



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

28th Quarter Monitoring Report

Monitoring Period: February – April 2021



August 2021

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, Bagerhat

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Acknowledgements

The Center for Environmental and Geographic Information Services (CEGIS) is indebted to Bangladesh-India Friendship Power Company (Pvt.) Limited (BIFPCL) for awarding the contract on “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, Bagerhat.” to CEGIS. The current document constitutes 28th quarterly monitoring aspects covering all the preselected parameters and locations as specified in EIA of Power plant as well as EIA of coal transportation.

CEGIS is grateful to Mr. Gurdeep Singh, Chairman, BIFPCL for his dynamic leadership in this sector. CEGIS also expresses its gratitude to Engr. Md. Belayet Hossain, Chairman, Bangladesh Power Development Board (BPDB), for his continuous inspiration and support in all respect for conducting the study successfully. Moreover, CEGIS Team appreciates and acknowledges Engr. Kazi Absar Uddin Ahmed, Managing Director of BIFPCL for his kind considerations and anticipations. In addition, CEGIS is also thankful to Subhash Chandra Pandey, Project Director for his direction and guidance during the study. CEGIS also appreciates the support and guidance of Ravindra Kumar, Chief Technical Officer; and Dr. Hridaya Nand Pandey, GM-EMG, BIFPCL throughout the study period.

Furthermore, CEGIS also appreciates Md. Ekhlashur Rahman Chaudhury, Manager (Mechanical), BIFPCL for accompanying the team while carrying out monitoring activities at Sundarbans and its adjoining areas. In addition, CEGIS is also grateful to the field officials of different Government and Non-Government Organizations (NGOs) for contributing and sharing their ideas and views towards the project activities and associated existing problems of the study area along with their suggestions for sustainable continuation of the project activities and associated issues regarding power plant construction.

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

<i>Aman:</i>	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.
<i>Aus:</i>	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.
<i>B Aus:</i>	Broadcast Aus
<i>Bazar:</i>	Market
<i>Beel:</i>	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
<i>Boro:</i>	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.
<i>Haat:</i>	Market place where market exchanges are carried out either once, twice or thrice a week, however not every day.
<i>Gear/Jaal:</i>	Different types of fishing net to catch fish from the water bodies.
<i>Kutchra:</i>	A house made of locally available materials with earthen floor, commonly used in the rural areas.
<i>Khal:</i>	A drainage channel usually small, sometimes man-made through which the water flows. These may or may not be perennial.
<i>Kharif:</i>	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).
<i>Perennial Khal:</i>	Water available in the khal all the year round.
<i>Pacca:</i>	Well-constructed building using modern masonry materials.
<i>Rabi:</i>	Dry agricultural crop growing season; mainly used for the cool winter season between November and February.
<i>Seasonal Khal:</i>	Water not available in the khal all the year round.
<i>T. Aman:</i>	Transplanted Aman
<i>Upazila:</i>	Upazila is an administrative subdivision of a District.

Executive Summary

This 28th quarterly monitoring report covers the status of EMP (Environmental Management Plan) implementation for the concurrent period (during construction stage) as recommended in the EIA (Environmental Impact Assessment) study of power plant vide Memo No: DoE/Clearance/5062/2011 dt. 05/08/2013 as well as EIA report of Coal Transportation vide Memo No: DoE/Clearance/5532/2016 dtd.31/01/2018. During the month of March, 2021 CEGIS team carried out the monitoring activities covering every monitoring aspects as assigned in the ToR (Terms of Reference) and approval conditions of DoE along with valuable suggestions and recommendations from different national and international organizations. In other words, the aspects can briefly be addressed as monitoring of the Environmental Compliances and monitoring of the selected environmental parameters such as ambient air quality, noise level, water quality, land resource, traffic management status, water resources management status, agricultural resources monitoring, fisheries resources, Socio-economic monitoring, aquatic & terrestrial ecosystem monitoring and the Sundarbans Reserve Forest (SRF) health monitoring.

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 monitoring activities regarding compliances covers the status of 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 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 has also recommended few measures as per EMP to be complied for ensuring environmental and social safeguarding of the project activities over the study area.

The recommendations include appropriate and adequate use of face mask and safeguarding of other health rules concerning COVID-19 situation, protection of waste water dumping from labour colony to the nearby water bodies, continuing the river bank protection works, restricting groundwater extraction, hastening the green belt development, raising awareness among the workers for managing the COVID-19 outbreak, blocking off areas where heavy machinery or vehicles are being used, 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 unintentional incidents 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, 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.

In course of air quality monitoring it was observed that the concentration of major air pollutants was found comparatively lower in the Sundarbans area than that of other monitoring locations. But due to the seasonal effect the concentration of the particulate matter was found to be slightly higher at Khan Jahan Ali Bridge area and in the township area comparable to the standards set by DOE. In order to minimize the

particulate matter concentration inside the power plant, it is suggested to take the necessary initiatives e.g. continuous or periodic water spraying on the connected road networks inside the power plant area, install water sprinkler system at the prominent infrastructures like office areas, township area etc., strictly maintains the vehicular speed at the sensitive areas and maintain the EMPs as stated in the EIA study of the power plant. However, major sources of criteria pollutants in and around the project site as observed were the piling activities, digging, tunnelling and burrowing works, jetty erection activities, major construction works of boiler and chimney, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads etc. Other sources of pollutants which may contribute to the existing pollution load are the small industries situated around the plant area like cement works and refinery industries etc., diffuse of sources like wood stoves, fires, and wind generated dust etc.

Again the noise levels at two commercial zones namely Chalna bazar (Dacope) and Khan Jahan Ali Bridge (toll office of Khan Jahan Ali Bridge) were recorded as 61.44 dB(A) and 54.65 dB(A) respectively. On the other hand, the observed noise levels at NW Corner of the Project area (Kaigar Daskati), Chunkuri-2 (Bajua), SW corner of the project area (Moidara) and Proposed Township area (Shapmari) were recorded as 49.50 dB(A), 51.31 dB(A), 55.24 dB(A) and 52.05 dB(A) respectively. Only SW corner of the project area (Moidara) got a bit exceedance just about of 0.24dB(A) than the standard. But, the only mixed zone of the study area e.g. Barni (Gaurambha) got the noise level as 52.34 dB(A) which was lower by 7.66 dB(A) than that of its corresponding standard value. Similarly, the levels of noise were found as 48.04 dB(A) and 43.42 dB(A) at Harbaria and Akram Point respectively which were also lower by 1.96 dB(A) and 6.58 dB(A) respectively with respect to their corresponding standard values. However, 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.

In course of water quality monitoring it was observed that the Passur River is highly influenced by tidal effects. Tidal penetration in the Passur River depends on seasonal change, upstream flow and catchment water discharge. However, the physico-chemical properties of Passur River changes with the tidal intrusion in different seasons. During this 28th quarterly monitoring, pH was found slightly alkaline in nature. Likewise, salinity during pre-monsoon was higher than the monsoon and the post-monsoon season and temperature as well as dissolved oxygen level was found in fair and favourable for the aquatic life forms.

However, during the winter, 2020, TDS and TH increased two to three folds in respect to the same seasons of last three consecutive years. TSS of the rivers remained same comparing to the previous post-monsoon seasons. High COD was found in all the monitoring stations. Nitrate (NO_3^-) level remained almost same and within the safe limit while phosphate (PO_4^{3-}) was found extremely high concentration in respect to the safe limit of aquatic organisms. It should be mentioned here that there are no known sources of Phosphate from the project site and its activities. However, the sources of this higher amount of PO_4^{3-} and in the study area will be further investigated in the next monitoring period. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and even no issues as well. Oil & grease concentration was found less than 2.0 mg/L, which is even less than half of the recommended concentration (10 mg/L) for Inland Surface Water. No TOC and PAH issues were found so far in the Passur-Sibsa RS. On the other hand, it was observed that the physical characteristics of groundwater quality was still in good condition and within the acceptable state for drinking purpose except slightly saline in the observed water quality. This salinity might be the reason of saline water infiltration due to excessive withdrawn of groundwater by the surrounding communities during the dry season. In addition, evaporation also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes.

Chemical characteristics of the groundwater quality are also found suitable and safe to drink based on the permissible limit for Bangladesh (Drinking water standards, ECR 1997). Only, chemical oxygen demand during 2014 and 2015 was higher than ECR, 1997. The observed groundwater is completely free from the metal pollution particularly Lead and Mercury. Out of 28 monitoring seasons, only two times Arsenic (As) became an issue temporarily with slightly higher concentrations than the drinking standards.

Again, the sediment quality of the Passur river was also checked and the analysis report has already been incorporated into this report. According to the analysis, only Mercury (Hg) exceeded the Average Shale value and Average Upper Crust value at all locations and Arsenic (As) crossed the Average Upper Crust value. In general, As and Pb concentration decreased at all sampling locations while Hg concentration increased. During this monitoring, maximum concentration of Arsenic (As) and Mercury (Hg) was found at Akram point while Lead (Pb) concentration increased in Harbaria. In Project site (jetty point), concentration of all elements was found well below during this monitoring period.

Vehicular movements were also observed while mostly were for the regular construction activities of the Power Plant as the construction activities of the Power Plant are progressing. During the period, Khulna-Mongla Road at Khudir Bottola received the highest traffic volume compared to the other two locations namely Khulna-Mongla Road at Gonai Bridge and Power Plant access road at Gonabelai Bridge. It is to be mentioned here that, during the morning time, traffic volume at Khudir Bottola was found to be lower compared to the previous monitoring period. On the other hand, Khulna Mongla Road at Gonai Bridge received lower traffic volume whereas, Power Plant access road at Gonabelai Bridge received higher traffic volume compared to the previous monitoring period. One of the key factors behind this heavy traffic volume at Khulna-Mongla Road at Khudir Bottola is the rigorous. On the other hand, reason behind the lower traffic volume at the other two locations may be because the survey date fell on two weekends. Moreover, current pandemic situation could be another reason for the lower traffic volume at those said two locations compared to the immediate previous monitoring results.

Monitoring of fisheries resources was conducted at 13 sampling sites and out of these sites, effective samplings were done eight (08) sites as fishing in other sites across the river course were not observed. Amongst the effective sites, five (05) were in the river and three (03) were in the country side (shrimp farms). The followings are the key findings of the 28th quarter monitoring in the fiscal year of 2020-21. Changes in habitat uses were observed in every past fiscal year along with the current one and the changes were mainly due to biophysical changes like tidal effect, forest erosion and vegetation coverage, seasonal variability, food availability and also fisheries management practices.

Moreover, through analyzing the type of habitat uses by different age group of fish species (based on the length-based community structure model) two types of habitats were found i.e. i) spawning and nursery ground and ii) ground for maturation and feeding. Shannon-Weiner diversity index was varied among the all quarters of the monitoring tiers. Highest Shannon-Weiner index was found at Chalna Point (0.96) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at Chandpai Point (0.37). However, maximum FSR was recorded at Chandpai (n=20), while very low FSR was recorded at Harbaria Point (n=3). Fries of fin fish were found dominating at two sapling sites i.e. Maidara and Chandpai Point but juvenile to adult age group were found dominating at Chalna, Harbaria and Charaputia. Among the observed species Chali Chingri, Motka Chingri, Vadi Chingri were dominant in the three sampling sites. Fish species like Amadi and Harina Chingri and Mutkura Baila got the maximum abundance among the migratory fish species observed during the 28th quarter. Moreover, among migratory species, Poma, Kain Magur and Gagla Tengra were observed to migrate long distance. The present study revealed the highest catch susceptibility was for Bepdi Jal (3.5 kg/haul). However, in this monitoring, the highest stocking rate in respect of Bagda was observed in Rajnagar Gher.

In course of ecological monitoring 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 50 tree species were recorded from all the monitoring sites with Shanon-Winner diversity index of 2.91. Canopy status of two studied homestead vegetation has been improved for expansion of branches of new planted trees. Plant health has slightly deteriorated at Rajnagar and Chalkghona sites due to land filling by saline sand particles from nearer khals whereas other two sites are unchanged. Date palm is the most affected tree species. 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 then Maidara River.

The Sundarbans forest health is being monitored quarterly as per monitoring schedule and so far, twenty-eight (28) surveys were conducted at four locations, namely Sutarkhali, Karamjal, Harbaria, and Akram point. Hiron point survey was not possible due to bad weather. Canopy cover was found increased in all PSPs from the last tier. However, illicit felling rates were comparatively higher in Sutarkhali point and logging was also severely done at Koromjol and Harbaria. The complex species Sundari was observed affected by top dying at Harbaria point. Koromjol got great species diversity with good regeneration process. Among the species, the height of Baen and Kakra is good in number. It is to be mentioned here that, the Akram point is situated at the confluence of Shibsa and Passur River and subjected to excessive erosion. Therefore, first subplot of Akram point has already been eroded and it was needed to add another sub plot in this plot. The number of crab hole and other parameters got no significant changes.

The socio-economic monitoring was done taking into consideration the status of impacts on livelihoods, working environment, community health and safety, and activities under the Corporate Social Responsibility (CSR). Physical observation, telephonic interview and informal interview were used as tools for collecting information on the social safeguard issues. Local labors are getting more working opportunities based on their skills than the previous time. People are having a positive attitude about the project as it is creating livelihood opportunity for them. Local people are getting interested and learn different skills as they can join in future.

The PMU trained the labor force to obey the health safety rules. Regular tool box training held before starting work to improve the working condition. Debriefing session also held with the BIFPCL to monitor the noncompliance issues. Furthermore, labor sheds found clean with adequate toilet facilities, drainage, and waste management and drinking water facilities. Local communities are not facing any kind of problems due to the construction activities. Plantation program is ongoing to improve the greenery environment within the boundary wall of that project. Under the CSR programs, medical campaigns at the community and labor colony was held and people received free treatment facilities. Additionally, wheel chair distribution, and capacity development training held in this period of monitoring as a part of the CSR activities.

1. Introduction

1.1 Background

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

The location of 2x660 MW MSTPP project encompasses Sapmari, Katakhal 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 variations. However, in March, 2021 CEGIS team has carried out the 28th quarterly monitoring activities covering all the preselected monitoring parameters and locations except Hiron point of Sundarbans because of 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.

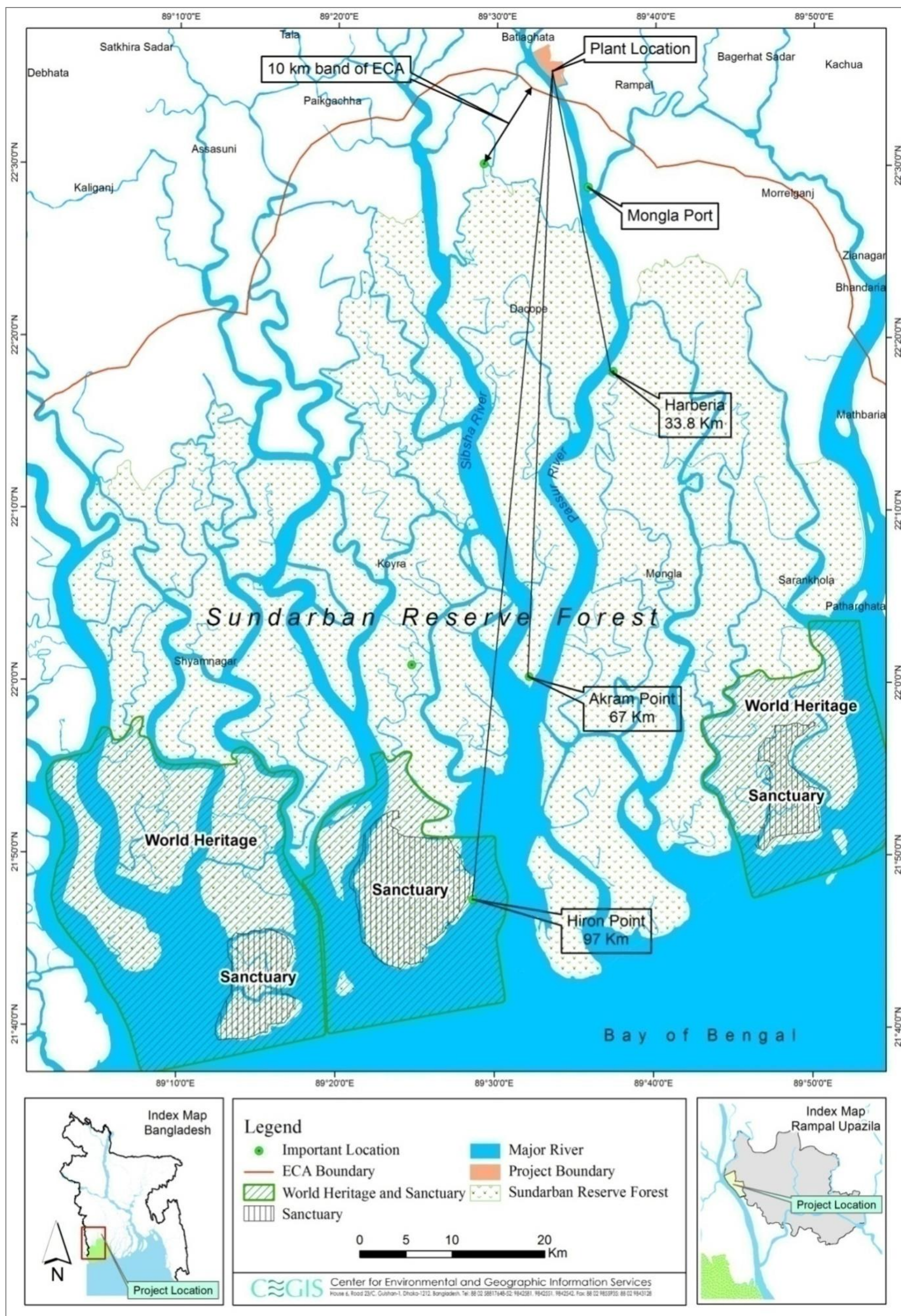


Figure 1.1: Location Map of the Study Area

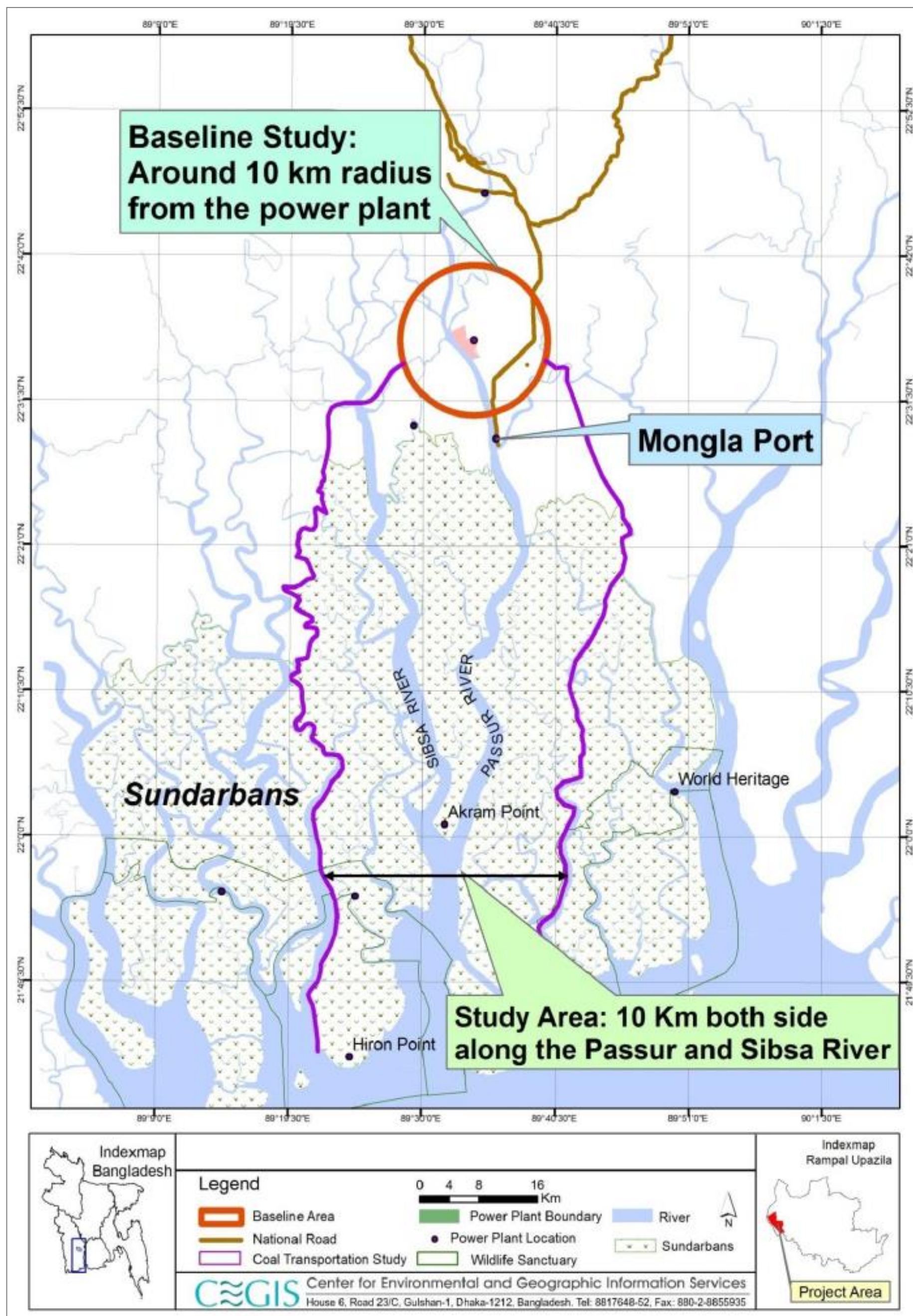


Figure 1.2: AOI of Environmental and Socio-economic Monitoring

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 28th 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) has been included in each of the social environment-monitoring program. The changes in important socio-economic indicators were examined through Focus Group Discussions (FGDs), Key informant interview(s) and other informal discussions with the local people in different locations of the project influenced area.

1.4.5 Major Component of Monitoring Study

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

- Physical Environment covers monitoring of air quality, noise level, water quality, Soil and land resources, traffic management and the morphological study;
- Biological environment covers monitoring of fisheries resources, ecological resources and the Sundarbans Reserve Forest (SRF) health conditions;
- Socio-economic environment covers compensation, resettlement/rehabilitation, project related employment generation, 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}, PM₁₀, and SPM), SO_x, NO_x, CO and O₃ 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}, PM₁₀, and SPM were tested by gravimetric method. The concentration was analyzed by West-Gaeke method. Likewise, the concentration of NO₂ was tested by Jacob and Hochheiser method and concentration of CO and Ozone (O₃) were measured by Metravi CO-10 meter and Tongdy O₃ 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 (PM_{2.5}, PM₁₀ and SPM), Oxides of Sulphur (SO_x), Oxides of Nitrogen (NO_x) 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**.

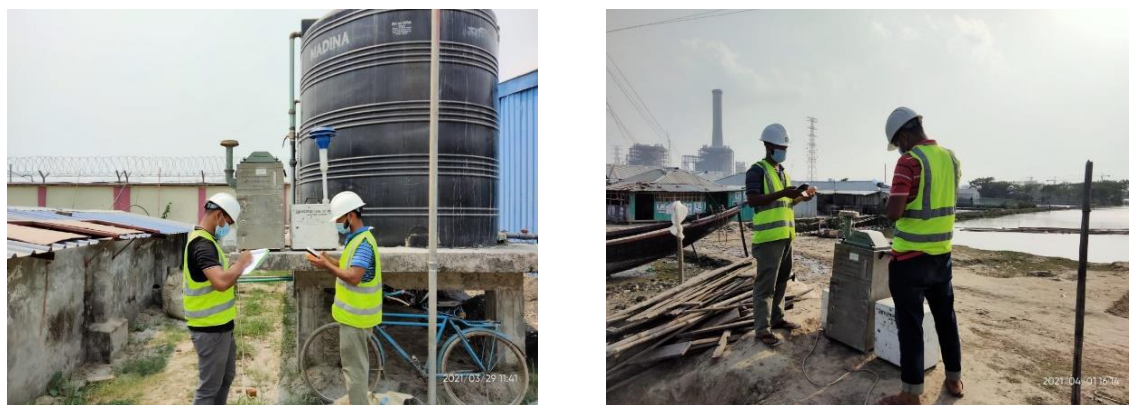


Figure 2.1: Acquisition of Air Quality Monitoring data

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 Katakhal.	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 NO _x : 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)	89°33'13.7"E 22°35'43"N		
13		Access road bridge area	89°35'16.49"E 22°34'37.11"N		

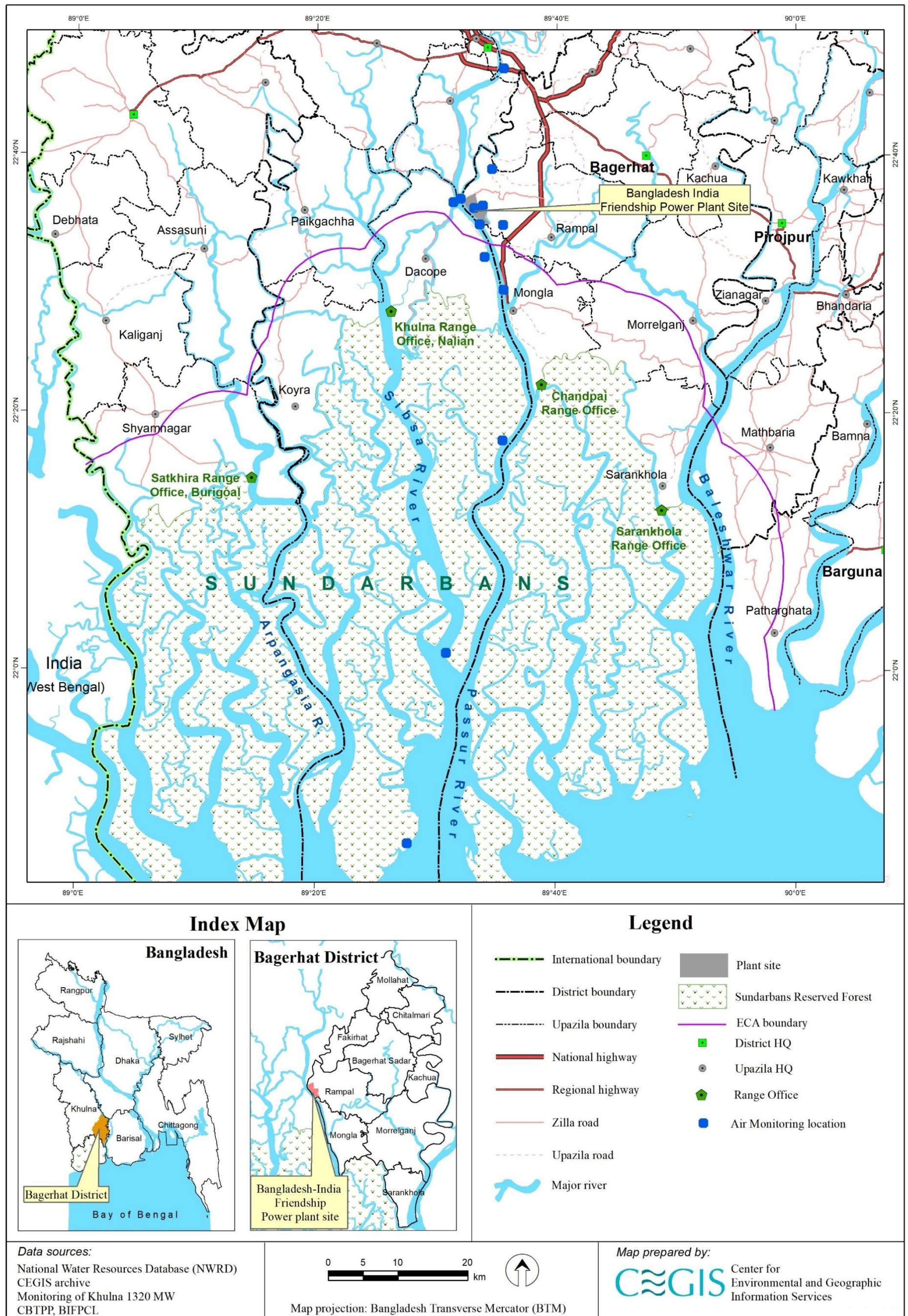


Figure 2.2: Air Quality Monitoring Locations

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 ($71.20 \mu\text{g}/\text{m}^3$) of $\text{PM}_{2.5}$ was found at Khan Jahan Ali Bridge toll plaza area whereas the minimum value ($41.33 \mu\text{g}/\text{m}^3$) was recorded at Akram Point area of the Sundarbans Reserve Forest (SRF). It can be mentioned here that the corresponding values of $\text{PM}_{2.5}$ for Township area, Mongla Port Area and Khan Jahan Ali Bridge were found slightly higher than the standard (ECR' 2005 i.e. $65 \mu\text{g}/\text{m}^3$) during this monitoring period. On the other hand, PM_{10} concentration was found highest ($129.71 \mu\text{g}/\text{m}^3$) at Mongla ghat area and lowest ($73.29 \mu\text{g}/\text{m}^3$) at Chalna bazar area. Similarly, the concentration of SPM was found higher at Khan Jahan Ali bridge toll plaza area ($193.61 \mu\text{g}/\text{m}^3$) whereas, the minimum concentration ($116.73 \mu\text{g}/\text{m}^3$) was observed at Chalna bazar area. During this monitoring period it was noticeable that, comparing with the standards the observed values of $\text{PM}_{2.5}$ for Khan Jahan Ali Bridge, Mongla ghat area and Township area slightly exceeded the standard values set by DoE i.e. $65 \mu\text{g}/\text{m}^3$ which might be due to the seasonal effect. However, in order to minimize the particulate matter concentration inside the power plant, the authority needs to take the necessary initiatives e.g. continuous or periodic water spraying on the connected road networks inside the power plant area, install water sprinkler system at the prominent infrastructures like office areas, township area etc., strictly maintain the vehicular speed at the sensitive areas and maintain the EMPs as stated in the EIA study of the power plant.

On the other hand, the concentration of Sulphur dioxide (SO_2) in ambient air was found much lower than the Bangladesh standard limit of ($365 \mu\text{g}/\text{m}^3$) at all the sampling locations. Among those, the maximum concentration ($23.72 \mu\text{g}/\text{m}^3$) was found at Township area of Power plant while the minimum concentration ($13.1 \mu\text{g}/\text{m}^3$) was recorded at Chalna bazar area. Similarly, the values of NO_x were also observed well below than the Bangladesh standard value of $100 \mu\text{g}/\text{m}^3$. Maximum concentration ($34.49 \mu\text{g}/\text{m}^3$) during this monitoring period was found Township area of Power plant area whereas the lowest concentration ($17.18 \mu\text{g}/\text{m}^3$) was recorded at Chalna bazar area. The contributor of such NO_x emission may be from local human hauler, car, bus etc. and SO_2 emission from industrial activities like brickworks, cement works, etc. in that area.

Furthermore, the maximum value of CO ($1 \mu\text{g}/\text{m}^3$) was measured at Township area though the results were found much lower than the standard value ($10,000 \mu\text{g}/\text{m}^3$) set in ECR' 2005. Similarly, the measured values of O_3 was found higher in township area ($108 \mu\text{g}/\text{m}^3$) and lowest at Gaurambha and Chalna bazaar area. 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**. The baseline condition of emissions of different infrastructures and sources are appended in **Table A2 of Appendix IV**.

Table 2.2: Air Quality Monitoring Results

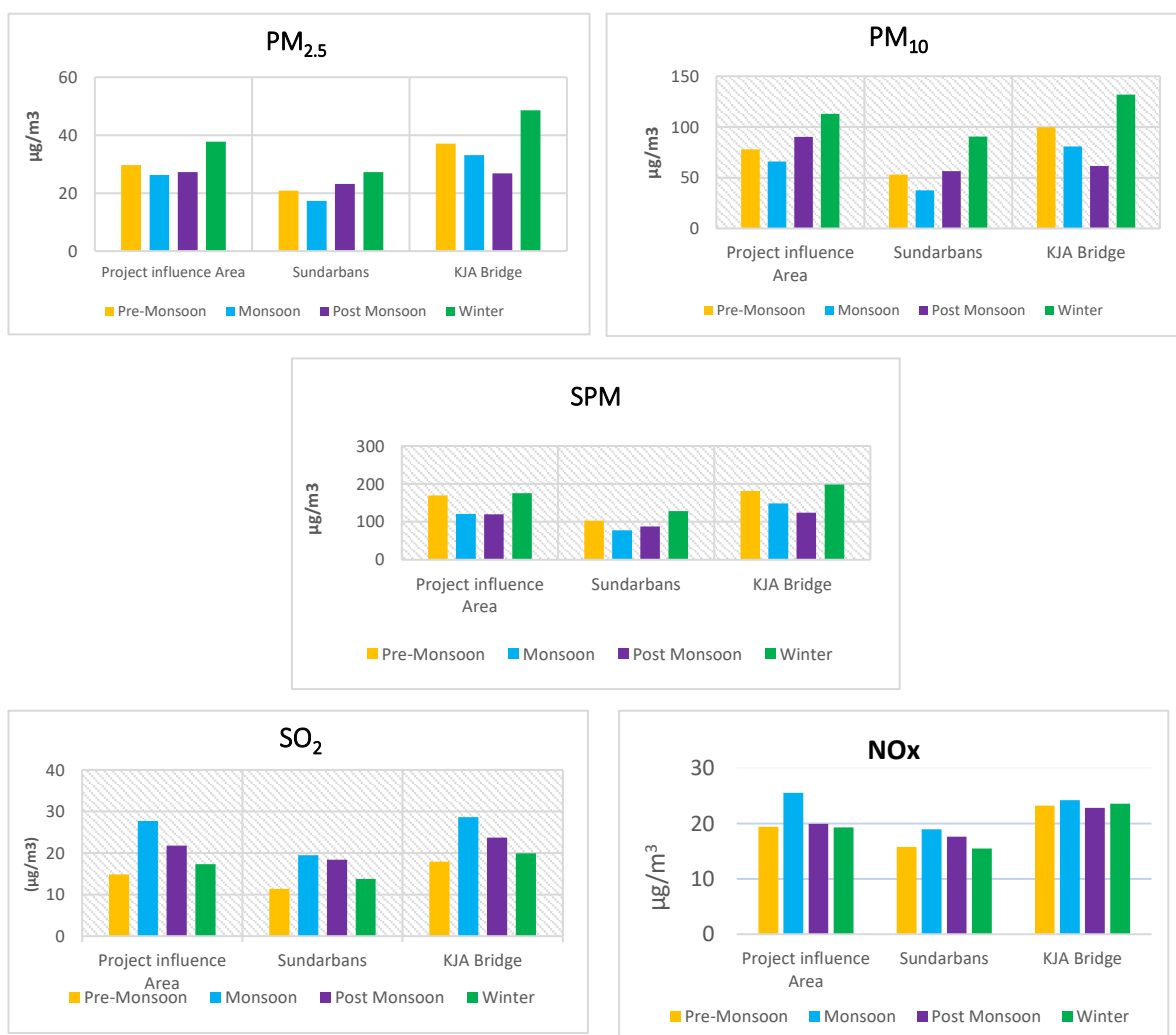
Sl. No.	Location	PM _{2.5} (µg/m ³)		PM ₁₀ (µg/m ³)		SPM (µg/m ³)		SO _x (µg/m ³)		NO _x (µg/m ³)		CO (mg/ m ³)		O ₃ (ppb)	
		Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*
1	South West corner of the Project boundary (Maidara)	49.13	65	103.88	150	155.14	200	16.26	365	22.31	100	0	10	16	157
2	North-east corner of the project boundary (Sapmari)	48.64	65	83.1	150	139.26	200	14.06	365	21.65	100	0	10	9	157
3	North-west corner of the Project boundary (Kaigardaskati)	58.81	65	97.61	150	161.8	200	16.58	365	27.42	100	0.2	10	14	157
4	Barni, Gaurambha union (4km North East from the chimney location)	62.29	65	103.42	150	154.35	200	13.52	365	19.371	100	0	10	2	157
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	53.36	65	86.44	150	128.36	200	19.66	365	24.21	100	0.1	10	28	157
6	Pankhali (Chalna), Dacope, (4km North West from the Chimney location)	42.62	65	73.29	150	116.73	200	13.1	365	17.18	100	0	10	2	157
7	Mongla Port Area	65.37	65	129.71	150	180.22	200	18.91	365	30.2	100	0.9	10	91	157
8	Harbaria, Sundarbans	46.13	65	82.83	150	133.1	200	16.58	365	18.73	100	0	10	3	157
9	Akram point, Sundarbans	41.33	65	84.16	150	131.46	200	17.44	365	23.5	100	0	10	8	157
10	Hiron Point, Sundarbans	NS	65	NS	150	NS	200	NS	365	NS	100	NS	10	NS	157
11	Khulna city near Khan Jahan Ali Bridge	71.2	65	120.38	150	193.61	200	20.64	365	28.35	100	3	10	63	157
12	Project site-1 (Township area)	67.82	65	108.2	150	170.4	200	23.72	365	34.49	100	1	10	108	157
13	Access road bridge area	64.73	65	119.7	150	173.9	200	19.16	365	23.74	100	0.2	10	46	157

Source: CEGIS field survey; STD*-Standard; NS-Not Surveyed

Seasonal variations among the air quality parameters

The values of all the criteria pollutants as averaged for the corresponding locations were found to be higher in Khan Jahan Ali Bridge area than the other locations in all seasons but lower in project influence area followed by the SRF area. On the other hand, the concentration of the measured parameters was found to be higher in winter seasons of the monitoring periods except for SO_x, NO_x and CO while the values of SO_x and NO_x were found to be higher in monsoon periods and for CO the concentration was found to be higher in post monsoon seasons. Moreover, the concentrations of SO_x, NO_x, CO and O₃ were found higher at Khan Jahan Ali bridge area in all seasons than the project influence area and the SRF area. It can be mentioned here that the concentration was always observed to be much lower in SRF area than the other areas and never exceeded comparing to the standards set by DoE (**Figure 2.3**)

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



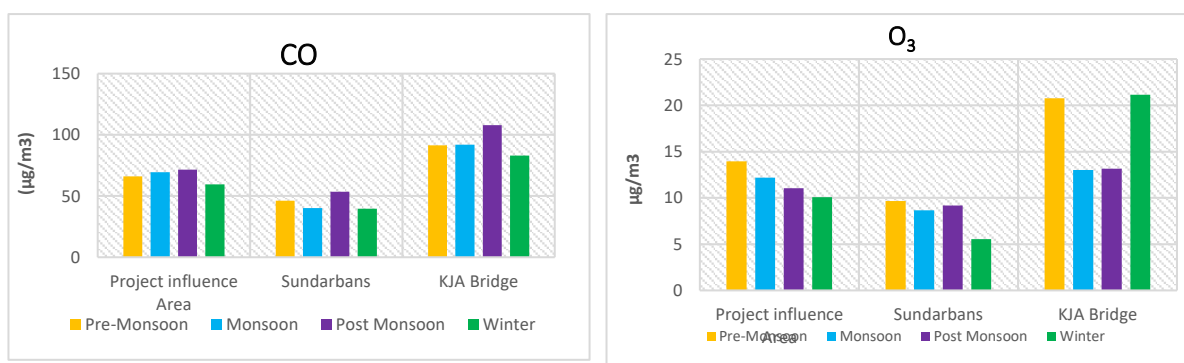


Figure 2.3: Seasonal Variation of the Air Quality Parameters

Cluster analysis

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 dendrogram (**Figure 2.4**) Hiron point (L10), Akram Point (L9) and Harbaria (L8) represents the locations of minimum pollution level situated inside the Sundarbans Forest area and are away from the nuclei of Mongla industrial zone and the project site. On the other hand, Chalna (L6), Mongla Ghat (L7) and Khan Jahan Ali Bridge in Khulna (L11) are subjected to higher in population density and increased industrial activities among all sites whereas moidara (L1), shapmari (L2), Gaurambha (L4) and bajua (L5) represent lower in population density and moderate commercial activities (**Figure 2.4**).

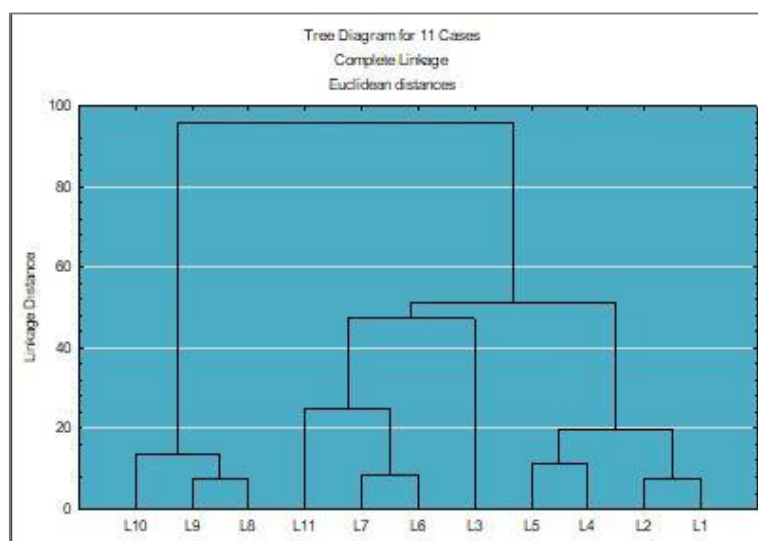


Figure 2.4: Dendrogram of the Monitoring Stations using Euclidean Distance

2.1.6 Findings

According to the observed data it can be concluded that the concentration of major air pollutants was found comparatively lower in the Sundarbans area than that of other monitoring locations. But due to the seasonal effect the concentration of the particulate matter was found to be slightly higher at Khan Jahan Ali Bridge area and in the township area comparable to the standards set by DOE. In order to minimize the particulate matter concentration inside the power plant, it is suggested to take the necessary initiatives e.g. continuous or periodic water spraying on the connected road networks inside the power plant area, install water sprinkler system at the prominent infrastructures like office areas, township area etc., strictly maintains the vehicular speed at the sensitive areas and maintain the EMPs as stated in the EIA study of the power plant.

However, major sources of criteria pollutants in and around the project site as observed were the piling activities, digging, tunneling and burrowing works, jetty erection activities, major construction works, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads and river Passur etc. Other sources of pollutants which may contribute to the existing pollution load are the small industries like cement works and refinery industries etc., diffuse sources like wood stoves, fires, and wind generated dust etc.

2.2 Noise Quality

Noise is the sound that is not wanted by the perceiver, because it is unpleasant, loud, or interferes with hearing. By extension, in experimental sciences, "noise" refers to any random fluctuations of data that makes more difficult the perception of an expected signal. From a physics standpoint, noise is indistinguishable from sound as both are vibrations through a medium, like air or water. In general point of view, noise is the chaotic feeling of sound where many sound waves are mixed and difficult to distinguish a single signal. Noise is described by a weighted sound intensity (or level), which represents sound heard by the human ear and is measured in units called decibels dB (A). However, engine boats, trawlers, small barges, ships plying over the waterways, birds' chirping, stormy wind, falling of leaves from the trees and the wave breaking sound were the main source of noise generation in and around the Sundarbans. On the other hand, construction activities, the urban and rural vehicles i.e. buses, trucks, local human haulers, auto-rickshaws, motorized vans, motorbikes etc. were much noticeable in the outside of Sundarbans area.

2.2.1 Methodology

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



Figure 2.5: Ambient Noise Acquisition

2.2.2 Sources of Noise in the study area

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

Table 2.3: Noise Monitoring Plan

SL. No.	Monitoring locations	GPS points	Time of noise monitoring
1	South West corner of the Project boundary	89°33'34.5"E; 22°34'33.8"N	Morning, Noon and evening
2	Proposed township area near Chimney location, Mauza: Sapmari Katakhal	89°32'3.8"E; 22°36'32.5"N	Morning, Noon and evening
3	North West corner of the Project boundary (Kaigar Daskati)	89°33'51.8"E; 22°36'1.06"N	Morning, Noon and evening
4	Barni, Gaurambha union (4km North East from the chimney location)	89°34'37.7"E; 22°38'51.8"N	Morning, Noon and evening
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	89°34'01.1"E; 22°32'3.3"N	Morning, Noon and evening
6	Pankhali, Dacope, (4km North West from the Chimney location)	89°31'24.2"E; 22°36'6.7"N	Morning, Noon and evening
7	Mongla Port Area	89°35'50.4"E; 22°28'24.8"N	Morning, Noon and evening
8	Harbaria, Sundarbans	89°35'34.2"E; 22°17'43.1"N	Morning and Noon
9	Akram point, Sundarbans	89°30'54.1"E; 22°23.50"N	Morning and Noon
10	Hiron Point, Sundarbans	89°27'53.2"E; 21°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

2.2.4 Status of Noise

In order to provide an overview of the observed data set, the average values for the respective locations have been appended in **Table 2.4** for ready reference; but the detailed Noise Level Data have been attached in Table C.1, C.2, C.3, C.4, C.5, C.6 and C.7 respectively in the **Appendix IV**.

The Department of Environment of the People's Republic of Bangladesh, an agency under the Ministry of Environment and Forests has set up the standard of permissible limits of noise level at day time for different classified areas. According to *Bangladesh Noise Pollution Control Rules (2006)*, the whole study area can be classified into five distinctive noise zones named as commercial, residential, mixed, industrial and silent zone. However, a brief description of the noise status for the pre-monsoon period is described in the following section. Among the zones levels of noise were recorded as 61.44 dB(A) and 54.65 dB(A) at Chalna bazar (Dacope) and Khan Jahan Ali Bridge (toll office of Khan Jahan Ali Bridge) respectively. For these locations, the standard level is 70 dB(A). So, it is calculated that levels of noise were 8.56 dB(A) and 15.35 dB(A) lower than that of their corresponding standard setup. NW Corner of the Project area (Kaigar Daskati), Chunkuri-2 (Bajua), SW corner of the project area (Moidara) and Proposed Township area (Shapmari) falls within the residential zone standard. Observed noise levels at these four locations were recorded as 49.50 dB(A), 51.31 dB(A), 55.24 dB(A) and 52.05 dB(A) respectively. In this class (residential), three locations showed no overtopping of standard noise value. Levels of noise were lower by 5.5 dB(A), 3.69 dB(A) and 2.95 dB(A) than that their corresponding standard values at NW Corner of the Project area (Kaigar Daskati), Chunkuri-2 (Bajua) and Proposed Township area (Shapmari) respectively. Only SW corner of the project area (Moidara) had a small amount of exceedance of 0.24dB(A) (**Figure 2.8**).

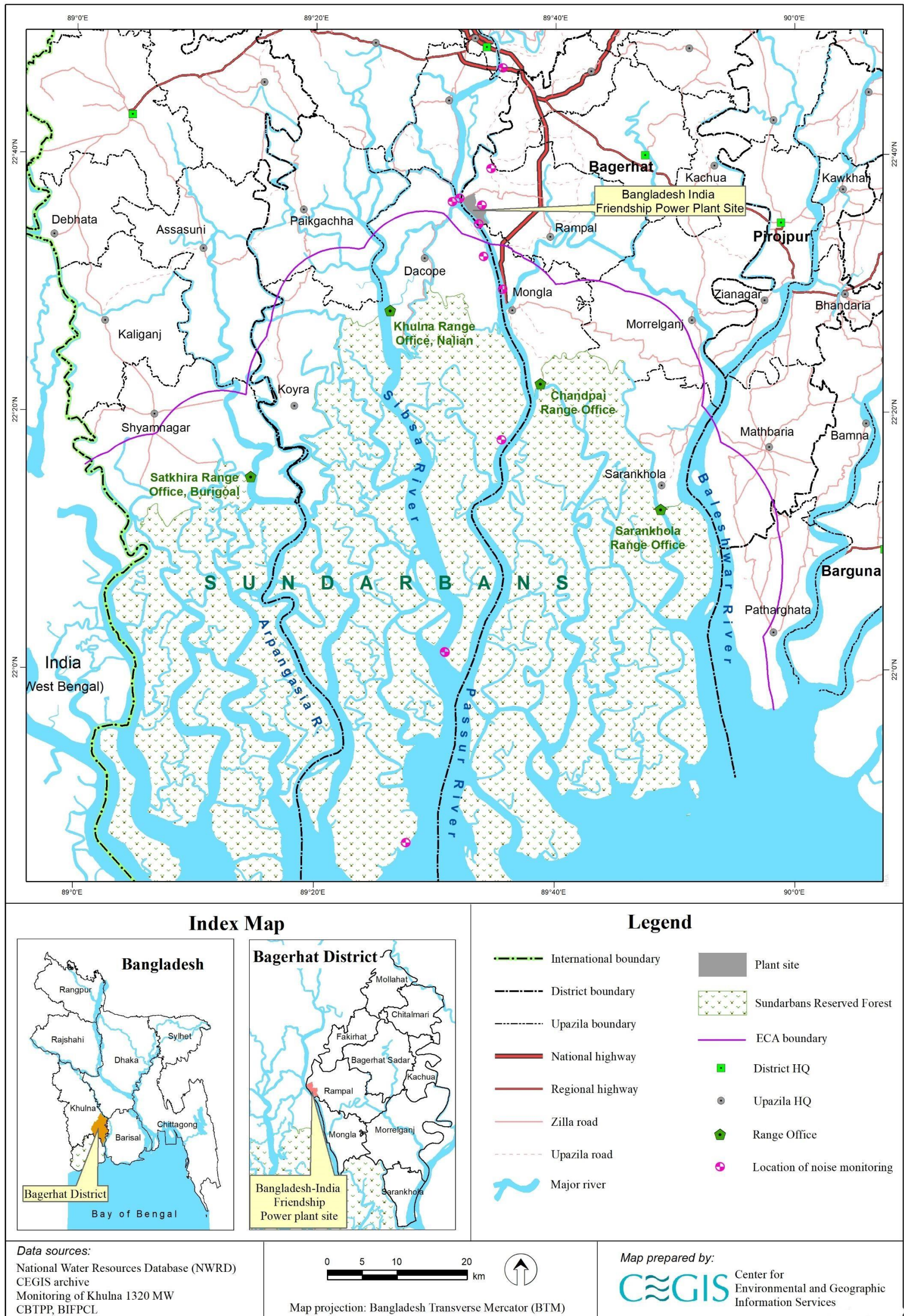


Figure 2.6: Noise Level Monitoring Locations

The only mixed zone of the study area is Barni (Gaurambha). The level of noise at this location was recorded as 52.34 dB(A) which was lower by 7.66 dB(A) than that of its standard value. The level of noise at Mongla Port, the only industrial zone under this study area was recorded as 53.63 dB(A) which was far lower by 16.37 dB(A) than that of its corresponding standard value (**Figure 2.8**).

Harbaria, Akram Point and Hiron Point of Sundarbans are under the silent class zone and the standard limit of ambient noise at daytime is 50 dB (A) (*Noise pollution control rules, 2006*). These three locations are the important biodiversity hot spot in the Sundarbans. However, among these three locations, Hiron point was not monitored in this monitoring season due to uneven and bad weather condition (**Figure 2.8**).

Levels of noise were found as 48.04 dB(A) and 43.42 dB(A) at Harbaria and Akram Point respectively. These were also lower by 1.96 dB(A) and 6.58 dB(A) respectively with respect to their corresponding values (**Figure 2.8**).

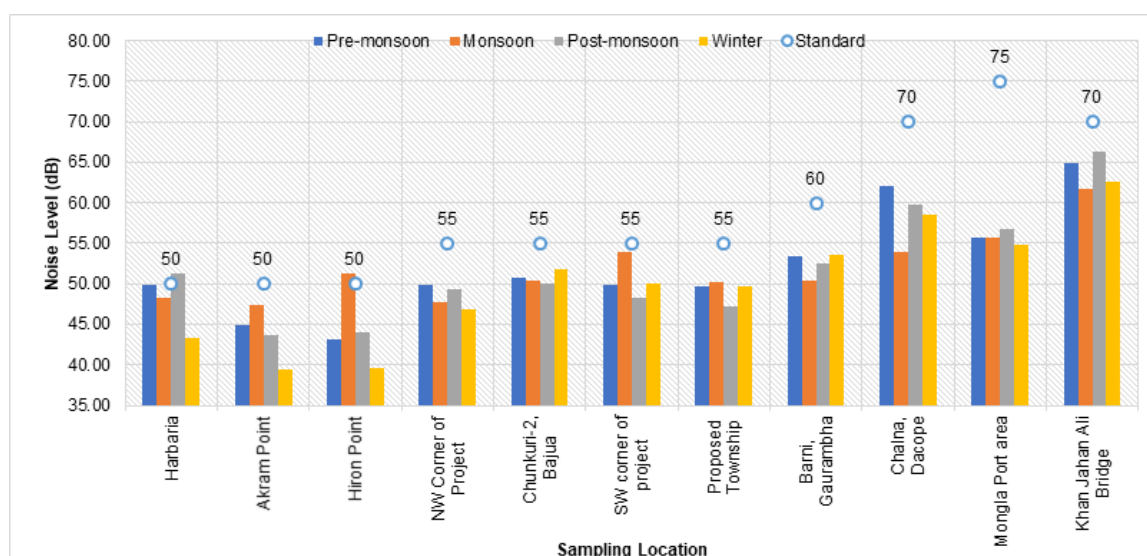


Figure 2.7: Status of average Noise level for all seasons at different locatons

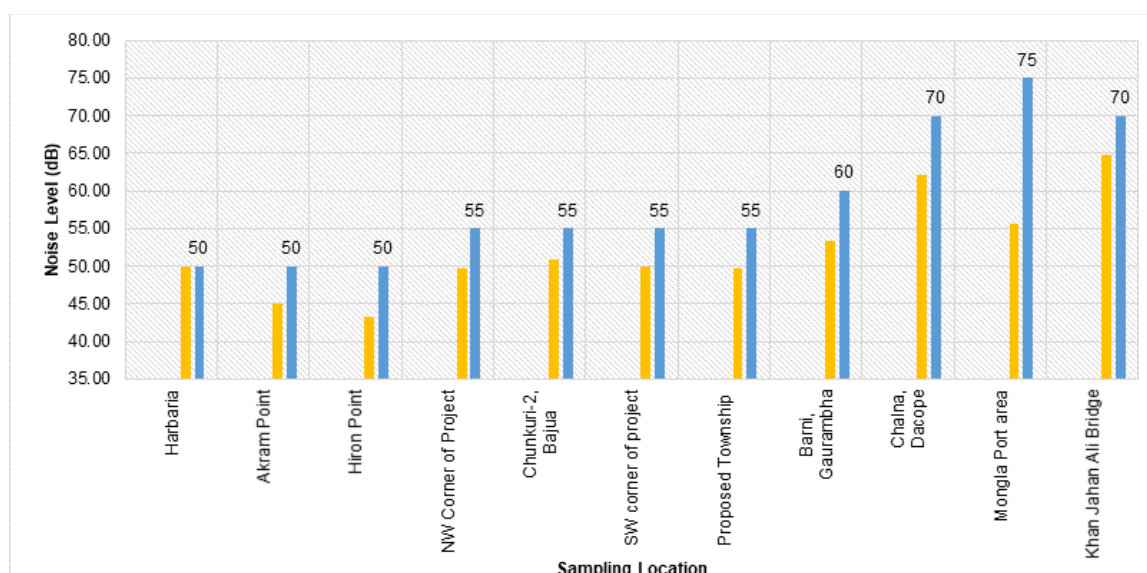


Figure 2.8: Status of average Noise Level at the Monitoring Locations (28th quarter)

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

Monitoring periods (Cont.)																
Sl.	Location	QM-28 (Apr-21)	QM-27 (Jan-21)	QM-26 (Nov-20)	QM-25 (Jul-20)	QM-23 (Feb-20)	QM-22 (Nov-19)	QM-21 (Jul-19)	QM-20 (Apr-19)	QM-19 (Feb-19)	QM-18 (Nov-18)	QM-17 (Jul-18)	QM-16 (Apr-18)	QM-15 (Jan-18)	QM-14 (Oct-17)	Std* (dB)
1	Chalna, Dacope	61.44	60.50	58.15	51.28	54.59	58.60	59.34	61.67	56.45	58.23	57.54	59.63	60.1	58.64	70
2	NW Corner of the Project area (Kaigar daskati)	49.50	51.42	48.48	43.37	45.42	51.11	55.18	56.85	50.75	58.82	45.63	47.90	49.3	46.95	55
3	Chunkuri-2, Bajua	51.31	47.05	45.91	48.75	55.44	55.27	59.36	51.68	50.18	48.69	47.54	52.93	51.4	50.44	55
4	SW corner of the project area (Moidara)	55.24	52.36	49.18	50.18	55.60	46.57	63.66	56.05	55.79	61.78	52.63	47.55	44.5	43.26	55
5	Proposed Township area (Shapmari)	52.05	49.09	44.45	53.72	48.95	54.88	54.53	58.83	58.13	50.68	44.25	50.81	53.3	43.93	55
6	Barni, Gaurambha	52.34	53.09	58.33	48.80	61.97	50.53	54.67	53.18	52.57	53.03	45.52	56.14	55.6	45.52	60
7	Khan Jahan Ali Bridge, Khulna	54.65	61.94	81.81	66.31	62.20	66.05	63.46	66.95	66.93	62.15	63.36	64.87	61.7	62.47	70
8	Mongla Port area	53.63	56.52	76.92	64.41	61.06	57.25	62.01	63.99	66.18	55.97	60.97	62.95	59.8	49.66	75
9	Harbaria, Sundarbans	48.04	44.40	54.54	49.97	43.94	44.10	44.90	48.43	49.67	48.80	50.28	47.93	44.4	46.48	50
10	Akram Point, Sundarbans	43.42	37.85	42.23	51.04	36.59	44.86	44.84	42.33	46.45	41.00	45.20	45.39	40.1	42.38	50
11	Hiron Point, Sundarbans	NM	38.85	50.70	NM	40.34	40.28	NM	NM	39.21	39.4	NM	NM	38.8	39.79	50

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

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

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

An updated water quality status of the Passur-Sibsa River system and adjacent water bodies have been depicted in this section. The methodologies used for the entire monitoring activities, both the national and international guidelines were followed and adopted. This report includes physical water quality parameters collected during 28th quarterly monitoring (April 2021) and the tested results obtained from the laboratory up to January 2021 (27th quarterly monitoring). The surface and groundwater quality were monitored in the respective locations performed during the previous monitoring. A number of identical parameters were selected to understand the quality of the water for community use, aquatic life, and for the Sundarbans Forest ecosystem itself.

2.3.1 Methodology

Water quality monitoring covers selection of water quality parameters, identification of sampling locations, determination of sampling frequency and evaluation criteria of the monitoring parameters etc. Standard approaches and methodologies were followed for the above-mentioned events. Both the surface and groundwater quality statuses in and around the Power Plant and the Sundarbans area were examined. The monitoring results have been presented graphically and been compared with the national standards (ECR, 1997 and all available amendments).

The samples were collected from eighteen (18) pre-selected locations (15 locations for surface water along the Passur River, Sibsa River, Maidhara River, near the proposed township area, and 3 locations for groundwater around the study area). The selected monitoring locations for the current monitoring program are shown in **Figure 2.9**. The details of the monitoring plan covering sampling locations, geographical locations, frequency and analysis techniques of sampling for surface and groundwater are given in **Table 2.5** and **Table 2.6** respectively.

Table 2.5: Groundwater Quality Monitoring Parameters, Locations and Plan

Sl No	Locations	GPS (Decimal Degree)		Frequency	Methods/Monitoring indicators/ Techniques
		Easting	Northing		
1	Near Proposed Township Area	89.566139°E	22.594167°N	Quarterly	In-situ testing of physical water quality parameters 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 locations (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		

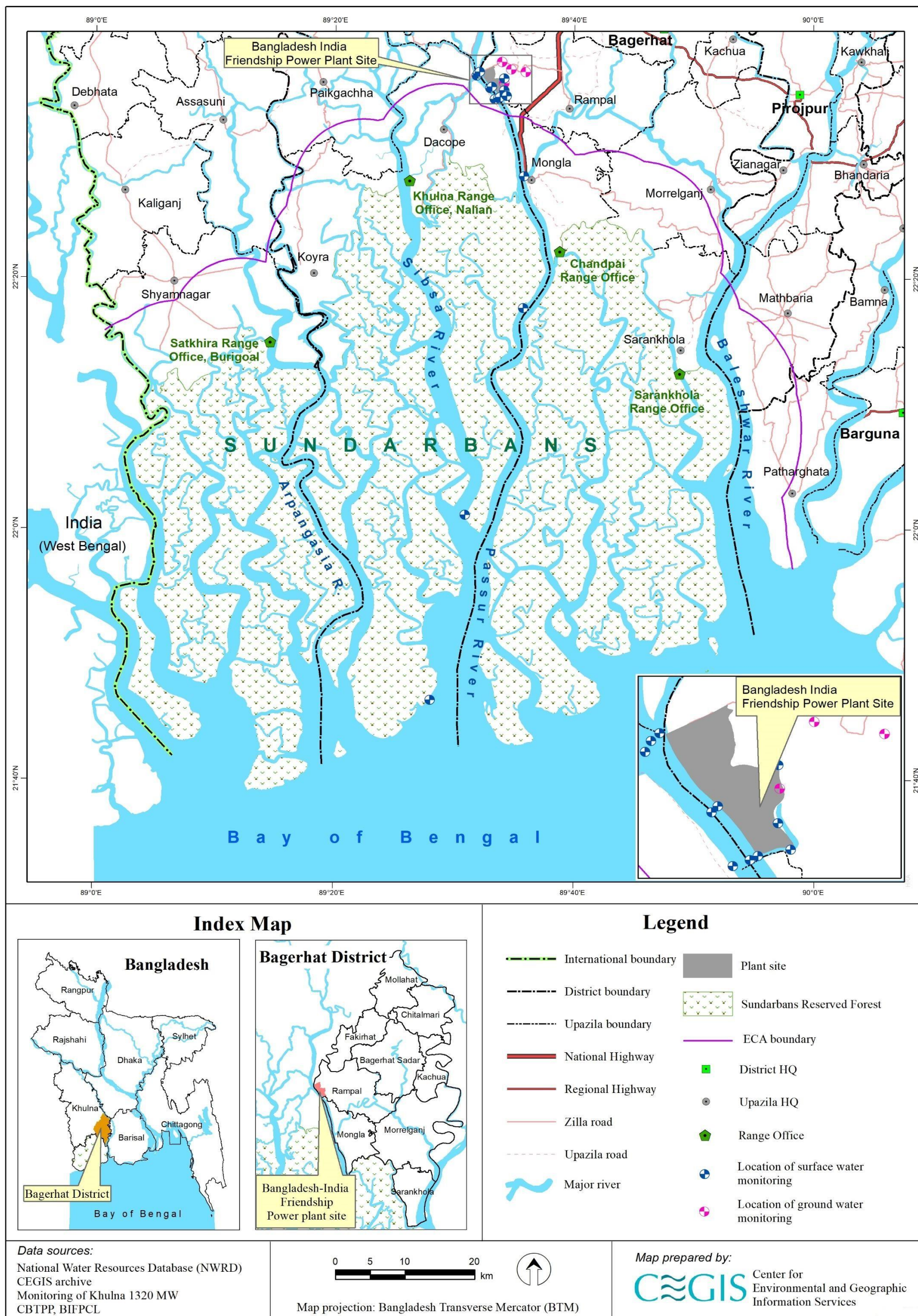


Figure 2.9: Surface Water and Groundwater Quality Monitoring Locations

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

Sl no	Monitoring Indicators	Locations	GPS (Decimal Degree)		Frequency	Methods/Tools/ Techniques
			Easting	Northing		
1	pH, Temperature, Salinity, DO, BOD ₅ , TDS,	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	TH, TSS, COD, Nitrate, Sulphate, Phosphate,	Middle of Passur River at 100m u/s of North West corner of the Project boundary	22.607222°N	89.528889°E		
3	Arsenic, Lead, Mercury, Oil & Grease, PAH, TOC, TC	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		

2.3.2 Selection of Parameters

Water quality parameters were selected based on tentative potential impacts to be generated during pre-construction, construction and operation phases of the Power Plant 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;
- 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. The analysed data of the additional parameters will be recorded and submitted to the DoE and other concerned authorities as per the condition no. 26 of the EIA approval of coal transportation study. Nevertheless, these three (03) additional parameters will be incorporated and discussed in the respective monitoring report (half yearly) after obtaining the analysed results from the respective organizations (BCSIR and DPHE).

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

The standard sampling procedure was followed for both surface and groundwater sampling to reduce the possibility of any error. Each sample was labelled at the time of sampling.

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 and storing below 10°C . Acidified sampling bottles were used for heavy metal (As, Pb, Hg) sample collection while wrinkle bottles were used for BOD_5 . All samples were preserved as per standard procedure. The in-situ testing of the water quality parameters are shown in **Figure 2.10**.



Figure 2.10: 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	°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°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

2.3.9 Water Quality Reporting Arrangement

Water quality status of the adjacent water bodies of power plants and the Sundarbans deep forests are being observed since April 2014. In this 28th quarterly water quality monitoring report, yearly variations of winter (January, 2021) for chemical water quality statuses and yearly variations in pre-monsoon (April 2021) for physical water quality statuses are presented and compared with the ECR' 1997 Standards. To do so, all sampling points are clustered in five different sampling sites considering homogenous characteristics of the sampling points as well as the type of ecosystem touching the sample points. The clustered sample monitoring sites and the logical explanation of the clusters are presented in the following **Table 2.8**.

Table 2.8: Monitoring Sites and Characteristics

SL	Monitoring sites	Site Characteristics
(a)	Power plant & adjacent areas	In this monitoring site, total 11 sampling points have been averaged to represent the water quality status of power plant and its adjacent surface water bodies. These 11 sampling points are situated in the same river system and embedded within 1km radius of power plant. In addition, previous monitoring results indicated same water chemistry. 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 situates at least 13km downstream of the power plant. This point is a confluence of Passur river and 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 situates around 15 km downstream of the Mongla-Passur confluence. This site is dominated by Sundarbans Forest. Heavy activities of mother vessels unloading and small cargo movement for carrying of clinker, coal and LPG gas. Influenced by tidal effects of Bay of Bengal.
(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 Sibsa river before mixing with Passur river at Sibsa point. This site is completely dominated by deep forests ecosystems. Influenced by tidal effects of Bay of Bengal.
(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 28th monitoring period (April 2021: Pre-monsoon season) are described below:

pH

Twentieth (28th) quarterly monitoring has been held in the month of April 2021, usually called the Pre-monsoon season of Bangladesh. During this visit, pH values in the monitoring sites are found to range between 7.8 and 8.9.

Generally, pH value was found to be the highest during April 2019 followed by the last April of 2021 among all the observations performed for the same pre-monsoon seasons. The main reason can be the high salinity

intrusion than previous time or no rainfall at all. During the last visit, salinity concentration was also found almost double than the previous pre-monsoon season of the years of 2014, 2015 and 2016 (**Figure 2.11**). Altogether, pH value was almost 8.3 near the power plant areas and around 8.2 inside the deep forests area. In the last pre-monsoon season, pH value showed distinct spatial variations and some of the records were found even higher than the ECR, 1997 Standard (6.5-8.5). That indicated slightly alkaline in nature.

The pH values of pre-monsoon and monsoon seasons were found to be comparatively lower than those of the post-monsoon and winter seasons (**Table B.1: Appendix-IV**). During post monsoon and winter season, river flow and water level normally reduced due to inadequate rainfall and insufficient inflow from U/S (upstream) of Passur-Sibsa RS (River System). As a result, pH values increased than those of the pre-monsoon and monsoon seasons, which has also reported by others (Rahman et al., 2013). Fluctuations in pH values during different season of the year can be attributed to factors like; removal of CO₂ 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 first, second, third, fourth, fifth, sixth and seventh year of Passur-Sibsa RS are presented in **Figure 2.11** 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 same pre-monsoon season. The values in this monitoring period, varied from 29°C -31°C among the monitored sites. Water temperature was found the highest at the Maidara-Ichamoti confluence (**Figure 2.12**). Observation sites outside the Sundarbans and the Deep mangrove forests showed the same average temperature of 30°C. According to the ECR, 1997, 30°C water temperature is still be tolerable by the aquatic organisms in tropical environment. However, there were some sites that showed increasing pattern of temperature rather than the ECR limit. That changes could be high salinity and hot environment of the last pre-monsoon season. Still, the power plant is not discharging any hot water into its surrounding environment as it is still in construction phase.

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. Recorded temperatures indicated that there was spatial variation among the monitoring sites even in the same season.

The measured temperature in the selected sites during the quarterly monitoring of first, second, third, fourth, fifth, sixth and seventh year are presented in **Figure 2.12** and all the observed dataset are attached in **Table B.2 of Appendix- IV**.

Salinity

The observed salinity concentration ranged between 6.5ppt and 10.9ppt during the last pre-monsoon season. The maximum salinity was observed at Akram point in the Sundarbans while minimum at the Maidara-Ichamoti River. In the last pre-monsoon (2021) monitoring, the salinity was found almost half compares to the salinity range of 2018 and 2019. Sufficient fresh water flow from upstream section of the river system reduced the salinity concentrations in the last pre-monsoon than the pre-monsoon seasons of 2018 and 2019.

In general, high salinity from sea water increased water salinity in the direction of downstream to upstream. In the monitored river systems, the highest salinity was observed in pre-monsoon season followed by winter season. 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 in the selected sampling stations of Passur-Sibsa RS of the 28th consecutive monitoring periods are presented in **Figure: 2.13** and all the observed dataset are attached in **Table B.3 of Appendix- IV**.

Dissolved Oxygen

The standard DO level for the fisheries in aquatic environment is more than 5.0 mg/L (ECR'1997). In the last pre-monsoon season, DO ranged from 5.4 mg/L to 8.5 mg/L which was found within the permissible limit recommended by DoE protocols. The average DO value of 6.8 mg/L was found near the power plant sites which declined very slightly inside the Sundarbans. Still, DO level hasn't been an issue in the observed river systems.

In case of seasonal variations, maximum concentrations were observed during monsoon and post monsoon season. Higher DO level in monsoon and post-monsoon season, basically was 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, still the DO concentration of Passur-Sibsa RS (near project site and inside the Sundarbans), are 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: 2.14** and all the observed dataset are attached in **Table B.4 of Appendix- IV**.

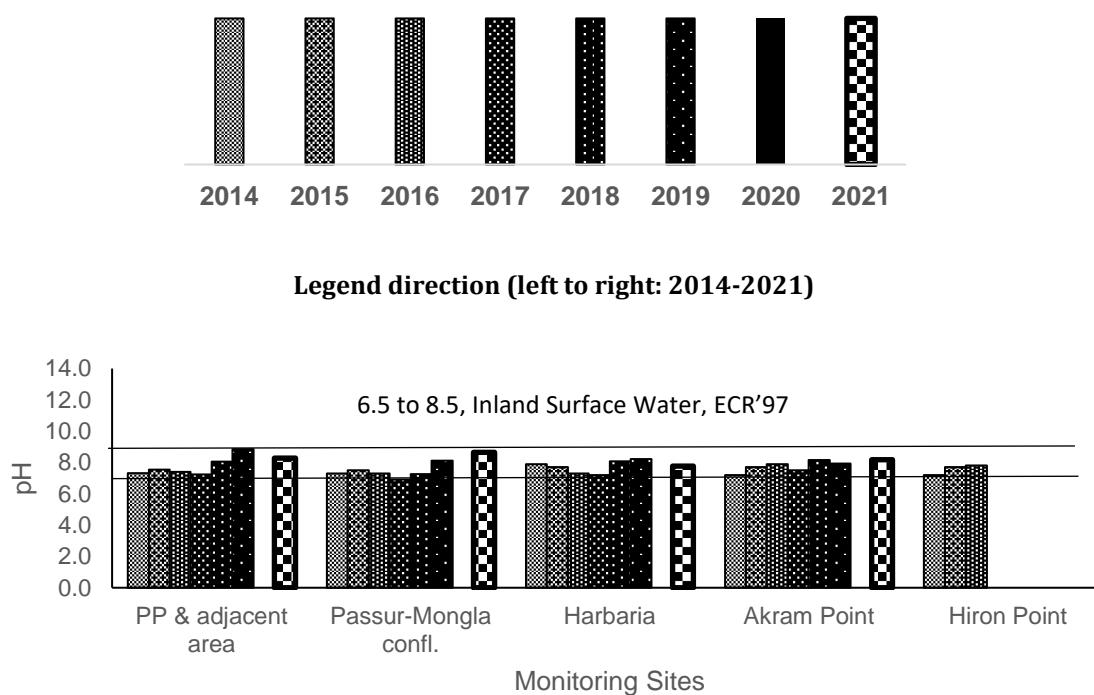


Figure 2.11: Variations in Pre-monsoon pH values in different monitoring sites

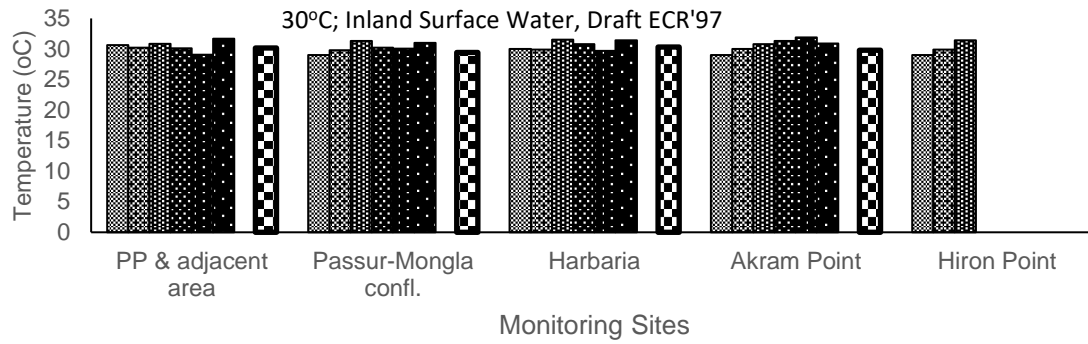


Figure 2.12: Variations in Pre-monsoon temperature in different monitoring sites

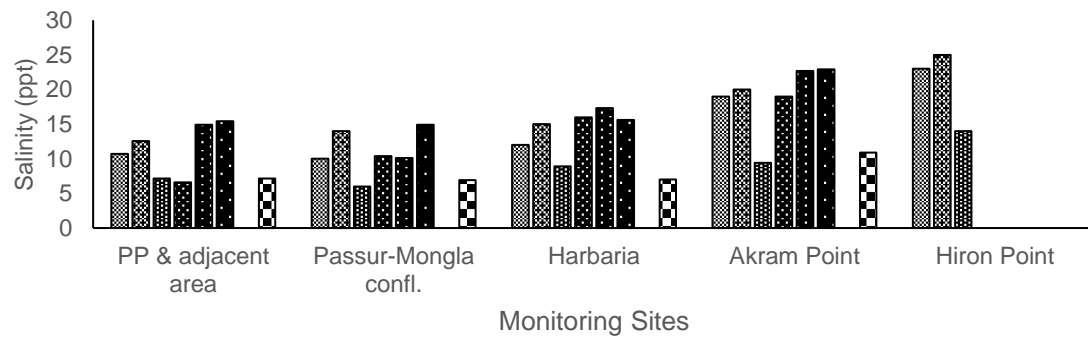


Figure 2.13: Variations in Pre-monsoon salinity in different monitoring sites

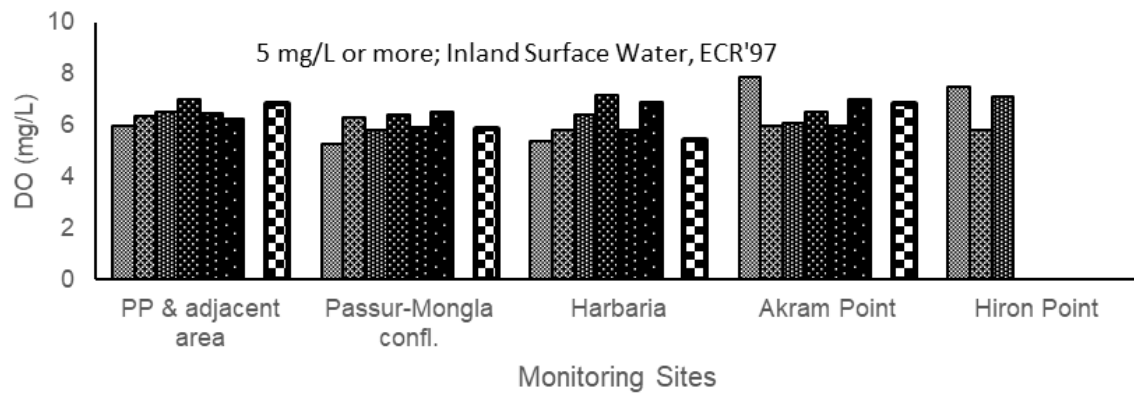


Figure 2.14: Variations in Pre-monsoon DO in different monitoring sites

Laboratory tested parameters

The laboratory tested results obtained up to 27th monitoring period (January 2021: Winter season) are described below:

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

TDS mainly indicates the presence of various kinds of minerals like ammonia, nitrate, phosphate, alkalis, some acids, sulphates and metallic ions etc., which comprise both colloidal and dissolved solids in water (Tareq M S et al., 2013). During the last winter, the TDS values were found to range between 2,320-4,450 mg/L near the power plant areas and 3,010-14,600 mg/L in the deep Sundarbans Forest areas (**Figure 2.15**). Above all these, the average TDS status are always showing the same pattern except the January of 2019 where TDS were found extremely high. The main reason of high TDS was the shifting of monitoring time a bit towards February due to unavoidable reason (beginning of February 2019 instead of January 2019). In the February of the year, upstream freshwater flow was even lower than the January. Above all these, the average TDS status are always showing the same pattern. For instance, TDS in power plant and adjacent areas are comparatively less than the deep Sundarbans Forest s **Table B.8: Appendix IV**).

In Passur-Sibsa RS, TDS has temporal variations as well. The TDS values during pre-monsoon and winter is high because of low rainfall and at the same time the tidal effects. The Bay of Bengal contains many minerals and turn the dominant composition of the said river system during pre-monsoon and winter. Therefore, in monsoon and post monsoon, the TDS concentration falls down to almost zero in some cases. Regarding spatial variation, towards downstream of the RS, usually high TDS concentrations due to tidal influence of the Bay of Bengal that contains lots of salts and other nutrients.

TH follows similar pattern as that of TDS e.g. high TH during pre-monsoon and winter season particularly. The higher the TDS results indicates the presence of higher nutrients in the water bodies. Insufficient freshwater supply due to low rainfall during winter and pre-monsoon period increase the TDS concentrations in Passur-Sibsa RS. Seawater contains huge quantity of calcium and magnesium along with other salt ions, which make the water hard. In the last winter season, the range was found to be 12,00-5,600 mg/L. Water body of power plant and its adjacent areas (2,545 mg/L) are less hard than the water body of the deep Sundarbans Forests (Akram point: 5,050 mg/L and Hiron Point: 5,600 mg/L) (**Figure 2.16**).

According to the Figure 2.16, it is noticeable that water hardness of the last three winters are comparatively higher than the other winter seasons. The water hardness is even higher than the ECR limit of 200-500mg/L. During the rainy season, the water hardness in all the monitoring stations in Passur River were found to be low whereas it was found remarkably higher in pre-monsoon season (**Table B.9: Appendix IV**). 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).

TSS includes solid materials of organic and inorganic in origins, which are normally suspended in water. In Passur and Sibsa RS, the suspended matters generally contain sand, clay, silt and loam. During the 27th quarterly monitoring period, the TSS concentrations among the monitoring sites varied from 6-11 mg/L (**Figure 2.17**). TSS values in every spots recorded during the last winter period found to be within the Bangladesh standard limit of 150 mg/L (ECR, 1997). At 2014, TSS reached more than 300mg/L at both the Akram and Hiron points due to the oil spillage occurred at 9th December 2014. Presence of suspended matters indicates the normal physical quality of the river water **Table B.10: Appendix IV**).

Generally, in Passur-Sibsa RS, TSS was found to be slightly higher in post-monsoon and winter season than those of pre-monsoon and monsoon. During post-monsoon and winter season, the TSS value increases, probably due to comparatively low amount of rains and less freshwater flow, urban runoff, industrial wastes, bank erosion, bottom feeders (such as carp), algae growth or wastewater discharges.

The status of TDS, TH and TSS of Passur River in the observed winter seasons at different monitoring sites are presented in **Figure 2.15, 2.16 and 2.17** respectively and all the observed dataset are attached in **Table B.8, Table B.9 and Table B.10 of Appendix- IV**.

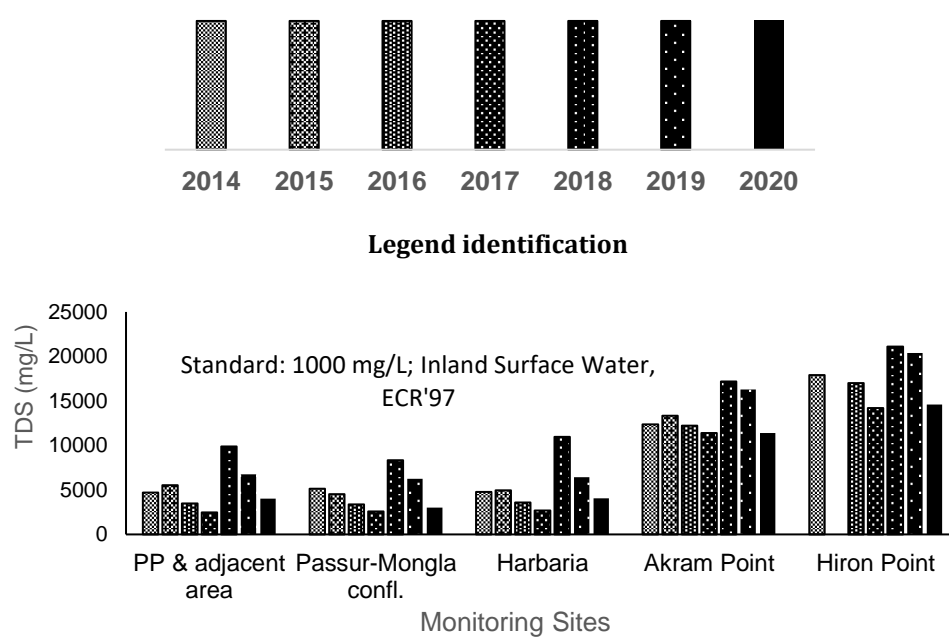


Figure 2.15: Variations in TDS concentrations in different monitoring sites

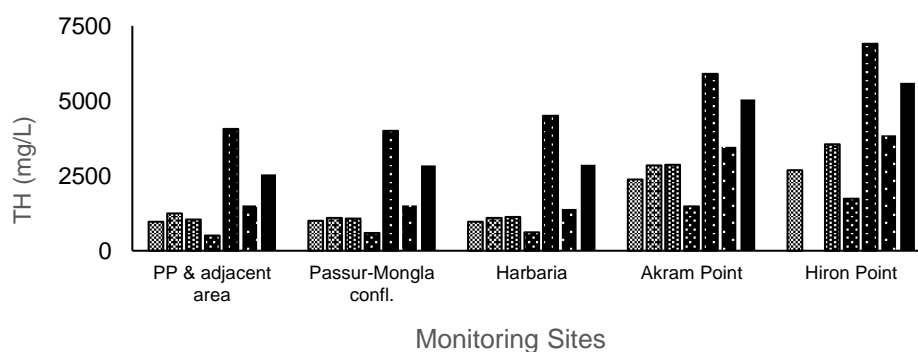


Figure 2.16: Variations in TH status in different monitoring sites

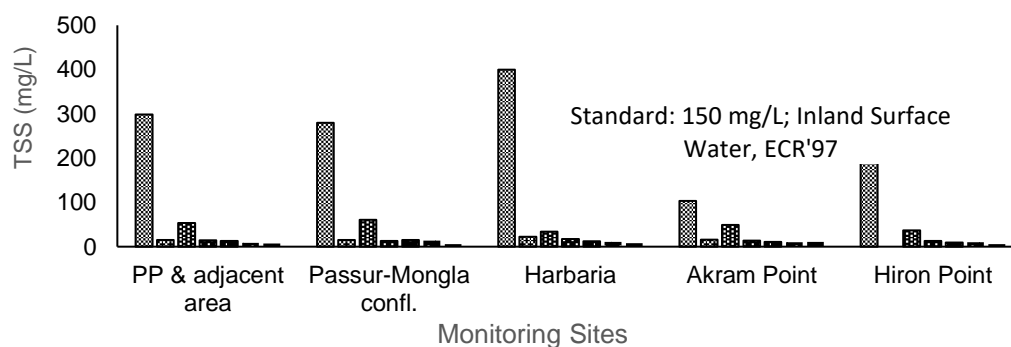


Figure 2.17: Variations in TSS concentrations in different monitoring sites

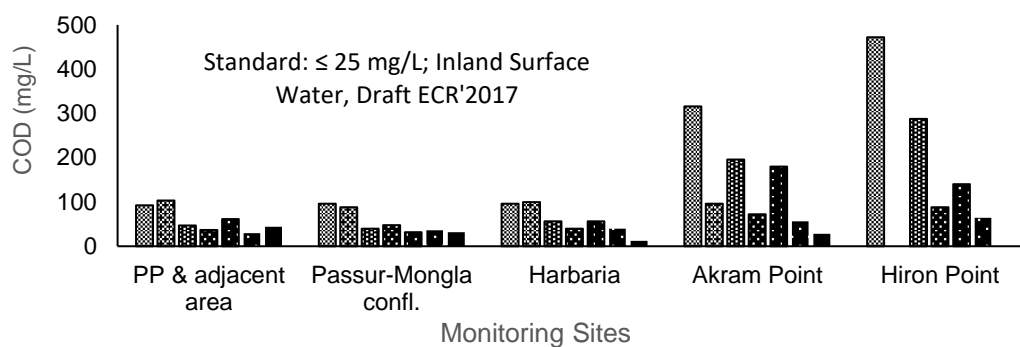


Figure 2.18: Variations in COD concentrations in different monitoring sites

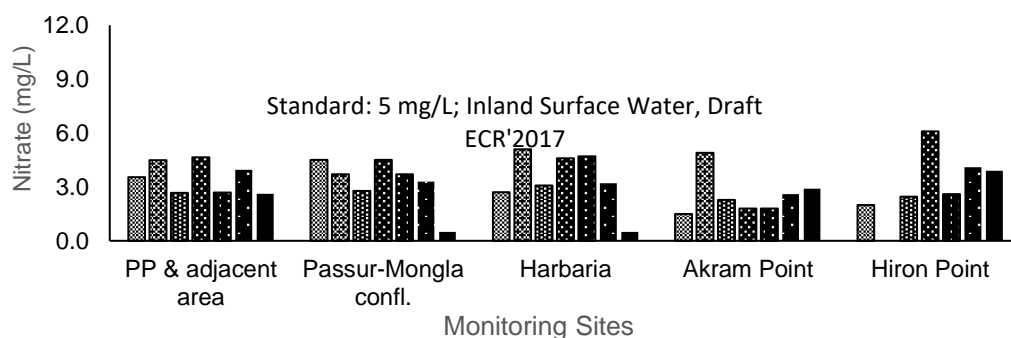


Figure 2.19: Variations in Nitrate concentrations in different monitoring sites

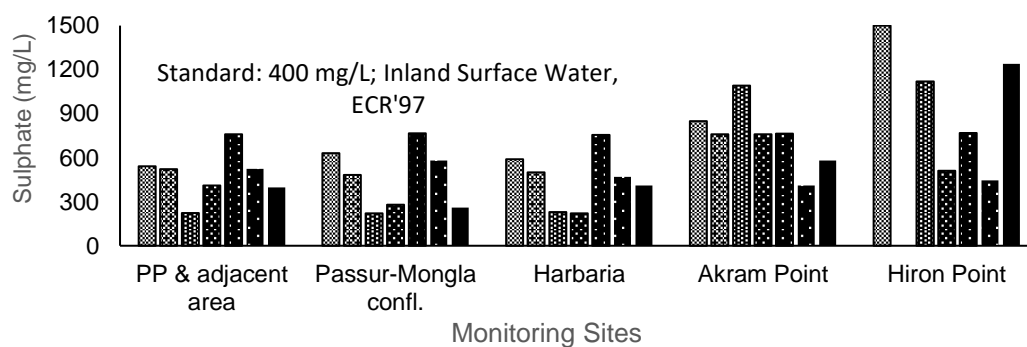


Figure 2.20: Variations in Sulphate concentrations in different monitoring sites

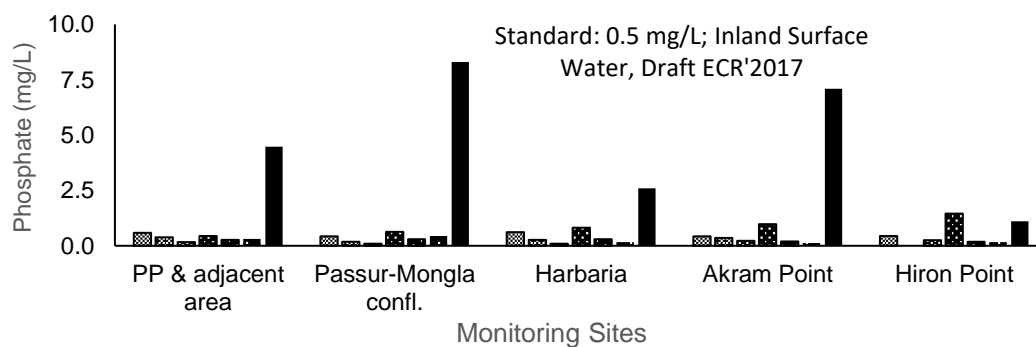


Figure 2.21: Variations in Phosphate concentrations in different monitoring sites

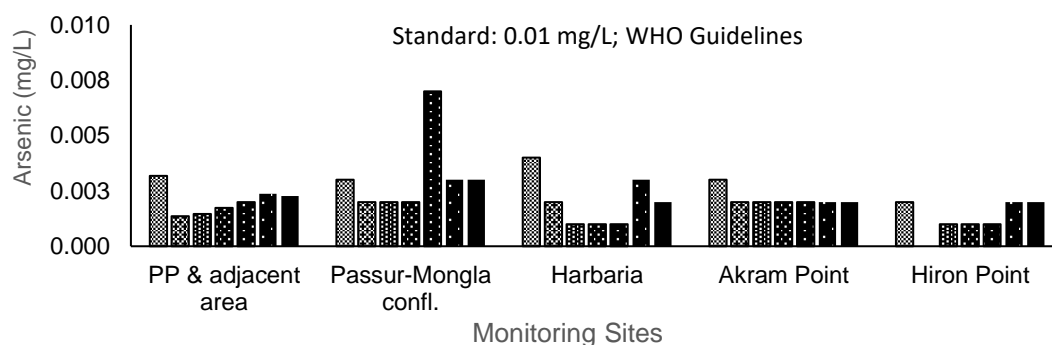


Figure 2.22: Variations in Arsenic concentrations in different monitoring sites

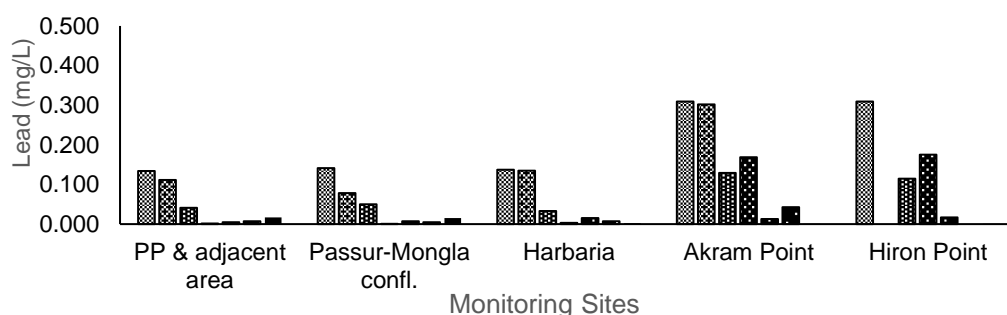


Figure 2.23: Variations in Lead concentrations in different monitoring sites

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 elevated levels of organic pollutants (Ayati, 2003). In fact, the higher the organic matter, the higher will be the decomposition and hence there will be a higher demand of O₂ in the water body.

COD concentrations varied from 8 mg/L to 56 mg/L during the last winter season (**Figure 2.18**). The highest value was found at the upstream of power plant site while the lowest was at Harbaria. The high values of COD indicate high level of organic pollution in the river water (Sivasubramaniam, 1999). **Figure 2.18** indicates that, organic loads are higher in the deep forests of Sundarbans than the upstream areas especially near the power plant and its adjacent areas. Deep forests supply many organic loads in the river while upstream loads as well increase the organic materials concentrations in huge at the downstream of the RS.

In the last monitoring results, most of the cases COD was found beyond the permissible limit of Draft ECR' 2017 (25 mg/L) inland surface water standard. Various activities near the power plant sites, other industrial and agricultural activities may influence the COD continuously. The extreme high COD at 2014 was the reason of oil spillage of that year which lead the death of planktons and other aquatic life forms ultimately increased the organic matter decomposition rate.

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 matter. 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 2.18** and the completely monitored dataset are provided in **Table B.6 of Appendix- IV**.

Nitrate, Sulphate and Phosphate

In the last monitoring, NO₃⁻ concentrations varied from 0.5 mg/L to 4.9 mg/L. The maximum concentration of 4.9mg/L, recorded at the Maidara River near township area whilst lowest concentration of 0.7mg/L was found at the left bank of Passur River near Project Site Jetty. NO₃⁻ concentration showed both temporal and seasonal variations in the same season among 27th quarterly monitoring. For instance, in the last winter season, power plant and adjacent areas NO₃⁻ concentration was found around 2.6mg/L, at Akram point was only 2.9mg/L and at Hiron point was 3.9 mg/L (Figure 2.19). However, the results obtained from all the monitoring sites were found to be within the standard concentration stated in Draft ECR'2017 (5 mg/L).

The highest values were found in pre-monsoon season of 1st quarter of 2nd year, which would 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 would be the result of surface run-off, agricultural run-off, atmospheric deposition and domestic wastes dumping together with industrial pollution from upstream.

Naturally, sulphate (SO₄²⁻) concentration is higher in seawater as well as in coastal river due to tidal interactions. The monitored dataset substantiates this fact i.e., SO₄²⁻ concentration of Passur-Sibsa RS increases in the direction of upstream to downstream. However, this variation is visible clearly in monsoon and pre-monsoon seasons only. Freshwater availability from upstream makes this variation.

The highest value (1240 mg/L) of Sulphate was found at Hiron point while the lowest value of 190 mg/L was at the Maidara River. Most of the observed dataset of Sulphate (SO₄²⁻) were found beyond the drinking standard limit (400 mg/L) specified in ECR, 1997. Near power plant areas the average concentration was found around 400 mg/L while in increase to more than 600 mg/L in the deep Sundarbans forests. Sulphate starts usually to increase from winter season and reaches at its highest peak in pre-monsoon season. Comparatively lower concentration of SO₄²⁻ in monsoon and post monsoon seasons could be due to the dilution effect of upstream freshwater (**Figure 2.20**).

Since the beginning of the monitoring activities, PO₄³⁻ concentrations mostly found to be a range of acceptable limit (less than 0.5 mg/L) except 2014 which was assumed to be the reason of oil spillage of 2014 in the Sundarbans. Suddenly, during the last winter season, it was found that phosphate level has been increased enormously in the Passur-Sibsa RS. Average phosphate near the power plant sites was found 4.5 mg/L which was even higher in the deep Sundarbans (5.1 mg/L). It should be mentioned here that there are no known sources of Phosphate from the project site and its activities.

Phosphate increases during wet season in the Passur-Sibsa RS due to the upstream flows, agricultural and surface runoff and also the other flows from the cities and the wetlands those carries phosphate in the dissolved forms. Interestingly it was found that last winter showed extreme phosphate level in the Passur-Sibsa RS. However, the sources of this higher amount of PO₄³⁻ and in the study area will be further investigated in the next monitoring period.

NO₃⁻, SO₄²⁻ and PO₄³⁻ concentrations at different monitoring sites of the 27 consecutive monitoring periods are shown in **Figure 2.19, 2.20 and in 2.21** and all the observed dataset are given in **Table B.11, Table B.12 and Table B.13 of Appendix- IV**.

Heavy Metals

It has earlier been revealed that Arsenic (As) concentrations varied between 0.002 to 0.003 mg/L. During this 27th monitoring, the results again fitted with the said range. Though there were some seasonal variations in Arsenic (As) concentrations, but still As concentration complies with the drinking water quality standard of WHO (0.01 mg/L). The Bangladesh limit is as high as of 0.05 mg/L (**Figure 2.22**).

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 27th monitoring period, the concentration of Pb ranged 0.001-0.022 mg/L (**Figure 2.23**). The standard concentration for inland surface water is 0.1 mg/L.

The values of Hg (Mercury) revealed a continuous consistency among all the spots in all the seasons. The values never exceeded 0.001 mg/L. In the winter, the concentrations persisted also the same. All the observed data found to be within the Bangladesh standard limit (0.05 mg/L) set by the ECR, 1997 of Bangladesh.

The average value of As and Pb concentrations at different monitoring sites of the consecutive monitoring periods for winter season are presented in **Figure 2.22 and in 2.23** 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 Passur-Sibsa River, samples were collected at five locations during low tide from the surface layer and analyzed following the standard testing method of APHA. The concentration of oil and grease 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 concentration of oil and grease in winter period in 2014, which might be due to accidental oil spillage occurred on 9 December 2014. An amount of 350,000 litres (Philips, 2014) of furnace oil had spilled in the river and spread over an area of 350 km² (Welle, 2014).

Oil and grease was ranged <2.0-2.93 mg/L for all the monitoring sites in the last winter season. In other seasons (Pre-monsoon, post monsoon and winter), this organic compound has increased in the last four consecutive years. Plying of motorized boats, launches and other tourist boats could be the reasons of high oil and grease including the RASH MELA Festival inside Sundarbans every year. Moreover, for the seasonal fishing at sea, the engine boats and other fishing boats contributes huge amount of oil and grease in the river water. Therefore, due to oil spillage and discharges of other organic residual from large number of marine vessels in the location; oil discharge from the fishing boats and other anthropogenic activities might be the reason of having such higher amount of oil and grease concentration sometimes.

Total Organic Carbon

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).

This study only considers TOC, which is very important in detecting contaminants in drinking water, cooling water, water used in semiconductor manufacturing, and water for pharmaceutical use. Three sites of Project Jetty, Harbaria and Hiron Point were monitored for TOC concentrations. According to the monitoring results, it was found that TOC concentrated less than 5.0 mg/L in each site. The normal standard for TOC varies from 7.0 mg/L to 10.0 mg/L in the river. Observed surface water is safe from TOC contaminant so far (**Table B.29: Appendix IV**).

PAHs (Polycyclic aromatic hydrocarbons)

During the last monitoring (monsoon), the PAHs was undetectable near the Project jetty site, Harbaria and at the Hirpon point. It indicates that there were no PAHs pollution until now in the Passur-Sibsa RS **Table B.28: Appendix IV**.

Findings

Passur River is highly influenced by tidal effects. Tidal penetration in the Passur River depends on seasonal change, upstream flow and catchment water discharge. However, the physico-chemical properties of Passur River changes with the tidal intrusion in different seasons.

In this 28th quarterly monitoring, pH was found slightly alkaline in nature. Salinity during pre-monsoon should be higher than the monsoon and the post-monsoon seasons. Temperature and dissolved oxygen level was found in fair and favorable for the aquatic life forms.

In this 27th quarter (winter, 2020), TDS and TH increased two to three folds in respect to the same seasons of last three consecutive years. TSS of the rivers remained same compare to the previous post-monsoon seasons. High COD was found in all the monitoring stations. Nitrate (NO_3^-) level remained almost same and within the safe limit while phosphate (PO_4^{3-}) was found extremely high concentration in respect to the safe limit of aquatic organisms. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and even no issues as well. Oil & grease concentration was found less than 2.0 mg/L, which is even less than half of the recommended concentration (10 mg/L) for Inland Surface Water. No TOC and PAH issues were found so far in the Passur-Sibsa RS.

2.3.10 Status of the Groundwater quality

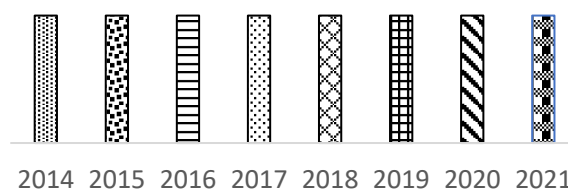
In-situ tested parameters

The in-situ tested results obtained up to 28th monitoring period (April 2021: Pre-monsoon season) are described below:

pH and Temperature

The values of pH and temperature of groundwater in the monitored sites complied with the drinking water quality standards as specified in ECR, 1997 (6.5-8.5 and 20-30°C respectively). The pH values during 28th monitoring scheme were found to vary from 8.0 to 8.3, while temperature ranged in between 23-24°C. No significant differences have been 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 28th consecutive monitoring results of pH and temperatures (pre-monsoon) of selected sites are presented in **Figure 2.24**. pH, Temperature and all the observed dataset are attached in **Table B.17** of **Appendix- IV**.



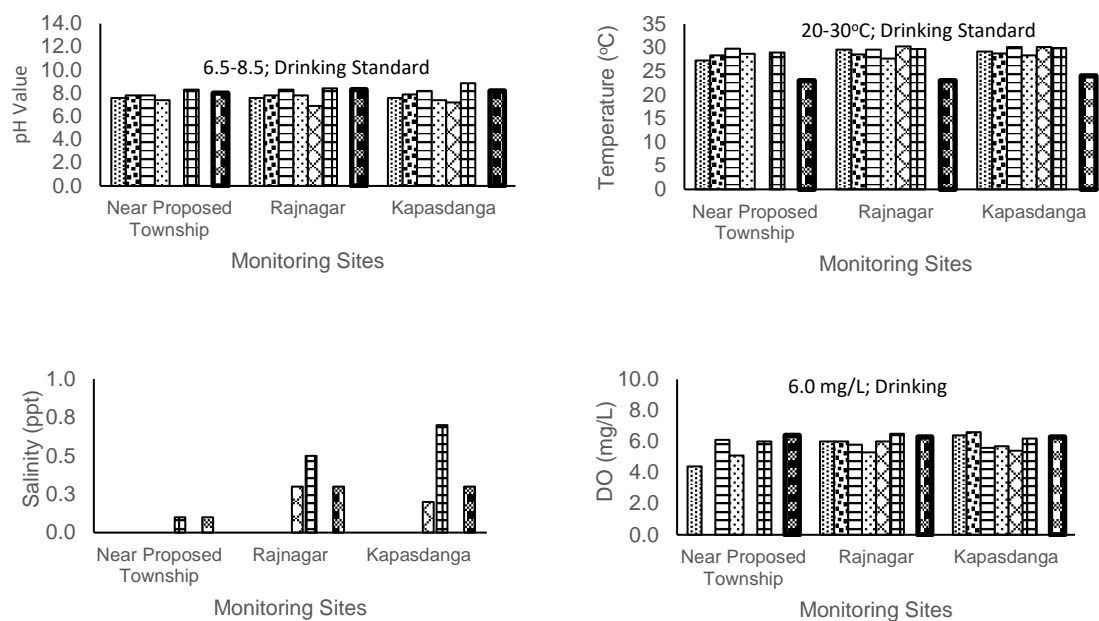


Figure 2.24: Status of pH, Temperature, DO and Salinity of pre-monsoon season of the last eight consecutive years

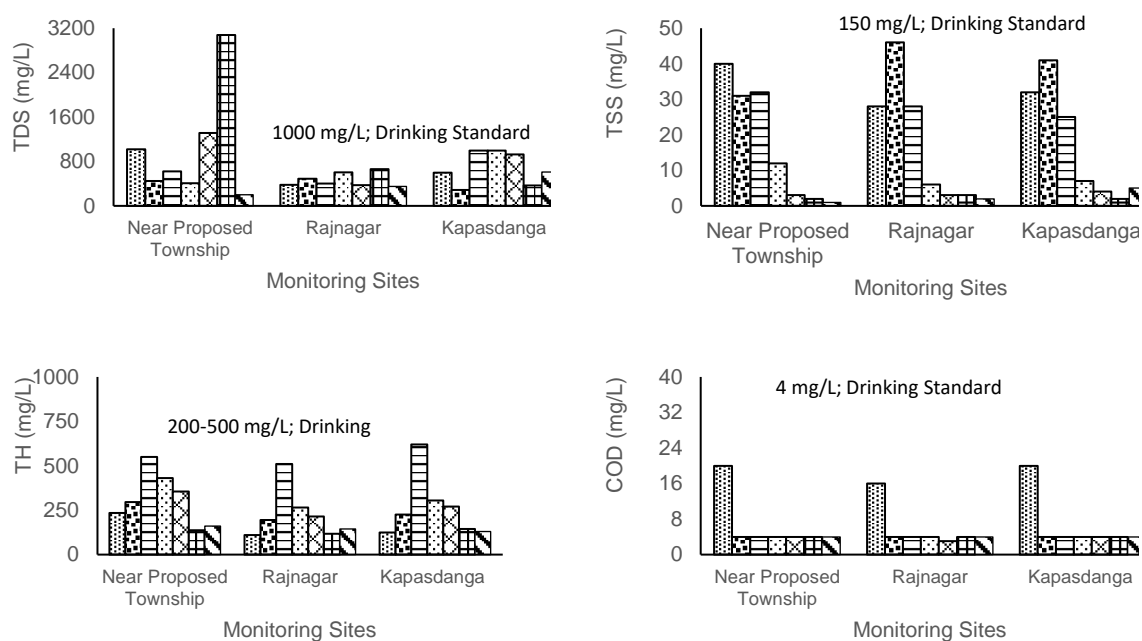


Figure 2.25: Status of TDS, TSS, TH and COD of winter season of the last seven consecutive years

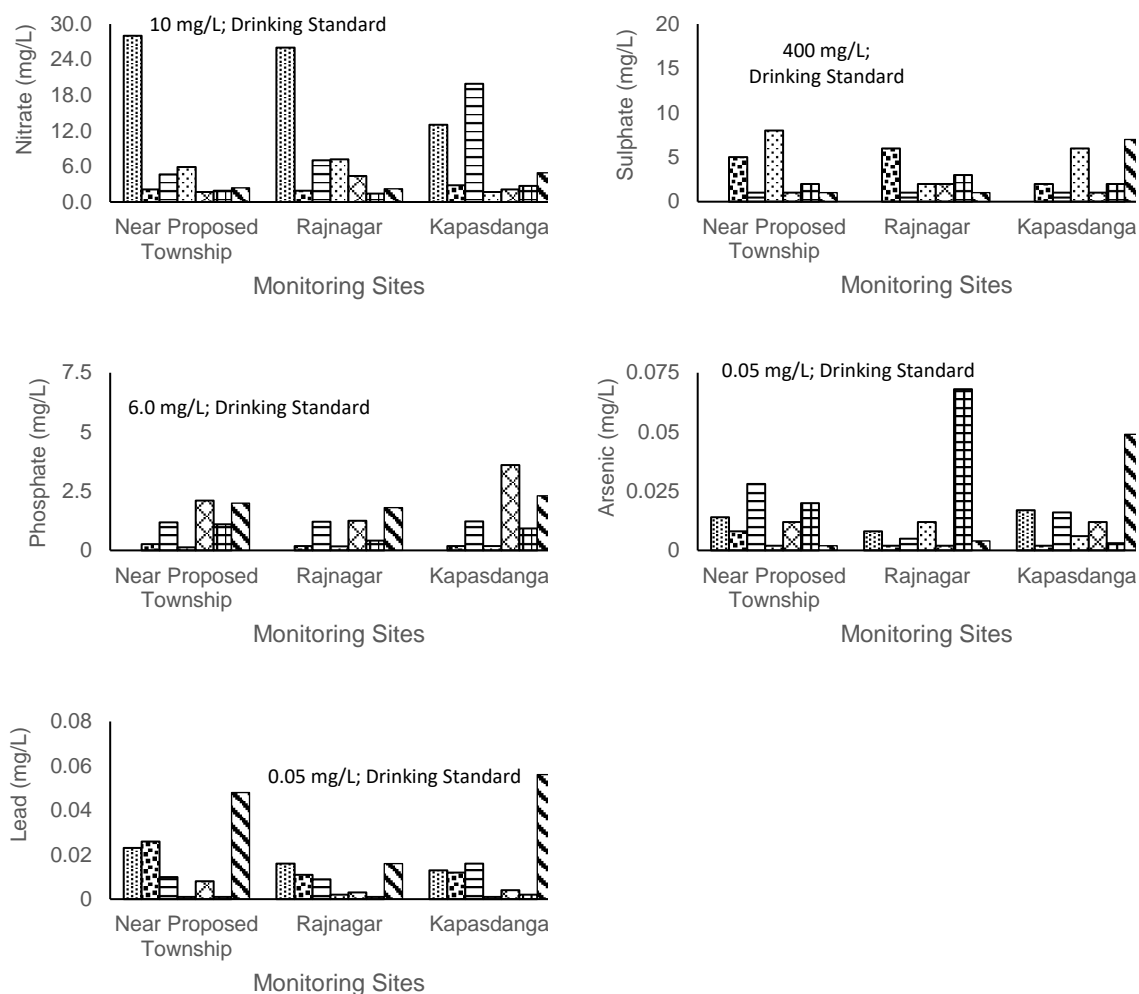


Figure 2.26: Status of Nitrate, Sulphate, Phosphate, Arsenic and Lead of winter season of the last seven consecutive years

Salinity and Dissolved Oxygen (DO)

Groundwater salinity concentration in all the monitoring sites were found to be negligible and in most of the cases below, the minimum detectable limits in all the consecutive monitoring seasons. During this monitoring season, average groundwater salinity of Rajnagar, Kapasdanga and Township area was 0.2 ppt (**Table B.18: Appendix- IV**).

DO ranged between 6.3 - 6.4 mg/L during this monitoring season. DO concentrations were found within the permissible limit of ECR, 1997 (6.0 mg/L), at all the three sites. A slight low DO concentration in drinking water might only reduce the taste of water. Higher DO level makes water tastier but causes corrosion to the supply pipe.

All monitoring results of salinity and DO of the selected monitoring sites are presented in **Figure 24: DO** and all the observed dataset of DO and Salinity are attached in **Table B.18 of Appendix- IV** respectively.

Laboratory tested parameters

The laboratory tested results obtained up to 27th monitoring period (January 2021: winter season) are described as follows:

TDS, TSS and TH

The highest TDS value of 610 mg/L was recorded at Kapasdanga followed by Rajnagar (350 mg/L) and Township near the plant site (200 mg/L), it complied completely with the ECR' 1997 (1,000 mg/L) (Figure 2.26: TDS).

TSS also known as non-filterable residue, are the solids (minerals and organic material) which remain trapped on a 1.2µm filter (U.S.EPA, 1998). During this monitoring period, the TSS concentrations ranged in between 1-5 mg/L, which complied with the Standard for Drinking Water, Bangladesh (TSS: 10mg/L, ECR, 1997) (Figure 2.26: TSS). Among all the four seasons, TSS was found much higher than the drinking standard quality particularly during the first three years of the winter. 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.

TH concentrations of the three monitored spots varied from 130 mg/L to 160 mg/L (Figure 2.26: TH) in the last winter season monitoring period. The maximum value was found near proposed Township area of the project site while the lowest was found at Kapasdanga. Over the last seven 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 Ca²⁺ 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: 2.25: TDS, TSS and TH** and all the observed dataset are attached in **Table B.19** and **B.20** of **Appendix- 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 for these sites in the last winter period were found only 4.0 mg/L. Except the year 2014, all the other winter seasons COD concentrations were also within the recommended limit for Bangladesh.

The COD concentrations of all the pre-monsoon period monitoring sites are given in **Figure 2.25: COD** and all the observed dataset are attached in **Table B.21** of **Appendix- IV**.

Nitrate, Sulphate and Phosphate

Nitrate (NO₃⁻) values ranged between 2.2 mg/L and 4.9 mg/L in the last winter period (**Figure 2.26**). The maximum value was recorded in Kapasdanga while the lowest was in Rajnagar. NO₃⁻ concentrations were within ECR, 1997 limit (10mg/L) in this 27th monitoring period. NO₃⁻ in groundwater showed both spatial and temporal variations in winter season.

Sulphate (SO₄²⁻) level has been monitored since 2015. On that time, SO₄²⁻ concentrations were complying with the Bangladesh Standard for Drinking Water Quality (400 mg/L). SO₄²⁻ concentration in groundwater did not show any pattern yet except a trend of comparatively high concentrations in winter than all other monitoring seasons.

On the other hand, the concentrations of PO₄³⁻ were found between 1.8 mg/L and 2.3 mg/L, which was within the standard limit of 6.0 mg/L (ECR'1997) (**Figure 2.26: Phosphate**). PO₄³⁻ concentration reached to its highest peak at 6.2 mg/L during the post-monsoon of 2014. PO₄³⁻ 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 2.26: 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 0.002 mg/L and 0.049 mg/L in the last winter which are very much within the Bangladesh standard for drinking water quality (ECR, 1997) (**Figure 2.26: Arsenic**). However, there were two cases during the entire monitoring scheme since 2014, the first one was during the winter period of 2019 (0.063 mg/L) and the second one was during the post-monsoon of 2020 (0.053 mg/L) at Rajnagar. The As level varies at this site but most of the time found to be at the safe drinking limit of arsenic contamination.

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 2.26: Lead**). However, the water of the tube-wells was found suitable for drinking purpose in terms of metal pollution status.

The observed values of As and Pb in all the winter seasons are presented in **Figure: 2.26: 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 represent the status of physical (April 2021), chemicals and metals status (January 2021) characteristics of drinking water. It has been observed that the physical characteristics of groundwater quality is still in good condition and in acceptable state for drinking purpose except slight salinity in the observed water. This salinity might be the reason of saline water infiltration due to excessive withdrawn of groundwater by the surrounding communities during the dry season. In addition, evaporation also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes.

Chemical characteristics of the groundwater quality are also found suitable and save to drink based on the permissible limit for Bangladesh (Drinking water standards, ECR 1997). Only, chemical oxygen demand during 2014 and 2015 was higher than ECR, 1997. The observed groundwater is completely free from the metal pollution particularly Lead and Mercury. Out of 28 monitoring seasons, only twice As became an issue temporarily with slightly higher concentrations than the drinking standards.

2.4 Land Resources Monitoring

2.4.1 Methodology

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

Sampling Frequency

The frequency of monitoring for land resources data collection was considered twice in a year. So, plot wise agricultural and land resources monitoring is accomplished in April and October in each year. Accordingly, agriculture production related data was collected during this monitoring field visit.

Monitoring Indicators

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

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

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

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

$$\text{ESP} = \frac{[\text{Na}^{+}]}{\text{CEC}} \times 100$$

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:

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

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

Location

The selected mauzas for monitoring are Baranpara (E-89°30'59.1", N-22°37'57.0") of Batiaghata Upazila, Chunkuri-2 (E-89°32'20.0", N-22°34'51.0") of Dacope Upazila, Kapalirmet (E-89°36'8.8", N-22°32'18.9") of Mongla Upazila, Chakgona (E-89°34'25.3", N-22°34'18.3") of Rampal Upazila and Basherhula (E-89°34'25.0", N-22°36'14.0") of Rampal Upazila under Khulna and Bagerhat Districts. However, a new sampling location (Bidyarbon- E-89°34'40.0", N-22°33'42.0") of Mongla Upazila was included with the previous ones for monitoring as per ToR. The sampling locations with their corresponding coordinates are stated in **Table 2.9**. Locations of collected soil samples are presented in **Figure 2.27**.

Table 2.9: 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"		

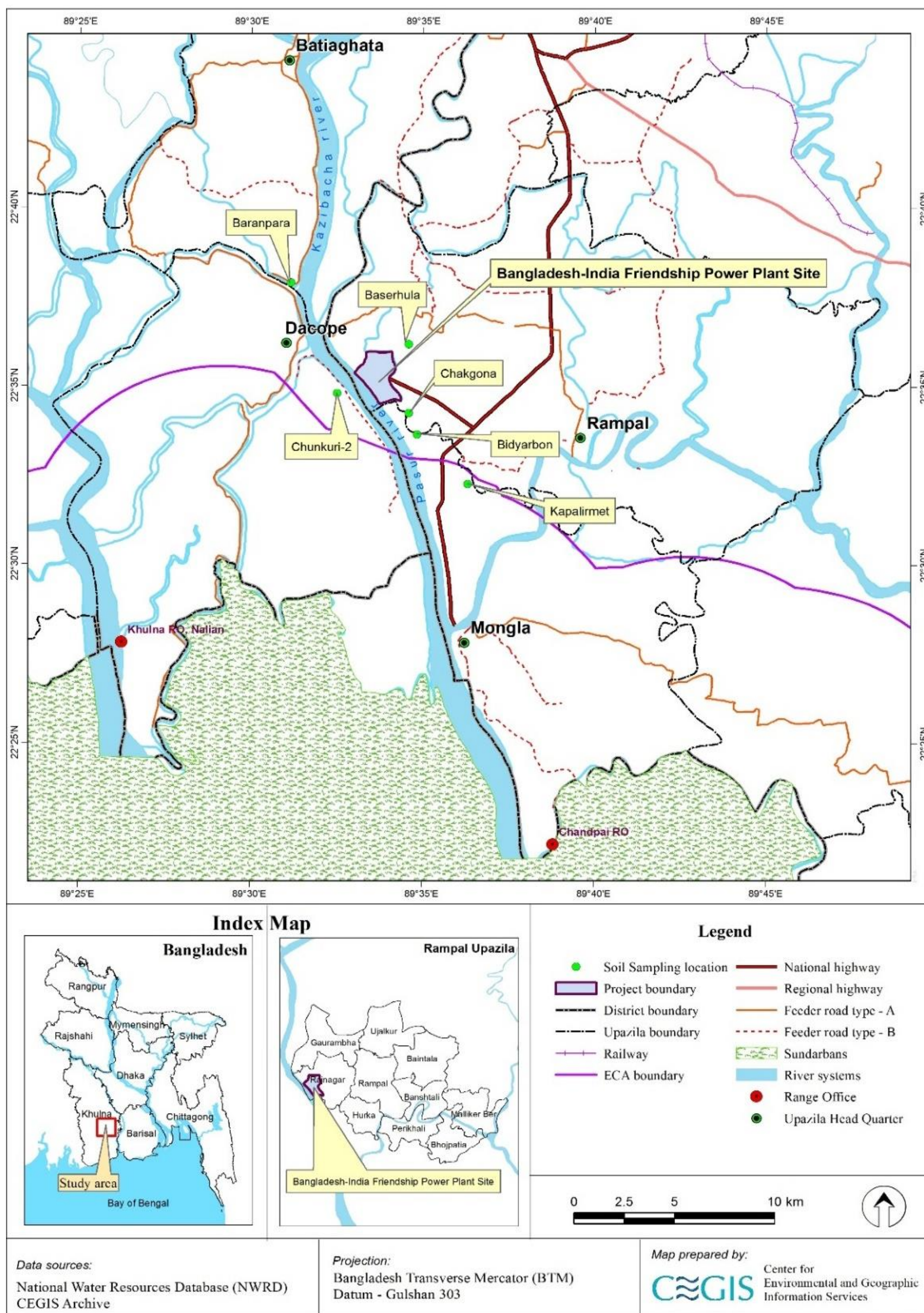


Figure 2.27: Land and Agricultural Resource Monitoring Locations

2.4.2 Process of Soil Samples Collection

Plot Selection

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

According to regular practice, soil samples are collected in October and April monitoring session. In accordance with it, soil samples were collected during this monitoring field visit. Collected soil samples were immediately sent to SRDI, Dhaka laboratory for chemical analysis. Analysis report will be incorporated with next (29th Monitoring) report.



Baranpara sampling location



Chunkuri-2 sampling location



Kapalirmet sampling location



Bidyarbon sampling location



Chakghona sampling location

Basherhula sampling location

Figure 2.28: Present condition of the monitoring locations

2.4.3 Agriculture Resources Monitoring

Monitoring of agriculture resources has been scheduled twice a year as per the monitoring plan of the ToR. 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. The agricultural monitoring locations remain same as the soil sampling locations which is presented in **Table 2.9** and **Figure 2.27**.

2.5 Monitoring Indicators

For data collection, six sampling plots have been selected on random basis within the project influence area during construction phase monitoring. The mauzas which were selected for land resources monitoring were considered as well as monitored for agricultural resources monitoring too.

During 28th quarterly visit, consultations and group discussions were organized with local people to know 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.

2.5.1 Present Cropping Patterns of Monitoring Plots

Detailed data on cropping pattern for this year were obtained through discussions with the plot owners. Based on the discussions, the plot based cropping patterns was identified and the associated data was collected in April.

Agriculture Plot-1 (Baranpara)

Baranpara monitoring plot is of about 0.4 Hectare. Due to waterlogging and associated problems Local Aman (Chapshail) is cultivated and use of chemical fertilizer and pesticides was not reported. No adverse impact was found in this monitoring plot during the monitoring time. On the other hand, the size of Chunkuri-2 monitoring plot is about 0.93 hectare. Local Aman (Benapole) was found to be cultivated in this plot in Kharif-II season. Another monitoring plot is Kapalirmet and the size is about 0.14 hectare. This plot was found to be cultivated only during the 1st monitoring period after that this was used for fish cultivation. So no crop production is found in this plot. Local Aman (Chapsail) was found at Chakghona monitoring plot during the field visit. The cropping practice and management practice remained same as previous monitoring. The detailed cropping pattern is shown in **Table E.2** of **Appendix IV**.

Agriculture Plot-2 (Chunkuri-2)

This monitoring plot is located at Chunkuri-2 and the size of the plot is about 0.93 hectare. Local Aman (Benapole) was found to be cultivated in this plot in Kharif-II season. The cropping practice and management practice remain same as the previous monitoring. Detailed cropping pattern has been shown in Table E.2 of Appendix IV.

Agriculture Plot-3 (Kapalirmet)

This monitoring plot size is about 0.14 hectare. This plot was only cultivated in 1st monitoring after that this was used for fish cultivation. So no crop production is found in this plot. Detailed for this plot is presented in **Table E.2 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 previous monitoring plot is converted to school cum cyclone shelter instead of agricultural land. So that, monitoring plot is shifted to the opposite bank of the river where cropping practice, water logging condition and other local factors are similar to the previous one. Local Aman (Chapsail) is found in the field during field visit where no chemical fertilizer is used. **Table E.2 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. The cropping practice and management practice remain same as the previous monitoring. Detailed cropping pattern is shown in **Table E.2 of Appendix IV**.

Agriculture Plot-6 (Bidyarban)

This sampling plot is newly selected for monitoring as per the TOR during 18th monitoring in November 2018 and accordingly, the monitoring is continuing in this plot. The size of the plot is 0.1 hectare. Only local Aman (Chapshail) is cultivated in this area during Kharif-II season. Detailed cropping pattern is shown in **Table E.2 of Appendix IV**.

2.5.2 Crop Production in Monitoring Plots

The information on crop production were collected after harvesting in April 2021. Crop production varies 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 (2.05 tons/plot) was observed in monitoring agriculture plot-2 (Chunkuri-2) and the lowest (0.3 tons/plot) rice production was observed in monitoring agricultural plot-6 (Bidyarban), because all the monitoring plots was cultivated Local Aman in 2020-21, except the monitoring plot of Kapalirmet. The monitoring plot (Kapalirmet) inundated by saline water in 2018-19. Farmers are practicing shrimp culture instead of traditional crops cultivation in this plot due to adverse impact of salinity (**Figure 2.29**).

Detailed information on crop production in monitoring plots is presented in the **Table E.3 of Appendix IV**.

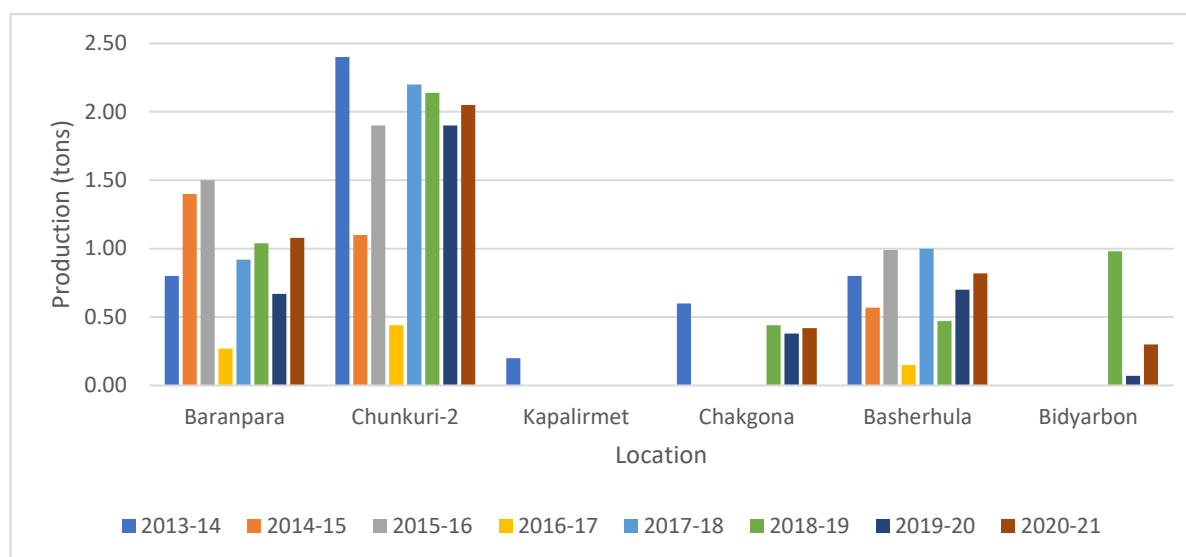


Figure 2.29: Trend of crop production in the monitoring year

2.5.3 Crop Damage in Monitoring Plots

No crop damage was observed during this monitoring field visit. Detailed crop damage information is presented in **Table E.4 of Appendix IV**

2.5.4 Livestock Resources Monitoring

The frequency of monitoring for livestock resources data collection is considered twice in a year. Next surveys will be conducted and reported accordingly. The frequency of monitoring for livestock resources data collection was considered twice in a year. During the monitoring period, some extensive consultations/group discussions were organized with local people to know the status of feed/fodder and diseases of livestock in the adjacent of the project area (Baranpara of Batiaghata, Chunkuri-2 of Dacope) and study area (Digraj bazar of Mongla, Bhaga bazar of Rampal). Livestock related data was collected in April, 2021 and described in the following sections and present livestock scenario is presented in **Figure 2.30**.



Cattles rearing scenario in the study area at April, 2021.



Sheep rearing scenario in the study area at April, 2021.



Chicken rearing scenario in the study area at April, 2021.

Goat rearing scenario in the study area at April, 2021.

Figure 2.30: present livestock scenario

2.5.5 Feed/Fodder condition of Livestock Resources

Overall feed and fodder situation remain unchanged. The farmers of the sampling points still claim for fodder shortage. Due to commercial use of land, grazing land become squeezed day by day. Under this situation livestock farming become difficult in the sampling areas.

2.5.6 Diseases of Livestock Resources

Diseases of livestock/poultry remain similar to the previous monitoring periods. 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 in year round. The severity of the infestation was reported more or less alike in this concurrent circumstances as for the past situations. The mortality rate of the livestock/poultry becomes negligible, due to immunization and insemination program run by Department of Livestock.

2.5.7 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 as follows:

- i. Soil fertility
- ii. Soil and ground water quality
- iii. Damage to surrounding crops.

Table 2.10: Monitoring of EMSAP Implementation

Sl. No.	Impacts	Mitigation Measures	Remarks on Due Diligence
1	Soil fertility might be impacted due to disposal of waste and waste water.	<ul style="list-style-type: none"> ▪ 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.	<ul style="list-style-type: none"> ▪ 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. 	Complied

Sl. No.	Impacts	Mitigation Measures	Remarks on Due Diligence
		<ul style="list-style-type: none"> Provide training and awareness building program to the labors and professionals. 	
3	Damage to surrounding crops due to project related activities.	<ul style="list-style-type: none"> Fencing of project area by drum sheet or Tarija. Limiting the construction activities and stocking within the project boundary. 	Complied

Source: Field Survey, April, 2021

2.6 Transportation Monitoring

2.6.1 Location of Traffic Survey

The traffic survey for this monitoring during the construction phase was conducted from April 2nd to April 4th, 2021 on two weekends and on one weekday at three pre-selected locations around the project site. Weather was sunny during the days when the survey was conducted. The selected sites were Khudir Bottola and Gonai Bridge at Khulna Mongla Road and Gonabelai Bridge at Power Plant access road presented in the **Figure 2.31**.

2.6.2 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.

2.6.3 Traffic Volume Calculation

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

Table 2.11: Vehicle conversion factors

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

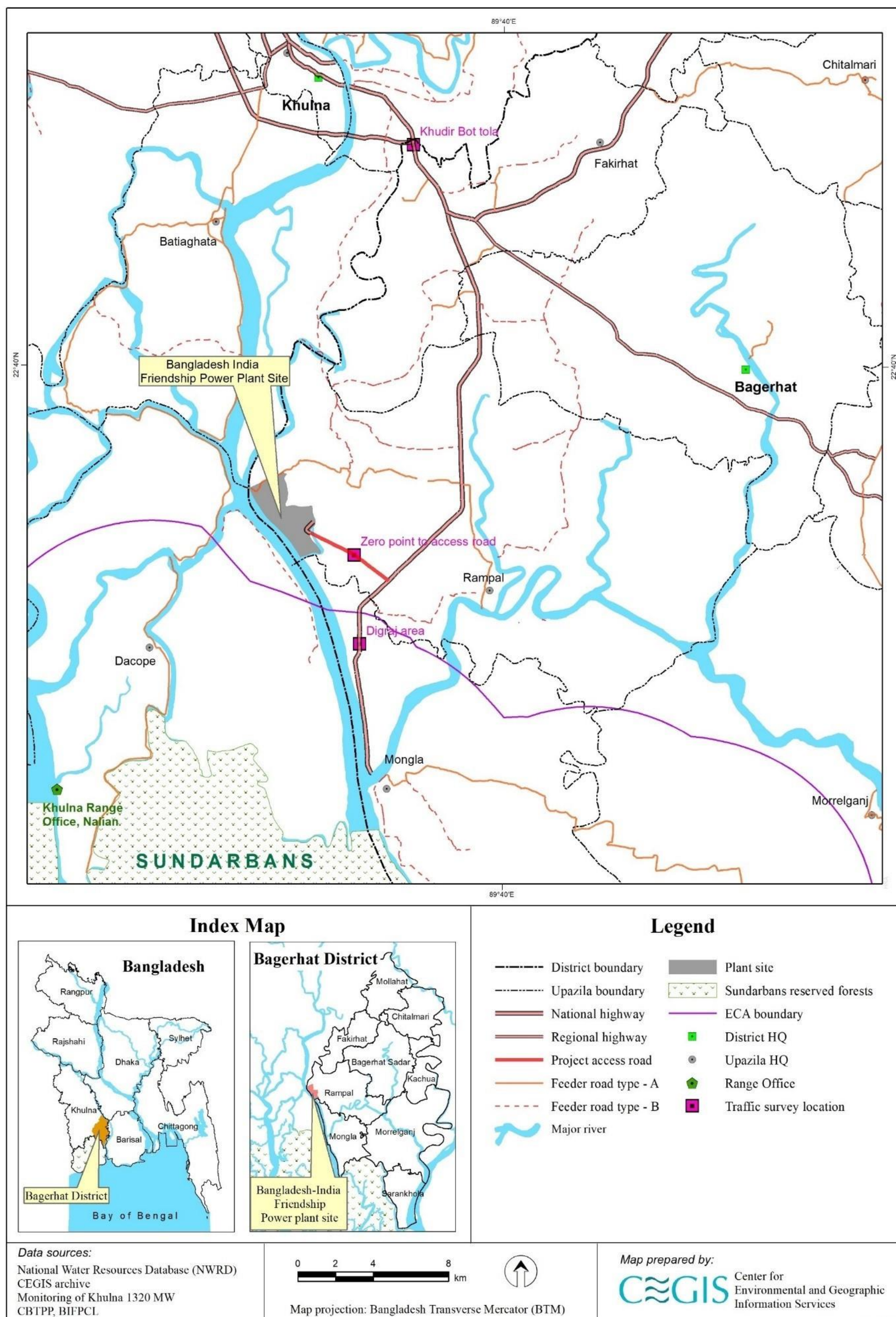


Figure 2.31: Locations of Traffic Survey

2.6.4 Results of Monitoring

The summary results of vehicular movements at three different locations in **Table 2.12** 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 2.12: Calculated PCU in Three Locations at Three Different Time Period

Location	7:00 AM to 10:00AM	12:00 PM to 2:00PM	17:00 PM to 19:00PM
Khulna Mongla Road at Khudir Bottola	280	1130	834
Khulna Mongla Road at Gonai Bridge	115	285	325
Power Plant access road at Gonabelai Bridge	80	130	159

Source: Field Survey, April, 2021

Similar to the earlier months monitoring report, vehicular movements were observed during the surveys were mostly for the regular construction activities of the Power Plant as the construction activities of the Power Plant are progressing heavily. Khulna Mongla Road at Khudir Bottola received the highest traffic volume compared to the other two locations namely Khulna Mongla Road at Gonai Bridge and Powerplant access road ay Gonabelai Bridge. It is to be mentioned here during the morning time traffic volume at Khudir Bottola was found to be lower compared to the previous monitoring period. On the other hand, Khulna Mongla Road at Gonai Bridge received lower traffic volume whereas, Power Plant access road at Gonabelai Bridge received higher traffic volume compared to the previous monitoring period. One of the key factors behind this heavy traffic volume at Khulna Mongla Road at Khudir Bottola is the rigorous and heavy construction works of the Power Plant. On the other hand, reason behind the lower traffic volume at the other two locations may be because the survey date fell on two weekends. Moreover, current pandemic situation could be another reason for the lower traffic volume at those said two locations compared to the immediate previous monitoring results. The detail survey findings regarding the traffic volume surveys as well as the detail calculations are attached in **Appendix E1, E2 and E3**.

2.7 Water resources monitoring

2.7.1 Monitoring of sedimentation (Chemical properties of riverbed sediment)

Sediment have been considered as an important environmental indicator for metal pollution in any natural ecosystem. The investigation of heavy metals in water and sediments could be used to assess the anthropogenic impacts and risks posed by waste discharges to the riverine ecosystems. Therefore, sediment quality assessment is done during environmental issues monitoring of this project.

Sampling frequency

The frequency of monitoring for sediment quality is considered twice in a year (January and July). Accordingly, sediment sampling was done in 27th monitoring (January, 2021; considered as dry season, 2021). Data analysis of that sampling is incorporated in this report.

Monitoring Indicators

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

Monitoring Indicators

The sampling locations are selected in both near places of project area and inside the Sundarbans. The sampling locations are stated in **Table 2.13**. Locations of collected samples are presented in **Figure 2.32**.

Table 2.13: 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"		

2.7.2 Process of Sediment Samples Collection

Plot Selection

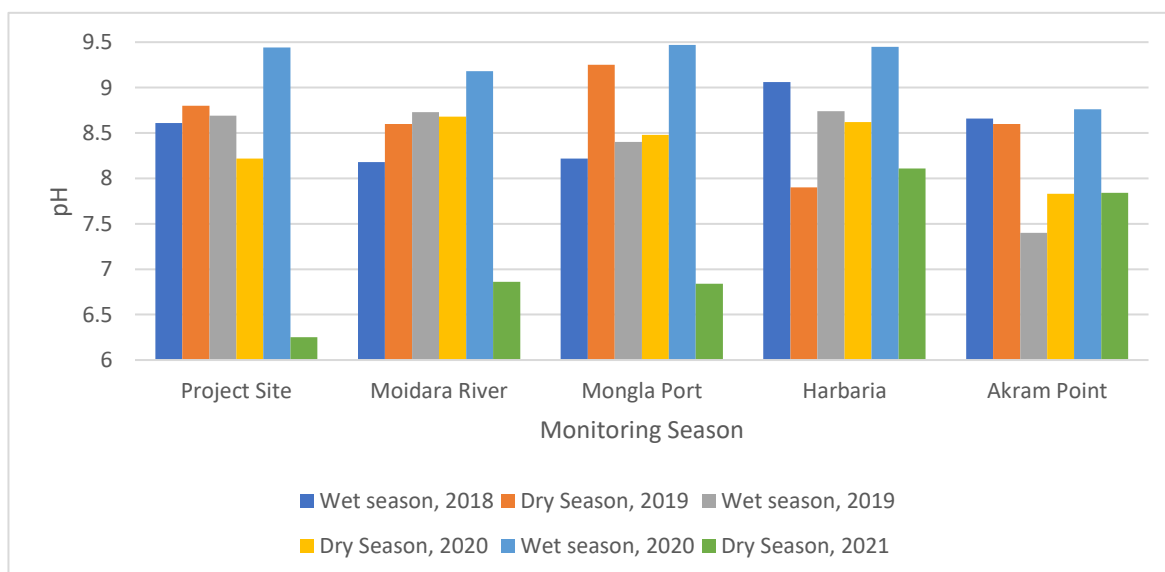
The sampling locations are selected on the basis of potential route of coal transshipment and assumed major polluted area. Project site and Moidara River is beside the power plant, while Harbaria and Akram point is inside the Sundarbans area where the coal transportation will take place. The sampling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

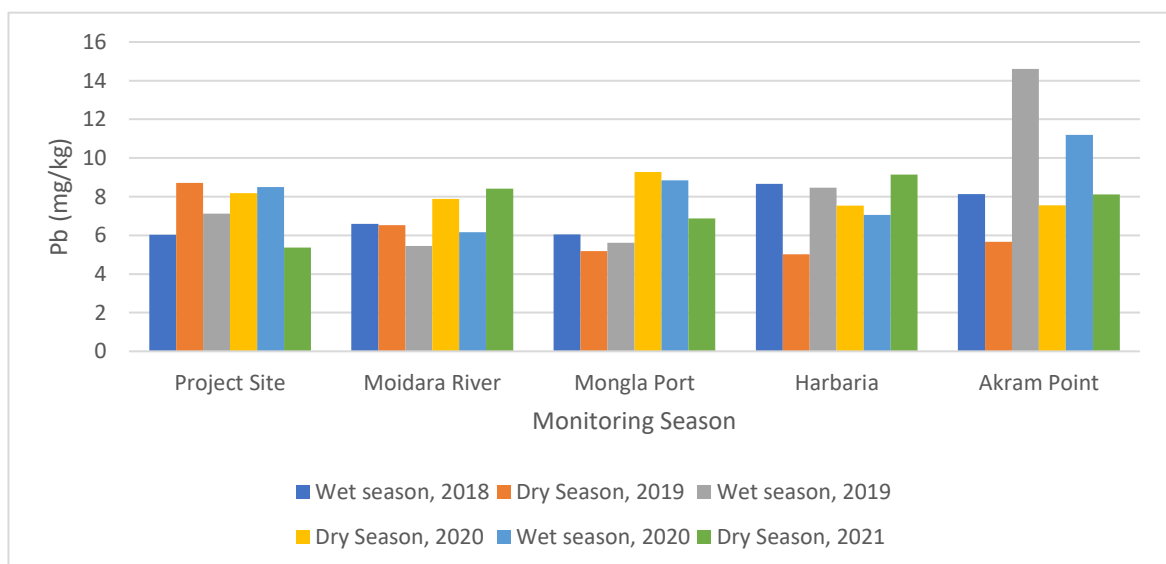
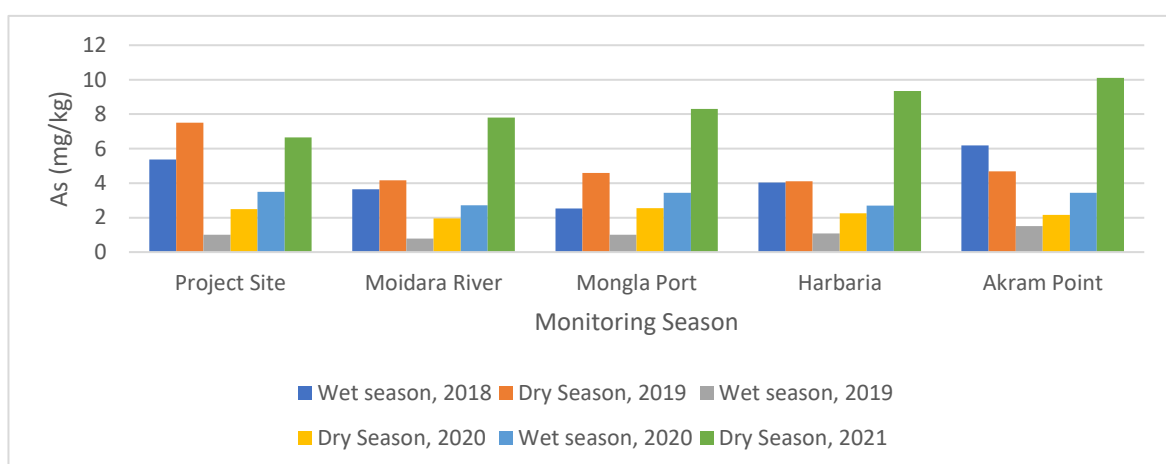
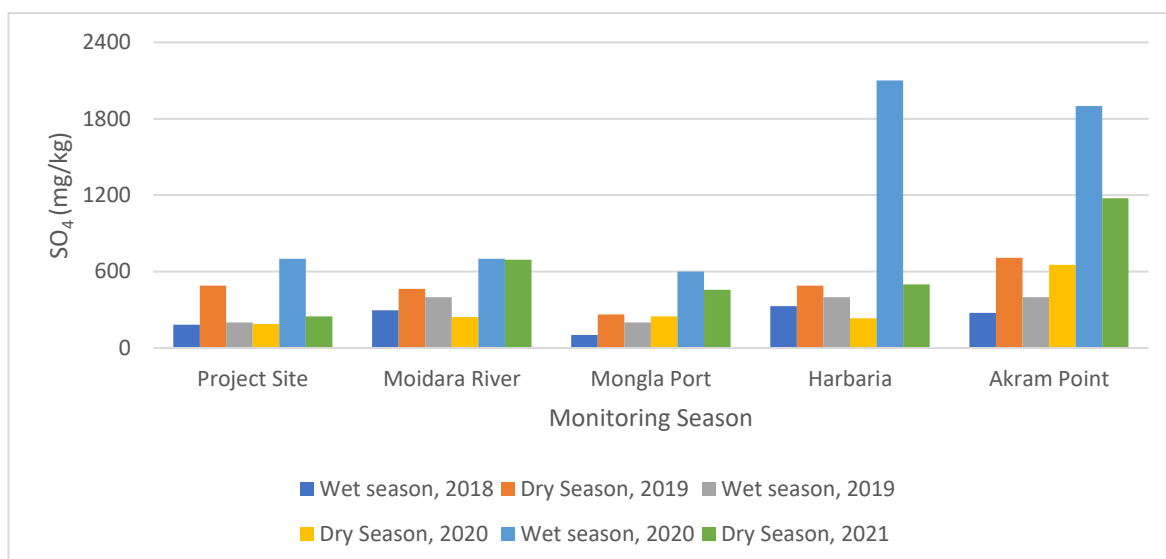
Sediment Samples Collection

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

Laboratory Analysis

Sediment samples are taken twice a year. Dry season samples are taken in January field visit and wet season samples are taken in July monitoring field visit. Accordingly, dry season, 2021 sample was taken in January, 2021 field visit (27th monitoring field visit). Data analysis of dry season, 2021 is incorporated in this report.





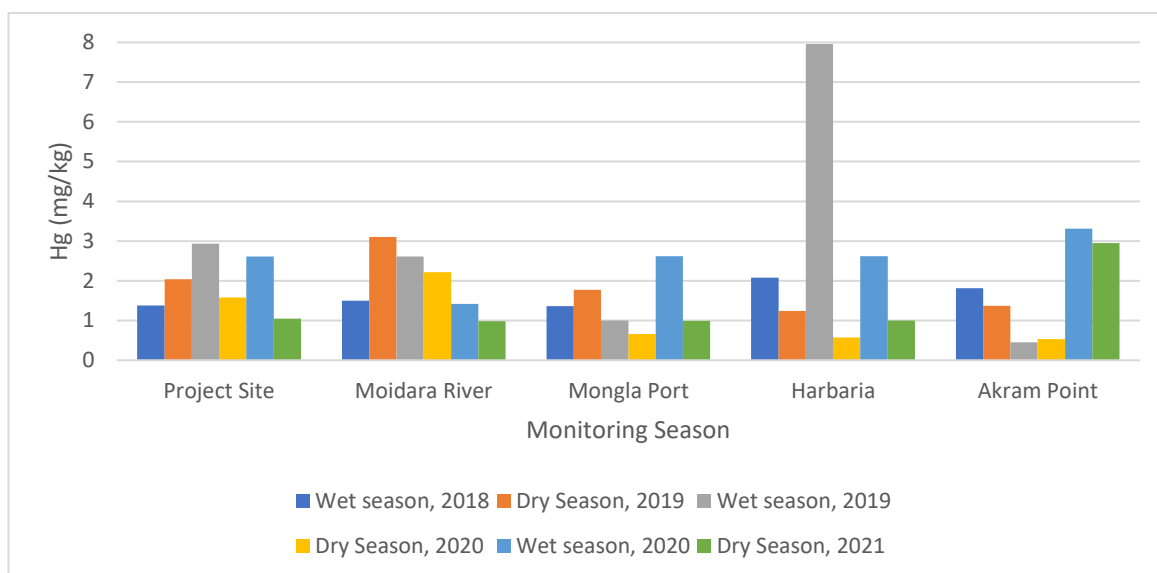


Figure 2.32: Sediment quality monitoring data at different locations of the Passur River (Dry Season, 2021)

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

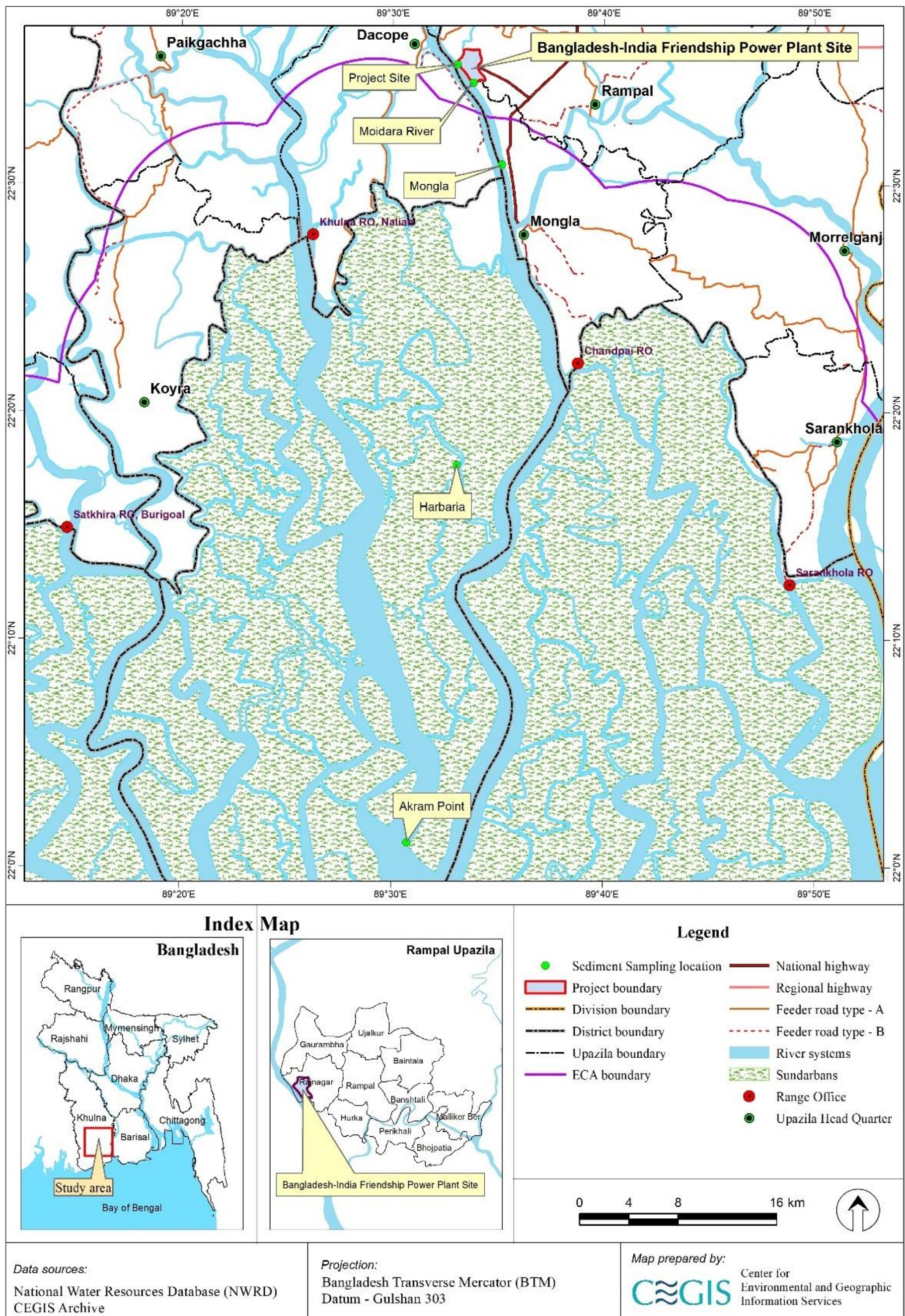


Figure 2.33: Sediment Sampling Locations

2.7.3 Status of sediment quality of the Passur River

The data presented in this report represents dry season, 2021 which was collected in January, 2021.

According to the analyzed data, only Mercury (Hg) exceed average shale value (ASV) (**Marowsky and Wedepohl, 1971**) and average upper crust value (AUCV) (**Rudnick and Gao, 2014**) whereas, Arsenic (As) crossed AUCV but within ASV and Lead (Pb) is within the stated values. 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, 2020), As and Pb concentration is reduced in all sampling locations while Hg concentration is increased. The maximum concentration for As and Hg is found in Akram port while in Harbaria, Pb scored the most. The average concentration for As, Pb and Hg during this monitoring is 8.44 ppm, 7.58 ppm and 1.39 ppm respectively. In project site (jetty point), concentration of all elements are well below of this monitoring average.

Table 2.14: 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 <i>et al.</i> , 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 biological resources around the project site were categorized into three major groups and monitored quarterly with the aim to establish baseline conditions to compare with the probable impact of proposed project in place. These groups include fisheries resources, ecological resources and Sundarbans Reserve Forest (SRF).

3.1 Fisheries Resources

The monitoring of twenty-seven quarters for the session of 2014-15, 2015-16, 2016-17, 2017-18, 2018-2019, 2019-20 as well as of 2020-21 were completed and reported earlier. This chapter contains the findings of 28th quarter and comparison with the earlier 27th quarters.

Location of Monitoring Sites

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

Table 3.1: The Sampling Locations for Monitoring of Fisheries Resources

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

Selection of Parameters

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



Figure 3.1: Fisheries Resources Monitoring Locations

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 sites. Moreover, the similarities in species composition among the sites were analyzed using the Jaccard Index (JI) for estimating the extent of similarity between pairs of data sets.

Fish Migration

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

Fish Diversity

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

Fish-Shrimp Culture Practice

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

Fish Production

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

3.1.2 Status of Monitoring

Followed by the quarter monitoring of the 2014-15, 2015-16, 2016-17, 2017-18, 2018-19 and, 2019-20 and 2020-21 (up to 26th quarter monitoring), 27th quarter monitoring of session 2020-21 was conducted during the period from 22-31 January, 2021. No fishing activities were observed at Haldikhali Khal (B), Bhodra (D), Harbaria (E), Jongra (G) and Maidara point (I) during field visit in this quarter monitoring.

Fish Habitat Status

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

Habitat Classification

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 tables show the classification of seven (07) sampling site for 1 to 15th quarter monitoring and ten (10) sampling sites from 16th to 25th quarter monitoring according to the ToR in respect of habitat uses for previous quarters of fisheries monitoring (Table 3.2).

Table 3.2: Classification of habitat use of 10 sampling sites

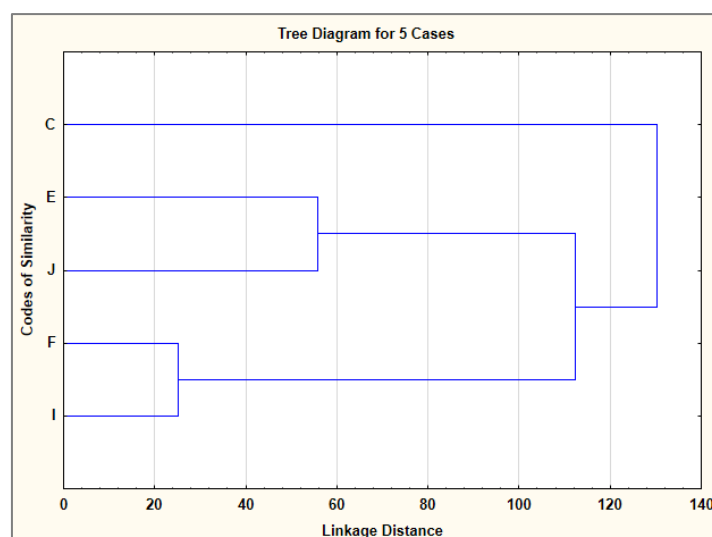
Monitoring Quarter	Type of Habitat Use
1 st (April, 2014)	<ul style="list-style-type: none"> Grazing Ground Grazing and Breeding Ground
2 nd (July, 2014)	<ul style="list-style-type: none"> Grazing Ground Spawning and Nursery Ground
3 rd (October, 2014)	<ul style="list-style-type: none"> Grazing Ground Grazing and Breeding Ground Spawning, Nursery and Grazing Ground
4 th (January, 2015)	<ul style="list-style-type: none"> Grazing Ground Grazing and Breeding Ground Spawning, Nursery and Grazing Ground
5 th (April, 2015)	<ul style="list-style-type: none"> Grazing Ground Nursery Ground Spawning and Nursery
6 th (August, 2015)	<ul style="list-style-type: none"> Grazing, Breeding Ground Spawning, and Nursery Ground
7 th (October, 2015)	<ul style="list-style-type: none"> Grazing Ground, Nursery Ground and Growing and Feeding
8 th (January, 2016)	<ul style="list-style-type: none"> Nursery and Feeding Ground Growing and Feeding
9 th (April, 2016)	<ul style="list-style-type: none"> Spawning and Nursery Ground Feeding and Growing Ground
10 th (July, 2016)	<ul style="list-style-type: none"> Nursery Ground Feeding and Breeding Ground
11 th (October, 2016)	<ul style="list-style-type: none"> Breeding and Spawning Ground Feeding and Grazing Ground
12 th (January, 2017)	<ul style="list-style-type: none"> Grazing and Spawning Ground Nursing Ground
13 th (April, 2017)	<ul style="list-style-type: none"> Grazing and Feeding Ground Nursing Ground
14 th (October, 2017)	<ul style="list-style-type: none"> Grazing and Feeding Ground Nursing Ground
15 th (January, 2018)	<ul style="list-style-type: none"> Grazing and Feeding Ground Nursing Ground
16 th (April, 2018)	<ul style="list-style-type: none"> Feeding ground Growing ground Nursing ground

Monitoring Quarter	Type of Habitat Use
17 th (July, 2018)	<ul style="list-style-type: none"> • Spawning and Nursery Ground • Nursery Ground with Feeding and Growing Capacity • Growing and Feeding Ground • Omni-ground
18 th (November, 2018)	<ul style="list-style-type: none"> • Ground for Maturation • Omni-Ground: Nursery and Feeding Ground/Migratory Route; Ground for Maturation; Growing and Maturation Ground; Maturation Ground for Juveniles
19 th (February, 2019)	<ul style="list-style-type: none"> • Ground for Feeding • Omni-Ground including Nursery Ground and Ground for Maturation
20 th (April, 2019)	<ul style="list-style-type: none"> • Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
21 st (July, 2019)	<ul style="list-style-type: none"> • Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
22 nd (November, 2019)	<ul style="list-style-type: none"> • Spawning and Nursery Ground • Omni-Ground including Feeding and Maturation Ground
23 rd (February, 2020)	<ul style="list-style-type: none"> • Nursery Ground • Spawning ground • Ground for maturation and feeding
25 th (July, 2020)	<ul style="list-style-type: none"> • Nursery Ground • Ground for maturation and feeding
26 th (November, 2020)	<ul style="list-style-type: none"> • Nursery Ground • Omni-Ground including Spawning and Nursery Ground, and Maturation Ground
27 th (January, 2021)	<ul style="list-style-type: none"> • Nursery Ground • Omni-Ground including Spawning and Nursery Ground, and Maturation Ground

During the 28th quarterly monitoring conducted in January of 2020-21 Session, the sampling sites were divided into two major classes and shown in the **Figure-3.2 (Figure D.1 of Appendix IV)**.

Spawning and Nursery Ground: The catch revealed that availability of Juvenile stage (Length group: <2cm, 2-3cm and 3-5cm) of different fish species were dominant at Chandpai (F) and Maidara point (I). It indicates that the mentioned sampling sites were found to be used as spawning and nursery ground supporting recruitment into juvenile age group for many medium and large sized fish species (Ref. Article No. XX: Fish Community Structure).

Omni-Ground: Another class, which is found to support multi-length groups (5-10cm, 10-20cm and >25cm) of observed fish species, was considered as the maturation and feeding-ground for fishes (following the considerations of Rahman, 1989 and 2005; Huda et al., 2003).

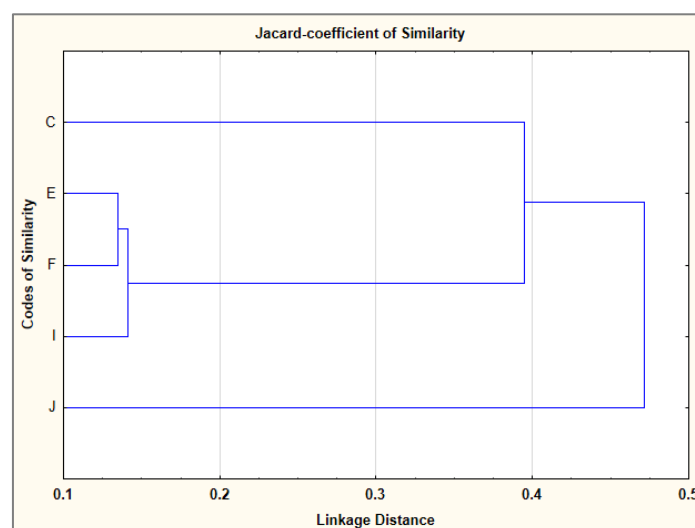


28th Monitoring, April, 2021

(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 dendrogram indicated the distances among the JI (Jaccard Coefficient Index) indices which are opposite to the JI values. It was found that the length-wise distribution relationship varied not only with the seasons but also with the year to year. In this quarterly monitoring in 2020-21 (28th), the JI value between the Harbaria Point (E) and Chandpai (F) sampling sites were the highest (**Figure 3.3**) which indicates the maximum similarity in species occurrence between the two sites out of 5 sampling sites of available fishing (**Figure D.2 and D.5 of Appendix IV**).



28th Monitoring, April, 2021

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

Habitat Suitability Index (HSI)

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)	HSI (2019-20)
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

Shannon-Weiner Index

In this monitoring year of 2020-21, species evenness also varies among the sampling sites. Highest Shannon-Weiner index was found at Chalna Point (0.96) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at the Chandpai (0.37) (**Table 3.4 and D.5 of Appendix -IV**). It has also been found that both the number of fish species found in in-situ catch and the evenness of their distribution within the sampling sites show high variation with the changing seasonal and yearly bio-physical conditions.

Fish Species Richness (FSR)

Fish species richness was identified through Simpson's Index¹. Considerable difference is noticed in the fish species richness (FSR) in different habitat classes (**Table 3.5 and 3.6 and Figure-3.4 and 3.5**). In this monitoring phase, species richness varies with the sampling sites. Maximum FSR was obtained at Chandpai (n=20), while very low FSR was recorded at Harbaria Point (n=3). 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, Charaputia Khal was home to rich assemblage of *Poma* and *Gagla Tengra*, Harbaria Point was of *Gagla Tengra* and *Kain Magur*. Chandpai was rich in *Vadi Chingri*, *Tiger Chingri* and *Mutkura*.

¹Simpson'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*													
	1 st QM	2 nd QM	3 rd QM	4 th QM	5 th QM	6 th QM	7 th QM	8 th QM	9 th QM	10 th QM	11 th QM	12 th QM	13 th QM	1 st QM	2 nd QM	3 rd QM	4 th QM	5 th QM	6 th QM	7 th QM	8 th QM	9 th QM	10 th QM	11 th QM	12 th QM	13 th 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	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	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	0.6	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	0.6	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	0.7	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	0.9	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	

Site Wise Species Diversity using Shannon-Weiner Index (14th to 28th QM)

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

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

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

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

Table 3.6: Site wise Rich Species Number (13th to 28th QM)

Site	Location	No. of Rich Species															
		2017-18			2018-19				2019-20				2020-21				
		13 th	14 th	15 th	16 th	17 th	18 th	19 th	20 th	21 st	22 nd	23 rd	25 th	26 th	27 th	28 th	
A	Akram Point	2	0	0	4	0	1	0	2	0	0	0	0	2	4	0	
B	Haldikhali	1	0	0	0	0	3	0	-	0	0	0	0	0	0	0	
C	Charaputia	0	0	0	4	0	0	4	7	0	0	5	0	3	3	2	
D	Bhodra	0	0	0	0	0	0	0	-	0	0	1	0	0	0	0	
E	Harbaria	7	6	6	0	2	4	0	2	0	0	2	0	1	0	2	
F	Chandpai	6	5	7	11	9	2	3	7	4	6	2	0	4	1	2	
G	Jongra	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	
H	Mongla Point	2	2	1	2	3	0	3	-	1	5	2	3	0	1	0	
I	Maidara	1	3	2	1	3	9	3	1	1	6	3	2	3	0	3	
J	Chalna Point	4	2	1	2	3	2	2	2	3	2	3	2	3	1	2	

Source: CEGIS Field Survey, April 2014-January 2021

*Golda**Chewa**Poma**Pheksha*

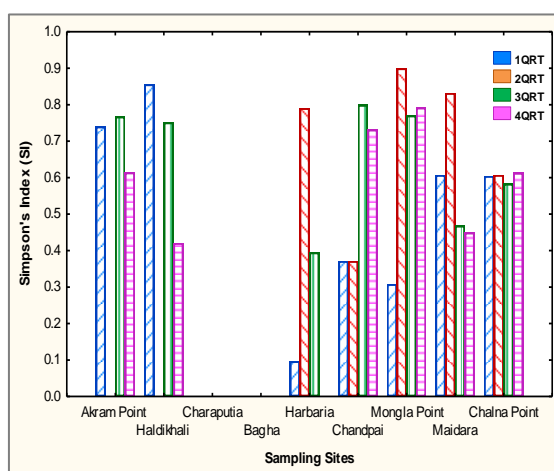


Tular Dandi

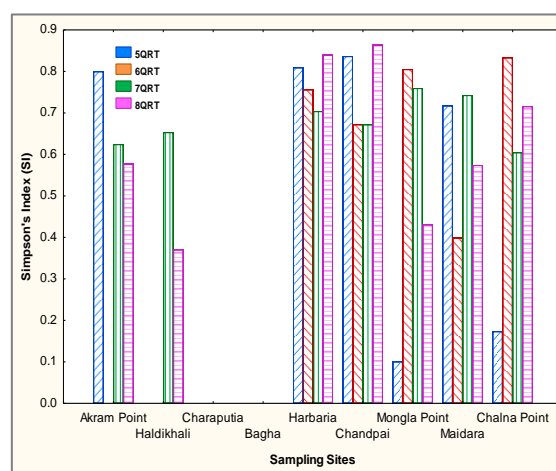


Kain Magur

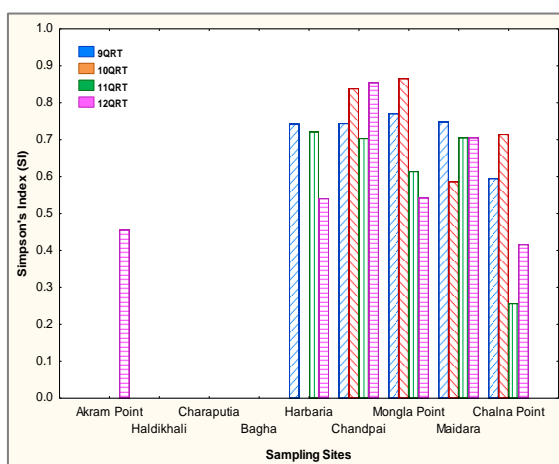
Figure 3.4: Different available observed fish species in 27th quarter monitoring



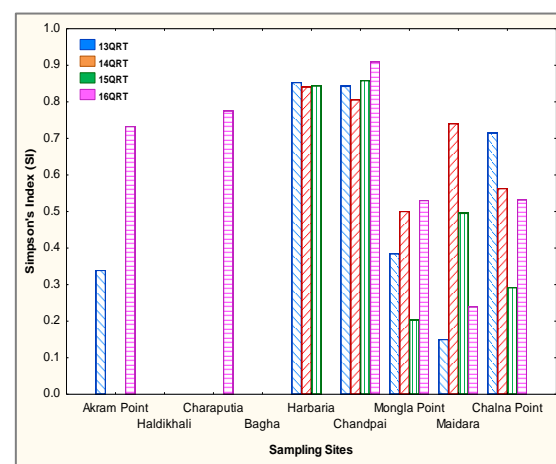
2014-2015



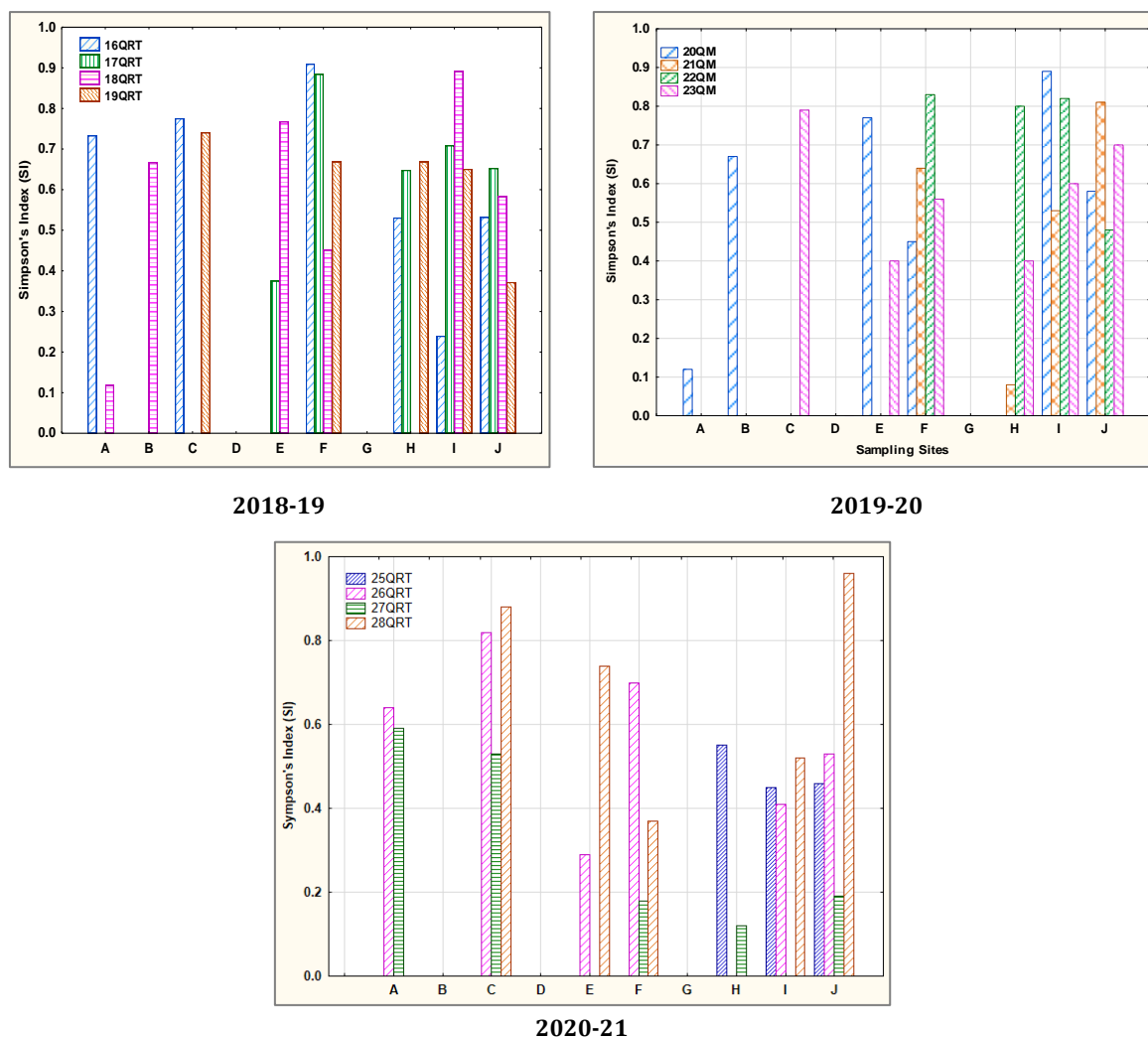
2015-2016



2016-2017



2017-18

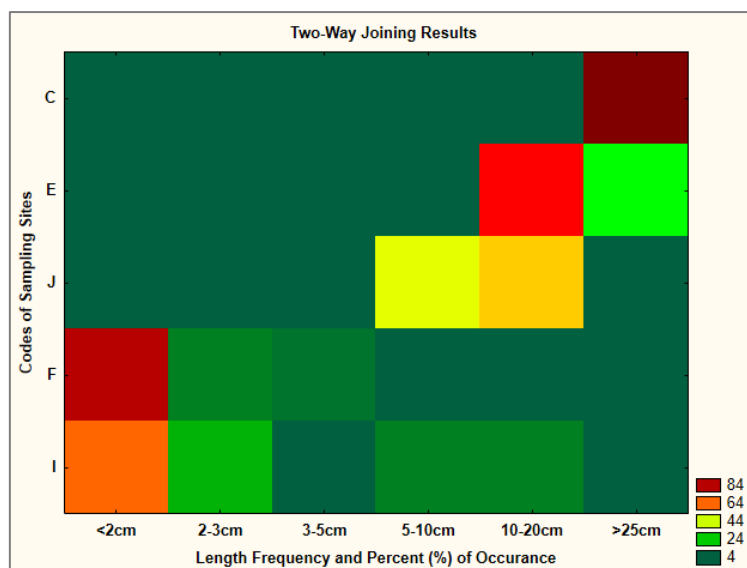


(FSR is identified through Simpson's Index)

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**). The following Table **D.3** of **Appendix IV** and **Figure 3.6** for 28th quarter of monitoring year of 2020-21 shows that fries were dominant at Chandpai and Maidara River but juvenile to adult age group were dominant at Chalna Point, Harbaria and Charaputia.



28th Monitoring, April, 2021

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 *Amadi*, *Harina* and *Mutkura* attain the maximum abundance among the migratory fish species observed in the 28th quarter of monitoring year, 2020-21. The relative abundance of the migratory species is given below in the **Figure 3.7**.

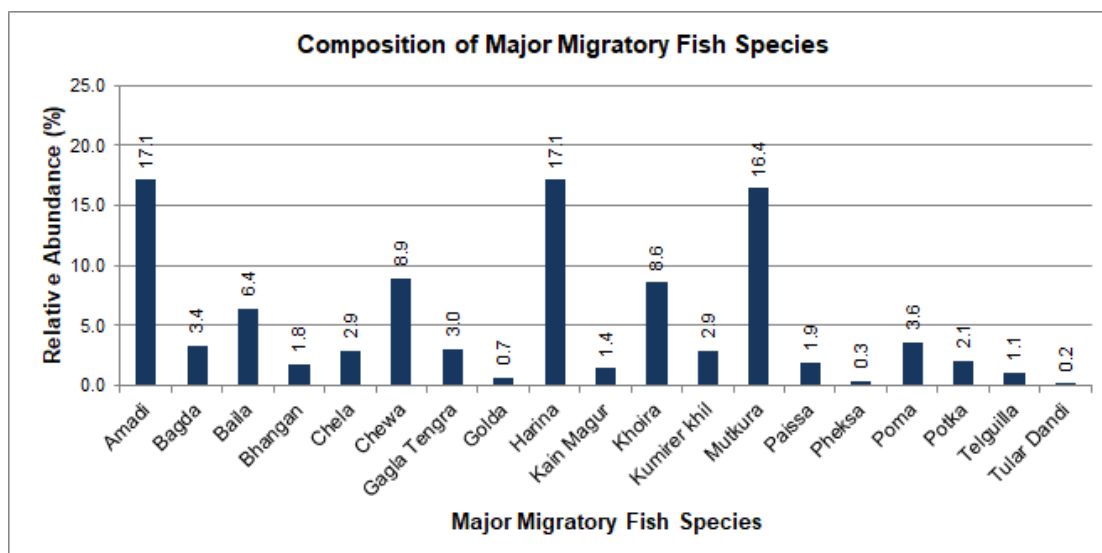


Figure 3.7: Relative abundance of major migratory fish species in sampling sites

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, Gagla Tengra and Kain Magur were observed to migrate long distance (**Figure 3.8 and Table D.6 of Appendix-IV**)

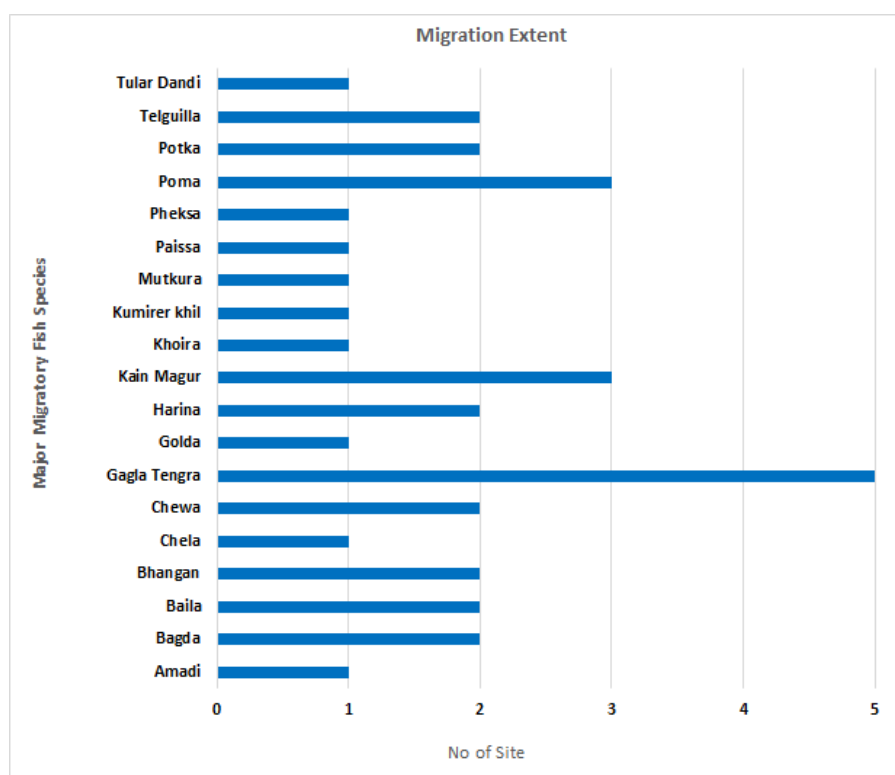


Figure 3.8: Migration extent of major migratory fish species in sampling sites

Shrimp/Fish Farm

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

Stocking Pattern

It is reported by the farmers of the shrimp farms that maximum stocking was found at Rajnagar Gher in case of Bagda Chingri.

Shrimp/Fish Growth Rate and Mortality

During the 28th quarter of monitoring, the highest growth rate was observed in the Rajnagar Gher followed by Chunkuri and Kapashdanga gher (**Table 3.7 and Table 3.8**).

Table 3.7: Growth Rate and Mortality of Fish/Shrimp (1st to 13th QM)

		Gher No.		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 Aug2015)		7 th QM (Oct 2015)		8 th QM (Jan 2016)		9 th QM		10 th QM		11 th QM		12 th QM		13 th QM	
1	0.3	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 (%)	
2	0.3	15-20	0.2	40	0.25	50	-	-	-	-	30	0.18	25	0.20	60	-	-	-	-	-	-	0.2	20	0.20	60	-	-	-	30
3	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	
4	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 3.8: Growth Rate and Mortality of Fish/Shrimp (14th to 28th QM)

Gher No.		14 th QM		15 th QM		16 th QM		17 th QM		18 th QM		19 th QM		20 th QM		21 st QM		22 nd QM		23 rd QM		25 th QM		26 th QM		27 th QM		28 th 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 (%)	
1	0.03	50	-	-	0.28	0.28	0.38	80	-	-	-	-	0.35	50	0.38	-	0.35	-	-	-	0.38	-	0.42	35	-	-	0.41	20	
2	0.38	35	-	-	0.42	0.42	0.30	70	0.30	80	-	-	0.45	80	0.44	-	0.45	-	-	-	0.48	-	0.45	30	-	-	0.35	90	
3	0.02	25	-	-	0.4	0.4	0.20	50	-	-	-	-	0.34	40	0.36	-	0.37	-	-	-	0.32	-	0.38	90	-	-	0.39	30	

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 (3.5 kg/haul) shown in **Table 3.9**. In 28th quarter monitoring, the highest productivity was found at Harbaria followed by Charaputia point and Maidara River (**Table 3.10**). It is to be noted that fries found in catch were not considered in the productivity assessment

Table 3.9: Total Catch in Different Gears in the Sampling Sites

Site	Habitat	Gear Name/Type	Haul Duration (hr)	No of Haul	kg/haul
C	Charaputia Khal	Hook	-	-	0.04
E	Passur River	Hook	-	-	0.03
F	Passur River	Khepla Jal	0.6	10	0.02
I	Maidara-Passur Confluence	Bepdi Jal	3.0	1	3.5
J	Passur River	Dora Jal	3.0	1	0.2

Source: Catch assessment survey, CEGIS, November 2020

** Weight of Fry is not considered for catch assessment

Table 3.10: Total Catch in the Sampling Sites

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

Sampling Site	Total Catch (kg)															
	13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM	
A	2	0	0	17	0	16	0	0.40	0	0	0	0	30.5	3.5	-	
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	18.95	33	12.7	
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	2.07	-	47.5	
F	0	0	0	0	0	0	0	0.00	0	0	0	0	0.6	-	2.3	
G	77.5	10.5	37.67	3	4	27	0	0.00	0	0	0	0	-	-	-	
H	0	0	0	0.33	22	0	5	0.00	11.5	0.2	20	10.5	-	4	-	
I	0.3	0.4	0.67	0.13	3	5	1.2	0.00	0.5	1.7	0.4	3.0	5	-	3.5	
I	0.12	0.3	0	1	0.25	1.2	0.6	0.17	1.6	0.8	0	6.3	7.5	-	0.3	

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

** Weight of Fry is not considered for catch assessment

**Figure 3.9: Fishing gears and crafts observed during 28th quarter monitoring**

Culture Fish Production

The present study on shrimp/fish farm in the 28th quarter monitoring phase was fish stocking phase so fish production was not observed in the Gher (**Table D-7, Appendix-IV**).

3.2 Monitoring of Ecosystem and Bio-diversity

3.2.1 Indicators Selection

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

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

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

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

3.2.2 Rationales for Selection of Locations

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

3.2.3 Terrestrial Ecosystem

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

Description of the selected homestead

The homestead in Rajnagar is located at 2.5 km. east from upper North-east boundary of the project site. This is situated inside the damp area as numerous small swamps exist inside and surround the homesteads. Water retention capacity of surface soil of this homestead is very low and for this reason very little number of grasses and other herbs are present. Land elevation of selected homestead at Kalekarber village is comparatively flood free. Chalkghona village is located about 0.5 km south from south-east boundary of the project. The selected homestead of this village is close to Maidara River to it's north side and saline water

shrimp farms to its south periphery. Presence of shallow ditches and peripheral waterbodies support to grow staple coverage of saline tolerant plant species. Borni village is located at about 3.0 km north from north-east boundary. This homestead is also dominated by planted tree species and soil condition is similar to Rajnagar site. Vegetation of this homestead have been severely been damaged by past Cyclone Aila.

Species Composition of selected homestead vegetation

Homestead at Rajnagar

This homestead is dominated by Gewa (*Excoecaria agallocha*) among all the trees due to its heist population which get favor from soil's salinity for luxurious succession. Beside this, 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*) also found to exist. The homestead very few grasses or undergrowth vegetation.

Homestead at Kalekarber dighi

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

Homestead at Chalkghona

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

Homestead at Barni

A total of 30 tree species have been recorded through quadrature sample survey of this homestead. Of which, Rendi Koroï (*Albizia saman*), Mahagoni (*Swietenia mahagoni*), Taal (*Borassus flabellifer*), Narikel (*Cocos nucifera*), Khejur (*Phoenix sylvestris*) are referable. The home owner have planted many fruit yielding trees which is now in sapling form. Among this, Kotbel (*Limonia acidissima*), Aam (*Mangifera indica*) and Safeda (*Manilkara zapota*) are common. Gewa (*Excoecaria agallocha*) was dominated at western part of this homestead now being less populated due to fell by the house owner. Tiger Fern (*Acrostichum aureum*) is a mangrove herb which presence at here also referable.

Random quadrature vegetation survey has been conducted at selected homesteads during recent monitoring tier. A total of 50 plant species (excluding undergrowths) has been recorded from 16 number of surveyed sample quadrates. Details of the survey result is presented in **Table 3.11 below**.

Diversity of plant species followed higher than the previous monitoring as two of the sampled homestead observed various newly planted saplings.

Table 3.11: Plant species composition of the sampled homesteads

Sl. No.	Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Total Number of individuals	Biodiversity Index
			Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16		
1	<i>Acrostichum aureum</i>	Tiger Fern		3	1		8	5		13				2			1	1	34	2.91
2	<i>Adhatoda vasica</i>	Bashok						1											1	
3	<i>Albizia richardiana</i>	Chambol					1				1				1				3	
4	<i>Albizia saman</i>	Rendi Koro	1		2		4		2		1				1	3			14	
5	<i>Areca catechu</i>	Supari					1	5		5		1							12	
6	<i>Azadirachta indica</i>	Neem				1	6	1											8	
7	<i>Borassus flabelifer</i>	Taal							2		4	1	4				2		13	
8	<i>Carica papaya</i>	Pepey								1									1	
9	<i>Citrus medica</i>	Lebu									1								1	
10	<i>Cocos nucifera</i>	Narikel	4	3	1	5	3	1	2	1		3	5	4	2			2	36	
11	<i>Colocasia sp</i>	Kochu						10		4					-				14	
12	<i>Cordia dichotoma</i>	Bohal/Gum Tree										1				1			2	
13	<i>Dentella repens</i>	Danton										1							1	
14	<i>Diospyrus pregrina</i>	Gab					4								1	3			8	
15	<i>Erythrina ovalifolia</i>	Mandar													1				1	
16	<i>Eucalyptus sp</i>	Eucalyptus					2												2	
17	<i>Euphorbia Tirucallii</i>	Pencil Cactus						15											15	
18	<i>Excoecaria agallocha</i>	Gewa	5	6		12	3	1	2	3						3	7	10	52	
19	<i>Ficus benjamina</i>	Lokkho Pakur	1																1	
20	<i>Ficus hispida</i>	Dumur								1		3	4						8	
21	<i>Gossypium herbaceum</i>	Karpus Tula																2	2	

Sl. No.	Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Total Number of individuals	Biodiversity Index
			Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16		
22	<i>Heritiera fomes</i>	Sundari	2					1											3	
23	<i>Heritiera fomes</i>	Sundari	2																2	
24	<i>Hibiscus tiliaceus</i>	Bola		2										5					7	
25	<i>Hibiscus tiliaceus</i>	Bola	3	3	3														9	
26	<i>Ipomoea fistulosa</i>	Dhol Kolmi						30	50										80	
27	<i>lannea coromandelica</i>	Jiga						5				2	1		40				48	
28	<i>Lawsonia inermis</i>	Mehedi			1					1									2	
29	<i>Limonia acidissima</i>	Kotbel			1				1						1				3	
30	<i>Mangifera indica</i>	Aam						2			1				5	3			11	
31	<i>Manilkara zapota</i>	Safeda							1		1								2	
32	<i>Mimusops elengi</i>	Bokul										1							1	
33	<i>Moringa oleifera</i>	Sazna					1							2	1				4	
34	<i>Musa sp</i>	Kola		4			21	3	3	3	5	10			6			2	57	
35	<i>Ocimum sanctum</i>	Tulshi								2					3	1		10	16	
36	<i>Phoenix sylvestris</i>	Khejur		2	2	2	1	1				1		4		3	1	11	28	
37	<i>Phyllanthus reticulatus</i>	Shitki						1						40					41	
38	<i>Phyllanthus acidus</i>	Orboroi								1	1					2			4	
39	<i>Pongamia pinnata</i>	Koroach		1												1			2	
40	<i>Psidium guajava</i>	Peyara						1		1	1				1				4	
41	<i>Sonneratia apetalla</i>	Kewra				1													1	
42	<i>Spondias mombin</i>	Amra					2	1											3	
43	<i>Streblus asper</i>	Shewra										1							1	

Sl. No.	Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Total Number of individuals	Biodiversity Index
			Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16		
44	<i>Swietenia mahagoni</i>	Mahagoni					7	4	4	1	25	15	4	11	4	3			78	
45	<i>Syzygium cumini</i>	Jaam													3				3	
46	<i>Tamarindus indica</i>	Tentul			2	1				1					1				5	
47	<i>Terminalia arjuna</i>	Arjun													1				1	
48	<i>Terminalia catapa</i>	Kathbadam														2			2	
49	<i>Vachellia nilotica</i>	Babla															1	1	2	
50	<i>Zizyphus sp</i>	Kul boroi						1							2				3	

Note: Q-Quadrant

Plant health

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

Plant Diseases and symptoms in homestead vegetation

Plant diseases observation of an area is needed to evaluate plant health and productivity. During initial field survey, some tree species were selected for regular observation of plant disease. In this regards, a number of common tree species have been observed in each homesteads.

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

Number of diseases affected trees

Plant health has been showed slightly deteriorated at Rajnagar and Chalkghona sites, whereas unchanged at Borni and Kalekarber sites. Comparing to same season monitoring in previous tier (Feb, 2020), severeness of date palm has observed in Rajnagar due to increase land salinity after filling up the homestead platform by sand collected from nearer khal bed. Most of the Date Palm are suffered from lethal yellowing and terminal bud destruction. At Chalkghona site, two *Excochordia* has newly affected which observed leaf curling. were detected in date palm. Following table (**Table 3.12**) represents the time series data on unhealthy plants in studied homesteads.

Table 3.12: 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-19	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021
Rajnagar	Cocos nucifera	17*	NS	10	5	5	15	4	5	NS	3	4	6	6	9	4	4	3	2	3	10	3	7	11	10
	Phoenix sylvestris	25	NS	15	4	4	22	9	13	NS	10	2	5	4	7	6	8	9	5	3	4	4	5	2	12
	Manilkara zapota	1	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	Albizia saman	2	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
	Excoecaria agallocha	55*	NS	-	1	1	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
	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	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	Psidium guajava	8	-	-	-	-	-	-	-	NS	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
	Tamarindus indica	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch	Cocos nucifera	39	25	19	5	5	34	20	-	NS	2	2	4	5	3	-	3	4	2	4	3	5	-	-	-
	Phoenix sylvestris	24	-	10	1	1	6	5	1	NS	1	-	5	2	3	-	-	1	2	2	1	3	-	1	3

Location	Plant Name	Total No. of Plant	No. of Unhealthy Plant																						
			Apr, 2014	Jun, 2014	Oct 2014	Jan 2015	Apr 2015	Aug, 2015	Oct, 2015	Jan, 2015	Oct, 2016	Jan, 2017	Jan, 2018	Apr, 2018	Jul, 2018	Nov, 2018	Feb-19	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021
	Albizia saman	3	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
	Excoecaria agallocha	36	-	-	1	1	-	-	-	NS	-	-	-	-	2	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Note: NS = Not Surveyed *=1 Cocos and 45 Excoecaria have been cut																									

Note: NS = Not Surveyed; *=1 Cocos and 45 Excoecaria have been cut; Source: CEGIS field survey

Vegetation Canopy Status

Species representation in different canopy layers of homestead vegetation

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

Estimated Canopy cover in homestead vegetation of sampling sites

Status of vegetation canopy has improving two sites, unchanged at one site and decreased at remaining one site. The causes behind the improvement is added additional canopy for expansion of branches of new planted trees at Borni and Chalkghona sites. At Kalekarber site, canopy cover has slightly decreased due to seasonal leaf fall of some deciduous trees and felling a number of trees by the homeowner. The canopy coverage trend was more or less same in each site compared to the status which was in February, 2020 (Table 3.13).

Table 3.13: 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
Rajnagar	NS	19	19	17	20	20	20	20	21	23	19	15	18	14	11	22	19	18	16
Borni	NS	26	18	18	12	14	20	20	25	25	23	21	21	23	20	21	21	20	18
Kalekarber	NS	20	24	25	23	24	24	22	24	26	25	23	24	24	25	24	25	25	24
Chalkghona	NS	13	24	22	17	21	21	20	21	27	26	25	16	18	21	22	22	22	20

Note: NS = Not Surveyed

Bird Habitat

Local birds and their nesting behaviour

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

Bird species and number of Bird nests in sampling sites

Two bird nest have observed at Rajnagar and Chalkghona and the nesting birds were Asian Pied Starling and Spotted Dove respectively. However, Table 3.14 represent the bird nest monitoring datasheet over the monitoring periods.

Table 3.14: Bird nest observation datasheet

Monitoring Tier	Location	Name of nesting Bird					
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove
1st QM (Apr 2014)	R	NS	NS	NS	NS	NS	
	B	-	-	1	-		
	K	NS	NS	NS	NS	NS	
	C	-	1	-	1	-	
2nd QM (Jun 2014)	R	12	4	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C			11		-	
3rd QM (Sep 2014)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
4th QM (Dec 2014)	R					-	
	B					-	
	K					-	
	C					-	
5th QM (Apr 2015)	R					-	
	B					-	
	K					-	
	C					-	
6th QM (Aug 2015)	R	1	5	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
7th QM (Jan 2016)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
7th QM (Jun 2016)	R	10	5	-	-	3	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	1	1	-	-	-	
11th QM (Oct 2016)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
12th QM (Jan 2017)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
13th QM (Jan 2018)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	1	-	-	-	
18th QM (Nov 2018)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
19th QM (Feb 2019)	R	-	-	-	-	-	
	B	-	-	-	-	-	

Monitoring Tier	Location	Name of nesting Bird					
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove
	K	-	-	-	-	-	
	C	-	-	-	1	-	
20th QM (Apr 2019)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
21th QM (Jul 2019)	R	-	-	-	1	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
22th QM (Nov 2019)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
22th QM (Feb 2020)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
23th QM (Jul 2020)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
24th QM (Nov 2020)	R	-	-	-	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
25th QM (Jan 2021)	R	-	-	1	1	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	
26th QM (Apr 2021)	R	-	-	1	-	-	
	B	-	-	-	-	-	
	K	-	-	-	-	-	
	C	-	-	-	-	-	1

Note: Location R=Rajnagar, B=Borni, K=Kalekarber, C=Chalkghona

3.2.4 Aquatic Ecosystem Monitoring

Rivers, canals, ponds and saline water 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 have merged with shrimp farms. Shrimp farms extend a large proportion of total watershed of the study area those are intervene by human. Therefore, canals are not an actual flowing or stagnant water system.

Monitoring Locations

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

Dolphin Occurrences

Dolphin migration route in the study area

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

Dolphin occurrence in Passur and Maidara River

Dolphin occurrence have been monitored within about 11 km length of Passur and Madara river surround the project area (From Chalna to Digraz Kheyaghat including Maidara River) through boat transact during Neap tide. A total of 8 dolphin was recorded in Passur or Maidara River during the survey. Of which 3 were at Passur Channel and another 5 was sighted within the Maidara River. **Figure 3.10** represents the survey transact and location of dolphin occurrence.

Dolphin occurrence in Dhangmari Khal, Shella Gang and Bhadra khal

Occurrence of Dolphin also surveyed at the Dhangmari Khal, Chandpai Shella Gang Wildlife Sanctuary and Bhadra Khal. In the case of Dhangmari Khal, total transect length was 14 km from Dhangmari-Passur confluence to Gagramari Forest Patrol Post up and down (**Figure 3.11**). A total of 16 dolphins with different sizes were recorded in Dhangmari Khal with an encounter rate 0.54/km/hour. In the case of Chandpai Shella Gang, the survey transact was bounded from Chandpai forest Office to Joymonirgol Thota which transect length was about 8 km (**Figure 3.12**). A total of 4 individuals have been sighted during one and half hour survey. The encounter rate was 0.29/km/hour. Most of the dolphins were found at the confluence point of Passur-Shella River.

The highest occurrence of dolphins observed at Bhadra Khal from which recorded 28 occurrences of dolphin within the 5.9 km reach from Bhadra Patrol Post. The encounter rate was 6.19 individuals/km/hr.

The distribution of dolphin occurrence at Bhadra Khal is presented in **Figure 3.13**.

Another short survey was conducted Karomjal, Harbaria and Akram Point while passing the river. Dolphin has been notified at Karomjal and Harbaria while travelling on boat. However, the survey result is included in **Table: 3.15**

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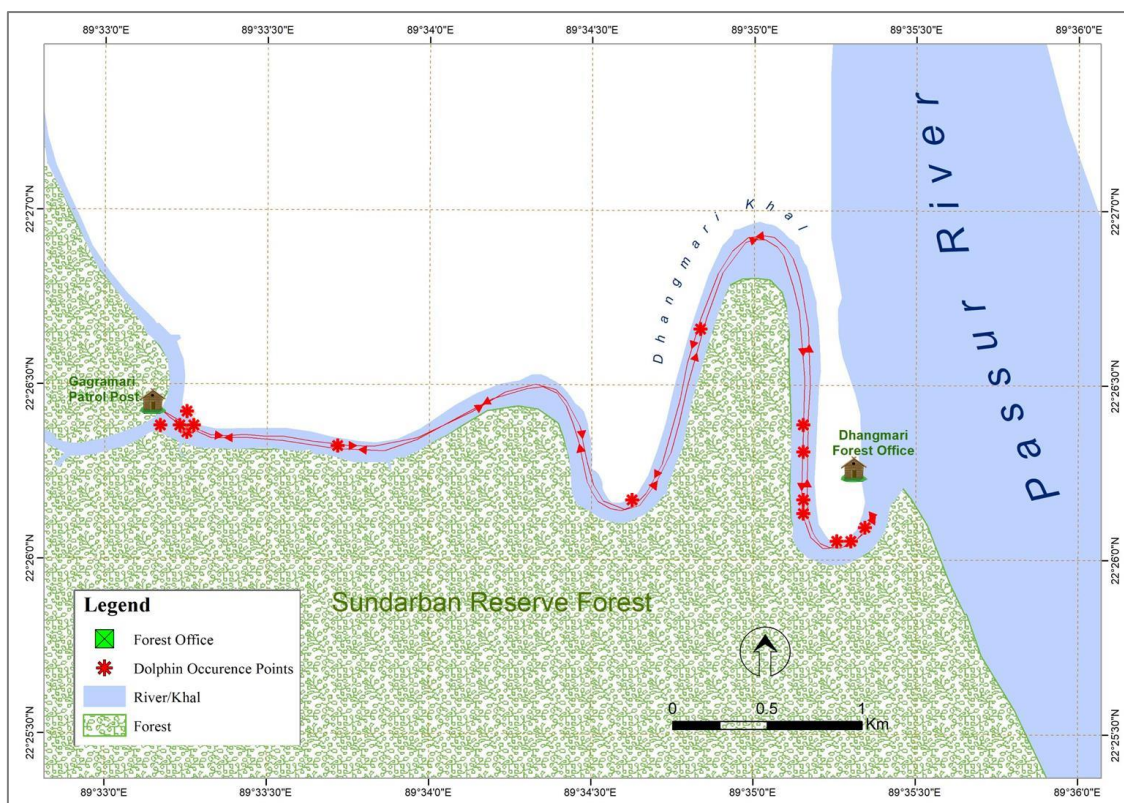


Figure 3.11 Location of dolphin Occurrence at Dhangmari Khal

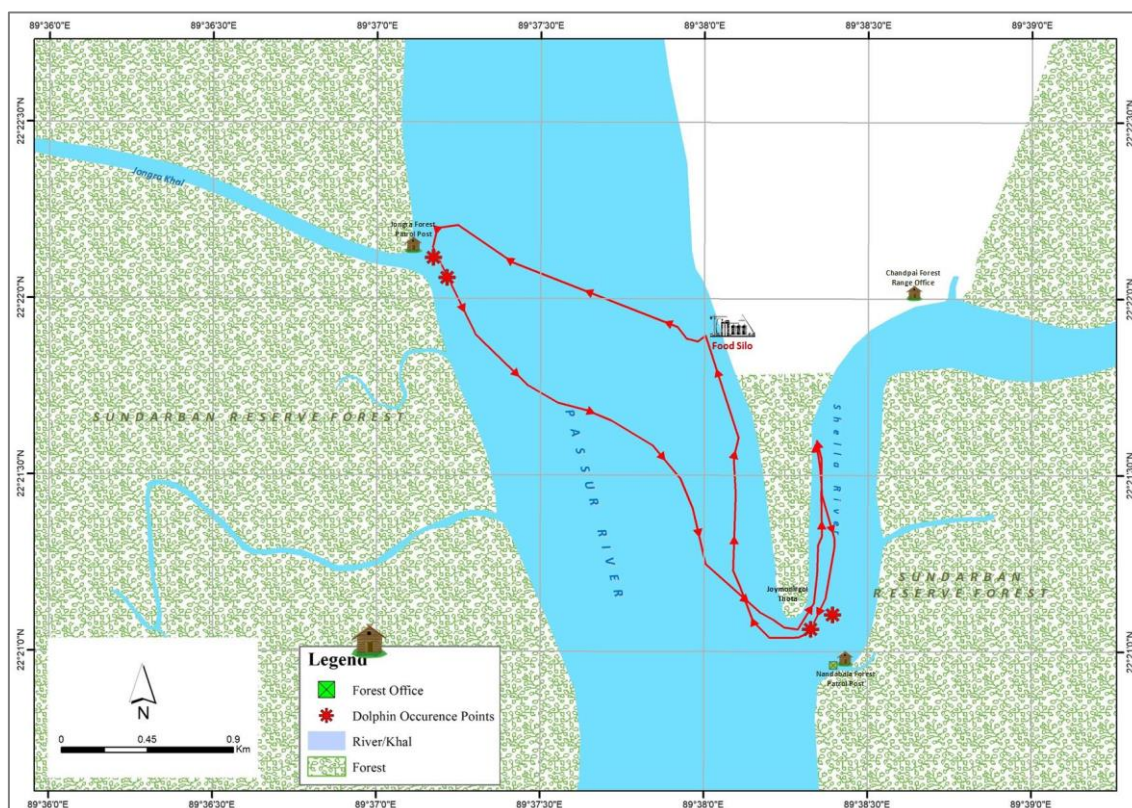


Figure 3.12: Location of dolphin Occurrence at Chandpai

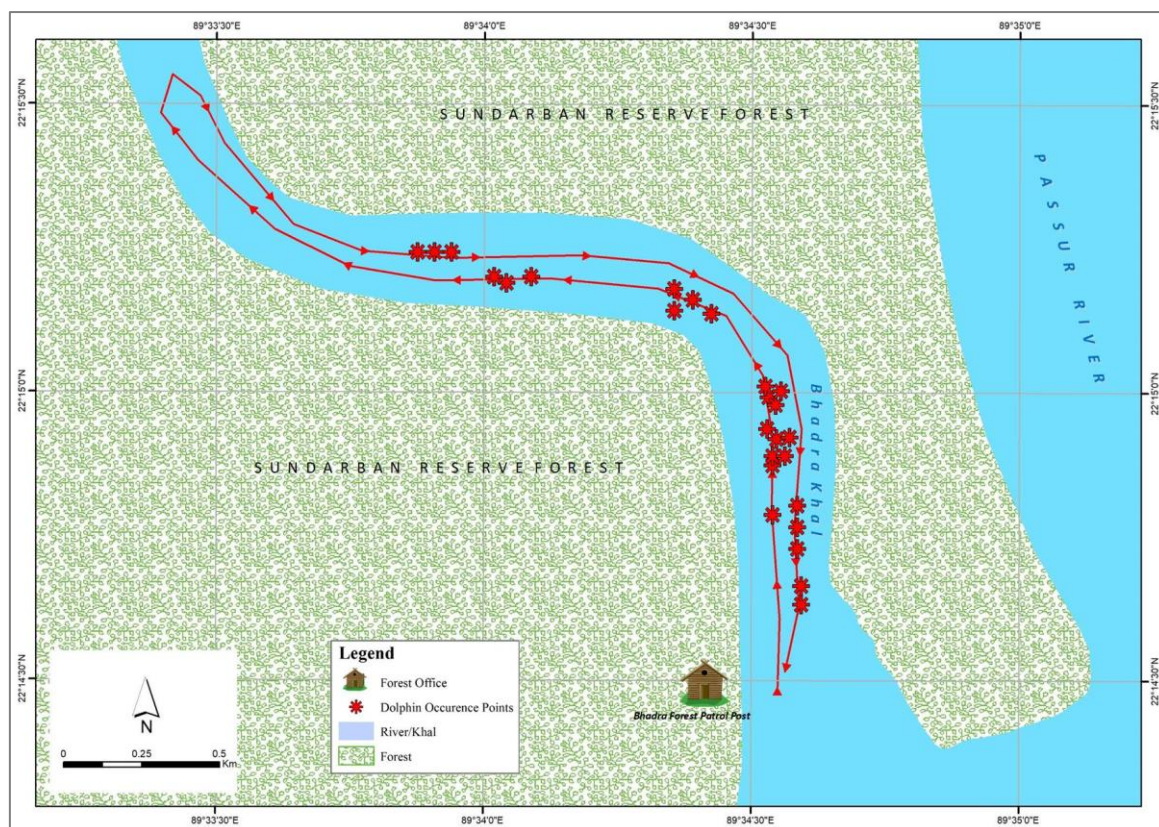


Figure 3.13: Location of dolphin Occurrence within Bhadra Khal

Table 3.15: Dolphin Observation Datasheet

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Moidara River	Shella River at Chandpai
14-Apr	FT	Y	NS	NS	NS	Y	NS
	NT	Y	NS	NS	NS	N	NS
14-Jun	FT	Y	NS	NS	NS	N	NS
	NT	Y	N	N	N	N	NS
14-Oct	FT	Y	NS	NS	NS	Y	NS
	NT	Y	Y	Y	N	Y	NS
15-Jan	FT	Y	Y	Y	NS	Y	NS
	NT	Y	Y	N	Y	N	NS
15-Apr	FT	Y	N	N	Y	Y	NS
	NT	Y	N	N	Y	N	NS
15-Aug	FT	Y	NS	N	NS	Y	NS
	NT	Y	Y	N	NS	N	NS
15-Oct	FT	NS	NS	Y	N	NS	NS
	NT	Y	Y	NS	Y	Y	NS
15-Oct	FT	Y	Y	Y	Y	N	NS
	NT	Y	N	N	NS	Y	NS
16-Jul	FT	Y	Y	Y	NS	Y	NS
	NT	Y	NS	Y	NS	NS	NS
16-Oct	FT	N	Y	Y	N	NS	NS
	NT	Y	Y	NS	N	Y	NS
17-Jan	FT	Y	Y	N	NS	N	NS
	NT	Y	Y	N	NS	Y	NS
18-Jan	FT	Y	NS	Y	N	NS	NS
	NT	Y	Y	N	N	Y	N
18-Jun	FT	Y	N	N	N	Y	Y
	NT	Y	NS	N	Y	Y	NS

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Moidara River	Shella River at Chandpai
18-Nov	FT	NS	N	N	N	NS	NS
	NT	Y	N	N	N	Y	Y
19-Feb	FT	NS	Y	Y	N	NS	Y
	NT	Y	N	N	Y	N	NS
19-Apr	FT	NS	Y	N	N	NS	NS
	NT	N	N	Y	N	N	Y
19-Jul	FT	Y	Y	N	N	Y	Y
	NT	Y	NS	N	N	N	NS
19-Nov	FT	NS	Y	Y	N	NS	Y
	NT	Y	Y	N	Y	Y	Y
20-Feb	FT	Y	Y	Y	Y	Y	Y
	NT	Y	N	NS	NS	Y	Y
20-Jul	FT	Y	N	N	N	Y	Y
	NT	Ns	Y	N	N	NS	Y
20-Nov	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
21-Jan	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
21-Apr	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS

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

Occurrence Status: Y = Occurred, N = Not occurred

3.3 Sundarbans Forest Health

Forest Health Monitoring program intended to decide the status, changes, and patterns in pointers of trees condition on certain time between time premise along the Passur River. 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 is 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 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 demonstarting positive changes intermittently, in spite of the fact that there has some occasional impact. Phonological changes were not found in all PSPs. The Forest Health Monitoring program uses data from various sources 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). 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.

3.4 Methodology

3.4.1 Permanent Sample Plot (PSP) Establishment and Layout

To set up permanent sample plots, five plots were established (**Figure 3.14**). 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 3.16**). The sites were selected considering the distance from the proposed project site, wind directions, coal transportation route, river systems and vegetation types.

3.4.2 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 behaviour, pest and disease.

3.4.3 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 12.62m radius have been laid out at 100m intervals in order to capture the maximum tree species (**Figure 3.15**). Because of the variation in species composition in SRF, observation plots were laid out from the coast, river or canal side to 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. Each subplot was again subdivided into four quadrates (**Figure 3.16**).

Table 3.16: General Description of Permanent Sampling Plots (PSPs)

Transect	Plot	Range	Compartment No.	GPS \pm (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

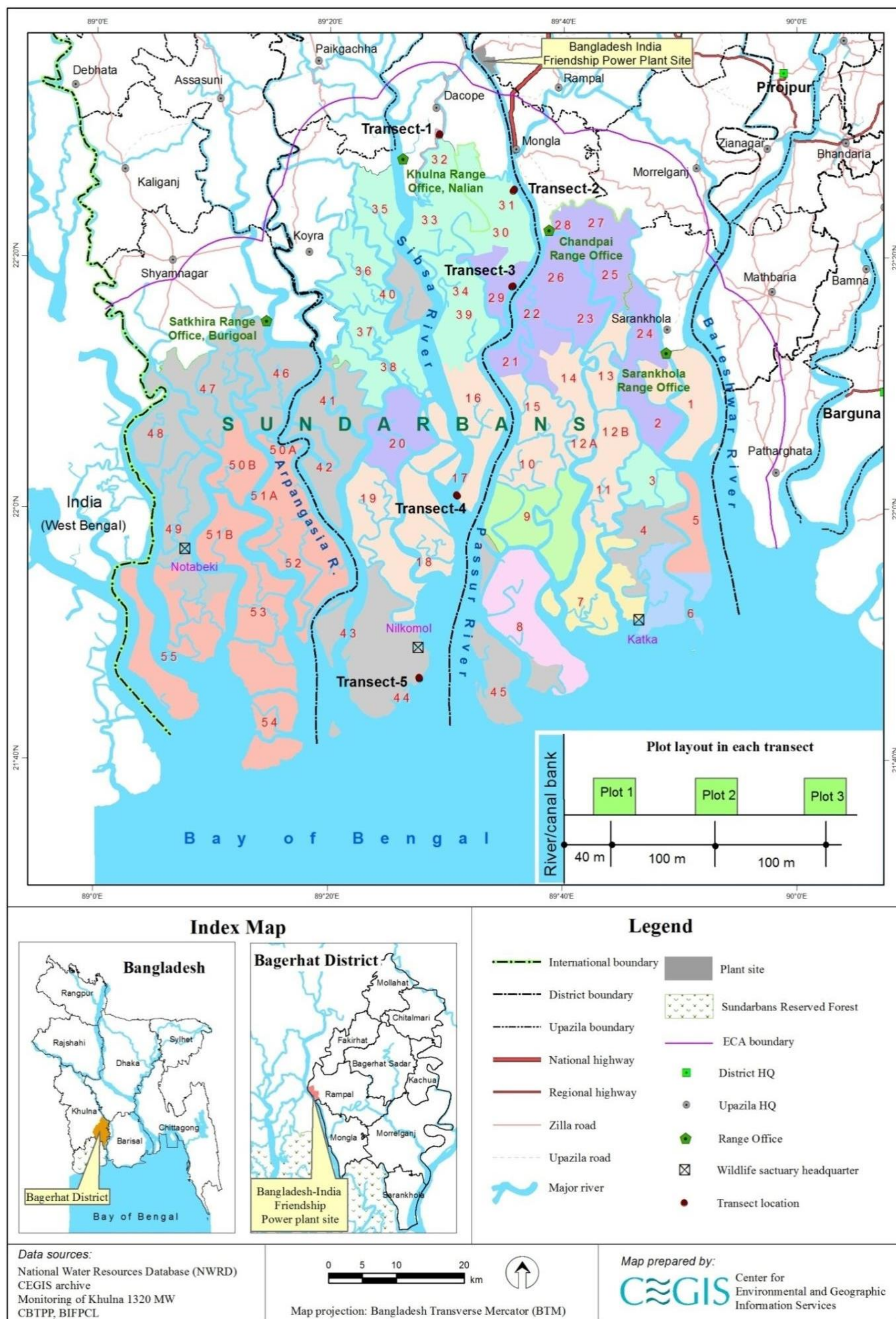


Figure 3.14: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)

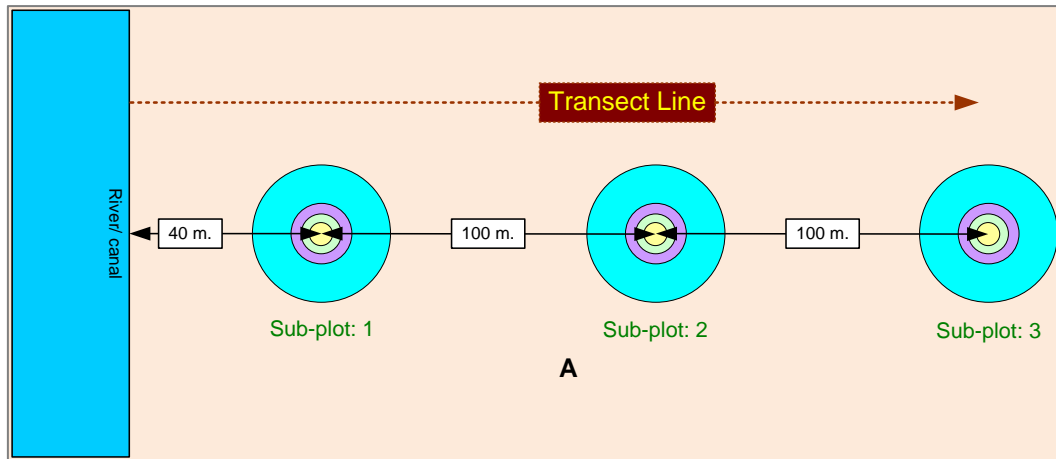


Figure 3.15: Layout of the Subplots and Transect Line Perpendicular from Ecotone (river or canal bank)

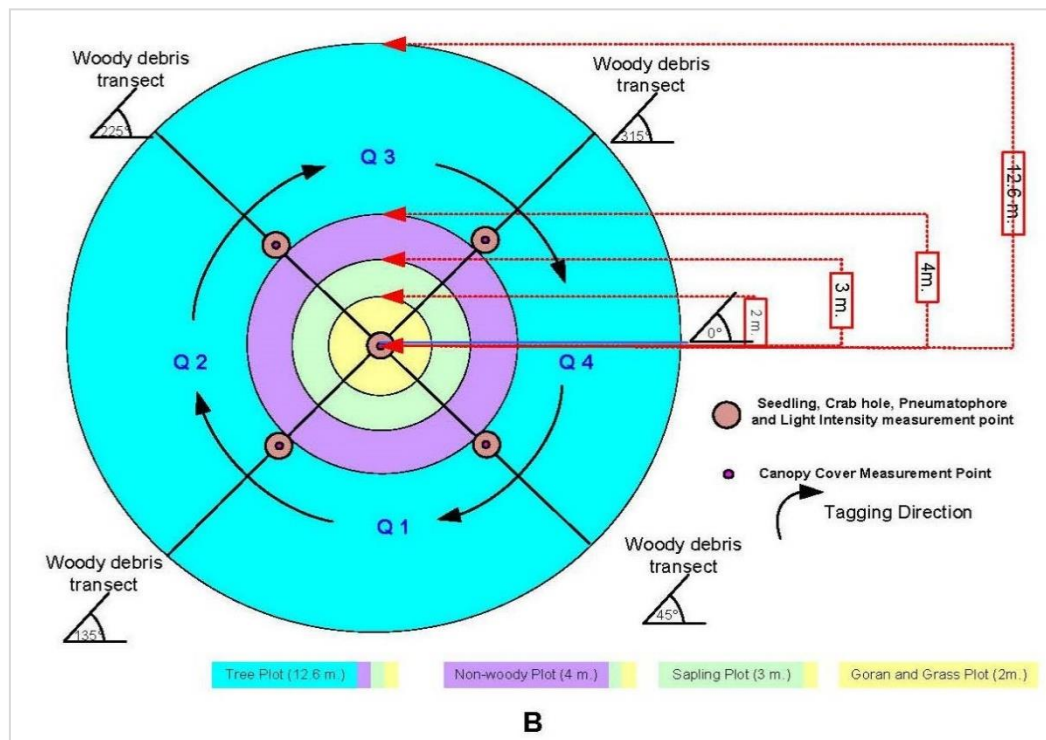


Figure 3.16: Layout of the Survey Activities in each Subplot

3.4.4 Methods

Tree growth

Tree species growth data were obtained from measured tree DBH. Individual tree DBH $\geq 5\text{cm}$ was considered for growth trend observation.

Vegetation Diversity

Tree species data were collected from the PSPs. Individual tree DBH $\geq 5\text{cm}$ was considered. Saplings (DBH $< 5\text{cm}$ and height 1.37m) and seedlings (height $< 1.37\text{m}$) 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 centring 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 centre 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 centre 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) = $\log_e (I/I_0) / -K$ leaf area / area of ground (Where, I = Under Canopy Light Intensity, I_0 = Open Canopy Light Intensity and K is Canopy light extension coefficient i.e., 0.5).

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.

3.4.5 Results and Discussion

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 3.17**). Gewa was the dominant species among all the PSPs which was confirmed by the Rank-abundance curves followed by Sundari and Kakra (**Figure 3.18**). Vegetation species richness has been identified through Shannon, Simpson and evenness Index (**Table 3.17**). 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.

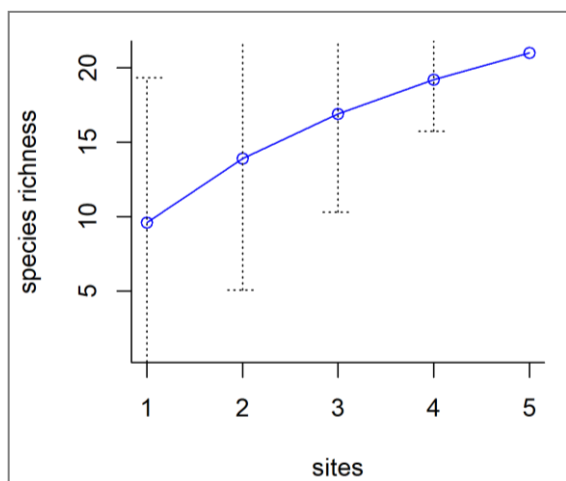


Figure 3.17: Species accumulation curve for the PSPs dataset.

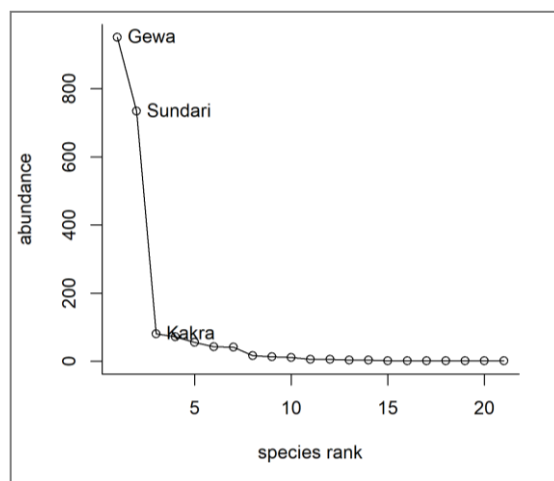


Figure 3.18: Rank-abundance curve for the sampled PSPs.

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)

Hiron point plot data was taken from last survey.

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 3.19**).

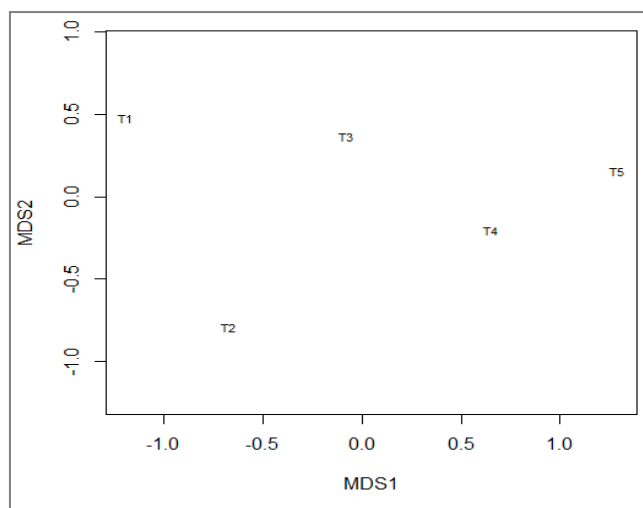


Figure 3.19: Ordination graph for a two-dimensional MDS based on the Bray-Curtis distance.

The best configuration out of 500 is shown here.

Table 3.17: Different Diversity Indices for Vegetation in the Sampled PSPs

PSPs	Shannon Index	Simpson Index	Evenness Index
Sutarkhali (T1)	1.06	0.46	0.26
Karamjol (T2)	2.09	0.83	0.44
Harbaria (T3)	1.31	0.64	0.25
Akram Point (T4)	0.83	0.47	0.39
Hiron Point (T5)	0.47	0.22	0.23

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 Akram point. Sundari has the highest amount of carbon stock (Table 3.18).

Table 3.18: Species Wise Total Carbon Stock (t/ha)

Species	T.C. 18 th Q.	T.C. 19 th Q.	T.C. 20 th Q.	T.C. 21 st Q.	T.C. 22 nd Q.	T.C. 23 rd Q.	T.C. 24 th Q.	T.C. 25 th Q.	T.C. 28 th Q.
Amoor	1.37	1.28	1.65	1.69	1.54	1.42	1.33	1.55	1.43
Baen	71.46	64.59	66.51	67.42	65.11	64.09	61.92	69.73	65.25
Bhutbutta	0.14	0.18	0.25	0.25	0.25	0.25	0.25	0.21	0.24
Bola	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0	0.09
Gewa	125	121.15	124.69	126.15	125.01	126.62	101.69	244.92	157.74
Goran	0.66	0.69	0.77	0.78	0.75	0.68	0.62	1.16	0.82
Kakra	53.35	50.93	51.99	52.35	52.15	52.19	51.96	55.35	53.17
Lakur	0	0	0	0	0	0	0	0	0
Passur	62.6	71.33	74.16	67.63	70.5	71.19	62.04	80.6	71.28
Sundori	446.01	450.82	475.6	465.01	468.22	466.09	460.59	512.19	479.62
Urmui	0.41	0.36	0.4	0.44	0.41	0.39	0.43	0.32	0.38
Vaila	0.8	0.83	0.74	0.74	0.74	0.74	0.81	0.9	0.82

N.B. TC-Total Carbon

Status of Forest Health Indicator

The tag number of trees (DBH ≥ 5 cm and lean angle greater than 45°) was monitored and rewritten if any new tree was found within 12.62 m radius circle of the Permanent Sample Plot (PSP).

There was significant variation ($p > 0.05$) in tree growth over the monitoring period for all the PSPs. This time of monitoring period, no notable change in seedling survival of all PSPs. It indicates well in forest health condition.



Measuring diameter at Sutarkhali



Measuring Height at Karamjol site



Measuring Light intensity at Harbaria



Measuring canopy cover at Akrampoint

Average number of pneumatophores per hectare was comparatively very low in Karamjol point area whereas pneumatophores density was highest in Akrampoint sample plots. There is no significant variation ($p > 0.05$) in pneumatophores density from last monitoring period for each PSPs except (**Figure 3.20**). This indicates that forest health condition is remaining same condition.

There is almost same condition ($p > 0.05$) in crab density over the monitoring period for Harbaria, Sutarkhali PSPs (**Figure 3.20**). Karamjol plot shows less from the last tier. However, Akram point crab density was significantly different then the other tier due to take a new 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. But all PSP shows increasing trend of canopy cover (**Figure 3.20**). This indicates that positive change in forest health condition.

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.



Figure 3.20: Ordination graph for a two-dimensional MDS based on the Bray-Curtis distance

The best configuration out of 500 is shown here.

Forest soil sampling

The soil sampling was carried out in seventh year first quarter (post winter) and the soil properties data after being analyzed has been incorporated in this tier (**Photo 3.15**).

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 centre of the 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:

$$\text{Bulk Density (BD)} = \text{Wt}_{105^\circ\text{C}} / \text{V}_{\text{core}}$$

$$\text{V}_{\text{core}} = \pi \text{D}_{\text{core}}^2 \text{L}_{\text{core}} / 4$$

Where, $\text{Wt}_{105^\circ\text{C}}$ is the weight of oven dried soil, V_{core} is the volume of the core, D_{core} is the inner diameter of the core and L_{core} is the length of the core.

Soil Salinity (EC)

Soil Salinity (EC) has been measured according to Mostara and Roy, 2008. 1:2 ratios 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 ratios 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

$$\text{LOI\%} = (\text{Wt}_{105^\circ\text{C}} - \text{Wt}_{450^\circ\text{C}}) / \text{Wt}_{105^\circ\text{C}}$$

Where, $\text{Wt}_{105^\circ\text{C}}$ is the weight of soil at 105 °C and $\text{Wt}_{450^\circ\text{C}}$ 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., $\text{Organic C\%} = \text{Organic matter (\%)} / 1.724$)

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 3.19: 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 content across the five monitoring sites were given in table 3.15. Lower bulk density indicates that the site has more organic matter. Only Harbaria 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 Sutarkhali Point (5.26 ms cm⁻¹), while this figure is lowest in Harbaria Point (3.85 ms cm⁻¹, Table 3.15). The OC% has been observed almost similar figure in all monitoring locations except Karamjal point which represents higher amount of OC (2.43%). The N concentration was found rise in Karamjol, Sutarkhali and Akram Point (Table 3.15). Lowest N concentration has been observed at Akram point site (Table 3.15). The P content is lowest at Harbaria point.

Table 3.20: 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	1.23	7.40	4.80	1.48	0.86	0.49
15-30	1.19	7.42	5.40	1.62	0.77	0.42
30-50	1.15	7.44	5.66	1.51	0.79	0.47
50-100	1.14	7.47	5.20	1.49	0.68	0.49
0-100	1.18	7.43	5.26	1.53	0.78	0.47
Karamjol						
0-15	1.13	7.45	3.58	2.53	0.97	0.52
15-30	1.13	7.43	4.87	2.40	1.02	0.49
30-50	1.16	7.31	5.44	2.47	0.77	0.53
50-100	1.13	7.36	5.95	2.32	0.76	0.53
0-100	1.14	7.39	4.96	2.43	0.88	0.52
Harbaria						
0-15	1.07	7.33	4.37	2.58	1.30	0.49
15-30	1.08	7.35	3.81	2.29	1.00	0.61
30-50	1.13	7.36	3.67	1.99	0.92	0.55
50-100	1.17	7.27	3.55	1.90	0.77	0.51
0-100	1.11	7.33	3.85	2.19	1.00	0.54
Akram Point						
0-15	1.17	7.47	4.34	2.16	0.64	0.49
15-30	1.22	7.41	4.87	2.05	0.78	0.51
30-50	1.18	7.37	4.59	1.97	0.71	0.51
50-100	1.26	7.32	4.32	1.74	0.54	0.53
0-100	1.21	7.39	4.53	1.98	0.67	0.51

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.

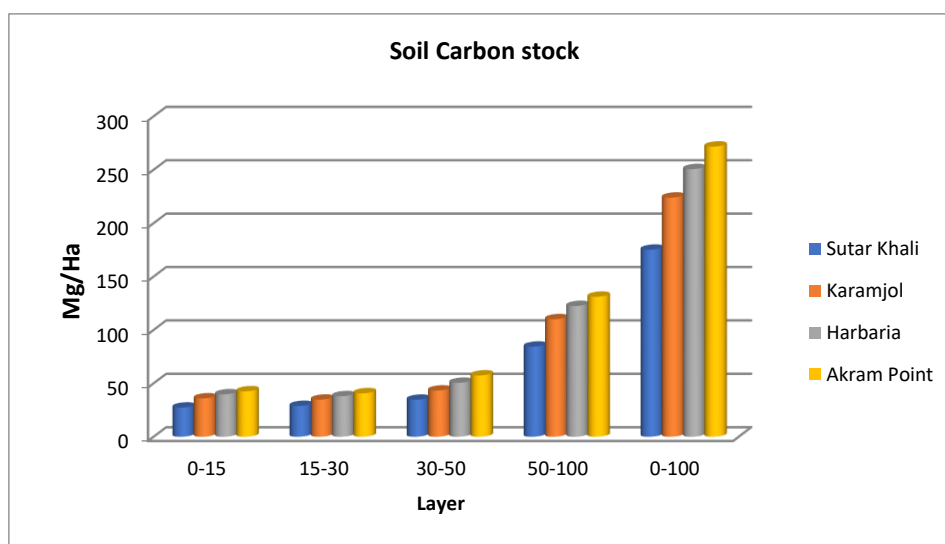


Figure 3.21: Soil carbon stock of four different plot

4. Social Environment

4.1 Introduction

The 28th social safeguard monitoring was held to understand the social safeguard status during the construction phase of the project. This monitoring was conducted following the guidelines of DoE, and Environmental Management Plan (EMP) of Environmental Impact Assessment (EIA). However, it is a follow up monitoring which is conducted quarterly (after consecutive 3 months) to monitor the compliance status in relation to the DoE' condition for the successful completion of construction activities, keeping a good working environment, and taking care of community health and safety issue. In this regard, in this monitoring, social safeguard issues considered based on the activities done from February, 2021 and April, 2021. Impacts on livelihoods, working environment, community health and safety, Corporate Social Responsibility (CSR) activities monitored in this stage of monitoring and provide suggestion to address the noncompliance issues.

4.2 Methodology

Physical observation was used as a data collection technique (during the field work) to understand the status of the following monitoring indicators. Besides, telephonic interview was conducted with the person concerned from Project Management Unit (PMU) to explore the recent Corporate Social Responsibility (CSR) activities. At the same time, pictures on CSR activities collected through online that represented the CSR activities of the PMU. The monitoring locations are shown in **Figure 4.1**

Additionally, informal interviews were carried out with local people at zero point, Kapasdanga, and Rajnagar Union. Additionally, consultation meeting was in presence of relevant professionals from the PMU for getting concerns on the social safeguard issues.

4.3 Results of Social Safeguard Status

Impact on Employment and Livelihood

According to the local people, engagement of the local labors increased than the previous time. The interest of local people become positive for being involved in the construction activities. As a result, the rate of local labors found in this stage of monitoring from the adjacent unions (i.e. Gaurambha, Kapasdanga, Hurka and Rampal)

Presently, local people stated that about 20% labors are working in the construction activities have the more positive attitudes, and they opined that livelihoods options started to increase due to the project intervention. Local people opened up small shops here which is possible because of the project implementation. Besides, improved communication made a contribution to promote their business than the previous time. Local people got more income opportunities to do small business due to bazar development.

Additionally, about 200 people were registered (under the motor vehicle federation) to run motor vehicles at the approach road to carry both goods and passenger, as a result, it was helping people to involve earning opportunities. Furthermore, local people started thinking to be skilled more as they can join in future during the operation phase of the project.

Working Environment

During the pandemic situation due to Covid 19, the PMU trained the labors to obey the health safety rules to keep them safe from the Coronavirus. In the construction site, people have no entry without the masks. Labors working at the construction site regulated to maintain the social distancing, wearing masks all time and washing their hands regularly. This practice also found in the labor shed. Considering the Coronavirus issue, local labors have no access to meet outside people and outsiders have no entrance to the labor sheds

as well as in the construction site. Labor sheds found clean with adequate toilet facilities, drainage, and waste management and drinking water facilities. The toolbox meeting was held every day in presence of safety officer. The identified non-compliance issue discussed with the PMU in a debriefing session in a written document. Additionally, no training no work campaign also ongoing to get competent working force. Before recruitment, all labors are monitored especially to work using PPE and height. After passing the test labors are selected to involve them into different construction activities.

Community Health

During the period of study, no grievance found from the local community due to the project construction activities. Every day, water sprays four times for suppressing dust and protecting project site and local people around the site from dust pollution.

Local communities at Gaurambha and Rajnagar unions reported that they are not encountering noise related problems due to construction activities. Additionally, the PMU was trying to ensure the green environment planting 65,000 plants within the boundary wall of that project.

4.4 Corporate Social Responsibility (CSR)

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

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:

Community development

During the period of monitoring, it was found that a program on blanket distribution held in January 2020 as a part of the CSR activities at the Rajnagar, Gaurambha union, zero point of Hurka, and Burirdanga unions. A total of 4,250 pcs of blanket distributed among the poor people. In addition, a total of 750 blankets were distributed at the orphanage of Dhaka city.

As a part of community development, wheel chair distributed among the disable people. This program was organized by the BIFPCL in December 2020 at the project site. Honorable chairman, of Power Development Board (PDB) Engineer Md Belayet Hossain, Project Director of MSTPP, Managing Director of BIFPCL and other personnel attended and distributed for supporting physically disabled people of adjacent unions from the project site. Following this programs, more wheel chair distributed among the disabled people. Besides, educational Kits distributed among the students who are living nearby to the project site. In addition, about 50,000 masks were distributed to the local people to build consciousness and tackle the situation arisen due to the spread of Coronavirus.



Figure 4.1: Distribution of Wheel chair and Blanket to the disabled and poor peoples

Medical Campaign

Monthly medical camp was held at Rajnagar and Burirdanga unions in November and December 2020 respectively. A total of 546 (298 at Rajnagar & 248 at Burirdanga) local people received free medical advice and medicines under the medical campaign. Besides, Labor colony medical camp was held in the month of November, December and January whereas a total of 588 labors received medical advice and medicines freely. Additionally, a boat medical camp was held on December 2020 at Laudop whereas a total of 172 people got free medical service. Following the previous medical campaign, till now, more than 55,000 received free treatment due to the campaign under the CSR activities.

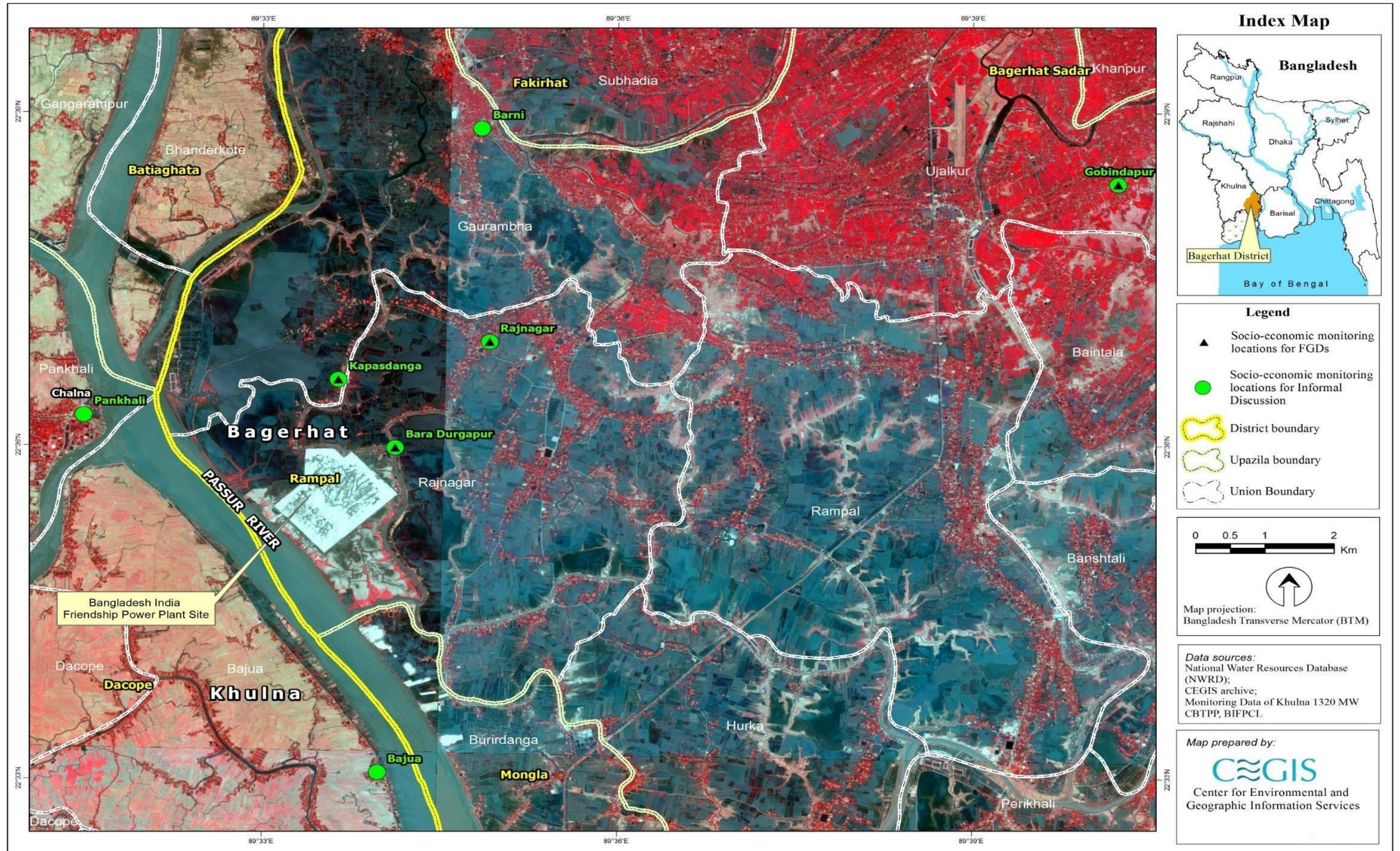


Figure 4.2: Socio-Economic Environment Monitoring Location

Capacity Building Programs

Capacity building trainings were offered to the local people under the CSR program for making the local people skillful. Under the programs, about till now 261 persons received training on sewing, and about 265 persons received computer literacy skill development training. The PMU arranged a masks distribution program. In this program about 50,000 distributed. Those masks were made by those trained women who received training on Sewing machine. This made an earning opportunity for them and made a confidence to work further accordingly. Capacity building trainings were offered to the local people under the CSR program for making the local people skillful. Under the programs, about till now 261 persons received training on sewing, and about 265 persons received computer literacy skill development training (Figure 4.3 and Figure 4.4).

Recommendations

- a. 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;
- b. Regular refilling is to be continued for making the desired and committed greenery effectively as per conditions of DoE;
- c. Continuing regular health checkup and disease monitoring for the daily laborer at work place as well as for the laborer staying at labor colony;
- d. Special attention should be given on `workers if they have any syndrome related to the COVID 19;
- e. CSR activities should be performed primarily among the PAPs on equitable manner. This should be audited by a third party monitoring team;
- f. Ensure proper safety equipments for battling against the COVID 19 virus;
- g. Create awareness about the Coronavirus disease (COVID-19);
- h. Wash hands and face immediate after entering the office substation from outside;
- i. Ensure masks for everyone who are working at the Project site;
- j. Health temperature should be checked before entering the Project site;
- k. Avoid (as much as possible) public transports, if possible walk on foot;
- l. Social distancing should be maintained in the labor shed as well as in the Project site;
- m. Paste poster on how to work during the COVID 19 situation for raising more awareness;
- n. Rehabilitates should be given preference in implementing CSR program as they are under serious threat of another shifting;
- o. Dust suppression by spraying water should be continued on construction sites, and other places where necessary to suppress dust and minimize air pollution;
- p. River water should be used for dust suppression activities and ground water use should be avoided completely;
- q. The PMU should be active and efficient in maintaining vehicle speed limits in the Project site;
- r. PAPs should be given priority in recruitment of manpower based on their skills;
- s. Special attention should be taken to introduce new programs under the CSR;

- t. Special attention should be taken care for assessing the needs to local schools and colleges for implementing different programs under the CSR;
- u. People are more positive about the project. To increase more awareness, it is required to arrange some consciousness program in which they can be more aware how this power plant will be operated and how this project will be beneficial for the local people;
- v. Local people are becoming aware about the new entrepreneurship development in this area; in this regard, training on entrepreneurship development should be arranged under the CSR activities.

5. Environmental Compliance

5.1 Introduction

Environmental monitoring has been conducted during March 2021. All of the bio-physical parameters have been monitored through rigorous field visit and lab analysis. Increasing the COVID cases in the country, the Government has announced country wise lockdown at the end of March which tried to restrict the human movement. The environmental compliance monitoring of Maitree Super Thermal Power Plant Construction has been conducted with telephonic conversation, filling questionnaires and field observation.

The construction works is running amid the COVID emergency situation. 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 area, township area, internal road networks, permanent drainage networks are being continued. The permanent jetty construction works are advancing for unloading the heavy machineries. EPC contractor i.e. Bharat Heavy Electricals Limited (BHEL) employed different local specialized sub-contractor i.e. KELLER, AFCON, POWER MAC etc. for progressing the construction works simultaneously.

The bridges and culvert area of the approach road has already been extended to six lane road requirement. Permanent structure for the security staff and visitors was constructed at the entrance point of the project area. The main Administrative center of BIFPCL and EPC contractor were shifted to the newly constructed buildings and maximum professionals of BIFPCL were shifted to the newly constructed township named Padma Abason.

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. Though, the project work was almost halted at the end of the March 2020, it came into full pace in July 2020. But, the second lockdown, has again slowdown the construction works. However, the construction activities are progressing the project site strict maintaining the Government Decision on COVID Guidelines. EPC tried to expedite the contractors and sub-contractors for completion of the project works within the stipulated timeframe maintaining the instruction and health safety guideline of the existing pandemic.

However, the present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews/discussion to the proponents through telephone and WhatsApp with project officials, contractor or sub-contractors, or relevant authorities. A comprehensive due diligence checklist was 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 as stated in EIA. The checklists are produced as Compliance Data Sheet that contains both quantitative and qualitative data. The summary of findings of the environmental compliance monitoring are presented in the following **Table no. 5.1, 5.2, 5.3 and 5.4** respectively.

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

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
1	Generation of Noise within the BIFPCL's Plant construction premises.	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Noise data are being monitored periodically on daily basis both night and day time at different potentially sensitive areas (Labour colony) and compared with the ECR-1997 Standard and are being documented by EPC contractor. Noise levels were found within the permissible limit near the project boundary. Workers at heavy noise generating activities (i.e., piling, rod cutting etc.) have been provided PPE (ear plug and ear muff) and its usage are being insured through safety audit clearance before start of work on every day. Idle machines / equipment / generators are switched off/throttled down. Generators with acoustic enclosures are only being used as and when required. Uses of noise damper has been ensured inside the project boundary. 	Complied	<ul style="list-style-type: none"> If construction activity would extend at night, additional measures to limit noise (within permissible standard) should be taken.
2	Dust generation from construction works	<ul style="list-style-type: none"> Limiting activities for producing fugitive dust particle within project area Vegetation clearance and base stripping should be minimized. Vehicle speed restriction must be enforced to control dust generation. Earthen roads and undeveloped roads should be avoided to minimize dust generation Construction materials must be covered to protect from wind action Spray water regularly for suppressing fugitive dust 	<ul style="list-style-type: none"> Monthly and periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. Mixing machine may generate localized dust during cement and concrete mixing. But all the crashing and storage of materials were recorded wet. Monitoring the vehicular speed and load Regular water spraying is being conducted at least four times in a day by three no of water tankers or as per requirement are being done to suppress fugitive dust. Roads are also cleaned regularly. 	Complied	<ul style="list-style-type: none"> Dust suppression activities should be monitored regular basis for maintaining the air quality within standard limit. Face mask should be use wear throughout the workplace. Clean the mud and other construction materials from the paved roads.

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Now-a days, earthen stock piles are covered by natural green tiny grasses. These are acting as shield cover for fugitive dust. Water is also being sprayed regularly on the stockpiles and registered. Substantial warning sign, speed limit and convex mirror have been displayed at the strategic locations. All vehicles are carrying dusty loads covered / watered over prior to leaving the site. No black smoke observed because of plant and equipment are well maintained. 		
3	Water Quality	<ul style="list-style-type: none"> Surface water must be saved from any harmful effluent emission and waste dumping from project site Provide closed system facilities and wastewater treatment plant to minimize discharge of effluents from worker's colony. Good housekeeping at workshop and construction site Appropriate equipment with safety measures should be used for storage and handling of lubricant Provide training and awareness building program to the workers during construction. The training and awareness programs are: <ol style="list-style-type: none"> Arrange weekly consultation session among the workers through plant site managers. The duration of consultation is one hour according to ISO-14001 standard, 	<ul style="list-style-type: none"> Surface concreting is being done at places where equipment is coming. Large surfaces area is available as for natural recharge. Ground water is not used for construction purpose. Construction waste water discharge is minimum and need based only. They are also meeting effluent norms. The same is being discharged through north-east corner of the project & also monitored regularly. Permanent drainage for water discharge has been constructed. Some are already been in operation. Closed system facility and wastewater treatment system on site and worker's colony is under construction. Waste water treatment as well as CEMS are under construction. For storage and handling of lubricants/oil/ chemicals appropriate equipment with safety measure is being used. For chemical storage license has been taken from the District Commissioner (DC) office, Bagerhat 	Complied at present	<ul style="list-style-type: none"> Good housekeeping at workshop and construction site should be continued

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		b) Arrange monthly environmental meeting among the mid-level officers through top management when those issues will be discussed under guidance of ECR 1997.	and Gaseous License has taken from the Department of Explosion. • Training and awareness program are being conducted regularly through PEP talks, lectures, one to one talk etc.		
4	Waste Generation	<ul style="list-style-type: none"> Limiting site clearance and base stripping activities within the project boundary. Gathering and stocking of construction materials and machinery must be within a limited area in the project boundary. The project area has to be fenced prior to initiation of construction activities. Stock piles of construction materials requiring cover up in order to protect them from wind and weathering action. The existing right of way have to be used for material transportation without creating any block Location of spoil stock pile ought to be located in safe area and protected from wind and rain action. 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 	<ul style="list-style-type: none"> Construction wastes are being collected and put at demarcated places. Heavy / mechanical equipment is kept at demarcated places. Burning of waste materials was not allowed inside plant. Proponent has engaged a company name Rahman Brothers in collaboration with the KCC for collection of waste from the disposal. Waste management training has been included in induction training of the labor. Local languages (Bengali) and English are being included in the signboards. Further development of environment friendly waste collection and disposal system like Solid Waste Management (SWM), STP etc. are being developed at the demarcated place in plant premises. SWM will have provision of segregation and reuse of waste as possible. There is a provision of development of solid waste management system which is given at clause no B12, Part no 9 of book no -2, page no 147-161. In which there is development of WMC which has waste collection, waste segregation at source, recycling, treatment and disposal of waste will be done. 	Complied	<ul style="list-style-type: none"> On site waste disposal facility should be increased. Scrubbing materials should be managed within the designated places.

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> Keep provision of different colored waste bin for dumping biodegradable, reusable and recyclable wastes. Keep provision of awareness building meeting and training for employees 	<ul style="list-style-type: none"> Separated labelled containers, recycling and waste segregation areas are included in solid waste management package which is under construction stages 		
5	Compensation and Resettlement	<ul style="list-style-type: none"> 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. 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 	<ul style="list-style-type: none"> 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. 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. Proponent has developed plans to monitoring the resettled PAPs 	In the process of Compliance	<ul style="list-style-type: none"> The CSR activities should be oriented towards the affected people or household;
6	Livelihood and living condition	<ul style="list-style-type: none"> The labor recruitment policy must be formulated in such a way that the local 	<ul style="list-style-type: none"> BIFPCL are recruiting the local people especially PAPs with the help of local government. 	Complied	<ul style="list-style-type: none"> Health and financial support should be available

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<p>laborers can easily get the chance of employment in the project work force.</p> <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Accidental log sheet or injury log book are being maintained. Provisions has been kept for health facilities to the labors as well as for the communities. Proponent has taken numbers of potential measures for COVID protection which is continued The wage of the labor was found compatible with the national standard. Available drinking water, sanitation facilities, prayer room are provided at site. Facemask and other sanitation facilities are provided for the labors and employees in association with medical check-up by the authority No incident has been recorded in this quarter as maximum work load was retarded due to COVID Pandemic. 		for the labour in case of COVID affected.
7	Green House Gas Controlling Measures	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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. Energy efficient component like light, AC and other equipment are used. Equipment, generators and vehicles were observed switched off during non-operation period. Vehicles are maintaining the road safety regulations and No GHG inventories were prepared yet. 	In the process of Compliance	<ul style="list-style-type: none"> GHGs inventory checklist should be prepared immediately at this stage;

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	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 labor level between local or migrating labor 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. • Routine medical checkup and emergency medical care has been ensured. • 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	<ul style="list-style-type: none"> • OHAS must be monitored the training for construction workers to protect from- • 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
2	Protecting Work Force	<ul style="list-style-type: none"> • 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, 	<ul style="list-style-type: none"> • 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. 	Being complied	<ul style="list-style-type: none"> • 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

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		spiritual, moral, or social development. <ul style="list-style-type: none"> No Forced Labor 	<ul style="list-style-type: none"> First Aid support is provided to the labors as required. Wearing the PPEs on the site is mandatory on this pandemic situation 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 sheds Awareness about Covid-19 is being spread among workers and office support staff. 		workers grievances, insurance policy related facilities and also contract clauses of the job to get maximum benefit.
3	Safety at site	<ul style="list-style-type: none"> Installation/Construction of Safety Fence around the Project area Use of Personnel Protective Equipment's (i.e. safety vest, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.); 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); 	<ul style="list-style-type: none"> 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; 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 mask. Increased the capacity of temporary hospital, doctors and 24hr availability of ICU supporting ambulance at the Project site; 	Being Complied	<ul style="list-style-type: none"> Monitoring about PPE and body temperature of labors. Electrocution / Firefighting facilities are properly maintained. Safety Data sheet is properly maintained.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> Provision of Health care facilities such as doctor, hospital etc. available at/nearby the Plant construction site; Availability of First Aid at work place; Preparation and Follow of Emergency Response Plan (ERP); Adequate fire precautions in place (e. g., fire extinguishers, escape routes etc.); Documentation and reporting of occupational accidents, diseases, and incidents; Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS 	<ul style="list-style-type: none"> Emergency contact address was found on the board at the site for any kind of sudden incident; The proponent arranged a meeting once in a week with EPC contractor on safety measures and follow up. EPC has made a contract with the Gazi Medical of Khulna city for emergency medical support. Medical checkup is mandatory for all before starting the work at the project site. 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 HIRA at site. 2 Ambulances, 1 MBBS doctor, 2 paramedical doctors and two medical checkup system are amiable for the workers as well as officials Third party safety team has been appointed for monitoring day to day safety activities. 		
4	Occupational Health and Safety procedure	<ul style="list-style-type: none"> Provision of complete EHS division in the Human Resources Planning/ Organogram Preparation of Safety Policy to be adopted during Plant operation 	<ul style="list-style-type: none"> Adequate number of safety officers have been employed by the EPC contractor and Sub-contractors. One safety park has been established for continual training as well as training during induction. 	Being Complied	<ul style="list-style-type: none"> Awareness build-up, strict to the safety issues, Continued the safety training, buildup the awareness and make the labour habituated with the safety procedure

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			<ul style="list-style-type: none"> The necessity of PPE and safety protocol has been displayed at signboard to make them aware. Medical aid, fire extinguishers, PPEs are being provided adequately. Regular Safety talk, safety meetings are being organized at site and also in class rooms. Photo are being attached. Keys safety instruction has been attached on class rooms wall. Adequate safety bill-boards etc. have been displaced all over the construction area. Photo are being attached here. Speed barriers are being augmented <p>Substantial warning sign, speed limit and convex mirror have been displayed at the strategic locations.</p>		<ul style="list-style-type: none">
5	Workers Well Being	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Workers are generally satisfied with the residence facilities since less number of labour are present due to COVID-19 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 etc. are being ensured in labor colony Workers get lemon or saline water during work period 	Being Complied	<ul style="list-style-type: none"> Freedom of Association, Rights & scope of bargaining should be open for the workers. Support to the COVID-19 affected labors urgently

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> The construction activities became slow further due to COVID pandemic. Boundary wall has been constructed around the project area. Water spraying has been conducted at least four times in a day by three no of water tankers or as per requirement are being done to suppress fugitive dust. Water is also being sprayed regularly on the stockpiles and registered. CEGIS is routinely communicating with the nearby communities for assessing impacts and related complaints on dust generation issue. Regular communication and consultation are taken places with the local government and local administration officials except this COVID situation Environmental parameters are continuously monitored in and around the project site by separate entities except the lockdown period 	Being complied	<ul style="list-style-type: none"> 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
2	Grievance of local people	<ul style="list-style-type: none"> • Availability and operation of Grievance Redress Mechanism; • Maintaining open communication channel with the local community. 	<ul style="list-style-type: none"> • 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 through the monitoring study conducted by CEGIS or local government 	Being complied	Put the grievance register outside the project boundary or at the project entrance gate so that the local community could easily state any grievance properly.
3	Risk of breaching Community Safety	<ul style="list-style-type: none"> • Construction of boundary wall/safety fence around the Project area; • Practicing Risk Assessment and Evaluation Process; • Practicing safe management for hazardous materials which may pose threat to the community; • Availability and operation of Emergency Response Plan; • Maintaining open communication channel with the local community; • Training and instruction to the security personnel about their behavior and communication with the local people; 	<ul style="list-style-type: none"> • Implement numbers of pollution mitigating system for protecting the dust and other pollution outside to the project area. • Strictly prohibited to enter outsider to the project site or labor camp. • Entry pass is required to enter the project site area. • Health check-up is mandatory to every labor during the induction training on which they get pass for work. • Sanitization and temperature scanner are being done at regularly. • No conflict has been noticed between local communities and project authorities or workers. 	Being complied	<ul style="list-style-type: none"> • Maintain social distancing with the communities • Facilitate sanitary facilities and raise awareness for COVID management • Trained to the Sundarbans dependent community to shift their livelihoods

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> Aware the security personnel about the right of the community people. 	<ul style="list-style-type: none"> 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. 		
4	Community Health and Risk	<ul style="list-style-type: none"> Provision of providing health service facilities to community if the Project poses any health risk like sexually transmitted disease, contract disease, vector-borne diseases; Implement all pollution mitigation measures to ensure safeguarding to community. 	<ul style="list-style-type: none"> Adopt a number of measures like thermal scanning, sanitization, face mask, isolation bed for COVID management Developed the medical facilities (consisting medical officer, medical assistant, office assistant) at Plant site for 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. Medical facilities for the local people has been running amid the COVID situation 	Being Complied	<ul style="list-style-type: none"> BIFPCL shall communicate regularly with the community to aware them about the COVID pandemic and how they manage it BIFPCL may introduce awareness program through miking, postering about COVID management for the community

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			<ul style="list-style-type: none"> Local people are coming to the office medical center for health issues where they are supported with health check-up and common medicine. Boat Medical camps was organized on where significant numbers of patients were taken treatment. EPC contractor is educating to the labors about protective action taken to avoid vector borne diseases and HIV positives and COVID pandemic 		
5	Youth Employment (Local)	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Regular communication is being maintained 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. 	Being Complied	<ul style="list-style-type: none"> 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 introduced immediately;
6	Public Communication, Consultation and Awareness	<ul style="list-style-type: none"> Arranging public communication/consultation meeting; Sharing of Project information with local people; Organizing environmental and social awareness programs/meetings. 	<ul style="list-style-type: none"> One social liaison officer is working (24x7) for developing relation with local communities. Regular consultation meetings are carried out with the local government and administration before the COVID situation Environmental and social awareness programs are organized and conducted by proponent on a regular basis. BIFPCL regularly display the progress (thru Video) of the development through their website (https://www.bifpcl.com/) and also disclosure meeting at the local government. 	Being Complied	<ul style="list-style-type: none"> 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;

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			<ul style="list-style-type: none"> 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. 		

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.	<ul style="list-style-type: none"> Installation of proper runoff drains; Use of sediment fences, traps and basins for trapping the sediment, if required. 	<ul style="list-style-type: none"> 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 for block-B. Solid waste has been managed by third parties and finally disposed to the KCC disposal areas Construction waste water discharge is minimum and need based only. They are also meeting effluent norms. The same is being discharged through north-east corner of the project & also monitored regularly. 	Being complied	<ul style="list-style-type: none"> Manage the drainage system during the upcoming monsoon heavy rainfall. Maintenance roads and bank protective works during the heavy rainfall.
2	Disturbance to nearby ecosystem due to different construction activities	<ul style="list-style-type: none"> 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; 	<ul style="list-style-type: none"> Main project activities (Construction and erection) are limited within the project boundary though some of the project activities (Gathering of stockpiles, concrete mixing activities) are being conducted in the south 	Being Complied	<ul style="list-style-type: none"> Regular monitoring of the planted trees. Reduce the rate of mortality at the sapling stages.

SI No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> 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 sensitive habitat. 	<p>western side of the project and near bank of the Passur River (Jetty construction).</p> <ul style="list-style-type: none"> The project construction works are curtailed temporarily due to worsen 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 50000 of 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 of the project site Employees are aware about the rescues of species and no harm to wild species 		<ul style="list-style-type: none"> Bird sheds shall be created at the green belt areas.
3	Disturbance to river, inter-tidal areas and wet lands	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Monitoring of ecosystem health of Sundarbans, and around the Project site is being continued. The project is not obstructing the surface water flow. BIFPCL has been started maintenance of the slop protection works Bank protection works of western bank of Maidhara river is progressing EPC Contractor is monitoring the discharged water quality at each of the outlet from this project on a monthly basis. 	Being Complied	<ul style="list-style-type: none"> Initiatives should be taken for excavation of silted reach of Maidara river to protect the rainfall runoff washout.

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<p>on an urgent basis before rainy season come, and;</p> <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> The project authority is constructing the permanent jetty as per approved layout. The Maidara river is showing its natural phenomena. 		

Table 5.5: Status of Compliance to the Conditions of DoE

Sl. No	Condition of DoE	Compliance Status	Remarks
1	This EIA Report is approved only for 1320 MW Khulna Coal Based Power Plant. Any expansion or extension of this Power Plant will require obtaining further Environmental Clearance with additional EIA Study.	BIFPCL has not yet initiated any plan for expansion or extension of the 2x660 MW Maitree Super Thermal Power Plant.	BIFPCL will comply with the condition prior to initiation of any expansion or extension of the Power Plant.
2	The Coal Specification and Power Plant technology should be maintained as per EIA report. In case any change in design the proponent must obtain consent from DoE.	The Coal Specification and Power Plant technology will be maintained as per EIA report. In case of any change in Plant design and coal specification, the proponent shall have to obtain early consent from DoE.	Suggested to comply as and when required.
3	Project Proponent may undertake activities for land development and infrastructural development of the Project.	BIFPCL has already completed land development activities for the Block-A area. Infrastructure development activities are in progress.	Being Complied.
4	Project Proponent may open L/C (Letter of Credit) for importing machineries for the Project, which shall also include machineries relating to waste treatment plant and other pollution control devices.	The appointed EPC contractor has already imported maximum Equipment & machineries relating to waste treatment plant and other pollution control devices through opening the L/C.	Being Complied.
5	The activity under Proposed Khulna 1320 MW Coal based Thermal Power Plant Construction and operation shall not release any pollutant that affect human health or will have damaging impact on the environment or natural resources.	BIFPCL engaged CEGIS as an independent entity for monitoring the construction activities for examining environmental impacts on quarterly basis before the construction works started and accordingly the environmental and social impacts are being monitored as per EMP since 2014. No significant impact of Power Plant activities on the surrounding environment or on the natural resources has been recorded and reported (by the community) yet.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		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 impact on project ambient air quality, discharge water quality and noise level around the project site, working and labor conditions, occupational safety procedures community grievances etc. as per the monitoring plan stated in the EIA.	
6	Proper and adequate mitigation measures shall be ensured throughout preparation, construction and operation period of the proposed Khulna 1320 MW Coal based Thermal Power Plant Project activities.	BIFPCL has taken befitting mitigation measures as per EMP and technical specification of main Plant at each of the stages of Project Development.	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 Bangladesh Forest Department (BFD).	Being Complied.
8	Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.	During the monitoring activities no noticeable impacts on fish habitats and fish breeding, feeding & nursery sites were recorded.	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 been reduced due to Covid-19 from April, 2020. Working activities are restricted to daytime and sometimes extends to the late evening. The community responses towards construction works of Power Plant are being monitored and recorded regularly. Moreover, BIFPCL has appointed one social liaison officer who is working (24x7) for developing relation with local communities. Regular consultation meetings are carried out with the local government and administration in order to receive and realize the grievances and accordingly to redress those. There is no grievances related to the noise effects registered yet from the nearby communities.	Being Complied.
10	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed Project period.	The number of labor are shortening in the labor due to worsening COVID situation. EPC contractor and sub-contractor are providing adequate sanitation facilities for the workers. Adequate sanitation facilities for health	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		safety from COVID-19 are supplied by the Contractor at the labor camps as well as in the work areas.	
11	In order to control noise pollution, vehicles & equipment shall undergo regular maintenance; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.	All vehicle & equipment used at site are under regular maintenance and registration process. Working during sensitive hours like night time and locating machinery close to sensitive receptor like near the labor camps are being avoided or managed through appropriate measures as observed during the monitoring period.	Being Complied
12	No solid waste can be burnt in the Project area. An environment friendly solid waste management should be in place during the whole period of the Project in the field.	Burning of waste materials is being prohibited inside the project area. Now, solid waste is managed with systematic processes. A solid waste management company is now collecting the solid waste from the project and dump it to the Khulna City Corporation (KCC) designated places. Development of environment friendly waste collection and disposal system like Solid Waste Management (SWM), STP etc. are being developed at the demarcated place in plant premises. In addition, waste management training has been included in induction training of the labor.	Being complied
13	Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be endangered or destructed.	Quarterly monitoring activities are being carried out to examine the potential impacts on habitat of flora and fauna. No significant changes are yet recorded. Moreover, monthly environmental monitoring has been performed for noticing any harmful air pollutant emission or waste discharge form the project area.	Being Complied
14	All the required mitigation measures suggested in the EIA report along with the emergency response plan are to be strictly implemented and kept operative / functioning on a continuous basis.	The 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 established their own Medical facilities for the labors. In case of emergency situation for both BIFPCL and EPC contractor contract was signed with a private hospital (GAZI medical, Khulna) for medical services. EHS team of BIFPCL, BHEL and Cholanmandalam 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. Monthly air quality monitoring at three locations inside the project boundary is being carried out. Based on the air quality monitoring findings and seasonal aspects site specific water spraying are scheduled. At least four times in a day by three	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		numbers of water tankers or as per requirement are being used to suppress fugitive dust.	
16	Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.	BIFPCL authority has selected designated areas for safe storage of construction materials. In addition, the maximum stock piles are covered or regularly sprinkling	Being Complied
17	Adequate considerations should be given to facilitate drainage system for runoff water from rain/tidal surge.	Adequate drainage system has been developed to facilitate storm water drainage runoff from rain/tidal surge from the project area.	Being Complied.
18	Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies	The drainage systems are functioning well to drain out the storm water systematically from the project area. Outlet trash screens were constructed at the end point of some of the drain.	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 is 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).	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 of Technical Specification. The covered Coal stockyard is now at the initial stages of construction.	Compliance action initiated.
23	100% utilization of fly ash and bottom ash should be planned and implemented throughout the operation of the Plant. There should only be a provision of small ash dyke that will not exceed 25 (twenty-five) acres of land to store residual ash.	100% utilization of fly ash has been planned and shall be implemented throughout the operation of this Plant. EOI has been received in this regard from nearby Cement Industries. 25 acres' area has been allocated to store residual ash in case of emergencies. The ash dyke is now under construction stage.	Compliance action initiated.

Sl. No	Condition of DoE	Compliance Status	Remarks
24	Integrated dry ash handling, loading, unloading and transportation system should be established.	Integrated dry ash handling, loading, unloading and transportation system will be established during the operation stage of the power plant. Provisions in line with this has been included in Technical Specification of main Plant EPC contract package (Section V, Chapter B4).	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 during the operation stage of the power plant. The procedures have been included in the technical Specification of EPC contract package. (Section V, Chapter B4). The construction silo is progressing.	Compliance action initiated
27	Resettlement and rehabilitation of the displaced population (including those who do not own land) should be done properly.	Land has been acquired as per the legal procedure of GoB. However, BPDB wrote to Ministry for suitable resettlement and rehabilitation as per DoE requirement. BPDB prepared an assessment (Livelihood Restoration Plan) regarding the rehabilitees (including those who do not own land) for this Power Plant. As per the recommendation of the LRP, a NGO "Samahar" completed Their tasks. 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.	Resettlement and rehabilitation action had been taken as per the law of the land, Bangladesh. However, BPDB conducted an assessment (Livelihood Restoration Plan) regarding the rehabilitees (including those who do not own land) for this Power Plant. Based on the recommendation of the LRP, local NGO conducted the training and other tasks to the PAPs. DC office is trying to resettle the PAPs at their selected sites according to the LRP.	Compliance action continued
29	Construction material should be properly disposed-off after construction work is over.	At present, the construction work is going on. Construction wastes are being collected and put at demarcated places Heavy/mechanical equipment are kept at demarcated places. Proponent has engaged one of the contractor (Khulna City Corporation (KCC) for safe disposal of waste materials form site. Further development of environment friendly waste collection and disposal system like Solid Waste Management (SWM), STP etc. are being developed at the demarcated place in plant premises. There is a provision of development of solid waste management system which is given at clause no B12 ,Part no 9 of book no -2 ,page no 147-161.In	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
		which there is development of WMC which has waste collection ,waste segregation at source, recycling ,treatment and disposal of waste will be done	
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. BIFPCL is taking appropriate actions based on EMP monitoring report. BIFPCL regularly updates the EMP and OHAS which assist to reduce the risk of accidental events further.	Being Complied
32	A third party/independent monitoring bodies excluding JVC/BPDB should be engaged immediately for monitoring of all activities during pre-construction, construction and operation phases as per monitoring plan of EIA report and monitoring report must be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	CEGIS has been engaged by BIFPCL as an independent monitoring entity for conducting environmental monitoring on a quarterly basis since February 2014. Since the contract, CEGIS has been conducting the monitoring programs quarterly and producing monitoring reports on quarterly basis which are submitted by CEGIS to BIFPCL for onward submission to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment as directed by DoE.	Being Complied
33	Regular monitoring of the susceptible places of Sundarbans for protecting ecosystem, biodiversity and forest coverage should be made using latest high-resolution image for keeping ambient environment.	The Monitoring activities of CEGIS 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.

Sl. No	Condition of DoE	Compliance Status	Remarks
35	There should be regularly disclosure of the report through workshops and websites and responses should be taken care accordingly.	CEGIS has been regularly carrying out public consultation at different levels. But there is no consultation workshops conducted in this quarter due to worsen 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. This will be continued throughout the life time 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).	Compliance action initiated
37	Management Information System (MIS) is to be developed for this coal-based Power Plant. The scope of MIS services will obviously include representing the real time monitored data especially environmental parameters displaying at Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment, BPDB and other concerned agencies/Ministries. The MIS should be web based for accessing every individual to show the real time monitored records.	The MIS will be prepared before commissioning of the Power Plant. For developing MIS, consultant will be engaged earlier. Specifications of MIS system is already included in EPC contract document. Technical Specification like DDCMIS, DDCS, PADO System, HART system, Plant MMS, Information management security system etc. have been included. Moreover, the EPC contractor is going to initiate this activity.	Compliance action initiated
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.	The Power Plant has been designed considering use of surface water only during all stages of project development and operation. The authority has already installed Reverse Osmosis (RO) Water Treatment Plant (ABM Water) for use ground water for potable and domestic purposes. A second unit of RO plant is now in operation fulfilling fresh water from both domestic and construction requirement. However, a 1200ft deep tube well has been recorded near the ABM water plant for backup during emergencies. Proponent informed that some time it is used to supply the drinking water.	Ground water is being withdrawn only for supplying the drinking water.

Sl. No	Condition of DoE	Compliance Status	Remarks
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, is also carrying out consultation with the local people with interviews on 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.	Being Complied
41	Additional Environmental baseline data to be collected as suggested in the EIA report and conveyed to DoE and other concern authorities.	All quarterly monitoring reports containing latest baseline data are being collected as suggested in the EIA study and are disseminated to DoE and other concerned authorities..	Being Complied
42	The Environmental Management Plan under the EIA study shall strictly be implemented and kept functioning on a continuous basis.	BIFPCL has been implementing all the EMP measures realistically phase by phase as suggested in EIA report and approval condition of DoE. The status of EMP implementation are also regularly monitored. Based on the monitoring, BIFPCL continuously updated the site specific EMP for better management of the potential impacts.	Being Complied
43	The Project authority shall submit a detail work plan with time schedule of development activities at least 7 (seven) days ahead of the work 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: <ul style="list-style-type: none"> • The date(s) on which the sample was taken; • The time(s) at which the sample was collected; • The point at which the sample was taken; and • The name of the person who collected the sample. 	The Monitoring report keeps all the records as suggested.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
46	The results of any monitoring, required to be conducted under this EIA report must be recorded.	BIFPCL has been collecting all the monitoring data and submitting with proper documentation and accordingly sharing with DoE on regular basis.	Being Complied
47	In case of any emergency, the following information shall be immediately 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 3 months (January, 2021 to March, 2021). With the spread of the COVID-19 outbreak, the construction works has been shrinking. At present, the labors are working to this project with proper COVID safety measures which 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 have instructed the EPC contractor to establish best practices on OHAS and keep all records for avoiding any incident as like earlier. However, taking numbers of initiatives by the EPC and proponent which have collectively reduce the incident in this quarter. No environmental, accidental, anthropogenic incident has been not recorded for the last 3 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.	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 has been performed in this time due to COVID situation. With the increasing COVID cases from March 2021, the proponent as well as the EPC have given high priority on health, safety and contagious diseases (COVID) issues. EPC have already revised the health and safety management manual and reshaped for pragmatic practicing. Moreover, CEGIS is monitoring the EMP implementation as a whole.	Complied at present.
49	All pollution incidents shall be reported immediately and simultaneously to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DoE) in Dhaka.	BIFPCL has established a proper mechanism for recording such incident as suggested in the ERP	Being complied
50	Appropriate permission would require to be obtained from the Forest Department in favor of cutting/felling on any plant/tree/sapling forested by any individual or government before doing such type of activity.	There is no need of cutting/felling down of any trees outside the project boundary. However, in future, if any such case arises, BIFPCL 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	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	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	Forest Department according to those mentioned in the EIA report.	plant about 116000 nos. 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. They planted 15000 fruits and medicinal plants at the laydown areas in the project site.	
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.
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 January 2021 to March 2021. 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	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	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
	water quality monitoring system and other pollution control equipment and obtaining Environmental Clearance Certificate, the proponent shall not start operation of the Project.	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.	
59	This EIA Approval has been issued with the approval of the appropriate authority.	BPDB and BIFPCL are thankful to DoE.	

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

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

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

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

Sl. No.	Conditions	Compliance status	Remarks
	religious and archeologically sensitive places shall be kept protected during project operation.	Project site. As a third party, CEGIS is now monitoring the potentially vulnerable locations and indicators which are sensitive to coal transportation in the Sundarbans ECA, Sundarbans Reserve Forest and Sundarbans World Heritage Site. Those information and data assist to protect the ecological critical areas in future during the operation of coal transportation.	
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, training, instruction and facilities for managing 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 do not reflect any significant changes of the habitat of flora and fauna of the project influenced Passur river and Sundarbans ecosystem.	Being Complied
10	All the required mitigation measures Suggested in the EIA report along with the emergency response plan are to be Strictly implemented and kept operative/functioning on a continuous basis.	The proponent is giving top priorities to occupational health and safety issues after few incidents. They have significantly revised the OHAS guideline and practice it seriously. During this COVID situation, BIFPCL is tried aware and manage Covid-19 of the workers and office support staff. Thermal scanning of workers is being done at regularly for checking fever.	Compliance action initiated

Sl. No.	Conditions	Compliance status	Remarks
11	To control dust, spraying of water over the earthen materials should be carried out from time to time	Periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. Water spraying at least four times in a day by three water tankers or as per requirement are being done to suppress fugitive dust.	Being Complied
12	The entire coal handling system should be designed as an enclosed (and not only covered) conveyor system. There should be integrated dust control system with dust extraction and bag filters at unloading areas and at each transfer points on the conveyor system.	In the BID document, the coal handling system has been mentioned as closed system with the integration of dust control measures. Moreover, continuous monitoring system has been instructed in the EIA monitoring section.	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 automated moisture sensor to control self-combustion.	EIA study of the Power Plant suggested to install water sprinkler in coal stockyard which has been repeated in EIA study of Coal transportation. However, all these stipulations have been included in the technical specification of Main Plant EPC contract package. The coal stockyard is now under construction stage.	Compliance Action initiated.
15	Construction material should be properly disposed of after the construction work is over.	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. 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. They are now working at 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	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	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
	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.	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.	
18	Regular monitoring of the susceptible places of the Sundarbans for protecting ecosystem, biodiversity and forest coverage should be made using latest high-resolution image for keeping ambient environment.	The Monitoring activities have been carried out by CEGIS as third-party independent entity. The study includes all of recommended issues vastly. The monitoring report contains analysis of ecosystem, habitat, and biodiversity and forest coverage at susceptible sites of Sundarbans. In addition to this, Forest Department has also suggested some survey & analysis of Sundarbans ecosystem along with the quarterly compliance monitoring report.	Being Complied.
19	Air, water, soil, biological and social data should be monitored regularly with a network monitoring system with a view to assess the natural quality of the Sundarbans and other fragile ecosystem and report of monitoring results should be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	The network monitoring system will be installed as a part of the project construction for online monitoring and it will run at the time in operation phase. All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5). 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 expect this COVID situation.	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.

Sl. No.	Conditions	Compliance status	Remarks
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.
25	All the vessels should follow applicable MARPOL Convention, Appendix 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>i.e.</i> 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 be maintained in future.	Being complied
29	Environmental Monitoring Reports According to specific format specified in the EIA Report shall be made available simultaneously to DOE Bagerhat District Office, Khulna Divisional Office and Headquarters on a quarterly basis during the project period.	Environmental Monitoring Reports 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 d) The name of the person who collected the sample.	The Monitoring report of CEGIS keeps all the records as suggested.	Being Complied
31	The results of any monitoring required to be conducted under this EIA report must be recorded.	CEGIS is 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

Sl. No.	Conditions	Compliance status	Remarks
32	<p>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:</p> <ol style="list-style-type: none"> 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.) 	<p>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 pre-cautious 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 due to worsen COVID situation.</p> <p>BIFPCL will adopt the ERP suggested on the EIA study of coal transportation in association with the NOSCAP and NPDM for any future incidents as suggested.</p>	Compliance Action initiated.
33	National Oil Spill Contingency Plan (NOSCAP) 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.	<p>BIFPCL has strengthening the mechanism for the incident 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.</p> <p>The institutional arrangement for managing the incident during coal transportation will be set up before operation stage based on the EIA and DoE recommendations. Moreover, monitoring activities is continued for checking any significant changes in natural ecosystem.</p>	Complied at Present.
35	All pollution incidents shall be reported immediately and simultaneously to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DOE) in Dhaka.	BIFPCL has established a proper mechanism for recording such incidents as suggested in the ERP. CEGIS has been engaged to monitor the social and environmental compliance monitoring on a regular interval.	Complied at Present.
36	Climate Change impacts and maximum storm surge height shall have to consider at the design and construction phase of the jetty.	The design level (elevation) of the land and earthen embankment has been fixed 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	Not applicable in this stage	Suggested to comply as and when required.

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

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Appendices

Appendix I: Checklist of Monitoring Environmental Compliances

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

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Generation of Noise within the BIFPCL's Plant premises	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Fencing the construction site by drum sheet or Tarjja of any other fencing • Arrangement of runoff drainage for reducing any water logging • Location of backfilling stockpile in safe area and protected from wind and rain action • No storing of backfilling materials/spoil stored on river bank/slope • No disposal of waste and wastewater to river or canal. 			
4	Waste Management System	<ul style="list-style-type: none"> • Provision of onsite waste management system 			
5	Compensation and Resettlement	<ul style="list-style-type: none"> • 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? 			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Does the Project pose any threat to the livelihood/living standards of the local people? • If yes, are adequate steps taken to reduce the impacts? • Has the company developed any policy which prioritizes the local laborers in employment opportunities? • Is there any possibility that large vehicle related to the Project will cause traffic induced disturbance/s to the local dwellers? • If yes, are there any mitigative steps taken to decrease the disturbance/s? • Has the road network been developed after the Project being proposed and during the construction phase? • Are there separate water and sanitation facilities for the construction workers in the Project area? 			
7	Green House Gas Controlling Measures	<ul style="list-style-type: none"> • 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

SI 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

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Working Conditions and Management of Worker Relationship	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.) 			

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		<ul style="list-style-type: none"> Practice of Tool box meeting, safety talks, Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.) Maintaining Material Safety Data Sheet (MSDS) Provision of Health care facilities such as doctor, hospital etc. available at/nearby the plant construction site Availability of First Aid at work place Preparation and Follow of Emergency Response Plan Adequate fire precautions in place (for example, fire extinguishers, escape routes etc.) Documentation and reporting of occupational accidents, diseases, and incidents Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS 			
3	Occupational Health and Safety Procedure	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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)

SI 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	<ul style="list-style-type: none"> • Construction of boundary wall around the Project area • 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	<ul style="list-style-type: none"> • Availability and operation of Grievance Redress Mechanism • Maintaining open communication channel with the local community 			
3	Risk of breaching Community Safety	<ul style="list-style-type: none"> • Construction of boundary wall/safety fence around the Project area • Practicing Risk Assessment and Evaluation Process • Practicing safe management for hazardous materials which may pose threat to the community • Availability and operation of Emergency Response Plan • Maintaining open communication channel with the local community • Training and instruction to the security personnel about their behaviour and communication with the local people • Aware the security personnel about the right of the community people 			
4	Community Health Risk	<ul style="list-style-type: none"> • 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 			<i>(Continued)</i>
5	Youth Employment	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • No encroachment of inter-tidal flood plain area • No disturbance to Dolphin community • Monitoring of Ecosystem Health and Monitoring of Sundarbans Forest Health • If required, embankment should be constructed considering a setback distance from river/canal bank • Slope protection work along the Maidara River should be completed on an urgent basis before rainy season come and • BIFPCL may take initiatives of excavating of silted reach of Maidara river near proposed township area to facilitate proper functioning of River for maintaining tidal dynamics 			

Appendix II: Photo Album

Environmental and Socio-economic Monitoring of Khulna 2×660 MW Power Plant for 28th monitoring program (April, 2021)



Monitoring team



In-situ water quality measurement



Observing fishing activities



Measuring tree height




Measuring noise level

Appendix III: Terms of References (ToR)

Background

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

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

Project Location:	<p>Upazila: Rampal, District: Bagerhat</p> <p>Site is located at 23 kms Southward of Khulna City and 14 kms. North-Eastward from Mongla Port.</p> 
Project Capacity:	1320 MW (2x660 MW), based on Ultra Super-critical Technology
Mode of Operation:	Base Load
Fuel:	Imported Coal
Fuel Transportation:	It is envisaged that imported coal from countries like Indonesia, Australia shall be transported through bigger ships, up to trans-shipment point, from where the coal shall be transported through barges to the coal unloading jetty at the plant end. From jetty to the power plant coal shall be transported through coal conveyor system.
Land & Land Development:	Based on the layout in the FR, it is estimated that approx. 575 acres of land will be required for the project. (375 Acres for Main Plant, 50 Acres for Township, 50 Acres for Jetty).

Evacuation of power:	Provision of line bays in generation switchyard for one no. 400 kV Double Circuit line and one no. 230 kV Double Circuit line have been kept. The Power evacuation (transmission line) system from the Project shall be at 400 kV level and will be outside the scope of the Project. 400 kV is being introduced for the first time in Bangladesh.
Expected Timeline for project implementation	The first unit of capacity 660 MW is scheduled to be synchronised in 41 months from the date of NTP to the EPC contractor for the Power project. Commissioning of the first unit of capacity 660 MW is envisaged at an interval of 5 months thereafter.

Broad Scope of Works

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

The Broad objectives of independent monitoring covers the following activities

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

The main objectives of this works are

- Monitoring of Social and Environmental parameters to update the baseline.
- Monitoring of Social and Environmental parameters during Implementation of the Project.
- Assistance to BIFPCL for implementation of Environmental Management Plan (EMP) during construction period.

-
- The scope of work of the Independent Monitoring will include the following specific tasks
 - Develop specific monitoring indicators, checklists, and questionnaires to undertake independent monitoring (a preliminary list of monitoring indicators has been given in the EMP) in consultation with BIFPCL, DoE, Forest Department and the Financer;
 - Review and verify the implementation progress of various EMP elements, particularly, mitigation plan, compliance monitoring, environmental trainings, documentation, and grievance redress mechanism;
 - Physical aspects would cover air quality, noise level, water quality and land resources;
 - Biological environment includes fisheries resources, ecological resources, Sundarbans Reserve Forest (SRF) health conditions including WHS;
 - Environmental compliance monitoring includes Monitoring of Environmental and Social Management System Action Plan Implementation, monitoring of labour and working conditions, monitoring of community health, safety and security and monitoring of biodiversity and sustainable management of living natural resources.
 - To establish baseline environmental conditions;
 - Provide and monitor the environmental parameter during construction activities.
 - To detect adverse environmental impacts for river dredging and other activities of site development;
 - Provide technical assistance to the client for implementation of the EMP during the power plant construction at different sector of construction activities.
 - To demonstrate whether the environmental control measures are operating as per designed;
 - To provide data for emission inventories;
 - To provide data at regular intervals for dissemination to the stakeholders
 - To provide data for improvement and updating of the monitoring program;
 - To assist in investigating the event of a trigger level or emission limit value being crossed.
 - Update baseline data as per monitoring schedule and location.
 - Provide technical assistance to the client for implementation of the EMP during power plant construction.
 - Review the EIA document to evaluate the EMP measures incorporated in the contract to mitigate different social and environmental hazards and risks during construction of the Project
 - Submit progress reports to the client.
 - Physical observation to assess that all mitigation measures mentioned in EMP are carried out in all place.
 - Sampling and carrying out necessary analysis of Environmental parameter such as surface & ground water quality, air quality, noise, Biological Environment, Socio-economic environment, Sundarbans Forest health etc. according to the monitoring framework in construction phase.
 - Morphological changes of the adjacent river of the project will be influenced by the constructional activities. River bank erosion-accretion, drainage system, tidal inundation etc. will be investigate after regular intervals in the study area as per monitoring location of the EIA. The procedure of investigation and methodologies of analysis will be the same as pre-

construction phases. River bed pollution will be identified through 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
	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	SO _x

Monitoring Parameter	Indicators
	NO _x
	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:

- SO_x: measured by Fluorescent signal generated by exiting SO₂ with UV light
- NO_x: measured by Chemiluminescent reaction between NO_x & O₃
- O₃: 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, PM₁₀, 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 PM₁₀ 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	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, Jul 2015	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	26 th QM, Oct, 2020	27 th QM, Jan, 2021	28 th QM, April, 2021	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	Sunny	Sunny	Sunny	
		Concentrations are in µg/m ³																											
SW Corner of the PP area	PM _{2.5}	33	37	25	33	47	25	22	34	19	5	9	24.8	8.12	28.2	32.9	28.4	15.2	31.1	27.3	21.7	37.76	51.32	27.12	18.71	44.18	55.35	49.13	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	107.16	106.13	103.88	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	149.73	163.48	155.14	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	26.63	14.74	16.26	365 ^{24hr}
	NO _x	26	29	27	31	29	35	29	18	18	12	10	11.3	10.7	7.5	17.7	12.8	10.2	14.8	12.4	16	55.08	24.97	12.12	8.82	16.62	37.16	22.31	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	2	0	0	(10000) ^{8hr}
Shapmari area	O ₃	27	26	19	22	26	12	5	4	1	1	1	5	03	10	03	9	13.2	7	9	6	25	10	8	8	8	9	16	157 ^{8hr}
	PM _{2.5}	39	48	48	39	34	18	17	35	25	3	8	25	14.6	8.5	31.5	26.7	15.8	35.7	30.6	18.9	50.24	19.34	19.14	20.35	29.17	52.74	48.64	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	84.3	112.04	83.1	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	119.22	170.33	139.26	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	14.15	18.32	14.06	365 ^{24hr}
	NO _x	29	39	27	26	24	46	25	16	22	6	8	15.7	11.8	6	18.6	10.2	13.1	13.6	13.8	13.9	24.97	58.39	18.77	10.17	14.18	29.9	21.65	100 ^{Annual}
NW Corner of	CO	165	210	230	164	136	127	102	77	22	31	108	66	78	79	69	27	25	30	21	20	4	11	44	4	0.013	0	0	(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	2	6	9	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	46.73	68.26	58.81	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	26 th QM, Oct, 2020	27 th QM, Jan, 2021	28 th QM, April, 2021	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	Sunny	Sunny	Sunny	
Concentrations are in µg/m ³																													
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	110.43	131.84	97.61	150 ^{24hr}
	SPM	234	217	157	310	244	321	66	187	115	31	35	168	91.7	63.9	161.7	116.2	76.3	156.2	125.5	119.2	60.45	175.13	100.04	101.33	160.3	180.43	161.8	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	25.82	16.19	16.58	365 ^{24hr}
	NO _x	23	28	22	32	39	43	21	18	16	5	11	14.7	7.1	9.2	11.7	14.3	5.9	15	11.3	13.5	58.39	43.45	17.53	10.55	18.91	34.1	27.42	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	0.012	0	0.2	(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	8	12	14	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	38.69	61.29	62.29	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	91.79	93.36	103.42	150 ^{24hr}
	SPM	233	244	183	277	236	79	112	176	268	69	30	167.8	95.6	57.2	171.9	90.6	5.2	113.5	127.5	92.2	75.13	102.17	98.74	82.02	128.48	159.8	154.35	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	20.17	16.47	13.52	365 ^{24hr}
	NO _x	25	28	22	26	27	44	32	21	16	12	9	19.3	9.8	5.0	16.7	7.3	7.4	10.7	13.8	13.8	43.45	57.02	11.58	10.62	14.47	21.18	19.371	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	0	0	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	0	6	2	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	43.91	59.18	53.36	65 ^{24hr}
	PM ₁₀	77	86	69	68	61	109	49	98	60	23	20	74.4	44.4	100.2	157.1	40.6	30.6	105.9	126.7	72.7	46.37	78.27	100.08	59.91	88.93	117.42	86.44	150 ^{24hr}
	SPM	117	113	162	183	188	175	94	167	167	31	48	162	110.6	127.8	200	108	78.6	128.5	146.6	117.6	80.31	100.95	146.72	146.72	139.04	188.27	128.36	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	29.94	16.45	19.66	365 ^{24hr}
	NO _x	23	26	27	24	18	49	23	16	25	10	8	18	11.2	8.4	20.7	11.6	8.4	14	13.8	13.7	44.92	40.09	20.04	10.19	18.32	26.14	24.21	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	0	0.1	0.1	(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	0	23	28	157 ^{8hr}	
Pankhali, Dacope	PM _{2.5}	47	49	57	41	39	34	25	47	15	8	10	38.7	15.8	17	72.3	15.9	11.1	24.8	28.6	15.8	24.03	24.03	33.26	16.63	33.32	66.31	42.62	65 ^{24hr}
	PM ₁₀	119	127	139	101	105	144	62	128	46	42	18	141.6	105	63.4	208.9	74.3	58.4	92	125.8	92.7	56.56	119.28	127.52	55.78	74.83	102.73	73.29	150 ^{24hr}
	SPM	297	266	254	208	299	339	183	198	114	78	34	194.6	179	87.5	223.9	154.1	98.4	139	178.2	141.1	93.5	100.95	160.02	70.23	111.95	156.56	116.73	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	21.39	16.16	13.1	365 ^{24hr}
	NO _x	41	39	36	26	27	47	23	15	19	9	9	19	18.7	10.2	17.7	13.7	12.1	13.4	14.9	11.7	51.09	17.72	19.02	10.52	12.12	28.54	17.18	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	0	1	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	4	20	2	157 ^{8hr}	
Mongla	PM _{2.5}	47	55	39	41	26	33	19	34	21	9	11	25.7	22.6	33.2	70.1	23.2	13.2	30.3	26.6	35	56.67	39.69	38.92	41.33	40.75	74.19	65.37	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, Jul 2015	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	26 th QM, Oct, 2020	27 th QM, Jan, 2021	28 th QM, April, 2021	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	Sunny	Sunny	Sunny		
		Concentrations are in µg/m ³																												
Port area	PM ₁₀	139	174	77	82	35	52	33	132	45	29	15	119.3	93.6	97	209.1	89.9	47.5	103.7	109.3	131	119	64.12	119.61	126.13	114.61	118.67	129.71	150 ^{24hr}	
	SPM	288	303	197	217	214	118	65	189	144	50	6	172.3	196	187.2	242	144.7	73.7	161.9	157.1	183.1	192.17	83.9	173.36	166.16	152.76	201.16	180.22	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	20.06	12.26	18.91	365 ^{24hr}	
	NO _x	44	39	33	27	17	40	20	13	14	10	8	15.3	15.1	10.7	18.4	13.2	7.2	16.8	12.6	17.8	57.02	46.58	13.34	11.29	9.69	19.25	30.2	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	0	2	0.9	(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	1	66	91	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	34.42	53.28	46.13	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	79.38	100.11	82.83	150 ^{24hr}	
	SPM	111	117	129	139	109	70	73	159	91	43	44	93.5	103.7	107	189.9	72.4	47.6	90.3	118.3	90.9	48.09	83.9	87.51	87.71	122.94	146.2	133.1	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	19.74	14.66	16.58	365 ^{24hr}	
	NO _x	19	22	27	18	22	34	22	14	16	8	10	13	7.7	9.3	15.2	8.3	5.4	13	10.1	13	41.91	46.58	9.9	8.13	10.16	21.44	0	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	0	0	3	(10000) ^{8hr}	
Akram Point, Sundarbans	O ₃	13	12	13	11	14	12	4	2	2	0	1	4	08	0	02	2	6	4	3	5	8	40	12	22	3	6	46.13	157 ^{8hr}	
	PM _{2.5}	17	19	23	18	49	NO	25	18	9	4	4	14.3	13.2	7.5	35.4	13.7	14	29.1	16.2	13	19.68	36.67	23.04	13.16	22.74	48.2	41.33	65 ^{24hr}	
	PM ₁₀	39	44	32	39	77	NO	32	77	31	15	14	85.5	96.0	37.8	150.6	36.4	41.6	100.2	93.2	51.9	43	87.15	82.91	58.82	56.74	90.12	84.16	150 ^{24hr}	
	SPM	114	133	97	88	102	NO	51	128	46	23	27	90.9	137.0	41.8	175.1	90.3	58	121.4	117.8	71.1	83.9	122.62	121.68	78.8	80.31	144.95	131.46	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	12.74	15.05	17.44	365 ^{24hr}	
	NO _x	17	19	22	17	27	NO	19	15	10	5	6	12.7	10.1	5.9	15.1	9.9	9.3	11.7	11.3	9.4	46.58	31.26	16.74	10.47	6.64	20.6	23.5	100 ^{Annual}	
Hiron Point, Sundarbans	CO	49	60	50	46	163	NO	92	64	21	37	101	58	79	69	52	21	25	28	17	14	38	24	20	14	0	0.2	0	(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	6	8	8	157 ^{8hr}	
	PM _{2.5}	15	23	19	17	28	NO	27	NO	17	NO	9	21.7	NO	17.0	40.5	NO	NO	23.4	18.2	NO	NO	27.76	17.39	NO	28.15	55.71	NO	65 ^{24hr}	
	PM ₁₀	44	38	34	41	60	NO	45	NO	40	NO	14	104.5	NO	92.1	149.8	NO	NO	86.7	96.1	NO	NO	67.89	72.45	NO	59.31	99.64	NO	150 ^{24hr}	
	SPM	101	119	107	97	110	NO	88	NO	132	NO	26	111.4	NO	102	173.7	NO	NO	107.9	127.8	NO	NO	90.31	94.28	NO	91.06	155.39	NO	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	11.36	16.2	NO	365 ^{24hr}	
	NO _x	18	18	19	22	20	NO	23	NO	19	NO	9	15.9	NO	7.8	18.1	NO	NO	12.5	10.9	NO	NO	44.92	8.65	NO	9.74	23.53	NO	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	0	0	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	1	11	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	48.32	88.71	71.2	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, Jul 2015	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	26 th QM, Oct, 2020	27 th QM, Jan, 2021	28 th QM, April, 2021	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	Sunny	Sunny	Sunny		
		Concentrations are in µg/m ³																												
Khulna City, near Khan Jahan Ali Bridge	PM ₁₀	139	117	91	84	75	89	49	112	69	68	24	145.9	99.5	39.6	213.9	38.8	45.4	57.9	91.3	125.9	47.05	59.19	116.16	119.11	109.63	159.22	120.38	150 ^{24hr}	
	SPM	301	287	239	219	222	181	101	181	112	107	64	189.7	187.2	127.9	243.4	78.9	69.9	102.9	158	173.4	100.95	78.09	157.28	167.18	157.35	240.18	193.61	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	29.58	18.8	20.64	365 ^{24hr}	
	NO _x	49	41	39	36	33	38	26	16	15	15	14	18.6	11.7	8.8	25	8.4	11.1	9.7	11.1	17.1	40.09	41.91	24.14	24.24	20.44	34.2	28.35	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	0.7	2	3	(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	0	80	63	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	41.29	166.72	67.82	65 ^{24hr}	
	PM ₁₀	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	70.3	60.8	111.7	88.7	61.6	96.71	98.15	122.73	86.26	97.16	234.41	108.16	150 ^{24hr}	
	SPM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	120.6	98.1	144.6	129.4	102.5	127.79	127.79	171.29	111.73	142.36	347.39	170.37	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	21.73	18.61	23.72	365 ^{24hr}	
	NO _x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	14	9	11.6	12.1	11.9	15.63	15.63	21.72	11.17	13.36	33.48	34.49	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	0	3	1	(10000) ^{8hr}	
Access road bridge	O ₃	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	9	4	9	1	5	19	11	4	2	0	212	108	157 ^{8hr}	
	PM _{2.5}	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	33.1	20.9	40.9	26.9	36.1	39.65	14.65	26.26	20.16	38.72	94.23	64.73	65 ^{24hr}	
	PM ₁₀	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	118.1	83.7	128.3	112.9	137	142.84	79.92	91.39	78.69	93.48	188.64	119.73	150 ^{24hr}	
	SPM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	142.5	106.2	177.8	168.2	163.2	171.2	109.25	126.13	102.03	136.66	269.3	173.92	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	18.11	20.23	19.16	365 ^{24hr}	
	NO _x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	14.8	13.4	15	13	17.6	21.32	55.08	9.04	9.22	9.92	26.3	23.74	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	0	0.8	0.2	(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	2	68	46	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 (PM₁₀), Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO_x). Sulfur dioxide (SO₂), Carbone Monoxide (CO) & Ozone (O₃);
- Standards for 1hr, 24hr or Annual are indicated using superscript;
- This monitoring was carried out by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model-Envirotech India APM-550).
- All data presented here are 8 hrs. Monitoring data.

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

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

Sampling Locations	Criteria Pollutant	Cement Industry	Condensate Fractionating Plant	LPG Bottling Plant	Brick Field	Road Traffic	Small vessels, engine boat	Inland Water Cargo vessel	Sea going Mother Vessel (MV)	Fly ash Carrier	Clinkers Carrier	Clinker, Fly Ash Handling	Coal Carrier (MV)	Coal Ash Carrier (MV)	Coal Carrier (Lighter Vessel)	Coal Ash Carrier (Lighter Vessel)	Coal Loading and Unloading	Coal Handling (Stock Yard, Conveyor belt, etc)	BIF Power Plant (PP)	Other Coal Based PP	Other Fuel Based PP	Dredging and Land Filling	Earth excavation	Other Construction Activities	Residential sources
	SOx	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Akram Point Sundarbans	PM	X	X	X	X	X	√	√	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hiron Point Sundarbans	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	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
Khulna City, near Khan Jahan Ali Bridge	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	√	√
Township area	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	√	√
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	Oct	Jan	Apr	Std*
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	7.2	7.0	8.1	7.9	7.6	7.8	7.6	7.1	7.5	7.27	6.9	7.6	7.2	7.1	8.28	8.1	8.4	7.9	8.18	9.0	6.8	7.9	8.4	6.9	6.9	8.5	8.3	6.5– 8.5
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	7.2	7.0	8.2	8.0	7.7	7.9	7.58	7.3	7.8	7.3	7	7.5	7.3	6.9	8.25	8.1	8.4	6.04	8.03	9.9	6.8	7.8	8.3	7.0	6.66	7.8	8.1	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	7.2	6.9	8.0	8.1	7.8	7.8	7.64	7.3	7.2	7.93	7.2	7.8	7.3	6.9	8.17	8.1	8.4	8.09	8.06	8.7	7.1	7.8	8.8	7.1	6.59	8.0	8.0	
4	Left Bank of Passur River at Project Site-Jetty	7.9	7.1	8.1	7.9	7.5	7.9	7.6	7.1	7.4	7.56	7.3	8.2	7.2	6.9	8.2	8.1	8.3	7.65	7.78	8.9	7.5	7.5	8.3	7.0	6.6	7.7	8.6	
5	Middle Passur River at Project Site-Jetty	7.1	6.9	8.1	7.9	7.6	8	7.58	7.5	7.8	7.6	7	8.5	7.8	7.2	8.21	8.1	8.3	8.20	7.97	8.4	7.2	7.4	8.3	7.2	6.77	7.7	8.0	
6	Right Bank of Passur River at Project Site-Jetty	7.1	6.9	8.2	7.9	7.7	8	7.62	7.6	7.4	7.9	6.9	8.7	7.4	7.2	8.2	8.1	8.2	7.87	8.04	8.5	6.7	7.4	8.0	7.2	6.88	7.8	8.9	
7	Left Bank of Passur River at South West corner from the Project boundary	7.4	7.0	8.1	7.6	7.5	8.1	7.78	8.1	7.6	7.94	7.2	8.1	6.9	7.2	8.39	8.0	8.4	8.11	7.89	9.3	7.4	7.3	8.6	7.4	7.13	7.8	8.2	
8	Middle of Passur River at South West corner from the Project boundary	7.4	6.9	8.0	7.5	7.2	8	7.6	8	7.1	8.04	7.5	8.6	6.8	7.1	8.15	8.1	8.5	7.44	7.85	8.7	6.5	7.2	8.2	7.6	6.82	8.0	8.4	
9	Right Bank of Passur River at South West corner from the Project boundary	7.3	6.8	8.0	7.8	7.3	8.1	7.64	7.9	7.2	8.2	7.3	8.9	7.1	7	8.16	8.1	8.5	7.07	8.06	8.4	7.3	7.2	8.3	7.8	6.8	7.8	8.3	
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	7.4	6.9	8.1	7.7	7.5	8.1	7.3	7.3	7.1	8.1	6.8	8.1	7.2	7.1	8.4	8.1	8.6	7.94	8.05	9.3	7.2	7.4	8.0	7.1	6.85	7.4	8.0	
11	Maidara river near proposed township area	7.4	6.8	8.1	7.3	7.6	6.9	7.56	7.1	7.4	7.8	7.1	7.6	7.4	7	7.92	7.6	7.3	7.631	7.8	8.2	7.0	7.3	7.9	6.9	6.83	7.5	8.3	
12	Passur river at Passur-Ghasiakhali confluence	7.3	6.8	7.4	8.2	7.5	7.9	7.1	7.4	7.3	7.3	6.9	7.2	6.9	6.8	7.48	7.3	8.3	7.02	8.65	8.1	7.0	8.0	8.3	7.1	7.06	7.8	8.6	
13	Passur river at Harbaria of Sundarbans	7.9	6.9	8.0	8.1	7.7	7.9	7.8	8.2	7.3	7.63	7.4	7.8	6.9	7.1	8.19	8.1	8.4	7.19	7.71	8.2	7.2	8.0	8.4	7.4	6.1	8.2	7.8	
14	Passur river at Akram point of Sundarbans	7.2	6.9	7.9	8.1	7.7	NS	7.63	8	7.9	7.67	7.1	8.2	7.2	7.1	8.22	8.2	8.2	8	7.77	7.9	7.1	7.8	8.2	7.7	6.6	7.7	8.2	
15	Passur river at Hiron po.000int of Sundarbans	7.2	7.0	7.0	8.1	7.7	NS	7.39	NS	7.8	NS	7.6	8.5	NS	6.8	8.2	NS	NS	7.18	7.79	NS	NS	7.8	8.2	NS	6.7	7.6	NS	

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	Oct	Jan	Apr	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	31	33	31	19	30	31.8	31.2	22.0	31.2	29.6	30.1	22.8	30	29.8	19.7	30	30	28	22.02	31	30	27	25	30	27.67	20	31	20°C – 30°C
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	31	33	31	20	30	30.5	31.8	21.0	31.1	29.1	30.8	22.5	30	30.1	19.8	30	30	26.85	21.96	31	30	27	25	30	27.68	20	30	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	31	33	30	20	30	30.5	30.9	21.0	30.8	29.4	30.4	22.1	29.8	30.2	20.2	31	30	27.49	21.82	31	30	27	24	31	27.7	20	30	
4	Left Bank of Passur River at Project Site-Jetty	31	33	31	19	31	30.8	31.3	22.0	31.4	30.1	30.1	22.8	31.3	30.1	20.3	28	30	28.38	22.62	31	30	28	24	30	27.82	20	30	
5	Middle Passur River at Project Site-Jetty	30	32	31	19	30	30.6	31.6	22.0	30.9	30.5	31.0	21.8	30.0	29.8	20.3	29	30	27.97	22.55	31	31	28	24	30	27.76	20	30	
6	Right Left Bank of Passur River at Project Site-Jetty	30	32	31	19	30	30.4	31.1	21.0	31.0	30.5	31.1	21.9	30.0	29.9	20.3	28	31	28.05	22.35	31	30	28	24	30	27.67	20	30	
7	Left Bank of Passur River at South West corner from the Project boundary	31	32	30	20	31	30.5	30.3	23.0	30.7	30.7	30.4	22.1	29.9	30.0	20.6	28	31	27.85	22.17	33	30	27	25	30	28.42	21	30	
8	Middle of Passur River at South West corner from the Project boundary	31	31	29	19	30	30.8	30.5	22.0	30.4	29.8	30.2	22.0	29.8	30.1	20.2	28	31	28	22.27	31	30	27	25	30	27.9	20	30	
9	Right Bank of Passur River at South West corner from the Project boundary	31	31	29	19	31	30.6	30.8	21.0	30.1	29.8	31.1	22.1	30.1	30.1	20.3	28	31	28	22.54	32	30	27	25	30	27.83	21	30	
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	30	31	28	19	30	30.8	31.8	22.0	31.2	30.4	31.1	21.9	30.3	29.9	19.1	28	31	27.62	22.06	33	30	27	25	30	28.67	22	31	
11	Maidara river near proposed township area	30	32	27	20	30	31.6	31.2	23.0	30.6	30.7	31.2	21.8	30.1	30.0	21.1	31	31	30.2	21	32	30	27	23	30	28	21	31	
12	Passur river at Passur-Ghasiakhali confluence	29	30	32	19	30	29.8	30.7	21	31.3	30.7	30.38	22.1	30.2	30	20.8	30	29	26.82	21.89	31	30	28	22	30	28.07	21	29	
13	Passur river at Harbaria of Sundarbans	30	30	27	22	30	29.0	30.8	22.0	31.5	30.9	29.9	23.1	30.2	29.8	21	30	29	27.62	21.81	31	31	30	24	31	28.35	21	30	
14	Passur river at Akram point of Sundarbans	29	29	30	21	30	NS	30.2	21.0	30.8	30.4	30.4	22.5	30.8	29.9	21.2	32	30	27.21	22.42	31	31	29	24	31	29.48	22	30	
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		29.02	22		

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

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.4: Dissolve Oxygen (DO) in Passur River

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

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: BOD₅ of Passur River Water

SL	Sampling Locations	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	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

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

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

SI	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	Jul	Oct	Jan
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22 QM	23QM	25QM	26QM	27QM
1	Left Bank of Passur River at South West corner from the Project boundary	<5	<5	<5	>15	16.9	9	<5	39	61	5	<5	9.2	5.73	<5	16.6	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	<2.0	2.93
2	Passur-Ghasiakhali Confluence	<5	<5	<5	>15	13	7.63	9.87	21	30.3	13.5	<5	15.6	<5	<5	<5	<5	<5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
3	Passur river at Harbaria of Sundarbans	<5	6.3	<5	>20	39.1	10.1	<5	14	26	5.73	<5	<5	<5	<5	<5	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
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	<2.0	<2.0	<2.0
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	<2.0	<2.0	NS

Source: CEGIS Field Survey

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

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

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

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	Jul	Oct	Jan	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	598	126	234	180	160	26	76	14	8	61	20	46	51	18	14	18	17	14	15	12	14	8	11	14	7	11	
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	45	92	193	210	167	25	80	12	7	48	18	52	42	15	15	17	16	11	12	14	11	7	8	6	11	6	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	53	112	174	230	170	127	65	14	10	56	16	48	48	22	14	22	15	15	14	13	13	6	7	11	8	7	
4	Left Bank of Passur River at Project Site-Jetty	54	99	227	450	160	30	92	17	10	62	20	42	52	16	13	20	18	11	12	11	12	8	8	12	7	7	
5	Middle Passur River at Project Site-Jetty	60	100	232	250	165	27	85	18	8	45	24	54	43	20	13	19	16	13	13	12	13	7	9	9	6	6	
6	Right Bank of Passur River at Project Site-Jetty	55	105	186	200	155	40	97	22	7	49	19	46	38	17	14	21	15	12	15	15	14	6	6	12	9	8	
7	Left Bank of Passur River at South West corner from the Project boundary	24	116	185	300	150	32	104	20	12	51	20	61	32	15	15	17	16	14	16	12	13	7	7	14	15	7	
8	Middle of Passur River at South West corner from the Project boundary	27	112	536	530	147	40	90	7	10	43	18	58	44	16	17	19	14	13	13	11	12	6	8	13	8	6	
9	Right Bank of Passur River at South West corner from the Project boundary	67	37	459	450	155	44	82	18	11	39	16	63	40	14	12	18	20	15	14	13	13	5	6	8	6	6	

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	Jul	Oct	Jan	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	7	65	798	280	148	36	96	11	7	42	24	55	37	26	14	23	13	11	14	14	15	9	13	11	8	7	
11	Maidara river near proposed township area	9	24	389	206	160	28	92	10	6	11	30	66	49	30	15	32	12	42	8	12	12	7	12	5	7	8	
12	Passur river at Passur - Mongla confluence	50	310	203	280	165	24	60	15	13	47	27	61	38	25	13	14	17	27	15	13	13	15	14	9	8	6	
13	Passur river at Harbaria of Sundarbans	65	90	869	400	160	42	74	22	18	31	18	61	33	27	17	15	13	22	12	11	12	11	11	17	5	8	
14	Passur river at Akram point of Sundarbans	115	99	28	103	150	NS	110	16	23	16	41	34	28	22	14	18	14	15	11	10	7	7	10	18	8	11	
15	Passur river at Hiron point of Sundarbans	91	72	267	200	180	NS	144	NS	15	NS	33	49	NS	16	13	NS	NS	6	9	NS	NS	5	10	NS	6	6	

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 (NO₃²⁻) concentration of Passur River System

SI	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	Jul	Oct	Jan
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.9	2.89	0.32	3	33	9.1	4	6.3	3	3.9	0.25	3.62	4.35	5.8	3	6.8	0.8	2.8	3.5	0.3	0.1	3.5	1.3	3	3.2	4.3
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	0.7	2.4	1.57	1.5	13	7.5	7.1	4.3	2.9	6.2	0.39	2.89	5.05	6.8	4.2	4.9	1.7	0.1	2.6	0.3	1.1	2.7	1.7	3.3	1.3	2.2
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.1	3.2	1.84	4.3	39	6.2	5	3.9	2.5	4.3	0.42	1.87	4.55	4.5	3.6	5.1	2.1	0.11	1.9	3.7	1.2	3.4	3.2	9.5	4.7	1.2
4	Left Bank of Passur River at Project Site-Jetty	1.3	0.76	1.64	3.1	48	6.6	5.7	3.1	2	5.1	0.76	2.25	6.11	7.1	3	2.8	2.8	1.7	2.1	3.0	1.5	3.0	4.5	2.9	2.5	0.7
5	Middle Passur River at Project Site-Jetty	1.4	2.69	1.42	2.2	69	6.1	3.3	5.2	3.1	2.7	0.52	2.46	3.4	3.1	4.7	5.2	1.8	0.9	2.2	1.2	1.5	1.7	2.7	1.9	2.6	3.1
6	Right Bank of Passur River at Project Site-Jetty	1.1	2.98	1.33	8.5	8	6.6	4.7	4.1	3.6	3.9	0.31	3.01	3.16	5	7.6	5.5	3.2	0.1	3.5	4.8	2.1	2.1	5.1	1.8	1.0	2.7
7	Left Bank of Passur River at South West corner from the Project boundary	0.75	2.13	1.85	2.7	87	14.9	4.4	4.9	2.6	3.6	0.2	3.64	3.14	4.1	8.8	2.6	4	0.1	4.2	0.5	1.5	2.0	7.4	1	0.5	1.8
8	Middle of Passur River at South West corner from the Project boundary	1.1	2.43	2.09	1.8	48	4	6.2	3.7	2.9	5.1	0.41	1.93	3.34	3.4	8.5	4.5	3.7	3.4	3.0	3.4	1.7	1.3	3.9	1.5	2.1	3.0
9	Right Bank of Passur River at South West corner from the Project boundary	1.2	2.05	2.21	1.9	128	4.9	4.4	4.4	2.6	4.9	0.63	2.17	2.00	3.1	2.8	5.3	3.8	0.7	3.1	4.1	0.5	2.2	4.1	1.3	3.0	1.9
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.3	2.18	2.26	6	62	7	4.9	5.6	2.7	5.2	0.4	2.46	3.61	2.3	1.6	5.9	4.4	2.3	2.1	5.0	3.1	2.9	4.7	3.9	1.5	3.0
11	Maidara river near proposed township area	0.5	0.88	1.98	4	48	3.1	2.9	3.9	3.1	5.3	0.32	3.1	1.60	3.2	3.4	3.9	3.1	0.12	1.3	2.9	2.5	1.6	4.9	2.1	1.3	4.9
12	Passur river at Passur - Mongla confluence	0.6	1.52	1.64	4.5	29	7.8	3.1	3.7	3	5.2	0.27	2.78	2.49	3.5	4.5	4.7	2.4	1.6	3.7	2.7	1.8	2.0	3.3	1.5	2.6	0.5
13	Passur river at Harbaria of Sundarbans	1.4	1.75	1.67	2.7	18	4.4	4.4	5.1	3.4	5.1	0.39	2.78	2.46	4.2	4.6	5.2	2.7	0.1	4.7	4.4	1.7	2.1	3.2	5.7	2.6	0.5
14	Passur river at Akram point of Sundarbans	2.7	3.32	0.59	1.5	25	NS	3.2	4.9	2.9	5.4	0.25	3.08	3.69	2.2	1.8	5.5	4.2	0.1	1.8	2.7	1.3	1.6	2.6	4	2.6	2.9
15	Passur river at Hiron point of Sundarbans	0.8	2.84	0.4	2	28	NS	11.5	NS	3.5	NS	0.38	2.28	NS	2.6	6.1	NS	NS	0.9	2.6	NS	NS	2.5	4.1	NS	2.6	3.9

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 (SO₄²⁻) concentration of Passur River System

SI	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	Jul	Oct	Jan
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	1840	20	26	580	1360	67	7	570	1080	18	5	230	422	29	630	1400	24	51	760	1460	23	37.0	490	4	3	270
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	1320	23	28	450	1260	11	8	590	1040	10	3	210	460	3	370	1320	18	49	756	1380	19	6.0	510	3	6	420
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	1280	36	34	480	1240	9	11	560	1020	13	4	200	1340	5	410	1440	20	46	764	1420	21	6.0	560	5	11	460
4	Left Bank of Passur River at Project Site-Jetty	1360	45	33	550	1240	26	10	550	1060	15	4	230	1380	2	310	1260	22	52	748	1410	16	5.0	530	8	5	410
5	Middle Passur River at Project Site-Jetty	1040	32	30	520	1120	6	8	580	980	17	6	280	1280	1	310	1200	21	38	760	1440	17	4.0	640	10	3	420
6	Right Bank of Passur River at Project Site-Jetty	1320	20	27	540	820	8	9	565	1100	14	5	230	1400	2	490	1400	16	42	762	1400	19	8.0	490	13	8	430
7	Left Bank of Passur River at South West corner from the Project boundary	1640	60	40	630	880	9	12	640	1060	15	6	230	880	2	700	1300	10	56	768	1500	15	25.0	520	16	6	450
8	Middle of Passur River at South West corner from the Project boundary	1520	40	35	560	1180	19	8	560	1020	18	5	231	1440	1	340	1380	24	52	760	1450	16	9.0	470	8	4	440
9	Right Bank of Passur River at South West corner from the Project boundary	1280	80	64	620	900	12	6	550	1080	12	8	250	1340	3	340	1240	22	39	770	1460	14	6.0	510	16	12	450
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	1120	20	63	570	1220	72	11	96	1040	11	14	160	1220	120	270	1200	21	65	758	1500	18	71.0	490	16	31	420
11	Maidara river near proposed township area	1320	210	63	460	840	27	9	480	1020	480	14	200	1340	76	350	1250	18	46	760	1490	12	55.0	565	21	26	190
12	Passur river at Passur - Mongla confluence	1360	620	44	630	980	39	13	482	1100	42	14	220	1220	5	280	1260	28	30	765	1446	14	33.0	580	12	21	260
13	Passur river at Harbaria of Sundarbans	1560	860	69	590	900	51	7	500	1080	60	19	220	1300	13	220	1300	35	20	756	1500	16	38.0	470	34	540	410
14	Passur river at Akram point of Sundarbans	2600	1400	1390	850	1540	NS	84	760	1650	620	190	230	1420	30	760	1460	620	250	764	1500	980	370.0	410	60	430	580
15	Passur river at Hiron point of Sundarbans	2080	1160	2360	1500	1920	NS	97	NS	2100	NS	320	1090	NS	2	510	NS	NS	780	769	NS	NS	540.0	445	NS	30	1240

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 (PO₄²⁻) 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	Jul	Oct	Jan	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.52	2.23	0.67	0.32	0.86	10	1.27	0.269	0.22	1.14	3.39	0.67	1.31	0.49	0.21	0.38	1.03	0.25	0.25	0.25	10.1	0.3	0.2	0.25	0.5	5.3	
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.5	1.99	1.12	0.61	0.53	0.23	1.97	0.269	0.36	1.76	4.11	0.31	1.72	2.5	0.16	0.25	0.83	0.3	0.30	0.32	0.6	0.3	0.2	0.27	0.5	3.5	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	1.1	2.55	0.95	0.7	0.72	0.67	1.94	0.179	0.27	1.77	4.58	0.09	2.73	2.8	0.3	0.29	0.76	0.22	0.17	0.40	0.5	0.4	0.3	0.3	0.5	3.2	
4	Left Bank of Passur River at Project Site-Jetty	2.1	0.45	0.92	0.43	0.49	0.27	2.53	0.357	0.31	2.31	2.76	0.07	2.77	3.3	0.19	0.38	0.88	0.24	0.20	0.30	0.6	0.2	0.3	0.35	0.7	2.9	
5	Middle Passur River at Project Site-Jetty	2.2	2.13	1.11	0.41	0.68	0.59	1.3	0.536	0.3	0.98	3.2	0.12	0.66	3.9	0.17	0.34	1.07	0.4	0.35	0.27	0.6	0.3	0.2	0.29	0.5	3.0	
6	Right Bank of Passur River at Project Site-Jetty	2	2.42	0.99	0.55	0.61	0.13	1.32	0.269	0.43	1.01	2.48	0.16	0.62	3.9	0.47	0.27	0.67	0.53	0.27	0.25	0.9	0.4	0.3	0.36	0.8	5.4	
7	Left Bank of Passur River at South West corner from the Project boundary	0.57	1.25	1.18	0.76	0.65	0.1	0.99	0.536	0.63	0.87	4.16	0.09	0.65	4.6	1.31	0.29	1.16	0.32	0.20	0.41	11.1	0.5	0.4	0.4	0.7	3.0	
8	Middle of Passur River at South West corner from the Project boundary	1.2	1.51	1.25	0.85	0.53	0.18	1.02	0.625	0.21	0.96	2.76	0.04	0.37	0.41	0.39	0.29	0.86	0.43	0.20	0.35	0.8	0.7	0.4	0.43	0.4	2.5	
9	Right Bank of Passur River at South West corner from the Project boundary	1.5	1.1	1	0.53	0.6	0.1	1.39	0.536	0.33	1.123	2.71	0.07	0.45	0.63	0.62	0.42	1.03	0.57	0.37	0.27	0.8	0.5	0.4	0.52	1.3	3.2	
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.55	2.1	1.27	0.59	0.7	0.5	1.27	0.351	0.19	1.06	2.836	0.07	0.61	0.51	0.38	0.24	0.83	0.27	0.40	0.28	0.5	0.6	0.5	0.25	1.2	13.1	
11	Maidara river near proposed township area	1.1	0.53	1.04	0.64	0.55	0.29	1.28	0.269	0.13	1	5.23	0.2	0.47	15.3	0.71	0.28	1.2	0.22	0.28	0.30	0.8	0.4	0.3	0.56	0.7	4.1	
12	Passur river at Passur - Mongla confluence	1.3	0.35	0.86	0.42	0.71	0.59	0.95	0.179	0.31	0.78	4.01	0.09	0.18	1.3	0.63	0.37	0.86	0.33	0.29	0.31	0.6	0.6	0.4	0.53	0.8	9.6	
13	Passur river at Harbaria of Sundarbans	1.1	0.56	1.22	0.61	0.59	0.89	0.35	0.269	0.42	0.53	1.16	0.09	0.21	3.15	0.81	0.26	0.5	0.25	0.30	0.52	0.6	0.7	0.2	0.4	0.3	2.6	
14	Passur river at Akram point of Sundarbans	1.3	0.29	0.8	0.42	0.61	NS	0.43	0.357	0.26	0.47	9.08	0.1	0.19	0.36	0.97	0.20	0.67	0.5	0.19	0.63	0.5	0.3	0.1	0.37	0.4	7.1	
15	Passur river at Hiron point of Sundarbans	7.51	0.29	1.09	0.44	0.47	NS	0.45	NS	0.36	NS	5.9	0.23	NS	0.55	1.45	NS	NS	0.61	0.18	NS	NS	0.3	0.2	NS	0.4	1.1	

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	Jul	Oct	Jan	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.002	0.003	0.004	0.003	0.002	0.002	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.004	0.003	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.002	
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.002	0.003	0.004	0.003	0.002	0.002	0.001	0.001	0.003	0.003	0.003	0.001	0.002	0.001	0.002	0.001	0.005	0.002	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.002	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.001	0.003	0.004	0.003	0.003	0.002	0.001	0.001	0.003	0.005	0.002	0.001	0.001	0.002	0.003	0.001	0.004	0.002	0.003	0.003	0.002	0.002	0.002	0.003	0.003	0.002	
4	Left Bank of Passur River at Project Site-Jetty	0.002	0.004	0.004	0.004	0.002	0.002	0.001	0.002	0.002	0.004	0.002	0.002	0.001	0.002	0.002	0.002	0.005	0.002	0.001	0.003	0.002	0.003	0.003	0.002	0.003	0.002	
5	Middle Passur River at Project Site-Jetty	0.002	0.004	0.004	0.003	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.003	0.002	0.001	0.003	0.002	0.003	0.002	0.004	0.003		
6	Right Bank of Passur River at Project Site-Jetty	0.002	0.003	0.003	0.003	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.003	0.003		
7	Left Bank of Passur River at South West corner from the Project boundary	<0.001	0.003	0.006	0.003	0.002	0.002	0.001	0.002	0.001	0.003	0.002	0.002	0.002	0.003	0.001	0.002	0.005	0.002	0.003	0.003	0.003	0.003	0.003	0.002	0.004	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	0.003	0.003	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	0.003	0.003	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	0.004	0.004	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	0.002	0.004	0.002	
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	0.004	0.003	0.002	0.003	
13	Passur river at Harbaria of Sundarbans	0.004	0.003	0.004	0.004	0.004	0.002	0.001	0.002	0.005	0.002	0.003	0.002	0.001	0.003	0.002	0.001	0.003	0.002	0.001	0.002	0.001	0.002	0.003	0.002	0.002	0.002	
14	Passur river at Akram point of Sundarbans	0.004	0.002	0.002	0.003	0.002	NS	0.001	0.002	0.006	0.001	0.003	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.003	0.002	0.002	
15	Passur river at Hiron point of Sundarbans	0.003	0.002	0.003	0.002	0.002	NS	0.001	NS	0.004	NS	0.002	0.002	NS	0.002	0.001	NS	NS	0.001	0.001	NS	NS	0.002	0.002	NS	0.009	0.002	

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	Jul	Oct	Jan
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.053	0.004	0.002	0.104	0.098	0.0059	0.007	0.168	0.203	0.01	0.009	0.024	0.002	0.003	0.001	0.002	0.002	0.003	0.004	0.003	0.001	0.001	0.008	0.006	0.002	0.016
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.055	0.002	0.003	0.104	0.102	0.0038	0.006	0.092	0.302	0.009	0.007	0.034	0.001	0.003	0.001	0.001	0.001	0.007	0.005	0.002	0.003	0.002	0.007	0.004	0.005	0.017
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.055	0.005	0.002	0.111	0.138	0.0058	0.008	0.176	0.347	0.017	0.01	0.03	0.003	0.003	0.002	0.004	0.02	0.017	0.007	0.004	0.002	0.001	0.009	0.007	0.006	0.018
4	Left Bank of Passur River at Project Site-Jetty	0.057	0.002	0.003	0.154	0.142	0.011	0.01	0.115	0.336	0.014	0.007	0.036	0.001	0.002	0.002	0.001	0.018	0.013	0.005	0.003	0.009	0.001	0.008	0.005	0.008	0.015
5	Middle Passur River at Project Site-Jetty	0.06	0.002	0.002	0.139	0.135	0.002	0.009	0.148	0.317	0.006	0.006	0.046	0.003	0.002	0.001	0.003	0.008	0.01	0.003	0.003	0.003	0.001	0.006	0.007	0.006	0.017
6	Right Bank of Passur River at Project Site-Jetty	0.058	0.002	0.002	0.138	0.156	0.0021	0.007	0.112	0.298	0.01	0.005	0.041	0.002	0.001	0.001	0.001	0.041	0.012	0.007	0.002	0.009	0.003	0.004	0.008	0.005	0.019
7	Left Bank of Passur River at South West corner from the Project boundary	0.053	0.002	0.003	0.16	0.142	0.0076	0.01	0.134	0.396	0.007	0.006	0.048	0.003	0.001	0.001	0.007	0.012	0.011	0.003	0.002	0.120	0.001	0.006	0.019	0.018	0.019
8	Middle of Passur River at South West corner from the Project boundary	0.054	0.003	0.004	0.153	0.148	0.002	0.011	0.099	0.323	0.006	0.007	0.044	0.009	0.002	0.001	0.003	0.015	0.014	0.004	0.003	0.006	0.002	0.008	0.009	0.008	0.017
9	Right Bank of Passur River at South West corner from the Project boundary	0.056	0.005	0.004	0.139	0.163	0.002	0.009	0.093	0.331	0.012	0.007	0.056	0.003	0.002	0.002	0.005	0.03	0.019	0.006	0.002	0.004	0.001	0.007	0.01	0.004	0.022

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	Oct	Jan	Apr	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	
1	Near Proposed Township	Deep (>600 ft)	0	0	0	1	TC	0	0	0	0	0	0	0	0	0	0	NF	NF	NF	0.1	0.1	0.1	0.0	0.1	0.1	0.18	0.1		
2	Rajnagar	Deep (>600 ft)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.3	0.1	0.1	0.1	0.5	0.1	0.0	0.1	0.1	0.1	0.1	0.3	
3	Kapashdanga	Deep (>600 ft)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.2	0.1	0.1	0.1	0.7	0.1	0.0	0.1	0.1	0.1	0.4	0.3	
4	Kalekharber	Shallow (<250 ft)	0	0	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF		

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	Oct	Jan	Apr	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	
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	6.4	6.4		
2	Rajnagar	Deep (>600 ft)	6	6.2	7.7	6.3	6	5.9	6.1	5.2	5.8	6.1	5.8	4.8	5.3	5.8	4.47	6.0	6	5.9	6.1	6.5	6.0	6.2	6.1	6.1	6.2	6.7	6.3	
3	Kapasdanga	Deep (>600 ft)	6.4	6.5	6.1	6.5	6.6	6	5.6	4.8	5.6	5.7	6.1	4.6	5.7	6.2	4.26	5.4	5.9	6.1	6.2	6.2	6.0	6.0	6.0	6.1	6	4.9	6.3	
4	Kalekharber	Shallow (<250 ft)	4.4	6	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF		

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	Jul	Oct	Jan
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM
1	Township near project site	Deep (>600 ft)	1113	999	-	1021	NO	881	377	447	1025	1000	617	623	395	602	405	NF	NF	NF	1315	915	25	900	3080	1196	139	200
2	Rajnagar	Deep (>600 ft)	4090	371	-	378	390	574	1007	491	384	408	382	401	617	996	602	615	390	365	376	380	602	385	660	701	335	350
3	Kapasdanga	Deep (>600 ft)	643	635	-	600	600	328	611	284	645	607	636	998	558	390	994	370	608	610	927	610	360	603	370	316	202	610
4	Kalekharber	Shallow (<250 ft)	1055	970	-	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

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	Jul	Oct	Jan
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22 nd QM	23 rd QM	25QM	26QM	27QM
1	Township near project site	Deep (>600 ft)	-	6	19	40	NF**	23	4	31	3	5	7	32	4	8	12	NF	NF	NF	3	3	2	4	2	1	3	1
2	Rajnagar	Deep (>600 ft)	-	6	2	28	4	16	5	46	4	4	4	28	10	10	6	12	2	6	3	2	1	3	3	3	5	2
3	Kapasdanga	Deep (>600 ft)	-	8	6	32	6	14	4	41	3	4	5	25	9	9	7	5	3	8	4	4	4	4	2	1	2	5
4	Kalekarber	Shallow (<250 ft)	-	48	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

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	Jul	Oct	Jan
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23 rd QM	25QM	26QM	27QM
1	Township near project site	Deep (>600 ft)	425	250	300	235	NO	225	325	295	305	320	175	550	720	145	NF	NF	NF	NF	355	235	97	145	137	625	232	160
2	Rajnagar	Deep (>600 ft)	220	175	180	110	138	125	450	195	263	248	295	510	420	240	265	195	235	178	215	182	167	245	118	210	185	145
3	Kapasdanga	Deep (>600 ft)	190	140	180	125	216	115	480	225	163	28	183	620	654	215	305	215	170	138	270	167	212	137	145	237	207	130
4	Kalekarber	Shallow (<250 ft)	780	450	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

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	Jul	Oct	Jan
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23 rd QM	25QM	26QM	27QM
1	Township near project site	Deep (>600 ft)	32	32	34	20	NO	12	4	4	4	4	4	4	4	8	NF	NF	NF	NF	4	352	4	4	4	4	4	4
2	Rajnagar	Deep (>600 ft)	28	28	18	16	14	10	8	4	4	4	4	4	4	8	4	4	4	4	3	4	4	4	4	4	4	4
3	Kapasdanga	Deep (>600 ft)	48	32	34	20	18	14	4	4	4	2	4	4	4	16	4	4	4	4	4	4	4	4	4	4	4	4
4	Kalekarber	Shallow (<250 ft)	32	36	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

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: NO₃⁻ 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	Jul	Oct	Jan		
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23 rd QM	25QM	26QM	27QM		
1	Township near project site	Deep (>600 ft)	0.20	0.48	<0.10	28	-	7.6	4.3	2.1	1.7	3.8	6.1	4.65	9.32	3.3	5.9	NF	NF	NF	1.7	4.4	1.4	1.8	1.9	1.7	0.5	2.4		
2	Rajnagar	Deep (>600 ft)	0.60	0.68	0.31	26	-	2.2	4.2	1.9	2.3	3.3	7.51	7.02	14.7	2.5	7.2	5.3	8.6	0.9	4.4	2.7	2.7	3.1	1.4	7.5	3.8	2.2		
3	Kapasdanga	Deep (>600 ft)	0.80	0.40	0.80	13	-	4.7	3.8	2.8	1.9	3.7	10.16	4.65	10.2	4.6	1.7	5.7	7.8	1.4	2.1	8.3	1.7	1.6	2.7	1.7	3.1	4.9		
4	Kalekarber	Shallow (<250 ft)	0.40	0.56	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF			

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: SO₄²⁻ Concentrations in Ground Water

Sl	Location	Typeof Tubewell	SO ₄ ²⁻ (mg/L)																											
			*BD Standard (400 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	Jul 25QM	Oct 26QM	Jan 27QM		
1	Township near project site	Deep (>600 ft)	-	3	-	-	-	-	1	5	1	1	1	1	5	1	8	NF	NF	NF	1	4	1	2	2	4	9	1		
2	Rajnagar	Deep (>600 ft)	-	2	-	-	-	-	2	6	2	1	1	1	1	1	2	2	4	1	2	1	2	2	3	3	3	1		
3	Kapasdanga	Deep (>600 ft)	-	10	-	-	-	-	2	2	8	1	1		3	2	6	4	6	1	1	4	1	1	2	4	3	7		
4	Kalekarber	Shallow (<250 ft)	NF	3	NF	-	-	-	-	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF		

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: PO₄³⁻ Concentrations in Ground Water

Sl	Location	Typeof Tubewell	PO ₄ ²⁻ (mg/L) *BD Standard (6.0 mg/L)																										
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	
1	Township near project site	Deep (>600 ft)	NF	2.2	-	0.74	NO	1.4	0.31	0.267	1.08	0.17	0.167	1.18	2.18	1.68	0.13	NF	NF	NF	2.1	2.3	0.3	1	1.1	0.3	0.7	2.0	
2	Rajnagar	Deep (>600 ft)	-	2.5	-	0.44	1.98	1.6	0.27	0.179	1.53	0.29	0.67	1.21	1.8	3.5	0.17	4.5	2.9	0.15	1.3	2.5	4.0	0.5	0.4	1.5	6.3	1.8	
3	Kapasdanga	Deep (>600 ft)	-	6.2	-	0.48	4.54	4.1	0.48	0.179	3.26	0.31	0.6	1.18	2.1	4.7	0.18	0.27	4.8	0.26	3.6	3.2	2.0	1.5	0.9	1.7	2.3	2.3	
4	Kalekarber	Shallow (<250 ft)	NF	1.2	NF	NF	NF	NF	NF	NF	NF	NF	NF	1.23	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	

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 concentrations (mg/L)																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	21QM	22QM	23 rd QM	25QM	26QM	27QM	
1	Township near project site	0.013	0.020	0.012	0.014	NO	0.015	0.002	0.008	0.018	0.012	0.033	0.028	0.012	0.014	0.002	0.001	NF	NF	0.014	0.012	0.014	0.001	0.018	0.020	0.022	0.003	0.002	
2	Rajnagar	0.006	0.009	0.006	0.008	0.01	0.014	0.012	0.002	0.007	0.018	0.011	0.005	0.022	0.004	0.012	0.022	0.012	0.007	0.003	0.012	0.006	0.027	0.006	0.068	0.045	0.053	0.004	
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	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	0.004	0.006	0.049	

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	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	22QM	23 rd QM	25QM	26QM	27QM	
1	Township near project site	0.002	<0.002	0.004	0.023	NO	0.002	0.006	0.026	0.019	0.002	0.001	0.01	0.001	0.003	0.001	0.001	0.001	NF	NF	0.008	0.004	0.018	0.002	0.001	0.001	0.004	0.048	
2	Rajnagar	<0.002	<0.002	<0.002	0.016	0.013	0.0027	0.021	0.011	0.007	0.002	0.001	0.009	0.001	0.007	0.002	0.001	0.001	0.001	0.004	0.003	0.004	0.002	0.008	0.001	0.001	0.006	0.016	
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	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	0.001	0.002	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; 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	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	21QM	22QM	23 rd QM	25QM	26QM	27QM	
1	Township near project site	<0.00015	<0.00015	<0.0005	<0.0005	<0.0005	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
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	0.003	<0.001	<0.001	<0.001	<0.001	<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	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	<0.001	NF	<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, 2019			February, 2020			July, 2020			January, 2021		
	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)	Project Jetty (mg/L)	Majhar point	Hiron point (mg/L)	Project Jetty (mg/L)	Majhar point	Hiron point (mg/L)
Acenaphthylene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Benzol (A) Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Benzol (A) Pyrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Benzol (B) Fluoranthene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Benzol (G, H, I) Perilene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Benzol (K) Fluoranthene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Dibenzol (A, H) Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND

Table B.29: TOC and TC concentrations of monitored locations

Monitoring sites	July, 2018		January, 2019		July, 2019		February, 2020		July, 2020		January, 2021	
	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)	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	152	9.17	1302	<5
Majhar point	21.9	25.1	24.8	18.8	21.7	18.1	21.7	18.1	200	9.48	1568	<5
Hiron point	NM	NM	6.8	5.7	NM	NM	8.1	6.7	NM	NM	9241	<5

(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))				QM2 (Noise Level in dB (A))				QM3 (Noise Level in dB (A))				QM4 (Noise Level in dB (A))				Std*
		Mar-14				Jul-14				Oct-14				Jan-15				Day time
		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	
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	
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

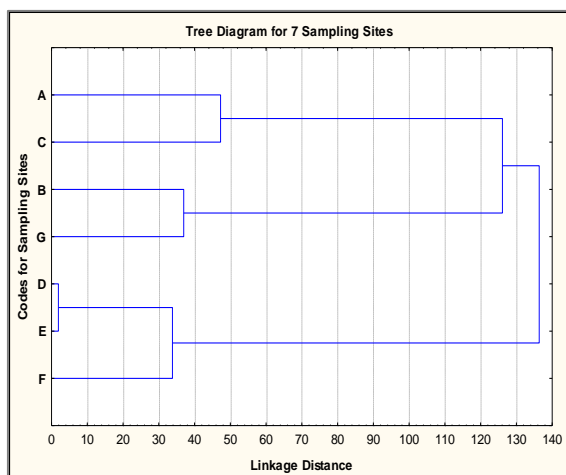
Sl No	Location	QM 21 (Noise Level in dB (A)) July-19				QM 22 (Noise Level in dB (A)) November-19				QM 23 (Noise Level in dB (A)) February 20				QM 25 (Noise Level in dB (A)) July, 20				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time	A. noon (13:00)	Evening (18:00)	Day time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

Source: CEGIS field Survey

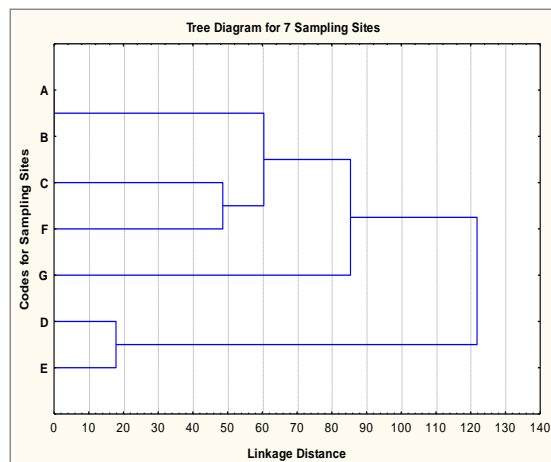
Note: NM-Not measured.

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

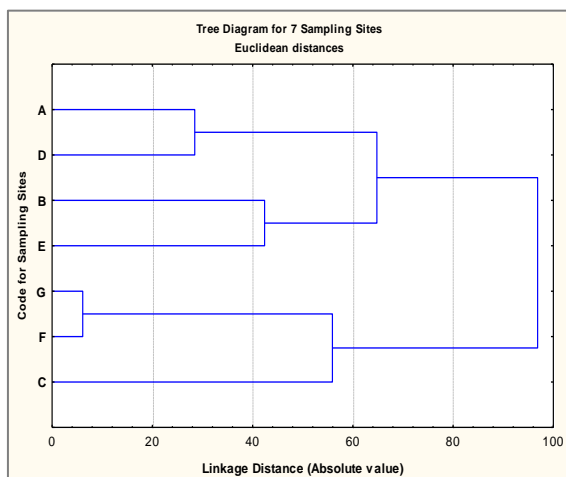
Sl No	Location	QM 26 (Noise Level in dB (A)) Oct, 2020				QM 27 (Noise Level in dB (A)) Jan, 2021				QM 28 (Noise Level in dB (A)) Apr, 2021				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)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

(D) Fisheries resources monitoring data**D1: Classification of functional habitat**

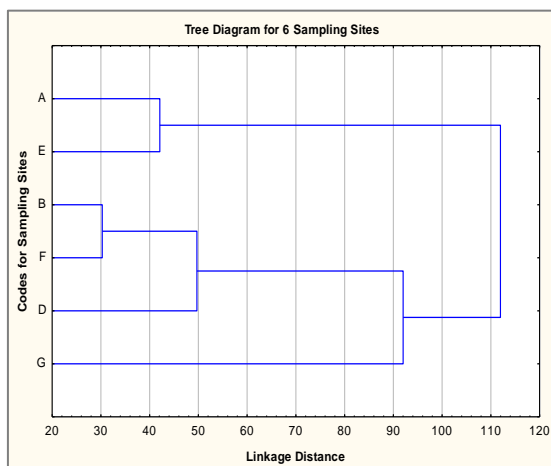
1st Monitoring, April, 2014



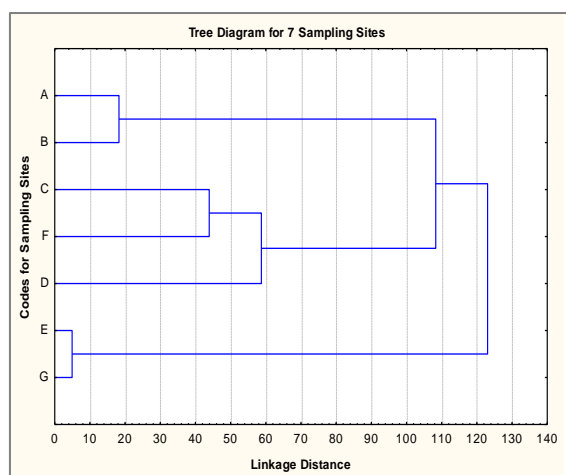
2nd Monitoring, July 2014



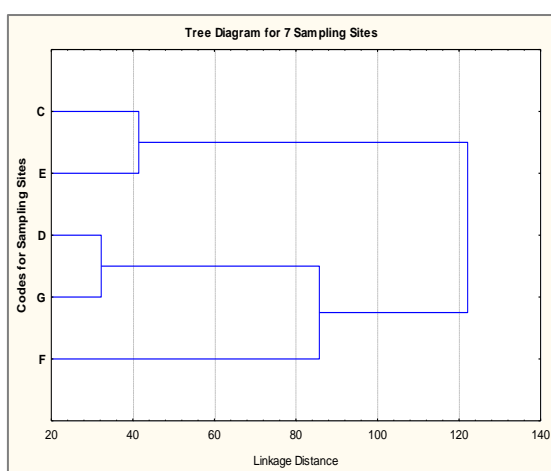
3rd Monitoring, October, 2014



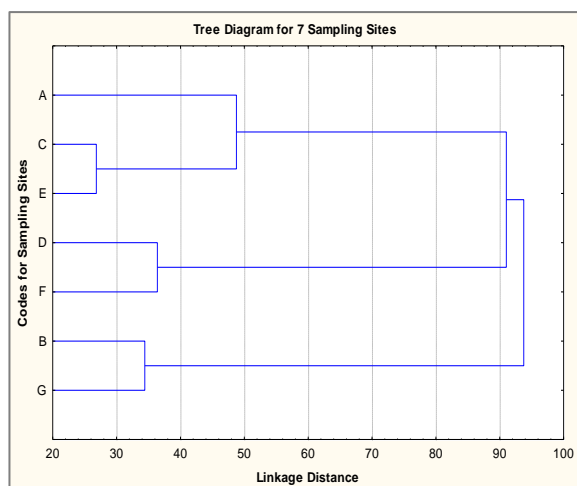
4th Monitoring, January 2015



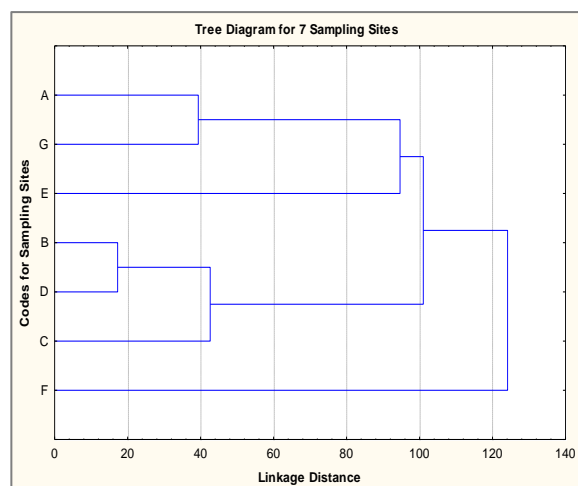
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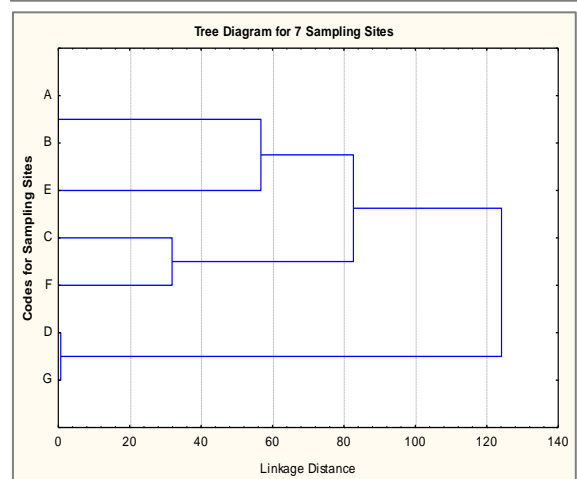
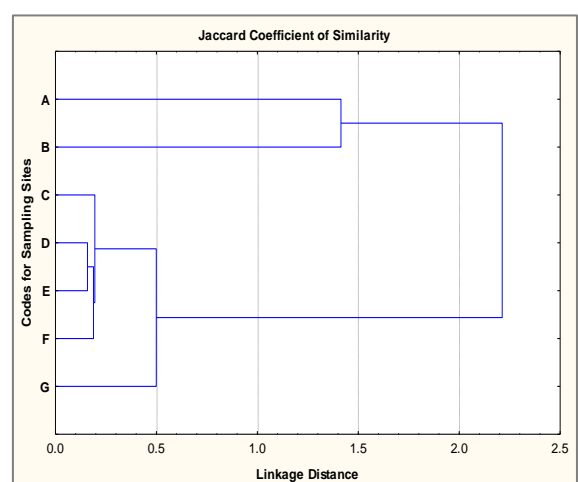
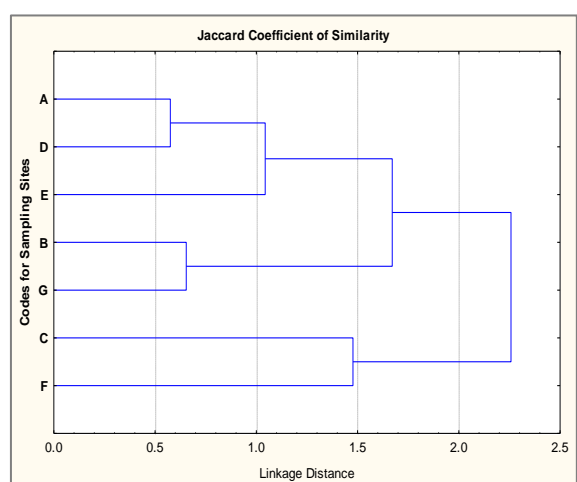
6th Monitoring, August, 2015



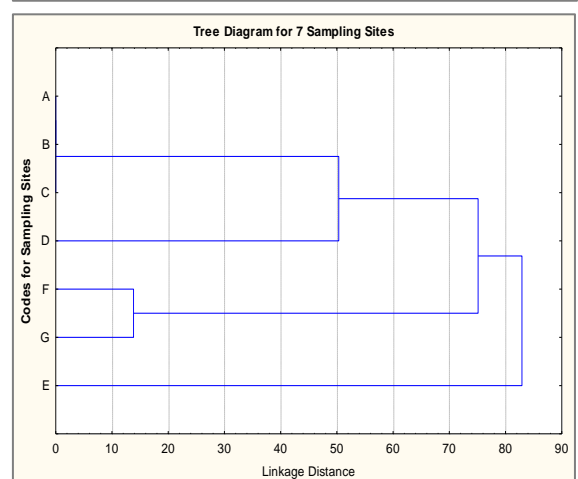
7th Monitoring, October, 2015



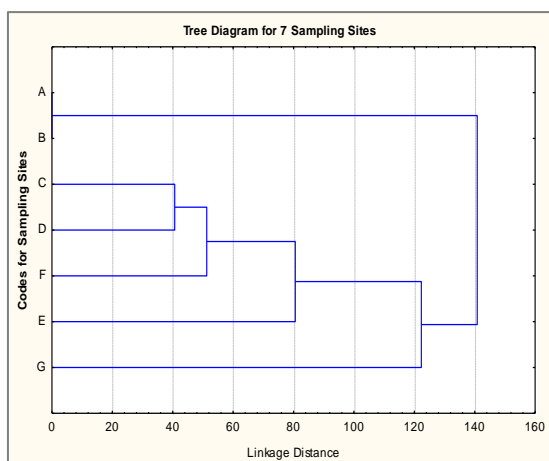
8th Monitoring, January, 2016



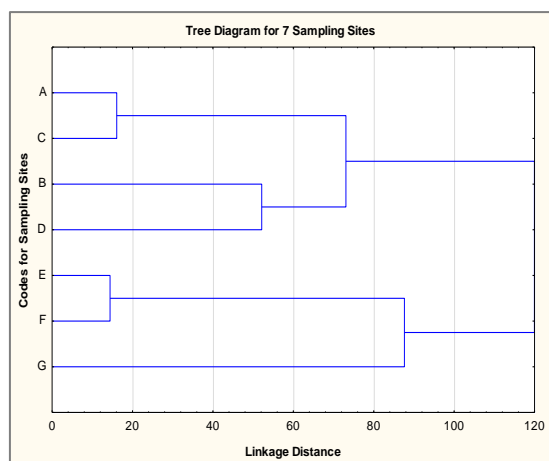
9th Monitoring, April, 2016



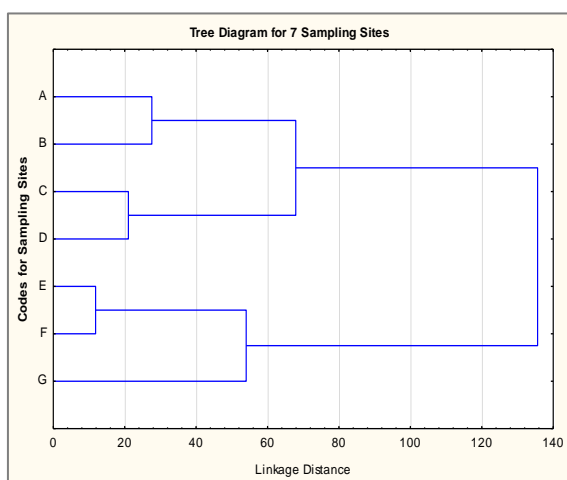
10th Monitoring, July, 2016



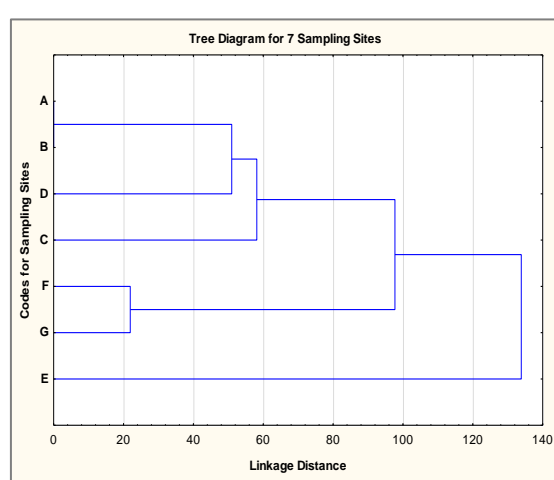
11th Monitoring, October, 2016



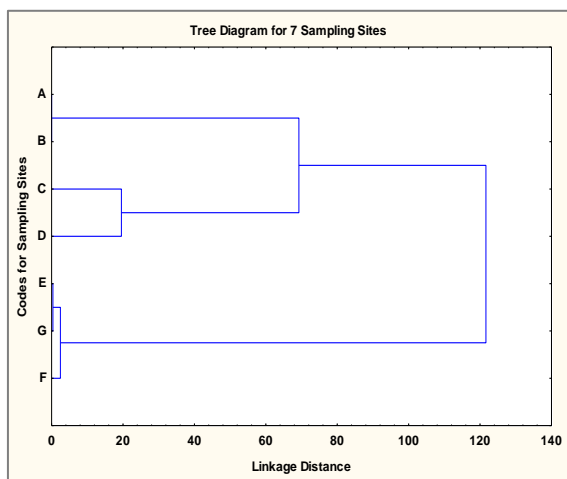
12th Monitoring, January, 2017



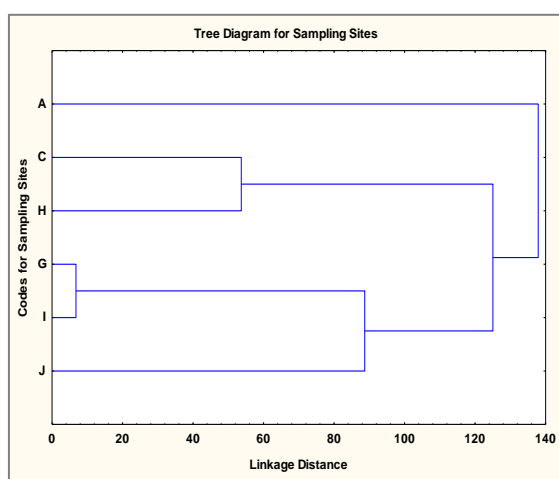
13th Monitoring, April, 2017



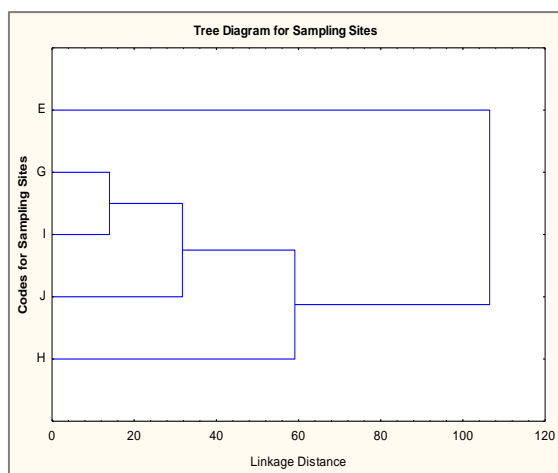
14th Monitoring, October, 2017



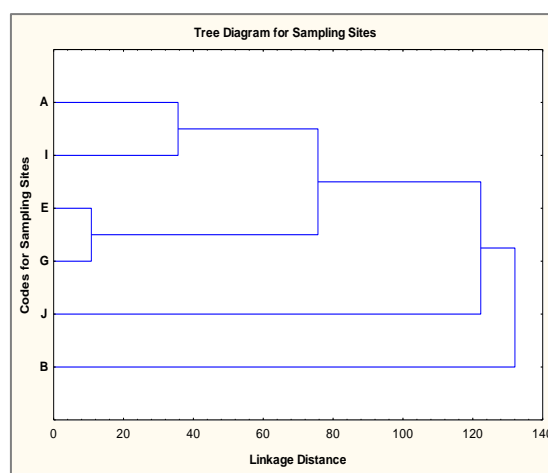
15th Monitoring, January, 2018



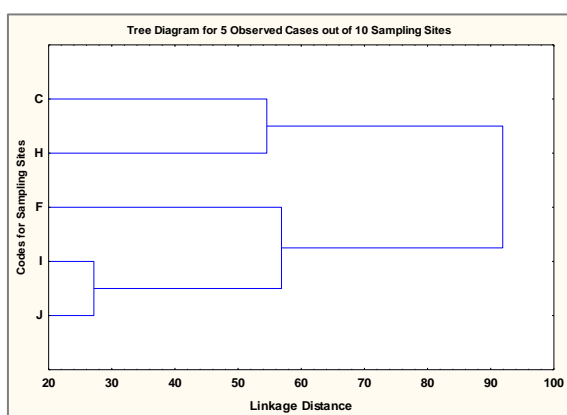
16th Monitoring, April, 2018



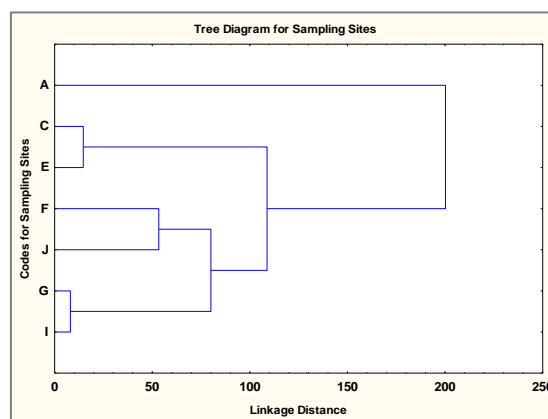
17th Monitoring, July, 2018



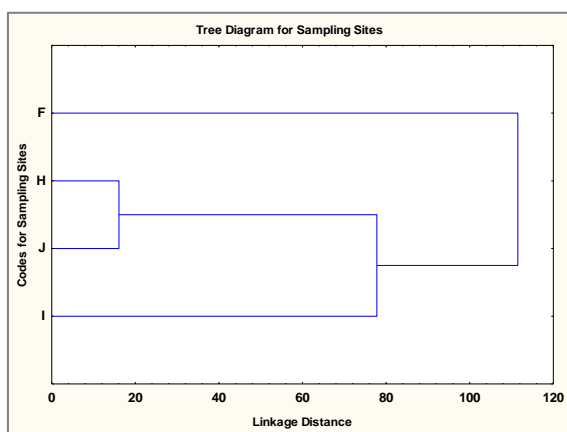
18th Monitoring, November, 2018



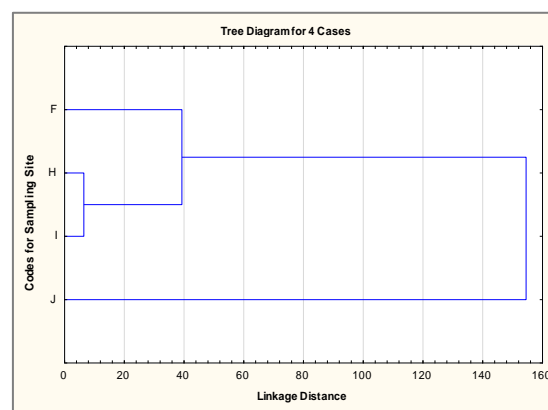
19th Monitoring, February, 2019



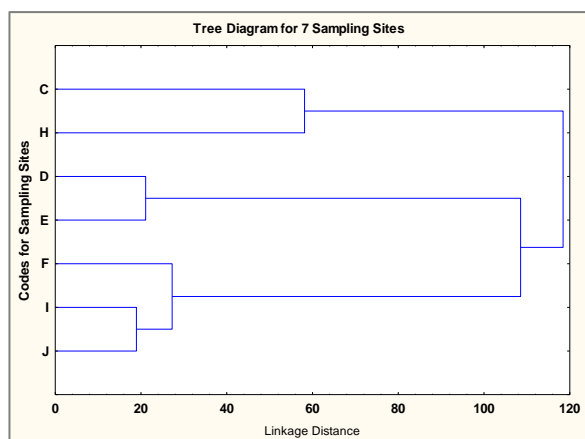
20th Monitoring, April, 2019



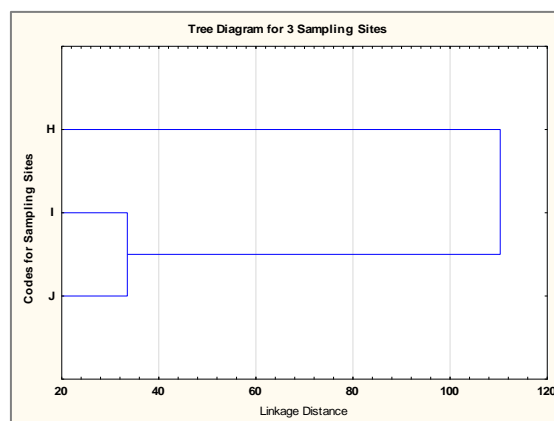
21st Monitoring, July 2019



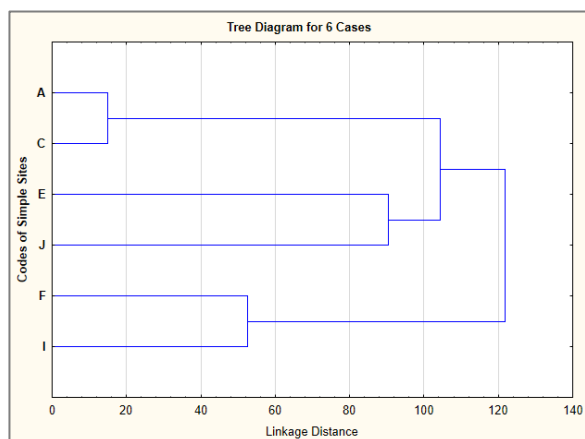
22nd Monitoring, November, 2019



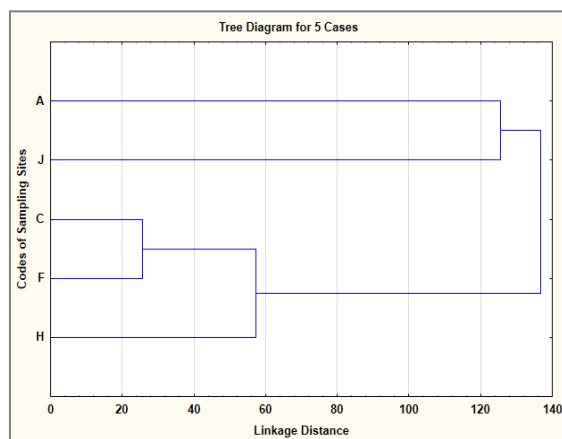
23rd Monitoring, February 2020



25th Monitoring, July 2020

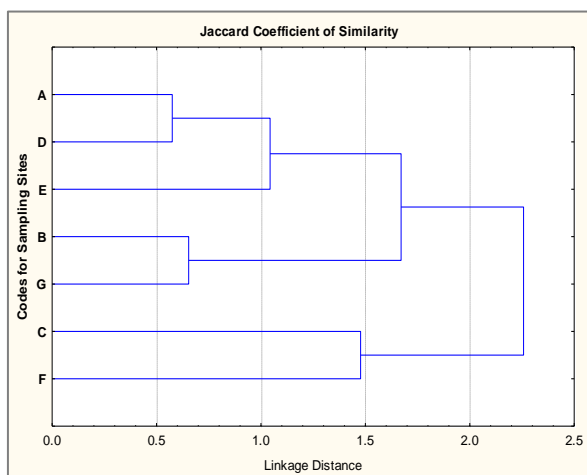
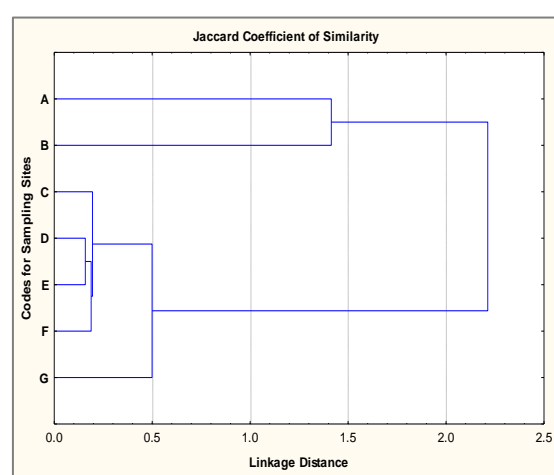


26th Monitoring, November 2020

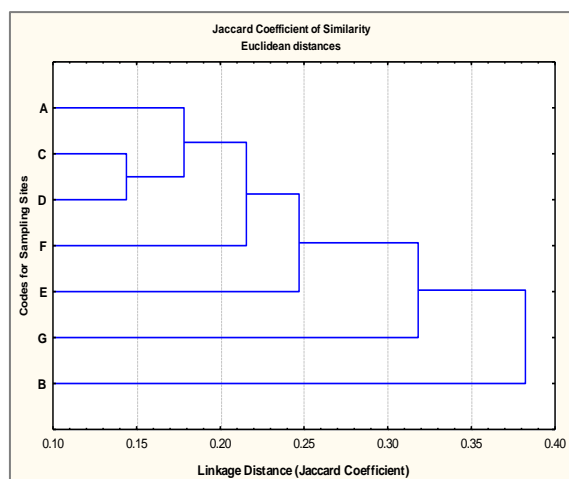


27th Monitoring, January 2021

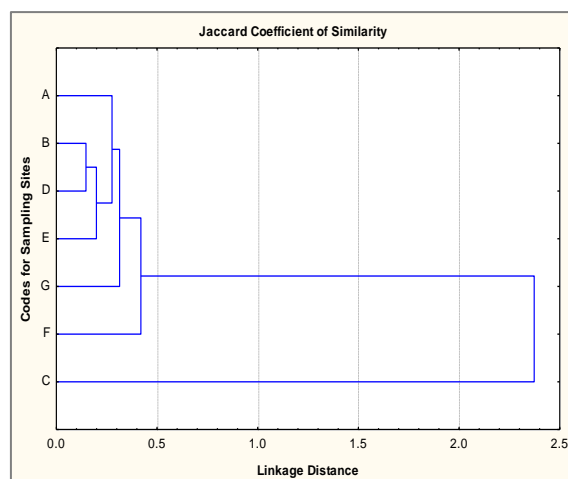
D2: Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence

1st Monitoring, April, 2014

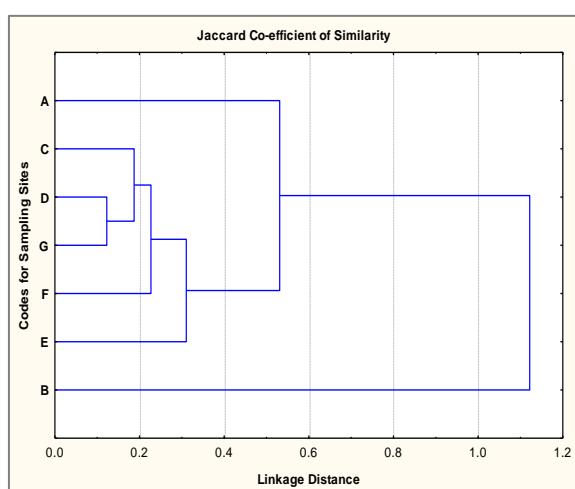
2nd Monitoring, July 2014



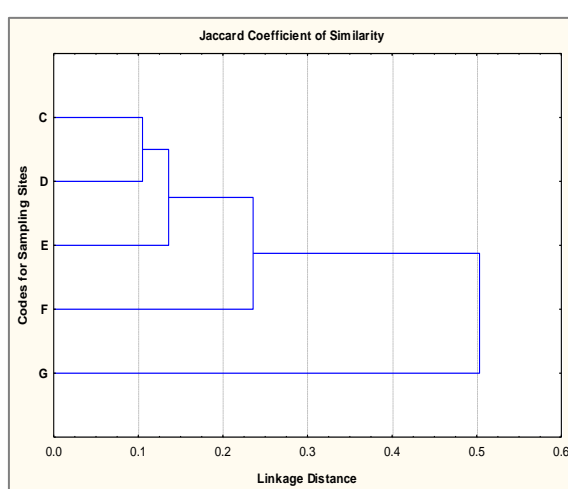
3rd Monitoring, October, 2014



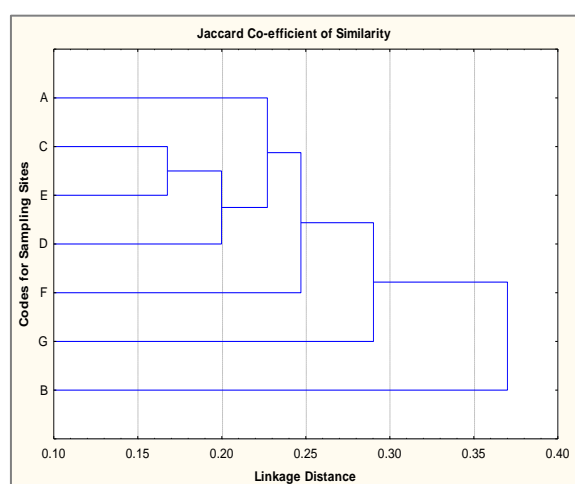
4th Monitoring, January, 2015



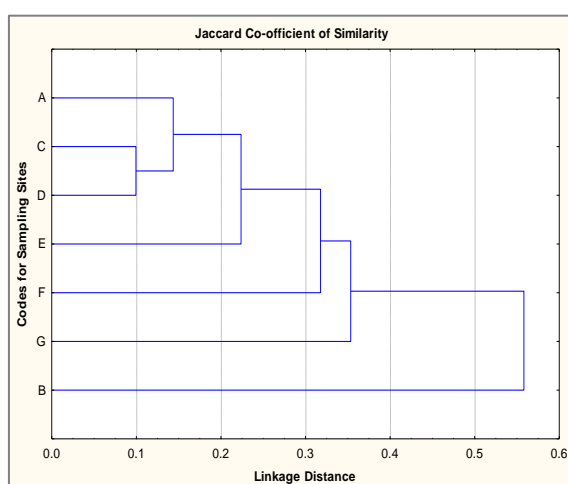
5th Monitoring, April, 2015



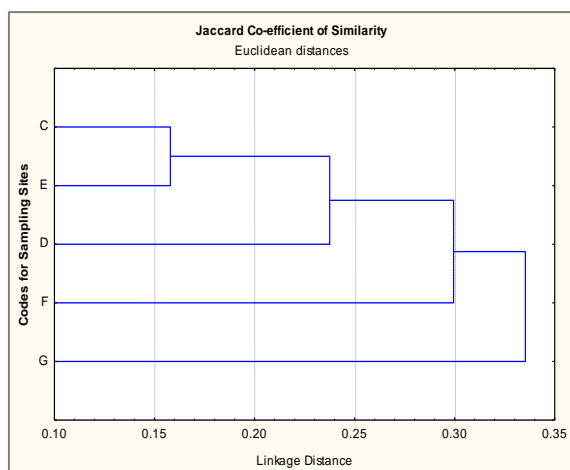
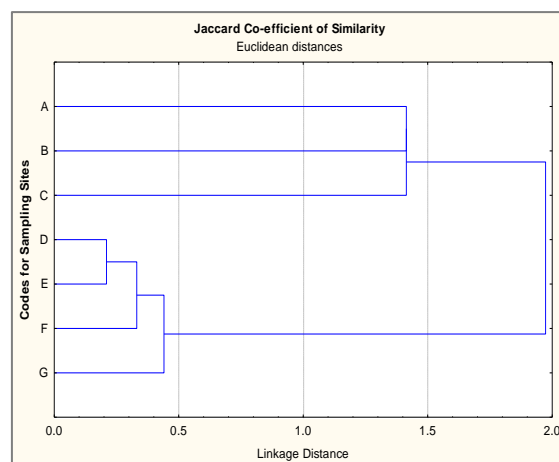
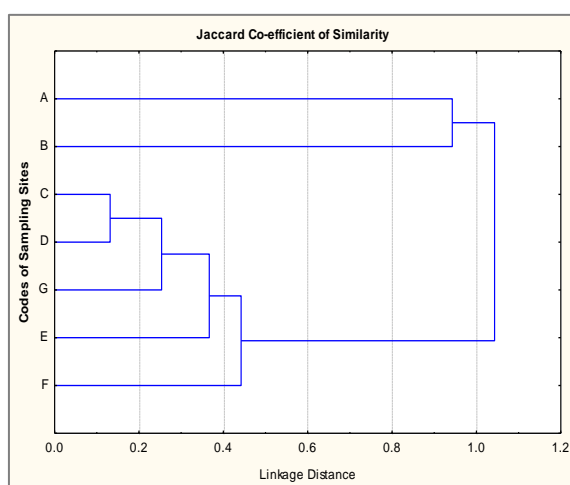
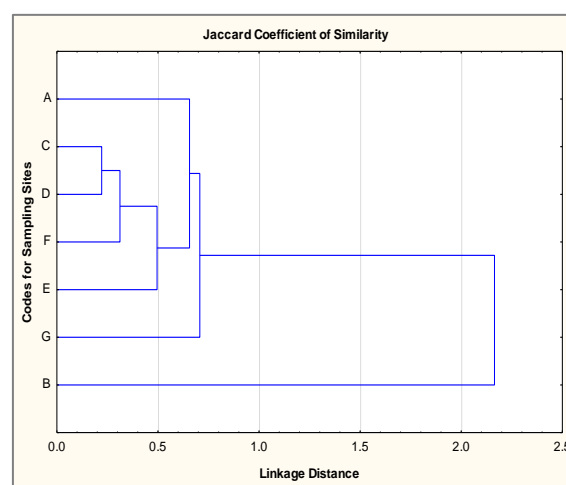
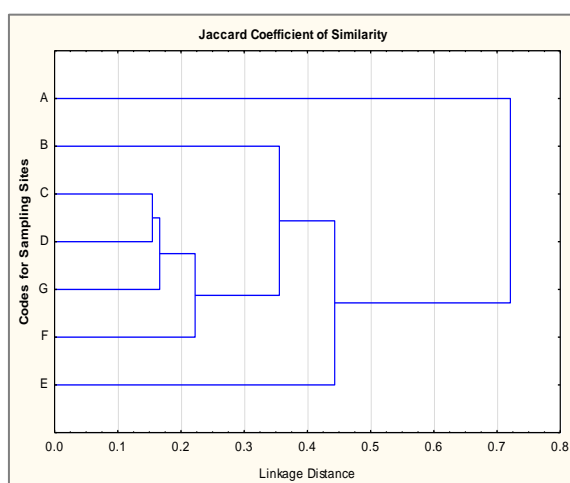
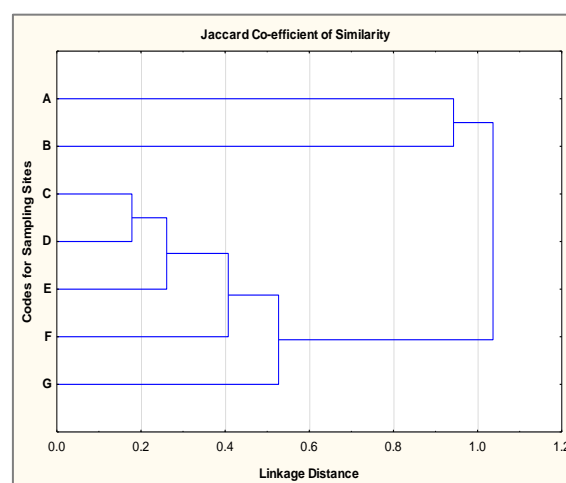
6th Monitoring, August, 2015

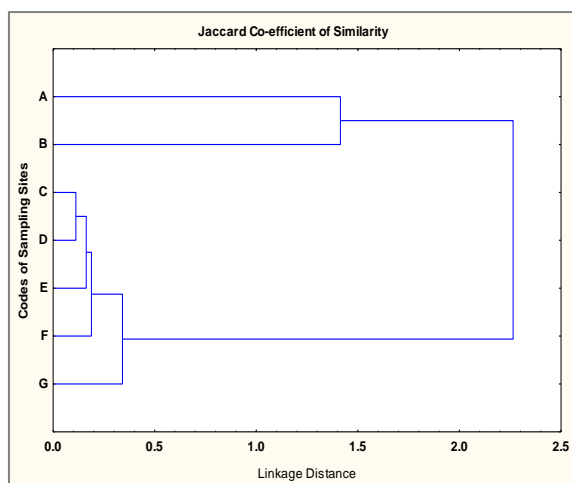
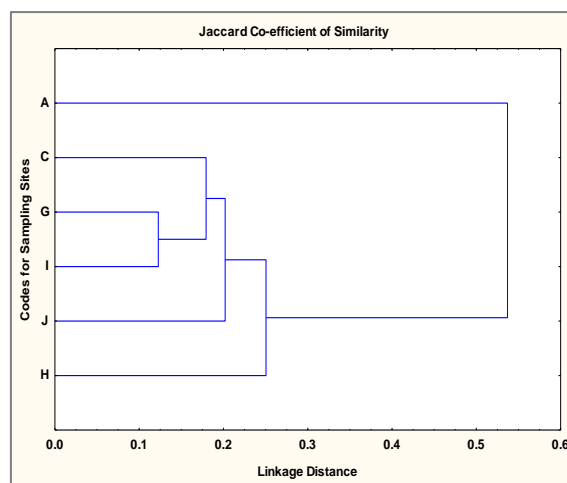
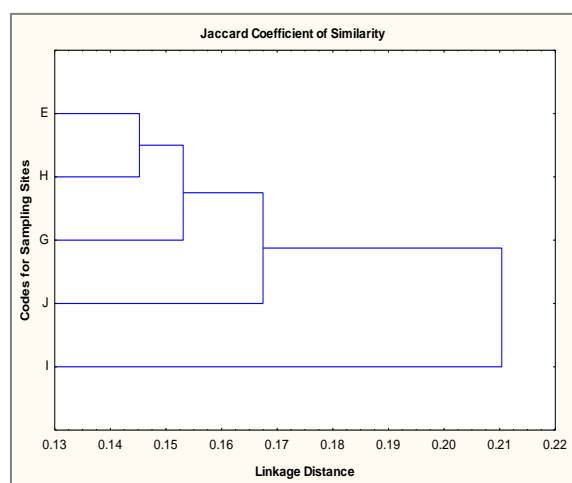
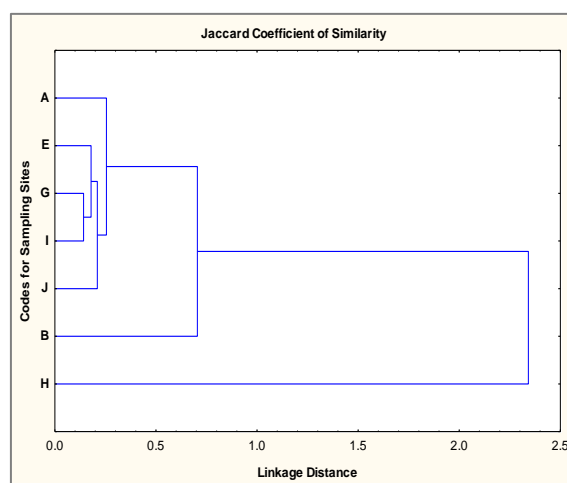
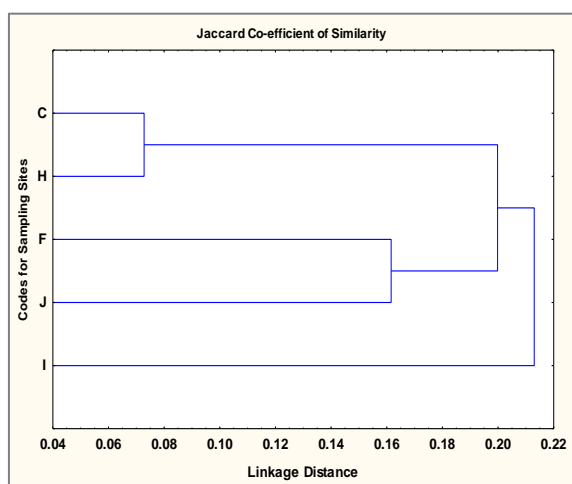
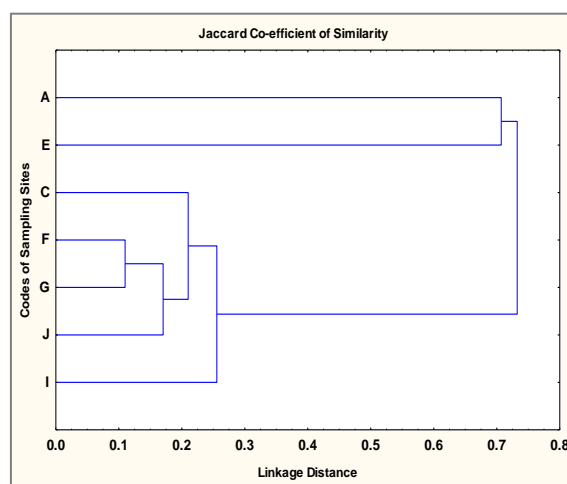


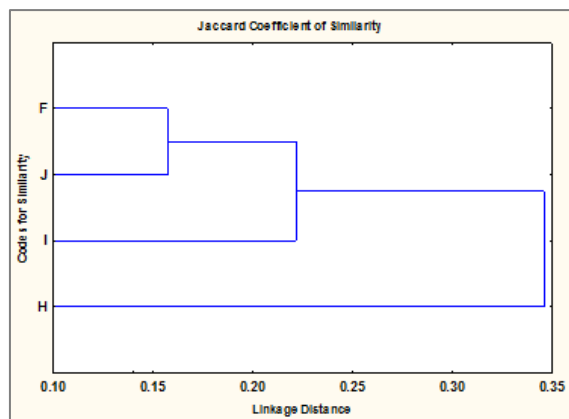
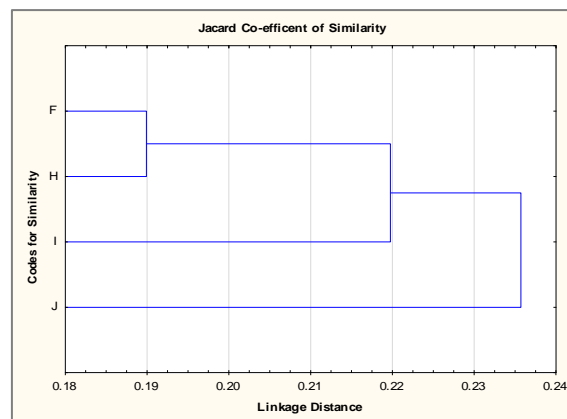
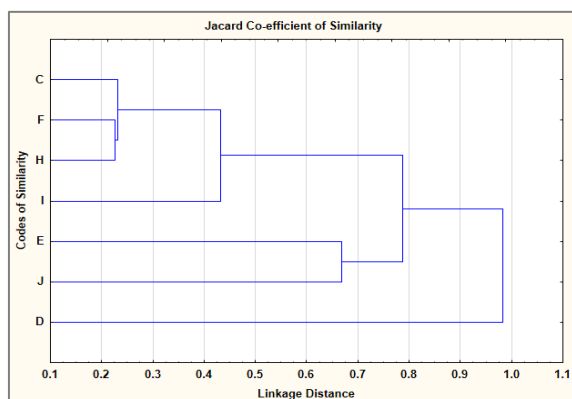
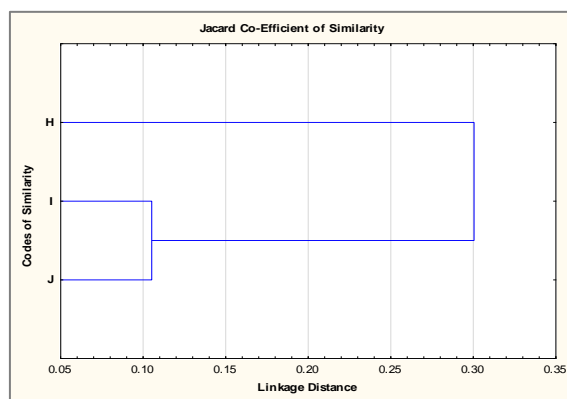
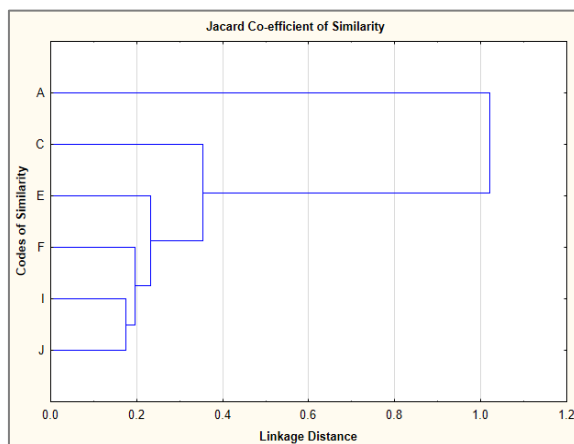
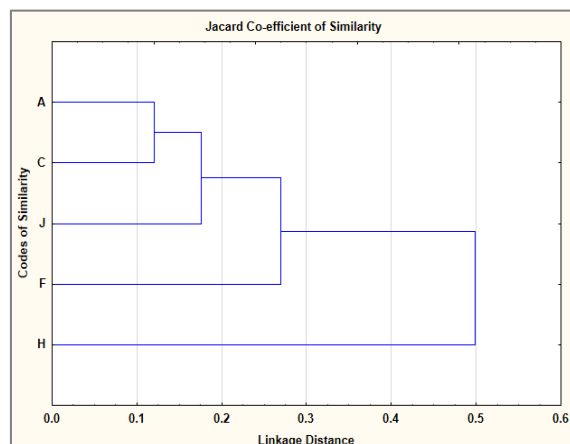
7th Monitoring, October, 2015



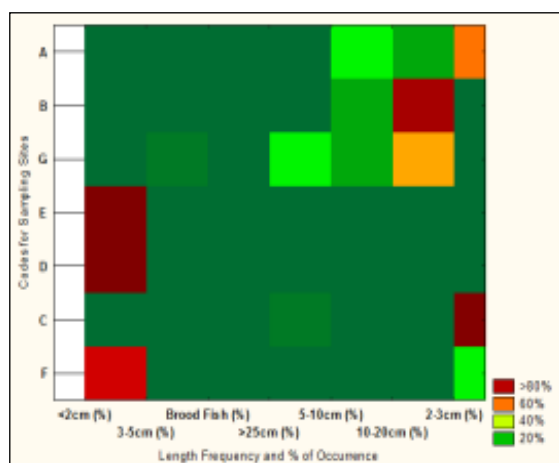
8th Monitoring, January, 2016

9th Monitoring, April, 201610th Monitoring, July, 201611th Monitoring, October, 201612th Monitoring, January, 201713th Monitoring, April, 201714th Monitoring, October, 2017

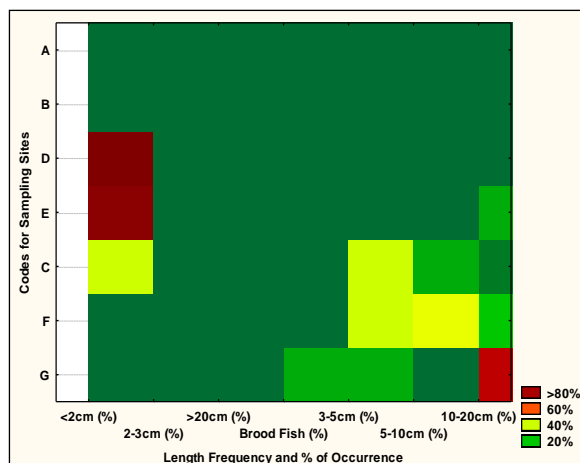
15th Monitoring, January, 201816th Monitoring, April, 201817th Monitoring, July, 201818th Monitoring, November, 201819th Monitoring, February, 201920th Monitoring, April, 2019

21st Monitoring, July 201922nd Monitoring, November 201923rd Monitoring, February 202025th Monitoring, July 202026th Monitoring, November, 202027th Monitoring, January, 2021

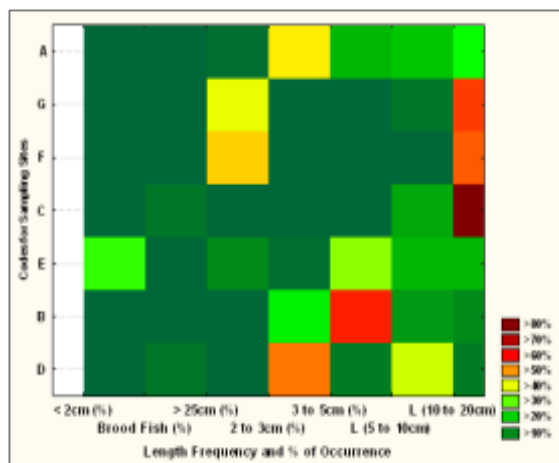
D3: Fish Community Structure



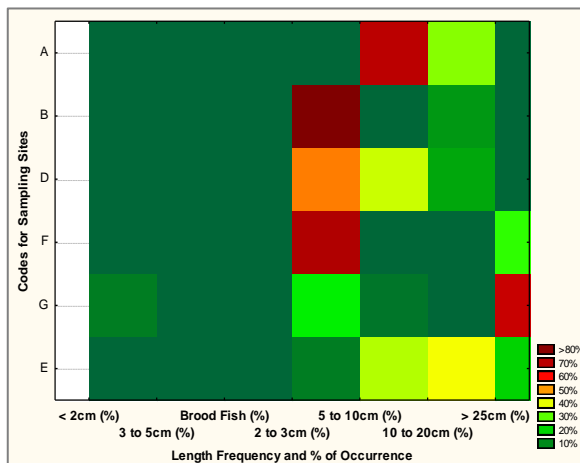
1st Monitoring, April, 2014



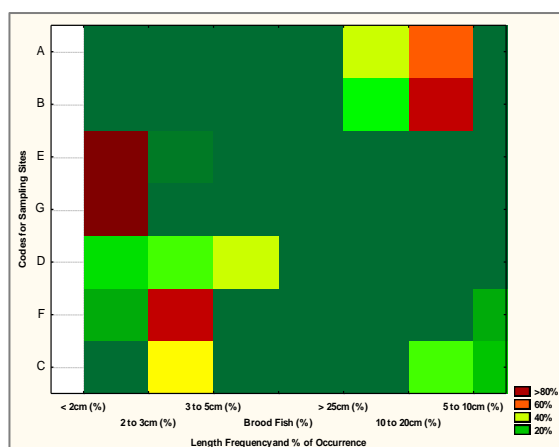
2nd Monitoring, July 2014



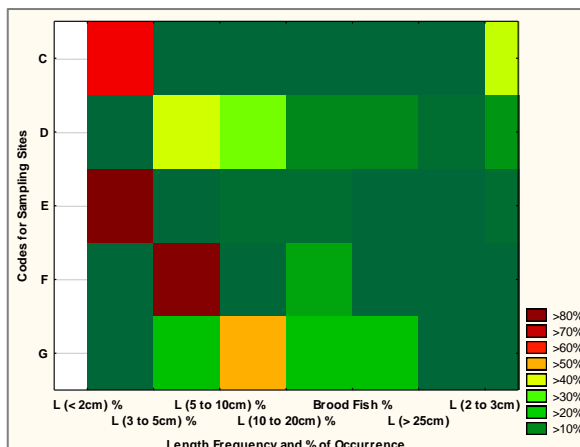
3rd Monitoring, October, 2014



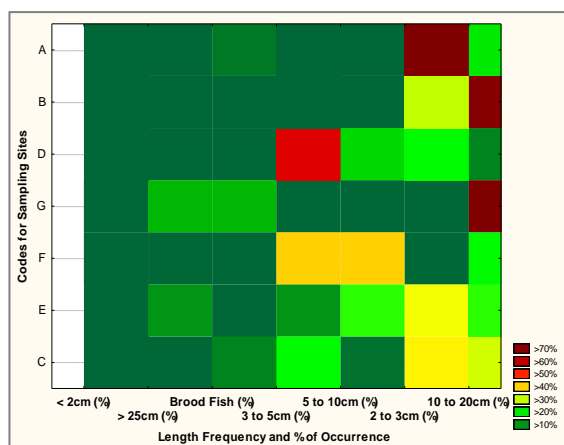
4th Monitoring, January 2015



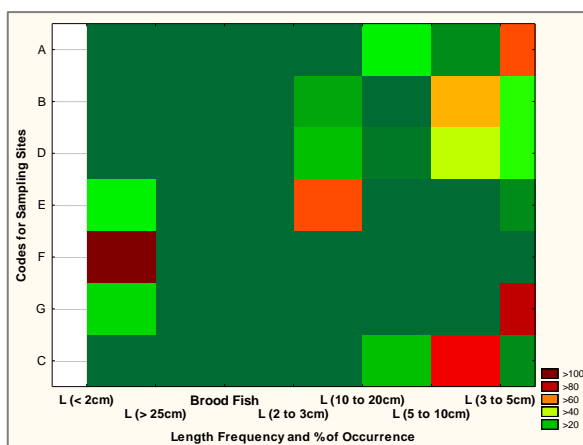
5th Monitoring, April, 2015



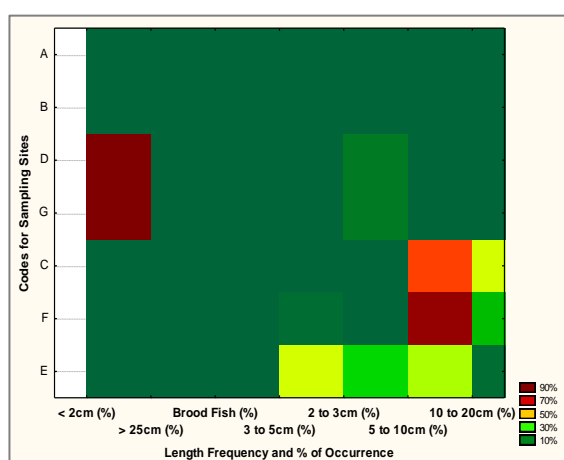
6th Monitoring, August, 2015



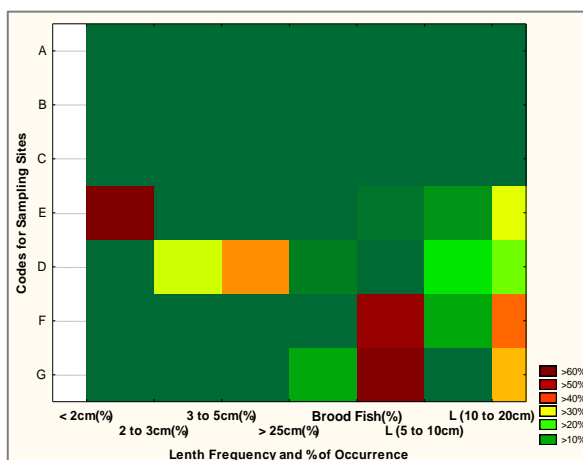
7th Monitoring, October, 2015



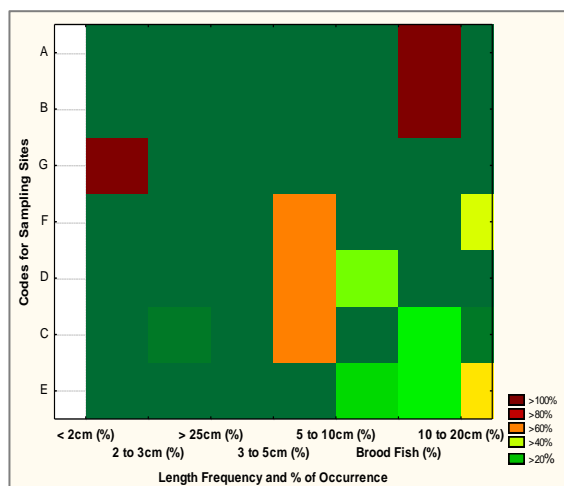
8th Monitoring, January, 2016



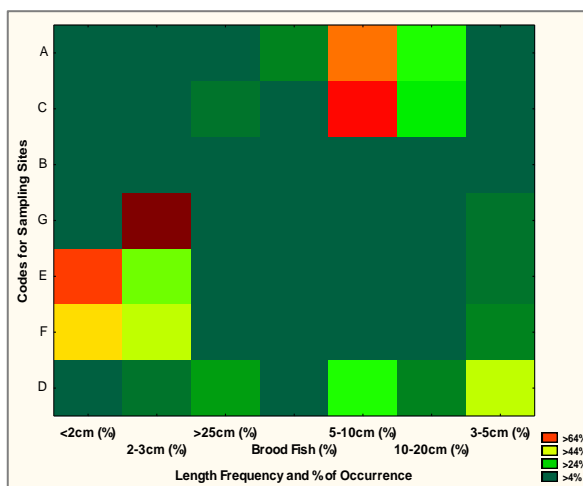
9th Monitoring, April, 2016



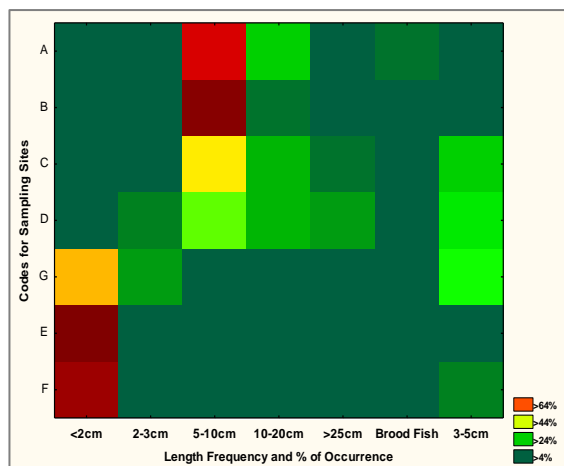
10th Monitoring, July, 2016



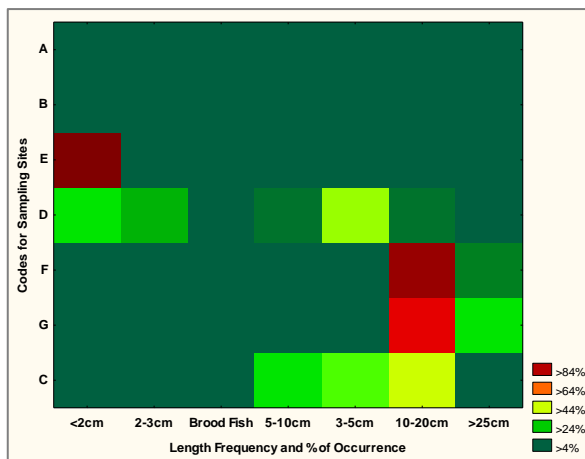
11th Monitoring, October, 2016



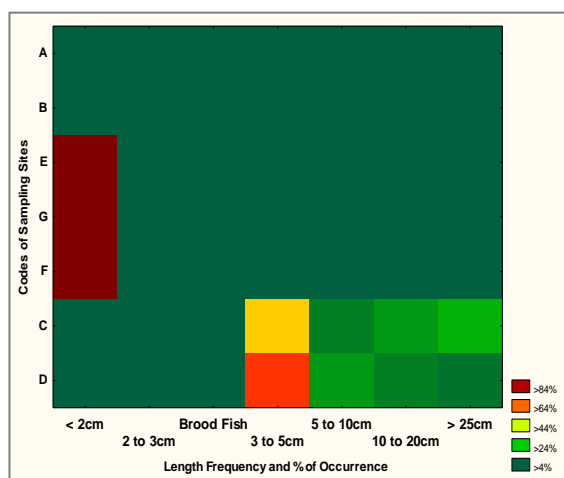
12th Monitoring, January, 2017



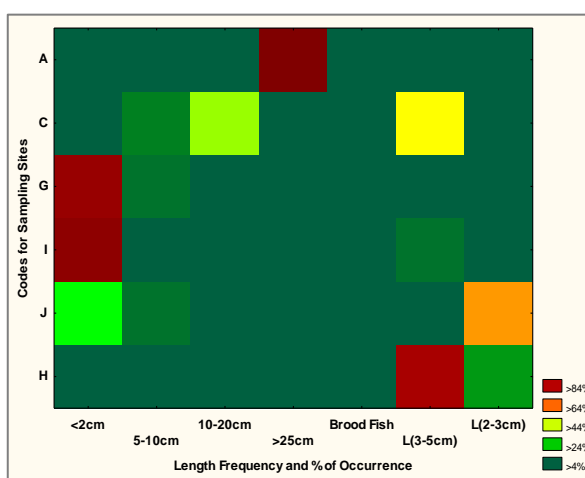
13th Monitoring, April, 2017



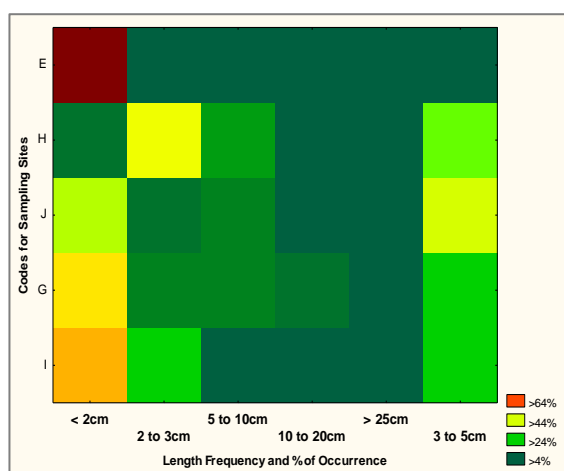
14th Monitoring, October, 2017



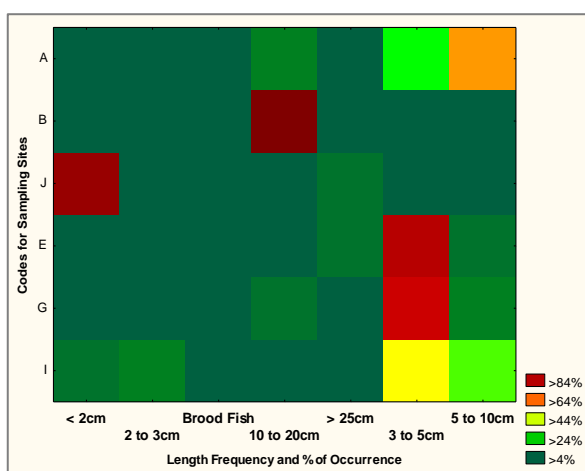
15th Monitoring, January, 2018



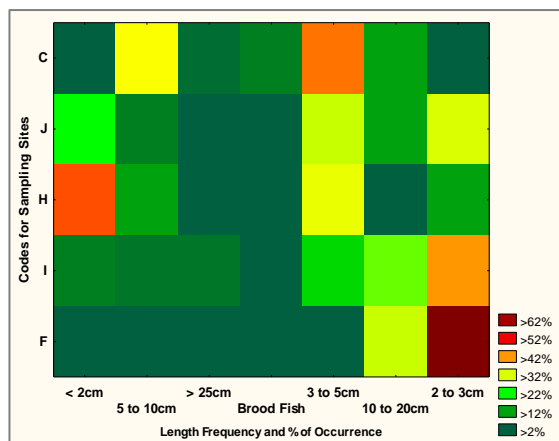
16th Monitoring, April, 2018



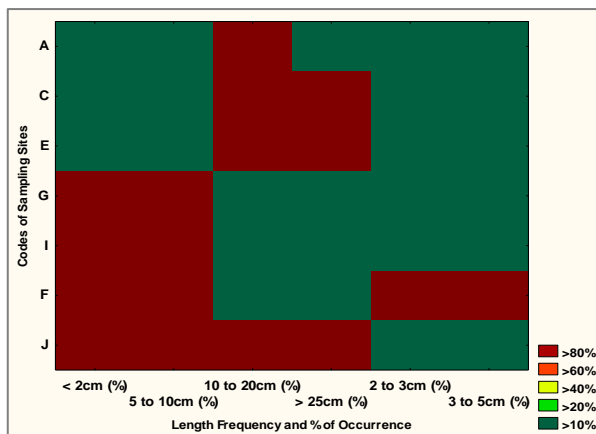
17th Monitoring, July, 2018



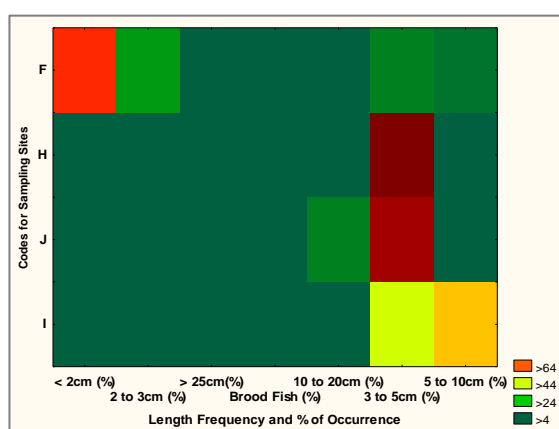
18th Monitoring, November, 2018



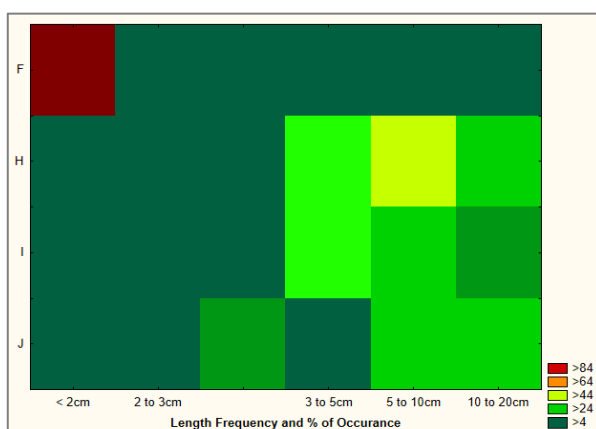
19th Monitoring, February, 2019



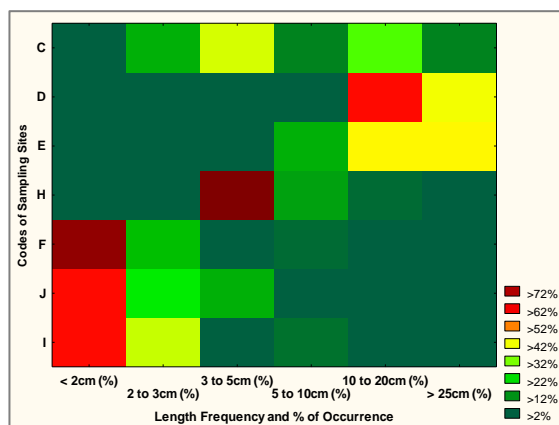
20th Monitoring, April, 2019



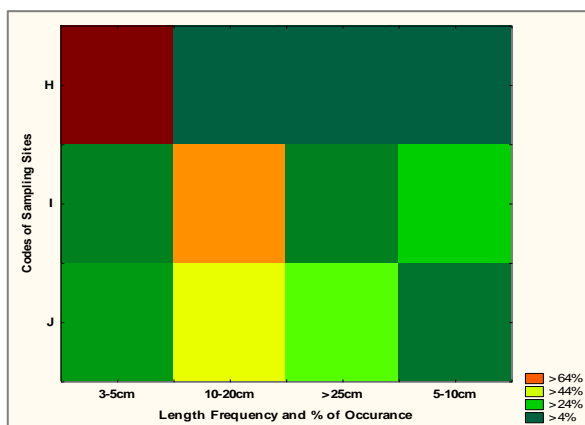
21st Monitoring, July 2019



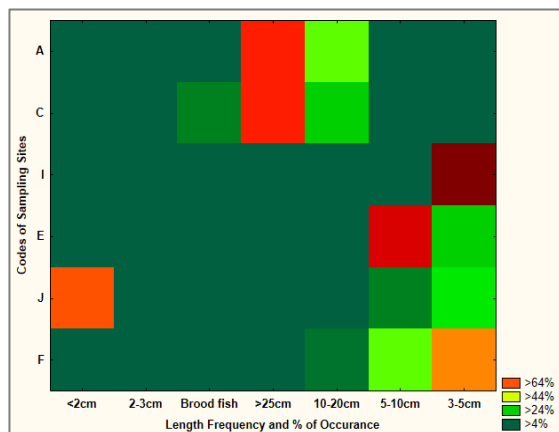
22nd Monitoring, November 2019



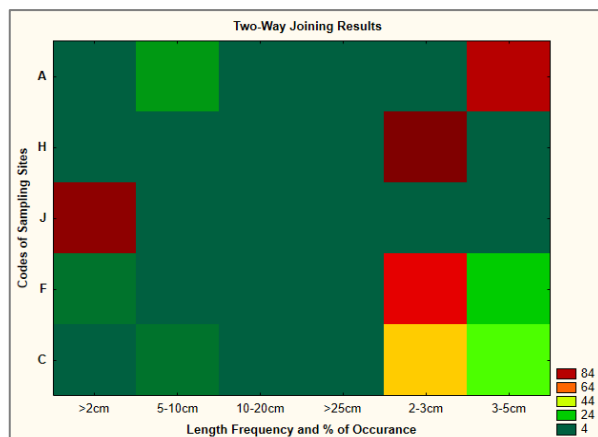
23rd Monitoring, February 2020



25th Monitoring, July 2020



26th Monitoring, November 2021

27th Monitoring, January, 2021

D.4: Occurrence of Species

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

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											
Tak Chanda	<i>Leiognathus equulus</i>	NO	+	-	-	-	-	-	+	-	-	+	-	-
Phessa	<i>Setipinna phasa</i>	NO	+	+	+	+	+	+	+	+	+	-	+	-
Teli Phessa	<i>Setipinna phasa</i>	DD	-	-	+	-	-	-	-	-	-	+	-	-
Poma	<i>Poma poma</i>	NO	+	+	+	+	+	+	+	+	+	+	+	+
Potka	<i>Chelonodon patoca</i>	NO	+	+	-	+	+	+	-	+	+	-	+	+
Shilong	<i>Silonia silondia</i>	EN	+	-	+	-	-	-	-	-	-	-	+	-
Tailla	<i>Eleutheronema tetradactylum</i>	DD	+	-	-	-	-	-	-	-	-	+	-	-
Tapse	<i>Polynemus paradiseus</i>	DD	+	+	+	-	-	+	+	+	-	-	+	+
Daitna	<i>Acanthopagrus latus</i>	DD	-	-	-	+	-	-	-	+	+	-	+	+
Shole	<i>Channa striatus</i>	DD	-	-	-	+	-	-	-	+	-	-	-	-
Magur	<i>Clarias batrachus</i>	DD	-	-	-	+	-	-	-	+	-	-	-	+
Koi	<i>Anabas testudineus</i>	DD	-	-	-	+	-	-	-	+	-	+	-	-
Vetki	<i>Lates calcarifer</i>	DD	-	-	-	+	+	+	+	+	+	-	+	+

Local Name	Scientific Name	Local Status*	13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
			'-' = No; '+' = Occurrence														
Hilsa	<i>Tenualosa ilisha</i>	NO	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-
Sagor Baim	<i>Anguilla bengalensis</i>	NT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bacha	<i>Eutropiichthys vacha</i>	CR	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Bagda Chingri	<i>Penaeus monodon</i>	DD	+	-	+	+	+	+	+	+	+	+	+	-	-	+	+
Banspata	<i>Brachypleura novae-zeelandiae</i>	NO	+	+	+	+	+	+	+	+	+	-	-	+	+	+	-
Kukurjib	<i>Cynoglossus lingua</i>	NO	-	-	+	-	-	-	+	-	+	+	-	+	-	+	-
Bele	<i>Glossogobius giuris</i>	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Aswine Bele	<i>Butis butis</i>	NO	+	+	+	+	+	-	+	+	-	-	-	-	-	-	-
Bairagi	<i>Coilia dussumieri</i>	NO	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+
Boishakhi Chingri	<i>Macrobrachium</i> sp.	NO	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-
Chammu Chingri	<i>Metapenaeus brevicornis</i>	DD	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+
Chaka Chingri	<i>Penaeus indicus</i>	DD	+	-	+	+	+	+	+	+	+	+	+	-	+	+	+
Ghora Chela	<i>Securicula gora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chanda Chela	<i>Securicula</i> sp.		-	-	+	+	+	+	-	-	-	+	+	-	-	-	-
Sada Chewa	<i>Trepauchen vagina</i>	NO	-	-	-	+	-	-	-	+	-	+	-	-	-	-	-
Lal Chewa	<i>Taenioides cirratus</i>	NO	+	+	-	+	+	-	+	+	-	-	+	-	-	-	+
Chhuri	<i>Trichiurus muticus</i>	NO	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-

Local Name	Scientific Name	Local Status*	13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
		'-' = No; '+' = Occurrence															
Sagor Chela	<i>Megalops cyprinoids</i>	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purabi Chela	<i>Thryssa purava</i>	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kabashi Tengra	<i>Mystus cavasius</i>	DD	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Gagra Tengra	<i>Nemapteryx nenga</i>	DD	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+
Gulsha Tengra	<i>Mystus bleekery</i>	DD	+	+	+	+	+	-	+	+	+	-	+	-	-	+	-
Harina Chingri	<i>Metapenaeus ensis</i>	DD	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ekthuto	<i>Hyporhamphus limbatus</i>	NO	+	+	-	-	+	+	+	+	+	+	-	-	-	+	-
Kakila	<i>Xenentodon cancila</i>	NO	-	+	-	-	+	-	-	-	-	+	-	-	+	-	-
Chapila	<i>Gudusia chapra</i>	NO	-	-	-	-	+	+	+	-	+	+	-	+	+	+	+
Kuchia	<i>Monopterus cuchia</i>	DD	+	+	+	+	+	+	-	+	+	-	+	+	-	+	+
Loitta	<i>Harpodon nehereus</i>	NO	+	-	+	-	-	-	-	+	-	-	-	-	-	-	-
Motka Chingri	<i>Macrobrachium villosimanusless</i>	DD	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+
Mud Crab	<i>Scylla serrata</i>	NO	+	+	+	+	-	+	+	+	-	+	+	-	-	-	-
Tular Dandi	<i>Sillaginopsis panijus</i>	NO	-	+	-	-	-	+	+	+	+	-	-	-	+	-	+
Paira Chanda	<i>Scatophagus argus</i>	DD	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-
Paissa	<i>Liza parsia</i>	NO	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
Pangas	<i>Pangasius pangasius</i>	CR	-	-	-	-	-	+	+	+	+	+	-	-	-	-	-
Tak Chanda	<i>Leiognathus equulus</i>	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pheksa	<i>Setipinna phasa</i>	NO	+	+	-	+	-	-	+	+	+	+	+	-	+	-	+
Teli Pheksa	<i>Setipinna phasa</i>	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Poma	<i>Poma poma</i>	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Potka	<i>Chelonodon patoca</i>	NO	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+
Shilong	<i>Silonia silondia</i>	EN	+	+	-	-	-	-	-	-	-	+	-	+	-	-	-
Tailla	<i>Eleutheronema tetradactylum</i>	DD	-	-	-	-	-	+	-	+	+	-	-	-	+	+	-
Tapse	<i>Polynemus paradiseus</i>	DD	-	+	+	+	+	+	+	+	+	-	+	+	+	-	-
Daitna	<i>Acanthopagrus latus</i>	DD	-	+	+	+	-	+	+	+	-	-	+	-	+	+	-
Shole	<i>Channa striatus</i>	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	+	-
Magur	<i>Clarias batrachus</i>	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Koi	<i>Anabas testudineus</i>	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vetki	<i>Lates calcarifer</i>	DD	+	+	+	+	-	+	+	-	+	-	-	-	+	-	-

D.5: 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	I	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Bagda	F	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	I	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Baila	F	0.00	86.47	13.53	0.00	0.00	0.00	0.00
	I	0.00	98.21	0.00	1.79	0.00	0.00	0.00
Bhangan	F	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	I	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Chaka Chingri	F	0.00	6.10	91.46	2.44	0.00	0.00	0.00
Chali Chingri	I	66.67	30.67	0.00	2.67	0.00	0.00	0.00
Chami Chingri	I	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Chamua Chingri	F	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Chela	F	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Chewa	F	0.00	33.94	13.76	52.29	0.00	0.00	0.00
	I	0.00	0.00	0.00	0.00	99.34	0.66	0.00
Dogra	I	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Gagla Tengra	C	0.00	0.00	0.00	0.00	0.00	100.00	0.00
	E	0.00	0.00	0.00	0.00	85.00	15.00	0.00
	F	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Goda Icha	I	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Golda	C	0.00	0.00	0.00	0.00	0.00	100.00	0.00
	E	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	F	0.00	0.00	0.00	0.00	66.67	33.33	0.00
	I	83.33	0.00	0.00	0.00	16.67	0.00	0.00
Harina	F	0.00	85.71	0.00	14.29	0.00	0.00	0.00
	I	0.00	54.55	0.00	45.45	0.00	0.00	0.00
Kain Magur	C	0.00	0.00	0.00	0.00	0.00	100.00	0.00
	E	0.00	0.00	0.00	0.00	0.00	100.00	0.00
	F	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Khoira	I	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Kumirer khil	F	0.00	23.53	47.06	29.41	0.00	0.00	0.00
Menua	F	0.00	34.78	65.22	0.00	0.00	0.00	0.00
Motka Icha	I	0.00	89.74	0.00	10.26	0.00	0.00	0.00
Mutkura	F	0.00	71.43	28.05	0.00	0.00	0.00	0.52
Paissa	F	26.67	71.11	2.22	0.00	0.00	0.00	0.00
Pheksa	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Poma	C	0.00	0.00	0.00	0.00	0.00	100.00	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
	F	0.00	67.59	32.41	0.00	0.00	0.00	0.00
	J	0.00	0.00	0.00	50.00	50.00	0.00	0.00
Potka	F	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Telguilla	F	0.00	0.00	64.29	35.71	0.00	0.00	0.00
	I	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Tepa	I	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Tiger chingri	F	0.00	88.11	11.89	0.00	0.00	0.00	0.00
	I	0.00	18.37	0.00	81.63	0.00	0.00	0.00
Tular Dandi	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Vadi chingri	F	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	I	100.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: CEGIS field survey, November 2020

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

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

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	-	-	-	-	-	-	-		-	-
	South-west of the Project	Age-1 adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
Loitta	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Akram Point	Juvenile	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	-	-	-		-	-
		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

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
		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	-	-	-	-	-	-	-	-		-	-
	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	-	-	-	-	-		-	-

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
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	-
	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		-		Feeding and Growing	-
		Age-1 adult	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		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
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	-	-	-	-	-			-	-
	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		-	-

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
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			-	-	-
	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	-	-	-	-

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	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	-	Feeding and Growing		-	-
		Adult	-	-	Feeding	Feeding	Feeding	-	Feeding	-	-		-	-
	Mongla Point	Adult	-	-	Feeding	Feeding	-	-	-	-	-		Feeding	-
	Chandpai	Juvenile and Adult	Feeding	Feeding and Growing	-	-	Feeding and Growing	-	Feeding and Growing	-	-		-	-
	Maidara	Juvenile and Adult	Feeding	Feeding and Growing	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
		Adult	-	-	Feeding	Feeding	-	Feeding	-	-	-		-	-
Paissa	Akram Point	Juvenile and Adult	Feeding	-	Feeding and Growing	Feeding	-	-	-	Feeding and Growing	-		-	Feeding
		Brood	-	-	-	-	-	-	-	-	-		-	Spawning
		Juvenile	-	-	-	-	-	-	Feeding and Growing			-	-	-
	Haldikhali	Juvenile and Adult	Feeding	-	Feeding and Growing	Feeding	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
	Harbaria	Juvenile-1 and Juvenile	-	-	Feeding	-	Feeding and Growing	-	Feeding and Growing	-	-		-	-
		Adult	-	-	-	-	-	-	-	Feeding	-		-	-

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	Breeding and Spawning	-	-	-	Nursing	-	-	-	Nursery		-	-
	Chandpai	Juvenile and Adult	-	-	Feeding and Growing	-	-	Nursery and Feeding	-	-	-		Feeding and Growing	Feeding
	Harbaria	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-			-
	Mongla Point	Fry	Breeding and Spawning	-	-	-	-	Nursery	-	-	Nursery		-	-
		Age-1 Juvenile	-	-	-	-	-	-	-Nursing, Feeding and Growing	-			-	-
		Age-1 Adult	-	-	-	-	Feeding and Growing	Feeding	-	-	Feeding and Growing		-	-
	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	-	-	-	-	-	-	-	-	-		-	-

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
	Haldikhali	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
		Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	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														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
Tapsi	Haldikhali	Juvenile and Age-1 adult	-	-	Grazing	-	-	-	-	-	-		-	-	-	-	-
		Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
		Age-1 adult and Brood fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Chalna Point	Adult	-	Feeding	-	-	Feeding	-	-	Feeding	Feeding		-	-	-	-	-
		Juvenile and Age-1 adult	Feeding	-	-	-	-	-	-	-	-		-	-	-	-	-
	Harbaria	Adult and Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-
		Juvenile	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	-	-		-	-	-	-	-
	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	-	-	-	-	-	-	-	-	-		-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	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	-	-	-	-		-	-	-	-	-
		Fry	Nursing	-	Nursing	-	-	-	-	-	-		Nursing	Nursing	-	-	-
	Mongla Point	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-
		Fry	Nursing	-	Nursing	-	-	-	-	-	-		-	-	-	-	-
	Maidara	Juvenile	-	-	-	-	-	Maturation	-	-	-	Feeding and Growing	-	-	-	-	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	-	-		-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
	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	-	-	Growing and Maturation	Maturation
	Chandpai	Fry and Juvenile	-	-	-	Nursing	-	-	-	-	-		-	-	-	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
		Juvenile	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-	-		-	-	-	-	-
		Adult		Feeding	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	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Maidara	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-
		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	-	-	-	-	-	-	-	-		-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
Chhuri	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Akram Point		-	-	-	-	-	-	-	-	-		-	-	-	-	-
Chela	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	Maturation and Feeding	-
	Harbaria	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-	Nursing and Maturation	-	-
	Chalna Point		-	-	-	Nursing and Feeding	-	-	-	-	-	Nursing and Maturation	-	Nursing and Maturation	-	-	-
	Chandpai		-	-	Feeding and Growing		-	-	-	Nursing	Nursing		-	-	Nursing and Maturation-	-	Feeding and Growing
	Mongla Point		-	Nursing	-	-	-	-	-	-	-	Nursing and Maturation	-	-	-	-	-
Gang Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Chandpai	Adult	-	-	-	-	Feeding	-	-	-	-		-	-	-	-	-
	Maidara	Fingerling	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-
	Mongla Point	Fingerling					Nursing	-	-	-	-		-	-	-	-	-
Ghagra Tengra	Chandpai	Juvenile and Age-1 adult	-	-	-	-	-	Maturation		-	-		-	-	Maturation	-	Maturation
		Brood Fish	-	-	Breeding	-	-	-	-	-	-		-	-	-	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-
	Chalna Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
	Mongla Point	Age-1 adult	-	-	-	-	-	-	Maturation and Feeding	-	Maturation and Feeding		-		-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	Feeding and Growing	-	-	-
	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	-	-	Feeding and Growing	-		-	-	Maturation	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Harbaria	Adult	Feeding	Breeding	-	-	-	-	Feeding	-		-	-	-	Maturation	-	Maturation
		Juvenile	-	-	-	-	Maturation	-	Maturation	-		-	-	-	-	-	-
	Charaputia	Juvenile and Age-1 adult	-					Maturation	-	-		Maturation	-	-	Maturation	-	Maturation
Gulsha Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Chandpai	Age-1 adult	Feeding	-	Feeding and Growing	-	-	-	-	-	-		-	-	-	-	-
		Juvenile	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-		-	-	-	-	-
	Charaputia	Juvenile	-	-	-		-	-	Feeding and Growing	-	-		-	-	-	-	-
		Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Maturation	-
	Mongla Point	Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-
		Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
	Harbaria	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-
		Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		-	Feeding and Growing		-	-
Potka	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Chalna Point	Fry	-	-	-	-	-	Nursing	-		-		-	-	-	-	-
	Chandpai	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-
		Juvenile	Feeding	-	-	-	-	-	Feeding and Growing	-	-		-	-	-	-	Feeding and Growing
		Adult	-	Feeding and Growing	Feeding	-	-	-	-	-	-		-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-
	Mongla Point	Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Maidara	Fry	-	-	-	Nursing	-	Nursing	-	Nursing	-		-	-	-	-	-
		Juvenile	-	-	-	-	-	Maturation	-	-	-		-	-	-	-	-
	Harbaria	Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Charaputia	Juvenile and adult	-	-	-	-	-	-	Feeding and Growing	-	-		-	-	-	Feeding and Growing	-
Paira Chanda	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Chewa	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Chandpai	Fry and Juvenile	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	Feeding and Growing

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
		Juvenile	-	Feeding and Growing	-	-	-	-	-	-	Feeding and Growing		-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	Nursing	-	-	-	-
	Chandpai	Juvenile-1	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	-	-	Nursing	Maturation	Maturation	-	-	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	Maturation
	Maidara	Juvenile	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	-	-
		Fry	-	-	Nursing	-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	-	-	-	Feeding	-	Feeding	-	-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	-		Maturation	-	-	-	-
Bele	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	Feeding	Maturation
	Chandpai	Fry	-	-	-	Nursing	Nursing	-	-	Nursing	-	Nursing	-	-	-	-	-
		Juvenile and Adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	Feeding and Growing-		-	-	-	Maturation and Feeding	-	-
	Jongra	Fry	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Fry	-	Nursing	-	-	Nursing	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Juvenile and Adult	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	-	-	-	-
		Fry	-	-	Nursing	Nursing	-	-	-	-			-	-	-	-	-
	Chalna Point	Fingerling	-	-	-	-	Nursing	-	-	-	-		Nursing	Nursing	-	-	-
		Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	Feeding and Growing

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
	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	-	-	-	-	-	-	-	Maturation and Feeding
Tairel	Chalna Point	Adult	-	-	-	-	-	-	Maturation	Maturation	Maturation and Feeding	-	-	-	Maturation and Feeding	-	-
	Akram Point	Adult	-	-	-	Feeding	-	-	-	-	-	-	-	-	-		-
		Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Maturation	-
	Charaputia	Juvenile	-	-	-	-	-	-	-	Maturation	-		-	-	-	-	-
	Harbaria	Age-1 Adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-	-	-	-
	Chandpai	Juvenile	-	-	-	-	-	Growing	-	-	Feeding and Growing		-	-	-	-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	Growing		-	-	-	-	-
Pheksa	Akram Point	Juvenile	-	-	-	-	-	Growing	-	-	-		-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	Feeding and Maturation	-			-	-	-	Maturation
	Chalna Point	Juvenile and Adult	-	-	-	Feeding and Growing	-	-	-	Maturation	Maturation			-	Maturation	-	-
		Adult	-	Feeding	-	-	-	-	Maturation	-	-	Feeding		-	-	-	-
	Mongla Point	Adult	-	-	-	-	-	-	Maturation	-	-		Feeding	-	-	-	-
		Juvenile	-	-	-	Growing	-	-		-	-	-	-	-	-	-	-
	Chandpai	Juvenile and Adult	-	-	-	Feeding and Growing	-	-	Maturation	--	-	-	-	-	-	-	-
	Maidara	Adult	-	Feeding	-	-	-	-	-	-	-	-	-	-	-	-	-
Paissa	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	Growing and Maturation	-	-	-	-	-	-	-	Growing and Maturation	-
		Brood	Spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Brood Fish	-	-	-	Spawning	-	-	-	-	-	-	-	-	-	-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Feeding	-
		Fry	-	-	-	-	-	-	-	-	-	-	Nursing	-	-	-	-
	Harbaria	Juvenile-1 and Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-	Feeding and Growing	-	-
		Adult	-	Feeding	-	-	-	-	-	-	-		-	-	-	-	-
	Chalna	Fry	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		Nursing	Nursing	-	Feeding	Feeding and Growing
	Chandpai	Fry	-	-	-	Nursing	-	-	Feeding and Growing	Nursing	Nursing	Nursing	Nursing	-	Feeding and Growing	Feeding	-
		Juvenile and Adult	Feeding	Feeding and Growing	-	Feeding and Growing	-	Maturation	-	-			-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing			-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
	Harbaria	Juvenile	-	-	Feeding and Growing	-	-	Maturation	-	-			-	-	Feeding and Growing	-	-
	Mongla Point	Fry	-	-	Nursing	-	-	-	-	-			-	-	-	-	-
		Age-1 Adult	-	-	-	-	-	-	-	-		Maturation	-	-	-	-	-
	Maidara	Fry, Juvenile and Age-1 adult	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-	Feeding and Growing	-	-
		Juvenile	-	-	-	-	-	Growing	-	-	-		Maturation	-	-	-	-
Banshpata	Chandpai	Juvenile	-	-	-	Growing	Feeding and Growing	-	-	-	-		-	-	-	-	-
		Adult	-	Feeding	Feeding	-	-	-	-	-	-		-	-	-	-	-
	Jongra	Juvenile	-	-	-	-	-	-	-	Maturation	-		-	-	-	-	-
	Charaputia	Juvenile and Age-1 Adult	-	-	-	Feeding	-	-	Growing and Maturation	-	-		-	-	-	Growing and Maturation	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Haldikhali	Juvenile and adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	Growing and Maturation	Growing and Maturation	-	-		-	-	Maturation	-	-
		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	-	-	-	-	-	-	-	-	-		-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose														
			13 th QM	14 th QM	15 th QM	16 th QM	17 th QM	18 th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM	27 th QM	28 th QM
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	-	-
	Chalna Point	Adult	-	-	-	-	-	Maturation	-	-	-	Feeding	-	-	-	-	-
Pangas	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-
	Charaputia	Adult	-	-	-	-	-	-	-	Feeding	-		-	-	-	-	-
	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

D.7: 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	-	-

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
Sub-total =		6.00		2.00		23		-
3	Bagda	1.38	Bagda	2.4	Bagda	1.5	-	-
	Harina Chingri	0.34	Harina Chingri	0.34	Paissa	10	-	-
	Chali Chingri	0.17	Chali Chingri	0.17	Tengra	10	-	-
	-	-	-	-	Bele	20	-	-
	-	-	-	-	Tilapia	22	-	-
	-	-	-	-	Rui	28	-	-
	-	-	-	-	Vetki	-	-	-
	-	-	-	-	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

Sampling Site	Total Catch (ton): 2015-2016							
	5th QM		6th QM		7th QM		8th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
	-	-	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
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
	-	0	-	-	-	0	-	0
Sub-total =	-	0	-	-	-	6	-	0
2	Bagda	1	-	-	Bagda	2	Bagda	0.0035
	Horina	0.14	-	-	Bele	1.6	Horina Chingri	0.288
	-	0	-	-	Chali Chingri	4	Paissa	0.22
	-	0	-	-	Horina Chingri	8	Tengra	0.305
	-	0	-	-	Paissa	0.28	Chela	0.45
	-	0	-	-	Tengra	0.8	Tilapia	0.53
	-	0	-	-	Tilapia	8	Vetki	0.06
Sub-total =	-	1.14	-	-	Vetki	2.4	Bele	0.15
3	Bagda	2	-	-	-	9	-	0
	-	0	-	-	Bagda	0.4	-	0
	-	0	-	-	Horina Chingri	0.35	-	0
	-	0	-	-	Paissa	0.06	-	0
	-	0	-	-	Tengra	0.4	-	0
Sub-total =	-	2	-	-	Tilapia	3.2	-	0
Grand-total =	-	3.14	-	-	-	4	-	2.01
					-	19	-	2.01

Source: CEGIS Field Survey, 2016-2017

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

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
							Bele	0.43	Vetki	0.01				
							Vetki	1.96						
							Tengra	4.20						
							Paissa	0.14						
							Tairel	0.003						
							Pheksa	0.001						
Sub-total =		0		14.2	-	-	=	34.38	=	2.75	=	25		
3	Bagda	0	Bagda	2	-	-	Bagda	0.50	Bagda	0.10	-	0	Bagda	-
	-	-	Paissa	8	-	-	Tilapia	1.50	Horina Chingri	0.00			Golda	-
	-	-	Tengra	2	-	-	Tengra	0.12	Paissa	0.00			Paissa	-
	-	-	Tilapia	5	-	-	Paissa	0.00	Tengra	0.00			Nilotica	-
	-	-	Rui	3	-	-	Horina Chingri	0.60	Tilapia	0.20			Khorsul	-
	-	-	Vetki	2	-	-								
	-	-	Catla	10	-	-								
Sub-total =	-	0	-	32	-	-								
Grand-total =	-	1	-	49.8	-	-	=	2.72	=	0.30	=	0		

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

	Total Catch (ton): 2019-20 and 2020-21																
Sampling Site/ Location	20 th QM		21 st QM		22 nd QM		23 rd QM		25 th QM		26 th QM		27 th 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)	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	Patari	0.2	-	-	Bagda	0.7	
	Horina	48	Harina	3.44	Harina	1.0	-	-	Harina	2.0	Tilapia	0.5	-	-	Harina	0.15	
	-	-	Tilapia	0.7	Chali	0.2	-	-	Tilapia	1.0	Paissa	0.05	-	-	-	-	
	-	-	Parse	0.17	Patari	0.3	-	-	-	-	Harina	0.2	-	-	-	-	
	-	-	-	-	Tairel	0.03	-	-	-	-	Carpu	1.0	-	-	-	-	
	-	-	-	-	Tilapia	0.5	-	-	-	-	Rui	0.05	-	-	-	-	
	-	-	-	-	Datina	0.02	-	-	-	-	Grass Carp	0.05	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	Golda	0.02	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	Bagda	0.3	-	-	-	-	
Sub-total =		80		7.0		2.8		0.02		4.2		2.37	-	-			
Kapashdanga-Muralia	Bagda	1.41	Bagda	6.74	Bagda	3.42	Harina	0.01	Bagda	4.84	Bagda	1.45	-	-	Bagda	0.04	
	Paissa	0.60	Golda	0.01	Harina	3.96	-	-	Hatina	0.92	Hatina	1.08	-	-	Hatina	0.14	
	Crab	0.00	Harina	0.65	Chali	0.38	-	-	Chali	0.20	Chali	0.30	-	-	Chali	0.03	
	Tilapia	0.30	Chali	0.04	Bele	2.11	-	-	Bele	0.27	Bele	0.19	-	-			
	Golda	0.10	Bele	0.09	Paissa	2.62	-	-	Paissa	0.04	Paissa	1.80	-	-			
	Horina Chingri	2.92	Tilapia	0.22	Tilapia	9.85	-	-	Tilapia	3.87	Tilapia	6.93	-	-			
	Chali Chingri	1.52	Tengra	0.57	Golda	0.04	-	-	Golda	0.03	Golda	0.03	-	-			
	Bele	1.35	Bhangan	0.08	Tengra	0.17	-	-	Tengra	0.01	Tengra	0.17	-	-			
	Tengra	0.27	-	-	Patari	2.25	-	-	Patari	0.11	Patari	0.25	-	-			
	Major Carp	0.55	-	-	Chemo	0.02	-	-	Datna	0.01	Catol	0.04	-	-			
	-	-	-	-	Datina	1.01	-	-	Rui	0.47	Chemo	0.32	-	-			
	-	-	-	-	Rui	1.27	-	-	Chaka	0.05			-	-			
	-	-	-	-	Chaka	0.01	-	-	-	1.56			-	-			
	-	-	-	-	Kailla	0.96	-	-	-	-			-	-			
	-	-	-	-	Nundi Bele	0.02	-	-	-	-			-	-			
	-	-	-	-	Kakra	0.49	-	-	-	-			-	-			
Sub-total =		9		8.0		29		0.01		12.38		12.57	-	-			
Chunkuri-2	Bagda	0.04	Patari	0.01	Tilapia	0.02	-	-	Paissa	0.05	Sada Chingri	0.03	-	-	Bagda	0.01	
	Paissa	0.00	Tair/Tailla	0.01	Paissa	0.066	-	-	Golda	0.03	Paissa	0.03	-	-	Harina	0.06	
	Khorsula	0.00	Bhangan	0.01	Khorsul	0.009	-	-	Kharulla	0.01	Patari	0.02	-	-	Kakra	0.01	
	Horina Chingri	0.10	Datina	0.03	Bagda	0.015	-	-	Bagda	0.10	Tengra	0.01	-	-			
	Motka	0.04	Bagda	0.02	Golda	0.006	-	-	Bele	0.03	Datina	0.02	-	-			
	Chali Chingri	0.03	Golda	0.03	Patari	0.015	-	-	Harina	0.15	Ilish	0.005	-	-			
	Chaka Chingri	0.01	Faissa	0.01	Harina	0.008	-	-	Tengra	0.02	Golda	0.01	-	-			
	Bele	0.01	Chaka Chingri	0.01	Chali	0.009	-	-	Tairu	0.03	Nilotica	0.06	-	-			
	Crab	0.03	Harina	0.02	China Punti	0.047	-	-	Chaka	0.01	Baila	0.004	-	-			

	Total Catch (ton): 2019-20 and 2020-21																
Sampling Site/ Location	20 th QM		21 st QM		22 nd QM		23 rd QM		25 th QM		26 th QM		27 th 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)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)			
	-	-	-	-	Tengra	0.008	-	-	Datina	0.02	Goda Chingri	0.001	-	-			
	-	-	-	-	Baila	0.003	-	-	-	-	Chaka Chingri	0.2	-	-			
	-	-	-	-	Datina	0.02	-	-	-	-	Harina	0.02	-	-			
											Chitra	0.004	-	-			
											Pheksa	0.01	-	-			
											Bhangan	0.004	-	-			
											Tairel	0.01	-	-			
											Golda	0.01	-	-			
											Bagda	0.02	-	-			
Sub-total =		0.24		0.15		0.46		0.00		0.44		0.25	-	-		0.008	

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

(E) Traffic Survey data

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

Date: April 04, 2021 (Sunday)

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	0	0	0	0	14	0	0	18	0
Auto Rickshaw	0.8	8	5	10	26	25	40	0	30	24
Van	0.6	40	27	40	70	99	101	7	149	94
Cycle	0.2	10	3	3	16	12	6	0	26	5
Human Howler	0.6	9	5	8	12	21	19	11	14	15
CNG	0.5	0	1	0	2	3	3	0	5	2
Private Car	1	18	6	24	41	49	90	7	48	55
Motor Cycle	0.3	90	48	41	161	199	108	4	278	85
Jeep	1	6	3	9	7	3	10	1	8	8
Pick-up	2	4	3	12	17	10	52	3	10	26
Micro	1	3	3	6	31	35	65	2	39	41
Bus	2.5	21	7	69	32	70	255	0	79	196
Light Truck	2	8	2	18	23	19	83	1	21	43

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
Medium Truck	2	2	3	10	41	60	201	2	91	185
Heavy Truck	2	13	3	31	19	17	71	9	19	56
			Total	280			1103			834

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

Date: April 02, 2021 (Friday)

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	1	10	0	9	16	0	27	43	0
Auto Rickshaw	0.8	1	0	1	6	0	5	5	0	4
Van	0.6	7	11	11	10	30	24	22	27	29
Cycle	0.2	2	2	1	3	2	1	2	4	1
Human Howler	0.6	11	9	12	14	12	15	26	20	28
CNG	0.5	0	5	3	0	9	4	1	27	14
Private Car	1	3	2	5	17	3	19	4	8	12
Motor Cycle	0.3	14	22	11	30	38	20	51	70	36
Jeep	1	1	1	2	6	2	7	4	2	5
Pick-up	2	0	1	3	8	5	25	3	5	15
Micro	1	3	2	5	8	3	11	4	9	13
Bus	2.5	4	6	24	9	6	36	7	13	48
Light Truck	2	3	3	11	7	4	21	5	8	24
Medium Truck	2	5	1	13	18	7	48	8	11	36
Heavy Truck	2	3	3	11	20	5	49	20	12	62
			Total	115			285			325


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

Date: April 03, 2021 (Saturday)

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	0	0	0	0	7	0	0	7	0	
Auto Rickshaw	0.8	1	2	2	2	3	4	0	1	1	
Van	0.6	7	11	11	14	14	16	7	13	12	
Cycle	0.2	1	1	0	1	2	1	0	2	0	
Human Howler	0.6	4	4	4	8	6	8	11	7	10	
CNG	0.5	0	0	0	0	0	0	0	0	0	
Private Car	1	3	0	3	2	2	4	7	5	12	
Motor Cycle	0.3	11	7	5	17	24	12	4	7	3	
Jeep	1	2	0	2	2	1	2	1	0	1	
Pick-up	2	1	1	5	3	3	10	3	4	14	
Micro	1	2	2	3	1	2	3	2	3	5	
Bus	2.5	0	0	0	1	1	4	0	1	3	
Light Truck	2	0	0	1	1	3	6	1	1	4	
Medium Truck	2	0	0	1	0	2	3	2	3	10	
Heavy Truck	2	12	9	43	13	17	59	9	33	84	
Total				80				130			159


(F) Monitoring Results

Air quality parameter analysis result



Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions



Memo # AECL
Project Title
Project Location

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

: 629
: 2x660 MW Maitree Super Thermal Project
: Rampal, Bagherhat

Description of Sample
Sample Collector
Sampling date
Reporting date

: Ambient Air
: Adroit Environment Consultants Ltd. (Monitoring team)
: 29th March to 10th April, 2021
: 29th April, 2021

Description of analysis


Sample Location ID	Concentration present of different parameter in ambient air							Remarks
	PM _{2.5}	PM ₁₀	SPM	SO ₂	NO _x	CO	O ₃	
AQ1	67.82	108.16	170.37	23.72	34.49	1	108	Not comply
AQ2	64.73	119.73	173.92	19.16	23.74	0.2	46	Not comply
AQ3	49.13	103.88	155.14	16.26	22.31	0	16	Complies
AQ4	48.64	83.10	139.26	14.06	21.65	0	9	Complies
AQ5	58.81	97.61	161.80	16.58	27.42	0.2	14	Not comply
AQ6	53.36	86.44	128.36	19.66	24.21	0.1	28	Complies
AQ7	62.29	103.42	154.35	13.52	19.71	0	2	Not comply
AQ8	71.20	120.38	193.61	20.64	28.35	3	63	Not comply
AQ9	65.37	129.71	180.22	18.91	30.20	0.9	91	Not comply
AQ10	46.13	82.83	133.10	16.58	18.73	0	3	Complies
AQ11	41.33	84.16	131.46	17.44	23.50	0	8	Complies
AQ12	42.62	73.29	116.73	13.10	17.18	0	2	Complies
Units	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	
Test Duration (Hours)	24	24	8	8	8	8	8	
Method of Analysis	Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob & Hochheiser	CO Meter	O ₃ Meter	
Bangladesh (DoE) Standard	65	150	200	365	100	10	157	
IFC/WB Standard	75	150	NF	125	200	NF	160	

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


1. Fine Particulate Matter (PM_{2.5}).
2. Respirable Dust Content (PM₁₀).
3. Suspended Particulate Matter (SPM).

4. Oxides of Nitrogen (NO_x).
5. Oxides of Sulfur (SO₂).
6. Carbone Mono-Oxide (CO).

Comment: Location AQ1, AQ8 & AQ9 doesn't conform to the allowable PM_{2.5} concentration.







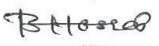
Md. Faisal Bin Mahmud
Sr. Chemist





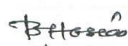
Md. Saiful Islam
Chief Operating Officer

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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: 868/ CC, DPHE, CL, Dhaka		Date: 11-04-2021				
Physical /Chemical/ Bacteriological Analysis of Water Sample						
Sample ID: CEN2021040131		Sample Receiving date: 07-02-2021				
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021		Sample Source: Surface Water				
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.		Dist: Bagerhat, Upa: Rampal				
Care Taker: CEGIS (Sample ID : SW-01)		Union:, Vill.:				
Sample Collection date: 31-01-2021		Date of Testing: 07/02/2021-08/04/2021				
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	0.0060	mg/L	AAS	0.00015
3	Calcium (Ca)	75	354	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	56	mg/L	CRM	-
5	Chloride	150-600	2180	mg/L	Titrimetric	-
6	Silica (SiO ₂)	0.0	22.4	mg/L	UVS	-
7	Bi-Carbonate (HCO ₃ ⁻)	0.0	137	mg/L	Titrimetric	-
8	Cr (Total)	0.05	0.008	mg/L	AAS	0.0003
9	Hardness	200-500	2800	mg/L	Titrimetric	-
10	Iron (Fe)	0.3-1	3.29	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.016	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	171	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	4.3	mg/L	UVS	0.10
14	Phosphate	6.0	5.3	mg/L	UVS	0.10
15	Potassium (K)	12.0	37	mg/L	AAS	-
16	Sodium (Na)	200	947	mg/L	AAS	0.34
17	Sulphate	400	270	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	3770	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	11	mg/L	Gravimetric Method	-
20	Turbidity	10	130	NTU	Turbidity Meter	-
21	Carbonate (CO ₃)	-	0.13	mg/L	Titrimetric	-
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.						
  						

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
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<u>Test Performed by:</u> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021		<u>Countersigned/Approved by:</u> 1.) Name: Mita Sarker Designation: Senior Chemist 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  11/04/2021 Md. Biplab Hossain Chief Chemist	
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Central Laboratory Mohakhali, Dhaka

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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample



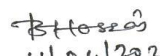
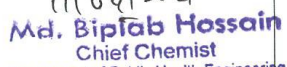
Sample ID: CEN2021040132	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-02)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

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	0.00579	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	32	mg/L	CRM	-
4	Cr (Total)	0.05	0.007	mg/L	AAS	0.0003
5	Hardness	200-500	2700	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.017	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.2	mg/L	UVS	0.10
8	Phosphate	6.0	3.5	mg/L	UVS	0.10
9	Sulphate	400	420	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4410	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: 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  11.04.2021 2.) Name: Md. Biplob Hossain Designation: Chief Chemist  11.04.2021 Md. Biplob 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: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040133	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-03)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

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	0.00081	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	20	mg/L	CRM	-
4	Cr (Total)	0.05	0.004	mg/L	AAS	0.0003
5	Hardness	200-500	2750	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.018	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.24	mg/L	UVS	0.10
8	Phosphate	6.0	3.2	mg/L	UVS	0.10
9	Sulphate	400	460	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4390	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: Md. Saiful Alam Khosru Designation: Sample Analyzer	 11.04.2021	1.) Name: Mita Sarker Designation: Senior Chemist	
2.) Name: Taslima Akhter Designation: Sample Analyzer	 11.04.2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	 11.04.2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka



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Department of Public Health Engineering
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Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com



Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040134	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-04)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021



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	0.00250	mg/L	AAS	0.00015
3	Calcium (Ca)	75	384	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	48	mg/L	CRM	-
5	Chloride	150-600	2470	mg/L	Titrimetric	-
6	Silica (SiO ₂)	0.0	12.6	mg/L	UVS	-
7	Bi-Carbonate (HCO ₃ ⁻)	0.0	132	mg/L	Titrimetric	-
8	Cr (Total)	0.05	0.005	mg/L	AAS	0.0003
9	Hardness	200-500	3000	mg/L	Titrimetric	-
10	Iron (Fe)	0.3-1	2.14	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.015	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	176	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	0.7	mg/L	UVS	0.10
14	Phosphate	6.0	2.9	mg/L	UVS	0.10
15	Potassium (K)	12.0	46	mg/L	AAS	-
16	Sodium (Na)	200	1065	mg/L	AAS	0.34
17	Sulphate	400	410	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	4150	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-
20	Turbidity	10	19	NTU	Turbidity Meter	-
21	Carbonate (CO ₃)	-	0.62	mg/L	Titrimetric	-

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

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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample



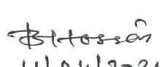
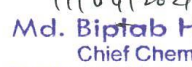
Sample ID: CEN2021040135	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-05)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021



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	0.0051	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	20	mg/L	CRM	-
4	Cr (Total)	0.05	0.003	mg/L	AAS	0.0003
5	Hardness	200-500	3100	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.017	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.1	mg/L	UVS	0.10
8	Phosphate	6.0	3.0	mg/L	UVS	0.10
9	Sulphate	400	420	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4170	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: 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  11.04.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biptab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample


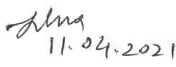
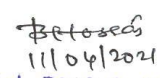
Sample ID: CEN2021040136	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-06)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

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	0.00094	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	56	mg/L	CRM	-
4	Cr (Total)	0.05	0.007	mg/L	AAS	0.0003
5	Hardness	200-500	2500	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.019	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.7	mg/L	UVS	0.10
8	Phosphate	6.0	5.4	mg/L	UVS	0.10
9	Sulphate	400	430	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4060	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: 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist 2.) Name: Md. Biplob Hossain Designation: Chief Chemist  Md. Biplob Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040137	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-07)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

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	0.00107	mg/L	AAS	0.00015
3	Calcium (Ca)	75	393	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	48	mg/L	CRM	-
5	Chloride	150-600	2450	mg/L	Titrimetric	-
6	Silica (SiO ₂)	0.0	4.2	mg/L	UVS	-
7	Bi-Carbonate (HCO ₃ ⁻)	0.0	142	mg/L	Titrimetric	-
8	Cr (Total)	0.05	0.004	mg/L	AAS	0.0003
9	Hardness	200-500	2550	mg/L	Titrimetric	-
10	Iron (Fe)	0.3-1	2.33	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.019	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	174	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	1.8	mg/L	UVS	0.10
14	Phosphate	6.0	3.0	mg/L	UVS	0.10
15	Potassium (K)	12.0	48	mg/L	AAS	-
16	Sodium (Na)	200	1060	mg/L	AAS	0.34
17	Sulphate	400	450	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	4100	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-
20	Turbidity	10	57	NTU	Turbidity Meter	-
21	Carbonate (CO ₃)	-	0.67	mg/L	Titrimetric	-

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



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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040138	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-08)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021



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	0.00318	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	56	mg/L	CRM	-
4	Cr (Total)	0.05	0.009	mg/L	AAS	0.0003
5	Hardness	200-500	3200	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.017	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.0	mg/L	UVS	0.10
8	Phosphate	6.0	2.5	mg/L	UVS	0.10
9	Sulphate	400	440	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4210	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: Md. Saiful Alam Khosru Designation: Sample Analyzer	 11.04.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 11/04/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 11.04.2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

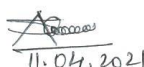
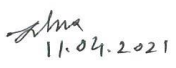
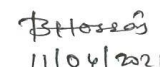
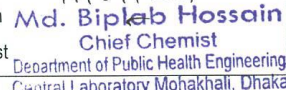
Sample ID: CEN2021040139	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-09)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021



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	0.00431	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.010	mg/L	AAS	0.0003
5	Hardness	200-500	2800	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.022	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.9	mg/L	UVS	0.10
8	Phosphate	6.0	3.2	mg/L	UVS	0.10
9	Sulphate	400	450	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4450	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: 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  11.04.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

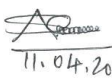

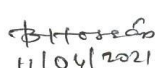
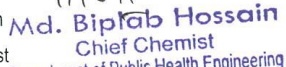
Sample ID: CEN2021040140	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-10)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021



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	0.00196	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	12	mg/L	CRM	-
4	Cr (Total)	0.05	0.008	mg/L	AAS	0.0003
5	Hardness	200-500	1400	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.019	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.0	mg/L	UVS	0.10
8	Phosphate	6.0	13.1	mg/L	UVS	0.10
9	Sulphate	400	420	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4170	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: 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  11/04/2021 2.) Name: Md. Biplob Hossain Designation: Chief Chemist  11.04.2021 Md. Biplob Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample



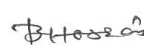
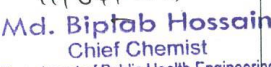
Sample ID: CEN2021040141	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-11)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

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	24	mg/L	CRM	-
4	Cr (Total)	0.05	0.002	mg/L	AAS	0.0003
5	Hardness	200-500	1200	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	4.9	mg/L	UVS	0.10
8	Phosphate	6.0	4.1	mg/L	UVS	0.10
9	Sulphate	400	190	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	2320	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: 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  11.04.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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 Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com



Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040142	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-12)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

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	0.00330	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	44	mg/L	CRM	-
4	Cr (Total)	0.05	0.007	mg/L	AAS	0.0003
5	Hardness	200-500	2850	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.015	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	0.5	mg/L	UVS	0.10
8	Phosphate	6.0	9.6	mg/L	UVS	0.10
9	Sulphate	400	260	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	3010	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: Md. Saiful Alam Khosru Designation: Sample Analyzer	 11.04.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 11.04.2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 11.04.2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	 11.04.2021 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: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040143	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-13)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021



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	0.00250	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	32	mg/L	CRM	-
4	Cr (Total)	0.05	0.010	mg/L	AAS	0.0003
5	Hardness	200-500	2870	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	0.5	mg/L	UVS	0.10
8	Phosphate	6.0	2.6	mg/L	UVS	0.10
9	Sulphate	400	410	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4060	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: Md. Saiful Alam Khosru Designation: Sample Analyzer	 11.04.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 11.04.2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 11.04.2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	 11.04.2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

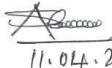

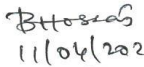

Sample ID: CEN2021040144	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-14)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

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	0.00430	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	12	mg/L	CRM	-
4	Cr (Total)	0.05	0.013	mg/L	AAS	0.0003
5	Hardness	200-500	5050	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.9	mg/L	UVS	0.10
8	Phosphate	6.0	7.1	mg/L	UVS	0.10
9	Sulphate	400	580	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	11400	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: 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  11.04.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040145	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Surface Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : SW-15)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021



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	0.00584	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	28	mg/L	CRM	-
4	Cr (Total)	0.05	0.007	mg/L	AAS	0.0003
5	Hardness	200-500	5600	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.9	mg/L	UVS	0.10
8	Phosphate	6.0	1.1	mg/L	UVS	0.10
9	Sulphate	400	1340	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	14600	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: Md. Saiful Alam Khosru Designation: Sample Analyzer	 11.04.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 11.04.2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 11.04.2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	 11.04.2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

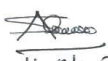

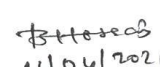

Sample ID: CEN2021040146	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Ground Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : GW-01)	Union:, Vill.:
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

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	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	160	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.048	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	2.4	mg/L	UVS	0.10
6	Phosphate	6.0	2.0	mg/L	UVS	0.10
7	Sulphate	400	1	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	200	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by: 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  11.04.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer  11.04.2021	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  11.04.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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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: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040147	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Ground Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : GW-02)	Union:, Vill.: Rajnagar
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	145	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.016	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	2.2	mg/L	UVS	0.10
6	Phosphate	6.0	1.8	mg/L	UVS	0.10
7	Sulphate	400	1	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	350	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: Md. Saiful Alam Khosru Designation: Sample Analyzer	 11.04.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 11/04/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 11.04.2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	 11/04/2021

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
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Lab Memo: 868/ CC, DPHE, CL, Dhaka

Date: 11-04-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021040148	Sample Receiving date: 07-02-2021
Ref. Memo No: 42.06.2626.119.37.001.21-0317 & Dated: 07-02-2021	Sample Source: Ground Water
Sent by: Md. Mutasim Billah, Project Leader, CEGIS, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID : GW-03)	Union:, Vill.: Karpasdanga
Sample Collection date: 31-01-2021	Date of Testing: 07/02/2021-08/04/2021





LABORATORY TEST RESULTS:



Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.049	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	130	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.056	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	4.9	mg/L	UVS	0.10
6	Phosphate	6.0	2.3	mg/L	UVS	0.10
7	Sulphate	400	7	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	610	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	5	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.


N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	 11.04.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 11/04/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 11-04-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka


	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 100		
Institute Name: Institute of National Analytical Research & Service (INARS)				
Analysis Report				
				
Analytical Service Cell Ref No: Feb2021029939 Lab ID: INS-158-162 Sample ID: A-158-162	Unit (Lab/Inst.) Ref No: A-158-162 Sample Receiving Date: 09/02/2021 Submission Date: 08 Feb 2021 Report Delivery Date: 10/03/2021			
Sample Description: Project site, Mongla port, Moidara Rivar, Harbaria, Akram point Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216 Number of Sample: 5				
Report Details:				
Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-158	Soil (Sample-1, Project site)	pH at 25.1C	6.25 (5% Solution)	4500-H ⁺ .B
		Sulphate (SO ₄)	248 mg/kg	4110.B
A-159	Soil (Sample-2, Mongla port)	pH at 25.2C	6.84 (5% Solution)	4500-H ⁺ .B
		Sulphate (SO ₄)	457 mg/kg	4110.B
A-160	Soil (Sample-3, Moidara River)	pH at 24.7C	6.86 (5% Solution)	4500-H ⁺ .B
		Sulphate (SO ₄)	692 mg/kg	4110.B
A-161	Soil (Sample-4, Harbaria)	pH at 25.1C	8.11 (5% Solution)	4500-H ⁺ .B
		Sulphate (SO ₄)	499 mg/kg	4110.B
				
<div style="display: flex; align-items: flex-start;"> <div style="width: 20px; height: 20px; border: 1px solid red; margin-right: 10px;"></div> <div> <p>Note:</p> <p>a. The results reported here pertained to the sample received in this laboratory only.</p> <p>b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.</p> <p>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.</p> <p>d. The report shall not be reproduced/published partly or fully without prior approval of the authority.</p> </div> </div>				
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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	জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"	 মুজিব শতবর্ষ 100
	বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)	

A-162	Soil (Sample-5, Akram point)	pH at 24.8C	7.84 (5% Solution)	4500-H ⁺ .B
		Sulphate (SO ₄)	1176 mg/kg	4110.B


 09.03.2021
 Analyst


 09/3/2021
 Section/Division In-Charge


 09.03.2021
 In-Charge/Director

Md. Abu Bakar Siddique
 Senior Scientific Officer
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 BCSIR, Dhaka-1205.

Muhammad Abdullah Al-Mansur
 Principal Scientific Officer
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205.

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"	 মুজিব ১০০
	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: Feb2021029939	Unit (Lab/Inst.) Ref No: A-158-162
Lab ID: INS-158-162	Sample Receiving Date: 09/02/2021
Sample ID: A-158-162	Submission Date: 08 Feb 2021
	Report Delivery Date: 10/03/2021
Sample Description: Project site, Mongla port, Moidara Rivar, Harbaria, Akram point	
Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216	
Number of Sample: 5	

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-158	Soil (Sample-1, Project site)	Arsenic (As)	6.66 mg/kg	3114.C
		Lead (Pb)	5.36 mg/kg	3111.B
		Mercury (Hg)	1.05 mg/kg	3112.B
A-159	Soil (Sample-2, Mongla port)	Arsenic (As)	8.30 mg/kg	3114.C
		Lead (Pb)	6.87 mg/kg	3111.B
		Mercury (Hg)	0.99 mg/kg	3112.B
A-160	Soil (Sample-3, Moidara River)	Arsenic (As)	7.80 mg/kg	3114.C
		Lead (Pb)	8.41 mg/kg	3111.B
		Mercury (Hg)	0.98 mg/kg	3112.B



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	জীবনের জন্য বিজ্ঞান শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন	 মুজিব ১০০ শতবর্ষ
	বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)	

A-161	Soil (Sample-4, Harbaria)	Arsenic (As)	9.35 mg/kg	3114.C
		Lead (Pb)	9.15 mg/kg	3111.B
		Mercury (Hg)	1.00 mg/kg	3112.B
A-162	Soil (Sample-5, Akram point)	Arsenic (As)	10.1 mg/kg	3114.C
		Lead (Pb)	8.12 mg/kg	3111.B
		Mercury (Hg)	2.95 mg/kg	3112.B


 ০৯.০৩.২০২১
 Analyst
Md. Abu Bakar Siddique
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 ০৯/০৩/২০২১
 Section/Division In-Charge
Muhammad Abdullah Al-Mansur
 Principal Scientific Officer
 Institute of National Analytical
 Research & Service (INARS)
 Dhaka-1205.


 ০৯.০৩.২০২১
 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

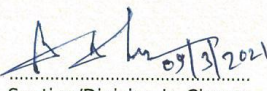
Dr. Quadrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh
 Telephone: 9671108, Fax: 88-02-9671108 E-mail: asc@bcsir.gov.bd Website: www.bcsir.gov.bd

	<p>জীবনের জন্য বিজ্ঞান</p> <p>শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন</p> <p>বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)</p> <p>BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)</p>	 <p>মুজিব শতবর্ষ 100</p>		
<p>Institute Name: Institute of National Analytical Research & Service (INARS)</p>				
<p><u>Analysis Report</u></p>				
				
<p>Analytical Service Cell Ref No: Feb2021029933</p> <p>Lab ID: INS-132-149</p> <p>Sample ID: A-132-149</p>	<p>Unit (Lab/Inst.) Ref No: A-132-149</p> <p>Sample Receiving Date: 09/02/2021</p> <p>Submission Date: 08 Feb 2021</p> <p>Report Delivery Date: 10/03/2021</p>			
<p>Sample Description: Mercury (Sample no-1,2,3,4,5,6,7,8,9,10, Shapmari, Mongla Confluence, Harbaria, Akram point, Hiron point, project site, rajnagar, kapashdanga)</p>				
<p>Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216</p>				
<p>Number of Sample: 18</p>				
<p>Report Details:</p>				
Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-132	Water (Sample-01)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-133	Water (Sample-02)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-134	Water (Sample-03)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-135	Water (Sample-04)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-136	Water (Sample-05)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-137	Water (Sample-06)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-138	Water (Sample-07)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-139	Water (Sample-08)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-140	Water (Sample-09)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
				
<p> Note:</p> <p>a. The results reported here pertained to the sample received in this laboratory only.</p> <p>b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.</p> <p>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.</p> <p>d. The report shall not be reproduced/published partly or fully without prior approval of the authority.</p>				
<p>Analytical Service Cell</p> <p>Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh</p> <p>Telephone: 9671108, Fax: 88-02-9671108 E-mail: asc@bcsir.gov.bd Website: www.bcsir.gov.bd</p>				
<p>Pages 1 of 2</p>		<p>10th of March 2021 11:35 AM</p>		

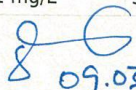
	জীবনের জন্য বিজ্ঞান শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন	
	বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)	

A-141	Water (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-142	Water, Shapmari (Sample-11)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-143	Water, Mongla Confluence (Sample-12)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-144	Water, Harbaria (Sample-13)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-145	Water, Akram Point (Sample-14)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-146	Water, Hiron Point (Sample-15)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-147	Water, Project site (Sample-16)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-148	Water, Rajnagar (Sample-17)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-149	Water, Kapashdanga (Sample-18)	Mercury (Hg)	Less than 0.001 mg/L	3112.B


 09.03.2021
 Analyst
Md. Abu Bakar Siddique
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 09.03.2021
 Section/Division In-Charge

Muhammad Abdullah Al-Mansur
 Principal Scientific Officer
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 BCSIR, Dhaka-1205.


 09.03.2021
 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


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	<p>জীবনের জন্য বিজ্ঞান</p> <p>শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন</p> <p>বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)</p>	 <p>মুজিব ১০০ শতবর্ষ</p>		
<p>Institute Name: Institute of National Analytical Research & Service (INARS)</p>				
<p><u>Analysis Report</u></p>				
				
<p>Analytical Service Cell Ref No: Feb2021029934</p>		<p>Unit (Lab/Inst.) Ref No: A-150-154</p>		
<p>Lab ID: INS-150-154</p>		<p>Sample Receiving Date: 09/02/2021</p>		
<p>Sample ID: A-150-154</p>		<p>Submission Date: 08 Feb 2021</p>		
		<p>Report Delivery Date: 10/03/2021</p>		
<p>Sample Description: Project jetty site, Mongla confluence, Harbaria, Akram point, Hiron point</p>				
<p>Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216</p>				
<p>Number of Sample: 5</p>				
<p>Report Details:</p>				
Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-150	Water (Project jetty site)	Oil & Grease	2.93 mg/L	5520.B
A-151	Water (Mongla Confluence)	Oil & Grease	Less than 2.0 mg/L	5520.B
A-152	Water (Harbaria)	Oil & Grease	Less than 2.0 mg/L	5520.B
A-153	Water (Akram point)	Oil & Grease	Less than 2.0 mg/L	5520.B
A-154	Water (Hiron point)	Oil & Grease	Less than 2.0 mg/L	5520.B
<div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p><i>Rokaia Sultana</i> 11.03.21</p> <p>Analyst</p> <p>Rokaia Sultana Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205</p> </div> <div style="text-align: center;"> <p><i>Sht.</i> 11-03-2021</p> <p>Section/Division In-Charge</p> <p>Shakila Akter Principal Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205</p> </div> <div style="text-align: center;"> <p><i>86</i> 11-03-2021</p> <p>In-Charge/Director</p> <p>Shamim Ahmed Director (In-Charge) Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205</p> </div> </div>				
<p> Note:</p> <p>a. The results reported here pertained to the sample received in this laboratory only.</p> <p>b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.</p> <p>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.</p> <p>d. The report shall not be reproduced/published partly or fully without prior approval of the authority.</p>				
<p>Analytical Service Cell</p> <p>Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh</p> <p>Telephone: 9671108, Fax: 88-02-9671108 E-mail: asc@bcsir.gov.bd Website: www.bcsir.gov.bd</p>				
<p>Pages 1 of 1</p>		<p>10th of March 2021 04:27 PM</p>		

	<p>জীবনের জন্য বিজ্ঞান</p> <p>শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন</p> <p>বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)</p>	 <p>মুজিব ১০০</p>		
<p>Institute Name: Institute of National Analytical Research & Service (INARS)</p>				
<p><u>Analysis Report</u></p>				
				
<p>Analytical Service Cell Ref No: Feb2021029936</p>		<p>Unit (Lab/Inst.) Ref No: A-155-157</p>		
<p>Lab ID: INS-155-157</p>		<p>Sample Receiving Date: 09/02/2021</p>		
<p>Sample ID: A-155-157</p>		<p>Submission Date: 08 Feb 2021</p>		
		<p>Report Delivery Date: 10/03/2021</p>		
<p>Sample Description: Jtty site, harbaria/majhar point, Hiron point</p>				
<p>Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216</p>				
<p>Number of Sample: 3</p>				
<p>Report Details:</p>				
Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-155	Water (Sample-01, Jetty site)	TOC (Total Organic Carbon)	Less than 5.0 mg/L	5310.B
		TOC (Total Organic Content)	1302 mg/L	5310.B
A-156	Water, (Sample-02, Harbaria/Majhar point)	TOC (Total Organic Carbon)	Less than 5.0 mg/L	5310.B
		TOC (Total Organic Content)	1568 mg/L	5310.B
A-157	Water (Sample-03, Hiron point)	TOC (Total Organic Carbon)	Less than 5.0 mg/L	5310.B
		TOC (Total Organic Content)	9241 mg/L	5310.B


 09.03.2021
 Analyst
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 09.03.2021
 In-Charge/Director
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Analytical Service Cell



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Pages 1 of 4

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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 MUJIB শতবর্ষ 100		
Institute Name: Institute of National Analytical Research & Service (INARS)				
Analysis Report				
				
Analytical Service Cell Ref No: Feb2021029936	Unit (Lab/Inst.) Ref No: A-155-157			
Lab ID: INS-155-157	Sample Receiving Date: 09/02/2021			
Sample ID: A-155-157	Submission Date: 08 Feb 2021			
Report Delivery Date: 10/03/2021				
Sample Description: Jtty site, harbaria/majhar 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: 3				
Report Details:				
Lab ID	Particulars of supplied sample	Parameters	Concentration (mg/L)	Test Method (APHA)
				
<div style="display: flex; align-items: flex-start;"> <div style="width: 20px; text-align: center; margin-right: 10px;">  </div> <div> Note: a. The results reported here pertained to the sample received in this laboratory only. b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date. c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory. d. The report shall not be reproduced/published partly or fully without prior approval of the authority. </div> </div>				
Analytical Service Cell Dr. Quadrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh Telephone: 9671108, Fax: 88-02-9671108 E-mail: asc@bcsir.gov.bd Website: www.bcsir.gov.bd				
Pages 2 of 4		10th of March 2021 12:48 PM		



		জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন" বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)		 মুজিব শতবর্ষ 100
A-155	Water, Poly aromatic hydrocarbon (PAH) Sample: 01, Jetty site	Acenaphthylene	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-156	Water, Poly aromatic hydrocarbon (PAH) Sample:02, Harbaria/Majhar point	Acenaphthylene	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


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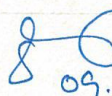
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	জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"	 মুজিব শতবর্ষ 100
	বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)	

A-157	Surface water, Poly aromatic hydrocarbon (PAH) Sample: 03, Hiron point	Acenaphthylene	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


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খুলনা বিশ্ববিদ্যালয়, খুলনা-৯২০৮
বাংলাদেশ।



Prof. Dr. Mahmood Hossain
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Results for January 2021 Samples

Site	Sub-plot	Serial no	Layer	Sample weight for Bulk density (g)	Organic carbon (%)	EC (mg/cm)	pH	Nitrogen final concentration (mg/g)	Phosphorus final concentration (mg/g)
Sutarkhal	1	1	0-15	117.9	1.79	3.62	6.64	0.992	0.39
		2	15-30	123.12	1.51	3.72	6.99	1.258	0.36
		3	30-50	131.73	1.06	5.18	7.25	1.198	0.418
		4	50-100	126.29	0.90	4.23	7.49	1.221	0.376
	2	5	0-15	111.54	2.05	2.27	7.2	0.723	0.43
		6	15-30	121.05	1.08	3.08	7.57	0.976	0.386
		7	30-50	124.67	1.14	3.03	7.48	0.968	0.384
		8	50-100	120.83	1.08	3.96	7.36	0.521	0.43
	3	9	0-15	120.84	1.25	3.26	7.3	0.912	0.42
		10	15-30	125.75	1.06	5.32	7.43	0.812	0.406
		11	30-50	121.9	1.27	6.86	7.34	0.032	0.364
		12	50-100	124.06	1.04	4.75	7.52	0.023	0.46
Karamjal	1	13	0-15	104.09	1.61	2.35	7.32	0.431	0.382
		14	15-30	110.43	1.06	3.45	7.45	0.561	0.402
		15	30-50	118.13	0.81	3.17	7.48	0.651	0.408
		16	50-100	111.45	0.85	3.94	7.28	0.821	0.374
	2	17	0-15	139.5	0.65	2.81	7.45	0.921	0.37
		18	15-30	120.2	0.48	3.34	7.68	0.612	0.498
		19	30-50	126.32	0.35	2.51	7.85	0.431	0.408
		20	50-100	125.98	0.63	3.54	7.44	0.723	0.406
	3	21	0-15	85.54	2.50	1.36	7.09	1.154	0.48
		22	15-30	99.73	2.54	1.74	7.08	0.912	0.496
		23	30-50	107.01	1.72	2.39	7.35	0.764	0.432
		24	50-100	117.41	1.61	2.54	7.16	1.022	0.446
Harbariya	1	25	0-15	126.56	1.75	2.33	6.82	1.042	0.404
		26	15-30	142.62	1.11	1.19	7.45	0.876	0.772
		27	30-50	133.28	1.17	2.37	7.8	0.876	0.412
		28	50-100	123.62	1.01	1.83	7.65	0.756	0.344
	2	29	0-15	118.6	1.36	4.28	7.15	0.761	0.46
		30	15-30	125.03	1.17	2.97	7.36	0.861	0.324
		31	30-50	122.59	1.01	2.91	7.38	0.431	0.442
		32	50-100	124.86	0.88	3.35	7.37	0.419	0.446
	3	33	0-15	130.15	1.25	3.5	7.07	0.909	0.418
		34	15-30	127.98	0.92	2.55	7.24	0.821	0.452
		35	30-50	126.78	0.70	3.83	7.38	0.729	0.416
		36	50-100	132.84	0.51	2.81	7.45	1.102	0.352
Hironpoint	1	37	0-15	113.73	0.96	2.47	7.29	0.862	0.432
		38	15-30	102.72	1.16	5.57	7.13	0.721	0.332
		39	30-50	97.71	0.64	4.62	7.31	0.821	0.374
		40	50-100	117.38	0.67	4.5	7.09	0.821	0.332
	2	41	0-15	111.56	2.11	3.07	7.22	0.412	0.336
		42	15-30	102.54	2.10	4.48	7.28	0.531	0.314
		43	30-50	102.08	1.78	5.34	7.32	0.761	0.322
		44	50-100	129.16	1.32	4.77	7.38	0.861	0.316
	3	45	0-15	105.49	1.71	5.12	7.14	0.814	0.296
		46	15-30	135.58	0.88	3.53	7.3	0.612	0.326
		47	30-50	138.52	0.64	4.27	7.31	0.762	0.352
		48	50-100	126.78	0.75	3.69	7.28	0.589	0.328
Akrampoint	1	49	0-15	129.12	1.06	3.14	7.27	0.772	0.276
		50	15-30	126.31	0.77	3.15	7.71	0.871	0.346
		51	30-50	117.64	0.92	3.27	7.69	0.461	0.318
		52	50-100	117.91	0.78	3.4	7.6	0.654	0.312
	2	53	0-15	134.88	0.71	2.89	7.57	0.392	0.33
		54	15-30	123.22	0.70	2.67	7.68	0.76	0.33
		55	30-50	122.5	0.70	2.11	7.7	0.488	0.344
		56	50-100	123.49	0.82	3.49	7.18	0.923	0.356
	3	57	0-15	109.39	0.61	2.62	7.49	0.985	0.342
		58	15-30	119.89	0.55	2.7	7.74	0.634	0.338
		59	30-50	108.23	0.44	3.28	7.71	0.794	0.426
		60	50-100	130.06	0.71	2.92	7.56	0.856	0.436

Mahmood