
Daitna	*Acanthopagrus latus*	DD	-	-	-	+	-	-	-	+	+	-	+	+
Shole	*Channa striatus*	DD	-	-	-	+	-	-	-	+	-	-	-	-
Magur	*Clarias batrachus*	DD	-	-	-	+	-	-	-	+	-	-	-	+
Koi	*Anabas testudineus*	DD	-	-	-	+	-	-	-	+	-	+	-	-
Vetki	*Lates calcarifer*	DD	-	-	-	+	+	+	+	+	+	-	+	+

Local Name	Scientific Name	Local Status*	13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
		'-' = No; '+' = Occurrence																				
Hilsa	*Tenualosa ilisha*	NO	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	+	-	+	-	+
Sagor Baim	*Anguilla bengalensis*	NT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bacha	*Eutropiichthys vacha*	CR	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Bagda Chingri	*Penaeus monodon*	DD	+	-	+	+	+	+	+	+	+	+	+	-	-	+	+	+	-	+	+	-
Banspata	*Brachypleura novae-zeelandiae*	NO	+	+	+	+	+	+	+	+	+	-	-	+	+	+	-	+	-	+	+	-
Kukurjib	*Cynoglossus lingua*	NO	-	-	+	-	-	-	+	-	+	+	-	+	-	+	-	+	-	+	-	+
Bele	*Glossogobius giuris*	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+
Aswine Bele	*Butis butis*	NO	+	+	+	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	+	-
Bairagi	*Coilia dussumieri*	NO	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	-	+	+	+

Local Name	Scientific Name	Local Status*	13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
		‘-‘ = No; ‘+’ = Occurrence																				
Boishakhi Chingri	*Macrobrachium* sp.	NO	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Chammu Chingri	*Metapenaeus brevicornis*	DD	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	+	+	-
Chaka Chingri	*Penaeus indicus*	DD	+	-	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	+	+	+
Ghora Chela	*Securicula gora*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chanda Chela	*Securicula* sp.	-	-	-	+	+	+	+	-	-	-	+	+	-	-	-	-	-	-	-	-	-
Sada Chewa	*Trepauchen vagina*	NO	-	-	-	+	-	-	-	+	-	+	-	-	-	-	-	+	-	+	+	-
Lal Chewa	*Taenioides cirratus*	NO	+	+	-	+	+	-	+	+	-	-	+	-	-	-	+	+	-	-	-	-
Chhuri	*Trichiurus muticus*	NO	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Sagor Chela	*Megalops cyprinoids*	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purabi Chela	*Thryssa purava*	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kabashi Tengra	*Mystus cavasius*	DD	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Gagra Tengra	*Nemapteryx nenga*	DD	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	-	+	+	-
Gulsha Tengra	*Mystus bleekery*	DD	+	+	+	+	+	-	+	+	+	-	+	-	-	+	-	-	-	+	-	+
Harina Chingri	*Metapenaeus ensis*	DD	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+
Ekthuto	*Hyporhampus limbatus*	NO	+	+	-	-	+	+	+	+	+	+	-	-	-	+	-	-	+	-	-	-
Kakila	*Xenentodon cancila*	NO	-	+	-	-	+	-	-	-	-	+	-	-	+	-	-	-	+	+	-	-
Chapila	*Gudusia chapra*	NO	-	-	-	-	+	+	+	-	+	+	-	+	+	+	+	-	+	+	+	+
Kuchia	*Monopterus cuchia*	DD	+	+	+	+	+	+	-	+	+	-	+	+	-	+	+	+	-	+	-	+
Loitta	*Harpodon nehereus*	NO	+	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	+	-
Motka Chingri	*Macrobrachium villosimanusless*	DD	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	-	+	+	+
Mud Crab	*Scylla serrata*	NO	+	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	+	+	+	+
Tular Dandi	*Sillaginopsis panijus*	NO	-	+	-	-	-	+	+	+	+	-	-	-	+	-	+	-	+	-	+	-
Paira Chanda	*Scatophagus argus*	DD	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	+	-	-
Paissa	*Liza parsia*	NO	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+
Pangas	*Pangasius pangasius*	CR	-	-	-	-	-	+	+	+	+	+	-	-	-	-	-	+	+	+	-	-
Tak Chanda	*Leiognathus equulus*	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pheksa	*Setipinna phasa*	NO	+	+	-	+	-	-	+	+	+	+	+	-	+	-	+	+	-	+	-	-
Teli Pheksa	*Setipinna phasa*	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Poma	*Poma poma*	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+
Potka	*Chelonodon patoca*	NO	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	+	-	+	+	-

Local Name	Scientific Name	Local Status*	13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
		'-' = No; '+' = Occurrence																				
Shilong	*Silonia silondia*	EN	+	+	-	-	-	-	-	-	-	+	-	+	-	-	-	+	+	-	-	-
Tailla	*Eleutheronema tetradactylum*	DD	-	-	-	-	-	+	-	+	+	-	-	-	+	+	-	+	+	-	-	-
Tapse	*Polynemus paradiseus*	DD	-	+	+	+	+	+	+	+	+	-	+	+	+	-	-	+	+	-	+	-
Daitna	*Acanthopagrus latus*	DD	-	+	+	+	-	+	+	+	-	-	+	-	+	+	-	-	-	+	-	-
Shole	*Channa striatus*	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-
Magur	*Clarias batrachus*	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Koi	*Anabas testudineus*	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Vetki	*Lates calcarifer*	DD	+	+	+	+	-	+	+	-	+	-	-	-	+	-	-	+	-	-	-	-

D.5: Length-wise species distribution (%) in sampling sites

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Banspata	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Bele	H	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Chaka Chingri	F	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	I	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Chali	H	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	J	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Chamua	F	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Chapila	J	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Chela	H	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	J	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Chewa	H	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Dogri	H	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	I	0.00	0.00	50.00	0.00	50.00	0.00	0.00
	J	0.00	0.00	50.00	50.00	0.00	0.00	0.00

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Goda Kathali	F	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	H	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Golda	I	33.33	0.00	33.33	0.00	33.33	0.00	0.00
	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Guilla	F	0.00	0.00	50.00	50.00	0.00	0.00	0.00
Harina	F	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	H	0.00	0.00	50.00	50.00	0.00	0.00	0.00
	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	J	0.00	0.00	50.00	50.00	0.00	0.00	0.00
Kuchia	H	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Nandi bele	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	J	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Paissa	F	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	I	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	J	0.00	0.00	33.33	66.67	0.00	0.00	0.00
Poa	J	0.00	0.00	50.00	50.00	0.00	0.00	0.00
Punti	I	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Tengra	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	J	0.00	0.00	50.00	50.00	0.00	0.00	0.00
Tiger Chingri	J	0.00	0.00	50.00	50.00	0.00	0.00	0.00

Source: CEGIS field survey, July 2022

D.6: Purpose, timing and extent of migration for different year-class of migratory fish species

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	**2nd QM**	**3rd QM**	**4th QM**	**5th QM**	**6th QM**	**7th QM**	**8th QM**	**9th QM**	**10th QM**	**11th QM**	**12th QM**
Tapsi	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding and Growing	-	-	-		-	-		-	-
	Akram Point	Juvenile and Age-1 adult	Feeding and Growing	-	-	-	-	-	Feeding	-	-		-	-
		Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Chalna Point	Age-1 adult and Brood fish	Feeding and Growing	Spawning	-	-	-	Feeding	Feeding and Spawning	-	-		Feeding and Growing	-
		Adult	-	-	Feeding and Growing	-	-	Feeding	Feeding	-	-			-
	Harbaria	Juvenile and Age-1 adult	Feeding and Growing	Feeding and Growing		-	-	-	-	-	-		-	Feeding
		Adult and Brood Fish	-	-	Breeding and Spawning	-	-	-	-	-	-		-	-
	Chandpai	Juvenile	-	-	Feeding and Growing	-	-	-	Feeding	-	-		Feeding	-
	Mongla Point	Adult	-	-	-	-	-	-	-	-	-			-
	South-west of the Project	Age-1 adult	Feeding and Growing	Feeding and Growing	Feeding and Growing	-	-	Feeding	-	-	-		-	-
		Brood Fish	-	-	-	-	-	Breeding and Spawning	-	-	-		-	-
Bairagi	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Akram Point	Juvenile and Age-1 adult	Feeding and Growing	-	-	-	Feeding and Growing	-	-	-	-		-	-
		Juvenile and Adult	-	-	-	-	-	-	-	Growing and Feeding	-		-	-
	Chandpai	Fry	Breeding and Spawning	Breeding and Spawning	Feeding and Growing	Feeding	-	Feeding	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Chalna Point	Juvenile and Age-1 adult	Feeding and Growing	-	-	-	Feeding and Growing	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	-		-	Nursing
	Harbaria	Juvenile	Feeding and Growing	-	-	-	-	Feeding	-	-	-		-	-
	Mongla Point	Fry	-	Nursing	-	Feeding	-	-	-	-	-		-	Nursing
		Juvenile	-	-	-	-	-	-	-	Feeding	-		-	-
	South-west of the Project	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	-		-	Nursing
Chapila	Haldikhali	Juvenile	Feeding and Growing	-	-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	Feeding and Growing	-	-	-	-	-	-	-	-		-	-
	Mongla Point	Fry	-	Nursing	-	-	-	-	-	-	-		-	-
	South-west of the Project	Age-1 adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
Loitta	Haldikhali	Juvenile and	Feeding	-	Feeding	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
		Age-1 adult	and Growing		and Growing									
	Akram Point	Juvenile	Feeding and Growing	-	-	-	Feeding and Growing	-	-	-	-		-	-
	Akram Point	Age-1 adult	-	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-		-	-
	Chandpai	Juvenile	Feeding and Growing	-	-	-	-	-	-	-	-		-	-
	Harbaria	Fry, Juvenile and Age-1 adult	-	Nursing, Feeding and Growing	-	-	-	-	-	-	-		-	-
	Chalna Point	Age-1 adult	-	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	Nursing		-	-
Poma	Haldikhali	Juvenile	Feeding and Growing	-	-	Feeding	-	-	-		-		-	-
	Akram Point	Juvenile	Feeding and Growing	-	-	-	-	-	-	Growing and Feeding	-		-	-
		Age-1 adult	-	-	Feeding and Growing	-	-	-	Feeding	Feeding	-		-	-
		Adult	-	-	-	-	-	-			-		-	-
	Chandpai	Fry and Juvenile	Breeding and Spawning	Nursing	-	-	-	Feeding	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
		Juvenile	-	-	Feeding and Growing	Feeding	Feeding and Growing	-	Feeding and Growing		-		Feeding and Growing	
		Adult	-	-	-	-	-	-	Feeding		-			
		Brood Fish	-	-	-	-	-	-	-		-		Spawning	-
	Haldikhali	Fry and Juvenile	-	-	Nursing	-	-	-	-	-	-		-	-
	Harbaria	Adult and Brood Fish	-	-	Breeding and Spawning	-	-	-	-	-	-		Feeding and Spawning	-
		Adult	-	-	-	-	-	-	Feeding		-		-	Feeding
		Fry and Juvenile						Spawning and Nursery	-	-	Feeding and Growing		-	-
	Mongla Point	Fry, Juvenile and Age-1 adult	-	-	Spawning, Feeding and Growing	-	-	-	-	Nursing	-		-	Nursing
		Juvenile	-	-	-	-	-	-	Feeding and Growing		-		-	-
		Age-1 Adult	-	-	-	-	-	-	Feeding	Feeding	-		-	-
		Adult	-	-		Feeding	-	Feeding	-	-	-		Feeding	-
		Brood Fish	-	-	-	-	-	-	-	-	-		Spawning	-
	South-west of the Project	Adult	-	-	Feeding	Feeding	-	Feeding	-	-	-		-	-
	Chalna Point	Juvenile, Adult and Brood Fish	Breeding and Spawning	-	-	-	-	-	-	-	-		Feeding, Growing and Spawning	-
		Juvenile and Adult	-	-	Feeding and Growing	Feeding	Feeding and Growing	-	Feeding and Growing	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	Nursery		-	Nursing
Chhuri	Haldikhali	Adult	Feeding	-	Feeding	-	-	-	-	-	-		-	-
	Akram Point		Feeding	-	Feeding	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
Chela	Haldikhali	Adult	Feeding	-	Feeding	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Adult	Feeding and Growing	-	-	-	-	-	-	-	-		-	-
	Harbaria	Fry and Juvenile	-	Feeding and Growing	-	-	-	Nursery	-	-	-		-	-
	Chandpai		-	-	-	-	-	-	-	Growing and Feeding	Nursery		-	-
Gang Tengra	Haldikhali	Adult	Feeding	-	Feeding	Feeding	-	-	-	-	-		-	-
	Akram Point	Adult	Feeding And Breeding	-	-	Feeding	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	Feeding	-	-	-	-	-	-		-	-
	Chandpai	Adult	-	-	Feeding	Feeding	-	-	-	-	-		-	-
Gagra Tengra	Chandpai	Juvenile and Age-1 adult	-	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-		-	-
	Chalna Point	Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
	Mongla Point	Age-1 adult	-	Feeding And Growing	-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Adult	-	-	Feeding and Growing	-	-	-	-	-	-		-	Feeding
		Adult	-	-	-	-	-	-	Feeding	-	-		-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-

<table>
<tr><th rowspan="2">Migratory Fish Species</th><th rowspan="2">Sampling Sites</th><th rowspan="2">Year Class*</th><th colspan="12">Migration Purpose</th></tr>
<tr><th>1st QM</th><th>2nd QM</th><th>3rd QM</th><th>4th QM</th><th>5th QM</th><th>6th QM</th><th>7th QM</th><th>8th QM</th><th>9th QM</th><th>10th QM</th><th>11th QM</th><th>12th QM</th></tr>
<tr><td></td><td>Harbaria</td><td>Adult</td><td>-</td><td>-</td><td>Feeding</td><td>-</td><td>Feeding and Growing</td><td>-</td><td>-</td><td>-</td><td>Feeding</td><td></td><td colspan="2">Feeding</td></tr>
<tr><td rowspan="10">Gulsha Tengra</td><td>Haldikhali</td><td>Adult</td><td rowspan="2">Feeding and Breeding</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Akram Point</td><td>Adult</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Chandpai</td><td>Age-1 adult</td><td>-</td><td>-</td><td>-</td><td>Feeding</td><td>-</td><td>Feeding</td><td>Feeding and Growing</td><td>-</td><td>-</td><td></td><td>-</td><td>Feeding</td></tr>
<tr><td>Juvenile</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td colspan="2">Feeding and Growing</td><td>-</td><td></td><td>Feeding and Growing</td><td>-</td></tr>
<tr><td rowspan="2">Mongla Point</td><td>Age-1 adult</td><td>-</td><td>Feeding and Growing</td><td>-</td><td>Feeding and Growing</td><td>-</td><td colspan="2">Feeding and Growing</td><td>-</td><td>Feeding and Growing</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Juvenile</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td colspan="2">Feeding and Growing</td><td>-</td><td></td><td rowspan="2">Feeding and Growing</td><td>-</td></tr>
<tr><td rowspan="2">Harbaria</td><td>Juvenile</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td colspan="2">Feeding and Growing</td><td>-</td><td></td><td>-</td></tr>
<tr><td>Age-1 adult</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Feeding and Growing</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Maidara</td><td>Juvenile and Age-1 Adult</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Feeding and Growing</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Chalna Point</td><td>Juvenile</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td>Feeding and Growing</td><td>-</td></tr>
<tr><td rowspan="6">Potka</td><td>Haldikhali</td><td>Adult</td><td>Feeding and Breeding</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td rowspan="3">Chandpai</td><td>Fry</td><td>Spawning</td><td>Spawning and Nursing</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Juvenile</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Feeding and Growing</td><td>-</td><td></td><td>-</td><td>Feeding</td></tr>
<tr><td>Adult</td><td>-</td><td>-</td><td>-</td><td>Feeding</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td>Feeding</td><td>-</td></tr>
<tr><td rowspan="2">Mongla Point</td><td>Fry</td><td>Spawning</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Juvenile</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Feeding</td><td></td><td>-</td><td>-</td></tr>
</table>

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
											and Growing			
	Harbaria	Fry	-	-	-	-	-	Nursery	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	-
Paira Chanda	Akram Point	Adult	Feeding	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry	Breeding and Spawning	-	-	-	-	-	-	-	-		-	-
Chewa	Akram Point	Juvenile and Adult	Feeding	-	Feeding and Growing	-	-	-	-	-			-	-
	Chandpai	Fry and Juvenile	Spawning	-	Feeding and Growing	-	Nursing and Grazing	Nursery	Feeding and Growing	-	Nursing		-	-
		Adult	-	-	-	Feeding	-	Feeding	-	Feeding	-		-	-
	Haldikhali	Juvenile and Adult	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Juvenile and Adult	-	-	Feeding and Growing	-	-	Feeding and Nursery	-	Feeding	-		-	-
	Mongla Point	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	South-west of the Project	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	-	-	-		-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
Bele	Akram Point	Adult	Feeding	-	Feeding	Feeding	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	-
	Haldikhali	Juvenile-1, Juvenile and Adult	-	-	Nursing and Growing	Feeding	-	-	-	-	-		-	-
	Harbaria	Juvenile and Adult	-	-	Feeding and Growing	-	Feeding and Growing	Nursery and Feeding	Feeding and Growing	-	-		-	-
	Chandpai	Fry	Breeding and Spawning	Nursing	-	-	Nursing	Nursery	-	-	Nursery		-	-
	Chandpai	Juvenile and Adult	-	-	Feeding and Growing	Feeding	-	Feeding	-	Feeding	-		Feeding and Growing	
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing				-	-
	Mongla Point	Fry	Breeding and Spawning	-	-	-	-	Nursery	-	-	-		-	-
	Mongla Point	Fry, Juvenile-1 and Juvenile			Nursing and Growing	-	-	-	-	-	-		-	-
	Mongla Point	Juvenile and Adult	-	-	-	Feeding	Feeding and Growing	Feeding	Feeding and Growing	-	-		-	-
	Chalna Point	Fry	Breeding and Spawning	Nursing	-	-	Nursing	-	-	Nursing	-		-	-
	Chalna Point	Adult	-	-	-	Feeding	-	-	-	-	-		-	-
	Maidara	Juvenile and Age-1 adult	-	Feeding and Growing	Feeding and Growing	Feeding	Feeding and Growing	-	-	-	Feeding and Growing		-	-
		Fry	-	-	-	-	-	-	-	Nursing	-		-	Nursing

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
Tular Dandi (Nona bele)	Akram Point	Adult	Feeding	-	-	-	-	-	-	-	-		-	-
	South-west of the Project	Adult	-	-	Feeding	-	-	-	-	-	-		Feeding	-
	Chalna Point	Adult	Feeding	-	Feeding	-	Feeding	-	Feeding	-	-		-	-
Tairel	Akram Point	Adult	Feeding	-	-	-	-	-	-	Feeding	-		-	-
	Harbaria	Age-1 Adult	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Mongla Point	Juvenile	Feeding	-	-	-	-	-	-	-	-		-	-
Pheksa	Akram Point	Adult	Feeding	-	-	-	-	-	-	Feeding	-		-	-
		Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Haldikhali	Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Haldikhali	Adult	-	-	-	Feeding	-	-	-	-	-		-	-
	Harbaria	Juvenile	-	-	-	-	-	-	-	-	Feeding And Growing		-	-
	Chalna Point	Juvenile and Adult	Feeding	Feeding and Growing	-	-	-	-	Feeding and Growing	-			-	-
		Adult	-	-	Feeding	Feeding	Feeding	-	Feeding	-	-		-	-
	Mongla Point	Adult	-	-	Feeding	Feeding	-	-	Feeding and Growing	-	-		Feeding	-
	Chandpai	Juvenile and Adult	Feeding	Feeding and Growing	-	-	Feeding and Growing	-		-	-		-	-
	Maidara	Juvenile and Adult	Feeding	Feeding and Growing	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
		Adult	-	-	Feeding	Feeding	-	Feeding	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
Paissa	Akram Point	Juvenile and Adult	Feeding	-	Feeding and Growing	Feeding	-	-	-	Feeding and Growing	-		-	Feeding
		Brood	-	-	-	-	-	-	-	-	-		-	Spawnin g
		Juvenile	-	-	-	-	-	-	Feeding and Growing			-	-	-
	Haldikhali	Juvenile and Adult	Feeding	-	Feeding And Growing	Feeding	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
	Harbaria	Juvenile-1 and Juvenile	-	-	Feeding	-	Feeding and Growing	-	Feeding and Growing	-	-		-	-
		Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Chandpai	Fry	Breeding and Spawning	-	-	-	Nursing	-	-	-	Nursery		-	-
	Chandpai	Juvenile and Adult	-	-	Feeding and Growing	-	-	Nursery and Feeding	-	-	-		Feeding and Growing	Feeding
	Harbaria	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-			-
	Mongla Point	Fry	Breeding and Spawning	-	-	-	-	Nursery	-	-	Nursery		-	-
		Age-1 Juvenile	-	-	-	-	-	-	Nursing, Feeding and Growing	-	Feeding and Growing		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
		Age-1 Adult	-	-	-	-	Feeding and Growing	Feeding	-	-			-	-
	Maidara	Fry, Juvenile and Age-1 adult	Breeding and Spawning	Feeding and Growing	-	-	Feeding and Growing	-	-	-			-	-
		Age-1 Juvenile, Juvenile and Age-1 Adult	-	-	-	-	-	-	Nursing, Feeding and Growing	-	-		Feeding and Growing	-
		Adult	-	-	-	-	-	Feeding	-	-	-		-	-
Banshpata	Chandpai	Juvenile	Feeding	-	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	Feeding	-	Feeding	-	-	-		-	-
	Akram Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
		Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Haldikhali	Juvnile and adult	-	-	Feeding and Growing	Feeding	-	-	Feeding and Growing	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	Feeding	Feeding		Feeding	-
	Mongla Point	Fry and Adult	Feeding	Nursing	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	Feeding	-	-	-	-	Feeding		-	-
	Maidara	Adult	-	-	Feeding	Feeding	-	Breeding and Spawning	-	-	-		-	-
	Chalna Point	Adult	-	-	Feeding	Feeding	-	-	-	-	-		-	-
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	Haldikhali	Brood Fish	-	-	-	-	-	-	-	-	-			-
		Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Chandpai	Adult and Brood Fish	-	-	-	-	-	-	Feeding and Breeding	-	-		-	-
	Mongla Point	Adult	-	-	Feeding	-	-	-	-	-	-		-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-		Feeding	-
	Chalna Point	Brood fish	-	-	-	-	-	Breeding and Spawning	-	-	-		-	-
Pangas	Haldikhali	Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Mongla Point	Juvenile and Adult	-	-	Feeding	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																			
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
Tapsi	Haldikhali	Juvenile and Age-1 adult	-	-	Grazing	-	-	-	-	-	-		-	-	-	-	-	-	-	Fish Species	-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Bagda Chingri	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		M&F	-
	Chalna Point	Age-1 adult and Brood fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
		Adult	-	Feeding	-	-	Feeding	-	-	Feeding	Feeding		-	-	-	-	-	-	-		-	-
	Harbaria	Juvenile and Age-1 adult	Feeding	-	-	-	-	-	-	-	-		-	-	-	-	-	Feeding	Feeding		-	-
		Adult and Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Bairagi	-	-
	Chandpai	Juvenile	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-	-	-	-	-	-	Banshpata	-	-
		Adult	-	-	-	-		-	-	-	-		Feeding	-	-	-	-	-	-		-	-
		Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
		Fry	-	-	Nursing	-	-	-	-	-	-		-	Nursing	-	-	-	-	-		-	-
	Maidara	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Bele	-	-
		Juvenile	-	-	-	-	-	Maturation	-	-	-		-	-	-	-	-	-	-		-	-
		Adult	-	-	-	-	Feeding	-	-	-	-		-	-	-	-	-	-	-		-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
Bairagi/ Amadi	Haldikhali	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	Feeding	Feeding		M&F	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Chandpai	Fry	-	Nursing	-	Nursing	-	-		Nursing	-		-	-	-	-	-	-	-	Bhol	-	-
		Juvenile	-	Feeding and Growing	Feeding and Growing	Feeding and Growing	-	Maturation	Feeding and Growing	-	Nursing		-	-	-	-	-	-	-	Bhut Bele	F&G	-
	Chalna Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	Feeding	-		-	-	-	-	-		-		-	-
		Fry	Nursing	-	-	-	-	Nursing	-	Nursing	-		-	-	-	-	-	-	-	Chaka Chingri	M	-
	Harbaria	Juvenile	-	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
	Mongla Point	Fry	Nursing	-	Nursing	-	-	-	-	-	-		Nursing	Nursing	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
	Maidara	Juvenile	-	-	-	-	-	Maturation	-	-	-	Feeding and Growing	-	-	-	-	Feeding and Growing	-	-	Chali Chingri	-	-
		Fry	Nursing	-	Nursing	-	-	Nursing	-	Nursing	-		-	-	-	-	-	-	-		-	-
	Charaputia	Adult	-	-	-	-	-	-	-	Feeding	-		-	-	-	-	-	-	-	Chamua Chingri	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-		-	-
Chapila	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																			
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
	Harbaria	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-	Chanda	F&G	F&G
	Mongla Point	Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-	-	-	Chapila	-	-
		Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	Feeding and Growing	-	-	-	-	-	Chela	-	-
		Adult	-	-	-	-	Feeding	-	Maturation	-	-		-	-	-	-	-	-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	Maturation	-	Maturation	Feeding	-	-	-	-	-	-	-		-	-
		Fry	-	-	-	-	-	Nursing	-	-	-		-	-	-	-	-	-	-	Chewa	-	-
	Maidara	Juvenile to Age-1 adult	-	-	-	-	-	Growing and Maturation	-	-	-		-	-	-	-	-	-	-		-	-
Loitta	Haldikhali	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Chhati Icha	-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Chitra	-	-
	Akram Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Chandpai	Juvenile	-	-	-	-	-	-	-	-	-		-	--	-	-	-	-	-		G	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-	Chota Bele	-	-
	Harbaria	Fry, Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Mongla Point	Fry	-	-	Nursing	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Chalna Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Datina	-	-
Poma	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
		Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	Maturation	-		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Dogri	-	-
	Charaputia	Brood Fish	-	-	-	Spawning	-	-		-	-		-	-	-	-	-	-	Maturation	Ekthuitta	-	-
		Juvenile and Adult	-	-	-	Feeding	-	-	Growing and Maturation	Feeding	-		Growing and Maturation	-	-	Growing and Maturation	Maturation		Nursing		-	-
	Chandpai	Fry and Juvenile	-	-	-	Nursing	-	-	-	-	-		-	-	-	-	-	-	-		-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-	-	-	Gagra Tengra	-	-
		Juvenile	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-	-		-	-	-	-	-	--	-		-	-
		Adult		Feeding	Feeding	Feeding	-	-	-	-	-		-	-	-	-	Feeding	-	-	Gangania	M&F	M&F
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-	Golda Chingri	-	-
	Haldikhali	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Harbaria	Adult and Brood Fish	-	-	-	-	-	-	-	-	-			-	-	-	-	Maturation	-		-	-
		Adult	Feeding	-	-	-	-	Feeding	-	-	-		-	-	-	-	-	-	-	Gulsha Tengra	-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-		Nursing	-	-	-	-	-	-		-	M&F
	Mongla Point	Fry, Juvenile and Age-1 adult	Nursing	-	-	-	Nursing	-	Feeding and Growing	-	-		Nursing and Maturation	-	-	-	-	-	-	Harina Chingri	-	-
		Fry	-	Nursing	-	-	-	-	-	-	-		-	Nursing	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	Nursing		-	-	-	-	-	Maturation	-		-	-
		Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Ilish	-	-
	Maidara	Adult	-	Feeding	-	-	-	-	Maturation and	-	-		Feeding	-	-	-	-	-	-	Java	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																			
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
									Feeding													
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	-	-	-		-	-
		Fry	-	-	-	-	-	Nursing	-	-	-	Nursing	-	-	-	-	-	-	-	Kain Magur	-	-
	Chalna Point	Juvenile and Adult	-	Feeding and Growing	-	-	-	Maturation and Feeding	Maturation and Feeding	-	Maturation and Feeding		-	Maturation and Feeding	-	-	-	-	-		-	-
		Fry	Nursing	-	-	-	-	-	-	-	-		-	-	-	-	-	Feeding	-	Kala Poa	-	-
Chhuri	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Akram Point		-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Kathali Chingri	-	-
Chela	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	Maturation and Feeding	-	-	-	Khoira	-	-
	Harbaria	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-	Nursing and Maturation	-	-	-	Feeding and Growing	Kholla	-	-
	Chalna Point		-	-	-	Nursing and Feeding	-	-	-	-	-	Nursing and Maturation	-	Nursing and Maturation	-	-	-	-	-		-	-
	Chandpai		-	-	Feeding and Growing		-	-	-	Nursing	Nursing		-	-	Nursing and Maturation	-	Feeding and Growing	-	-	Kuchia	-	-
	Mongla Point		-	Nursing	-	-	-	-	-	-	-	Nursing and Maturation	-	-	-	-	-		-		-	-
Gang Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Kukurjib	-	F&G
	Chandpai	Adult	-	-	-	-	Feeding	-	-	-	-		-	-	-	-	-	-	-	Kumirer Khil	-	-
	Maidara	Fingerling	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-	-	-		-	-
	Mongla Point	Fingerling					Nursing	-	-	-	-		-	-	-	-	-	-	-	Menua	-	-
		Age-1 Adult					Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
Ghagra Tengra	Chandpai	Juvenile and Age-1 adult	-	-	-	-	-	Maturation		-	-		-	-	Maturation	-	Maturation	-	-		-	-
		Brood Fish	-	-	Breeding	-	-	-	-	-	-		-	-	-	-	-	-	-	Motka Chingri	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-	-	-		-	M
	Chalna Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	Nursing	-		-	-
	Mongla Point	Age-1 adult	-	-	-	-	-	-	Maturation and Feeding	-	Maturation and Feeding		-		-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	Feeding and Growing	-	-	-	-	-		-	-
	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	-	-	Feeding and Growing	-		-	-	Maturation	-	-	-	Feeding and Growing	Mutkura Bele	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	Feeding	Maturation		-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Nandi Bele	-	-
	Harbaria	Adult	Feeding	Breeding	-	-	-	-	Feeding	-		-	-	-	Maturation	-	Maturation	-	Maturation		-	-
		Juvenile	-	-	-	-	Maturation	-	Maturation	-		-	-	-	-	-	-	-	-	Paissa	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																			
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
	Charaputia	Juvenile and Age-1 adult	-					Maturation	-	-		Maturation	-	-	Maturation	-	Maturation	-	-		-	-
Gulsha Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Feeding and Growing		-	-
	Chandpai	Age-1 adult	Feeding	-	Feeding and Growing	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
		Juvenile	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-		-	-	-	-	-	-	Maturation		-	-
	Charaputia	Juvenile	-	-	-		-	-	Feeding and Growing	-	-		-	-	-	-	-	-	-	Pangas	-	-
		Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	Phesa	-	-
	Mongla Point	Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-	Poa	-	-
	Harbaria	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
		Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		-	Feeding and Growing		-	-	-	-		-	-
Potka	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Poikka	-	F&G
	Chalna Point	Fry	-	-	-	-	-	Nursing	-		-		-	-	-	-	-	-	-	Potka	-	-
	Chandpai	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-		-	-
		Juvenile	Feeding	-	-	-	-	-	Feeding and Growing	-	-		-	-	-	-	Feeding and Growing	-	-	Punti	-	-
		Adult	-	Feeding and Growing	Feeding	-	-	-	-	-	-		-	-	-	-	-	-	-	Rekha	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-		-	-
	Mongla Point	Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Serboti	-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Tairel	-	-
	Maidara	Fry	-	-	-	Nursing	-	Nursing	-	Nursing	-		-	-	-	-	-	-	-	Tao Paissa	-	-
		Juvenile	-	-	-	-	-	Maturation	-	-	-		-	-	-	-	-	-	Feeding and Growing		-	-
	Harbaria	Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Charaputia	Juvenile and adult	-	-	-	-	-	-	Feeding and Growing	-	-		-	-	-	Feeding and Growing	-	-	Feeding and Growing	Tengra	-	-
Paira Chanda	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	M&F
Chewa	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Feeding and Growing	Thurina	-	-
	Chandpai	Fry and Juvenile	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	Feeding and Growing	-	-	Tiger Chingri	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																			
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
		Juvenile	-	Feeding and Growing	-	-	-	-	-	-	Feeding and Growing		-	-	-	-	-	-	-		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	Feeding	-	Topse	-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	Nursing	-	-	-	-	-	-	Fish Species	-	-
	Chandpai	Juvenile-1	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-	Bagda Chingri	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	-	-	Nursing	Maturation	Maturation	-	-	-	-	-	-		-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	Maturation	-	-		-	-
	Maidara	Juvenile	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	-	-	-	-		-	-
		Fry	-	-	Nursing	-	-	-	-	-		-	-		-	-	-	-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	-	-	-	Feeding	-	Feeding	-	-	-	-	-	Bairagi	-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	-		Maturation	-	-	-	-	-	Feeding and Maturation		-	-
Bele	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Banshpata	-	-
		Juvenile	-	-	-	-	-	-	-				-	-	-	Feeding	Maturation	-	-		-	-
	Chandpai	Fry	-	-	-	Nursing	Nursing	-	-	Nursing	-	Nursing	-	-	-	-	-	-	-		-	-
		Juvenile and Adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	Feeding and Growing		-	-	-	Maturation and Feeding	-	-	-	Feeding and Maturation		-	-
	Jongra	Fry	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-	-	Bele	-	-
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
	Mongla Point	Fry	-	Nursing	-	-	Nursing	-	-	-	-	-	-	-	-	-	-	-	-		-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	-	-	-	-		-		-	-
	Chalna Point	Fry	-	-	Nursing	Nursing	-	-	-	-			-		-	-	-	-	Feeding and Maturation		-	-
		Fingerling	-	-	-	-	Nursing	-	-	-	-		Nursing	Nursing	-	-	-	-	-		-	-
		Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	Feeding and Growing	Maturation	-		-	-
	Maidara	Juvenile and Age-1 adult	-	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	Maturation and Feeding	Maturation and Feeding	Maturation and Feeding	-	-	-	-	-	-	Bhol	-	-
		Fry	Nursing	-	Nursing	-	-	-	-	-		-	-		-	-	-	-	-	Bhut Bele	-	-
	Charaputia	Juvenile and Age-1 adult	-	-	-	-	-	Maturation	-	-		-	-		-	-	-	-	-		-	-
Tular Dandi (Nona bele)	Akram Point	Adult	-	-	-	-	-	-	-	Feeding and Maturation	-		-	-	-	-	-	-	-	Chaka Chingri	-	-
	Chandpai	Age-1 Adult	-	-	Feeding	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	Growing	-	-	-		-	-	-	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-	-	-	-	-	-	-	-	-	Chali Chingri	-	-
	Maidara	Adult	-	Feeding	-	-	-	-	Maturation	-	-	-	-	-	-	-	Maturation and Feeding	-	-		-	-
	Chalna Point	Adult	-	-	-	-	-	-	Maturation	Maturation	Maturation and	-	-	-	Maturation and	-	-	-	Maturation	Chamua Chingri	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																			
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
											Feeding				Feeding							
Tairel	Akram Point	Adult	-	-	-	Feeding	-	-	-	-	-	-	-	-	-		-	-	Maturation		-	-
		Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Maturation	-	-	-		-	G&M
	Charaputia	Juvenile	-	-	-	-	-	-	-	Maturation	-		-	-	-	-	-	-	-		-	-
	Harbaria	Age-1 Adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-	-	-	-	-	-	Chanda	-	-
	Chandpai	Juvenile	-	-	-	-	-	Growing	-	-	Feeding and Growing		-	-	-	-	-	Maturation g	-	Chapila	-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	Growing		-	-	-	-	-	-	Maturating	Chela	-	-
	Maidara	Juvenile	-	-	-	-	-	Growing	-	-	-		-	-	-	-	-	-	-		-	-
Pheksa	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	G&M
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	Feeding and Maturation	-			-	-	-	Maturation	-	Maturating	Chewa	-	G&M
	Chalna Point	Juvenile and Adult	-	-	-	Feeding and Growing	-	-	-	Maturation	Maturation			-	Maturation	-	-	-	-		-	-
		Adult	-	Feeding	-	-	-	-	Maturation	-	-	Feeding		-	-	-	-	-	-	Chhati Icha	-	-
	Mongla Point	Adult	-	-	-	-	-	-	Maturation	-	-		Feeding	-	-	-	-	-	-	Chitra	-	-
		Juvenile	-	-	-	Growing	-	-		-	-	-	-	-	-	-	-	-	-		-	-
	Chandpai	Juvenile and Adult	-	-	-	Feeding and Growing	-	-	Maturation	--	-	-	-	-	-	-	-	-	Growing and Maturation		-	-
	Maidara	Adult	-	Feeding	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Chota Bele	-	-
Paissa	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	Growing and Maturation	-	-	-	-	-	-	-	Growing and Maturation	-	-	-		-	-
		Brood	Spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Growing and Maturation		-	-
	Charaputia	Brood Fish	-	-	-	Spawning	-	-	-	-	-	-	-	-	-	-	-	Feeding	-		-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Feeding	-	-	Growing and Maturation	Datina	-	-
		Fry	-	-	-	-	-	-	-	-	-	-	Nursing	-	-	-	-	-	-		-	-
	Harbaria	Juvenile-1 and Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-	Feeding and Growing	-	-	-	-		-	-
		Adult	-	Feeding	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Chalna	Fry	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		Nursing	Nursing	-	Feeding	Feeding and Growing	-	-	Dogri	-	-
	Chandpai	Fry	-	-	-	Nursing	-	-	Feeding and Growing	Nursing	Nursing	Nursing	Nursing	-	Feeding and Growing	Feeding	-	-	-	Ekthuitta	-	-
		Juvenile and Adult	Feeding	Feeding and Growing	-	Feeding and Growing	-	Maturation	-	-			-	-	-	-	-	-	Feeding and Growing		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing			-	-	-	-	-	-	-		-	-
	Harbaria	Juvenile	-	-	Feeding and Growing	-	-	Maturation	-	-			-	-	Feeding and Growing	-	-	-	-	Gagra Tengra	-	-
	Mongla Point	Fry	-	-	Nursing	-	-	-	-	-			-	-	-	-	-	-	-		-	-
		Age-1 Adult	-	-	-	-	-	-	-	-		Maturation	-	-	-	-	-	-	-	Gangania	-	-
	Maidara	Fry, Juvenile and Age-1 adult	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-	Feeding and Growing	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																			
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM
		Juvenile	-	-	-	-	-	Growing	-	-	-		Maturation	-	-	-	-	-	-	Golda Chingri	-	-
Banshpata	Chandpai	Juvenile	-	-	-	Growing	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		M&F	-
		Adult	-	Feeding	Feeding	-	-	-	-	-	-		-	-	-	-	-	-	Growing and Maturation		-	-
	Jongra	Juvenile	-	-	-	-	-	-	-	Maturation	-		-	-	-	-	-	-	-	Gulsha Tengra	-	-
	Charaputia	Juvenile and Age-1 Adult	-	-	-	Feeding	-	-	Growing and Maturation	-	-		-	-	-	Growing and Maturation	-	-	-		-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Feeding and growing	Harina Chingri	-	-
	Haldikhali	Juvenile and adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-
	Mongla Point	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-		-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	Growing and Maturation	Growing and Maturation	-	-		-	-	Maturation	-	-	Maturation	-		-	-
		Adult	-	Feeding	-	-	-	Feeding	-	-	-		-	-	-	-	-	Maturation	-	Ilish	-	-
	Chalna Point	Juvenile and Age-1 Adult	-	-	-	-	-	-	Growing and Maturation	Feeding	Growing and Maturation		-	Growing and Maturation	-	-	-	-	Maturation	Java	-	-
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Maturation		-	-
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	-	-	-	Maturation	Kain Magur	-	-
	Chalna Point	Adult	-	-	-	-	-	Maturation	-	-	-	Feeding	-	-	-	-	-	Nursining	-		-	-
Pangas	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Maturation	Kala Poa	-	-
	Charaputia	Adult	-	-	-	-	-	-	-	Feeding	-		-	-	-	-	-	-	-		M&F	-
	Mongla Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-	-	-	-	-	-	Kathali Chingri	-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	Feeding and Growing	-	-	-	-		-	-		-	-

*Source: Field findings at different times; *Only Age-1 to Brood fish was allowed to interpret the migration purpose; F = Feeding; Sp = Spawning*

D.7: The Present Catch in Three Sampling Ghers

Table D-5: The Present Catch in Three (03) Sampling Ghers

Sampling Site	Total Catch (ton): 2014-2015							
	1st QM (April, 2014)		2nd QM (July, 2014)		3rd QM		4th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
1	Bagda	5	Bagda	6.42	Bagda	4.8	-	-
	Vetki	1.57	Bele	0	Gusha Chingri	-	-	-
	Bele	0.98	Cheng	0	Harina Chingri	-	-	-
	Harina Chingri	0.78	Bhangan	0	Rui (kg)	-	-	-
	Chali Chingri	0.11	Chali Chingri	0	Catla (kg)	-	-	-
	Chaka Chingri	0.08	-	-	-	-	-	-
	Sub-total =	**8.52**		**6.42**		**4.8**	**-**	**-**
2	Bagda	4	Bagda	1	Bagda	7	-	-
	Harina Chingri	2	Harina Chingri	0.33	Vetki	1	-	-
	Chali Chingri	0.18	Chali Chingri	0.08	Paissa	10	-	-
	-	-	Golda Chingri	0.01	Phessa	2.4	-	-
	-	-	Bele	0.08	Bhangan	1.7	-	-
	-	-	Tengra&Paissa	0.04	Golda Chingri	0.9	-	-
	-	-	-		Gulsha Tengra	0.2	-	-
	Sub-total =	**6.00**		**2.00**		**23**		**-**
3	Bagda	1.38	Bagda	2.4	Bagda	1.5	-	-
	Harina Chingri	0.34	Harina Chingri	0.34	Paissa	10	-	-
	Chali Chingri	0.17	Chali Chingri	0.17	Tengra	10	-	-
	-	-	-	-	Bele	20	-	-
	-	-	-	-	Tilapia	22	-	-
	-	-	-	-	Rui	28	-	-
	-	-	-	-	Vetki	-	-	-

Sampling Site	Total Catch (ton): 2014-2015							
	1st QM (April, 2014)		2nd QM (July, 2014)		3rd QM		4th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
	-	-	-	-	Harina Chingri	-	-	-
	-	-	-	-	Chami Chingri	-	-	-
	-	-	-	-	Catla	56	-	-
	-	-	-	-	Mrigel	50	-	-
Sub-total =		**1.89**		**2.91**		**197.5**	**-**	**-**
Grand-total =		**17.00**		**11.33**		**226.5**	**-**	**-**

Source: CEGIS Field Survey, 2014-2015

Sampling Site	Total Catch (ton): 2015-2016							
	5th QM		6th QM		7th QM		8th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
1	Bagda	-	Bagda	1.6	Bagda	2	Catla	2
	Horina Chingri	1	Horina Chingri	1	Horina Chingri	3.2	Glass Carp	0.1
	Tengra	-	Chali Chingri	0.5	Gusha Chingri	0.8	Horina Chingri	0.8
	Paissa	-	Paissa	0.25	Paissa	24	Minar Carp	0.1
	Chela	-	Bele	0.25	Vetki	0.2	Nilotica	1.6
	Vetki	-	-	-	Kailla	0.4	Paissa	0.6
	-	-	-	-	Bele	0	Rui	3
	-	-	-	-	Tilapia	0	Vetki	0.8
	-	-	-	-	Catla	0	-	0
	-	-	-	-	Minar Carp	0	-	0
	-	-	-	-	Glass Carp	0	-	0
	-	-	-	-	Kakra	0.4	-	0
Sub-total=	**-**	**1**	**-**	**3.06**	**-**	**31**	**-**	**9**
2	Bagda	-	Bagda	1.67	Bagda	0	-	0
	-	-	Chali Chingri	0.30	Horina Chingri	0	-	0
	-	-	Horina Chingri	0.50	Chali Chingri	0	-	0

Sampling Site	Total Catch (ton): 2015-2016							
	5th QM		6th QM		7th QM		8th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
	-	-	Bele	0.30	Tilapia	0	-	0
	-	-	Paissa	0.25	Vetki	0	-	0
	-	-	-	-	Tengra	0	-	0
	-	-	-	-	Paissa	0	-	0
Sub-total=	**-**	**0**	**-**	**3.02**	**-**	**0**	**-**	**0**
3	Bagda	-	Bagda	3.5	Bagda	0.4	-	0
	-	-	-	-	Paissa	3.2	-	0
	-	-	-	-	Vetki	0.4	-	0
	-	-	-	-	Tilapia	0.06	-	0
	-	-	-	-	Horina Chingri	0.35	-	0
	-	-	-	-	Chali Chingri	0.6	-	0
	-	-	-	-	Chaka Chingri	0.1	-	0
	-	-	-	-	Tengra	0	-	0
	-	-	-	-	Bele	0	-	0
	-	-	-	-	Tairel	0.06	-	0
	-	-	-	-	Bhangan	0	-	0
Sub-total =	**-**	**-**	**-**	**-**	**-**	**5.17**	**-**	**0**
Grand-total =	**-**	**1**		**3.5**		**36.17**	**-**	**9**

Source: CEGIS Field Survey, 2015-2016

Sampling Site	Total Catch (ton): 2016-2017							
	9th QM		10th QM		11th QM		12th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
1	-	0	-	-	Bagda	3	-	0
	-	0	-	-	Tengra	0.1	-	0
	-	0	-	-	Horina Chingri	0.8	-	0
	-	0	-	-	Paissa	0.1	-	0
	-	0	-	-	Vetki	2	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
Sub-total =	**-**	**0**	-	-	**-**	**6**	**-**	**0**
2	Bagda	1	-	-	Bagda	2	Bagda	0.0035
	Horina	0.14	-	-	Bele	1.6	Horina Chingri	0.288
	-	0	-	-	Chali Chingri	4	Paissa	0.22
	-	0	-	-	Horina Chingri	8	Tengra	0.305
	-	0	-	-	Paissa	0.28	Chela	0.45
	-	0	-	-	Tengra	0.8	Tilapia	0.53
	-	0	-	-	Tilapia	8	Vetki	0.06
	-	-	-	-	Vetki	2.4	Bele	0.15
Sub-total =		**1.14**	-	-	**-**	**9**	**-**	**0**
3	Bagda	2	-	-	Bagda	0.4	-	0
	-	0	-	-	Horina Chingri	0.35	-	0
	-	0	-	-	Paissa	0.06	-	0
	-	0	-	-	Tengra	0.4	-	0

Sampling Site	Total Catch (ton): 2016-2017							
	9th QM		10th QM		11th QM		12th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
	-	0	-	-	Tilapia	3.2	-	0
Sub-total =	**-**	**2**	**-**		**-**	**4**	**-**	**2.01**
Grand-total =	**-**	**3.14**	**-**		**-**	**19**	**-**	**2.01**

Source: CEGIS Field Survey, 2016-2017

Sampling Site	Total Catch (ton): 2017-2018 and 2018-19													
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM	
	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton
1	Bagda	0	Bagda	3	-	-	Bagda	2.00	Bagda	0.76	Bagda	0	Bagda	-
	Horina Chingri	1	Rui (kg)	1.3	-	-	Golda	0.10	Bele	0.20	Catla	1.2	Paissa	-
	Tengra	0	Catla (kg)	1	-	-	Rui	0.12	Chali	1.20	Common Carp	0.3	-	-
	Paissa	0	-	-	-	-	Grass Carp	0.20	Golda	0.00	Grass Carp	0.3	-	-
	Chela	0	-	-	-	-	Catla	0.30	Horina	1.60	Rui	4.2	-	-
	Vetki	0	-	-	-	-	Tilapia	0.45	Paissa	0.00			-	-
							Horina	0.10	Tilapia	12.80			-	-
							Gusha	0.00					-	-
							Paissa	0.00					-	-
							Khorulla	0.00					-	-
							Vetki	0.00					-	-
							Gulsha	0.00					-	-
							Bele	0.00					-	-
Sub-total =	-	1	-	3.6	-	-	=	3.27	=	16.56	=	6	-	-
2	Bagda	0	Bagda	5	-	-	Bagda	**3.93**	Bagda	1.48	Bagda	5	Bagda	-
	-	-	Vetki	0.5	-	-	Golda	**0.13**	Bele	0.06	Bhangan	0.05	Paissa	-
	-	-	Paissa	7	-	-	Rui	**8.41**	Bhangan	0.01	Catla	3	Datina	-
	-	-	Phessa	1	-	-	Tilapia	**5.90**	Catla	0.00	Chali	0.4		

Sampling Site	Total Catch (ton): 2017-2018 and 2018-19													
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM	
	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton
	-	-	Bhangan	0.7	-	-	Nilotica	**0.00**	Chali	0.04	Golda	0.08		
							Khorulla	**0.00**	Chel	0.01	Horina	1.8		
							Mrigel	**0.00**	Golda	0.00	Paissa	0.8		
							Catla	**0.00**	Horina	0.50	Rui	3		
							Grass Carp	**0.11**	Motka	0.05	Tengra	0.8		
							Common Carp	**5.55**	Paissa	0.03	Tilapia	8		
							Sarpunti	**0.53**	Rui	0.00	Vetki	2		
							Horina	**1.91**	Tengra	0.13				
							Chali Chingri	**1.16**	Tilapia	0.41				
							Bele	**0.43**	Vetki	0.01				
							Vetki	**1.96**						
							Tengra	**4.20**						
							Paissa	**0.14**						
							Tairel	**0.003**						
							Pheksa	**0.001**						
Sub-total =		**0**		**14.2**	-	-	=	**34.38**	=	**2.75**	=	**25**		
	Bagda	0	Bagda	2	-	-	Bagda	**0.50**	Bagda	0.10	-	0	Bagda	-
	-	-	Paissa	8	-	-	Tilapia	**1.50**	Horina Chingri	0.00			Golda	-
	-	-	Tengra	2	-	-	Tengra	**0.12**	Paissa	0.00			Paissa	-
3	-	-	Tilapia	5	-	-	Paissa	**0.00**	Tengra	0.00			Nilotica	-
	-	-	Rui	3	-	-	Horina Chingri	**0.60**	Tilapia	0.20			Khorsul	-
	-	-	Vetki	2	-	-								
	-	-	Catla	10	-	-								

Sampling Site	Total Catch (ton): 2017-2018 and 2018-19													
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM	
	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton
Sub-total =	**-**	**0**	**-**	**32**	-	-								
Grand-total =	**-**	**1**	**-**	**49.8**	-	-	**=**	**2.72**	**=**	**0.30**	**=**	**0**		

Source: CEGIS Field Survey, 2017-18 and 2018-19

Total Catch (ton): 2019-20, 2020-21 and 2021-22																										
Sampling Site/ Location	20th QM		21st QM		22nd QM		23rd QM		25th QM		26th QM		27th QM		28th QM		29th QM		30th QM		31st QM		32nd QM		33rd QM	
	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)
Bhekatkhali Khal, Rajnagar	Bagda	32	Bagda	2.72	Bagda	0.8	Harina	0.02	Bagda	1.2	Patari	0.2	-	-	Bagda	0.7	Bagda	0.5	Patari	0.30	-	-	Bagda	1.2	Bagda	1.2
	Horina	48	Harina	3.44	Harina	1.0	-	-	Harina	2.0	Tilapia	0.5	-	-	Harina	0.15	Harina	0.6	Harina	0.10	-	-	Harina	0.5	Harina	0.2
	-	-	Tilapia	0.7	Chali	0.2	-	-	Tilapia	1.0	Paissa	0.05	-	-	-	-	Paissa	0.05	Tilapia	1.20	-	-				
	-	-	Parse	0.17	Patari	0.3	-	-	-	-	Harina	0.2	-	-	-	-	Tilapia	2.0	Chali	0.10	-	-				
	-	-	-	-	Tairel	0.03	-	-	-	-	Carpu	1.0	-	-	-	-	Chali	0.3								
	-	-	-	-	Tilapia	0.5	-	-	-	-	Rui	0.05	-	-	-	-										
	-	-	-	-	Datina	0.02	-	-	-	-	Grass Carp	0.05	-	-	-	-										
											Golda	0.02	-	-	-	-										
											Bagda	0.3	-	-	-	-										
Sub-total =		**80**		**7.0**		**2.8**		**0.02**		**4.2**		**2.37**	**-**	**-**		**0.85**		**3.45**		**1.70**	**-**	**-**		**1.7**		**1.4**
Kapashdanga-Muralia	Bagda	1.41	Bagda	6.74	Bagda	3.42	Harina	0.01	Bagda	4.84	Bagda	1.45	-	-	Bagda	0.04	Bagda	2.73	Bagda	0.07	-	-	Bagda	3.2	Bagda	1.5
	Paissa	0.60	Golda	0.01	Harina	3.96	-	-	Hatina	0.92	Hatina	1.08	-	-	Hatina	0.14	Harina	0.96	Harina	0.81	-	-	Harina	0.28	Harina	0.16
	Crab	0.00	Harina	0.65	Chali	0.38	-	-	Chali	0.20	Chali	0.30	-	-	Chali	0.03	Chali	0.11	Chali	0.01	-	-	Chali	0.12	Chali	0.1
	Tilapia	0.30	Chali	0.04	Bele	2.11	-	-	Bele	0.27	Bele	0.19	-	-			Bele	0.44	Bele	0.58			Bele	0.15	Bele	0.15

Total Catch (ton): 2019-20, 2020-21 and 2021-22																										
Sampling Site/ Location	20th QM		21st QM		22nd QM		23rd QM		25th QM		26th QM		27th QM		28th QM		29th QM		30th QM		31st QM		32nd QM		33rd QM	
	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)
	Golda	0.10	Bele	0.09	Paissa	2.62	-	-	Paissa	0.04	Paissa	1.80	-	-			Paissa	0.2	Paissa	0.34			Paissa	0.1	Paissa	0.2
	Horina	2.92	Tilapia	0.22	Tilapia	9.85	-	-	Tilapia	3.87	Tilapia	6.93	-	-			Tilapia	12.9	Tilapia	7.82			Tilapia	4.5	Tilapia	1.5
	Chali	1.52	Tengra	0.57	Golda	0.04	-	-	Golda	0.03	Golda	0.03	-	-			Tengra	0.01	Tengra	0.02			Patari	0.4	Tengra	0.1
	Bele	1.35	Bhangan	0.08	Tengra	0.17	-	-	Tengra	0.01	Tengra	0.17	-	-					Patari	1.76					Patari	0.6
	Tengra	0.27	-	-	Patari	2.25	-	-	Patari	0.11	Patari	0.25	-	-					Datina	0.06					Datina	0.14
	Major Carp	0.55	-	-	Chemo	0.02	-	-	Datna	0.01	Catol	0.04	-	-					Rui	0.27					Rui	0.6
	-	-	-	-	Datina	1.01	-	-	Rui	0.47	Chemo	0.32	-	-					Kailla	0.03					Kailla	0.1
	-	-	-	-	Rui	1.27	-	-	Chaka	0.05			-	-												
	-	-	-	-	Chaka	0.01	-	-	-	1.56			-	-												
	-	-	-	-	Kailla	0.96	-	-	-	-			-	-												
	-	-	-	-	Nundi Bele	0.02	-	-	-	-			-	-												
	-	-	-	-	Kakra	0.49	-	-	-	-			-	-												
Sub-total =		**9**		**8.0**		**29**		**0.01**		**12.38**		**12.57**	**-**	**-**		**0.21**		**17.38**		**11.76**	**-**	**-**		**8.39**		**5.15**
Chunkuri-2	Bagda	0.04	Patari	0.01	Tilapia	0.02	-	-	Paissa	0.05	Sada Chingri	0.03	-	-	Bagda	0.01	Paissa	0.12	Paissa	0.08	-	-	Bagda	0.04	Bagda	0.05
	Paissa	0.00	Tair/Tailla	0.01	Paissa	0.066	-	-	Golda	0.03	Paissa	0.03	-	-	Harina	0.06	Bagda	0.04	Bagda	0.04	-	-	Harina	0.07	Harina	0.4
	Khorsula	0.00	Bhangan	0.01	Khorsul	0.009	-	-	Kharulla	0.01	Patari	0.02	-	-	Kakra	0.01	Tilapia	0.08	Tilapia	0.16	-	-			Paissa	0.4
	Horina	0.10	Datina	0.03	Bagda	0.015	-	-	Bagda	0.10	Tengra	0.01	-	-			Harina	0.06	Harina	0.04						
	Motka	0.04	Bagda	0.02	Golda	0.006	-	-	Bele	0.03	Datina	0.02	-	-			Kakra	0.12	Patari	0.04						
	Chali	0.03	Golda	0.03	Patari	0.015	-	-	Harina	0.15	Ilish	0.005	-	-			Patari	0.02	Kala Chingri	0.04						

Total Catch (ton): 2019-20, 2020-21 and 2021-22																										
Sampling Site/ Location	**20th QM**		**21st QM**		**22nd QM**		**23rd QM**		**25th QM**		**26th QM**		**27th QM**		**28th QM**		**29th QM**		**30th QM**		**31st QM**		**32nd QM**		**33rd QM**	
	Fish Species	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**
	Chaka	0.01	Faissa	0.01	Harina	0.008	-	-	Tengra	0.02	Golda	0.01	-	-			Kala Icha	0.04	Sada Chingri	0.04						
	Bele	0.01	Chaka Chingri	0.01	Chali	0.009	-	-	Tairu	0.03	Nilotica	0.06	-	-			Sada Icha	0.04	Golda	0.01						
	Crab	0.03	Harina	0.02	China Punti	0.047	-	-	Chaka	0.01	Baila	0.004	-	-			Bele	0.01								
	-	-	-	-	Tengra	0.008	-	-	Datina	0.02	Goda Chingri	0.001	-	-			Golda	0.01								
	-	-	-	-	Baila	0.003	-	-	-	-	Chaka Chingri	0..2	-	-												
	-	-	-	-	Datina	0.02	-	-	-	-	Harina	0.02	-	-												
											Chitra	0.004	-	-												
											Pheksa	0.01	-	-												
											Bhangan	0.004	-	-												
											Tairel	0.01	-	-												
											Golda	0.01	-	-												
											Bagda	0.02	-	-												
Sub-total =		**0.24**		**0.15**		**0.46**		**0.00**		**0.44**		**0.25**	**-**	**-**		**0.08**		**0.54**		**0.45**	**-**	**-**		**0.11**		**0.13**

Sampling Site	Total Catch (ton): 2017-2018 and 2018-19													
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM	
	Species	**ton**	**Species**	**ton**	**Species**	**ton**	**Species**	**ton**	**Species**	**ton**	**Species**	**ton**	**Species**	**ton**
	Bagda	0	Bagda	3	-	-	Bagda	2.00	Bagda	0.76	Bagda	0	Bagda	-
	Horina Chingri	1	Rui (kg)	1.3	-	-	Golda	0.10	Bele	0.20	Catla	1.2	Paissa	-
	Tengra	0	Catla (kg)	1	-	-	Rui	0.12	Chali	1.20	Common Carp	0.3	-	-
	Paissa	0	-	-	-	-	Grass Carp	0.20	Golda	0.00	Grass Carp	0.3	-	-
	Chela	0	-	-	-	-	Catla	0.30	Horina	1.60	Rui	4.2	-	-
	Vetki	0	-	-	-	-	Tilapia	0.45	Paissa	0.00			-	-
1							Horina	0.10	Tilapia	12.80			-	-
							Gusha	0.00					-	-
							Paissa	0.00					-	-
							Khorulla	0.00					-	-
							Vetki	0.00					-	-
							Gulsha	0.00					-	-
							Bele	0.00					-	-
Sub-total =	**-**	**1**	**-**	**3.6**	-	-	=	**3.27**	=	**16.56**	**=**	**6**	**-**	**-**
	Bagda	0	Bagda	5	-	-	Bagda	**3.93**	Bagda	1.48	Bagda	5	Bagda	-
	-	-	Vetki	0.5	-	-	Golda	**0.13**	Bele	0.06	Bhangan	0.05	Paissa	-
	-	-	Paissa	7	-	-	Rui	**8.41**	Bhangan	0.01	Catla	3	Datina	-
	-	-	Phessa	1	-	-	Tilapia	**5.90**	Catla	0.00	Chali	0.4		
2	-	-	Bhangan	0.7	-	-	Nilotica	**0.00**	Chali	0.04	Golda	0.08		
							Khorulla	**0.00**	Chel	0.01	Horina	1.8		
							Mrigel	**0.00**	Golda	0.00	Paissa	0.8		
							Catla	**0.00**	Horina	0.50	Rui	3		
							Grass Carp	**0.11**	Motka	0.05	Tengra	0.8		

Sampling Site	Total Catch (ton): 2017-2018 and 2018-19													
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM	
	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton
							Common Carp	**5.55**	Paissa	0.03	Tilapia	8		
							Sarpunti	**0.53**	Rui	0.00	Vetki	2		
							Horina	**1.91**	Tengra	0.13				
							Chali Chingri	**1.16**	Tilapia	0.41				
							Bele	**0.43**	Vetki	0.01				
							Vetki	**1.96**						
							Tengra	**4.20**						
							Paissa	**0.14**						
							Tairel	**0.003**						
							Pheksa	**0.001**						
Sub-total =		**0**		**14.2**	-	-	=	**34.38**	=	**2.75**	=	**25**		
3	Bagda	0	Bagda	2	-	-	Bagda	**0.50**	Bagda	0.10	-	0	Bagda	-
	-	-	Paissa	8	-	-	Tilapia	**1.50**	Horina Chingri	0.00			Golda	-
	-	-	Tengra	2	-	-	Tengra	**0.12**	Paissa	0.00			Paissa	-
	-	-	Tilapia	5	-	-	Paissa	**0.00**	Tengra	0.00			Nilotica	-
	-	-	Rui	3	-	-	Horina Chingri	**0.60**	Tilapia	0.20			Khorsul	-
	-	-	Vetki	2	-	-								
	-	-	Catla	10	-	-								
Sub-total =	**-**	**0**	**-**	**32**	-	-								
Grand-total =	**-**	**1**	**-**	**49.8**	-	-	**=**	**2.72**	**=**	**0.30**	**=**	**0**		

Source: CEGIS Field Survey, 2017-18 and 2018-19

Sampling Site/ Location	Total Catch (ton): 2019-20, 2020-21 and 2021-22																					
	20th QM		21st QM		22nd QM		23rd QM		25th QM		26th QM		27th QM		28th QM		29th QM		30th QM		31st QM	
	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Fish Species	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)
Bhekatkhali Khal, Rajnagar	Bagda	32	Bagda	2.72	Bagda	0.8	Harina	0.02	Bagda	1.2	Patari	0.2	-	-	Bagda	0.7	Bagda	0.5	Patari	0.30	-	-
	Horina	48	Harina	3.44	Harina	1.0	-	-	Harina	2.0	Tilapia	0.5	-	-	Harina	0.15	Harina	0.6	Harina	0.10	-	-
	-	-	Tilapia	0.7	Chali	0.2	-	-	Tilapia	1.0	Paissa	0.05	-	-	-	-	Paissa	0.05	Tilapia	1.20	-	-
	-	-	Parse	0.17	Patari	0.3	-	-	-	-	Harina	0.2	-	-	-	-	Tilapia	2.0	Chali	0.10	-	-
	-	-	-	-	Tairel	0.03	-	-	-	-	Carpu	1.0	-	-	-	-	Chali	0.3				
	-	-	-	-	Tilapia	0.5	-	-	-	-	Rui	0.05	-	-	-	-						
	-	-	-	-	Datina	0.02	-	-	-	-	Grass Carp	0.05	-	-	-	-						
											Golda	0.02	-	-	-	-						
											Bagda	0.3	-	-	-	-						
Sub-total =		**80**		**7.0**		**2.8**		**0.02**		**4.2**		**2.37**	**-**	**-**		**0.85**		**3.45**		**1.70**		**-**
Kapashdanga-Muralia	Bagda	1.41	Bagda	6.74	Bagda	3.42	Harina	0.01	Bagda	4.84	Bagda	1.45	-	-	Bagda	0.04	Bagda	2.73	Bagda	0.07	-	-
	Paissa	0.60	Golda	0.01	Harina	3.96	-	-	Hatina	0.92	Hatina	1.08	-	-	Hatina	0.14	Harina	0.96	Harina	0.81	-	-
	Crab	0.00	Harina	0.65	Chali	0.38	-	-	Chali	0.20	Chali	0.30	-	-	Chali	0.03	Chali	0.11	Chali	0.01	-	-
	Tilapia	0.30	Chali	0.04	Bele	2.11	-	-	Bele	0.27	Bele	0.19	-	-			Bele	0.44	Bele	0.58		
	Golda	0.10	Bele	0.09	Paissa	2.62	-	-	Paissa	0.04	Paissa	1.80	-	-			Paissa	0.2	Paissa	0.34		
	Horina	2.92	Tilapia	0.22	Tilapia	9.85	-	-	Tilapia	3.87	Tilapia	6.93	-	-			Tilapia	12.9	Tilapia	7.82		
	Chali	1.52	Tengra	0.57	Golda	0.04	-	-	Golda	0.03	Golda	0.03	-	-			Tengra	0.01	Tengra	0.02		
	Bele	1.35	Bhangan	0.08	Tengra	0.17	-	-	Tengra	0.01	Tengra	0.17	-	-					Patari	1.76		
	Tengra	0.27	-	-	Patari	2.25	-	-	Patari	0.11	Patari	0.25	-	-					Datina	0.06		
	Major Carp	0.55	-	-	Chemo	0.02	-	-	Datna	0.01	Catol	0.04	-	-					Rui	0.27		
	-	-	-	-	Datina	1.01	-	-	Rui	0.47	Chemo	0.32	-	-					Kailla	0.03		

Sampling Site/ Location	Total Catch (ton): 2019-20, 2020-21 and 2021-22																					
	20th QM		21st QM		22nd QM		23rd QM		25th QM		26th QM		27th QM		28th QM		29th QM		30th QM		31st QM	
	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Fish Species	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)
	-	-	-	-	Rui	1.27	-	-	Chaka	0.05			-	-								
	-	-	-	-	Chaka	0.01	-	-	-	1.56			-	-								
	-	-	-	-	Kailla	0.96	-	-	-	-			-	-								
	-	-	-	-	Nundi Bele	0.02	-	-	-	-			-	-								
	-	-	-	-	Kakra	0.49	-	-	-	-			-	-								
Sub-total =		**9**		**8.0**		**29**		**0.01**		**12.38**		**12.57**	**-**	**-**		**0.21**		**17.38**		**11.76**		**-**
Chunkuri-2	Bagda	0.04	Patari	0.01	Tilapia	0.02	-	-	Paissa	0.05	Sada Chingri	0.03	-	-	Bagda	0.01	Paissa	0.12	Paissa	0.08	-	-
	Paissa	0.00	Tair/Tailla	0.01	Paissa	0.066	-	-	Golda	0.03	Paissa	0.03	-	-	Harina	0.06	Bagda	0.04	Bagda	0.04	-	-
	Khorsula	0.00	Bhangan	0.01	Khorsul	0.009	-	-	Kharulla	0.01	Patari	0.02	-	-	Kakra	0.01	Tilapia	0.08	Tilapia	0.16	-	-
	Horina	0.10	Datina	0.03	Bagda	0.015	-	-	Bagda	0.10	Tengra	0.01	-	-			Harina	0.06	Harina	0.04		
	Motka	0.04	Bagda	0.02	Golda	0.006	-	-	Bele	0.03	Datina	0.02	-	-			Kakra	0.12	Patari	0.04		
	Chali	0.03	Golda	0.03	Patari	0.015	-	-	Harina	0.15	Ilish	0.005	-	-			Patari	0.02	Kala Chingri	0.04		
	Chaka	0.01	Faissa	0.01	Harina	0.008	-	-	Tengra	0.02	Golda	0.01	-	-			Kala Icha	0.04	Sada Chingri	0.04		
	Bele	0.01	Chaka Chingri	0.01	Chali	0.009	-	-	Tairu	0.03	Nilotica	0.06	-	-			Sada Icha	0.04	Golda	0.01		
	Crab	0.03	Harina	0.02	China Punti	0.047	-	-	Chaka	0.01	Baila	0.004	-	-			Bele	0.01				

	Total Catch (ton): 2019-20, 2020-21 and 2021-22																					
Sampling Site/ Location	**20th QM**		**21st QM**		**22nd QM**		**23rd QM**		**25th QM**		**26th QM**		**27th QM**		**28th QM**		**29th QM**		**30th QM**		**31st QM**	
	Fish Species	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Fish Species**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**
	-	-	-	-	Tengra	0.008	-	-	Datina	0.02	Goda Chingri	0.001	-	-			Golda	0.01				
	-	-	-	-	Baila	0.003	-	-	-	-	Chaka Chingri	0..2	-	-								
	-	-	-	-	Datina	0.02	-	-	-	-	Harina	0.02	-	-								
											Chitra	0.004	-	-								
											Pheksa	0.01	-	-								
											Bhangan	0.004	-	-								
											Tairel	0.01	-	-								
											Golda	0.01	-	-								
											Bagda	0.02	-	-								
Sub-total =		**0.24**		**0.15**		**0.46**		**0.00**		**0.44**		**0.25**	**-**	**-**		**0.08**		**0.54**		**0.45**		**-**

Source: CEGIS Field Survey, 2019-2020 and 2020-2021

(E) Traffic Survey data

Table E.1: Traffic Volume Survey at Khulna Mongla Road (Khudir Bottola)

Date: July 27, 2022 (Wednesday)

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	**Factor**	**Khulna to Mongla**	**Mongla to Khulna**	**PCU**	**Khulna to Mongla**	**Mongla to Khulna**	**PCU**	**Khulna to Mongla**	**Mongla to Khulna**	**PCU**
Pedestrian	0	54	81	0	14	39	0	6	85	0
Auto Rickshaw	0.8	0	0	0	0	1	1	0	0	0
Van	0.6	319	316	381	151	206	214	175	276	271
Cycle	0.2	41	92	27	23	22	9	28	32	12
Human Howler	0.6	29	8	22	25	15	24	4	11	9
CNG	0.5	57	60	59	24	23	24	11	17	14
Private Car	1	121	52	173	48	71	119	43	100	143
Motor Cycle	0.3	553	468	306	252	278	159	265	253	155
Jeep	1	29	24	53	16	7	23	11	22	33
Pick-up	2	24	15	78	11	128	278	27	18	90
Micro	1	67	31	98	32	27	59	17	61	78
Bus	2.5	186	97	708	111	110	553	67	131	495
Light Truck	2	46	14	120	21	19	80	17	22	78
Medium Truck	2	163	158	642	253	108	722	104	185	578
Heavy Truck	2	34	13	94	28	26	108	28	22	100
			Total	**2760**		**Total**	**2372**		**Total**	**2056**

Table E.2: Traffic Volume Survey at Khulna Mongla Road (Gonai Bridge)

Date: July 25, 2022 (Monday)

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	Factor	Khulna to Mongla	Mongla to Khulna	PCU	Khulna to Mongla	Mongla to Khulna	PCU	Khulna to Mongla	Mongla to Khulna	PCU
Pedestrian	0	55	61	0	7	7	0	16	14	0
Auto Rickshaw	0.8	0	0	0	0	0	0	0	0	0
Van	0.6	12	27	23	60	94	92	104	93	118
Cycle	0.2	4	4	2	8	10	4	9	13	4
Human Howler	0.6	25	21	28	20	23	26	21	25	28
CNG	0.5	60	77	69	21	25	23	73	78	76
Private Car	1	37	19	56	14	17	31	18	58	76
Motor Cycle	0.3	125	50	53	77	96	52	126	207	100
Jeep	1	7	2	9	2	0	2	4	11	15
Pick-up	2	10	4	28	6	6	24	11	10	42
Micro	1	43	15	58	10	16	26	8	43	51
Bus	2.5	50	33	208	17	20	93	15	43	145
Light Truck	2	4	3	14	10	7	34	3	11	28
Medium Truck	2	50	18	136	59	56	230	30	70	200
Heavy Truck	2	15	4	38	15	11	52	11	19	60
			Total	**720**		**Total**	**688**		**Total**	**943**

Table E.3: Traffic Volume Survey at Power Plant access road (Gonabelai Bridge)

Date: July 26, 2022 (Tuesday)

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	**Factor**	**Power Plant to Zero Point**	**Zero Point to Power plant**	**PCU**	**Power Plant to Zero Point**	**Zero Point to Power plant**	**PCU**	**Power Plant to Zero Point**	**Zero Point to Power plant**	**PCU**
Pedestrian	0	17	27	0	18	15	0	16	10	0
Auto Rickshaw	0.8	0	0	0	0	0	0	0	0	0
Van	0.6	94	25	71.4	23	45	40.8	67	48	69
Cycle	0.2	16	243	51.8	18	18	7.2	85	21	21.2
Human Howler	0.6	12	24	21.6	14	18	19.2	17	19	21.6
CNG	0.5	36	38	37	7	9	8	9	8	8.5
Private Car	1	2	15	17	5	4	9	8	3	11
Motor Cycle	0.3	41	314	106.5	58	71	38.7	144	71	64.5
Jeep	1	1	2	3	2	2	4	0	3	3
Pick-up	2	5	7	24	2	4	12	4	3	14
Micro	1	8	11	19	3	3	6	11	4	15
Bus	2.5	1	1	5	0	1	2.5	1	0	2.5
Light Truck	2	1	1	4	1	27	56	3	27	60
Medium Truck	2	2	5	14	5	0	10	25	0	50
Heavy Truck	2	0	0	0	5	0	10	5	0	10
			Total	**374**		**Total**	**223**		**Total**	**350**

Table E.4: Existing Cropping Pattern of Monitoring Agriculture Plot

Monitoring agriculture plot	Cropping pattern																										
	2013-14			2014-15			2015-16			(2016-17)			(2017-18)			(2018-19)			(2019-20)			(2020-21)			(2021-2022)		
	K-I	K-II	R	K-I	K-II	R	K-I	K-II	R	K-I	K-II	R	K-I	K-II	R	K-I	K-II	R	K-I	K-II	R	K-I	K-II	R	K-I	K-II	R
Monitoring Spot-1 (Baranpara)	F	L.A.	F	F	H.A.	F	F	H.A.	F	F	H.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	23	67
Monitoring Spot-2 (Chunkuri-2)	F	H.A.	F	F	L.A.	F	F	H.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	23	F
Monitoring Spot-3 (Kapalirmet)	F	L.A.	F	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*	F*
Monitoring Spot-4 (Chakgona)	F	L.A.	F	F	F**	F	F	F**	F	F	F**	F	F	F**	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F
Monitoring Spot-5 (Basherhula)	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	L.A.	F
Monitoring Spot-6 (Bidyarbon)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	L.A.	F	F	L.A.	F	F	L.A.	F	F	23	F

*Source: Based on field info/;rmation and farmers interviewed, May, 2022. *previously cultivated. ** data was not collected due to unavailability/change of sampling plot.* ***K-I:*** *Kharif-I (March-June),* ***K-II:*** *Kharif-II (July-October) and* ***R:*** *Rabi (November-February).* ***Fallow****: F,* ***Local Aman****: L.A.,* ***BRRIdhan-23****: 23,* ***BRRIdhan-67****:67.* ***HYV Aman****: H.A.*

Table E.5: Results of Crop production in Monitoring Plots

Monitoring Agricultural Plot	Production and Yeild	Crop Production																										
		2013-14			2014-15			2015-2016			2016-17			2017-18			2018-19			2019-2020			2020-21			2021-2022		
		K-I	K- II	R	K-I	K- II	R	K-I	K- II	R	K-I	K- II	R	K-I	K- II	R	K-I	K- II	R	K-I	K- II	R	K-I	K- II	R	K-I	K- II	R
Monitoring Spot-1 (Baranpara)	Production (ton/Plot)	-	0.8	-	-	1.4	-	-	1.5	-	-	0.27	-	-	0.92	-	-	1.04	-	-	0.67	-	-	1.08	-	-	1.14	2.1
	Yield (ton/Ha)	-	1.9	-	-	3.5	-	-	3.8	-	-	2.5	-	-	2.3	-	-	2.6	-	-	2.5	-	-	2.6	-	-	2.9	5.3
Monitoring Spot-2 (Chunkuri-2)	Production (ton/Plot)	-	2.4	-	-	1.1	-	-	1.9	-	-	0.44	-	-	2.2	-	-	2.14	-		1.9	-	-	2.05	-	-	2.92	-
	Yield (ton/Ha)	-	2.6	-	-	1.7	-	-	2	-	-	2.4	-	-	2.4	-	-	2.3	-		2.25	-	-	2.25	-	-	3.1	-
Monitoring Spot-3 (Kapalirmet)	Production (ton/Plot)	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	-
	Yield (ton/Ha)	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monitoring Spot-4 (Chakgona)	Production (ton/Plot)	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.44	-	-	0.38	-	-	0.42	-	-	0.36	-
	Yield (ton/Ha)	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.92	-	-	1.85	-	-	1.87	-	-	1.6	-
Monitoring Spot-5 (Basherhula)	Production (ton/Plot)	-	0.8	-	-	0.57	-	-	0.99	-	-		-	-	1	-	-	0.47	-	-	0.7	-	-	0.82	-	-	0.80	-
	Yield (ton/Ha)	-	1.8	-	-	1.9	-	-	2.1	-	-	1.9	-	-	2.2	-	-	1.57	-	-	1.6	-	-	1.6	-	-	1.7	-
Monitoring Spot-6 (Bidyarbon)	Production (ton/Plot)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.98	-	-	0.07	-	-	0.3	-	-	0.36	-
	Yield (ton/Ha)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1	-	-	2.1	-	-	2.1	-	-	3.6	-

*Source: Based on field information and farmers interviewed, May, 2022. *previously cultivated. ** data was not collected due to unavailability/change of sampling plot.* ***K-I:*** *Kharif-I (March-June),* ***K-II:*** *Kharif-II (July-October) and* ***R:*** *Rabi (November-February).* ***Yield is calculated for clean rice.***

Table E.6: Results of Crop Damage in Monitoring Plots

Monitoring site	2013-14			2014-15			2015-16			2016-17			2017-18			2018-19			2019-2020			2020-2021			2021-2022		
	Area (ha)	Prod. (tons)	Causes	Area (ha)	Prod. (tons)	Causes	Area (ha)	Prod. (tons)	Causes	Area (ha)	Prod. (tons)	Causes	Area (ha)	Prod. (tons)	Causes	Area (ha)	Prod. (tons)	Causes	Area (ha)	Prod. (tons)	Causes	Area (ha)	Prod. (tons)	Causes	Area (ha)	Prod. (tons)	Causes
Monitoring agriculture land-1	-	N.F.	-	-	-	-	-	N.F.	-	0.06	0.024*	E	-	N.F.	-	-	N.F.	-	0.13	0.33*	F	-	N.F	-	-	N.F	-
Monitoring agriculture land-2	-	N.F.	-	0.33*	0.4*	E	-	N.F.	-	-	-	-	-	N.F.	-	-	N.F.	-	0.08	0.19*	F	-	N.F	-	-	N.F	-
Monitoring agriculture land-3	-	N.F.	-	-	-	-	-	N.F.	-	-	-	-	-	N.F.	-	-	N.F.	-	-	N.F.	-	-	N.F	-	-	N.F	-
Monitoring agriculture land-4	-	N.F.	-	-	-	-	-	N.F.	-	-	-	-	-	N.F.	-	-	N.F.	-	0.03	0.05*	F	-	N.F	-	-	N.F	-
Monitoring agriculture land-5	-	N.F.	-	0.17*	0.12*	E	-	N.F.	-	0.09	0.019*	E	-	N.F.	-	-	N.F.	-	0.03	0.05*	F	-	N.F	-	-	N.F	-
Monitoring agriculture land-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.F.	-	0.07	0.14*	Both E and F	-	N.F	-	-	N.F	-
Total	-	-	-	0.50*	0.52*		-	-	-	0.15	0.043*	-	-	-	-				0.34	0.76*		-	-	-	-	-	-

*Source: Based on field information and farmers interviewed, May, 2022 * Crop damage, **N.F.-Not found*

Note: A: water logging due to heavy rainfall, B: water logging due to internal river water, C: water logging, D: Salinity, E: Other (Pest infestation), F: Tropical Cyclone.

(F) Monitoring results

Adroit Environment Consultants Ltd.

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AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Project Title : 2×660 MW Maitree Super Thermal Project
Project Location : Rampal, Bagherhat

Description of Sample : Ambient Air
Sample Collector : Adroit Environment Consultants Ltd. (Monitoring team)
Sampling date : 21st July to 2nd August, 2022
Reporting date : 7th September, 2022

Description of analysis

Sample Location ID	Concentration present of different parameter in ambient air							
	$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO	O_3	Remarks
AQ1	51.29	69.28	134.27	14.56	20.23	1.3	38	Complies
AQ2	28.43	53.42	89.45	11.39	20.47	02	23	Complies
AQ3	34.84	56.18	106.28	11.04	23.18	0.3	12	Complies
AQ4	41.2	64.29	118.62	12.58	18.4	1	16	Complies
AQ5	39.36	58.03	108.2	13.29	20.63	0.4	11	Complies
AQ6	38.48	53.19	103.72	11.08	21.94	0.2	29	Complies
AQ7	27.55	51.98	93.44	10.57	16.4	0.8	14	Complies
AQ8	69.28	100.28	189.38	23.66	39.12	2.1	66	Not Complies
AQ9	43.8	62.53	120.3	14.55	22.3	0.1	29	Complies
AQ10	49.15	74.7	141.48	14.9	20.82	0.4	31	Complies
AQ11	30.22	60.21	103.5	12.59	19.69	0.9	24	Complies
AQ12	42.85	69.02	127.39	12.71	23.16	0.4	37	Complies
Units	μg/m³	μg/m³	μg/m³	μg/m³	μg/m³	mg/ m³	μg/m³	
Test Duration (Hours)	24	24	8	8	8	8	8	
Method of Analysis	Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob & Hochheiser	CO Meter	O_3 Meter	
DoE Standard	65	150	200	365	100	10	157	
IFC/WB Standard	75	150	NF	125	200	NF	160	

(NF – not found, DoE – Department of Environment.)

Note: *This monitoring report was usually accomplished by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model- Envirotech India AAS-127 Mini).*

1. Fine Particulate Matter ($PM_{2.5}$).
2. Respirable Dust Content (PM_{10}).
3. Suspended Particulate Matter (SPM).
4. Oxides of Nitrogen (NO_X).
5. Oxides of Sulfur (SO_2).
6. Carbone Mono-Oxide (CO).

Comment: *Fine particulate matter concentration at location AQ8 doesn't conform to the standard allowable limit.*

Md. Faisal Bin Mahmud
Sr. Chemist

Md. Saiful Islam
Chief Operating Officer

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080013	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Calcium (Ca)	75	92	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	24	mg/L	CRM	-
5	Chloride	150-600	2850	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	40	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.023	mg/L	AAS	0.0003
8	Hardness	200-500	2500	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	3.02	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	232	mg/L	AAS	0.05
12	Phosphate	6.0	0.40	mg/L	UVS	0.10
13	Potassium (K)	12.0	85	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	4870	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-
16	Turbidity	10	50.6	NTU	Turbidity Meter	-
17	Carbonate (CO3)	-	0.19	mg/L	Titrimetic	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

04/08/2022
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Chief Chemist
Department of Public Health Engineering
Central Laboratory Mohakhali, Dhaka

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Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	BHossain 04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	Akhter 04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080014	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	28	mg/L	CRM	-
4	Cr (Total)	0.05	0.024	mg/L	AAS	0.0003
5	Hardness	200-500	2400	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
7	Phosphate	6.0	0.30	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	4800	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	10	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	BHossain 04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	Akhter 04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080015	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	48	mg/L	CRM	-
4	Cr (Total)	0.05	0.028	mg/L	AAS	0.0003
5	Hardness	200-500	2250	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.010	mg/L	AAS	0.001
7	Phosphate	6.0	0.26	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	4350	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	11	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080016	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-04)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00018	mg/L	AAS	0.00015
3	Calcium (Ca)	75	104	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	36	mg/L	CRM	-
5	Chloride	150-600	3170	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	48	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.027	mg/L	AAS	0.0003
8	Hardness	200-500	2500	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	7.12	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	233	mg/L	AAS	0.05
12	Phosphate	6.0	0.35	mg/L	UVS	0.10
13	Potassium (K)	12.0	93	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	5250	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	12	mg/L	Gravimetric Method	-
16	Turbidity	10	109	NTU	Turbidity Meter	-
17	Carbonate (CO3)	-	0.35	mg/L	Titrimetic	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Alam

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Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka — Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080017	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-05)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00017	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	24	mg/L	CRM	-
4	Cr (Total)	0.05	0.023	mg/L	AAS	0.0003
5	Hardness	200-500	2350	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.003	mg/L	AAS	0.001
7	Phosphate	6.0	0.29	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	4920	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	9	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080018	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-06)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	20	mg/L	CRM	-
4	Cr (Total)	0.05	0.033	mg/L	AAS	0.0003
5	Hardness	200-500	2100	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
7	Phosphate	6.0	0.32	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	4060	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	11	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080019	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-07)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Calcium (Ca)	75	97	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	24	mg/L	CRM	-
5	Chloride	150-600	3100	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	45	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.020	mg/L	AAS	0.0003
8	Hardness	200-500	2550	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	17.02	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	227	mg/L	AAS	0.05
12	Phosphate	6.0	0.35	mg/L	UVS	0.10
13	Potassium (K)	12.0	88	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	5150	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	18	mg/L	Gravimetric Method	-
16	Turbidity	10	142	NTU	Turbidity Meter	-
17	Carbonate (CO3)	-	0.33	mg/L	Titrimetic	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

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04.08.2022

04/08/2022
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Department of Public Health Engineering
Central Laboratory Mohakhali, Dhaka

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Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka — Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080020	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-08)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	48	mg/L	CRM	-
4	Cr (Total)	0.05	0.030	mg/L	AAS	0.0003
5	Hardness	200-500	2400	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Phosphate	6.0	0.38	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	5070	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	13	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka   Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080021	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-09)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	52	mg/L	CRM	-
4	Cr (Total)	0.05	0.038	mg/L	AAS	0.0003
5	Hardness	200-500	2460	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
7	Phosphate	6.0	0.37	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	4750	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	12	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka   Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080022	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-10)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	56	mg/L	CRM	-
4	Cr (Total)	0.05	0.042	mg/L	AAS	0.0003
5	Hardness	200-500	2450	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.010	mg/L	AAS	0.001
7	Phosphate	6.0	0.20	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	5100	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	19	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka — Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080023	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-11)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	96	mg/L	CRM	-
4	Cr (Total)	0.05	0.026	mg/L	AAS	0.0003
5	Hardness	200-500	3100	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.012	mg/L	AAS	0.001
7	Phosphate	6.0	0.25	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	8900	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	16	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 84/ CC, DPHE, CL, Dhaka — Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080024	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-12)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	96	mg/L	CRM	-
4	Cr (Total)	0.05	0.024	mg/L	AAS	0.0003
5	Hardness	200-500	2300	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.017	mg/L	AAS	0.001
7	Phosphate	6.0	0.30	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	7820	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	15	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080025	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-13)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	240	mg/L	CRM	-
4	Cr (Total)	0.05	0.029	mg/L	AAS	0.0003
5	Hardness	200-500	4000	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.010	mg/L	AAS	0.001
7	Phosphate	6.0	0.31	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	12200	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	13	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080026	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Surface Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-14)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	36	mg/L	CRM	-
4	Cr (Total)	0.05	0.032	mg/L	AAS	0.0003
5	Hardness	200-500	5000	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
7	Phosphate	6.0	0.26	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	16400	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	17	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080027	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Ground Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-01, Project site)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.008	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	320	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
5	Phosphate	6.0	0.27	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	1150	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	2	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka

Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080028	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Ground Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-02, Rajnagar)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	165	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Phosphate	6.0	0.32	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	360	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 84/ CC, DPHE, CL, Dhaka — Date: 04-08-2022

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2022080029	Sample Receiving date: 16-06-2022
Ref. Memo No: 42.06.2626.119.37.001.22- 1492 & Dated: 14-06-2022	Sample Source: Ground Water
Sent by:Md. Mutasim Billah ,Project Leader , Power & Energy Division, CEGIS, Dkaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-03, Karpasdanga)	Union:, Vill.:
Sample Collection date:	Date of Testing: 16/06/2022-31/07/2022

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.064	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	275	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Phosphate	6.0	0.30	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	620	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	2	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 04.08.2022	1.) Name: Mita Sarker Designation: Senior Chemist	BHossain 04/08/2022
2.) Name: Taslima Akhter Designation: Sample Analyzer	04.08.2022	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Environmental Laboratory

Memo No ELAB2022080016.. — Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of Water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant — Code: FPC007
Sample Type: Surface Water — ID: FPC007_001 — Collection Date: Aug/2022
Location: N/A
Received From: Md. Mutasim Billah — Received Date: 01/09/2022 — Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-01	NO3	10	8.4135	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0481	ppm	UV-VIS	
03		SO_4^{2-}	400	36.325	ppm	UV VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by	Approved by
Name: Rafiqul Islam & Rafiqul Alam	Name: Rafiqul Alam
Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert	Designation: Laboratory Expert
Signature: RAlam 31.10.2022	Signature: RAlam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001656 — Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. — Code: FPC006

Sample Type: Surface Water — ID: FPC007_002 — Collection Date: Aug/2022

Location: N/A

Received From: Md. Mutasim Billah — Received Date: 01/09/2022 — Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-02	NO_3^-	10	13.523	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0250	ppm	UV-VIS	
03		SO_4^{2-}	400	33.659	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: RAlam 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001657 — Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. — Code: FPC006

Sample Type: Surface Water — ID: FPC007_003 — Collection Date: Aug/2022

Location: N/A

Received From: Md. Mutasim Billah — Received Date: 01/09/2022 — Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-03	NO_3^-	10	12.745	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.6901	ppm	UV-VIS	
03		SO_4^{2-}	400	46.923	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: RAlam 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001658 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_004 Collection Date: Aug/2022

Location: Jetty.

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-04	NO_3^-	10	10.790	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0516	ppm	UV-VIS	
03		SO_4^{2-}	400	41.557	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by
Name: Rafiqul Islam & Rafiqul Alam
Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert
Signature: RAlam 31.10.2022

Approved by
Name: Rafiqul Alam
Designation: Laboratory Expert
Signature: RAlam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001659 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_005 Collection Date: Aug/2022

Location: N/A

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-05	NO_3^-	10	8.7079	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0209	ppm	UV-VIS	
03		SO_4^{2-}	400	22.286	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by
Name: Rafiqul Islam & Rafiqul Alam
Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert
Signature: RAlam 31.10.2022

Approved by
Name: Rafiqul Alam
Designation: Laboratory Expert
Signature: RAlam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001660 | Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. | Code: FPC006

Sample Type: Surface Water | ID: FPC007_006 | Collection Date: Aug/2022

Location: N/A

Received From: Md. Mutasim Billah | Received Date: 01/09/2022 | Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-06	NO_3^-	10	9.3808	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0216	ppm	UV-VIS	
03		SO_4^{2-}	400	29.533	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: RAlam 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001661 | Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. | Code: FPC006

Sample Type: Surface Water | ID: FPC007_007 | Collection Date: Aug/2022

Location: N/A

Received From: Md. Mutasim Billah | Received Date: 01/09/2022 | Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-07	NO_3^-	10	11.147	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0209	ppm	UV-VIS	
03		SO_4^{2-}	400	37.169	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: RAlam 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001662 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_008 Collection Date: Aug/2022

Location: N/A

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-08	NO_3^-	10	8.4976	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0613	ppm	UV-VIS	
03		SO_4^{2-}	400	45.682	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: RAlam 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 31.10.2022

CEGIS Center for Environmental and Geographic Information Services
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Environmental Laboratory

Memo No. ELAB202208001663 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_009 Collection Date: Aug/2022

Location: N/A

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-09	NO_3^-	10	11.000	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0086	ppm	UV-VIS	
03		SO_4^{2-}	400	52.044	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

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Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001664 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_010 Collection Date: Aug/2022

Location: N/A

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-10	NO_3^-	10	14.427	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0064	ppm	UV-VIS	
03		SO_4^{2-}	400	36.654	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001665 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_011 Collection Date: Aug/2022

Location: Shapmari

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-11	NO_3^-	10	6.4160	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.0036	ppm	UV-VIS	
03		SO_4^{2-}	400	158.91	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001666 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_012 Collection Date: Aug/2022

Location: Mongla.

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-12	$NO3^{-}$	10	8.0561	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		$PO4^{3-}$	6	0.0572	ppm	UV-VIS	
03		$SO4^{2-}$	400	111.23	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: R Alam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001667 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_013 Collection Date: Aug/2022

Location: Harbaria

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-13	$NO3^{-}$	10	15.352	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested
02		$PO4^{3-}$	6	0.2280	ppm	UV-VIS	
03		$SO4^{2-}$	400	200.60	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: R Alam 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: R Alam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001668 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Surface Water ID: FPC007_014 Collection Date: Aug/2022

Location. Akram Point.

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	SW-14	NO_3^-	10	10.853	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.1257	ppm	UV-VIS	
03		SO_4^{2-}	400	517.86	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

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Environmental Laboratory

Memo No. ELAB202208001669 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Ground Water ID: FPC007_015 Collection Date: Aug/2022

Location: PPJ

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	GW-15	NO_3^-	10	4.3343	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.3290	ppm	UV-VIS	
03		SO_4^{2-}	400	2.1054	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001670 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Ground Water ID: FPC007_016 Collection Date: Aug/2022

Location: Kapashdanga.

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	GW-16	NO_3^-	10	12.304	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	1.4467	ppm	UV-VIS	
03		SO_4^{2-}	400	6.8356	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: R Alam 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: R Alam 31.10.2022

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Environmental Laboratory

Memo No. ELAB202208001671 Date: 31/10/2022

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC006

Sample Type: Ground Water ID: FPC007_017 Collection Date: Aug/2022

Location: Rajanagar.

Received From: Md. Mutasim Billah Received Date: 01/09/2022 Testing Date: 01/09-31/10/22

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard	Concentration Present	Unit	Analysis Method	Remarks
01	GW-17	NO_3^-	10	1.9372	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		PO_4^{3-}	6	0.3236	ppm	UV-VIS	
03		SO_4^{2-}	400	1.7690	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: R Alam 31.10.2022

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: R Alam 31.10.2022

জীবনের জন্য বিজ্ঞান
"শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)
BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: Institute of National Analytical Research & Service (INARS)

Analysis Report

Analytical Service Cell Ref No: Jun2022033651	Unit (Lab/Inst.) Ref No: A-818-821
Lab ID: INS-818-821	Sample Receiving Date: 19/06/2022
Sample ID: A-818-821	Submission Date: 15 Jun 2022
	Report Delivery Date: 18/07/2022

Sample Description: RIver water Sample ID: Project jetty, Mongla, Harbaria, Akram point

Client's Details: Mahadi Hassan
Center For Environmental And Geographic Information Services
House#House No. 06, , Road No. 23/C, Dhaka-1216

Number of Sample: 4

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-818	Water (Sample:01, Project Jetty)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-819	Water (Sample:02, Mongla)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-820	Water (Sample:03, Harbaria)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-821	Water (Sample:04, Akram Point)	Oil and Grease	Less than 2.0 mg/L	5520.B

18.07.2022
Analyst
Md. Ripaj Uddin
Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

18.7.2022
Section/Division In-Charge
Md. Ahedul Akbor
Senior Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

18.07.2022
In-Charge/Director
Shamim Ahmed
Director (In-Charge)
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

Note:
a. The results reported here pertained to the sample received in this laboratory only.
b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory.
d. The report shall not be reproduced/published partly or fully without prior approval of the authority.

Analytical Service Cell
Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh
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Pages 1 of 1

18th of July 2022 09:56 AM

জীবনের জন্য বিজ্ঞান
"শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)
BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: Institute of National Analytical Research & Service (INARS)

Analysis Report

Analytical Service Cell Ref No: Jun2022033650	Unit (Lab/Inst.) Ref No: A-801-817
Lab ID: INS-801-817	Sample Receiving Date: 19/06/2022
Sample ID: A-801-817	Submission Date: 15 Jun 2022
	Report Delivery Date: 18/07/2022

Sample Description: River water sample ID: 01,02,03,04,05,06,07,08,09,10, shapmari, mongla, harbaria, akram point, power plant , rajnagar, kapashdanga

Client's Details: Mahadi Hassan
Center For Environmental And Geographic Information Services
House#House No. 06, , Road No. 23/C, Dhaka-1216

Number of Sample: 17

Report Details:

Lab ID	Particulars of supplied sample	Parameter	Concentration	Test Method (APHA)
A-801	River water (Sample-01)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-802	River water (Sample-02)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-803	River water (Sample-03)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-804	River water (Sample-04)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-805	River water (Sample-05)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-806	River water (Sample-06)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-807	River water (Sample-07)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-808	River water (Sample-08)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-809	River water (Sample-09)	Mercury (Hg)	Less than 0.001 mg/L	3112.B

Note:
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Analytical Service Cell
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Pages 1 of 2

18th of July 2022 10:36 AM

জীবনের জন্য বিজ্ঞান

"শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)

BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

A-810	River water (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-811	River water (Sample-Shapmari)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-812	River water (Sample-Mongla)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-813	River water (Sample-Harbaria)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-814	River water (Sample-Akram Point)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-815	River water (Sample-Power Plant)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-816	River water (Sample-Rajnagar)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-817	River water (Sample- kapashdanga)	Mercury (Hg)	Less than 0.001 mg/L	3112.B

18.07.2022
Analyst

Mehedi Hasan
Scientific Officer
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BCSIR, Dhaka-1205

18.7.2022
Section/Division In-Charge

Md. Ahedul Akbor
Senior Scientific Officer
Institute of National Analytical
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BCSIR, Dhaka-1205

18/07/2022
In-Charge/Director

Shamim Ahmed
Director (In-Charge)
Institute of National Analytical
Research & Service (INARS)
BCSIR, Dhaka-1205

Note:

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