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

25th Quarter Monitoring Report

Monitoring Period: May 2020– July 2020

October 2020

CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212. Bangladesh. Tel: 88 02 58817649-52; 9842581, 9842551 Fax: 88 02 9843128, http://www.cegisbd.com

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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	Bangladesh 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 25th quarterly monitoring report covers the status of EMP (Environmental Management Plan) implementation 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 monthe of July, 2020 CEGIS team carried out the monitoring activities covering every monitoring aspects as assigned in the ToR (Terms of Reference) and approval conditions from 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, chemical properties of river bed materials, agricultural resources monitoring, fisheries resources, Socio-economic monitoring, aquatic & terrestrial ecosystem monitoring and the Sundarbans Reserve Forest (SRF) health monitoring.

The progress of Maitree Super Thermal Power Plant has been dropped due to the sudden outbreak of the COVID-19. At the initial stage of this pandemic, the project implementation activities were like extension and development of internal road network, jetty construction activities, construction of key components, mechanical and civil infrastructure development works etc. After withdrawal of government holiday/lockdown due to the pandemic outbreak, the project authority again started to work carefully step by steps prioritizing the health issues for the workers and officers.

The environmental due diligence for this project covers the Environmental Management System Action Plan, Occupational Health and Safety & Workers' wellbeing, Biodiversity and Sustainable Management of Natural Resources etc. The monitoring team observed that BIFPCL is typically complying with the EMPs as suggested in the EIA report of the Power Plant as well as in the EIA report of Coal Transportation. In addition, as an Environmental Monitoring agency, CEGIS also recommended few measures as per EMP to be complied for ensuring environmental and social safeguarding of the study area.

The recommendations include appropriate and adequate use of face mask and safeguarding of other health rules, protection of waste water dumping from labour colony to the nearby water bodies, river bank protection works, restricting groundwater extraction, hastening the green belt development, raising awareness among the workers for managing the COVID-19 outbreak, proper implementation for workers association and insurance policies, placement of sufficient waste coloured disposal bins in appropriate locations and most importantly, the continuous inspection of occupational and health safety by the project authority.

According to the document of BIFPCL, the Occupational Health and Safety Policies; grievance redress mechanism; Emergency preparedness and response plan; Fire safety plan; Stakeholder Engagement Plan etc. are being implemented as required. Most importantly, the EPC contractor has continued the specific measures/initiatives for avoiding any intendent like disease outbreak and accidental incidents. OHS department are arranging robust training sessions, health check-up, thermal scanning and proper hygiene system for COVID protection, employing lockout/ tag out procedures, inspection of all machineries/equipment and tools to ensure that they are in good working order, blocking off areas where heavy machinery or vehicles are being used, ensuring license or proper training for workers/drivers/operators/supervisors to operate machineries/equipment/tools and vehicles etc. They are also documenting the daily monitoring of EMP implementation activities like use of PPEs, noise level and water sprinkling at the sensitive places.

On the other hand, all the measured values of the air quality parameters for all locations were found well below the standard limit set by ECR' 2005. Seasonal variation of the data reflects no significant changes in the concentrations of air pollutants for the corresponding locations. Cluster analysis of the air quality data shows that, Hiron point, Akram Point and Harbaria of Sundarbans represents the locations of minimum pollution level and are away from the nuclei of Mongla industrial zone and the project area. In contrast, Chalna, Mongla Ghat, and Khan Jahan Ali Bridge in Khulna represent the area of maximum pollution as these areas are subjected to higher in population density and increased industrial activities among all sites whereas moidara shapmari, Gaurambha and Bajua represent lower in population density and moderate commercial activities with moderate pollution level. However, according to the measured values, it can be said that the present air shed is not a degraded air shed as no significant exceedances or variation has ever been recorded among the concentrations of criteria pollutants.

In course of noise level monitoring, the observed data was not found to exceed the Bangladesh standard limit of noise level at eight locations during this monitoring but at Akram Point it was found to exceed the Bangladesh standard limit which might be due to the birds' chirping, stormy wind, wave breaking on the shoreline, howling of leaves and so on. However, during the entire monitoring periods it was found that, the noise level of nine locations were found to exceed the Bangladesh standard limit for their corresponding standard values in their different monitoring seasons which might be due to traffic mobilization, industrial activities, vessels movement within the rivers and local vehicles were the anthropogenic sources of noise.

The water quality was also monitored like the previous tiers as the physico-chemical properties Passur river's water is highly influenced by tidal effects with seasonal changes, upstream flow and catchment water discharge. During the monitoring tier (monsoon, 2020), the physico-chemical properties of water of the Passur-Sibsa RS were found fairly healthy. Some fluctuations were observed in the concentrations of parameters among different sites though the corresponding values of pH, Temperature and DO level were found quite good beside the project site and in the Sundarbans Reserve Forest (SRF). TDS, TH and TSS concentrations in the observed RS were found compatible to the national and international standards whereas high COD was found in all the monitoring sites which might be the effect of sediment loads and high nutrients contributed by the Bay of Bengal. Nitrate (NO_3^-) and Phosphate (PO_4^{3-}) were found within a very standard range in respect to a natural river. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and showed no issues as well.

Oil and grease concentration were found less than 4.0 mg/L, which is far below from the recommended concentration (10.0 mg/L) for Inland Surface Water as per ECR, 1997. TOC and PAHs concentration were found still within the permissible limit of inland surface water quality of river. Moreover, chemical characteristics of the groundwater were also found suitable for all sites and safe for drinking purpose as per drinking water standards, ECR 1997 but TDS concertation was found slightly higher in the project site. The groundwater quality of the observed area is free from any kind of metal pollution except Arsenic contamination in Rajnagar. But this concentration for a shorter period of time is not as dangerous as to stop drinking water from the tube well. However, this issue will be checked carefully during the upcoming monitoring period and necessary measures will be suggested accordingly.

Monitoring of agricultural resources was conducted in July, 2020 instead of April, 2020 due to COVID-19 situation. Therefore, crop production and damage data were collected in July, 2020 instead of April, 2020. Crop production was reported to be reduced at all locations due to the impact of tropical cyclone BULBUL. In Bidyarban, pest infestation was reported to be another reason for more crop damage along with cyclone BULBUL. The crop production was found maximum in Chunkuri-2 whereas minimum was in Bidyarban. Livestock resource was found to be similar like the previous tiers. However, number of freely reared livestock are decreased due to lack of grazing land as reported by the local people.

Traffic surveys were carried out at three preselected locations around the project site namely Khudir Bottola area, Gonai Bridge at Khulna Mongla Road and Gonabelai/taltola Bridge at Power Plant access road. The analyzed data represents that the Khulna-Mongla Highway receives the largest number of vehicles, compared to other surveyed roads. It was also observed that the vehicular movements during the survey were mostly for the regular activities in the surveyed region and rigorous construction activity of the MSTPP resulted in a limited number of vehicular movements on the surrounding road network.

Monitoring of fisheries resources revealed the changes in habitat uses by fish caused mainly due to biophysical changes like tidal effect, forest erosion and vegetation coverage, seasonality, food availability and also fisheries management practices. Moreover, two types of habitats were found through analyzing the type of habitat uses by different age group of fish species (based on the length-based community structure model) i.e. i) nursery ground and ii) ground for maturation and feeding. Shannon-Weiner diversity index was also observed to vary between the recent quarter with that of all previous quarters. Highest Shannon-Weiner index was found at Mongla point (0.55) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at Maidara River (0.45). Maximum FSR was recorded at the Chalna point (n=15), while very low FSR was recorded at Maidara site (n=6). Fries of fin fish were found dominated at three sampling sites i.e. Mongla, Maidara and Chalna Point whereas juvenile to adult age group were found dominant at Maidhara and Chalna Point. Among the fishe species Tapse, Poma, Amadi and Chewa were observed to be dominant in the three sampling sites. Fish species like *Tapse* was found to be the abundant among the migratory fish species observed. Moreover, among migratory species, Poma, Paissa, Chewa and Banspata were observed to migrate for a long distance. During this monitoring, the highest stocking rate in respect of Bagda was observed in Rajnagar Gher followed by Kapashdanga and Chunkuri-2. The highest catch susceptibility was also found in case of Bepdi Jal (10.5 kg/haul).

For ecological resources monitoring the vegetation composition, plant diversity, vegetation canopy status, plant health, bird habitat status, dolphin occurrence in river systems were monitored during this monitoring season. A total of 45 tree species were recorded from all the monitoring sites with a Shanon-Winner diversity index of 3.33. Canopy status of all studied homestead was found reduced due to the effect of Cyclone Amphan. Status of plant health also changed at all the locations for the above mentioned cause. No bird nest observed at any site. Dolphin occurrence was recorded at Passur and Maidara River and some connected tributaries of Passur River like Shella Gang, Dhangmari and Bhadra Khal. The occurrence was found higher at Bhadra and Dhangmari Khal and the highest encounter rate was recorded (0.68 Individual/km/hour) at Bhadra Khal.

Forest Health Monitoring program was intended to decide the status, changes, and patterns in pointers of trees condition on certain time between time premise along the Passur River. The Checking markers included plant growth, tree regeneration, tree crown condition, tree damage, lichen network, plant diversity, soil chemistry, and plant physiology were seen in the permanent sample plots (PSPs). It can be predicted in terms of seedling density, pneumatophores, crab hole, canopy cover and leaf area index (m^2 leaf area/m^2 ground area) that the forest condition is demonstrating positive changes intermittently, in spite of the fact that there has some occasional impact. Phenological changes were not found in all PSPs. During this tier, Hiron point could not be monitored due to worse weather condition. Seedling percentage was found increased in Sutarkhali and the Sedimentation rates were also found comparatively higher in Sutarkhali plot. The complex species sundari was found affected with top dying in Harbaria. The Akram point is situated at the confluence of Shibsa and Passur River. Therefore, during tidal inflow the forest floor carry large amount of sediment than other locations. The number of crab hole increased at this site but the other parameter showed insignificant changes. Generally, it tends to be said that forest health condition along the Passur River is in stable condition.

As a follow up study of social safeguard monitoring, the 25th monitoring was held to understand the social safeguard status based on the guidelines of DoE and EMP of EIA report. Physical observation, telephonic interview and informal interviews were taken place to collect data on livelihoods, occupational health and safety, working condition and community health and current activities of Corporate Social Responsibility (CSR).

However, this period of monitoring was passed a crucial time when a pandemic situation prevailed due to the spread of Covid 19 virus. The rate of local labor recruitment was being increased and it made a good opportunity for local labors as pandemic situation made a negative impact on local livelihoods. The PMU was continuing their plan to make local people semi-skilled to skilled in order to increase the engagement of more local people into the power plant.

The number of working forces decreased (due to the pandemic situation) and the PMU ensured social distancing and other health safety rules (suggested by WHO and Bangladesh public health expert) to ensure safety at workplace. Additionally, the PMU encouraged labors to obey health safety rules when they are staying at the Labor sheds. Regular monitoring is occurring by the PMU for increasing the level of consciousness to overcome the pandemic situation.

The project authority was trying to maintain all safety measures for avoiding accidental cases and keeping good health of workers. The toolbox meeting was held every day and all labors were found as well known about their safety measures (use of PPE and other safety measures). However, labor sheds at the project site were found clean and the workers were found satisfied with the concurrent adequate toilet facilities, kitchen, waste management, drainage and drinking water facilities. Dust suppression activities were found adequate as the authority put more emphasize on water spraying systems and decrease the number of working hours during the night shift. For developing green belt around the project site, the authority planned to plant about two lacs of trees of local species as stated earlier. the authority informed that about 1,15,070 plants were planted and monitoring was continued to avoid high mortality rate of plants.

The CSR activities were continuing by the project authority. Under the CSR, about 2,850 people from 11 unions of Rampal and Mongla upazilla benefited by the relief distribution program. In this program, food Items distributed by Alhaj Talukder Abdul Khaleq, the Honorable city Mayor of Khulna whereas UNO of Rampal upazilla, Deputy project director from BIFPCL and union chairman were presented and participated in this program. Additionally, Reverse osmosis (Ro) water filter was inaugurated in Gaurambha and Rajnagar union. According to local people, this RO filter will be very helpful to get fresh drinking water as salinity is the major problem for local community.

1. Introduction

1.1 Background

As per the scope of works, 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 are being broadly monitored. As an independent environmental monitoring team, CEGIS was engaged for conducting the said activities in accordance with the 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**)**.** According to 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 variation. But due to COVID-19 outbreak, Ministry of Health and Family Welfare, Bangladesh enforced lockdown throughout the country and as a result the monitoring team could not carry out the 24th quarterly monitoring program. However, in July, 2020 (monsoon season) CEGIS team has carried out the 25th monitoring activities. The current document constitutes the 25th quarterly monitoring aspects covering all the preselected monitoring parameters and locations. Besides, during this period the Hiron point of Sundarbans was not visited due to rough weather condition.

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 (to monitor the ambient air quality). Potential noise generation sources are also identified and selected for noise level monitoring. 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 are 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 are 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 for ensuring environmental sustainability and social acceptability.

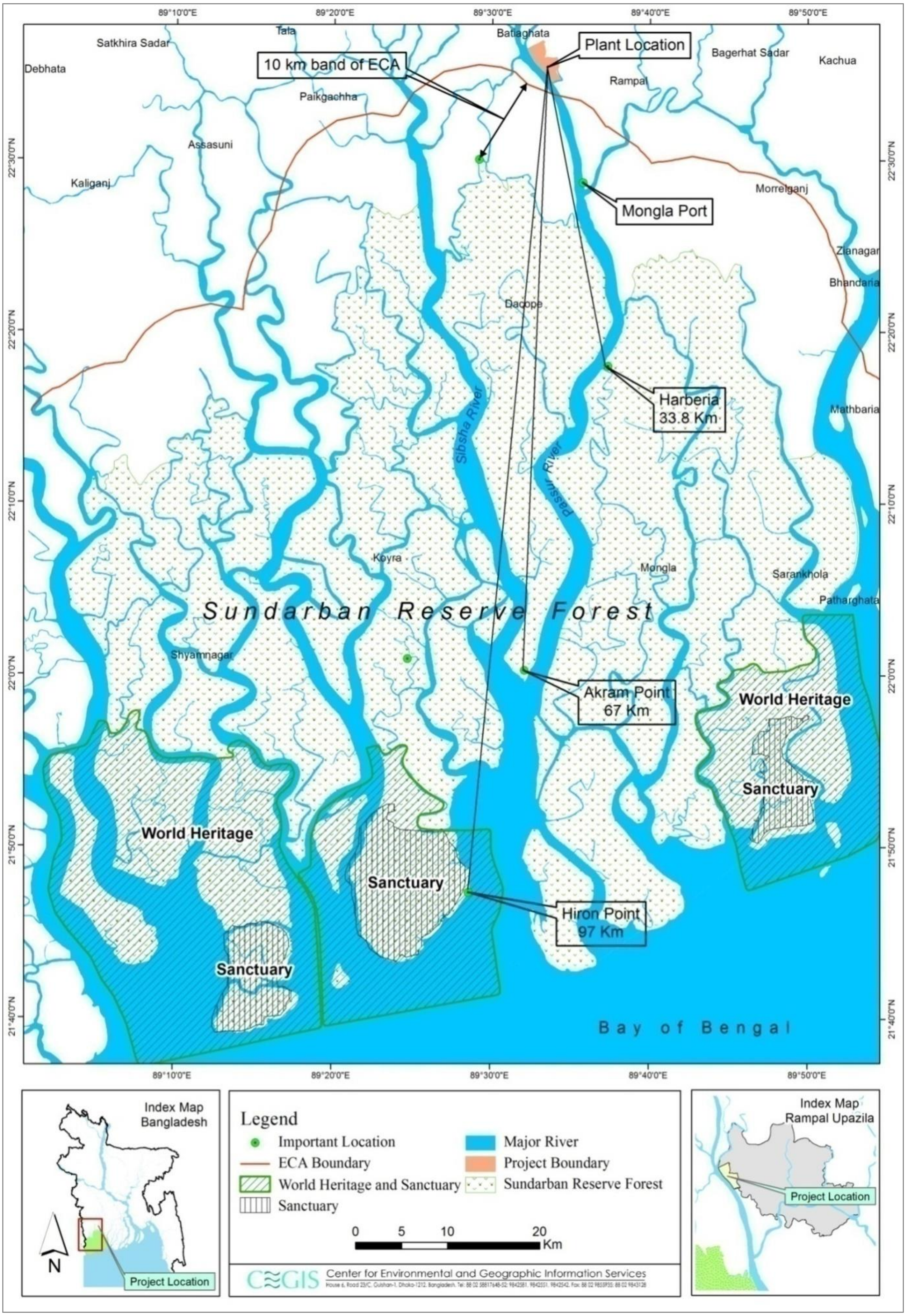


Figure 1.1: Location Map of the Study Area

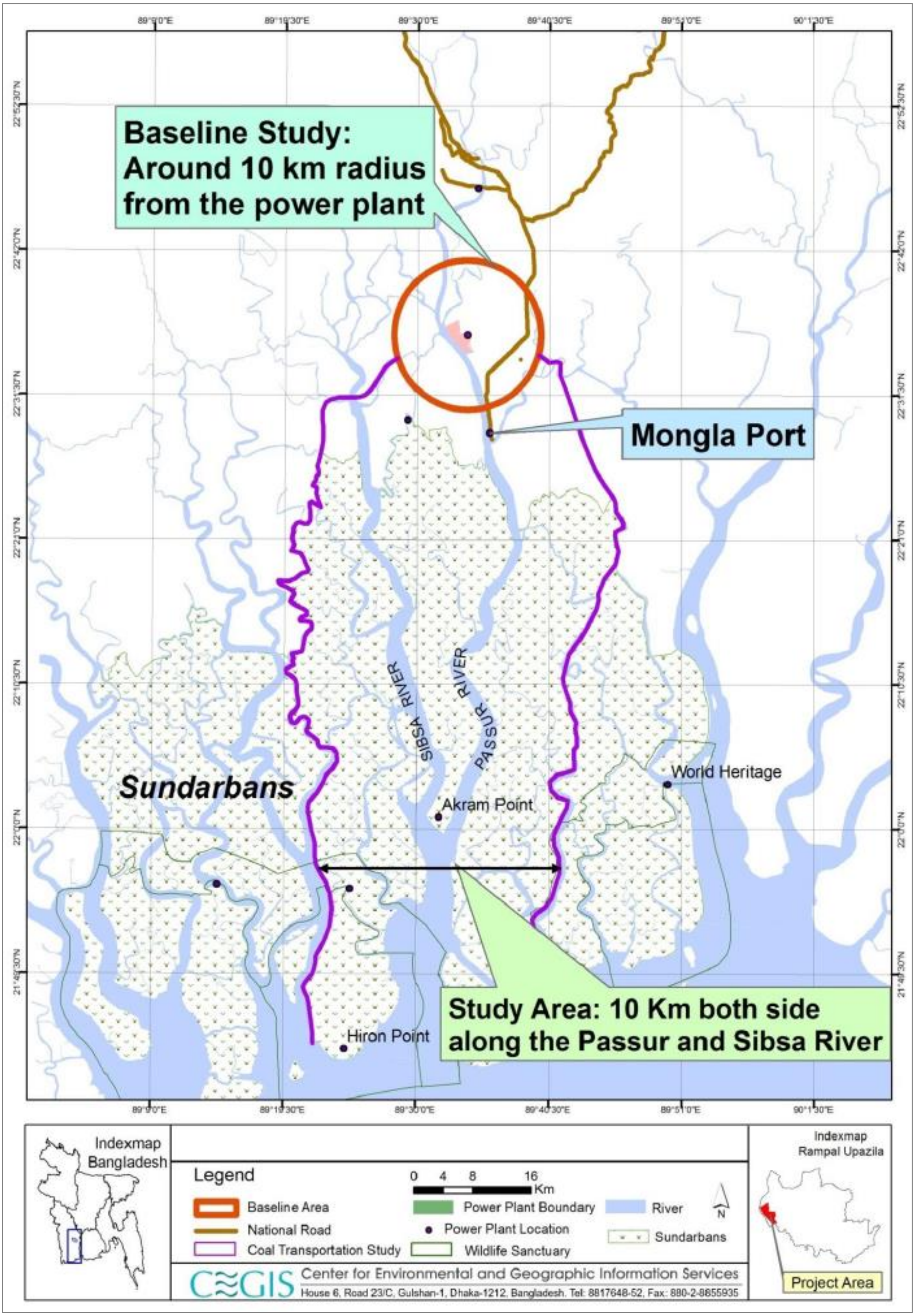


Figure 1.2: AOI of Environmental and Socio-economic Monitoring

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 report 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 25th 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 so 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) are included in each of the social environment-monitoring program. The changes in important socio-economic indicators are 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, labor 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; Labor 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 as 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 pre-construction, construction and operation stages. However, during the recent visit, all the preselected parameters and locations were monitored at locations except at Hiron point of Sundarbans (due to rough weather condition the team could not reach) to see if any major changes occurred due to concurrent construction and supporting erection activities of the project.

2.1.1 Methodology

In general, Particulate Matters (i.e., $PM_{2.5}$, PM_{10}, and SPM), SOx, NOx, CO and O_3 are expected to be generated from the coal-based Power Plant activities at its different phases i.e. pre-construction, construction and operation. The monitoring locations as well as the indicators were selected during the EIA study based on a number of selected 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. A comprehensive discussion on the recently assessed air quality is reported in the following sections.

2.1.2 Method of Sampling and Laboratory Testing

Respirable Dust Sampler (Model-Envirotech India APM-460 BL) and Fine Particulate Sampler (Model-Envirotech India APM-550) were used to collect air samples from the selected sites. The $PM_{2.5}$, PM_{10}, and SPM were tested by gravimetric method. The concentration was analyzed by West-Gaeke method. Likewise, the concentration of NO_2 was tested by Jacob and Hochheiser method and concentration of 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 to the Mongla Port Area and project site are: the cement factories, non-regulated mechanized boats, cargo vessels and ships 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. may be big sources of air pollutants i.e., Particulate matters (PM2.5, PM10 and SPM), Oxides of Sulphur (SOx), Oxides of Nitrogen (NOx) and Green House Gases (GHGs) in the forest area. 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 generally monitored at the fixed locations for each of the monitoring quarters. As per recommendations of DoE, two additional locations were included in the existing monitoring locations for this quarter. 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		

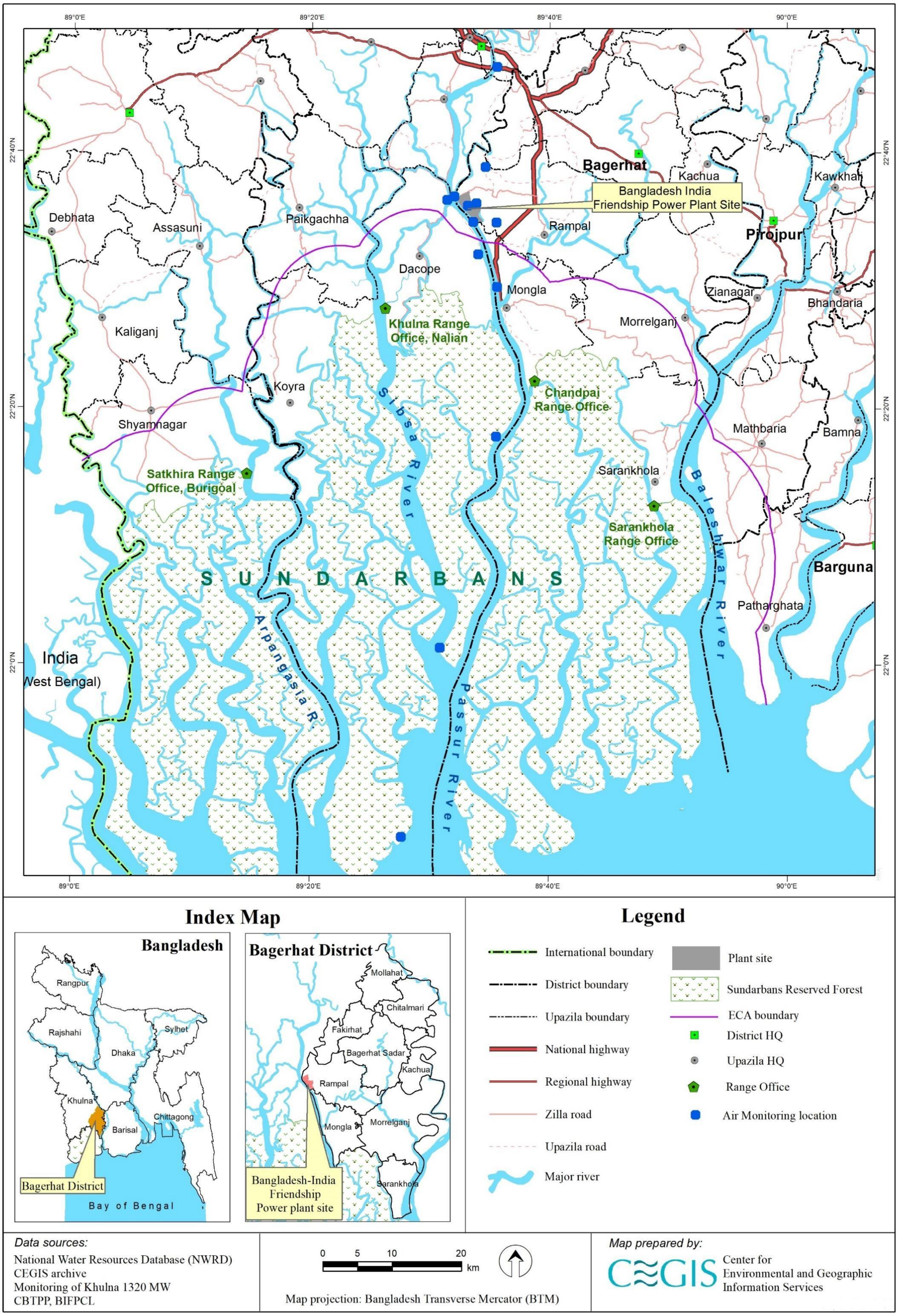


Figure 2.2: Air Quality Monitoring Locations

2.1.5 Status of Air Quality

In general, air quality is expressed in terms of the standards set forth for public health and welfare protection (against decreased visibility and damage to human being, animals, crops, vegetation etc.). The concentrations of the criteria pollutants along with the air pollution emission standards set by DoE are listed in **Table 2.2**.

During this season, the maximum value (46.73 µg/m^3) of $PM_{2.5}$ was found at Khan Jahan Ali Bridge area whereas the minimum value (13.16 µg/m^3) was recorded at Akram Point of the Sundarbans. On the other hand, PM_{10} concentration was found highest (126.13 µg/m^3) at Mongla Ghat area and lowest (55.78 µg/m^3) at Chalna area which might be due to the heavy rainfall. Comparing to the standards it can easily be mentioned here that the concentration of PM2.5 and PM10 were found well below the DoE limit. Likewise, the concentration of SPM was found higher at Mongla Ghat area (166.16 µg/m^3) whereas, the minimum concentration (70.23 µg/m^3) was observed at Chalna area which could be also due to the heavy rainfall occurring on that day. The observed values of SPM were also found within the standard limit (200 µg/m^3).

The concentration of Sulphur dioxide (SO_2) in ambient air were found much lower than the Bangladesh standard limit of (365 µg/m^3) at all the sampling locations. Among those, the maximum concentration (30.73 µg/m^3) was found at Khan Jahan Ali Bridge area while the minimum concentration (13.31 µg/m^3) was recorded at Harbaria of the Sundarbans. Similarly, the values of NOx were also observed well below than the Bangladesh standard value of 100 µg/m^3. The maximum concentration (24.24 µg/m^3) during this monitoring period was found at Khan Jahan Ali bridge area whereas the lowest concentration (8.13 µg/m^3) was recorded at Harbaria of the Sundarbans.

The maximum value (24 µg/m^3) of CO was measured at Mongla ghat area though the results were found much lower than the standard value (10,000 µg/m^3) set in ECR' 2005. In addition, the measured values of O_3 both in the Sundarbans Forest Area and Project area were found within a range of 22 ppb to 2 ppb, which are negligible comparing to the Bangladesh standards limits of 157 µg/m^3. From the measured values, it can be concluded that effect of seasonal variations on the surrounding environment may be the prominent reason for increasing/decreasing of the concentrations of the criteria pollutants for the corresponding air sheds. Seasonal variations among the concentrations of the parameters are provided in **Figure 2.3** and all the monitoring results are attached in **Table A1 of Appendix IV.**

Table 2.2: Air Quality Monitoring Results (July, 2020)

Sl. No.	Location	PM$_{2.5}$ (µg/m^3)		PM$_{10}$ (µg/m^3)		SPM (µg/m^3)		SOx (µg/m^3)		NOx (µg/m^3)		CO (mg/ m^3)		O$_3$ (ppb)	
		Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*
1	South West corner of the Project boundary (Maidara)	18.71	65	80.28	150	98.26	200	19.91	365	8.82	100	0	10	8	157
2	North-east corner of the project boundary (Sapmari)	20.35	65	71.06	150	95.24	200	17.44	365	10.17	100	4	10	6	157
3	North-west corner of the Project boundary (Kaigardaskati)	21.93	65	76.76	150	101.33	200	16.21	365	10.55	100	2	10	8	157
4	Barni, Gaurambha union (4km North East from the chimney location)	18.04	65	59.02	150	82.02	200	24.29	365	10.62	100	0	10	8	157
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	18.22	65	59.91	150	146.72	200	18.74	365	10.19	100	10	10	8	157
6	Pankhali (Chalna), Dacope, (4km North West from the Chimney location)	16.63	65	55.78	150	70.23	200	16.73	365	10.52	100	0	10	2	157
7	Mongla Port Area	41.33	65	126.13	150	166.16	200	22.04	365	11.29	100	24	10	2	157
8	Harbaria, Sundarbans	20.11	65	62.24	150	87.71	200	**13.31**	365	8.13	100	8	10	22	157
9	Akram point, Sundarbans	13.16	65	58.82	150	78.8	200	**15.06**	365	10.47	100	114	10	4	157
10	Hiron Point, Sundarbans	NM	65	NM	150	NM	200	NM	365	NM	100	NM	10	NM	157
11	Khulna city near Khan Jahan Ali Bridge	46.73	65	119.11	150	167.18	200	30.73	365	24.24	100	18	10	4	157
12	Project site-1 (Proposed Township area)	22.08	65	86.26	150	111.73	200	20.61	365	11.17	100	2	10	2	157
13	Access road bridge area	20.16	65	78.69	150	102.03	200	18.82	365	9.22	100	0	10	8	157

Source: CEGIS field survey; STD-Standard*

Findings of the previously monitored data with seasonal variation has been appended in the following section-

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 (L7) 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 area. 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 moidara (L1), shapmari (L2), Gaurambha (L4) and bajua (L5) represent lower in population density and moderate commercial activities **(Figure 2.4).**

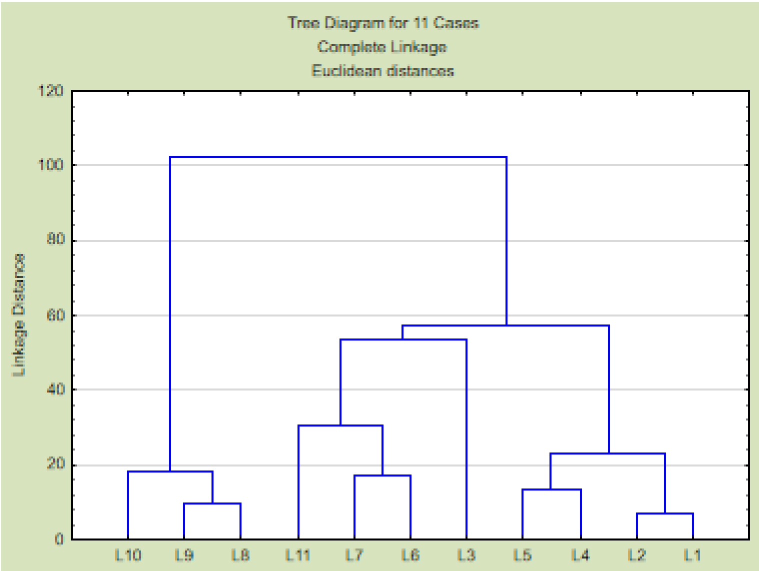


Figure 2.4: Dendogram of the Monitoring Stations using Euclidean Distance

2.1.6 Findings

All the measured values of the parameters for all locations were found well below the standard limit set by ECR' 2005. No significant changes were observed among the concentrations of air pollutants for the corresponding locations. Hiron point, Akram Point and Harbaria 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 area. On the other hand, Chalna, Mongla Ghat,and Khan Jahan Ali Bridge in Khulna are subjected to higher in population density and increased industrial activities among all sites whereas moidara shapmari, Gaurambha and Bajua represent lower in population density and moderate commercial activities However, according to the measured values, it can be said that the present air shed is not a degraded air shed as no significant exceedances or variation has ever been recorded among the concentrations of criteria pollutants.

2.2 Noise Quality

Generally, the level of noise is monitored at eleven locations during every monitoring season. But due to the rough weather condition the team could not reach to the Hiron point of Sundarbans. Hence the noise level for this site were not monitored in this season.

2.2.1 Methodology

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 (Hiron point was not monitored in this season), 1 (one) at Mongla Ghat area and the remaining 1 (one) was selected at the Khan Jahan Ali Bridge toll plaza area.

Figure 2.5: Ambient Noise Acquisition

2.2.2 Sources of Noise in the study area

Among the sources of noise generation, the urban and rural vehicles i.e. bus, truck, local human haulers, auto-rickshaws, motorized vans, motorbikes etc. were much noticeable in the study area. On the other hand, engine boats, trawlers, small barges, ships plying over the waterways and the wave breaking sound were found across the River Passur.

2.2.3 Locations of Noise Level Monitoring

Out of eleven (11) locations, three locations were inside the Sundarbans, six 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

SL. No.	Monitoring locations	GPS points	Time of noise monitoring
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
12	Township area of ppower		

2.2.4 Status of Noise

In order to provide an overview of the observed data the average values for the respective locations were appended in **Table 2.4** for ready reference; but the detailed Noise Level Data were attached in **Table C1, C2**, **C3, C4, C5, C6** respectively in the **Appendix IV**.

Dacope Upazila Parishad

This monitoring location is a commercial area and located at a distance of 4 km in the North West direction of the proposed Chimney location. According to the Noise Pollution Control Rules (2006), noise level standard for this area at day time is 70 dB and the level of noise was recorded as 51.28 dB (A) which was found to be 18.72 dB (A) lower than that of Bangladesh standard limit (70 dB) (**Table 2.4**). The significant noise sources at this place were noticed as road traffics, engine operated van (locally called Nosimon), motor bikes, easy bikes (battery operated tri-cycle), noise form hat/bazar etc.

North West Corner of the Project Area (Kaigar Daskati)

The North West (NW) corner of the Project site is under the Kaigar Daskati mauza of Gaurambha union. The selected monitoring site is a residential area. However, the standard value for this area is 55 dB (A) at day time (Noise Pollution Control Rules, 2006). The average day time noise level during this monitoring period was recorded as 43.37 dB (A) which was 11.63 dB (A) lower than that of Bangladesh standard limit.

Chunkuri-2, Bajua

This area is located at 4km South West direction from the chimney location. This site is a residential area and the standard has been set as 55 dB (A) at day time (Noise control rule, 2006). During this monitoring period, the noise level was found to be 48.75 dB (A) which was 6.25 dB (A) lower than that of Bangladesh standard limit. However, the observed noise sources were rural crowd, noise from river side homesteads and engine boats plying across the River Passur etc.

South West corner of the Project area

The South West corner of the Project area is in Maidara Khal of Rajnagar union. This area is a residential area and the standard limit of noise is 55 dB at day time (ECR, 1997). The level of noise at this monitoring location was found to be 50.18 dB (A) during this tier which was 4.82 dB (A) lower than that of Bangladesh standard limit. Frequent movement of water vessels over the Moidara Khal was one of the main reasons of noise generation in this area.

Shapmari area

The proposed township area of the Power Plant is located at the northeast portion of the Project area. The prominent noise sources were the construction activities and some discrete local gathering from the surrounding homesteads. This is a residential area and the standard has been set as 55 dB (A) at daytime (Noise control rule, 2006). The level of sound during this monitoring period was recorded as 53.72 dB (A) in this site which was 1.28 dB (A) lower than that of standard limit.

Barni, Gaurambha

This area can be characterized as both the residential and commercial interests and the standard noise limit for this kind of mixed zone has been set as 60 dB (A) at day time. The noise level was found as 48.80 dB (A) during this monitoring season which is 11.20 dB (A) lower than the standard value.

Khan Jahan Ali Bridge, Khulna

This is a commercial zone. The monitoring site is occupied by the toll office of Khan Jahan Ali Bridge and local tourism spots. The average noise level was found as 66.31 (A) which is 3.69 dB (A) lower than the Bangladesh standard limit of day time noise level for the corresponding category. The highway traffic was found to be the main source of noise generation. Besides, the site attracts local visitors for its scenic beauty which also creates a significant source of noise generation in this area.

Mongla Port area

This area is heavily occupied with the industrial set up and the corresponding standard value for the industrial area is 75 dB (A) for the day time. During this period, the average day time noise level at this location was observed as 64.41dB (A). however, the sources of noise were mostly noticeable from road traffic (heavy vehicles, light vehicles, etc.), noise from Mongla Port activities (crane, ships, etc.) and local mob in the Ghat area.

Harbaria, Sundarbans

Harbaria area of the Sundarbans is considered as a hot spot of biodiversity. Most of the sea going vessels used to anchor at this site for transshipment of goods and commodities. The area is under the silent zone and the standard limit of ambient noise at daytime is 50 dB (Noise pollution control rules, 2006). The noise level found as 49.97 dB (A) during this monitoring period which was 0.03 dB (A) lower than that of standard limit. However, movement of ships, sound created by running engines of anchored ships and barges, transshipment activities, bird's chirping, wave breaking sound and wind action on tree leaves were observed to be the main sources of noise in this site.

Akram point, Sundarbans

Akram Point of the Sundarbans is another biodiversity hot spot in the Sundarbans. This area is under the silent zone and the ambient daytime noise standard is 50 dB (A). The average day time ambient noise level during this monitoring season was observed as 51.04 dB (A) which was 1.04 dB (A) higher than that of Bangladesh standard value. However, Birds' chirping, stormy wind, wave breaking sound and falling of leaves from the trees were found as the main sources of noise. Seasonal variations of noise level are shown in **Figure 2.7.**

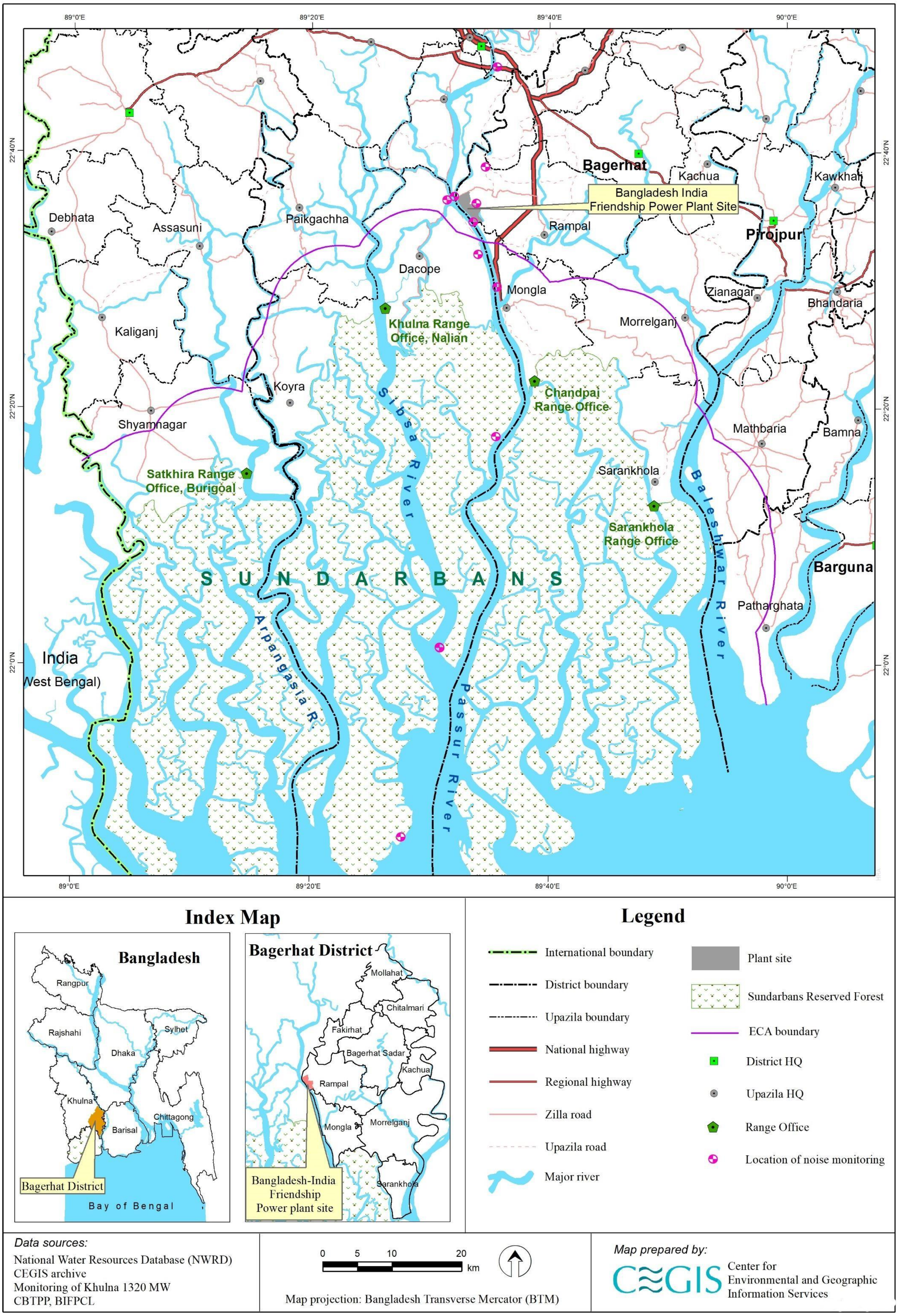


Figure 2.6: Noise Level Monitoring Locations

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

		Monitoring periods															
Sl.	**Location**	**QM 1 (Apr-14)**	**QM 2(Jul-14)**	**QM 3 (Oct-14)**	**QM 4 (Jan-15)**	**QM 5 (Apr-15)**	**QM 6 (Jul-15)**	**QM 7 (Oct-15)**	**QM 8 (Jan-16)**	**QM 9 (Apr-16)**	**QM 10 (Jul-16)**	**QM 11 (Oct-16)**	**QM-12 (Jan-17)**	**QM-13 (Apr-17)**	***QM-14 (Oct-17)***	**QM-15 (Jan-18)**	**Std***
1	*Chalna, Dacope*	68.13	52.87	54.63	53.28	57.08	49.77	65.12	66.07	65.08	52.42	65.51	59.29	61.62	58.64	60.1	70
2	*NW Corner of the Project area (Kaigar Daskati)*	51.89	NM	41.92	35.25	44.67	41.56	41.94	50.96	50.79	52.65	55.48	44.52	47.19	46.95	49.3	55
3	*Chunkuri-2, Bajua*	57.76	52.55	51.39	49.29	47.05	40.66	47.43	53.62	44.49	53.4	51.55	55.31	50.44	50.44	51.4	55
4	*SW corner of the project area (Moidara)*	49.2	47.6	45.95	36.03	43.58	43.75	42.7	60.44	54.50	65.37	48.51	45.19	43.25	43.26	44.5	55
5	*Proposed Township area (Shapmari)*	48.75	46.68	41.92	41.47	41.47	46.75	50.52	53.77	53.37	55.79	43.69	42.62	42.65	43.93	53.3	55
6	*Barni, Gaurambha*	58.84	49.95	49.78	43.6	54.17	46.18	55.16	59.16	53.97	56.75	54.91	49.05	44.83	45.52	55.6	60
7	*Khan Jahan Ali Bridge, Khulna*	71.7	60.8	66.28	61.72	73.45	52.82	64.25	68.45	65.85	63.77	60.95	55.57	56.72	62.47	61.7	70
8	*Mongla Port area*	61.24	53.84	60.5	38.69	48.15	39.61	47.01	52.7	49.88	52.86	49.86	48.95	47.61	49.66	59.8	75
9	*Harbaria, Sundarbans*	40.88	56.13	55.3	34.38	65.37	35.03	50.75	45.2	44.55	52.9	55.33	41.18	54.10	46.48	44.4	50
10	*Akram Point, Sundarbans*	40.94	47.9	43.98	34.32	54.86	NM	49.6	42.95	42.95	47.96	41.77	38.08	44.30	42.38	40.1	50
11	*Hiron Point, Sundarbans*	38.63	51.29	47.98	37.37	47.84	NM	46.06	NM	43.11	NM	44.38	42.29	NM	39.79	38.8	50

		Monitoring periods (Cont.)									
Sl.	**Location**	**QM-16 (Apr-18)**	**QM-17 (jul-18)**	**QM-18 (Nov-18)**	**QM-19 (Feb-19)**	**QM-20 (Apr-19)**	**QM-21 (Jul-19)**	**QM-22 (Nov-19)**	**QM-23 (Feb-20)**	**QM-25 (jul-20)**	**Std***
1	*Chalna, Dacope*	59.63	57.54	58.23	56.45	61.67	59.34	58.60	54.59	51.28	70
2	*NW Corner of the Project area (Kaigar daskati)*	47.90	45.63	58.82	50.75	56.85	55.18	51.11	45.42	43.37	55
3	*Chunkuri-2, Bajua*	52.93	47.54	48.69	50.18	51.68	59.36	55.27	55.44	48.75	55
4	*SW corner of the project area (Moidara)*	47.55	52.63	61.78	*55.79*	56.05	63.66	46.57	55.60	50.18	55
5	*Proposed Township area (Shapmari)*	50.81	44.25	50.68	*58.13*	58.83	54.53	54.88	48.95	53.72	55

Sl.	Location	Monitoring periods (Cont.) QM-16 (Apr-18)	QM-17 (jul-18)	QM-18 (Nov-18)	QM-19 (Feb-19)	QM-20 (Apr-19)	QM-21 (Jul-19)	QM-22 (Nov-19)	QM-23 (Feb-20)	QM-25 (jul-20)	Std*
6	*Barni, Gaurambha*	56.14	45.52	53.03	52.57	53.18	54.67	50.53	61.97	48.80	60
7	*Khan Jahan Ali Bridge, Khulna*	64.87	63.36	62.15	66.93	66.95	63.46	66.05	62.20	66.31	70
8	*Mongla Port area*	62.95	60.97	55.97	66.18	63.99	62.01	57.25	61.06	64.41	75
9	*Harbaria, Sundarbans*	47.93	50.28	48.80	49.67	48.43	44.90	44.10	43.94	49.97	50
10	*Akram Point, Sundarbans*	45.39	45.20	41.00	46.45	42.33	44.84	44.86	36.59	51.04	50
11	*Hiron Point, Sundarbans*	NM	NM	39.4	39.21	NM	NM	40.28	40.34	NM	50

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

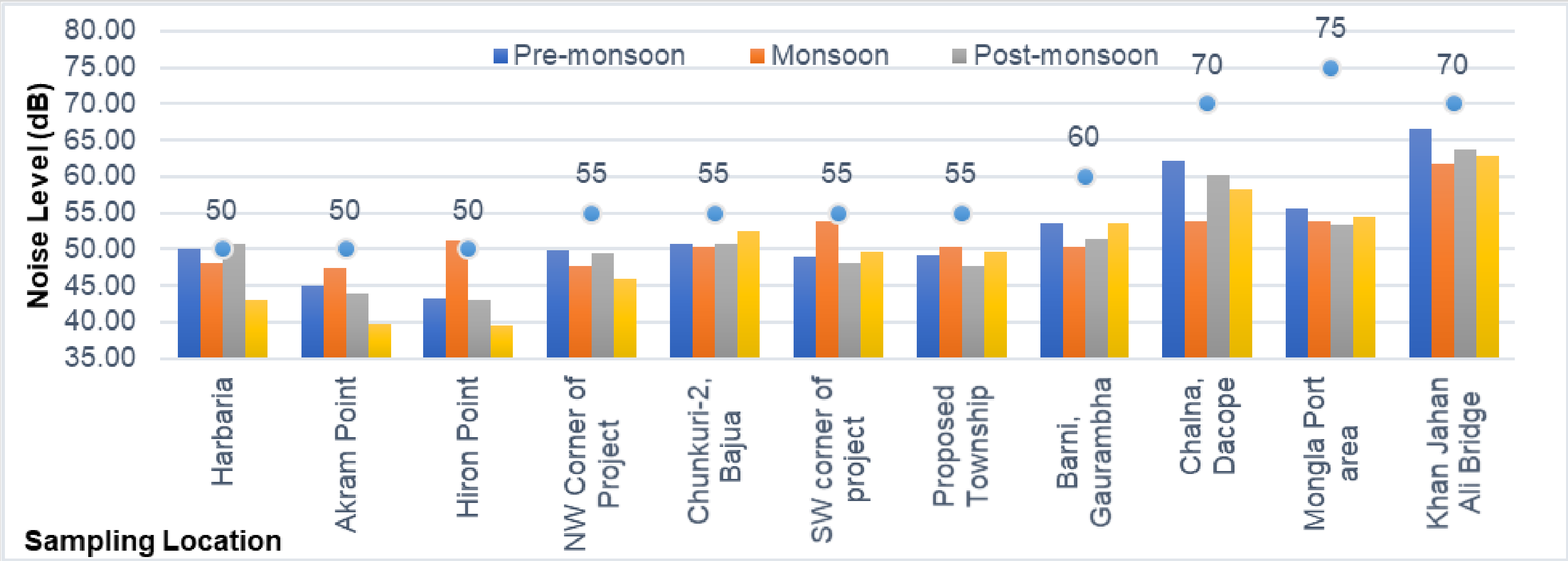


Figure 2.7: Status of Noise Level at the Monitoring Locations

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 (**Table 2.4**).

2.3 Water Quality

This section presents an updated water quality status of the Passur-Sibsa River system and adjacent waterbodies. Both national and international guidelines were followed to assess the water quality status. This report includes results and corresponding analysis of selected in-situ water quality parameters of samples collected during 25th quarterly monitoring (July 2020) and the tested results obtained from the laboratory up to February, 2020 (23rd quarterly monitoring). Due to the COVID-19 Pandemic, the 24th Compliance Monitoring Program was postponed. However, several identical sites were selected in order to observe the quality of water those are potentially used by community, aquatic life, industries and eco-elements of the Sundarbans Reserve Forest ecosystem.

2.3.1 Methodology

The method followed 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. The statuses of the surface and groundwater quality in and around the project site and the Sundarbans Forest area were examined following standard methods of monitoring. The monitoring results were presented graphically and checked if there was any exceedance from the national standards (ECR, 1997 and all available amendments).

Samples were collected from 17 pre-selected locations [14 locations for surface water in the Passur, Sibsa, Maidara River, near the proposed township area, and three (03) locations for groundwater across the study area] as shown in **Figure 2.8**. 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: 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	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 measurement (pH, Temperature, Salinity, DO) and Laboratory analysis (TDS, TH, TSS, COD, Nitrate, Sulphate, Phosphate, Arsenic, Lead, Mercury, Oil & Grease, PAH, TOC,TC).
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		

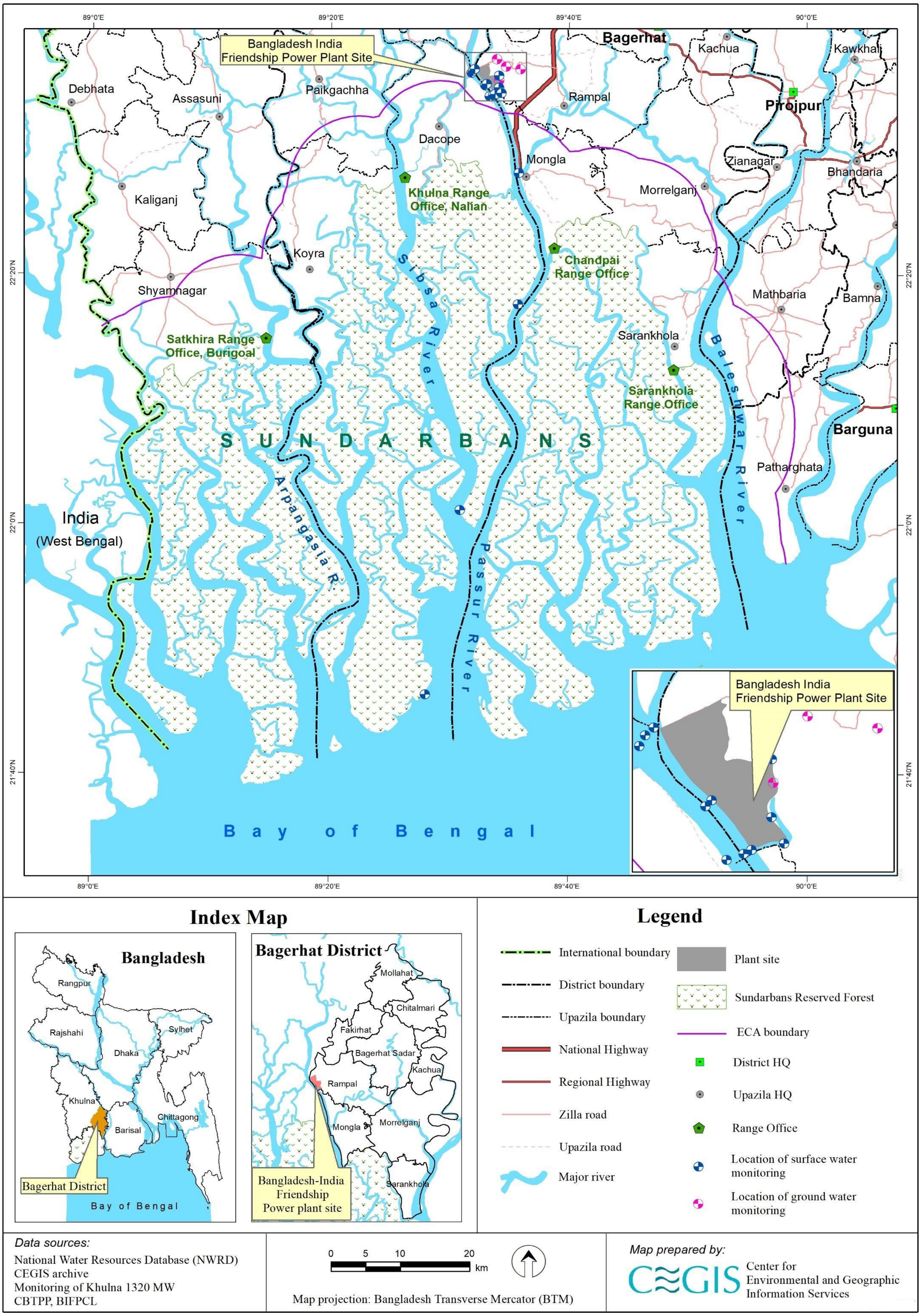


Figure 2.8: Surface Water and Groundwater Quality Monitoring Locations

Table 2.6: 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 by Horiba U-50 multi-meter. Sample preserving and Laboratory analysis at DPHE Central Laboratory and BCSIR for inorganic non-metallic, aggregate organic and metals quality. However, one of the monitoring location (Kalekarber) has been found damaged since 2015. Hence, the corresponding data for this location were not collected.
2	Rajnagar	89.576056˚E	22.612528˚N		
3	Kapasdanga	89.563000˚E	22.622528˚N		

2.3.2 Selection of Parameters

Water quality parameters were selected based on potential impacts to be exerted during pre-construction, construction and operation phases of the Project.

2.3.3 Surface Water Quality Parameters

The selected parameters for surface water quality include Temperature, pH, Dissolved Oxygen (DO), Total Dissolve Solids (TDS), Total Suspended Solids (TSS), Total Hardness (TH), Turbidity, Biochemical Oxygen Demand (BOD), 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. The parameters were categorized into 4 groups:

- Physical and aggregate properties i.e. pH, Temperature, Salinity, Hardness, TDS, TSS, Turbidity, Oil & Grease;
- Inorganic non-metallic constituents i.e., DO, NO_3^-, PO_4^{3-} and SO_4^{2-};
- Aggregate organic constituents i.e. BOD, 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 the monitoring study as per recommendation of the DoE approved coal transportation study monitoring framework (condition no. 26 of the EIA approval of coal transportation study) and accordingly recorded.

2.3.4 Groundwater Quality Parameters

Ground water quality parameters 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).

2.3.5 Sampling Procedure

Standard sampling s were followed for both surface and groundwater monitoring to make the water quality status representative and accurate. From sampling bottle preparation to sample collection, preservation and transportation to the designated laboratory, every task was performed with appropriate procedures.

2.3.6 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 30-50m away from the riverbank and at a depth of 6 cm 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. All samples were preserved as per standard procedure (**Figure 2.9**).

Figure 2.9: Water Sample Collection and insitu Testing of Water Parameters

2.3.7 Groundwater Sampling Procedure

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.

2.3.8 Water Quality Parameter Analysis Techniques/Methods

Water quality parameters were analyzed 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	^{0}C	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^{0}C	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
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

BOD_5 could not be tested in the laboratory as transportation time of samples for BOD_5 test is only 6 hrs. and the sampling locations are within the Sundarbans Reserve Forest area from where it requires several days to carry the sample to the nearest laboratory i.e. at Khulna.

2.3.9 Water Quality Reporting Arrangement

Water quality status of the project area and the Sundarbans forests are observed since April 2014. During this 25th quarterly water quality monitoring report, yearly variations of winter (February, 2020) for chemical water quality statuses and yearly variations in monsoon (July 2020) for physical statuses of water quality 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)	Project site & adjacent areas	In this monitoring site, total 11 sampling points have been averaged to represent the water quality status of project site and its adjacent surface water bodies. These 11 sampling points are situated in the same river system and located within 1 km radius of the project area. In addition, previous monitoring results were obtained from characteristically same sites. 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 comprises with an individual monitoring point situated at least 13 km downstream of the project site. This point is a confluence of the Passur river and the Mongla-Ghasiakhali Channel. The terrestrial ecosystem is mostly dominated by agricultural lands followed by rural settlements.
(c)	Harbaria	Harbaria site comprises with an individual monitoring point situated around 15 km downstream of the Mongla-Passur confluence. This site is surrounded by the Sundarbans Forest. Huge activities of mother vessel unloading and loading of lighterage vessel and their movements for transporting clinker, coal and LPG gas are held in this place. This point has tidal influence.
(d)	Akram point	Akram Point is an individual point, which is, located around 35 km downstream of the Harbaria point. This site is situated on the bank of the Sibsa river before meeting with the Passur river at Sibsa point. This site is completely dominated by deep forest ecosystems. This point has tidal influence.
(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 Bay of Bengal. This site is also an individual monitoring point.

Status of Surface Water Quality

In-situ tested parameters

The in-situ tested results obtained up to 25th monitoring period (July 2020: Monsoon Season) are described below**.**

pH

The Twenty Fifth (25th) water quarterly monitoring program was conducted in monsoon in the month of July 2020. The monitoring result revealed that, pH values ranged from 6.9 and 7.8. The lowest pH value was found in the Middle of Passur River at 100m u/s of North West corner from the Project boundary whilst highest was at Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence. Generally, pH value was found to be the highest during pre-monsoon than all other monitoring periods. The main reason might be due to the high salinity intrusion during that period. pH value of this monitoring result complied with the inland surface water quality standard of 6.5-8.5 (ECR'97) completely (**Figure 2.10**). Averagely, pH value was almost 7.2 near the power plant areas and around 7.4 inside the deep forests.

Slightly higher values were observed in the deep Sundarbans forests was because of high tidal influence in the area. Monsoon pH usually indicates normal water quality in nature.

During post monsoon and winter season, overland run-off, river flow and water level normally reduced due to less rainfall and less inflow from upstream (u/s) of the Passur-Sibsa RS (River System). As a result, pH values increased than those of the pre-monsoon and monsoon seasons, which was also reported by others (*Rahman et al., 2013*). In addition to that, post-monsoon showed a little bit lower pH value than the winter season, as post-monsoon is characterized by rainfall in August while rainfall in January is normally zero.

Fluctuations in pH values during different seasons 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 Passur-Sibsa RS are presented in **Figure 2.10** and the observed dataset are attached in **Table B.1 of Appendix- IV.**

Temperature

Surface water temperature indicated close conformity with the previously monitored values for the monsoon season. During this tier it was found that water temperature varied in between 30^0C-31^0C (**Figure 2.11**). Deep mangrove forests only showed the average temperature of 31^0C while at the more upstream area (near power plant site) it was around 30^0C. According to the ECR, 1997, 30^0C water temperature is still be tolerable by the aquatic organisms in tropical environment. 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, which is also applicable for the water temperature and thus it differs largely than the other season's temperatures. The measured temperature for the quarterly monitoring programs are presented in **Figure 2.11** and all the observed dataset are attached in **Table B.2 of Appendix- IV.**

Salinity

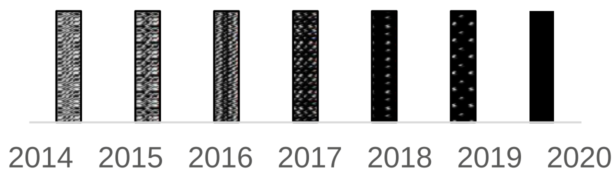
The salinity of the water samples ranged in between 0.2 ppt to 4.0 ppt during the monitoring tier. Near the power plant site, salinity was recorded very lower (ranged from 0.2 to 0.5 ppt) which might be due to the huge freshwater coming from upstream. On the contrary, high salinity usually occurs at the downstream area of the RS e.g. deep Sundarbans forest as this part receives huge saline water from the Bay of Bengal during high tide. In monsoon this deep forest area even shows low salinity concentrations like 2.0-4.0 ppt because of freshwater flow from upstream (**Table B.3: Appendix-IV**).

In the observed river system, the highest salinity was observed in pre-monsoon season followed by winter season. Freshwater unavailability from upstream and the dominated tidal factors are the main reason of high salinity concentration in pre-monsoon and winter. The water salinity data for consecutive monitoring periods are presented in **Figure: 2.12** and all the observed dataset are attached in **Table B.3 of Appendix- IV.**

Dissolved Oxygen (DO)

Oxygen level in running water varies a lot. Fluctuation of DO even occurs with the tidal effects (low tide and high tide). And also, the DO level of the river water of Bangladesh varies abruptly which receives both freshwater from upstream and sea water during tides. during the last monsoon, dissolved oxygen level in water body was found to be almost same comparing with previous monsoon seasons (**Figure 2.13**). Both the power plant and deep forest monitoring sites showed the DO level of 6.2 in an average. In case of surface water standard, DO limit must not be dropped than 5.0mg/L at any cost. Lower DO than the standard limit (ECR' 1997) will first harm the aquatic organisms (plankton) and then the fish community.

In case of seasonal variations, maximum concentrations were observed during monsoon and post monsoon seasons. Higher DO level in monsoon and post-monsoon season, were for heavy rainfall and freshwater availability. During winter, salinity affects the temperature and then water temperature affects the holding capacity of DO in water. However, the DO concentration of Passur-Sibsa RS (near project site and inside the Sundarbans) are still complying with the water usable for irrigation, as irrigation usable DO concentration limit is only 5.0 mg/L (ECR, 1997). Pre-monsoon variations of DO at the monitoring sites of Passur-Sibsa RS are shown in **Figure: 2.13** and all the observed dataset are attached in **Table B.4 of Appendix- IV.**



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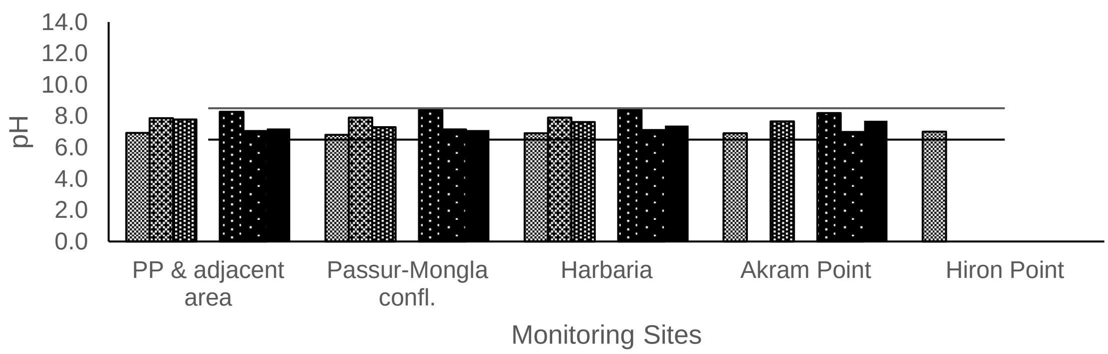


Figure 2.10 Variations in monsoon pH values in different monitoring sites

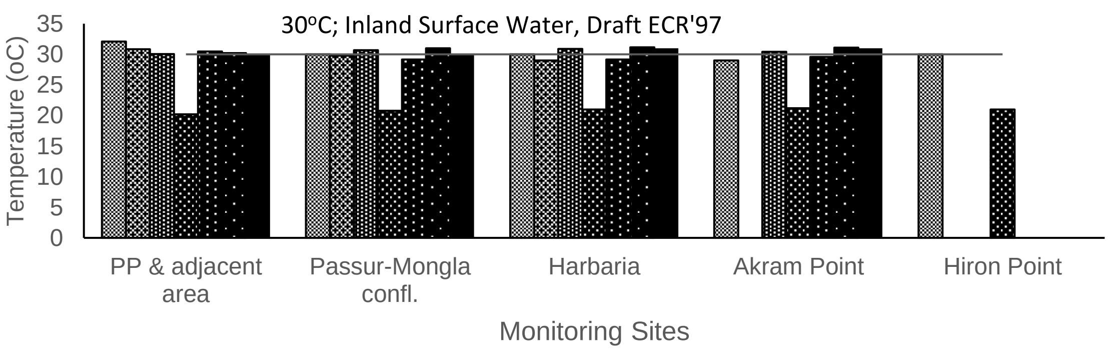


Figure 2.11: Variations in monsoon temperature in different monitoring sites

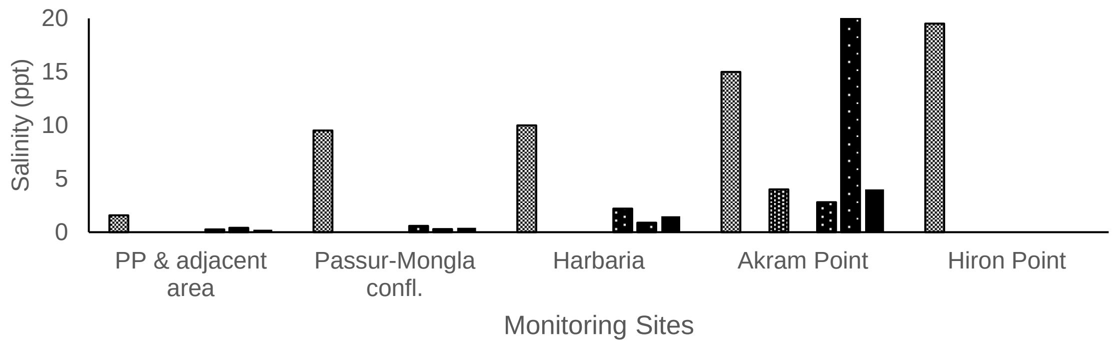


Figure 2.12: Variations in monsoon salinity in different monitoring sites

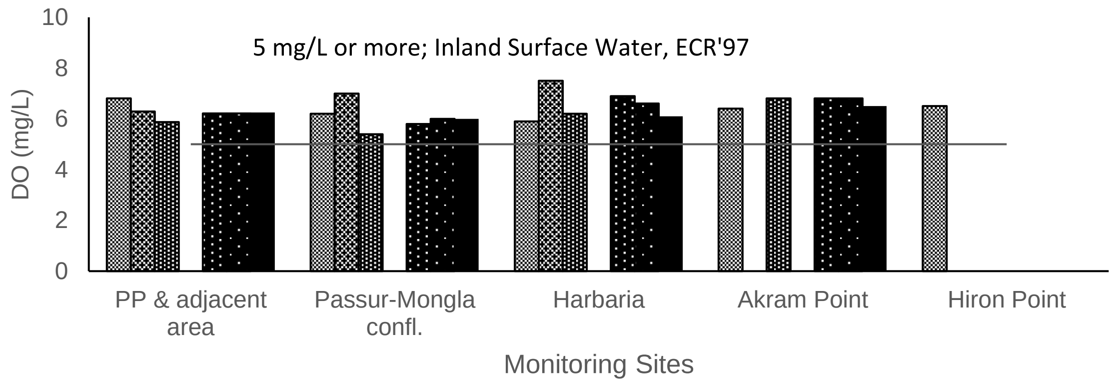


Figure 2.13: Variations in monsoon DO in different monitoring sites

Laboratory tested parameters

The laboratory tested results obtained up to Winter period is described below -

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

Total Dissolved Solids (TDS) mainly indicates the presence of various kinds of minerals like ammonia, nitrate, phosphate, alkalis, some acids, sulphates and metallic ions etc. which comprises both colloidal and dissolved solid states in water (Tareq M S et al., 2013).

During the last winter period, TDS values were found within the range of 5,800mg/L to 20,400mg/L. However, the average TDS concentrations always showed the same pattern. For instance, TDS values of the water bodies beside the power plant and adjacent areas were found comparatively lower than the deep Sundarbans Forests. In Passur-Sibsa RS, the TDS concentrations showed both the spatial and temporal variations. In pre-monsoon and winter, TDS is usually found higher because of low rainfall and tidal effects. Therefore, in monsoon and post monsoon, the TDS concentration fell down to 200 mg/L in most of the cases excluding the SRF. Regarding spatial variation, TDS concentration was observed in increasing level as progressing towards downstream of this RS. This is happened due to tidal influence of the Bay of Bengal that contains lots of salts and other nutrients.

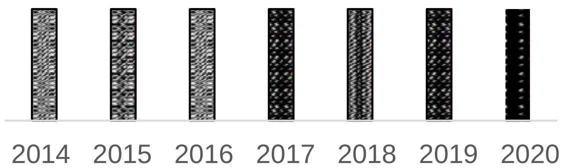
Total Hardness (TH) followed the similar pattern as that of TDS e.g. high amount of TH was found during pre-monsoon and winter season than of monsoon. The higher the TDS, the higher the nutrients and therefore higher occurrence of TH. Insufficient freshwater supply due to low rainfall during winter and pre-monsoon period increase the TDS concentrations in the Passur-Sibsa RS. In addition, seawater contains huge quantity of minerals including calcium and magnesium, which make the water hard.

During the last winter period, the TH was found to be within the range of 1,040-3,800 mg/L with an average concentration of 1,515 mg/L beside the project site and 2,555 mg/L in the SRF (**Figure 2.16**). Water around the power plant and its adjacent areas was observed less hard than of inside the SRF (**Figure 2.15**). It is noticeable that water hardness of the monitoring sites of the last two winter periods are comparatively higher than the other winter seasons. January to February the hardness reaches to its highest concentration in this river system. The water hardness was found even higher than the ECR limit of 200-500mg/L. On the other hand, the water hardness in all the monitoring stations in Passur River were found to be lower whereas it was found remarkably higher in pre-monsoon season. In generally, water hardness is found to be higher in monsoon season but in Passur River, it is found to be higher in pre-monsoon season due to the saline water intrusion toward upstream (Rahman et al., 2013).

Total Suspended Solids (TSSs) 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 6 mg/L to 14 mg/L as observed in the winter. TSS values in every spot recorded during the last winter period found to be within the permissible limit of 150 mg/L (ECR, 1997). In 2014, TSS reached more than 300mg/L at both the Akram and the Hiron point due to the oil spillage incident occurred at 9th December 2014. 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 (**Figure 2.16**).

Generally, in the Passur-Sibsa RS, TSS is found to be higher in post-monsoon and winter seasons than those of pre-monsoon and monsoon. During post-monsoon and winter season, the TSS value increases, probably 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 the Passur River at different monitoring sites are presented in **Figure 2.14, 2.15 and 2.16** respectively and all the observed datasets are attached in **Table B.8, Table B.9 and Table B.10 of Appendix- IV** respectively**.**



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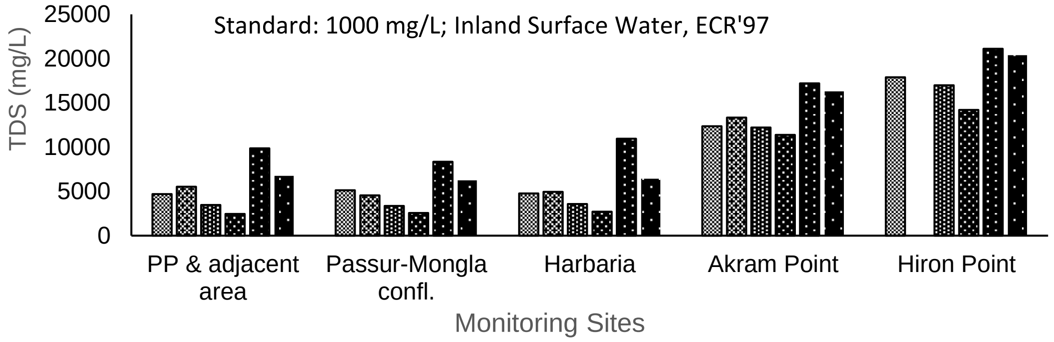


Figure 2.14: Variations in TDS concentrations in different monitoring sites

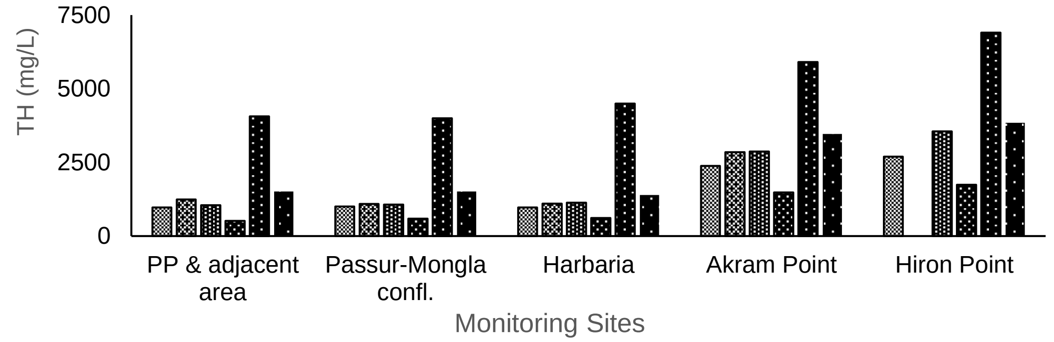


Figure 2.15: Variations in TH status in different monitoring sites

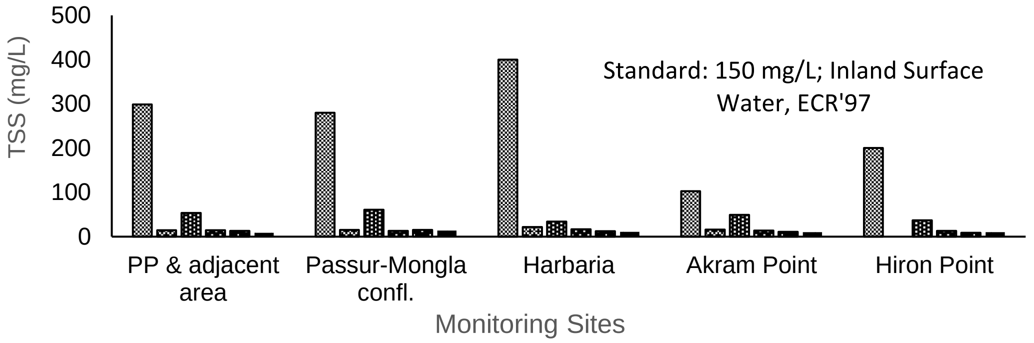


Figure 2.16: Variations in TSS concentrations in different monitoring sites

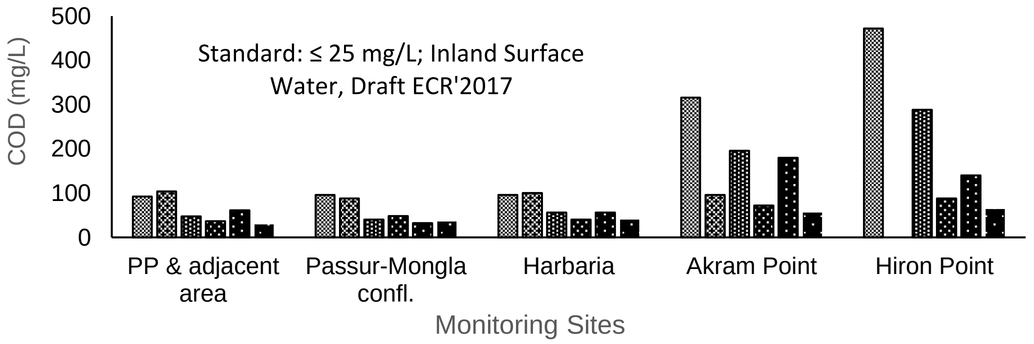


Figure 2.17: Variations in COD concentrations in different monitoring sites

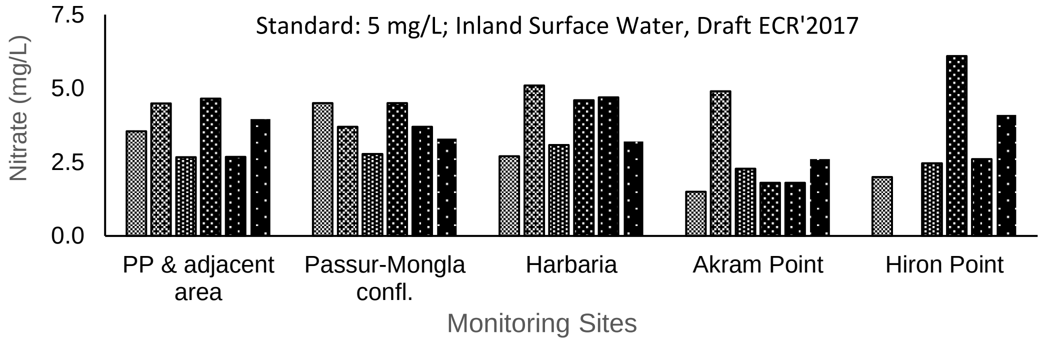


Figure 2.18: Variations in Nitrate concentrations in different monitoring sites

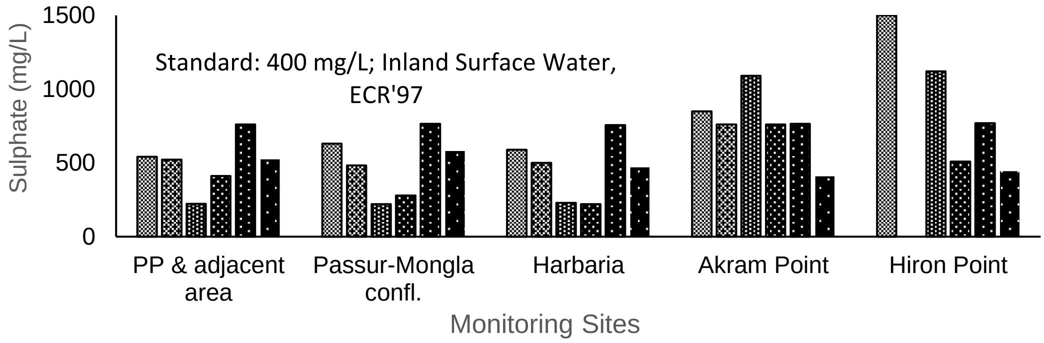


Figure 2.19: Variations in Sulphate concentrations in different monitoring sites

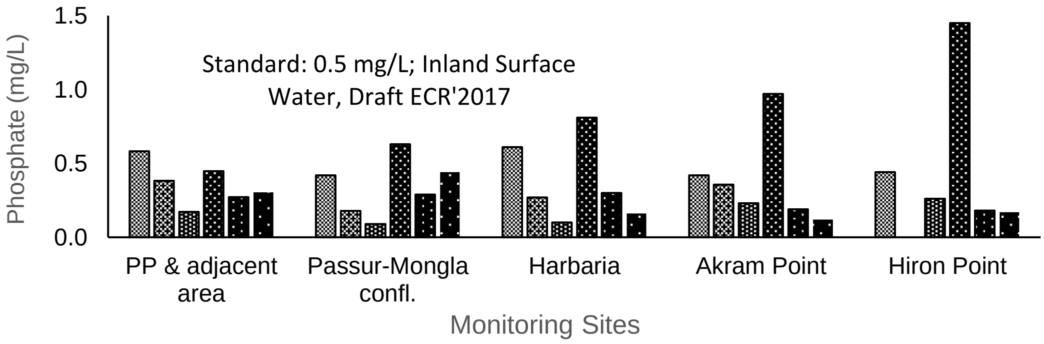


Figure 2.20: Variations in Phosphate concentrations in different monitoring sites

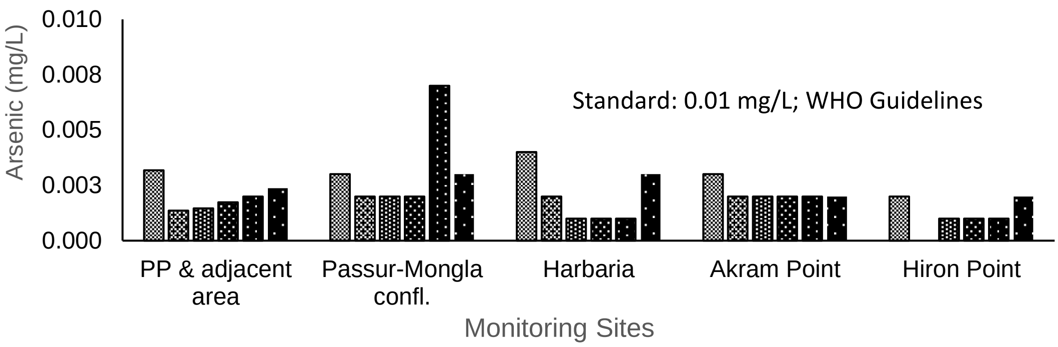


Figure 2.21: Variations in Arsenic concentrations in different monitoring sites

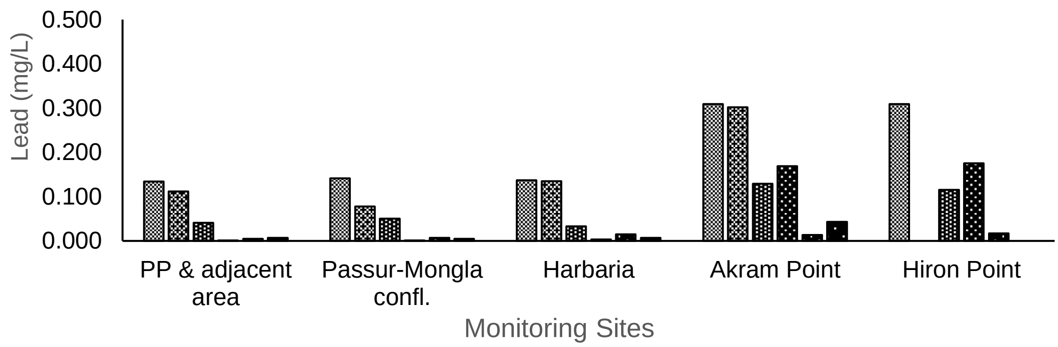


Figure 2.22: Variations in Lead concentrations in different monitoring sites

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 increased 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 64 mg/L during the last winter season. The highest value was found at the Hiron point while the lowest was found at Middle of Passur river at the S/W corner of the project site. The high values of COD indicate high level of organic pollution in the river water (Sivasubramanium, 1999). **Figure 2.17** indicates that, organic loads are higher in the SRF (avg. 49 mg/L) than the upstream areas especially near the power plant and its adjacent areas (avg. 30 mg/L). The SRF itself contributes large quantity of organic loads in the river system while contribution of upstream organic load increases the concentration of organic matter hugely at the downstream of the RS. The concentrations of COD are for all of the monitoring sites complied with the permissible limit as per Draft ECR’ 2017 (25 mg/L) for inland surface water. For example, the concentration of COD at the monitoring point of south west corner of the project site is 20 mg/L. Various activities in the project site, other industrial and agricultural activities may influence the COD continuously. The occurrence of extremely high COD in 2014 was the reason of oil spillage of that year which led the death of planktons and other aquatic life forms ultimately increased the decomposition rate of organic matters.

Over the year, COD concentration was found to be higher in pre-monsoon season followed by winter as these seasons had insignificant rainfall comparing to those of other seasons and which actually increased the density of organic matters. The COD concentrations of pre-monsoon and winter seasons (dry) were found higher than those of monsoon and post-monsoon seasons. In monsoon, higher discharge diluted the COD load of the river water, which in turn reduced COD concentration in post monsoon. All observed values of COD are shown in **Figure 2.17** and the completely monitored datasets are provided in **Table B.6 of Appendix- IV.**

Nitrate, Sulphate and Phosphate

Usually, Nitrogen is the limiting factor in the marine environment. Therefore, nitrate plays very active role in primary production including the dynamism of aquatic organisms. During the last winter, the **NO_3^-** concentrations occurred high around the power plant site (avg. 4.0 mg/L) than the SRF (avg. 3.3 mg/L). NO_3^- concentration showed both the temporal and seasonal variations in the study areas (**Figure 2.18**). However, the results obtained from all the monitoring sites were found to be within the standard stated in ECR'1997 (10mg/L).

The highest values were found in pre-monsoon season of 1st quarter of 2nd year, which could be due to the higher amount of surface and groundwater runoff, dissolution of nitrogen-rich geological deposits, and biological degradation of organic matter as observed from numerous studies (Spencer, 1975; Kinne, 1984; Gleick, 1993; Wetzel, 2001; Rabalais, 2002) (**Table B.9**). High nitrate concentration was found in monsoon period across the Passur-Sibsa RS, which could be the result of surface run-off, agricultural run-off, atmospheric deposition and domestic wastes dumping together with industrial pollution from upstream.

Similarly, **Sulphate (SO_4^{2-})** concentration is generally found higher in seawater as well as in coastal river due to tidal interactions. The monitored dataset substantiates this fact i.e., SO_4^{2-} concentrations of the Passur-Sibsa RS were found increased in the direction of upstream to downstream. This variation is visible clearly in monsoon and pre-monsoon seasons only. Freshwater availability from upstream makes this variation.

During the last winter period sulphate showed reverse tendency of high concentrations at the more downstream area. For instance, average concentration of 525 mg/L was occurred around the project site while 476 mg/L was at the SRF. However, all the observed dataset of SO_4^{2-} found within the standard limit (400 mg/L) specified in ECR, 1997 except Hiron Point. Comparatively lower concentration of SO_4^{2-} in monsoon and post monsoon seasons could be due to the dilution effect of upstream freshwater (**Figure 2.19**).

On the other hand, **PO_4^{3-}** concentrations were found to be within the range of 0.2 - 0.4 mg/L during February, 2020 (**Figure 2.20**). Based on the **Figure 2.21**, it is examined that, PO_4^{3-} concentration did not show any spatial variation during last winter but showed temporal variation. Upstream anthropogenic activities probably could be the reason for this kind of trend along with pattern of rainfalls and bio-geochemical cycles of nitrogen. All the monitoring values complied with the permissible limit as per Draft ECR, 2017 (0.5 mg/L of PO_4^{3-}) for the inland surface water. The recorded low phosphates value during dry 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**).

NO_3^-, SO_4^{2-} and PO_4^{3-} concentrations at different monitoring sites are shown in **Figure 2.18, 2.19 and in 2.20** and all the observed dataset are given in **Table B.11, Table B.12** and **Table B.13** of **Appendix- IV**.

Heavy Metals

During the last winter Arsenic (As) concentrations varied in between 0.001 to 0.006 mg/L which showed the similar pattern as observed in the previously monitored periods.

Lead (Pb) dissolved in water is very harmful to aquatic organisms; due to bioaccumulation, it increases in body tissue of organisms (Rompas, 2010). It is also evident that organic fertilizer, which comes from lime and compost fertilizers, can contain heavy metal, e.g., NPK fertilizer (phosphate fertilizers containing Pyromorphite- $Pb_5(PO_4)_3$ like the way said by Zhu et. al., 2004), which may result in higher amount of Pb concentration in river water. During the last winter period, the concentration of Pb ranges from 0.0034 to 0.056mg/L (**Figure 2.22**). The standard concentration for inland surface water is 0.1 mg/L.

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 winter, 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 winter season are presented in **Figure 2.21 and in 2.22** and all the observed dataset are given in **Table B.14, Table B.15** and **Table B.16** of **Appendix- IV**.

Oil and Grease

In order to measure the concentration of oil and grease in the Passur-Sibsa River System, samples were collected at five locations during low tide from the surface layer and analyzed following the standard testing method of APHA. The concentrations of oil and grease as found at different monitoring sites are presented in **Table-B.7 of Appendix-IV.**

During monsoon and post monsoon periods, the concentration of oil and grease were found lower than that of winter and pre-monsoon season. It appears from the data that Passur and Sibsa river system recorded high concentrations of oil and grease in winter period in 2014, which might be due to occurrence of accidental oil spillage on 9 December 2014. An amount of 350,000 litres (Philips, 2014) of furnace oil spilled in the river and spread over an area of 350 km^2 (Welle, 2014).

In the last winter season, oil and grease found to be <2.0 mg/L-4.4 mg/L **(Table-B.7 of Appendix-IV)**. The permissible limit of oil and grease for inland water quality is 10 mg/L. However, sometimes oil and grease are found to be more than 10 mg/L. Mainly accidental cases are the real reason behind it. Otherwise the oil and grease concentration are found to be normal most of the time in the said RS. Besides, increasing number of regulated and non-regulated mechanized vessels used for different purposes like cargo transport, human transport including tourist could be the reasons of high oil and grease including the RASH MELA Festival inside the Sundarbans every year. Moreover, indiscriminate discharge of bilge water (oil and grease mixed water) by the non-regulated mechanized boats particularly during seasonal fishing at sea, contributes contamination to river water. Generally, International Maritime Organization (IMO) certified vessels maintain all kinds of regulations applicable for them.

Total Organic Carbon (TOC)

Total Carbon (TC) represents all the carbon in the sample, including both inorganic and organic carbon. Total Organic Carbon (TOC) is the amount of carbon found in an organic compound and is often used as a non-specific indicator of water quality or cleanliness of pharmaceutical manufacturing equipment. Total Inorganic Carbon (TIC) often referred to as inorganic carbon (IC), carbonate, bicarbonate, and dissolved carbon dioxide (CO2). The amount of TOC in water sources varies widely from <0.1 to >25 mg/L in drinking water to >100 mg/L in wastewater.

This study considers TC and TOC, which are very important in detecting contaminants in drinking water, cooling water, water used in semiconductor manufacturing, and water for pharmaceutical use. Three sites e.g. Project Jetty, Majhar point and Hiron Point were monitored for TC and TOC concentrations (**Table 2.9**).

Table 2.9: Total Carbon and Total Organic Carbon status

Monitoring sites	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Inorganic Carbon (mg/L)
Project jetty site	2742	32	2710
Majhar point	1555	33	1523
Hiron Point	5123	5	5118

According to the monitoring results, it was found that except Hiron point, both the project area and the SRF contains high TOC in term of drinking water purposes. But, complied with the waste water permissible limit (>100 mg/L). But, the normal standard for TOC varies from 7.0 mg/L to 10.0 mg/L in river. In term of inland river water quality, TOC complies with the permissible limit for the last monitoring results. The data are attached in **Table B29** of **Appendix IV**.

PAHs (Polycyclic aromatic hydrocarbons)

Polycyclic aromatic hydrocarbons (**PAHs**, also ***polyaromatic hydrocarbons*** *or* ***polynuclear aromatic hydrocarbons***) are hydrocarbons-organic compounds containing only carbon and hydrogen that are composed of multiple aromatic rings (organic rings in which the electrons are delocalized). PAHs are uncharged, non-polar molecules found in coal and in tar deposits. They are also produced by the thermal decomposition of organic matter (for example, in engines and incinerators or when biomass burns in forest fires).

Most PAHs are insoluble in water, which limits their mobility in the environment, although PAHs sorb to fine-grained organic-rich sediments. Aqueous solubility of PAHs decreases approximately logarithmically as molecular mass increases. Two-ringed PAHs, and to a lesser extent three-ringed PAHs, dissolve in water, making them more available for biological uptake and degradation. Further, two- to four-ringed PAHs volatilize sufficiently to appear in the atmosphere predominantly in gaseous form, although the physical state of four-ring PAHs can depend on temperature. In contrast, compounds with five or more rings have low solubility in water and low volatility; they are therefore predominantly in solid state, bound to particulate air pollution, soils, or sediments. In solid state, these compounds are less accessible for biological uptake or degradation, increasing their persistence in the environment.

PAHs have a strong affinity for organic carbon, and thus highly organic sediments in rivers, lakes, and the ocean can be a substantial sink for PAHs. Algae and some invertebrates such as protozoans, mollusks, and many polychaetes have limited ability to metabolize PAHs and bio-accumulate disproportionate concentrations of PAHs in their tissues; however, PAH metabolism can vary substantially across invertebrate species. Most vertebrates metabolize and excrete PAHs relatively rapidly. Tissue concentrations of PAHs do not increase (bio-magnify) from the lowest to highest levels of food chains.

PAHs transform slowly to a wide range of degradation products. Biological degradation by microbes is a dominant form of PAH transformation in the environment. Soil-consuming invertebrates such as earthworms speed PAH degradation, either through direct metabolism or by improving the conditions for microbial transformations. Abiotic degradation in the atmosphere and the top layers of surface waters can produce nitrogenated, halogenated, hydroxylated, and oxygenated PAHs; some of these compounds can be more toxic, water-soluble, and mobile than their parent PAHs.

For the consecutive monitoring periods, the PAHs was found as undetectable near the Project jetty, Majhar point and at the Hiron point. It indicates that there were no PAHs pollution until now in the Passur-Sibsa RS. All data are attached in **Table B28** of **appendix IV.**

Findings

The Passur 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 the Passur River changes with the tide conditions in different seasons.

In this 25th quarterly monitoring (monsoon, 2020), physical conditions of the Passur-Sibsa RS were found fairly healthy. There were some fluctuations in the concentrations of parameters among different sites only. In addition, pH, Temperature and DO level was found quite good at the project site and in the SRF. On the other hand as detected till Winter, 2020, the TDS, TH and TSS concentration in the observed RS found compatible to national and international standards. High COD was found in all the monitoring sites and is high in the SRF which might be the effect of sediment loads and high nutrients contributed by the Bay of Bengal. Nitrate (NO_3^-) and Phosphate (PO_4^{3-}) were also found in a very standard range in respect to a natural river.

In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and no issues as well. Oil and grease concentration were found less than 4.0 mg/L, which is far below the recommended concentration (10.0 mg/L) for Inland Surface Water as per ECR, 1997. TOC and PAHs concentration are still in permissible limit of inland surface water quality of river.

2.3.10 Status of the Groundwater Quality

In-situ tested parameters

The in-situ tested results obtained up to 25th monitoring period (July 2020: Monsoon season) are described below-

pH and Temperature

Groundwater pH and temperature complied with the drinking water quality standards as specified in ECR, 1997 (6.5-8.5 and 20^{0}C -30^{0}C respectively). The pH values during 25th monitoring scheme were found to be varied from 8.0 to 8.1, while temperature ranged in between 30^{0}C-31^{0}C. No significant differences were observed against the previous monsoon season results. Similarly, no significant variation was recorded in groundwater temperature over the monitoring periods.

Both the results of pH and Temperature were found more or less consistent with all those to the previously obtained respective season's data. The twenty-fifth consecutive monitoring results of pH and temperatures of selected sites are presented in **Figure 2.23: pH, Temperature** and all the observed dataset are attached in **Table B.17** of **Appendix- IV**.

<u>Salinity and Dissolved Oxygen (DO)</u>

Groundwater salinity concentration in all the monitoring sites occurred at 0.1ppt (**Figure 2.23: Salinity**). In fact, salinity in groundwater never crosses 0.1ppt in the monsoon season till the 25th monitoring. Freshwater recharge is the main factor of this status.

DO results ranges from 6.0mg/L to 6.1mg/L during this monitoring season. Level of DO in groundwater was found fair for human drinking purpose (not less than 6.0mg/L or too high). However, slight DO level changes 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 2.23: DO** and all the observed dataset of DO and Salinity are attached in **Table B.18** of **Appendix- IV** respectively.

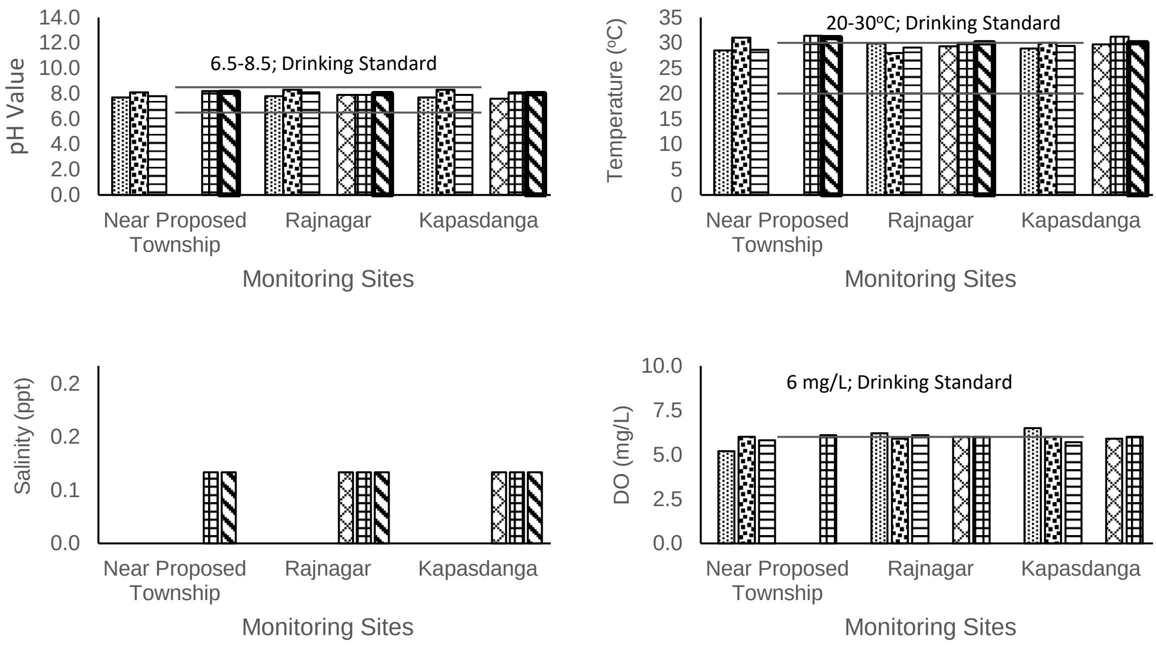


Figure 2.23: Status of pH, temperature, Salinity and DO of winter seasons of the last six consecutive years

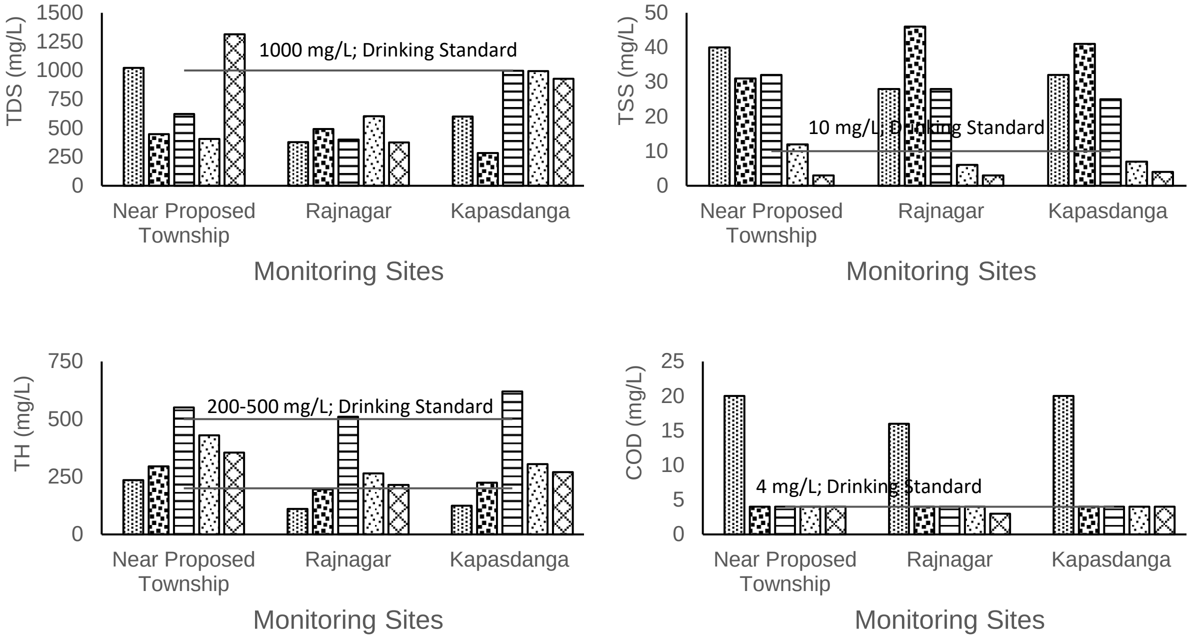
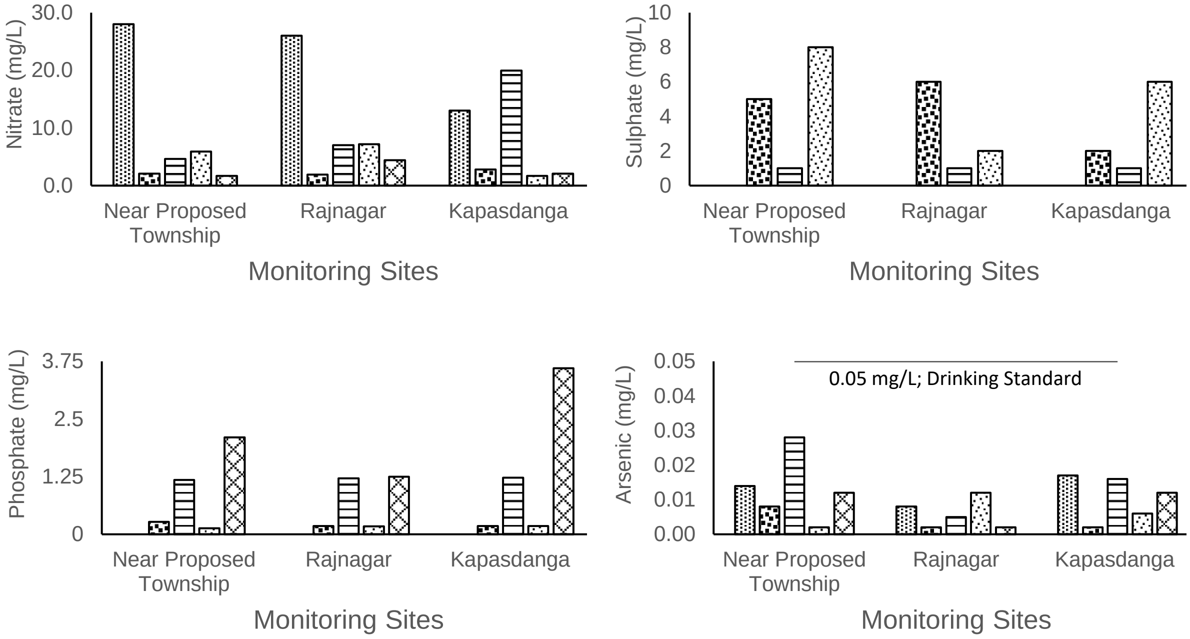


Figure 2.24: Status of TDS, TSS, TH and COD of winter seasons of the last six consecutive years



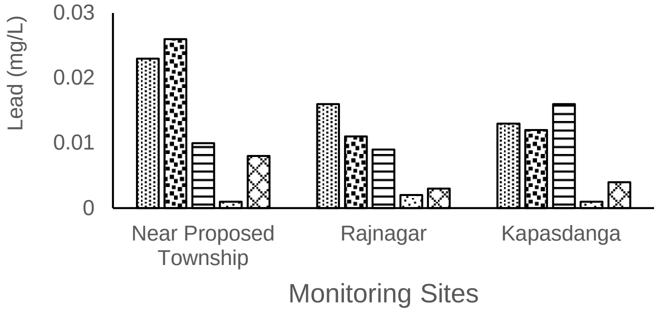


Figure 2.25: Status of Nitrate, Sulphate, Phosphate, Arsenic and Lead of winter seasons of the last six consecutive years

Laboratory tested parameters

The laboratory tested results obtained up to 25th monitoring period (January 2020: winter season) are described as follows:

TDS, TSS and TH

The highest TDS value of 3,080 mg/L was recorded Near Township area while the lowest was at Kapasdanga (370 mg/L). In addition, Rajnagar showed the double concentration of Kapasdanga. Both Rajnagar and Kapasdanga groundwater are safe for drinking purposes in respect to the recommended limit of Bangladesh (1000mg/L) **(Figure 2.24: TDS**). But, water from township area are not suitable for drinking purposes according to the drinking water quality status (ECR'97).

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). Among all the monitoring seasons, the observed TSS concentrations were much higher in winter season than the other monitoring seasons (pre-monsoon, monsoon and post-monsoon). This variation would be due to lack of freshwater availability for sufficient groundwater recharging. In addition, evaporation have also condensed the water along with its suspended matters. During the monitoring period, the TSS concentrations ranges from 2-3mg/L, which complied with the permissible limit of drinking water, Bangladesh (TSS: 10mg/L, ECR, 1997) (**Figure 2.24: TSS**).

TH concentrations from three monitoring spots vary from 118 mg/L to 145 mg/L (**Figure 2.24: TH**) in the last winter season. The maximum value was found at Kapasdanga while the lowest was found at Rajnagar. Over the last six winter seasons, drinking water hardness complied with standard limit (200-500 mg/L) set by the ECR 1997 most of the time. So far, no incidents of weathering of Ca^{2+} bearing minerals or excessive application of lime was found during the monitoring periods which could cause excessive amount of TH in groundwater.

Groundwater TDS, TSS and TH values of the consecutive winter periods are presented in **Figure: 2.24: TDS, TSS and TH** and all the observed dataset are attached in **Table B.19, Table B.20** of A**ppendix- IV.**

Chemical Oxygen Demand

The Bangladesh standard for COD in drinking water is 4.0 mg/L. Monitoring sites completely complied with the Bangladesh Standard as COD concentrations in the last winter period was found within 4.0 mg/L. Except the year 2014, all the other winter seasons COD concentration were found within the recommended limit for Bangladesh. The COD concentrations of all the monitoring sites are given in **Figure 2.24: COD** and all the observed dataset are attached in Table **B.21** of **Appendix- IV**.

Nitrate, Sulphate and Phosphate

Nitrate (NO_3^-) values ranged from 1.4 mg/L to 2.7 mg/L during the last winter period (**Figure 2.25: Nitrate and Table B.22**). The maximum value was recorded in Kapasdanga while the lowest was in Rajnagar area. NO_3^- concentrations were within ECR, 1997 limit (10mg/L) and showed both spatial and temporal variations in winter seasons.

Sulphate (SO_4^{2-}) level is being monitored since 2015 (didn't consider at the first monitoring held at 2014). On that time, SO_4^{2-} concentrations were complying with the Bangladesh Standard for Drinking Water Quality (400 mg/L). SO_4^{2-} concentration in groundwater did not show any pattern yet except a trend of comparatively high concentrations in winter than all other monitoring seasons (**Appendix-IV: Table B.23**).

On the other hand, during the last winter, the concentrations of PO_4^{3-} were found between 0.4 mg/L and 1.1 mg/L, which was within the standard limit of 6.0 mg/L (ECR'1997) (**Figure 2.24: Phosphate**). PO_4^{3-} concentration reached to its highest peak at 6.2 mg/L during the post-monsoon of 2014. 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 winter seasons NO_3^-, SO_4^{2-} and PO_4^{3-} concentrations of groundwater are presented in **Figure 2.25: Nitrate, Sulphate** and **Phosphate,** and all the observed dataset are attached in **Table B.22, B.23, and B.24** 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 0.07 mg/L in the last monitoring. It was found that groundwater of Rajnagar crosses the Bangladesh Permissible limit this time. It was also evident that this is the first-time tube well from Rajnagar showed As contamination among all the six winter seasons. This case will be observed further whether this situation prevails for a short period of time or for a longer period. Usually, in a coastal area of South West Region, with the changes of groundwater recharge rate, As concentration can be varied for a short period of time.

Lead (Pb) and Mercury (Hg) concentrations were also measured and the values were found within the permissible limit specified in ECR' 1997 (0.05 mg/L for Pb and 0.001 mg/L for Hg). The concentration of Pb showed only spatial variation to some extent (**Figure 2.25: Lead**). However, the water of the tube-wells was found suitable for drinking purpose in terms of metal pollution status except Rajnagar for As. The observed values of As and Pb in all the pre-monsoon period monitored sites are presented in **Figure: 2.25: Arsenic, Lead** and all the observed dataset of As, Pb and Hg are presented in **Table B.25, B.26 and B.27** of **Appendix-IV**.

Remarks

This concluding remark represents that the physical characteristics of groundwater quality is still in good condition and in acceptable state for drinking purpose.

Chemical characteristics of the groundwater quality are also found suitable and safe to drink based on permissible limit as per drinking water standards, ECR' 1997 except high TDS near the Township Area and recent As contamination at Rajnagar area. In addition, chemical oxygen demand during 2014 and 2015 was higher than ECR' 1997 limit also. The groundwater quality of the observed area is free from any kind of metal pollution except Arsenic contamination in Rajnagar. But this concentration for a shorter period of time is not as dangerous as to stop drinking water from the tube well.

2.4 Land Resources Monitoring

2.4.1 Methodology

Monitoring of selected indicators is very crucial for better management of land resources in the study area. In terms of land resources monitoring plot/land use, soil fertility/nutrient status (soil reaction i.e. pH; EC; OM; base cations i.e. Ca, Mg, K and Na; status of macro nutrients i.e. N, P and S; status of micro nutrients i.e. B, Fe, Mn and Zn), soil contamination with heavy metals (Pb and Cd) and soil salinity were considered as the major indicators. Sodium absorption ratio (SAR), exchangeable sodium percentage (ESP) can be calculated from the analyzed data. It can also be mentioned that the structural change of soils in the sampling plots may also be identified from these data.

On the other hand, discussion with local people and opinions from the experts were considered as the prime methods of agricultural resources and livestock resources monitoring. The use of agricultural inputs, present cropping patterns by land type, crop damages and other conditions like drainage congestion/water logging, salinity intrusion or other natural calamities induced impacts, diseases and pest infestation as well as management practices and crop production in the selected locations of the monitoring area were considered as the major criteria for the agricultural resources monitoring. Similarly, status of feed/fodder and diseases of livestock in the adjacent area of the project area were considered as major criteria for the livestock resources monitoring

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

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

ESP is the sodium absorbed by soil particles as a percentage of the Cation Exchange Capacity (CEC) and is calculated as:

$$ESP = \frac{[Na}{CEC} X\ 100$$

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:

$$ESP = \frac{[Na^{+}]}{[Ca^{2+}+Mg^{2+}+Na^{+}+K^{+}]} \times 100$$

ESP is used to characterize 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 2.10**. Locations of collected soil samples are presented in **Figure 2.28**.

Table 2.10: Land Resources Monitoring Plan

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

2.4.2 Process of Soil Samples Collection

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 also considered as potential local factors for the said purpose. All the selected plots were characterized as medium high land (F_1), which are normally flooded in that a range of 30-90 cm and remain inundated for more than two weeks to for few months during the monsoon/flood period.

According to regular practice, soil samples are collected in October and April in each year. But during April, 2020 the Samples could not be collected due to COVID-19 outbreak and lockdown related issues. However, to manage consistency of time series data, experts from CEGIS visited to all six sampling locations during July, 2020. But all of these sampling locations were found submerged **(Figure 2.26)**. As, submerged soil chemistry differs from dry soil chemistry hence there could be a chance of misunderstanding on time series data interpretation if this data of July, 2020 would be incorporated. After evaluating all of these reasons, soil samples were not collected during this monitoring field visit. Soil sample collection in October, 2020 (post-monsoon) season will be commenced in normal way and analysis of data will be incorporated thereafter.

present condition of Baranpara

present condition of Chunkuri-2

present condition of Kapalirmet

present condition of Bidyarbon

present condition of Chakgona

present condition of Basherhula

Figure 2.26: Present condition of the sampling plots

2.4.3 Agriculture Resources Monitoring

Monitoring of agriculture resources has also been scheduled twice a year as per the monitoring plan of the ToR. This year's scheduled monitoring is shifted to July instead of April due to COVID-19 situation. This time the data on Local Aman (Production, damage, input use etc.) was collected through informal interview (KII, RRA and FGD) with the local farmers from the monitoring area.

2.4.4 Present cropping pattern at the monitoring plots

Detail data on cropping pattern for this year was obtained through discussions with the plot owners which are mentioned in the following sections-

Agriculture Plot-1 (Baranpara)

This area of this plot is about 0.4 Hectare. Due to waterlogging and associated problems Local Aman (Chapshail) was cultivated in this monitoring plot where no chemical fertilizer and pesticides were used. This monitoring plot was hit by tropical cyclone BULBUL. As a result, almost one-third crop production was reduced. As pe the discussion the cropping pattern and management practice remained same as of the previous monitoring. The detailed cropping pattern is shown in **Table F.1** of **Appendix IV**.

Agriculture Plot-2 (Chunkuri-2)

This monitoring plot is located at Chunkuri-2 and the size is about 0.93 hectare. Local Aman (Benapole) was found to be cultivated in this plot in Kharif-II season. Tropical cyclone BULBUL also inflicted damage in this location which reduced production. Detailed cropping pattern is shown in **Table F.1** of **Appendix IV.**

Agriculture Plot-3 (Kapalirmet)

This monitoring plot size is about 0.14 hectare. This plot was found to be cultivated only during the 1st monitoring tier in later the plot has been used for fish cultivation. So, no crop production was ever found in this plot after the 1st monitoring tier. Detailed information for this plot is presented in **Table F.1** of **Appendix IV**.

Agriculture Plot-4 (Chakgona)

This monitoring plot is located at Chakgona and the size of the plot is about 0.23 hectare. The plot which was used for monitoring previously has been converted to school cum cyclone shelter instead of agricultural land. So that, monitoring plot is shifted to the opposite bank of the canal where cropping practice, water logging condition and other local factors were found to be similar to the previous one. Local Aman (Chapsail) was found to be cultivated during the field visit where use of chemical fertilizer was not reported. A decrease in Crop production was also reported due to tropical cyclone BULBUL. Detail cropping pattern is presented in **Table F.1** of **Appendix IV**

Agriculture Plot-5 (Basherhula)

This monitoring plot is located in Basherhula and the size of the plot is about 0.47 hectare. Local Aman (Chapshail) was found to be cultivated in this plot. Chemical fertilizer (Urea @ 50kg/plot) and granular pesticides (Basudin @1kg/plot) were reported to be used in the plot. Only Leaf folder was observed in this plot as pest infestation. The cropping practice and management practice remain same as of the previously monitored period. Slight production loss was reported in this location due to tropical cyclone BULBUL. Detailed cropping pattern is shown in **Table F.1** of **Appendix IV.**

Agriculture Plot-6 (Bidyarbon)

The size of the plot is 0.1 hectare. Only local Aman (Chapshail) is cultivated in this area during Kharif-II season. Production in this plot was severely damaged during this monitoring. Tropical cyclone made the initial damage while pest infestation (rice stem borer) wrapped up the process. Almost two-third production of this plot was lost due to these two situations. Detailed cropping pattern is shown in **Table F.1** of **Appendix IV**.

2.4.5 Crop Production in Monitoring Plots

As per discussion, the crop production varied from plot to plot and variety to variety due to fertility status and management practices of the plot. For this reason, the production level of the plots is not same. The highest rice production (1.9 tons/plot) was reported in plot-2 (Chunkuri-2) whie the lowest (0.07 tons/plot) was reported in plot-6 (Bidyarbon). As because

Local Aman was cultivated at all the monitoring plots in 2019-20 except the monitoring plot of Kapalirmet. On the other hand, the monitoring plot (Kapalirmet) inundated by saline water in 2018-19. Farmers have been practicing shrimp farming instead of crop cultivation in this plot due to adverse impact of salinity.

Detailed information on crop production in monitoring plots is presented in the **Table F.2 of Appendix IV and Figure 2.27**.

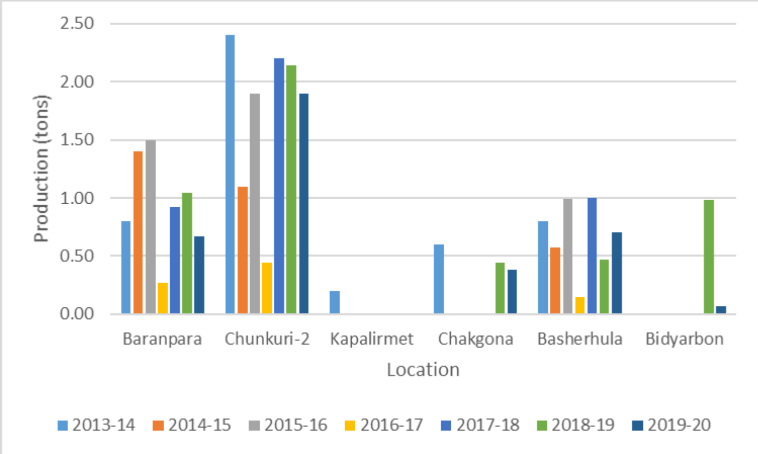


Figure 2.27: Trend of crop production in the monitoring year

2.4.6 Crop Damage in Monitoring Plots

Crop damage was also reported at all the monitoring locations during this field visit and the impact of tropical cyclone BULBUL was reported as the prime reason for the daamage. Besides, pest infestation was also reported in one location (Bidyarbon). The amount of crops reduction was 0.76 tons. Detailed crop damage information is presented in **Table F.3** of **Appendix IV.**

Monitoring of EMP during construction activities on land and agriculture resources

At present, the following activities on land and agriculture resources are in progress at project site and surrounding areas:

a. Soil fertility; ii) Soil and ground water quality and iii) Damage to surrounding crops.

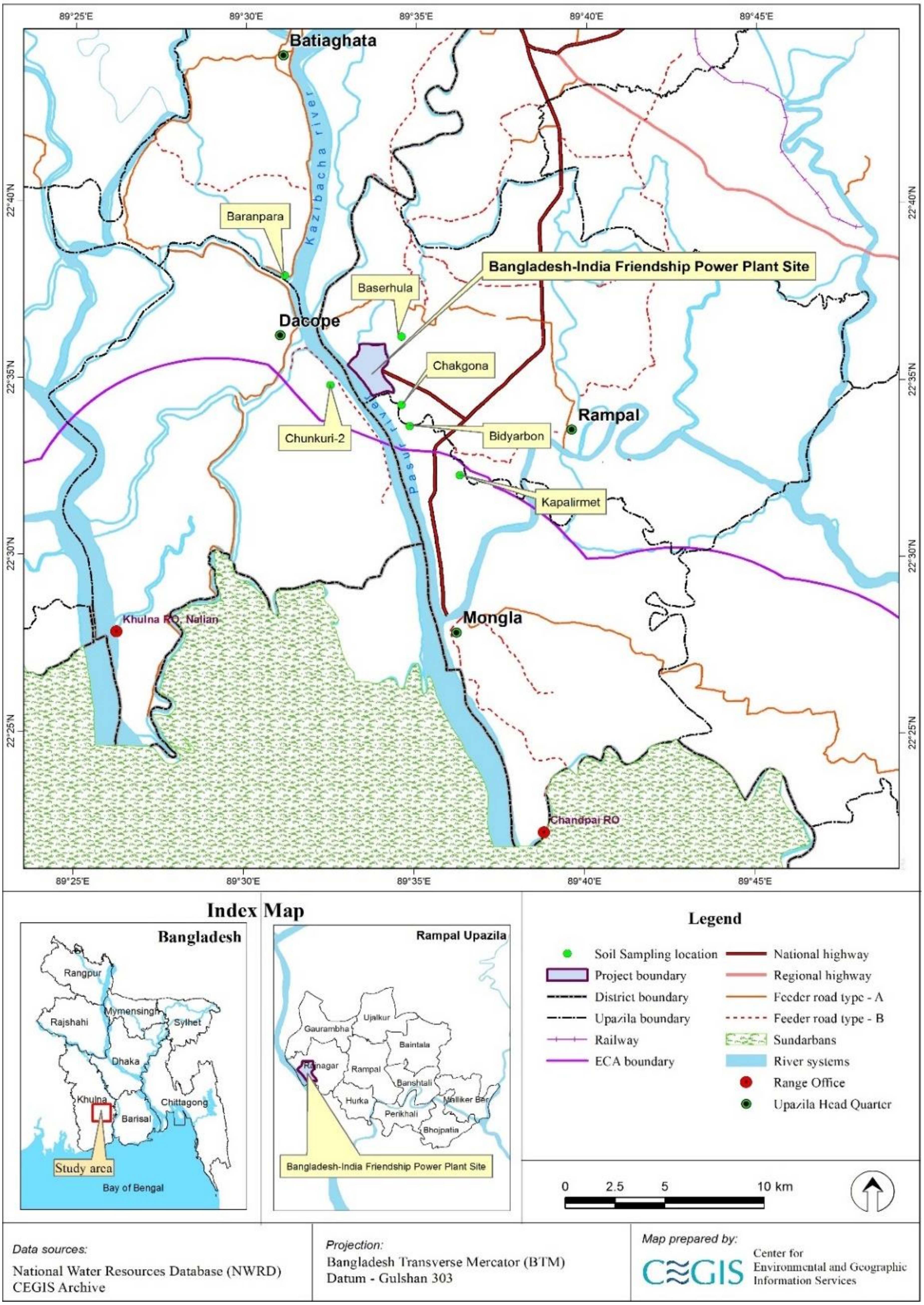


Figure 2.28: Land Resource Monitoring Locations

Table 2.11: Monitoring of EMSAP Implementation

Sl. No.	Possible Impacts during construction stage	Mitigation Measures	Remarks on Due Diligence
1	Soil fertility might be impacted due to disposal of waste and waste water.	▪ Construction materials must be collected, stored, and disposed in an appropriate manner. ▪ Recycled waste should be disposed in a suitable landfill.	Complied
2	Soil and ground water quality might be deteriorated by leakage of oil, fuels and hazardous chemicals from tank or storage.	▪ Harmful effluents and waste leakage from oil and chemical tank or storage must be controlled strictly ▪ Wastes or used oil must be stored in a designated area for disposal through authorized vendors. ▪ Measures must be undertaken for fire suppression and the neutralization and collection of any spilled materials ▪ Treatment plant must be installed. ▪ Provide training and awareness building program to the labors and professionals.	Complied
3	Damage to surrounding crops due to project related activities.	▪ Fencing of project area by drum sheet or Tarija. ▪ Limiting the construction activities and stocking within the project boundary.	Complied

Source: Field Survey, July 2020

2.4.7 Livestock Resources Monitoring

Livestock related data was collected in July, 2020 and described in the following sections and present livestock scenario is presented in **Figure 2.29**.

2.4.8 Feed/Fodder condition of Livestock Resources

Overall feed and fodder situation remained unchanged as of the previously monitored periods. The farmers reported for fodder shortage for their livestocks. Due to commercial use of land, the grazing land is squeezing day by day. Under this situation livestock farming became difficult in the sampling areas.

2.4.9 Diseases of Livestock Resources

Diseases of livestock/poultry remain similar to the previous monitoring periods (16^{th} and 18^{th} monitoring). According to Veterinary Surgeon (VS) of the Rampal upazila, the unhygienic condition of the courtyard is between July to November for spreading diseases to livestock and poultry populations. However, some diseases were also found round the year. The severity of the infestation was reported more or less alike in this concurrent circumstance as for the past situations. The mortality rate of the livestock/poultry became negligible, due to immunization and insemination program run by the Department of Livestock.

Cattles rearing scenario in the study area

Sheep rearing scenario in the study area

Duck rearing scenario in the study

Goat rearing scenario in the study area

Figure 2.29: present livestock scenario

2.5 Transportation Monitoring

2.5.1 Location of Traffic Survey

The traffic survey was conducted from July 17 to 19, 2020 on two weekends and on one-week day at three pre-selected location. Weather was found sunny during the surveys 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 2.30**.

2.5.2 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.

2.5.3 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 2.12.**

Table 2.12: 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

2.6 Results of Monitoring

The summary results of vehicular movements at three different locations in **Table 2.13** shows that, the Passenger Car Unit (PCU) per hour suggest that the Khulna-Mongla Highway receives the largest number of vehicles, compared to other surveyed roads.

Table 2.13: 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	734	630	295
Khulna Mongla Road at Digraj	201	216	220
Power Plant access road at Ichamoti Bridge	56	46	60

Source: Field Survey, July, 2020

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. Compared to the previous monitoring report, traffic volume and traffic nature in all the three surveyed locations were found to be higher. One of the key factors behind this heavy traffic volume is the rigorous and heavy construction works of the Power Plant. The detail survey findings regarding the traffic volume surveys as well as the detail calculations are attached in **Annex E.1, E.2 and E.3**.

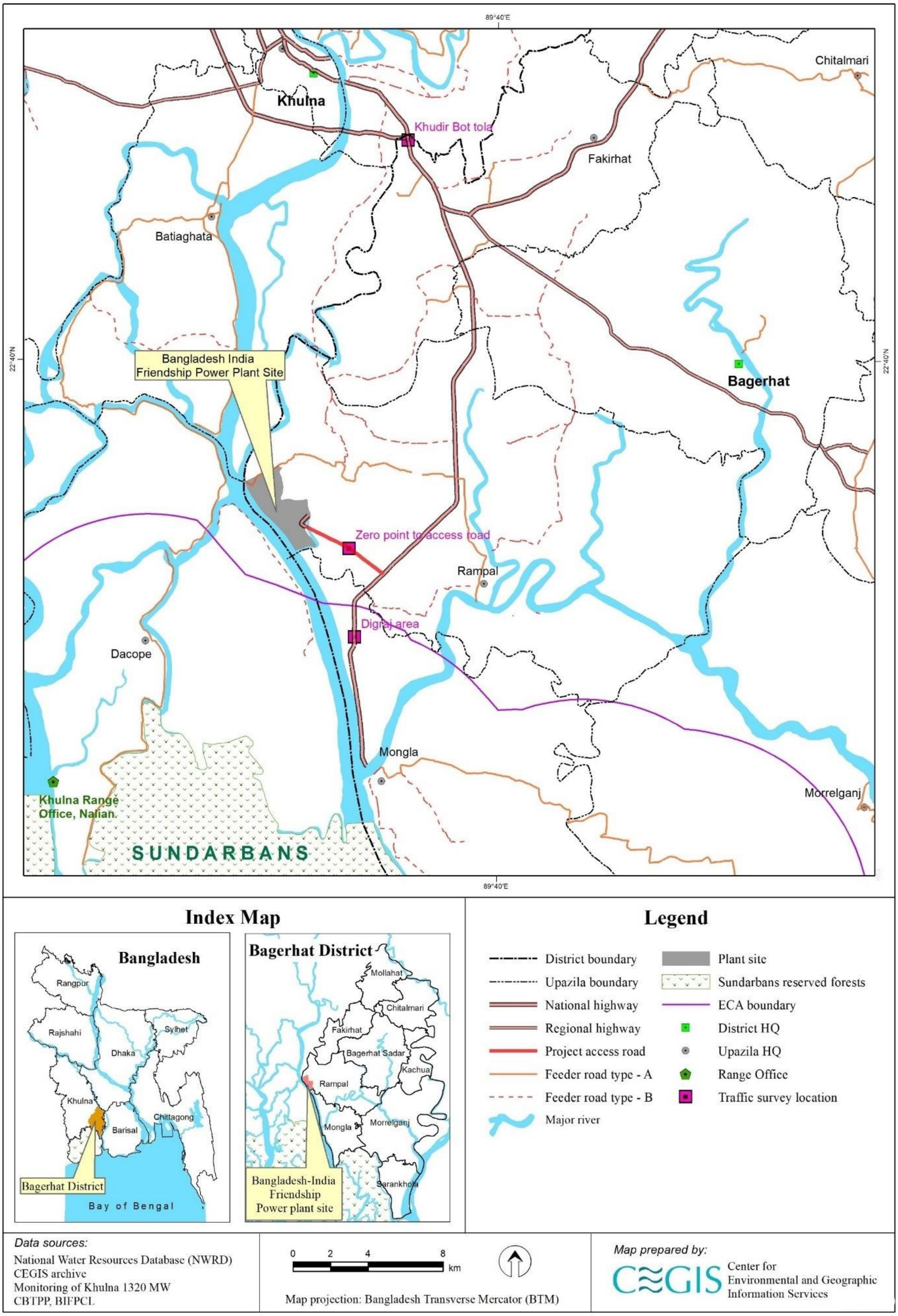


Figure 2.30: Locations of Traffic Survey

2.7 Water resources monitoring

2.7.1 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 2020 to June 2020. 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.

2.7.2 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 2020 to June 2020. After that, data were plotted in the same graph for Hiron Point and Mongla Port which is presented in **Figure 2.31**.

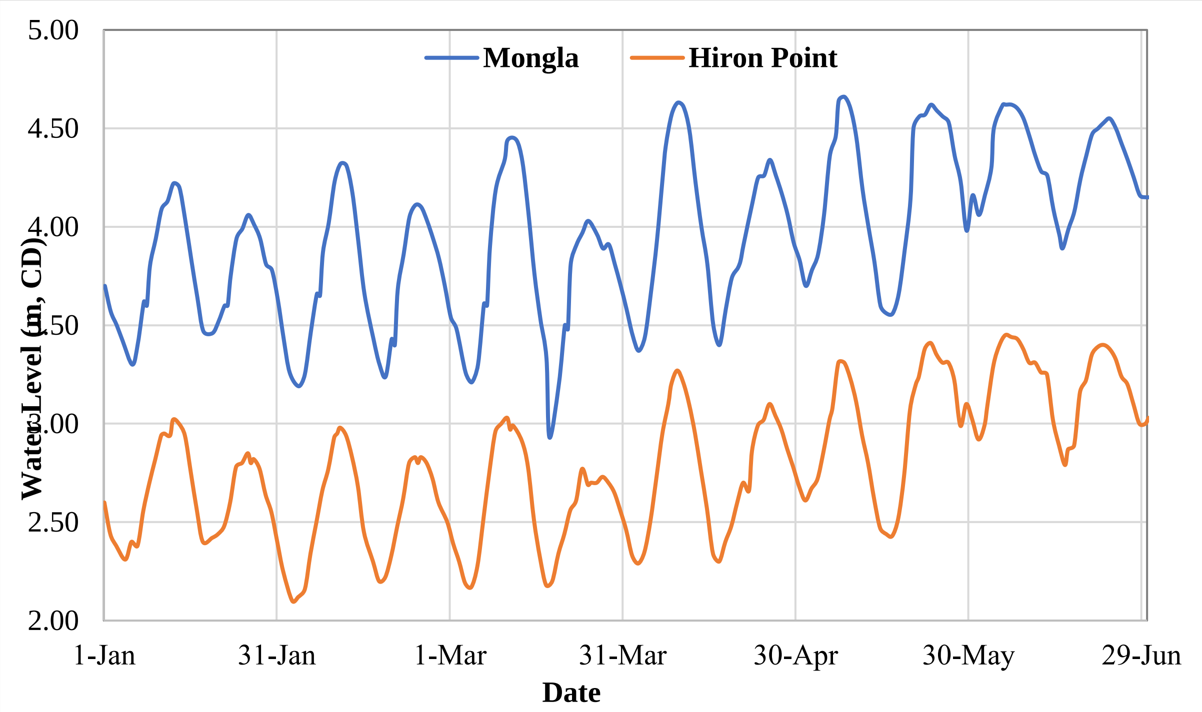


Figure 2.31: Peak water level at Hiron Point and Mongla Port for the period from January 2020 to June 2020

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 considering the distance between stations.

For the assessment of the lag time and peak attenuation between two stations for two different quarters, water level data of year 2020 from January to March as well as April to June were analyzed respectively.

It was found that during no-moon period, peak water level of 2.94 m in February 2020 at Hiron Point travels through tide to upstream at Mongla Port where its peak water level is 4.31 m on the same day (**Figure 2.32**). The peak attenuation between these two stations is 1.37 m during no-moon period in February 2020. It was also found that the travelling time or lag time to reach this peak is around 1 hour 50 minutes. Additionally, peak attenuation for the month January and March 2020 are 1.2 and 1.31 respectively. While the lag time are hour 35 minutes and 1 hour 28 minutes correspondingly for the month of January and March 2020 (**Figure 2.32**). The methodology is shown in **Figure 2.32**. 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 2020 is about 1 hour 38 minutes while the peak attenuation is nearly 1.30 m.

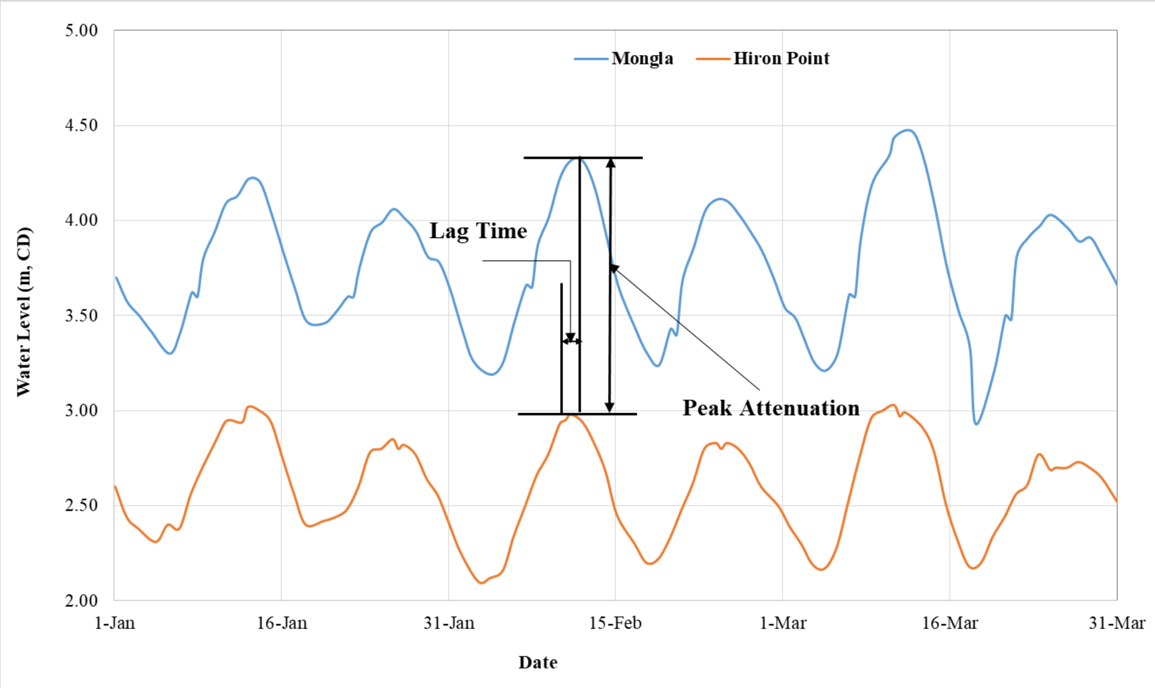


Figure 2.32: Process of calculation of lag time & peak attenuation during the period January-March 2020

Furthermore, analysis was done for the period of April to June 2020 (**Figure 2.33**). It was found that the peak attenuation during the month of April and May are 1.40 and 1.35 respectively while it is 1.18 for the month of June 2020.

On the other hand, the lag time to reach peak water level from Hiron Point to Mongla Port for the month of April and May is same which is 1 hour 15 minutes while it is about 1 hour 20 minutes for the month of June 2020 (**Figure 2.33**). 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 2020 is about 1 hour 17 minutes while the peak attenuation is nearly 1.31 m.

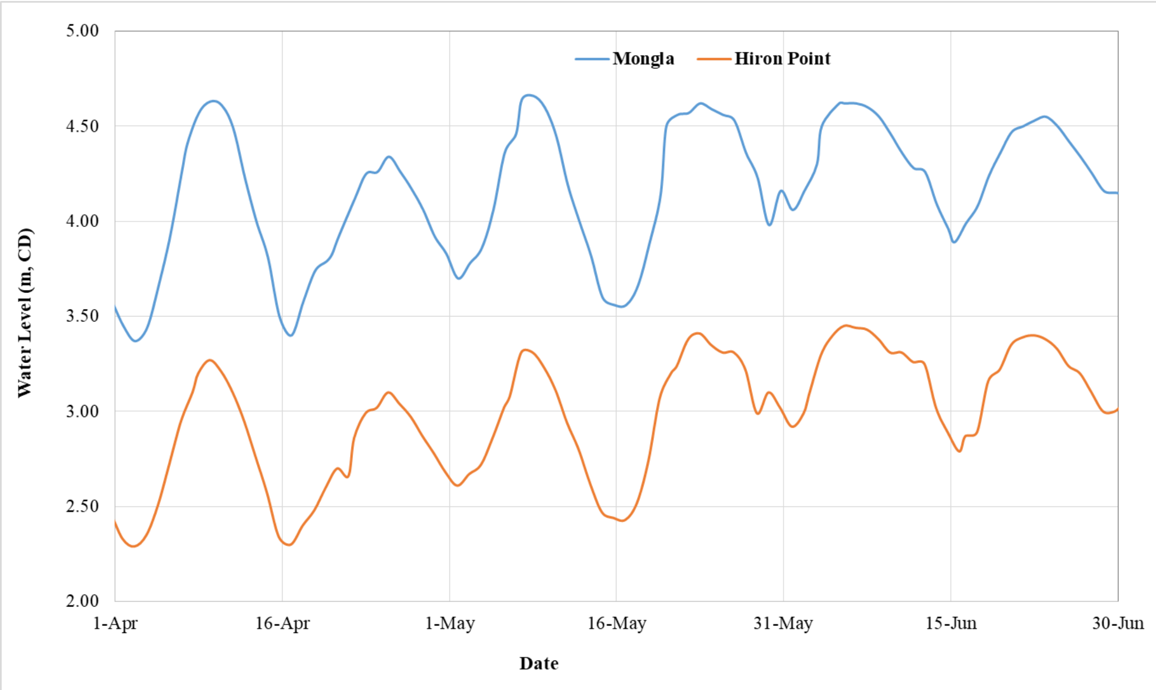


Figure 2.33: Peak water level at Hiron Point and Mongla Port for the period from April 2020 to June 2020

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 2020 is about 1 hour 28 minutes while the peak attenuation is nearly 1.30 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 45 minutes to reach at Rampal Jetty area where peak attenuation is nearby 1.54 m.

2.7.3 Erosion and accresion

Bangladesh is a riverine country. Rivers in different hydrological regions have different characteristics. Rivers in the northern parts have fluvial characteristics while it is tidal in the south. The Passur River is one of the dynamic and major rivers in the southern parts of Bangladesh. Rampal power plant is being constructed along the left bank of the Passur River (**Figure 1**). It is always important to monitor the morphological characteristics of the river at regular interval to assess the dynamics of the river in case of any development works. Monitoring of river dynamics like erosion, accretion and shifting of the bankline of the Passur River with a half-yearly basis may facilitate the proper planning and management of the development work.

2.7.4 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 and identify the locations of erosion and accretion as well as the shifting of bankline in half yearly period. The steps of images processing and analysis is briefly explained below-

2.7.5 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 February 2020- September 2020 were collected. After that, satellite images were geo-referenced to have the same projection system. Then, it was found that one image differs with other image. In that case, images were co-registered to avoid the distortion with each image.

2.7.6 Delineation of Banklines

After collection and processing of images, banklines were delineated for the mentioned period using Arc-GIS tool. Then, banklines were analyzed and superimposed to assess the erosion-accretion and shifting of the river during period from February 2020 to September 2020.

2.7.7 Monitoring of Erosion and Accretion

For monitoring the half yearly riverbank erosion and accretion at the project site, Mongla, Harbaria and Akram point areas, banklines of the Passur River were superimposed with 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 February 2020 to September 2020 (**Figure 2.34**) although there are red color in few locations along its both banks during its passage from Chalna to Hiron Point which may be considered as not significant.

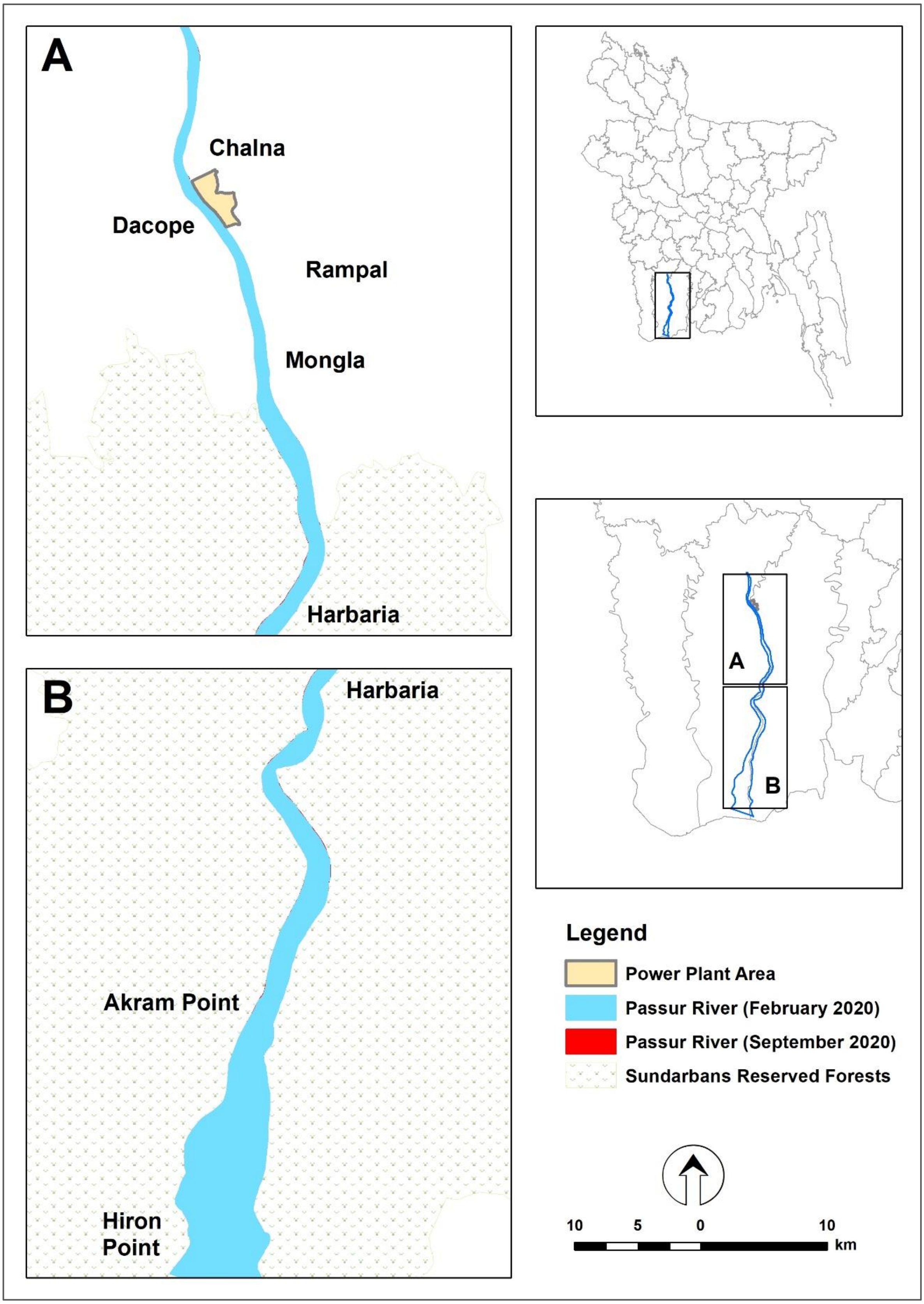


Figure 2.34: Riverbank Erosion and Accretion of the Passur River from February 2020 to September 2020

2.7.8 Monitoring of Chemical Properties of Bed Materials

2.7.9 Methodology

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.

2.7.9.1 Sampling Frequency

The frequency of monitoring for sediment quality is considered twice in a year. Accordingly, sediment sampling was done in 23rd monitoring (February, 2020; considered as dry season, 2020). Data analysis of that sampling is incorporated in this report. Moreover, wet season, 2020 sample is taken in 25th monitoring (July, 2020). This assessment report will be incorporated in 26th monitoring report.

2.7.9.2 Monitoring Indicators

The main objective of sediment quality monitoring is to find out the heavy metal accumulation in sediments due to anthropogenic activities. 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 Sulphate.

2.7.9.3 Location

The sampling locations have been selected in both surrounding of the project area and inside the Sundarbans. The sampling locations are stated in **Table 2.14**. Locations of collected samples are presented in **Figure 2.35**.

Table 2.14: Location and 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)	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″		

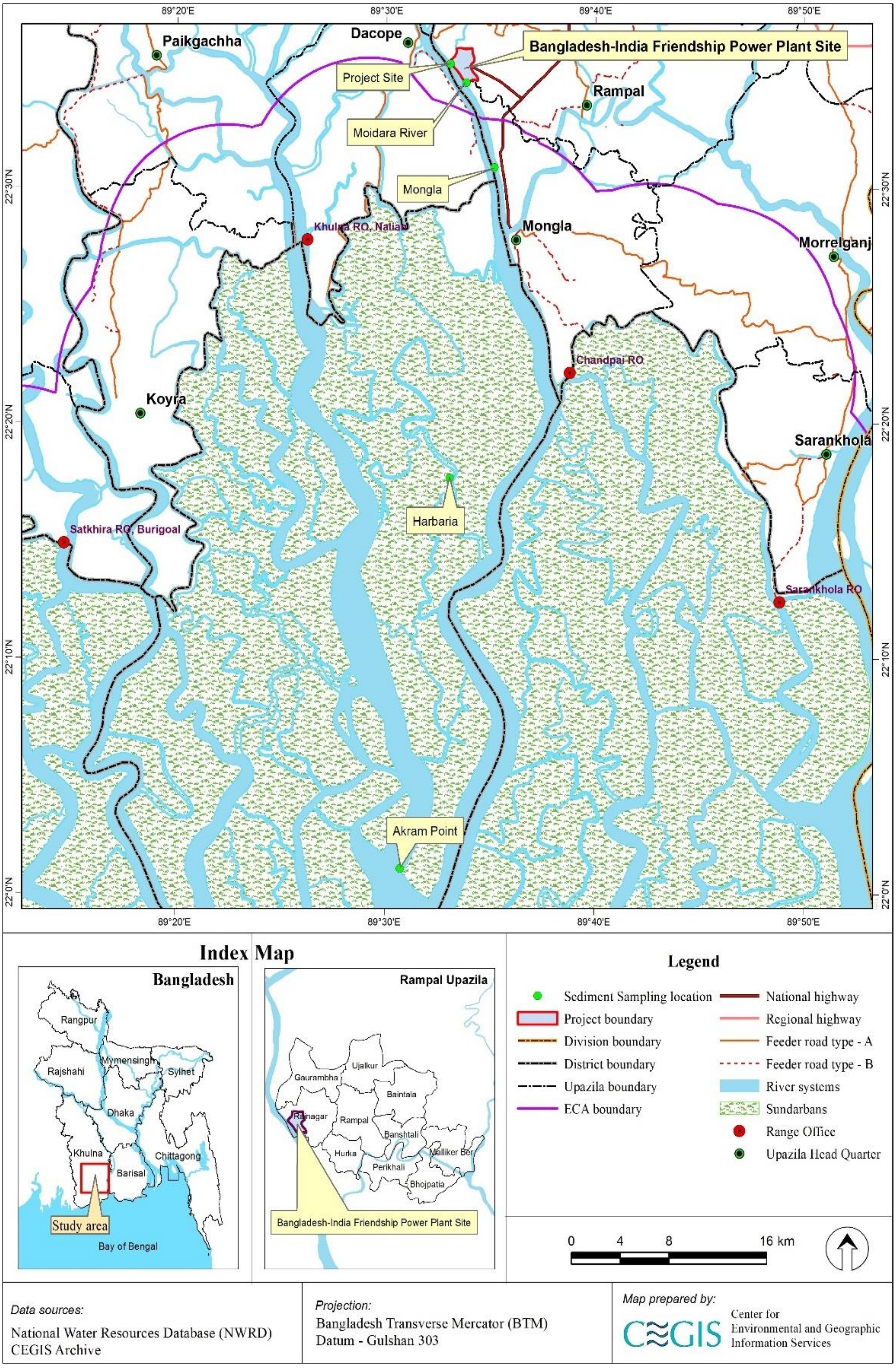


Figure 2.35: Sediment Sampling Locations

2.7.10 Process of Sediment Samples Collection

Plot Selection

The sampling locations are selected on the basis of potential route of coal transhipment considering the approval conditions of EIA of coa; trasportation. 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 be taken place. The sampling points were selected on the basis of TOR. Expert's judgement were 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

Sediment samples are taken twice a year. Accordingly, dry season, 2020 sample was taken in February, 2020 field visit (23rd monitoring field visit). Data analysis of dry season, 2020 is incorporated in this report.

Moreover, sediment samples of wet season, 2020 is in 25th monitoring field visit (July, 2020). Collected sediment samples have been handed over to BCSIR, Dhaka for laboratory analysis immediate after that field visit.

Table 2.15: Sediment quality monitoring data at different locations of the Passur River (Dry Season, 2020)

Site No	Season	Location	pH	SO_4 (mg/kg)	As (mg/kg)	Pb (mg/kg)	Hg (mg/kg)
1	Wet Season, 2018	Project Site	8.61	184	5.37	6.03	1.38
2		Moidara River	8.18	297	3.65	6.59	1.5
3		Mongla Port	8.22	103	2.53	6.05	1.36
4		Harbaria	9.06	329	4.04	8.67	2.08
5		Akram Point	8.66	277	6.18	8.13	1.81
1	Dry Season, 2019	Project Site	8.8	489	7.51	8.71	2.04
2		Moidara River	8.6	464	4.16	6.52	3.1
3		Mongla Port	9.25	264	4.6	5.19	1.77
4		Harbaria	7.9	490	4.1	5.02	1.24
5		Akram Point	8.6	708	4.69	5.67	1.37
1	Wet Season, 2019	Project Site	8.69	200	1	7.13	2.93
2		Moidara River	8.73	400	0.78	5.45	2.61
3		Mongla Port	8.4	200	1	5.62	1
4		Harbaria	8.74	400	1.08	8.46	7.96
5		Akram Point	7.4	400	1.5	14.6	0.45
1	Dry Season, 2020	Project Site	8.22	187	2.5	8.18	1.58
2		Moidara River	8.68	244	1.95	7.89	2.22

Site No	Season	Location	pH	SO_4 (mg/kg)	As (mg/kg)	Pb (mg/kg)	Hg (mg/kg)
3		Mongla Port	8.48	248	2.54	9.28	0.66
4		Harbaria	8.62	234	2.26	7.54	0.57
5		Akram Point	7.83	653	2.15	7.55	0.53

**Field sample collected by CEGIS and sample analysis in BCSIR in different seasons.*

2.7.11 Status of sediment quality of the Passur River

The data presented in this report represents dry season, 2020 which was collected in February, 2020 (23rd monitoring).

According to the analyzed data, only Mercury (Hg) exceed average shale value **(Marowsky and Wedepohl, 1971)** and average upper crust value **(Rudnick and Gao, 2014)**. Other two trace element (As and Pb) value found within the stated limits even in published reports (Ali *et al*., 2018). Compared to previous dry season monitoring report (January, 2019), As and Hg concentration is reduced in all sampling locations while Pb concentration is increased. In general, a decreasing pattern towards the sea is found for all of the elements. The maximum concentration for As and Pb is found in Mongla port while in Moidara river, Hg scored the most. The average concentration for As, Pb and Hg during this monitoring is 2.28 ppm, 8.08 ppm and 1.11 ppm respectively. In project site (jetty point), concentration of all elements are crossed this monitoring average.

Table 2.16: Reference level of different metals in sediment of the Passur River

Sl No.	Name of Heavy metal	Average upper crust concentration (ppm)	Average Shale Value (ppm)	Average heavy metal content in the Passur River in ppm (Ali *et al.,* 2018)	
				Summer	Winter
01.	Arsenic (As)	4.8	14	8.87	12.4
02.	Lead (Pb)	17	20	21.9	33.6
03.	Mercury (Hg)	0.05	0.26	-	-

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 component of the biological environment around the project site and along the Passur river were categorized into three major groups and which are fisheries resources, ecological resources and Sundarbans Reserve Forest (SRF).

3.1 Fisheries Resources

This portion of the report contain the findings of fisheries resources monitoring for the recently monitored season (July, 2020) and comparison with the previously monitored quarters.

Location of Monitoring Sites

During this phase, the monitoring activities were carried out in 13 pre-selected locations where 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 resources 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 investigating the stocking pattern, growth rate and mortality rate. Fish production monitoring was divided into capture and shrimp/fish farm production.

3.1.1 Methodology

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. Basic life requirements for fish community are given in **Table D.1 of Appendix IV**.

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. The 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.

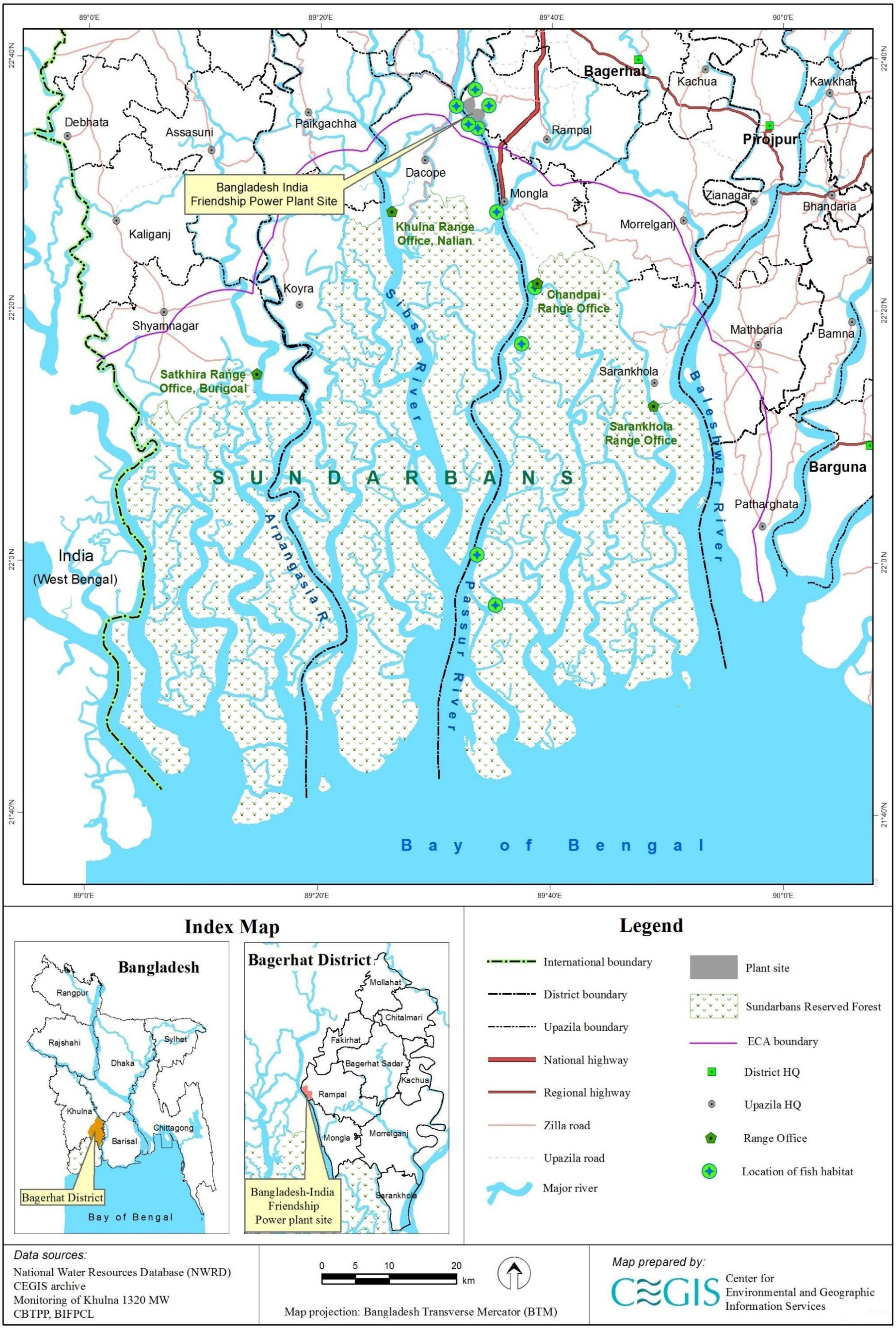


Figure 3.1: Fisheries Resources Monitoring Locations

3.1.2 Status of Monitoring

Followed by the quarterly monitoring of the 2014-15, 2015-16, 2016-17, 2017-18, 2018-19 and 2019-20, the recently conducted monitoring session of 2020-21 was conducted during the period from July 16 to July 24, 2020. No fishing activities were observed at Akram Point (A), Haldikhali Khal (B), Charaputia (C), Bhodra (D), Harbaria (E), Chandpai (F) and Jongra-Passur Confluence (G) during field visit in this quarter monitoring due to banning of fishing 65 days (20 May-23 July) by the Government of Bangladesh in order to boost the fish stocks.

Fish Habitat Status

Fish habitat status was also found varied due to habitat classification and habitat use pattern of different life stages of different fish species.

<u>Habitat Classification</u>

Habitat classification was analyzed by using the length-wise distribution of different fish species in the sampling sites. The length of different life stages of fish species was identified and evaluated from literature review. Linkage distance was calculated with the similarity in distribution. The entire stretch of the Passur River System consists of three major behavioral habitats. The sampling sites were classified on the basis of abundance of different life stages of fish species in those habitats. The following **Table 3.2** show the classification of seven (07) sampling site for 1 to 15th quarter monitoring and ten (10) sampling sites from 16th to 22nd quarter monitoring according to the ToR in respect of habitat uses for previous quarters of fisheries monitoring (**Table D.1 of Appendix IV**).

Table 3.2: Classification of Habitat use of 10 Sampling Sites

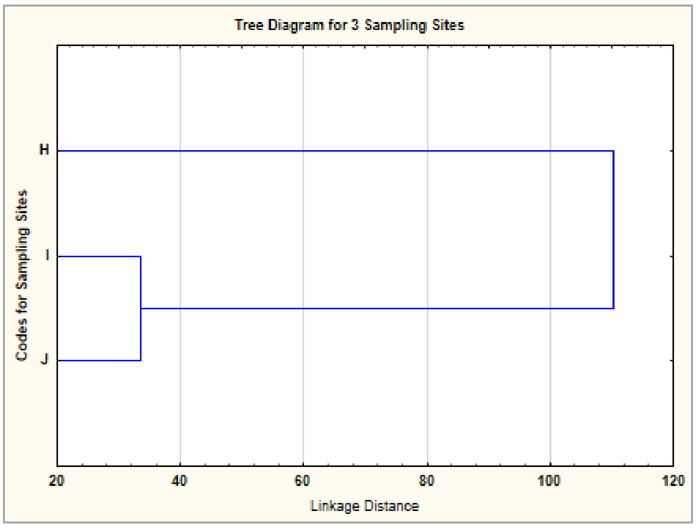
Monitoring Quarter	Type of Habitat Use
1st quarter (April, 2014)	• Grazing Ground • Grazing and Breeding Ground
2nd quarter (July, 2014)	• Grazing Ground • Spawning and Nursery Ground
3rd quarter (October, 2014)	• Grazing Ground • Grazing and Breeding Ground • Spawning, Nursery and Grazing Ground
4th quarter (January, 2015)	• Grazing Ground • Grazing and Breeding Ground • Spawning, Nursery and Grazing Ground
5th quarter (April, 2015)	• Grazing Ground • Nursery Ground • Spawning and Nursery
6th quarter (August, 2015)	• Grazing, Breeding Ground • Spawning, and Nursery Ground
7th quarter (October, 2015)	• Grazing Ground, • Nursery Ground and • Growing and Feeding
8th quarter (January, 2016)	• Nursery and Feeding Ground • Growing and Feeding
9th quarter (April, 2016)	• Spawning and Nursery Ground • Feeding and Growing Ground

Monitoring Quarter	Type of Habitat Use
10th quarter (July, 2016)	• Nursery Ground • Feeding and Breeding Ground
11th quarter (October, 2016)	• Breeding and Spawning Ground • Feeding and Grazing Ground
12th quarter (January, 2017)	• Grazing and Spawning Ground • Nursing Ground
13th quarter (April, 2017)	• Grazing and Feeding Ground • Nursing Ground
14th quarter (October, 2017)	• Grazing and Feeding Ground • Nursing Ground
15th quarter (January, 2018)	• Grazing and Feeding Ground • Nursing Ground
16th quarter (April, 2018)	• Feeding ground • Growing ground • Nursing ground
17th quarter (July, 2018)	• Spawning and Nursery Ground • Nursery Ground with Feeding and Growing Capacity • Growing and Feeding Ground • Omni-ground
18th quarter (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 quarter (February, 2019)	• Ground for Feeding • Omni-Ground including Nursery Ground and Ground for Maturation
20th quarter (April, 2019)	• Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
21st quarter (July, 2019)	• Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
22nd quarter (November, 2019)	• Spawning and Nursery Ground • Omni-Ground including Feeding and Maturation Ground
23rd quarter (February, 2020)	• Nursery Ground • Spawning ground • Ground for maturation and feeding
24th quarter (April, 2020)	• Monitoring activities was not carried out due to COVID-18 and lockdown related issues

During the 25th quarterly monitoring conducted in July of 2020-2021 Session, the sampling sites were divided into two major classes and shown in the **Figure-3.2**.

a) **Nursery Ground:** The catch revealed that availability of Juvenile stage (Length group: 3-5cm and 5-10cm) of different fish species were dominant at Mongla Point (H). It indicates that the mentioned sampling site was found to be used as nursery ground and ground supporting recruitment into adult age group for many medium and large sized fish species.

b) **Ground for Maturation and Feeding:** The sampling sites, Maidara (I) and Chalna (J) were found to be rich in juvenile and adult fishes. The length group of 5-10cm, 10-20cm and >25cm were significantly found in these sites. These sites were thus considered as the ground for maturation and feeding in respect of the observed fish species.

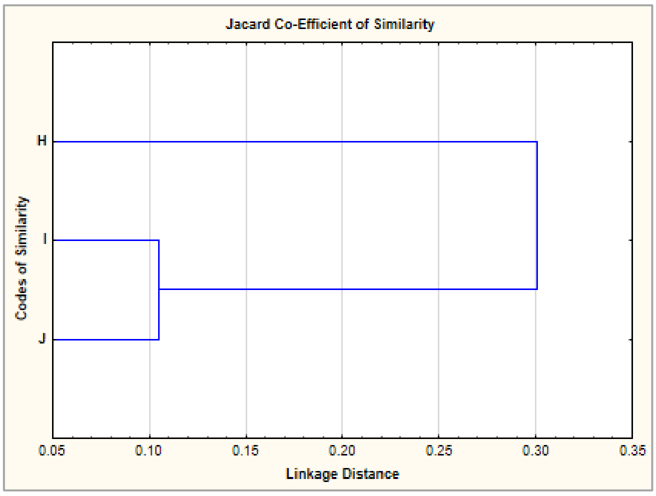


25th Monitoring, July 2020

(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, **Table D.2 of Appendix-IV**) 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 2020-21 the JI value between the Maidara (I) and Chalna (J) sampling sites were the highest (**Figure 3.3**) which indicates the maximum similarity in species occurrence between these two sites out of 3 sampling sites of available fishing.



25th Monitoring, July 2020

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

<u>*Habitat Suitability Index (HSI)*</u>

Habitat Suitability Index (HSI) was determined for the year of 2014-15 and 2015-16 considering the exposure to water quality and the production performance of different fish species. Production performance was measured through considering length-structured production assessment model (E. L. Cadima, 2003). Suitability analysis was conducted by applying Iyengar and Sudarshan (1982) developed model. All data was normalized through using UNDP developed normalization equation (*UNDP, 2006*).

In the first year of monitoring, Sheola Khal at Chandpai was found as the most suitable habitat for fish species among the Passur River System. Sheola Khal has also been identified as the most suitable in second year which is followed by Harbaria, Akram Point, Haldikhali, Mongla Point, Maidara and Chalna Point (**Table 3.3).** In third year (2016-17) of monitoring, Harbaria Khal was found to be mostly suitable habitat for fish. In 2017-18, the Sheola Khal at Chandpai was highly suitable habitat, which was observed to support various length groups of diversified fishes. In the last monitoring year (2018-19), the Sheola Khal at Chandpai attained again highest suitability index, which indicates that this habitat has the potentiality to support various length groups of diversified fishes.

Table 3.3: Habitat Suitability Index (HSI) for Selected Spot in the Study Area

Sampling Sites	Location	HSI* (2014-15)	HSI (2015-16)	HSI (2016-17)	HSI (2017-18)	HSI (2018-19)
A	Akram Point	0.33	0.56	0.45	0.4	0.35
B	Haldikhali	0.41	0.54	0.51	0.45	0.22
C	Charaputia	-	-	-	0.25	0.31
D	Bhodra	-	-	-	-	-
E	Harbaria	0.23	0.64	0.85	0.6	0.46
F	Chandpai	0.52	0.72	0.81	0.85	0.87
G	Jongra	-	-	-	-	0.18
H	Mongla Point	0.32	0.43	0.45	0.55	0.53
I	Maidara	0.22	0.25	0.35	0.6	0.68
J	Chalna Point	0.22	0.32	0.33	0.42	0.64

**HSI value is calculated on the basis of life requirement and length-age structured population dynamics model*

Note: The HSI will be calculated on the basis of one-year monitoring data

Fish Diversity

<u>*Shannon-Weiner Index*</u>

In this monitoring year of 2020-21, species evenness also varies among the sampling sites. Highest Shannon-Weiner index was found at Mongla Point (0.55) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at the Maidara River (0.45) (shown in the **Table 3.4 and 3.5**). 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. The different fish species caught in different catches are shown in **Figure 3.4**.

Fish Species Richness (FSR)

Fish species richness was identified through Simpson's Index[1]. Considerable difference is noticed in the fish species richness (FSR) in different habitat classes (**Table 3.6 and 3.7** and **Figure-3.5**).

In this monitoring phase, species richness varies with the sampling sites. Maximum FSR was obtained at Chalna Point (n=15), while very low FSR was recorded at Maidara site (n=6). Different scenarios of richness were found in this quarter in comparison to the previous monitoring years. Among habitats in upstream portions of the Passur River, Chalna Point was home to rich assemblage of Chewa and Chamni Chingri, Maidara River was of Chewa and Harina Chingri. In midstream portion, Mongla was rich in Tapse, Bhola and Amadi.

[1]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 3.4: Site Wise Species Diversity using Shannon–Weiner Index (1st to 13th QM)

Site	Species No													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 3.5: Site Wise Species Diversity using Shannon–Weiner Index (14th to 23rd 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	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM
A	0	0	3	0	8	0	2	0	0	0	0	0	0	0.92	0	0.16	0	0.65	0	0	0	0
B	0	0	0	0	2	0	-	0	0	0	0	0	0	0	0	0.92	0	-	0	0	0	0
C	0	0	12	0	0	24	11	0	0	10	0	0	0	0.69	0	0	1.69	0.86	0	0	0.78	0
D	0	0	0	0	0	0	-	0	0	1	0	0	0	0	0	0	0	-	0	0	0	0
E	0	0	0	17	12	0	2	0	0	2	0	0	0	0	0.31	0.73	0	0.99	0	0	0.72	0
F	6	17	0	0	0	13	22	19	11	11	0	0.85	0.81	0	0	0	1.44	0.74	0.5	0.81	0.56	0
G	81	29	21	16	19	0	26	0	0	0	0	0.62	0.74	0.78	0.85	0.34	0	0.58	0	0	0	0
H	112	13	3	18	2	13	-	5	11	10	11	0.54	0.21	0.55	0.49	0	1.44	-	0.14	0.76	0.40	0.55
I	3	13	12	10	17	11	8	9	11	12	6	0.88	0.33	0.21	0.65	0.85	1.46	0.14	0.52	0.80	0.54	0.45
J	4	5	10	14	11	21	12	14	9	8	15	0.78	0.32	0.54	0.52	0.52	0.98	0.50	0.71	0.50	0.64	0.46

**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 3.6: 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 3.7: Site wise Rich Species Number (13th to 25th QM)

Site	Location	No. of Rich Species											
		2017-18			2018-19				2019-20				2020-21
		13th	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	25th
A	Akram Point	2	0	0	4	0	1	0	2	0	0	0	0
B	Haldikhali	1	0	0	0	0	3	0	-	0	0	0	0
C	Charaputia	0	0	0	4	0	0	4	7	0	0	5	0
D	Bhodra	0	0	0	0	0	0	0	-	0	0	1	0
E	Harbaria	7	6	6	0	2	4	0	2	0	0	2	0
F	Chandpai	6	5	7	11	9	2	3	7	4	6	2	0
G	Jongra	0	0	0	0	0	0	0	3	0	0	0	0
H	Mongla Point	2	2	1	2	3	0	3	-	1	5	2	3
I	Maidara	1	3	2	1	3	9	3	1	1	6	3	2
J	Chalna Point	4	2	1	2	3	2	2	2	3	2	3	2

Source: CEGIS Field Survey, April 2014-July 2020

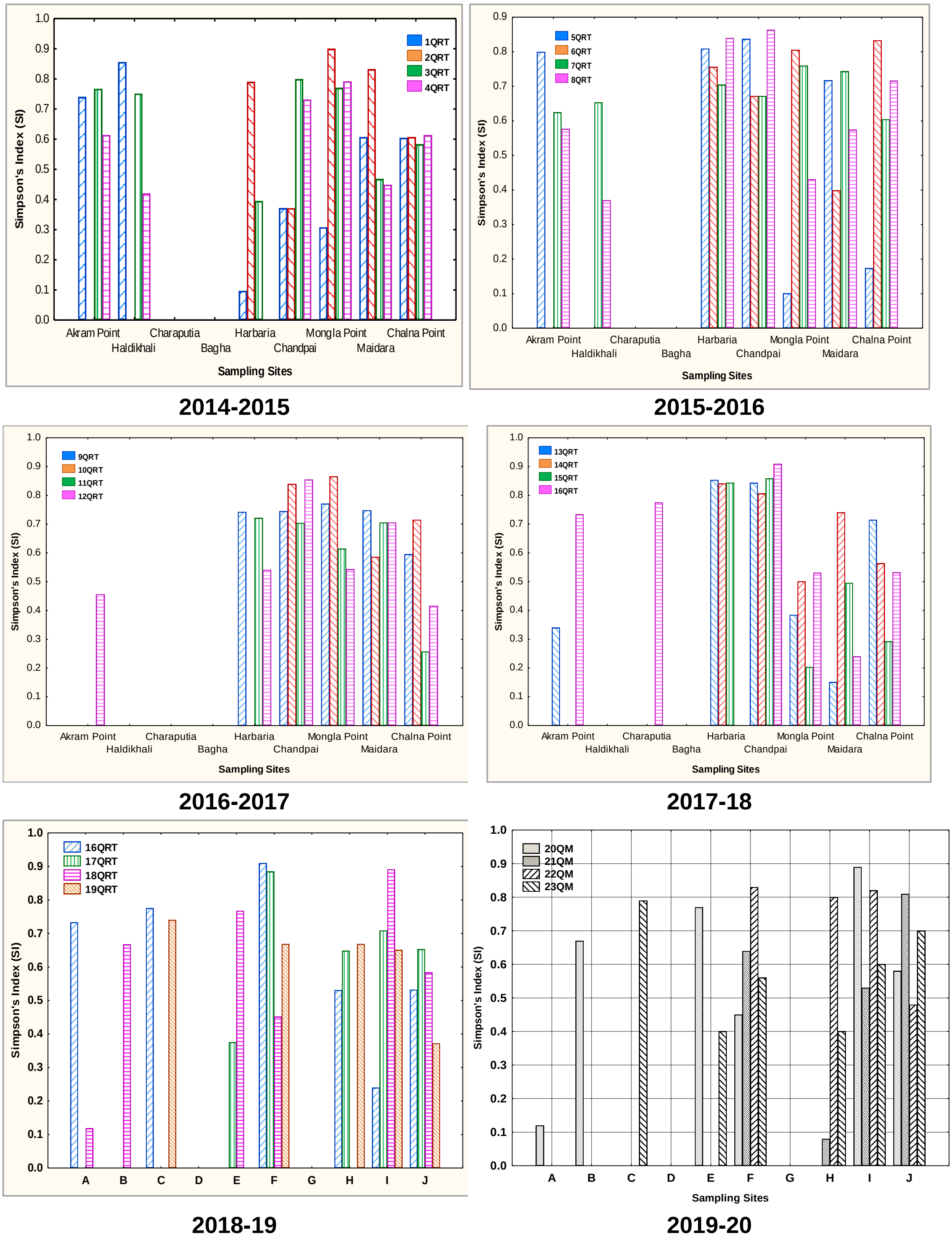
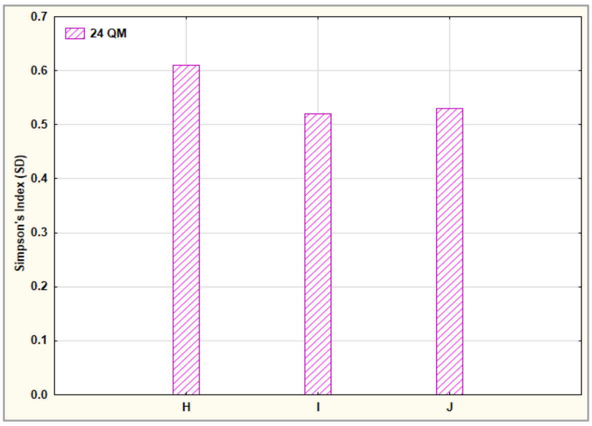


Figure 3.4: Available Fish Species Observed in Different Quarters Monitoring



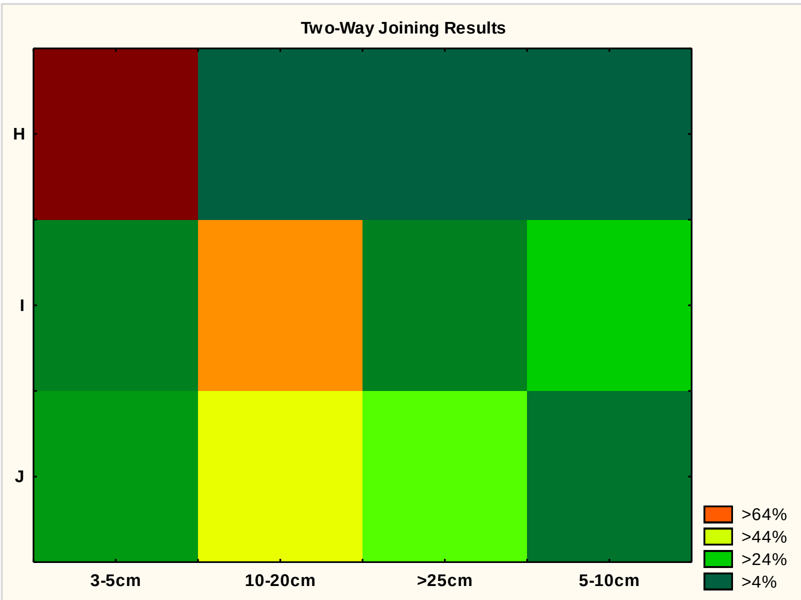
2020-21

(FSR is identified though Simpson's Index)

Figure 3.5: Site-wise Fish Species Richness (FSR) in the Passur River System

Fish Community Structure

Fish community structure was analyzed through counting the length-wise fish individuals (**Figure 3.6**). Table **D.4** of **Appendix IV** and **Figure 3.6** for 25th quarter of monitoring year of 2020-21 shows that fries were dominant at three sampling sites i.e. Mongla, Maidara and Chalna Point but juvenile to adult age group were dominant at Maidhara and Chalna Point. The catch revealed that among the fishes Tapse, Poma, Amadi and Chewa were dominant in the three sampling sites.



25th Monitoring, July, 2020

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

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

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 *Tapse* attain the maximum abundance among the migratory fish species observed in the 25th quarter of monitoring year, 2020-21. The relative abundance of the migratory species is given below in the **Figure 3.7**.

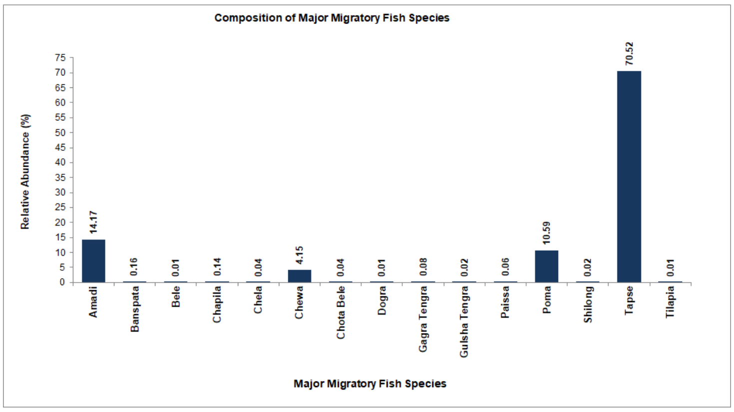


Figure 3.7: Relative Abundance of Major Migratory Fish Species in Sampling Sites

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, Poma, Paissa, Chewa and Banspata were observed to migrate long distance (**Figure 3.8 and Table D.7 of Appendix IV**).

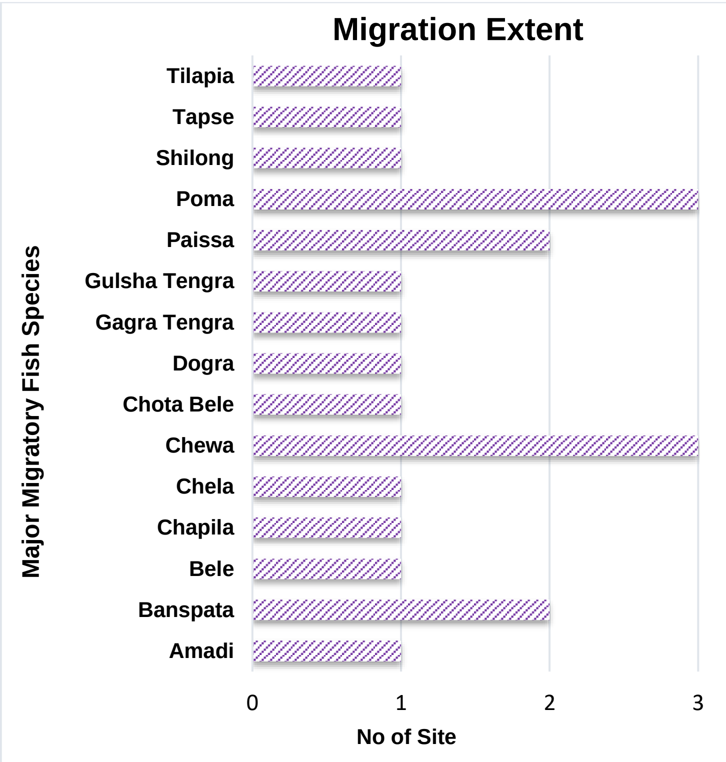


Figure 3.8: Migration Eextent of Major Migratory Fish Species in Sampling Sites

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 fish stocking was started during this monitoring period. The availability of wild seed (Post Larvae) was found to be increased during this monitoring. For this reason, most of the farmers collected wild seeds for their farms.

In this monitoring year, the highest stocking rate in respect of Bagda was observed in case of gher in Rajnagar followed by Kapashdanga and that of Chunkuri-2. On the other hand, stocking density in respect of Paissa was highest at Chunkuri-2 followed by Rajnagar (**Table 3.8**).

Table 3.8: Stocking Pattern of Fish/Shrimp Farm

Location	Fish Species	Stocking Density (No/ha)	Stocking Date
Rajnagar *(42.09 ha)*	Bagda	9,266	March, 2020
	Paissa	4,277	
	Rui	288	
	Tilapia	161	
Kapashdanga-Muralia *(115.7ha)*	Bagda	8,429	March, 2020
	Patari	316	
Chunkuri-2 *(6.07ha)*	Paissa	26,359	March, 2020
	Golda	160	
	Kharulla	2,471	
	Bagda	3,295	

Shrimp/Fish Growth Rate and Mortality

During the 25th quarter of monitoring, the highest growth rate has been observed in the Kapasdanga Gher. (**Table 3.9** and **Table 3.10)**.

Table 3.9: 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	
	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
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
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

Table 3.10: Growth Rate and Mortality of Fish/Shrimp (14th to 25rd QM)

Gher No.	14th QM		15th QM		16th QM		17th QM		18th QM		19th QM		20th QM		21st QM		22nd QM		23rd QM		25th 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 (%)
1	0.03	50	-	-	0.28	0.28	0.38	80	-	-	-	-	0.35	50	0.38	-	0.35		-	-	0.38	-
2	0.38	35	-	-	0.42	0.42	0.30	70	0.30	80	-	-	0.45	80	0.44	-	0.45		-	-	0.48	-
3	0.02	25	-	-	0.4	0.4	0.20	50	-	-	-	-	0.34	40	0.36	-	0.37		-	-	0.32	-

Source: CEGIS Field Survey, 2014, 2015, 2016, 2017, 2018, 2019 & 2020

Fish Production

Capture Fish Production

The present study revealed that the highest catch susceptibility was also found in case of Bepdi Jal (10.5kg/haul) shown in **Table 3.11**. In 25th quarter monitoring, the highest productivity was found at Mongla Point followed by Chalna Point and Maidara) (**Table 3.12 and 3.13**).

Table 3.11: Total Catch in Different Gears in the Sampling Sites

Site	Habitat	Gear Name/Type	Haul Duration (hr)	No of Haul	kg/haul
A	Confluence at Akram Point	Not Found	-	-	-
B	Haldikhali Khal	Not Found	-	-	-
C	Charaputia Khal	Not Found	-	-	-
D	Bhodra Confluence	Not Found	-	-	-
E	Harbaria Khal	Not Found	-		-
F	Passur River	Not Found	-	-	-
G	Passur-Jongra Confluence	Not Found	-	-	-
H	Passur-Mongla Confluence	Bepdi jal	3.0	1	10.5
I	Passur-Maidara Confluence	Bepdi Jal	3.0	2	1.5
		Thela Jal	0.07	10	0.02
J	Passur River, Chalna Point	Khepla Jal	0.08	8	0.03
		Bepdi Jal	3.0	3	1.7

Source: Catch assessment survey, CEGIS, July, 2020

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

Table 3.12: Total Catch in the Sampling Sites (From 1st to 13th QM)

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

Table 3.13: Total Catch in the Sampling Sites (From 14th to 25rd QM)

Sampling Site	Total Catch (kg)											
	13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM
A	2	0	0	17	0	16	0	0.40	0	0	0	0
B	0.25	0	0	0	0	1	0	0.00	0	0	0	0
C	0	0	0	1.50	0	0	93	17.50	0	0	4.6	0
D	0	0	0	0	0	0	0	0.00	0	0	1.35	0
E	8.13	1.5	2.56	0	0.1	2	0	0.50	0	0	1.17	0
F	0	0	0	0	0	0	0	0.00	0	0	0	0
G	77.5	10.5	37.67	3	4	27	0	0.00	0	0	0	0

Sampling Site	Total Catch (kg)											
	13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM
H	0	0	0	0.33	22	0	5	0.00	11.5	0.2	20	10.5
I	0.3	0.4	0.67	0.13	3	5	1.2	0.00	0.5	1.7	0.4	3.0
J	0.12	0.3	0	1	0.25	1.2	0.6	0.17	1.6	0.8	0	6.3

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

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

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

The present study on shrimp/fish farm in the 25th quarter monitoring phase showed that the highest production was observed in the Gher of Kapashdanga **(Table D-8, Annex-IV)**.

3.2 Monitoring of Ecosystem and Bio-diversity

3.2.1 Indicators Selection

Indicators for terrestrial and aquatic ecosystems were 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. Which is furtherly triggered by 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, birds are very sensitive to their habitat conditions. Changes of environmental parameters, land use and vegetation composition directly affect bird’s habitat of a locality. Broadly, two types of birds are found in an area; local and migratory. To observe local bird habitat’s suitability, number of bird nest and nesting bird species may be considered as good indicators. Numbers of wetlands where migratory birds come in each migration season have also been considered to observe migratory bird habitat suitability of that area.

In respects of aquatic ecosystems, dolphin availability is an ecological indicator which indicates good water quality as well as suitable aquatic habitat. This aquatic mammal is present in all the river systems of the study area. However, 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

Four (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 area. All the selected locations for terrestrial ecosystem monitoring are at the northern sites and hence the Besides t, nearest tip of Sundarban Reserve Forest is located at a sum of 14 km south from the project area. Various other ecological indicators of different locations of this forest were also observed for forest health monitoring too.

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 the selected homestead's 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 the 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,grasses and herbs are hardly found. Likewise, the selected homestead at Kalekarber village is comparatively flood free. This is located at about 1.8 km. east from the project site. On the other hand, Chalkghona village is located about 0.5 km south from the project site. The selected homestead 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. In addition, Borni village is located at about 3.0 km north from the project site. Sampled homestead at Borni is situated at the middle part of the village. This homestead is 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

Homestead at Rajnagar

This homestead is dominated by Gewa *(Excoecaria agallocha)*. Among all the trees this species holds the highest population which get favor from soil's salinity for luxurious succession. Besides, Safeda *(Manilkara zapota)* and Boroi *(Zizyphus sp)* are the two species of fruit yielding trees. Monocots fruits including Narikel *(Cocos nucifera)* and Khejur *(Phoenix sylvestris)* occupied the top canopy of the vegetation. In addition, a number of Bola *(Hibiscus tiliaceus),* Kewra *(Sonneratia apetala)* and one Sundari (*Heritiera fomes)* were found to exist in this homestead.

Homestead at Kalekarber Dighi

Two species like Narikel *(Cocos nucifera)* and Khejur *(Phoenix sylvestris)* occupies the top canopy in this homestead. The homestead occupies many Mahagoni (*Swietenia mahagoni*) saplings. Jaam (Sygizium cumini), Tetul (Tamarindus indica), Aam *(Mangifera indica)*, Safeda *(Manilkara zapota)*, Peyara *(Psidium guajava)* and Boroi (Zizyphus sp) got the common height which was found not more than 7 m. Mahagoni *(Swietenia mahagoni),* Rendi Koroi *(Albizia saman)* and Raj Koroi *(A. richardiana)* were observed as timber producing trees which occupied top canopy height (more than 10m). Beside this, Neem *(Azadirachta indica),* Bakul (*Mimusops elengii)* and few numbers of Kola (Musa sp.) were found in these homesteads.

Homestead at Chalkghona

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

Homestead at Barni

Rendi Koroi *(Albizia saman)*, Mahagoni *(Swietenia mahagoni*), Taal *(Borassus flabellifer)*, Narikel *(Cocos nucifera) and* Khejur *(Phoenix sylvestris)* can be referable for this homestead. The home owner planted many fruit yielding trees which is now in sapling form. Among those, Kotbel *(Limonia acidissima)*, Aam *(Mangifera indica)* and Safeda *(Manilkara zapota)* are common. Once Gewa *(Excoecaria agallocha)* was found as dominated at the western part of this homestead but during the recent visit it became less populated as the house owner cut off most of the species. Tiger Fern *(Acrostichum aureum),* a mangrove herb which was also found to bed exist in this homestead.

Random quadrate vegetation survey was conducted at the selected homesteads during the recent monitoring tier. A total number of 45 plant species (excluding under growths) were recorded from 16 number of surveyed sampling quadrates. Details of the survey result is presented in **Table 3.14** below.

Table 3.14: Plant species composition of the sampled homesteads

Species Name	**Local Name**	**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**		
Acacia moniliformes	Akashmoni						1											1	
Accia arabica	Babla															2		2	**3.98**
Acrostichum aureum	Tiger Fern						4	1	2				8			5	10	30	
Albizia richardiana	Chambol						1							1				2	
Albizia saman	Rain Tree					2		2	1	5				1	3			14	
Arica catechu	Sundari						1	14	3	1								19	
Azadirachta indica	Neem		2				8	2										12	
Azadirachta indica	Neem		1							3								4	
Borassus flabeliffer	Taal					2			1				3					6	
Carica papaya	Pepey			20														20	
Cocos nucifera	Narikel	4	1	2	4	2	4	2	2	3	4	6	5	3	1	4		47	
Colocasia sp	Bokul							20						20				40	
Cordia dichotoma	Bohal/Gum Tree														3			3	
Delonix regia	Krishnochura								1									1	
Diospyrus blancoi	Bilati Gab									2								2	
Diospyrus pregrina	Gab													2	2			4	
Erythrina ovalifolia	Mandar													1				1	
Euphorbia Tirucallii	Pencil Cactus						3											3	
Excoecaria agallocha	Gewa	5		3	25		2	2	6							15	15	73	
Ficus hispida	Dumur								1				5					6	
Ficus religiosa	Aswath							1					2					3	
Heritiera fomes	Sundari	2																2	
Hibiscus tiliaceus	Bola					5	2	1					5					13	
Ipomoea fistulosa	Dhol Kolmi					50			1									51	
Lawsonia inermis	Mehedi		1						1									2	
Lepisanthes rubiginosa	Amjum/ Baraharina		2															2	
Limonia acidissima	Kotbel			7		1												8	
Mangifera indica	Aam										1			4				5	
Mimusops elengi	Bokul										1							1	
Moringa oleifera	Sazna						1						1	1				3	
Musa sp	Kola			1			8			28	3			2				42	
Pandanus sp	Keya Kanta				1													1	

Species Name	**Local Name**	**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**		
Phoenix sylvestris	Khejur		3	3	5		1	1					5	3				21	
Phyllanthus emblica	Amloki								1						2			3	
Pongamia pinnata	Koroach														3			3	
Psidium guajava	Peyara								1	3				1				5	
Punica granatum	Bedana													1	2			3	
Sonneratia caseolaris	Ora																1	1	
Spondias mombin	Amra						1											1	
Swietenia mahagoni	Mahagoni					4		2		25	22	5	5	3	3			69	
Tamarindus indica	Tentul				1				2					1				4	
Terminali arjuna	Arjun						1							1				2	
Terminalia catapa	Kathbadam						1							20				21	
Zizyphus sp	Kul boroi						1							2				3	
	Jigar						20		2					20	2			44	

Note: Q-Quadrate

Plant health

Structure of vegetation community of this area is tree dominant. Random shrimp farming with saline water may be considered as a big threat to plant health of this area as the Plant health of this area was not found satisfactory. Expansion of shrimp farming in this area has triggered incretion of salinity of soils. For this reason, overall plant succession, growth and productivity is being changed day by day.

Plant Diseases and symptoms in homestead vegetation

Plant diseases observation of an area is necessary to evaluate plant health and productivity. During initial field survey, some of the tree species were selected for regular observation for monitoring plant disease. In this regard, a number of common tree species were observed in each homestead.

Leaf spot, lethal yellowing, leaf blast, nut fall, Mite damage on nut fruit are common diseases of the plants in the study area. A brief discussion was also held with home owners about diseases of selected economic plants. Although, all plant symptoms and diseases are not visible in a same time of the year hence some of those were 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 at 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 status were found to be improved slightly comparing to previous monitoring period at all the locations. Coconut (*Cocos nucifera)* and Date Palm (*Phoenix sylvestris)* are the main affected species at all sites and most of them are signed with lethal bole rot, narrowing upper trunk and radish brown leaves. Except the disease-affected monocots, other plants were found healthy. However, comparing to the July, 2019 monitoring period, the plant health were found deteriorating due to the devastating Cyclone Amphan. Following table represents the proportion of healthy and unhealthy plants in studied homesteads. (**Table 3.15**).

Table 3.15: No. of 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 2019	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020
Rajnagar	Cocos nucifera	**17***	NS	10	5	5	15	4	5	NS	3	4	6	6	9	4	4	3	2	3	10	3
	Phoenix sylvestris	**25**	NS	15	4	4	22	9	13	NS	10	2	5	4	7	6	8	9	5	3	4	4
	Manilkara zapota	**1**	NS	-	-	-	-	-	-	NS	-	-	-	-	-		-	-	-	-	-	-
	Albizia saman	**2**	NS	-	-	-	-	-	-	NS	-	-	-	-	-		-	-	-	-	-	-
	Excoecaria agallocha	**55***	NS	-	1	1	-	-	-	NS	-	-	-	-	-		-	-	-	-	-	-
	Mangifera indica	**3**	NS	1	-	-	2	-	-	NS	-	-	1	-	-	1	-	-	-	-	-	-
	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	-
	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	-	-	-	-	-		-	-		-	-	-
	Excoecaria agallocha	**18**	-	-	-	-	-	-	-	NS	-	-	-	-	-		1	-		-	-	-
	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
	Phoenix sylvestris	**10**	-	3	-	-	1	-	1	NS	3	-	3	-	-		-	-			-	3
	Mangifera indica	**5**	1	1	-	-	-	-	-	NS	-	-	-	-	-		-	-			-	-
	Manilkara zapota	**2**	-	-	-	-	1	-	-	NS	-	-	-	-	-		-	-			-	-
	Borassus flabellifer	**8**	-	-	-	-	-	-	-	NS	-	-	-	-	-		-	-			-	-
	Zizyphus sp	**1**	-	-	-	-	-	-	-	NS	-	-	-	-	-		-	-			-	-
	Psidium guajava	**8**	-	-	-	-	-	-	-	NS	-	-	1	-	-		-	-			-	-

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 2019	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020
	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
	Albizia saman	**3**	-	-	-	-	1	-	-	NS	-	-	-	-	-		1	-			-	-
	Excoecaria agallocha	**36**	-	-	1	1	-	-	-	NS	-	-	-	-	2		-	-			-	-
	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	-	-	-	-	-		-	-			-	-

Source: CEGIS field survey

Vegetation canopy status

Species representation in different canopy layers of homestead vegetation

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

Estimated Canopy cover in homestead vegetation of sampling sites

the canopy cover reduced at all the studied homesteads due to hit by cyclone Amphan in May, 2020. In addition, at least 25 Gewa trees and 10 Date palms were cut down by the homeowner at Rajnagar site for land developing within the settlement platform. Canopy coverage of the studied homesteads is represented in following T**able 3.16**

Table 3.16: 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	Nov, 2018	Feb, 2019	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020
Rajnagar	NS	19	19	17	20	20	20	20	21	23	19	15	18	14	11	22	19	18	16	14	11
Borni	NS	26	18	18	12	14	20	20	25	25	23	21	21	23	20	21	21	20	18	20	17
Kalekarber	NS	20	24	25	23	24	24	22	24	26	25	23	24	24	25	24	25	25	24	24	22
Chalkghona	NS	13	24	22	17	21	21	20	21	27	26	25	16	18	21	22	22	22	20	23	17

Note: NS = Not Surveyed

Bird Habitat

Local birds and their nesting behaviour

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

3.2.4 Aquatic Ecosystem Monitoring

Rivers, canals, ponds and shrimp farms are main wetland forms in the study area. Of which, river bear the flowing/ lotic and ponds bear the stagnant/lentic water systems. Canals of this area are merged with the shrimp farms which extend the proportion of total watershed of the study area. Therefore, canals are not an actual flowing or stagnant water system in this area.

Monitoring Locations

Passur is the only 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. aquatic mammals (Dolphin) were also monitored as along with the River Passur, both of the river systems (Sailtakhali and Ichamoti) favors River Dolphin throughout the year.

Dolphin Occurrences

Dolphin migration route in the study area

Two types of dolphin species (Ganges River Dolphin and Irrawaddi Dolphin) usually travel throughout the Passur River for whole of the year. The Ganges river dolphin usually migrates from estuary regions to upstream through the 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 the upstream of Passur river. Ganges Dolphins also roam through Maidara River mainly during high tide. Siltation and narrowing of upstream branches is limiting the length of migration area day by day.

Dolphin occurrence in Passur and Maidara River

Dolphins occurrences were monitored for about 10 km length of Passur and 1 km length of Maidara river (From Digraz Kheya Ghat to Chalna Bazar including Maidara River) through boat transact during high tide. A total of 5 no. of dolphin occurrences were recorded during the survey. Of which three dolphins were observed at Passur River and two at Maidara river. This survey transect was carried out for about 17 km which took two hours. The analzed encounter rate was 0.15 individuals/km/hour (**Figure 3.9**).

Dolphin occurrence in Dhangmari Khal and Shella Gang

Dolphin occurrences were also observed at the Dhangmari Khal, Chandpai Shella Gang Wildlife Sanctuary and Bhadra Khal. In case of Dhangmari Khal, the total transect length was 13.6 km during full Tide, medium wave and drippling rain from Dhangmari-Passur confluence to Gagramari Forest Patrol Post up and down. A total of 11 nos. of dolphins were recorded in Dhangmari Khal for 1 hours and 39 min of transact time. The encounter rate was 0.60 individuals/km/hour (**Figure 3.10**).

In case of Chandpai Shella Gang, the survey transact was bounded up from Passur River near Jongra Forest Patrol Post Bazar to Shela Gang near Joymoni and it eas conducted during mid spring tide. The transect length was about 10 km (**Figure 3.11**). A total of 5 dolphin individuals were sighted during 48 minutes survey. The encounter rate was 0.31 individuals/km/hour.

Another survey was conducted at Bhadra Khal inside Sundarbans Reserve Forest during mid-tide. During this monitoring, a total of 4 dolphins were recorded within the 3.2 km reach of Bhadra Khal from Bhadra Patrol Post to Bhadra- Passur confluence.

The distribution of dolphin occurrence at Bhadra Khal is presented in **Figure 3.12**. However, the survey result is included in **Table: 3.17**

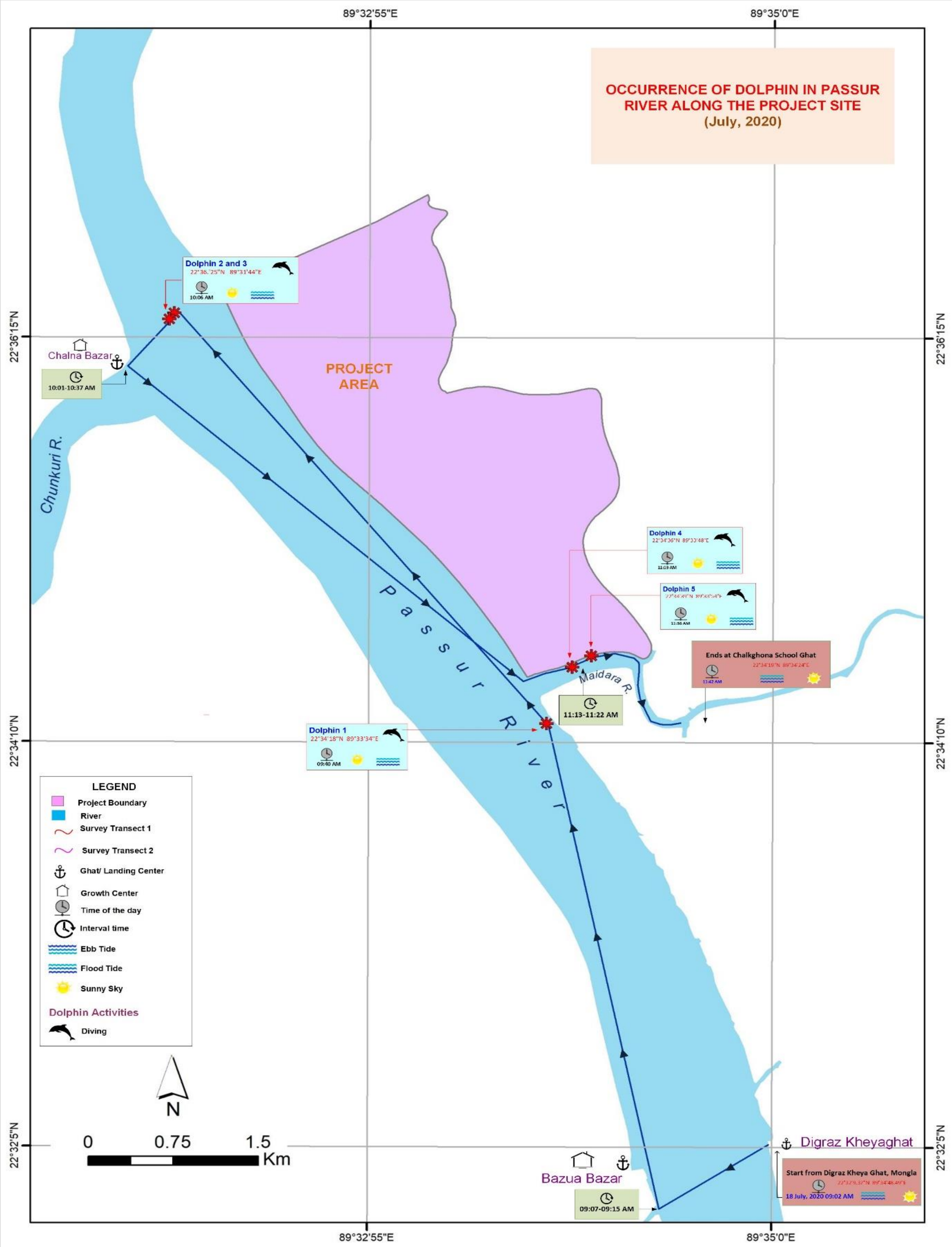


Figure 3.9: Occurrence of dolphin at Passur and Maidara River along the project site

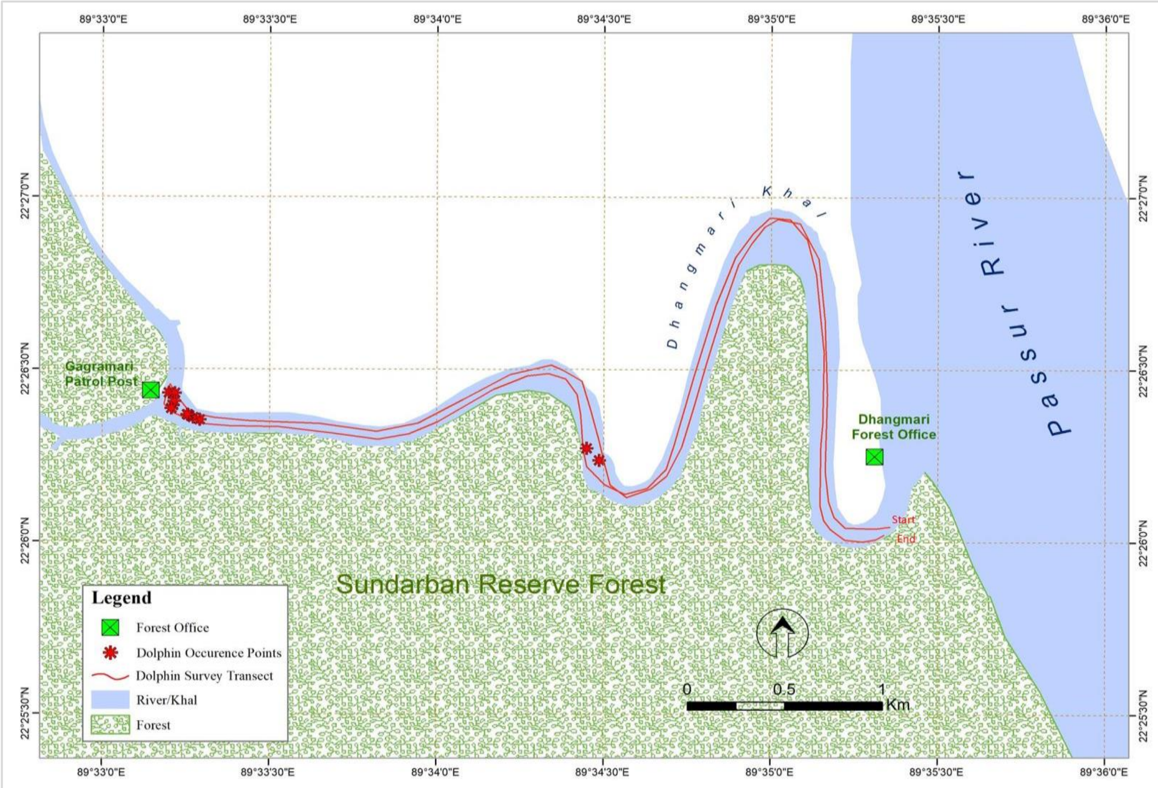


Figure 3.10: Location of dolphin Occurrence at Dhangmari Khal

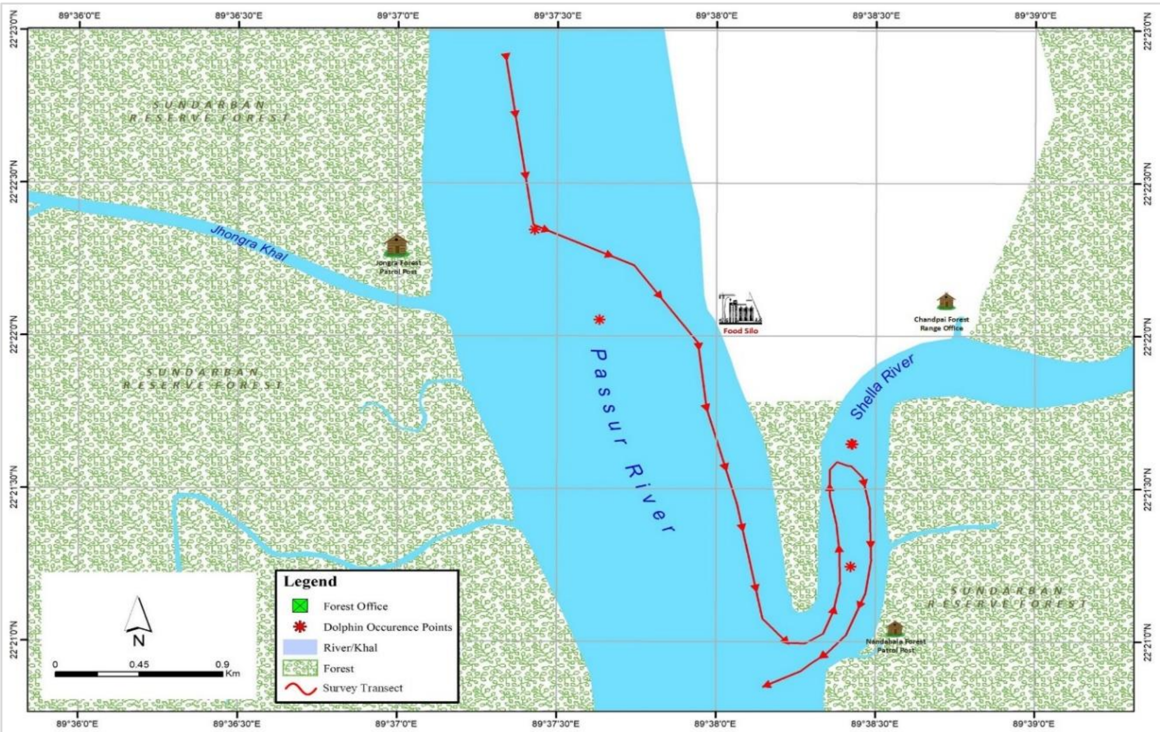


Figure 3.11: Location of dolphin Occurrence at Chandpai (Shella River to Jongra Khal)

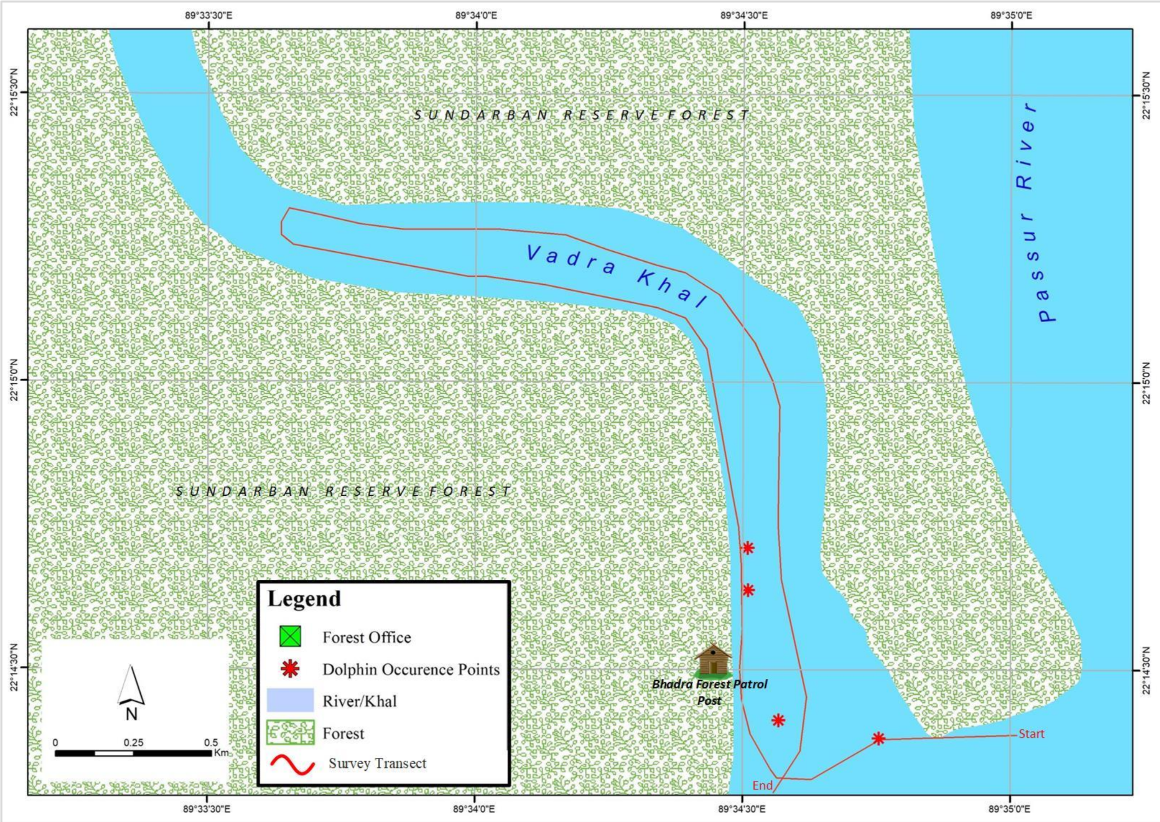


Figure 3.12: Location of Dolphin Occurrence at Bhadra Khal

Table 3.17: Dolphin Observation Datasheet

Location of River systems	Occurrence Status																																							
	Apr 2014		Jun 2014		Oct 2014		Jan 2015		Apr 2015		Aug 2015		Oct 2015		Oct 2015		Jul 2016		Oct 2016		Jan 2017		Jan 2018		Jun 2018		Nov 2018		Feb 2019		Apr 2019		Jul 2019		Nov, 2019		Feb, 2020		Jul, 2020	
	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT	FT	NT
Project Site	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NS	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	NS	Y	NS	Y	NS	N	Y	Y	NS	Y	Y	Y	Y	Ns
Karamjal	NS	NS	NS	N	NS	Y	Y	Y	N	N	NS	Y	NS	Y	Y	N	Y	NS	Y	Y	Y	Y	NS	Y	N	NS	N	N	Y	N	Y	N	Y	NS	Y	Y	Y	N	N	Y
Harbaria	NS	NS	NS	N	NS	Y	Y	N	N	N	N	N	Y	NS	Y	N	Y	Y	Y	NS	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	N	Y	N	Y	NS	N	N
Akram Point	NS	NS	NS	N	NS	N	NS	Y	Y	Y	NS	NS	N	Y	Y	NS	NS	NS	N	N	NS	NS	N	N	N	Y	N	N	N	Y	N	N	N	N	N	Y	Y	NS	N	N
Moidara River	Y	N	N	N	Y	Y	Y	N	Y	N	Y	N	NS	Y	N	Y	Y	NS	NS	Y	N	Y	NS	Y	Y	Y	NS	Y	NS	N	NS	N	Y	N	NS	Y	Y	Y	Y	NS
Shella River at Chandpai	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	N	Y	NS	NS	Y	Y	NS	NS	Y	Y	NS	Y	Y	Y	Y	Y	Y

Note: FT=Flood Tide, NT=Neap Tide, NS=Not Surveyed,

Occurrence Status: Y = Occurred, N = Not occurred

3.3 Findings

Vegetation composition, plant diversity, vegetation canopy status, plant health, bird habitat status, dolphin occurrence in river systems have been monitored for this monitoring season. A total of 45 tree species were recorded from all the monitoring sites with Shanon-Winner diversity index of 3.33. Canopy status of all studied homestead has been reduced due to affect of Cyclone Amphan. Status of plant health also have minor changed all the locations for the earlier mentioned cause. No bird nest observed at any site.

Dolphin occurrence was recorded at Passur and Maidara River and some connected tributaries of Passur River like Shella Gang, Dhangmari and Bhadra Khal. The occurrence followed high at Bhadra Khal and Dhangmari Khal. The highest encounter rate was recorded 0.68 Individual/km/hour at Bhadra Khal

3.4 Sundarbans Forest Health

The Forest Health Monitoring program depends on a number of variables such as ground plots (i.e. long-term monitoring plot) surveys, aerial surveys, and other biotic and abiotic data sources and develops analytical approaches to address forest health issues that affect the sustainability of forest ecosystems. One of the widely used forests healthy monitoring Bio-indicators is growth trend overtime and its relation with leaf are 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 considered to be another good indicator of forest health. Lichens often grow on trees and shrubs, absorbing nutrients from the atmosphere. as lichens are very sensitive to air pollution—particularly to sulfur dioxide, fluoride, and ammonia—their presence or absence is an indicator of forest health. The acidity of a tree’s bark can also affect lichen abundance (Smith et al. 2003). If air is very badly polluted with Sulphur dioxide there may be no lichens present, just green algae may be found. If the air is clean, shrubby, hairy and leafy lichens become abundant (Bates et al 1996). 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 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 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.

To discern the true scenario of power plant impact on forest health, it is mandatory to create a baseline condition. Taking this into consideration, CEGIS has been conducting forest health monitoring program at five locations namely Sutarkhali, Karamjal, Harbaria, Akram point and Hiron Point at Sundarbans Reserve Forest (SRF) along the Passur River. The parameters that included in this monitoring program were tree growth, regeneration capacity, lichen abundance, plant diversity, biomass and carbon stock.

3.5 Methodology

3.5.1 Permanent Sample Plot (PSP) Establishment and Layout

To set up permanent sample plots, five plots were established (**Figure 3.13**). Among those, five sites are along the Passur River at Karamjal, Harbaria, Akram point and in Hiron point respectively and the fifth plot is near Sutarkhali forest office (**Table 3.18**). The sites were selected considering the distance from the proposed project site, wind directions, coal transportation route, river systems and vegetation types.

3.5.2 Bio-Indicators for Forest Health Monitoring

There are many Bio-indicators for forest health monitoring. As the study forest is a mangrove forest, some of the mangrove traits were also selected as Bio-indicator. The Bio-indicators observed in this forest health monitoring program were seedling regeneration, pneumatophores, species diversity, crab hole density, canopy cover, leaf phenology, Leaf Area Index, Tree growth, phenological behavior, pest and disease.

3.5.3 Sampling Design of Permanent Sample Plots (PSPs)

In each site, a transect line was laid out perpendicular to river or canal bank. Along the transect line, three circular nested subplots of 12.62 m radius have been laid out at 100m intervals in order to capture the maximum tree species. Because of the variation in species composition in SRF, observation plots were laid out from the coast, river or canal side to upper slope zone where forest area is denser. The location of the first subplot was 40m away from ecotone zone in order to save the subplot from river bank erosion (**Figure 3.14**). Each subplot was again subdivided into four quadrates. The plot layout is shown in **Figure 3.15**.

Table 3.18: General Description of Permanent Sampling Plots (PSPs)

Transect	Plot	Range	Compartment No.	GPS ± (m)		Soil Description	Plot Location Notes
				Latitude (N)	Longitude (E)		
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	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

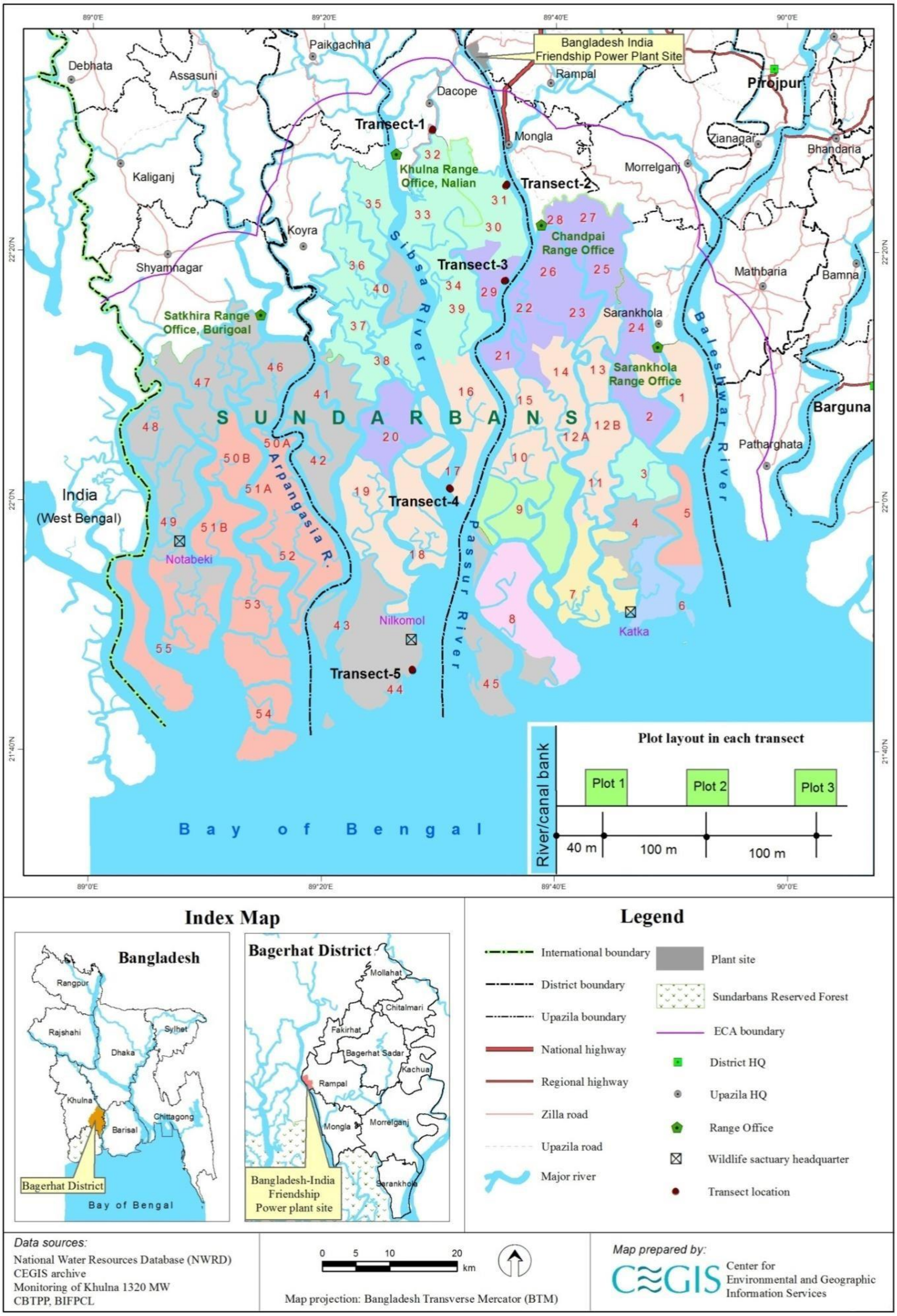


Figure 3.13: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)

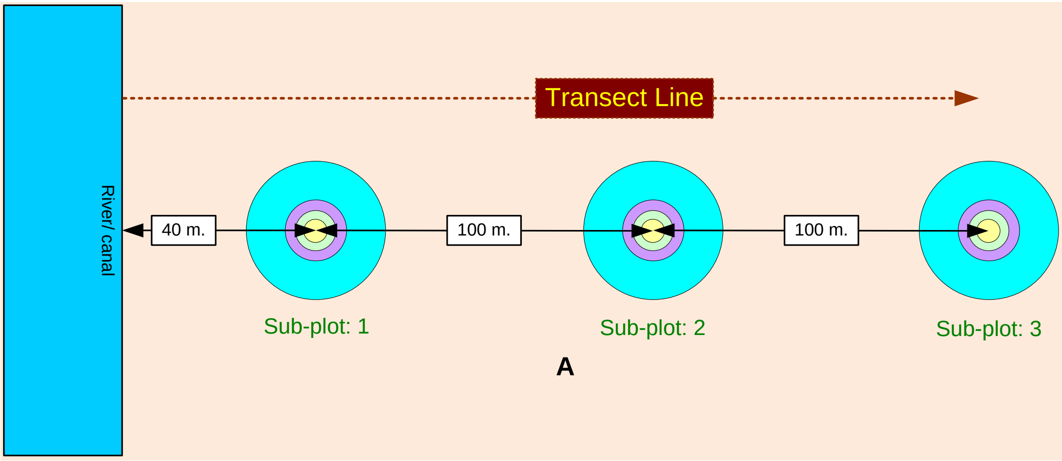


Figure 3.14: Layout of the Subplots and Transect Line Perpendicular from Ecotone (river or canal bank)

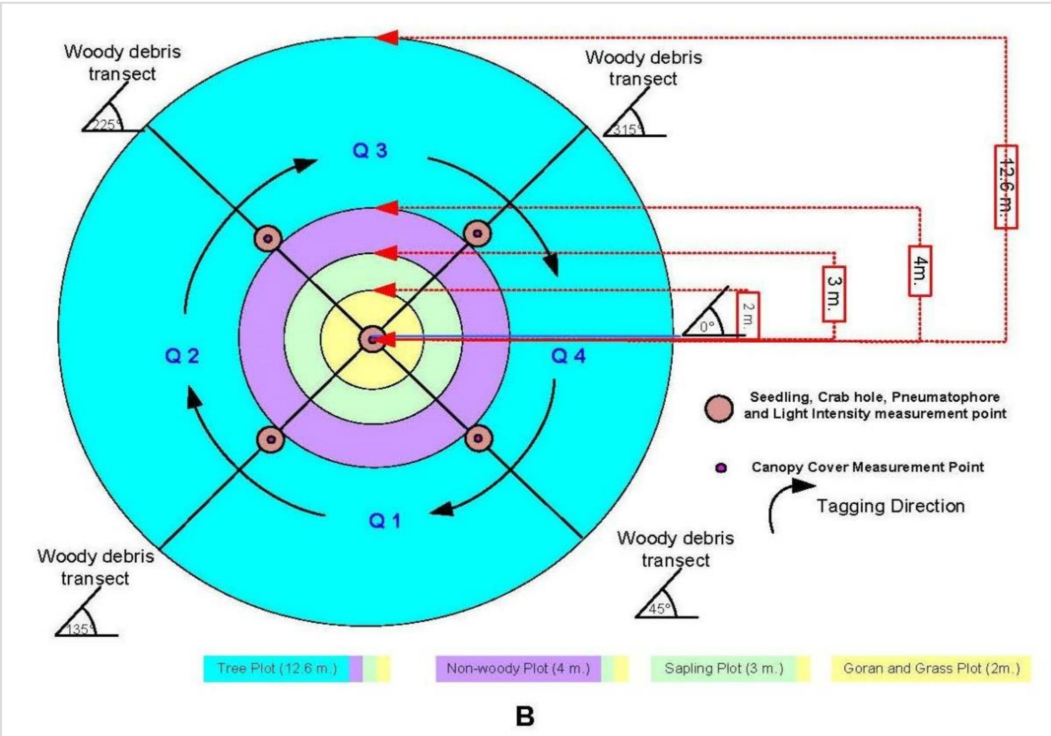


Figure 3.15: Layout of the Survey Activities in each Subplot

3.5.4 Methods

Tree growth

Tree species growth data were obtained from measured tree DBH. Individual tree DBH ≥5cm was considered for growth trend observation.

Vegetation Diversity

Tree species data were collected from the PSPs. Individual tree DBH ≥5cm was considered. Saplings (DBH<5cm and height 1.37m) and seedlings (height<1.37m) were assessed within 3m and 2m radius circle respectively in each PSP. Seedlings were counted species wise and their status of living was also recorded. For saplings, species name and DBH were recorded along with the living status.

Diversity analysis was calculated using the species richness, Shannon diversity (H′), and Simpson diversity (D′) and Evenness (E) indices (Magurran & Mcgill 2011). All the calculations were done using R package (Kindt & Coe 2005). Species accumulation curves (SAC; or species-richness curves, collector's curves, species effort curves) were used to estimate the number of vegetation species in the PSPs. Species accumulation curves shows the species richness for combinations of sites. Canonical Correspondence Analysis (CCA) was used to analyze the relationship between distribution of plants and environmental variables.

Pneumatophores

The total numbers of living pneumatophores were recorded within a circular area of 1m radius centering each of the four points of all the subplots.

Crab hole

Crab plays an important role in mangrove ecosystems such as decomposing litter fall which play an important role in increasing soil fertility. In order to record the crab density, crab hole abundance was monitored. For this purpose, the crab holes were counted within an area of 1m radius circle in each subplot's center and in the midpoint of four transect.

Canopy Cover

Canopy cover percentage was estimated by a spherical densitometer (i.e. Densitometers a gridded convex mirror that provides a simple and inexpensive approach of 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 not become visible in the mirror. After levelling the instrument using the level bubble, the dots which had not been occupied by canopy were systematically counted. In each subplot, the meter readings have been taken at four points facing north, south, east, and west direction including the center point of the subplot. The canopy cover was calculated by taking the average of these readings.

Leaf Area Index

Leaf Area Index (LAI) is a key structural characteristic of forest ecosystems because of the role of green leaves in controlling many biological and physical processes in plant canopies. LAI influences net canopy photosynthesis. Light absorption by the forest canopy can be used to estimate Leaf Area Index (LAI). In this monitoring report, LAI was calculated as follows:

Leaf Area Index (LAI) = loge (I/Io)/-K leaf area / area of ground (Where, I = Under Canopy Light Intensity, Io = Open Canopy Light Intensity and K is Canopy light extension coefficient i.e., 0.5)

Biomass and carbon stock estimation in trees

From each plot tree species were identified and each individual was recorded. Diameter at breast height (1.37m) and height was measured in the field. Total biomass of trees was estimated after adding above and below ground biomass. As the study was conducted in a reserved forest area, it was not possible to cut all the tress and brought them to laboratory for estimating biomass. After reviewing models developed by several authors from across the world (e.g., FAO 1997, Brown et al. 1989), the generic allometric model developed by Chave et al. (2014) was used for measuring biomass as this widely used for tropical region tree standing biomass. Below ground biomass was calculated considering 15% of above ground biomass (Mac-Dicken 1997). After calculating biomass, carbon content was calculated based on the assumption that carbon content is 50 percent of the dry woody biomass (Brown 1997). Aboveground biomass and carbon were calculated on a per-hectare (ha) basis. The model for above ground biomass estimation is as follows:

$$AGB=0.0673 \times (\rho D^2H)^{0.976}$$

Where, Y = above ground biomass in Kg; H = Height of the trees in meter; D = Diameter at breast height (1.3m) in cm; ρ = Wood density in units of g/cm^3.

Leaf Phenology

Leaf phenological trait of major mangrove species such as leaf emergence, leaf shedding, flowering and fruiting and fruit/ propagule dropping time was investigated through secondary information. Leaf phenology has been first introduced in this study for the first time. From next field inventory, leaf phenological behavioral change will be monitored.

Pest and Diseases

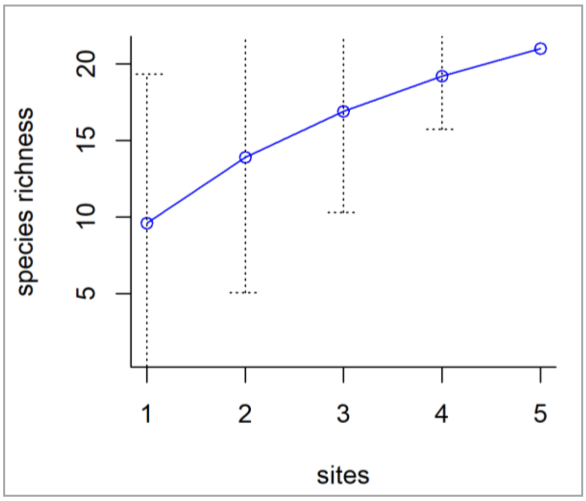
Pest and disease type of the Sundarbans mangrove forest was investigated through literature review, which was then verified in the field through visual observation.

3.6 Results and Discussion

3.6.1 Vegetation Diversity, Richness and Compositional Variation

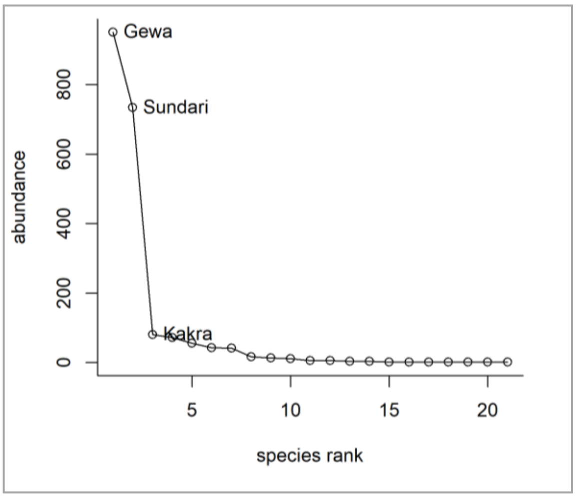
A species accumulation curve shows the species richness for combinations of sites. These curves portray the average pooled species richness when all sites are combined together. The output shows that the average richness for all possible combinations of 5 sites is 21 (Hiron Point data was obtained from last census) (**Figure. 3.16**). Gewa was the dominant species among all the PSPs which was confirmed by the Rank-abundance curves followed by Sundari and Kakra (**Figure 3.17**). Vegetation species richness has been identified through Shannon, Simpson and evenness Index (Table 3.19). Considerable difference was noticed in the species richness in five PSPs. All the three indices show that transect 2 (Karamjal) has more diversity compare to other PSPs).

Multidimensional scaling (MDS) is a popular approach for graphically representing relationships between objects (e.g. plots or samples) in multidimensional space. The samples are then usually represented graphically in two dimensions such that the distance between points on the plot approximates their multivariate dissimilarity as closely as possible. In the present study, Akram point (T4) and Hiron point (T5) were close to each other indicating similarity in species composition in these two PSPs. In contrast, T1 (Sutarkhali), T2 (Karamjal) and T3 (Harbaria) were far away from T4 and T5 indicating dissimilarity in species composition (**Figure 3.18**)



The bars indicate +2 and -2 standard Deviations (N.B. 1=Sutarkhali, 2=Karamjal, 3= Harbaria, 4=Akram Point, 5=Hiron Point. Hiron point plot data was taken from last survey)

Figure. 3.16: Species accumulation curve for the PSPs dataset



Hiron point plot data was taken from last survey.

Figure 3.17: Rank-abundance curve for the sampled PSPs

Multidimensional scaling (MDS) is a popular approach for graphically representing relationships between objects (e.g. plots or samples) in multidimensional space. The samples are then usually represented graphically in two dimensions such that the distance between points on the plot approximates their multivariate dissimilarity as closely as possible. In the present study, Akram point (T4) and Hiron point (T5) were close to each other indicating similarity in species composition in these two PSPs. In contrast, T1 (Sutarkhali), T2 (Karamjal) and T3 (Harbaria) were far away from T4 and T5 indicating dissimilarity in species composition.

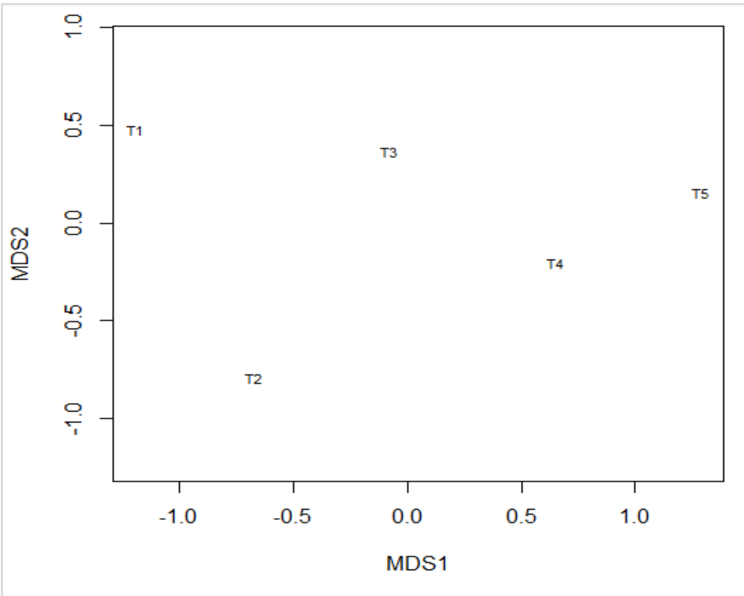


Figure 3.18: Ordination graph for a two-dimensional MDS based on the Bray-Curtis distance. The best configuration out of 500 is shown here.

Table 3.19: Different Diversity Indices for Vegetation in the Sampled PSPs

Site	Shannon Index	Simpson Index	Evenness Index
T1	1.06	0.46	0.26
T2	2.09	0.83	0.44
T3	1.31	0.64	0.25
T4	0.83	0.47	0.39

N.B. Hiron Point Plot data was not considered in diversity indices analysis.

3.6.2 Carbon Stock in Trees

Over the census period, there was no significant difference (P>0.05) in tree carbon stock for all the PSPs. However, an increasing trend in carbon stock was observed in all PSPs except harbaria. Sundari has the highest amount of carbon stock **(Table 3.20).**

Table 3.20: Species wise Total Biomass and Carbon Stock (t/ha)

Species	T.C. 18th Q.	T.C. 19th Q.	T.C. 20th Q.	T.C. 21st Q.	T.C. 22st Q.	T.C. 23st Q.	T.C. 25th Q
Amoor	1.37	1.28	1.65	1.69	1.54	1.42	1.33
Baen	71.46	64.59	66.51	67.42	65.11	64.09	61.92
Bhutbutta	0.14	0.18	0.25	0.25	0.25	0.25	0.25
Bola	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Gewa	125.00	121.15	124.69	126.15	125.01	126.62	101.69
Goran	0.66	0.69	0.77	0.78	0.75	0.68	0.62
Kakra	53.35	50.93	51.99	52.35	52.15	52.19	51.96
Lakur	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Passur	62.60	71.33	74.16	67.63	70.50	71.19	62.04
Sundori	446.01	450.82	475.60	465.01	468.22	466.09	460.59
Urmui	0.41	0.36	0.40	0.44	0.41	0.39	0.43
Vaila	0.80	0.83	0.74	0.74	0.74	0.74	0.81

N.B. TB-Total Biomass, TC-Total Carbon

3.6.3 Status of Forest Health Indicators

The tag number of trees (DBH ≥ 5cm and lean angle greater than 45º) was monitored and rewritten if any new tree was found within 12.62 m radius circle of the Permanent Sample Plot (PSP).There was no significant variation (p>0.05) in tree growth over the monitoring period for all the PSPs The Seedling density among the four PSP was not significantly different (P>0.05) except Hiron point. Hiron poin is subjected to sedimentation. An increasing trend of seedling survival was found in Sutarkhali. This is because of the time of seed germination and seedling survival in the observed PSPs.

recording data at Sutarkhali site

Measuring DBH at Karamjol site

Measuring Height at Harbaria

Measuring Canopy cover at Akram point

Figure 3.19: Recording the tatus of forest health indicators

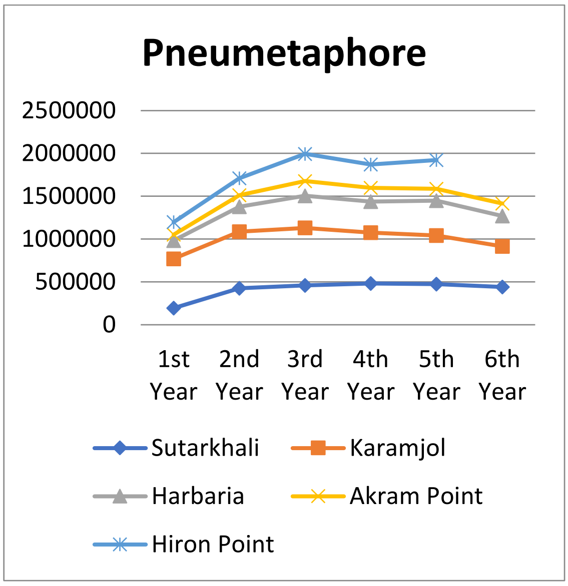
Average number of pneumatophores per hectare was comparatively very low in Akram point area whereas pneumatophores density was highest in Karamjol sample plots. There is no significant variation ($p>0.05$) in pneumatophores density over the monitoring period for each PSPs (**Figure 3.21**). This indicates that forest health condition is not deteriorating in terms of steady state condition of pneumatophores density over time.

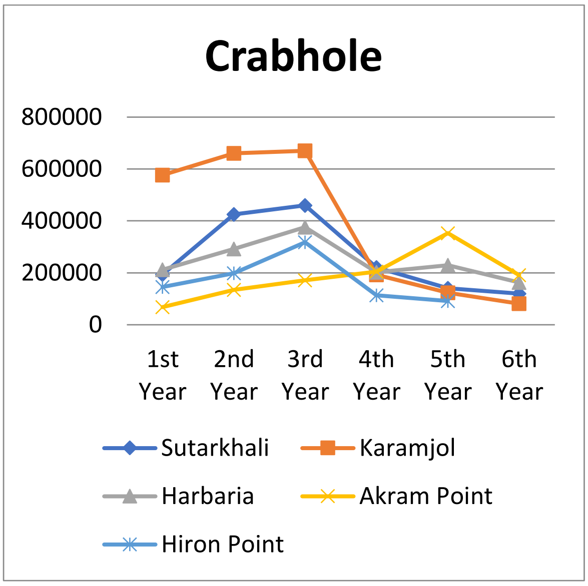
There is no significant variation ($p>0.05$) in crab density over the monitoring period for Harbaria, Sutarkhali PSPs (**Figure 3.20**). Karamjol plot shows increasing trend from the last tier. However, Akram point crab density was significantly different then the other sample plot ($p<0.05$). All the PSPs (Sutarkhali, karamjol, herbaria point) canopy cover doesn't vary significantly ($P>0.05$). Akram point PSP's permanent plot canopy cover was lower compare to the rest of PSPs canopy cover percentage (**Figure 3.20**).

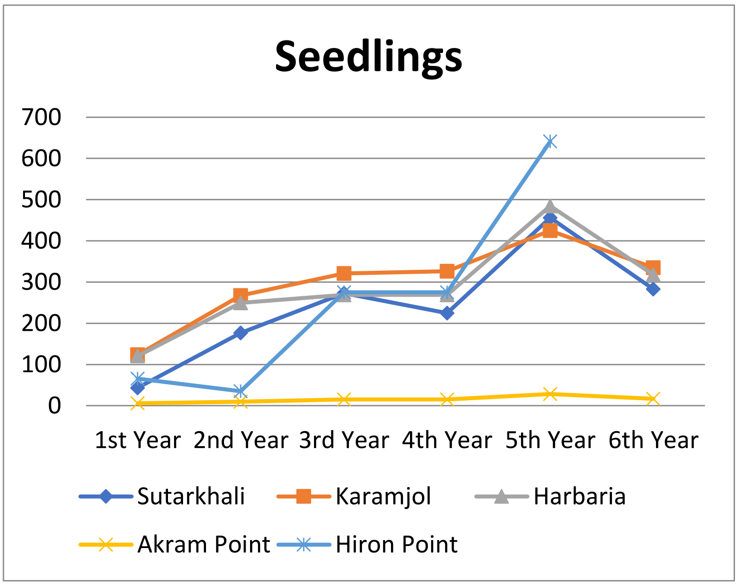
The LAI (Light Area Index) influences daily rate of net canopy photosynthesis which results in exchange of atmospheric CO_2. The minimum the ratio of under canopy to open canopy light intensity value indicates the maximum LAI. There was no significant prominent trend observed for all the PSP's (**Figure 3.20**).

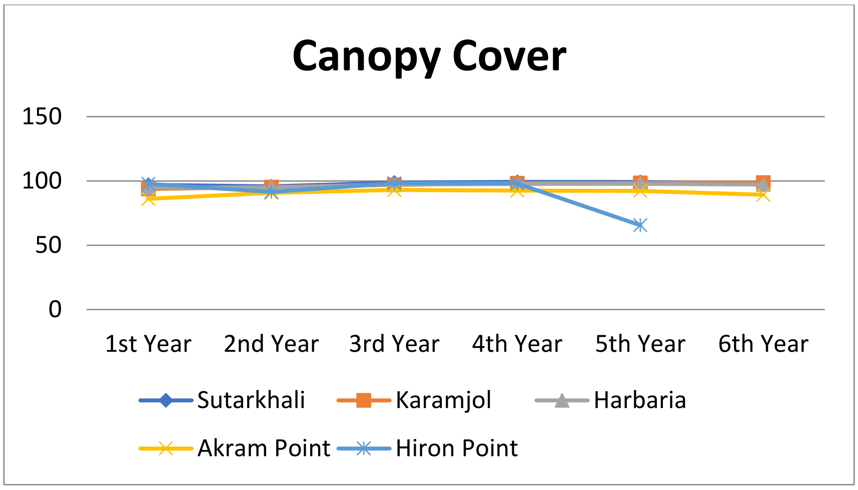
There were no changes observed in phenological behavior of the dominant tree species during the monitoring period.

Diseases in trees can also be used as forest health bio-indicator. A number of diseases has been identified by researchers as chief causes of population decline of the tree species Avicennia spp., Rhizophora spp., Heritiera spp., Pandanus spp., Phoenix spp. and Acanthus spp (Rahman et al. 2010). Certain important diseases of Sundarban mangroves are leaf blight, Dieback, stump and collar rot, trunk gall, root rot, leaf blight, leaf necrosis, powdery mildew (Rahman et al. 2010). However, in the present study, 'top dying' of Sundari and bark hollow of gewa was observed in all the PSPs. Almost most of the Sundari trees were suffering from 'top dying' disease at Harbaria plot. In additionally mortality rate of different species is very low in all PSP's.









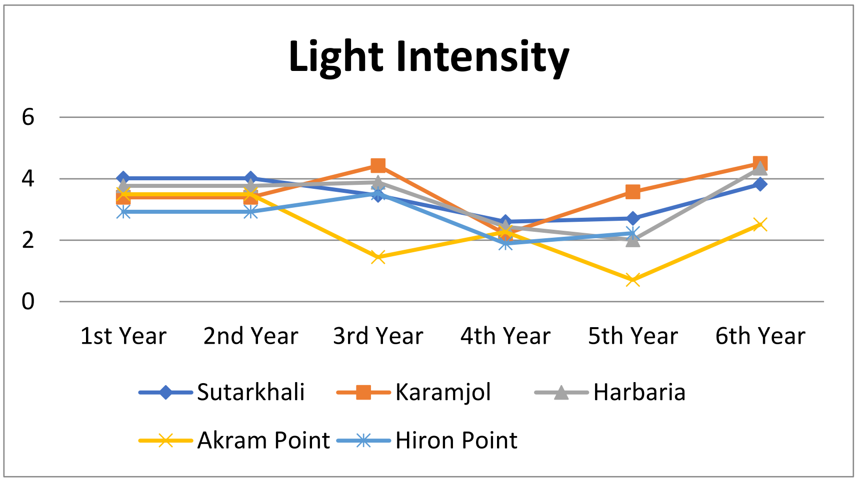


Figure 3.20: Pneumatophore, Crab Hole Density, Seedling Density,canopy cover and LAI over different census period (Each year represent average of 4 monitoring period except Hiron point)

Soil sampling

The soil sampling was carried out in sixth year fourth quarter (post winter) and the soil properties data after being analyzed has been incorporated in this tier.

An open face split auger (1m long) has been used to pull out one-meter long soil core. Soil core has been taken around the center of each plot. From the 100 cm soil core, a 5 cm long subsample has been taken from the middle point of 0-15, 15-30, 30-50 and 50-100 cm intervals for bulk density, soil pH, salinity, soil nutrients (Ca, Mg, Al, K, N and P) and organic carbon assessment (Kuaffman, and Donato, 2012).

Bulk Density

Bulk density has been measured according to Maynard and Curran, 2007. Collected samples have been oven-dried at 105°C until constant weight by using an air flow oven (Wisd, WOF-W305, Korea). The oven-dried samples have been weighted and the corresponding volume of core has been measured and bulk density (BD) of the soil sample has been calculated with the following equation:

Bulk Density (BD) = Wt105°C/Vcore

Vcore = πDcore^2Lcore/4

Where, Wt105°C is the weight of oven dried soil, Vcore is the volume of the core, Dcore is the inner diameter of the core and Lcore is the length of the core.

Soil Salinity (EC)

Soil Salinity (EC) has been measured according to Mostara and Roy, 2008. 1:2 ratio of soil and water (w/v) extraction has been followed to determine soil EC. 10 g of soil has been added with 20 ml of distilled water in a 250 ml Erlenmeyer flask. This mixture has been shaken on a reciprocating shaker for 1 hour and was filtered through Whatman No-1 filter paper. EC of the filtrated extraction has been measured by using an EC meter (Neomet EC-470L, istekInc, Korea)

Soil pH

Soil pH has been measured according to Miller and Kissel, 2010. 1:2 ratio of soil and water (w/v) extraction has been followed to determine soil pH. 10 g of soil has been added with 20 ml of distilled water in a 250 ml Erlenmeyer flask. The mixture has been shaken on a reciprocating shaker for 30 min and allowed the slurry to settle for 30 min. pH of the slurry has been measured by a pH meter (Hach, sension3, USA).

Total Organic Carbon

Loss of ignition (LOI) method has been followed to measure organic carbon in soil sample (Allen et al., 1974). One gram of soil has been taken in a pre-weighted porcelain cup and oven-dried at 105 °C for 24 hours. The oven-dried sample has then been placed in digital Muffle furnace (WiseTherm F, Wisd, Korea) at 450 °C for four hours. After ignition the sample has then been placed in desiccators to allow it to room temperature and weight it again to calculate the loss of ignition (LOI%) using the following formula

LOI% = (Wt105 °C – Wt450 °C)/Wt105 °C

Where, Wt105 °C is the weight of soil at 105 °C and Wt450 °C is the weight of soil at 450 °C.

The LOI% is usually accounted as organic matter percentage. A total of 50% of LOI% or ash free mass has been considered as the C content in the sample (Allen, 1989). However, the LOI or organic matter can be converted to organic carbon according to Nelson and Sommers, 1996 by using a universal conversion factor 1.724 (Van Bemmelen factor) based on the assumption that organic matter contains 58% organic C (i.e., Organic C% = Organic matter (%)/l.724)

Soil Total Kjeldahl Nitrogen

Soil Total Kjeldahl Nitrogen has been measured according to Baethgen and Alley (1989). The digestion of soil sample has been carried out with concentrated H_2SO_4 catalyst mixture (100:10:1 of K_2SO_4:$CuSO_4$: Se) (Bremner and Mulvaney, 1982) in a block digester (VELP DK-6, VELP Scientifica) and diluted the digest with distilled water to a final volume of 100 ml. The Nitrogen concentration of the digest has been then analyzed colorimetrically using UV-VIS Spectrophotometer (Hitachi U-2910, Japan). 5.5 ml working buffer solution (0.1M Na_2HPO_4, 5% Na-K tartrate, 5.4% NaOH), 4 ml Na Salicylate-Na nitroprusside solution (15% - 0.03%), 2 ml Na hypochlorite solution have been added to 1 ml of aliquots. Absorbance of the sample has been then measured at 650 nm wavelength after 45 minutes.

Soil Total Phosphorus

Total Phosphorus in soil has been measured according to Olsen and Sommers (1982). The digestion of soil sample has been carried out with concentrated HNO_3 and 60% Perchloric acid ($HClO_4$). The digest has been then diluted to a final volume of 100 ml with distilled water. 10 ml of Ammonium Paramolybdate-Vanadate reagent was added in 2 ml of sample aliquots and diluted the solution to 25 ml with distilled water. The Phosphorus concentration has been then analyzed colorimetrically with UV-VIS Spectrophotometer (Hitachi U-2910, Japan) at 470 nm wavelength after 20 minutes of sample preparation (**Table 3.21**).

Table 3.21: Relevance of Key Soil Variables

Type of variable	Key soil variable	Layer	Relevance
Carbon and nitrogen	Total organic C, total N, and carbonates	Organic	Forest nutrition, atmospheric N deposition, and climate change
		Mineral	Forest nutrition (0–20 cm), C, and N sinks
Nutrients	Total P, Ca, Mg, K, Mn, and S	Organic	Atmospheric deposition of basic cations and stock of macronutrients
		Mineral	Weathering rates, critical loads of acidity, and stock of macronutrients
Acidity, cation exchange characteristics	pH, carbonates, cation exchange capacity, base saturation, and exchangeable cations	Organic and mineral	Buffering acid input and acidification status
	Acid ammonium oxalate extractable Al and Fe	Mineral	
Heavy metals	Pb, Cu, Zn, Cd, Cr, Ni, and Hg	Organic	Atmospheric metal deposition
		Mineral	Atmospheric metal deposition, calculation critical loads (0–20 cm), and deficiency of oligo elements
Physical soil variables	Particle-size distribution and soil texture	Mineral	Soil classification, estimation of plant available water, and nutrient exchange capacity
	Organic layer mass	Organic	Calculation of stocks
	Bulk density of the fine earth, coarse fragment content, and soil depth	Mineral	Calculation of stocks, nutrient supply to plants, index for compaction, and rootable soil volume
	Soil water retention characteristic	Organic	Water balance models, nutrient fluxes, and estimation of soil porosity
		Mineral	

Source: *Cools and De Vos (2010).*

Soil properties

The concentrations and vertical distribution pattern of soil C, N and P in wetland ecosystems were affected by the types of plant community. The type of plant community, plant diversity and the presence of dominant species had differences in root distribution, the amount of litter returned to soil and plant cycling. The mean bulk density, Soil pH, soil salinity (EC), OC%, N and P contain across the five monitoring sites were given in **Table 3.22**. Lower bulk density indicates that the site has more organic matter. Only Hiron point have increase bulk density. According to this fact the Harbaria site's soil contained more organic matter, less compact, and more porous. Soil salinity has been found highest in Karamjol Point (5.52 ms cm-1), while this figure is lowest in Hiron Point (3.16 ms cm^{-1}, Table 3.15). The OC% has been observed almost similar figure in all monitoring locations except Hiron point which represents lower amount of OC (1.56%). The N concentration was found similar in Karamjol, Sutarkhali and Akram Point (Table 3.15). Lowest N concentration has been observed at Hironpoint site (**Table 3.22**). The P content is lowest at Hiron point. The Hiron point shows poor concentration of soil properties because of the location's high elevation compared to others and results in lower litter decomposition.

Table 3.22: Mean soil properties among the four monitoring sites in SRF

Soil depth (cm)	Soil parameters					
	Bulk density (g cm^{-3})	Soil pH	Soil Salinity (EC) ms cm^{-1}	OC %	N (mg g^{-1})	P (mg g^{-1})
Sutar Khali						
0-15	1.21	6.82	3.91	1.81	0.83	0.37
15-30	1.17	6.93	3.34	2.20	0.84	0.38
30-50	1.11	6.89	3.61	1.95	0.43	0.40
50-100	1.13	6.82	4.68	2.14	0.45	0.35
0-100	1.21	6.86	3.89	2.03	0.64	0.38
Karamjol						
0-15	1.20	6.79	5.79	2.05	0.77	0.41
15-30	1.27	6.91	5.71	1.69	0.63	0.38
30-50	1.24	6.94	5.87	1.41	0.44	0.41
50-100	1.22	6.95	4.70	1.57	0.90	0.39
0-100	1.23	6.90	5.52	1.68	0.69	0.40
Harbaria						
0-15	1.26	6.52	4.27	2.18	0.91	0.31
15-30	1.19	6.97	4.25	2.15	0.79	0.29
30-50	1.22	6.80	3.38	1.98	0.61	0.31
50-100	1.20	6.73	3.33	2.06	0.78	0.31
0-100	1.22	6.76	3.81	2.09	0.77	0.31
Akram Point						
0-15	1.25	7.13	3.58	1.83	0.67	0.30
15-30	1.19	6.98	3.99	1.70	0.72	0.32
30-50	1.16	7.06	3.85	1.43	0.39	0.29
50-100	1.22	6.95	3.71	1.36	0.70	0.36
0-100	1.20	7.03	3.78	1.58	0.62	0.32
Hiron Point						
0-15	1.25	6.55	2.42	1.12	0.52	0.72
15-30	1.31	6.70	3.33	1.70	0.50	0.61
30-50	1.31	6.56	3.58	1.68	0.61	0.45
50-100	1.27	6.60	3.3	1.74	0.55	0.40
0-100	1.28	6.60	3.16	1.56	0.55	0.54

Soil carbon stock of different plot shows different range and Storage of SOC results from interactions among the dynamic ecological processes of photosynthesis, decomposition, and soil respiration **Figure 3.21**.

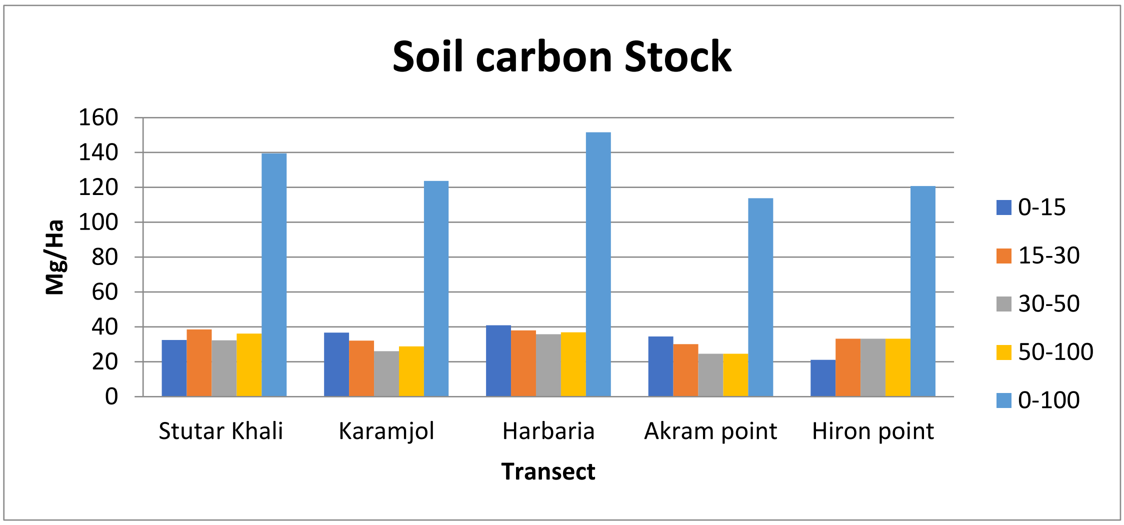


Figure 3.21: Soil carbon stock of five different plot

Overall, the scenario it can be says that there are no significant changes of mean soil properties among the monitoring sites.

3.6.4 Summary

Considering Rampal Power plant establishment, Forest Health Monitoring program intended to decide the status, changes, and patterns in pointers of trees condition on certain time interim premise along the Passur River. The monitoring indicators included plant growth, tree regeneration, tree crown condition, tree damage, lichen communities, plant diversity, soil chemistry, and plant physiology were observed in the permanent sample plots (PSPs).it can be predicted in terms of seedling density, pneumatophores, crab hole, canopy cover and leaf area index (m^2 leaf area/m^2 ground area) that the forest condition is showing positive changes periodically, although there has some seasonal effect. Phonological changes were not seen in all PSPs. But Sedimentation rates are comparatively high in Hiron Point plot. In addition, logging is severely affected at Koromjol and Hiron Point. The complex species sundari have been died in a part of Akram point and Koromjol plot. On the other hand, Harbaria point has no significant change observed during the last visit. Among the species, the height of Sundari is comparatively high in Harbaria and Goran species are dominant in Akram Point. The Akram Point is situated at the confluence of Shibsa and Passur River. The area have subjected to excessive erosion. About 45m area from the river side along the plot (2 quadrate of first subplot) are already effected by erosion. Therefore, during tidal inflow the forest floor carry large amount of soil sediment than other locations but in depth side the number of seedling almost zero so that It can assume that, the forest will be experiencing retrogression process where the climax species are started decaying. Generally, it tends to be said that forest health condition along the Passur River is in stable condition.

4. Social Environment

4.1 Socio-economic Condition and Social Safeguard

This 25th Social Safeguard monitoring on Rampal Power Plant is prepared as a follow up study of 23rd monitoring to explore the safeguard status (during the phase of construction), suggested by DoE and EMP of EIA report. However, it is a regular monitoring study which has important contribution for implementing DoE's conditions in order to maintain social safeguard standard for the successful completion of the project**.**

4.2 Methodology

Physical observation used as a data collection tool (during the field work) to understand the construction activities in view of auditing following issues, i.e., occupational health and safety, labor shed condition, toilet facilities for workers, kitchen, drinking water and food condition of labor sheds, use of PPE by the construction workers and waste management.

Telephonic interview was conducted with concern person from PMU to explore the recent CSR activities. At the same time, pictures on CSR activities collected through online that represented the CSR activities of PMU.

Informal interviews were carried with local people located at Kapasdanga, and Rajnagar Union. Additionally, a virtual consultation meeting was held whereas relevant professionals from PMU participated and stated about different activities which is related to the social safeguard issues

Employment and Livelihood

Responsible BIFPCL official reported that the rate of recruitment of local labor in the project site is increasing over the time. Overcoming personal and social barriers, the local people are communicating the Project Authority to work there and involving themselves if found any scope.

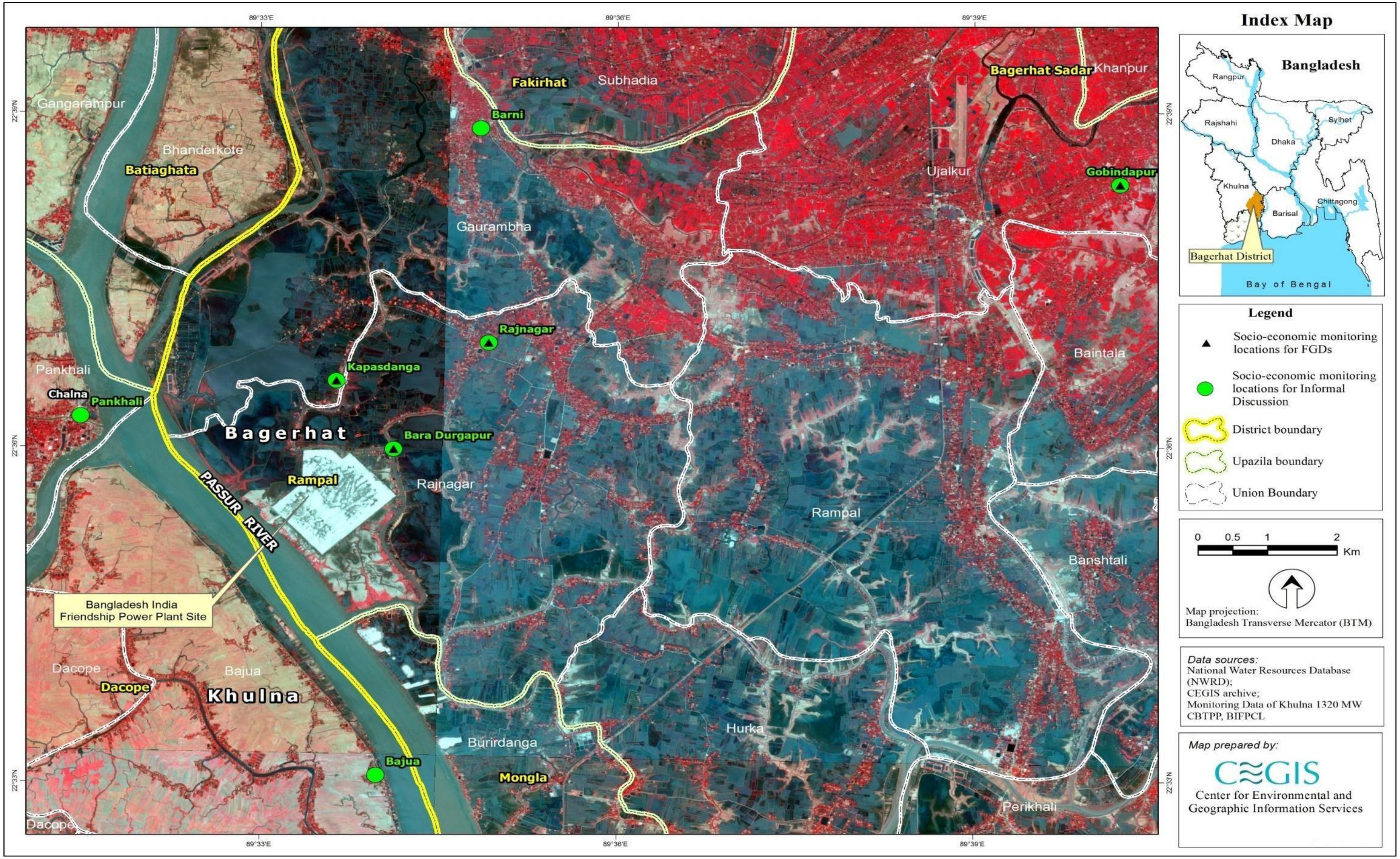


Figure 4.1: Socio-Economic Environment Monitoring Location

4.2.1 Results of Social Safeguard Status

Impact on Employment and Livelihood

The rate of local labor recruitment is increasing according to the local people who are living in the adjacent union (i.e.Gaurambha and Rajnagar).

The pandemic due to Covid 19 restricted earning, stuck them at home, losing opportunities to work outside but working opportunities at the Rampal Power Plant helps local labors to regular earning. The Project Authority planned to make local people semi-skilled to skilled so that they can be involved in construction and post construction phases of the project. Considering this aspect, they made a plan to engage Bangladesh Industrial and Technical Assistance Center (BITAC) for providing trainings on different technical issues like electronics, welding, plumbing, etc. Under this plan, the Project Management Unit (PMU) has fixed selection criteria and consulted with respective Local Government Institutes (LGIs) for listing and assembling people from the local communities to involve them in different batches of the training program in which technical labors can join as working force for operating different segments in coming future.

Working Environment

The motto of *"No training No work"* is working as safeguard to labors on safety issue. Prioritization given in safety measures due to Covid -19 pandemic. However, the number of working force decreased but they have to maintain social distancing and other health safety rules (suggested by WHO and Bangladesh public health expert) to ensure safety at workplace. At the same time, project authority doesn't allow people from outside, and safety issues regarding the aspects of Covid 19 maintained properly at the project site. Additionally, the PMU encourages labors to obey health safety rules when they are staying at the Labor sheds. Regular monitoring is occurring by the PMU for increasing the level of consciousness to overcome the pandemic situation.

Besides, toolbox meeting is held every day by the Safety Manager which is being monitored by the PMU, and observation of BHEL written in a document addressing as noncompliance issues. Debriefing to BIFPCL is also held so that they can monitor the noncompliance issues.

Monitoring study revealed that labor sheds are quite clean and workers are satisfied with adequate toilet facilities, kitchen, waste management, drainage, and drinking water and supply water facilities.

Community Health

The Project Authority sprays water on the unpaved road four times a day for suppressing dust and protecting project site and local people around the site from dust pollution.

According to local people, noise is not coming to the locality due to the construction at day and night.

Noise monitoring report helped in awareness building to the construction workers in limiting noise emission. It was reported that there was no noise induced disturbances to local community.. For making greenery in the project site, the Authority has planned to plant about two lacs of trees of local species. It was reported that about 1,15,070 plants were already planted and monitoring is going on to avoid high mortality rate. According to PMU, refilling of about 10,000 trees was done and planted new batch of 15,000 fruit trees and mangrove plants with the technical support of Bangladesh Forest Department (BFD).

Corporate Social Responsibility (CSR)

The BIFPCL is committed to observe the Corporate Social Responsibility (CSR) in ways best fitted to the locality. Despite the CSR is usually observed during operation phase, the Authority has already started different activities under CSR program in construction phase. They have been conducting medical campaigns along with different socially demand-based programs including community development, capacity building and social mobilization. With the observance of CSR activities, community people are getting benefits and making positive attitudes towards the project.

Following activities were done under the CSR activities which were monitored in this stage of monitoring:

4.2.2 Community Development

Under the CSR activities, different initiatives are taken by the project authority. During the Covid 19 pandemic, local people especially, day laborer had to face problems due to restriction involving work outside. Because of this, the PMU of Rampal Power Plant distributed relief to the local people as a part of CSR activities. About 2,850 needy people from 11 unions of Rampal and Mongla upazilla got beniffited by this relief distriubution program. In this program, food Items distributed by Alhaj Talukder Abdul Khaleq, the Honorable city Mayor of Khulna whereas UNO of Rampal upazilla,Deputy project director from BIFPCL and union chairman were presented and participated in this program. Local people and LGI representatives thanked BIFPCL for this noble activity.

Figure 4.2: Relief distribution program under the CSR program of BIFPCL

Beside this program, Reverse osmosis (Ro) water filter was inaugurated in Gaurambha and Rajnagar union. This RO filter will be very helpful to get fresh drinking water as salinity is the major problem in those communities.

Figure 4.3: Inauguration of RO water filter Pond under the CSR of BIFPCL

4.2.3 Capacity Building Programs

Capacity building trainings were offered to the local people under the CSR program for making the local people skillful. Under such programs, about 211 persons received training on sewing, and about 215 persons received computer literacy skill development training.

Figure 4.4: Computer Training under the CSR Activities

Figure 4.5: Sewing Training under the CSR Activities

Recommendations

- Heavy machineries should be checked regularly and properly to avoid the risks of accident;
- It is very essential to improve/refurbish old machineries and ensure fitness certificate;
- For assessing the needs of local communities and future CSR activities, coordination meetings are required to arrange on a regular basis;

- Involve more local work forces by building capacity to them on plumbing, masonry, carpentering, electrician & electronics, welding, driving, safety, rock binding, and machineries as they can be prepared as semi-skilled working force for this project;
- Regular refilling is to be continued for making the desired and committed greenery effectively as per conditions of DoE;
- Continuing regular health checkup and disease monitoring for the daily labor as well as for the labor residing at labor colony;
- Ensure proper safety equipment for battling against the Covid 19 virus
- Create awareness about the Corona virus (COVID-19);
- Wash hands and face immediate after entering the office substation from outside;
- Ensure Masks for everyone who are working at the project site
- Health temperature should be checked before entering the project site
- Ensure not to make large crowds;
- Drink sufficient warm water at certain intervals;
- Avoid (as much as possible) public transports, is possible walking on foot
- Social distancing should be maintained in the labor shed as well as the project site
- Paste poster on how to work during the Covid 19 situation for raising more awareness
- Special attention should be given on `workers if they have any syndrome related to the Covid 19
- Care should be taken that all employees, visitors and contractors, use PPE at the work place. All air generating materials should be kept covered;
- Proper utilization of equipment should be ensured and good quality machineries would be used to avoid noise pollution;
- Water purifier would have to be provided to the project site for getting safe drinking water;
- Emergency preparedness and response plan; fire prevention, protection and control plan should be monitored regularly by the EPC contractor;
- Though the laborers are satisfied with availability of toilets and beds for labors in the labor sheds but numbers of these two items should be increased for making better living environment and for maintaining the international norms;
- The labor sheds should be provided with lockers so that the laborers can feel safe with their valuable belongings;
- Entry of outsiders should be prohibited in the officer as well as in the labor colony;
- Awareness on Covid 19 would have to be increased among the labors who are residing at the labor colony.

- CSR activities should be performed primarily among the PAPs on equitable manner. This should be audited by a third-party monitoring team;
- Rehabilitees should be given preference in implementing CSR program as they are under serious threat of another shifting;
- Special Medical Campaign should be arranged for the rehabilitees living at Kapasdanga and Pargovindapur Mouza along with other facilities;
- Dust suppression by spraying water should be continued on construction sites, and other places where necessary to suppress dust and minimize air pollution;
- River water should be used for dust suppression activities and ground water should be avoided completely;
- The PMU should be active and efficient in maintaining vehicle speed limits in the project site;
- PAPs should be given priority in recruitment of manpower based on their skills;

5. Environmental Compliance

5.1 Introduction

According to the project planning, the first unit of Maitree Super Thermal Power plant will be in operation by September 2021. But unfortunately, the COVID-19 outbreak has retarded the project progress. The project work was almost halted at the end of the March 2020. Maximum construction labor left from the project site for maintaining the Government Decision on Health & Safety Guidelines. Therefore, the project work was retarded for few months though labors were gradually returning to project site from July, 2020. The Engineering, Procurement and Construction (EPC) contractor tried to expedite the contractors and sub-contractors for completion of the project works within the stipulated timeframe maintaining the health safety guideline of the existing pandemic.

During the environmental compliance monitoring of Power Plant Construction program, it was observed that construction of all most all the major component were initiated. Most of the mechanical and electrical components were found laid systematically on the vast open area of Block II. The civil construction activities at the Boiler, Turbine and Generator, cooling tower, Chimney and other heavy equipment, stack point, Jetty, township, internal road networks, permanent drainage networks have been progressing. The mechanical construction works like boiler, ESP, FGD, Turbine etc. became slow down due to shortage of skilled labor as they had gone other parts of the country or abroad from the beginning of COVID outbreak. Equipment are transported to the Project site by road. However, the permanent jetty construction works are advancing for unloading the heavy machineries transported through waterways by the Passur River.

The approach road including extension of the two-lane approach road (5.5 km) from Babur Bari point at Khulna - Mongla Highway to the Project site was completed. The bridges and culvert area have already been extended to six lane road requirement. Permanent structure for the security staff and visitors has been constructed at the entrance point approach point and entrance point of the power plant project. The eastern part of the project is now guided with heavy slope protection works at present.

The main Project Office of BIFPCL and EPC contractor's office are shifted to the newly constructed buildings. A good number of professionals of BIFPCL have been shifted to the newly constructed townships. At the same time, the EPC contractor i.e. Bharat Heavy Electricals Limited (BHEL) has already employed different local specialized sub-contractor construction firms such as DIPON, KELLER, AFCON, POWER MAC etc. for progressing the construction works simultaneously.

The present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews to the proponents with telephone and WhatsApp, project officials, contractor or sub-contractors, or relevant bodies etc. by the study team. A comprehensive due diligence checklist has been prepared to monitor the environmental compliance of different components e.g., Environmental and Social Management System and Action Plan; Labor and Working Condition; Community Health, Safety and Security; Biodiversity and Sustainable Management of Living Natural Resources.

The aim of this compliance checklists is to check the implementation and effectiveness of mitigation measures. The checklists are produced as Compliance Data Sheet that contains both quantitative and qualitative data. The details of the compliance checklist are attached in Appendix I. 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 level has been monitored periodically every month for both night and day time at different potentially sensitive areas except April to June 2020 and compared with the ECR Standard. • Workers at the place of heavy noise generating activities (i.e. piling, rod cutting) were found using PPE e.g. ear plug and mask • Idle machines/equipment/ generators were found switched off/throttled down. • Air tighten door, silencer of the vehicles, acoustic enclosure for the generator has been recorded	• Complied • All of the locations inside the power plant boundary should be considered as industrial area for compliance monitoring	• If construction activity would extend at night, additional measures to limit noise (within permissible standard) should be taken. • Use of enclosure to protect the noise sources • Schedule to be made for heavy noise generating works. • Communicate with the nearby community beforehand about activities and possible noise generation.
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.	• Daily 2 times water spraying in the project site with three tankers even in this monsoon. • Periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. • Use of face mask by the labors working at site.	Complied	• Daily monitoring of dust suppression activities including water spraying is needed for maintaining the air quality within standard limit; • Check the labor must use face mask

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Earthen roads and undeveloped roads should be avoided to minimize dust generation • 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.	• Covering of some of the stockpiles but watering them. • Cement debagging process has been done at storage • Mixing machine may generate localized dust during cement and concrete mixing. But all the crashing and storage of materials were recorded wet. • Wet earthen materials are transported instead of dry sand and silt • Covered the soil/sand trucks with tent • Monitoring the vehicular speed and load • Spraying water on the roads regularly and use of register for documenting		throughout the workplace • May use Method 22 (Visible emission observations) for visual inspection of dust at construction site. • Clear the mud over the paved roads
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	• Drainage system has been improved in the project and permanent drainage system is constructed. Some are already been in operation to discharge storm water in this monsoon • EPC contractor is checking the water quality of outfalls on monthly basis except April to June, 2020 through third parties.	Partially complied • Manage and initially treat the waste water from the labour shed • Ground water should not use for sprinkling purposes	• Any kind of liquid waste from the project site must be protected.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		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 duration of consultation is one hour according to ISO-14001 standard, b) Arrange monthly environmental meeting among the mid-level officers through top management when those issues will be discussed under guidance of ECR 1997.	• Adequate sanitary toilets have been constructed at the labor sheds. • New RO plant is being constructed • Onsite sanitation facilities have been developed at the working area • Training and awareness program are being continued maintaining the national safety guideline for COVID-19 management. Drainage system is being maintained properly. • No waste water treatment plant has been found available for treating the discharged waste water from labor shed • Ground water is being withdrawn near the RO plant of ABM Company for using water sprinkling.		
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.	• Heavy equipment and mechanical equipment are kept in the demarcated places. • Solid waste collection process have been managed with third parties • Waste bins are installed without color code at different strategic points;	Maximum Complied	• The number of Waste Disposal Bin/s with labelling should be increased at labor shed, and at working area. • Scrubbing materials should be managed within the designated places

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• 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. • 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.	• Burning of waste materials was not observed. • BIFPCL has engaged a company named Rahman Brothers in collaboration with the Khulna City Corporation (KCC) for collection of waste, safe disposal of waste materials form project site. • Iron and food packages are separated at sources of waste generation • Waste management disposal procedure has been included into the induction training of the labor • Local language (Bengali) with pictures are being included in the signboards. • No spoil or waste dumping recorded during the field investigation • But heavy rainfall washing out the wastes to the nearby drains and water bodies • Licensed has been taken from the department of explosive, fire and safety for storing petro – chemicals • Lots of scrubs were scattered near the boiler construction area		

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Keep provision of awareness building meeting and training for employees	• Colored waste disposal bins for different types of waste were not observed during the field visit.		
5	Compensation and Resettlement	• Proper resettlement action plan 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 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.	• Compensation has been given to the rightful owners of the land as per the laws of Bangladesh e.g., 'Acquisition and Requisition of Immovable Property Ordinance, 1982'. • Compensation was paid by the local DC office. • 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 related employment. • A significant number of affected people (especially who deserve) are working at the construction site. • 136 indirectly affected people were given compensation by the DC Office, Bagerhat. • About one third of the labor has been recorded from the locals.	In the process of Compliance	• The CSR activities should be oriented towards the affected people or household; • Trained to the Sundarbans dependent livelihoods group as a part of CSR activities • The proponent may initiate cooperatives for the PAPs along with training

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		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	• The project authority has given training on computer and swing to the nearby villagers including PAPs which is stopped at present due to COVID • 17 families got their residence who have shifted their houses from project area to Kapashdanga.		
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. • 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.	• BIFPCL are recruiting the local people especially PAPs with the help of local government to work during construction. • Accidental log sheet or injury log book are being maintained. • Provides health facilities to the labour as well as communities • Proponent has taken numbers of measures for COVID protection • The wage of the labor is compatible with the national standard. • Available drinking water, sanitation facilities, prayer room are provided at site. • No incident has been recorded in this quarter since maximum work has been retarded due to COVID-19.	Complied	• Health and financial support should be available for the labour in case of COVID affected. • Evaluation and monitoring of the workplace safety situation

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
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. • 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	• Fitness certification of vehicles and equipment are ensured for the construction works • The EPC Contractor using relatively new equipment and vehicles to reduce the GHGs emission. • Equipment, generators and vehicles were observed switched off during non-operation period. • Vehicles are not kept at the stand regularly • Vehicles are maintaining the road safety regulations. • No GHG inventories were prepared for this project	In the process of Compliance	• GHGs inventory checklist should be prepared immediately at this stage; • Introduce vehicular registration for the construction site • Energy efficient component like light, AC, equipment is to be used for the project purposes

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 run through the HR polices and switching their professionals as per demand of the project. • Since the work has been retarded due to COVID, the EHS department is also monitoring the occupational health safety issues carefully. No accident has been recorded in this quarter, • No discrimination was recorded among at labour level between local or migrating labour in Bangladesh • EPC contractor deployed an OHAS Company named Cholamandalam for ensuring occupational safety. • BIFPCL has ensured minimum wage and working hours for the labor as per GoB rules and regulation. • Induction training and regular training of first aid, toolbox are being Continued in association with COVID management guideline. • Contractor has taken insurance policy for engaging labors as per labor policy of Bangladesh.	Being Complied	OHAS must be monitored the training for construction workers to protect from- • Falls (from heights); • Trench collapse; • Scaffold collapse; • Electric shock and arc flash/arc blast; • Failure to use proper personal protective equipment; and • Repetitive motion injuries. • To develop labour association protecting labour interest • Create fund to support the labour/his families in case of any fatalities • Health and financial support should be provided if any labour affected by COVID

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	• EPC contractors and sub-contractors are not employing any child labor in the project area. • No forced labor has been recorded in the project. • Proper documentation of contract with the worker is being maintained which includes working hour, wage and benefit. • First Aid support is provided to the labors as required. • Thermal scanning of workers is being done at regular frequency for checking any condition of fever. • Workers must get the safety clearance before initiating any work like – routine checkup of the work places and administrative clearance • Work in hot condition and height need another permission • Sanitization is being done at regular intervals at Offices and labor • ▪ Awareness about Covid 19 is being spread among workers and office support staff.	Being complied	• The insurance policy should cover the accidental case or injuries of the labors; • 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	• Thermal scanning of workers is being done at regular frequency for checking any condition of fever. • BIFPCL has demarcated the specific construction site with warning sign;	Being Complied	• Monitoring about the use of face musk and COVID symptom of the labors • Try to develop the habit of the worker for safety worker like

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		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 (ERP); • Adequate fire precautions in place (e. g., fire extinguishers, escape routes etc.); • Documentation and reporting of occupational	• Basic Medical care with free medicine and counseling is being provided to workers on regular basis. • • Most of the Labor and Project personnel are using appropriate PPEs like reflecting vest, helmet, and safety shoes etc. and most important the face musk. • Increased the capacity of temporary hospital, doctors and 24hr availability of ICU supporting ambulance at the Project site; • Emergency contact address was found on the board at the site for any kind of sudden incident; • EPC has made a contract with the Gazi Medical of Khulna city for emergency medical support. • Sanitization is being done at regular intervals of the labors • ▪ Awareness about Covid 19 is being spread among workers and office support staff. • The major construction work at site has been performed in presence of safety officer. • Fire extinguisher was found at required places. • Weekly checking of all the safety records and implementation of HERA at site.		protecting the dangerous part of machine, vigilant for moving cranes, hooks or other lifting equipment, fall protection, extra-attention on electrical works etc.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		accidents, diseases, and incidents; • Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS	• 2 Ambulances, 1 MBBS doctor, 2 paramedical doctors and two medical checkup system are amiable for the workers as well as officials		
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	• BIFPCL have separate EHS division incorporating environmental specialist, safety officer, firefighting officers, public relation officers, doctors etc • Adequate number of safety officers have been employed by the, EPC contractor and Sub-contractors. • The project OHAS policies were revised for functioning the occupational safety system. • Entry of outsiders is strictly prohibited in plant premise and labor colony. • Sanitization is being done at regular intervals • Awareness about Covid 19 is being spread among workers and office support staff. • Medical aid, fire extinguisher, PPEs are provided adequately. • Adequate workers shed and sanitation facility has been developed; • Onsite medical facilities have been improved and EPC contractor has made	In the process of Compliance	• Awareness build-up, strict to the safety issues, • Empower and responsible the safety officers at site. • Continued the safety training, buildup the awareness and make the labour habituated with the safety procedure • Use dust musk to the labour at work site

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			agreement with the government or Private hospital for severe injuries. • Prevent outside movement of workers. • Thermal scanning of workers is being done at regular frequency for checking any condition of fever. • BIFPCL has already established a Health unit and BHEL has established a full-fledged EHS unit. • Site-specific Environmental Health & Safety checking is being continued. • Isolation rooms are created by each sub-agencies. • Liaison is done with local Govt and Pvt. hospital for any unwanted medical situation		
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 generally satisfied with the residence facilities since less number of labour are present due to COVID situation • 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 , mobile recharges etc are being ensured in labor colony , to • Workers get lemon or saline water during work period	Being Complied	• Freedom of Association, Rights & scope of bargaining should be open for the workers. • The proponent has to look after the following issues – equal benefit for the direct labor, contracted labor, day labor etc., emotional support and health surveillance. • Support to the COVID affected labors urgently

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			• 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. • Grievance of the workers were usually addressed especially for safety issues.		

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.	• The construction activities were quite slow for the last 4 months due to COVID pandemic. • Boundary wall has been constructed around the project area. • Water spraying has been conducted 2 times in a day to reduce the dust emission in this monsoon • 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 the COVID situation (April to June 2020) • Environmental parameters are continuously monitored in and around the	Being complied	• Any complaint regarding noise and dust from local people must be addressed immediately and recorded accordingly in the register.

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			project site by separate entities except (April to June 2020).		
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. • BIFPCL regularly display the progress of the development through their website (https://www.bifpcl.com/) and disclosure meeting at the local government • Grievance register has been placed at the BIFPCL main office inside the project boundary. • BIFPCL is also receiving grievance from local community through local government like Union Chairman or Local Administration • Proponent is observing the community grievance or quarries though the monitoring study conducted by CEGIS or local government	Being complied	• Put the grievance register outside the project boundary so that the local community could easily state any grievance properly.
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;	• Implement numbers of pollution mitigating system for protecting the dust and other pollution outside to the project area during this monsoon also. • Strictly prohibited to enter outsider to the project site or labour camp. • Health check-up is mandatory to every labor during the induction training on which they get pass for work.	Being complied	• Maintain social distancing with the communities • Facilitate sanitary facilities and raise awareness for COVID management • Equity and rationality should be maintained

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		• 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; • Aware the security personnel about the right of the community people.	• Sanitization and temperature scanner are being done at regularly • No conflict has been noticed between local communities and project authorities or workers • Maintaining communication with local community regarding their grievance about the worker and work facilities. • The routine (twice in every week) medical checkup with essential medicine facilities from BIFPCL and specialized medical camp nearby village are now going to reschedule for the community due to COVID situation. • Distribution of essential food items , soaps to nearby villages and contract workers is done. • The proponent is also contributing fund from CSR for training, lab development at Digraj college, RO drinking water supply at Mongla which is supplying 1000 liter fresh water per hour and arranged football tournament, gift to the bright student, school lab development etc to make a congenial relation with the communities.		for the implementation of CSR fund. • Trained to the Sundarbans dependent community to shift their livelihoods
4	Community Health and Risk	• Provision of providing health service facilities to community if the Project poses any health risk like sexually transmitted disease,	• Adopt a number of measures like thermal scanning, sanitization, face mask, isolization bed for COVID management • Developed the medical facilities (consisting medical officer, medical assistant, office assistant) at Plant site for	Being Complied	• BIFPCL shall communicate regularly with the community to aware them about the COVID pandemic and how thy manage it

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		contract disease, vector-borne diseases; • Implement all pollution mitigation measures to ensure safeguarding to community.	checkup the communicable diseases of the workers and staffs; • Distribution of essential food items , soaps to nearby villages and contract workers is done. • BIFPCL is going to arrange again the weekly health service program (medical consultation and free medicine) for the local community considering the COVID situation • A total of - people has been received medical assistance from BIFPCL where a total of 39872 people received regular treatment and 3234 people revived medical assistance from monthly campaign. • EPC contractor is educating to the labors about protective action taken to avoid vector borne diseases and HIV positives and COVID pendamic		• BIFPCL may introduce awareness program through mike, poster about COVID management for the community
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 take palaces with the local government and community representatives for labor recruitment; • The proponent took a number of initiatives to encourage local students through awarding them scholarships before the COVID situation. Las two months they have initiated few initiatives	Being Complied	• Training related to 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

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
					introduced immediately;
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.	• The project authority is Displaying only the Project information on a display board at Project site; • Project related every updated information has been uploaded in BIFPCL website (https://www.bifpcl.com/) • The local people are aware regarding the project activities from multiple sources like consultation, display board, website etc • The stakeholder consultations have not been conducted with the community people due to COVID situation.	Being Complied	• BIFPCL may use print media, social media, digital media might be used for spreading the project right information • The proponent should aware the local people about the rumor regarding the project;

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.	• Construction of permanent drainage system to discharge water from the project area. • The connectivity of Maidara River is being maintained. • EPC Contractor is monitoring the water quality on monthly basis at every outlet of the project site. • Bank protective works has been continued at the western bank of Maidhara river especially the project eastern part.	Being complied	• Manage the drainage system during the monsoon heay rainfall

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
			• Solid waste has been managed by third parties and finally disposed to the KCC disposal areas		
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; • 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;	• Project activities are limited within the project boundary. • The project construction works are curtailed temporarily due to COVID situation • Limiting the vegetation clearance within the Project boundary especially around the ash impoundment. • Plantation program is in progress with the help of forest department. • The client is going to plant 50000of fruits and medicinal plants as per the greenbelt position of layout by 2019-2020 • Local plant species like Goalpata, Sundori, Bain, Keora for green plantation are being planted • They are maintaining the EMP for protecting the adjacent ecosystem • No alien species has been recorded • Wild species like avifauna and mammals are now recorded in the greenery areas • Employees are aware about the rescues of species and no harm to wild species	Being Complied	• Regular monitoring of the planted trees. • Reduce the rate of mortality at the sapling stages. • Bird sheds shall be created at the green belt areas.

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• No degradation of sensitive habitat.			
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 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	• Monitoring of ecosystem health of Sundarbans, and around the Project site is being continued; • The project is not obstructing the surface water flow even in the heavy monsoon rainfall. • BIFPCL has been started maintenance of the slop protection works • EPC Contractor is monitoring the discharged water quality at each of the outlet from this project on a monthly basis. • The project authority is constructing the permanent jetty as per approved layout. • The Maidara river is showing its natural phenomena.	Being Complied	• Initiatives should be taken for excavation of silted reach of Maidara river near the proposed township area to facilitate proper functioning of River during dry period.

5.2 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.	There is no extension plan has been conceived by BIFPCL 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 will be maintained as per EIA report. In case of any change in Plant design and coal specification the proponent shall have to obtain consent early 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 activities for the block –A area. Infrastructure development activities in the Project are in progress.	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.
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. They have been monitoring the environmental and social impact as per EMP plan since 2014. No significant impact of Power Plant activities on the surrounding environment or on the natural resources has been reported yet. Moreover, all the necessary pollution control measures and technologies *i.e.* Effluent Treatment Plant, ESP, and FGD etc. have already been incorporated in the technical specification of main Plant of EPC package as per DoE stipulations. The EPC contractor is constructing the Plant as per the contracted technical specification. Moreover, environmental compliance monitoring is also being continued in the project site in order to assess the	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		impact onproject ambient air quality, discharge water quality and noise level around the project site according to the monitoring plan.	
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 been takenbefitting mitigation measures as per EMP at each of the stages of Project Development. As a third-party independent entity, CEGIS has been appointed to monitor the mitigation measures adopted by the proponent during the present construction stage.	Being Complied.
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, archaeological place in and around the site. Quarterly monitoring program has been continuing since 2014 to the potentially project influence area of the Sundarbans Reserve Forest, Ecologically Critical Area and World Heritage Site as per the guidance of DOE and FD.	Being Complied.
8	Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.	The construction works are progressing with tight environmental monitoring. The quarterly monitoring results reveal no noticeable impacts on fish habitats and fish breeding, feeding & nursery sites. In fact, there is no significant changes over the habitat of potential fish breeding, feeding and nursery sites of Passur river.	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.	The construction works has reduced due to Covid 19 from April 2020.Threfore, limited types of work has been progressed during the last 3 months. Working activities are restrictedto daytime hours. CEGIS has also monitored the community response towards construction works of Power Plant regularly. Moreover, BIFPCL is keeping close communication with local government institute to receive their grievance related to project activities.	Being Complied.
10	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed Project period.	The number of labor are shorten in the labor due to COVID situation. Around 1750 has been stayed at the labor camps at present. EPC contractor and sub-contractor are providing adequate sanitation facilities for the workers. Adequate sanitation facilities for health safety from COVID are supplied by the Contractor at the labor camps as well as in the work areas.	Being Complied
11	In order to control noise pollution, vehicles & equipment shall undergo regular maintenance;	All vehicle & equipment used at site are under regular maintenance and registration process. Working during sensitive hours like night	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.	time and locating machinery close to sensitive receptor like near the labor camps are being avoided or managed through appropriate measures in this 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.	No solid waste is burnt inside the project boundary. Now, solid waste is being managed systematic process. A solid waste management company is now collecting the solid waste from the project and dump it to the KCC designated places for solid waste dumping.	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 noting any harmful air pollutant emission or waste discharge form project.	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 project authority has increased the medical facilities for workers. An ICU supported ambulance and an MBBS with two paramedical doctors are now available at site. EPC contactor has establish their own Medical facilities for the labors. For emergency stages for both BIFPCL and EPC contractor, hada contract with government or private hospital (GIZI medical) for emergency medical services. 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.	Being Complied
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. Fourwater tanker are dedicated for sprinkling wateron the potentially dust emitting areas. The project ambient air are observed relatively clear due to limited work activities for COVID situation and monsoon rainfall.	BeingComplied

Sl. No	Condition of DoE	Compliance Status	Remarks
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, BIFPCL has already constructed the permanent drainage system to discharge water from the Project site.	Being Complied
17	Adequate considerations should be given to facilitate drainage system for runoff water from rain/tidal surge.	Adequate attempthas been adopted to facilitate drainage system for runoff water from rain/tidal surge. Watersystem was not interruptedby the project activities.	Being Complied.
18	Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies	The drainage system are functioning well to drain out the storm water systematically inside the project. There is no clogging or obstruct has been recorded to the canal or drain of the project in this monsoon.	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 control system with dust extraction and bag filters at unloading areas and at each transfer points on the conveyor system.	Entire coal handling system has been designed as an enclosed conveyor system as per DoE requirement. 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 Main Plant EPC contract package. Refer Section V, B4 of Technical Specification. The tender for coal transportation shall include the technical specification and EMP of coal transportation study.	Compliance action initiated.
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 at construction stage.	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 covered coal stockyard is now at construction stage.	Compliance action initiated.
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	Compliance action initiated.

Sl. No	Condition of DoE	Compliance Status	Remarks
		of Technical Specification. Coal stockyard is now at the initial stages of construction.	
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. Only 25 acres area has been allocated to store residual ash in case of emergencies. The ash impoundment 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. Provisions in line with this has been included in Technical Specification of main Plant EPC contract package (Section V, Chapter B4).	Compliance action initiated.
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 is progressing.	Compliance action initiated
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. The procedures have been included in the technical Specification of EPC contract package. (Section V, Chapter B4).	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. BPDBprepared 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. Moreover, DC office has rehabilitated around 32 families at Foyla and 17 families at Koigardaskati so far now.	Compliance action continued
28	Resettlement plan should be properly implemented and people should be adequately compensated.	Land was acquired by GoB. Resettlement and rehabilitation action had been taken as per the law of the land, Bangladesh. However, BPDB conducted an assessment (Livelihood Restoration Plan)	Compliance action continued

Sl. No	Condition of DoE	Compliance Status	Remarks
		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.	
29	Construction material should be properly disposed-off after construction work is over.	At present, the construction work is going on. Storage of construction materials are scattered especially the major construction area. It is hard to manage the construction scrubs at present. Solid Waste Management plan has also been prepared keeping the provisions in line with this (Section-V, B12, and Part 9 of Technical Specification). The proponent is now communicating with the external agencies to peak the construction scrubs and safe disposal.	Compliance action initiated
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 relevant stages. CEGIS, as an environmental consultant of BIFPCL is monitoring the implementation status of EMP on a quarterly basis. BIFPCL is taking appropriate actions based on EMP monitoring report. BIFPCL regularly updates the EMP and OHAS which assist to reduce the impacts and accidental events further.	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	CEGIS has been engaged by BIFPCL as an independent monitoring entityfor 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	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	Headquarters of the Department of Environment simultaneously.	Headquarters of the Department of Environment as directed by DoE.	
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 included 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 been monitored and reported by CEGIS through the quarterly monitoring report.	Being Complied.
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 is regularly carrying out public consultation at different levels. There is no consultation workshops conducted in this quarter due to COVID situation. 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 will be installed when the Plant will be in operation phase and will continue throughout the life time of the 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). The project is now at construction stage.	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	The MIS will be prepared before commissioning of the Plant. The consultant for developing MIS will be engagedearlier. Specifications of MIS system is already included in EPC contract	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
	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 for accessing every individual to show the real time monitored records.	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 activities.	
38	JVC should provide all sort of logistics support to DoE and other relevant agencies for monitoring environment related items/events.	BIFPCL is ready to 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 maintain the health and safety protocol of the construction site.	Being complied
39	No ground water should be allowed to use for plant purposes.	In compliance of the DoE approval condition no. 39 of EIA Report, “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 being constructed for supplying fresh water. During the compliance monitoring visit, a 1200ft deep tube well has been recorded still near the ABM water plant where water has been withdrawal. In this regard, the representative of the Proponent informed the Team that the cause of withdrawal is 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.	Pre-construction phase of the Plant was completed and the construction phase has been continued. BIFPCL has appointed a social worker and officers who regularly visits nearby community to consult with the local people. Besides, CEGIS, appointed by the Project authority as environmental monitoring consultant, is also carrying out consultation with the local people with interviews on	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		regular basis for better performance of the Project as a whole. No stakeholder consultation meeting has not been conducted in this quarter due to COVID situation.	
41	Additional Environmental baseline data to be collected as suggested in the EIA report and conveyed to DoE and other concern authorities.	CEGIS has been engaged since February 2014, for preparing Detailed Environmental Baseline. CEGIS has submitted annual monitoring report along with all quarterly monitoring reports containing latest baseline data to BIFPCL for further dissemination to DoE and other concerned authorities. Moreover, CEGIS monitored additional environmental data as suggested from DOE and FD.	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 by CEGIS. 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 commences in the field to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	The construction works is now going on. BIFPCL has submitted the detailed work plan seven (7) days before start of the construction activities to the suggested offices of DOE.	Being complied
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 Monitoring report keeps all the records as suggested.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	• 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.		
46	The results of any monitoring, required to be conducted under this EIA report must be recorded.	CEGIS is recording all the monitoring data and submitting to BIFPCL through proper documentation. The report is being shared with DoE on regular basis.	Being Complied
47	In case of any emergency, the following information shall be immediately be 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 happened during the last 5 months (March 2020 to July, 2020). Spreading the COVID-19 outbreak, the construction works was nearly stopped from April, 2020 to June 2020. In the beginning of July 2020, the labors are joining to this project with proper COVID safety measures ensured by BHEL. BIFPCL has given top priority on safety issues as like environment for this project after the bitter experience of two incidents. They hasinstructed theEPC 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 which have collectively reduce the incident in this quarter. No environmental, accidental, anthropogenicincident has been not recorded for the last 5 months.	Complied at present
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.	So far, no such incident has occurred in this quarter. 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. Limited scale of construction works have been performedin this time due to COVID situation. With the increasing construction activities from July 2020, the proponent as well as the EPC have given high priority on health and safety issues. EPC have already revised the health and safety management manual and reshaped for pragmatic practicing.	Complied at present.

Sl. No	Condition of DoE	Compliance Status	Remarks
		Moreover, CEGIS is monitoring the EMP implementation as a whole.	
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.	So far, no such incident has happened. BIFPCL has established a proper mechanism for recording such incident as suggested in the ERP. CEGIS has been engaged to monitor the social and environmental compliance on a regular interval.	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 would seek for appropriate permission from the Forest Department.	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.	An MoU has been signed with Forest Dept., Bangladesh on 24.02.2015 for implementation of Afforestation Program. Initial target is to plant 2 lac saplings in 3 years. By this time, Forest Department has targeted initially to plant about 116000nos. of saplings of different species. A fresh Agreement with BFD was signed on 24.01.2018 for plantation of 5 Lakh trees for at the end of construction stages. In this quarter, the planted 15000 fruits and medicinal plants at the laydown areas in the project site.	Being Complied
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 been 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.

Sl. No	Condition of DoE	Compliance Status	Remarks
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. Therefore, no incident has been occurred from March 2020 to July 2020. Meanwhile, a number of CSR activities are ongoing at Project site, like free medical camp, Boat Medical camp, and medicines, free potable water supply to the local people, medical campaign, training etc. infrastructure development of nearby school.	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	
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. The functional and technical specification of the main Plant includes 275 Meter high 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 for preventing pollution. All these stipulations have been included in the technical specification of Main Plant EPC contract package. Moreover, BIRPCL 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.	

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-

5.3 Compliance to the 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.	No. modification of this Project as well as Coal Transportation has happened yet. 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 per 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 Power Plant machineries complying the national laws and regulation.	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 started. 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. An 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	Suggested to comply at operation phase.

Sl. No.	Conditions	Compliance status	Remarks
		implementation of mitigation measures for the construction period. They have developed a skilled manpower and system for ensuring the EMP during operation stage.	
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 potential impact 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 operation period.	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 yet now.	Being Complied
8	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.	At present, the civil construction of the Project including Jetty construction activities are progressing. The jetty construction works is running limitedly under this COVID situation. BIFPCL, EPC contractor and sub-contractors are providing sufficient safety materials and component for protecting from COVID and improve hygiene at labor camps and workplaces.	Being Complied
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.	The construction of Jetty is being carried as per EMP guidelines. Moreover, regular monitoring activities are being carried out to assess the significant changes due to jetty construction activities. The quarterly monitoring reports	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
		do not reflect any significant changes of the habitat of flora and fauna of the project influenced Passur river and Sundarbans ecosystem	
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 after few incidents. They have significantly revised the OHAS guideline and practice it seriously. During this COVID situation, BIFPCL are tried to spread awareness about Covid 19 among workers and office support staff.Thermal scanning of workers is being done at regular frequency for checking any condition of fever. There is no incident recorded yet now from March 2020 to July 2020 in the project site.	Compliance action initiated
11	To control dust, spraying of water over the earthen materials should be carried out from time to time	Daily rainfall and limited construction activities have reduced the concentration of particulate matter in ambient air of the project. However, Water spraying for dust suppression are currently functioning to control the dust over the exposed earthen areas and roads. It is also monitoring and recorded daily.	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.	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 Covered coal stockyard is now under construction stage.	Compliance Action initiated.
14	The entire coal stockyard should be Covered with water sprinkler provided with	EIA study of the Power Plant suggested to install water sprinkler in coal stockyard which has been repeated in EIA study of Coal	Compliance Action initiated.

Sl. No.	Conditions	Compliance status	Remarks
	automated moisture sensor to control self-combustion.	transportation. However, all these stipulations have been included in the technical specification of Main Plant EPC contract package. The coal stockyard is now under construction stage.	
15	Construction material should be properly disposed of after the construction work is over.	The proponent is preparing an environmentally friendly procedure for disposing off the construction material like scraps as well as other construction wastes. They have already contracted one organization in association with KCC for solid waste management. The construction scrubs are recorded scattered in the project site. They are now trying to contract a third party to remove the construction scrubs from the project site.	Compliance Action initiated.
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.	Being Complied.

Sl. No.	Conditions	Compliance status	Remarks
		In addition to this, Forest Department has also suggested some survey & analysis of Sundarbans ecosystem along with the quarterly compliance monitoring report.	
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). All the environmental monitoring reports are available on the CEGIS website at present.	Being Complied.
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 to 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.	Not applicable in this stage	Suggested to Comply as and when required.
23	Vessels of this project should follow the MPA guidelines and protocol to ensure no hindrance to other vessels.	Not applicable in this stage	Suggested to Comply as and when required.
24	The vessels used for this project should maintain IMO criteria to enable identification of substances harmful to the marine environment.	Not applicable in this stage	Suggested to Comply as and when required.

Sl. No.	Conditions	Compliance status	Remarks
25	All the vessels should follow applicable MARPOL Convention, Annex V on the prevention of pollution by garbage from ships.	Not applicable in this stage	Suggested to Comply as and when required.
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 functioning on a continuous basis.	BIFPCL has so far been implementing the EMP measures phase by phase as suggested in EIA report and approval condition of DoE. The status of EMP implementation are also regularly monitored by CEGIS.	Being Complied
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.	The jetty construction works is now going on. Beforehand, BIFPCL has submitted the detailed work plan seven (7) days before starting of the construction activities to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously. It must bemaintained 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 of the Power Plant project including Jetty construction 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 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	The Monitoring report of CEGIS keeps all the records as suggested.	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
	d) The name of the person who collected the sample.		
31	The results of any monitoring required to be conducted under this EIA report must be recorded.	CEGIS is recording all the monitoring data 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: 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.)	Emergency Reporting/ Emergency response Plan have been prepared for the Power Plant which includes the Jetty. Health and safety management manual have been revised for better and precautious implementation of OHAS after few fatal incidents. They have taken a lot of care regarding occupational health and safety. The jetty construction works have become reduce during the last four months due to COVID. However, there is no record of COVID patient during up to July 2020 as BIFPCL has taken a lot of initiatives. 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.	Compliance Action initiated.
33	National Oil Spill Contingency Plan (NOSCOP) should be followed to establish an organizational structure to combat marine pollution	Not applicable in this stage	Suggested to comply as and when required.
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 strengthening the mechanism for theincident as suggested that is notify to 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. They will prepare the institutional arrangement for managing the incident during coal transportation system before the operation based on the EIA and DoE recommendations. Moreover,	Complied at Present.

Sl. No.	Conditions	Compliance status	Remarks
		monitoring activities is continued for checking any significant changes in natural ecosystem.	
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 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 March, and Mazhar point should be used from April to October every year for transporting coal which has been mentioned in the EIA Report.	Not applicable in this stage	Suggested to comply as and when required.
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.			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
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 • 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?			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• 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 • 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.)			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• 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			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• 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			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• 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 25th monitoring program (July, 2020)

Monitoring team

Ambient Noise level acquisition

Measuring the light intensity

Measuring tree height

Collecting Forest soil samples

Measuring tree DBH

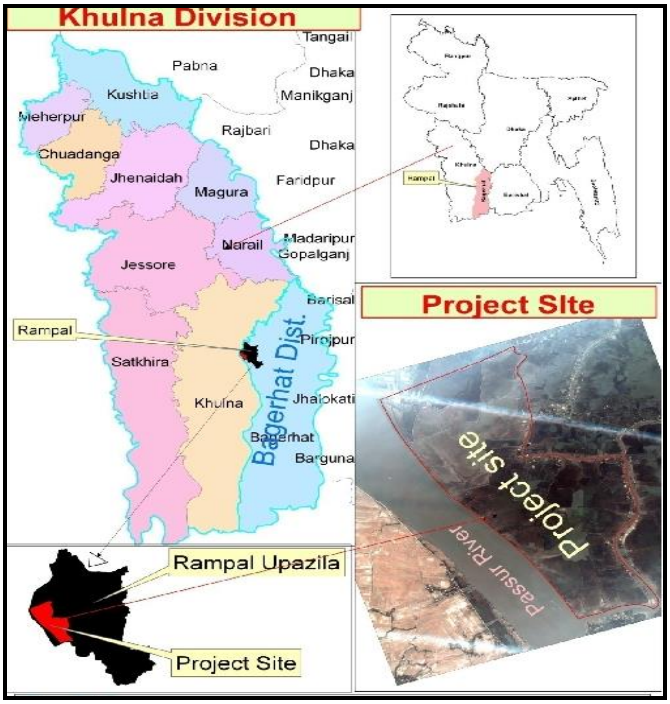
Data acquisition for forest health

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

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


</td></tr>
<tr><td>Project Capacity:</td><td>1320 MW (2x660 MW), based on Ultra Super-critical Technology</td></tr>
<tr><td>Mode of Operation:</td><td>Base Load</td></tr>
<tr><td>Fuel:</td><td>Imported Coal</td></tr>
<tr><td>Fuel Transportation:</td><td>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.</td></tr>
</table>

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
	Soil quality (Salinity, pH, OM,)
	Cropping pattern and crop intensities
	Irrigation and crop production
	Farmers survey result
Fisheries	Fish diversity and specification

Monitoring Parameter	Indicators
	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	Bangladesh (DoE) Standard (ECR 2005)
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	
		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	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	127.65	68.12	80.28	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	108.48	98.26	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	65^{24hr}
	PM_{10}	814.69	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	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	106.35	95.24	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{8hr}
NW Corner of	$PM_{2.5}$	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	65^{24hr}

Locations of Monitoring	Pollutants	1^{st} QM, Apr 2014	2^{nd} QM, Jul 2014	3^{rd} QM, Oct 2014	4^{th} QM, Jan 2015	5^{th} QM, Apr 2015	6^{th} QM, Jul2015	7^{th} QM, Oct 2015	8^{th} QM, Jan 2016	9^{th} QM, Apr 2016	10^{th} QM, Jul 2016	11^{th} QM, Oct 2016	12^{th} QM, Jan 2017	13^{th} QM, April, 2017	14^{th} QM, Oct, 2017	15^{th} QM Jan, 2018	16^{th} QM April, 2018	17^{th} QM, Jul 2018	18^{th} QM, Nov, 2018	19^{th} QM, Feb, 2019	20^{th} QM, Apr, 2019	21^{st} QM, Jul, 2019	22^{nd} QM, Jul, 2019	23^{rd} QM, Feb, 2020	25^{th} QM, July, 2020	Bangladesh (DoE) Standard (ECR 2005)
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	
			Concentrations are in µg/m³																							
the PP area	**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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	65^{24hr}
	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{8hr}
	$PM_{2.5}$	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	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	Bangladesh (DoE) Standard (ECR 2005)
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	
			Concentrations are in $\mu g/m^3$																							
Pankhali, Dacope	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{8hr}
Harbaria, Sundarbans	$PM_{2.5}$	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	65^{24hr}
	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{8hr}
Akram Point,	$PM_{2.5}$	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	65^{24hr}

Locations of Monitoring / Weather	Pollutants	1st QM, Apr 2014 / Sunny	2nd QM, Jul 2014 / Rainy/ Cloudy	3rd QM, Oct 2014 / Sunny	4th QM, Jan 2015 / Sunny	5th QM, Apr 2015 / Sunny	6th QM, Jul2015 / Rainy/ Cloudy	7th QM, Oct 2015 / Sunny/ Rainy	8th QM, Jan 2016 / Sunny	9th QM, Apr 2016 / Sunny	10th QM, Jul 2016 / Rainy/ Cloudy	11th QM, Oct 2016 / Rainy/ Cloudy	12th QM, Jan 2017 / Sunny	13th QM, April, 2017 / Sunny/ Cloudy	14th QM, Oct, 2017 / Sunny	15th QM Jan, 2018 / Sunny	16th QM April, 2018 / Sunny/ Cloudy	17th QM, Jul 2018 / Rainy/ Cloudy	18th QM, Nov, 2018 / Sunny/ Cloudy	19th QM, Feb, 2019 / Sunny	20th QM, Apr, 2019 / Sunny	21st QM, Jul, 2019 / Sunny/ Cloudy	22nd QM, Jul, 2019 / Sunny/ Cloudy	23rd QM, Feb, 2020 / Sunny	25th QM, July, 2020 / Rainy/ Cloudy	Bangladesh (DoE) Standard (ECR 2005)
		Concentrations are in μg/m³																								
Sundarbans	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	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	Bangladesh (DoE) Standard (ECR 2005)
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	
		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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	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	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	200^{8hr}
	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	365^{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	100^{Annual}
	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	$(10000)^{8hr}$
	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	157^{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	√

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	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
	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
	PM	√	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
Khulna City, near Khan Jahan Ali Bridge	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	pH Values																								
		Apr	July	Oct	Jan	Apr	July	Oct	Jan	Apr	July	Oct	Jan	Apr	Oct	Jan	Apr	July	Nov	Feb	Apr	July	Nov	Feb	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	
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	
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	
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	
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	
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	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	
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	
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	6.5– 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	
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	
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	
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	
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	
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	
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	

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 in Passur River

Sl. No.	Sampling Locations	Temperature (°C)																								
		Apr	Jul	Oct	Apr	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	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	
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	
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	
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	
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	
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	
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	
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	20°C – 30°C
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	
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	
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	
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	
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	
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	
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	
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		

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	Salinity (ppt)																								
		Apr 1QM	Jul 2QM	Oct 3QM	jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Oct 14QM	Jan 15QM	Apr 16QM	Jul 17QM	Nov 18QM	Feb 19QM	Apr 20QM	July 21QM	Nov 22QM	Feb 23QM	July 25QM	
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	**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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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		

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 in Passur River

SL	Sampling Locations	Dissolve Oxygen (mg/L)																								
		Apr 1QM	Jul 2QM	Oct 3QM	Jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Oct 14QM	Jan 15QM	Apr 16QM	Jul 17QM	Nov 18QM	Feb 19QM	Apr 20QM	July 21QM	Nov 22QM	Feb 23QM	July 25QM	
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	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	
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	
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	
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	
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	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	
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	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	
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	
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	
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	
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	
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	
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		

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)

Table B.5: BOD_5 of Passur River Water

SL	Sampling Locations	Apr 1QM	Jul 2QM	Oct 3QM	Jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Oct 14QM	Jan 15QM	Apr 16QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	3.4	2.2	1.9	1.6	3.1	3	2.1	2.1	2.8	2.4	2.8	1.8	2.1	1.9	2.1	3	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	3.3	4.1	2.3	3.2	2.4	1.9	2.2	3.2	2.8	2.7	1.9	3.4	2.1	1.9	2	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	2.2	2.8	3.4	2.7	3.1	2.9	3.4	1.9	3	2.5	2.8	1.9	2.5	2.7	1.9	3	
4	Left Bank of Passur River at Project Site-Jetty	3.2	3.1	4.0	0.8	3	4.4	3.2	1.1	3.6	2.1	3.1	2.1	2.4	2.8	2.0	4	
5	Middle of Passur River at Project Site-Jetty	3.0	2.5	3.5	1.4	3.5	4.3	3.7	2.4	3.3	2.2	2.5	2.2	2.6	2.4	2.0	4	
6	Right Bank of Passur River at Project Site-Jetty	5.8	3.5	3.6	2.0	3.4	3.7	2.9	1.7	3.1	3.1	2.9	2.1	3.1	2.1	2.3	4	
7	Left Bank of Passur River at South West corner from the Project boundary	3.9	2.8	2.6	1.0	3.1	5.3	2.2	1.2	3.1	2.9	2.4	2.1	3.2	2.4	2.0	5	
8	Middle of Passur River at South West corner from the Project boundary	3.8	3.3	2.8	2.6	3.2	5.2	2.3	2.3	2.6	2.7	2.7	1.9	2.5	2.7	1.9	5	
9	Right Bank of Passur River at South West corner from the Project boundary	6.5	3.8	2.9	2.1	3.4	5	3.1	2.4	3	3.1	3.1	2.1	2.6	2.3	2.1	5	
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	3.2	3.3	5.5	1.5	3.2	3.9	4.2	2.7	3.3	3.4	2.8	1.8	3.4	2.4	2.1	4	
11	Maidara river near proposed township area	4.1	3.7	4.0	2.0	3.4	4.2	1.6	1.8	3.5	3.2	2.9	2.1	3.2	2.1	2.0	4	
12	Passur river at Passur-Ghasiakhali confluence	2.3	2.2	1.7	2.0	3.3	4.9	2.1	2.2	3.4	2.8	2.3	2	2.7	3.1	2.4	3.1	
13	Passur river at Harbaria of Sundarbans	2.2	2.5	2.6	1.9	2.4	3.9	2.7	2.1	3.2	2.8	2.7	2.1	2.7	3.1	2.9	2.3	
14	Passur river at Akram point of Sundarbans	3.4	2.2	1.9	1.6	3.1	3	2.1	2.1	2.8	2.4	2.8	1.8	2.1	1.9	2.1	3	
15	Passur river at Hiron point of Sundarbans	4.9	3.3	4.1	2.3	3.2	2.4	1.9	2.2	3.2	2.8	2.7	1.9	3.4	2.1	1.9	2	

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: COD of Passur River System

Sl	Sampling Locations	COD (mg/L)																						
		Apr 1QM	Jul 2QM	Oct 3QM	Jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Oct 14QM	Jan 15QM	Apr 16QM	Jul 17QM	Nov 18QM	Feb 19QM	Apr 20QM	July 21QM	Nov 22QM	Feb 23QM
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

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: Oil and grease concentration of Passur River System

Sl	Sampling Locations	Oil and Grease (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	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22 QM	23QM	
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	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	
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	10
4	Passur river at Hiron 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	
5	Akram 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	

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: TDS of Passur River System

SL	Sampling Locations	TDS (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
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

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: TH Passur River System

SL	Sampling Locations	TH (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
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM
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
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
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
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
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
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
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
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
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
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
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
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
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

SL	Sampling Locations	TH (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
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM
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
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

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: TSS Passur River System

SL	Sampling Locations	TSS (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
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM
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
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
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
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
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
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
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
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
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
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	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
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
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
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
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

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: Nitrate (NO_3^{2-}) concentration of Passur River System

Sl	Sampling Locations	NO_3^{2-} (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
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM
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**
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	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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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: Sulphate (SO_4^{2-}) concentration of Passur River System

Sl	Sampling Locations	SO_4^{2-} (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
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM
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
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	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
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
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
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
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
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
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
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
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
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
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
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
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

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: Phosphate (PO_4^{2-}) concentration of Passur River System

Sl	Sampling Locations	PO_4^{2-} (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
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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: Arsenic (As) concentration of Passur River System

Sl	Sampling Locations	As (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**
		1QM	**2QM**	**3QM**	**4QM**	**5QM**	**6QM**	**7QM**	**8QM**	**9QM**	**10QM**	**11QM**	**12QM**	**13QM**	**14QM**	**15QM**	**16QM**	**17QM**	**18QM**	**19QM**	**20QM**	**21QM**	**22QM**	**23QM**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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: Pb concentration of Passur River System

Sl	Sampling Locations	Pb (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**
		1QM	**2QM**	**3QM**	**4QM**	**5QM**	**6QM**	**7QM**	**8QM**	**9QM**	**10QM**	**11QM**	**12QM**	**13QM**	**14QM**	**15QM**	**16QM**	**17QM**	**18QM**	**19QM**	**20QM**	**21QM**	**22QM**	**23QM**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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.16: Hg concentration of Passur River System

Sl	Sampling Locations	Hg (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**
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	**23QM**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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.17: pH and Temperature of Ground Water

Sl	Locations	Tube Well Type	pH value																						
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM
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	MF	7.1	8.3	8.2	7.2	7.8	**8.1**
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**
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**
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	

Source: CEGIS Field Survey

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

Locations	Tube Well Type	Temperature (ºC)																						
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM
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
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
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
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	

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.18: Salinity and DO in Groundwater

Sl	Locations	Tube Well Type	Salinity (ppt)																						
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM
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
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
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
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

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	DO (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	July
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM
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
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
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
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

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.19: TDS and TSS concentrations in Groundwater

SL	Locations	Type of tube wells	TDS (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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22nd QM	23rd QM
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
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
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
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	

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	TSS (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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22nQM	23rd QM
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
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	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
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

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.20: TH concentrations in Groundwater

Sl No	Locations	Type of tubewell	TH (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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23rd QM
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
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
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
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	

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.21: COD concentrations of monitored ground water locations

Sl	Locations	Tube-well Type	COD (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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23rd QM
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**
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**
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	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	

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.22: NO_3^- Concentrations in Ground Water

Sl	Locations	Type of tube well	NO_3^{2-} (mg/L) *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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23rd QM
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**
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**
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**
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	

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.23: SO_4^{2-} Concentrations in Ground Water

Sl	Location	Typeof Tubewell	SO_4^{2-} (mg/L) *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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23rd QM
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
2	**Rajnagar**	**Deep (>600 ft)**	-	2	-	-	-	-	2	6	2	1	1	1	1	1	2	2	4	1	2	1	2	2	3
3	**Kapasdanga**	**Deep (>600 ft)**	-	10	-	-	-	-	2	2	8	1	1		3	2	6	4	6	1	1	4	1	1	2
4	**Kalekarber**	**Shallow (<250 ft)**	NF	3	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:

*NF=Nonfunctional; *Drinking water quality standards, The Environment Conservation Rules, 1997*

Table B.24: PO_4^{3-} Concentrations in Ground Water

Sl	Location	Typeof Tubewell	PO_4^{2-} (mg/L) *BD Standard (6.0 mg/L)																						
			Apr 1QM	Jul 2QM	Oct 3QM	Jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Oct 14QM	Jan 15QM	Apr 16QM	Jul 17QM	Nov 18QM	Feb 19QM	Apr 20QM	July 21QM	Nov 22QM	Feb 23rd QM
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**
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**
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**
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

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.25: As concentrations (mg/L) of monitored ground water locations

Sl	Locations	As (mg/L) *BD Standard (0.05 mg/L)																						
		Apr 1QM	Jul 2QM	Oct 3QM	Jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Jul 14QM	Oct 15QM	Jan 16QM	Apr 17QM	Jul 18QM	Nov 19QM	Feb 20QM	Apr 21QM	July 21QM	Nov 22QM	Feb 23rd QM
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
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
3	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
4	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

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: Pb concentrations (mg/L) of monitored ground water locations

Sl	Locations	Pb (mg/L) *BD Standard (0.05 mg/L)																						
		Apr 1QM	Jul 2QM	Oct 3QM	Jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Jul 14QM	Oct 15QM	Jan 16QM	Apr 17QM	Jul 18QM	Nov 19QM	Feb 20QM	Apr 21QM	July 22QM	Nov 22QM	Feb 23rd QM
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
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
3	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
4	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

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: Hg concentrations (mg/L) of monitored ground water locations

Sl	Locations	Hg (mg/L) *BD Standard (0.001 mg/L)																						
		Apr 1QM	Jul 2QM	Oct 3QM	Jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Jul 14QM	Oct 15QM	Jan 16QM	Apr 17QM	Jul 18QM	Nov 19QM	Feb 20QM	Apr 21QM	July 21QM	Nov 22QM	Feb 23rd QM
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**
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**
3	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**
4	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**

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.28: PAH concentrations of monitored locations

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

Table B.29: TOC concentrations of monitored locations

Monitoring sites	July, 2018		January, 2019		July, 2020		February, 2020	
	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)
Project jetty site	26.4	19.5	20.7	14.3	17.2	13.6	37.5	26.4
Majhar point	21.9	25.1	24.8	18.8	21.7	18.1	21.7	18.1
Hiron point	NM	NM	6.8	5.7	NM	NM	8.1	6.7

(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

Note: NM-Not measured.

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 Survey

Note: NM-Not measured.

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

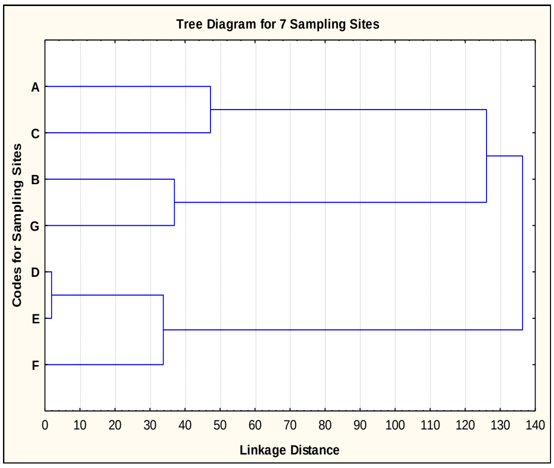
Sl No	Location	QM 21 (Noise Level in dB (A)) July-19				QM 22 (Noise Level in dB (A)) November-19				QM 23 (Noise Level in dB (A)) February 20				QM 25 (Noise Level in dB (A)) July, 20			
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day 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
1	Chalna, Dacope	55.92	60.88	61.23	59.34	58.98	61.03	55.78	58.60	56.24	54.09	53.45	54.59	52.00	51.11	50.56	51.28
2	NW Corner of the Project area	56.44	53.21	55.88	55.18	48.92	53.45	50.97	51.11	40.96	43.33	51.98	45.42	43.9	42.95	43.26	43.37
3	Chunkuri-2, Bajua	56.15	63.34	58.60	59.36	58.39	52.92	54.51	55.27	59.78	51.59	54.96	55.44	49.42	48.52	48.32	48.75
4	SW corner of the Project area	66.94	58.41	65.65	63.66	47.67	49.98	42.05	46.57	56.35	54.05	56.40	55.60	49.91	49.78	50.85	50.18
5	Project site near Shapmari area	53.14	55.40	55.05	54.53	53.97	55.80	54.77	54.86	51.02	47.91	47.93	48.95	54.55	53.21	52.88	53.72
6	Barni, Gaurambha	51.36	57.98	NM	54.67	53.69	49.37	48.53	50.53	57.37	60.48	68.05	61.97	56.53	40.65	49.21	48.80
7	Khan Jahan Ali Bridge, Khulna	63.38	60.55	66.44	63.46	65.19	67.65	65.32	66.05	60.75	62.81	63.05	62.20	65.55	66.86	66.52	66.31
8	Mongla Port area	60.49	62.10	63.43	62.01	60.24	55.66	55.85	57.25	59.74	62.38	61.07	61.06	64.92	67.90	63.71	66.41
9	Harbaria, Sundarbans	47.62	42.18	NM	44.90	43.48	44.71	NM	44.10	45.59	42.29	41.35	43.94	47.80	52.15	41.2	49.97
10	Akram Point, Sundarbans	44.05	45.62	NM	44.84	47.12	42.60	NM	44.86	NM	36.59	40.46	36.59	51.04	45.11	43.1	51.04
11	Hiron Point, Sundarbans	NM	NM	NM	NM	39.2	41.34	NM	40.28	41.3	39.41	NM	40.34	NM	NM	NM	NM

Source: CEGIS field Survey

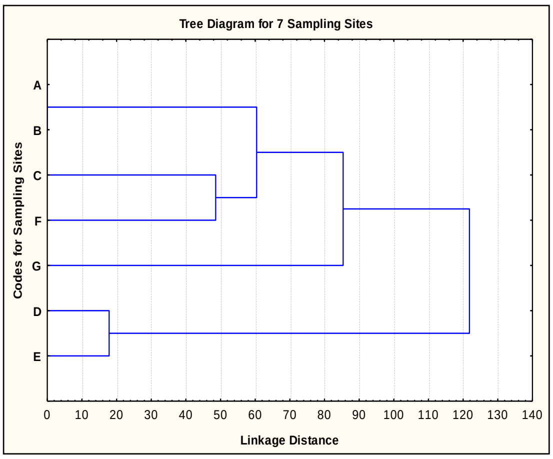
Note: NM-Not measured.

(D) Fisheries resources monitoring data

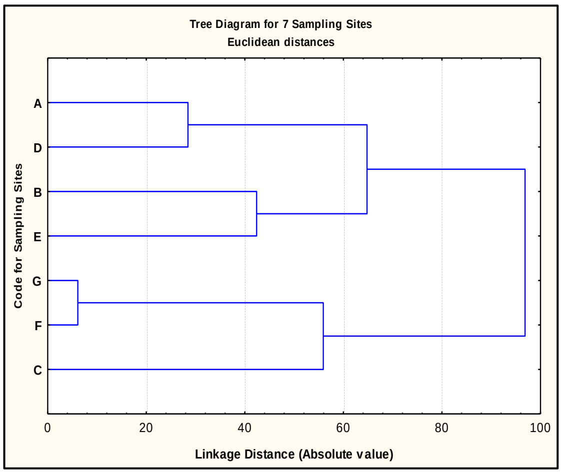
D1: Classification of functional habitat



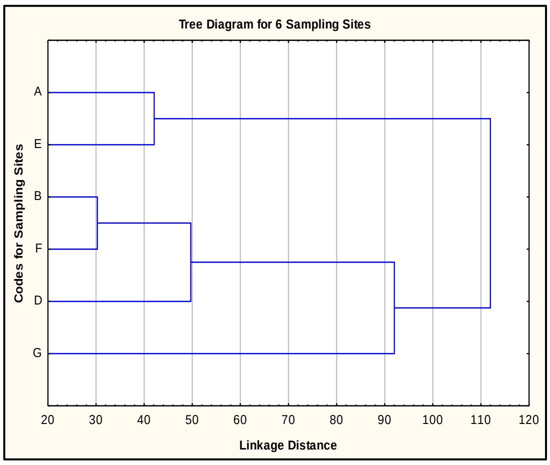
1st Monitoring, April, 2014



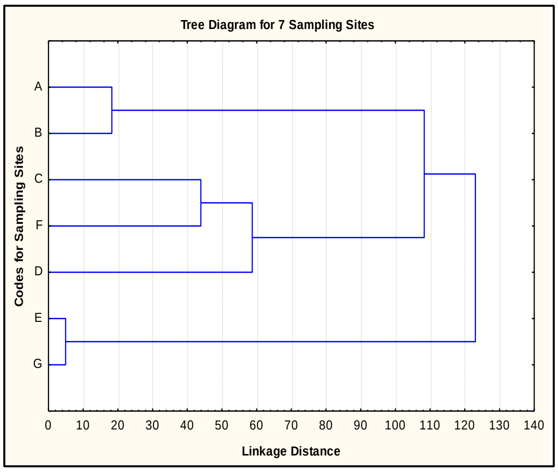
2nd Monitoring, July 2014



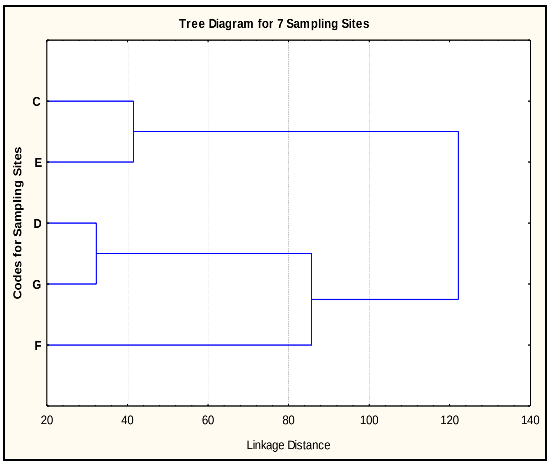
3rd Monitoring, October, 2014



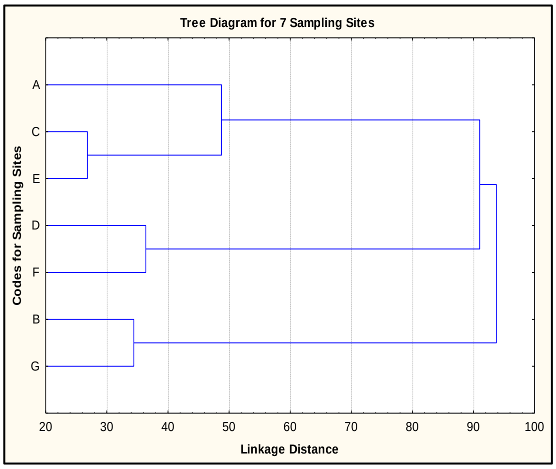
4th Monitoring, January 2015

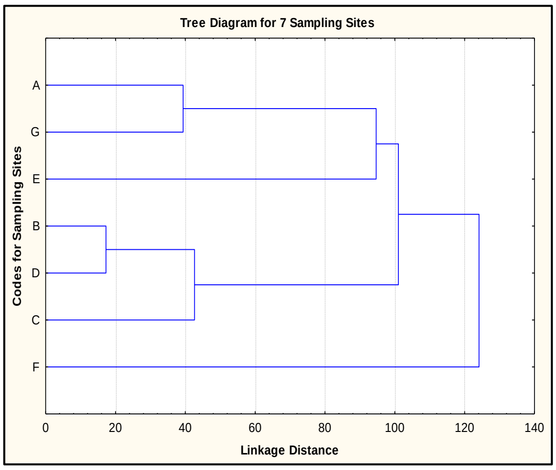


5th Monitoring, April, 2015



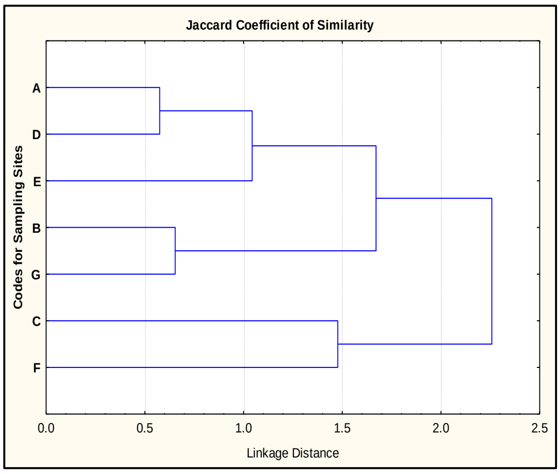
6th Monitoring, August, 2015

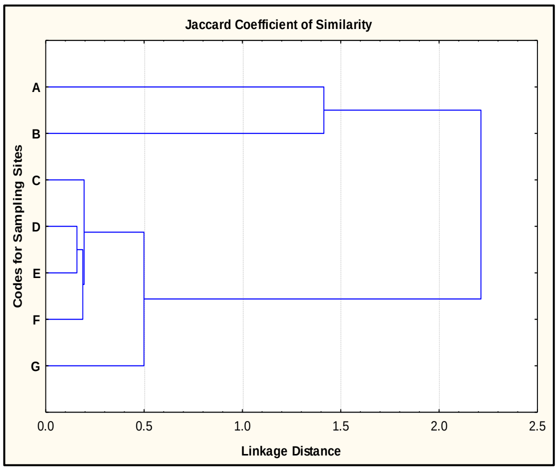


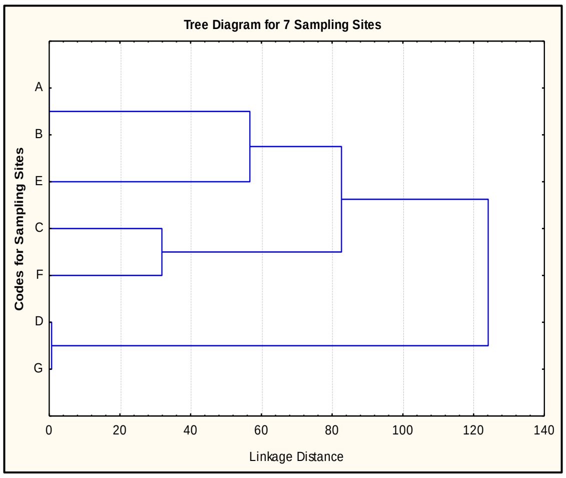


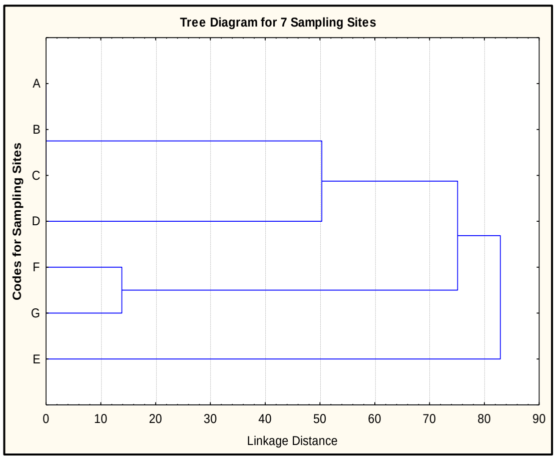
7th Monitoring, October, 2015

8th Monitoring, January, 2016



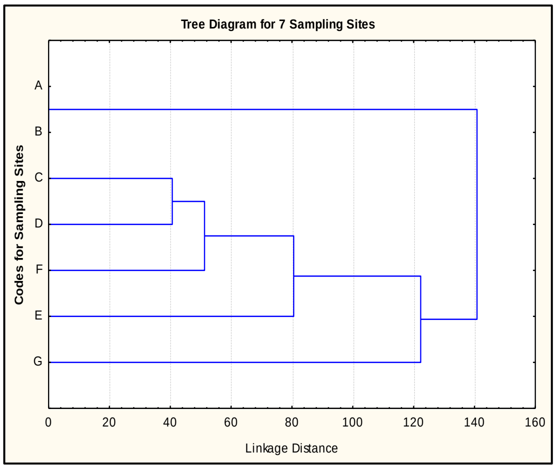




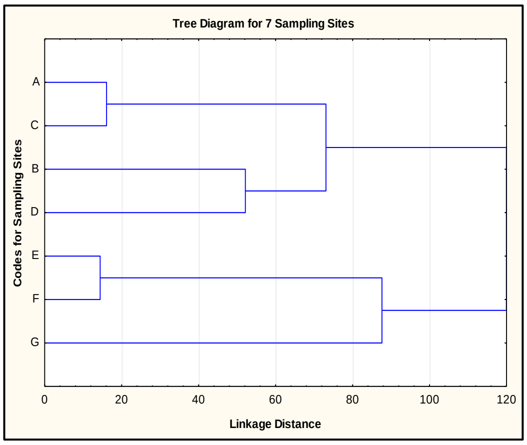


9th Monitoring, April, 2016

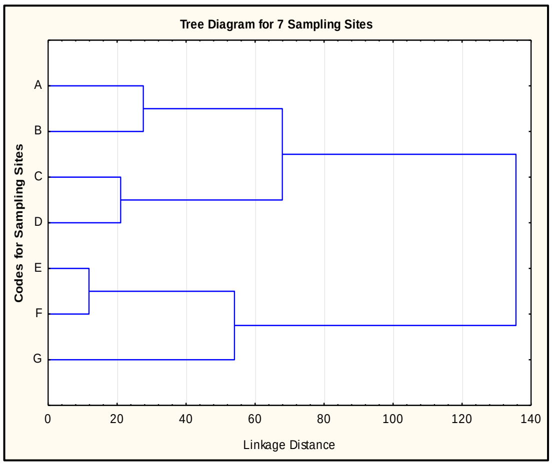
10th Monitoring, July, 2016



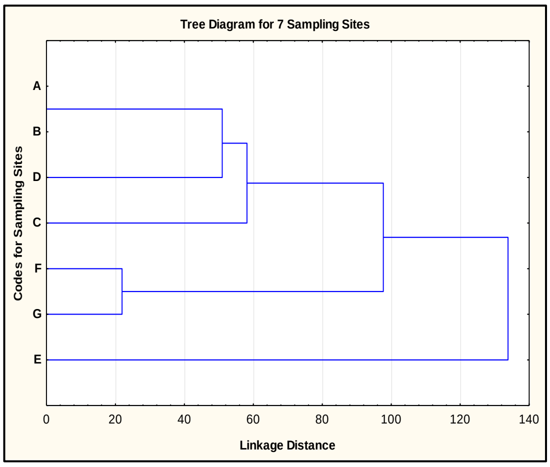
11th Monitoring, October, 2016



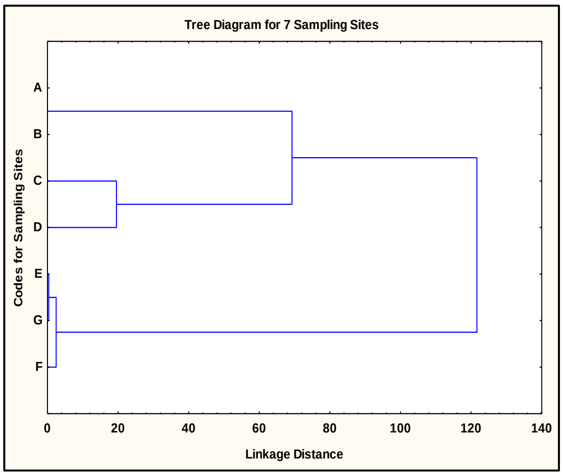
12th Monitoring, January, 2017



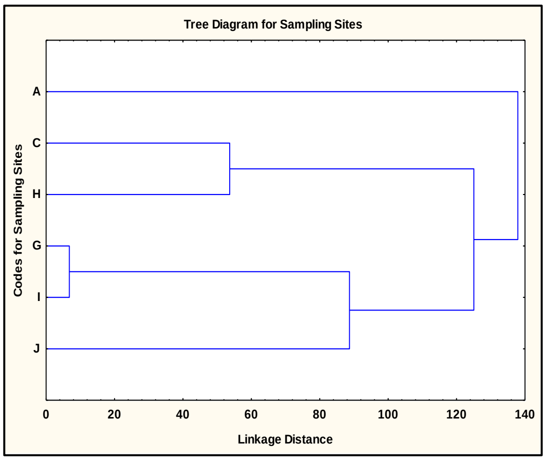
13th Monitoring, April, 2017



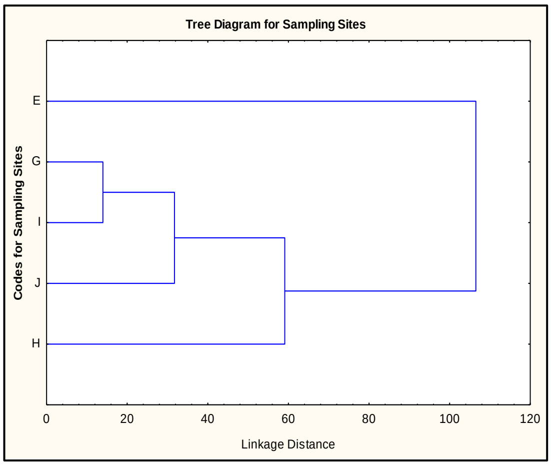
14th Monitoring, October, 2017



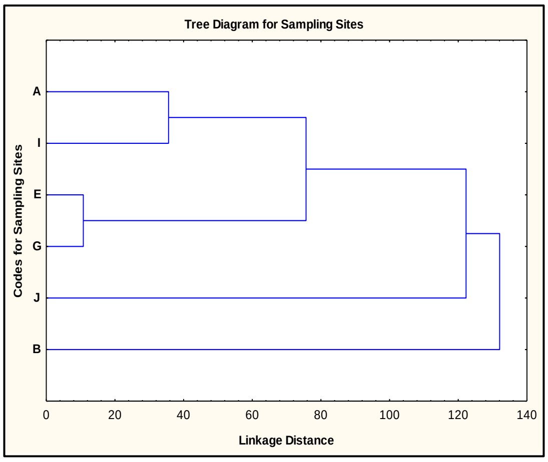
15th Monitoring, January, 2018



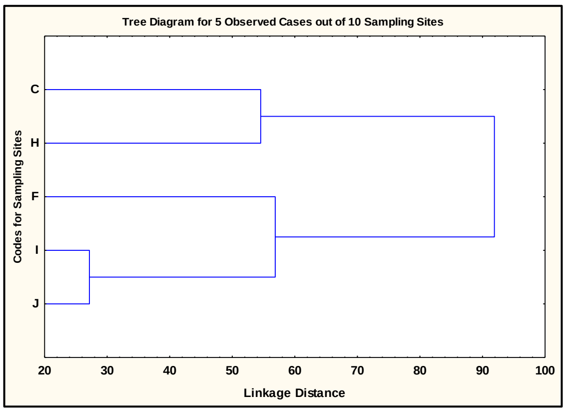
16th Monitoring, April, 2018



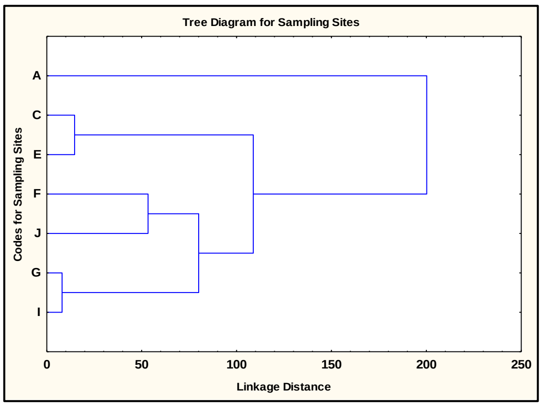
17th Monitoring, July, 2018



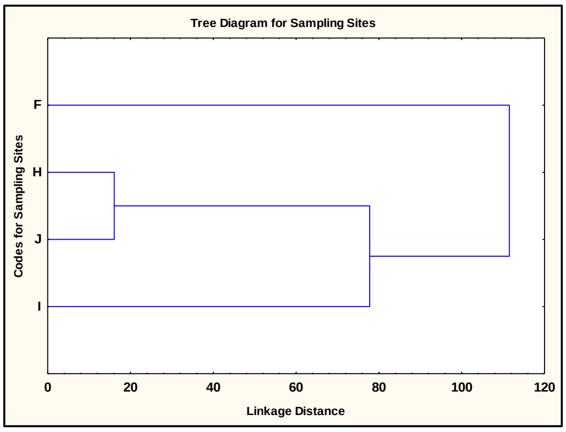
18th Monitoring, November, 2018



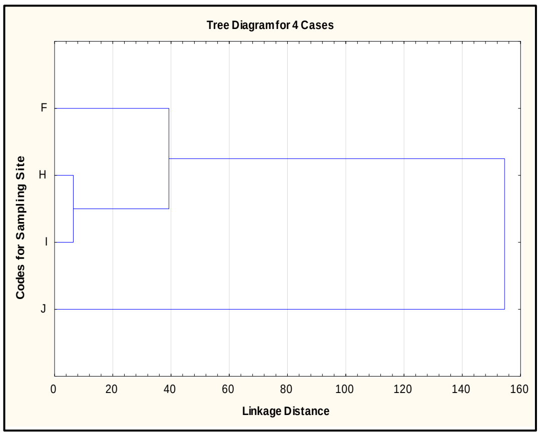
19th Monitoring, February, 2019



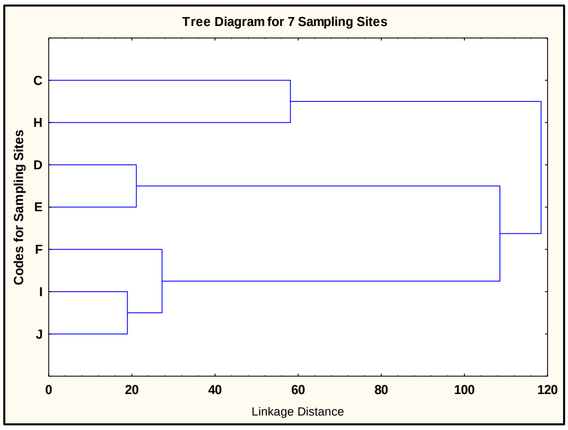
20th Monitoring, April, 2019



21st Monitoring, July 2019

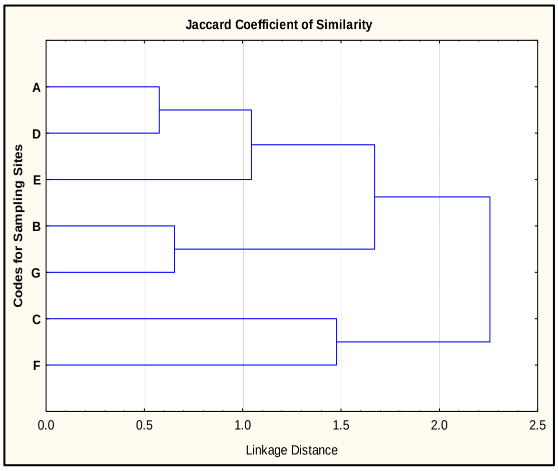


22nd Monitoring, November, 2019

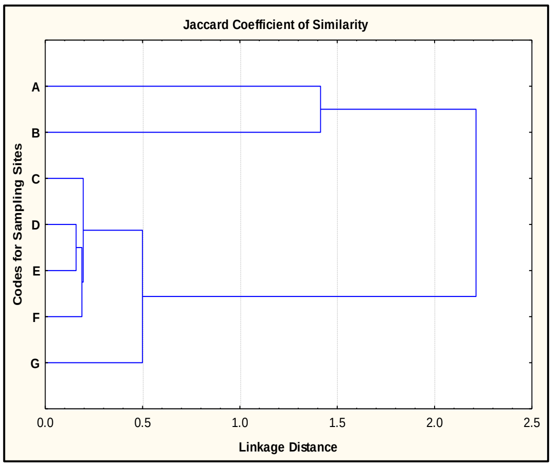


23rd Monitoring, February, 2020

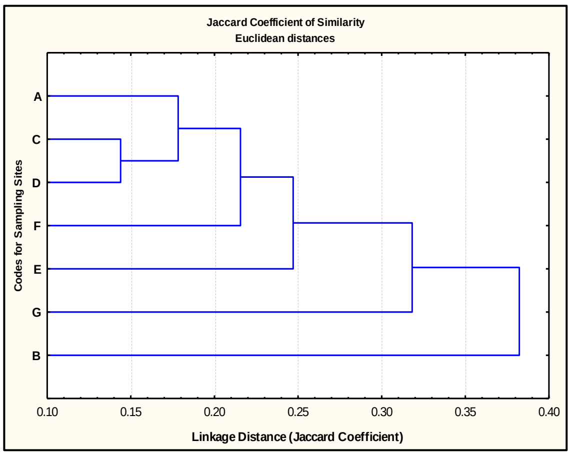
D2: Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence



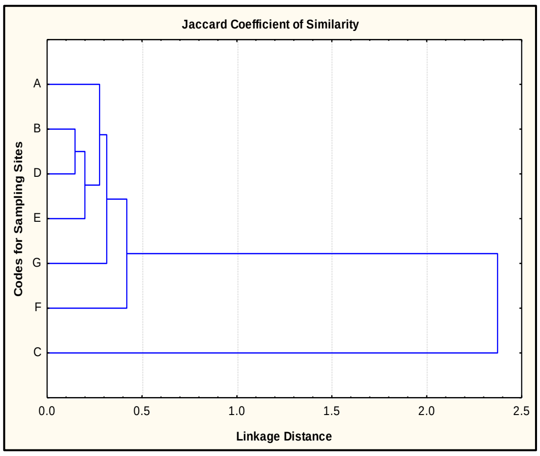
1st Monitoring, April, 2014



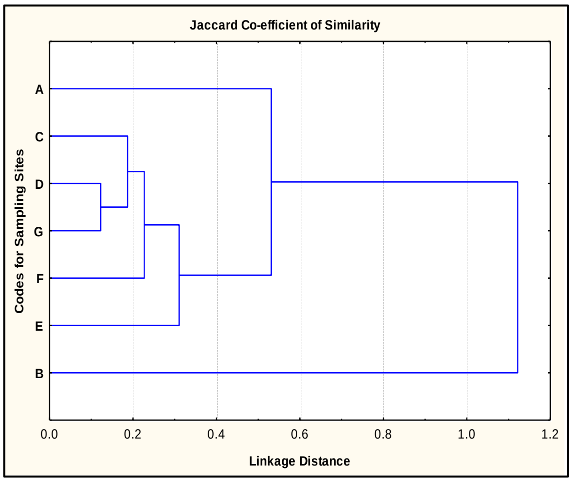
2nd Monitoring, July 2014



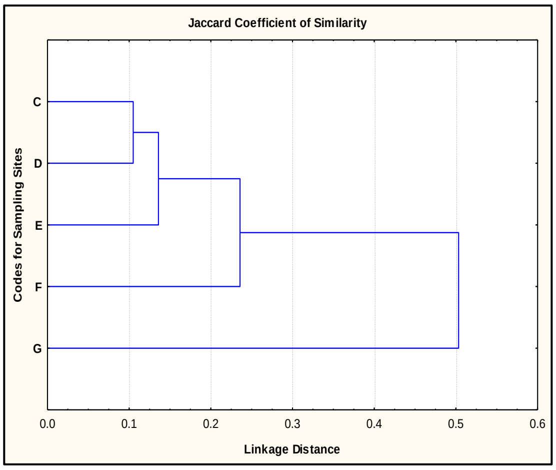
3rd Monitoring, October, 2014



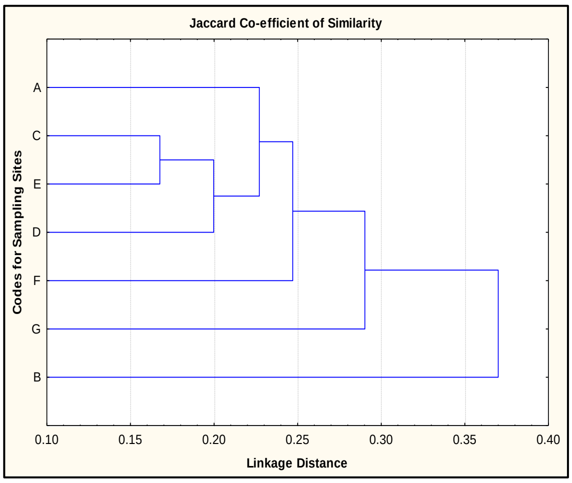
4th Monitoring, January 2015



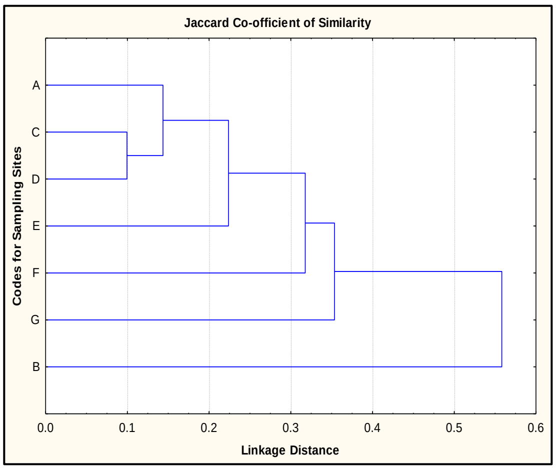
5th Monitoring, April, 2015



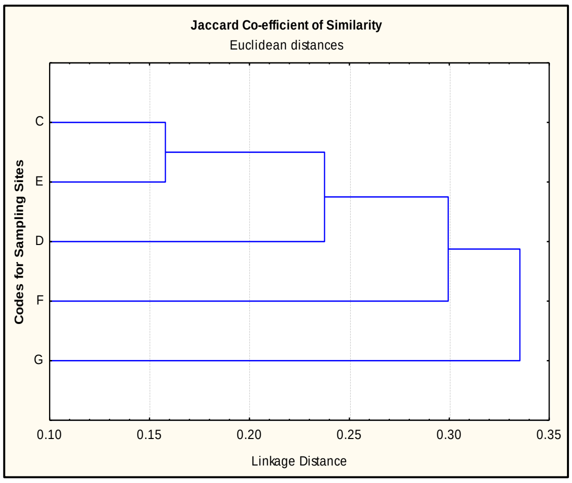
6th Monitoring, August, 2015



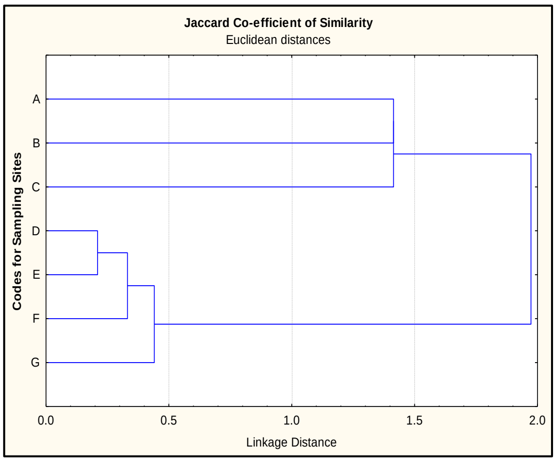
7th Monitoring, October, 2015



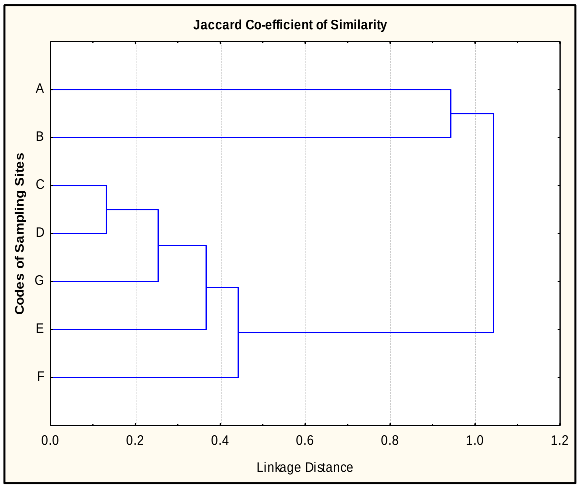
8th Monitoring, January, 2016



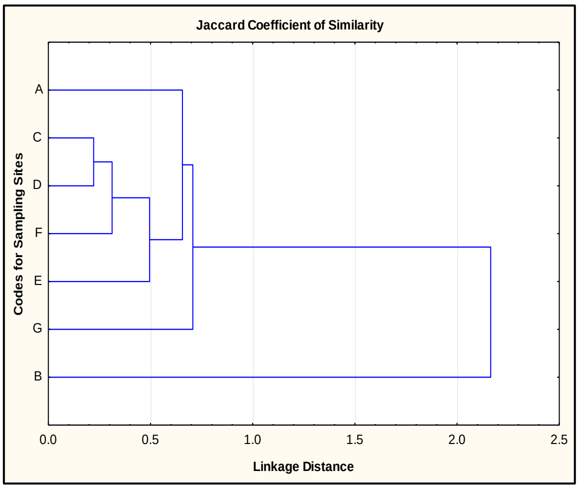
9th Monitoring, April, 2016



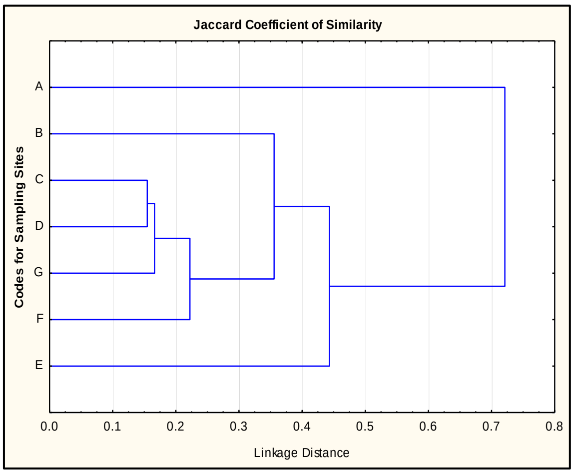
10th Monitoring, July, 2016



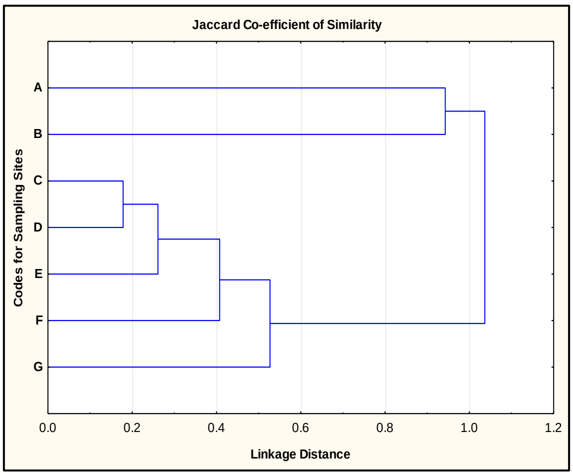
11th Monitoring, October, 2016



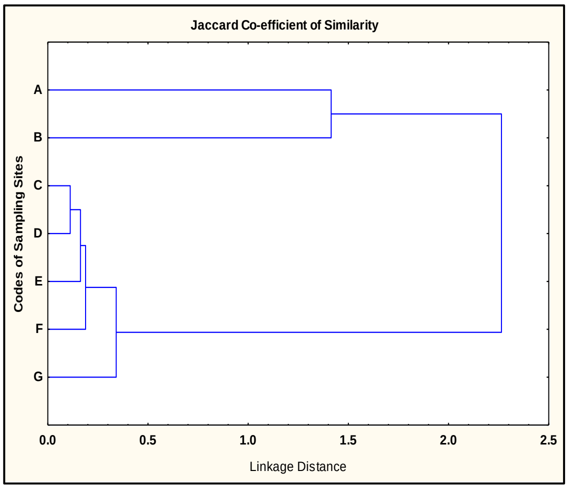
12th Monitoring, January, 2017



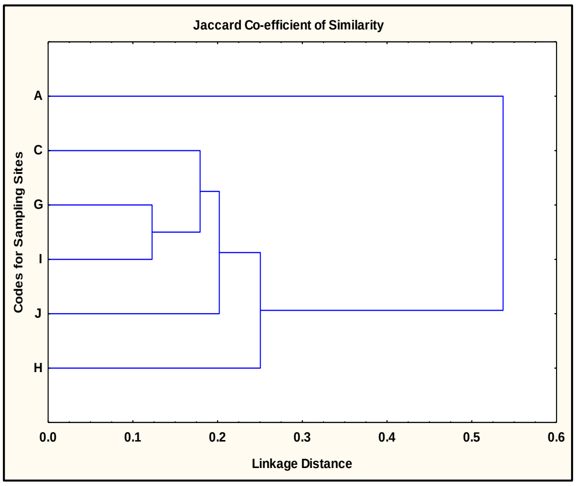
13th Monitoring, April, 2017



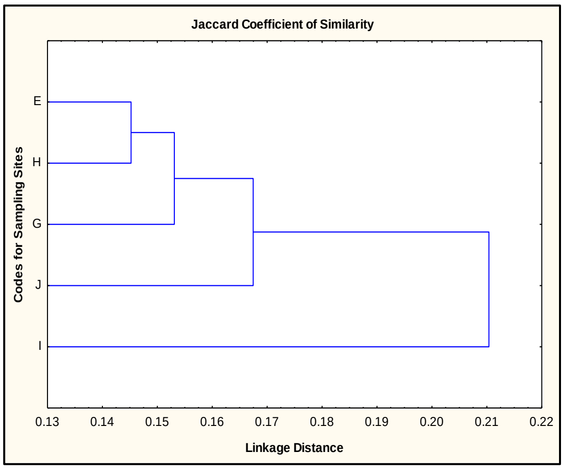
14th Monitoring, October, 2017



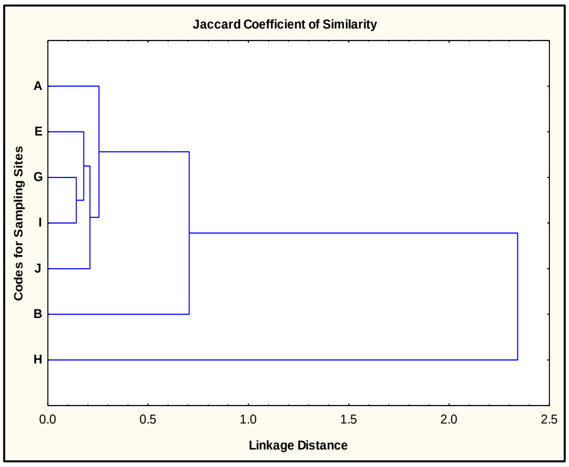
15th Monitoring, January, 2018



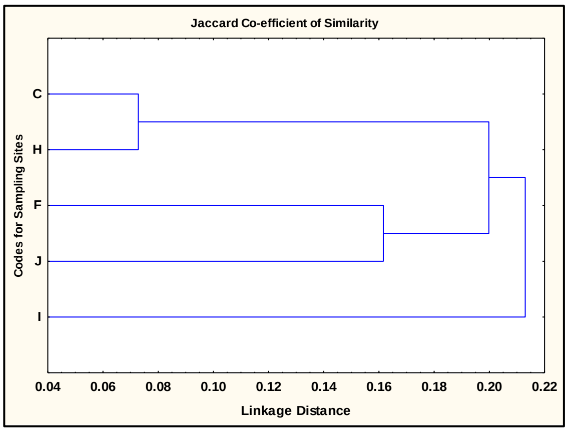
16th Monitoring, April, 2018



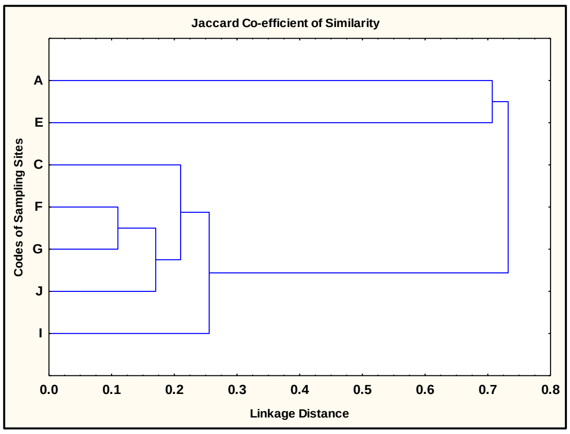
17th Monitoring, July, 2018



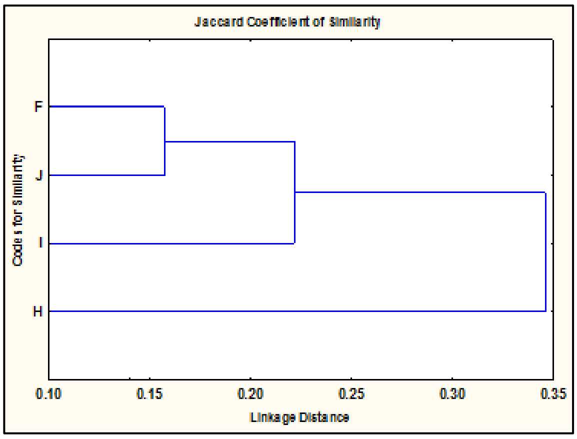
18th Monitoring, November, 2018



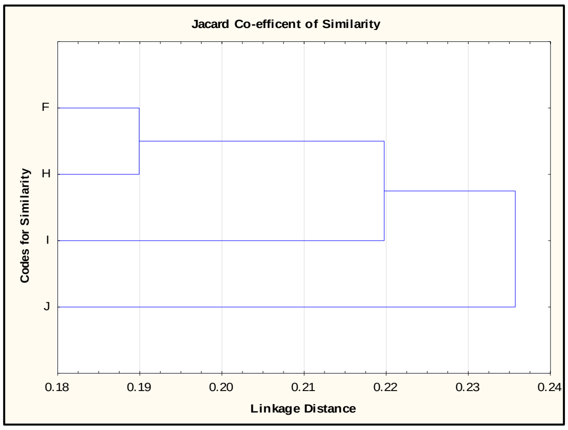
19th Monitoring, February, 2019



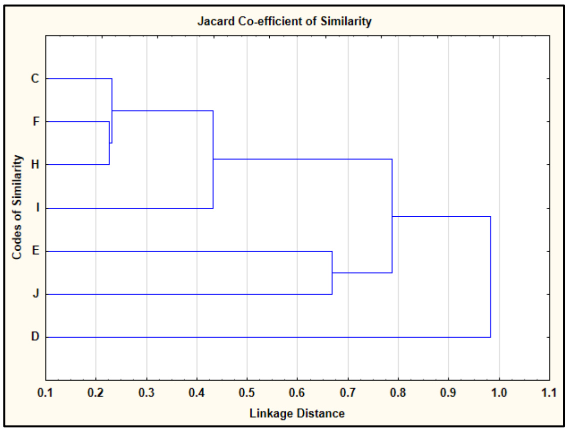
20th Monitoring, April, 2019



21st Monitoring, July 2019



22nd Monitoring, November 2019



23rd Monitoring, February 2020

D3: Different Fish Species in different quarter monitoring

Rupchanda in 1stQuarter of 1st Year

Chela in 2nd Quarter of 1st Year

Phesa, Chela, Hilsa, Gagla Tengra

Harina Chingri

Fish Species at 3rd Quarter Monitoring of 1st Year 2014-15

Amadi Chela

Banspata

Fish Species in Upstream of Passur River at 4th Quarter Monitoring of 1st Year 2014-15

Adult Poma in Chalna Point

Fry of Bagda at Chalna Point

Meth and Gagra Tengra

Gagra Tengra

Fish species found in 1st quarter of the second monitoring year (2015-16)

Mutkure and Paissa

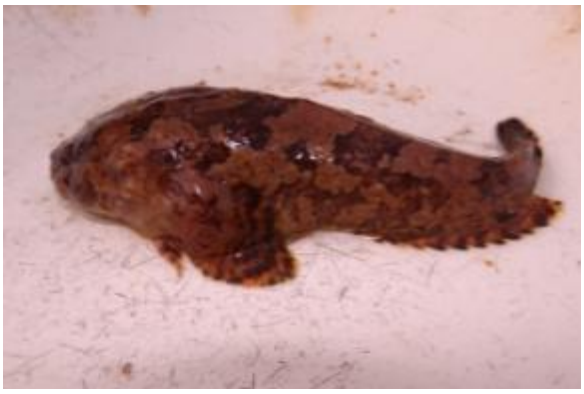
Khorsula

Menu

Vetki

Fish species found in 2nd quarter of the second monitoring year (2015-16)

Gulsha Tengra, Bele, Aswine Bele and Paissa



Gangania

Telcupa

Golda

Kain Magur

A Mix of Culture and Capture Fishes

Fish species found in 3rd quarter of the second monitoring year (2015-16)

Tau Paissa

Bele

Horina Chingri

Gulsha and Gagra Tengra

Jaba

Female Gulsha Tengra

Fry Fishes

Chata Bele

Fish species found in 4th quarter of the second monitoring year (2015-16)

Kain Magur

Banspata, Vetki, Koidda and Poma

Fish species found in 1st quarter of the 3rd monitoring year (2016-17)

Poma and Tapsi

Tapsi

Fish species found in 2nd quarter of the 3rd monitoring year (2016-17)

Miscellaneous Fish Species

Hilsha

Tapse

Poma and Tapse

Fish species found in 3rd quarter of the 3rd monitoring year (2016-17)

Catch Sample

Juvenile of Kain Magur

Khayra Chela

Jevenile of Pangas

Brood Paissa

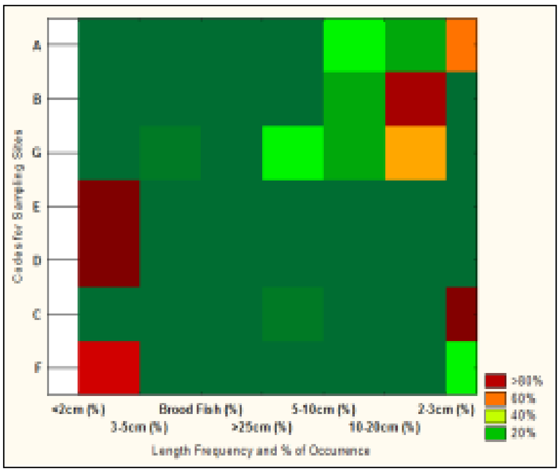
Paissa and Gagra Tengra

Aswene Bele, Daitna, Tapse and Chitra

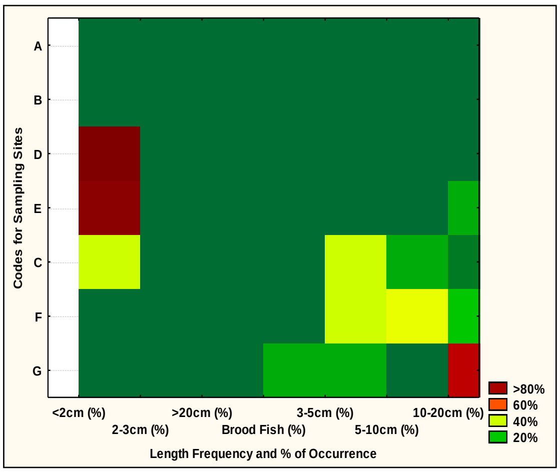
Dry Fish of Khayra Chela

Fish species found in 12th quarter of the monitoring year 2016-17

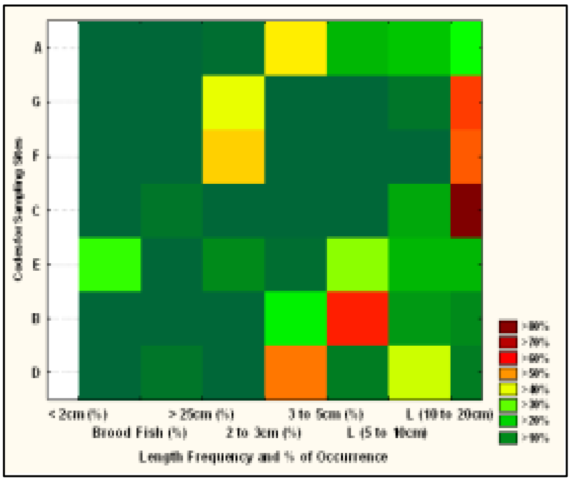
D4: Fish Community Structure



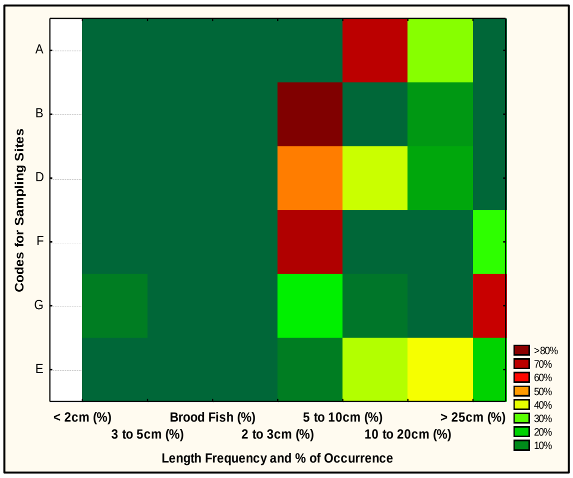
1st Monitoring, April, 2014



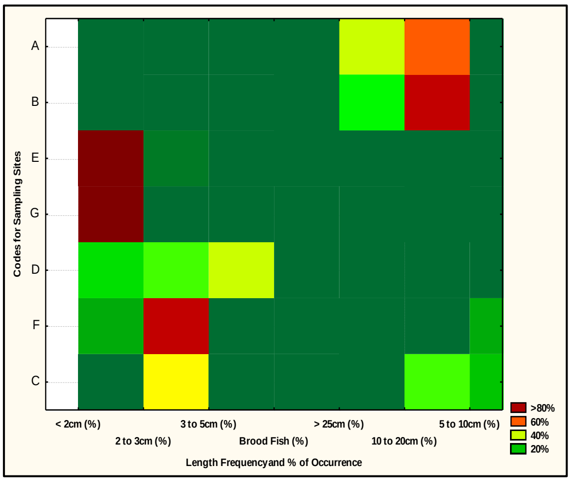
2nd Monitoring, July 2014



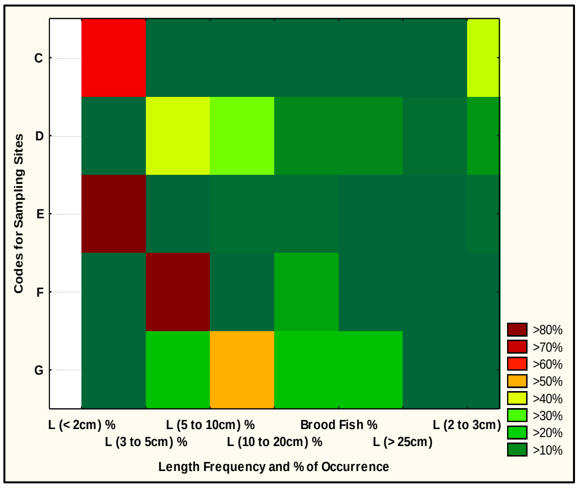
3rd Monitoring, October, 2014



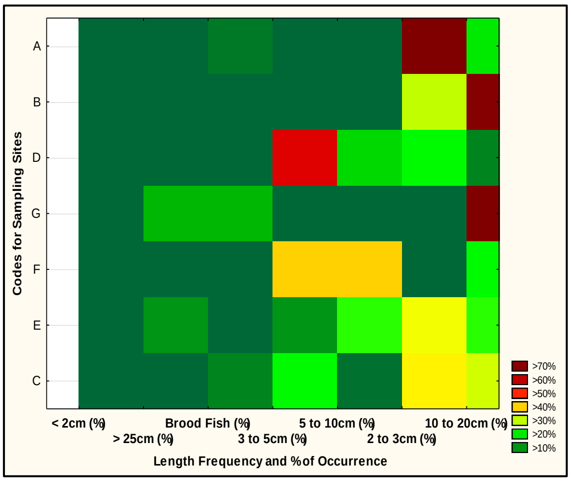
4th Monitoring, January 2015



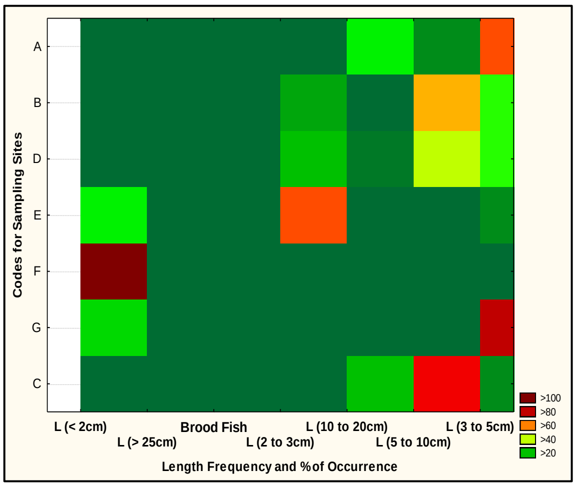
5th Monitoring, April, 2015



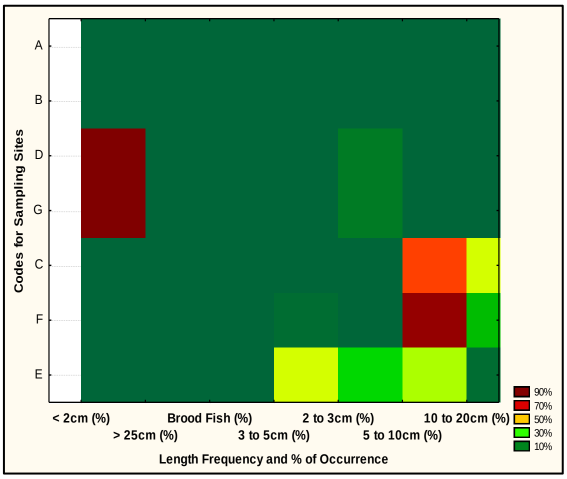
6th Monitoring, August, 2015



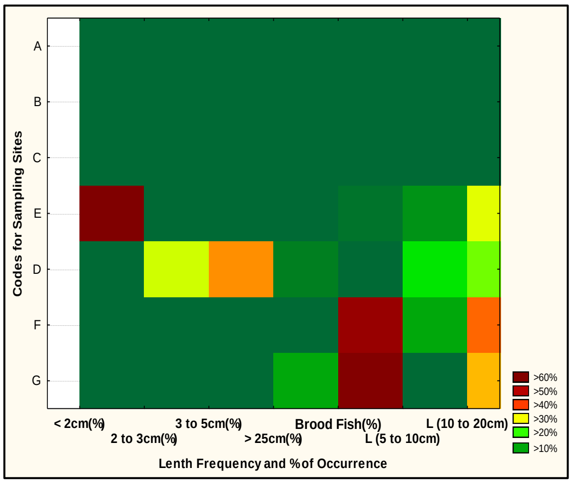
7th Monitoring, October, 2015



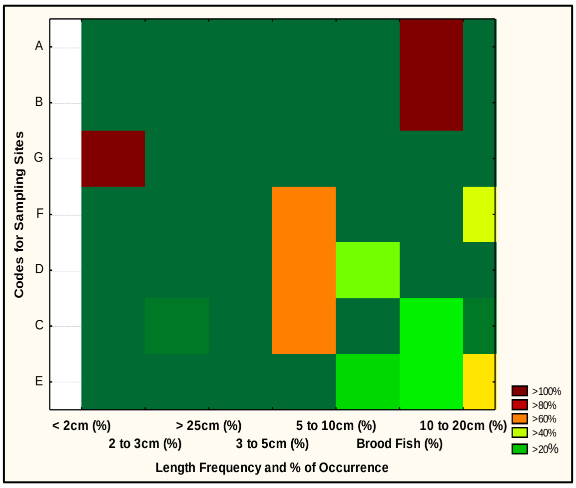
8th Monitoring, January, 2016



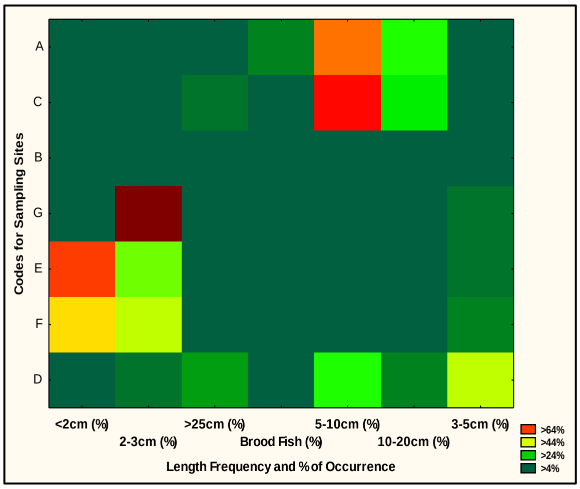
9th Monitoring, April, 2016



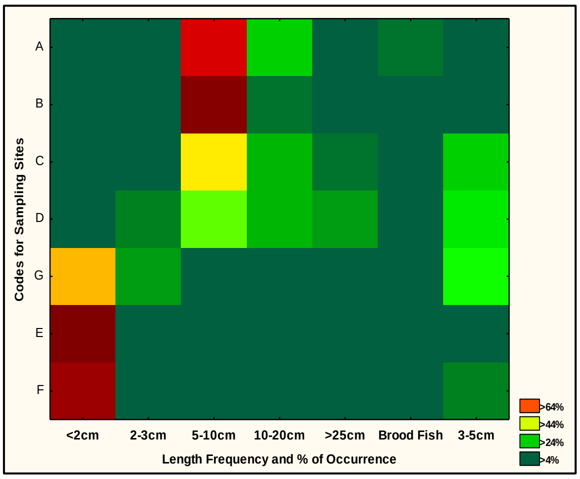
10th Monitoring, July, 2016



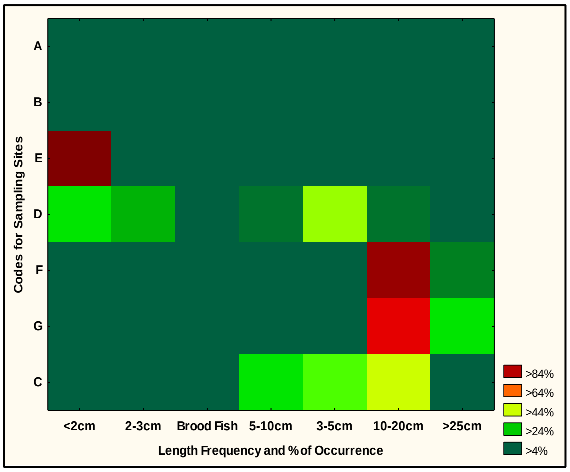
11th Monitoring, October, 2016



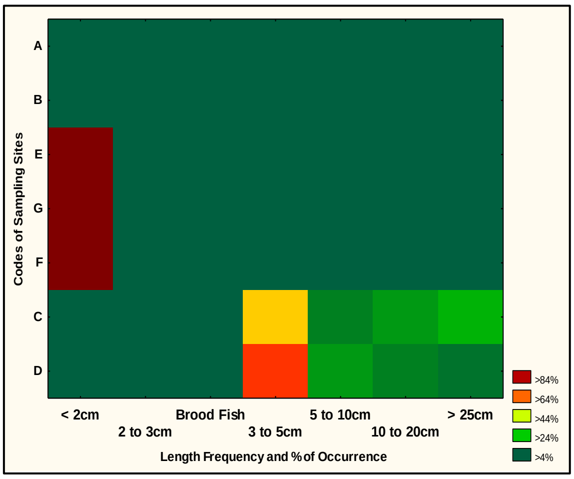
12th Monitoring, January, 2017



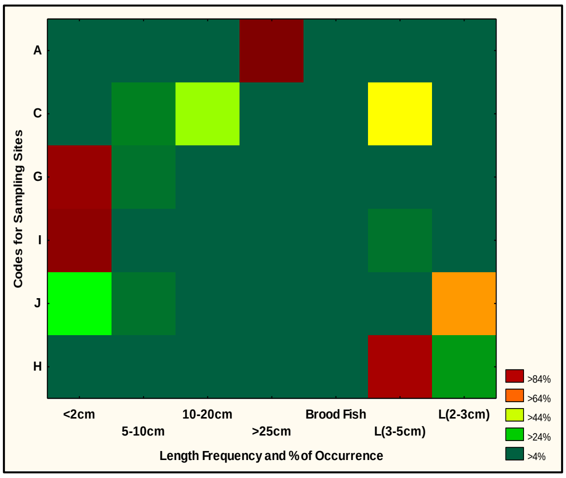
13th Monitoring, April, 2017



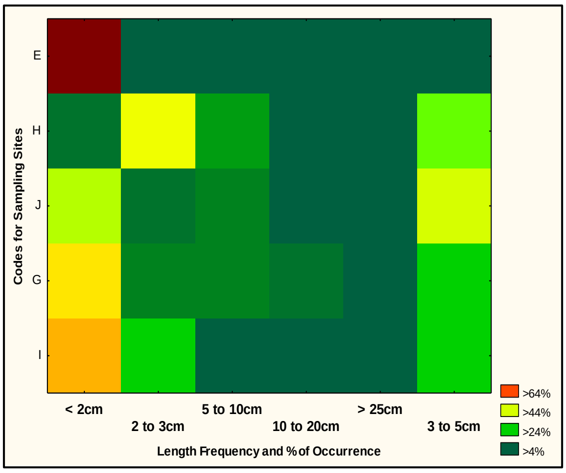
14th Monitoring, October, 2017



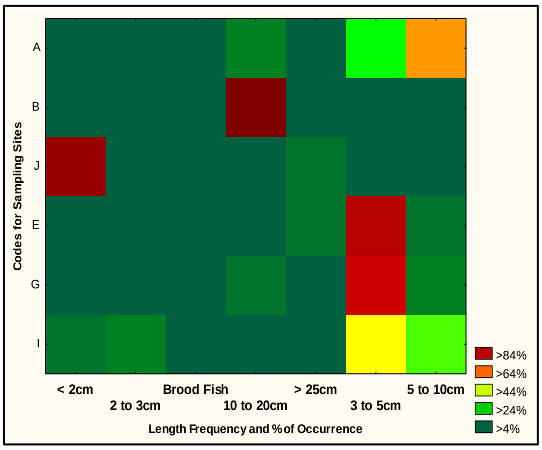
15th Monitoring, January, 2018



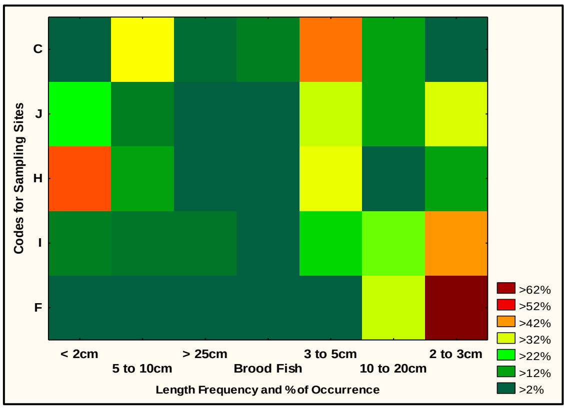
16th Monitoring, April, 2018



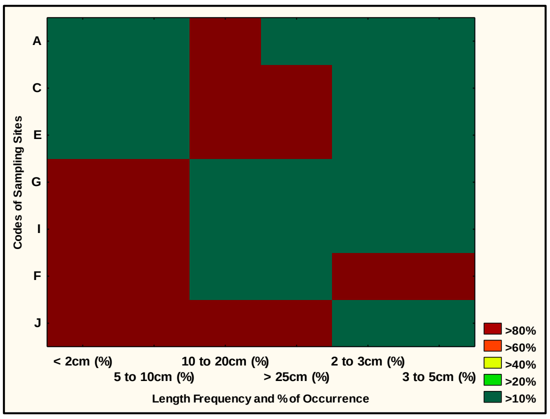
17th Monitoring, July, 2018



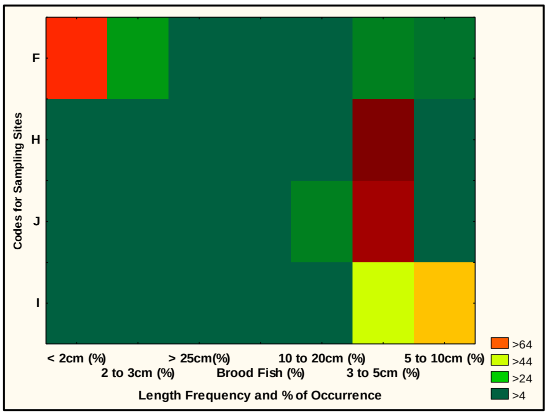
18th Monitoring, November, 2018



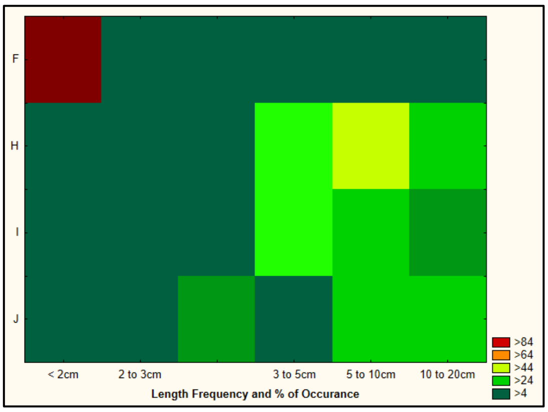
19th Monitoring, February, 2019



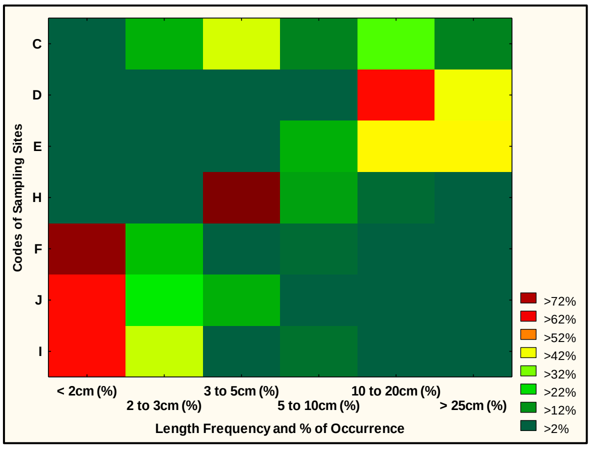
20th Monitoring, April, 2019



21st Monitoring, July 2019



22nd Monitoring, November 2019



23rd Monitoring, February 2020

D.5: 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	+	-	-	-	-	-	-	-	-	-	+	-

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											
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	+	-	-	-	-	-	+	-	-	+	-	-
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
		'-' = 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	-	+	-	-	+	-	-	-	-	+	-	-

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
		‘-‘ = No; ‘+’ = Occurrence												
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	+	+	+	+	+	+	+	+	-	-	-	-
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	+	+	+	+	-	+	+	-	+	-	-	-

D6: Length-wise species distribution (%) in sampling sites

Fish Species	Site	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Amadi	H	0.00	0.00	99.50	0.50	0.00	0.00	0.00
Banspata	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
Bele	J	0.00	0.00	0.00	50.00	50.00	0.00	0.00
Chamni Chingri	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Chamua Chingri	H	0.00	0.00	60.00	40.00	0.00	0.00	0.00
Chapila	H	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Chela	J	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Chewa	H	0.00	0.00	90.91	9.09	0.00	0.00	0.00
	I	0.00	0.00	0.00	0.00	93.02	6.98	0.00
	J	0.00	0.00	0.00	0.00	88.89	11.11	0.00
Chota Bele	H	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Dimua Icha	H	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	J	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Dogra	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Gagra Tengra	H	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Goda Chingri	J	0.00	0.00	71.43	28.57	0.00	0.00	0.00
Golda Chingri	J	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Gulsha Tengra	J	0.00	0.00	20.00	80.00	0.00	0.00	0.00
Harina	I	0.00	0.00	27.75	72.25	0.00	0.00	0.00
	J	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Kalti	H	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Mota Chingri	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Paissa	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	J	0.00	0.00	25.00	75.00	0.00	0.00	0.00
Poma	H	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	I	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00

Fish Species	Site	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Shilong	J	0.00	0.00	0.00	66.67	33.33	0.00	0.00
Taki	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Tapse	H	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Tilapia	I	0.00	0.00	100.00	0.00	0.00	0.00	0.00

Source: CEGIS field survey

D7: 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	-	-	-		-	-

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
		Brood Fish	-	-	-	-	-	Breeding and Spawning	-	-	-		-	-
Bairagi	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-	-		-	-
	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	-	-	-	-	-	-	-		-	-

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
	South-west of the Project	Age-1 adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
Loitta	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding 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	-	-	-	-	-	-		-	-
Chela	Haldikhali	Adult	Feeding	-	Feeding	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Adult	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
	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	-	-		-	-
	Harbaria	Adult	-	-	Feeding	-	Feeding and Growing	-	-	-	Feeding		Feeding	
Gulsha Tengra	Haldikhali	Adult	Feeding and Breeding	-	-	-	-	-	-	-	-		-	-
	Akram Point	Adult		-	-	-	-	-	-	-	-		-	-
	Chandpai	Age-1 adult	-	-	-	Feeding	-	Feeding	Feeding and Growing	-	-		-	Feeding
		Juvenile	-	-	-	-	-	-	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
	Mongla Point	Age-1 adult	-	Feeding and Growing	-	Feeding and Growing	-	Feeding and Growing		-	Feeding and Growing		-	-
		Juvenile	-	-	-	-	-	-	Feeding and Growing		-		Feeding and Growing	-
	Harbaria	Juvenile	-	-	-	-	-	-	Feeding and Growing		-			-
		Age-1 adult	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing	-			-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		Feeding and Growing	-
Potka	Haldikhali	Adult	Feeding and Breeding	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry	Spawning	Spawning and Nursing	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	Feeding
		Adult	-	-	-	Feeding	-	-	-	-	-		Feeding	-
	Mongla Point	Fry	Spawning	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	Feeding 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	-	-	-	-	-			-	-

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	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	-	-	-	-	-		-	-
		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				-	-

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
	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
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	-			-	-

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<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 rowspan="6"></td><td></td><td>Adult</td><td>-</td><td>-</td><td>Feeding</td><td>Feeding</td><td>Feeding</td><td>-</td><td>Feeding</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Mongla Point</td><td>Adult</td><td>-</td><td>-</td><td>Feeding</td><td>Feeding</td><td>-</td><td>-</td><td rowspan="2">Feeding and Growing</td><td>-</td><td>-</td><td></td><td>Feeding</td><td>-</td></tr>
<tr><td>Chandpai</td><td>Juvenile and Adult</td><td>Feeding</td><td>Feeding and Growing</td><td>-</td><td>-</td><td>Feeding and Growing</td><td>-</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td rowspan="3">Maidara</td><td>Juvenile and Adult</td><td>Feeding</td><td>Feeding and Growing</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>Feeding and Growing</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Adult</td><td>-</td><td>-</td><td>Feeding</td><td>Feeding</td><td>-</td><td>Feeding</td><td>-</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td rowspan="11">Paissa</td><td rowspan="3">Akram Point</td><td>Juvenile and Adult</td><td>Feeding</td><td>-</td><td>Feeding and Growing</td><td>Feeding</td><td>-</td><td>-</td><td>-</td><td>Feeding and Growing</td><td>-</td><td></td><td>-</td><td>Feeding</td></tr>
<tr><td>Brood</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td>-</td><td>Spawning</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>-</td><td>-</td></tr>
<tr><td rowspan="2">Haldikhali</td><td>Juvenile and Adult</td><td>Feeding</td><td>-</td><td>Feeding and Growing</td><td>Feeding</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>Feeding and Growing</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Harbaria</td><td>Juvenile-1 and Juvenile</td><td>-</td><td>-</td><td>Feeding</td><td>-</td><td>Feeding and Growing</td><td>-</td><td>Feeding and Growing</td><td>-</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Adult</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Feeding</td><td>-</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Chandpai</td><td>Fry</td><td>Breeding and Spawning</td><td>-</td><td>-</td><td>-</td><td>Nursing</td><td>-</td><td>-</td><td>-</td><td>Nursery</td><td></td><td>-</td><td>-</td></tr>
<tr><td>Chandpai</td><td>Juvenile and Adult</td><td>-</td><td>-</td><td>Feeding and Growing</td><td>-</td><td>-</td><td>Nursery and Feeding</td><td>-</td><td>-</td><td>-</td><td></td><td rowspan="2">Feeding and Growing</td><td>Feeding</td></tr>
<tr><td>Harbaria</td><td>Juvenile</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>Mongla Point</td><td>Fry</td><td>Breeding and Spawning</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Nursery</td><td>-</td><td>-</td><td>Nursery</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
		Age-1 Juvenile	-	-	-	-	-	-	-Nursing, Feeding and Growing	-	Feeding and Growing		-	-
		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
Tapsi	Haldikhali	Juvenile and Age-1 adult	-	-	Grazing	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-
	Chalna Point	Age-1 adult and Brood fish	-	-	-	-	-	-	-	-	-		-	-
		Adult	-	Feeding	-	-	Feeding	-	-	Feeding	Feeding		-	-
	Harbaria	Juvenile and Age-1 adult	Feeding	-	-	-	-	-	-	-	-		-	-
		Adult and Brood Fish	-	-	-	-	-	-	-	-	-		-	-
	Chandpai	Juvenile	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	-	-		-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
		Adult	-	-	-	-		-	-	-	-		Feeding	-
		Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
		Fry	-	-	Nursing	-	-	-	-	-	-		-	Nursing
	Maidara	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	Maturation	-	-	-		-	-
		Adult	-	-	-	-	Feeding	-	-	-	-		-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-
Bairagi / Amadi	Haldikhali	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-

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
	Chandpai	Fry	-	Nursing	-	Nursing	-	-		Nursing	-		-	-
		Juvenile	-	Feeding and Growing	Feeding and Growing	Feeding and Growing	-	Maturation	Feeding and Growing	-	Nursing		-	-
	Chalna Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	Feeding	-		-	-
		Fry	Nursing	-	-	-	-	Nursing	-	Nursing	-		-	-
	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	-	-
		Fry	Nursing	-	Nursing	-	-	Nursing	-	Nursing	-		-	-
	Charaputia	Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-
Chapila	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Harbaria	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
	Mongla Point	Fry	-	-	-	-	Nursing	-	-	-	-		-	-
		Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	Feeding and Growing
		Adult	-	-	-	-	Feeding	-	Maturation	-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	Maturation	-	Maturation	Feeding	-	-
		Fry	-	-	-	-	-	Nursing	-	-	-		-	-
	Maidara	Juvenile to Age-1 adult	-	-	-	-	-	Growing and Maturation	-	-	-		-	-
Loitta	Haldikhali	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Akram Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
	Chandpai	Juvenile	-	-	-	-	-	-	-	-	-		-	--
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-
	Harbaria	Fry, Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
	Mongla Point	Fry	-	-	Nursing	-	-	-	-	-	-		-	-
	Chalna Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	-		-	-
Poma	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-
		Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-
	Charaputia	Brood Fish	-	-	-	Spawning	-	-		-	-		-	-
		Juvenile and Adult	-	-	-	Feeding	-	-	Growing and Maturation	Feeding	-		Growing and Maturation	-

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
	Chandpai	Fry and Juvenile	-	-	-	Nursing	-	-	-	-	-		-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-
		Juvenile	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-	-		-	-
		Adult		Feeding	Feeding	Feeding	-	-	-	-	-		-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-
	Haldikhali	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Harbaria	Adult and Brood Fish	-	-	-	-	-	-	-	-	-			-
		Adult	Feeding	-	-	-	-	Feeding	-	-	-		-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-		Nursing	-
	Mongla Point	Fry, Juvenile and Age-1 adult	Nursing	-	-	-	Nursing	-	Feeding and Growing	-	-		Nursing and Maturation	-
		Fry	-	Nursing	-	-	-	-	-	-	-		-	Nursing
		Juvenile	-	-	-	-	-	-	-	-	Nursing		-	-
		Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-
	Maidara	Adult	-	Feeding	-	-	-	-	Maturation and Feeding	-	-		Feeding	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding
		Fry	-	-	-	-	-	Nursing	-	-	-	Nursing	-	-
	Chalna Point	Juvenile and Adult	-	Feeding and Growing	-	-	-	Maturation and Feeding	Maturation and Feeding	-	Maturation and Feeding		-	Maturation and Feeding
		Fry	Nursing	-	-	-	-	-	-	-	-		-	-
Chhuri	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-
	Akram Point		-	-	-	-	-	-	-	-	-		-	-
Chela	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-
	Harbaria	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Chalna Point		-	-	-	Nursing and Feeding	-	-	-	-	-	Nursing and Maturation	-	Nursing and Maturation
	Chandpai		-	-	Feeding and Growing		-	-	-	Nursing	Nursing		-	-
	Mongla Point		-	Nursing	-	-	-	-	-	-	-	Nursing and Maturation	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-
Gang Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-
	Chandpai	Adult	-	-	-	-	Feeding	-	-	-	-		-	-
	Maidara	Fingerling	-	-	-	-	Nursing	-	-	-	-		-	-

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
	Mongla Point	Fingerling					Nursing	-	-	-	-		-	-
	Mongla Point	Age-1 Adult					Feeding and Growing	-	-	-	-		-	-
Ghagra Tengra	Chandpai	Juvenile and Age-1 adult	-	-	-	-	-	Maturation		-	-		-	-
Ghagra Tengra	Chandpai	Brood Fish	-	-	Breeding	-	-	-	-	-	-		-	-
Ghagra Tengra	Chandpai	Fry	-	-	-	-	Nursing	-	-	-	-		-	-
Ghagra Tengra	Chalna Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-
Ghagra Tengra	Mongla Point	Age-1 adult	-	-	-	-	-	-	Maturation and Feeding	-	Maturation and Feeding		-	
Ghagra Tengra		Juvenile	-	-	-	-	-	-	-	-	-	-	-	Feeding and Growing
Ghagra Tengra	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	-	-	Feeding and Growing	-		-	-
Ghagra Tengra	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-
Ghagra Tengra	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-
Ghagra Tengra	Harbaria	Adult	Feeding		Breeding	-	-	-	-	Feeding	-		-	-
Ghagra Tengra	Harbaria	Juvenile	-		-	-	-	Maturation	-	Maturation	-		-	-
Ghagra Tengra	Charaputia	Juvenile and Age-1 adult	-						Maturation	-	-		Maturation	-
Gulsha Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-
Gulsha Tengra	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-
Gulsha Tengra	Chandpai	Age-1 adult	Feeding	-	Feeding and Growing	-	-	-	-	-	-		-	-
Gulsha Tengra	Chandpai	Juvenile	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-		-	-
Gulsha Tengra	Charaputia	Juvenile	-	-	-		-	-	Feeding and Growing	-	-		-	-
Gulsha Tengra	Mongla Point	Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
Gulsha Tengra	Mongla Point	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
Gulsha Tengra	Harbaria	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
Gulsha Tengra	Harbaria	Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
Gulsha Tengra	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-
Gulsha Tengra	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		-	Feeding and Growing
Potka	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-
Potka	Chalna Point	Fry	-	-	-	-	-	Nursing	-		-		-	-
Potka	Chandpai	Fry	-	-	-	-	-	-	-	Nursing	-		-	-

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
		Juvenile	Feeding	-	-	-	-	-	Feeding and Growing	-	-		-	-
		Adult	-	Feeding and Growing	Feeding	-	-	-	-	-	-		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-
	Mongla Point	Fry	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Maidara	Fry	-	-	-	Nursing	-	Nursing	-	Nursing	-		-	-
		Juvenile	-	-	-	-	-	Maturation	-	-	-		-	-
	Harbaria	Fry	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Charaputia	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
Paira Chanda	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry	-	-	-	-	-	-	-	-	-		-	-
Chewa	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry and Juvenile	-	-	-	-	-	-	-	Nursing	-		-	-
		Juvenile	-	Feeding and Growing	-	-	-	-	-	-	Feeding and Growing		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-
	Haldikhali	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-
	Harbaria	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	Nursing	-
	Chandpai	Juvenile-1	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	-	-	Nursing	Maturation	Maturation	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-
	Maidara	Juvenile	-	-	-	-	-	-	-	-	-	Maturation	-	-
		Fry	-	-	Nursing		-	-	-	-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	-	-	-	Feeding	-	Feeding
		Age-1 Juvenile	-	-	-	-	-	-	-	-	-		Maturation	-
Bele	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-				-	-
	Haldikhali	Juvenile-1, Juvenile and Adult	-	-	-	-	-	-	-		-		-	-
	Harbaria	Juvenile and Adult	-	-	-	-	-	-	-		-		-	-
	Chandpai	Fry	-	-	-	Nursing	Nursing	-	-	Nursing	-	Nursing	-	-
		Juvenile and Adult	Feeding and Growing	-	Feeding and Growing		-	-	-	-	Feeding and Growing-		-	-
	Jongra	Fry	-	-	-		-	-	-	Nursing	-		-	-
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-			-
	Mongla Point	Fry	-	Nursing	-	-	Nursing	-	-	-	-			-
		Fry, Juvenile-1 and 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
		Juvenile and Adult	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	-
	Chalna Point	Fry	-	-	Nursing		Nursing	-	-	-	-			-
		Fingerling	-	-	-	-	Nursing	-	-	-	-		Nursing	Nursing
		Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding
		Adult	-	-	-	-	-	-	-	-	-		-	
	Maidara	Juvenile and Age-1 adult	-	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	Maturation and Feeding	Maturation and Feeding	Maturation and Feeding	-
		Fry	Nursing	-	Nursing		-	-	-	-	-		-	-
	Charaputia	Juvenile and Age-1 adult	-	-	-		-	-	Maturation	-	-		-	-
Tular Dandi (Nona bele)	Akram Point	Adult	-	-	-	-	-	-	-	Feeding and Maturation	-		-	-
	Chandpai	Age-1 Adult	-	-	Feeding	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	Growing	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	Nursing	-		-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-
	Maidara	Adult	-	Feeding	-	-	-	-	Maturation	-	-		-	-
	Chalna Point	Adult	-	-	-	-	-	-	Maturation	Maturation	Maturation and Feeding		-	-
Tairel	Akram Point	Adult	-	-	-	Feeding	-	-	-	-	-		-	-
	Charaputia	Juvenile	-	-	-	-	-	-	-	Maturation	-		-	-
	Harbaria	Age-1 Adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	Chandpai	Juvenile	-	-	-	-	-	Growing	-	-	Feeding and Growing		-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	Growing		-	-
	Maidara	Juvenile	-	-	-	-	-	Growing	-	-	-		-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-
Pheksa	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-				-
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Haldikhali	Adult	-	-	-	-	-	-	-	-	-			-
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	Feeding and Maturation	-			-
	Harbaria	Juvenile	-	-	-	-	-	-	-	-	-			-
	Chalna Point	Juvenile and Adult	-	-	-	Feeding and Growing	-	-	-	Maturation	Maturation			-
		Adult	-	Feeding	-	-	-	-	Maturation	-	-	Feeding		-
	Mongla Point	Adult	-	-	-	-	-	-	Maturation	-	-		Feeding	-
		Juvenile	-	-	-	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
	Chandpai	Juvenile and Adult	-	-	-	Feeding and Growing	-	-	Maturation	--	-		-	-
	Maidara	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-
		Adult	-	Feeding	-	-	-	-	-	-	-		-	-
Paissa	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	Growing and Maturation	-	-	-		-	-
		Brood	Spawning	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Haldikhali	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Charaputia	Brood Fish	-	--	-	Spawning	-	-	-	-	-		-	-
		Fry											Nursing	-
	Harbaria	Juvenile-1 and Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
		Adult	-	Feeding	-	-	-	-	-	-	-		-	-
	Chalna	Fry	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		Nursing	Nursing
	Chandpai	Fry	-	-	-	Nursing	-	-	Feeding and Growing	Nursing	Nursing	Nursing	Nursing	-
		Juvenile and Adult	Feeding	Feeding and Growing	-	Feeding and Growing	-	Maturation	-	-			-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing			-	-
	Harbaria	Juvenile	-	-	Feeding and Growing	-	-	Maturation	-	-			-	-
	Mongla Point	Fry	-	-	Nursing	-	-	-	-	-			-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-			-	-
		Age-1 Adult	-	-	-	-	-	-	-	-		Maturation	-	-
	Maidara	Fry, Juvenile and Age-1 adult	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	--
		Age-1 Juvenile, Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	Growing	-	-	-		Maturation	-
		Adult	-	-	-	-	-	-	-	-	-		-	-

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
Banshpata	Chandpai	Juvenile	-	-	-	Growing	Feeding and Growing	-	-	-	-		-	-
		Adult	-	Feeding	Feeding	-	-	-	-	-	-		-	-
	Jongra	Juvenile	-	-	-	-	-	-	-	Maturation	-		-	-
	Charaputia	-	-	-	-	Feeding	-	-	Growing and Maturation	-	-		-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-
	Haldikhali	Juvnile and adult	-	-	-	-	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-
	Mongla Point	Fry and Adult	-	-	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	Growing and Maturation	Growing and Maturation	-	-		-	-
		Adult	-	Feeding	-	-	-	Feeding	-	-	-		-	-
	Chalna Point	Juvenile and Age-1 Adult	-	-	-	-	-	-	Growing and Maturation	Feeding	Growing and Maturation		-	Growing and Maturation
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-		-	-
	Haldikhali	Brood Fish	-	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Harbaria	Brood Fish	-	-	-	-	-	-	-	-	-		-	-
	Chandpai	Adult and Brood Fish	-	-	-	-	-	-	-	-	-		-	-
	Mongla Point	Adult	-	-	-	-	-	-	-	-	-		-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-	Maturation	-	-
	Chalna Point	Adult	-	-	-	-	-	Maturation	-	-	-	Feeding	-	-
		Brood fish	-	-	-	-	-	-	-	-	-		-	-
Pangas	Haldikhali	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
	Charaputia	Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-
	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*

D8: The Present Catch in Three 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	-	-

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
	-	-	-	-	Rui	28	-	-
	-	-	-	-	Vetki	-	-	-
	-	-	-	-	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
	-	-	Bele	0.30	Tilapia	0	-	0
	-	-	Paissa	0.25	Vetki	0	-	0
	-	-	-	-	Tengra	0	-	0
	-	-	-	-	Paissa	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
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

Sampling Site	Total Catch (ton): 2016-2017							
	9th QM		10th QM		11th QM		12th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
	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
	-	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						

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
							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		
	-	-	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**		
3	Bagda	0	Bagda	2	-	-	Bagda	**0.50**	Bagda	0.10	-	0	Bagda	-

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**
	-	-	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

	Total Catch (ton): 2019-20 and 2020-21									
Sampling Site/ Location	**20th QM**		**21st QM**		**22nd QM**		**23rd QM**		**25th QM**	
	Fish Species	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**
Bhekatkhali Khal, Rajnagar	Bagda	32	Bagda	2.72	Bagda	0.8	Harina	0.02	Bagda	1.2
	Horina	48	Harina	3.44	Harina	1.0	-	-	Harina	2.0
	-	-	Tilapia	0.7	Chali	0.2	-	-	Tilapia	1.0
	-	-	Parse	0.17	Patari	0.3	-	-	-	-
	-	-	-	-	Tairel	0.03	-	-	-	-
	-	-	-	-	Tilapia	0.5	-	-	-	-
	-	-	-	-	Datina	0.02	-	-	-	-
	Sub-total =	**80**		**7.0**		**2.8**		**0.02**		**4.2**
Kapashdanga-Muralia	Bagda	1.41	Bagda	6.74	Bagda	3.42	Harina	0.01	Bagda	4.84
	Paissa	0.60	Golda	0.01	Harina	3.96	-	-	Hatina	0.92
	Crab	0.00	Harina	0.65	Chali	0.38	-	-	Chali	0.20

Sampling Site/ Location	Total Catch (ton): 2019-20 and 2020-21									
	20th QM		21st QM		22nd QM		23rd QM		25th QM	
	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)
	Tilapia	0.30	Chali	0.04	Bele	2.11	-	-	Bele	0.27
	Golda	0.10	Bele	0.09	Paissa	2.62	-	-	Paissa	0.04
	Horina Chingri	2.92	Tilapia	0.22	Tilapia	9.85	-	-	Tilapia	3.87
	Chali Chingri	1.52	Tengra	0.57	Golda	0.04	-	-	Golda	0.03
	Bele	1.35	Bhangan	0.08	Tengra	0.17	-	-	Tengra	0.01
	Tengra	0.27	-	-	Patari	2.25	-	-	Patari	0.11
	Major Carp	0.55	-	-	Chemo	0.02	-	-	Datna	0.01
	-	-	-	-	Datina	1.01	-	-	Rui	0.47
	-	-	-	-	Rui	1.27	-	-	Chaka	0.05
	-	-	-	-	Chaka	0.01	-	-	Chemo	1.56
	-	-	-	-	Kailla	0.96	-	-	-	-
	-	-	-	-	Nundi Bele	0.02	-	-	-	-
	-	-	-	-	Kakra	0.49	-	-	-	-
Sub-total =		**9**		**8.0**		**29**		**0.01**		**12.38**
Chunkuri-2	Bagda	0.04	Patari	0.01	Tilapia	0.02	-	-	Paissa	0.05
	Paissa	0.00	Tair/Tailla	0.01	Paissa	0.066	-	-	Golda	0.03
	Khorsula	0.00	Bhangan	0.01	Khorsul	0.009	-	-	Kharulla	0.01
	Horina Chingri	0.10	Datina	0.03	Bagda	0.015	-	-	Bagda	0.10
	Motka	0.04	Bagda	0.02	Golda	0.006	-	-	Bele	0.03
	Chali Chingri	0.03	Golda	0.03	Patari	0.015	-	-	Harina	0.15
	Chaka Chingri	0.01	Faissa	0.01	Harina	0.008	-	-	Tengra	0.02
	Bele	0.01	Chaka Chingri	0.01	Chali	0.009	-	-	Tairu	0.03
	Crab	0.03	Harina	0.02	China Punti	0.047	-	-	Chaka	0.01

Sampling Site/ Location	Total Catch (ton): 2019-20 and 2020-21									
	20th QM		21st QM		22nd QM		23rd QM		25th QM	
	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)
	-	-	-	-	Tengra	0.008	-	-	Datina	0.02
	-	-	-	-	Baila	0.003	-	-	-	-
	-	-	-	-	Datina	0.02	-	-	-	-
	Sub-total =	**0.24**		**0.15**		**0.46**		**0.00**		**0.44**

(E) Traffic Survey data

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

Date: July 19, 2020

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	8	2	0	7	3	0	13	2	0
Auto Rickshaw	0.8	9	17	20	7	15	17	0	9	8
Van	0.6	43	78	73	42	62	62	7	58	39
Cycle	0.2	10	16	5	7	6	3	1	4	1
Human Howler	0.6	10	6	9	5	10	8	7	3	6
CNG	0.5	0	2	1	1	0	0	0	1	1
Private Car	1	14	33	47	15	17	32	0	15	15
Motor Cycle	0.3	60	99	48	68	89	47	3	83	26
Jeep	1	1	12	12	1	6	7	1	4	4
Pick-up	2	20	42	122	24	21	90	4	14	36
Micro	1	18	15	33	14	8	21	1	6	6
Bus	2.5	25	35	148	24	25	123	0	15	36
Light Truck	2	4	15	38	5	14	36	0	7	14
Medium Truck	2	19	23	82	13	20	66	2	23	49
Heavy Truck	2	33	16	97	34	26	118	3	25	56
			Total	**734**			**630**			**295**

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

Date: July 17, 2020

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	10	7	0	16	2	0	4	4	0
Auto Rickshaw	0.8	0	0	0	0	0	0	0	0	0
Van	0.6	19	13	19	14	2	10	8	2	6
Cycle	0.2	2	1	1	1	2	1	1	7	2
Human Howler	0.6	12	14	15	10	11	12	8	7	9
CNG	0.5	1	0	0	0	0	0	0	0	0
Private Car	1	2	1	3	2	2	4	3	8	10
Motor Cycle	0.3	26	17	13	26	32	17	17	32	15
Jeep	1	0	3	3	2	3	4	0	4	4
Pick-up	2	2	2	7	4	2	11	4	2	12
Micro	1	13	4	17	4	3	7	5	4	9
Bus	2.5	7	6	33	9	7	39	6	8	35
Light Truck	2	4	1	11	0	3	6	4	1	10
Medium Truck	2	2	7	19	11	5	30	9	8	34
Heavy Truck	2	18	12	59	28	10	76	22	16	76
				Total			**216**			**220**

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

Date: July 18, 2020

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	**Factor**	**Babubari to Plant site**	**Plant site to Babubari**	**PCU**	**Babubari to Plant site**	**Plant site to Babubari**	**PCU**	**Babubari to Plant site**	**Plant site to Babubari**	**PCU**
Pedestrian	0	5	2	0	2	5	0	5	10	0
Auto Rickshaw	0.8	1	1	2	3	1	2	0	1	1
Van	0.6	7	7	9	8	11	11	7	5	8
Cycle	0.2	2	1	1	2	2	1	1	1	0
Human Howler	0.6	9	5	8	6	4	6	7	5	7
CNG	0.5	0	0	0	0	0	0	0	0	0
Private Car	1	1	0	1	2	0	2	0	2	2
Motor Cycle	0.3	15	5	6	10	7	5	3	7	3
Jeep	1	4	1	5	2	0	2	1	1	1
Pick-up	2	1	3	8	1	3	7	4	4	16
Micro	1	4	2	5	4	4	7	1	2	2
Bus	2.5	0	0	0	0	0	0	0	0	0
Light Truck	2	0	0	1	0	1	1	0	0	0
Medium Truck	2	0	0	1	0	0	0	2	0	4
Heavy Truck	2	4	1	9	1	1	3	3	5	16
			Total	**56**			**46**			**60**

(F) Traffic Survey data

Table F.1: 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)		
	K-I	K-II	Rabi	K-I	K-II	Rabi	K-I	K-II	Rabi	K-I	K-II	Rabi	K-I	K-II	Rabi	K-I	K-II	Rabi	K-I	K-II	Rabi
Monitoring Spot-1 (Baranpara)	Fallow	Local Aman	Fallow	Fallow	HYV Aman	Fallow	Fallow	HYV Aman	Fallow	Fallow	HYV Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow
Monitoring Spot-2 (Chunkuri-2)	Fallow	HYV Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	HYV Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow
Monitoring Spot-3 (Kapalirmet)	Fallow	Local Aman	Fallow	Fallow	Fallow *	Fallow	Fallow	Fallow *	Fallow	Fallow	Fallow *	Fallow	Fallow *	Fallow	Fallow	Fallow	Fallow*	Fallow	Fallow	Fallow*	Fallow
Monitoring Spot-4 (Chakgona)	Fallow	Local Aman	Fallow	Fallow	Fallow *	Fallow	Fallow	Fallow *	Fallow	Fallow	Fallow *	Fallow	Fallow *	Fallow	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow
Monitoring Spot-5 (Basherhula)	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow
Monitoring Spot-6 (Bidyarbon_	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Fallow	Local Aman	Fallow	Fallow	Local Aman	Fallow

*Source: Based on field information and farmers interviewed. *previously cultivated.* ***K-I:*** *Kharif-I (March-June),* ***K-II:*** *Kharif-II (July-October) and Rabi (November-February)*

Table F.2: Results of Crop production in Monitoring Plots

Monitoring Plots	Crop Production																				
	2013-14			2014-15			2015-2016			2016-17			2017-18			2018-19			2019-2020		
	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi
Monitoring agriculture land -1																					
Production (ton/Plot)	-	0.8*	-	-	1.4*	-	-	1.5*	-	-	0.27*	-	-	0.92*	-	-	1.04*	-	-	0.67	-
Yield (ton/Ha)	-	1.9*	-	-	3.5*	-	-	3.8*	-	-	2.5*	-	-	2.3*	-	-	2.60*	-	-	2.5*	-
Monitoring agriculture land- 2																					
Production (ton/Plot)	-	2.4*	-	-	1.1	-	-	1.9*	-	-	0.44*	-	-	2.2*	-	-	2.14*	-		1.9	
Yield (ton/Ha)	-	2.6*	-	-	1.7*	-	-	2.0*	-	-	2.4*	-	-	2.4*	-	-	2.30*	-		2.25	
Monitoring agriculture land- 3																					
Production (ton/Plot)	-	0.2*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Monitoring Plots	Crop Production																				
	2013-14			2014-15			2015-2016			2016-17			2017-18			2018-19			2019-2020		
	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi	K-I	K- II	Rabi
Yield (ton/Ha)	-	1.6*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monitoring agriculture land- 4																					
Production (ton/Plot)	-	0.6*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.44*	-	-	0.38*	-
Yield (ton/Ha)	-	1.9*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.92*	-	-	1.85*	-
Monitoring agriculture land-5																					
Production (ton/Plot)	-	0.8*	-	-	0.57*	-	-	0.99*	-	-	0.15*	-	-	1.0*	-	-	0.47*	-	-	0.7*	-
Yield (ton/Ha)	-	1.8*	-	-	1.9*	-	-	2.1*	-	-	1.9*	-	-	2.2*	-	-	1.57*	-	-	1.6*	-
Monitoring agriculture land-6																					
Production (ton/Plot)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.98*	-	-	0.07*	-
Yield (ton/Ha)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.10*	-	-	2.10*	-

*Source: Based on field information and farmers interviewed, July,2020, * indicates cleaned rice*

Table F.3: Results of Crop Damage in Monitoring Plots

Monitoring site	2013-14			2014-15			2015-16			2016-17			2017-18			2018-19			2019-2020		
	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
Monitoring agriculture land-2	-	N.F.	-	0.33*	0.4*	E	-	N.F.	-	-	-	-	-	N.F.	-	-	N.F.	-	0.08	0.19*	F
Monitoring agriculture land-3	-	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

Monitoring site	2013-14			2014-15			2015-16			2016-17			2017-18			2018-19			2019-2020		
	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-5	-	N.F.	-	0.17*	0.12*	E	-	N.F.	-	0.09	0.019*	E	-	N.F.	-	-	N.F.	-	0.03	0.05*	F
Monitoring agriculture land-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.F.	-	0.07	0.14*	Both E and F
Total	-	-	-	**0.50***	**0.52***		-	-	-	**0.15**	**0.043***	-	-	-	-				0.34	0.76*	

*Source: Based on field information and farmers interviewed, July, 2020 * 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.

(G) Monitoring Results

Air quality parameter analysis result

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Data Table 1- Air Quality Analysis Result

	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
Towards access to	AQ1	44.26	122.73	171.29	34.12	21.72	18	4	Complies
	AQ2	26.26	91.39	126.13	16.16	9.04	22	6	Complies
Moidara	AQ3	27.12	68.12	108.48	18.35	12.12	28	8	Complies
Shayemari	AQ4	19.14	83.22	106.35	27.41	18.77	44	9	Complies
Kajodarh	AQ5	21.61	77.69	100.04	19.68	17.53	30	9	Complies
Bajua	AQ6	39.44	100.08	146.72	36.14	20.04	18	22	Complies
Gaurambh	AQ7	26.66	61.11	98.74	18.88	11.58	32	12	Complies
KJAB	AQ8	40.22	116.16	157.28	28.31	24.14	32	10	Complies
Mongla	AQ9	38.92	119.61	173.36	31.33	13.34	29	4	Complies
Harbaria	AQ10	17.81	63.27	87.51	16.47	9.90	30	12	Complies
Hiron	AQ11	17.39	72.45	94.28	13.33	8.65	36	7	Complies
Akram	AQ12	23.04	82.91	121.68	24.21	16.74	20	2	Complies
Chalna	AQ13	33.26	127.52	160.02	30.89	19.02	11	2	Complies
	Units	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	ppb	
	Test Duration (Hours)	24	8	8	8	8	8	8	
	Method of Analysis	Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob & Hochheiser	CO Meter	O_3 Meter	
	Bangladesh (DoE) Standard for ambient Air	65	150	200	365	100	10,000	157	
	IFC/WB Standard	75	150	NF	125	200	NF	160	

7.0 Terminology:

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. Sulphur Di-Oxide (SO_2), 6. Carbone Mono-Oxide (CO), 7. Ozone (O_3) & 8. DoE- Department of Environment, NF – Not found.

8.0 Comment

The above result for ambient air quality monitoring shows the PM2.5, PM10, SPM, SO2, NOx & CO concentrations of the ambient air. From the above analysis it is observed that the concentration of all the parameters are below the allowable limit as per Bangladesh Standard and International standard for ambient air. Although particulate matter concentration in **AQ1, AQ9** & **AQ13** is higher than usual, so caution shall be taken in these areas. Installation of sprinkler system may suffice the current dust situation inside the power plant area.

2/12, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel : +88-02-9116712-13
Mob: 01733376609-10, Fax: +88-02-9116714, Email: nukhan05@gmail.com, aecldhaka@gmail.com
www.aecl-bd.org

Forest Soil Parameter analysis result

অধ্যাপক ড. মাহমুদ হোসেন
ফরেস্ট্রি এন্ড উড টেকনোলজি ডিসিপ্লিন
খুলনা বিশ্ববিদ্যালয়, খুলনা-৯২০৮
বাংলাদেশ।

Prof. Dr. Mahmood Hossain
Forestry & Wood Technology Discipline
Khulna University, Khulna-9208
Bangladesh.

Results for February 2020 Samples

Site	Sub-plot	Layer	Sample weight for Bulk density (g)	Organic carbon (%)	EC (ms/cm)	pH	Nitrogen final concentration (mg/g)	Phosphorus final concentration (mg/g)
Sutarkhali	1	0-15	136.50	1.56	4.56	6.76	0.95	0.37
		15-30	115.75	3.19	4.02	6.77	1.06	0.35
		30-50	110.67	2.06	4.15	6.94	1.10	0.38
		50-100	109.92	2.28	5.09	6.80	1.06	0.32
	2	0-15	120.25	1.69	3.58	6.64	0.68	0.35
		15-30	117.69	1.62	2.82	7.14	0.84	0.39
		30-50	119.66	1.66	2.91	7.21	0.19	0.46
		50-100	118.13	1.95	4.39	6.74	0.28	0.34
	3	0-15	107.35	2.17	3.58	7.05	0.85	0.38
		15-30	117.51	1.80	3.19	6.89	0.61	0.41
		30-50	102.45	2.13	3.77	6.51	0.01	0.37
		50-100	110.04	2.20	4.57	6.92	0.01	0.39
Karamjal	1	0-15	117.46	2.36	8.23	6.72	0.29	0.40
		15-30	123.05	1.92	8.01	6.83	0.43	0.41
		30-50	128.55	1.30	6.03	6.89	0.45	0.39
		50-100	130.76	1.27	4.01	6.93	0.72	0.37
	2	0-15	123.74	1.90	4.13	6.75	0.94	0.33
		15-30	125.27	1.58	3.71	7.05	0.57	0.39
		30-50	121.12	1.16	3.32	7.12	0.02	0.48
		50-100	115.82	1.15	3.41	7.16	0.64	0.37
	3	0-15	118.76	1.88	5.02	6.91	1.09	0.51
		15-30	131.41	1.58	5.40	6.84	0.89	0.35
		30-50	121.04	1.76	8.27	6.82	0.86	0.35
		50-100	120.34	2.30	6.67	6.75	1.33	0.44
Harbariya	1	0-15	131.21	2.15	4.80	6.37	1.22	0.32
		15-30	120.22	1.99	3.82	7.26	0.93	0.28
		30-50	118.01	1.86	3.26	7.32	0.81	0.29
		50-100	116.67	2.07	3.52	7.11	0.70	0.28
	2	0-15	132.98	2.04	5.46	7.09	0.60	0.28
		15-30	126.84	1.87	5.88	6.98	0.63	0.27
		30-50	132.59	1.58	3.17	6.71	0.19	0.31
		50-100	125.71	1.86	3.45	6.63	0.42	0.32
	3	0-15	112.65	2.35	2.55	6.09	0.91	0.34
		15-30	110.40	2.58	3.05	6.68	0.82	0.32
		30-50	115.45	2.50	3.70	6.36	0.83	0.33
		50-100	116.53	2.24	3.03	6.46	1.23	0.33
Hironpoint	1	0-15	125.12	0.71	2.15	6.62	0.62	1.09
		15-30	139.78	1.24	4.35	6.66	0.71	0.92
		30-50	136.98	1.71	5.28	6.42	0.69	0.54
		50-100	137.60	1.86	3.17	6.67	0.86	0.36
	2	0-15	122.88	0.71	0.60	6.72	0.30	0.70
		15-30	129.48	2.30	2.68	6.96	0.16	0.44
		30-50	131.79	1.88	2.40	6.75	0.74	0.40
		50-100	119.16	1.92	2.67	6.53	0.69	0.44
	3	0-15	126.12	1.95	4.51	6.32	0.65	0.36
		15-30	123.64	1.57	2.96	6.49	0.62	0.47
		30-50	124.14	1.46	3.07	6.50	0.41	0.41
		50-100	124.48	1.45	4.06	6.59	0.09	0.40
Akrampoint	1	0-15	128.81	1.46	2.01	7.16	0.57	0.30
		15-30	133.21	1.48	3.35	7.53	0.70	0.31
		30-50	120.30	1.42	2.18	7.64	0.25	0.30
		50-100	128.46	1.47	2.19	7.22	0.55	0.32
	2	0-15	129.84	2.44	5.77	7.04	0.44	0.27
		15-30	106.90	2.19	5.45	6.82	0.71	0.33
		30-50	107.17	1.87	5.63	7.02	0.43	0.27
		50-100	110.66	1.61	5.19	6.88	0.87	0.37
	3	0-15	115.61	1.59	2.96	7.19	1.01	0.32
		15-30	118.19	1.44	3.17	6.59	0.76	0.33
		30-50	119.83	1.01	3.73	6.51	0.49	0.30
		50-100	126.36	0.99	3.74	6.75	0.68	0.38

Phone: (PABX) 041-720171-3, 724717 Ext.-2111 (Off.) Fax: 880-41-731244, 880-41-724717 e-mail: mahmoodhossain@hotmail.com

Water quality parameters analysis result

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: Mar2020023058	Unit (Lab/Inst.) Ref No: A-228-232
Lab ID: INS-228-232	Sample Receiving Date: 10/03/2020
Sample ID: A-228-232	Submission Date: 10 Mar 2020
	Report Delivery Date: 02/06/2020
Sample Description: Project site, Mongla port, Moidara Rivar, Harbaria, Akram point (Analysis of River bed sediment sample)	
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: 5	

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-228	River bed sediment (Sample: 01, Project site)	Arsenic (As)	2.50 mg/kg	3114.C
		Lead (Pb)	8.18 mg/kg	3111.B
		Mercury (Hg)	1.58 mg/kg	3112.B
A-229	River bed sediment (Sample: 02, Mongla port)	Arsenic (As)	1.95 mg/kg	3114.C
		Lead (Pb)	7.89 mg/kg	3111.B
		Mercury (Hg)	2.22 mg/kg	3112.B
A-230	River bed sediment (Sample: 03, Moidara River)	Arsenic (As)	2.54 mg/kg	3114.C
		Lead (Pb)	9.28 mg/kg	3111.B
		Mercury (Hg)	0.66 mg/kg	3112.B

Note:

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Analytical Service Cell
Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh
Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

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BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

A-231	River bed sediment (Sample: 04, Harbaria)	Arsenic (As)	2.26 mg/kg	3114.C
		Lead (Pb)	7.54 mg/kg	3111.B
		Mercury (Hg)	0.57 mg/kg	3112.B
A-232	River bed sediment (Sample: 05, Akram point)	Arsenic (As)	2.15 mg/kg	3114.C
		Lead (Pb)	7.55 mg/kg	3111.B
		Mercury (Hg)	0.53 mg/kg	3112.B

02.06.2020
Analyst
Dr. Sabina Yasmin
Senior Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

2.6.2020
Section/Division In-Charge
মোঃ অহেদুল আকবর
উর্ধ্বতন বৈজ্ঞানিক কর্মকর্তা
ইনস্টিটিউট অব ন্যাশনাল এনালাইটিক্যাল রিসার্চ এন্ড সার্ভিস (আইএনএআরএস)
বিসিএসআইআর, ঢাকা

3/6/2020
In-Charge/Director
Shamim Ahmed
Director (In-Charge)
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

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Analytical Service Cell
Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh
Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

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BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: Institute of National Analytical Research & Service (INARS)

Analysis Report

Analytical Service Cell Ref No: Mar2020023058	Unit (Lab/Inst.) Ref No: A-228-232
Lab ID: INS-228-232	Sample Receiving Date: 10/03/2020
Sample ID: A-228-232	Submission Date: 10 Mar 2020
	Report Delivery Date: 02/06/2020

Sample Description: Project site, Mongla port, Moidara Rivar, Harbaria, Akram point (Analysis of River bed sediment sample)

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: 5

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-228	River bed sediment (Sample: 01, Project site)	pH at 24.8°C	8.22	4500-H^+.B
		Sulphate (SO_4)	187 mg/kg	4110.B
A-229	River bed sediment (Sample: 02, Mongla port)	pH at 25.1°C	8.68	4500-H^+.B
		Sulphate (SO_4)	244 mg/kg	4110.B
A-230	River bed sediment (Sample: 03, Moidara River)	pH at 25.1°C	8.48	4500-H^+.B
		Sulphate (SO_4)	248 mg/kg	4110.B
A-231	River bed sediment (Sample: 04, Harbaria)	pH at 25.1°C	8.62	4500-H^+.B
		Sulphate (SO_4)	234 mg/kg	4110.B

Note:
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Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

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BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

মুজিব শতবর্ষ MUJIB 100

A-232	River bed sediment (Sample: 05, Akram point)	pH at 24.8^{0}C	7.83	4500-H^{+}.B
		Sulphate (SO_4)	653 mg/kg	4110.B

02-06-2020 — Analyst
Dr. Sabina Yasmin
Senior Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

2/6/2020 — Section/Division In-Charge
মোঃ অহেদুল আকবর
উর্ধ্বতন বৈজ্ঞানিক কর্মকর্তা
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বিসিএসআইআর, ঢাকা

3/6/2020 — In-Charge/Director
Shamim Ahmed
Director (In-Charge)
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

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Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

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BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: Institute of National Analytical Research & Service (INARS)

Analysis Report

Analytical Service Cell Ref No: Mar2020023050	Unit (Lab/Inst.) Ref No: A-202-206
Lab ID: INS-202-206	Sample Receiving Date: 10/03/2020
Sample ID: A-202-206	Submission Date: 10 Mar 2020
	Report Delivery Date: 18/03/2020
Sample Description: jetty site, Mongla comfluence, Harbaria, Akram Point, Hiron 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: 5	

Report Details:

Lab ID	Particulars of supplied sample	Parameter	Concentration	Test Method (APHA)
A-202	Water (Jetty site)	Oil and Grease	2.28 mg/L	5520.B
A-203	Water (Mongla comfluence)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-204	Water (Harbaria)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-205	Water (Akram Point)	Oil and Grease	4.35 mg/L	5520.B
A-206	Water (Hiron Point)	Oil and Grease	2.30 mg/L	5520.B

18.03.2020
Analyst
A. H. M. Shofiul Islam Molla Jamal
Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205.

18.3.2020
Section/Division In-Charge

22.03.2020
In-Charge/Director
Shamim Ahmed
Director (In-Charge)
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

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Analytical Service Cell
Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh
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BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: Institute of National Analytical Research & Service (INARS)

Analysis Report

Analytical Service Cell Ref No: Mar2020023051	Unit (Lab/Inst.) Ref No: A-207-224
Lab ID: INS-207-224	Sample Receiving Date: 10/03/2020
Sample ID: A-207-224	Submission Date: 10 Mar 2020
	Report Delivery Date: 01/06/2020
Sample Description: Mercury (Sample no.1 to sample no. 18)	
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: 18	

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-207	Water, (Sample-01)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-208	Water, (Sample-02)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-209	Water, (Sample-03)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-210	Water, (Sample-04)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-211	Water, (Sample-05)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-212	Water, (Sample-06)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-213	Water, (Sample-07)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-214	Water, (Sample-08)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-215	Water, (Sample-09)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-216	Water, (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B

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Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh
Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

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জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন,সব মানুষের উন্নয়ন"

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BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

মুজিব শতবর্ষ MUJIB 100

A-217	Water, (Sample-11)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-218	Water, (Sample-12)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-219	Water, (Sample-13)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-220	Water, (Sample-14)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-221	Water, (Sample-15)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-222	Water, (Sample-16)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-223	Water, (Sample-17)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-224	Water, (Sample-18)	Mercury (Hg)	Less than 0.001 mg/L	3112.B

01.06.2020
Analyst
Dr. Sabina Yasmin
Senior Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR Dhaka-1205

01-06-2020
Section/Division In-Charge
Shakila Akter
Principal Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

02/06/2020
In-Charge/Director
Shamim Ahmed
Director (In-Charge)
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

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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: Mar2020023057	Unit (Lab/Inst.) Ref No: A-225-227
Lab ID: INS-225-227	Sample Receiving Date: 10/03/2020
Sample ID: A-225-227	Submission Date: 10 Mar 2020
	Report Delivery Date: 16/06/2020
Sample Description: Project jetty site, Harbaria, Hiron 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: 3	

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration (mg/L)	Test Method (APHA)

Note:

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16th of June 2020 12:43 PM

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-225	Water (Sample: 01, Jetty site)	Acenapthylene	ND	6440.B
		Anthracene	ND	6440.B
		Benzo (A) Anthracene	ND	6440.B
		Benzo(A) Pyrene	ND	6440.B
		Benzo(B) Fluoranthene	ND	6440.B
		Benzo(G,H,I) Perilene	ND	6440.B
		Benzo(K) Fluoranthene	ND	6440.B
		Chrysene	ND	6440.B
		Dibenzo(A,H) Anthracene	ND	6440.B
		Fluorene	ND	6440.B
		Phenanthrene	ND	6440.B
		Pyrene	ND	6440.B
A-226	Water (Sample: 02, Harbaria)	Acenapthylene	ND	6440.B
		Anthracene	ND	6440.B
		Benzo(A) Anthracene	ND	6440.B
		Benzo(A) Pyrene	ND	6440.B
		Benzo(B) Fluoranthene	ND	6440.B
		Benzo(G,H,I) Perilene	ND	6440.B
		Benzo(K) Fluoranthene	ND	6440.B
		Chrysene	ND	6440.B
		Dibenzo(A,H) Anthracene	ND	6440.B
		Fluorene	ND	6440.B
		Phenanthrene	ND	6440.B
		Pyrene	ND	6440.B

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.
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Analytical Service Cell
Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh
Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

16th of June 2020 12:43 PM

জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন,সব মানুষের উন্নয়ন"

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BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

A-227	Water (Sample: 03, Hiron Point)	Acenapthylene	ND	6440.B
		Anthracene	ND	6440.B
		Benzo(A) Anthracene	ND	6440.B
		Benzo(A) Pyrene	ND	6440.B
		Benzo(B) Fluoranthene	ND	6440.B
		Benzo(G,H,I) Perilene	ND	6440.B
		Benzo(K) Fluoranthene	ND	6440.B
		Chrysene	ND	6440.B
		Dibenzo(A,H) Anthracene	ND	6440.B
		Fluorene	ND	6440.B
		Phenanthrene	ND	6440.B
		Pyrene	ND	6440.B

16.06.2020
Analyst
Dr. Sabina Yasmin
Senior Scientific Officer
Institute of National Analytical
Research & Service (INARS)
BCSIR, Dhaka-1205

16.6.2020
Section/Division In-Charge
মোঃ [illegible] আকবর
উর্ধ্বতন বৈজ্ঞানিক কর্মকর্তা
ইনস্টিটিউট অব ন্যাশনাল এনালাইটিক্যাল
রিসার্চ এন্ড সার্ভিস (আইএনএআরএস)
বিসিএসআইআর, ঢাকা

16/6/2020
In-Charge/Director
Shamim Ahmed
Director (In-Charge)
Institute of National Analytical
Research & Service (INARS)
BCSIR, Dhaka-1205

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Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh
Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

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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: Mar2020023057	Unit (Lab/Inst.) Ref No: A-225-227
Lab ID: INS-225-227	Sample Receiving Date: 10/03/2020
Sample ID: A-225-227	Submission Date: 10 Mar 2020
	Report Delivery Date: 16/06/2020
Sample Description: Project jetty site, Harbaria, Hiron 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: 3	

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-225	Water (Sample: 01, Jetty site)	TOC (Total Organic Carbon)	32.3 mg/L	5310.B
		TOC (Total Organic Content)	2742 mg/L	5310.B
A-226	Water (Sample: 02, Harbaria)	TOC (Total Organic Carbon)	32.5 mg/L	5310.B
		TOC (Total Organic Content)	1555 mg/L	5310.B
A-227	Water (Sample: 03, Hiron Point)	TOC (Total Organic Carbon)	Less than 5.0 mg/L	5310.B
		TOC (Total Organic Content)	5123 mg/L	5310.B

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Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

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জীবনের জন্য বিজ্ঞান

"শেখ হাসিনার দর্শন,সব মানুষের উন্নয়ন"

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)

BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

মুজিব শতবর্ষ MUJIB 100

16.06.2020 16.6.2020 16/06/2020

Analyst | Section/Division In-Charge | In-Charge/Director

Dr. Sabina Yasmin
Senior Scientific Officer
Institute of National Analytical
Research & Service (INARS)
BCSIR Dhaka-1205

মোঃ আব্দুল আকরাম
ঊর্ধ্বতন বৈজ্ঞানিক কর্মকর্তা
ইনস্টিটিউট অব ন্যাশনাল এনালাইটিক্যাল
রিসার্চ এন্ড সার্ভিস (আইএনএআরএস)
বিসিএসআইআর, ঢাকা

Shamim Ahmed
Director (In-Charge)
Institute of National Analytical
Research & Service (INARS)
BCSIR, Dhaka-1205

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/1, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060074	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-01)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Calcium (Ca)	75	171	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
5	Chloride	150-600	4560	mg/L	Titrimetic	-
6	Silica (Sio2)	0.0	35.8	mg/L	UVS	-
7	Bi-Carbonate (HCO3-)	0.0	153	mg/L	Titrimetic	-
8	Cr (Total)	0.05	0.003	mg/L	AAS	0.0003
9	Hardness	200-500	1540	mg/L	Titrimetic	-
10	Iron (Fe)	0.3-1	1.44	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	19	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	1.3	mg/L	UVS	0.10
14	Phosphate	6.0	0.19	mg/L	UVS	0.10
15	Potassium (K)	12.0	8	mg/L	AAS	-
16	Sodium (Na)	200	182	mg/L	AAS	0.34
17	Sulphate	400	490	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	6800	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	11	mg/L	Gravimetric Method	-
20	Turbidity	10	46	NTU	Turbidity Meter	-
21	Carbonate (CO3)	-	0.114	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.

Page 1 of 2

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

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: Mahabuba Sabina Motin Designation: Sample Analyzer	Motin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/2, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060075	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-02)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	1485	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.7	mg/L	UVS	0.10
8	Phosphate	6.0	0.23	mg/L	UVS	0.10
9	Sulphate	400	510	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	6950	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	8	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Mmotin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	BHossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212

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

Lab Memo: 59/3, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060076	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-03)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	6	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	1530	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.2	mg/L	UVS	0.10
8	Phosphate	6.0	0.30	mg/L	UVS	0.10
9	Sulphate	400	560	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	7300	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	7	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Motin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/4, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060077	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-04)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

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	170	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	5	mg/L	CRM	-
5	Chloride	150-600	4550	mg/L	Titrimetic	-
6	Silica (Sio2)	0.0	6.4	mg/L	UVS	-
7	Bi-Carbonate (HCO3-)	0.0	155	mg/L	Titrimetic	-
8	Cr (Total)	0.05	0.004	mg/L	AAS	0.0003
9	Hardness	200-500	1580	mg/L	Titrimetic	-
10	Iron (Fe)	0.3-1	3.85	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	14	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	4.5	mg/L	UVS	0.10
14	Phosphate	6.0	0.27	mg/L	UVS	0.10
15	Potassium (K)	12.0	9	mg/L	AAS	-
16	Sodium (Na)	200	180	mg/L	AAS	0.34
17	Sulphate	400	530	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	6760	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	8	mg/L	Gravimetric Method	-
20	Turbidity	10	13	NTU	Turbidity Meter	-
21	Carbonate (CO3)	-	0.290	mg/L	Titrimetic	-

Page 1 of 2

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

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
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2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	BHossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/5, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060078	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-05)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00017	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	1560	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.7	mg/L	UVS	0.10
8	Phosphate	6.0	0.20	mg/L	UVS	0.10
9	Sulphate	400	640	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	6760	mg/L	Multimeter	-
11	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
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2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/6, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060079	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-06)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	1490	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	5.1	mg/L	UVS	0.10
8	Phosphate	6.0	0.26	mg/L	UVS	0.10
9	Sulphate	400	490	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	6900	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	6	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: Mahabuba Sabina Motin Designation: Sample Analyzer	UMotin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	BHossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/7, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060080	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-07)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Calcium (Ca)	75	171	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
5	Chloride	150-600	4520	mg/L	Titrimetic	-
6	Silica (Sio2)	0.0	34.5	mg/L	UVS	-
7	Bi-Carbonate (HCO3-)	0.0	153	mg/L	Titrimetic	-
8	Cr (Total)	0.05	0.006	mg/L	AAS	0.0003
9	Hardness	200-500	1530	mg/L	Titrimetic	-
10	Iron (Fe)	0.3-1	0.61	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	14	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	7.4	mg/L	UVS	0.10
14	Phosphate	6.0	0.39	mg/L	UVS	0.10
15	Potassium (K)	12.0	11	mg/L	AAS	-
16	Sodium (Na)	200	184	mg/L	AAS	0.34
17	Sulphate	400	520	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	6740	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-
20	Turbidity	10	16	NTU	Turbidity Meter	-
21	Carbonate (CO3)	-	0.570	mg/L	Titrimetic	-

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

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: Mahabuba Sabina Motin Designation: Sample Analyzer	23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/8, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060081	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-08)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	1560	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.9	mg/L	UVS	0.10
8	Phosphate	6.0	0.41	mg/L	UVS	0.10
9	Sulphate	400	470	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	6450	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	8	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: Mahabuba Sabina Motin Designation: Sample Analyzer	23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/10, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060083	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-10)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

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	7	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	1460	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	4.7	mg/L	UVS	0.10
8	Phosphate	6.0	0.47	mg/L	UVS	0.10
9	Sulphate	400	490	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	7250	mg/L	Multimeter	-
11	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Motin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	BHossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/11, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060084	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-11)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	UVS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.004	mg/L	AAS	0.0003
5	Hardness	200-500	1440	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	4.9	mg/L	UVS	0.10
8	Phosphate	6.0	0.26	mg/L	UVS	0.10
9	Sulphate	400	565	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	5800	mg/L	Multimeter	-
11	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Motin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/12, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060085	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-12)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

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	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	1510	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.005	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.3	mg/L	UVS	0.10
8	Phosphate	6.0	0.44	mg/L	UVS	0.10
9	Sulphate	400	580	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	6240	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	14	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Motin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/13, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060086	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-13)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	5	mg/L	CRM	-
4	Cr (Total)	0.05	0.007	mg/L	AAS	0.0003
5	Hardness	200-500	1390	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.2	mg/L	UVS	0.10
8	Phosphate	6.0	0.16	mg/L	UVS	0.10
9	Sulphate	400	470	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	6430	mg/L	Multimeter	-
11	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: Mahabuba Sabina Motin Designation: Sample Analyzer	23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/14, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060087	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-14)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00062	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	6	mg/L	CRM	-
4	Cr (Total)	0.05	0.003	mg/L	AAS	0.0003
5	Hardness	200-500	3470	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.043	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.6	mg/L	UVS	0.10
8	Phosphate	6.0	0.12	mg/L	UVS	0.10
9	Sulphate	400	410	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	16300	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	7	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: Mahabuba Sabina Motin Designation: Sample Analyzer	23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/15, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060088	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-15)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00059	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	7	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	3850	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.056	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	4.1	mg/L	UVS	0.10
8	Phosphate	6.0	0.17	mg/L	UVS	0.10
9	Sulphate	400	445	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	20400	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	6	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Motin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/16, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060089	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Ground Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: GW-01, Karpasdanga)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

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	145	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	2.7	mg/L	UVS	0.10
6	Phosphate	6.0	0.93	mg/L	UVS	0.10
7	Sulphate	400	2	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	370	mg/L	Multimeter	-
9	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Mmotin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/16, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060089	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Ground Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: GW-01, Karpasdanga)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

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	145	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	2.7	mg/L	UVS	0.10
6	Phosphate	6.0	0.93	mg/L	UVS	0.10
7	Sulphate	400	2	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	370	mg/L	Multimeter	-
9	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Mmotin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	BHossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/9, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060082	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Suface Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: SW-09)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	5	mg/L	CRM	-
4	Cr (Total)	0.05	0.001	mg/L	AAS	0.0003
5	Hardness	200-500	1485	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	4.1	mg/L	UVS	0.10
8	Phosphate	6.0	0.37	mg/L	UVS	0.10
9	Sulphate	400	510	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	6700	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	6	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: Mahabuba Sabina Motin Designation: Sample Analyzer	Motin 23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/17, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060090	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Ground Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: GW-02, Rajnagar)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.068	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	118	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	1.4	mg/L	UVS	0.10
6	Phosphate	6.0	0.42	mg/L	UVS	0.10
7	Sulphate	400	3	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	660	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	3	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: Mahabuba Sabina Motin Designation: Sample Analyzer	23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B.Hossain 23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 59/18, CC, DPHE, CL, Dhaka

Date: 23-07-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020060091	Sample Receiving date: 09-03-2020
Ref. Memo No: 42.06.2626.119.37.001.19- 3189 & Dated: 08-03-2020	Sample Source: Ground Water
Sent by:Md. Mutasim Billah ,Program Leader (ESEM of 2×660MW MSTPP) , CEGIS, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS, Dhaka (Sample: GW-03, Project Site)	Union:, Vill.:2×660 MW Thermal Power Plant
Sample Collection date: 08-03-2020	Date of Testing: 09/03/2020- 16/07/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.020	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	137	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	1.9	mg/L	UVS	0.10
6	Phosphate	6.0	1.1	mg/L	UVS	0.10
7	Sulphate	400	2	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	3080	mg/L	Multimeter	-
9	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: Mahababa Sabina Motin Designation: Sample Analyzer	23-07-2020	1.) Name: Mita Sarker Designation: Senior Chemist	23/07/2020
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	23.07.2020	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	23/07/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.

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