



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

26th Quarter Monitoring Report

Monitoring Period: August 2020 – October 2020



January 2021

26th Quarter Monitoring Report

Monitoring Period: August 2020– October 2020

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

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 26th 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, Secretary, Mr. Md. Habibur Rahman, Ministry of Power, Energy and Mineral Resources (MoPEMR) and 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. Animesh Jain, 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 Mr. Md. Mizanur Rahman, DM (F & S) and Mr. Md. Mehedi Hasan, Assistant Manager (C & M), 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.

Table of Contents

Acknowledgements	i
List of Tables	vi
List of Figures	vii
Abbreviations and Acronyms	xi
Units	xiii
Units Conversion Table	xiii
Glossary	xv
Executive Summary	xvii
1. Introduction	1
1.1 Background	1
1.2 Objectives	1
1.3 Criteria for Selection of Monitoring Sites/Locations	1
1.4 Main Stakeholders	5
1.4.1 Forest Department	5
1.4.2 Department of Environment (DoE)	5
1.4.3 Bangladesh India Friendship Power Company (Pvt.) Limited (BIFPCL)	5
1.4.4 Local Community	5
1.4.5 Major Component of Monitoring Study	6
2. Physical Environment	7
2.1 Air Quality	7
2.1.1 Methodology	7
2.1.2 Method of Sampling and Laboratory Testing	7
2.1.3 Pollution Sources in the Sundarbans	7
2.1.4 Monitoring Locations	7
2.1.5 Status of Air Quality	11
2.1.6 Findings	14
2.2 Noise Quality	15
2.2.1 Methodology	15
2.2.2 Sources of Noise in the study area	16
2.2.3 Locations of Noise Level Monitoring	16
2.2.4 Status of Noise	16
2.2.5 Findings	22

2.3	Water Quality	22
2.3.1	Methodology	22
2.3.2	Selection of Parameters	27
2.3.3	Surface Water Quality Parameters	27
2.3.4	Groundwater Quality Parameters	28
2.3.5	Sampling Procedure	28
2.3.6	Surface Water Sampling Procedure	28
2.3.7	Groundwater Sampling Procedure	28
2.3.8	Water Quality Parameter Analysis Techniques/Methods.....	28
2.3.9	Water Quality Reporting Arrangement	29
2.3.10	Status of the Groundwater quality.....	41
2.4	Land Resources Monitoring.....	46
2.4.1	Methodology	46
2.4.2	Process of Soil Samples Collection.....	51
2.4.3	Agriculture Resources Monitoring	51
2.4.4	Present cropping pattern at the monitoring plots.....	51
2.4.5	Crop Production in Monitoring Plots	53
2.4.6	Crop Damage in Monitoring Plots	53
2.4.7	Livestock Resources Monitoring	53
2.4.8	Feed/Fodder condition of Livestock Resources	53
2.4.9	Diseases of Livestock Resources	54
2.4.10	Diseases of Livestock	54
2.5	Transportation Monitoring	55
2.5.1	Location of Traffic Survey	55
2.5.2	Methodology	55
2.5.3	Traffic Volume Calculation.....	55
2.6	Results of Monitoring.....	55
2.6.1	Monitoring of Chemical Properties of Bed Materials.....	59
2.6.2	Methodology	59
2.6.3	Process of Sediment Samples Collection	59
2.6.4	Status of sediment quality of the Passur River:	60
3.	Biological Environment	65
3.1	Fisheries Resources.....	65
3.1.1	Methodology	66
3.1.2	Status of Monitoring	69

3.2	Monitoring of Ecosystem and Bio-diversity	82
3.2.1	Indicators Selection	82
3.2.2	Rationales for Selection of Locations	83
3.2.3	Terrestrial Ecosystem	83
3.2.4	Aquatic Ecosystem Monitoring	90
3.3	Sundarbans Forest Health	95
3.4	Methodology	95
3.4.1	Permanent Sample Plot (PSP) Establishment and Layout.....	95
3.4.2	Bio-Indicators for Forest Health Monitoring	96
3.4.3	Sampling Design of Permanent Sample Plots (PSPs).....	96
3.4.4	Methods	99
3.4.5	Results and Discussion	101
3.4.6	Carbon Stock in Trees	102
3.4.7	Status of forest health indicators	103
4.	Social Environment	107
4.1	Introduction	107
4.2	Methodology	107
4.3	Results of Social Safeguard Status	107
4.4	Corporate Social Responsibility (CSR)	108
5.	Environmental Compliance	115
5.1	Introduction	115
5.2	Status of Compliance to the Conditions of DoE.....	136
5.3	Compliance to the Conditions of DoE (EIA study of Coal Transportation)	149
	References	157
	Appendices.....	163
	Appendix I: Checklist of Monitoring Environmental Compliances	165
	Appendix II: Photo Album	173
	Appendix III: Terms of References (ToR)	175
	Appendix IV: Monitoring Data	181

List of Tables

Table 2.1: Air Quality Monitoring Plan	8
Table 2.2: Air Quality Monitoring Results (October, 2020)	12
Table 2.3: Noise Monitoring Plan	16
Table 2.4: Summary of the Ambient Noise Levels Recorded in Consecutive Monitoring Periods	20
Table 2.5: Surface Water Quality Monitoring Parameters, Locations and Plan	23
Table 2.6: Groundwater Quality Monitoring Parameters, Locations and Plan	27
Table 2.7: Testing Methodology of Water Quality Parameter	29
Table 2.8: Monitoring Sites and Characteristics	30
Table 2.9: Land Resources Monitoring Plan	47
Table 2.10: Vehicle conversion factors	55
Table 2.11: Calculated PCU in Three Locations at Three Different Time Period	56
Table 2.12: Location and Sediment Monitoring Plan	59
Table 2.13: Reference level of different metals in sediment of the Passur River	60
Table 2.14: Chemical properties of River Bed sediment	63
Table 3.1: The Sampling Locations for Monitoring of Fisheries Resources	65
Table 3.2: Classification of habitat use of 10 sampling sites	69
Table 3.3: Habitat Suitability Index (HSI) for selected spot in the study area	73
Table 3.4: Site Wise Species Diversity using Shannon–Weiner Index (1st to 13th QM) ..	74
Table 3.5: Site Wise Species Diversity using Shannon–Weiner Index (14th to 26th QM) ..	74
Table 3.6: Site wise Rich Species Number (1 st to 12 th QM)	75
Table 3.7: Site wise Rich Species Number (13th to 26th QM)	75
Table 3.8: Growth Rate and Mortality of Fish/Shrimp (1st to 13th QM)	80
Table 3.9: Growth Rate and Mortality of Fish/Shrimp (14th to 24th QM)	80
Table 3.10: Total Catch in Different Gears in the Sampling Sites	81
Table 3.11: Total Catch in the Sampling Sites	81
Table 3.12: Plant species composition of the sampled homesteads	85
Table 3.13: No. of unhealthy plants in studied homesteads	88
Table 3.14: Vegetation Canopy Cover in different Studied Homesteads	89
Table 3.15: Presence of migratory birds at different wetland inside the study area	90
Table 3.16: Dolphin Observation Datasheet	94
Table 3.17: General Description of Permanent Sampling Plots (PSPs)	96
Table 3.18: Diversity indices for vegetation in the Sampled PSPs	101
Table 3.19: Species Wise Total Carbon Stock (t/ha)	103

Table 3.20: Average Biomass and Carbon Stock Over Different Census Period (t/ha) .	103
Table 3.21: Phenological Behavior of Major Mangrove Species in the PSPs.....	106
Table 5.1: Monitoring of Environmental and Social Management System Action Plan Implementation	116
Table 5.2: Monitoring of Labor and Working Condition	122
Table 5.3: Monitoring of Community Health, Safety and Security	127
Table 5.4: Monitoring of Biodiversity and Sustainable Management of Living Natural Resources	133
Table 5.5: Compliance conditions of DoE (EIA study of Coal transportation)	149

List of Figures

Figure 1.1: Location Map of the Study Area	3
Figure 1.2: AOI of Environmental and Socio-economic Monitoring	4
Figure 2.1: Acquisition of Air Quality Monitoring data	8
Figure 2.2: Air Quality Monitoring Locations.....	9
Figure 2.3: Seasonal Variation of the Air Quality Parameters	14
Figure 2.4: Dendrogram of the Monitoring Stations using Euclidean Distance	14
Figure 2.5: Ambient Noise Acquisition	15
Figure 2.6: Noise Level Monitoring Locations	17
Figure 2.7: Status of Noise Level at the Monitoring Locations.....	19
Figure 2.8: Surface Water and Groundwater Quality Monitoring Locations	25
Figure 2.9: Water Sample Collection and insitu Testing of Water Parameters	28
Figure 2.9: Legend direction (left to right: 2014-2020)	32
Figure 2.10: Variations in post-monsoon pH values in different monitoring sites.....	33
Figure 2.11: Variations in post-monsoon temperature in different monitoring sites	33
Figure 2.12: Variations in post-monsoon salinity in different monitoring sites	33
Figure 2.13: Variations in post-monsoon DO in different monitoring sites	34
Figure 2.14: Legend identification (left to right: 2014-2020)	35
Figure 2.15: Variations in TDS concentrations in different monitoring sites (monsoon) .	36
Figure 2.16: Variations in TH status in different monitoring sites (monsoon).....	36
Figure 2.17: Variations in TSS concentrations in different monitoring sites (monsoon) .	36
Figure 2.18: Variations in COD concentrations in different monitoring sites (monsoon)	36
Figure 2.19: Variations in Nitrate concentrations in different monitoring sites (monsoon)	37
Figure 2.20: Variations in Sulphate concentrations in different monitoring sites (monsoon)	37

Figure 2.21: Variations in Phosphate concentrations in different monitoring sites (monsoon)	37
Figure 2.22: Variations in Arsenic concentrations in different monitoring sites (monsoon)	38
Figure 2.23: Variations in Lead concentrations in different monitoring sites (monsoon)	38
Figure 2.24: Legend direction (left to right: 2014-2020)	42
Figure 2.25: Status of pH, Temperature and DO of post-monsoon seasons of the last seven consecutive years	42
Figure 2.26: Status of TDS, TSS, TH and COD of monsoon seasons of the last seven consecutive years	43
Figure 2.27: Status of Nitrate, Sulphate, Phosphate, Arsenic and Lead of monsoon seasons of the last seven consecutive years	44
Figure 2.28: Land and Agricultural Resource Monitoring Locations	49
Figure 2.29: Soil sample collection from sampling plot	51
Figure 2.30: Present Cropping pattern in the monitoring plots	53
Figure 2.31: View of livestock at November, 2020	54
Figure 2.32: Locations of Traffic Survey	57
Figure 2.33: Sediment Sampling Locations	61
Figure 3.1: Fisheries Resources Monitoring Locations	67
Figure 3.2: Habitat classification on the basis of different life stages of fish species	71
Figure 3.3: Dendrogram showing similarity in binary species composition in three sampling sites	72
Figure 3.4: Different available observed fish species in 26 th quarter monitoring	76
Figure 3.5: Site-wise fish species richness (FSR) in the Passur River System	77
Figure 3.6: Habitat Distribution of Different Life Stages of Fish Species	78
Figure 3.7: Relative abundance of major migratory fish species in sampling sites	79
Figure 3.9: Fishing gears and crafts used in fishing at sampling sites	82
Figure 3.10: Land filling and death coconut plant at Rajnagar site	87
Figure 3.11: Occurrence of dolphin at Passur and Maidara River along the project site	92
Figure 3.12: Location of dolphin Occurrence at Dhangmari Khal	93
Figure 3.13: Location of dolphin Occurrence at Chandpai	93
Figure 3.14: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)	97
Figure 3.15: Layout of the Subplots and Transect Line Perpendicular from Ecotone (river or canal bank)	99
Figure 3.16: Layout of the Survey Activities in each Subplot	99
Figure 3.17: Species accumulation curve for the PSPs dataset	101
Figure 3.18: Rank-abundance curve for the sampled PSPs	101
Figure 3.19: Ordination graph for MDS	102

Figure 3.20: CCA ordination	102
Figure 3.21: Field activities for monitoring of Sundarbans Forest Health.....	104
Figure 3.22: Pneumatophore, Crab Hole Density, Seedling Density, canopy cover and LAI over different census period	105
Figure 4.1: Socio-Economic Environment Monitoring Location	109
Figure 4.2: Inauguration of Reverse Osmosis Water Treatment Plant for the local community.....	111

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>Kutcha:</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 26th quarterly monitoring report covers the status of EMP (Environmental Management Plan) implementation during construction stage as recommended in the EIA (Environmental Impact Assessment) study of power plant vide Memo No: DoE/Clearance/5062/2011 dt. 05/08/2013 as well as EIA report of Coal Transportation vide Memo No: DoE/Clearance/5532/2016 dtd.31/01/2018. During the month of October, 2020 CEGIS team carried out the monitoring activities covering every monitoring aspects as assigned in the ToR (Terms of Reference) and mentioned in the 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 COVID19 situation, protection of waste water dumping from labour colony to the nearby water bodies, river bank protection works, restricting groundwater extraction, hastening the green belt development, raising awareness among the workers for managing the COVID-19 outbreak, 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 found that all the measured values of the air quality parameters for all locations were well below the standard limit set by ECR' 2005. Seasonal variation of the data reflects no significant changes in the concentrations of air pollutants for the corresponding locations. Cluster analysis of the air quality data shows that, Hiron point, Akram Point and Harbaria of Sundarbans represents the locations of minimum pollution level and are away from the nuclei of Mongla industrial zone and the project area. In contrast, Chalna, Mongla Ghat, and Khan Jahan Ali Bridge in Khulna represent the area of maximum pollution as these areas are subjected to higher in population density and increased industrial activities among all sites whereas moidara shapmari, Gaurambha and Bajua represent lower in population density and moderate commercial activities with moderate pollution level. However, according to the measured values, it can be said that the present air shed is not a degraded air shed as no significant exceedances or variation has ever been recorded among the concentrations of criteria pollutants.

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.

The Passur is highly influenced by tidal effects. Tidal penetration in the Passur River depends on seasonal change, upstream flow and catchment water discharge. However, the physico-chemical properties of the Passur River changes with the tide conditions in different seasons. During this 26th quarterly monitoring (post-monsoon, 2020), physical conditions of the Passur-Sibsa River system (RS) were found fairly healthy. There were some fluctuations in the concentrations of parameters among different sites only. In addition, pH, Temperature and DO level was found quite good at the project site and in the Sundarbans Reserve Forest (SRF) area.

TSS concentration in the observed RS found compatible to national and international standards. On the contrary, during the last monsoon, TDS and TH was found quite higher in the Maidara River only. This could be runoff from adjacent project site and agricultural field. The other observation sites were found to be within normal range of concentration especially for TDS and TH. On the other hand, high COD was found in all the monitoring sites. As it is high in the SRF, this may be the effect of sediment loads and high nutrients contributed by the Bay of Bengal. Nitrate (NO_3^-) and Phosphate (PO_4^{3-}) were found in a very standard range in respect to a natural river except Phosphate in Maidara River. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and even no issues as well. Oil and grease have not become an issue as well as this parameter was consistently complying with the permissible limit of Bangladesh during the water quality monitoring of rivers.

Moreover, this concluding remark regarding the status of physical (Post-monsoon 2020), chemicals and metals (Monsoon 2020) characteristics of drinking water states that the physical characteristics of groundwater quality was still in good condition and acceptable state for drinking purpose.

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

Soil samples were collected during this monitoring and were immediately sent to SRDI, Dhaka laboratory for analysis. The result will be incorporated in next report. It was also found from the field observation that Local Aman was planted in three monitoring spots (Chankuri-2, Chakgona and Baserhula) while HYV Aman was planted in two (Baranpara and Bidyarbon). Kapalirmit was still used for fish cultivation. *Benapole* and *Chapshail* variety is used as local varieties while *BR23* and *BR30* is used as HYV variety. No major crop damage related information was recorded except small scale rat damage in Bidyarbon.

However, in course of monitoring of chemical properties of river bed materials, the observed results of the sediment samples showed that the concentration of Mercury (Hg) exceeded the average shale value and upper crust value. Other two elements (As and Pb) were found within the standard limit. Maximum concentration of Hg and Pb is found in Akram while As concentration maximized at Project site (Jetty point).

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

Monitoring of 26th quarter for fisheries resources was conducted at 13 sampling sites which were set at the inception stage. It was found that, the changes in habitat uses in every past fiscal year along with the current one (as compared to the fiscal year of 2014-2015, 2015-2016, 2017-2018, 2018-2019 and 2019-20), caused mainly due to biophysical changes of the area like tidal effect, forest erosion and vegetation coverage, seasonal variability, food availability and also fisheries management practices. Shannon-Weiner diversity index has also checked which varied between 26th quarters with that of all previous quarters. Highest Shannon-Weiner index was found at Charaputia (0.82) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at Harbaria (0.29). However, maximum FSR was obtained Maidara River (n=16), while very low FSR was recorded at Charaputia (n=4). Fries of fin fish were found dominant at Chandpai Point but juvenile to adult age group were dominant at Akram Point, Charaputia, Harbaria, Maidhara and Chalna Point. Among the fishes *Bata*, *Khorsulla*, *Goda Icha* and *Motka Icha* were found dominant in the six sampling sites. Fish species like *Bata* attain the maximum abundance among the migratory fish species as observed in the 26th quarter of monitoring year. Moreover, among migratory species, *Poma*, *Paissa*, *Gagla* and *Datina* were observed to migrate through a long distance. The present study showed the highest catch susceptibility in case of Fash Jal (5.04 kg/haul).

In course of ecological resources monitoring vegetation composition, plant diversity, vegetation canopy status, plant health, bird habitat status, dolphin occurrence in river systems were monitored for this monitoring season. A total of 54 tree species were recorded from all the monitoring sites with Shannon-Winner diversity index of 3.76. Vegetation canopy status was found improved at two sites and unchanged at one site but drastically reduced at Rajnagar

site due to land filling activities through khal by the home owner. Status of plant health also found very poor at Rajnagar site for the same reason of land filling and increase soil salinity. Except Rajnagar other three site's plant health showed improvement trends. On the contrary the occurrence of overseas migratory birds was found at only in the large shrimp farms in Kaigardaskathi but only local migratory birds were seen at the other monitoring sites. Migratory birds were facing disturbances from noise and lightings during night from the construction sites as reported by the local inhabitants. Dolphin occurrence was also recorded at Passur and Maidara River and some connected tributaries of Passur River like Shella Gang and Dhangmari Khal. The occurrence was recorded higher in Shella Gang at Chandpai and encounter rate was recorded 1.17 Individual/km/hour.

The Sundarbans forest health is being monitored quarterly as per monitoring schedule and so far and the 26th survey was conducted at five locations namely Sutarkhali, Karamjal, Harbaria, Akram point and Hiron point. From the monitoring it was found that the soil deposition rate was very high in Hiron point (almost 1.5 feet) and might be due to mortality of seedling. Sandy soil doesn't allow the keora or gewa regeneration in that point. However, Seedling percentage was found very low in Hiron point and remained in almost same condition comparing to the last tier. No significant changes were observed during the last visit at Harbaria point except the Top Dying of the complex species (Sundari). The death rate was encountered as very low in all Permanent Sampling Plots (PSPs). In addition, crab hole density was observed increasing in all PSPs. Moreover, Koromjol had great species diversity with wealth regeneration process. Among the species, the height of *Baen* and *Kakra* was good in number. The Akram point is situated at the confluence of Shibsa and Passur River.

In course of socio-economic monitoring it was found that the engagement of local labors with the progress of construction activities was increasing. It was also found that the project authority was helping the local people in more income generation activities indirectly. About 10-13 nos. of stalls (grocery and tea) and a whole sale fish market had already been developed at zero point (*where the approach road of the project started*). Local people got some income opportunities to do small business due to bazar development. Additionally, about 170 people were registered (under the motor vehicle federation) to run motor vehicles at the approach road to carry both goods and passengers and as a result the people got more income opportunities in the area.

On the other hand, the project authority was trying to maintain all safety measures for avoiding accidental cases and keeping good health of workers. The toolbox meeting is being held every day and all labors found as well known about their safety measures (use of PPE and other safety measures). The safety engineers from BHEL are providing report to the BIFPCL as observed. Labor sheds were found as clean and the workers were satisfied with adequate toilet facilities, kitchen, waste management, drainage, and drinking water and supply water facilities.

Community safety and ensuring good environment got the first priority for the BIFPCL. Noise pollution was hardly reported by the local people. Under the CSR, wheel chairs were distributed among the disabled people at the nearby villages. A newly medical center was inaugurated at the project site and medical campaigns i.e Boat medical and free medical are being run as a part of CSR activities. For ensuring access to clean water, three Reverse Osmosis Water Treatment Plant were established at Rajnagar and Gaurambha union and a total of 725 nos of people would be benefitted due to the water treatment facilities.

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

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

Monitoring of Environmental parameters and associated data collection is being continued considering the spatial as well seasonal variation. However, in October, 2020 CEGIS team has carried out the 26th quarterly monitoring activities. The current document constitutes the 26th quarterly monitoring aspects covering all the preselected monitoring parameters and locations. Besides, during this period the Hiron point of Sundarbans was not visited due to rough weather condition.

1.2 Objectives

The prime objectives of the study are:

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

1.3 Criteria for Selection of Monitoring Sites/Locations

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

- Wind speed and direction, sensitive receptors in and around the vicinity of the project site (to monitor the ambient air quality). Potential noise generation sources are also identified and selected for noise level monitoring. Similarly, sites for water quality monitoring were selected considering the water resources (Maidara and other nearer water bodies, Passur River from Chalna to Hiron Point) likely to be impacted by the project activities.

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

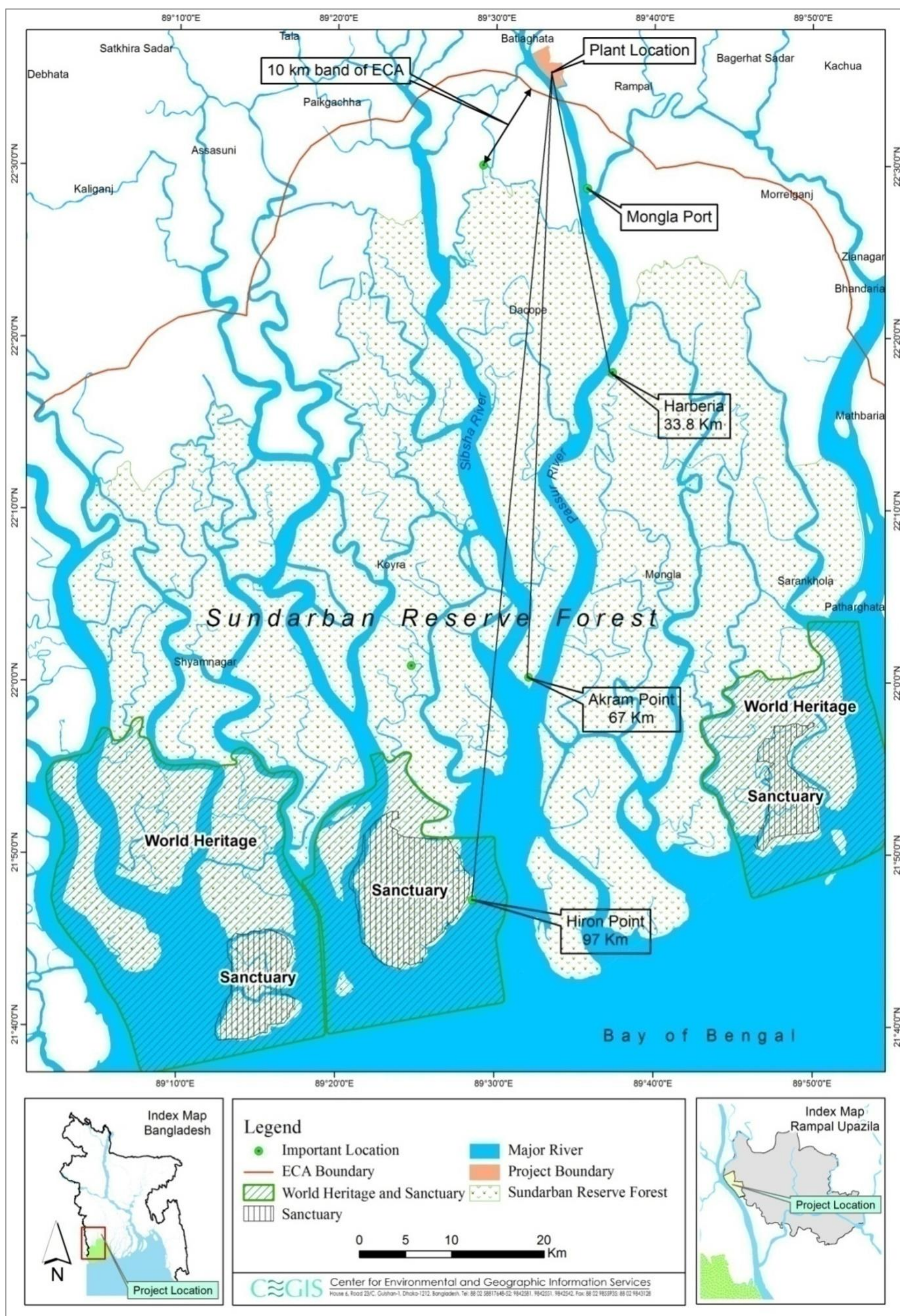


Figure 1.1: Location Map of the Study Area

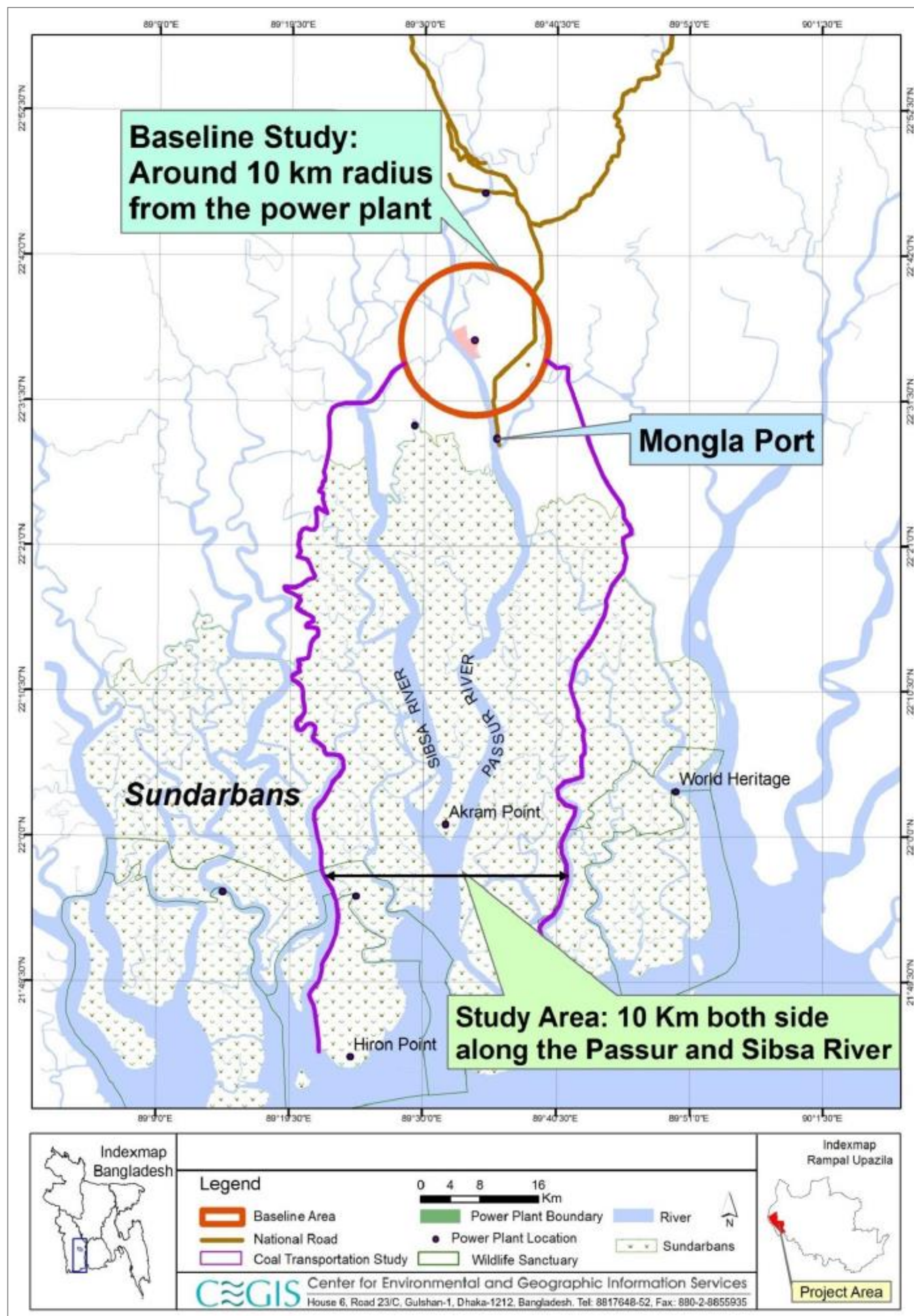


Figure 1.2: AOI of Environmental and Socio-economic Monitoring

1.4 Main Stakeholders

1.4.1 Forest Department

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

- Inclusion of a Soil Scientist and a Botanist in the monitoring team,
- Monitoring of regeneration, in growths (seedlings), diseases and pests (if necessary, to carry out laboratory analysis),
- Monitoring of soil nutrients (macro, micro) and heavy metals,
- Monitoring of floral diversity, species richness and dominance,
- 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 26th quarterly monitoring will also be forwarded to the same officials of the corresponding Departments.

1.4.2 Department of Environment (DoE)

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

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

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

1.4.4 Local Community

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

1.4.5 Major Component of Monitoring Study

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

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

2. Physical Environment

2.1 Air Quality

Air is considered as one of the major environmental components and in this connection the parameters and monitoring locations of air quality were selected considering the major effects to be exerted by the power project activities during pre-construction, construction and operation stages. However, during the recent visit, all the preselected parameters and locations were monitored at locations except at Hiron point of Sundarbans (due to rough weather condition the team could not reach) to see if any major changes occurred due to concurrent construction and supporting erection activities of the project.

2.1.1 Methodology

In general, Particulate Matters (i.e., PM_{2.5}, 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		

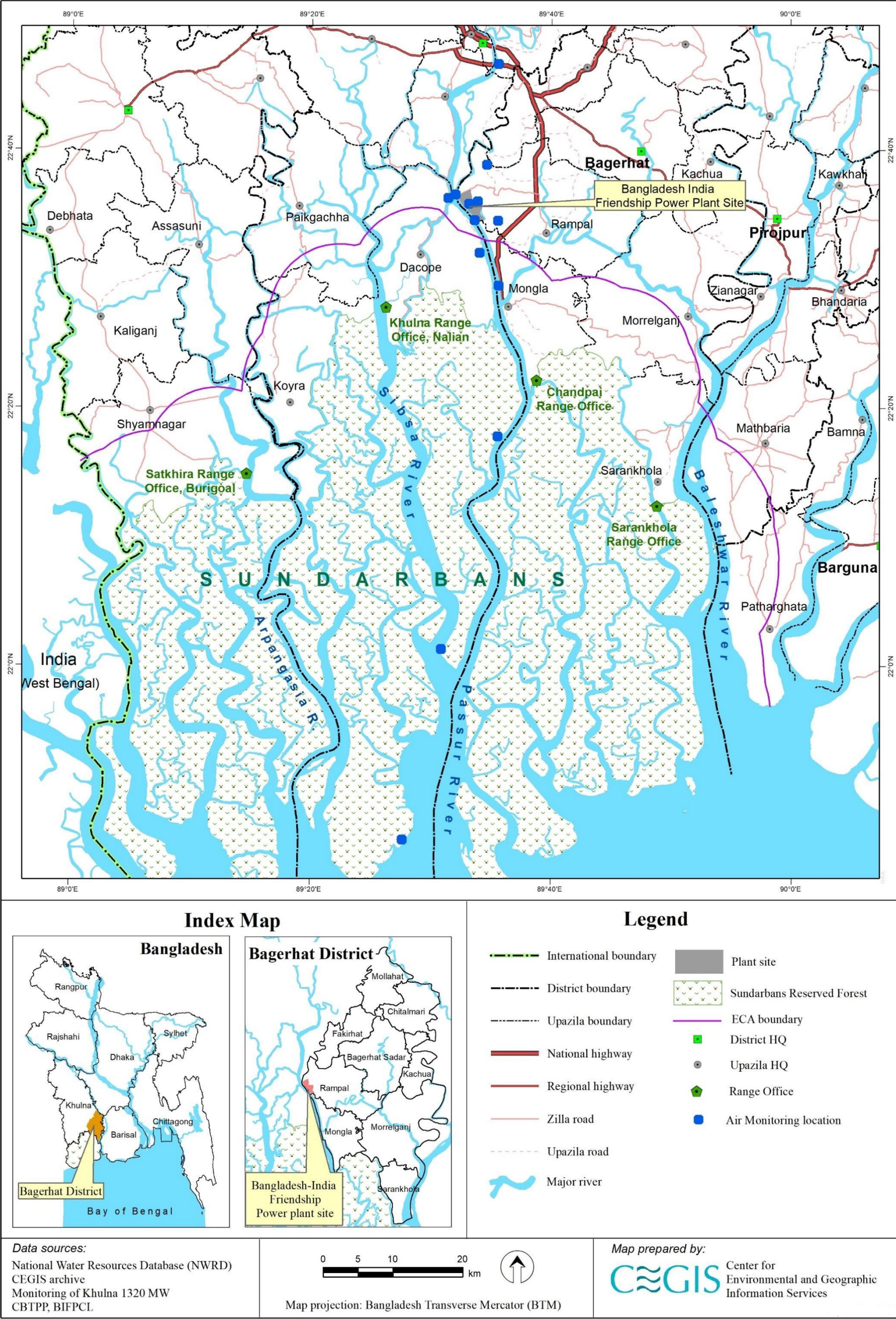


Figure 2.2: Air Quality Monitoring Locations

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 ($48.32 \mu\text{g}/\text{m}^3$) of $\text{PM}_{2.5}$ was found at Khan Jahan Ali Bridge area whereas the minimum value ($22.74 \mu\text{g}/\text{m}^3$) was recorded at Akram Point of the Sundarbans. On the other hand, PM_{10} concentration was found highest ($114.61 \mu\text{g}/\text{m}^3$) at Mongla Ghat area and lowest ($56.74 \mu\text{g}/\text{m}^3$) at Akram point which might be due to the heavy rainfall. Comparing to the standards it can easily be mentioned here that the concentration of $\text{PM}_{2.5}$ and PM_{10} were found well below the DoE limit. Likewise, the concentration of SPM was found higher at Koigardashkatir Char ($160.30 \mu\text{g}/\text{m}^3$) whereas, the minimum concentration ($80.31 \mu\text{g}/\text{m}^3$) was observed at Akram Point. The observed values of SPM were also found within the standard limit ($200 \mu\text{g}/\text{m}^3$) too.

On the other hand, the concentration of Sulphur dioxide (SO_2) in ambient air were 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 ($29.94 \mu\text{g}/\text{m}^3$) was found at Bajua area while the minimum concentration ($11.36 \mu\text{g}/\text{m}^3$) was recorded at Hiron point of the Sundarbans. Similarly, the values of NO_x were also observed well below than the Bangladesh standard value of $100 \mu\text{g}/\text{m}^3$. The maximum concentration ($20.44 \mu\text{g}/\text{m}^3$) during this monitoring period was found at Khan Jahan Ali bridge area whereas the lowest concentration ($6.64 \mu\text{g}/\text{m}^3$) was recorded at Akram Point of the Sundarbans. The contributor of such NO_x emission may be from local human hauler, car, bus and SO_2 emitted from industries like brickworks, cement works, iron and steel making industries etc.

Furthermore, the maximum value of CO ($0.7 \mu\text{g}/\text{m}^3$) was measured at Khan Jahan Ali Bridge area though the results were found much lower than the standard value ($10,000 \mu\text{g}/\text{m}^3$) set in ECR' 2005. In addition, the measured values of O_3 both in the Sundarbans Forest Area and Project area were found much lower than the Standard limit $157 \mu\text{g}/\text{m}^3$ set by DoE, BD. Maximum value ($8 \mu\text{g}/\text{m}^3$) was found at Maidara and Koigardashkatir Char area during the monitoring time. From the measured values, it can be concluded that effect of seasonal variations on the surrounding environment may be the prominent reason for increasing/decreasing of the concentrations of the criteria pollutants for the corresponding air sheds. Seasonal variations among the concentrations of the parameters are provided in **Figure 2.3** and all the monitoring results are attached in **Table A1 of Appendix IV**.

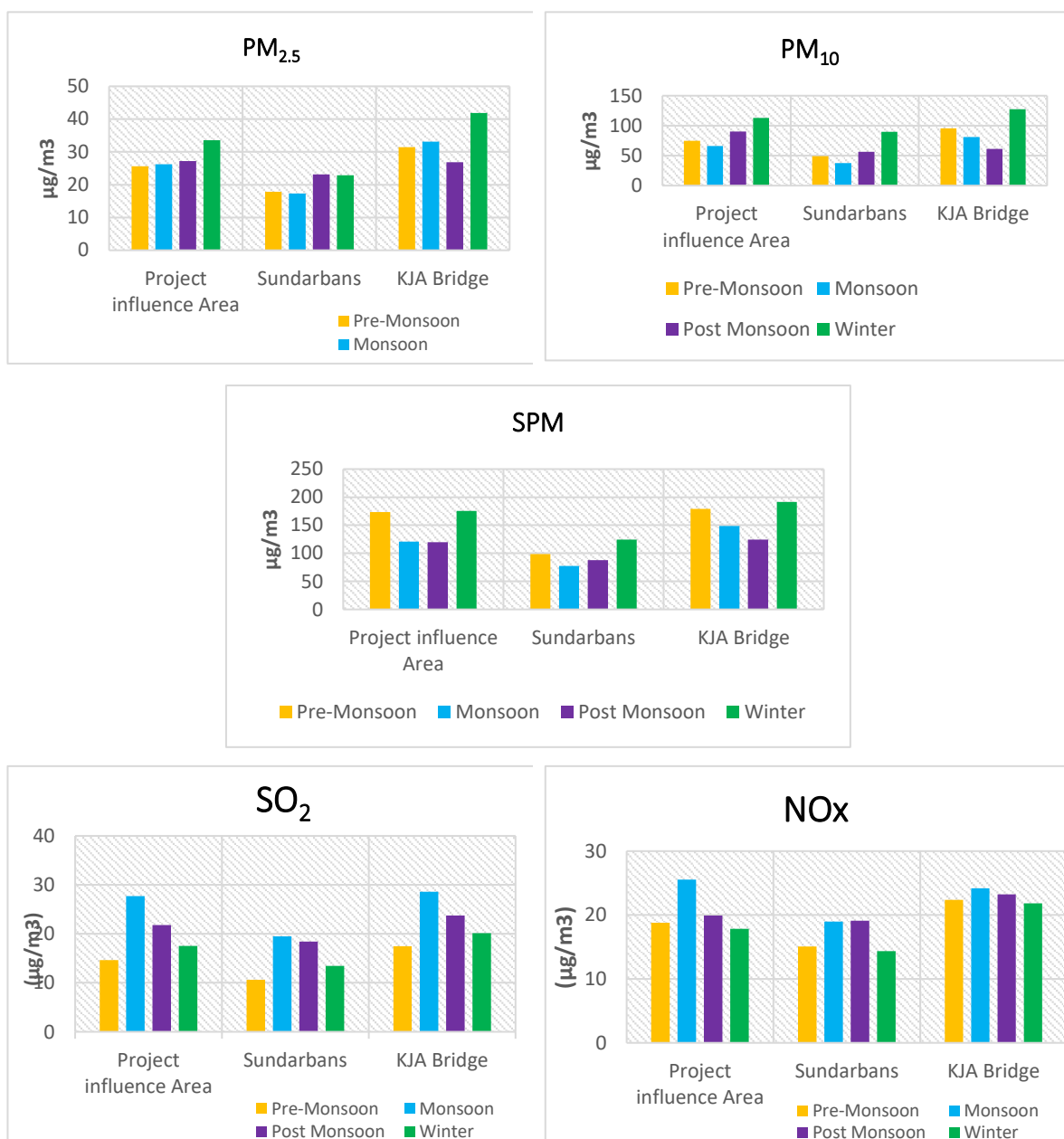
Table 2.2: Air Quality Monitoring Results (October, 2020)

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)	44.18	65	107.16	150	149.73	200	26.63	365	16.62	100	2	10	8	157
2	North-east corner of the project boundary (Sapmari)	29.17	65	84.3	150	119.22	200	14.15	365	14.18	100	0.013	10	2	157
3	North-west corner of the Project boundary (Kaigardaskati)	46.73	65	110.43	150	160.3	200	25.82	365	18.91	100	0.012	10	8	157
4	Barni, Gaurambha union (4km North East from the chimney location)	38.69	65	91.79	150	128.48	200	20.17	365	14.47	100	0	10	0	157
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	43.91	65	88.93	150	139.04	200	29.94	365	18.32	100	0	10	0	157
6	Pankhali (Chalna), Dacope, (4km North West from the Chimney location)	33.32	65	74.83	150	111.95	200	21.39	365	12.12	100	0	10	4	157
7	Mongla Port Area	40.75	65	114.61	150	152.76	200	20.06	365	9.69	100	0	10	1	157
8	Harbaria, Sundarbans	34.42	65	79.38	150	122.94	200	19.74	365	10.16	100	0	10	3	157
9	Akram point, Sundarbans	22.74	65	56.74	150	80.31	200	12.74	365	6.64	100	0	10	6	157
10	Hiron Point, Sundarbans	28.15	65	59.31	150	91.06	200	11.36	365	9.74	100	0	10	1	157
11	Khulna city near Khan Jahan Ali Bridge	48.32	65	109.63	150	157.35	200	29.58	365	20.44	100	0.7	10	0	157
12	Project site-1 (Proposed Township area)	41.29	65	97.16	150	142.36	200	21.73	365	13.36	100	0	10	0	157
13	Access road bridge area	38.72	65	93.48	150	136.66	200	18.11	365	9.92	100	0	10	2	157

Source: CEGIS field survey; STD*-Standard

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 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.

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



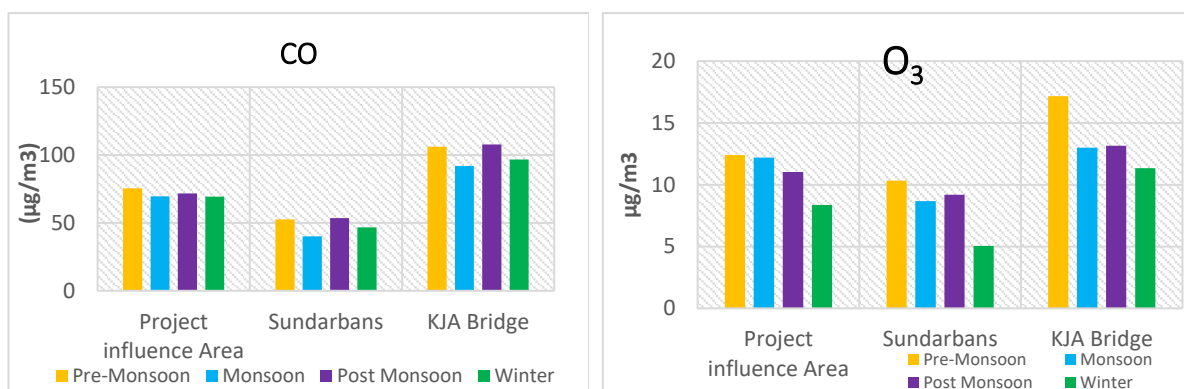


Figure 2.3: Seasonal Variation of the Air Quality Parameters

Cluster analysis was performed to identify the grouping pattern of the criteria pollutants along with their corresponding locations. Euclidean distances were observed to measure the distances among the objects using as variables (annual average concentrations of the seven studied variables for every station). According to the dendrogram (**Figure 2.4.**) Hiron point (L10), Akram Point (L9) and Harbaria (L7) represents the locations of minimum pollution level situated inside the Sundarbans Forest area and are away from the nuclei of Mongla industrial zone and the project 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**).

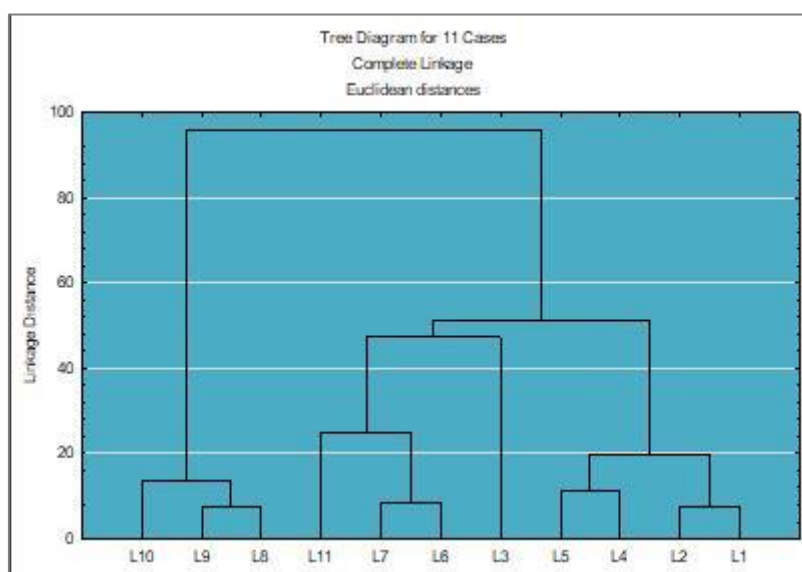


Figure 2.4: Dendrogram of the Monitoring Stations using Euclidean Distance

2.1.6 Findings

All the measured values of the parameters for all locations were found well below the standard limit set by ECR' 2005. No significant changes were observed among the concentrations of air pollutants for the corresponding locations and the corresponding periods of the same season of the previously monitored years. It can also be noted that, the concentrations of major air pollutants were found comparatively lower in the Sundarbans area than that of other monitoring locations. However, according to the measured values, it can be said that the

present air-shed is not a degraded air-shed as no significant exceedances or variation has ever been recorded among the concentrations of criteria pollutants as compared with the standards set by the DoE and IFC.

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

2.2.1 Methodology

Noise levels were measured thrice in a day (morning, afternoon and evening) at 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 (01) at Khan Jahan Ali Bridge and the remaining one (01) 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
12	Township area of power		

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 C1, C2, C3, C4, C5, C6** and **C7** respectively in the **Appendix IV**.

However, the Department of Environment of the People's Republic of Bangladesh, an agency under the Ministry of Environment and Forests has set up the standard of permissible limits of noise level at day time for different classified areas. According to Bangladesh Noise Pollution

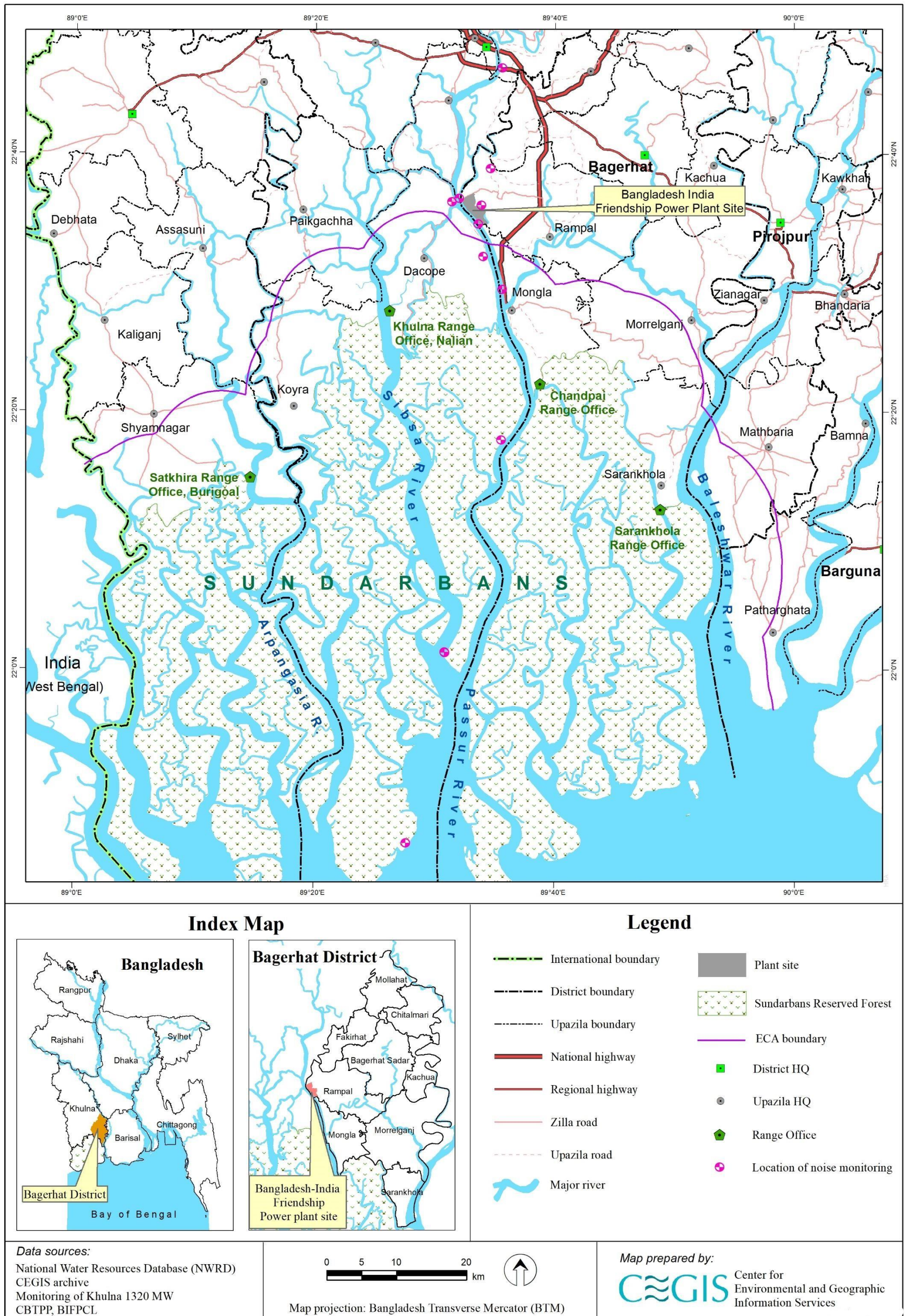


Figure 2.6: Noise Level Monitoring Locations

Control Rules (2006), the eleven monitored locations fall under different classified area like residential, commercial, mixed, silent and industrial class.

Observed noise level at *Chalna*, a commercial area located at a distance of 4 km to the north-west direction of the proposed chimney location was recorded as 58.15 dB whereas its standard level is 70 dB (**Table: 2.4**). Levels of noise at *Kaigar Daskati* (48.48 dB) situated at the Gucchha Gram, a residential area located at north-west corner of the project area; *Chunkuri-2* (45.91 dB) located at 4km south-west direction from the chimney location; *Maidara Khal* (49.18 dB), south-west corner of the project area and a residential area and; *Shapmani* (44.45 dB), proposed township area didn't cross their corresponding standard limits (55 dB) of noise level (**Table: 2.4**). The level of noise at *Barni (Gaurambha)* was found to be 58.33 dB which was 1.67 dB lower than that of standard limit (60 dB) of noise level for this location (**Table: 2.4**). *Akram Point* (42.23 dB), an ecologically silent zone was also not found to exceed the Bangladesh standard limit (50 dB) of its corresponding standard values (**Table: 2.4**).

On the other hand, observed noise levels at four locations namely *Khan Jahan Ali Bridge* (81.81 dB), a commercial zone; *Mongla Port* (76.92 dB), an industrial zone and; *Harbaria* (54.54 dB) & *Hiron Point* (50.70 dB) of Sundarbans, two more ecologically silent zones were found to exceed the Bangladesh standard limit of noise of their corresponding values (**Table: 2.4**). The standard limits of noise at day time for *Khan Jahan Ali Bridge* and *Mongla Port* are 70 dB and 75 dB respectively whereas the *Harbaria* and *Hiron point*, two ecologically critical areas have the same standard limit of noise (50 dB).

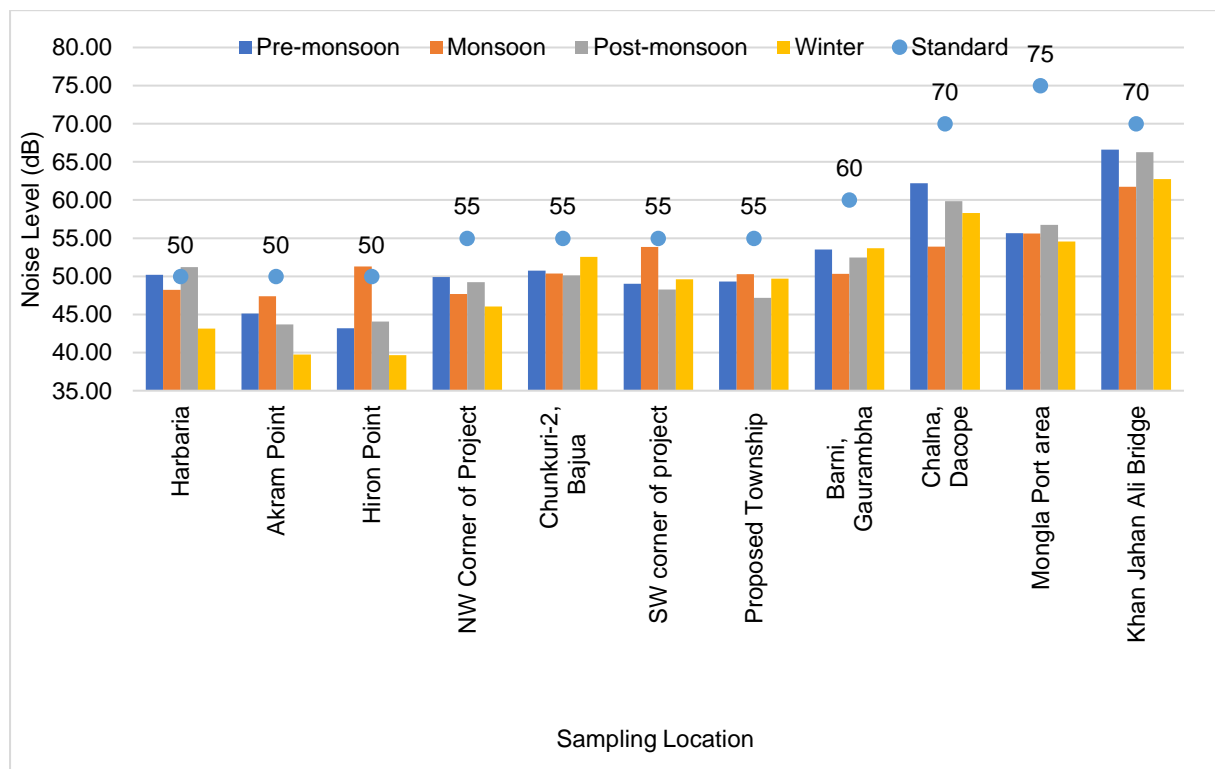


Figure 2.7: Status of Noise Level at the Monitoring Locations

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

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

Monitoring periods (Cont.)												
Sl.	Location	QM-16 (Apr-18)	QM-17 (Jul-18)	QM-18 (Nov-18)	QM-19 (Feb-19)	QM-20 (Apr-19)	QM-21 (Jul-19)	QM-22 (Nov-19)	QM-23 (Feb-20)	QM-25 (Jul-20)	QM-25 (Oct-20)	Std*
1	Chalna, Dacope	59.63	57.54	58.23	56.45	61.67	59.34	58.60	54.59	51.28	58.15	70
2	NW Corner of the Project area (Kaigar daskati)	47.90	45.63	58.82	50.75	56.85	55.18	51.11	45.42	43.37	48.48	55
3	Chunkuri-2, Bajua	52.93	47.54	48.69	50.18	51.68	59.36	55.27	55.44	48.75	45.91	55
4	SW corner of the project area (Moidara)	47.55	52.63	61.78	55.79	56.05	63.66	46.57	55.60	50.18	49.18	55
5	Proposed Township area (Shapmari)	50.81	44.25	50.68	58.13	58.83	54.53	54.88	48.95	53.72	44.45	55
6	Barni, Gaurambha	56.14	45.52	53.03	52.57	53.18	54.67	50.53	61.97	48.80	58.33	60

Monitoring periods (Cont.)												
Sl.	Location	QM-16 (Apr-18)	QM-17 (Jul-18)	QM-18 (Nov-18)	QM-19 (Feb-19)	QM-20 (Apr-19)	QM-21 (Jul-19)	QM-22 (Nov-19)	QM-23 (Feb-20)	QM-25 (Jul-20)	QM-25 (Oct-20)	Std*
7	Khan Jahan Ali Bridge, Khulna	64.87	63.36	62.15	66.93	66.95	63.46	66.05	62.20	66.31	81.81	70
8	Mongla Port area	62.95	60.97	55.97	66.18	63.99	62.01	57.25	61.06	64.41	76.92	75
9	Harbaria, Sundarbans	47.93	50.28	48.80	49.67	48.43	44.90	44.10	43.94	49.97	54.54	50
10	Akram Point, Sundarbans	45.39	45.20	41.00	46.45	42.33	44.84	44.86	36.59	51.04	42.23	50
11	Hiron Point, Sundarbans	NM	NM	39.4	39.21	NM	NM	40.28	40.34	NM	50.70	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

This section presents an updated water quality status of the Passur-Sibsa River system and adjacent waterbodies. Both national and international guidelines were followed to assess the water quality status during monitoring. This report includes results and corresponding analysis of selected water quality parameters of samples collected during 26th quarterly monitoring (October 2020) and the tested results obtained from the laboratory up to July, 2020 (25th quarterly monitoring). Due to the COVID-19 Pandemic, the 24th Compliance Monitoring Program was postponed. Several identical sites were selected to observe the quality of water those are potentially used by community, aquatic life, industries and eco-elements of the Sundarbans Reserve Forest ecosystem.

2.3.1 Methodology

The method followed for water quality monitoring covers selection of water quality parameters, identification of sampling locations, determination of sampling frequency and evaluation criteria of the monitoring parameters etc. The statuses of the surface and groundwater quality in and around the project site and the Sundarbans area were examined following standard methods of monitoring. The monitoring results have been presented graphically and checked if there is any exceedance from the national standards (ECR, 1997 and all available amendments).

Samples were collected from 18 pre-selected locations [15 locations for surface water in the Passur, Sibsa, Maidara River, near the proposed township area, and three (03) locations for groundwater across the study area] as shown in **Figure 2.8**. The details of the monitoring plan covering sampling locations, geographical locations, frequency and analysis techniques of sampling for surface and groundwater are given in **Table 2.5** and **Table 2.6** respectively.

Table 2.5: Surface Water Quality Monitoring Parameters, Locations and Plan

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

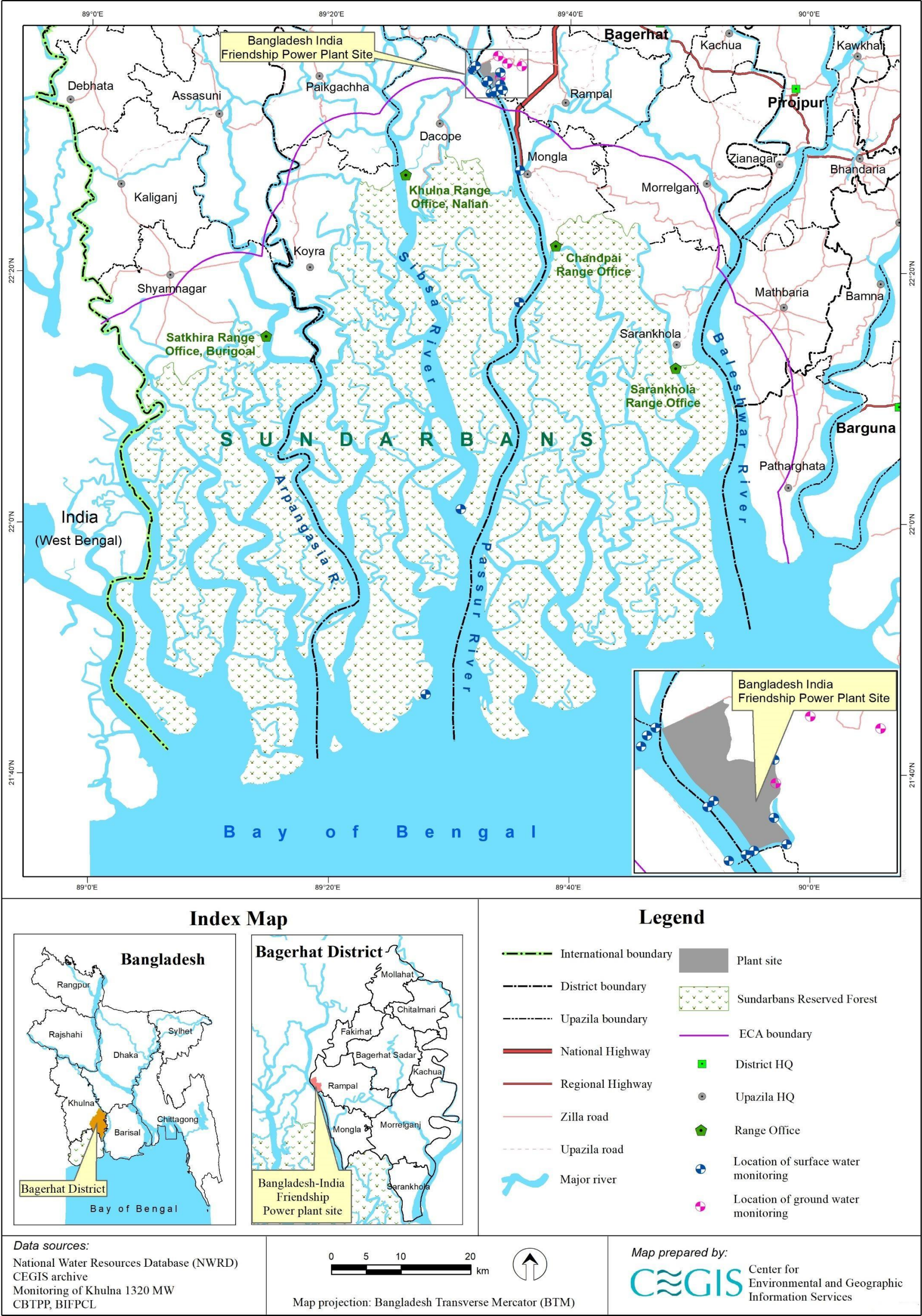


Figure 2.8: Surface Water and Groundwater Quality Monitoring Locations

Table 2.6: Groundwater Quality Monitoring Parameters, Locations and Plan

SI 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		

2.3.2 Selection of Parameters

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

2.3.3 Surface Water Quality Parameters

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

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

However, some additional parameters i.e., PAH (Polycyclic Aromatic Hydrocarbons), TOC (Total Organic Carbon) and TC (Total Carbon) were included in the monitoring study as per recommendation of the DoE approved coal transportation study monitoring framework. 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

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

2.3.6 Surface Water Sampling Procedure

The study area is highly influenced by tidal variation. Hence, temporal and spatial variations of tides were considered in sampling procedure. Surface water samples were collected at a distance of 30-50m away from the riverbank and at a depth of 6 cm below the water surface during low tides or relative slag period after the low tide for all parameters except oil and grease. The non-acidified sampling bottles were rinsed with respective water samples before sampling. Acidified sampling bottles were used for heavy metal (As, Pb, Hg) sample collection. All samples were preserved as per standard procedure (**Figure 2.9**).



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

2.3.7 Groundwater Sampling Procedure

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

2.3.8 Water Quality Parameter Analysis Techniques/Methods

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

Table 2.7: Testing Methodology of Water Quality Parameter

Parameters	Methods/Measuring Tools	Unit	BD Standard (ECR 1997)
Temperature	Horiba U-50 multimeter	°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 project area and the Sundarbans forests are being observed since April 2014. In this 26th quarterly water quality monitoring report, yearly variations of monsoon (July, 2020) for chemical water quality statuses and yearly variations in Post-monsoon (October 2020) 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)	Project site & adjacent areas	In this monitoring site, total 11 sampling points have been averaged to represent the water quality status of project site and its adjacent surface water bodies. These 11 sampling points are situated in the same river system and located within 1 km radius of the project area. In addition, previous monitoring results were obtained from characteristically same sites. Therefore, this study makes the clusters to represent the water quality status of the areas in a more explainable and understandable way.
(b)	Mongla-Passur confluence	This monitoring site comprises with an individual monitoring point situated at least 13 km downstream of the project site. This point is a confluence of the Passur river and the Mongla-Ghasiakhali Channel. The terrestrial ecosystem is mostly dominated by agricultural lands followed by rural settlements.
(c)	Harbaria	Harbaria site comprises with an individual monitoring point situated around 15 km downstream of the Mongla-Passur confluence. This site is surrounded by the Sundarbans Forest. Huge activities of mother vessel unloading and loading of lighterage vessel and their movements for transporting clinker, coal and LPG gas are held in this place. This point has tidal influence.
(d)	Akram point	Akram Point is an individual point, which is, located around 35 km downstream of the Harbaria point. This site is situated on the bank of the Sibsa river before meeting with the Passur river at Sibsa point. This site is completely dominated by deep forest ecosystems. This point has tidal influence.
(e)	Hiron Point	Hiron Point is the furthest point of this surface water-monitoring scheme. This point is at 25 km downstream of the Akram point. Deep forests and marine habitats are the main characteristics of the site. This site is completely exposed to Bay of Bengal. This site is also an individual monitoring point.

Status of Surface Water Quality

In-situ tested parameters

The in-situ tested results obtained up to 26th monitoring period (October 2020: Post-monsoon Season) are described below:

pH

The Twenty Sixth (26th) water quarterly monitoring was conducted in post-monsoon in the month of October 2020. The monitoring result revealed that, pH values ranges from 6.1 and 7.1. The lowest pH value was found at Harbaria whilst highest was at Middle of Passur River at 100m u/s of North West corner from the Project and Passur river at Mongla-Passur confluence. The last monitoring season showed consistency to all the other post-monsoon monitoring seasons (**Table B.1: Appendix-IV**).

Altogether, pH value was 6.8 near the power plant areas and 6.6 inside the Sundarbans. However, until now, pH value did not violate the ECR' 1997 Standard yet (6.5-8.5 inland water; *SCHEDULE-3* and 6-9 for project waste disposal; *SCHEDULE-10*).

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

Fluctuations in pH values during different seasons of the year can be attributed to factors like; removal of 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 2.10** and the observed dataset are attached in **Table B.1 of Appendix- IV**.

Temperature

Comparatively low surface water temperature was recorded in the last monitoring season (post-monsoon) than the other monitoring period in all the observed sites (**Figure 2.11**). All the points of South West corner from the project boundary and Maidara river showed the lowest temperature (28°C) while high temperature was observed at the Akram point and Hiron point (29°C). According to the ECR, 1997; 30°C water temperature is still be tolerable by the aquatic organisms in tropical environment. High saline prone areas (deep mangrove forest including Hiron Point) may increase the temperature a bit due to its high electrical conductivity comes from various ions of salts (Salt of Na, K, I, Mg etc.). It can be concluded that, construction works does not influence water temperature until to date.

The surface water temperature largely depends on daily weather condition (Bartram J et al., 1996). According to the seasonal weather pattern of Bangladesh the temperature drops to a minimum level during winter, which is also applicable for the water temperature and thus it differs largely than the other season's temperatures.

The measured temperature in the selected sites during the quarterly monitoring programs of first, second, third, fourth, fifth, sixth and seventh year are presented in **Figure 2.11** and all the observed dataset are attached in **Table B.2 of Appendix- IV**.

Salinity

The observed salinity concentration ranged between 0.1ppt and 2.6ppt during the post-monsoon period. However, there was found minor spatial variations in salinity concentration adjacent to the power plant areas. The maximum salinity was observed at Hiron Point in the Sundarbans. The highest salinity at the Hiron point was because of complete seawater influence. Besides, in all the sampling locations close to the project site the salinity range was found 0.1-0.2ppt. During this monitoring period, salinity concentration was supposed to be the lowest (0.0ppt) near the project site based on the previous post-monsoon season (2017)

salinity records. But, at the last three consecutive post-monsoons (2018-2020), the salinity increased a bit even near about the project boundary (**Table B.3 of Appendix- IV**).

In the observed river system, the highest salinity was observed in pre-monsoon season followed by winter season. Freshwater unavailability from upstream and the dominated tidal factors are the main reason of high salinity concentration in pre-monsoon and winter. The water salinity data in the selected sampling stations of Passur-Sibsa RS of the 26th consecutive monitoring periods are presented in **Figure: 2.12** and all the observed dataset are attached in **Table B.3 of Appendix- IV**.

Dissolved Oxygen

Oxygen level in running water varies a lot. Fluctuation of DO even occurs within the tidal effect of low tide and high tide. And also, river in Bangladesh that receives both freshwater and sea water changes the DO level abruptly. In addition to that, seasonal variation is also visible in the observed RS. In the last post-monsoon, dissolved oxygen level in water body was found to be almost same range comparing with previous same seasons (**Figure 2.13**). The power plant monitoring sites showed the DO level of 8.4 in an average while inside the Sundarbans it was found around 7.2 mg/L. In case of surface water standard, DO limit must not be dropped than 5.0mg/L at any cost. Lower DO than the standard limit (ECR' 1997) will first harm the aquatic organisms (plankton) and then the fish community.

In case of seasonal variations, maximum concentrations were observed during monsoon and post monsoon season. Higher DO level in monsoon and post-monsoon season, were for heavy rainfall and freshwater availability. During winter, salinity affects the temperature and then water temperature affects the holding capacity of DO in water. However, 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: 2.13** and all the observed dataset are attached in **Table B.4 of Appendix- IV**.

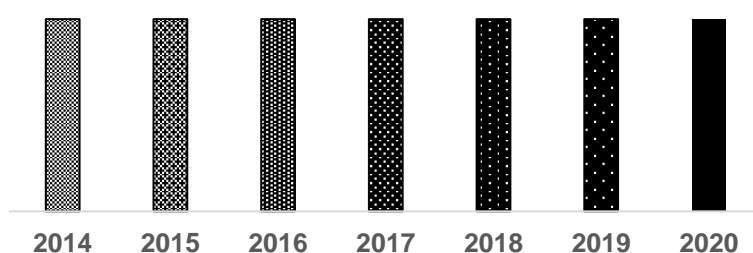


Figure 2.9: Legend direction (left to right: 2014-2020)

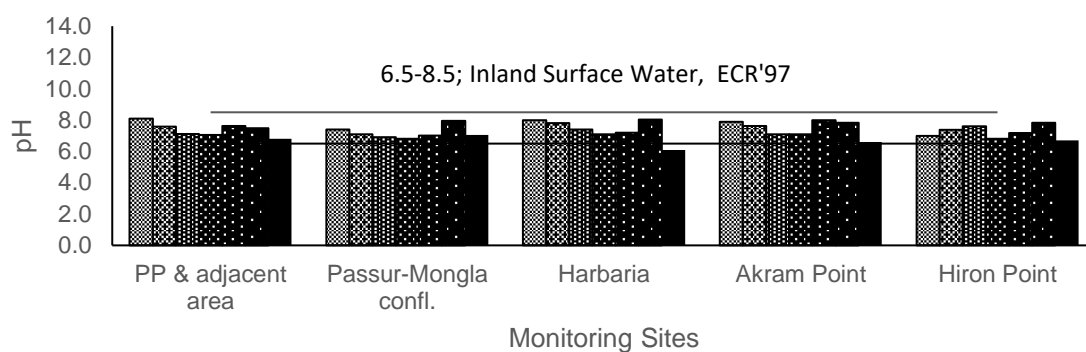


Figure 2.10: Variations in post-monsoon pH values in different monitoring sites

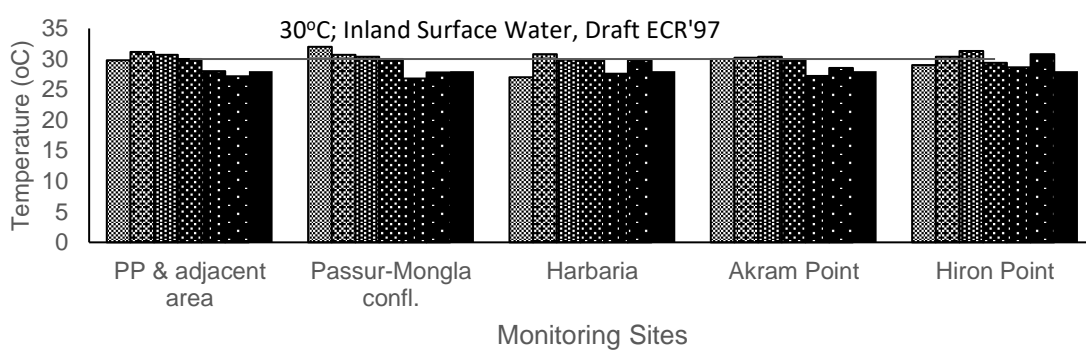


Figure 2.11: Variations in post-monsoon temperature in different monitoring sites

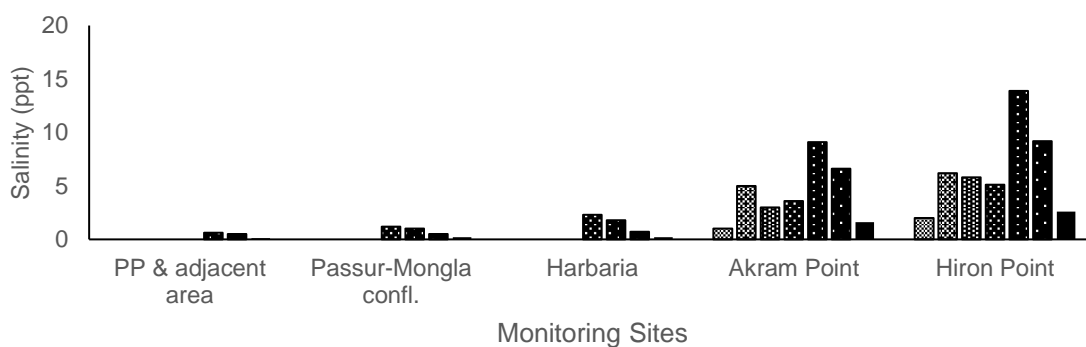


Figure 2.12: Variations in post-monsoon salinity in different monitoring sites

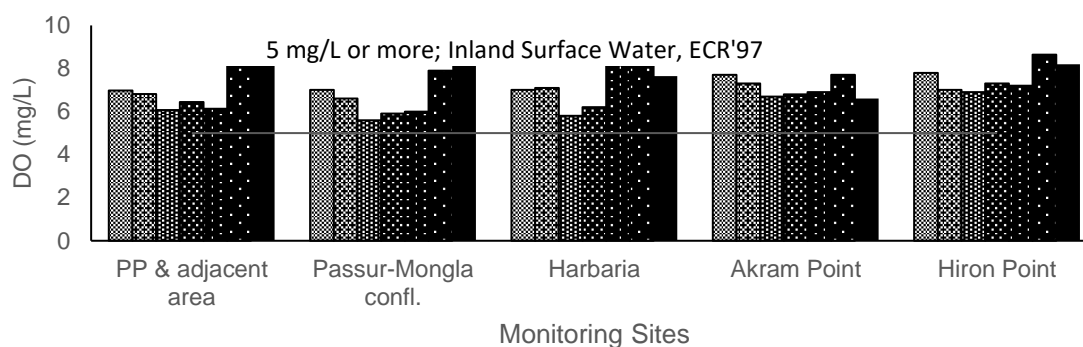


Figure 2.13: Variations in post-monsoon DO in different monitoring sites

Laboratory tested parameters

The laboratory tested results obtained up to 25th monitoring period (July 2020: monsoon season) are described below:

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

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

During the last monsoon period, the TDS values were found to range between 114 mg/L to 4,188 mg/L, which was almost same as all other previous monsoon seasons in the power point adjacent areas (**Figure 2.15**) except the Sundarbans sites. For instance, TDS in power plant and adjacent areas (400 mg/L) are comparatively less than the deep Sundarbans Forests (1,806 mg/L). 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 less than 200 mg/L in most of the cases excluding the deep forests. Regarding spatial variation, the more it is downstream of this RS, the higher the TDS concentrations due to tidal influence of the Bay of Bengal that contains huge of salts and other nutrients.

In the Passur-Sibsa RS, TDS has both spatial and temporal variations. In pre-monsoon and winter, TDS is usually high because of low rainfall and tidal effects. Therefore, in monsoon and post monsoon, the TDS concentration falls down to less than 200 mg/L in most of the cases excluding the SRF. Regarding spatial variation, TDS concentration was observed in increasing level as progressing towards downstream of this RS. This is happened due to tidal influence of the Bay of Bengal that contains lots of salts and other nutrients.

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

In the last monsoon, TH showed same pattern of concentrations (200-300 mg/L) found in the Power point adjacent areas and the Sundarbans areas (800-1,000 mg/L) from 2014-2018. In 2019 monsoon, the concentrations were found higher in both the upstream (around 2,000 mg/L) and downstream (2,500 mg/L) areas of the Passur-Sibsa river system which was due to the low rainfall of that season. Usually in rainy season, TH is supposed to be lower in concentrations. In the power point adjacent areas, for the last monsoon (2020) the hardness is in the acceptable limit of the ECR'97. In the deep Sundarbans hardness always found to be comparatively higher than the standard value of surface water.

Generally, water hardness is found to be higher in monsoon season but in Passur River, it is found to be higher in pre-monsoon season due to the saline water intrusion toward upstream (Rahman et al., 2013).

Total Suspended Solids (TSSs) include solid materials of organic and inorganic in origins, which are normally suspended in water. In the Passur-Sibsa RS, the suspended matters generally contain sand, clay, silt and loam.

TSS concentrations among the monitoring sites varied from 5 mg/L to 18 mg/L observed in the last monitoring results. TSS values in every spot recorded during the last monsoon period found to be within the permissible limit of 150 mg/L (ECR, 1997). At 2014, TSS reached more than 150 mg/L at Mongla-Passur Confluence due to the oil spillage incident occurred at 9th December 2014. After that, the issue was not found any more, and the water bodies reinstated its properties naturally. Above all, in the Passur-Sibsa RS, TSS showed consistency in the concentrations of suspended matters.

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

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

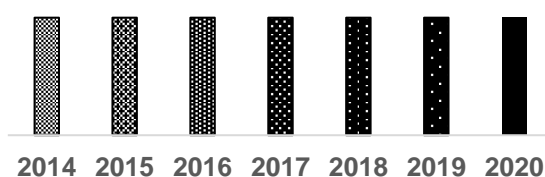


Figure 2.14: Legend identification (left to right: 2014-2020)

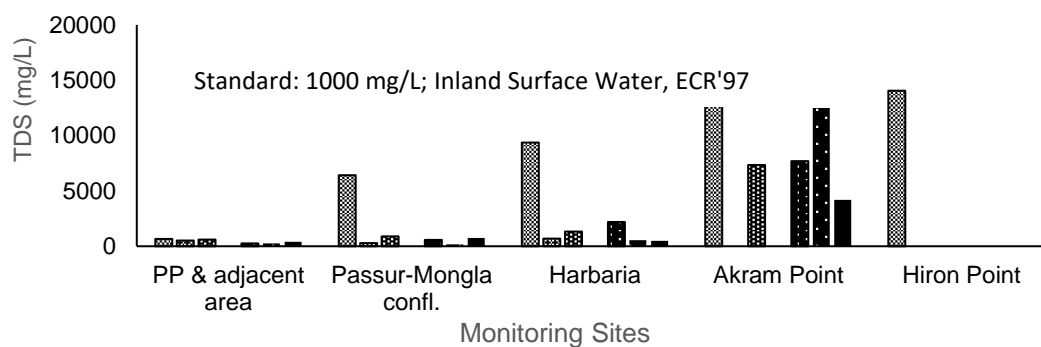


Figure 2.15: Variations in TDS concentrations in different monitoring sites (monsoon)

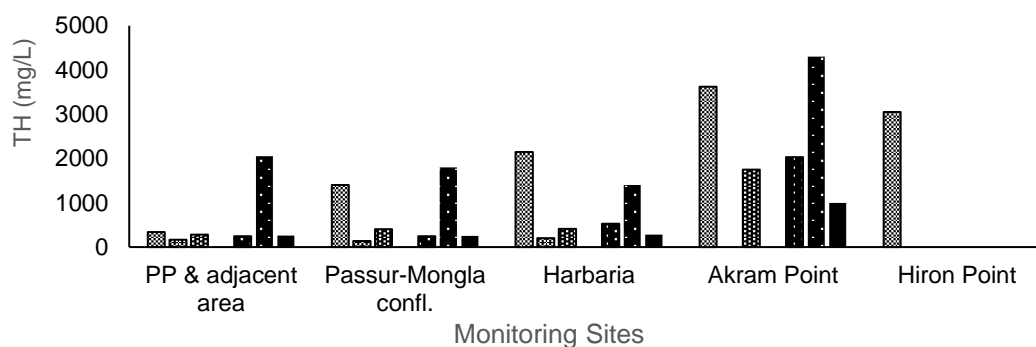


Figure 2.16: Variations in TH status in different monitoring sites (monsoon)

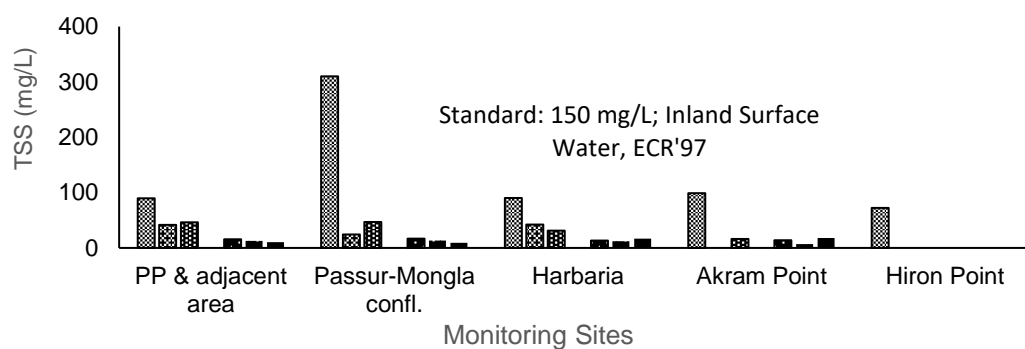


Figure 2.17: Variations in TSS concentrations in different monitoring sites (monsoon)

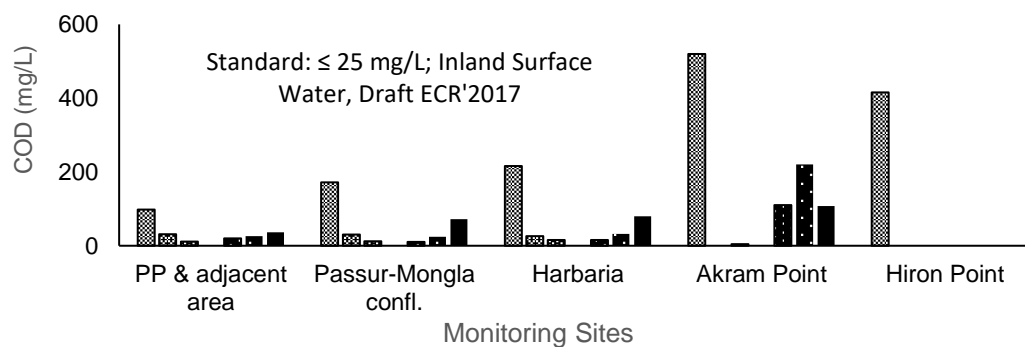


Figure 2.18: Variations in COD concentrations in different monitoring sites (monsoon)

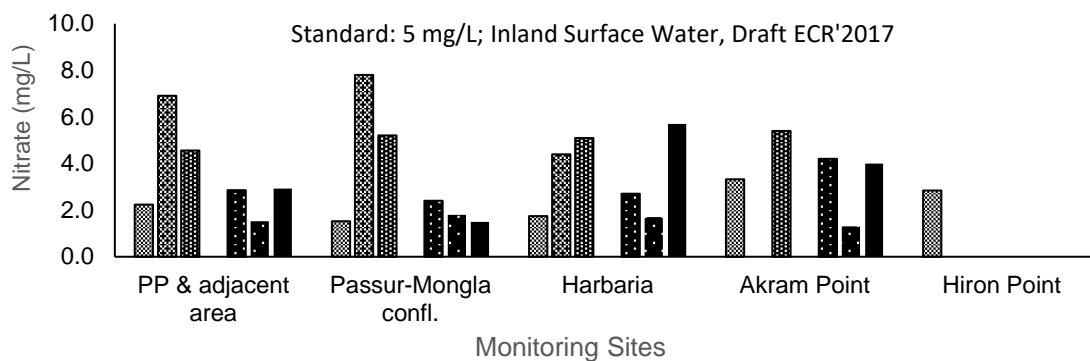


Figure 2.19: Variations in Nitrate concentrations in different monitoring sites (monsoon)

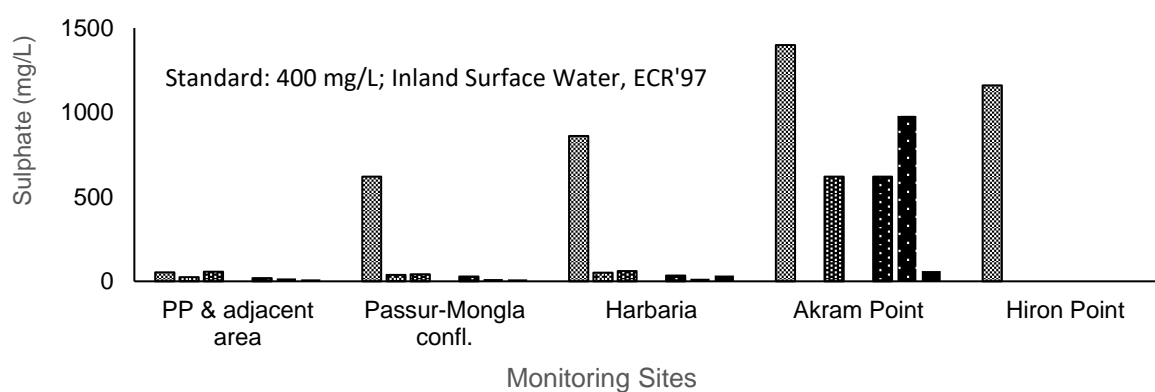


Figure 2.20: Variations in Sulphate concentrations in different monitoring sites (monsoon)

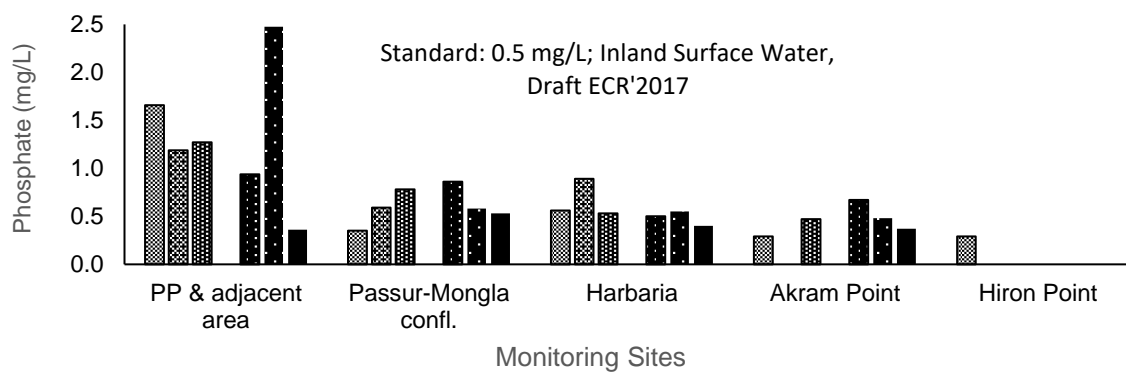


Figure 2.21: Variations in Phosphate concentrations in different monitoring sites (monsoon)

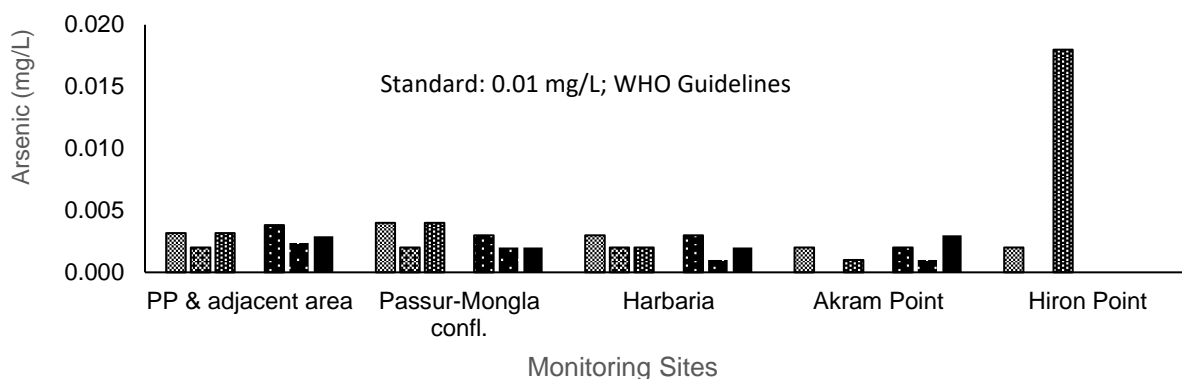


Figure 2.22: Variations in Arsenic concentrations in different monitoring sites (monsoon)

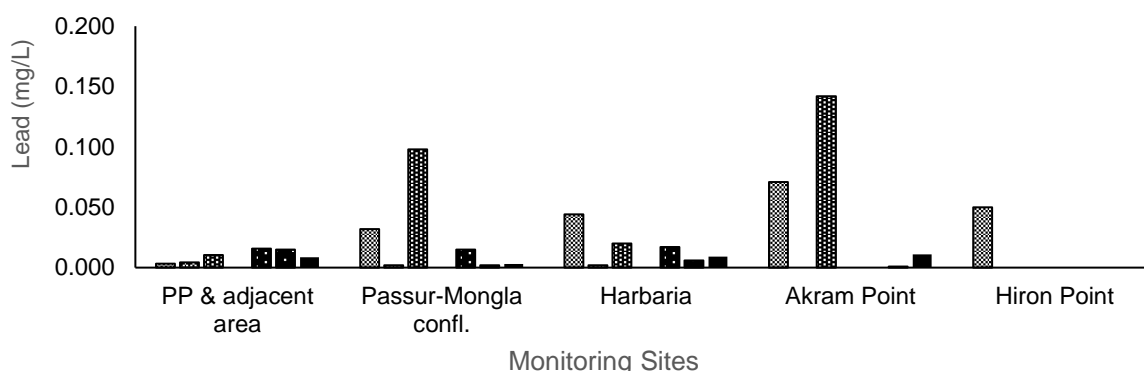


Figure 2.23: Variations in Lead concentrations in different monitoring sites (monsoon)

Chemical Oxygen Demand (COD)

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

COD concentrations varied from 28 mg/L to 108 mg/L during the last monsoon season. The highest value was found at the Akram Point. 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 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. COD concentrations of all the monitoring sites found slightly higher than the Draft ECR' 2017 (25 mg/L). Various activities at project jetty may influence the COD continuously. The average COD of power point areas was 37 mg/L while it was raised to 87 mg/L at the SRF. The extreme high COD at 2014 was the reason of oil spillage of that year which led 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 has insignificant rainfall comparing to those of other seasons and which actually increased the density of organic matters. In monsoon, freshwater availability

diluted the COD load of the river water, which in turn reduced COD concentration in post monsoon as well. All observed values of COD are shown in **Figure 2.18** and the completely monitored datasets are provided in **Table B.6 of Appendix- IV**.

Nitrate, Sulphate and Phosphate

Usually, nitrogen is the limiting factor in the marine environment. Therefore, nitrate plays very active role in primary production including the dynamism of aquatic organisms. In the last monitoring, NO_3^- concentrations occurred low at the power plant site (avg. 2.9 mg/L) than the SRF (avg. 3.7 mg/L).

NO_3^- concentration shows both temporal and seasonal variations in the study areas (**Figure 2.19**). However, the results obtained from all the monitoring sites were found to be within the standard stated in ECR'1997 (10mg/L). Even complied with the ECR standard, there is a trend of high nitrate at the SRF than the upstream areas. High nitrate concentration was found in monsoon period across the Passur-Sibsa RS, which could be the result of surface run-off, agricultural run-off, atmospheric deposition and domestic wastes dumping together with industrial pollution from upstream. Sometimes, in pre-monsoon season, nitrate was also found comparatively high but within the range of ECR limit. (**Table B.11 of Appendix- IV**).

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

In the last monitoring, sulphate showed similar pattern of the previous monsoon data. Low sulphate at the upstream areas than the SRF. The average sulphate near power point areas was found 11 mg/L while at the SRF it become 35 mg/L. Among all the monsoons, sulphate was found at its lowest concentration in all the monitoring sites. This may be the result of heavy rainfall during the sampling time. However, all the observed dataset of SO_4^{2-} found within the standard limit (400 mg/L) specified in ECR, 1997. Comparatively lower concentration of SO_4^{2-} in monsoon and post monsoon seasons could be due to the dilution effect of upstream freshwater (**Figure 2.20 and Table B.12, Appendix- IV**).

PO_4^{3-} concentrations were found to be in the range of 0.3 - 0.6 mg/L during the last monitoring period (Monsoon 2020) (**Figure 2.21**). Based on the **Figure 2.21**, it is examined that, PO_4^{3-} concentration showed very little spatial variation in last monsoon. Upstream anthropogenic activities probably the reason for this kind of trend along with pattern of rainfalls and bio-geochemical cycles of nitrogen. All the monitoring sites complied with the permissible limit as per Draft ECR 2017 rules of 0.5 mg/L of PO_4^{3-} in the inland surface water except the site of Maidara river. In Maidara River the concentration was found 0.6 mg/L which was due to the runoff from agricultural field into the small river.

The recorded low phosphates value during dry seasons might be attributed to the limited flow of upstream freshwater, high salinity and utilization of phosphate by phytoplankton, stated by Senthilkumar et al., 2002; Rajasegar, 2003 (**Table B.13 of Appendix- IV**).

NO_3^- , SO_4^{2-} and PO_4^{3-} concentrations at different monitoring sites 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 0.001 to 0.006 mg/L. During this 26th monitoring, the results again fitted with the said range. Though there were some seasonal variations in As concentration, 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 26th monitoring period, the concentration of Pb ranges from 0.003 to 0.011 mg/L (**Figure 2.23**). The standard concentration for inland surface water is 0.1 mg/L.

The values of Mercury (Hg) revealed consistency among all the monitoring points in all the seasons in all monitoring quarters. The values never exceeded 0.001 mg/L. In the last monsoon, the concentrations also remain same. All the observed data are found to be within the permissible limit (0.05 mg/L) as per ECR, 1997.

The average value of As and Pb concentrations at different monitoring sites of the consecutive monitoring quarters for winter season are presented in **Figure 2.22 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 the Passur-Sibsa River System, samples were collected at five locations during low tide from the surface layer and analyzed following the standard testing method of APHA. The concentrations of oil and grease are presented in **Table-B.7 of Appendix-IV**.

During monsoon and post monsoon periods, the concentration of oil and grease were found lower than that of winter and pre-monsoon season. It appears from the data that Passur and Sibsa river system recorded high concentrations of oil and grease in winter period in 2014, which might be due to occurrence of accidental oil spillage on 9 December 2014. An amount of 350,000 litres (Philips, 2014) of furnace oil spilled in the river and spread over an area of 350 km² (Welle, 2014).

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

Findings

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

In this 26th quarterly monitoring (post-monsoon, 2020), physical conditions of the Passur-Sibsa RS were found fairly healthy. There were some fluctuations in the concentrations of parameters among different sites only. In addition, pH, Temperature and DO level was found quite good at the project site and in the SRF.

In this 26th quarter (Monsoon, 2020), TSS concentration in the observed RS found compatible to national and international standards. On the contrary, in the last monsoon TDS and TH was quite higher in the Maidara River only. This could be runoff from adjacent agricultural field and the filling of lands by sand on the east side of the river. The other observation sites were found to be within normal range of concentration especially for TDS and TH.

High COD was found in all the monitoring sites. As it is high in the SRF, this may be the effect of sediment loads and high nutrients contributed by the Bay of Bengal. Nitrate (NO_3^-) and Phosphate (PO_4^{3-}) found in a very standard range in respect to a natural river except Phosphate in Maidara River. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and even no issues as well.

Oil and grease have not become an issue as well as this parameter was consistently complying with the permissible limit of Bangladesh during the water quality monitoring of rivers.

2.3.10 Status of the Groundwater quality

In-situ tested parameters

The in-situ tested results obtained up to 26th monitoring period (October 2020: Post-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 26th monitoring scheme were found to vary from 7.4 to 8.0, while temperature was ranged 27°C to 28°C. No significant differences have been observed in relation to the previous post-monsoon season. 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 26th monitoring results of pH and temperature of selected sites are presented in **Figure 2.25: pH and Temperature**. However, for all the observed dataset and are attached in **Table B.17 of Appendix- IV**.

Salinity and Dissolved Oxygen (DO)

In the last post-monsoon, 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, groundwater salinity of all three sites were found to be 0.0 ppt (**Table B.18: Appendix- IV**).

DO results ranges from 6.0mg/L to 6.2mg/L during this monitoring season. Level of DO in groundwater was found fair for human drinking purpose (not less than 6.0mg/L or too high). However, slight DO level changes in drinking water might only reduce the taste of water. Higher DO level makes water tastier but causes corrosion to the supply pipe.

All monitoring results of salinity and DO of the selected monitoring sites are presented in **Figure 2.25: DO** and all the observed dataset of DO and Salinity are attached in **Table B.18** of **Appendix- IV** respectively.

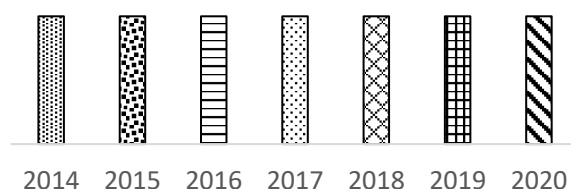


Figure 2.24: Legend direction (left to right: 2014-2020)

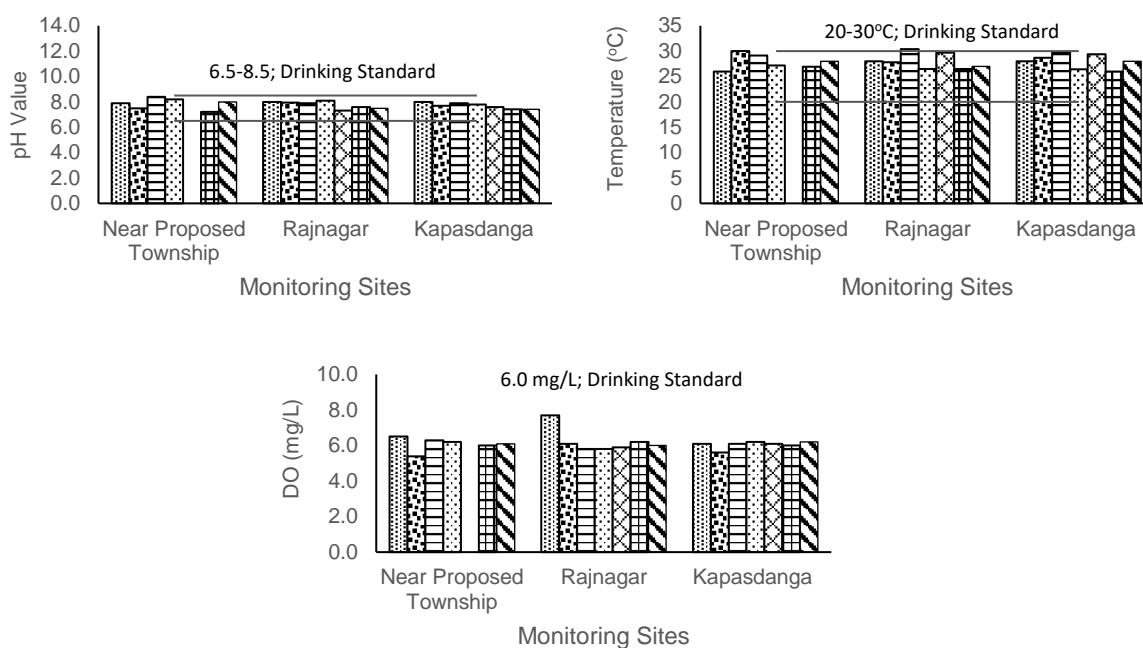


Figure 2.25: Status of pH, Temperature and DO of post-monsoon seasons of the last seven consecutive years

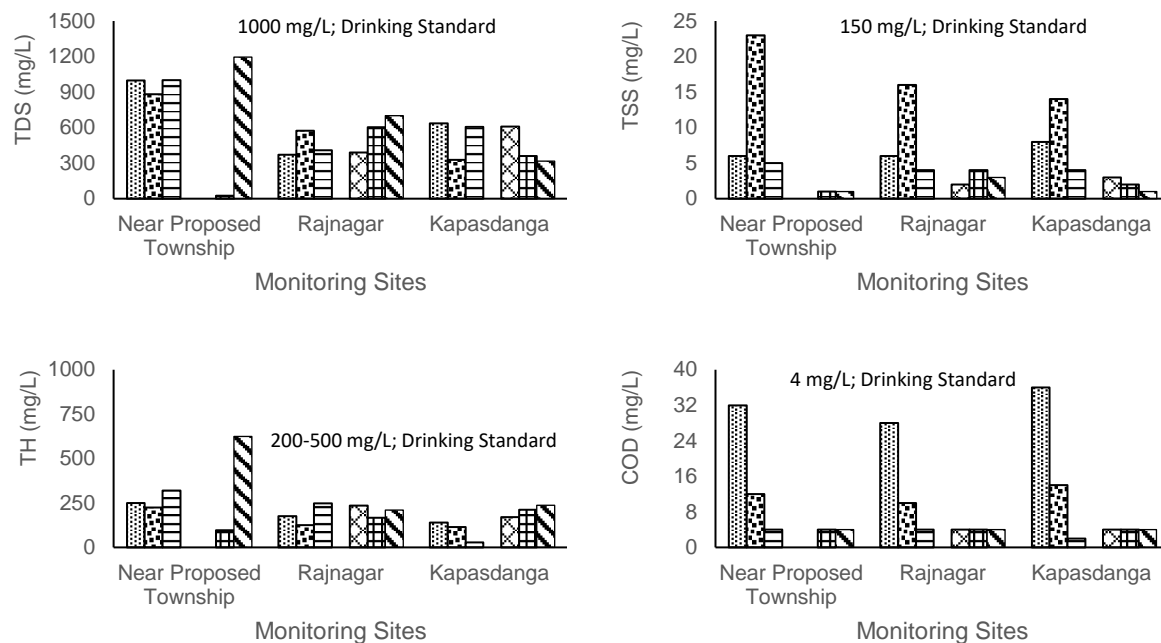
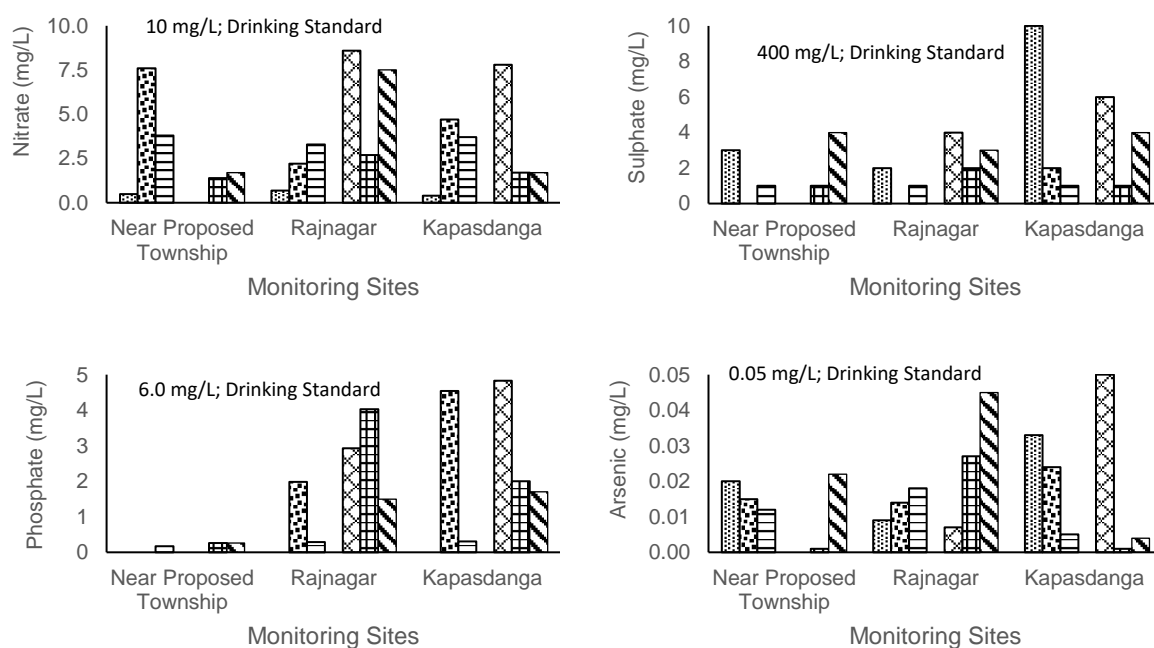


Figure 2.26: Status of TDS, TSS, TH and COD of monsoon seasons of the last seven consecutive years



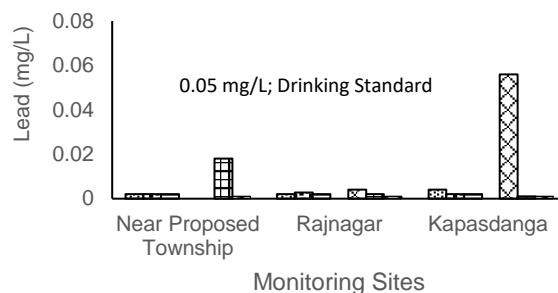


Figure 2.27: Status of Nitrate, Sulphate, Phosphate, Arsenic and Lead of monsoon seasons of the last seven consecutive years

Laboratory tested parameters

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

TDS, TSS and TH

The highest TDS value of 1,196 mg/L was recorded Near Township area while the lowest was at Kapasdanga (316 mg/L). In addition, Rajnagar (around 700 mg/L) showed the double concentration of Kapasdanga. Both Rajnagar and Kapasdanga groundwater are safe for drinking purposes in respect to the recommended limit of Bangladesh (1,000mg/L) (**Figure 2.26: TDS**). But, water from township area is not suitable for drinking purposes according to the drinking water quality status (ECR'97). High TDS in township area might be the high nutrients in the water. Monitoring team will find out the real reason behind this slightly higher TDS concentration at the township monitoring site.

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 1-3 mg/L, which complied with the permissible limit of drinking water, Bangladesh (TSS: 10mg/L, ECR, 1997) (**Figure 2.26: TSS**). Among all the monitoring seasons, the observed TSS concentrations were much lower in monsoon season than the winter season (**Table B.19**). These variations would be due to lack of freshwater availability for sufficient groundwater recharging during winter. In addition, evaporation have also condensed the water along with its suspended matters in winter.

TH concentrations from three monitoring spots vary from 210 mg/L to 625 mg/L (**Figure 2.26: TH**) in the last monsoon season. The maximum value was found at Township area while the lowest was found at Rajnagar. Over the last seven monsoon seasons, hardness in drinking water complied with the permissible limit (200-500 mg/L) set by the ECR 1997 most of the time except the last monsoon record at the township area. 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 monsoon periods are presented in **Figure: 2.26: TDS, TSS and TH** and all the observed dataset are attached in **Table B.19** and **B.20 22** of Appendix- IV.

Chemical Oxygen Demand

The Bangladesh standard for COD in drinking water is 4.0 mg/L. Drinking water of the monitored tube wells for the last monsoon completely complied with the Bangladesh Standard as COD concentrations in the last monsoon period was found within 4.0 mg/L. Except the year 2014, all the other winter seasons COD concentration were also found within the permissible limit for Bangladesh.

The COD concentrations of all the monitoring sites are given in **Figure 2.26: COD** and all the observed dataset are attached in Table B.21 of **Appendix- IV**.

Nitrate, Sulphate and Phosphate

Nitrate (NO_3^-) values ranged 1.7 - 7.5 mg/L in the last monsoon (**Figure 2.27: Nitrate and Table B.24**). The maximum value was recorded in Rajnagar while the lowest was in Kapasdanga. NO_3^- concentrations were found to be allowable limit for drinking in Bangladesh (10mg/L). NO_3^- in groundwater showed both spatial and temporal variations in the monsoon season.

Sulphate (SO_4^{2-}) level has been monitored since 2015 (didn't consider at the first monitoring held at 2014). On that time, SO_4^{2-} concentrations were complying with the Bangladesh Standard for Drinking Water Quality (400 mg/L). SO_4^{2-} concentration in groundwater did not show any pattern yet except a trend of comparatively high concentrations in winter than all other monitoring seasons (**Appendix-IV: Table B.22**).

On the other hand, in the last monsoon, the concentrations of PO_4^{3-} were found between 0.3 mg/L and 1.7 mg/L, which was within the standard limit of 6.0 mg/L (ECR'1997) (**Figure 2.27: Phosphate**). PO_4^{3-} concentration reached to its highest peak at 6.2 mg/L during the post-monsoon of 2014. PO_4^{3-} concentrations actually have both spatial and temporal variations but which is minor in the interest of this monitoring objectives as well as drinking purpose by the community resides there.

The observed winter seasons NO_3^- , SO_4^{2-} and PO_4^{3-} concentrations of groundwater are presented in **Figure 2.27: 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 0.004 mg/L and 0.045 mg/L in the last monsoon monitoring. During monsoon, the As didn't show the level of concentrations that can pose threats to human health. However,

It was found that groundwater of Rajnagar crosses the Bangladesh Permissible limit in the last winter. It was also evident that this is the first-time tube well from Rajnagar showed As contamination among all the seven winter seasons. This case will be observed further whether this situation prevails for a short period of time or for a longer period. Usually, in a coastal area of South West Region, with the changes of groundwater recharge rate, As concentration can be varied for a short period of time.

Lead (Pb) and Mercury (Hg) concentrations were also measured and the values were found within the permissible limit specified in ECR 1997 (0.05 mg/L for Pb and 0.001 mg/L for Hg).

The concentration of Pb showed only spatial variation to some extent (**Figure 2.27: Lead**). However, the water of the tube-wells was found suitable for drinking purpose in terms of metal pollution status except Rajnagar for As during the last winter.

The observed values of As and Pb in all the pre-monsoon period monitored sites are presented in **Figure: 2.27: 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 (Post-monsoon 2020), chemicals and metals (Monsoon 2020) 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.

Chemical characteristics of the groundwater quality are also found suitable and safe to drink based on permissible limit as per drinking water standards, ECR 1997 except high TDS near the Township Area. In addition, chemical oxygen demand during 2014 and 2015 was higher than ECR, 1997 limit also. The groundwater quality of the observed area is free from any kind of metal pollution except Arsenic contamination in Rajnagar. But this concentration for a shorter period of time is not as dangerous as to stop drinking water from the tube well. However, this high arsenic issues in Rajnagar need to be checked carefully during the upcoming monitoring period and necessary measures for the safe consuming of drinking water will be given.

2.4 Land Resources Monitoring

2.4.1 Methodology

Monitoring of selected indicators are 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 soils of the study area. Before that (during pre-construction and construction stage), only natural phenomena are responsible to alter soil parameters.

Sampling Frequency

The frequency of monitoring for land resources data collection has been considered twice in a year. Accordingly, the plot use data was collected in the 26th monitoring program during November 9th, 2020 to November 13th, 2020.

Monitoring Indicators

The continuous monitoring has given an opportunity to observe seasonal changes 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) analyzed from a saturated paste soil extract.

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

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 2.28**.

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	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"		

Site No.	Monitoring indicators	Location	GPS (Decimal Degree)		Sampling Frequency	Methods/ Tools/ Techniques
			Easting	Northing		
3	production and damage	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"		

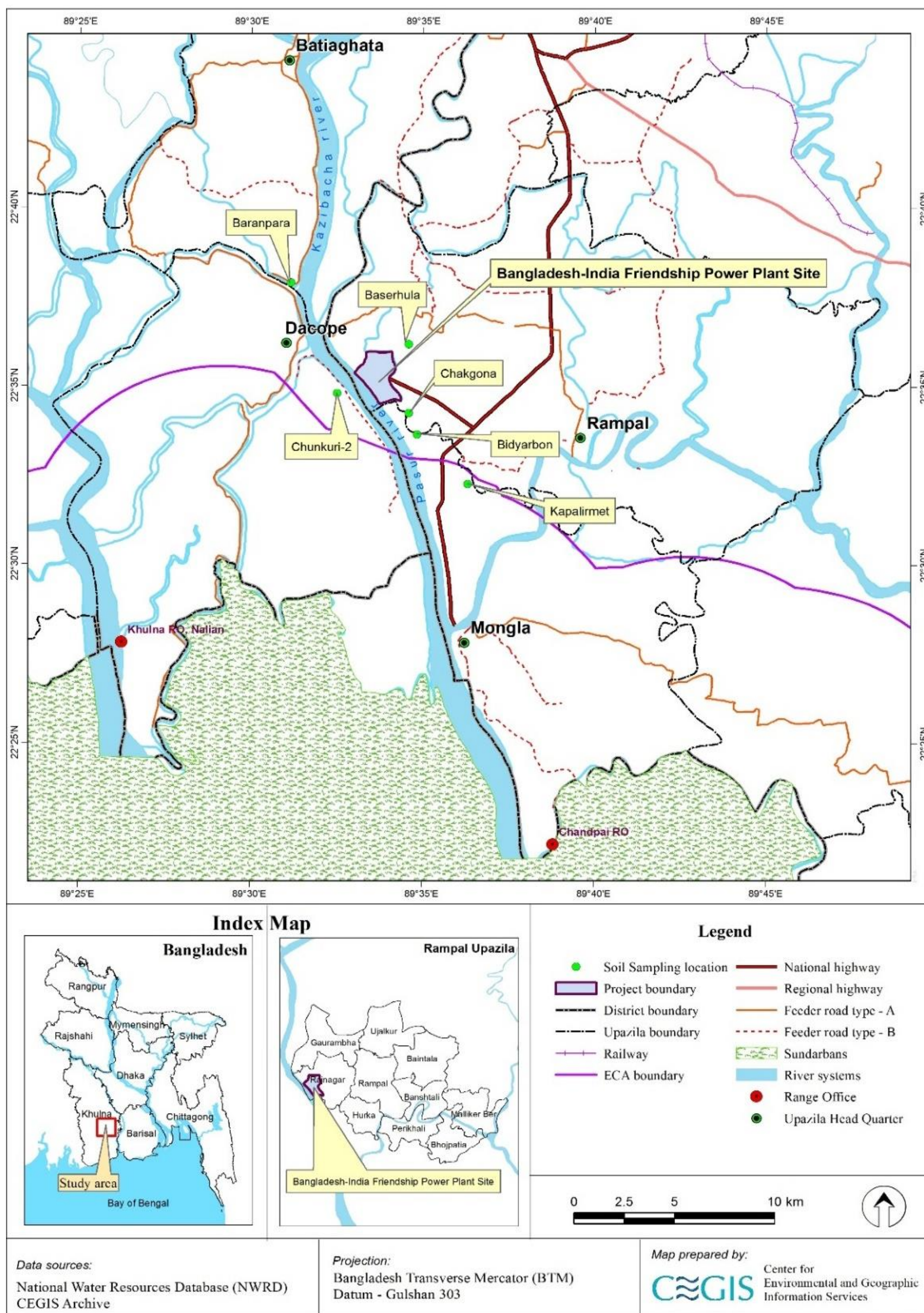


Figure 2.28: Land and Agricultural Resource Monitoring Locations

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 of ash movement purpose. All the selected plots were characterized as medium high land (F_1), which are normally flooded in the range of 30-90 cm and remain inundated for more than two weeks to few months during the flood period.

Soil Samples Collection

Standard procedure was followed during the collection of soil samples. In every plot, minimum three pits were dug through augur to collect composite sample (**Figure 2.29**). Each plot had three composite samples, top soil (0-15 cm), sub soil (15-30 cm) and sub stratum (30-45 cm). Soil samples were preserved in an air-tight plastic bag for laboratory analysis.



Soil sample collection from sampling plot-5 (Baserhula).



Soil sample collection form Sampling plot-2 (Chunkuri-2).

Figure 2.29: Soil sample collection from sampling plot

2.4.3 Agriculture Resources Monitoring

Monitoring of agriculture resources has been scheduled twice a year as per the monitoring plan of the ToR and accordingly, the survey was conducted in November, 2020. The data on agricultural practice (Production, damage, input use etc.) was collected through informal interview (KII, RRA and FGD) with the local farmers from the monitoring area.

2.4.4 Present cropping pattern at the monitoring plots

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 were collected in November, 2020 and described in the following sections and presented in **Figure 2.30**:

Agriculture Plot-1 (Baranpara)

This plot is located at Baranpara mauza and the area is about 0.4 hectare. During 25th monitoring, the plot was found to be under cultivation condition. BR30 was cultivated in this plot. For this production, limited amount of chemical fertilizers and pesticides were applied. The cropping practice and management practice remained same as the previous monitoring. The detailed cropping pattern is shown in **Table F.1 of Appendix IV**.

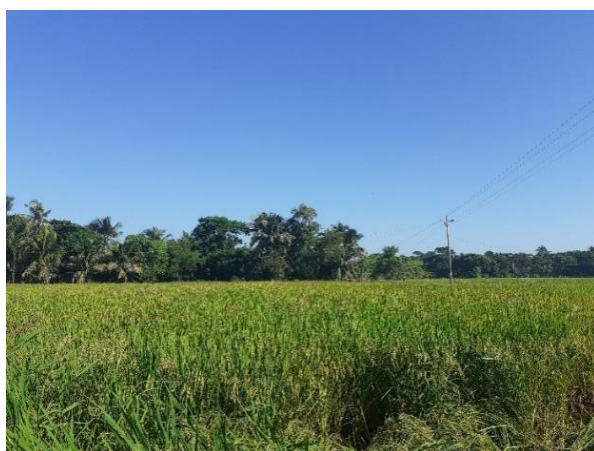
Agriculture Plot-2 (Chunkuri-2)

This monitoring plot is located at Chunkuri-2 and the size of the plot is about 0.93 hectare. Local Aman (Benapole) was found to be cultivated in this plot in Kharif-II season. No chemical fertilizers were applied in this plot. The cropping practice and management practice remained same as the previous monitoring. Detailed cropping pattern has been shown in **Table F.1 of Appendix IV**.

Agriculture Plot-3 (Kapalirmet)

This monitoring plot is located at Kapalirmet and the size of the plot is about 0.14 hectare. During the 1st monitoring period of pre-construction phase, it was found to be cultivated, but later on, this plot remained fallow from the 2nd and 3rd monitoring program due to increase in salinity. According to the opinion of the local people, Bangladesh Water Development Board (BWDB) decided to re-excavate the Ghona River and hence they had to remove all the obstacles to facilitate the re-excavation of the Golbuniakhhal mouth. Then the saline water was allowed to enter into the settlement areas including their cultivated plots during the year 2014 -15 and remained inundated by saline water. As a result, farmers started practicing shrimp culture instead of cultivating traditional crops in these plots. However, a number of farmers tried to cultivate crops in their plot in this adverse condition, but all crops were actually damaged due to the above mentioned fact.

Owners of Shrimp farms of this area used the saline water in these plots for shrimp culture as there was no scope to drain out saline water from this area. The situation is still not in farmers' favor. Farmer of this land decided that they would not cultivate crops in future due to increase in salinity. Rather they would only practice the shrimp culture in future. It was observed during the recent monitoring period that, the plot still remained fallow. Detailed for this plot is presented in **Table F.1 of Appendix IV**.



View of Monitoring plot-1 (Baranpara) at November, 2020.



View of Monitoring plot-2 (Chunkuri-2) at November, 2020.



View of Monitoring plot -3 (Kapalirmet) at November, 2020.



View of Monitoring plot-4 (Chakgona) at November, 2020.



View of Monitoring plot-5 (Basherhula) at November, 2020.



View of Monitoring plot-6 (Bidyarbon) at November, 2020.

Figure 2.30: Present Cropping pattern in the monitoring plots

2.4.5 Crop Production in Monitoring Plots

The information on crop production were collected after harvesting in April 2021. For this reason, crop production details will be incorporated in April, 2021 report (27th monitoring).

2.4.6 Crop Damage in Monitoring Plots

The information on crop damage will be collected after harvesting in April 2021. For this reason, crop damage details will be incorporated in April, 2021 report (27th monitoring)

2.4.7 Livestock Resources Monitoring

Livestock related data was collected in November, 2020 and described in the following sections and present livestock scenario is presented in **Figure 2.31**.

2.4.8 Feed/Fodder condition of Livestock Resources

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

2.4.9 Diseases of Livestock Resources

Feed and fodder condition remain similar to the previous monitoring. During this monitoring, a shortage of fodder in the area was reported in two monitoring spots (Chakgona and Basherhula). Respondents reported that they started selling cows due to demisting of the grazing land after incursion of the area in the project. Even the authority (BIFPCL and Forest department), jail (Khoar) cows when it enters into the project area. On the other side, forest department is using the stated land for afforestation which is a mandatory issue for power plant or any other infrastructures from environmental point of view. To protect the new forest area, they have a right to jail unwanted cows. Under this situation, monthly single cow rearing cost increased up to 1000 BDT which creates an extra burden to the poor farmers and forced them to sell cows.



Figure 2.31: View of livestock at November, 2020

2.4.10 Diseases of Livestock

Diseases of livestock occurs in every year in the study area. According to the opinion of local people, major bacterial and viral diseases include Peste des Petits Ruminants (PPR), Foot and Mouth Disease (FMD) and Tarka (Anthrax) etc. were observed in the study area. Major poultry diseases were reported as Duck plague, Duck pox, Diarrhoea, Newcastle (Ranikhet), Fowl pox and Fowl cholera etc. The most vulnerable period is considered in between July and

November for spreading diseases to livestock and poultry populations. However, some diseases were also reported to prevail round the year. The severity of the infestation was reported to be alike in this current situation than the past. The mortality rate of the livestock/poultry becomes negligible, due to immunization and insemination program run by the Department of Livestock.

2.5 Transportation Monitoring

2.5.1 Location of Traffic Survey

The traffic survey was conducted from November 4th to November 6th, 2020 on two weekends and on one-week day at three pre-selected locations. Weather was found sunny during the surveys conducted. The selected sites were Khudir Bottola and Gonai Bridge at Khulna Mongla Road and Gonabelai Bridge at Power Plant access road presented in the **Figure 2.32**.

2.5.2 Methodology

The traffic survey during the construction phase is generally conducted on two weekdays and on one weekend at three pre-selected locations around the project site. Weather is also monitored during the survey conducted.

2.5.3 Traffic Volume Calculation

The survey results were used in computing the traffic volume of these roads in Passenger Car Unit (PCU). PCU is a matrix used in Transportation Engineering, to assess traffic-flow rate on roadways. A PCU is essentially the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car. While calculating the traffic volume in PCU, vehicle conversion factors suggested by the Roads and Highway department of Bangladesh were used as mentioned in **Table 2.10**.

Table 2.10: Vehicle conversion factors

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

2.6 Results of Monitoring

The summary results of vehicular movements at three different locations in **Table 2.11** 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 2.11: 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	507	631	541
Khulna Mongla Road at Digraj	291	495	496
Power Plant access road at Ichamoti Bridge	80	86	121

Source: Field Survey, November, 2020

Similar to the earlier months monitoring report, vehicular movements were observed during the surveys were mostly for the regular construction activities of the Power Plant as the construction activities of the Power Plant are progressing heavily. Compared to the previous monitoring report, traffic volume and traffic nature in all the three surveyed locations were found to be higher. One of the key factors behind this heavy traffic volume is the rigorous and heavy construction works of the Power Plant. The detail survey findings regarding the traffic volume surveys as well as the detail calculations are attached in Appendix E1, E2 and E3.

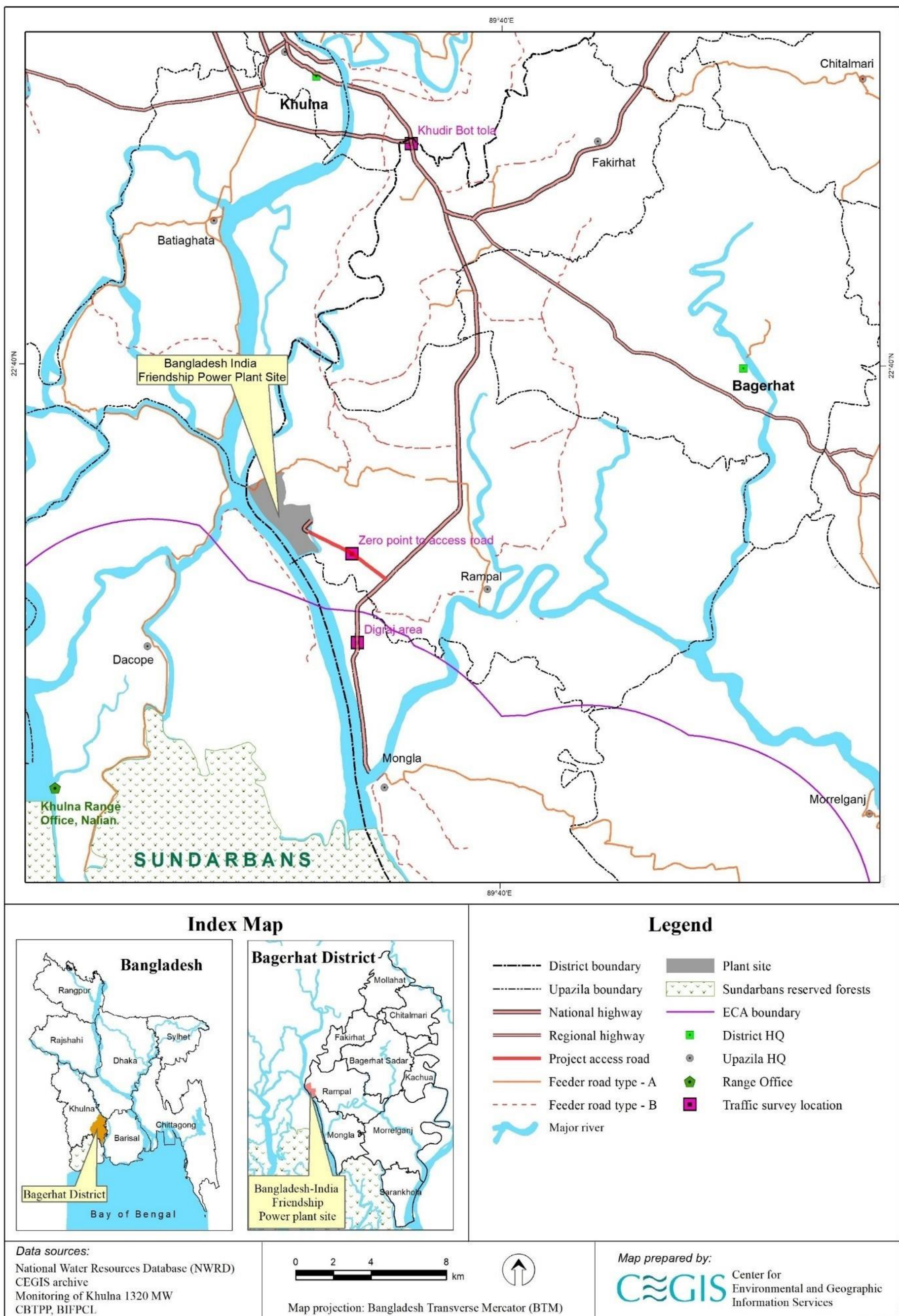


Figure 2.32: Locations of Traffic Survey

2.6.1 Monitoring of Chemical Properties of Bed Materials

2.6.2 Methodology

Sediment has 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, the sediment sampling was done in 25th monitoring (July, 2020).

Monitoring Indicators

The main objective of sediment quality monitoring is to find out the heavy metal accumulation in sediments due to anthropogenic activities. To find out the answers a biannual sediment monitoring is done in different sampling points. The major indicators for monitoring are heavy metals (As, Pb and Hg), pH and Sulphate.

Location

The sampling locations have been selected in both surrounding of the project area and inside the Sundarbans. The sampling locations are stated in **Table 2.12**. Locations of collected samples are presented in **Figure 2.33**.

Table 2.12: 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"		

2.6.3 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

Collected sediment samples have been handed over to the BCSIR, Dhaka for laboratory analysis immediately after 25th monitoring and incorporated in this report. Reference level of different metals in sediment of the Passur River are provided in **Table 2.13**.

2.6.4 Status of sediment quality of the Passur River:

The data presented in this report represents wet season, 2020 which was collected in July, 2020 (25th monitoring).

According to the analyzed data, only Mercury (Hg) exceed average shale value (**Marowsky and Wedepohl, 1971**) and average upper crust value (**Rudnick and Gao, 2014**). Other two trace element (As and Pb) value found within the stated limits even in published reports (Ali *et al.*, 2018). During this monitoring Arsenic (As) concentration increased in all locations from previous dry season monitoring. Lead (Pb) concentration decrease in two locations (Harbaria and Akram point) while increased in other three. On the other hand, Mercury (Hg) concentration is increased in all locations except Mongla and Akram point (**Table 2.14**)

In general, an increasing trend of Hg towards sea is found. The other two elements didn't show any specific pattern. The upstream flow might push the elements towards sea. Two out of three elements show the maximum concentration in outer sea (Akram point). The Maximum concentration for Pb and Hg is found in Akram point while in project site (Jetty point) As scored the most.

Table 2.13: Reference level of different metals in sediment of the Passur River

SI 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	-	-

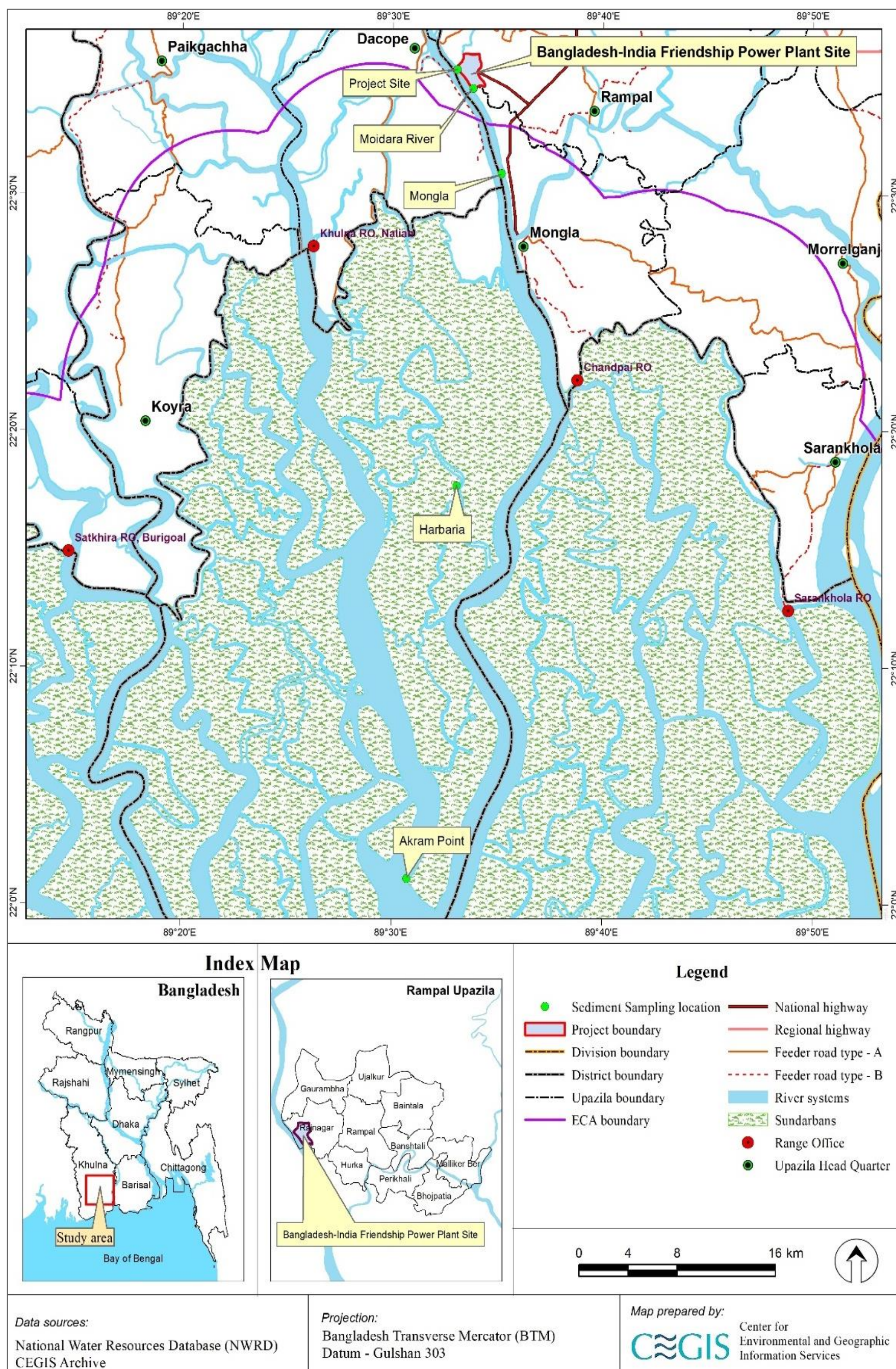


Figure 2.33: Sediment Sampling Locations

Table 2.14: Chemical properties of River Bed sediment

Site. No	Location	Monitoring Parameters														
		pH					SO ₄ ²⁻ (mg/kg)					As (mg/kg)				
		Wet season, 2018	Dry Season, 2019	Wet season, 2019	Dry Season, 2020	Wet season, 2020	Wet season, 2018	Dry Season, 2019	Wet season, 2019	Dry Season, 2020	Wet season, 2020	Wet season, 2018	Dry Season, 2019	Wet season, 2019	Dry Season, 2020	Wet season, 2020
1	Project Site	8.61	8.8	8.69	8.22	9.44	184	489	200	187	700	5.37	7.51	1	2.5	3.5
2	Moidara River	8.18	8.6	8.73	8.68	9.18	297	464	400	244	700	3.65	4.16	0.78	1.95	2.72
3	Mongla Port	8.22	9.25	8.4	8.48	9.47	103	264	200	248	600	2.53	4.6	1	2.54	3.44
4	Harbaria	9.06	7.9	8.74	8.62	9.45	329	490	400	234	2100	4.04	4.1	1.08	2.26	2.69
5	Akram Point	8.66	8.6	7.4	7.83	8.76	277	708	400	653	1900	6.18	4.69	1.5	2.15	3.44

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

Site No	Location	Monitoring Parameters									
		Pb (mg/kg)					Hg (mg/kg)				
		Wet season, 2018	Dry Season, 2019	Wet season, 2019	Dry Season, 2020	Wet season, 2020	Wet season, 2018	Dry Season, 2019	Wet season, 2019	Dry Season, 2020	Wet season, 2020
1	Project Site	6.03	8.71	7.13	8.18	8.49	1.38	2.04	2.93	1.58	2.61
2	Moidara River	6.59	6.52	5.45	7.89	6.17	1.5	3.1	2.61	2.22	1.42
3	Mongla Port	6.05	5.19	5.62	9.28	8.85	1.36	1.77	1	0.66	2.62
4	Harbaria	8.67	5.02	8.46	7.54	7.06	2.08	1.24	7.96	0.57	2.62
5	Akram Point	8.13	5.67	14.6	7.55	11.2	1.81	1.37	0.45	0.53	3.31

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

3. Biological Environment

Biological resources include all living organisms within an ecosystem which interact with one another as well as with the concerned physical environment. The component of the biological environment around the project site and along the Passur river were categorized into three major groups and which are fisheries resources, ecological resources and Sundarbans Reserve Forest (SRF).

3.1 Fisheries Resources

The monitoring of twenty-five 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 26th quarter and comparison with the earlier 25 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.

3.1.1 Methodology

Fish Habitat Status

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

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.

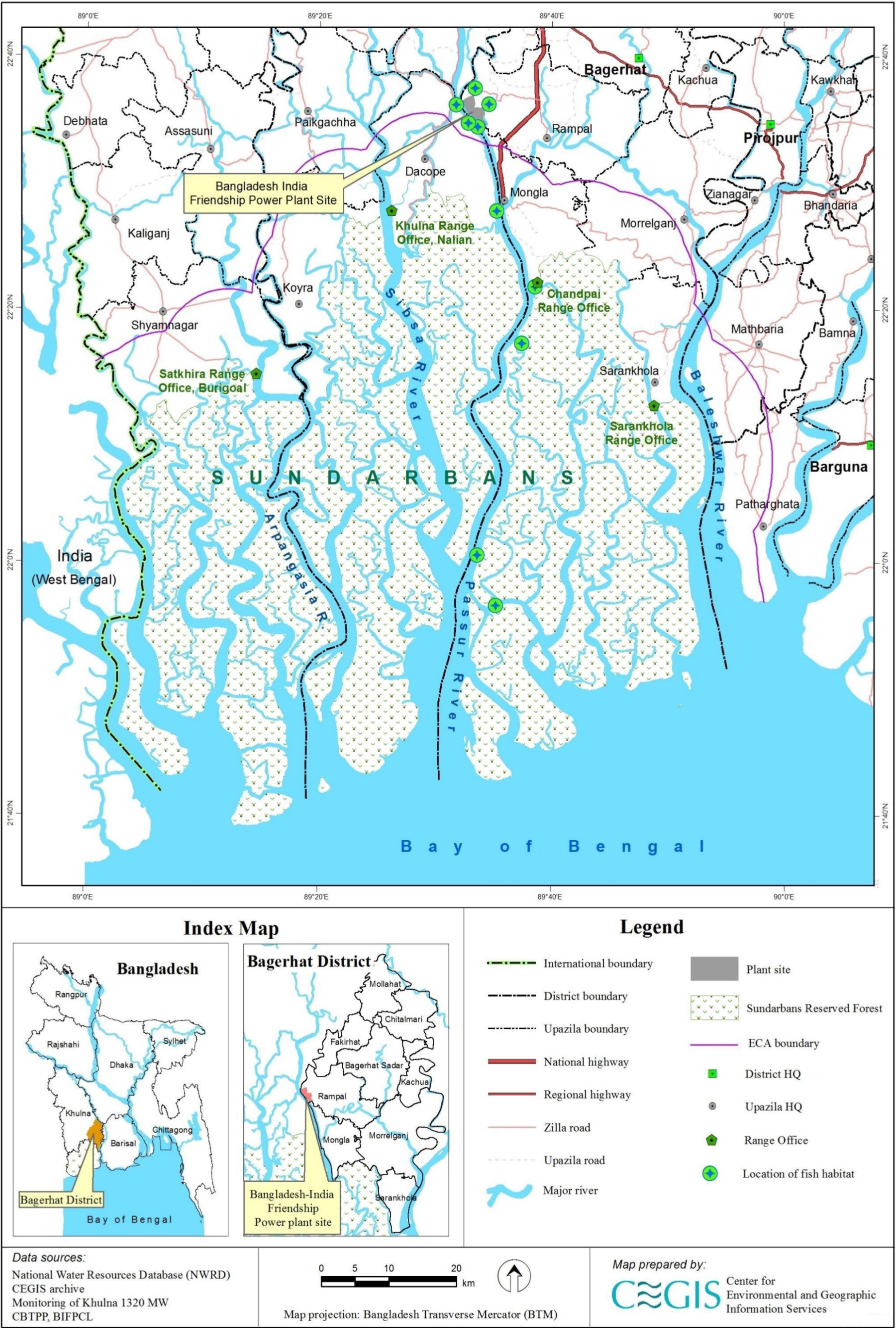


Figure 3.1: Fisheries Resources Monitoring Locations

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 25th quarter monitoring), 26th quarter monitoring of session 2020-21 was conducted during the period from 3-12 November, 2020. No fishing activities were observed at Haldikhali Khal (B), Bhodra (D), Jongra (G) and Mongla point (H) 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	<ul style="list-style-type: none"> • Nursery Ground

Monitoring Quarter	Type of Habitat Use
(July, 2016)	<ul style="list-style-type: none"> • 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
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

During the 26th quarterly monitoring conducted in November 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)**.

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

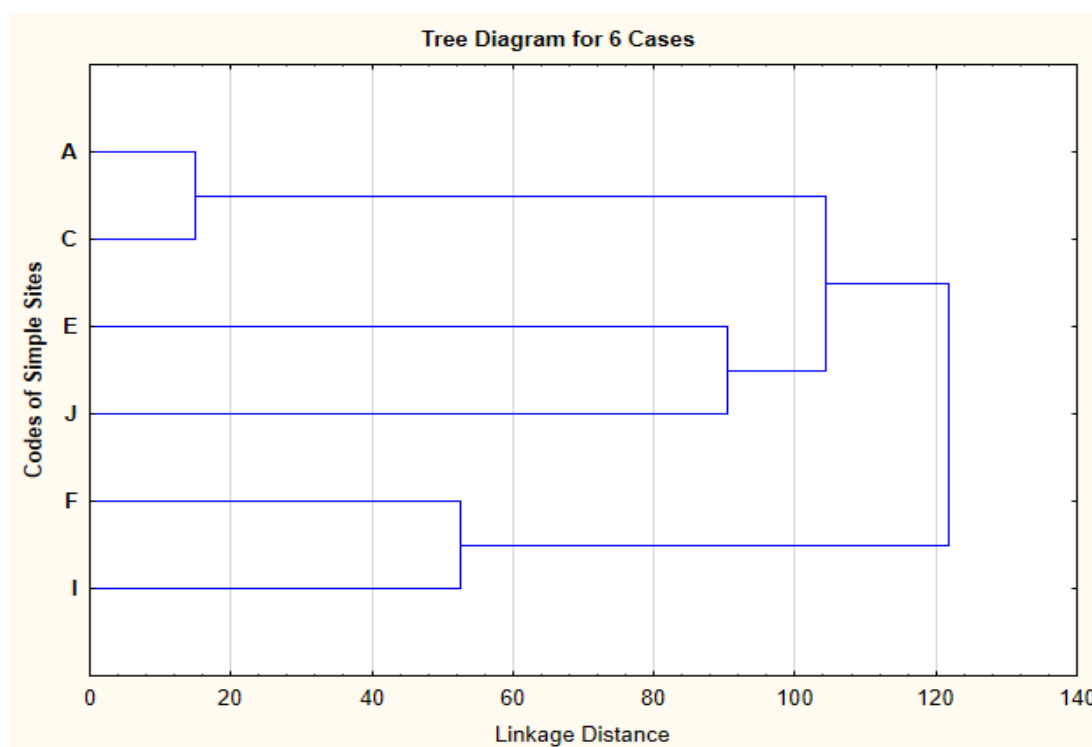
Omni-Ground: Another class, which is found to support multi-length groups (<2cm, 2-3cm, 3-5cm, 5-10cm, 10-20cm, >25cm and brood fish) of observed fish species, was considered as the omni-ground for fishes. Fishes of this class mainly belong to two major habitats- a) Spawning and Nursery Ground and b) Maturation Ground.

Spawning and Nursery Ground

Among the sampling sites, the sampling sites, Harbaria (E) and Chalna (J) were identified as spawning and nursery ground for high abundance of fry and juvenile fishes.

Maturation Ground

The sampling sites, Akram Point (A) and Maidara (I) were found to be rich in adult age-group along with brood fish. Presence of dominant length groups of 10-20cm and >25cm indicate that the sites function as the maturation ground of different fish species (following the considerations of Rahman, 1989 and 2005; Huda et al., 2003).

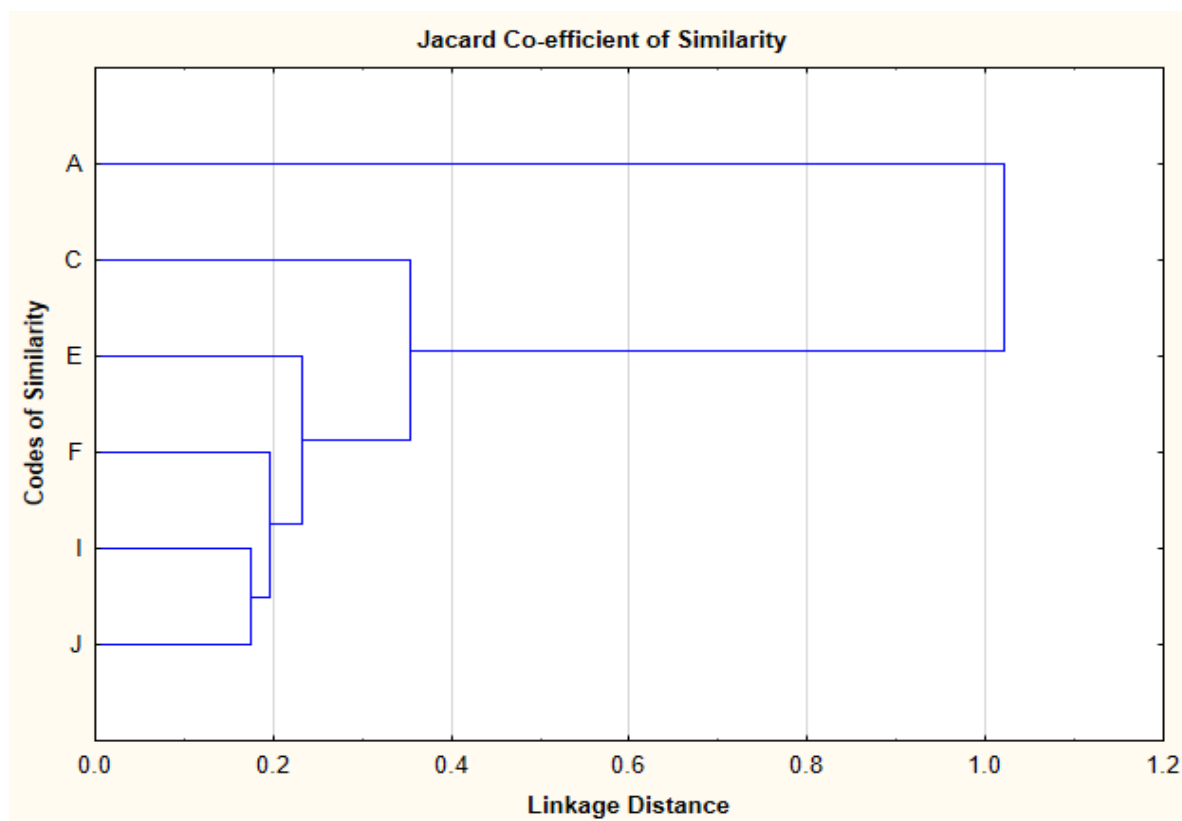


26th Monitoring, November 2020

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

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

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 (26th), the JI value between the Maidara (I) and Chalna (J) sampling sites were the highest (**Figure 3.3**) which indicates the maximum similarity in species occurrence between these two sites out of 6 sampling sites of available fishing (**Figure D.2 of Appendix IV**).



26th Monitoring, November 2020

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)	HIS (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 Charaputia (0.82) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at the Harbaria (0.29) (shown in **Table 3.1.4**). It has also been found that both the number of fish species found in in-situ catch and the evenness of their distribution within the sampling sites show high variation with the changing seasonal and yearly bio-physical conditions. The different fish species caught in different catches are shown in **Figure 3.4**.

Fish Species Richness (FSR)

Fish species richness was identified through Simpson's Index¹. Considerable difference is noticed in the fish species richness (FSR) in different habitat classes (**Table 3.4** and **3.7** and **Figure-3.5**).

In this monitoring phase, species richness varies with the sampling sites. Maximum FSR was obtained at Maidara River (n=16), while very low FSR was recorded at Charaputia (n=4). Different scenarios of richness were found in this quarter in comparison to the previous monitoring years. Among habitats in upstream portions of the Passur River, Chalna Point was home to rich assemblage of *Bata*, *Kechki* and *Khorulla*, Maidara River was of *Chali Chingri*, *Goda Icha* and *Motka Chingri*. In midstream portion, Chandpai was rich in *Chamua Chingri* and *Goda Icha*.

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	0.9	0.74
B	12	0	24	14	0	0	11	3	0	0	1	0	5	0.9	0	0.6	0.4	0	-	0.6	0.6	0	0	0	0	0.37
C	2	12	9	0	11	26	18	24	17	0	23	10	18	0.3	0.77	0.4	0	0.8	0.6	0.5	0.7	0.6	0	0.6	0.6	0.79
D	12	22	15	26	27	24	20	25	8	19	32	27	15	0.3	0.78	0.7	0.5	0.7	0.7	0.5	0.7	0.6	0.6	0.6	0.8	0.76
E	7	13	10	11	6	16	9	9	15	12	5	4	4	0.4	0.6	0.8	0.8	0.2	0.7	0.9	0.4	0.7	0.5	0.7	0.7	0.51
F	3	13	6	4	10	8	14	6	7	5	7	12	9	0.8	0.77	0.5	0.6	0.7	0.4	0.8	0.7	0.8	0.7	0.9	0.9	0.53
G	6	3	5	7	18	3	8	6	6	4	12	3	15	0.7	0.82	0.7	0.7	0.2	1	0.7	0.8	0.6	0.9	0.2	0.7	0.67

Table 3.5: Site Wise Species Diversity using Shannon–Weiner Index (14th to 26th 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	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	
A	0	0	3	0	8	0	2	0	0	0	0	7	0	0	0.92	0	0.16	0	0.65	0	0	0	0	0	0.64
B	0	0	0	0	2	0	-	0	0	0	0	0	0	0	0	0	0.92	0	-	0	0	0	0	0	0
C	0	0	12	0	0	24	11	0	0	10	0	4	0	0	0.69	0	0	1.69	0.86	0	0	0.78	0	0.82	
D	0	0	0	0	0	0	-	0	0	1	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	0	0	0.31	0.73	0	0.99	0	0	0.72	0	0.29	
F	6	17	0	0	0	13	22	19	11	11	0	12	0.85	0.81	0	0	0	1.44	0.74	0.5	0.81	0.56	0	0.70	
G	81	29	21	16	19	0	26	0	0	0	0	0	0.62	0.74	0.78	0.85	0.34	0	0.58	0	0	0	0	0	0
H	112	13	3	18	2	13	-	5	11	10	11	0	0.54	0.21	0.55	0.49	0	1.44	-	0.14	0.76	0.40	0.55	0	
I	3	13	12	10	17	11	8	9	11	12	6	16	0.88	0.33	0.21	0.65	0.85	1.46	0.14	0.52	0.80	0.54	0.45	0.41	
J	4	5	10	14	11	21	12	14	9	8	15	11	0.78	0.32	0.54	0.52	0.52	0.98	0.50	0.71	0.50	0.64	0.46	0.53	

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

Table 3.6: Site wise Rich Species Number (1st to 12th QM)

Site	Location	No. of Rich Species											
		2014-2015				2015-2016				2016-2017			
		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 3.7: Site wise Rich Species Number (13th to 26th 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	
A	Akram Point	2	0	0	4	0	1	0	2	0	0	0	0	2	
B	Haldikhali	1	0	0	0	0	3	0	-	0	0	0	0	0	
C	Charaputia	0	0	0	4	0	0	4	7	0	0	5	0	3	
D	Bhodra	0	0	0	0	0	0	0	-	0	0	1	0	0	
E	Harbaria	7	6	6	0	2	4	0	2	0	0	2	0	1	
F	Chandpai	6	5	7	11	9	2	3	7	4	6	2	0	4	
G	Jongra	0	0	0	0	0	0	0	3	0	0	0	0	0	
H	Mongla Point	2	2	1	2	3	0	3	-	1	5	2	3	0	
I	Maidara	1	3	2	1	3	9	3	1	1	6	3	2	3	
J	Chalna Point	4	2	1	2	3	2	2	2	3	2	3	2	3	

Source: CEGIS Field Survey, April 2014-November 2020



Golda Chingri



Datina



Gagla Tengra



Medh Machh



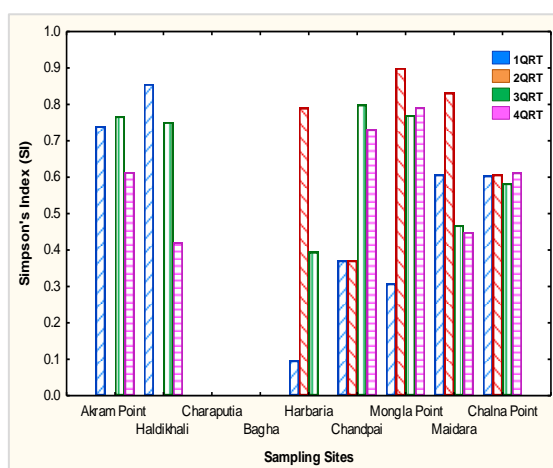
Kain Magur



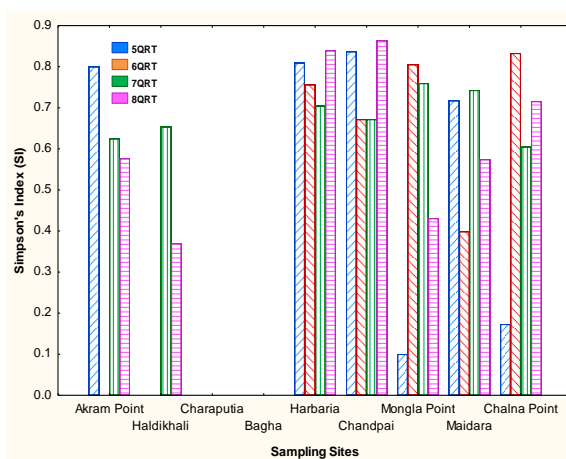
Kathali Chingri

Source: CEGIS Field Survey, November 2020

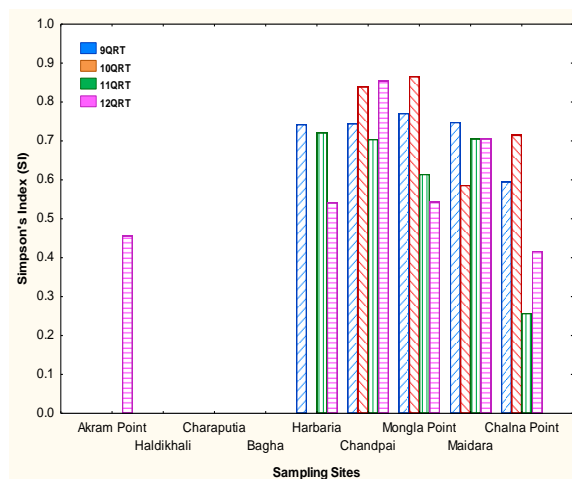
Figure 3.4: Different available observed fish species in 26th quarter monitoring



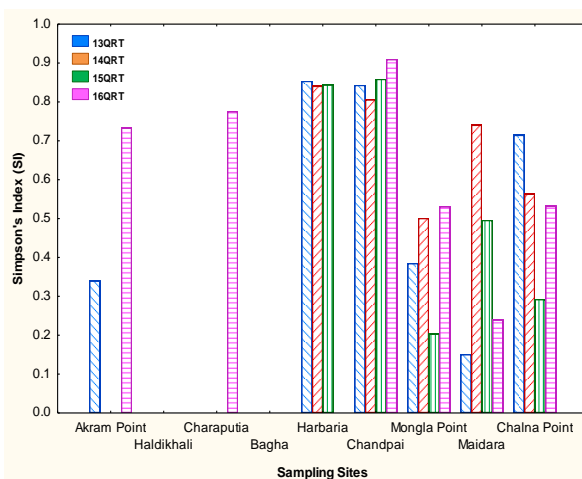
2014-2015



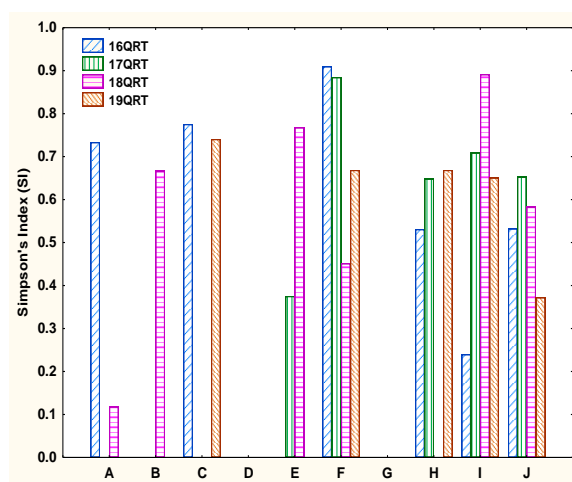
2015-2016



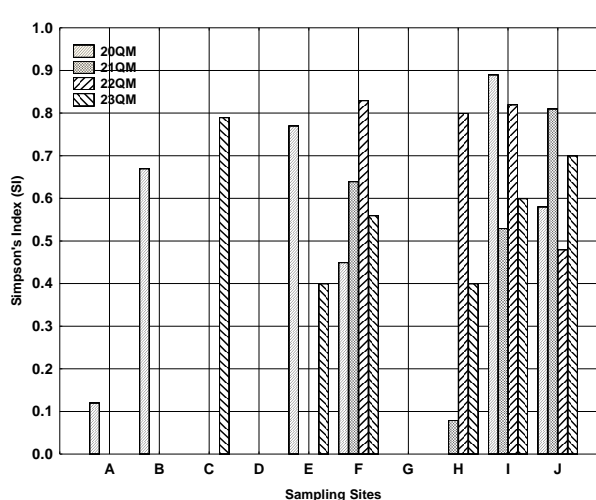
2016-2017



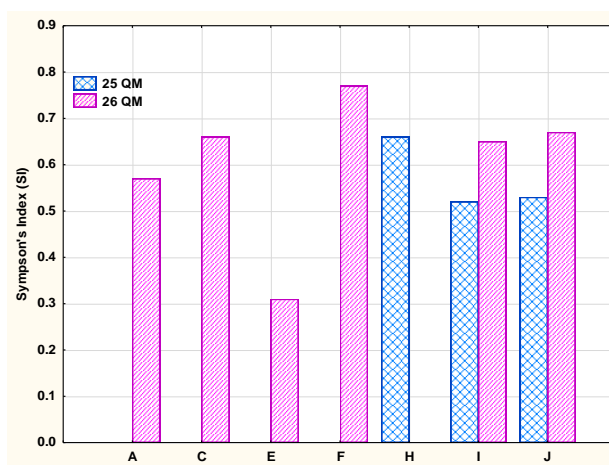
2017-2018



2018-2019



2019-2020



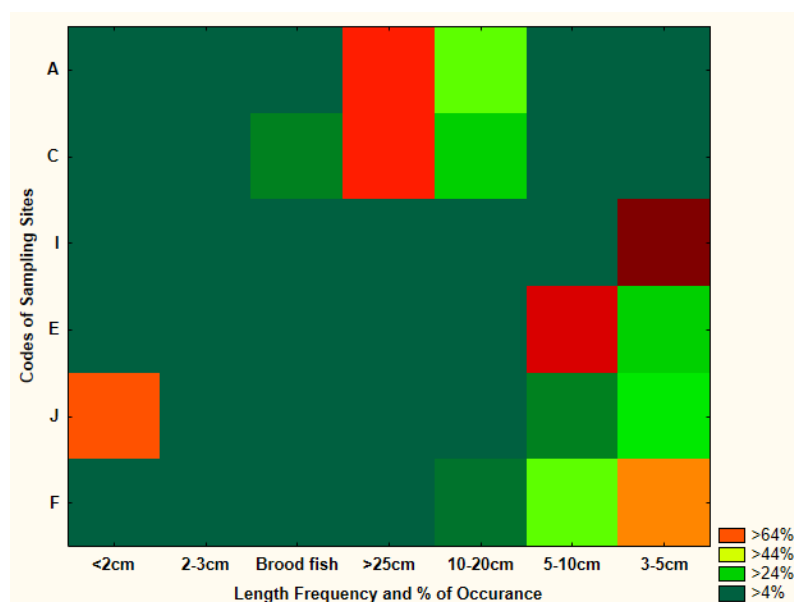
2020-2021

(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 and D.5** of **Appendix IV** and **Figure 3.6** for 26th quarter of monitoring year of 2020-21 shows that fries were dominant at Chandpai Point but juvenile to adult age group were dominant at Akram Point, Charaputia, Harbaria, Maidhara and Chalna Point.



26th Monitoring, November 2020

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

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

Fish Migration

Migratory Species Diversity

Migratory species were identified by analyzing the common species available in the regular catch from the sampling sites. Fish species like *Bata* attain the maximum abundance among the migratory fish species observed in the 26th quarter of monitoring year, 2020-21. The relative abundance of the migratory species is given below in the **Figure 3.7**.

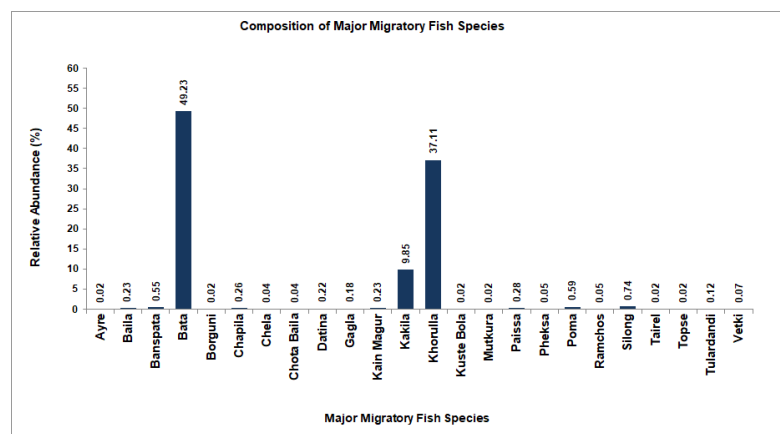


Figure 3.7: Relative abundance of major migratory fish species in sampling sites

Migration Extent, Time and Purpose

Major fish species showed interesting pattern in distribution for exploiting different purposes mentioned in the following table all along the sampling sites. Among migratory species, Poma, Paissa, Gagla and Datina were observed to migrate long distance (**Figure 3.8 and Table D.6 and Table D.6 of Appendix IV**).

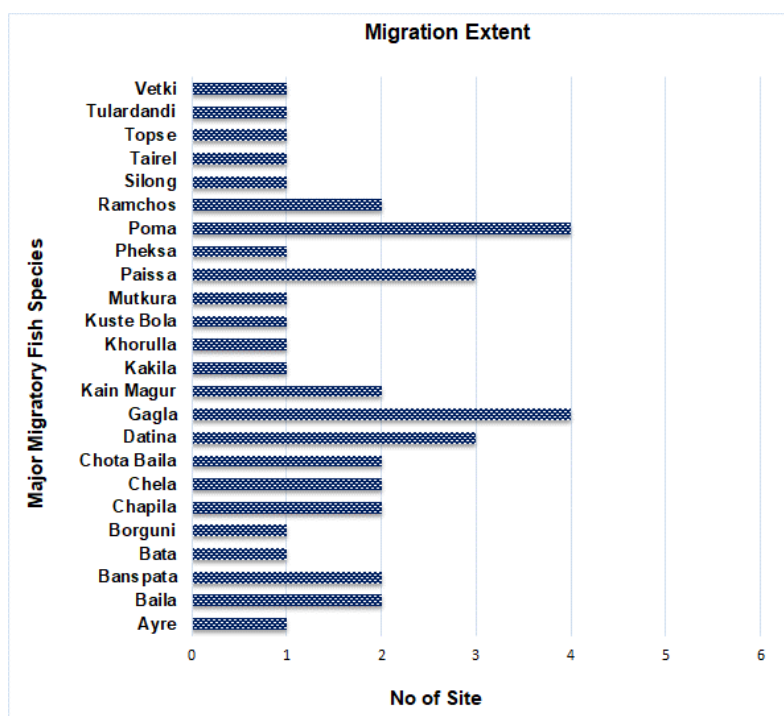


Figure 3.8: Migration extent of major migratory fish species in sampling sites

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 fish stocking was not done during this monitoring period because this time was mainly harvesting period.

Shrimp/Fish Growth Rate and Mortality

During the 26th quarter of monitoring, the highest growth rate has been observed in the Kapasdanga Gher. On the other hand, highest mortality had been observed to Chunkur-2 Gher because the cyclone Amphan in 2020 washed out most of fishes of the Gher (**Table 3.8** and **Table 3.9**).

Table 3.8: 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 (Aug 2015)		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	
	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)
1	0.3	15-20	0.2	40	0.25	50	-	-	-	30	0.18	25	0.20	60	-	-	-	-	0.2	20	0.20	60	-	-	-	30
2	0.3	30-35	0.3	94	0.25	10	-	-	-	-	0.14	20	0.15	100	-	-	0.21	15	0.3	40	0.25	50	-	-	-	10
3	0.2	25-30	0.2	25	0.20	65	-	-	-	10	0.15	50	0.25	20	-	-	0.17	30	0.15	30	0.20	30	-	-	-	25

Table 3.9: Growth Rate and Mortality of Fish/Shrimp (14th to 24th 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	
	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)
1	0.03	50	-	-	0.28	0.28	0.38	80	-	-	-	-	0.35	50	0.38	-	0.35	-	-	-	0.38	-	0.42	35
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
3	0.02	25	-	-	0.4	0.4	0.20	50	-	-	-	-	0.34	40	0.36	-	0.37	-	-	-	0.32	-	0.38	90

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 Fash Jal (5.04kg/haul) shown in **Table 3.10**. In 26th quarter monitoring, the highest productivity was found at Akram Point followed by Charaputia and Harbaria (**Table 3.11**).

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

Site	Habitat	Gear Name/Type	Haul Duration (hr)	No of Haul	kg/haul
A	Confluence at Akram Point	Fash Jal	12	6	5.04
		Borshi	-	-	-
B	Haldikhali Khal	Not Found	-	-	-
C	Charaputia Khal	Borshi	-	-	-
D	Bhodra Confluence	Not Found	-	-	-
E	Harbaria Khal	Khepla Jal	0.25	4	0.5
		Borshi			
F	Passur River	Khepla Jal	0.17	10	0.06
G	Passur-Jongra Confluence	Not Found	-	-	-
H	Passur-Mongla Confluence	Not Found	-	-	-
I	Passur-Maidara Confluence	Charpata Jal	12	1	5
J	Passur River, Chalna Point	Poma Jal	0.33	3	0.83
		Phesa Jal	2	3	0.83

Source: Catch assessment survey, CEGIS, November 2020

** Weight of Fry is not considered for catch assessment

Table 3.11: 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
A	2	0	0	17	0	16	0	0.40	0	0	0	0	30.5
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
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
F	0	0	0	0	0	0	0	0.00	0	0	0	0	0.6
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	-
I	0.3	0.4	0.67	0.13	3	5	1.2	0.00	0.5	1.7	0.4	3.0	5
J	0.12	0.3	0	1	0.25	1.2	0.6	0.17	1.6	0.8	0	6.3	7.5

*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 used in fishing at sampling sites

Culture Fish Production

The present study on shrimp/fish farm in the 26th quarter monitoring phase showed that the highest production was observed in the Gher of Kapashdanga (**Table D-7, Appendix-IV**).
Monitoring of Ecosystem and Bio-diversity

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

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.

3.2.3 Terrestrial Ecosystem

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

Description of the selected homestead

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

Species Composition of selected homestead vegetation

Homestead at Rajnagar

This homestead is dominated by Gewa (*Excoecaria agallocha*) among all the trees due to its highest 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 homesteads have many Mahagoni (*Swietenia mahagoni*) saplings which population is also high. Jaam (*Syngium cumini*), Tentul (*Tamarindus indica*), 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 Koro (*Albizia saman*) and Raj Koro (*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

Rendi Koro (*Albizia saman*), Mahagoni (*Swietenia mahagoni*), Taal (*Borassus flabellifer*), Narikel (*Cocos nucifera*), Khejur (*Phoenix sylvestris*) are referable. The home owners 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 quadrat vegetation survey has been conducted at selected homesteads during recent monitoring tier. A total of 54 plant species (excluding undergrowths) has been recorded from 16 number of surveyed sample quadrates within the homesteads. Details of the survey result is presented in **Table 3.12** below.

Table 3.12: Plant species composition of the sampled homesteads

Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Total Number of individuals	Biodiversity Index
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
<i>Accia arabica</i>	Babla															1		1	3.76
<i>Achyranthus aspera</i>	Apang													10				10	
<i>Acrostichum aureum</i>	Tiger Fern						3	3		3			5			1	3	18	
<i>Adhatoda vasica</i>	Bashok							1										1	
<i>Aegle marmelos</i>	Bel									1								1	
<i>Albizia richardiana</i>	Chambol									1		3			1			5	
<i>Albizia saman</i>	Rain Tree					2	4			1				3	1			11	
<i>Aphanamixis polystachya</i>	Rhyna									2		2						4	
<i>Areca catechu</i>	Supari					1	1	12		1								15	
<i>Azadirachta indica</i>	Neem		1	1		1		1			2	1	4					11	
<i>Borassus flabelifer</i>	Taal					2			1	2			3			2		10	
<i>Carica papaya</i>	Pepey								1									1	
<i>Citrus medica</i>	Lebu														1			1	
<i>Cocos nucifera</i>	Narikel	2	1	3	3	2	3	2	1	3	3	7	5	1	2	2		40	
<i>Colocasia sp</i>	Mankochu							20							30			50	
<i>Cordia dichotoma</i>	Bohal										1			1				2	
<i>Delonix regia</i>	Krishnochura								1									1	
<i>Dentella repens</i>	Danton													1				1	
<i>Diospyrus pregrina</i>	Gab									4				3	1			8	
<i>Erythrina ovalifolia</i>	Mandar														1			1	
<i>Euphorbia Tirucallii</i>	Pencil Cactus					10												10	
<i>Excoecaria agallocha</i>	Gewa	5	5	8	10			3	4							20	10	65	
<i>Ficus benjamina</i>	Lokkho Pakur						1											1	
<i>Ficus hispida</i>	Dumur								2		1	6						9	
<i>Ficus religiosa</i>	Aswath						1	1										2	
<i>Heritiera fomes</i>	Sundari	7						1										8	
<i>Hibiscus tiliaceus</i>	Bola					6	10						3					19	
<i>Ipomoea fistulosa</i>	Dhol Kolmi					25												25	
<i>Lawsonia inermis</i>	Mehedi		1			1												2	
<i>Lepisanthes rubiginosa</i>	Amjum/ Baraharina		1															1	

Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Total Number of individuals	Biodiversity Index
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
<i>Limonia acidissima</i>	Kotbel		1							1								2	
<i>Mangifera indica</i>	Aam					4					2	1	1	4	14			26	
<i>Manilkara zapota</i>	Safeda					1				1								2	
<i>Mimusops elengi</i>	Bokul										1							1	
<i>Moringa oleifera</i>	Sazna						1								1			2	
<i>Musa sp</i>	Kola						10			18	11				5	1		45	
<i>Ocimum sanctum</i>	Tulshi								2					5	20			27	
<i>Phoenix sylvestris</i>	Khejur		3	2	2		1	1			1					1	1	12	
<i>Phyllanthus emblica</i>	Amloki													1				1	
<i>Phyllanthus reticulatus</i>	Shitki							1					20		1			22	
<i>Pongamia pinnata</i>	Koroach								1					2				3	
<i>Psidium guajava</i>	Peyara					1			1	3								5	
<i>Punica granatum</i>	Bedana					1									2			3	
<i>Sesbania bispinosa</i>	Dhaincha															10		10	
<i>Sonneratia apetalla</i>	Kewra			1													1	2	
<i>Swietenia mahagoni</i>	Mahagoni					3	3	3		29	30	6	15	3	3			95	
<i>Syzygium cumini</i>	Jaam														2			2	
<i>Tagetes sp</i>	Ganda													4				4	
<i>Tamarindus indica</i>	Tentul				1				2									3	
<i>Terminalia arjuna</i>	Arjun														1			1	
<i>Terminalia catapa</i>	Kathbadam													3				3	
<i>Unknown 1</i>							1	3	3									7	
<i>Zizyphus sp</i>	Kul boroi		1					1							2			4	
<i>Lannea coromandelica</i>	Jigar						20						5		25			50	

Note: Q-Quadrat

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 spot, lethal yellowing, leaf blast, nut fall, Mite damage on nut fruit are common diseases of the plants in the study area. A brief discussion was 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

Except Rajnagar, Plant health status have been improved all the sites than previous monitoring period. In the case of Rajnagar site, Coconut (*Cocos nucifera*) and Date Palm (*Phoenix sylvestris*) are the main affected species and most of them are signed with lethal bole rot, narrowing upper trunk and radish brown leaves. Homestead platform of this site is developed through land filling by bed materials of nearer khals. Which caused anaerobic situation of the site and death all of the undergrowths. Following table represents the number of disease affected unhealthy plants in studied homesteads (**Table 3.13**).



Figure 3.10: Land filling and death coconut plant at Rajnagar site

Table 3.13: No. of unhealthy plants in studied homesteads

Location	Plant Name	Total No. of Plant	No. of Unhealthy Plant																				
			Apr-14	Jun-14	Oct-14	Jan-15	Apr-15	Aug-15	Oct-15	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
Rajnagar	Cocos nucifera	17*	NS	10	5	5	15	4	5	NS	3	4	6	6	9	4	4	3	2	3	10	3	-
	Phoenix sylvestris	25	NS	15	4	4	22	9	13	NS	10	2	5	4	7	6	8	9	5	3	4	4	5
	Manilkara zapota	1	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1
	Albizia saman	2	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Excoecaria agallocha	55*	NS	-	1	1	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mangifera indica	3	NS	1	-	-	2	-	-	NS	-	-	1	-	-	1	-	-	-	-	-	-	-
	Psidium guajava	2	NS	2	-	-	2	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
Borni	Cocos nucifera	10	7	3	-	-	3	1	2	NS	1	2	3	1	2		1	1	1	2	1	-	-
	Phoenix sylvestris	12	-	5	4	4	3	1	4	NS	4	3	4	2	1		-	1	1	-	-	-	-
	Borassus flabellifer	6	3	1	-	-	-	-	-	NS	-	-	-	-	-	1	1	-	-	-	-	1	-
	Mangifera indica	6	3	3	1	1	4	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Excoecaria agallocha	18	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-
	Swietenia mehogani	11	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Areca catechu	10	-	6	2	2	8	2	2	NS	-	1	-	3	-	-	-	-	-	-	-	-	-
	Manilkara zapota	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Psidium guajava	2	2	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
Kalekarber Dighi	Cocos nucifera	56	35	5	1	1	2	2	3	NS	1	1	-	6	3	-	1	3	1	7	4	2	-
	Phoenix sylvestris	10	-	3	-	-	1	-	1	NS	3	-	3	-	-	-	-	-	-	-	-	3	-
	Mangifera indica	5	1	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Manilkara zapota	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Borassus flabellifer	8	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Zizyphus sp	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1
	Psidium guajava	8	-	-	-	-	-	-	-	NS	-	-	1	-	-	-	-	-	-	-	-	-	-
	Tamarindus indica	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cocos nucifera	39	25	19	5	5	34	20	-	NS	2	2	4	5	3	-	3	4	2	4	3	5	-
Chalkghona	Phoenix sylvestris	24	-	10	1	1	6	5	1	NS	1	-	5	2	3	-	-	1	2	2	1	3	-
	Albizia saman	3	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-
	Excoecaria agallocha	36	-	-	1	1	-	-	-	NS	-	-	-	-	2	-	-	-	-	-	-	-	-
	Manilkara zapota	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
	Psidium guajava	17	1	7	-	-	-	-	-	NS	-	-	-	-	-	1	3	-	-	1	-	-	-
	Mangifera indica	7	2	1	-	-	-	-	-	NS	-	1	-	1	-	-	-	-	-	-	-	-	-
	Borassus flabellifer	2	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-

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 boles 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

Vegetation canopy cover has been improved at two sites, unchanged at one site and drastically reduced at Rajnagar site. Except, Rajnagar site, all the homestead platforms found newly plantations which are in growing form and contribute a tiny portions of whole canopy cover. In the case of Rajnagar site, most of the plants are in unhealthy due to land filling by khal bed materials, tree felling by home owners and also for salinity increase at nearer wetlands. Comparing the data between November 2019 and this monitoring tier, canopy coverage has estimated more or less similar at all the sites except Rajnagar site in following **Table 3.14**

Table 3.14: Vegetation Canopy Cover in different Studied Homesteads

Location	% of canopy Coverage																			
	Apr 2014	Jun 2014	Oct 2014	Jan 2015	Apr 2015	Aug 2015	Oct 2015	Jan 2016	Jul 2016	Oct 2016	Jan 2017	Jan 2018	Apr 2018	Jul 2018	Nov, 2018	Feb, 2019	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020
Rajnagar	NS	19	19	17	20	20	20	20	21	23	19	15	18	14	11	22	19	18	16	14
Borni	NS	26	18	18	12	14	20	20	25	25	23	21	21	23	20	21	21	20	18	20
Kalekarber	NS	20	24	25	23	24	24	22	24	26	25	23	24	24	25	24	25	25	24	24
Chalkghona	NS	13	24	22	17	21	21	20	21	27	26	25	16	18	21	22	22	22	20	23

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. No bird nest has been observed any one monitoring site.

Migratory birds and their habitats

Migratory and local migratory winter birds follow at large shrimp gher along the study area. According to local people and physical observation, Common Coot, Common Snipe, Black Winged Stilt, Ruddy Shelduck, Little Grebe etc are common winter visitor of this area. In

addition, local Ruddy Breasted Crane, Common Sandpiper, Great Egret, Pond Heron, Little Cormorant are also found at most of the monitoring wetlands of the study area.

Except two wetlands, all the monitoring sites observed local migratory birds. Of which, occurrence of local migratory birds was high at Chotocharar Gher and Koigar Daskati Gher. Overseas migratory birds have informed only at Koigar Daskati Gher. But the population is very low as previous years. According to local knowledgeable persons, population of migratory birds are reducing day by day from these wetlands for illegal hunting, re-starting shrimp culture within short intervals from shrimp harvesting in past year and indiscriminate use of pesticides in agriculture field and shrimp farms. In addition to this, noise from construction vehicle movement through the Power Plan approach road, noise from the construction sites during night, vehicle and construction lightings are disturbing the migratory birds which are roaming at the nearby wetland (shrimp farms).

Following table **Table 3.15** show the presence of migratory birds at the important wetlands inside the study area.

Table 3.15: Presence of migratory birds at different wetland inside the study area

Wetland Name	Wetland type	Approximate distance from project Boundary (Km.)	Presence of Birds	
			February 2020	
			LM	M
Choto Charargher	Saline Water Shrimp Farm	0.10	Yes	No
Boro Charargher	"	0.10	Yes	No
Putimari Gher	"	1.10	Yes	No
Golbunia Gher	"	0.1	Yes	No
Shukariar Gher	"	1.25	No	No
Koigar Daskati Gher	"	0.25	Yes	Yes
Badyamari Gher	"	1.00	No	No
Chalkghonar Beel	"	1.50	Yes	No

Note: 'LM'=Local Migratory, 'M'=Migratory, 'Y'=Yes

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 (Sailtakhali and Ichamoti) exists as an internal river system. Both of the river systems are support River Dolphin whole of the year. Hence, status of aquatic mammals (Dolphin) in these river systems has been monitored.

Dolphin 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.

Dolphin occurrence in Passur and Maidara River

Occurrences of dolphins have been monitored within about 10 km length of Passur and 1 km length of Maidara river surround the project area (From Digraz Kheya Ghat to Chalna Bazar including Maidara River) through boat transact during neap to mid spring tide. A total of 9 dolphins were recorded during this survey. Of which 3 dolphins were observed at Passur River and six were at Maidara river. This survey transect was about 16.6 km and total time spend about two hours. The encounter rate was 0.29 individuals/km/hour (**Figure 3.11**).

Dolphin occurrence in Dhangmari Khal and Shella Gang

Dolphin occurrence also observed at the Dhangmari Khal, Chandpai Shella Gang Wildlife Sanctuary and Bhadra Khal. In the case of Dhangmari Khal, total transect length was 13.6 km during full Tide, medium wave and sunny sky condition from Dhangmari-Passur confluence to Gagramari Forest Patrol Post up and down (**Figure 3.12**). A total of 13 dolphins were recorded in Dhangmari Khal within about 1 hours and 39 min of transact time. The encounter rate was 0.58 individuals/km/hour.

In the case of Chandpai Shella Gang, the survey transact was bounded from Passur River reach near Joymoni Food Silo to Shella Gang near Joymoni during mid spring tide. The transect length was about 6.5 km (**Figure 3.13**). A total of 5 dolphin individuals have been sighted during 40 minutes' survey. The encounter rate was 1.17 individuals/km/hour. However, the survey result is included in **Table: 3.16**

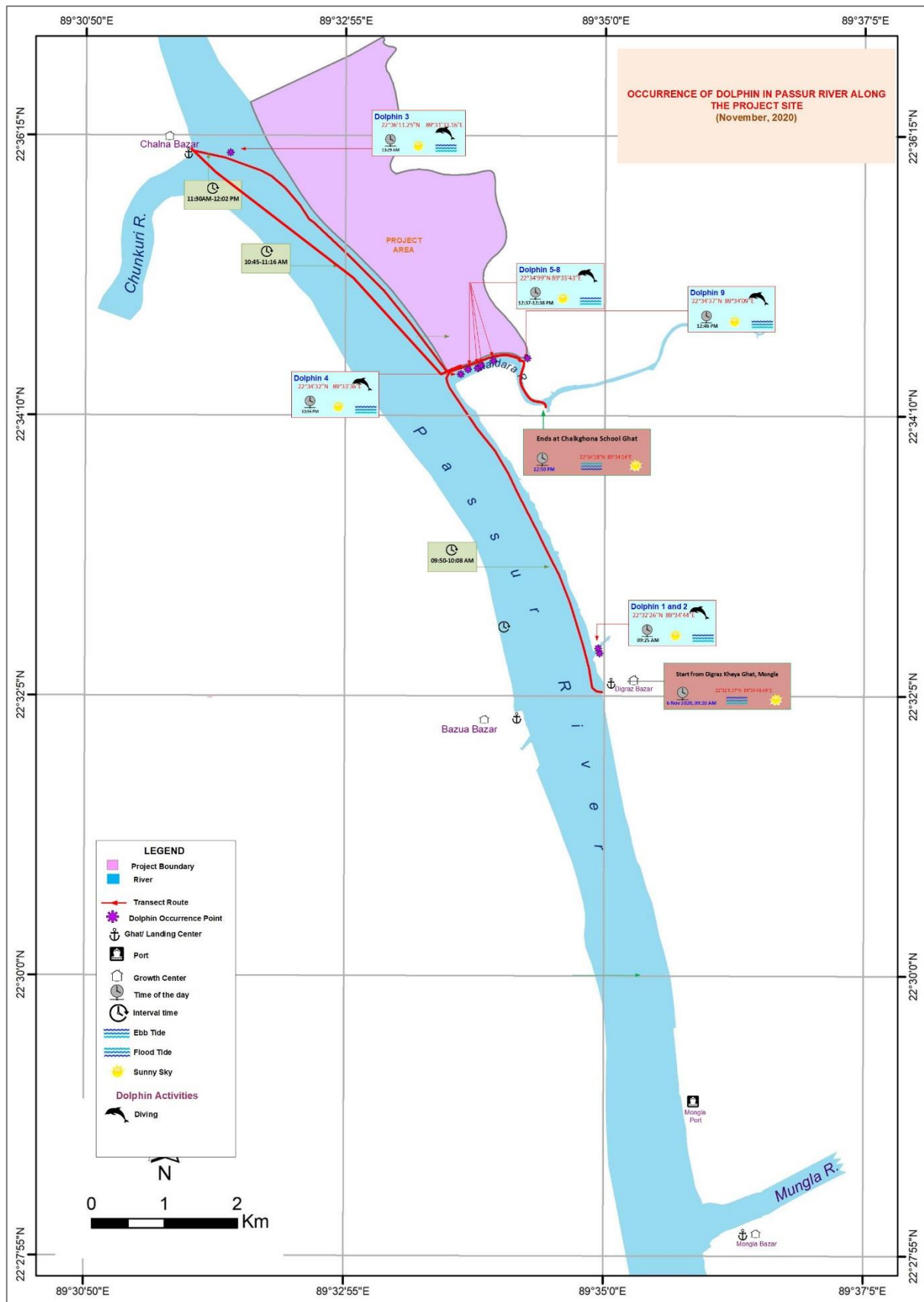


Figure 3.11: Occurrence of dolphin at Passur and Maidara River along the project site

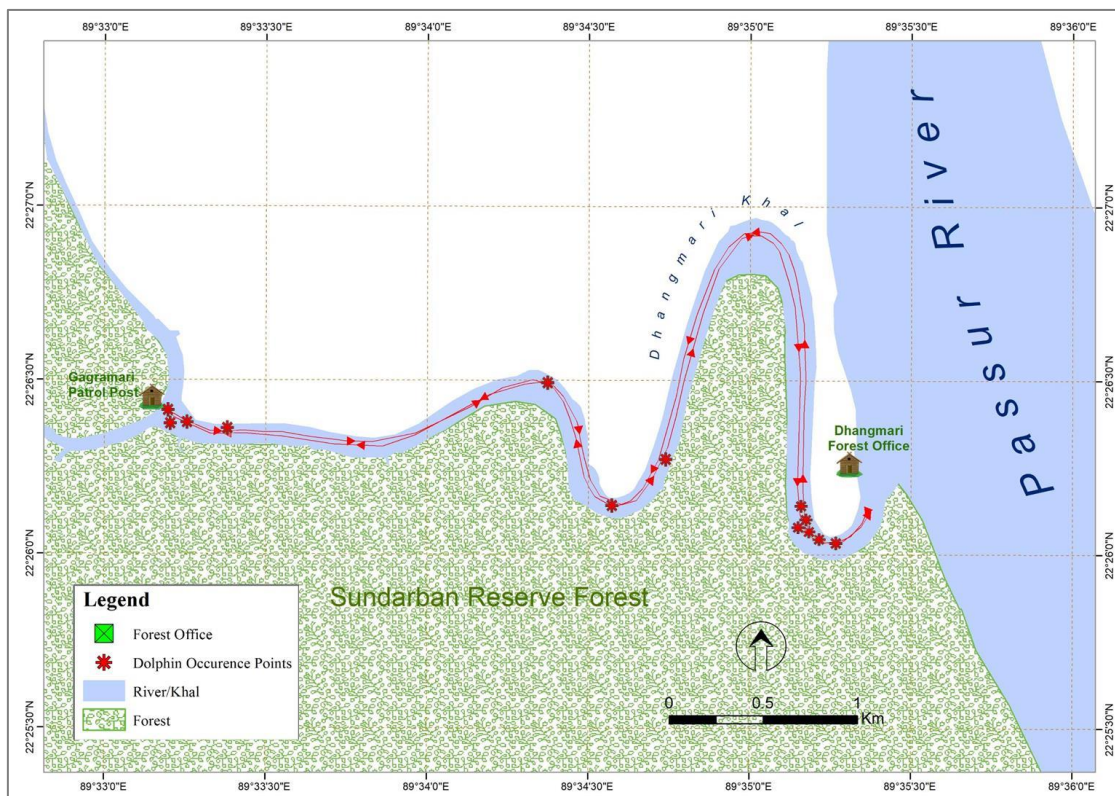


Figure 3.12: Location of dolphin Occurrence at Dhangmari Khal

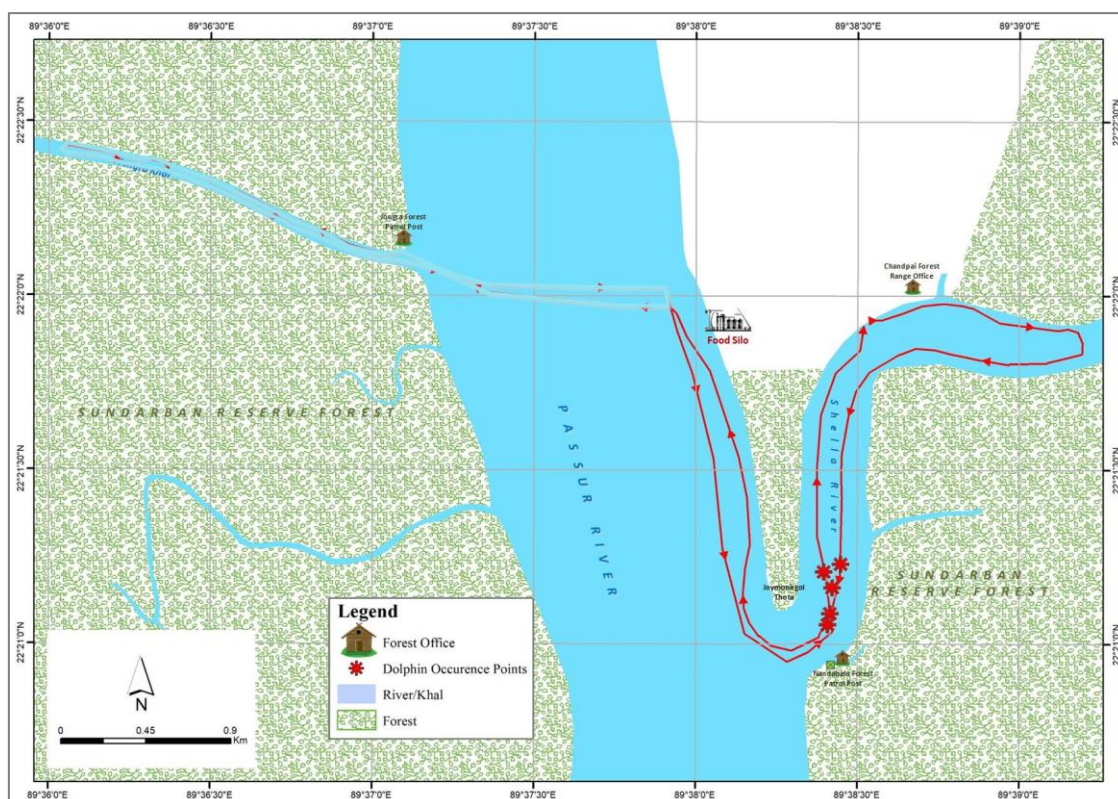


Figure 3.13: Location of dolphin Occurrence at Chandpai

Table 3.16: Dolphin Observation Datasheet

Location of River systems	Occurrence Status																																									
	Apr-14		Jun-14		Oct-14		Jan-15		Apr-15		Aug-15		Oct-15		Oct-15		Jul-16		Oct-16		Jan-17		Jan-18		Jun-18		Nov-18		Feb-19		Apr-19		Jul-19		Nov, 2019		Feb, 2020		Jul, 2020		Nov 2020	
	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T
Project Site	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NS	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	NS	Y	NS	Y	NS	N	Y	Y	NS	Y	Y	Y	Y	NS	NS	Y
Karamjal	NS	NS	NS	N	NS	Y	Y	Y	N	N	NS	Y	NS	Y	Y	N	Y	NS	Y	Y	Y	NS	Y	N	NS	N	N	Y	N	Y	N	Y	N	NS	Y	Y	Y	N	N	Y	NS	NS
Harbaria	NS	NS	NS	N	NS	Y	Y	N	N	N	N	N	Y	NS	Y	N	Y	Y	Y	NS	N	Y	N	N	N	N	N	N	Y	N	N	Y	N	N	Y	NS	N	N	NS	NS	NS	
Akram Point	NS	NS	NS	N	NS	N	NS	Y	Y	Y	NS	NS	N	Y	Y	NS	NS	NS	N	N	NS	NS	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	Y	NS	N	N	NS	NS
Moidara River	Y	N	N	N	Y	Y	Y	N	Y	N	Y	N	NS	Y	N	Y	Y	NS	NS	Y	N	Y	NS	Y	Y	Y	NS	Y	NS	N	NS	N	Y	N	NS	Y	Y	Y	Y	NS	NS	Y
Shella River at Chandpai	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	N	Y	NS	NS	Y	Y	NS	NS	Y	Y	NS	Y	Y	Y	Y	Y	Y	Y	NS	

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

Occurrence Status: Y = Occurred, N = Not occurred

3.3 Sundarbans Forest Health

The Forest Health Monitoring program utilizes information from different sources, for example, ground plots studies, flying overviews, and other biotic and abiotic information sources and creates scientific ways to deal with address backwoods medical problems that influence the maintainability of forest environments. One of the broadly utilized timberlands solid checking Bio-pointers is development pattern additional time and its connection with leaf area index. The Forest Health Monitoring program utilizes information from different sources, for example, ground plots (for example long haul checking plot) studies, flying overviews, and other biotic and abiotic information sources and creates scientific ways to deal with address backwoods medical problems that influence the maintainability of woodland environments. One of the broadly utilized timberlands solid checking Bio-pointers is development pattern additional time and its connection with leaf area index (Beets and Whitehead 1996). Stands with a high leaf area index will accumulate more biomass and total volume per ha than stands with a low leaf area, other things being equal (Beets et al. 2008). Lichen abundance is another good indicator of forest health. Lichens often grow on trees and shrubs, absorbing nutrients from the atmosphere. Because lichens are very sensitive to air pollution—particularly to sulfur dioxide, fluoride, and ammonia—their presence or absence is an indicator of forest health. The acidity of a tree's bark can also affect lichen abundance (Smith et al. 2003). If air is very badly polluted with sulphur dioxide there may be no lichens present, just green algae may be found. If the air is clean, shrubby, hairy and leafy lichens become abundant (Bates et al 1996). The quality of the soil in a forest is another important indicator of forest health (USDA Forest Service. 2007). An evaluation of soil quality usually involves measuring the soil's physical, chemical, and biological makeup at different depths. Plant species diversity is another Bio-indicator of healthy forest. One way to assess this diversity is to determine whether there is a mix of plant species of different sizes and ages, thus creating forest "layers" that provide habitat for many species (Greenleaf Forestry and Wood Products Inc. 2010). 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). A healthy forest has good regeneration capacity, which is also a bio-indicator of forest health monitoring. These bio-indicators will be investigated in Sundarbans Reserve Forest (SRF) in light of the Rampal Power Plant Installation. To recognize the genuine situation of intensity plant sway on woods wellbeing, it is obligatory to make a gauge condition. Contemplating this, CEGIS is leading woods wellbeing checking program at five areas specifically Sutarkhali, Karamjal, Harbaria, Akram point and Hiron Point at Sundarbans Reserve Forest (SRF) along the Passur River. The boundaries that remembered for this checking program were forest development, recovery limit, lichen bounty, plant variety, biomass and carbon stock.

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 3.17**). 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. 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 3.15**). The plot layout is **Figure 3.16**.

Table 3.17: 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

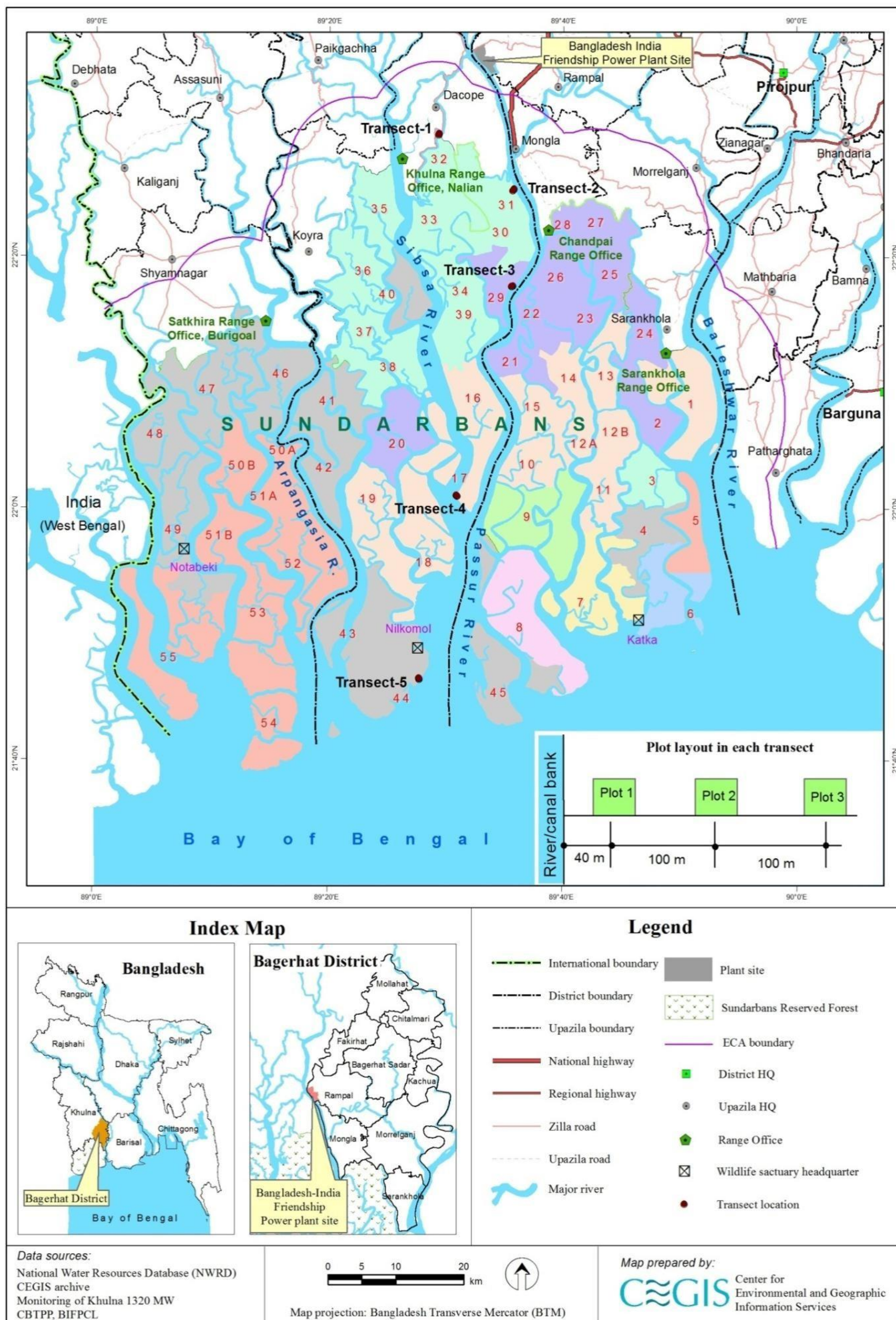


Figure 3.14: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)

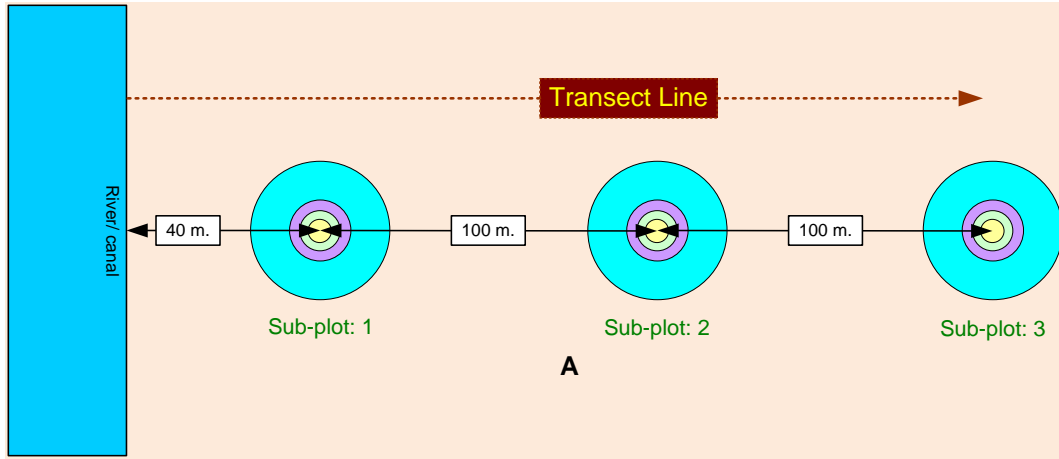


Figure 3.15: Layout of the Subplots and Transect Line Perpendicular from Ecotone (river or canal bank)

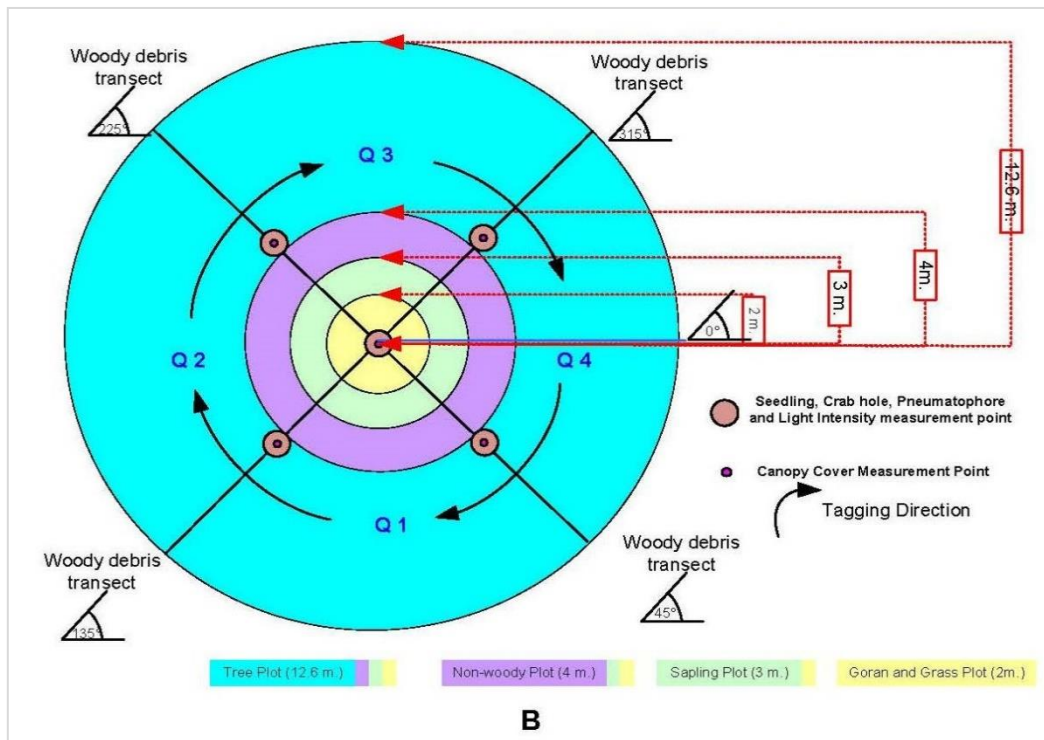


Figure 3.16: Layout of the Survey Activities in each Subplot

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.

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 (**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 3.18**). 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

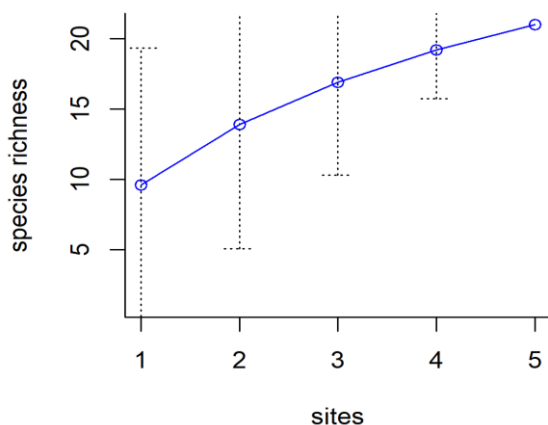


Figure 3.17: Species accumulation curve for the PSPs dataset

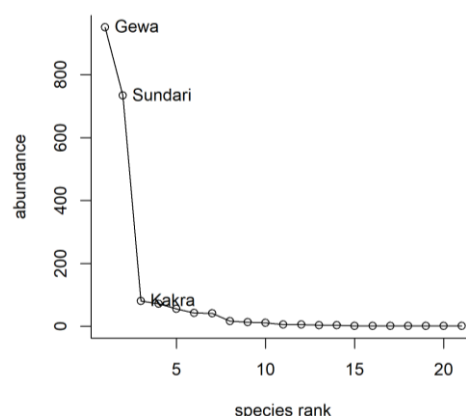


Figure 3.18: Rank-abundance curve for the sampled PSPs

The bars indicate +2 and -2 standard Deviations (N.B. 1=Sutarkhali, 2=Karamjal, 3= Harbaria, 4=Akram Point, 5=Hiron Point.

Table 3.18: 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

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**). The vectors represent environmental variables. The length of the vector is proportional to its importance and the angle between two vectors reflects the degree of correlation between variables. The angle between a vector and each axis is related to its correlation with the axis (**Figure 3.20**)

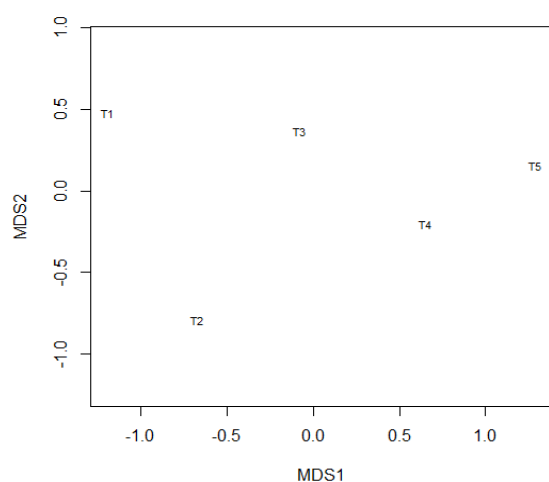


Figure 3.19: Ordination graph for MDS

[A two-dimensional MDS based on the Bray-Curtis distance. The best configuration out of 500 is shown]

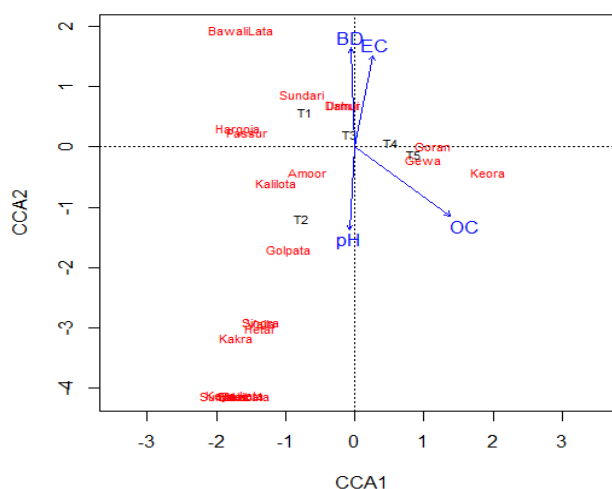


Figure 3.20: CCA ordination

[The vectors represent environmental variables. The length of the vector is proportional to its importance and the angle between two vectors reflects the degree of correlation between variables. The angle between a vector and each axis is related to its correlation with the axis]

3.4.6 Carbon Stock in Trees

Over the census period, there was no significant difference ($P > 0.05$) in tree carbon stock for all the PSPs (**Table 3.19 and 3.20**). However, an increasing trend in carbon stock was observed in all PSPs except harbaria. Sundari has the highest amount of carbon stock.

Table 3.19: 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 st Q.	T.C. 23 st Q.	T.C. 24 th Q.	T.C. 25 th Q.
Amoor	1.37	1.28	1.65	1.69	1.54	1.42	1.33	1.28
Baen	71.46	64.59	66.51	67.42	65.11	64.09	61.92	68.59
Bhutbutta	0.14	0.18	0.25	0.25	0.25	0.25	0.25	0.14
Bola	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Gewa	125.00	121.15	124.69	126.15	125.01	126.62	101.69	213.48
Goran	0.66	0.69	0.77	0.78	0.75	0.68	0.62	1.05
Kakra	53.35	50.93	51.99	52.35	52.15	52.19	51.96	50.84
Lakur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Passur	62.60	71.33	74.16	67.63	70.50	71.19	62.04	60.80
Sundori	446.01	450.82	475.60	465.01	468.22	466.09	460.59	508.68
Urmui	0.41	0.36	0.40	0.44	0.41	0.39	0.43	0.41
Vaila	0.80	0.83	0.74	0.74	0.74	0.74	0.81	0.77

N.B. TC-Total Carbon

Table 3.20: Average Biomass and Carbon Stock Over Different Census Period (t/ha)

25 th Monitoring Quarter						
	AGB	BGB	TB	AGC	BGC	TC
Sutarkhali	141.94	21.29	163.23	70.97	10.65	81.62
Karamjal	299.96	44.99	344.96	149.98	22.50	172.48
Harbaria	214.17	32.12	246.29	107.08	16.06	123.15
Akram Point	115.63	17.34	132.98	57.82	8.67	66.49

3.4.7 Status of forest health indicators

The tag number of trees (DBH \geq 5cm 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 no significant variation ($p > 0.05$) in tree growth over the monitoring period for all the PSPs. The Seedling density among the five PSP was not significantly different ($P > 0.05$) except Hiron point. Hiron point is subjected to huge sedimentation about 1.5feet. An increasing trend of seedling survival was found in Sutarkhali. This is because of the time of seed germination and seedling survival in the observed PSPs. The field activities are shown in **Figure 3.21**



Measuring Canopy cover at Akram point



Measuring Height at Hiron point site



Measuring DBH at Starkhali



Counting crab hole at Harbaria

Figure 3.21: Field activities for monitoring of Sundarbans Forest Health

There is no significant variation ($p>0.05$) in pneumatophores density over the monitoring period for each PSPs (**Figure 3.22**) except karamjal. Karmjal shows reduce in number due to mortality. Average number of pneumatophores per hectare was comparatively very low in Akram point area whereas pneumatophores density was highest in Karamjol sample plots. This indicates that forest health condition is not deteriorating in terms of steady state condition of pneumatophores density over time.

There is a variation ($p>0.05$) in crab density the last monitoring period for all PSPs (**Figure 3.22**). All the plot shows increasing trend. It indicates that positive change in forest condition. However, Akram point crab density was significantly different than the other sample plot ($p<0.05$).

All the PSPs (Sutarkhali, karamjol, herbaria point) canopy cover doesn't vary significantly ($P>0.05$). Akram point PSP's permanent plot canopy cover was lower compare to the rest of PSPs canopy cover percentage (**Figure 3.22**).

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 3.22**).

There were no changes observed in phenological behavior of the dominant tree species during the monitoring period. (**Table 3.21**)

However, in the present study, 'top dying' of Sundari and bark hollow of gewa was observed in all the PSPs. Almost most of the Sundari trees were suffering from 'top dying' disease at Harbaria plot. In additionally mortality rate of different species is very low in all PSP's

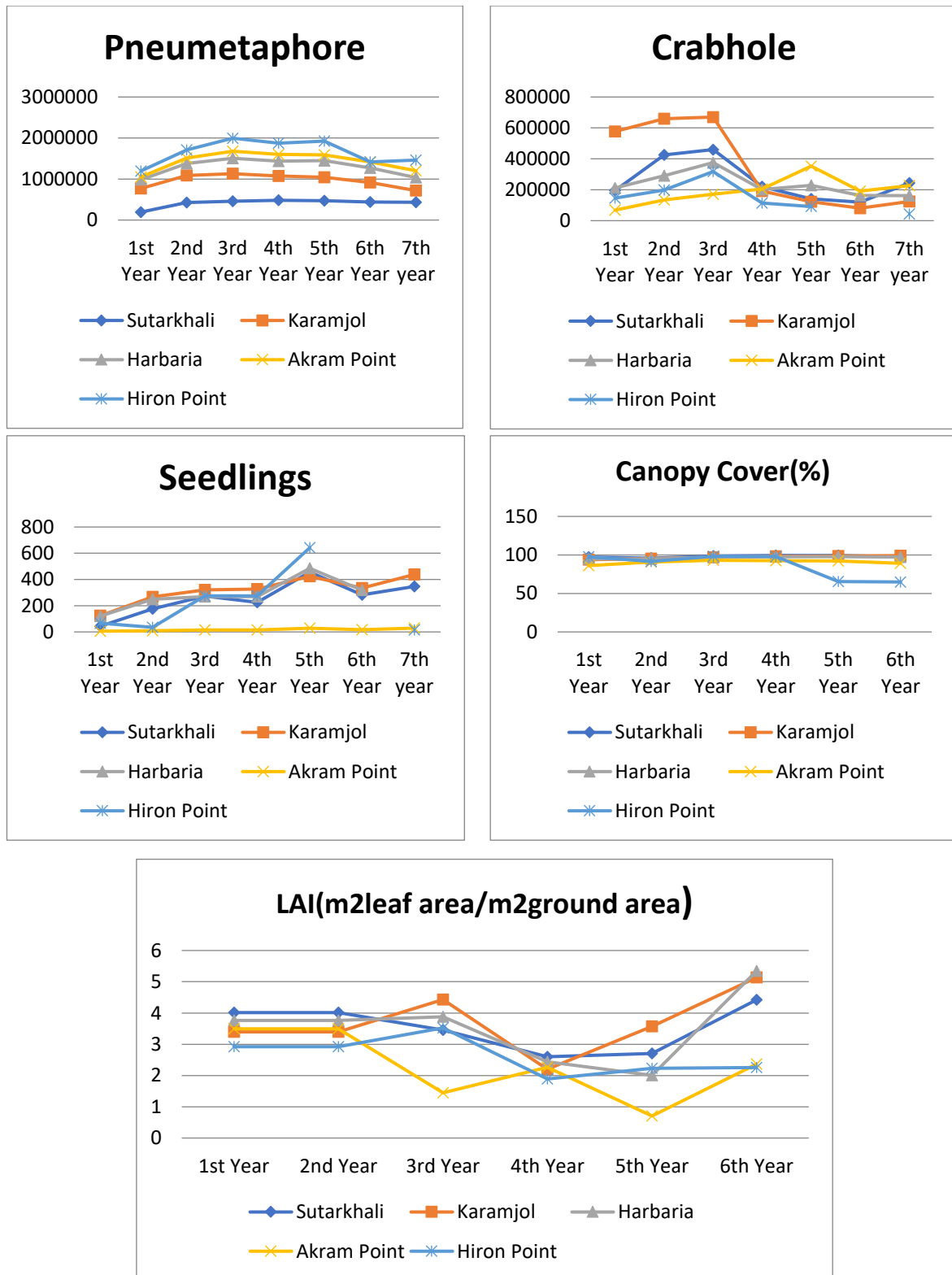


Figure 3.22: Pneumatophore, Crab Hole Density, Seedling Density, canopy cover and LAI over different census period

(Each year represent average of 5 monitoring period , 1st tier of 7th year)

Table 3.21: Phenological Behavior of Major Mangrove Species in the PSPs

Species	Months											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Leafing												
Sundari												
Gewa												
Goran												
Kakra												
Passur												
Leaf Shedding												
Sundari												
Gewa												
Goran												
Kakra												
Passur												
Flowering												
Sundari												
Gewa												
Goran												
Kakra												
Passur												
Fruiting												
Sundari												
Gewa												
Goran												
Kakra												
Passur												
Seed/Popagule dropping time												
Sundari												
Gewa												
Goran												
Kakra												
Passur												

4. Social Environment

4.1 Introduction

This 26th Social Safeguard monitoring conducted to explore the safeguard status (during the phase of construction) following the suggestion of DoE and EMP of EIA report. In the safeguard monitoring, working condition, impact on livelihoods, community health and CSR activities assessed in order to understand the compliance status during the construction stage of the project.

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, viz., occupational health and safety, toilet facilities for workers, condition of kitchen and food, drinking water, and labor sheds, use of PPE by the construction workers and waste management.

The 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.

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

4.3 Results of Social Safeguard Status

Impact on Employment and Livelihood

Rate of local laborers are being increased based on the opinion of community living at Gaurambha, Kapasdanga and Hurka unions. However, local people are mostly engaged in non-technical works but people are trying to open up new business nearby to the power plant area. It was found that about 10-13 nos. stalls (grocery and tea) and a whole sale fish market developed at zero point of Rampal power plant (*where the approach road started*). Local people got some income opportunities to do small business due to bazar development. Additionally, about 170 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 helps people to involve income opportunities. According to people, because of the construction work, people from different areas come to join work, which help them to generate new earning opportunity for local people. Furthermore, working opportunity for local people started to increase due to the regular activities of Rampal Power Plant. Local people started thinking to be skilled as they can join in future related to this power plant. Because of that local people especially young generation are started to join different skill development programs.

Working Environment

The PMU encourages laborers to obey health safety rules in both construction site and the labor sheds. In construction site, No mask no entry motto continued to maintain a safe environment. Labors who are working at the project site are maintaining social distancing and other health safety rules (suggested by WHO and Bangladesh public health expert) to combat against the Covid 19 virus.

Besides, toolbox meeting is held every day with the Safety Manager which is being monitored by the PMU, and observation of BHEL written in a document addressing as noncompliance issues. Moreover, debriefing session with the BIFPCL held in order to monitor the noncompliance issues. Furthermore, Labor sheds found clean with adequate toilet facilities, drainage, and waste management and drinking water facilities.

Community Health

This monitoring found that water sprays occurred four times in a day for suppressing dust and protecting project site and local people around the site from dust pollution.

Local people reported that they are not encountering noise related problems due to construction activities. For ensuring green environment, about 65,000 plants were already planted and monitoring is going on to see the activities in caring, protecting the plants and reducing the death rate of the plants.

4.4 Corporate Social Responsibility (CSR)

The BIFPCL is committed to continue the CSR activities for ensuring local people with the activities of Maitree Super Thermal Power Project. There are different activities are running based on the demand of local communities.

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

Wheel Chair Distribution

Community engagement is one of the key pillars of corporate social responsibility (CSR), alongside the concern with the workplace. Following the target and key concern of local problems, wheel chair distributed among the disable people at the nearby village. This program was inaugurated at the Rajnagar union in which disable people would be benefitted, according to the BIFPCL authority.

Free medical Campaign

Spreading the free medical campaign for local people was the target of the CSR program. A free medical campaign was held at the Maitree Super Thermal Power Project site. In this campaign, a total of 299 patients got free treatment. In addition, boat medical campaign also held whereas 161 patients receive free treatment. Furthermore, another medical center was established in order to facilitate more treatment facilities at the power plant site on 30 October 2020.

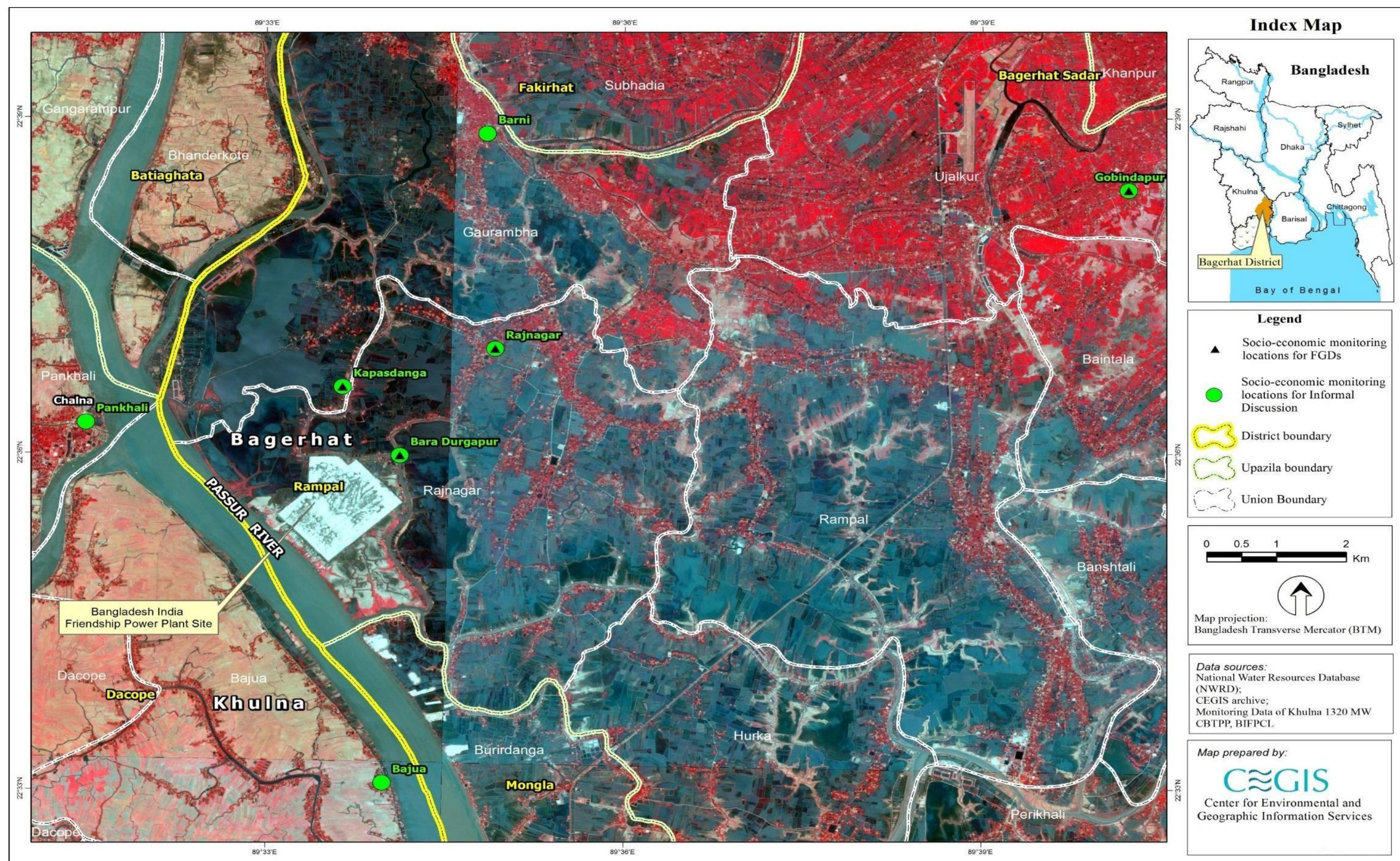


Figure 4.1: Socio-Economic Environment Monitoring Location

Ensuring Safe Drinking Water

During this monitoring, it has observed that different activities done under the CSR program. However, it is regular activities but there is some different works initiated for the community development. Ensuring safe drinking water is a prioritized work considered in the CSR of BIFPCL. Considering the access to water, 1.5 k.m pipeline installed at the Barni Sairabad (Gaurambha union) whereas a total of 250 families will be benefitted. On the other hand, 2 k.m water distribution system and a Reverse Osmosis Water Treatment Plant with 500 LPH capacity inaugurated at Prasadnagar (Gaurambha union) whereas a total of 225 families are expected to be benefitted. Besides, another Reverse Osmosis Water Treatment Plant with ATM system (source: Pond) and 1000 LPH capacity installed at Kalekharber of Rajnagar union whereas 350 families are expected to be benefitted. Additionally, 500 LPH capacity base Ro treatment plant established at Gonabelai Khanjahan Palli whereas BIFPCL is expected that a total of 250 families would be benefitted by this initiative **Figure 4.2**.



Figure 4.2: Inauguration of Reverse Osmosis Water Treatment Plant for the local community

Capacity Building

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

For ensure capacity and capable them to run their livelihoods a total of 146 No Sewing machines were distributed among the qualified female participants (in both written & practical exam of skill development) in tailoring /sewing on 31 October 2020. During this program, Honorable Deputy minister of Environment, Forest and climate change was attended and distributed the machines.

Recommendations

- a. Local need assessment should be conducted for prioritization of CSR activities;
- b. Heavy machineries should be checked regularly and properly to avoid the risks of accident;
- c. PAPs should be given priority in recruitment of manpower based on their skills;
- d. It is very essential to improve/refurbish old machineries and ensure fitness certificate;
- e. For assessing the needs of local communities and future CSR activities, coordination meetings are required to arrange on a regular basis;
- f. Involvement of local labor should be increased;
- g. Continuing regular health checkup and disease monitoring for the daily laborer at work place as well as for the laborer staying at labor colony;
- h. Ensure proper safety equipments for battling against the COVID 19 virus;
- i. awareness about the Coronavirus disease (COVID-19) should be Created to avoid the risks at the workplace;
- j. Special attention should be given on `workers if they have any syndrome related to the COVID 19;
- k. Care should be taken that all employees, visitors and contractors, use PPE at the work place. All air generating materials should be kept covered;
- l. Water purifier should be provided to the Project site for getting safe drinking water;
- m. Emergency preparedness and response plan; fire prevention, protection and control plan should be monitored regularly by the EPC contractor;
- n. Though the laborers are satisfied with availability of toilets and beds for laborers in the labor sheds but numbers of these two items should be increased for making better living environment and for maintaining the international norms;
- o. The labor sheds should be provided with lockers so that the laborers can feel safe with their valuable belongings;
- p. Entry of outsiders should be prohibited in the office as well as in the labor colony;
- q. Awareness on COVID 19 should be increased among the laborers who are staying at the labor colony;
- r. Health insurance should be ensured for labors who are working at the project site;
- s. CSR activities should be performed primarily among the PAPs on equitable manner. This should be audited by a third-party monitoring team;
- t. Rehabilitates should be given preference in implementing CSR program as they are under serious threat of another shifting;
- u. Special medical campaign should be arranged for the rehabilitates living at Kapasdanga and Pargovindapur Mouza along with other facilities;

- v. Dust suppression by spraying water should be continued on construction sites, and other places where necessary to suppress dust and minimize air pollution;
- w. River water should be used for dust suppression activities and ground water use should be avoided completely;
- x. The PMU should be active and efficient in maintaining vehicle speed limits in the Project site;

5. Environmental Compliance

5.1 Introduction

During the environmental compliance monitoring of Power Plant Construction program, it was observed that construction of almost all of the major components were initiated. Most of the mechanical and electrical components were found laid systematically on the vast open area of Block II. The civil construction activities at the Boiler, Turbine and Generator, cooling tower, Chimney and other heavy equipment, stack point, Jetty area, township area, internal road networks, permanent drainage networks are being continued. It was found that the equipment were transported to the Project site by road during this monitoring tier. On the other hand, the permanent jetty construction works are advancing for unloading the heavy machineries transported through the the Passur River.

The approach road including extension of the two-lane approach road (5.5 km) from Babur Bari point at Khulna - Mongla Highway to the Project site was completed. The bridges and culvert area 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 a number of professionals of BIFPCL were shifted to the newly constructed township. At the same time, the EPC contractor i.e. Bharat Heavy Electricals Limited (BHEL) employed different local specialized sub-contractor i.e. DIPON, KELLER, AFCON, POWER MAC etc. for progressing the construction works simultaneously.

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

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. 	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. Schedule to be made for heavy noise generating works. Communicate with the nearby community beforehand about activities and possible heavy noise generation.
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. 	<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. 	Complied	<ul style="list-style-type: none"> Daily monitoring of dust suppression activities including water spraying is needed for maintaining the air quality within standard limit;

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> Earthen roads and undeveloped roads should be avoided to minimize dust generation Construction materials must be covered to protect from wind action Spray water regularly for suppressing fugitive dust Dust particle generated from access road must be controlled by spraying water during dry season. Stock piles of construction materials must be covered in order to protect from wind action. An appropriate freeboard must be maintained in trucks hauling construction materials. 	<ul style="list-style-type: none"> 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. 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. 		<ul style="list-style-type: none"> Check the labor must use face mask throughout the workplace May use Method 22 (Visible emission observations) for visual inspection of dust at construction site. Clear the mud over the paved roads
3	Water Quality	<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 	<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. 	Complied at present	<ul style="list-style-type: none"> Any kind of liquid waste from the project site must be protected. Good housekeeping at workshop and construction site should be continued

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> 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, Arrange monthly environmental meeting among the mid-level officers through top management when those issues will be discussed under guidance of ECR 1997. 	<ul style="list-style-type: none"> Samples of same are analysed by CEGIS and report is being submitted through monthly report. 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 	<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 one of the contractor (Khulna City Corporation (KCC) for safe disposal of waste materials from site. Waste management training has been included in induction training of the labour. 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 	In the process of Compliance	<ul style="list-style-type: none"> The number of Waste Disposal Bin/s with labelling should be increased at labor shed, and at working area. Scrubbing materials should be managed within the designated places.

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> Construction wastes must be reused or recycled as and where possible Burning of waste material should be restricted Quality housekeeping practice must be maintained by regular inspection and checking. Keep onsite waste collection and disposal facilities Keep provision of different colored waste bin for dumping biodegradable, reusable and recyclable wastes. Keep provision of awareness building meeting and training for employees 	<p>(SWM), STP etc. are being developed at the demarcated place in plant premises.</p> <ul style="list-style-type: none"> 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. 		
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 	<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. 	In the process of Compliance	<ul style="list-style-type: none"> The CSR activities should be oriented towards the affected people or household; Trained to the Sundarbans dependent livelihoods group as a part of CSR activities The proponent may initiate cooperatives for the PAPs along with training

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> • 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"> • 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. 		
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 laborers can easily get the chance of employment in the project work force. • Govt./NGOs need to provide support the skill development program and income generation activities to local people; • For the increased movement of people and heavy vehicles, the road networks must be developed. • Keep provision of sanitary toilet, one toilet for 10 persons. 	<ul style="list-style-type: none"> • BIFPCL are recruiting the local people especially PAPs with the help of local government. • 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 • The wage of the labor was found compatible with the national standard. 	Complied	<ul style="list-style-type: none"> • Health and financial support should be available for the labour in case of COVID affected. • Evaluation and monitoring of the workplace safety situation.

Sl. No.	Potential Impacts		Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
			<ul style="list-style-type: none"> Available drinking water, sanitation facilities, prayer room are provided at site. No incident has been recorded in this quarter as maximum work load was retarded due to COVID-19. 		
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; Introduce vehicular registration for the construction site.

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. • 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- • Falls (from heights); • Trench collapse; • Scaffold collapse; • Electric shock and arc flash/arc blast; • Failure to use proper personal protective equipment; and • Repetitive motion injuries. • To develop labour association protecting labour interest • Create fund to support the labour/his families in case of any fatalities • Health and financial support should be provided if any labour affected by COVID
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, 	<ul style="list-style-type: none"> • EPC contractors and sub-contractors are not employing any child labor in the project area. 	Being complied	<ul style="list-style-type: none"> • The insurance policy should cover the accidental case or injuries of the labors;

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		mental, spiritual, moral, or social development. • No Forced Labor	• No forced labor has been recorded in the project. • Proper documentation of contract with the worker is being maintained which includes working hour, wage and benefit. • First Aid support is provided to the labors as required. • Thermal scanning of workers is being done at regular frequency for checking any condition of fever. • Workers must get the safety clearance before initiating any work like – routine checkup of the work places and administrative clearance • Work in hot condition and height need another permission • Sanitization is being done at regular intervals at Offices and labor sheds • Awareness about Covid-19 is being spread among workers and office support staff.		• Awareness work should be continued regarding the local cultural values, STD, redressing of workers grievances, insurance policy related facilities and also contract clauses of the job to get maximum benefit.
3	Safety at site	• Installation/Construction of Safety Fence around the Project area • Use of Personnel Protective Equipment's (i.e. safety vest, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.); • Safety trainings for workers (i.e. fire control, working at height, working in heat, first aid etc.); • Practice of Tool box meeting, safety talks	• 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.	Being Complied	• Monitoring about the use of face mask and COVID symptom of the labors • Try to develop the habit of the worker for safety worker like protecting the dangerous part of machine, vigilant for moving cranes, hooks or other lifting equipment, fall

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"> • Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.); • Maintaining Material Safety Data Sheet (MSDS); • Provision of Health care facilities such as doctor, hospital etc. available at/nearby the Plant construction site; • Availability of First Aid at work place; • Preparation and Follow of Emergency Response Plan (ERP); • Adequate fire precautions in place (e. g., fire extinguishers, escape routes etc.); • Documentation and reporting of occupational accidents, diseases, and incidents; • Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS 	<ul style="list-style-type: none"> • 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; • Emergency contact address was found on the board at the site for any kind of sudden incident; • EPC has made a contract with the Gazi Medical of Khulna city for emergency medical support. • Sanitization is being done at regular intervals of the labors • Awareness about Covid 19 is being spread among workers and office support staff. • The major construction work at site has been performed in presence of safety officer. • Fire extinguisher was found at required places. • Weekly checking of all the safety records and implementation of HERA at site. • 2 Ambulances, 1 MBBS doctor, 2 paramedical doctors and two medical 		protection, extra-attention on electrical works etc.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			checkup system are amiable for the workers as well as officials		
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. PPE has been displayed to make them aware. Medical aid, fire extinguishers, PPEs are being provided adequately. Induction trainings and awareness programme were given to 2021 no people (Work force) during month of Oct,20. Regular Safety talk, safety meetings are being organised at site and also in class rooms. Photo are being attached. Adequate safety bill-boards etc. have been displaced all over the construction area. Photo are being attached here. Speed barriers are being augmented Substantial warning sign, speed limit and convex mirror have been displayed at the strategic locations. 	In the process of Compliance	<ul style="list-style-type: none"> Awareness build-up, strict to the safety issues, Empower and responsible the safety officers at site. Continued the safety training, buildup the awareness and make the labour habituated with the safety procedure Use dust mask to the labour at work site
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.; 	<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 	Being Complied	<ul style="list-style-type: none"> Freedom of Association, Rights & scope of bargaining should be open for the workers.

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"> • 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"> • 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 • 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. 		<ul style="list-style-type: none"> • The proponent has to look after the following issues – equal benefit for the direct labor, contracted labor, day labor etc., emotional support and health surveillance. • Support to the COVID-19 affected labors urgently

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 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. • 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. • 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 	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
			<p>except the COVID situation (April to June 2020)</p> <ul style="list-style-type: none"> Environmental parameters are continuously monitored in and around the project site by separate entities except (April to June 2020). 		
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 	Being complied	<ul style="list-style-type: none"> Put the grievance register outside the project boundary so that the local community could easily state any grievance properly.

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			conducted by CEGIS or local government		
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; • Aware the security personnel about the right of the community 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. • 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 • 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 	Being complied	<ul style="list-style-type: none"> • Maintain social distancing with the communities • Facilitate sanitary facilities and raise awareness for COVID management • Equity and rationality should be maintained for the implementation of CSR fund. • Trained to the Sundarbans dependent community to shift their livelihoods

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			<p>reschedule for the community due to COVID situation.</p> <ul style="list-style-type: none"> • 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; 	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 mike, poster 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"> • 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 • Total 299 patients have been given treatment in Oct,20. • Office medical centre 70 patients were given • Boat Medical camps was organised on 17.10.20. Total 161 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 	<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 	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,

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		local labors according to their skills and capacities.	students through awarding them scholarships before the COVID situation.		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. • BIFPCL regularly display the progress (thru Video) of the development through their website (https://www.bifpcl.com/) and also disclosure meeting at the local government. • The local people are aware regarding the project activities from multiple sources like consultation, display board, website etc • The stakeholder consultations have not been conducted with the community people due to COVID situation. 	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;

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

SI 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 especially the project eastern part. • 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. • Samples of same are analysed by CEGIS and report is being 	Being complied	<ul style="list-style-type: none"> • Manage the drainage system during the monsoon heavy rainfall

SI No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
			submitted through monthly report.		
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; • 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. 	<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 western side of the project and near bank of the Passur River (Jetty construction). • The project construction works are curtailed temporarily due to COVID situation • Limiting the vegetation clearance within the Project boundary especially around the ash impoundment. • Plantation program is in progress with the help of forest department. • The client is going to plant 50000of fruits and medicinal plants as per the greenbelt position of layout by 2019-2020 • Local plant species like Goalpata, Sundori, Bain, Keora 	Being Complied	<ul style="list-style-type: none"> • Regular monitoring of the planted trees. • Reduce the rate of mortality at the sapling stages. • Bird sheds shall be created at the green belt areas.

SI No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
			<p>for green plantation are being planted</p> <ul style="list-style-type: none"> • They are maintaining the EMP for protecting the adjacent ecosystem • No alien species has been recorded • Wild species like avifauna and mammals are now recorded in the greenery areas • Employees are aware about the rescues of species and no harm to wild species 		
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 • 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 near the proposed township area to facilitate proper functioning of River during dry period.

SI 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. 		

5.2 Status of Compliance to the Conditions of DoE

SI. 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 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 t 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	BIFPCL engaged CEGIS as an independent entity for monitoring the construction activities for examining environmental impacts on quarterly basis before the	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
	will have damaging impact on the environment or natural resources.	<p>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.</p> <p>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.</p>	
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	The construction works has been reduced due to Covid-19 from April, 2020. Working activities are restricted to daytime and	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
	well as implementation schedules of the works shall be notified in advance to nearby residents.	sometimes extends to 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.	
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 COVID situation. EPC contractor and sub-contractor are providing adequate sanitation facilities for the workers. Adequate sanitation facilities for health safety from COVID-19 are supplied by the Contractor at the labor camps as well as in the work areas.	Being Complied
11	In order to control noise pollution, vehicles & equipment shall undergo regular maintenance; 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 span.	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 prohibited inside the project area. Now, solid waste is being managed with systematic processes. A solid waste management company is now collecting the solid waste from the project and dump it to the 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	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	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	of any flora and fauna would be endangered or destructed.	environmental monitoring has been performed for noting any harmful air pollutant emission or waste discharge form the project area.	
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 contractor 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. water spraying at least four times in a day by three no of water tankers or as per requirement are being done to suppress fugitive dust	BeingComplied
16	Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.	BIFPCL authority has selected designated areas for safe storage of construction materials. In addition, BIFPCL has already earthen stock piles are covered by natural green tiny grasses. These are acting as shield cover for fugitive dust	Being Complied
17	Adequate considerations should be given to facilitate drainage system for runoff water from rain/tidal surge.	Adequate attempt has been adopted to facilitate drainage system for runoff water from rain/tidal surge as BIFPCL has already constructed the permanent drainage system for discharging water from the project area.	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 each of the drain.	Being Complied.
19	The entire coal handling system should be designed as an enclosed (and not only covered) conveyor system.	Entire coal handling system is designed as an enclosed conveyor system as per DoE requirement. Integrated dust	Compliance action initiated.

Sl. No	Condition of DoE	Compliance Status	Remarks
	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.	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.	
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.
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	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
		Specification of main Plant EPC contract package (Section V, Chapter B4). The construction work is progressing.	
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).	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 from site. Further development of environment friendly waste collection and disposal system like Solid Waste Management (SWM),	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
		<p>STP etc. are being developed at the demarcated place in plant premises.</p> <p>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</p>	
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 impacts and accidental events further.	Being Complied
32	A third party/independent monitoring bodies excluding JVC/BPDB should be engaged immediately for monitoring of all activities during pre-construction, construction and operation phases as per monitoring plan of EIA report and monitoring report must be submitted to Bagerhat District Office, Khulna Divisional Office and 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.

Sl. No	Condition of DoE	Compliance Status	Remarks
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.	<p>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.</p> <p>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.</p>	Compliance action initiated.
35	There should be regularly disclosure of the report through workshops and websites and responses should be taken care accordingly.	CEGIS is regularly carrying out public consultation at different levels. There is no consultation workshops conducted in this quarter due to COVID situation. All the monitoring reports are being kept available on website of BIFPCL (www.bifpcl.com)	Being Complied.
36	Online air and water quality monitoring system should be made functional throughout the life of the Plant.	<p>The online monitoring system will be installed when the Plant will be in operation phase and will continue throughout the life time of the Plant.</p> <p>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).</p>	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.	<p>The MIS will be prepared before commissioning of the Plant. The consultant for developing MIS 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.</p>	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
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.	<p>In compliance of the DoE approval condition no. 39 of EIA Report, "No ground water should be allowed to use for plant purposes". The Power Plant has been designed considering use of surface water only during all stages of project development and operation.</p> <p>The authority has already installed Reverse Osmosis (RO) Water Treatment Plant (ABM Water) for use ground water for potable and domestic purposes. A second unit of RO plant is being constructed for supplying fresh water.</p> <p>During the compliance monitoring visit, a 1200ft deep tube well has been recorded still near the ABM water plant where water has been withdrawal. In this regard, the representative of the Proponent informed the Team that the cause of withdrawal is to supply the drinking water.</p>	Ground water is being withdrawn only for supplying the drinking water.
40	Conduct stakeholder meetings on regular basis for better performance of the Project as a whole.	Pre-construction phase of the Plant was completed and the construction phase has been continued. BIFPCL has appointed a social worker and officers who regularly visits nearby community to consult with the local people. Besides, CEGIS, appointed by the Project authority as environmental monitoring consultant, is also carrying out consultation with the local people with interviews on 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

Sl. No	Condition of DoE	Compliance Status	Remarks
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
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	No single emergency incident happened during the last 3 months (July, 2020 to October, 2020). With the spread of the COVID-19 outbreak, the construction works was nearly stopped from April, 2020 to June 2020. In the beginning of July 2020,	Complied at present

Sl. No	Condition of DoE	Compliance Status	Remarks
	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>the labors are joining to this project with proper COVID safety measures ensured by BHEL.</p> <p>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.</p>	
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.	<p>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.</p> <p>With the increasing construction activities from July 2020, the proponent as well as the EPC have given high priority on health and safety issues. EPC have already revised the health and safety management manual and reshaped for pragmatic practicing. Moreover, CEGIS is monitoring the EMP implementation as a whole.</p>	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	There is no need of cutting/felling down of any trees outside the project boundary. However, in future, if any such case arises,	Being complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	plant/tree/sapling forested by any individual or government before doing such type of activity.	BIFPCL would seek for appropriate permission from the Forest Department.	
51	Re-vegetation and re-plantation under green belt activities shall be undertaken in consultation with the Forest Department according to those mentioned in the EIA report.	An MoU has been signed with Forest Dept., Bangladesh on 24.02.2015 for implementation of Afforestation Program. Initial target is to plant 2 lac saplings in 3 years. By this time, Forest Department has targeted initially to plant about 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. In this quarter, the planted 15000 fruits and medicinal plants at the laydown areas in the project site.	Being Complied
52	Climate Change impacts and maximum storm surge height shall have to consider at the design and construction phase.	The design level (elevation) of the land and earthen embankment has been designed and constructed considering the climate change impact and maximum storm surge height.	Being Complied
53	A separate EIA/morphological study shall have to be conducted for coal transportation and river dredging to develop sound environmental management plan towards conservation of ecosystem and biodiversity.	Coal transportation will be done through the existing maritime route, which is Mongla Port Authority (MPA) controlled waterways. M/s. Institute of Water Modelling (IWM) has already completed the EIA study for the dredging activity and submitted the report to MPA. A separate EIA study for Coal Transportation was conducted by M/s. Center for Environment and Geographic Information Services (CEGIS) which has been approved by DoE.	Being Complied.
54	A full-fledged institutional setup for EHS and CSR must be put in place before operation of the Power Plant.	A full-fledged institutional setup for EHS activities have been operated. After the consecutive accidents, the EHS process has been drastically re-arranged and reshaped. Therefore, no incident has been occurred from March 2020 to July 2020. Meanwhile, a number of CSR activities are ongoing at Project site, like free medical camp, Boat Medical camp, and medicines, free potable water supply to the local people, medical campaign, training etc. infrastructure development of nearby school.	In the process of compliance

Sl. No	Condition of DoE	Compliance Status	Remarks
55	The Project authority shall extend active cooperation to DoE officials to facilitate their visit to the site as and when necessary.	BIFPCL is extending its all-out cooperation to DoE.	Being Complied
56	Violation of any of the above conditions shall render this approval void.	Noted by BIFPCL	
57	Any injunction on this Project from the Honorable Supreme Court/High Court Division shall render this approval void.	Noted by BIFPCL	
58	Without installation of 275 Meter Height Chimney, Effluent Treatment Plant (ETP), Waste Water Treatment Plant (WWTP), Settling Pond, Desalinization Plant, API Oil Water Separator, High Efficiency Electro Static Precipitator (ESP), 'closed-loop' Flue Gas Desulfurization (FGD), Low NOx Burner, online air and water quality monitoring system and other pollution control equipment and obtaining Environmental Clearance Certificate, the proponent shall not start operation of the Project.	At present, the Plant is in construction phase. The functional and technical specification of the main Plant includes 275-Meter-high Chimney, Effluent Treatment Plant (ETP), Waste Water Treatment Plant (WWTP), Settling Pond, Desalinization Plant, API, Oil Water Separator, High Efficiency Electro Static Precipitator (ESP), 'closed-loop' Flue Gas Desulfurization (FGD), Low NOx Burner, online air and water quality monitoring system for preventing pollution. All these stipulations have been included in the technical specification of Main Plant EPC contract package. Moreover, BIRPCL has got the Environmental Renewal Certificate each of the year through maintaining the conditions of DOE.	Compliance action initiated
59	This EIA Approval has been issued with the approval of the appropriate authority.	BPDB and BIFPCL are thankful to DoE.	

5.3 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 5.5: 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,	Suggested to comply at operation phase.

Sl. No.	Conditions	Compliance status	Remarks
		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.	
6	Any heritage site, ecologically critical areas, and other environmentally, religious and archeologically sensitive places shall be kept protected during project operation.	There is no Religious and Archaeological place in and around the Project site. As a third party, CEGIS is now monitoring the potential impact locations and indicators which are sensitive to coal transportation in the Sundarbans ECA, Sundarbans Reserve Forest and Sundarbans World Heritage Site. Those information and data assist to protect the ecological critical areas in future operation period.	Suggested to comply at operation phase.
7	Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding and nursery sites.	Development of coal transportation system will be followed through best practices, EMPs of EIA of Coal Transportation Report, national and international rules and guideline. Since, the environmental monitoring indicators are not observed any anomalies, it can be concluded that the construction work is progressing in environment friendly procedure yet now.	Being Complied
8	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.	At present, the civil construction of the Project including Jetty construction activities are progressing. The jetty construction works is running limitedly under this COVID situation. BIFPCL, EPC contractor and sub-contractors are providing sufficient safety materials and component for protecting from COVID and improve hygiene at labor camps and workplaces.	Being Complied
9	Proper and adequate on-site precautionary Measures and safety measures shall be ensured so that no habitat of any flora and fauna would be endangered or destructed.	The construction of Jetty is being carried as per EMP guidelines. Moreover, regular monitoring activities are being carried out to assess the significant changes due to jetty construction activities. The quarterly monitoring reports	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
		do not reflect any significant changes of the habitat of flora and fauna of the project influenced Passur river and Sundarbans ecosystem	
10	All the required mitigation measures Suggested in the EIA report along with the emergency response plan are to be Strictly implemented and kept operative/functioning on a continuous basis.	The proponent is giving top priorities to occupational health and safety issues after few incidents. They have significantly revised the OHAS guideline and practice it seriously. During this COVID situation, BIFPCL are tried to spread awareness about Covid-19 among workers and office support staff. Thermal scanning of workers is being done at regular frequency for checking any condition of fever.	Compliance action initiated
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 no of 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.

Sl. No.	Conditions	Compliance status	Remarks
15	Construction material should be properly disposed of after the construction work is over.	The proponent is preparing an environmentally friendly procedure for disposing off the construction material like scraps as well as other construction wastes. They have already contracted one organization in association with KCC for solid waste management. The construction scrubs are recorded scattered in the project site. They are now trying to contract a third party to remove the construction scrubs from the project site.	Compliance Action initiated.
16	As described in the report environmental monitoring should be strictly followed and monitoring report should be shared with DOE to ensure the environmental management properly.	BIFPCL has engaged CEGIS for environmental monitoring the environmental management plan in February 2014. Accordingly, each quarterly monitoring report has been submitted and shared with DoE, which are also available at BIFPCL web site.	Being Complied.
17	A third party/independent monitoring bodies excluding BIFPCL should be engaged immediately for monitoring of all the activities during pre-construction, construction and operation phases as per monitoring plan of EIA report and monitoring report must be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	CEGIS, as an independent monitoring body has been engaged by BIFPCL since February 2014 and still continued. From then on, CEGIS has been conducting the monitoring programs quarterly and producing monitoring reports on regular basis which are submitted by CEGIS to BIFPCL for onward submission to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment as directed by DoE.	Being Complied
18	Regular monitoring of the susceptible places of the Sundarbans for protecting ecosystem, biodiversity and forest coverage should be made using latest high-resolution image for keeping ambient environment.	The Monitoring activities have been carried out by CEGIS as third-party independent entity. The study includes all of recommended issues vastly. The monitoring report contains analysis of ecosystem, habitat, and biodiversity and forest coverage at susceptible sites of Sundarbans. In addition to this, Forest Department has also suggested some survey & analysis of Sundarbans ecosystem along with the quarterly compliance monitoring report.	Being Complied.

Sl. No.	Conditions	Compliance status	Remarks
19	Air, water, soil, biological and social data should be monitored regularly with a network monitoring system with a view to assess the natural quality of the Sundarbans and other fragile ecosystem and report of monitoring results should be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	The network monitoring system will be installed as a part of the project construction for online monitoring and it will run at the time in operation phase. All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5). All the environmental monitoring reports are available on the CEGIS website at present.	Being Complied.
20	There should be regular disclosure of the report through workshops and websites and responses should be taken care accordingly.	All of the environmental monitoring reports and other relevant reports are available on website of BIFPCL (www.bifpcl.com). BIFPCL as well as CEGIS is regularly carrying out public consultation at local level to get the responses from the community.	Being Complied.
21	BIFPCL should provide all sort of logistics support to DOE and other relevant agencies for monitoring environment related items/events.	BIFPCL is ready to provide all sort of logistic support as and when required by DoE and other relevant agencies for monitoring of Plant construction activities and environmental items/events.	Suggested to Comply as and when required.
22	In order to control noise pollution, vessels and equipment shall undergo regular maintenance; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.	Not applicable in this stage	Suggested to Comply as and when required.
23	Vessels of this project should follow the MPA guidelines and protocol to ensure no hindrance to other vessels.	Not applicable in this stage	Suggested to Comply as and when required.
24	The vessels used for this project should maintain IMO criteria to enable identification of substances harmful to the marine environment.	Not applicable in this stage	Suggested to Comply as and when required.
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	Environmental baseline data has been collected by third party <i>i.e.</i>	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
	as suggested in the EIA report and conveyed to DOE and other concern authorities.	CEGIS. CEGIS has submitted reports of quarterly monitoring containing latest baseline data to BIFPCL for further dissemination to DoE and other concerned authorities.	
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	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
		shared with DoE on regular basis through monitoring reports.	
32	In case of any emergency, the following information shall immediately be reported to Bagerhat District Office, Khulna Divisional office and Headquarters of the Department of Environment (DOE) simultaneously: a. Nature of incident (oil spill, fire, accident, collision, land slide etc.) b. Personnel affected (injured, missing, fatalities, etc.) c. Emergency support available and its location (standby transport, medical facilities, etc.) d. Weather conditions e. Current operations (abandoning the site, firefighting, etc.)	Emergency Reporting/ Emergency response Plan have been prepared for the Power Plant which includes the Jetty. Health and safety management manual have been revised for better and 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 the last four months due to COVID. BIFPCL will adopt the ERP suggested on the EIA study of coal transportation in association with the NOS COP and NPDM for any future incidents as suggested.	Compliance Action initiated.
33	National Oil Spill Contingency Plan (NOS COP) should be followed to establish an organizational structure to combat marine pollution	Not applicable in this stage	Suggested to comply as and when required.
34	The project authority or its employees must notify the Department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.	BIFPCL has strengthening the mechanism for 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. The institutional arrangement for managing the incident during coal transportation system before the operation based on the EIA and DoE recommendations. Moreover, monitoring activities is continued for checking any significant changes in natural ecosystem.	Complied at Present.
35	All pollution incidents shall be reported immediately and simultaneously to the Bagerhat District Office, Khulna Divisional Office and	BIFPCL has established a proper mechanism for recording such incidents as suggested in the ERP. CEGIS has been engaged to monitor the social and	Complied at Present.

Sl. No.	Conditions	Compliance status	Remarks
	Headquarters of the Department of Environment (DOE) in Dhaka.	environmental compliance monitoring on a regular interval.	
36	Climate Change impacts and maximum storm surge height shall have to consider at the design and construction phase of the jetty.	The design level (elevation) of the land and earthen embankment has been fixed considering the climate change impact and maximum storm surge height.	Being Complied
37	The transshipment point Faraway Buoy at the Bay should be used from November to March, and Mazhar point should be used from April to October every year for transporting coal which has been mentioned in the EIA Report.	Not applicable in this stage	Suggested to comply as and when required.
38	Violation of any of the above conditions shall render this approval void.	Noted by BIFPCL	-
39	Any injunction on this project from the Honorable Supreme Court/High Court Division shall render this approval void.	Noted by BIFPCL	-
40	This EIA approval is valid for one year from the date of issuance and the project authority shall apply for renewal to the Bagerhat District Office of DoE at Bagerhat with a copy to Head Office of DOE in Dhaka.	The authority is maintaining the renewal process as suggested. As like previous years, BIFPCL has got the renewal for this year.	Being complied

References

- "Assessing the oil spill's impact on Bangladesh's Sundarbans forest". Deutsche Welle. December 17, 2014.
- Ali, M.M; M.L. Ali; M. S. Islam and M. Z. Rahman. 2018. Assessment of toxic metals in water and sediment of Pasur River in Bangladesh. *Water Sci Technol.* 77 (5): 1418-1430.
- Awashthi, S.K. 2000. Prevention of Food Adulteration Act No. 37 of 1954. Central and State rules as amended for 1999 (3rded.). New Delhi: Ashoka Law House.
- Badran M (2001) Dissolved oxygen, chlorophyll a and nutrient seasonal cycles in waters of the Gulf of Aqaba, Red Sea. *Aquat Ecosys Health Manag* 4(2):139–150.
- BARC (Bangladesh Agricultural Research Council). 2012. Fertilizer Recommendation Guide, Bangladesh Agricultural Research Council, Farmgate, Dhaka.
- Bartram J and Balance R (1996), Water Quality Monitoring - A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes, UNEP/WHO, Chapter 2.
- Bates, J. W., Mcnee P. J. and Mcleod. A. R. 1996. Effects of Sulphur Dioxide and Ozone on Lichen Colonization of Conifers in the Liphook Forest Fumigation Project The New Phytologist 132,653-660.
- Beets, P.N., Bulman L.S., Pearce S.H. 2008. Relationships between leaf area, growth, tree health attributes and LiDAR. Client Report No. 12713.
- Beets, P.N., Whitehead, D. 1996. Carbon partitioning in *Pinus radiata* stands in relation to foliar nitrogen status. *Tree Physiology* 16:131-138
- Brown S. 1997. Estimating biomass and biomass change of tropical forests: a primer. FAO Forestry Paper 134. FAO, Rome, Ital
- Brown SAJ, Gillespie JR, Lugo AE. 1989. Biomass estimation methods for tropical forests with application to forest inventory data. *For. Sci.* 35 (4):881–902
- CEGIS. (2013). Environmental Impact Assessment of 2X (500-660) MW Coal Based Thermal Plant to be Constructed at the Location of Khulna (p. 456). Bangladesh.
- Chave J, Andalo C, Brown S, Cairns M. A., Chambers, J. Q., Eamus D et al (2005) Tree allometry and improved estimation of carbon stocks and balance in tropical forests. *Oecologia* 145: 87–99
- Chave J, Rejou-Mechain M, Burquez A, Chidumayo E, Colgan MS, Delitti WBC, Duque A, Eid T, Fearnside PM, Goodman RC, Henry M, Martinez-yrizar A, Mugasha WA, Muller Landau HC, Mencuccini M, Nelson BW, Ngomanda A, Nogueira EM, Ortiz-malavassi E, Pelissier R, Ploton P, Ryan CM, Saldarriaga J, Vieilleden G. 2014. Improved allometric models to estimate the aboveground biomass of tropical trees. *Glob. Change Biol.* 20: 3177–3190.

- Das, S., M. De, D. Ganguly, T.K. Maiti, A. Mukherjee, T.K. Jana and T.K. De, 2012. Depth integrated microbial community and physico-chemical properties in mangrove soil of Sundarban, India. *Adv. Microbiol.*, 2: 234-240.
- Donato, D.C., Kauffman, J.B., Stidham, M.A. (2009) Protocols for measuring and reporting carbon stocks in mangrove forests. Unpublished report prepared for the workshops on Global Climate Change and Carbon Financing: Opportunities for Bangladesh. Dhaka, Bangladesh, 28, October–9 November 2009.
- Eckman, J.E., (1979) Small-scale patterns and processes in a soft-substratum intertidal community. *J. Mar. Res.* 37:437–457.
- Eckman, J.E., (1983) Hydrodynamic processes affecting benthic recruitment. *Limnol. Oceanogr.* 28: 241–257
- FAO 1997. Estimating biomass and biomass change of tropical forests: a primer, Rome, Italy: FAO Forestry Paper No. 134
- Ferreira, T.O., X.L. Otero, V.S. de Souza Jr., P. Vidal-Torrado, F. Macias and L.P. Firme, 2010. Spatial patterns of soil attributes and components in a mangrove system in Southeast Brazil (Sao Paulo). *J. Soils Sediments*, 10: 995-1006.
- Gleick, P.H. (Ed.), 1993. *Water in Crisis: A Guide to the World Fresh Water Resources*. Oxford University Press, New York
- Goldman, S. 2005. *Information theory*. Dover, New York.
- Greenleaf Forestry and Wood Products Inc. 2010. "Forest Health Checklist." http://www.greenleafforestry.com/greenleafservices_006.htm
- Harmon, M. E. and J. Sexton (1996). Guidelines for measurements of woody detritus in forest ecosystems. U. S. LTER Publication No. 20.
- Heath, R.C., 1989. *Basic Ground-Water Hydrology*. U.S. Geological Survey Water-Supply Paper 2220, 84p.
- Hossain M.D., Nuruddin. A.A. 2016. Review Article Soil and Mangrove: A Review. *Journal of Environmental Science and Technology*. 9: 198-207.
- Hossain, M., Siddique M. R. H., Bose, A., Limon, S.H., Chowdhury, M.R. K., Saha, S. (2012) Allometry, above-ground biomass and nutrient distribution in *Cerriops decandra* (Griffith) Ding Hou dominated forest types of the Sundarbans mangrove forest, Bangladesh. *Wetlands Ecol Manage* DOI 10.1007/s11273-012-9274-2
- Hossain, M.Z., C.B. Aziz and M.L. Saha, 2012. Relationships between soil physico-chemical properties and total viable bacterial counts in Sunderban mangrove forests, Bangladesh. *Dhaka Univ. J. Biol. Sci.*, 21: 169-175.
- Kabata-Pendias, A. and H. Pendias, 1992. *Trace Elements in Soils and Plants*, 2nd ed. CRC press, Boca Raton, 365pp
- Kauffman, J.B. and Donato, D.C. (2012) Protocols for the measurement, monitoring and reporting of structure, biomass and carbon stocks in mangrove forests. Working Paper 86. CIFOR, Bogor, Indonesia.

- Khan, H.R., S. Rahman, M.S. Hussain and T. Adachi, 1993. Morphology and characterization of an acid sulfate soil from mangrove flood plain area of Bangladesh. *Soil Phys. Cond. Plant Growth*, 68: 25-36.
- Kinne, O. (Ed.), 1984. *Marine Ecology*. John Wiley and Sons, London
- Komiyama A, Ong JE, Pongparn S (2008) Allometry, biomass, and productivity of mangrove forests: A review. *Aquat Bot* 89:128–137
- M. H. Rahman and H. Ishiga, "Arsenic pollution in soil and groundwater of Bangladesh," in *Proceedings of the International Conference on Energy and Environment*, vol. 2, pp. 1626–1632, 2003.
- M. M. Rahman, B. K. Mandal, T. Roy Chowdhury et al., "Arsenic groundwater contamination and sufferings of people in North 24-Parganas, one of the nine arsenic affected districts of West Bengal, India," *Journal of Environmental Science and Health A: Toxic/Hazardous Substances and Environmental Engineering*, vol. 38, no. 1, pp. 25–59, 2003. View at Publisher · View at Google Scholar · View at Scopus
- MacArthur, R.H. & MacArthur, J.W. (1961) On bird species diversity. *Ecology*, 42: 594–598.
- Macdicken K.G. 1997. A guide to monitoring carbon storage in forestry and agroforestry projects. *Specialist*, 3: 1– 87.
- Margalef, R. (1958) "Information theory in ecology," *General Systems Yearbook*, vol. 3, pp. 36–71,
- Marowsky, G. and K.H. Wedepohl. 1971. General trends in the behavior of Cd, Hg, Tl and Bi in some major rock forming processes. *Geochimica et Cosmochimica Acta*. 35(12): 255-267.
- Moore, P.D. & Chapman, S.B. (Ed.) (1986) *Methods in Plant Ecology*. Blackwell Scientific Publications. 581.5 MET
- Moreno, A.N.M. and J.H.M. Calderon, 2011. Quantification of organic matter and physical-chemical characterization of mangrove soil at Hooker Bay, San Andres Island-Colombia. *Proceedings of the Global Conference on Global Warming*, July 11-14, 2011, Lisbon, Portugal, pp: 1-7.
- Nelson D., 2002; *Natural Variations in the Composition of Groundwater*; Groundwater Foundation Annual Meeting; Oregon Department of Human Services Springfield, Oregon; oages 1-8.
- Odum, E. P. (1971) *Fundamentals of Ecology*, WB Saunders, Philadelphia, Pa, USA, 1971.
- Pearson T, Walker S, Brown S (2005) *Sourcebook for land use, land-use changes Forestry Projects*. Report from BioCF and Winrock International. Available at: <http://www.winrock.org/ecosystems/tools.asp?>
- Phillips, Tom (13 December 2014). "Fears for rare wildlife as oil 'catastrophe' strikes Bangladesh". *The Daily Telegraph*. Retrieved 15 December 2014.
- Pielou, E.C. (1969) *An Introduction to Mathematical Ecology*. John Wiley & Sons, Inc., New York, 286 pp.
- Rabalais, N.N., 2002. Nitrogen in aquatic ecosystems. *Ambio* 31, 102–112.

- Rahman M., Rahman M T., Rahman M S., Rahman F., Ahmed J U., Shakera B., Halim M A., 2013; Water quality of the largest mangrove forest; Canadian Chemical Transactions; Volume, Issue 2., Page 141-156.
- Rahman MM, Islam SkA. 2015. Phenophases of Five Mangrove Species of the Sundarbans of Bangladesh. *Int. J. Bus. Soc. Sci. Res.* 4(1): 77-82.
- Rahman MM, Rahman MM, Islam KS. 2010. The causes of deterioration of Sundarban mangrove forest ecosystem of Bangladesh: conservation and sustainable management issues. *AACL Bioflux* 2, 77-90.
- Rahman, M. M. (2012) Relationship between carbon storage, vegetation type and salinity in Sundarbans Reserved Forest. M. Sc. Thesis. Forestry and Wood Technology Discipline, Khulna University, Khulna-9208, Bangladesh.
- Rajasegar, M. 2003. Physico-chemical characteristics of the Vellar estuary in relation to shrimp farming. *J. Environ. Biol.* 24: 95-101.
- Raman S M B, Sarder L, Rahaman M S, Ghosh A K, Biswas S K, Siraj S S, Huq K A, Hasanuzzaman A F M and Islam S S (2013), Nutrient dynamics in the Sundarbans mangrove estuarine system of Bangladesh under different weather and tidal cycle, *Ecological process*, springer, page 5.
- Rambok, E., S. Gandaseca, O.H. Ahmed and N.M.A. Majid, 2010. Comparison of selected soil chemical properties of two different mangrove forests in Sarawak. *Am. J. Environ. Sci.*, 6: 438-441.
- Rompas, R. M. (2010). *Marine Toxicology*. Indonesian Marine Council. Jakarta.
- Rudnick, R.L. and S. Gao. 2014. Composition of the Continental Crust. *Treatise on Geochemistry*, Second Ed., Chapter 4: 1- 64.
- S. A. Haque, 2006. Review article, salinity problems and crop production in coastal regions of Bangladesh. Department of Soil Science, Bangladesh Agricultural University, Mymensingh, Bangladesh. *Pak. J. Bot.*, 38(5): 1359-1365.
- Sah, K.D., A.K. Sahoo, S.K. Gupta and S.K. Banerjee, 1989. Mangrove vegetations of sunderbans and their effect on the physicochemical and nutrient status of the soils. *Proc. Indian Nat. Sci. Acad. Part B: Biol. Sci.*, 55: 125-132
- Schnitzer SA, DeWalt SJ, Chave J (2006) Censusing and measuring lianas: A quantitative comparison of the common methods. *Biotropica* 38(5): 581-591
- Senthilkumar, S., P. Santhanam and P. Perumal 2002. Diversity of phytoplankton in Vellar estuary, southeast coast of India. In: *Proc. 5th Indian Fisheries Forum* (Eds. S. Ayyappan, J.K. Jena and M. Mohan Joseph). Published by AFSIB, Mangalore and AeA, Bhubanewar, India. pp. 245-248
- Shukla, S.R. and Chandel, S. P. (1980) *Plant ecology*. 4th Edn. S. Chandel and Co. Ramnagar, New Delhi –110055. 197
- Sivasubramaniam R (1999). Water quality of river Periyar (River Suruliyar) in Tamil Nadu. In: Mishra SR (Ed.). *Limnological Research in India*. Daya publishing house, Delhi

- Skilleter, G.A., Warren, S. (2000) Effects of habitat modification in mangroves on the structure of mollusc and crab assemblages *Journal of Experimental Marine Biology and Ecology*, 244: 107–129
- Smith, Gregory L., and Thomas R. Baker. 2003. "Lichens as Bioindicators." In *The Middle School Science Classroom*, NSTA ScienceScope, 16–19. http://tbaker.com/tbaker/academics/papers/published/sciscope_lichens/released_byNSTA/Lichens%20as%20Bioindicators.pdf
- Spencer, C., 1975. The micronutrient elements. In: Riley, J.P., Skirrow, G. (Eds.), *Chemical Oceanography*, vol. II, seconded. Academic Press, London
- Sukardjo, S., 1994. Soils in the mangrove forests of the Apar Nature Reserve, Tanah Grogot, East Kalimantan, Indonesia. *Southeast Asian Stud.*, 32: 385-398.
- Sukumar, R., Dattaraja, H. S., Suresh H. S. et al. 1992. "Long-term monitoring of vegetation in a tropical deciduous forest in Mudumalai, southern India," *Current Science*, 62:608–616,
- Tareq M S., Rahaman S M., Rikta Y S., Islam S M N., Sultana M S 2013; Seasonal Variations in Water Quality of the Ganges and Brahmaputra River, Bangladesh; Jahangirnagar University Environmental Bulletin, Vol.2; pages (71-82)
- USDA Forest Service. 2007. "Soil Vital Signs: Soil Quality Index (SQI) for Assessing Forest Soil Health." http://www.fs.fed.us/rm/pubs/rmrs_rp065.pdf.
- Warren, J.H., (1990) Role of burrows as refuges from subtidal predators of temperate mangrove crabs. *Mar. Ecol. Prog. Ser.* 67:295–299
- Weiss R (1970) the solubility of nitrogen, oxygen and argon in water and seawater. *Deep Sea Res Oceanogr Abstr* 17(4):721–735
- Wetzel, R.G., 2001. *Limnology*, 3rd ed. Academic Press
- WHO (World Health Organization), *Guidelines for drinking water quality*, 2nd Edition; 1993
- WHO, the International Network to Promote Household Water Treatment and Safe Storage 2007
- Zhu Y G., Chen, S. B., & Yang, J. C., 2004; Effects of Soil Amendments on Lead Uptake by Two Vegetable Crops from a Lead-Contaminated Soil from Anhui, China. *Environ Int.*, 30(3), 351-356. <http://dx.doi.org/10.1016/j.envint.2003>.

Appendices

Appendix I: Checklist of Monitoring Environmental Compliances

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

SI 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 plan and compensation plan if the Project needs any land acquisition addressing 			

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies <ul style="list-style-type: none"> • Resettlement of the PAPs • cash for compensation of land (CCL) before resettlement • formal agreement with the affected people prior to migration/resettlement • Sufficient standing crop compensation • Compensation for shift able structures? • Retention of salvageable materials? • Compensation for loss of trading income? • one-time moving assistance • grant to cover loss of regular wage income • Has a resettlement plan been developed which includes compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies? • Provide/take extra care/caution for the disadvantaged/vulnerable group(s) (i.e. women, children, ethnic minorities, indigenous people etc.) • Provision of monitoring the compensation and resettlement process 			
6	Livelihood and living	<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? 			

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		<ul style="list-style-type: none"> 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.) • 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.) 			

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		<ul style="list-style-type: none"> 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 are Installation of water spraying system to control dusts Conducting dust monitoring and visual inspection around the site boundary Adoption of Noise management plan 			
2	Grievance of local people	<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 			

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		<ul style="list-style-type: none"> • 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 			(Continued)
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)

SI 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 			

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		<ul style="list-style-type: none">• 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 26th monitoring program (November, 2020)



Monitoring team



Ambient Noise level acquisition



Measuring the light intensity



Measuring tree height



Measuring tree DBH



Collection of water sample




Data acquisition for forest health

Appendix III: Terms of References (ToR)

Background

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

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

Project Location:	<p>Upazila: Rampal, District: Bagerhat 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 though this study during construction of the power plant.
- Monitoring of floral resources will be performed quarterly. The indicators and procedures of flora monitoring will be relatively same as earlier studies of this projects. Plant composition, canopy coverage, indigenous and exotic species, plant intensities will be the main monitoring indicators during construction phases.
- Monitoring of faunal resources will be performed quarterly at the construction period. Faunal resources survey will coincide with floral resources survey as it will provide more insight about the inter-dependency between flora and fauna in an ecosystem.
- Render any other related services as and when requested.
- Conduct community level consultation in a regular interval and disclose project level information.
- Keep liaison with different organization like Govt department, NGOs, and relevant stakeholders.

The Monitoring parameter & associated indicator are given below

Monitoring Parameter	Indicators
Socio-economy	Livelihood and Occupation
	Income and expenditure
	Displacement and Migration
	Cultural and heritage
	Health and sanitation
	Risks and accidental assessment
	Transportation and communication
	Public and private Infrastructure development
Ecology and Biodiversity	Bio-indicator Assessment
	Movement of indigenous/ native species
	Envision of exotic species and regime dominance
	Species composition (Flora and Fauna)
	Assessment the services of dependent ecosystem
Agriculture	Land use and canopy coverage
	Soil quality (Salinity, pH, OM,)
	Cropping pattern and crop intensities
	Irrigation and crop production
	Farmers survey result
Fisheries	Fish diversity and specification

Monitoring Parameter	Indicators
	Fish production and availability
	Fisher survey result
Noise level	Sound level at the sensitive zone
Water resources	DO, BOD, COD, Salinity, TDS, TS, pH, Hg, Pb
	Total Hardness, Hg, NO ₃ and PO ₄
	River Morphology,
	Tidal inundation
	Drainage Network
	Erosion and Accretion
	Ground water quality
Air quality	SOx
	NOx
	SPM (PM ₁₀ and PM _{2.5})
	CO

Air quality monitoring progress

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

- SOx: measured by Fluorescent signal generated by exiting SO₂ with UV light
- NOx: measured by Chemilumiscent reaction between NOx & 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	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	
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	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	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	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	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	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	(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	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	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	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	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	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	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	(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	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	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	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		
			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	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	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	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	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	(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	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	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	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	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	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	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	(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	0	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	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	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	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	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	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	(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	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	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	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	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	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	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	(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	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	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																										Bangladesh (DoE) Standard (ECR 2005)
		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	Rainy/ Cloudy	Sunny						
Weather			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	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	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	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	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	(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	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	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	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	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	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	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	(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	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	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	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	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	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	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	(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	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	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	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	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	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	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	(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	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	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																										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		
		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	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	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	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	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	(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	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	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	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	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	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	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	(10000) ^{8hr}	
	O ₃	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	9	4	9	1	5	19	11	4	2	0	157 ^{8hr}	
Access road bridge	PM _{2.5}	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	33.1	20.9	40.9	26.9	36.1	39.65	14.65	26.26	20.16	38.72	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	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	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	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	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	(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	157 ^{8hr}	

Note(s): Concentrations are in $\mu\text{g}/\text{m}^3$

- 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	√	√
	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	√	√
	GHGs	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	
	NOx	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	
	PM	X	X	X	X	X	√	√	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	
Akram Point Sundarbans	SOx	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	
	GHGs	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	
Hiron Point Sundarbans	SOx	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	
	GHGs	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	√	
Khulna City, near Khan Jahan Ali Bridge	SOx	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	
	NOx	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	√	
	GHGs	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	√	√	√	
Township area	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	√	√	√	
	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	X	X	X	
Access road bridge area	SOx	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	
	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

SI	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	
		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	
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	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	
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	
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	
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	
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	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	
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	
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	
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	
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	
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	
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	
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	
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	

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

SI. 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	
		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	
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°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	
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	
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	
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	
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	
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	
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	
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	
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	
11	Maidara river near proposed township area	30	32	27	20	30	31.6	31.2	23.0	30.6	30.7	31.2	21.8	30.1	30.0	21.1	31	31	30.2	21	32	30	27	23	30		
12	Passur river at Passur-Ghasiakhali confluence	29	30	32	19	30	29.8	30.7	21	31.3	30.7	30.38	22.1	30.2	30	20.8	30	29	26.82	21.89	31	30	28	22	30	28.07	
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	
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	
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	

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	
		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	
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	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	
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	
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	
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	
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	
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	
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	
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	
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	
11	Maidara river near proposed township area	9.0	4.5	0.0	4.5	9	0	0	2.5	6.3	0	0	3.8	6.9	0	2.52	9.0	0.2	0.02	9.9	8.0	1.0	0.3	4.0	0.5		
12	Passur river at Passur-Ghasiakhali confluence	10.0	9.5	0.0	5.0	14	0	0	4.8	6	0	0	6.7	10.4	1.2	10.8	10.0	0.6	1	7.9	14.9	0.4	0.5	3.6	0.4	0.2	
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	
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	
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	

Source: CEGIS Field Survey

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

Table B.4: Dissolve Oxygen in Passur River

SL	Sampling Locations	Dissolve Oxygen (mg/L)																										
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct		
		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		
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	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		
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		
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		
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		
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		
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		
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		
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		
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		
11	Maidara river near proposed township area	6.7	6.8	8.0	6.2	6.5	6.4	7.1	5.2	5.9	5.4	6.4	6.7	7.1	6.2	5.11	6.7	6.3	6	6.0	6.2	6.0	7.7	7.5	6.1			
12	Passur river at Passur-Ghasiakhali confluence	5.3	6.2	7.0	6.5	6.3	7	6.6	5.4	5.8	5.4	5.6	5.9	6.4	6.4	5.23	5.95	5.8	6	6.9	6.5	6.2	7.9	8.6	6.0	8.14		
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		
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		
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		

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	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	288	24	6	128	87	42	32	124	220	8	12	56	52	24	48	276	20	56	72	188	36	56	24	32	
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	
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	
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	
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	
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	
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	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	
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	
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	
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	
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	
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	
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	
15	Passur river at Hiron point of Sundarbans	540	416	122	472	470	NS	96	NS	160	NS	56	196	NS	4	88	NS	NS	76	140	NS	NS	72	64		

Source: CEGIS Field Survey

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

Table B.7: Oil and grease concentration of Passur River System

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	
		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	
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	10
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	<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	<1	<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	
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	

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
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	13060	251	176	4360	14400	937	158	5570	13400	179	138	3100	13400	496	1913	14500	315	855	9940	15800	290	480	6800	134
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
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
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
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
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
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
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
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
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
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
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
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
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
15	Passur river at Hiron point of Sundarbans	21500	14050	5720	17900	25300	NS	5830	NS	25500	NS	4120	12210	NS	4450	14190	NS	NS	12500	21110	NS	NS	5750	20400	

Source: CEGIS Field Survey

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

Table B.9: TH Passur River System

SL	Sampling Locations	TH (mg/L)																								
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
15	Passur river at Hiron point of Sundarbans	4850	3050	1440	2690	3640	NS	1460	NS	5050	NS	810	2870	NS	905	1740	NS	NS	4200	6900	NS	NS	1225	3850		

Source: CEGIS Field Survey

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

Table B.10: TSS Passur River System

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

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	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
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	
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	
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	
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	
15	Passur river at Hiron point of Sundarbans	91	72	267	200	180	NS	144	NS	15	NS	33	49	NS	16	13	NS	NS	6	9	NS	NS	5	10		

Source: CEGIS Field Survey

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

Table B.11: Nitrate (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	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	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	
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	
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	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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
15	Passur river at Hiron point of Sundarbans	0.8	2.84	0.4	2	28	NS	11.5	NS	3.5	NS	0.38	2.28	NS	2.6	6.1	NS	NS	0.9	2.6	NS	NS	2.5	4.1		

Source: CEGIS Field Survey

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

Table B.12: Sulphate (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	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	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	
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	
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	
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	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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
15	Passur river at Hiron point of Sundarbans	2080	1160	2360	1500	1920	NS	97	NS	2100	NS	320	1090	NS	2	510	NS	NS	780	769	NS	NS	540.0	445		

Source: CEGIS Field Survey

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

Table B.13: Phosphate (PO₄²⁻) concentration of Passur River System

SI	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	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
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	
15	Passur river at Hiron point of Sundarbans	7.51	0.29	1.09	0.44	0.47	NS	0.45	NS	0.36	NS	5.9	0.23	NS	0.55	1.45	NS	NS	0.61	0.18	NS	NS	0.3	0.2		

Source: CEGIS Field Survey

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

Table B.14: Arsenic (As) concentration of Passur River System

SI	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	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	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	
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	
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	
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	
5	Middle Passur River at Project Site-Jetty	0.002	0.004	0.004	0.003	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.003	0.002	0.001	0.003	0.002	0.003	0.002	0.002	
6	Right Bank of Passur River at Project Site-Jetty	0.002	0.003	0.003	0.003	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.002	
7	Left Bank of Passur River at South West corner from the Project boundary	<0.001	0.003	0.006	0.003	0.002	0.002	0.001	0.002	0.001	0.003	0.002	0.002	0.002	0.003	0.001	0.002	0.005	0.002	0.003	0.003	0.003	0.003	0.002	0.005	
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	
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	
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	
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	
12	Passur river at Passur - Mongla confluence	0.002	0.004	0.003	0.003	0.004	0.002	0.001	0.002	0.003	0.004	0.003	0.002	0.002	0.002	0.001	0.002	0.003	0.001	0.007	0.003	0.002	0.004	0.003	0.002	
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	
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	
15	Passur river at Hiron point of Sundarbans	0.003	0.002	0.003	0.002	0.002	NS	0.001	NS	0.004	NS	0.002	0.002	NS	0.002	0.001	NS	NS	0.001	0.001	NS	NS	0.002	0.002		

Source: CEGIS Field Survey

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

Table B.15: Pb concentration of Passur River System

SI	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	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	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	
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	
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	
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	
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	
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	
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	
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	
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	
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.053	0.004	0.004	0.143	0.135	0.002	0.07	0.023	0.35	0.008	0.008	0.038	<LOQ	0.003	0.002	0.002	0.01	0.008	0.004	0.002	0.003	0.002	0.008	0.013	
11	Maidara river near proposed township area	0.048	0.004	<0.002	0.133	0.14	0.002	0.008	0.067	0.275	0.015	0.007	0.056	0.001	0.011	0.001	0.003	0.016	0.017	0.005	0.003	0.004	0.003	0.006	0.005	
12	Passur river at Passur - Mongla confluence	0.05	0.032	<0.002	0.141	0.14	0.002	0.009	0.078	0.258	0.098	0.011	0.05	0.0001	0.011	0.001	0.002	0.015	0.009	0.007	0.003	0.002	0.002	0.005	0.003	
13	Passur river at Harbaria of Sundarbans	0.043	0.044	0.004	0.137	0.13	0.002	0.012	0.135	0.228	0.02	0.01	0.05	0.001	0.005	0.003	0.003	0.017	0.009	0.015	0.002	0.006	0.014	0.007	0.009	
14	Passur river at Akram point of Sundarbans	0.194	0.071	0.032	0.309	0.297	NS	0.084	0.302	0.359	0.142	0.126	0.033	0.009	0.004	0.169	0.001	0.062	0.018	0.013	0.002	0.001	0.019	0.043	0.011	
15	Passur river at Hiron point of Sundarbans	0.224	0.05	0.07	0.309	0.291	NS	0.073	NS	0.607	NS	0.151	0.129	NS	0.019	0.175	NS	NS	0.014	0.017	NS	NS	0.008	0.056		

Source: CEGIS Field Survey

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

Table B.16: Hg concentration of Passur River System

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

Source: CEGIS Field Survey

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

Parameters for ground water quality monitoring

Table B.17: pH and Temperature of Ground Water

SI	Locations	Tube Well Type	pH value																									
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	
			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	
1	Near Proposed Township	Deep (>600 ft)	7.6	7.7	7.9	8	TC	8.1	7.49	7.6	7.8	7.8	8.4	8.1	7.4	8.2	6.9	NF	NF	MF	7.1	8.3	8.2	7.2	7.8	8.1	7.4	
2	Rajnagar	Deep (>600 ft)	7.6	7.8	8	8.2	7.8	8.3	7.93	8.1	8.3	8.1	7.9	7.5	7.8	8.1	7.4	6.9	7.9	7.3	6.9	8.4	7.9	7.6	7.3	8.0	8	
3	Kapasdanga	Deep (>600 ft)	7.6	7.7	8	8.1	7.9	8.3	7.7	7.9	8.2	7.9	7.9	7.6	7.4	7.8	7.2	7.2	7.6	7.6	6.5	8.9	8.1	7.4	7.5	8.0	8	
4	Kalekharber	Shallow (<250 ft)	6.3	6.5	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF				

Source: CEGIS Field Survey

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

Locations	Tube Well Type	Temperature (°C)																								
		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
		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
Near Proposed Township	Deep (>600 ft)	27.3	28.5	26	24.5	TC	31	30	24	29.8	28.6	29.1	25.1	28.7	27.2	22.9	NF	NF	NF	23.8	29	31.4	27	24	31	27
Rajnagar	Deep (>600 ft)	29.6	29.9	28	22.5	28.6	28	27.8	23	29.6	29.1	30.4	24.3	27.7	26.5	23.8	30.3	29.3	30	23.7	30	30.0	27	23	30	28
Kapasdanga	Deep (>600 ft)	29.2	28.9	28	25.1	28.8	30	28.7	25	30.1	29.4	29.8	24	28.4	26.4	23.6	30.1	29.7	29	23.2	30	31.2	26	23	30	27
Kalekharber	Shallow (<250 ft)	27.5	28.7	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF		

Source: CEGIS Field Survey

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

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

Table B.18: Salinity and DO in Groundwater

SI	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	
			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	
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	
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	
3	Kapashdanga	Deep (>600 ft)	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		
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			

Source: CEGIS Field Survey

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

SI	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	
			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	
1	Near Proposed Township	Deep (>600 ft)	4.4	5.2	6.5	6.7	TC	6	5.4	4.9	6.1	5.8	6.3	4.5	5.1	6.2	5.2	NF	NF	NF	6.0	6.0	6.1	6.0	6.0	6.0	V	
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	
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	Kalekharber	Shallow (<250 ft)	4.4	6	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF		

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring:

NF=Non-functional *Drinking water quality standards, The Environment Conservation Rules, 1997

Table B.19: TDS and TSS concentrations in Groundwater

SL	Locations	Type of tube wells	TDS (mg/L)																								
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
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	
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	
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	
4	Kalekharber	Shallow (<250 ft)	1055	970	-	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF			

Source: CEGIS Field Survey

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

SL	Locations	Type of tube wells	TSS (mg/L)																								
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	
			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	
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	
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	
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	
4	Kalekharber	Shallow (<250 ft)	-	48	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	Nf	NF			

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

SI 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	
			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	
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	
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	
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	
4	Kalekarber	Shallow (<250 ft)	780	450	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF			

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring:

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

Table B.21: COD concentrations of monitored ground water locations

SI	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	
			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	
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	
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	
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	Kalekarber	Shallow (<250 ft)	32	36	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF			

Source: CEGIS Field Survey

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

Table B.22: NO₃⁻ Concentrations in Ground Water

SI	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	
			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	
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	
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	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	
4	Kalekarber	Shallow (<250 ft)	0.40	0.56	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF			

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring:

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

Table B.23: SO₄²⁻ Concentrations in Ground Water

SI	Location	Type of 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	
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	
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	Kapasdanga	Deep (>600 ft)	-	10	-	-	-	-	2	2	8	1	1		3	2	6	4	6	1	1	4	1	1	2	4	
4	Kalekarber	Shallow (<250 ft)	NF	3	NF	-	-	-	-	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF			

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring:

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

Table B.24: PO₄³⁻ Concentrations in Ground Water

SI	Location	Type of 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	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	
1	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	
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	
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	
4	Kalekarber	Shallow (<250 ft)	NF	1.2	NF	NF	NF	NF	NF	NF	NF	NF	NF	1.23	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF		

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring:

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

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

SI	Locations	As (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
		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
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
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
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	0.004
4	Kapasdanga	0.036	0.033	0.020	0.017	0.034	0.024	0.011	0.002	0.047	0.005	0.016	0.028	0.010	0.027	0.002	0.001	0.004	0.050	0.004	0.012	0.022	0.001	0.033	0.003	

Source: CEGIS Field Survey

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

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

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

SI	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
		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
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
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
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	0.001
4	Kapasdanga	<0.002	0.004	<0.002	0.013	0.017	0.002	0.005	0.012	0.008	0.002	0.001	0.016	0.001	0.002	0.001	0.001	0.001	0.001	0.056	0.004	0.006	0.001	0.001	0.002	

Source: CEGIS Field Survey

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

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

Table B.27: Hg concentrations (mg/L) of monitored ground water locations

SI	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
		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
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
2	Rajnagar	<0.00015	<0.00015	<0.0005	<0.0005	<0.00015	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001
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
4	Kapasdanga	<0.00015	<0.00015	<0.0005	<0.0005	<0.00015	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001		<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	

Source: CEGIS Field Survey

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

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

Table B.28: PAH concentrations of monitored locations

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

Table B.29: TOC concentrations of monitored locations

Monitoring sites	July, 2018		January, 2019		July, 2019		February, 2020		July, 2020	
	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	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	9.17	152
Majhar point	21.9	25.1	24.8	18.8	21.7	18.1	21.7	18.1	9.48	200
Hiron point	NM	NM	6.8	5.7	NM	NM	8.1	6.7	NM	NM

(C) Noise Level monitoring data

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

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

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

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

SI 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

SI 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

SI 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

SI 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

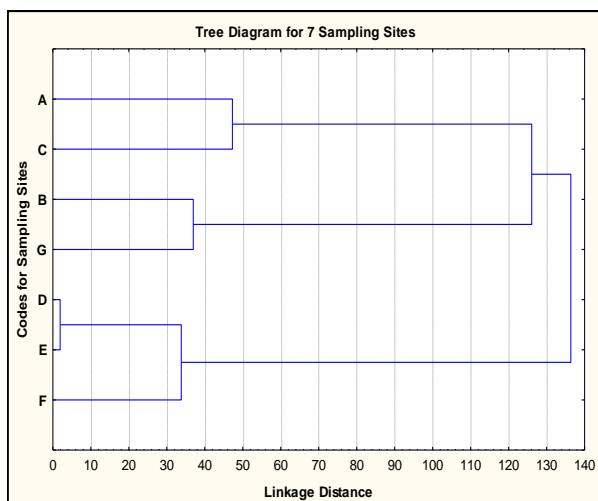
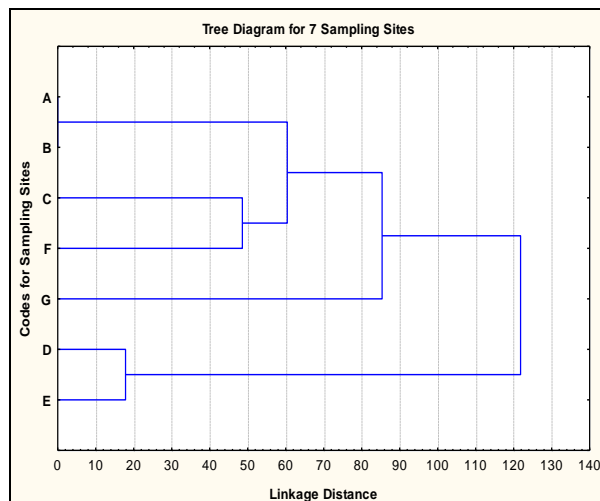
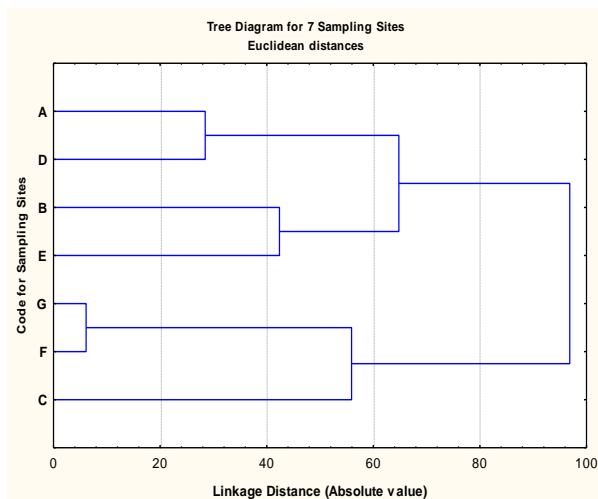
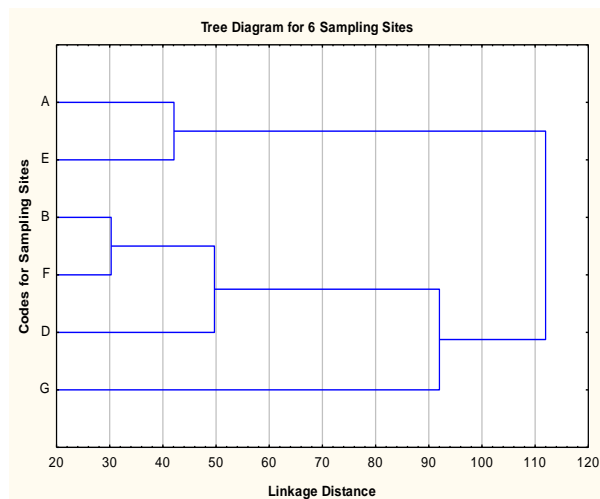
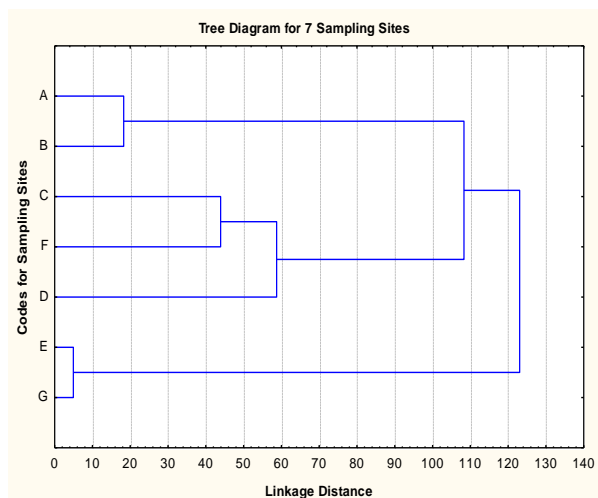
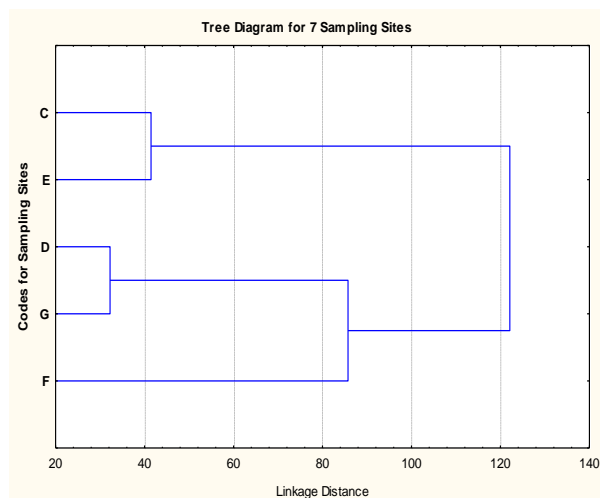
SI No	Location	QM 21 (Noise Level in dB (A)) July-19				QM 22 (Noise Level in dB (A)) November-19				QM 23 (Noise Level in dB (A)) February 20				QM 25 (Noise Level in dB (A)) July, 20			
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day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

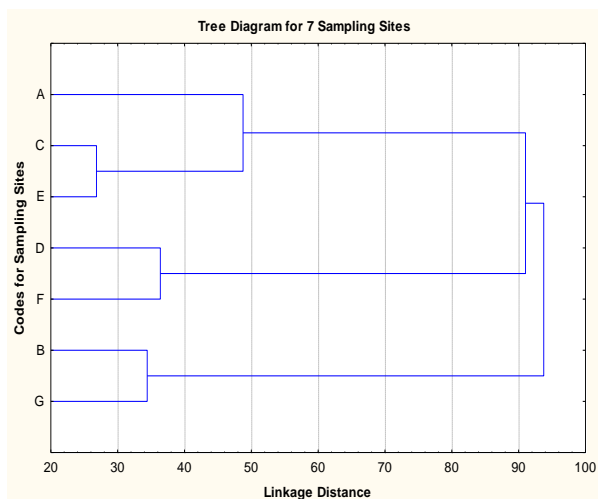
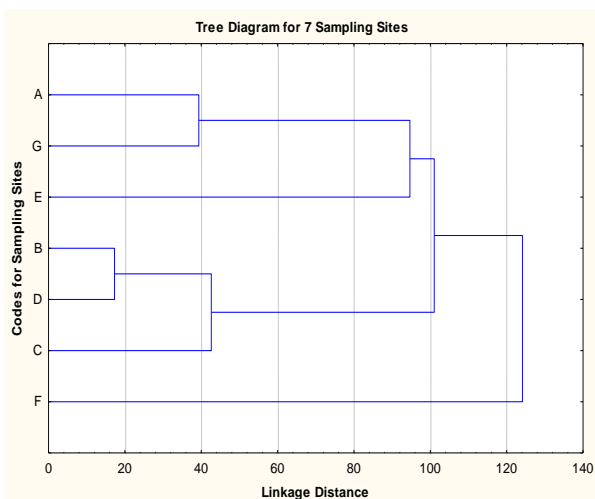
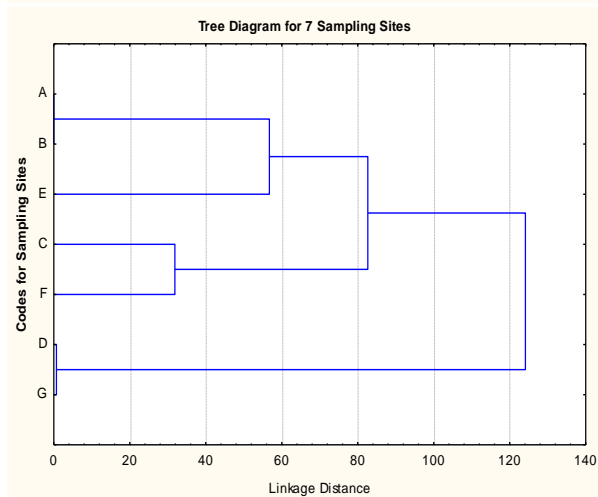
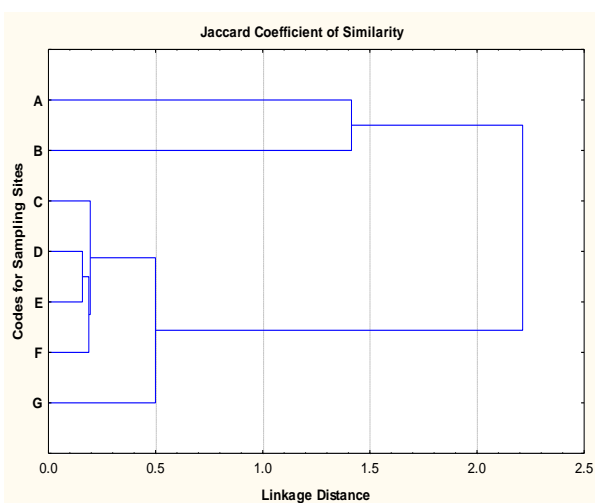
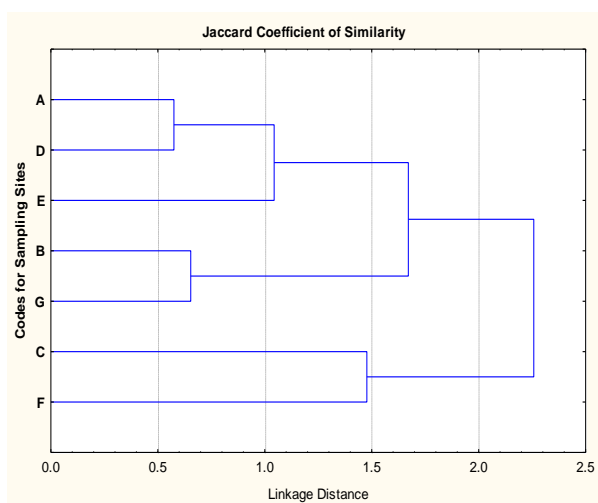
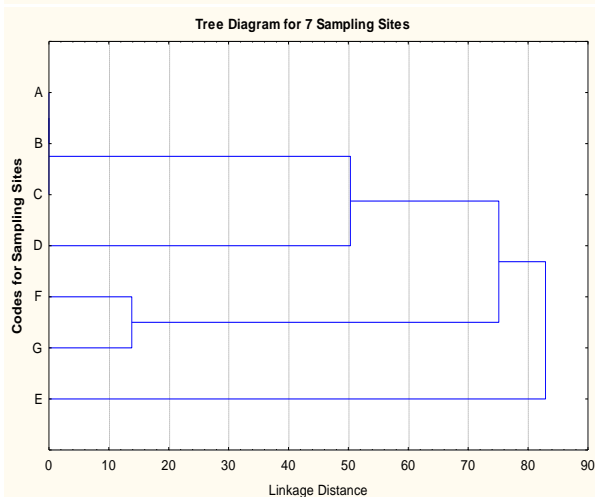
Source: CEGIS field Survey

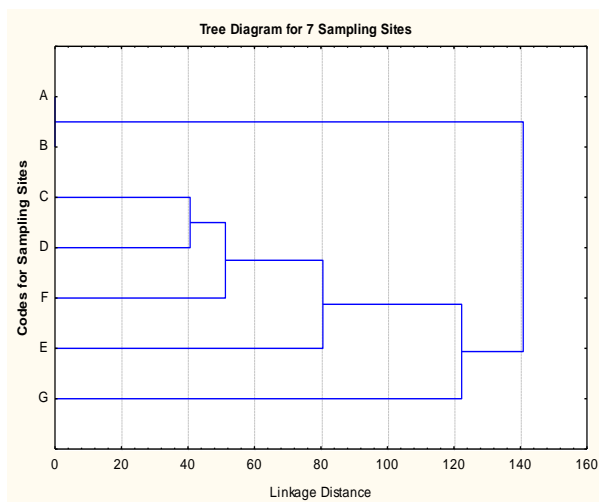
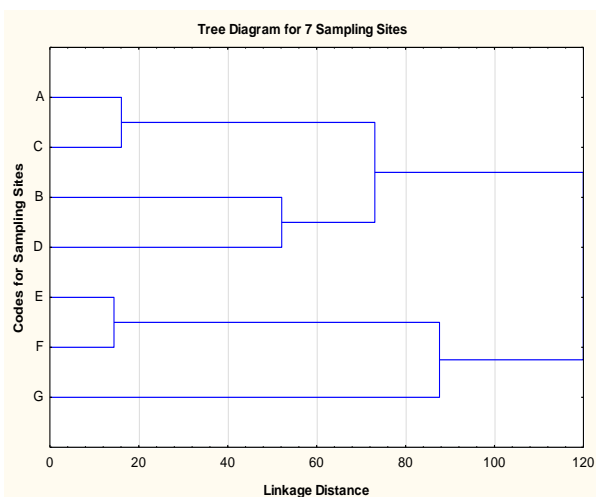
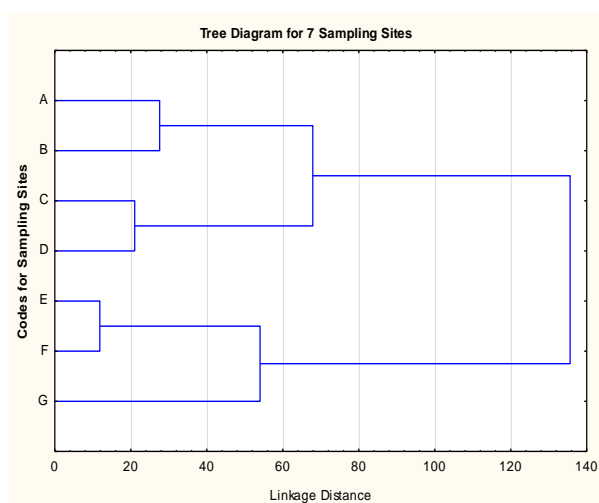
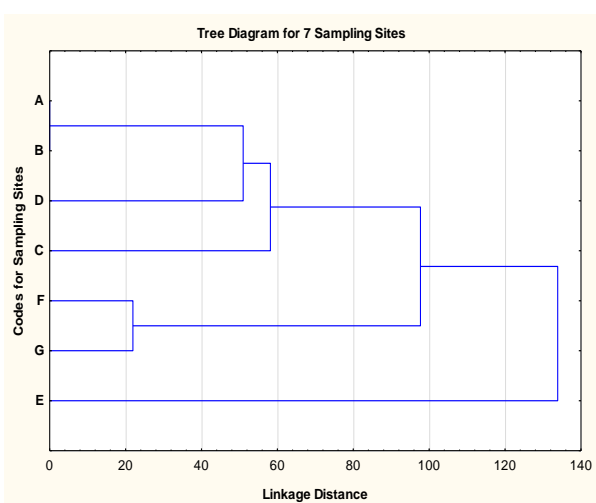
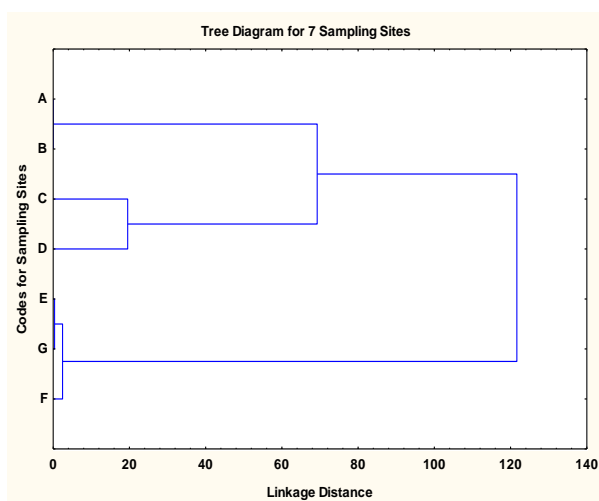
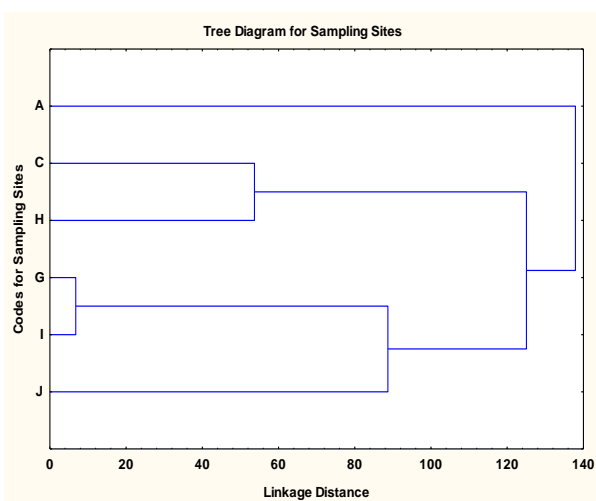
Note: NM-Not measured.

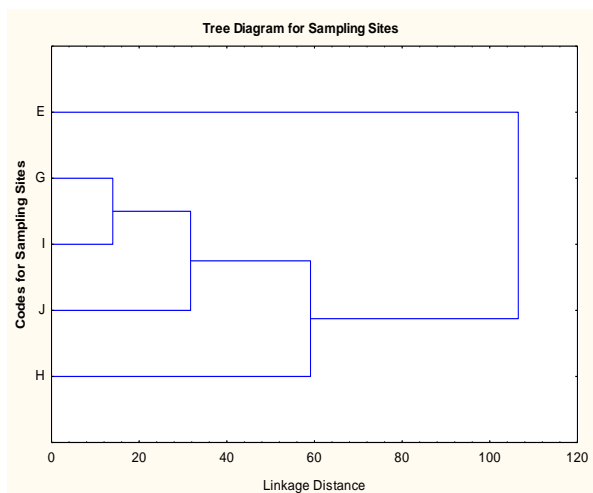
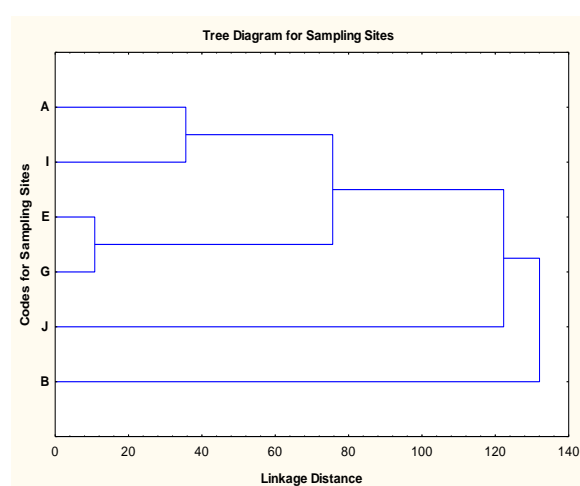
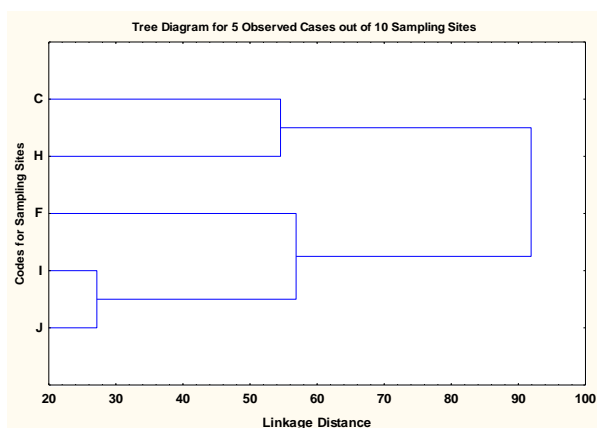
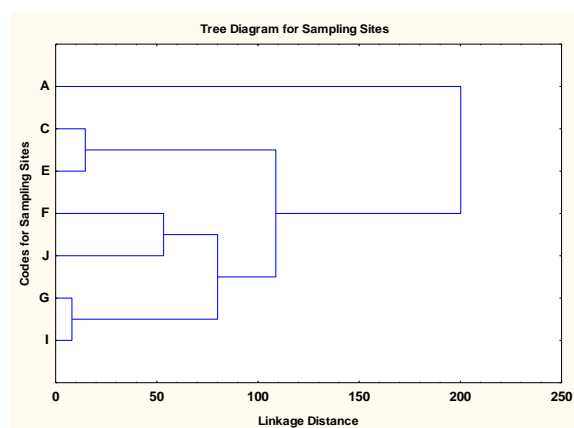
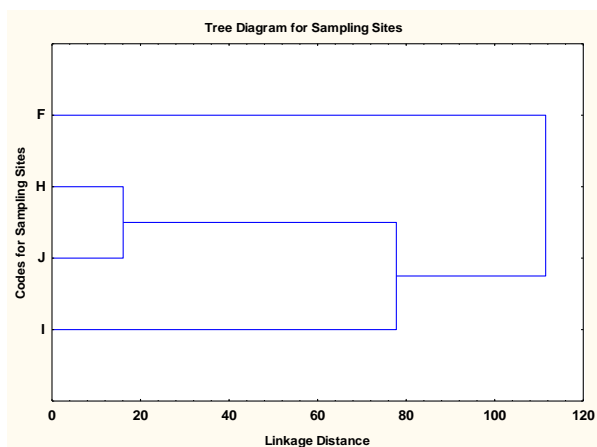
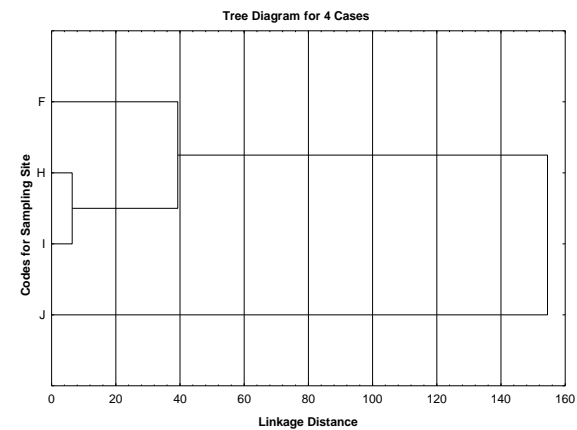
Table C.6 Ambient noise monitoring status at the monitored locations

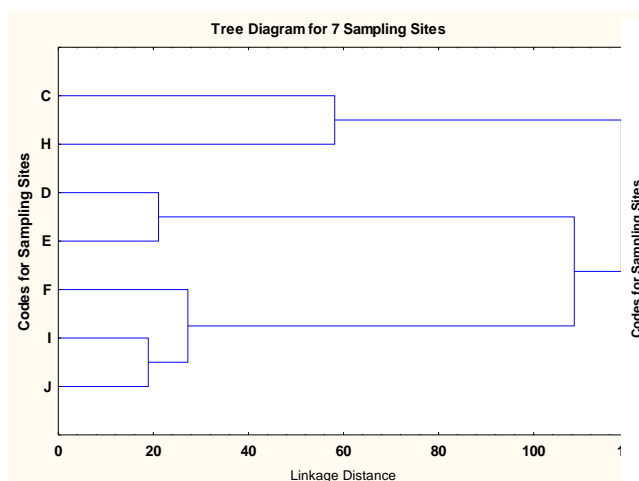
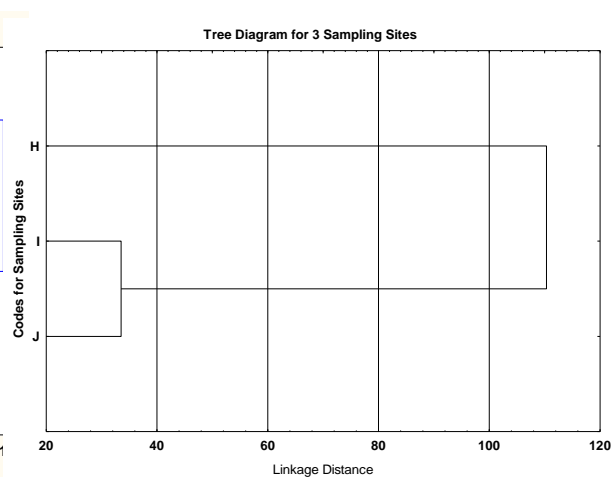
SI No	Location	QM 26 (Noise Level in dB (A)) Oct, 2020			
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG
1	Chalna, Dacope	65.91	51.62	56.93	58.15
2	NW Corner of the Project area	47.82	50.15	47.45	48.48
3	Chunkuri-2, Bajua	43.58	47.68	46.45	45.91
4	SW corner of the Project area	49.50	48.83	49.22	49.18
5	Project site near Shapmari area	50.23	41.71	41.43	44.45
6	Barni, Gaurambha	67.71	51.76	55.51	58.33
7	Khan Jahan Ali Bridge, Khulna	81.72	81.45	82.25	81.81
8	Mongla Port area	74.72	75.67	80.37	76.92
9	Harbaria, Sundarbans	59.01	NM	50.06	54.54
10	Akram Point, Sundarbans	NM	42.23	NM	42.23
11	Hiron Point, Sundarbans	52.40	49.01	NM	50.70

(D) Fisheries resources monitoring data**D1: Classification of functional habitat****1st Monitoring, April, 2014****2nd Monitoring, July 2014****3rd Monitoring, October, 2014****4th Monitoring, January 2015****5th Monitoring, April, 2015****6th Monitoring, August, 2015**

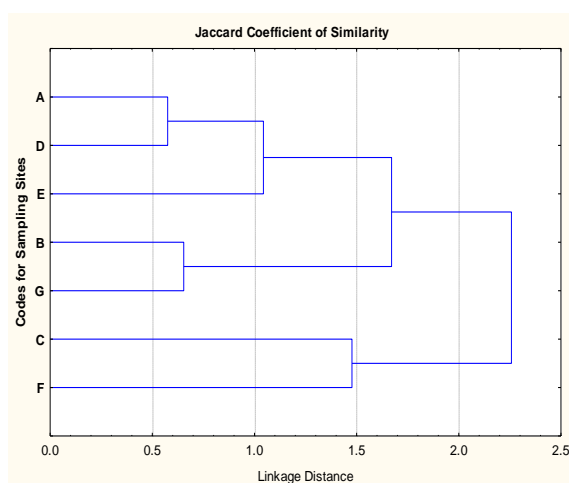
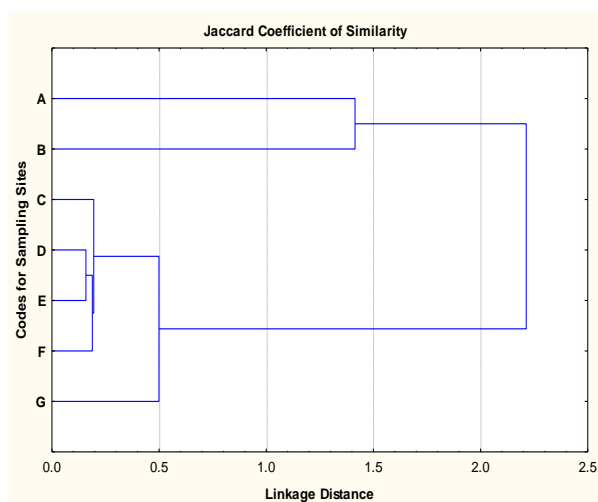
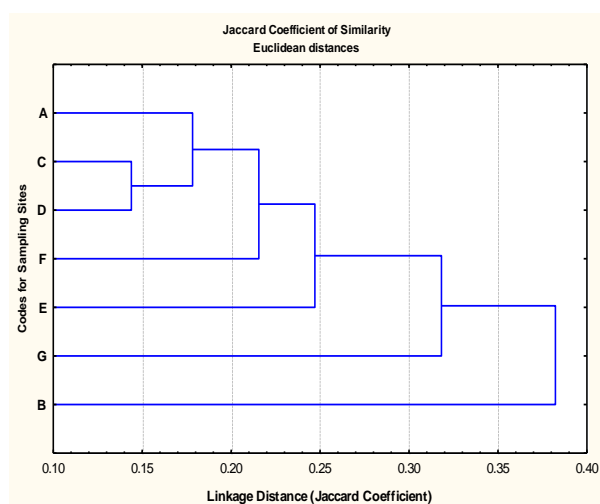
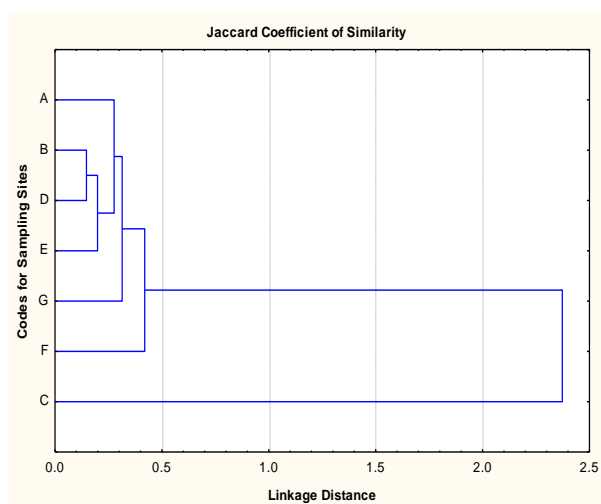
7th Monitoring, October, 20158th Monitoring, January, 20169th Monitoring, April, 201610th Monitoring, July, 2016

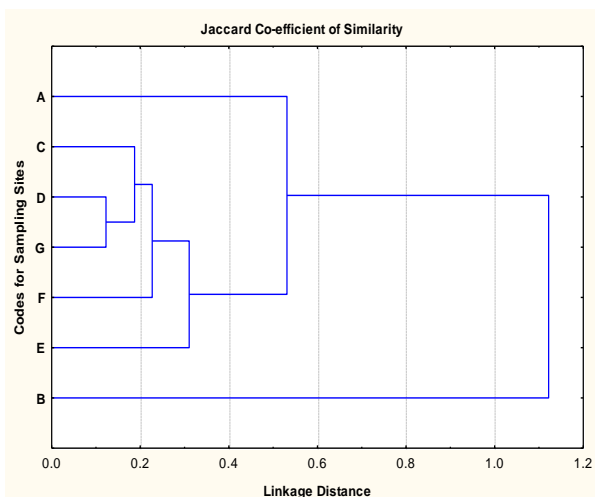
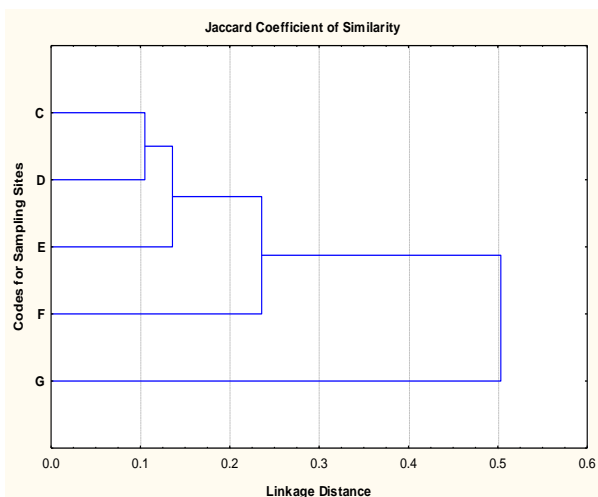
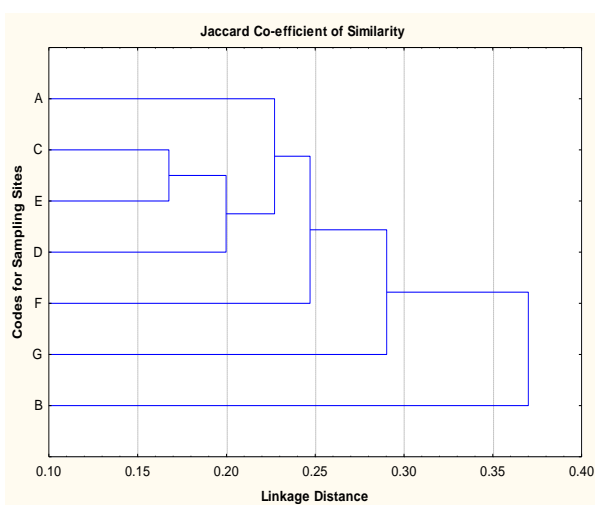
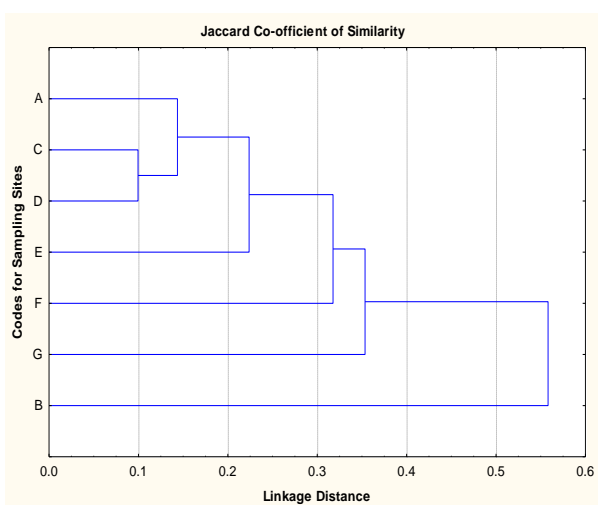
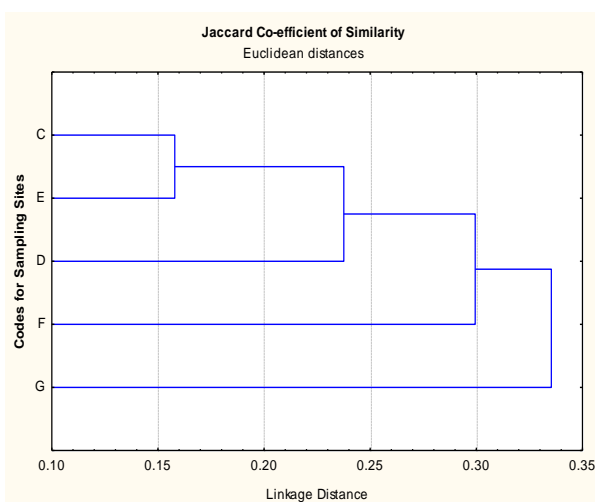
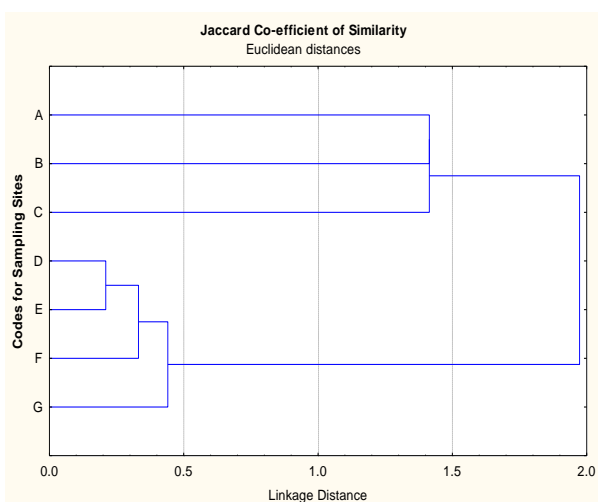
11th Monitoring, October, 201612th Monitoring, January, 201713th Monitoring, April, 201714th Monitoring, October, 201715th Monitoring, January, 201816th Monitoring, April, 2018

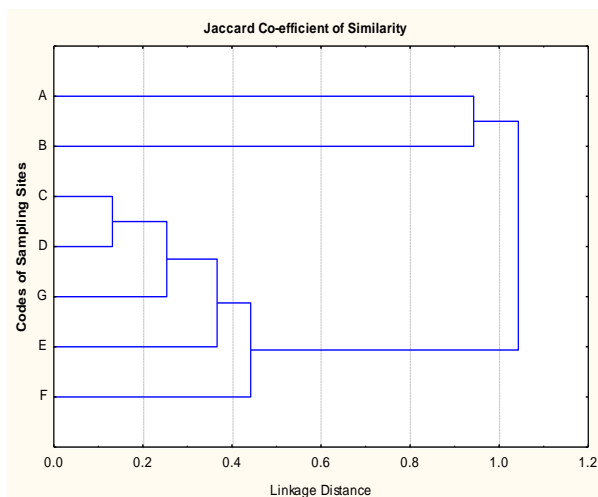
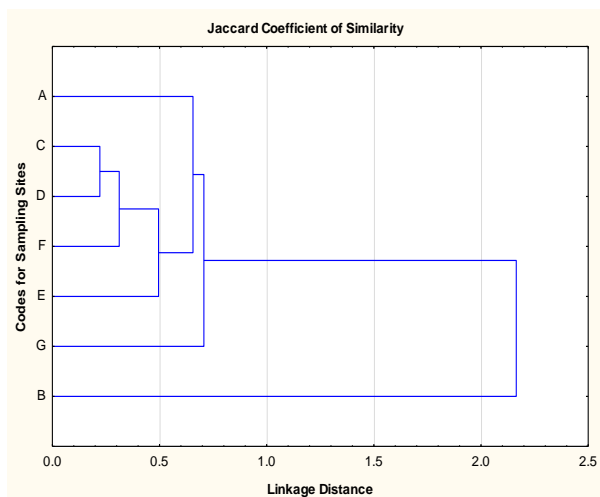
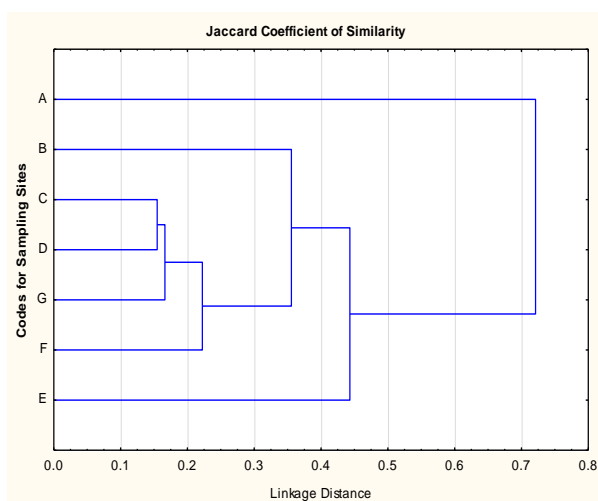
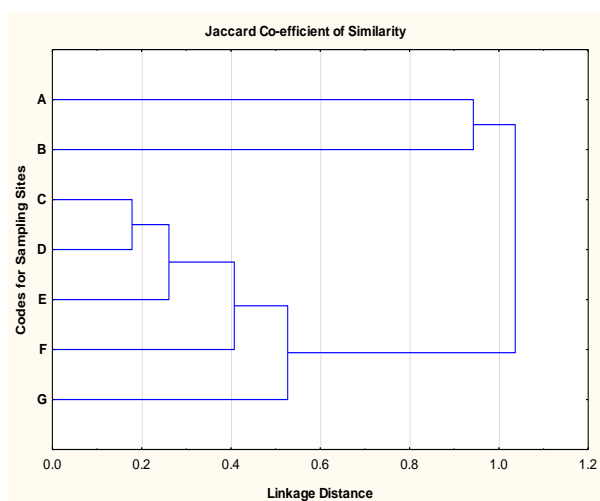
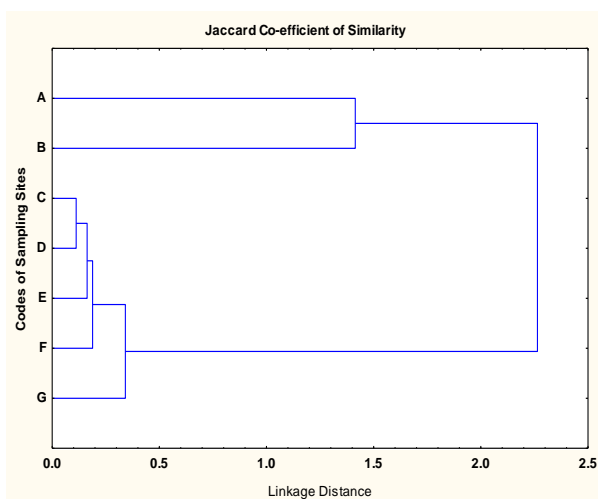
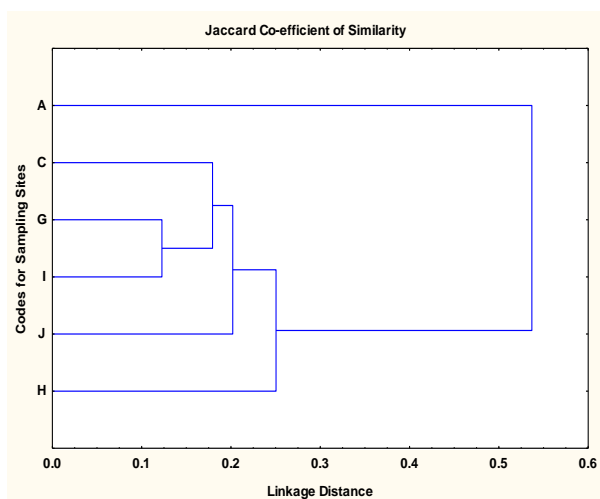
17th Monitoring, July, 201818th Monitoring, November, 201819th Monitoring, February, 201920th Monitoring, April, 201921st Monitoring, July 201922nd Monitoring, November, 2019

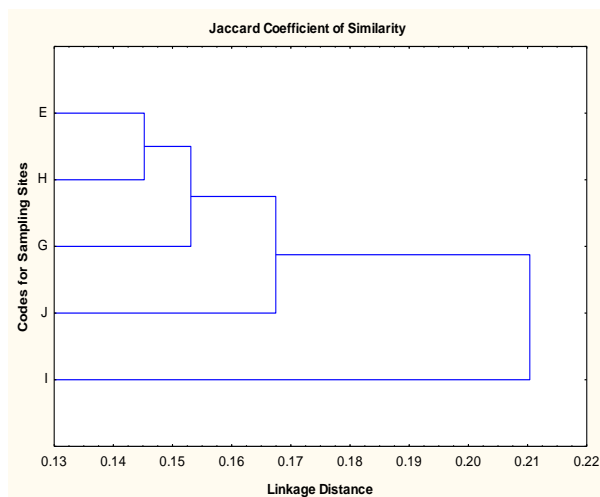
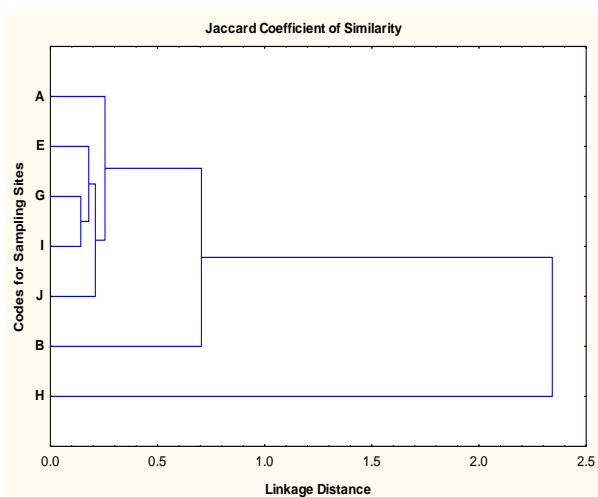
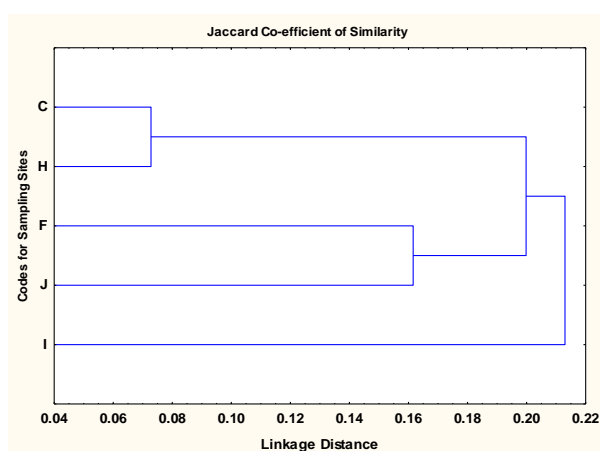
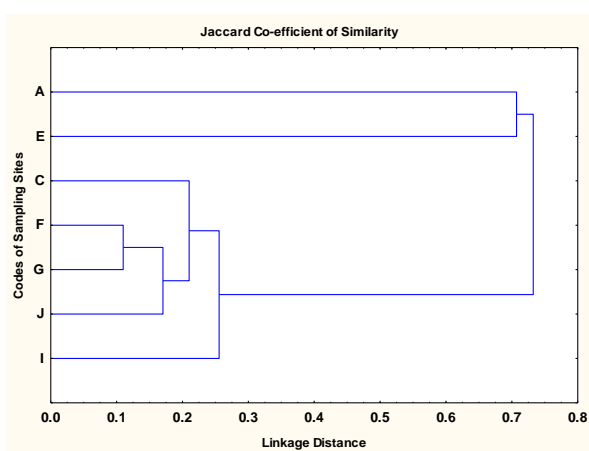
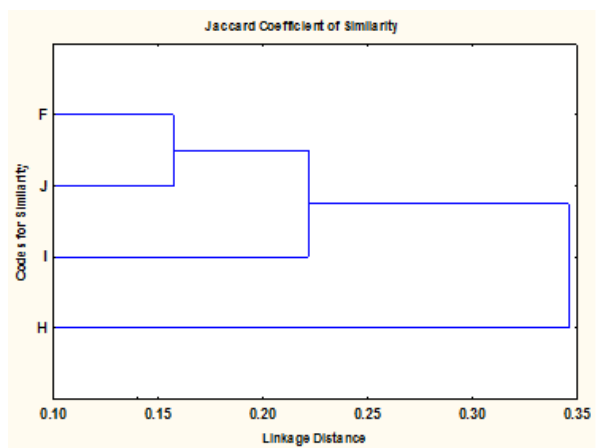
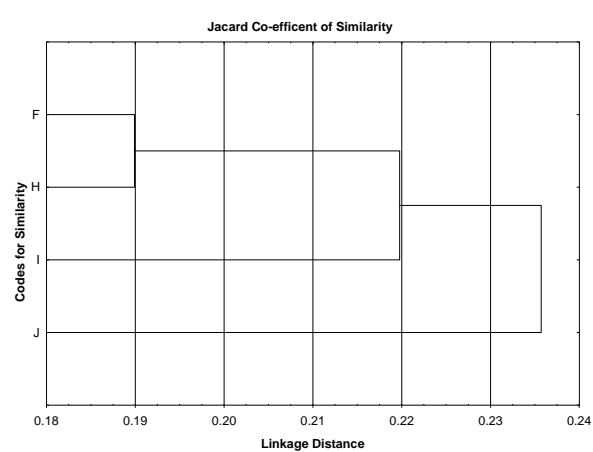
23rd Monitoring, February 202025th Monitoring, July 2020

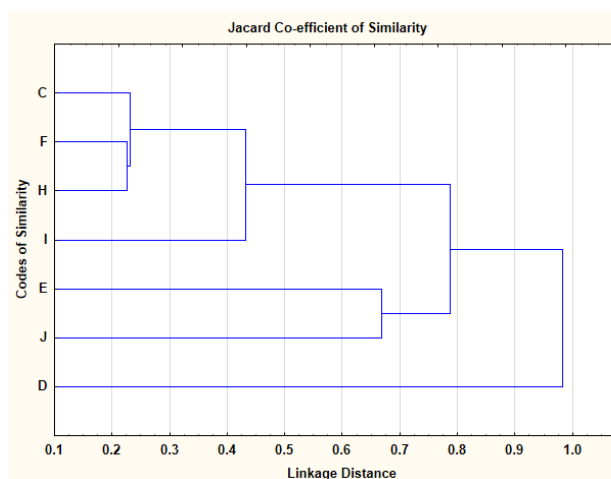
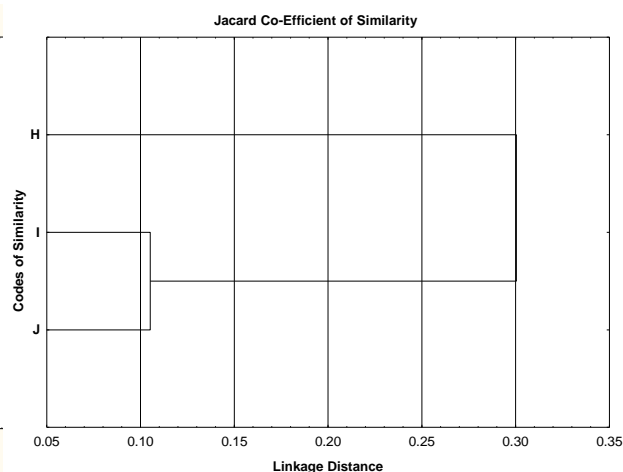
D2: Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence

1st Monitoring, April, 20142nd Monitoring, July 20143rd Monitoring, October, 20144th Monitoring, January 2015

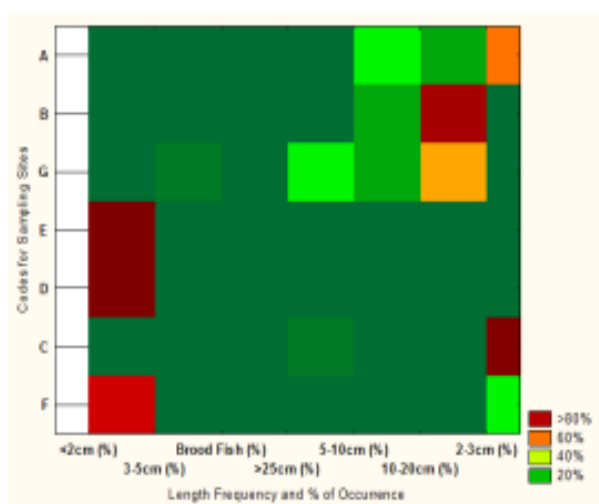
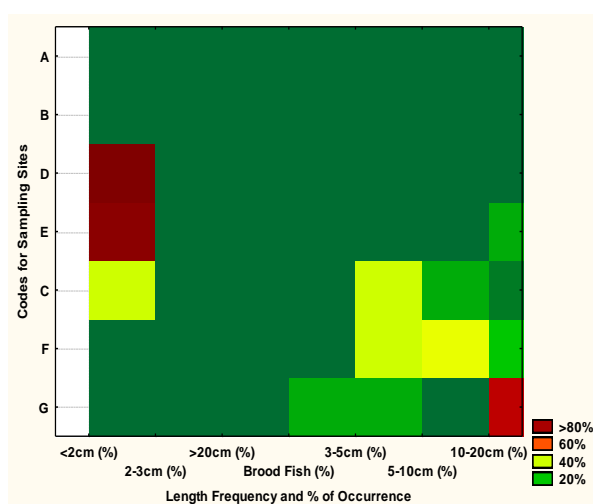
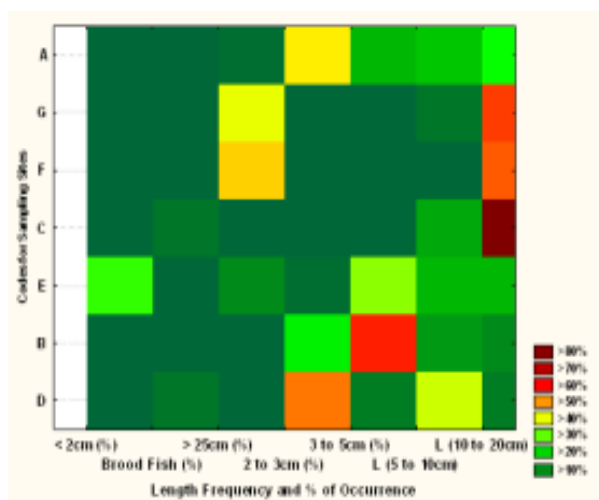
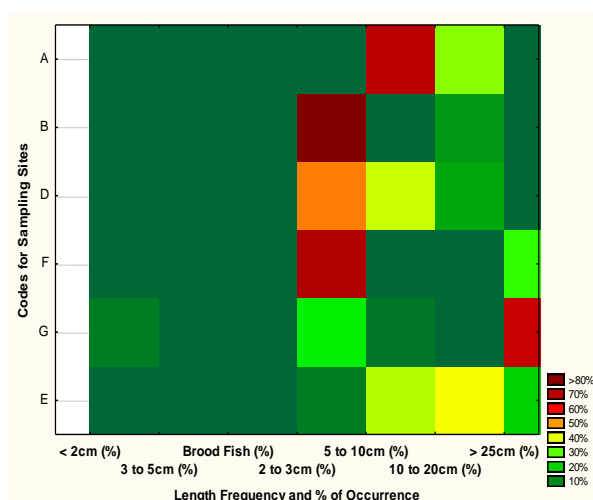
5th Monitoring, April, 20156th Monitoring, August, 20157th Monitoring, October, 20158th Monitoring, January, 20169th Monitoring, April, 201610th Monitoring, July, 2016

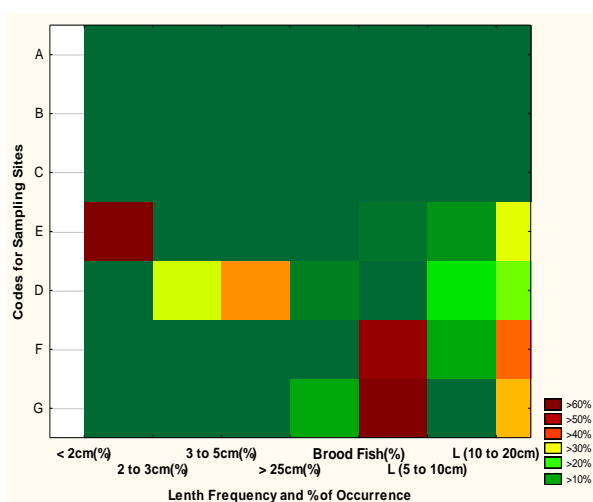
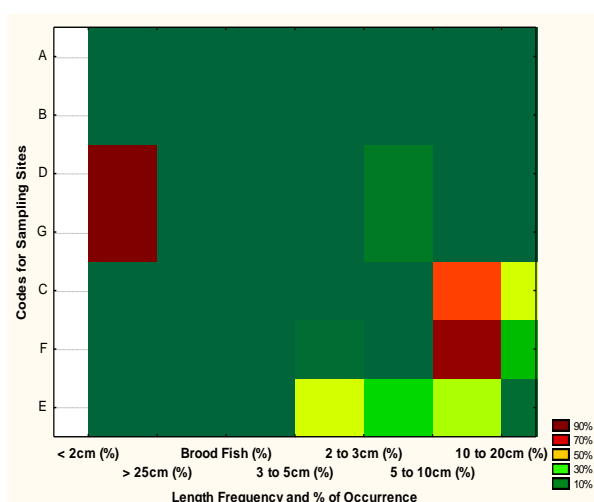
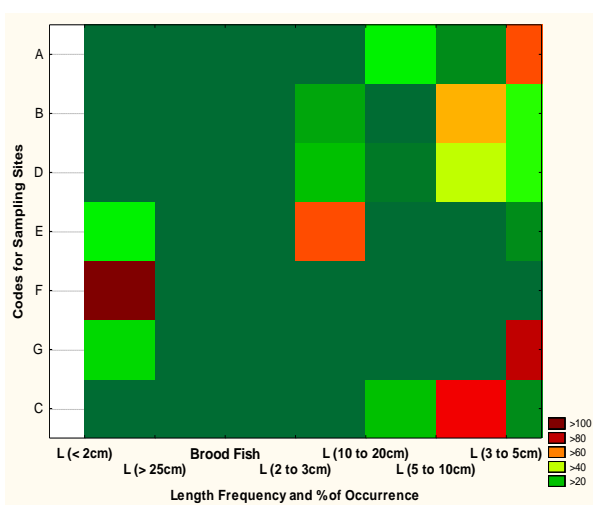
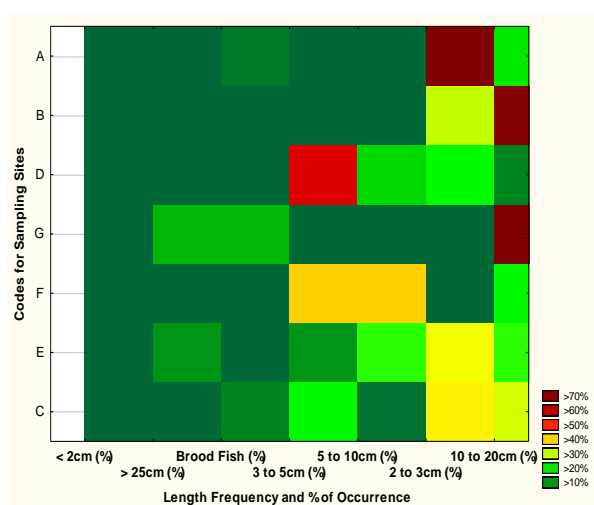
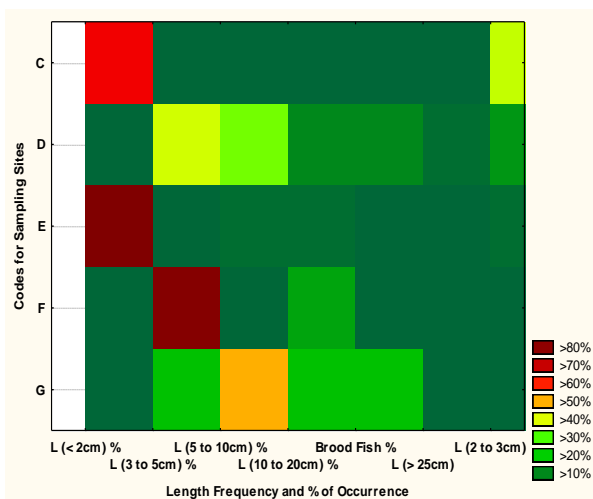
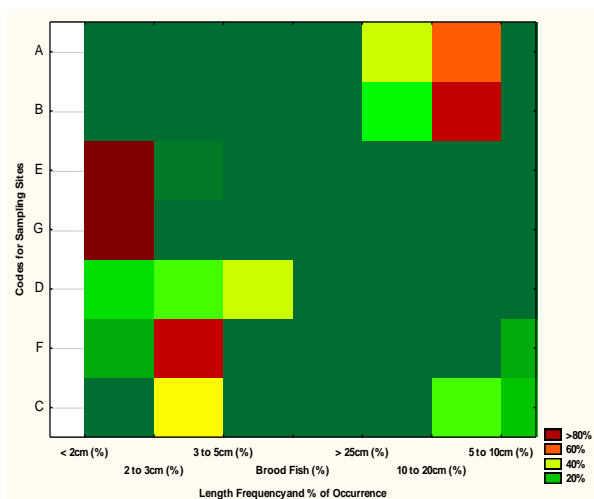
11th Monitoring, October, 201612th Monitoring, January, 201713th Monitoring, April, 201714th Monitoring, October, 201715th Monitoring, January, 201816th Monitoring, April, 2018

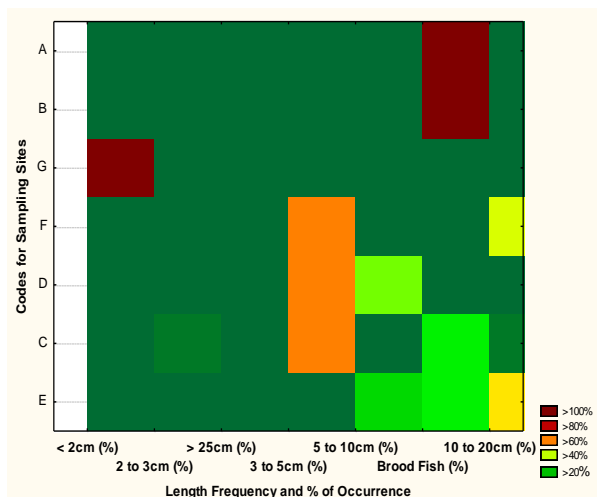
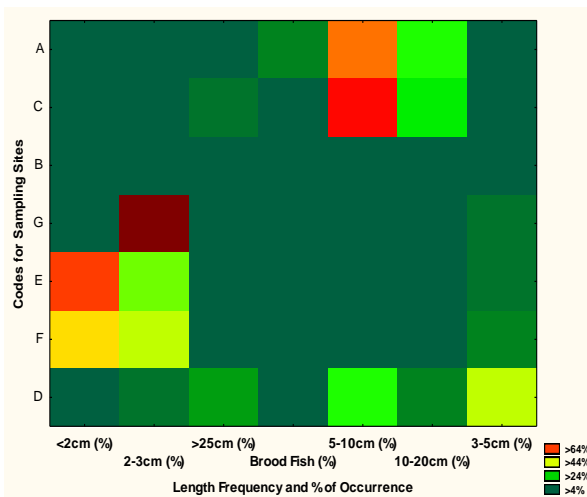
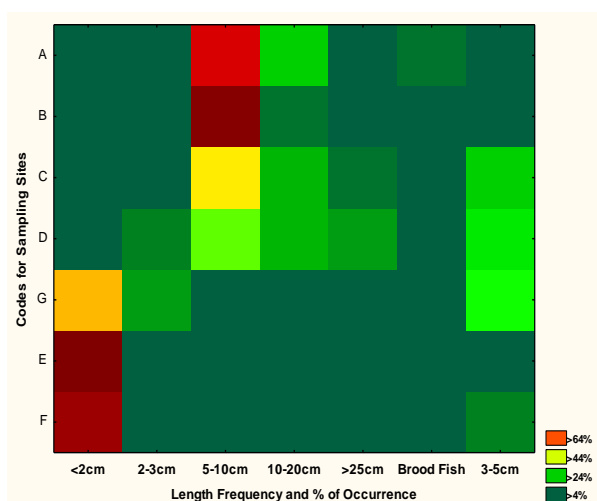
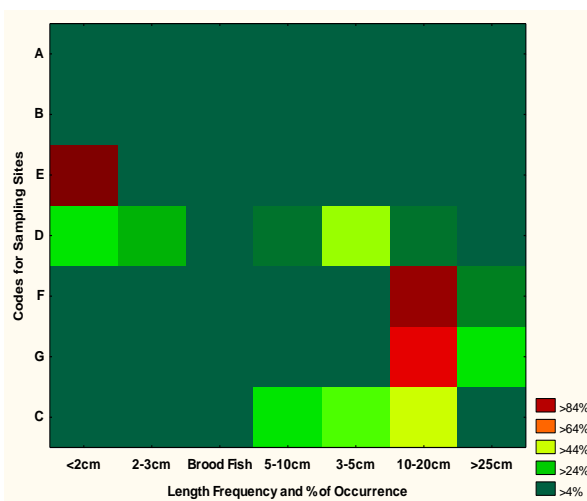
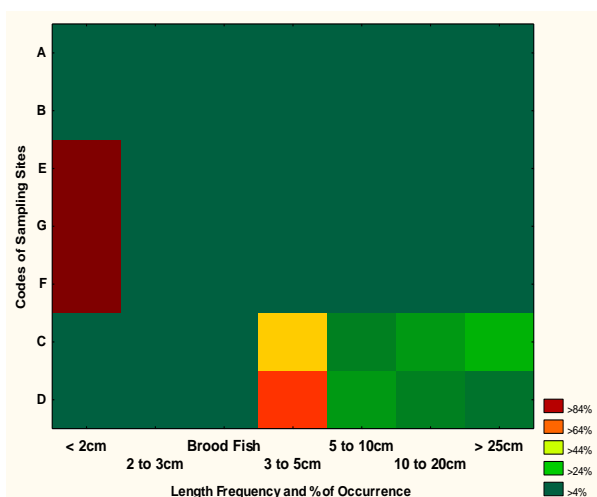
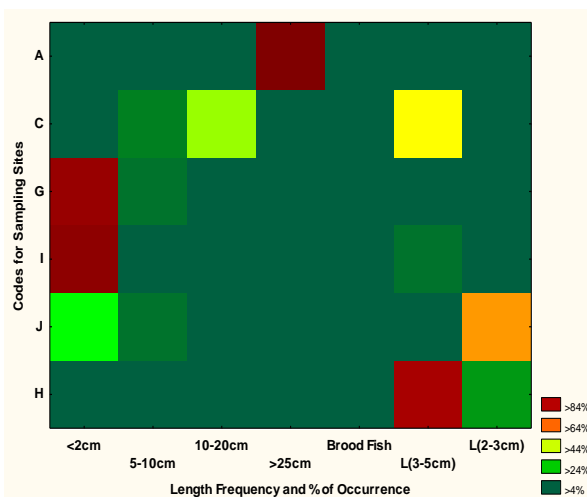
17th Monitoring, July, 201818th Monitoring, November, 201819th Monitoring, February, 201920th Monitoring, April, 201921st Monitoring, July, 201922nd Monitoring, November, 2019

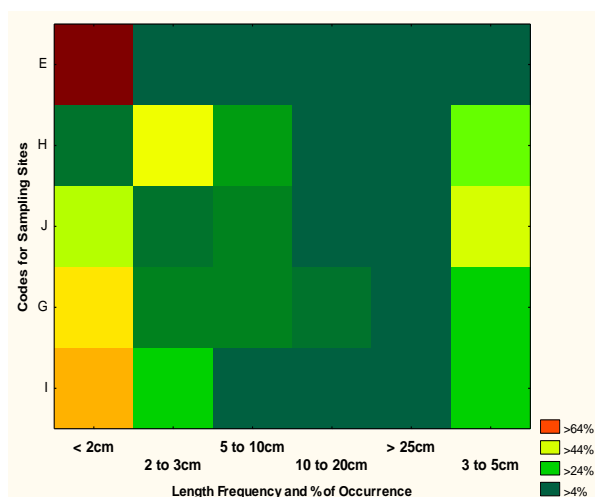
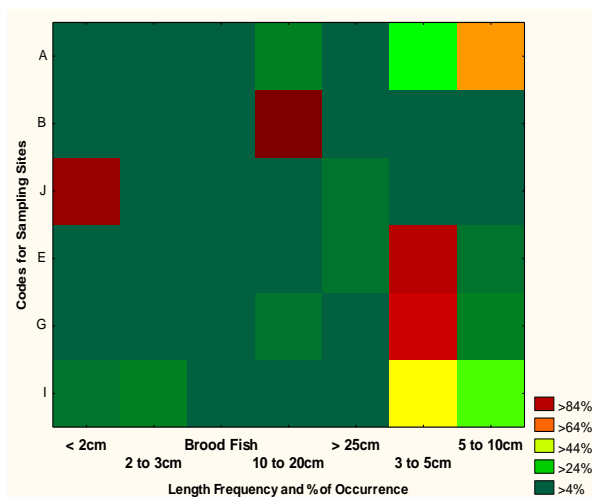
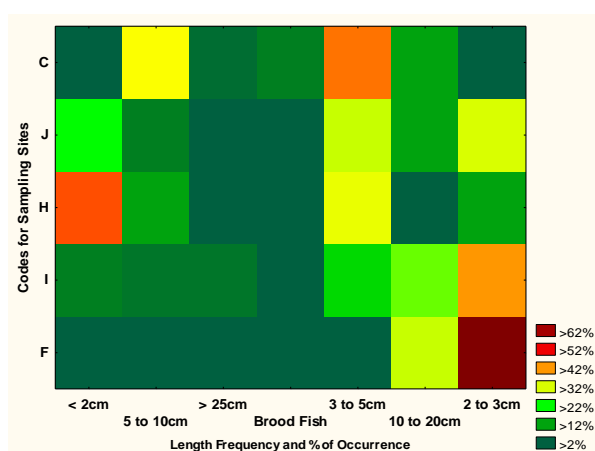
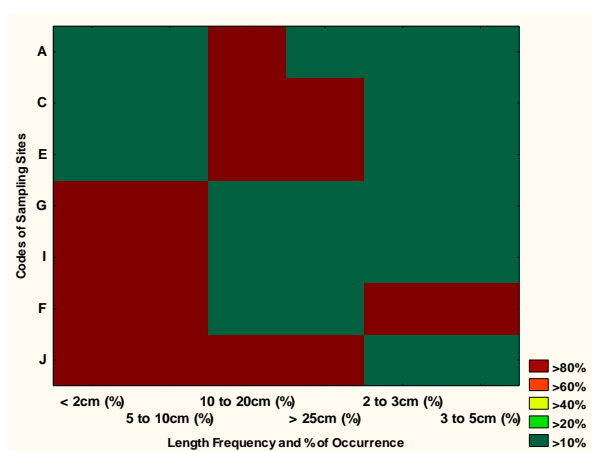
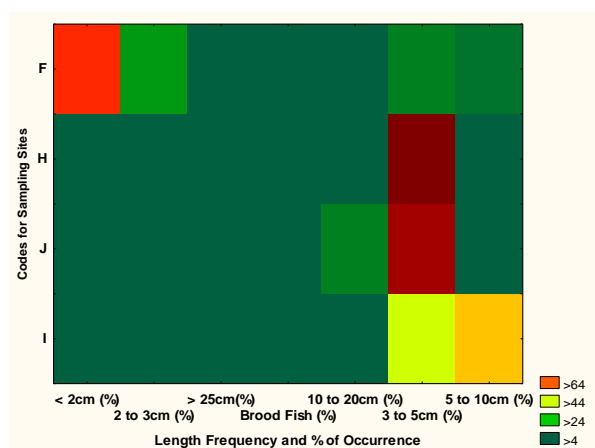
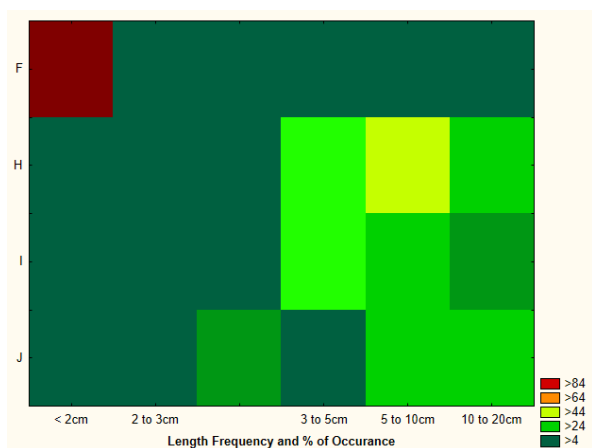
23rd Monitoring, February 202025th Monitoring, July 2020

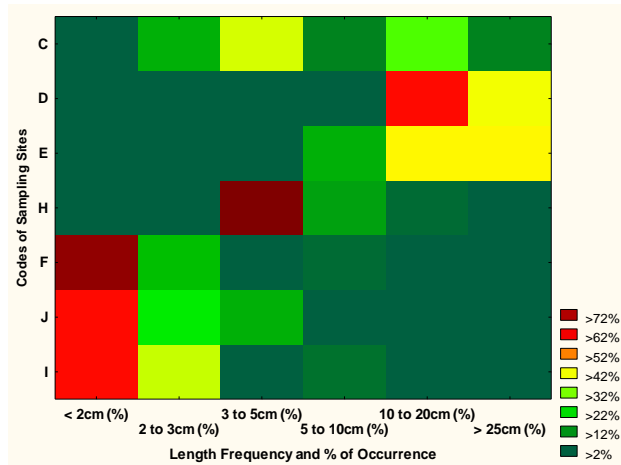
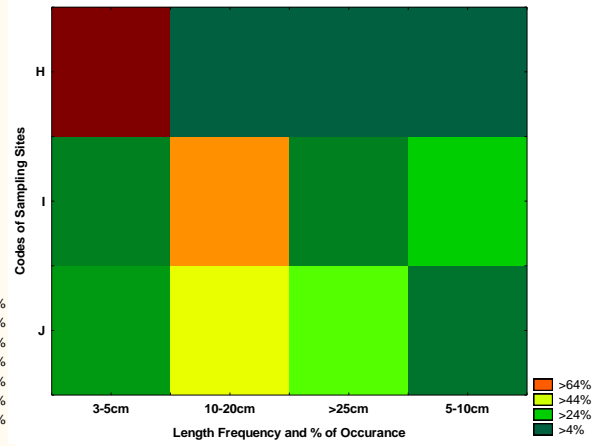
D3: Fish Community Structure

1st Monitoring, April, 20142nd Monitoring, July 20143rd Monitoring, October, 20144th Monitoring, January 2015



11th Monitoring, October, 201612th Monitoring, January, 201713th Monitoring, April, 201714th Monitoring, October, 201715th Monitoring, January, 201816th Monitoring, April, 2018

17th Monitoring, July, 201818th Monitoring, November, 201819th Monitoring, February, 201920th Monitoring, April, 201921st Monitoring, July 201922nd Monitoring, November 2019

23rd Monitoring, February 202025th Monitoring, July 2020

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>Trepauchen 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	+	-	-	-	-	-	-	-	-	-	+	-

Local Name	Scientific Name	Local Status*	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
			‘-’ = No; ‘+’ = Occurrence											
Chapila	<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	+	-	+	-	-	-	-	+	-	-	-	+
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
		‘-’ = 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 giurus</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	-	-	-	+	-	-	-	-	-	-	-	-	-
Sagor Chela	<i>Megalops cyprinoids</i>	NO	-	-	-	-	-	-	-	-	-	-	-	-	-
Purabi Chela	<i>Thyrssa 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	-	+	-	-	+	-	-	-	-	+	-	-	+

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
			‘-’ = No; ‘+’ = Occurrence												
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	-	+	-	-	-	+	+	+	+	-	-	-	+
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
Ayre	I	0	0	0	0	0	100	0
Baila	F	0	0	0	25	75	0	0
	I	0	0	0	0	100	0	0
Banspata	I	0	0	0	0	0	100	0
	J	0	0	0	0	0	100	0
Bata	J	100	0	0	0	0	0	0
Borguni	F	0	0	0	100	0	0	0
Chali	I	0	0	100	0	0	0	0
Chamua	E	0	0	100	0	0	0	0
	F	0	0	65.96	34.04	0	0	0
Chapila	F	0	100	0	0	0	0	0
	I	0	0	100	0	0	0	0
Chela	E	0	0	0	100	0	0	0
	F	0	0	50	50	0	0	0
Chota Baila	I	0	0	0	0	0	100	0
	J	0	0	0	0	100	0	0
Datina	A	0	0	0	0	16.67	83.33	0
	C	0	0	0	0	100	0	0
	I	0	0	0	0	100	0	0
Dogra	F	0	0	0	100	0	0	0
	I	0	0	100	0	0	0	0
Gagla	A	0	0	0	0	100	0	0
	C	0	0	0	0	30	70	0
	E	0	0	0	0	100	0	0
	F	0	0	0	0	100	0	0
Goda Icha	F	0	0	0	100	0	0	0
	I	0	0	100	0	0	0	0
Golda	A	0	0	0	0	50	50	0
	C	0	0	0	0	70.59	29.41	0
	E	0	0	0	0	37.5	62.5	0

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
	I	0	0	0	0	0	100	0
Harina	E	0	0	100	0	0	0	0
	F	0	0	0	100	0	0	0
Kain Magur	A	0	0	0	0	0	100	0
	C	0	0	0	0	0	88.89	11.11
Kakila	J	0	0	0	100	0	0	0
Kathali Chingri	E	0	0	0	100	0	0	0
Kechki	J	0	0	100	0	0	0	0
Khalisa	I	0	100	0	0	0	0	0
Khorulla	I	0	0	0	66.67	33.33	0	0
	J	100	0	0	0	0	0	0
Kuste Bola	A	0	0	0	0	0	100	0
Motka	F	0	0	0	100	0	0	0
	I	0	0	100	0	0	0	0
Mutkura	E	0	0	0	100	0	0	0
Parse	E	0	0	0	100	0	0	0
	F	0	0	0	87.5	12.5	0	0
	I	0	0	0	100	0	0	0
Phekxa	J	0	0	0	0	100	0	0
Poa	A	0	0	0	0	100	0	0
	C	0	0	0	0	100	0	0
	I	0	0	0	0	0	100	0
	J	0	0	0	0	84.96	15.04	0
Ramchos	F	0	0	0	0	100	0	0
	J	0	0	0	0	100	0	0
Silong	I	0	0	0	0	100	0	0
Tairel	E	0	0	0	100	0	0	0
Topse	J	0	0	0	0	0	100	0
Tulardandi	J	0	0	0	0	90	10	0
Vetki	A	0	0	0	0	0	100	0

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	-	-	-	-	-	-
		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

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	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	-	-	-	-	-	-		-	-
	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	-		-	-

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

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

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Mongla Point	Age-1 adult	-	Feeding and Growing	-	Feeding and Growing	-	Feeding and Growing		-	Feeding and Growing		-	-
		Juvenile	-	-	-	-	-	-	Feeding and Growing		-		Feeding and Growing	-
	Harbaria	Juvenile	-	-	-	-	-	-	Feeding and Growing		-		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	-
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	-	-	-	-	-	-		-	-

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	Juvenile and Adult	-	-	Feeding and Growing	-	-	Feeding and Nursery	-	Feeding	-		-	-
	Mongla Point	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	South-west of the Project	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	-	-	-		-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
Bele	Akram Point	Adult	Feeding	-	Feeding	Feeding	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	-
	Haldikhali	Juvenile-1, Juvenile and Adult	-	-	Nursing and Growing	Feeding	-	-	-	-	-		-	-
	Harbaria	Juvenile and Adult	-	-	Feeding and Growing	-	Feeding and Growing	Nursery and Feeding	Feeding and Growing	-	-		-	-
	Chandpai	Fry	Breeding and Spawning	Nursing	-	-	Nursing	Nursery	-	-	Nursery		-	-
	Chandpai	Juvenile and Adult	-	-	Feeding and Growing	Feeding	-	Feeding	-	Feeding	-		Feeding and Growing	
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing				-	-
	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	-	-	-	-	-		-	-

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
	Maidara	Juvenile and Age-1 adult	-	Feeding and Growing	Feeding and Growing	Feeding	Feeding and Growing	-	-	-	Feeding and Growing		-	-
		Fry	-	-	-	-	-	-	-	Nursing	-		-	Nursing
Tular Dandi (Nona bele)	Akram Point	Adult	Feeding	-	-	-	-	-	-	-	-		-	-
	South-west of the Project	Adult	-	-	Feeding	-	-	-	-	-	-		Feeding	-
	Chalna Point	Adult	Feeding	-	Feeding	-	Feeding	-	Feeding	-	-		-	-
Tairel	Akram Point	Adult	Feeding	-	-	-	-	-	-	Feeding	-		-	-
	Harbaria	Age-1 Adult	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Mongla Point	Juvenile	Feeding	-	-	-	-	-	-	-	-		-	-
Pheksa	Akram Point	Adult	Feeding	-	-	-	-	-	-	Feeding	-		-	-
		Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Haldikhali	Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Haldikhali	Adult	-	-	-	Feeding	-	-	-	-	-		-	-
	Harbaria	Juvenile	-	-	-	-	-	-	-	-	-		-	-
	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	-	-	-	-	-	-	-		-	-

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

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
		Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Haldikhali	Juvenile and adult	-	-	Feeding and Growing	Feeding	-	-	Feeding and Growing	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	Feeding	Feeding		Feeding	-
	Mongla Point	Fry and Adult	Feeding	Nursing	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	Feeding	-	-	-	-	Feeding		-	-
	Maidara	Adult	-	-	Feeding	Feeding	-	Breeding and Spawning	-	-	-		-	-
	Chalna Point	Adult	-	-	Feeding	Feeding	-	-	-	-	-		-	-
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	Haldikhali	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
		Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	Chandpai	Adult and Brood Fish	-	-	-	-	-	-	Feeding and Breeding	-	-		-	-
		Adult	-	-	Feeding	-	-	-	-	-	-		-	-
	Mongla Point	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-		Feeding	-
Pangas	Chalna Point	Brood fish	-	-	-	-	-	Breeding and Spawning	-	-	-		-	-
	Haldikhali	Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Mongla Point	Juvenile and Adult	-	-	Feeding	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose												
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM
Tapsi	Haldikhali	Juvenile and Age-1 adult	-	-	Grazing	-	-	-	-	-	-		-	-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-
	Chalna Point	Age-1 adult and Brood fish	-	-	-	-	-	-	-	-	-		-	-	-
		Adult	-	Feeding	-	-	Feeding	-	-	Feeding	Feeding		-	-	-
	Harbaria	Juvenile and Age-1 adult	Feeding	-	-	-	-	-	-	-	-		-	-	-
		Adult and Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-
	Chandpai	Juvenile	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	-	-		-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-	-
		Adult	-	-	-	-	-	-	-	-	-		Feeding	-	-
		Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-
		Fry	-	-	Nursing	-	-	-	-	-	-		-	Nursing	-
	Maidara	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-
		Juvenile	-	-	-	-	-	Maturation	-	-	-		-	-	-
		Adult	-	-	-	-	Feeding	-	-	-	-		-	-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-
Bairagi / Amadi	Haldikhali	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-
	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	-

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

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

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

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

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

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

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

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

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose												
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19 th QM	20 th QM	21 st QM	22 nd QM	23 rd QM	25 th QM	26 th QM
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	Growing and Maturation	Growing and Maturation	-	-		-	-	-
		Adult	-	Feeding	-	-	-	Feeding	-	-	-		-	-	-
	Chalna Point	Juvenile and Age-1 Adult	-	-	-	-	-	-	Growing and Maturation	Feeding	Growing and Maturation		-	Growing and Maturation	-
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-
	Haldikhali	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-	-
	Harbaria	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-
	Chandpai	Adult and Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-
	Mongla Point	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-
		Age-1 Adult	-	-	-	-	-	-	-	-	-	Maturation	-	-	-
	Chalna Point	Adult	-	-	-	-	-	Maturation	-	-	-	Feeding	-	-	-
		Brood fish	-	-	-	-	-	-	-	-	-		-	-	-
Pangas	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-
	Charaputia	Adult	-	-	-	-	-	-	-	Feeding	-		-	-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	Feeding and Growing	-	-	-

Source: Field findings at different times

*Only Age-1 to Brood fish was allowed to interpret the migration purpose; F = Feeding; Sp = Spawning

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	-	-
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	-	-
Sub-total =		1.89		2.91		197.5	-	-
Grand-total =		17.00		11.33		226.5	-	-

Source: CEGIS Field Survey, 2014-2015

Sampling Site	Total Catch (ton): 2015-2016							
	5th QM		6th QM		7th QM		8th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
1	Bagda	-	Bagda	1.6	Bagda	2	Catla	2
	Horina Chingri	1	Horina Chingri	1	Horina Chingri	3.2	Glass Carp	0.1
	Tengra	-	Chali Chingri	0.5	Gusha Chingri	0.8	Horina Chingri	0.8
	Paissa	-	Paissa	0.25	Paissa	24	Minar Carp	0.1
	Chela	-	Bele	0.25	Vetki	0.2	Nilotica	1.6
	Vetki	-	-	-	Kailla	0.4	Paissa	0.6
	-	-	-	-	Bele	0	Rui	3
	-	-	-	-	Tilapia	0	Vetki	0.8
	-	-	-	-	Catla	0	-	0
	-	-	-	-	Minar Carp	0	-	0
	-	-	-	-	Glass Carp	0	-	0
	-	-	-	-	Kakra	0.4	-	0
Sub-total=	-	1	-	3.06	-	31	-	9
2	Bagda	-	Bagda	1.67	Bagda	0	-	0
	-	-	Chali Chingri	0.30	Horina Chingri	0	-	0
	-	-	Horina Chingri	0.50	Chali Chingri	0	-	0
	-	-	Bele	0.30	Tilapia	0	-	0
	-	-	Paissa	0.25	Vetki	0	-	0
	-	-	-	-	Tengra	0	-	0
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
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
Sub-total =	-	0	-	-	-	6	-	0
2	Bagda	1	-	-	Bagda	2	Bagda	0.0035
	Horina	0.14	-	-	Bele	1.6	Horina Chingri	0.288
	-	0	-	-	Chali Chingri	4	Paissa	0.22
	-	0	-	-	Horina Chingri	8	Tengra	0.305
	-	0	-	-	Paissa	0.28	Chela	0.45
	-	0	-	-	Tengra	0.8	Tilapia	0.53
	-	0	-	-	Tilapia	8	Vetki	0.06
	-	-	-	-	Vetki	2.4	Bele	0.15
Sub-total =		1.14	-	-	-	9	-	0
3	Bagda	2	-	-	Bagda	0.4	-	0
	-	0	-	-	Horina Chingri	0.35	-	0
	-	0	-	-	Paissa	0.06	-	0
	-	0	-	-	Tengra	0.4	-	0
	-	0	-	-	Tilapia	3.2	-	0
Sub-total =	-	2	-	-	-	4	-	2.01
Grand-total =	-	3.14	-	-	-	19	-	2.01

Source: CEGIS Field Survey, 2016-2017

Sampling Site	Total Catch (ton): 2017-2018 and 2018-19													
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM	
	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton
1	Bagda	0	Bagda	3	-	-	Bagda	2.00	Bagda	0.76	Bagda	0	Bagda	-
	Horina Chingri	1	Rui (kg)	1.3	-	-	Golda	0.10	Bele	0.20	Catla	1.2	Paissa	-
	Tengra	0	Catla (kg)	1	-	-	Rui	0.12	Chali	1.20	Common Carp	0.3		
	Paissa	0	-	-	-	-	Grass Carp	0.20	Golda	0.00	Grass Carp	0.3		
	Chela	0	-	-	-	-	Catla	0.30	Horina	1.60	Rui	4.2		
	Vetki	0	-	-	-	-	Tilapia	0.45	Paissa	0.00				
							Horina	0.10	Tilapia	12.80				
							Gusha	0.00						
							Paissa	0.00						
							Khorulla	0.00						
							Vetki	0.00						
							Gulsha	0.00						
							Bele	0.00						
Sub-total =	-	1	-	3.6	-	-	=	3.27	=	16.56	=	6		
2	Bagda	0	Bagda	5	-	-	Bagda	3.93	Bagda	1.48	Bagda	5	Bagda	-
	-	-	Vetki	0.5	-	-	Golda	0.13	Bele	0.06	Bhangan	0.05	Paissa	-
	-	-	Paissa	7	-	-	Rui	8.41	Bhangan	0.01	Catla	3	Datina	-
	-	-	Phessa	1	-	-	Tilapia	5.90	Catla	0.00	Chali	0.4		
	-	-	Bhangan	0.7	-	-	Nilotica	0.00	Chali	0.04	Golda	0.08		
							Khorulla	0.00	Chel	0.01	Horina	1.8		
							Mrigel	0.00	Golda	0.00	Paissa	0.8		
							Catla	0.00	Horina	0.50	Rui	3		
							Grass Carp	0.11	Motka	0.05	Tengra	0.8		
							Common Carp	5.55	Paissa	0.03	Tilapia	8		
							Sarpunti	0.53	Rui	0.00	Vetki	2		
							Horina	1.91	Tengra	0.13				
							Chali Chingri	1.16	Tilapia	0.41				
							Bele	0.43	Vetki	0.01				
							Vetki	1.96						
							Tengra	4.20						
							Paissa	0.14						
							Tairel	0.003						

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
							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	
	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
	Horina	48	Harina	3.44	Harina	1.0	-	-	Harina	2.0	Tilapia	0.5
	-	-	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
Sub-total =		80		7.0		2.8		0.02		4.2		Golda
Kapashdanga-Muralia	Bagda	1.41	Bagda	6.74	Bagda	3.42	Harina	0.01	Bagda	4.84	Bagda	0.3
	Paissa	0.60	Golda	0.01	Harina	3.96	-	-	Hatina	0.92		2.37
	Crab	0.00	Harina	0.65	Chali	0.38	-	-	Chali	0.20	Bagda	1.45
	Tilapia	0.30	Chali	0.04	Bele	2.11	-	-	Bele	0.27	Hatina	1.08
	Golda	0.10	Bele	0.09	Paissa	2.62	-	-	Paissa	0.04	Chali	0.30
	Horina Chingri	2.92	Tilapia	0.22	Tilapia	9.85	-	-	Tilapia	3.87	Bele	0.19
	Chali Chingri	1.52	Tengra	0.57	Golda	0.04	-	-	Golda	0.03	Paissa	1.80
	Bele	1.35	Bhangan	0.08	Tengra	0.17	-	-	Tengra	0.01	Tilapia	6.93
	Tengra	0.27	-	-	Patari	2.25	-	-	Patari	0.11	Golda	0.03

	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	
	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)
	Major Carp	0.55	-	-	Chemo	0.02	-	-	Datna	0.01	Tengra	0.17
	-	-	-	-	Datina	1.01	-	-	Rui	0.47	Patari	0.25
	-	-	-	-	Rui	1.27	-	-	Chaka	0.05	Catol	0.04
	-	-	-	-	Chaka	0.01	-	-	Chemo	1.56	Chemo	0.32
	-	-	-	-	Kailla	0.96	-	-	-	-		
	-	-	-	-	Nundi Bele	0.02	-	-	-	-		
	-	-	-	-	Kakra	0.49	-	-	-	-		
Sub-total =		9		8.0		29		0.01		12.38		
Chunkuri-2	Bagda	0.04	Patari	0.01	Tilapia	0.02	-	-	Paissa	0.05		
	Paissa	0.00	Tair/Tailla	0.01	Paissa	0.066	-	-	Golda	0.03		12.57
	Khorsula	0.00	Bhangan	0.01	Khorsul	0.009	-	-	Kharulla	0.01	Sada Chingri	0.03
	Horina Chingri	0.10	Datina	0.03	Bagda	0.015	-	-	Bagda	0.10	Paissa	0.03
	Motka	0.04	Bagda	0.02	Golda	0.006	-	-	Bele	0.03	Patari	0.02
	Chali Chingri	0.03	Golda	0.03	Patari	0.015	-	-	Harina	0.15	Tengra	0.01
	Chaka Chingri	0.01	Faissa	0.01	Harina	0.008	-	-	Tengra	0.02	Datina	0.02
	Bele	0.01	Chaka Chingri	0.01	Chali	0.009	-	-	Tairu	0.03	Ilish	0.005
	Crab	0.03	Harina	0.02	China Punti	0.047	-	-	Chaka	0.01	Golda	0.01
	-	-	-	-	Tengra	0.008	-	-	Datina	0.02	Nilotica	0.06
	-	-	-	-	Baila	0.003	-	-	-	-	Baila	0.004
	-	-	-	-	Datina	0.02	-	-	-	-	Goda Chingri	0.001
Sub-total =		0.24		0.15		0.46		0.00		0.44		Chaka Chingri

(E) Traffic Survey data

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

Date: November 06, 2020 (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	52	4	0	38	7	0	81	10	0
Auto Rickshaw	0.8	8	11	15	14	13	21	1	23	19
Van	0.6	46	54	60	46	36	49	5	99	62
Cycle	0.2	11	14	5	6	20	5	0	20	4
Human Howler	0.6	6	4	6	2	8	6	4	9	8
CNG	0.5	0	1	1	0	1	1	0	5	2
Private Car	1	7	29	36	19	25	44	2	44	46
Motor Cycle	0.3	63	124	56	113	156	81	8	234	73
Jeep	1	1	7	8	4	6	10	5	3	8
Pick-up	2	8	8	31	14	6	39	0	14	28
Micro	1	7	19	26	11	18	29	3	12	15
Bus	2.5	28	32	149	44	26	175	0	34	85
Light Truck	2	13	7	38	13	14	52	3	15	35
Medium Truck	2	7	18	48	19	23	83	0	38	75
Heavy Truck	2	12	4	31	9	11	39	21	20	82
			Total	507			631			541

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

Date: November 05, 2020 (Thursday)

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	Factor	Khulna to Mongla	Mongla to Khulna	PCU	Khulna to Mongla	Mongla to Khulna	PCU	Khulna to Mongla	Mongla to Khulna	PCU
Pedestrian	0	8	7	0	6	10	0	9	9	0
Auto Rickshaw	0.8	6	4	8	7	8	12	5	5	7
Van	0.6	21	15	21	14	34	29	12	23	21
Cycle	0.2	3	4	1	1	2	1	5	4	2
Human Howler	0.6	14	22	21	17	26	26	18	27	27
CNG	0.5	0	1	0	0	0	0	2	0	1
Private Car	1	8	7	15	8	17	25	7	20	27
Motor Cycle	0.3	31	36	20	47	53	30	31	66	29
Jeep	1	6	4	10	4	3	7	4	7	11
Pick-up	2	4	3	15	8	6	28	5	12	32
Micro	1	7	3	10	5	4	8	4	10	13
Bus	2.5	5	8	33	9	15	59	10	17	66
Light Truck	2	8	6	27	8	11	38	10	6	30
Medium Truck	2	21	12	65	36	36	143	17	67	167
Heavy Truck	2	13	8	42	30	16	91	17	16	64
		Total								
		291			495			496		

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

Date: November 04, 2020 (Wednesday)

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	3	2	0	2	3	0	4	5	0
Auto Rickshaw	0.8	2	3	4	2	3	4	1	0	1
Van	0.6	7	14	13	11	8	11	5	6	6
Cycle	0.2	0	6	1	0	1	0	0	0	0
Human Howler	0.6	7	4	6	9	3	7	4	3	4
CNG	0.5	0	0	0	0	0	0	0	0	0
Private Car	1	1	5	6	1	1	2	2	3	4

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	
Motor Cycle	0.3	4	15	6	17	14	9	8	2	3	
Jeep	1	2	1	3	1	0	1	5	1	6	
Pick-up	2	0	1	2	2	0	4	0	0	0	
Micro	1	1	4	5	1	3	4	3	1	3	
Bus	2.5	0	0	0	1	1	4	0	0	0	
Light Truck	2	1	1	3	0	2	4	3	10	26	
Medium Truck	2	1	3	8	2	2	6	0	0	0	
Heavy Truck	2	4	7	23	7	9	32	21	13	68	
Total				80				86			121

(F) Cropping pattern

Table F.1: Existing Cropping Pattern of Monitoring Agriculture Plot

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

Source: Based on field information and farmers interviewed. *previously cultivated.

K-I: Kharif-I, **K-II:** Kharif-II, **R:** Rabi. **F:** Fallow, **L.A.:** Local Aman, **H.A.:** HYV Aman.

(G) Monitoring Results

Air quality parameter analysis result



Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions



AECL LABORATORY ANALYSIS REPORT AMBIENT AIR QUALITY TEST REPORT

Memo # **AECL**
Project Title : **798**
Project Location : **2x660 MW Maitree Super Thermal Project**
Description of Sample : **Rampal, Bagherhat**
Sample Collector : **Ambient Air**
Sampling date : **Adroit Environment Consultants Ltd. (Monitoring team)**
Reporting date : **1st November ~ 13th November, 2020**
Reporting date : **29th November, 2020**

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	41.29	97.16	142.36	21.73	13.36	0	0	Complies
AQ2	38.72	93.48	136.66	18.11	9.92	0	2	Complies
AQ3	44.18	107.16	149.73	26.63	16.62	2	8	Complies
AQ4	29.17	84.30	119.22	14.15	14.18	0.013	2	Complies
AQ5	46.73	110.43	160.30	25.82	18.91	0.012	8	Complies
AQ6	43.91	88.93	139.04	29.94	18.32	0	0	Complies
AQ7	48.32	109.63	157.35	29.58	20.44	0.7	0	Complies
AQ8	40.75	114.61	152.76	20.06	9.69	0	1	Complies
AQ9	34.42	79.38	122.94	19.74	10.16	0	3	Complies
AQ10	28.15	59.31	91.06	11.36	9.74	0	1	Complies
AQ11	22.74	56.74	80.31	12.74	6.64	0	6	Complies
AQ12	33.32	74.83	111.95	21.39	12.12	0	4	Complies
AQ13	38.69	91.79	128.48	20.17	14.47	0	0	Complies
Units	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	ppm	µg/m ³	
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 for ambient Air	65	150	200	365	100	9	157	
IFC/WB Standard	75	150	NF	125	200	NF	160	

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

Comment: From the above analysis, it is discernible that all the parameters conform to the given allowable limits.



Md. Faisal Bin Mahmud
Sr. Chemist

Md. Saiful Islam
General Manager

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

www.aecl-bd.org

Water quality parameters analysis result

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

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

Analysis Report



Analytical Service Cell Ref No: Sep2020024932	Unit (Lab/Inst.) Ref No: A-163-164
Lab ID: INS-163-164	Sample Receiving Date: 01/09/2020
Sample ID: A-163-164	Submission Date: 01 Sep 2020
	Report Delivery Date: 29/09/2020
Sample Description: Project Jetty Site and Harbaria	
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: 2	

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-163	Water (Sample-01, Project Jetty Site)	TOC (Total Organic Carbon)	9.17 mg/L	5310.B
		TOC (Total Organic Content)	152 mg/L	5310.B
A-164	Water (Sample-02, Harbaria)	TOC (Total Organic Carbon)	9.48 mg/L	5310.B
		TOC (Total Organic Content)	200 mg/L	5310.B

29.09.2020
A. H. M. Shafiqul Islam Molla Jamal
Scientific Officer
Institute of National Analytical
Research & Service (INARS)
BCSIR, Dhaka-1205



29.09.2020
Section/Division In-Charge
মোঃ অহেদুল আকবর
উপস্থাপন বৈজ্ঞানিক কর্মকর্তা
ইনস্টিটিউট অব ন্যাশনাল এনালাইটিক্যাল
রিসার্চ এন্ড সার্ভিস (আইএনএআরএস)
বিসিএসআইআর, ঢাকা



29/09/2020
Shamim Ahmed
In-Charge/Director
Director (In-Charge)
Institute of National Analytical
Research & Service (INARS)
BCSIR, Dhaka-1205

Note:

- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.

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

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

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

Analysis Report



Analytical Service Cell Ref No: Sep2020024932	Unit (Lab/Inst.) Ref No: A-163-164
Lab ID: INS-163-164	Sample Receiving Date: 01/09/2020
Sample ID: A-163-164	Submission Date: 01 Sep 2020
	Report Delivery Date: 29/09/2020
Sample Description: Project Jetty Site and Harbaria	
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: 2	

Report Details:

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




Note:

- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.

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

		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-163	Water (PAH) Sample: 01, Project 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-164	Water (PAH) Sample: 02, Harbaria	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	






Note:

- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.

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) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)</p>	 <p>মুজিব শতবর্ষ ১০০</p>
---	---	---

29.09.2020
Analyst
A. H. M. Shofiul Islam Molla Jamal
Scientific Officer
Institute of National Analytical
Research & Service (INARS)
BCSIR, Dhaka-1205

29.09.2020
Section/Division In-Charge
মোঃ আহমেদ শামিম
উপস্থাপক পরিচালক
ইনস্টিটিউট অব ন্যাশনাল এনালাইটিক্যাল
রিসার্চ এন্ড সার্ভিস (আইএনএআরএস)
বিসিএসআইআর, ঢাকা

29.09.2020
In-Charge/Director
Shamim Ahmed
Director (In-Charge)
Institute of National Analytical
Research & Service (INARS)
BCSIR, Dhaka-1205





Note:

- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.

Analytical Service Cell

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

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

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


Analysis Report

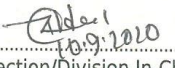


Analytical Service Cell Ref No: Sep2020024946	Unit (Lab/Inst.) Ref No: A-170-173
Lab ID: INS-170-173	Sample Receiving Date: 01/09/2020
Sample ID: A-170-173	Submission Date: 01 Sep 2020
	Report Delivery Date: 10/09/2020
Sample Description: Jetty site, Mongla confluence, Harbaria, Akram Point	
Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216	
Number of Sample: 4	

Report Details:

Lab ID	Particulars of supplied sample	Parameter	Concentration	Test Method (APHA)
A-170	Water (Jetty site)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-171	Water (Mongla confluence)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-172	Water (Harbaria)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-173	Water (Akram point)	Oil and Grease	Less than 2.0 mg/L	5520.B


 10/09/2020
 Analyst
 Dr. Sabina Yasmin
 Senior Scientific Officer
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205


 10/09/2020
 Section/Division In-Charge
 মোঃ আব্দুল করিম
 উর্ধ্বতন বৈজ্ঞানিক কর্মকর্তা
 ইনস্টিটিউট অব ন্যাশনাল ওয়ানলাইটক্যাল
 রিসার্চ এন্ড সার্ভিস (আইএনএসআরএস)
 বিসিএসআইআর, ঢাকা


 10/09/2020
 In-Charge/Director
 Shamim Ahmed
 Director (In-Charge)
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205





Note:

- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.

Analytical Service Cell

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

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

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

Analysis Report



Analytical Service Cell Ref No: Sep2020024943	Unit (Lab/Inst.) Ref No: A-165-169
Lab ID: INS-165-169	Sample Receiving Date: 01/09/2020
Sample ID: A-165-169	Submission Date: 01 Sep 2020
	Report Delivery Date: 24/09/2020
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-165	Sediment (Sample-01, Project Site)	pH at 24.8° C	9.44	4500-H ⁺ .B
		Sulphate (SO ₄)	0.07 %	4110.B
A-166	Sediment (Sample-02, Mongla Port)	pH at 25.1° C	9.47	4500-H ⁺ .B
		Sulphate (SO ₄)	0.06 %	4110.B
A-167	Sediment (Sample-03, Moidara Rivar)	pH at 24.7° C	9.18	4500-H ⁺ .B
		Sulphate (SO ₄)	0.07 %	4110.B
A-168	Sediment (Sample-04, Harbaria)	pH at 25.2° C	9.45	4500-H ⁺ .B
		Sulphate (SO ₄)	0.21 %	4110.B





Note:

- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.

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

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

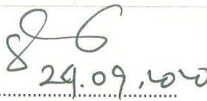
A-169	Sediment (Sample-05, Akram Point)	pH at 24.8° C	8.76	4500-H ⁺ .B
		Sulphate (SO ₄)	0.19 %	4110.B


 24.09.2020
 Analyst

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


 24.09.2020
 Section/Division In-Charge

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


 24.09.2020
 In-Charge/Director

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





Note:

- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.

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

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

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

Analysis Report



Analytical Service Cell Ref No: Sep2020024928	Unit (Lab/Inst.) Ref No: A-146-162
Lab ID: INS-146-162	Sample Receiving Date: 01/09/2020
Sample ID: A-146-162	Submission Date: 01 Sep 2020
	Report Delivery Date: 10/09/2020
Sample Description: Mercury (Sample no.1 to sample no. 17)	
Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216	
Number of Sample: 17	

Report Details:

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-146	Water, (Sample-01)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-147	Water, (Sample-02)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-148	Water, (Sample-03)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-149	Water, (Sample-04)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-150	Water, (Sample-05)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-151	Water, (Sample-06)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-152	Water, (Sample-07)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-153	Water, (Sample-08)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-154	Water, (Sample-09)	Mercury (Hg)	Less than 0.001 mg/L	3112.B





Note:


- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.


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

	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-155	Water, Maidara (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-156	Water, Shapmaria (Sample-11)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-157	Water, Mongla HT (Sample-12)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-158	Water, Harbaria (Sample-13)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-159	Water, Akram Point (Sample-14)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-160	Water, Plant G.W (Sample-15)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-161	Water, Rajnagar (Sample-16)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-162	Water, Kapashdanga (Sample-17)	Mercury (Hg)	0.003 mg/L	3112.B


 10.09.2020
 Analyst
Aynun Nahar
 Scientific Officer
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205


 10.09.2020
 Section/Division In-Charge
Muhammad Abdullah Al-Mansur
 Principal Scientific Officer
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205


 10.09.2020
 In-Charge/Director
Shamim Ahmed
 Director (In-Charge)
 Institute of National Analytical
 Research & Service (INARS)
 BCSIR, Dhaka-1205





Note:

- The results reported here pertained to the sample received in this laboratory only.
- Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
- 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.
- The report shall not be reproduced/published partly or fully without prior approval of the authority.

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

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

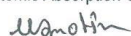
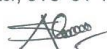
Sample ID: CEN2020100101	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Calcium (Ca)	75	26	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	32	mg/L	CRM	-
5	Chloride	150-600	22	mg/L	Titrimetric	-
6	Silica (SiO ₂)	0.0	32	mg/L	UVS	-
7	Bi-Carbonate (HCO ₃ ⁻)	0.0	92	mg/L	Titrimetric	-
8	Cr (Total)	0.05	0.014	mg/L	AAS	0.0003
9	Hardness	200-500	205	mg/L	Titrimetric	-
10	Iron (Fe)	0.3-1	9.44	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	4.97	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	3	mg/L	UVS	0.10
14	Phosphate	6.0	0.25	mg/L	UVS	0.10
15	Potassium (K)	12.0	5	mg/L	AAS	-
16	Sodium (Na)	200	14	mg/L	AAS	0.34
17	Sulphate	400	4	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	134	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	14	mg/L	Gravimetric Method	-
20	Turbidity	10	1010	NTU	Turbidity Meter	-
21	Carbonate (CO ₃)	-	0.35	mg/L	Titrimetric	-

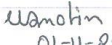
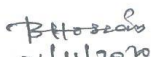


Comments: Sample was collected & supplied by client.



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

Md. Biplab Hossain
 Chief Chemist
 Department of Public Health Engineering
 Central Laboratory, Mohakhali, Dhaka

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

<u>Test Performed by:</u>		<u>Signature</u>		<u>Countersigned/Approved by:</u>		<u>Signature</u>
1.)	Name: Mahabuba Sabina Motin Designation: Sample Analyzer	 01-11-2020		1.)	Name: Mita Sarker Designation: Senior Chemist	 01/11/2020
2.)	Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	 01.11.2020		2.)	Name: Md. Biplab Hossain Designation: Chief Chemist	 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

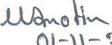

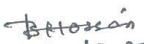
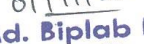
Sample ID: CEN2020100102	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	36	mg/L	CRM	-
4	Cr (Total)	0.05	0.019	mg/L	AAS	0.0003
5	Hardness	200-500	200	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.3	mg/L	UVS	0.10
8	Phosphate	6.0	0.27	mg/L	UVS	0.10
9	Sulphate	400	3	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	114	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: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  01/11/2020 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	--

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

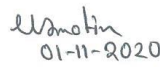

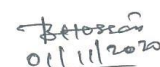
Sample ID: CEN2020100103	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	28	mg/L	CRM	-
4	Cr (Total)	0.05	0.010	mg/L	AAS	0.0003
5	Hardness	200-500	187	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	9.5	mg/L	UVS	0.10
8	Phosphate	6.0	0.30	mg/L	UVS	0.10
9	Sulphate	400	5	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	116	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: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	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
--	--

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020100104	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-04)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Calcium (Ca)	75	32	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	24	mg/L	CRM	-
5	Chloride	150-600	45	mg/L	Titrimetric	-
6	Silica (SiO ₂)	0.0	42.5	mg/L	UVS	-
7	Bi-Carbonate (HCO ₃ ⁻)	0.0	97	mg/L	Titrimetric	-
8	Cr (Total)	0.05	0.033	mg/L	AAS	0.0003
9	Hardness	200-500	217	mg/L	Titrimetric	-
10	Iron (Fe)	0.3-1	13.40	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.005	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	8.06	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	2.9	mg/L	UVS	0.10
14	Phosphate	6.0	0.35	mg/L	UVS	0.10
15	Potassium (K)	12.0	6	mg/L	AAS	-
16	Sodium (Na)	200	37	mg/L	AAS	0.34
17	Sulphate	400	8	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	221	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	12	mg/L	Gravimetric Method	-
20	Turbidity	10	2750	NTU	Turbidity Meter	-
21	Carbonate (CO ₃)	-	0.45	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.

U. Amin



A. Hossain

Dr. Biplob Hossain
 Chief Chemist
 Department of Public Health Engineering
 Mohakhali, Dhaka

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

<u>Test Performed by:</u> 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer Signature: <i>M. Sabina Motin</i> 01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature: <i>A. Khosru</i> 01.11.2020		<u>Countersigned/Approved by:</u> 1.) Name: Mita Sarker Designation: Senior Chemist Signature: <i>M. Sarker</i> 01/11/2020 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature: <i>Md. Biplab Hossain</i> 01/11/2020	
--	--	--	--

Md. Biplab Hossain
 Chief Chemist
 Department of Public Health Engineering
 Central Laboratory Mohakhali, Dhaka

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

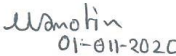

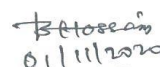
Sample ID: CEN2020100105	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-05)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00017	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	36	mg/L	CRM	-
4	Cr (Total)	0.05	0.027	mg/L	AAS	0.0003
5	Hardness	200-500	215	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.9	mg/L	UVS	0.10
8	Phosphate	6.0	0.29	mg/L	UVS	0.10
9	Sulphate	400	10	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	125	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	9	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.

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

Test Performed by: 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer  01-01-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	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
--	--

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

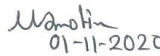
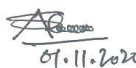
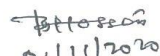
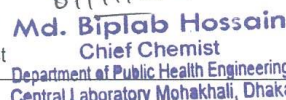
Sample ID: CEN2020100106	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-06)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00020	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	40	mg/L	CRM	-
4	Cr (Total)	0.05	0.022	mg/L	AAS	0.0003
5	Hardness	200-500	202	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.8	mg/L	UVS	0.10
8	Phosphate	6.0	0.36	mg/L	UVS	0.10
9	Sulphate	400	13	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	132	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	12	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.

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

Test Performed by: 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  01/11/2020 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	--

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020100107	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-07)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020

LABORATORY TEST RESULTS:

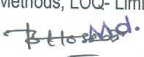
Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.005	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Calcium (Ca)	75	56	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	48	mg/L	CRM	-
5	Chloride	150-600	37	mg/L	Titrimetric	-
6	Silica (SiO ₂)	0.0	46	mg/L	UVS	-
7	Bi-Carbonate (HCO ₃ ⁻)	0.0	99	mg/L	Titrimetric	-
8	Cr (Total)	0.05	0.025	mg/L	AAS	0.0003
9	Hardness	200-500	195	mg/L	Titrimetric	-
10	Iron (Fe)	0.3-1	39.36	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.019	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	10.48	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	1.0	mg/L	UVS	0.10
14	Phosphate	6.0	0.40	mg/L	UVS	0.10
15	Potassium (K)	12.0	9	mg/L	AAS	-
16	Sodium (Na)	200	29	mg/L	AAS	0.34
17	Sulphate	400	16	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	195	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	14	mg/L	Gravimetric Method	-
20	Turbidity	10	3500	NTU	Turbidity Meter	-
21	Carbonate (CO ₃)	-	0.37	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.



Wamolin

AR


Bipra Hossain
 Chief Chemist
 Department of Public Health Engineering
 Mohakhali, C

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	L'OO
<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p><u>Test Performed by:</u></p> <p>Signature</p> <p>1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer</p> <p>2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer</p> </div> <div style="width: 48%;"> <p><u>Countersigned/Approved by:</u></p> <p>Signature</p> <p>1.) Name: Mita Sarker Designation: Senior Chemist</p> <p>2.) Name: Md. Biplab Hossain Designation: Chief Chemist</p> </div> </div>						

Md. Biplab Hossain
 Chief Chemist
 Department of Public Health Engineering
 Central Laboratory Mohakhali, Dhaka

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

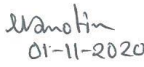

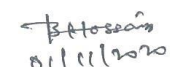
Sample ID: CEN2020100108	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-08)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	36	mg/L	CRM	-
4	Cr (Total)	0.05	0.019	mg/L	AAS	0.0003
5	Hardness	200-500	210	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.5	mg/L	UVS	0.10
8	Phosphate	6.0	0.43	mg/L	UVS	0.10
9	Sulphate	400	8	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	128	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	13	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.

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

Test Performed by: 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01-11-2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	--

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020100109	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-09)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	42	mg/L	CRM	-
4	Cr (Total)	0.05	0.020	mg/L	AAS	0.0003
5	Hardness	200-500	207	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.010	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.3	mg/L	UVS	0.10
8	Phosphate	6.0	0.52	mg/L	UVS	0.10
9	Sulphate	400	16	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	114	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: Mahabuba Sabina Motin Designation: Sample Analyzer 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	---

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

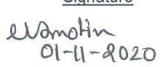

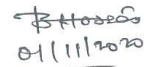
Sample ID: CEN2020100110	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-10)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00017	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	310	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.013	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.9	mg/L	UVS	0.10
8	Phosphate	6.0	0.25	mg/L	UVS	0.10
9	Sulphate	400	16	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	229	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: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	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
--	--

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

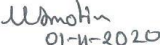

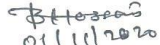

Sample ID: CEN2020100111	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-11)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00039	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	48	mg/L	CRM	-
4	Cr (Total)	0.05	0.011	mg/L	AAS	0.0003
5	Hardness	200-500	742	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.005	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.1	mg/L	UVS	0.10
8	Phosphate	6.0	0.56	mg/L	UVS	0.10
9	Sulphate	400	21	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	2893	mg/L	Multimeter	-
11	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: 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  01/11/2020 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	---

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

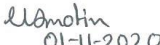

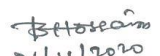
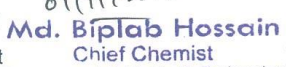
Sample ID: CEN2020100112	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-12)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00020	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	72	mg/L	CRM	-
4	Cr (Total)	0.05	0.017	mg/L	AAS	0.0003
5	Hardness	200-500	250	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.003	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.5	mg/L	UVS	0.10
8	Phosphate	6.0	0.53	mg/L	UVS	0.10
9	Sulphate	400	12	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	740	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	9	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.

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

Test Performed by: 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01-11-2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  01/11/2020 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  01/11/2020 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	---

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

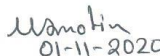

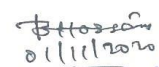
Sample ID: CEN2020100113	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-13)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00023	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	80	mg/L	CRM	-
4	Cr (Total)	0.05	0.021	mg/L	AAS	0.0003
5	Hardness	200-500	280	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	5.7	mg/L	UVS	0.10
8	Phosphate	6.0	0.40	mg/L	UVS	0.10
9	Sulphate	400	34	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	489	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	17	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.

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

Test Performed by: 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer <div style="text-align: right;"> <i>Signature</i>  01-11-2020 </div> 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer <div style="text-align: right;">  01.11.2020 </div>	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist 2.) Name: Md. Biplab Hossain Designation: Chief Chemist <div style="text-align: right;">  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka </div>
--	---

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

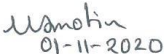
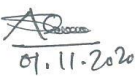


Sample ID: CEN2020100114	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Surface Water
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (SW-14)	Union:, Vill.:
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00034	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	108	mg/L	CRM	-
4	Cr (Total)	0.05	0.043	mg/L	AAS	0.0003
5	Hardness	200-500	1000	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.011	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	4.0	mg/L	UVS	0.10
8	Phosphate	6.0	0.37	mg/L	UVS	0.10
9	Sulphate	400	60	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	4188	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	18	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: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  01/11/2020 2.) Name: Md. Biplob Hossain Designation: Chief Chemist  Md. Biplob Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	--

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

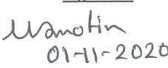
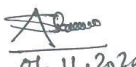
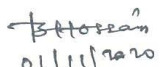

Sample ID: CEN2020100115	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Tube Well
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (GW-01)	Union:, Vill.: Project ground water
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.022	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	625	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	1.7	mg/L	UVS	0.10
6	Phosphate	6.0	0.26	mg/L	UVS	0.10
7	Sulphate	400	4	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	1196	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: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  01/11/2020 2.) Name: Md. Biplob Hossain Designation: Chief Chemist  Md. Biplob Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	--

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

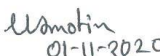
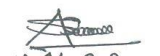
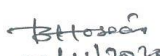

Sample ID: CEN2020100116	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Tube Well
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (GW-02)	Union:, Vill.: Karpasdanga
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020



LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.045	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	210	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	7.5	mg/L	UVS	0.10
6	Phosphate	6.0	1.5	mg/L	UVS	0.10
7	Sulphate	400	3	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	701	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	3	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.

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

Test Performed by: 1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	---

	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: 353/ CC, DPHE, CL, Dhaka

Date: 01-11-2020

Physical /Chemical/ Bacteriological Analysis of Water Sample

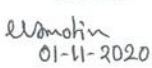
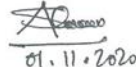
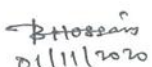

Sample ID: CEN2020100117	Sample Receiving date: 01-09-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1446 & Dated: 31-08-2020	Sample Source: Tube Well
Sent by: Director, PRMRD, CEGIS, Gulshan-1, Dhaka-1212.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (GW-03)	Union:, Vill.: Rajnagar
Sample Collection date:	Date of Testing: 01/09/2020-29/09/2020

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	237	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	1.7	mg/L	UVS	0.10
6	Phosphate	6.0	1.7	mg/L	UVS	0.10
7	Sulphate	400	4	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	316	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: Mahabuba Sabina Motin Designation: Sample Analyzer  01-11-2020 2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer  01.11.2020	Countersigned/Approved by: 1.) Name: Mita Sarker Designation: Senior Chemist  01/11/2020 2.) Name: Md. Biplab Hossain Designation: Chief Chemist  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
--	---