Addendum to Initial Environmental Examination

Bangladesh: Dhaka and Western Zone Transmission Grid Expansion Project

FINAL REPORT

ADDENDUM -1

July 2022

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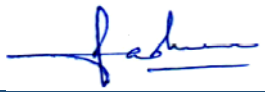
Reviewed by: 	
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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AIS	Air-Insulated Switchgear
AP	Affected Persons
ASL	Above Sea Level
BMD	Bangladesh Meteorological Department
CAP	Corrective Action Plan
CHT	Chattogram Hill Tracts
DoE	Department of Environment
DPP	Development Project Proposal
DPs	Displaced Persons
DSC	Design and Supervision Consultants
DWZTGEP	Dhaka and Western Zone Transmission Grid Expansion Project
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
EQS	Environment Quality Standards
ESMS	Environmental and Social Management System
FGD	Focus Group Discussion
GIS	Gas Insulated Switchgear
GoB	Government Of Bangladesh
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GSS	Grid Substation
HES	Health Environment and Safety

IEC	Important Environmental Component
IEE	Initial Environmental Examination
ISC	Important Social Component
IUCN	International Union for Conservation for Nature
LGI	Local Government Institutions
LGRC	Local Grievance Redress Committee
LILO	Line-In Line-Out
MoEFCC	Ministry of Environment, Forest and Climate Change
NGO	Non-Governmental Organization
PAI	Project's Area of Influence
PAP	Project Affected Persons
PCB	Polychlorinated Biphenyl
PCRs	Physical Cultural Resources
PDB	Power Development Board
PGCB	Power Grid Company of Bangladesh
PMU	Project Management Unit
PPE	Personal Protective Equipment
PSMP	Power System Master Plan
RCC	Reinforced Cement Concrete
RMA	Resource Management Associates (Pvt) Ltd.
RoW	Right of Way
RP	Resettlement Plan
SF6	Sulfur Hexafluoride
SPS	Safeguard Policy Statement
SWTGEP	Southwest Transmission Grid Expansion Project
UPI	Union Parishad Institutions

WEIGHTS AND MEASURES		
cm	-	centimeter
ha	-	hectare
km	-	kilometer (1,000 meters)
kV	-	kilovolt (1,000 volts)
kW	-	kilowatt (1,000 watts)
m	-	meter
mm	-	millimeter
MVA	-	mega-volt ampere
MW	-	megawatt

1 INTRODUCTION

This report is addendum to the original IEE report[1] that was approved by ADB in July, 2019. The addendum is only in respect of two lines; Satkirha to Manirampur and Gopalganj (N)-Shibchar. The report is based on the final alignment of the EPC Contractor and considers the risks and impacts in order to formalize the management plan. The original IEE depicted a detailed project description, baseline data, impact assessment and management plans and remains as applicable for the project.

The additional risks and mitigation measures under this addendum for Satkhira to Manirampur 132 kV transmission line and Gopalganj (N)-Shibchar 230 kV Transmission Line are described in this report.

1.1 Background

The Power Division, under the Ministry of Power, Energy and Mineral Resources (MPEMR) leads the power sector while the Bangladesh Energy Regulatory Commission (BERC) is the regulatory agency which regulates electricity, gas, and petroleum sectors. The electricity sector is unbundled into generation, transmission, and distribution segments. Backbone transmission lines and substation network in the country are operated by the Power Grid Company of Bangladesh Limited (PGCB). As of December 2018[2], PGCB network comprised, transmission lines operated at 400 kV, 230 kV and 132 kV voltage levels with a total length of 11,396 circuit km and 125 132/33 kV substations with a cumulative capacity of 20,211 MVA. Development of transmission and distribution network in line with generation has been identified as a key element of the power sector strategy in the 'Bangladesh Seventh Five Year Plan FY2016 - FY2020'. Development of an inter-region transmission network is required due to the unbalance in concertation of generation and demand, while local network expansions are required to cater the increasing demand at new load centers. Due to the growing electricity demand, a considerable number of grid substations and transmission lines have already been overloaded. Therefore, urgent upgrades and expansions are required by PGCB to supply power to the key economic corridors in the southern and western regions including greater Dhaka area.

The Dhaka and Western Zone Transmission Grid Expansion Project (DWZTGEP) focuses on expanding the local transmission network to deliver electricity to new and expanding load centers while meeting the network operating criteria. PGCB has appointed EQMS Consulting Limited for Conducting Social Value Assessment Surveys, Preparation, Upgradation, and Implementation of Resettlement Action Plans and Environmental and Social Safeguard Supervision and Monitoring for the Proposed Grid Substations and Transmission Lines.

The concept paper for the project was approved by ADB on 6th March 2019, comprising three main investment components. The loan was made effective on 16 July 2020.

Component 1: Transmission system in Greater Dhaka expanded. The project will construct and commission substations with a total capacity of 4,450 MVA and 40 km of transmission lines in Greater Dhaka.

Component 2: Transmission system in Western Zone expanded. The project will construct and commission substations with a total capacity of 3,070 MVA and 368 km of transmission lines in western zone.

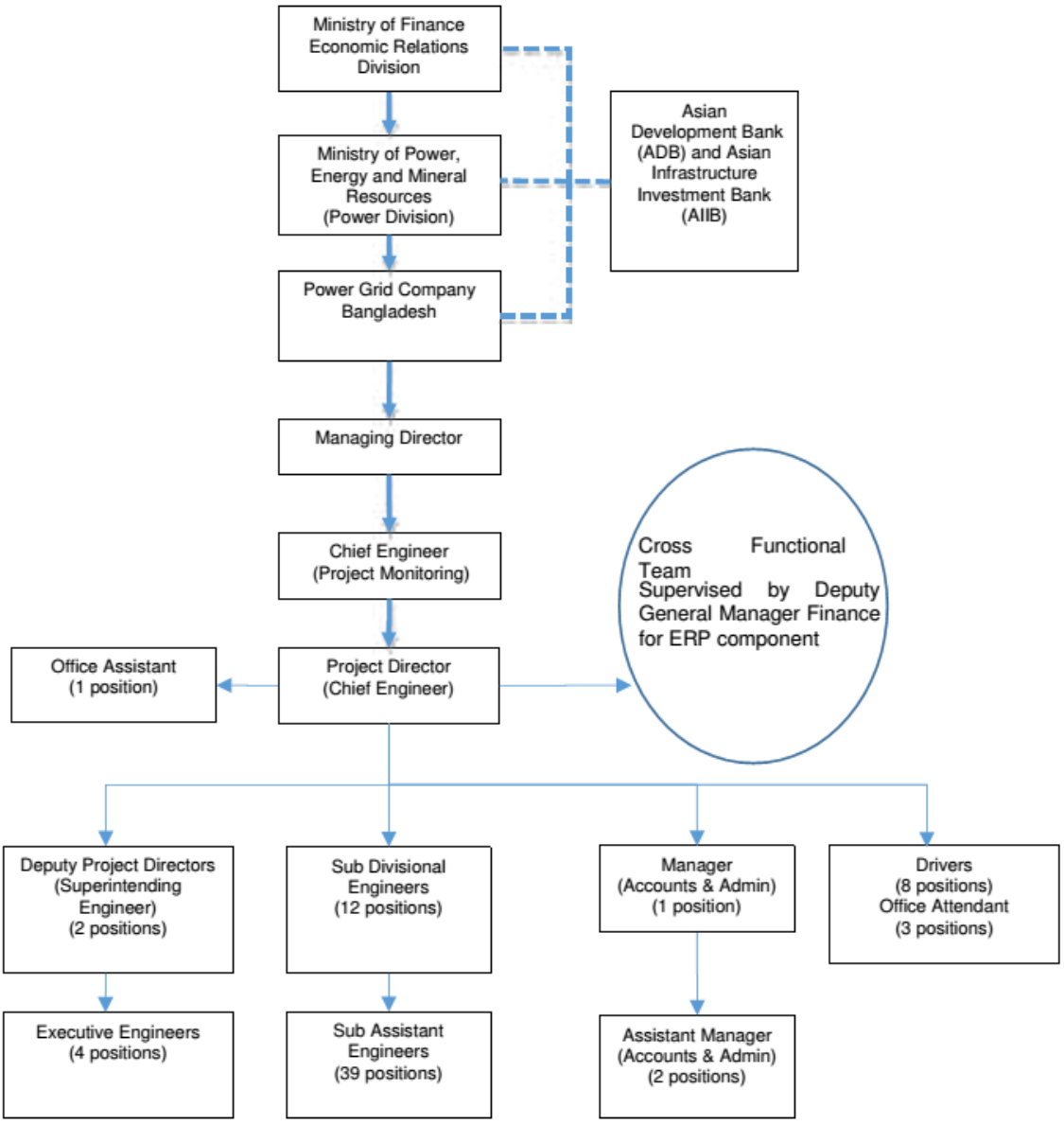
Component 3: Institutional Capacity of PGCB strengthened. The project will enhance capacity by (a) supporting installation and operation of an enterprise resource planning (ERP) system to assist PGCB in optimally managing its capital-intensive assets; (b) establishing a Drone Inspection Center within the operation and maintenance department of PGCB with some gender equality element.

[1]https://www.adb.org/projects/documents/ban-51137-003-iee.

[2] Power Grid Company of Bangladesh Ltd. PGCB at a glance.

On behalf of the government, overall coordination of the project will be managed by MPEMR. PGCB will be the Executing Agency (EA) for Component 1, 2 and 3. The project preparation, implementation, monitoring, and reporting to ADB and the government will be handled by the Project Management Unit (PMU) established by PGCB. EPC Contractors with separate environmental officer and Health & Safety Officer for each package will implement Environment Management Plan (EMP). Designated PMU engineers will be trained and supervised by the PGCB safeguards unit to work together with contractors for EMP implementation. Figure 1-1 shows the institutional framework for DWZTGEP.

Figure 1-1: Institutional Framework for Dhaka and Western Zone Transmission Grid Expansion Project



Source: PGCB.

Note: ERP component implementation will be supervised by a deputy general manager (project finance) with support from PGCB's Cross Functional Team which comprises 7 members.

ADB = Asian Development Bank, AIIB = Asian Infrastructure Investment Bank, ERP = Enterprise Resources Planning, PGCB = Power Grid Company of Bangladesh Limited., P&D = planning and design.

2 ADMINISTRATIVE AND LEGAL FRAMEWORK

This chapter provides legal and regulatory framework, covering national requirements as well as guidelines and standards to address environmental and social risks of any proposed project and its associated components and to protect and conserve the environment from any adverse impacts. The intent of this chapter is to discuss the regulatory context, which is directly related to environmental compliance, which must be adhered to by all parties involved in the project throughout the planning, construction, and operation.

Several new policies and guidelines have been introduced since the original IEE was produced and taken into account this addendum for assessment. The newly introduced policies/laws/guidelines are: National Environment Policy, 2018, EIA Guidelines for Industry, 2021 and Grid Code, 2019.

2.1 Environmental related policies in Bangladesh

Table 2-1: Related policies in Bangladesh

Policies	Description/ Applicability of Acts
National Environment Policy, 2018	• Ensuring sustainable development through reducing human pressure on nature and natural resources. • Considering environmental protection as an integral part of the development programs planned to meet the need of the present and future generations. • Making natural resources extraction, use, environmental conservation, etc. to be based on science. • Considering environmental impacts and risks in extracting and using natural resources. • Evaluating the economic contribution of ecosystem services simultaneously to that of natural resources. • Giving priority to poor and underprivileged groups of people to ensure their participation, equity, justice, accessibility to the use of natural resources, and getting ecosystem services on which, they are dependent. • Taking initiatives to prevent misuse and ensure optimum water, land, natural gas, and other natural resources in the production process as well as day-to-day purposes. • Encouraging sustainable use of new and renewable resources. • Enhancing long-term poverty alleviation and food security through conserving biological diversity. • Realizing compensation from persons and institutes those who are liable to environmental pollution through applying polluter pay principle. • Including environmental conservation and preservation in all national policies and ensuring implementation of the environment policy at both government and nongovernment levels. • Giving priority to preventive measures over curative measures in environmental conservation. • Including adaptation and mitigation programs in all development projects to address adverse impacts of climate change. • Ensure sustainable utilization of ecosystem goods and services. • Implementation of the 3R principle in the utilization of resources.

Policies	Description/ Applicability of Acts
	• Strengthening the institutional and legal capacity of the institution (Government, local, private, and technical) relevant to the enforcing and implementation of rules and regulations relating to environmental policy and environment conservation. • Ensuring considerations of climate change and challenges of calamities in all kinds of infrastructure projects. • Reducing all SLCP (Short-Lived climate pollutants) that are harmful to health and the environment. • Taking development programs considering sustainable production and consumption as an integral part of environmental conservation to meet the need of present and future generations. • Allocating necessary funds to all areas of environmental conservation, preservation, and control. • Taking up programs in favor of a flourishing environment-friendly economy
National Environment Management Action Plan, 1995	• Identification of key environmental issues affecting Bangladesh; • Identification of actions necessary to halt or reduce the rate of environmental degradation; • Improvement of the natural environment; • Conservation of habitats and biodiversity; • Promotion of sustainable development; and • Improvement of the quality of life of the people.
The National Biodiversity Strategy and Action Plan, 2004	• Conserve and restore the biodiversity of the country for the wellbeing of the present and future generations; • Ensure that long-term food, water, health, and nutritional securities of the people are met through conservation of biological diversity; • Maintain and improve environmental stability of ecosystems; • Ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations; • Guarantee the safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country; and • Stop introduction of invasive alien species, genetically modified organisms, and living modified organisms.
Environment and Social Related Legislations in Bangladesh	
The Environment Conservation Act, 1995 and Subsequent Amendments	• Declaration of Ecologically Critical Areas (ECAs); • Obtaining an Environmental Clearance Certificate (ECC); • Regulation with respect to vehicles emitting smoke harmful to the environment; • Regulation of development activities from an environmental perspective; • Promulgation of standards for quality of air, water, noise, and soils in different areas and for different purposes; • Promulgation of acceptable limits for discharging and emitting waste; and • Formulation of environmental guidelines relating to control and mitigation of environmental pollution, conservation, and improvement of the environment.

Policies	Description/ Applicability of Acts
The Environment Conservation Rules, 1997 and Subsequent Amendments	• The NEQS for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise, and vehicular exhaust; • Categorization of industries, development projects, and other activities on the basis of actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollution load; • Procedure for obtaining ECC; • Requirements for undertaking IEE and EIA's as well as formulating EMP according to categories of industries/development projects/activities; and • Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.
Noise Pollution (Control) Rules, 2006	• According to the Rules, motor honking within a 100-meter radius of a hospital, school, and office is prohibited. • The rules also do not allow the use of brick crushers and cement mixers within a 500-meter radius of a residential area. Besides, prior permission is mandatory for using loudspeakers or megaphones. • The rules stipulate safety and precautionary measures in workplaces, designated authorities for allowing noise-generating appliances.
EIA Guidelines for Industry, 2021	The EIA Guidelines for Industry, 2021, introduced by the Department of Environment, Bangladesh, is the only guideline for conducting an Environmental Impact Assessment in Bangladesh. It is not only for industries but also for all types of development works.

Table 2-2: Relevant National Environmental Regulations

Regulation	Brief Description	Remarks
Environment Court Act 2000 (amended in 2002 and 2010)	This Act is under the Judiciary and MoEFCC to ensure the resolution of disputes on environmental and social damages resulting from any development activities. This Act also allows for the completion of environment-related legal proceedings effectively	PGCB will ensure that all potential environmental complaints will be dealt with effectively at the project level through the PMU. SPS 2009 requires setting up of a grievance redress mechanism for projects known to cause potential environmental impacts
Bangladesh Water Act 2013	Makes provisions for integrated development, management, abstraction, distribution, use, protection, and conservation of water resources	Transmission line will cross rivers: Kapotaksha river, Betna river, Buri Bhadra River, Harihar river, Kumar River, Arialkha river and PGCB will ensure compliance with this Act.
Vehicle Act 1927, the Motor Vehicles Ordinance 1983	These are under the Bangladesh Road Transport Authority (BRTA) which regulates vehicular emissions and noise including road safety.	This regulation will be complied with by vehicles that may be used during the

Regulation	Brief Description	Remarks
		construction and operation of Transmission line.
Factories Act 1965 and Bangladesh Labour 2006, Bangladesh Labor Act 2013	Regulations that aim to protect the interests and rights of the workers and to ensure their safety.	Workers recruited under Transmission line will be provided with PPE (if needed) and will comply with these regulations. No worker under 18 years old will be recruited
The Forest Act 1927 (amended in 1982 and 1989)	This Act under the MoEFCC aims to protect forest resources.	Transmission line will not traverse protected forest areas or other forest types.
Telegraph Act 1885	Under the Ministry of Posts and Telecommunications, this provides power to the Telegraph Authority to alter the position of gas or water pipes or drain (Sect. 14; a and b).	The route for Transmission line was selected considering this Act.
Electricity Act 2018	Relates to the supply and use of electrical energy, allows any person to secure a license to supply energy and to put down or place electrical supply lines for the transmission of energy. The Act provides that the licensee, in the exercise of any of the powers conferred by or under this Act, will cause as little damage, detriment, and inconvenience as may be, and will make full compensation for any damage, detriment or inconvenience caused by the licensee or by anyone employed by the licensee.	Transmission line referred to the applicable provisions in this Act.
The Antiquities Act 1968 (amended 1976)	Regulation on the preservation and protection of antiquities.	
Natural Water Bodies Protection Act 2000	According to this Act, the character of water bodies i.e., rivers, canals, tanks, or floodplains identified as water bodies in the master plans or in the master plans formulated under the laws establishing the municipalities in division and district towns shall not be changed without approval of the concerned ministry. This Act is under the Rajdhani Unnayan Kartipakkha/Town Development Authority/Municipalities.	Any part of Transmission line that will cross rivers, ponds, canals, and drainage channels will refer to this Act and will secure the required approval and clearances.
Wildlife (Protection and Safety) Act 2012	Provides for the conservation and safety of biodiversity, forest, and wildlife of the country by repealing the existing law relating to the conservation and management of wildlife of Bangladesh. Under this Act, hunting, trapping, the killing of wildlife is strictly prohibited.	Transmission line will not affect areas of habitats known to host wildlife. The route is along with urban areas.

Regulation	Brief Description	Remarks
National River Protection Act 2013	Creation of National River Protection Commission to manage and control water and environmental pollution, etc., and ensure socio-economic development of a multi-use and rational use of natural resources	Transmission line will ensure compliance with relevant provisions of this Act
The Protection and Conservation of Fish Act 1950 (amended 1973, 1982, 1995, 2002)	Provides for the requirements for the protection and conservation of fish. This Act defines fish as "all cartilaginous, bony fishes, prawn, shrimp, amphibians, tortoise, turtles, crustacean animals, mollusks, echinoderms and frogs at all stages in their life history."	Transmission lines will cross Kapotaksha river, Betna river, Buri Bhadra River, Harihar river, Kumar River, Arialkha river and will ensure that no protected fish species under this Act will be destroyed or affected. Any potential impact will be mitigated.
Acquisition and Requisition of Immovable property Act, 2017	The 2017 Act requires that compensation be paid for (i) land and assets permanently acquired (including houses, trees, and standing crops,); and (ii) any other impacts caused by such acquisition.	-
Environment Conservation Rules 1997	has promulgated the Environment Conservation Rules 1997 under the ECA 1995 to evaluate, review the Environmental Impact Assessment (EIA) of various projects and activities, and procedures are established for approval.	Transmission line will comply with this rule.
Grid Code 2019	The Grid Code specifies criteria, guidelines, basic rules, procedures, responsibilities, standards, and obligations for the operation, maintenance, and development of the Electricity Transmission System of Bangladesh to ensure transparent, non-discriminatory, and economic access and use of the Grid, whilst maintaining a safe, reliable and efficient operation of the same to provide a quality and secure electricity supply as reasonably as practicable.	Transmission line will ensure the compliance of this grid code.
Hazardous Waste (e-waste) Management Rules, 2021	On June 10, 2021, Bangladesh's Department of Environment (DOE) published the Hazardous Waste (e-waste) Management Rules, 2021 under the Bangladesh Environmental Protection Act, 1995. The E-waste rule covers the products listed in the Schedule (home appliances, monitoring and control equipment, medical equipment, automatic machines, IT and communication equipment), and establishes obligations for manufacturers, assemblers, collectors, sellers, and consumers of the products. The rule also sets provisions to limit the use of the 10 substances covered by the EU	Transmission line will ensure compliance with relevant provisions of this rules.

Regulation	Brief Description	Remarks
	RoHS Directive. This regulation entered in force upon publication. The main provisions of this regulation are as follows. • Manufacturers, traders, sellers, transporters, repairers, collection centers, recyclers, dismantlers, etc. of the subject products are required to register with a prescribed form to the DOE. When applying for registration, they shall also submit the Waste Electrical and Electronic Equipment (WEEE) management plan. • Registered manufacturers, recyclers, etc. shall obtain environmental clearance in accordance with the Bangladesh Environmental Protection Rules, 1997. • Manufacturers have to establish individual or joint collection centers and set aside funds for the management of the Waste Electrical and Electronic Equipment (WEEE). • For fluorescent lamps and mercury incandescent lamps, if they cannot be recycled, they need to be handed over to collection centers for storage and disposal. • Manufacturers, importers, etc. shall meet the collection targets for the Waste Electrical and Electronic Equipment (WEEE) as specified in the Schedule (10% in the first year of the implementation, 20% in the second year, 30% in the third year, 40% in the 4th year, and 50% in the fifth year and thereafter). • In order to facilitate the proper management of the Waste Electrical and Electronic Equipment (WEEE), the name, address and contact information of the trader or seller as well as the information on the registered collection center shall be displayed on the product or on the product label, or this information shall be provided to consumers or large consumers. • Traders, sellers and collectors of the Waste Electrical and Electronic Equipment (WEEE) shall receive them from consumers at designated points and transport them to collection centers.	

Regulation	Brief Description	Remarks
Solid Waste Management Regulations 2021	The Solid Waste Management Regulations 2021 were published in Bangladesh on December 23, 2021, under the Bangladesh Environmental Protection Act, 1995. The Regulations define the responsibilities of businesses involved in solid waste management and impose collection, recycling, and disposal obligations according to Extended Producer Responsibility (EPR) on manufacturers of non-biodegradable products such as glass, plastic, and bottles. The Regulations also include provisions for the treatment of solid waste such as composting and energy recovery. The main provisions of the Regulations are as follows. • When recovering resources from waste, the principles of management that consider the waste hierarchy, such as the 3Rs, segregation, and reduction, must be followed at all stages from waste generation to final disposal. • Responsibilities of waste generators, consumers, and users: — Dispose of waste in accordance with the regulations of authorities including local government. — Dispose of waste separately. — Do not dump, store, or burn waste outdoors. • Responsibilities of manufacturers and importers of products — Collect non-biodegradable products such as glass, plastic, polyethylene, multi-layered packaging, bottles, and cans from consumers and recycle or dispose of them if appropriate. — Determine work plans and implementation procedures for recycling and disposal. — Ensure that EPR is properly implemented. — Submit an annual report to the Department of Environment (DOE) on the amount of plastic recycled. — Raise public awareness of proper waste management.	Transmission line will ensure compliance with relevant provisions of this regulations.

3 PROJECT DESCRIPTION

This addendum is only in respect of two lines; (i) Satkirha to Manirampur 132 kV double circuit transmission line and (ii) Gopalganj (N)-Shibchar 230 kV double circuit transmission line (Initially operated at 132 kV).

Satkirha to Manirampur route was finalized during original IEE (ref: Table 6.1 of the original IEE, https://www.adb.org/projects/documents/ban-51137-003-iee) after the detailed route survey and analysis. Gopalganj (N)-Shibchar route analysis was not completed during the during original IEE. However, after the detailed route survey and analysis, the route was finalized with minimal deviation from the first, second and third stage surveys (ref: Table 6.1 of the original IEE). The final alignments avoided all types of settlements beneath the RoW from start to end. Lesser number of trees to be cut for final alignments than the original routes (see Table 5-2). The summary and comparisons of both the final routes and original routes are given in Table 3-1 and Figure 3-2.

Table 3-1: The summary and comparisons of Final and Original Alignments

SN	Subproject	Final Alignment				Original Routes
		Size/Length	**Upazilla**	**District**	**Division**	**Size/Length**
1.	**Satkhira-Manirampur 132 kV double circuit transmission line**	33 km; 33 angle towers; 66 suspension towers.	Keshabpur. Manirampur. Patkelghata. Satkhira Sadar, Tala	Jashore, Khulna, Satkhira	Khulna	31.9 km; 33 angle towers; 66 suspension towers.
2.	**Gopalganj (North)-Shibchar 230 kV double circuit transmission line (Initially operated at 132 kV)**	25 km; 21 angle towers; 43 suspension towers	Bhanga. Rajoir. Shibchar	Gopalganj, Faridpur, Madaripur	Dhaka	21.7 km; Two terminal, 21 angle towers and 43 suspension towers.

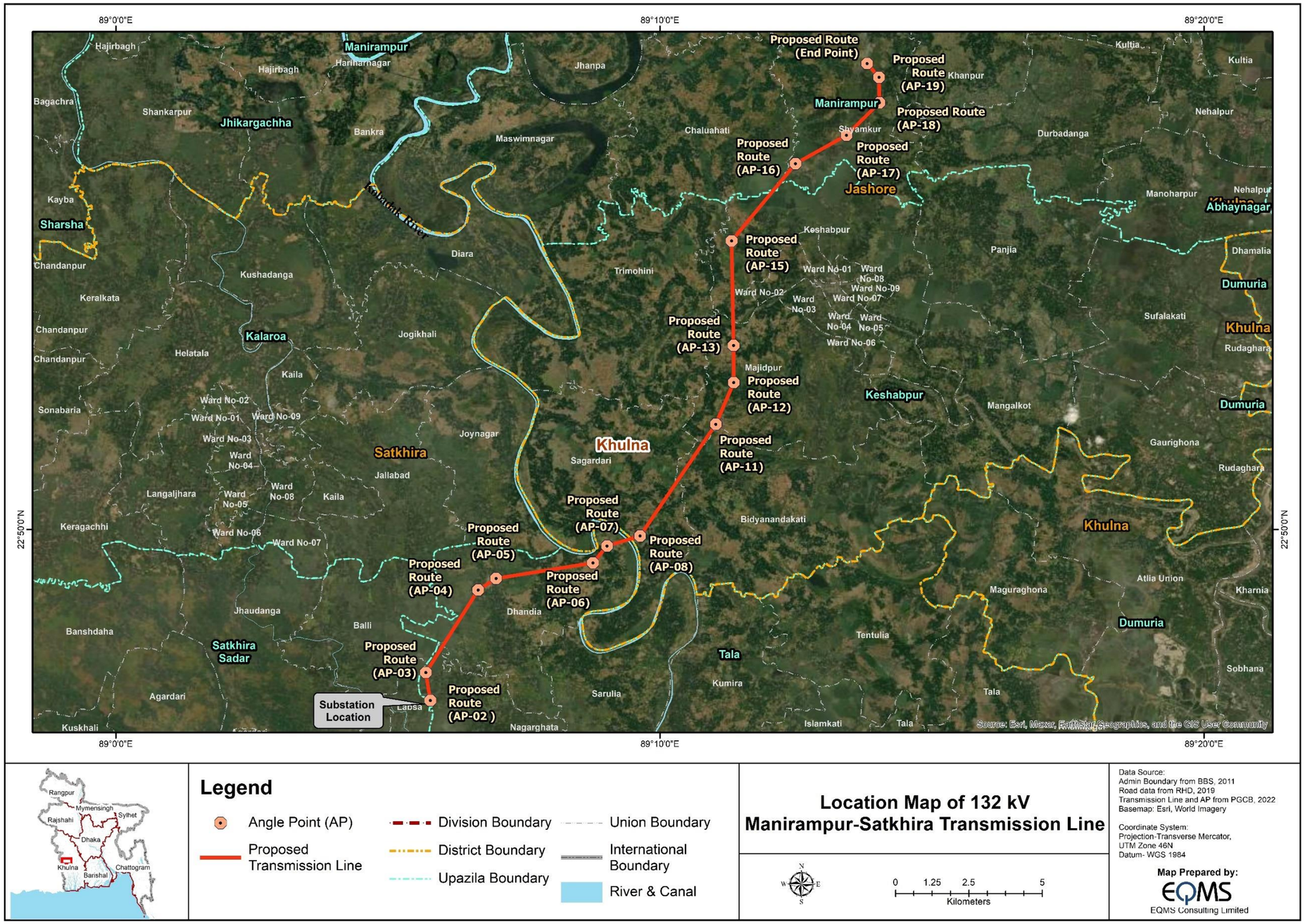
3.1 Site Details

3.1.1 Location of the Project Site

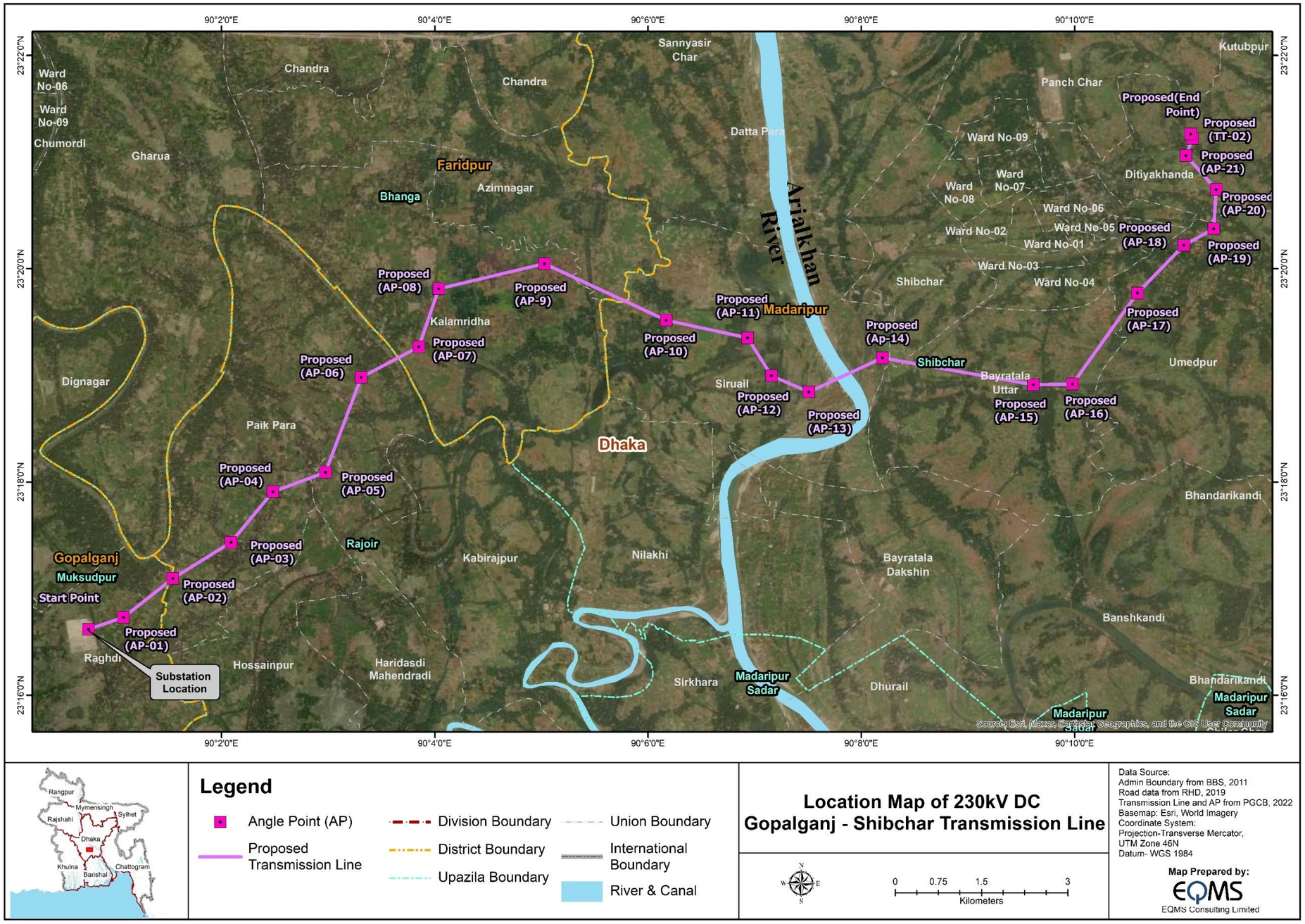
This addendum is only in respect of two lines which are (i) Satkirha to Manirampur and (ii) Gopalganj (N) to Shibchar. These alignments comprise two administrative divisions and six districts of Bangladesh: three in Khulna division (Jashore, Satkirha and Khulna), three in Dhaka division (Gopalganj, Madaripur, and Faridpur). As per the Table 3.1 of the original IEE, https://www.adb.org/projects/documents/ban-51137-003-iee), and current site visits, the Satkirha to Manirampur alignment covers Keshabpur, Manirampur, Patkelghata, Satkhira Sadar and Tala Upazilla under Jashore and Satkirha districts. Gopalganj (N) to Shibchar double circuit transmission line Bhanga, Rajoir and Shibchar Upazilla under Faridpur and Madaripur. The final alignments have been deviated minimally from the original IEE. As per the EMP requirement, PGCB to avoid housing or school structures directly underneath the line. As per the confirmation from PGCB and on ground site visits, there are no housing or school structures directly lies underneath these final routes of the contractor. The major waterbodies covered in the final routes are rivers and gher, however, the transmission line will not pose any risk to these wetlands as well as seasonal habitats of wildlife and birds.

The coordinates of the final alignments and elevation details are given in **Annex A.**

Figure 3-1: Proposed Route of the Transmission Lines



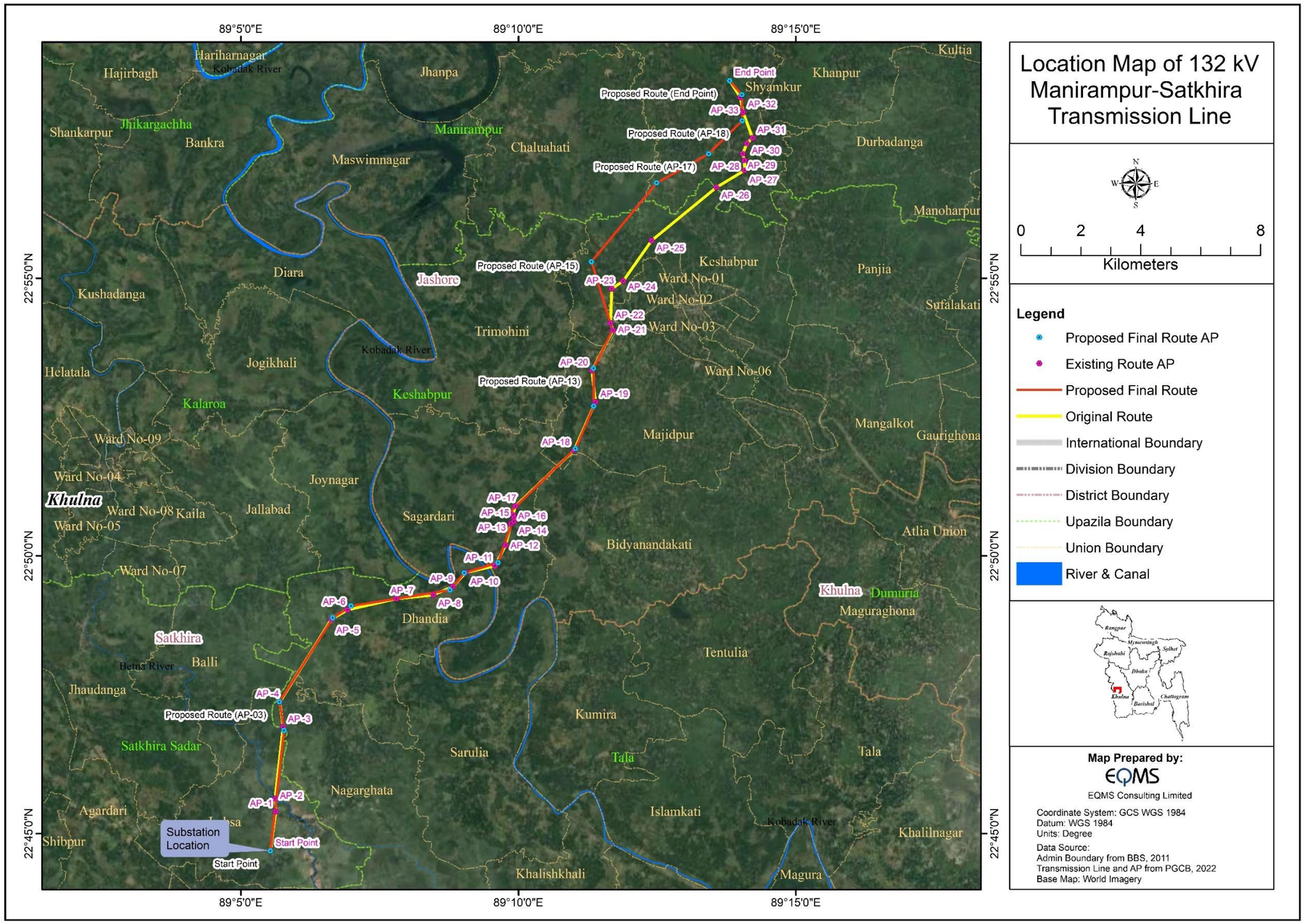
Satkhira- Manirampur



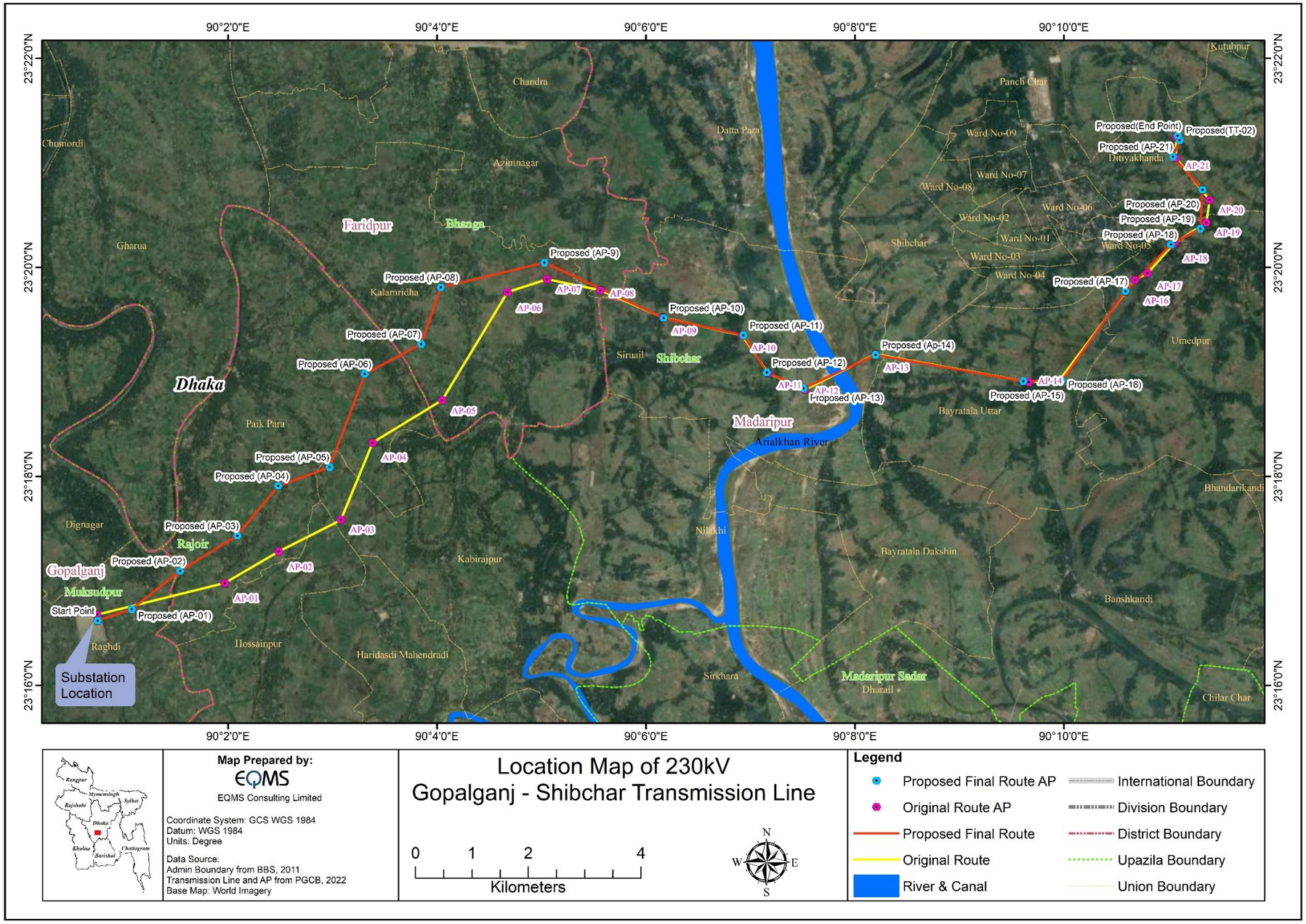
Gopalganj- Shibchar

Source: Final routes provided by PGCB, 2022

Figure 3-2: Differences in Alignments: Original v Final Alignments



Satkhira- Manirampur



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Gopalganj- Shibchar

Source: Original v Final Alignments provided by PGCB, 2022

4 ENVIRONMENTAL AND SOCIAL BASELINE

This section describes the existing environmental and social baseline status of proposed overhead transmission lines (Satkhira-Manirampur 132 kV double circuit transmission line and Gopalganj (North)-Shibchar 230 kV double circuit transmission line.

4.1 Methodology

The analysis was completed through on-ground reconnaissance and surveys to establish an understanding of the environmental and socio-economic baseline. Data for this chapter were collected from:

- Primary Sources: This included gathering information from field surveys, laboratory analysis and consultations/FGDs in the project area.
- Secondary Sources: This included data from literature reviews, maps and monitoring reports;

The baseline condition of environmental quality in the locality of project study area serves as the basis for identification, prediction, and evaluation of impacts. The baseline environmental quality is assessed through field studies within the impact zone for various components of the environment such as air, noise, water, land and socio-economic etc.

Data was collected from secondary sources for the macro-environmental setting like climate (temperature, rainfall, wind speed & direction and humidity), physiography, geology etc. Primary environmental baseline information was collected from the project site and surrounding area to know the current environmental and socio-economic condition of the project study area. Data on ambient air, noise quality, surface water and ground/drinking water quality were gathered from onsite environmental quality monitoring. FGDs were also carried out to investigate local environmental conditions, issues, and possible impacts.

The baseline environment is discussed in three broad categories: (i) Physical Environment which includes factors such as topography, geology, earthquake risk, climate, hydrology/drainage, and environmental pollution related elements; (ii) Biological Environment, which includes flora, fauna, Protected Areas, wildlife sanctuaries, forest reserves, and the general ecosystem; and; (iii) Socio-economic Environment, which includes anthropological factors like demography, income, land use, land requirements and infrastructure.

4.2 Physical Environment

4.2.1 Climate

Although less than half of Bangladesh lies within the tropics, the presence of the Himalaya Mountain range has created a tropical macro-climate across most of the east Bengal land mass. Bangladesh is divided into seven climatic zones and the sub projects are located in five climatic zones.

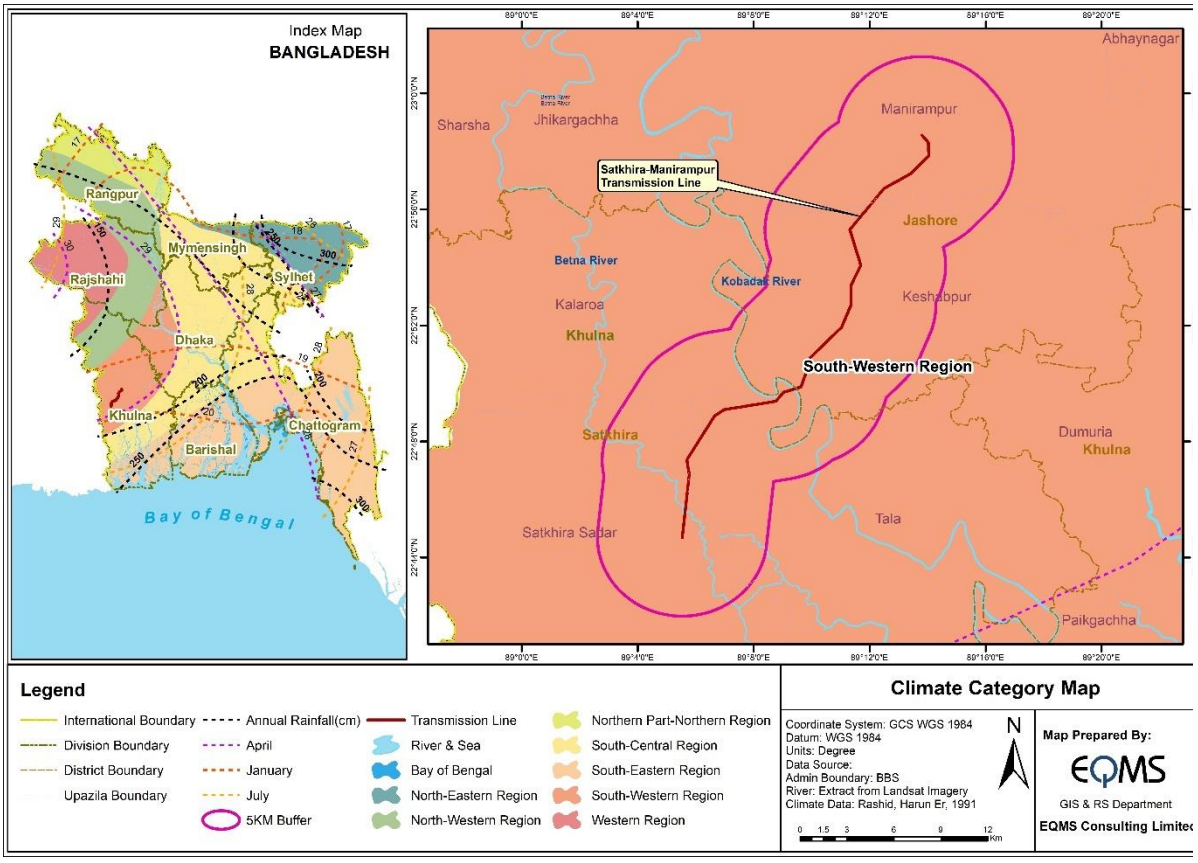
Three distinct seasons can be recognized in Bangladesh: the post-monsoon season from November to February; the pre-monsoon hot season from March to May, and the rainy monsoon season which lasts from June through to October. The month of March may also be considered as the spring season, and the period from mid-October to mid-November may be called the autumn season.

The post-monsoon season (November-February) begins first in the west-central part of the country, where its duration is about four months, and it advances toward the east and south, reaching the eastern and southern margins of the country by mid-March, where its duration is about one month.

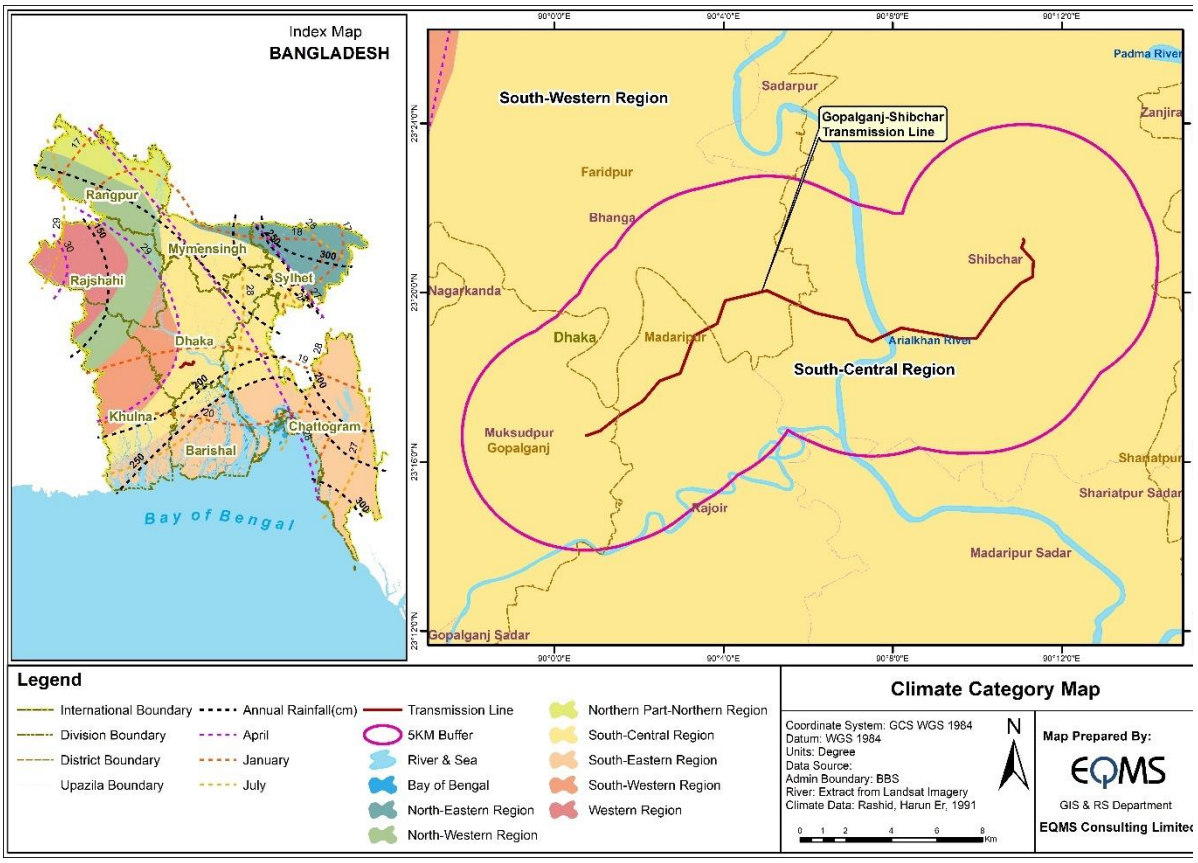
The pre-monsoon hot season (March-May) is characterized by high temperatures and the occurrence of thunderstorms. April is the hottest month when mean temperatures range from 27°C in the east and south to 31°C in the west-central part of the country. In the western part, summer temperatures sometimes reach up to 40°C. After the month of April, the temperature dampens due to increased cloud cover. The pre-monsoon season is the transition period when the northerly or north-westerly winds of

the winter season gradually change to the southerly or south-westerly winds of the summer monsoon or rainy season (June-September). During the early part of this season, the winds are neither strong nor persistent. However, with the progression of this season, wind speed increases, and the wind direction becomes more persistent. Figure 4-1 represents different climatic zones in Satkhira-Manirampur and Gopalganj- Shibchar route.

Figure 4-1 Climatic Zones of Satkhira- Manirampur and Gopalganj- Shibchar



Climate Category of Satkhira to Manirampur



Climate Category of Gopalganj- Shibchar

Source: Rashid, Haroun Er, 1991.

4.2.1.1 Climate at Satkhira and Manirampur

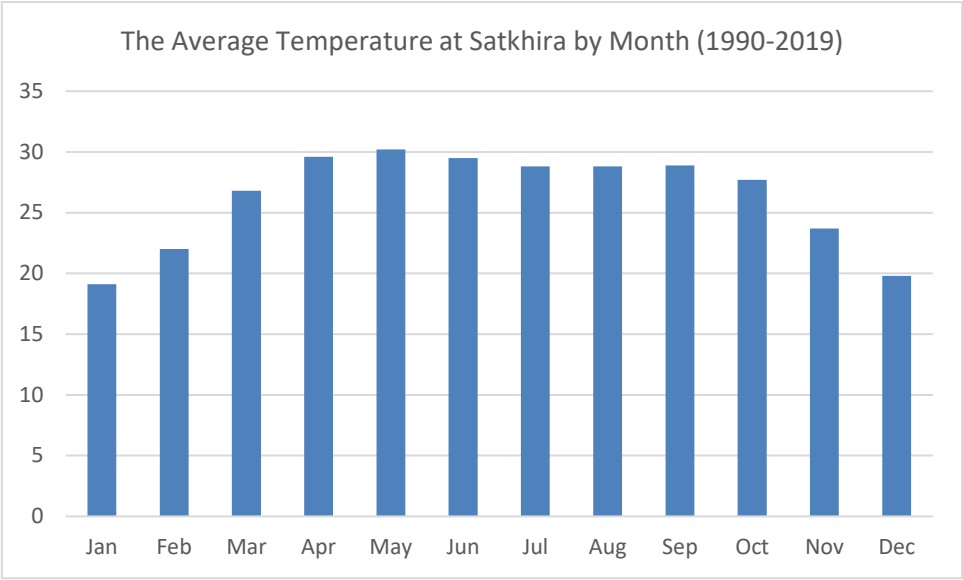
The source of climate data is Bangladesh Meteorological Department (BMD). The climate data was collected from nearby BMD station. For Satkhira-Manirampur alignments, data was collected from Jashore BMD station, which has the coverage for all the districts crossed within this route. The average annual temperature is 26.2 °C in Satkhira and Manirampur. About 1655 mm of precipitation falls annually. The least amount of rainfall occurs in December. The average in this month is 6 mm. With an average of 347 mm, the most precipitation falls in July. The temperatures are highest on average in May, at around 30.2°C. January has the lowest average temperature of the year. It is 19.1°C. The variation in the precipitation between the driest and wettest months is 341 mm. During the year, the average temperatures vary by 11.1 °C.

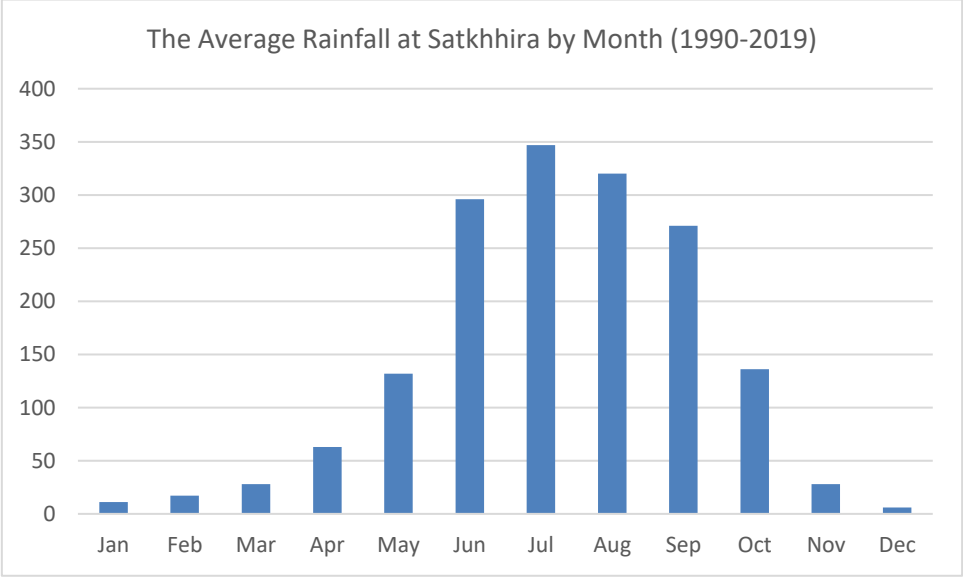
Table 4-1: Average temperature and rainfall at Satkhira and Manirampur by month

Average	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Avg. Temperature (°C)	19.1	22	26.8	29.6	30.2	29.5	28.8	28.8	28.9	27.7	23.7	19.8
Avg. Rainfall (mm)	11	17	28	63	132	296	347	320	271	136	28	6

Source: Bangladesh Meteorological Department (BMD)

Figure 4-2: Distribution of Rainfall & Temperature at Satkhira and Manirampur.





Source: Bangladesh Meteorological Department (BMD)

4.2.1.2 Climate at Gopalganj and Shibchar

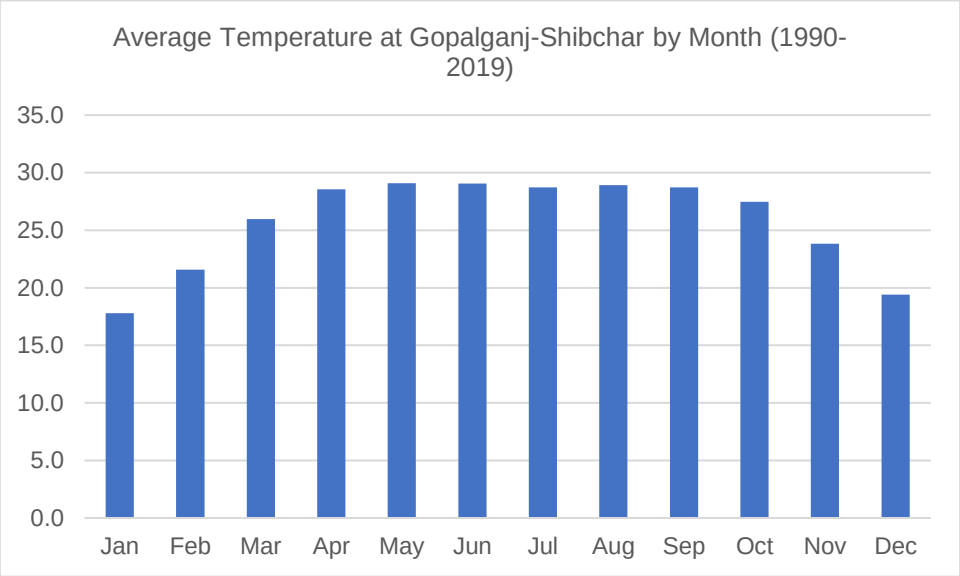
The source of climate data is Bangladesh Meteorological Department (BMD). The climate data was collected from nearby BMD station. For Gopalganj (N) -Shibchar alignments, data was collected from Madaripur BMD station, which has the coverage for all the districts crossed within this route. The average annual temperature is 25.8 °C in Gopalganj and Shibchar. About 1922 mm of precipitation falls annually. The least amount of rainfall occurs in December. The average rainfall in this month is 5 mm. With an average of 383 mm, the most precipitation falls in July. The temperature is the highest on average in May & June, at around 29.1°C. January has the lowest average temperature of the year. It is 17.8°C. The variation in the precipitation between the driest and wettest months is 378 mm. During the year, the average temperatures vary by 11.3 °C.

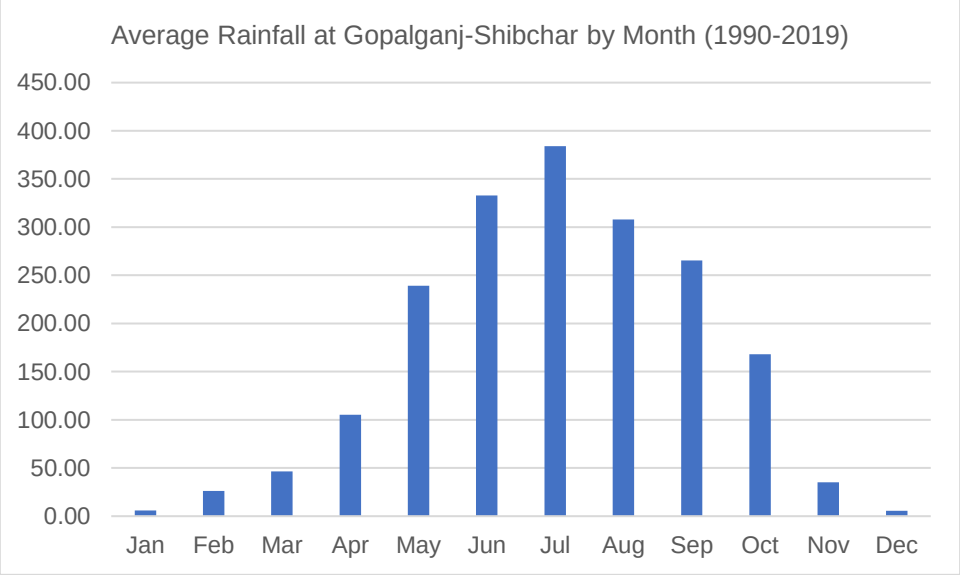
Table 4-2: Average temperature and rainfall at Gopalganj and Shibchar by month

Average	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Avg. Temperature	17.8	21.6	26.0	28.6	29.1	29.1	28.7	28.9	28.7	27.5	23.8	19.4
Avg. Rainfall	5.98	26.19	46.37	105.1	239.2	333.0	383.9	308.0	265.3	168.1	35.17	5.65

Source: Bangladesh Meteorological Department (BMD)

Figure 4-3: Distribution of Rainfall & Temperature at Gopalganj-Shibchar





Source: Bangladesh Meteorological Department (BMD)

4.2.2 Water Quality

4.2.2.1 Surface Water

Overhead transmission lines in Dhaka and Western zone cross 31 rivers. Satkhira to Manirampur 132kV double circuit transmission line crosses Kapotaksha river, Betna river, Buri Bhadra River and Harihar river. The width of these rivers is more than 100 m (Table 4-3) during monsoon. Gopalganj (N) to Shibchar 230 kV double circuit transmission line crosses Kumar River and Arialkha river; and the average width of these rivers are 276 m.

Table 4-3: Name of rivers and transmission lines

No.	Overhead Transmission Line	Names and Widths of River
1.	Manirampur- Satkhira 132 kV double circuit transmission line	Kapotaksha river, Betna river, Buri Bhadra River, Harihar river (all rivers >100 m)
2.	Gopalganj (North)- Shibchar 230 kV double circuit transmission line	Kumar river, Arialkha river (276 m)

4.2.2.1.1 Surface Water Sampling Methods

The samples have been analyzed for parameters covering bacteriological and physio-chemical characteristics which include certain heavy metals and trace elements. Surface water samples has been collected as grab water sample in a standard sampling bottle and 250 ml sterilized clean PET bottle to complete physio-chemical and bacteriological tests respectively. The samples have been analyzed as per standard procedure/method given in Standard Method for Examination of Drinking Water Edition 20, published by APHA as well as using on site field test kit. Details of the sampling procedures are shown in Table 4-4.

Table 4-4: Analysis Method for Surface Water Samples

Sl. No.	Parameters	Unit	Analysis Method
1.	Biochemical Oxygen Demand (BOD)	mg/L	5 days Incubation
2.	Chemical Oxygen Demand (COD)	mg/L	Closed Reflux Method
3.	Dissolved Oxygen (DO)	mg/L	Hanna Combo Meter
4.	Electrical Conductivity (EC)	µS/cm	Hanna Combo Meter
5.	pH	--	Hanna Combo Meter
6.	Salinity	ppt	Hanna Combo Meter
7.	Temperature (T)	°C	Hanna Combo Meter
8.	Hardness	mg/L	Colorimetric Method
9.	Total Dissolved Solid (TDS)	mg/L	Hanna Combo Meter

Sources: Information Taken from EQMS Wet Laboratory

The quality of surface water was compared with the standards for Inland Surface Water, Environment Conservation Rules (ECR) and 1997-Schedule 3 (A) whereas the groundwater was compared with the Drinking Water Standard ECR Schedule-3 (B), 1997. The standards have been presented along with the monitoring results of surface water for comparison.

4.2.2.1.2 Surface Water Sampling Locations

EQMS team has observed various source of water throughout the transmission line. The alignment will not traverse areas that are protected by the GoB but will cross six major rivers: Kapotaksha river, Betna river, Buri Bhadra River, Harihar river, Kumar River and Arialkha river. There are some small cannels, ponds, gher were observed in the project sites. Five surface water samples were collected for surface water quality monitoring during the month of January 2022. The samples were collected from nearby River or Cannel of the alignment.

Table 4-5: Surface Water Sampling Location

Sl. No.	Code	Sampling Location	GPS Coordinate	Type of Source	Sampling Time	Sampling Date
Satkhira to Manirampur						
1.	SW1	Kapotaksha Nod, AP7/2	22°49'48.54"N 89° 9'22.54"E	River	01:22 PM	09.01.2022
2. .	SW2	Local Cannel, AP17/3	22°57'37.07"N 89°13'48.86"E	cannel	03:55 PM	09.01.2022
3.	SW3	Betna River, AP3A	22°45'11.67"N 89° 6'25.06"E	River	08:30 AM	09.01.2022
Gopalganj to Shibchar						
4.	SW4	Near AP-01	23°16'29.4"N 90° 00'49.7"E	Cannel	11:20 AM	14.03.2022
5.	SW5	Near AP-08	23°19'48.774"N 90° 5'28.104"E	Cannel	1:25 PM	14.03.2022
6.	SW6	Near AP-16	23°19'52.74"N 90° 10'42.3"E	Pond	2:35 PM	14.03.2022

Table 4-6: Surface Water Sampling Location

Satkhira to Manirampur

SW1, Kapotaksha Nod AP 7/2

SW2, Local Cannel, AP 17/3


SW3, Betna River, AP 3A

Gopalganj to Shibchar


SW4, AP 01


SW5, AP-08


SW6, AP-16

4.2.2.1.3 Result Analysis

The analyzed results for surface water were compared to Rule 12, Schedule-3 (A), Bangladesh Standards (ECR, 1997). Results of inland surface water analysis are presented in (Table 4-7).

Table 4-7: Surface Water Analysis Result

Parameters		Concentration								
		BOD	COD	DO	EC	pH	Salinity	T	Hardness	TDS
	Unit	mg/L	mg/L	mg/L	µS/cm	--	ppt	°C	mg/L	mg/L
Satkhira to Manirampur										
SW1	Baseline (Jan. 2022)	1.6	17	6.2	320	7.6	0.21	23.4	280	260
SW2	Baseline (Jan. 2022)	1.8	25	5.5	460	6.8	0.12	22.6	152	220
SW3	Baseline (Jan. 2022)	1.9	27	5.9	540	7.9	0.19	22.4	230	285
Gopalganj to Shibchar										
SW4	March 2022	1.2	8	5.7	180	7.3	0.13	23.4	80	110
SW5	March 2022	1.5	6	5.4	160	6.9	0.08	22.4	72	90
SW6	March 2022	0.9	12	5.8	280	7.1	0.10	22.2	90	130
Bangladesh Standards*		6 or less	--	5 or more	--	6.5 – 8.5	--	--	--	--

*NB: *Rule 12, Schedule-3 (A), ECR.1997, Bangladesh*

4.2.2.1.4 Discussion

The surface water samples have been taken from a running river named Kapotaksha, Betna, Kumar and Arialkha runs adjacent to the proposed transmission line project. Regular high tide and low tide occur here most of the river and the sedimentation is remarkable. According to tasted result the tested parameters remain under the Bangladesh standard.

- **Biological Oxygen Demand (BOD):** Biological Oxygen Demand is the quantity of oxygen required by bacteria and other microorganisms during the biochemical degradation and transformation of

organic matter present in water under aerobic conditions. BOD_5 is an index of the biodegradable organics present. Biological oxygen demanding wastes consume the dissolved oxygen from water. In Satkhira-Manirampur transmission line, the average value of BOD_5 varied from 0.7 to 1.8 mg/L. For Gopalganj (N) – Shibchar double circuit transmission line, the average value of BOD_5 varied from 0.9 to 1.9 mg/L. In all the locations, the average value of BOD_5 was found within the limits of national standards. So, these low values of BOD_5 indicate the status of oxygen efficiency in the water body which can be helpful to aquatic flora and fauna like fish and microorganisms.

- **Chemical Oxygen Demand (COD):** The chemical oxygen demand is commonly used to indirectly measure the number of organic compounds in water. Most applications of COD determine the number of organic pollutants found in surface water (e.g., lakes and rivers) or wastewater, making COD a useful measure of water quality. In Satkhira-Manirampur transmission line, the average value of COD varied from 17 to 27 mg/L, whereas, in Gopalganj (N) – Shibchar double circuit transmission line, the average value of COD varied from 6 to 12 mg/L. In all the locations, the average value of COD was found within the limits of national standards.
- **Dissolved Oxygen (DO):** The presence of sufficient DO in water is a positive sign of a healthy water body but the deficiency of DO is a signal of pollution. DO for all the samples of surface water are remained above 5 which recommended by DoE.
- **Electrical Conductivity (EC):** The electrical conductivity (EC) is usually used for indicating the total concentration of the ionized constituents of water. In Satkhira-Manirampur transmission line, the values of EC of the surface water varied from 320 to 540 µs/cm, whereas, in Gopalganj (N) – Shibchar double circuit transmission line, the values of EC of the surface water varied from 160 to 280 µs/cm. The values indicate the very low amount of ionization in sampling water bodies.
- **pH:** The pH of surface water may continuously be fluctuating depending on the seasonal variation. pH amount fluctuating between the range of neutral nature. It's also noticeable that all the samples of surface water remain between the standard of Bangladesh. There have no construction wastes thrown into the surface water body.
- **Salinity:** The salinity of surface water may continuously be fluctuating depending on the seasonal variation. Salinity in Satkhira-Manirampur transmission line fluctuates between the range of 0.12 to 0.21 ppt. Salinity in Gopalganj (N) – Shibchar double circuit transmission line ranges between 0.08 to 0.13 ppt. It's also noticeable that all the samples of surface water contained a moderate amount of salinity.
- **Temperature (T):** Temperature for all the surface water samples below from the Bangladesh standard. Seasonal variation is completely responsible for decreasing the temperatures.
- **Total Dissolved Solid (TDS):** The high number of suspended dissolved solids in water increases the water density; it influences the osmoregulation of freshwater organisms and reduces the solubility of gases. TDS in Satkhira-Manirampur transmission line ranges from 220 to 285 mg/L. TDS in Gopalganj (N) – Shibchar transmission line ranges from 90 to 130 mg/L. High tide and low tide, sand absorption, or the effluent with suspended particles, such as stormwater from the bathroom, sprayed water runoff contained sand particles, etc. can be responsible for fluctuating TDS.
- **Hardness:** Hardness is a measure of divalent salts, or positively charged ions, particularly calcium (Ca2+) and magnesium (Mg2+), in water. Total hardness is the sum of the concentrations of Ca2+ and Mg2+, expressed in ppm calcium carbonate. In Satkhira-Manirampur transmission line, Hardness value found ranges from 152 to 280 mg/L. In Gopalganj (N) – Shibchar transmission line, Hardness value found ranges from 152 to 280 mg/L.

4.2.2.2 Ground Water

4.2.2.2.1 Ground Water Sampling Methods

Ground water samples has been collected from the Ground water supply point or deep tube well or shallow tube well set up in the construction area. Ground water samples has been collected in a standard sampling bottle and 250 ml sterilized clean PET bottle for complete physio-chemical and bacteriological tests respectively. The samples have been analysed as per standard

procedure/method given in Standard Method for Examination of Water and Wastewater Edition 20, published by APHA as well as using a site field test kit. Details of the analysis method and protocol are presented in Table 4-8.

Table 4-8: Analysis Method for Ground Water Samples

Sl. No.	Parameters	Unit	Analysis Method
1.	Biochemical Oxygen Demand (BOD)	mg/L	5 days Incubation
2.	Chemical Oxygen Demand (COD)	mg/L	Closed Reflux Method
3.	Dissolved Oxygen (DO)	mg/L	Hanna Combo Meter
4.	Electrical Conductivity (EC)	µS/cm	Hanna Combo Meter
5.	pH	--	Hanna Combo Meter
6.	Salinity	ppt	Hanna Combo Meter
7.	Temperature (T)	°C	Hanna Combo Meter
8.	Hardness	mg/L	Colorimetric Method
9.	Total Dissolved Solid (TDS)	mg/L	Hanna Combo Meter

Sources: Information Taken from EQMS Laboratory

4.2.2.2.2 Ground-Water Sampling Locations

Ground water samples were collected for determining the quality of existing sources. Ground water in the project area was selected as the source of groundwater. During the site visit, no springs or deep wells/tubewell were found within the ROW of these two lines. Detail of the sampling location is provided in Table 4-9.

Table 4-9: Locations and Descriptions of Ground-Water Sampling

Sl. No.	Code	Sampling Location	GPS Coordinate	Type of Source	Sampling Time	Sampling Date
Satkhira to Manirampur						
1.	GW1	Uttor Sarsha, Dhandia, Patelghata, Satkhira (Near AP 6/2)	22°49'34.38"N 89° 8'59.49"E	Tube-Well	01:43 PM	09.01.2022
2.	GW2	Atadanga, Monirumpur, Jashore (Near AP 16/4)	22°57'0.79"N 89°13'3.20"E	Tube-Well	02:54 PM	09.01.2022
3.	GW3	Balerputa, Tala, Satkhira (Near AP 3A)	22°45'17.13"N 89° 6'35.47"E	Tube-Well	08:37 AM	09.01.2022
Gopalganj to Shibchar						
4.	GW4	Near AP-01	23°16'25.89"N 90° 0'46.002"E	Tube-Well	10:50 AM	14.03.2022
5.	GW5	Near AP-08	23°19'50.418"N 90° 5'27.582"E	Tube-Well	1:05 PM	14.03.2022
6.	GW6	Near AP-16	23°19'52.644"N 90° 10'42.81"E	Tube-Well	2:15 PM	14.03.2022

4.2.2.2.3 Sampling Photographs

Satkhira to Manirampur


GW1, Uttor Sarsha, Dhandia, Patelghata, Satkhira (Near AP 6/2)


GW2: Atadanga, Monirumpur, Jashore (Near AP 16/4)


GW3: Balerputa, Tala, Satkhira (Near AP 3A)

Gopalganj to Shibchar	
	
GW4: Near AP-08	
	
GW5: Near AP-08:	
	
GW3: Near AP-16	

4.2.2.2.4 Ground-Water Quality Analysis Results

Analysis results of the Ground water are represented in Table 4-10 where the values are compared with the standard limit.

Table 4-10: Ground Water Quality Analysis Results

Parameters		Concentration								
		BOD	COD	DO	EC	pH	Salinity	T	Hardness	TDS
	Unit	mg/L	mg/L	mg/L	µS/cm	--	ppt	°C	mg/L	mg/L
Satkhira to Manirampur										
GW1	Baseline (Jan. 2022)	0.1	1.5	6.2	1370	7.3	0.52	22.5	560	243
GW2	Baseline (Jan. 2022)	0.2	2.6	5.6	1450	7.0	0.14	22.2	480	176
GW3	Baseline (Jan. 2022)	0.2	3.3	5.8	1620	7.7	0.28	21.9	690	258
Gopalganj to Shibchar										
GW4	March 2022	0.1	1.2	6.1	480	7.41	0.10	22.4	150	220
GW5	March 2022	0.1	2.0	6.1	490	7.33	0.08	22.4	172	240
GW6	March 2022	0.1	1.5	6.3	530	7.38	0.05	22.4	131	258
Bangladesh Standards*		0.2	4	6	-	6.5-8.5	-	20-30	200-500	1000

NB:

**Rule 12, Schedule-3(B), ECR.1997, Bangladesh*

4.2.2.2.5 Discussion

According to the ground, water quality parameters monitoring most of them are under BD standard values. There has not been any groundwater degradation observed during this baseline monitoring period. There have no chemical and hazardous elements leaching into the ground. Regular groundwater sampling will be conducted during construction period. If any impact will observe in the future, the proper initiative will be taken immediately.

- **Biological Oxygen Demand (BOD):** A BOD level of 1-2 ppm is considered very good. There will not be much organic waste present in the water supply. In all samples, the tested result shows the value of BOD is 0.1 to 0.2 mg/l which indicated the good condition of groundwater.
- **Chemical Oxygen Demand (COD):** The chemical oxygen demand is commonly used to indirectly measure the number of organic compounds in water. In all samples, the tested values of groundwater samples range from 1.2 to 3.3 mg/L which is well within the national standard.
- **Dissolved Oxygen (DO):** Dissolved oxygen is necessary to many forms of life including fish, invertebrates, bacteria, and plants. DO for all the samples of ground water are range from 5.6 to 6.3 mg/L.
- **Electrical Conductivity (EC):** The electrical conductivity (EC) is usually used for indicating the total concentration of the ionized constituents of water. In Satkhira-Manirampur transmission line, the EC of the ground water varied from 1370 to 1620 µs/cm. In Gopalganj (N) – Shibchar double circuit transmission line, the EC of the ground water varied from 480 to 530 µs/cm.
- **pH:** pH for all locations varied from 7.0 to 7.7 and the water quality shows the basic or neutral state which can be no harm to consume. Besides, the change of pH in every location may be occurred for different sources.
- **Salinity:** In the southwestern coastal region of Bangladesh, options for drinking water are limited by groundwater salinity. Recently, aquaculture ponds in areas with a thin surface clay layer have increased the salinity in the underlying shallow aquifers. The tested samples salinity fluctuates between the range of 0.05 to 0.52 ppt in all samples. It's also noticeable that all the samples of ground water contained a moderate amount of salinity.
- **Hardness:** Hardness is a measure of divalent salts, or positively charged ions, particularly calcium (Ca^{2+}) and magnesium (Mg^{2+}), in water. Total hardness is the sum of the concentrations of Ca^{2+} and Mg^{2+}, expressed in ppm calcium carbonate. In Satkhira-Manirampur transmission line, the Hardness value found ranges from 480 to 690 mg/L. In Gopalganj (N) – Shibchar double circuit transmission line, the Hardness value found ranges from 131 to 172 mg/L. All the values were found within the national standards.
- **Total Dissolved Solid (TDS):** Total Dissolved Solids (TDS) data can be used to identify the presence of currently undeveloped fresh or brackish groundwater at depth that may require protection. In Satkhira-Manirampur transmission line, TDS of the groundwater ranges from 176 to 258 mg/L. In Gopalganj (N) – Shibchar double circuit transmission line, TDS of the groundwater ranges from 220 to 258 mg/L. All the values were found within the national standards.
- **Temperature (T):** Temperature for all the ground water samples below from the BD standard. Seasonal variation is completely responsible for decreasing the temperatures.

4.2.3 Air Quality

The subprojects are located in suburban areas of Bangladesh (smaller cities and towns, mixed in the rural context). This section identifies the status of the ambient air quality in two alignments: Satkhira-Manirampur transmission line and Gopalganj (N) – Shibchar double circuit transmission line. In these areas, ambient air quality is dependent on many factors like air movement, traffic volume, congestion, emissions from motor vehicles, and suspended dust particles. A continuous monitoring scheme is essential to evaluate air quality and for the development of any plan for mitigation of health risks caused by polluted air. The "criteria pollutants," particulate matter (PM_{10}, $PM_{2.5}$), CO, SOx and NOx must be monitored. Hence, to establish the baseline air quality, as per the monitoring plan, a primary analysis of air quality is proposed, before commencing the construction activities of subprojects.

4.2.3.1 Air Quality Monitoring Methods

The existing ambient air quality of the both the alignments have been monitored during the construction period of the project. The ambient status of major air pollutants viz. Particulate Matter (SPM, $PM_{10,}$ and $PM_{2.5}$), Gaseous substances (NO_x, $SO_{2,}$ O_3 and CO) and Lead has been assessed.

Haz-Scanner™ (HIM 6000)/Lata Envirotech APM 250 has been used to monitor the ambient air quality. The particulate and gaseous samples have been monitored and analysed as per the procedures specified in Table 4-11.

Table 4-11: Methodology for the Analysis of Ambient Air Quality.

Sl. No.	Parameters	Analysis Procedure
1.	SPM	Particulates Sensor Light Scattering Nephotometer/ Gravimetric
2.	PM_{10}	Particulates Sensor Light Scattering Nephotometer/ Gravimetric
3.	$PM_{2.5}$	Particulates Sensor Light Scattering Nephotometer/ Gravimetric
4.	SO_2	High Sensitivity Electrochemical/ West-Geake
5.	NO_x	High Sensitivity Electrochemical/ Jacob & Hochheiser
6.	03	High Sensitivity Electrochemical/ Ozone meter
7.	Pb	AAS

Sources: Information Taken from EQMS Laboratory

Table 4-12: Air Sample Collection Time and Data Converted Time

Sl. No.	Parameters	Sample Collection time (Hr.)	Conversion Time (Hr.)
1.	SPM	8	-
2.	PM_{10}	24	24
3.	$PM_{2.5}$	24	24
4.	SO_2	24	24
5.	NO_x	24	24
6.	CO	8	-
7.	O_3	8	8
8.	Pb	8	24

Sources: Information Taken from EQMS Laboratory

4.2.3.2 Air Quality Monitoring Locations

The objective of the surrounding air quality observing system was to set up the standard encompassing air quality in the study area. The profile of the Project is mainly rural and urban mixed with two major river confluences. The major sources of air pollution noted within the study area include vehicular movement and domestic emissions apart from the existing infrastructure. Ambient air quality has been monitored in the project activities. The location details are as follows Table 4-13. Besides, the monitoring locations map is attached in the annex section for more clarification.

Air quality monitoring samples has been monitored for a defined time interval and from different sampling points within project areas (Table 4-13) of Satkhira to Manirampur and Gopalganj to Shibchar. Air quality analysis results are shown in Table 4-15.

Table 4-13: Air Quality Measurement Locations and Descriptions

SL No	Sample ID	GPS Coordinate	Location Details
Satkhira to Manirampur			
1.	AQ1	22°46'59.19"N 89° 5'42.00"E	Nagar Ghata, Satkhira Sadar (Near AP 2/1) Agricultural Field

SL No	Sample ID	GPS Coordinate	Location Details
2.	AQ2	22°57'37.97"N 89°13'47.58"E	Aminpur, Shampur, Manirampur, Jashore (Near AP 17/3) Just beside Jashore-Manirampur-Keshabpur Highway Road
Gopalganj to Shibchar			
3.	AQ3	23°16'26.64"N 90° 0'50.82"E	Project substation Surrounding area
4.	AQ4	23°19'50.83"N 90° 5'27.18"E	Residential Area
5.	AQ5	23°19'52.74"N 90°10'42.25"E	Residential Area

Monitoring photos are showed in Table 4-14.

Table 4-14 Air Quality Monitoring Pictures

Satkhira to Manirampur	
	
AQ1	
	
AQ2	

Gopalganj to Shibchar	
	
AQ3	
	
AQ4	
	
AQ5	

4.2.3.3 Analysis Results and Discussion

Among all the parameters of ambient air, SPM, CO, Pb and O_3 had been taken for 8 hours and the rest of the parameters were taken on a 24-hourly basis. Both particulate and gaseous samples had been analyzed as per the proper procedures. Analysis results of every location are briefly mentioned in the following Table 4-15.

Table 4-15: Air Quality Analysis Results

Sl. No.	Code	Period	Ambient Air Pollution Concentration in µg/m^3							CO ppm
			$PM_{2.5}$	PM_{10}	SO_2	NO_X	SPM	O_3	Pb	
Satkhira to Manirampur										
1.	AQ1	Jan. 2022	41.6	66.3	16.7	25.3	112.4	12.9	BDL	0.403
2.	AQ2	Jan. 2022	61.4	96.5	32.8	42.5	175.8	26.4	BDL	1.814
Gopalganj to Shibchar										
3.	AQ3	Mar. 2022	46.9	96.2	11.4	23.5	156.8	18.1	BDL	0.02
4.	AQ4	Mar. 2022	38.4	72.5	4.7	16.1	131.4	12.5	BDL	0.01
5.	AQ5	Mar. 2022	35.3	74.1	14.8	26.2	139.5	22.4	BDL	0.01
Duration (hours)			24	24	24	24	8	8	8	8
*Bangladesh Standard			65	150	365	100 (Annual)	200	157	0.5	9
**IFC/WHO Standard			25	50	20	40 (Annual)	-	100	-	-

Note:

**According to ECR 1997 and Subsequent amendment 19th August 2005; vide S.R.O. No.220-Law/2005*

***WHO Ambient Air Quality Guideline Values (2005 and 2000), which are also being referred in the World Bank and IFC's General EHS Guidelines (2007).*

BDL-Below Detection level

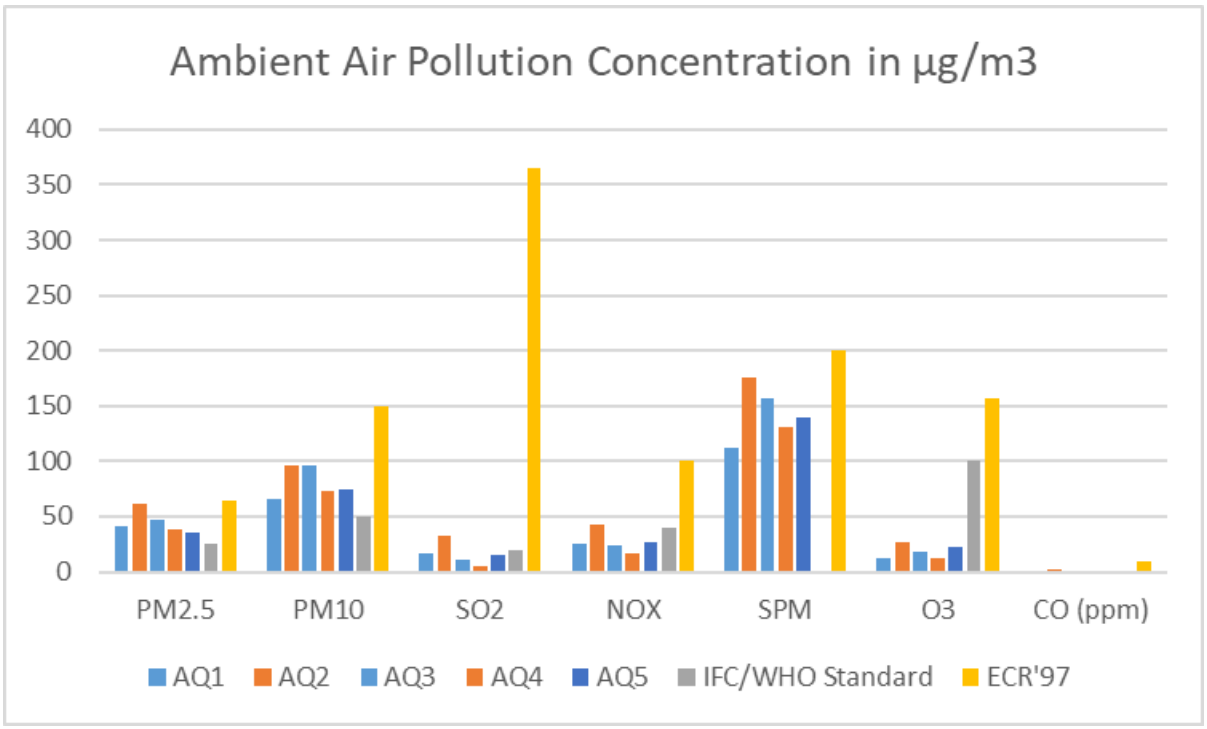


Figure 4-4 Comparison of Baseline Air Quality of Satkhira to Manirampur and Gopalganj to Shibchar with IFC/WHO and ECR 97 Standards.

Particulate Matter ($PM_{2.5}$): The result of particulate matter under 2.5 micron has been under the BD standard (ECR 1997) level but cross IFC/WHO standard in January 2022 and March 2022 for both Satkhira to Manirampur and Gopalganj to Shibchar respectively. Vehicle movement on local Road in dry season and dry surface is the main reason to cross the standard (IFC/WHO).

Particulate Matter (PM_{10}): The result of particulate matter under 10 microns has been under the BD standard (ECR 1997) level but cross IFC/WHO standard in January 2022 and March 2022 for both Satkhira to Manirampur and Gopalganj to Shibchar respectively. Vehicle movement on local Road in dry season and dry surface is the main reason to cross the standard (IFC/WHO).

Sulphur Dioxide (SO_2): In Satkhira to Manirampur line, SO_2 concentration has been recorded in the range of 16.7 to 32.8 µg/m^3. During the monitoring period, the maximum SO_2 concentration has been reported at Aminpur, Shampur, Manirampur, Jashore (Near AP 17/3) (AQ2) of as 32.8 µg/m^3 in January 2022. So, in this month, SO_2 concentrations at all the monitoring locations have been reported well below ECR 1997 and IFC/WHO standard level exception AQ2 (Figure 4-4).

In Gopalganj to Shibchar transmission line, SO_2 concentration has been recorded in the range of 4.7 to 14.8 µg/m^3 in March 2022. The concentration of SO_2 is reported low in AP-08 (AQ4) as 4.7 µg/m^3. During the monitoring period, the maximum SO_2 concentration has been reported at AP-16 (AQ5) of as 14.8 µg/m^3. So, in this month, SO_2 concentrations at all the monitoring locations have been reported well below ECR 1997 and IFC/WHO standard level.

Oxides of Nitrogen (NO_x): In Satkhira to Manirampur line, NO_x concentration has been recorded in the range of 25.3-42.5 µg/m^3. During the monitoring period, the maximum NO_x concentration has been reported in Aminpur, Shampur, Manirampur, Jashore (Near AP 17/3) (AQ2) as concentration 42.5 µg/m^3 in January 2022. NO_X concentration for all location has been recorded as under the standard of ECR'97 and IFC/WHO standard exception AQ2 (Figure 4-4).

In Gopalganj to Shibchar transmission line, NO_x concentration has been recorded in the range of 16.1-26.2 µg/m^3 in March 2022. During the monitoring period, the maximum NO_x concentration has been

reported at AP-16 (AQ3) as concentration 26.2 µg/m^3. NO_X concentration for all location has been recorded as under the standard of ECR'97 and IFC/WHO standard.

Suspended Particulate Matter (SPM): The ambient air quality has been monitored in January 2022 in Satkhira to Manirampur line and in Gopalganj to Shibchar transmission line during March 2022. The 8-hourly SPM concentration in ambient air in the study area has been recorded at Aminpur, Shampur, Manirampur, Jashore (Near AP 17/3) (AQ2) was 175.8 µg/m^3 which is higher than other locations. All the location below from the national standard of ECR'97 (Figure 4-4). There has no standard found for SPM in IFC/WHO rather than only exists ECR'97.

In Gopalganj to Shibchar transmission line, the 8-hourly high SPM concentration in ambient air in the study area has been recorded at AP-01 (AQ3) area was 156.8 µg/m^3. All the location below from the national standard of ECR'97

Carbon Monoxide (CO): In Satkhira to Manirampur line, 8 hourly CO concentrations are reportedly low (<1 ppm) at the monitoring location while comparing with ECR'97 (Figure 4-4). A higher concentration of CO level is recorded at Aminpur, Shampur, Monirampur, Jashore (Near AP 17/3) (AQ2).

In Gopalganj to Shibchar transmission line, A higher concentration of CO level is recorded at AP-01 (AQ3). Comparing to Baseline most of the location have been below from ECR'97 of CO concentration.

Oxone (O_3): In Satkhira to Manirampur line, 8 hourly O_3 concentration has been recorded in the range of 12.5-26.4 µg/m^3 in. During the monitoring period, the maximum O_3 concentration has been reported in Aminpur, Shampur, Manirampur, Jashore (Near AP 17/3) (AQ2) as concentration 26.4 µg/m^3.

In Gopalganj to Shibchar transmission line, the 8-hourly high O_3 concentration in ambient air in the study area has been recorded at AP-16 (AQ5) area was 22.4 µg/m^3. O_3 concentration for all location has been recorded as under the standard of ECR'97 and IFC/WHO standard

4.2.4 Noise Level

4.2.4.1 Noise Level Monitoring Methods

This section identifies the status of the ambient noise level in two alignments: Satkhira-Manirampur transmission line and Gopalganj (N) – Shibchar double circuit transmission line. The ambient noise level has been measured within the project area for one hour a daytime in every location. One Noise data logger sound level meter (Techoplus, Model: SLM25K) has been used to collect the ambient noise levels. After getting all the noise data it has been downloaded to a computer. The noise meter has been settled in a tripod and kept 2-3 m away from the sources. The only sensitive areas have been covered. The noise level has been analyzed according to the methodology and compared with the Environment Conservation Rules (ECR), 1997- Schedule 4 and Noise Pollution Control Rules, 2006. The SLM has been oriented towards the facility of interest for each measurement taken. The SLM has been calibrated before the noise monitoring survey is carried out. The sound level has been recorded in form of A-weighted equivalent continuous sound pressure level (L_{Aeq}) values with the use of A-weighting filters in the noise measuring instrument.

Table 4-16: Noise Level Standards/ Guidelines

Sl. No.	Category of Area/Receptor	Bangladesh*		IFC-WHO**	
		Day [dB(A)] 6 AM – 9 PM	Night [dB(A)] 9 PM – 6 AM	Day [dB(A)] 7 AM – 10 PM	Night [dB(A)] 10 PM – 7 AM
1.	Silent Zone	50	40	55	45
2.	Residential Area	55	45	55	45
3.	Mixed Area	60	50	-	-
4.	Commercial Area	70	60	70	70
5.	Industrial Area	75	70	70	70

*Note: *The Bangladesh National Ambient Noise Standards have been taken from Schedule 4 (Standards for Sound) of the Environmental Conservation Rules, 1997 amended October 7, 2006; **Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999; As per IFC EHS noise level guidelines, Noise impacts should not exceed the levels presented in the above table.*

Note: The day time is considered from 6 a.m. to 9 p.m. and the night time is from 9 p.m. to 6 a.m.

Area within 100 meters of hospital or education institution or government designated / to be designated/ specific institution/ establishment are considered Silent Zone. Use of motor vehicle horn or other signals and loudspeakers are forbidden in Silent Zone.

4.2.4.2 Noise Level Monitoring Locations

Noise levels were recorded at five locations in two lines in the study area. Noise levels were recorded in the form of sound pressure levels using a digital sound level meter. Detail list of noise level sampling location are given in Table 4-17. Noise level was measured at every location at different time. The sound level is recorded in form of A-weighted equivalent continuous sound pressure level (Leq) values with the use of A-weighting filters in the noise measuring instrument.

Table 4-17: Sensitive Noise Locations and Descriptions Satkhira to Manirampur and Gopalganj to Shibchar

Sl. No.	Code	Location	GPS Coordinates	Sampling Date	Time		Category
					Day	Night	
Satkhira to Manirampur							
1.	NL-1	Near AP 2/1	22°46'58.26"N 89° 5'34.31"E	09.01.2022	09:02 AM	09:16 PM	Residential Area
2.	NL-2	Near AP 17/3	22°57'43.38"N 89°13'48.10"E	10.01.2022	10:23 AM	09:12 PM	Mixed Area
Gopalganj to Shibchar							
3.	NL-3	AP-01	23°16'26.64"N 90° 0'50.82"E	12.03.2022	08:37 AM	09:05 PM	Industrial Area
4.	NL-4	AP-08	23°19'50.83"N 90° 5'27.18"E	13.03.2022	10:08 AM	09:31 PM	Mixed Area
5.	NL-5	AP-16	23°19'52.74"N 90°10'42.25"E	14.03.2022	12:02 AM	09:16 PM	Residential Area

Table 4-18 Noise level Monitoring Pictures.

Satkhira to Manirampur	
	
NL1	
	
NL2	
Gopalganj to Shibchar	
	
NL3	


NL4


NL5

4.2.4.3 Analysis Results and Discussion

An electronic and auto-recorded noise meter has been used to conduct the study. The recorded noise levels summary monitoring results are shown in Table 4-19.

Table 4-19: Noise Level Monitoring Results

Sl. No.	Code	Period	Ambient Noise Level [dB(A)]		1 Hour Leq		ECR'97 Standard		IFC/WHO Standard	
			Leq_{day}	Leq_{night}	Max	Min	Day	Night	Day	Night
		Satkhira to Manirampur								
1.	NL1	Jan.2022	51.1	35.4	71.4	33.7	55	45	55	45
2.	NL2	Jan.2022	57.3	45.7	76.2	39.4	60	50	-	-
		Gopalganj to Shibchar								
3.	NL3	March 2022	56.4	37.1	75.2	32.0	75	70	70	70
4.	NL4	March 2022	54.7	41.5	79.3	37.2	60	50	-	-

Sl. No.	Code	Period	Ambient Noise Level [dB(A)]		1 Hour Leq		ECR'97 Standard		IFC/WHO Standard	
			Leq_{day}	Leq_{night}	Max	Min	Day	Night	Day	Night
5.	NL5	March 2022	47.9	40.4	71.8	36.5	55	45	55	45

Note:
** According to ECR 1997 and Subsequent amendment on 2006*
***Guidelines for Community Noise, World Health Organization (WHO), 1999; As per IFC EHS noise level guidelines*

According to Bangladesh Environmental Quality Standard ECR'97 categorizations, the current monitoring location falls into Residential area (NL1 and NL5) Mixed Zone (NL2 & NL4) and Industrial Area (NL3). The daytime noise level all locations values are below from BD Standard and IFC-WHO (Figure 4-5).

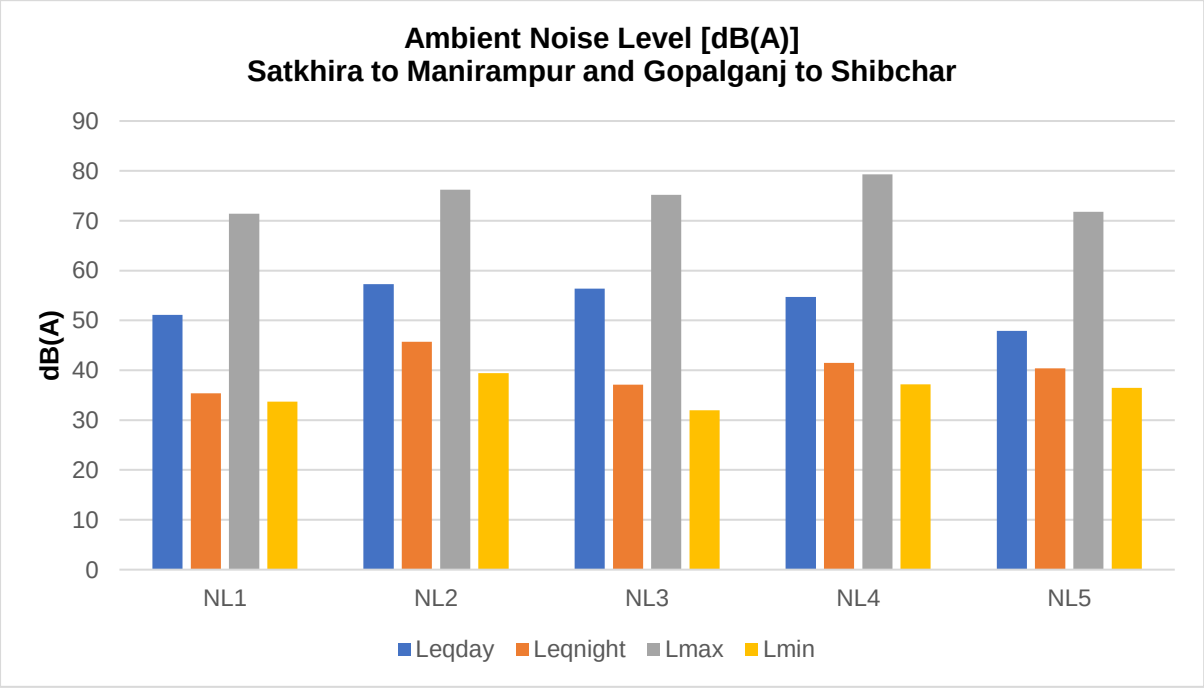


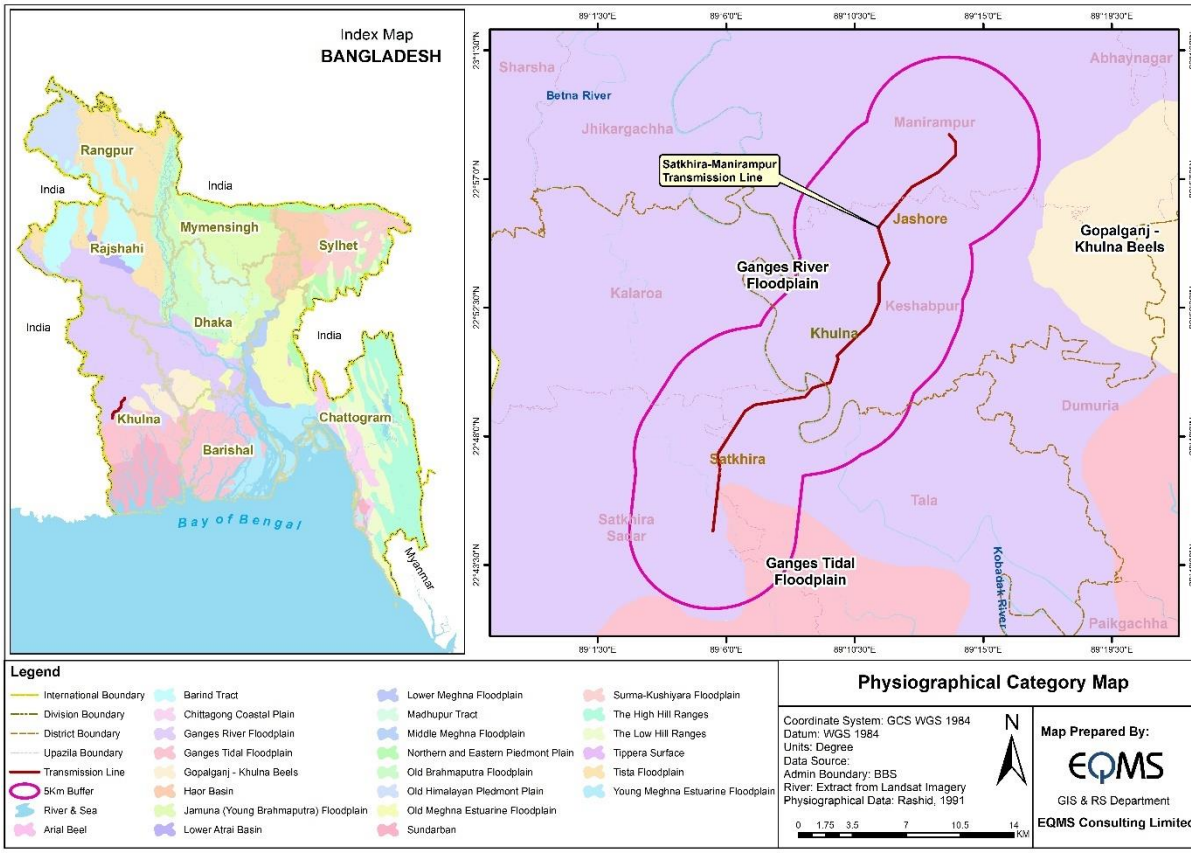
Figure 4-5: Noise level of Satkhira to Manirampur and Gopalganj to Shibchar

The night-time noise level of all location's values is bellow from the standard of Bangladesh and IFC-WHO (**Figure 4-5**).

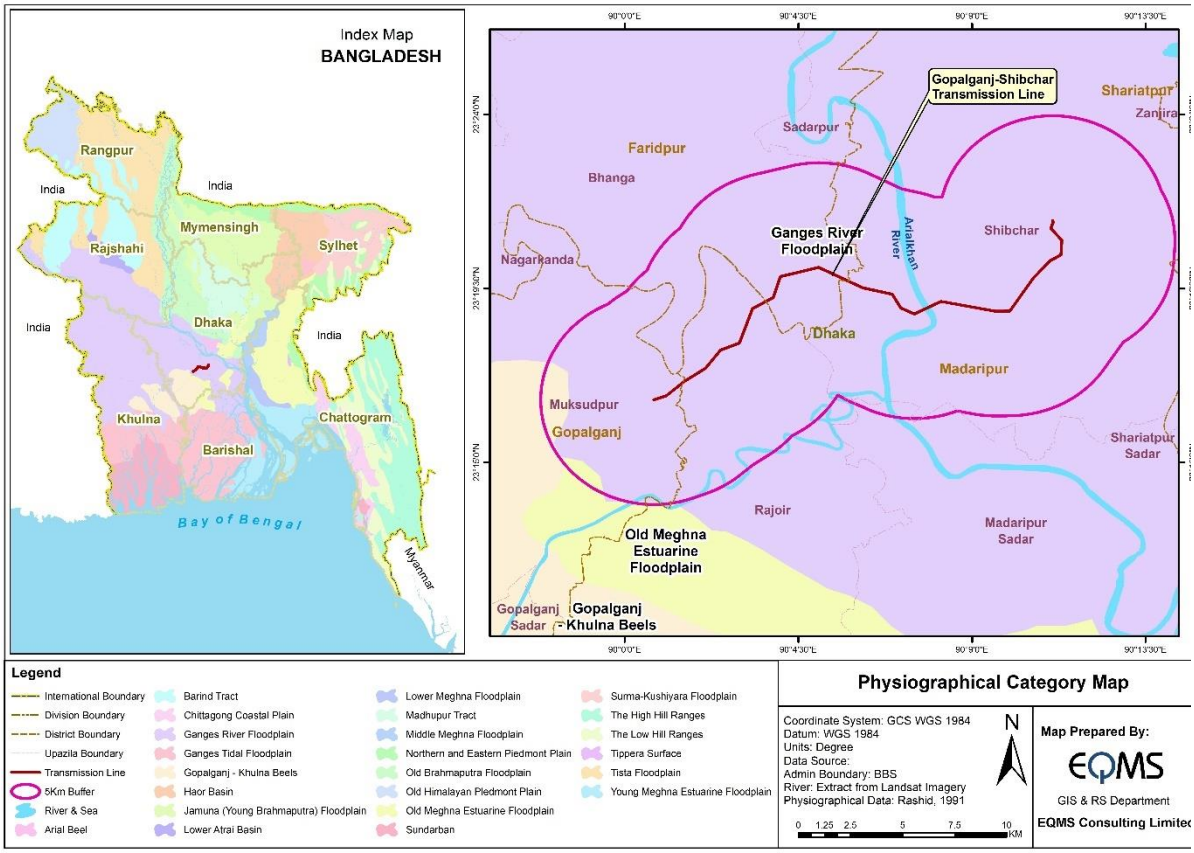
4.2.5 Physiographic Features

In the context of physiography, Bangladesh is classified into three distinct regions: (a) floodplains; (b) terraces; and (c) hills each having distinguishing characteristics of its own. Further, the physiography of the country has been divided into 24 sub regions and 54 units. The physiography of 5km buffer of Satkhira- Manirampur route and Gopalganj- Shibchar route fall in Ganges River Floodplain. Figure 4-6 shows the physiographic condition of Satkhira- Manirampur and Gopalganj- Shibchar.

Figure 4-6: Physiographic Map of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur



Gopalganj- Shibchar

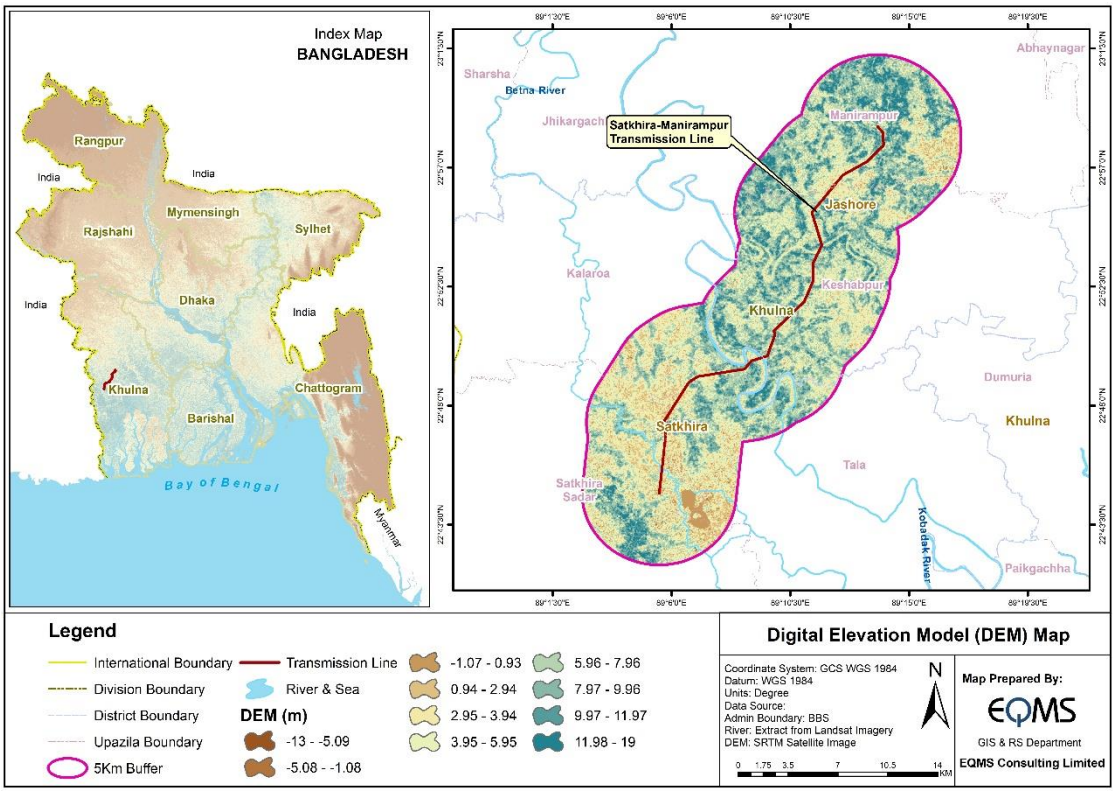
4.2.6 Topography

Bangladesh is one of the largest deltas in the world formed by the confluence of three Himalayan rivers: the Ganges (Padma); the Brahmaputra (Jamuna); and, the Meghna, with a long coastline along the Bay of Bengal. Floodplains (80%), terraces (8%) and hills (12%) cover the land area.

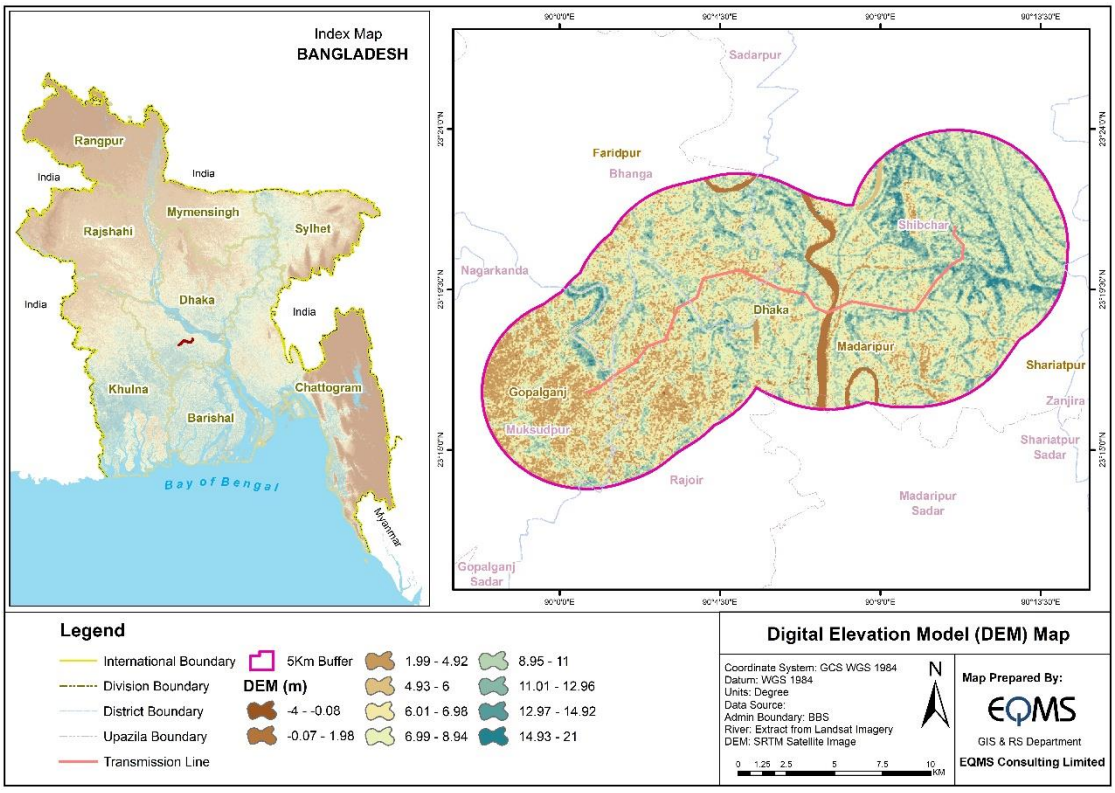
The country has a considerable topographic diversity. It has three distinctive features: (i) a broad alluvial plain subject to frequent flooding; (ii) a slightly elevated relatively older plain; and, (iii) a small hill region drained by flashy rivers. The south is a highly irregular deltaic coastline of about 600 km fissured by many estuarine rivers and channels flowing into the Bay of Bengal. The alluvial plain is part of the larger plain of Bengal, which is sometimes called the Lower Gangetic Plain. Elevations of the plains are less than 10 m above the sea level; elevations further decline to near sea level in the coastal south. Most of the southwest project area in Khulna and Barishal divisions lies in the alluvial plain. The hilly areas of the south eastern region of Chattogram, the northeasters hills of Sylhet and highlands in the north and northwest are of low elevation. The Chattogram Hills constitute the only significant hill system in the country. They rise steeply to narrow ridgelines, with elevation ranging between 600 m and 900 m above mean sea level. The highest point of 1,230 m is at Mt. Keokradong. In between the hilly ridges lie the valleys that generally run north to south. West of the Chattogram hills is a narrow, wet coastal plain lying parallel to the shoreline.

The average elevation of Satkhira- Manirampur alignment is 5m. The average elevation of Gopalganj-Shibchar alignment is 8.5m. The topographic map of these alignments is shown in Figure 4-7.

Figure 4-7: Topography of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur



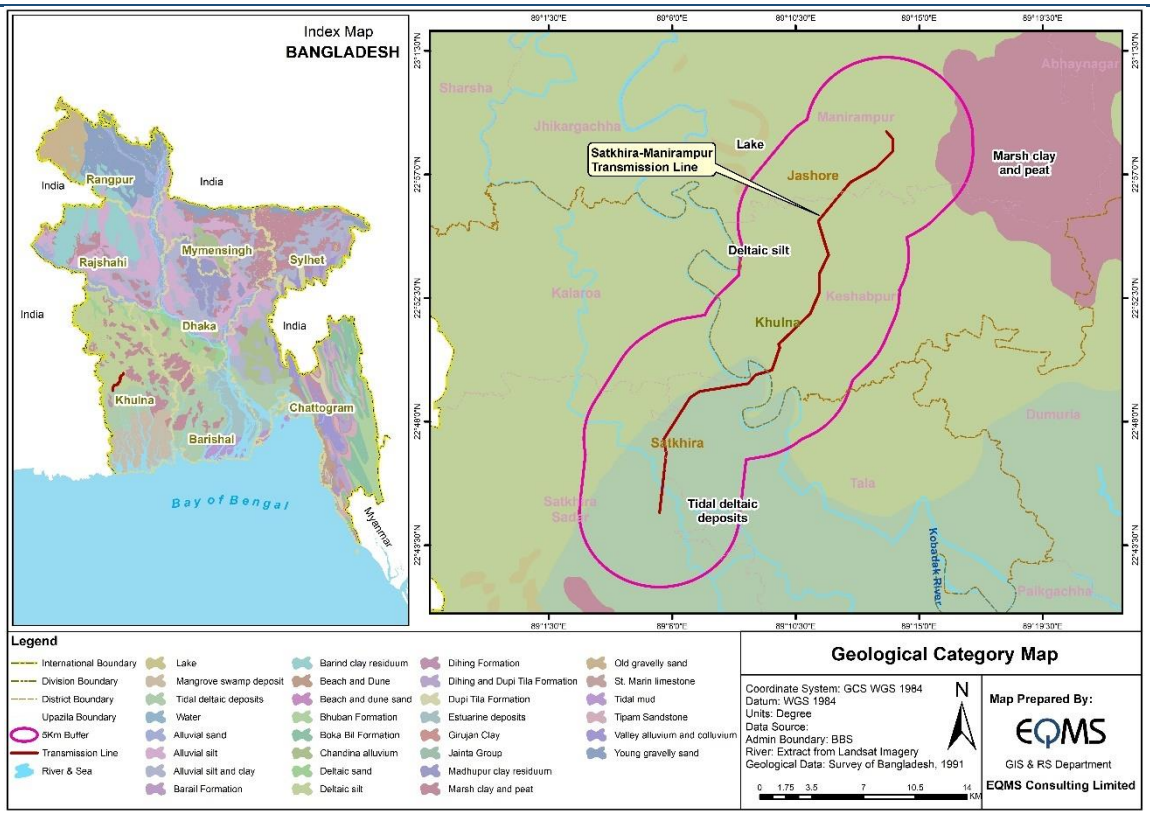
Gopalganj- Shibchar

Source: SRTM Satellite Image

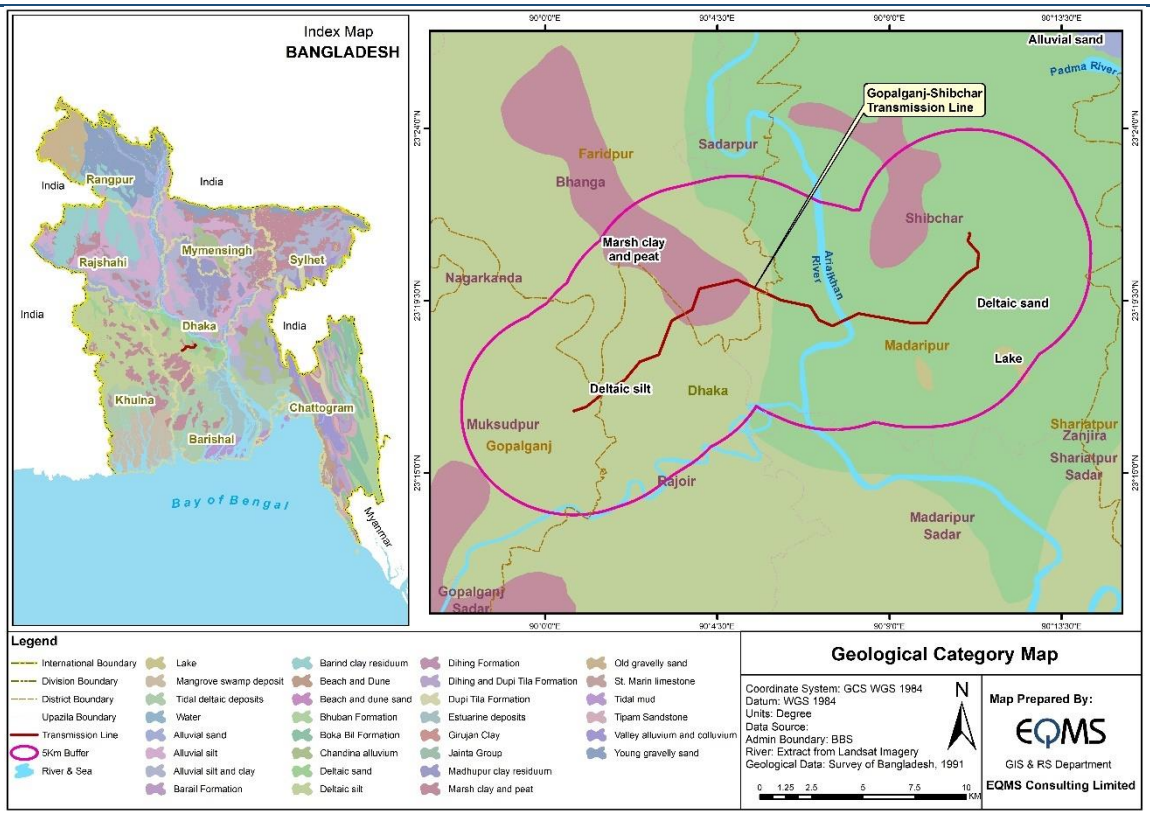
4.2.7 Geology

Bangladesh is situated to the east of the Indian sub-continental plate. Nearly 85% of Bangladesh is underlain by deltaic and alluvial deposits of the Ganges, Brahmaputra, and Meghna River systems. The project area consists of Holocene alluvial deposits in the floodplain and predominantly consisting of fine sand, silts and clay. The site is on deep Cenozoic deposits that overlie Precambrian basement rock. The Precambrian rocks form the basement of all geological formations of the Bengal Basin and shield areas. The materials deposited are a mixture of sediments transported by the old Brahmaputra and by the Jamuna (Brahmaputra) River. The generalized geological features of the project area are shown in the geological map of Bangladesh. As per the geological category map of Bangladesh, the majority of the 5km buffer of Satkhira- Manirampur route falls under Deltaic silt category (Figure 4-8). A portion of the alignment falls under the geological category of tidal deltaic deposits and marsh clay and peat. As per the geological category map, the majority of the 5km buffer of Gopalganj- Shibchar route falls under Deltaic silt and Deltaic sand categories (Figure 4-8). A portion of the Gopalganj- Shibchar alignment falls under the geological category of Lake and marsh clay and peat.

Figure 4-8: Geology of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur



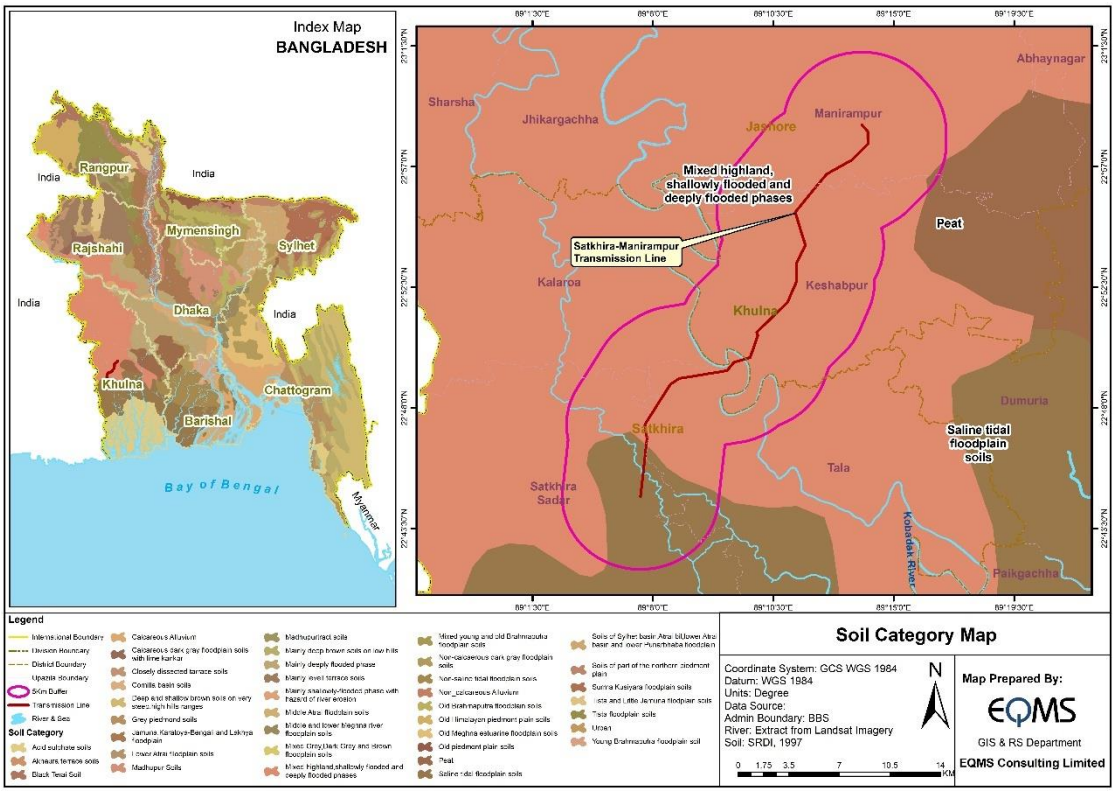
Gopalganj- Shibchar

Source: Survey of Bangladesh

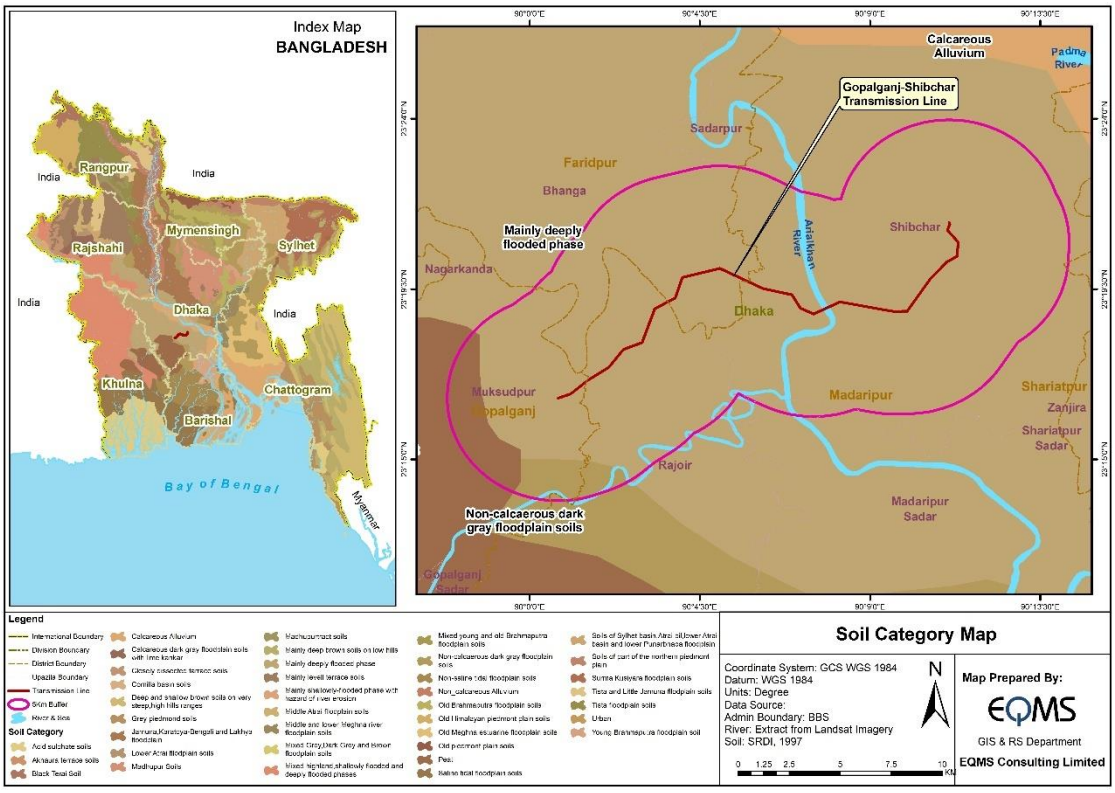
4.2.8 Soil

The project areas fall into seven different soil formation zones (Figure 4-9). The general soil types of 500m buffer of Satkhira- Manirampur route and Gopalganj- Shibchar route include the following: saline tidal floodplain, peat, mixed highland, shallow flooded and deeply flooded phase (Satkhira- Manirampur) and mainly deeply flooded phase, non-calcareous dark gray floodplain soils and calcareous alluvium soils in the north (Gopalganj- Shibchar). The soil category of Satkhira- Manirampur and Gopalganj- Shibchar is shown in Figure 4-9.

Figure 4-9: Soil Category of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur



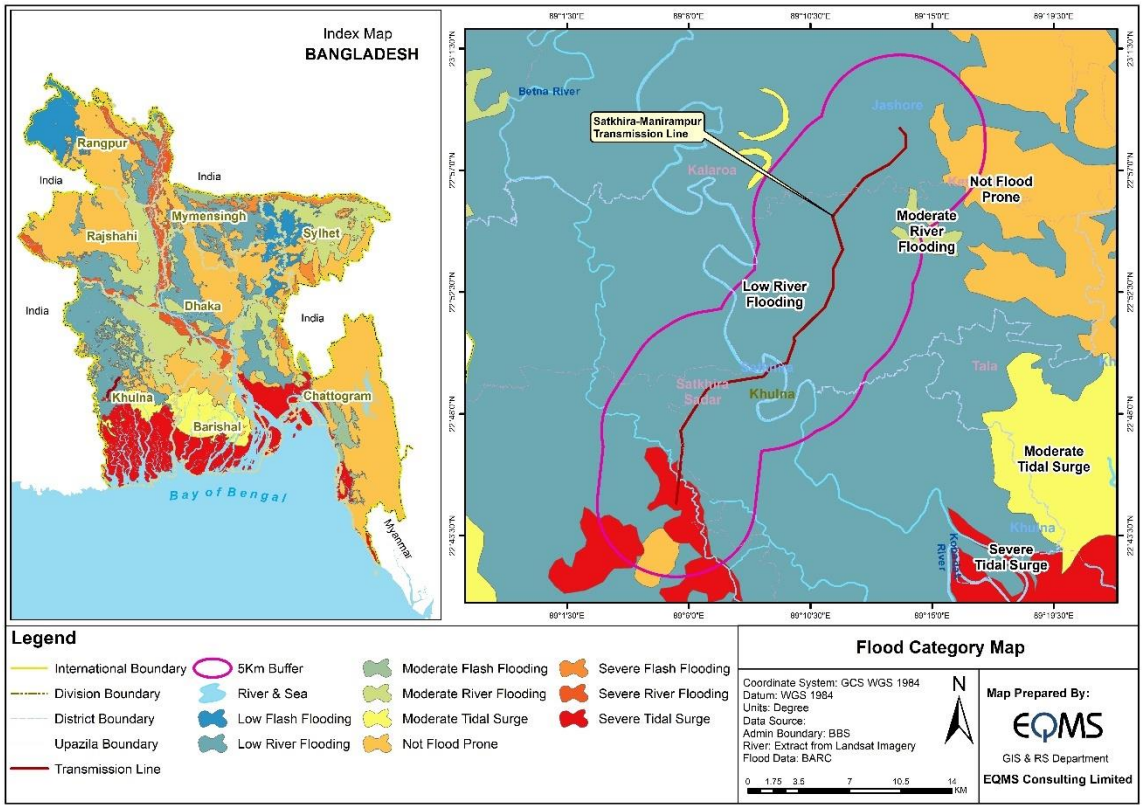
Gopalganj- Shibchar

Source: Soil Resource Development Institute (SRDI)

4.2.9 Flood prone areas

Bangladesh is prone to flooding, due to being situated on the Ganges Delta with many tributaries flowing into the Bay of Bengal. Flooding normally occurs during the monsoon season from June to September. The convectional rainfall of the monsoon is added to by relief rainfall caused by the Himalayas. Meltwater from the Himalayas is also a significant input and contributes to floods every year. This often lasts for about a month. Seventy-five percent of Bangladesh is less than 10 m above sea level and 80% is floodplain; therefore, the country is very much at risk of widespread damage due to floods, despite its development. Each year in Bangladesh about 26,000 km^2 (around 18%) of the country is flooded[3] [4]. As per the flood category map, Satkhira- Manirampur alignments fall under low river flooding zone. A portion of the 5km buffer is vulnerable to severe tidal surge. The flood category map of Gopalganj- Shibchar alignment shows that majority of the 5km buffer of the route is prone to moderate river flooding. Figure 4-10 represents flood prone areas of Satkhira- Manirampur and Gopalganj- Shibchar.

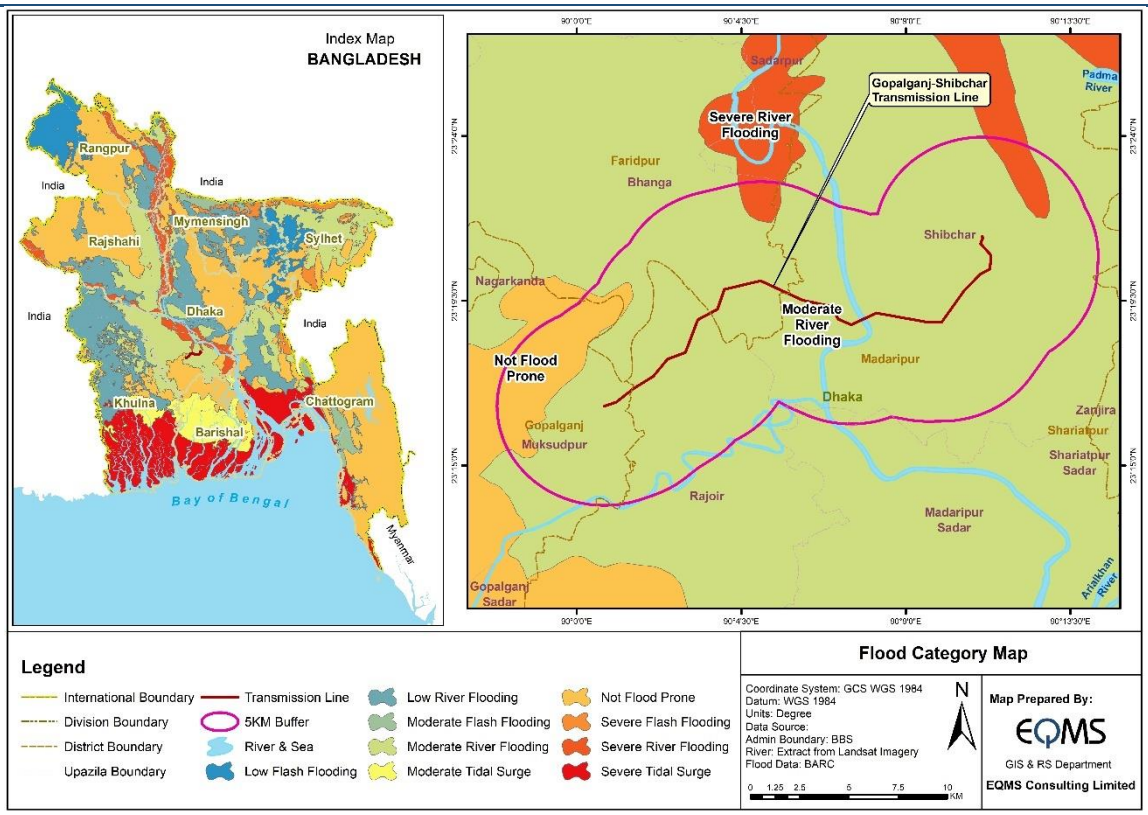
Figure 4-10: Flood Prone Category of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur

[3] http://en.banglapedia.org/index.php?title=Bangladesh Soil

[4] Bangladesh Agricultural Research Council (BARC)/GIS Project, BGD/95/006)



Gopalganj- Shibchar

Source: Bangladesh Agricultural Research Council (BARC)

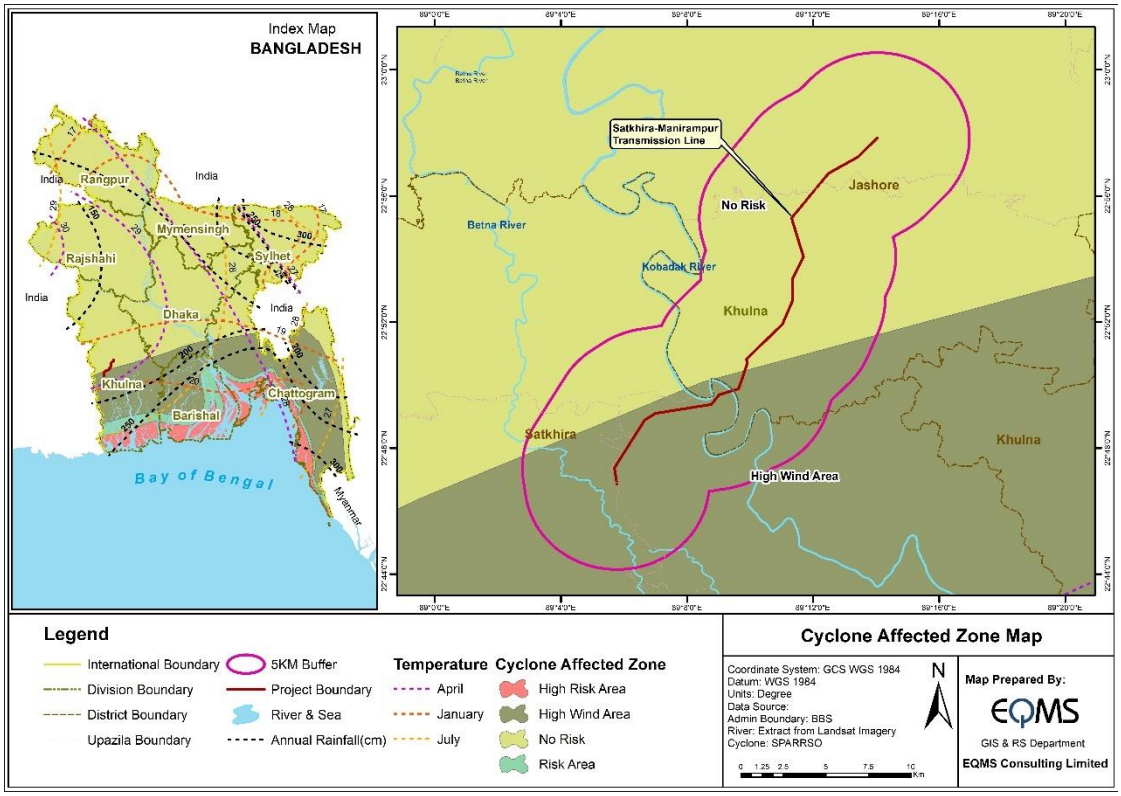
4.2.10 Cyclones

Bangladesh coast is one of the most cyclone prone areas of the world due to its geographical location and funnel shaped coast of the Bay of Bengal. Most of the damage occurs in the coastal regions of Khulna, Patuakhali, Barishal, Noakhali and Chattogram and the offshore islands of Bhola, Hatiya, Sandwip, Manpura, Kutubdia, Maheshkhali, Nijhum Dwip, Urir Char and other newly formed islands. Figure 4-11 shows cyclone affected area map of Bangladesh.

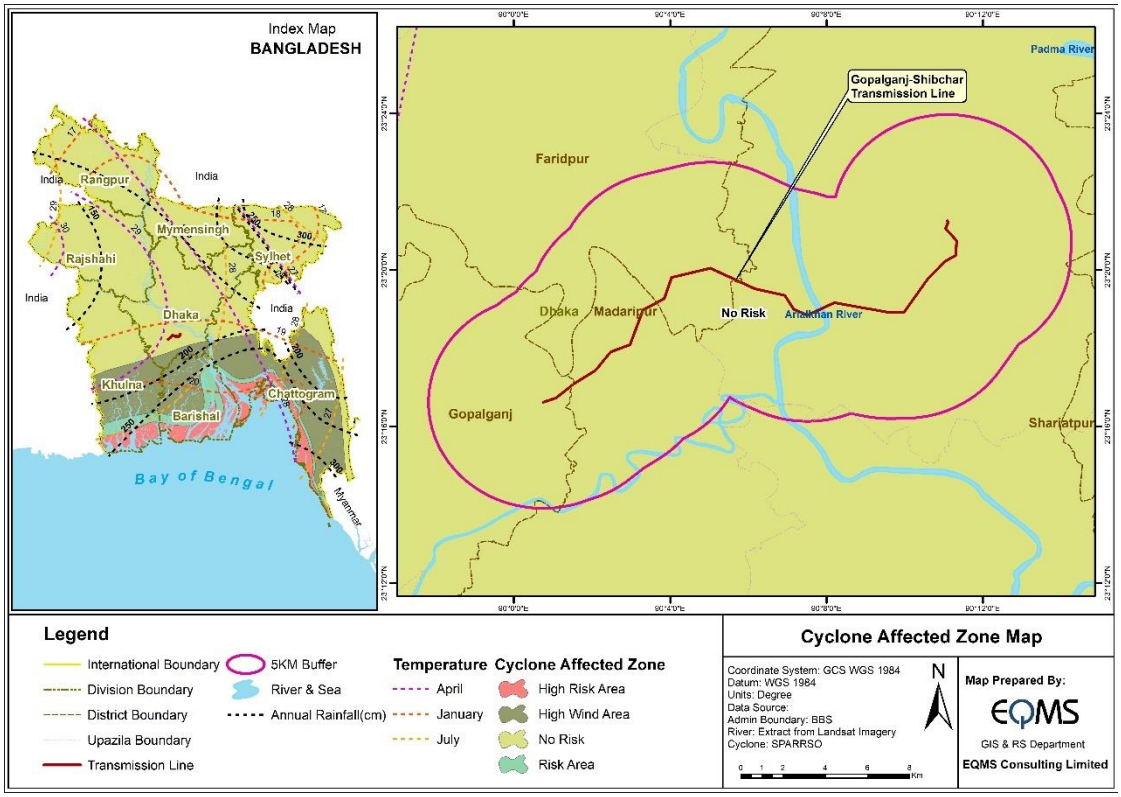
Devastating cyclones and associated storm surges hit the coastal zones almost every year and are usually accompanied by high-speed winds, sometimes reaching 250 km/hr. or more and with 3 m to 10 m high waves, causing extensive damage to life, property and livestock. These cyclones usually occur in two seasons, April- May and October-November i.e., before and after the monsoon season.

As per the cyclone affected zone map, majority of the Satkhira- Manirampur alignment and all of Gopalganj- Shibchar route do not pose any risk due to cyclone. A portion of the Satkhira- Manirampur route fall under high wind area. Figure 4-11 shows the cyclone affected zone map of the Satkhira-Manirampur and Gopalganj- Shibchar routes.

Figure 4-11: Cyclone affected zone map of the Satkhira- Manirampur and Gopalganj- Shibchar alignments



Satkhira- Manirampur



Gopalganj- Shibchar

Source: Bangladesh Space Research and Remote Sensing Organization (SPARRSO)

4.2.11 River Erosion

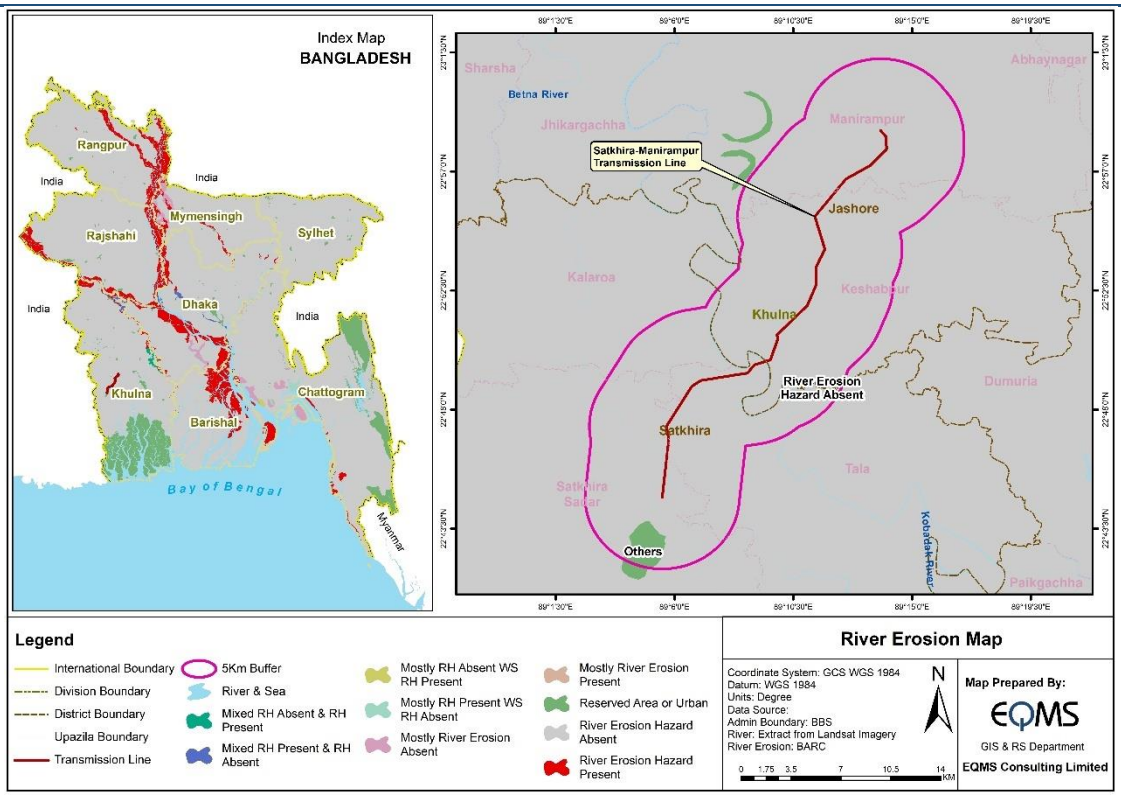
During the monsoon, extensive riverbank spills and riverbank erosion are typical. Riverbank erosion mainly occurs due to the braided nature of rivers in Bangladesh, and is further aggravated by heavy rainfall, particularly upstream, and increased water flow. Most recently, due to climate change, the rate of riverbank erosion has drastically increased, resulting in collapse of riverbanks and devastation of whole Unions and Upazila.

Every year, riverbank erosion leads to millions of people being affected as it results in damage and loss of crops, cattle, housing structures, and farmland. Additionally, it erodes away public infrastructure and communication systems. The unpredictable shifting behavior of the rivers and their encroachments not only affect the rural floodplain population but also the urban growth centers and infrastructures.

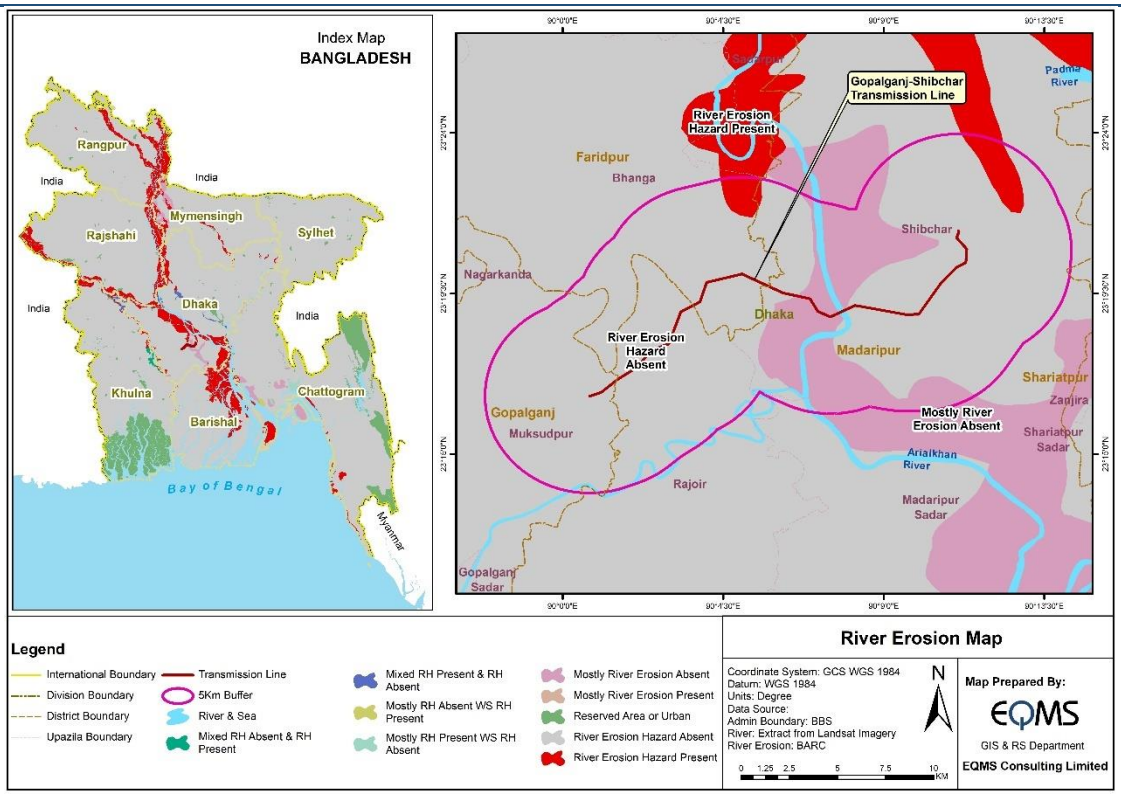
According to the Bangladesh Water Development Board (BWDB) the most erosion prone districts are Bogra, Sirajganj, Kurigram, Lalmonirhat, Gaibandha and Rangpur, in the country's north, and Chandpur, Manikganj, Rajbari Shariatpur, and Faridpur in Dhaka zone, with Tangail and Jamalpur in Mymensingh zone, and the coastal areas of Patuakhali. The most erosion prone area in Bangladesh is Sirajganj, which faced a total land erosion at a rate of 622.2 ha, according to a CEGIS study in 2009 (Unnayan Onneshan 2012).

As per river erosion map, river erosion hazard is absent in majority of the Satkhira- Manirampur route and Gopalganj- Shibchar route. The river erosion map of Satkhira- Manirampur and Gopalganj- Shibchar routes is shown in Figure 4-12.

Figure 4-12: River erosion map of Satkhira- Manirampur and Gopalganj- Shibchar routes.



Satkhira- Manirampur



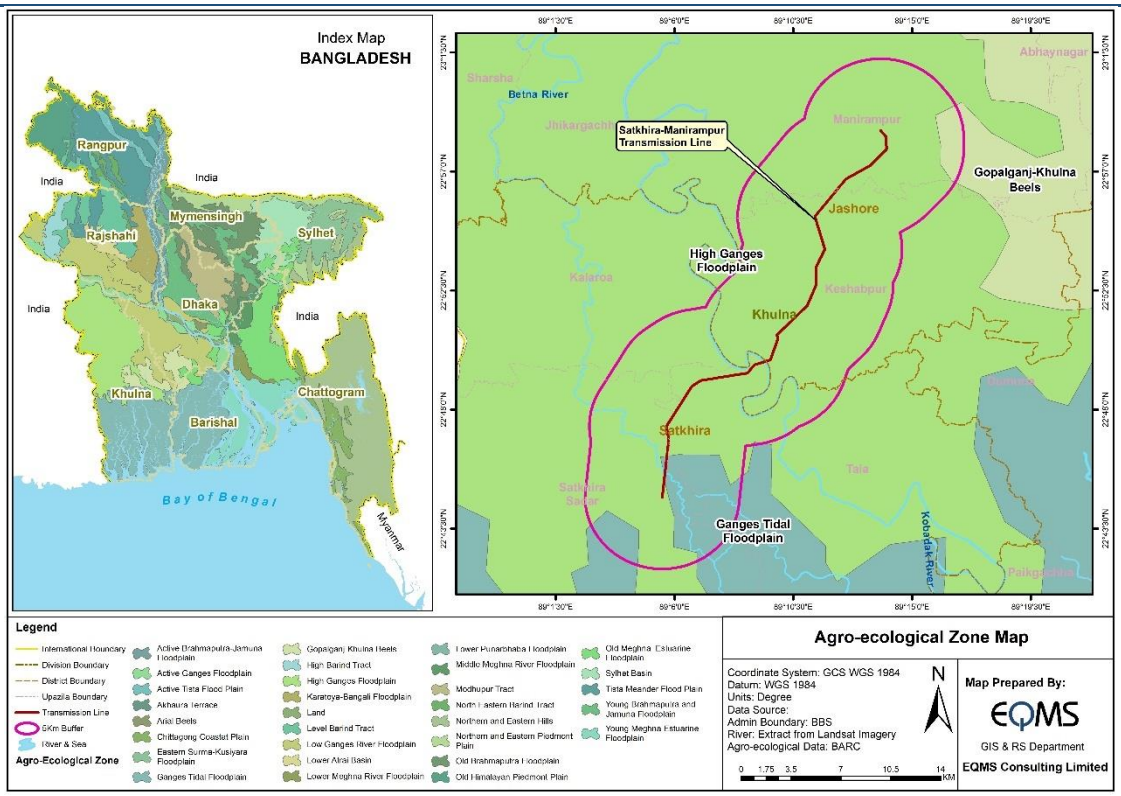
Gopalganj- Shibchar

Source: Bangladesh Agricultural Research Council (BARC)

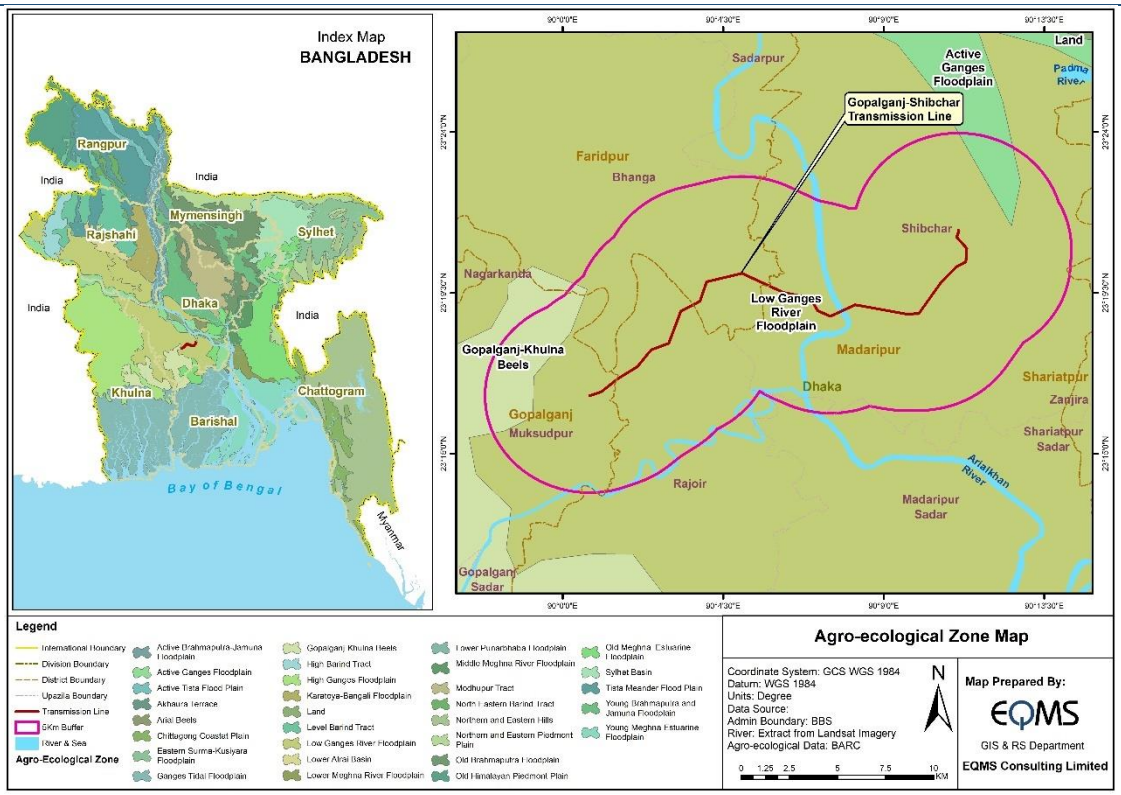
4.2.12 Agro-ecological zones of Bangladesh

The agro-ecological zones of Bangladesh have been identified based on four elements including physiography, soils, land levels in relation to flooding, and agro-climatology. Bangladesh has been tentatively divided into 30 agro-ecological zones. These 30 zones have been further subdivided into 88 agro-ecological sub-regions, which have been further subdivided into 535 agro- ecological units. Satkhira- Manirampur transmission line alignment falls in the High Ganges Floodplain. On the other hand, Gopalganj- Shibchar route fall in the Low Ganges River Floodplain. The Agro-ecological zone of Satkhira- Manirampur and Gopalganj- Shibchar has been shown in Figure 4-13.

Figure 4-13: Agro-ecological zone of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur



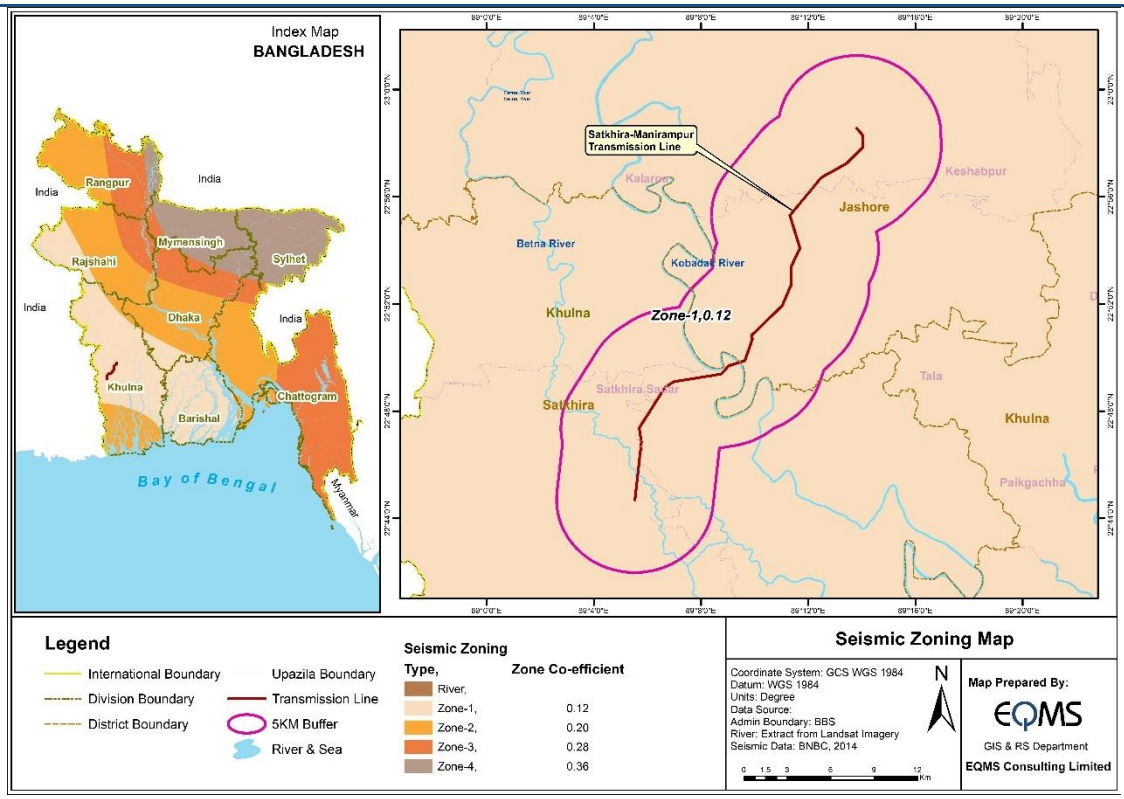
Gopalganj- Shibchar

Source: Bangladesh Agricultural Research Council (BARC)

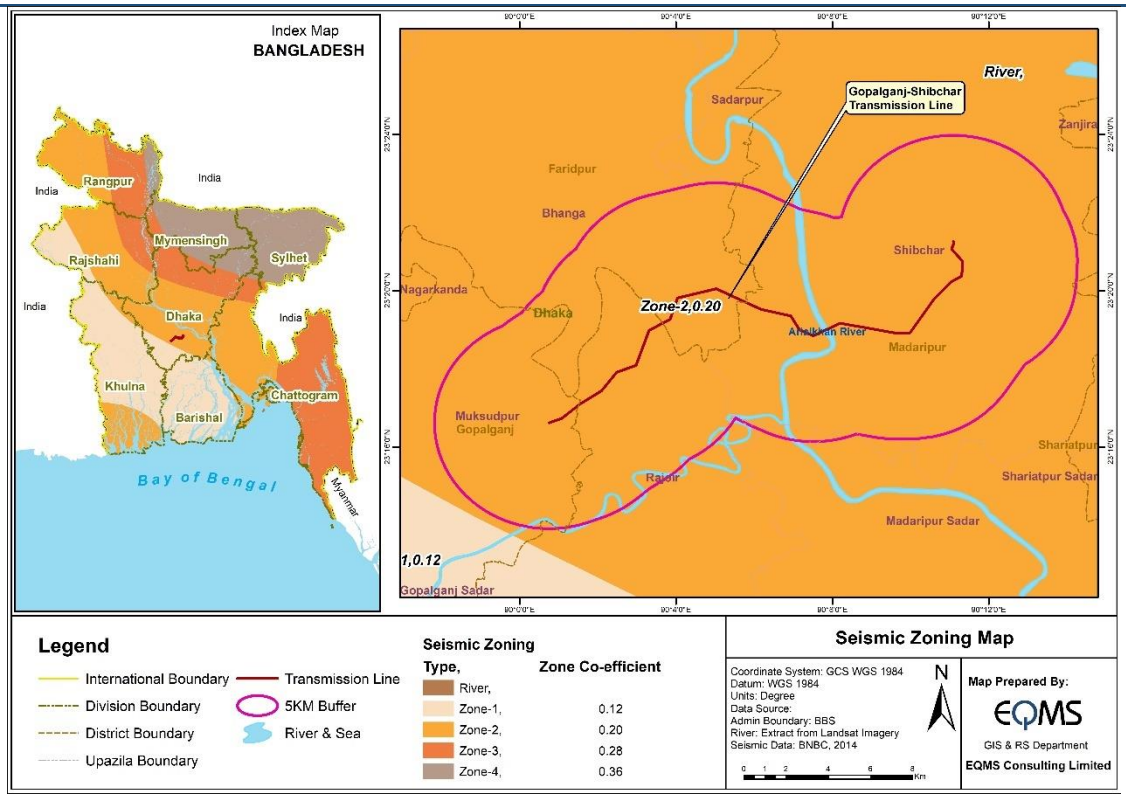
4.2.13 Seismic zones of Bangladesh

Bangladesh can be affected by moderate to strong earthquake events due to its proximity to the collision boundary of the Northeast moving Indian plate and the Eurasian Plate. Strong historical earthquakes with magnitude greater than 7.0 (Richter scale) have affected parts of Bangladesh in the last 150 years; some of them had their epicenters within the country. As per Bangladesh National Building Code (BNBC) seismic zoning map, Satkhira to Manirampur alignment falls into Zone-1 having the coefficient of 0.12. Gopalganj- Shibchar alignment falls in the Zone-2, which has the zoning coefficient of 0.20. The seismic zoning map of Satkhira- Manirampur and Gopalganj- Shibchar has been shown in Figure 4-14.

Figure 4-14: Seismic zoning of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur



Gopalganj- Shibchar

Source: Bangladesh National Building Code (BNBC)

4.2.14 Land Use Interpretation of the Study Area

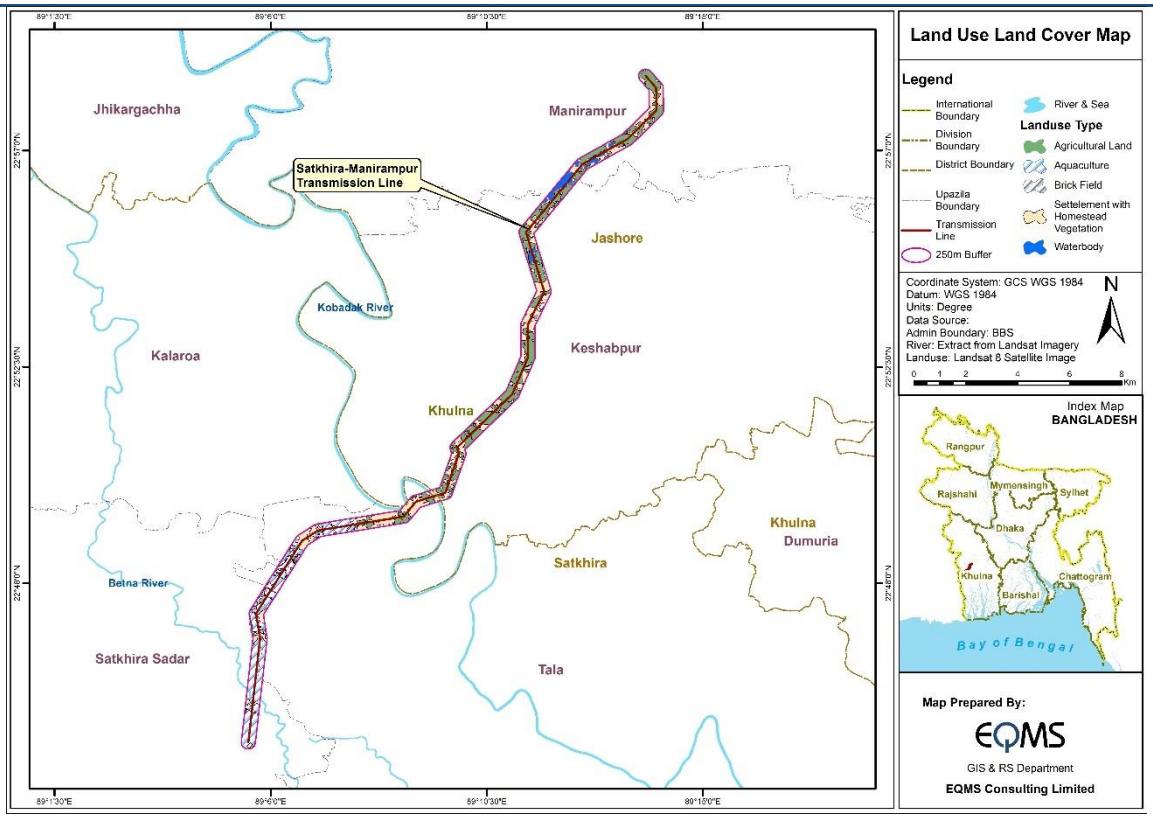
4.2.14.1 Satkhira to Manirampur

The predominant land use-land cover of 500 m buffer (250m each side of the alignment) of Satkhira to Manirampur route includes homestead plantation and vegetation (35.60%) and agriculture land (34.65%). Other category land-use and land cover in the study area includes brick kiln (1.29%) and waterbody (3.88%), Aquaculture (24.58%) etc. During the survey, no settlements were found beneath the proposed transmission line route. The major waterbodies covered are rivers and gher, however, the transmission line will not pose any risk to seasonal habitats/wetlands and birds. The land use of the study area is presented in Table 4-20 and Figure 4-15.

Table 4-20: Land Use Pattern for Satkhira to Manirampur Route

Type	Area (Acres)	Percentage
Agricultural Land	1435.86	34.65
Aquaculture	1018.83	24.58
Brick Field	53.50	1.29
Settlement with Homestead Vegetation	1475.21	35.60
Waterbody	160.93	3.88
Total	**4144.33**	**100.00**

Figure 4-15: Land Use Map of Satkhira to Manirampur Route



Source: GIS Mapping and Interpretation of Satellite imagery by EQMS

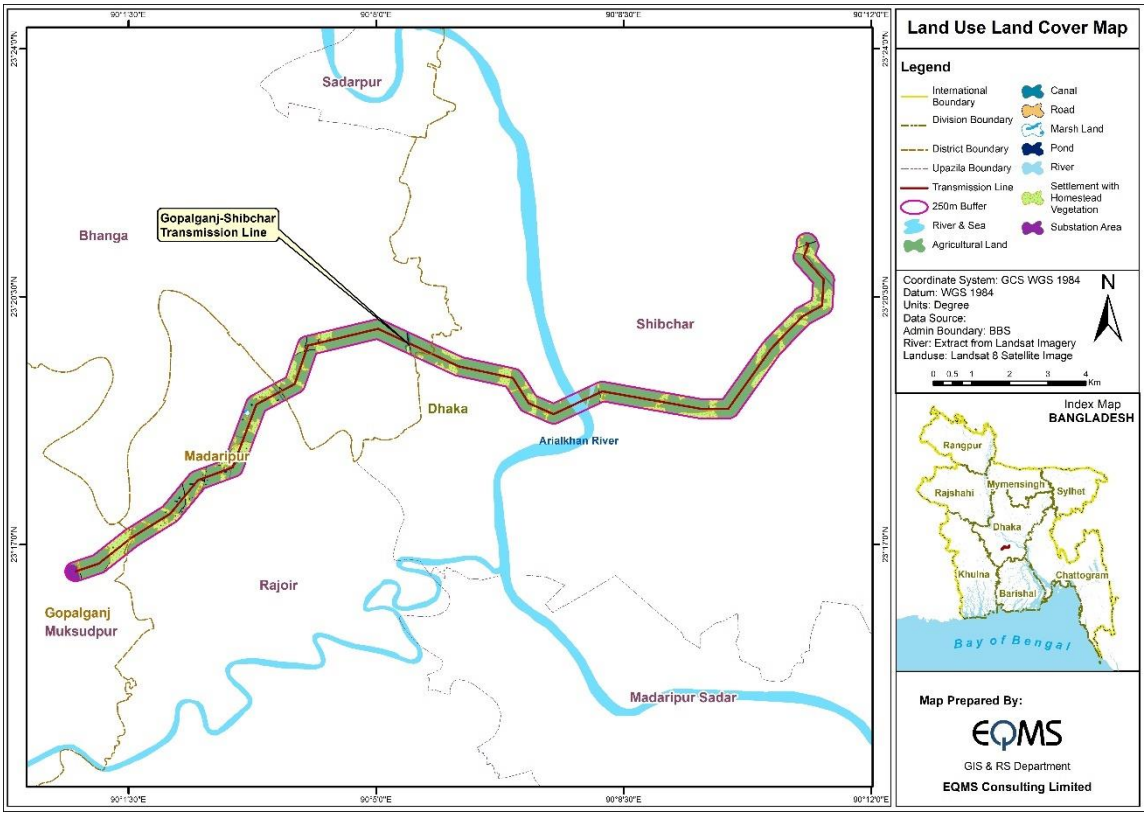
4.2.14.2 Gopalganj to Shibchar

The significant land use-land cover of 500 m buffer (250m each side of the alignment) of Gopalganj to Shibchar route includes homestead plantation and vegetation (22.61%) and agriculture land (73.19%). Other category land-use and land cover in the study area includes Marsh lands (0.14%) and waterbody (2.69%), road (0.45%) and substation area (0.92%) etc. During the survey, no settlements were found beneath the proposed transmission line route. The 230 kV transmission line will not pose any risk to seasonal habitats/wetlands and birds. The land use of the study area is presented in Table 4-20 and Figure 4-16.

Table 4-21: Land Use Pattern for Gopalganj to Shibchar Route

Type	Area (Acres)	Percentage
Agricultural Land	2302.95	73.19
Waterbodies	84.67	2.69
Marsh lands	4.35	0.14
Settlement with Homestead Vegetation	722.50	22.61
Road	14.18	0.45
Substation area	28.89	0.92
Total	**3146.53**	**100.00**

Figure 4-16: Land Use Map of Gopalganj to Shibchar Route



Source: GIS Mapping and Interpretation of Satellite imagery by EQMS

4.3 Bio-Ecological Zones

Within a relatively small geographic area, Bangladesh has a diverse array of ecosystems. Being a low-lying deltaic country, seasonal variation in water availability is the major factor, which generates different ecological scenarios in Bangladesh. Temperature, rainfall, physiographic variations in soil and different hydrological conditions play vital roles in the country's diverse ecosystems. The ecosystems of Bangladesh are categorized into two major groups: (i) land based and (ii) aquatic. The land-based ecosystems include forest and hill ecosystems, agroecosystems and homestead ecosystems, while seasonal and perennial wetlands, rivers, lakes, coastal mangroves, coastal mudflats and chars, and marine ecosystems fall into the aquatic category.

In 2002, the International Union for Conservation of Nature (IUCN) classified the country into 12 bio-ecological zones (25 sub-bio-ecological zones) according to factors such as fauna and flora, geographical characteristics, annual average rainfall, administrative regions, soil types, water level in Bangladesh.

4.3.1 Diversity of Floral and Faunal Species

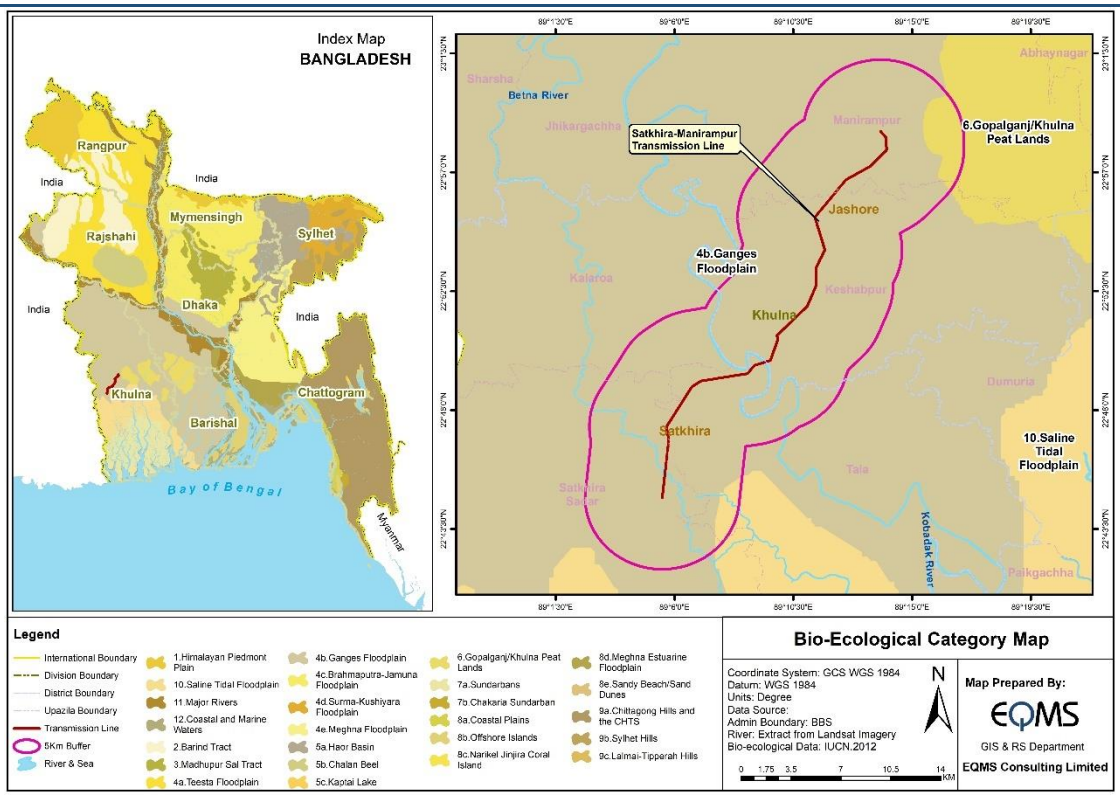
The subproject impact areas are mixed with different vegetation. Crops and vegetables dominate and are cultivated in the surrounding areas and include mainly paddy (rice), jute, mustard, onion, garlic, potato and a variety of homestead vegetables. A sizeable number of fruit trees with economic value were observed in the project area.

As per EQMS Survey 2022, In Satkhira to Manirampur transmission line, the number of trees estimated in the 12 m clearing width of the line was 1,149 (>5 m in height). The common trees are Areca nut palm, Date palm (Khejur), Mahogany, Mango, Margosa, and Palmyra. The number of trees in the clearing width which are less than 5 m was 969.

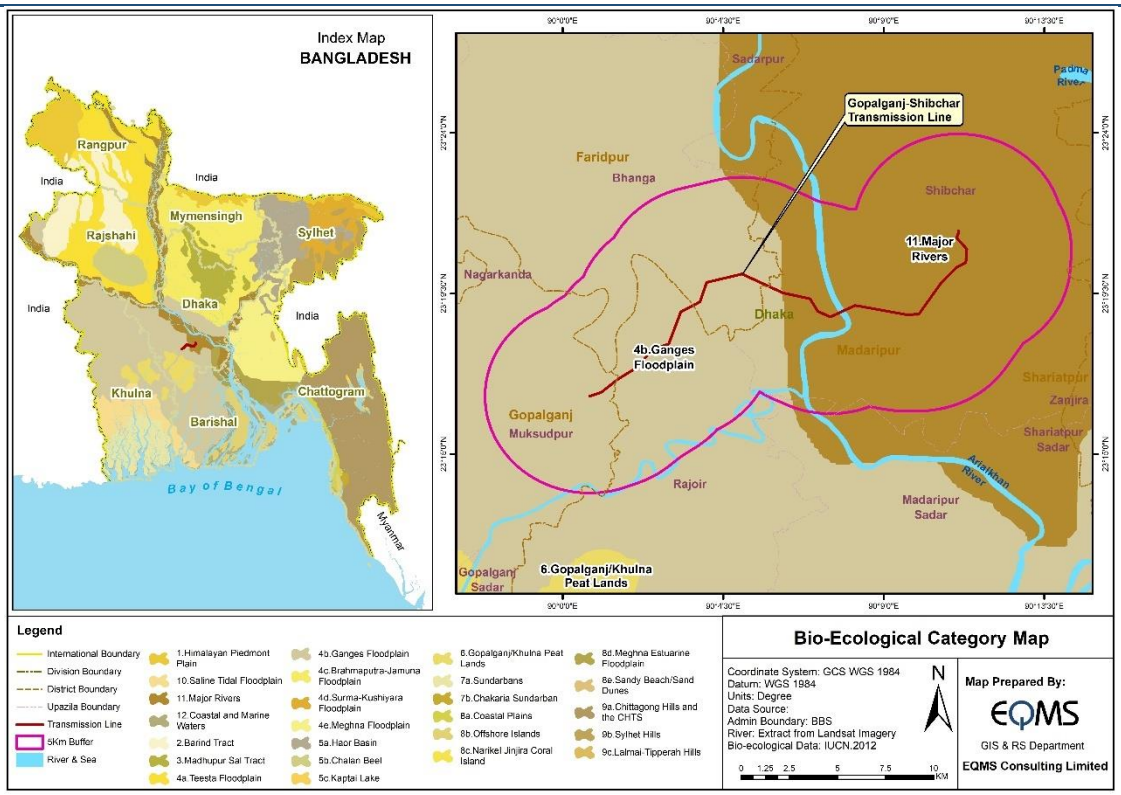
The trees which are greater than 5 m in height found in the direct impact zone (12 m clearing width) of the Gopalganj (N)-Shibchar 230 kV Transmission Line is 1,553 excluding bamboo and banana trees. The trees less than 5 m in height recorded at 3,329 within the direct impact zone. The common tree species are Albizia (Karol), Mahogany, Mango, Palmyra, Dalbergia (Shisu), Jackfruit, Date palm, Acacia and Chamble.

No IUCN Red listed threatened species were recorded during site visit walkover. Major waterbodies covered in the alignments are rivers and gher. The proposed transmission line will not pose any risk to seasonal habitats/wetlands and birds. Bio-ecological Zones of Satkhira- Manirampur and Gopalganj-Shibchar is shown in Figure 4-17.

Figure 4-17: Bio-ecological Zones of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur



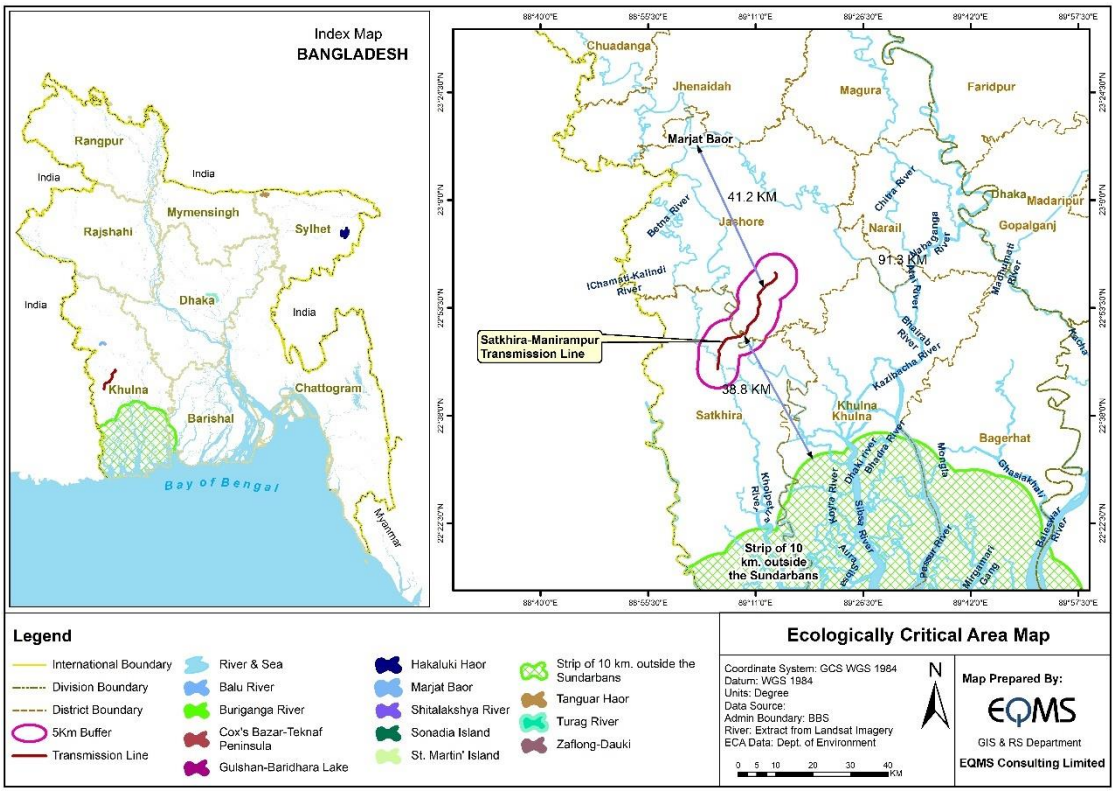
Gopalganj- Shibchar

Source: International Union for Conservation of Nature (IUCN)

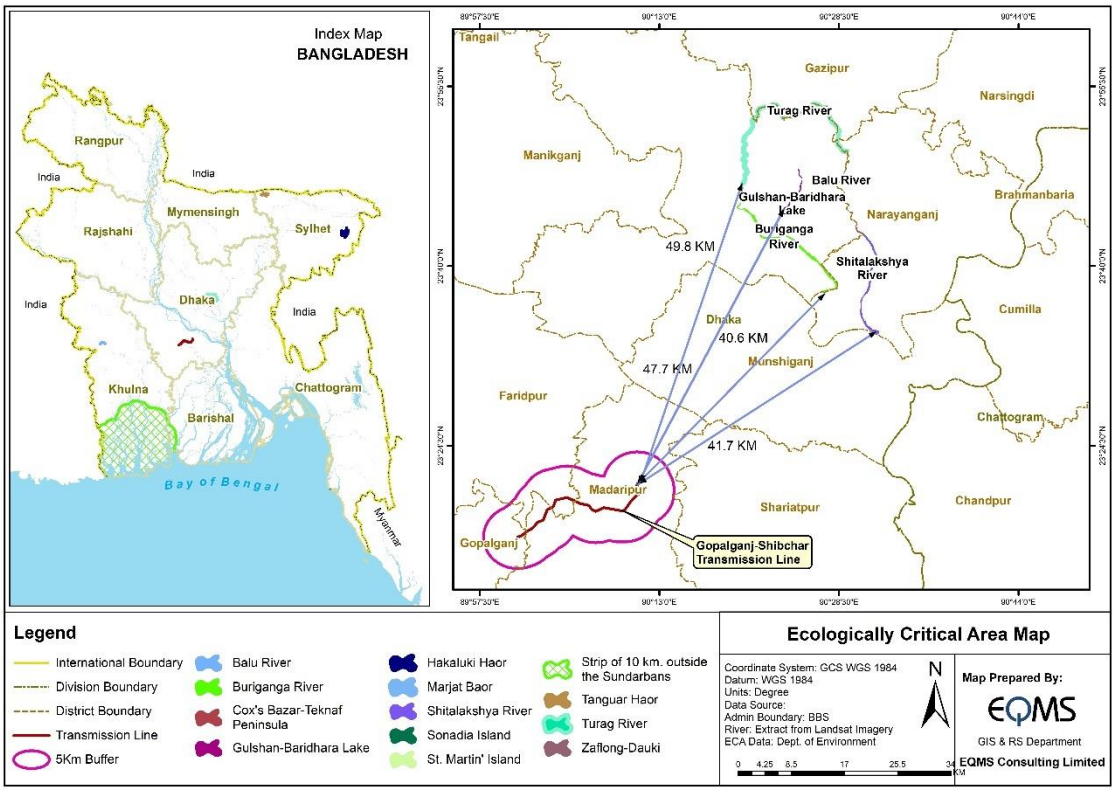
4.3.2 Ecologically Critical Area (ECA)

There are two ECAs situated near Satkhira- Manirampur transmission line. These are the Sundarbans and Marjat Baor. The Sundarbans border lies 38.8 km away from transmission line and Marjat Baor situated far away from the line is about 41.2 km. The nearest ECA from the Gopalganj- Shibchar alignment is Buriganga river. The approximate distance from the route is 40.6km. The ECAs near transmission lines of Satkhira- Manirampur and Gopalganj- Shibchar is shown in Figure 4-18.

Figure 4-18: ECAs near transmission lines of Satkhira- Manirampur and Gopalganj- Shibchar



Satkhira- Manirampur



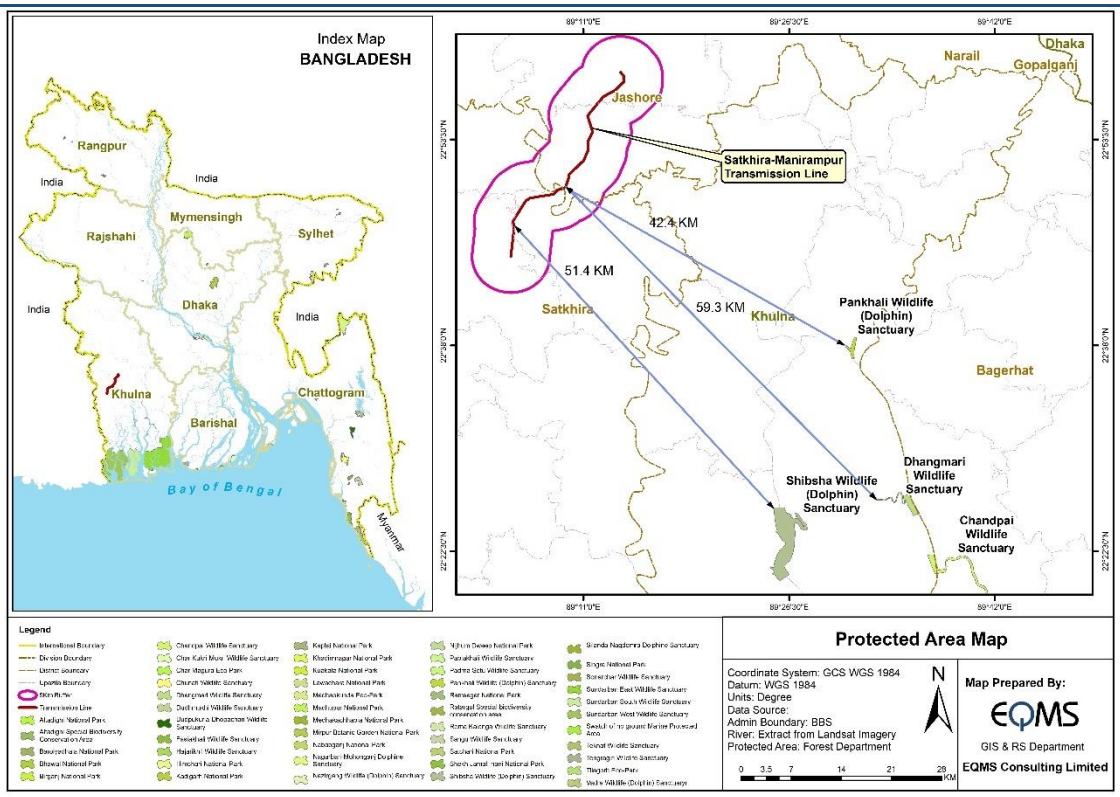
Gopalganj- Shibchar

Source: Department of Environment (DOE)

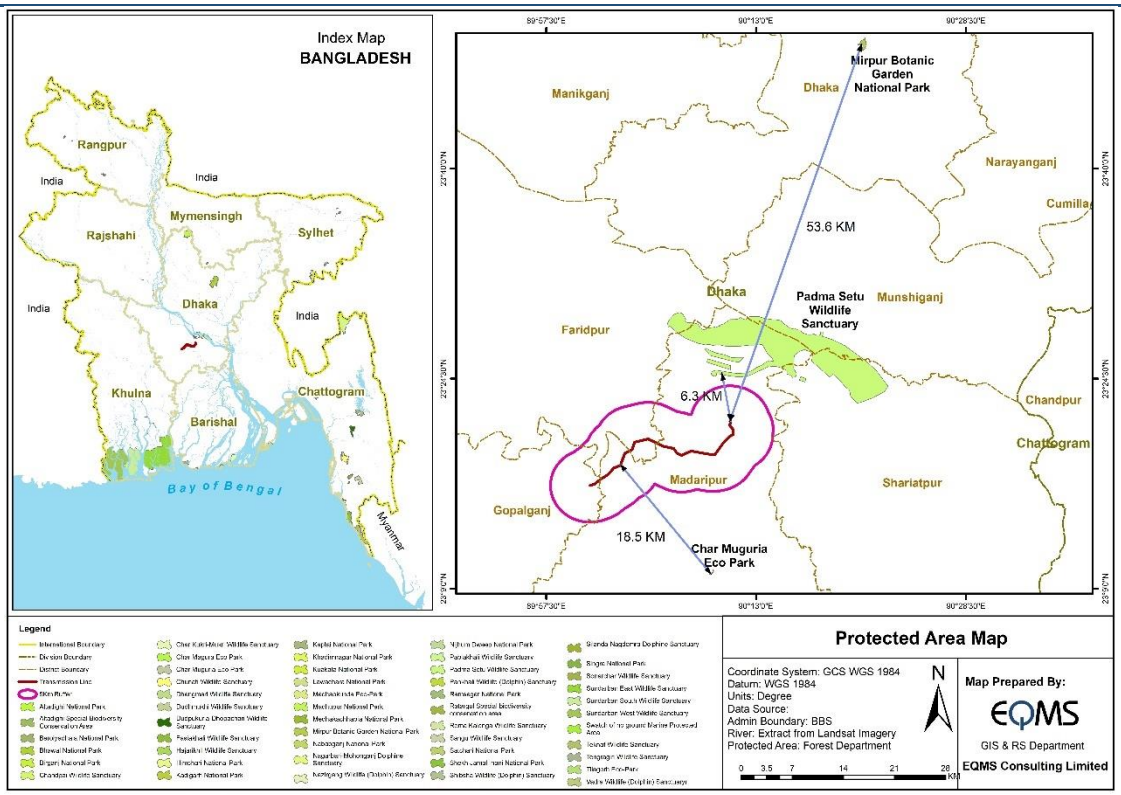
4.3.3 Protected Areas

The nearest protected areas that are situated in the South-East corner from Satkhira- Manirampur transmission line are: Pankhali Wildlife (Dolphin) Sanctuary (42.4km), Shibsha Wildlife (Dolphin) Sanctuary etc. The nearest protected area from Gopalganj- Shibchar route is Padma Bridge Wildlife Sanctuary (6.3km).

Figure 4-19: Protected areas near transmission lines of Satkhira- Manirampur and Gopalganj-Shibchar



Satkhira- Manirampur



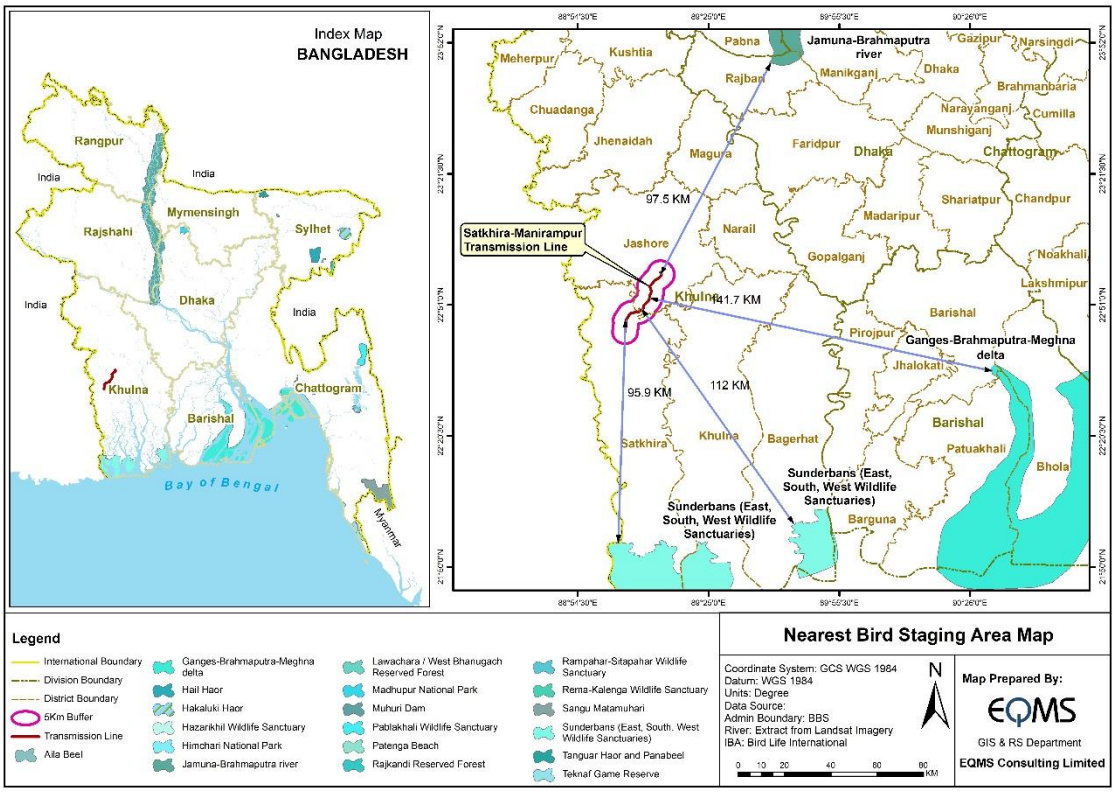
Gopalganj- Shibchar

Source: Forest Department (FD)

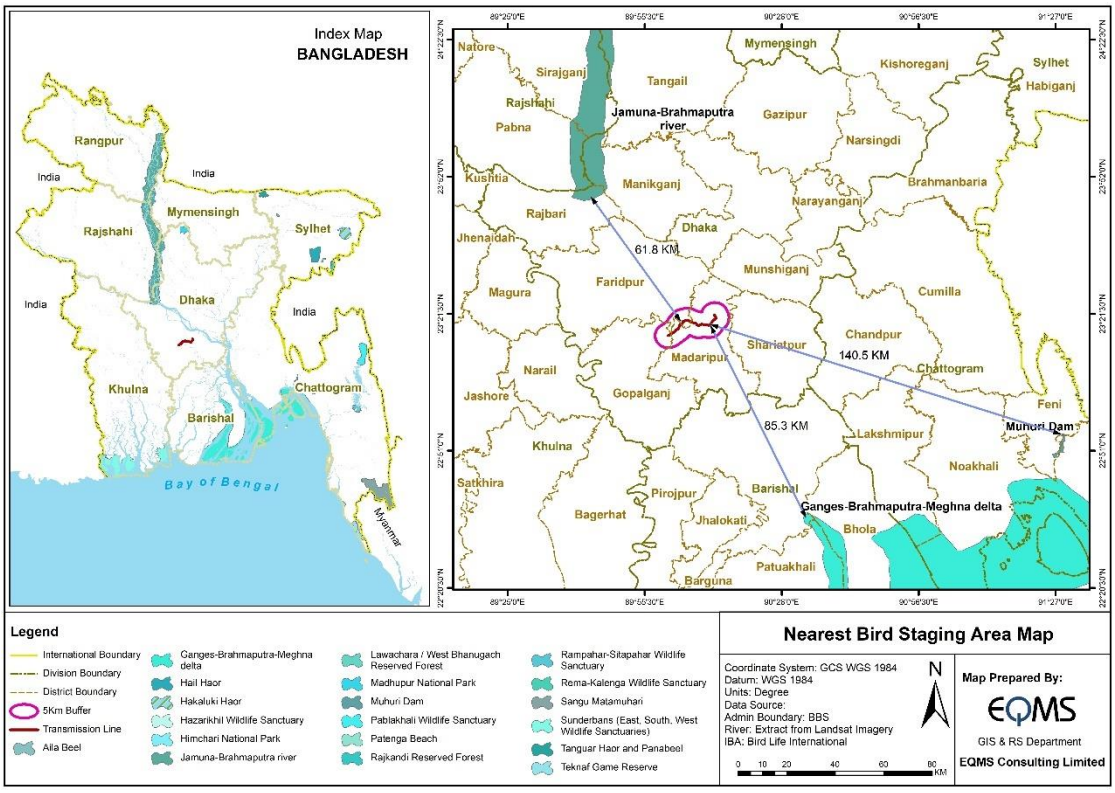
4.3.4 Important Bird Areas

Bangladesh's Important Bird Areas (IBAs) cover less than 4% of the total land area of the country, reflecting the great reduction and fragmentation of natural habitats. However, additional sites are likely to be added to this preliminary list of IBAs in the future. Of the 20 IBAs in Bangladesh, 11 support globally threatened species, 10 have biome-restricted species and nine qualify as IBAs because they hold large congregations of water birds. Ten IBAs (53%) contain examples of terrestrial forest ecosystems, which together cover all significant areas of forest known to remain in Bangladesh. They include the Indo- Malayan tropical dry forests in Madhupur National Park (IBA 1) to the north of Dhaka, three IBAs in north-eastern Bangladesh where Indochinese tropical moist forest is the dominant biome, and six IBAs in the Chattogram hill tracts in the south-east of the country, where Indochinese tropical moist forest and Sino-Himalayan subtropical forest are the main habitats. The nearest IBA, the Sundarbans (East, South, West Wildlife sanctuaries) is located at 95.9 km away from the Satkhira to Manirampur route. The nearest IBA, Jamuna-Brahmaputra River is located at 61.8 km away from the Gopalganj- Shibchar route. Figure 4-20 shows the transmission alignments and the nearest IBAs.

Figure 4-20: Project locations and nearest Bird Staging Areas (IBA) in Bangladesh



Satkhira to Manirampur



Gopalganj to Shibchar

Source: BirdLife International

4.4 Socio- economic Information and Profile

4.4.1 Satkhira to Manirampur

The socio-economic profile of the affected HHs is presented following demographic profile of the HHs. A total of 138 HHs comprising 516 people will be affected by the project with average HH size 3.8 which is lower than the national average (4.3) according to BBS (2011).

Table 4-22: General Profile of Affected Population

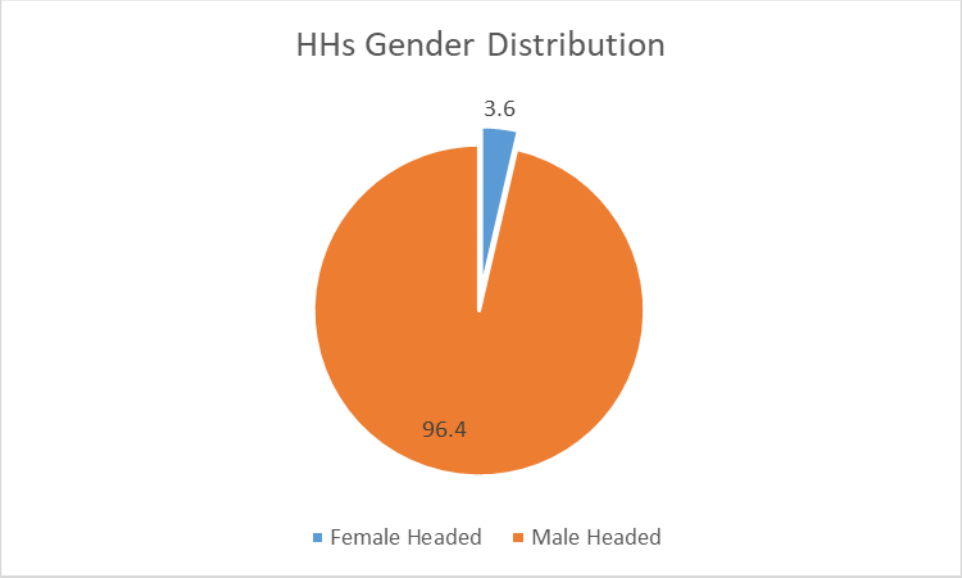
Number of total affected households	138
Number of total populations	516
Average HH size	3.8

Source: EQMS census and IOL survey, January 2022

4.4.1.1 Demographic Profile of Affected HHs

Demographic profile of the affected community has been analyzed as part of socioeconomic profile of the project area. This comprises of gender profile and age-sex distribution of the PAPs. Precisely, only 3.6% of the HHs are female headed, while the remaining 96.4% are male headed HHs against 88% male headed HHs in national level (BBS, 2011)[5]. However, the general scenario in Bangladesh is similar as most of the HHs are headed by male.

Figure 4-21: HHs Gender Distribution in the project area



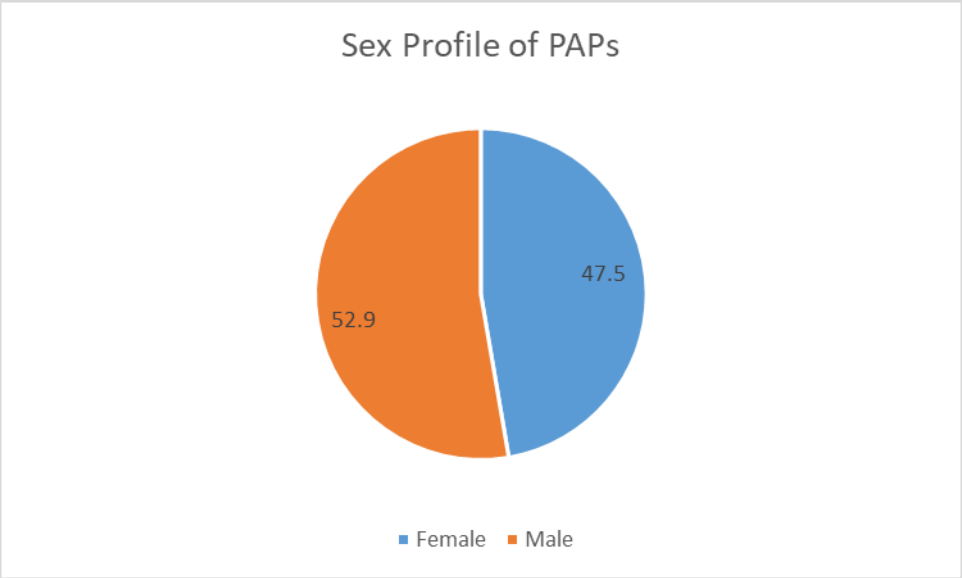
Source: EQMS census and IOL survey, January 2022

4.4.1.2 Sex Profile of Affected Populations

Sex profile of the affected HHs is shown in Figure. From the sex profile, we can find out that the percentage of male populations is higher than the females in the project area. The overall male female ratio of the project area is 100:112.98 (the national ratio is 100:99.68) which implies that the project area is different from the corresponding national condition with a higher female population.

[5] POPULATION AND HOUSING CENSUS 2011, Socio-Economic and Demographic Report, National Series, Volume - 4

Figure 4-22: Sex Profile of the affected population

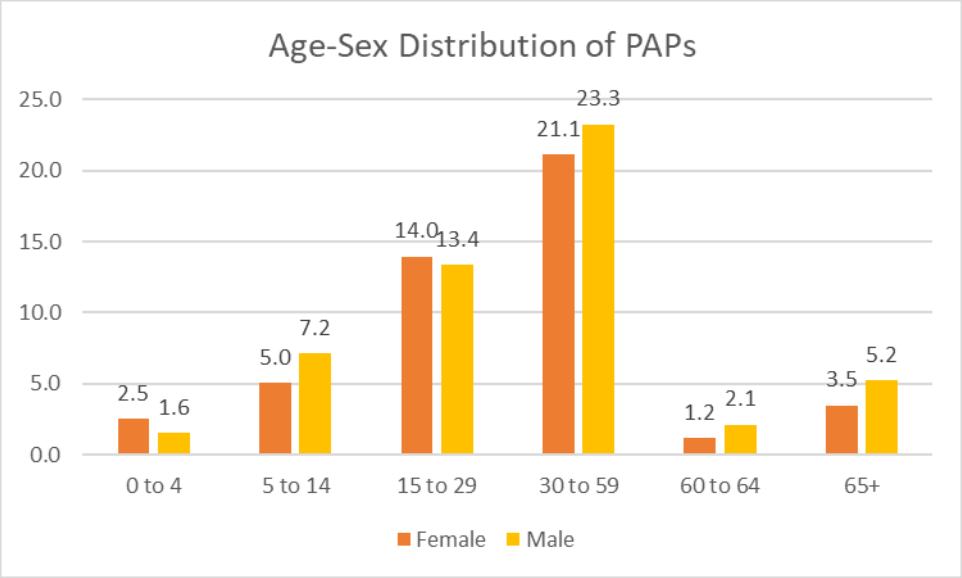


Source: EQMS census and IOL survey, January 2022

4.4.1.3 Age and Sex Distribution of Affected Population

Figure to the below presents age-sex distribution of the affected HHs. The survey findings indicate that population percentage increases respectively from the age group of 5-14 years. According to the age group distribution, the most prominent one is 30-59 years, which comprises of 23.3% of the total male population and 21.1% of the total female population. The numbers of affected persons steadily decrease at age limit 60-64 years. The steady decline in the number of populations after this age limit can be considered significant for low life expectancy in the region. It is almost similar to the national scenario.

Figure 4-23 Age-Sex Distribution of PAPs in the project area



Source: EQMS census and IOL survey, January 2022

4.4.1.4 Level of Education of PAPs

Education level of the affected population is presented in the below Table. The table demonstrates that primary and secondary level enrolment is high in the area. It also indicates that higher education rate is

high among female population. Furthermore, illiteracy is high among male population. HH members whose age is 5 years and above are counted in this analysis. As per the consultation and site visit, there were no educational institutions under the transmission lines. Survey team found Aminpur Shyamkur Govt. Primary School and Shikarpur Government Primary School which are distanced from the line approximately 500 meters. During consultation and socio-economic survey, consultants found that the proposed project will not hamper the regular activities of these educational institution.

Table 4-23 Level of Education of PAPs

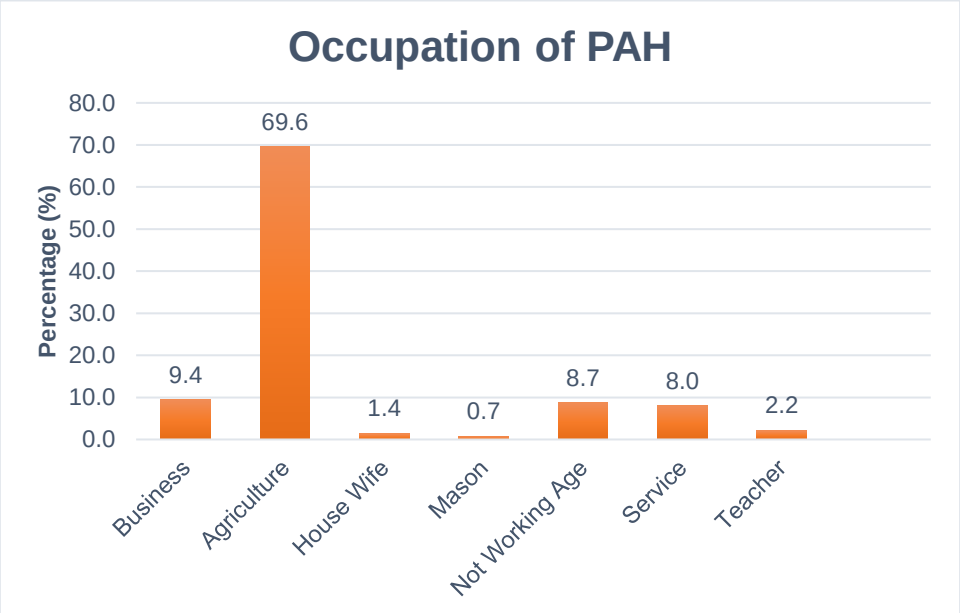
Level of Education	Female		Male	
	Count	%	Count	%
Primary	90	17.4	88	17.1
SSC	53	10.3	53	10.3
HSC	25	4.8	38	7.4
Hon's or Equivalent	14	2.7	25	4.8
MA or Equivalent	6	1.2	18	3.5
Islamic Education (Madrasa)	0	0.0	1	0.2
Not School Going Age	16	3.1	13	2.5
Illiterate	40	7.8	36	7.0
Total	244	47.3	272	52.8

Source: EQMS census and IOL survey, January 2022

4.4.1.5 Primary Occupation of PAHs

According to the census of the affected households 69.6% HHs primary occupation is agriculture. There will not be any impact on their income as compensation will be paid for the entire season and after one season; affected HHs will be able to use land as usual. Based on the income level, their socio-economic condition is better than rest of the population in that region. In addition to Agriculture, the other significant occupations are business, retired person, service, etc.

Figure 4-24: Occupation of PAH

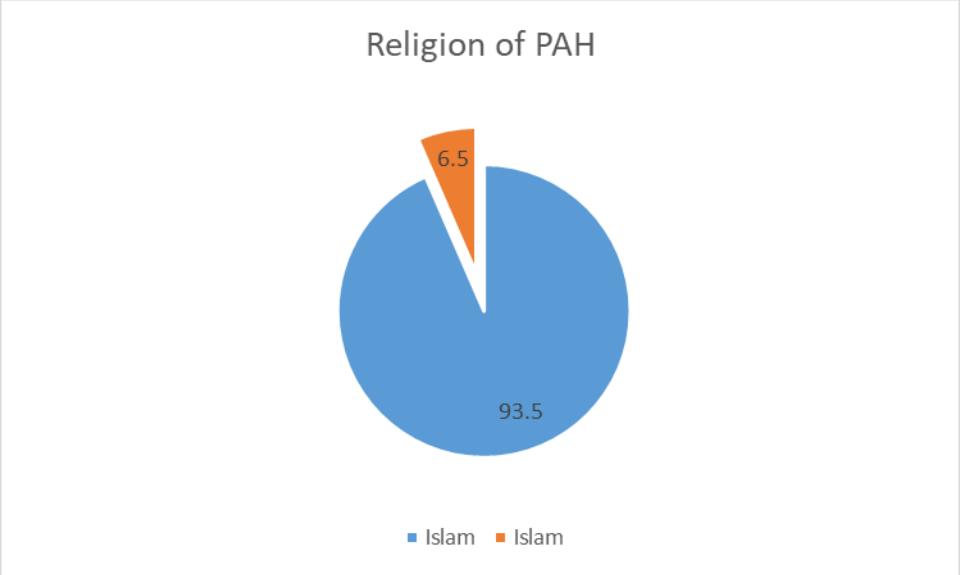


Source: EQMS census and IOL survey, January 2022

4.4.1.6 Religion of PAHs

The religious background of the affected HHs is presented in figure revealing that most of the population of affected household are Muslim (93.5%). On the other hand, 6.5% of the affected households are Hindu in religion in this project area. Therefore, there is no opportunity for religious discrimination through this project.

Figure 4-25: Religion of PAHs in the Project Area



Source: EQMS census and IOL survey, January 2022

4.4.1.7 Income of Affected HH

The average monthly incomes of 34.7% households are Tk 10,000 to 15,000. Another 21.7% have monthly incomes ranging from Tk 15,000 to Tk 25,000. Households receiving monthly incomes between Tk 5,000 to Tk 10,000 are 15.2%. Monthly incomes of the below 5,000 are 1.4%. As per the official poverty line of Bangladesh, households earning an annual income of less than Tk 102,000 are considered those living below the poverty line.

Table 4-24: Monthly Income of the AHHs

Monthly Income	Frequency	Percent (%)
Below 5000	2	1.4
5000 to 10000	21	15.2
10000 to 15000	47	34.1
15000 to 25000	30	21.7
25000 to 35000	12	8.7
35000 to 45000	5	3.6
Above 45000	5	3.6
Total	122	88.4

Source: EQMS census and IOL survey, January 2022

4.4.1.8 Energy Use of PAHs

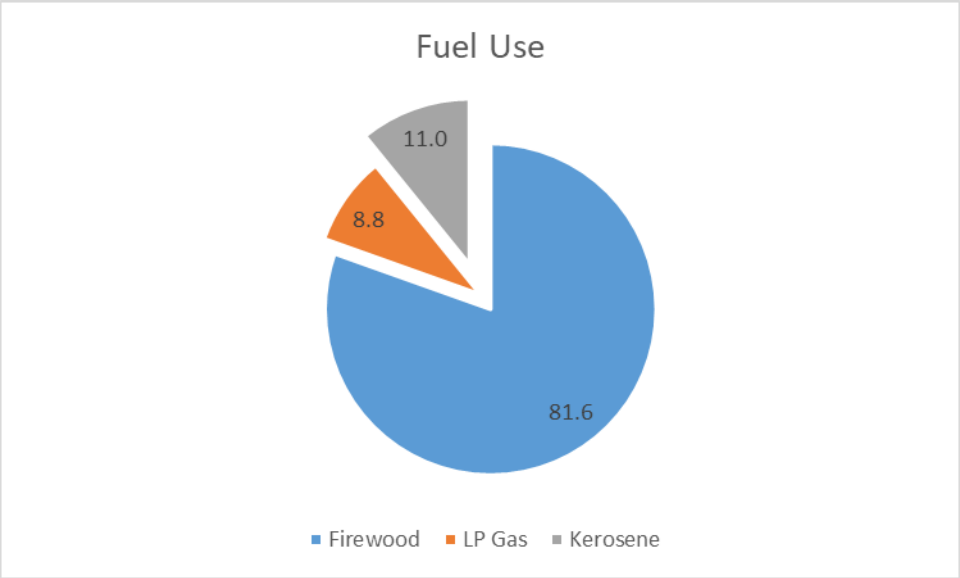
Electricity is the main source of lighting for 100% grid connected households. Households use multiple and combined energy sources for domestic purposes. Electricity is also used by 41.6% in combination with firewood and kerosene.

Households in the project affected areas experience frequent load shedding which deprives them regular supply of electricity throughout the day. Daily power shedding is extensive and continues for several hours both daytime and night. Load shedding adversely affect the farmers in irrigating their cultivation fields and providing a regular supply of water, children's studies at nighttime, and women in watching television programs during their leisure time. Sleep at night after a day's hard work is difficult as they cannot operate fans particularly during warm seasons. Despite irregular and limited power supply, households lament over having to pay high electricity bills.

4.4.1.9 Fuel Source of PAHs

Firewood is the main source of energy used by most of the households (81.6%) for cooking and boiling purposes followed by 8.6% using liquefied petroleum gas, particularly by people living closer to urban areas. Kerosene is used by 11.0% which is very harmful for the health and environment caused by indoor pollutants.

Figure 4-26: Fuel Source of PAHs



Source: EQMS census and IOL survey, January 2022

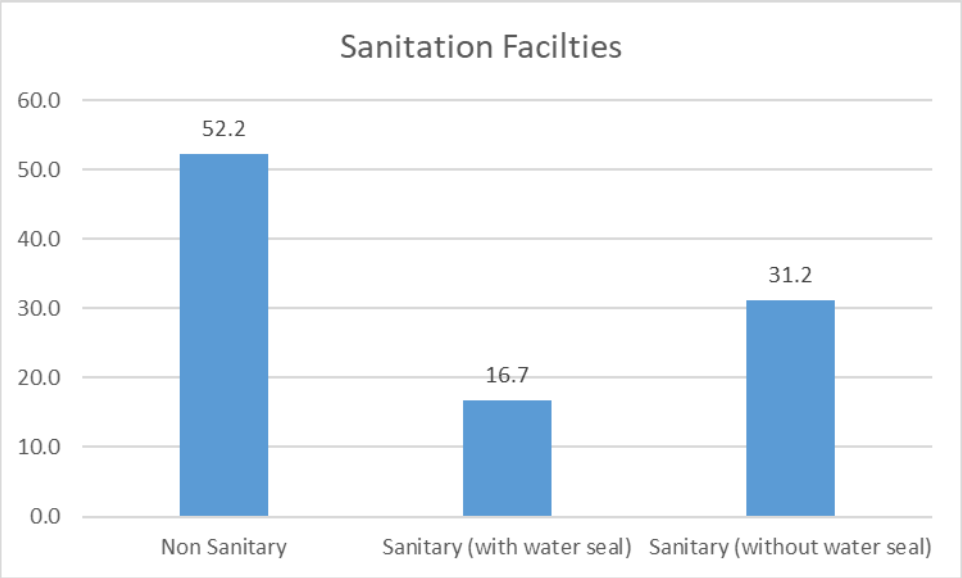
4.4.1.10 Water Source of AHs

The major source of drinking water is tube-well where about 98% population use tube-wells water and 2% people have access to deep tube-well water. The uses of river water for the domestic purposes were not recorded during the census. However, river water used in domestic animals bathing and for the irrigation. During the site visit and consultation with the local community, landowners and the women group; no tube wells (shallow/deep) were identified under the transmission line /in the ROW.

4.4.1.11 Sanitation Facilities of AHs

About 16.7% and 31.2% of households use water sealed and non-water-sealed sanitary latrine facility, respectively, whereas about 52.2% households use non-sanitary facilities. The following Figure shows sanitation facility of the project area.

Figure 4-27: Sanitation Facilities of AHs



Source: EQMS census and IOL survey, January 2022

4.4.1.12 Transportation and Communications

The proposed transmission line will cross Jashore to Satkhira highway (R 755) road. The average distance of transmission towers from the Highway Road will be 200 meters. The transmission line will also cross the village internal roads communication such as the Keshabpur to Razgong road, Keshabpur to Kalaroa road and Keshabpur to Chingra road. Most of these internal communication roads are Semi metaled and Kutcha roads. Any transmission towers, which may affect the transportation system of the local people and vehicles, could not find on the road by the consultants during the site visit and socio-economic survey. The proposed transmission line from Satkhira to Manirampur crosses two rivers named Kapotaksha and Buri Bhadra in between towers no. 7/2 to 7/3 and 13/2 to 13/3. The average distance from the river side of the towers in both side is approximately 150 to 200 meters where there will be no such impact in towers as well as river side.

4.4.1.13 Common Property Resources

4.4.1.13.1 Religious Institution

No religious institutions were found under the transmission line/ in ROW during the site visit and socio-economic survey. Some religious institutions such as Mosque, Mandir and Shoshan are located within on average of 500 meters from the proposed transmission line which will not be hampered for the transmission towers and transmission line.

4.4.1.13.2 Hat - Bazar

There are some local markets such as Bogoti Baysa Mor Bazar, Dormutia Bazar, Sharirampur Bazar, Barihati Natun Bazar and Katakhali Bazar in the nearest location of proposed transmission line. Abdus Sattar Shopping Complex is also located within the 200 meters of the proposed transmission line. The regular activities of local market will not be hampered for the construction of transmission tower.

4.4.1.14 Health and Services

No major chronic illnesses are reported from the subproject affected areas. However, incidence of water borne diseases and skin ailments were frequently reported during consultations. People approach multiple institutions for medical care and treatment. Government hospitals or university hospitals are accessed by 51% for their medical and health needs followed by 42% reaching the private hospitals or private physicians. Medication from pharmacies is sought by 7%. Despite the presence of several health

and medical service institutions, access to them from rural areas is rather remote. Distance from the households to such institutions varies from 2 km to 7 km across the project affected areas. Medical services at private clinics are expensive and unaffordable to many families. Government hospitals in local areas lack enough medicine, diagnostic facilities and staff. Patients must wait in long queues. For serious illnesses, people must go to Dhaka for treatment. People sometimes travel more than 100 km to get their medical tests done.

4.4.1.15 Role of Women and Gender Issues

Women in the project affected areas are engaged in multiple activities. Apart from their household roles such as household cooking, cleaning, fetching water, feeding children, helping in children's studies and looking after the in-laws (particularly those living in extended families), women across the project areas also make a significant contribution to the household economy

Despite strong pressures from the families to dissuade women finding employment, they take a lead role in livestock farming and take care of the feeding of their cattle, goats and poultry. Home gardening is another important economic activity of women, produce of which is used for both household consumption and marketing. Other forms of economic activities conducted by women include agricultural labor work, dressmaking, handicraft-making, employment in apparel industries etc. Educated women are employed in both government and private sector jobs. Women's earnings are mainly used for children's education and clothing, to supplement the households' consumption needs, and to repay the past debts. Some women would also save some money to be used in emergencies or for their children's future. In some communities, however, it has been reported that women must hand over their earnings to husbands or else get prior consent of the husband to spend their earnings. Women also participate in the activities of NGOs like BRAC and Grameen Bank to access micro-credit which they would use to buy cattle, goats and poultry.

Household level decision-making is largely vested with the husband. A few instances of joint decision making by both men and women were reported. Women also perform a significant role in managing household assets despite the key immovable assets like land and house are owned by men. Physical assets such as land and jewelry received by women as part of their dowry remain in her possession but in some occasions, they are transferred to the ownership of men as part of matrimonial agreements. Women are discouraged from participating in social and political activities mostly by their male counterparts. However, many women struggle to change this situation.

4.4.1.16 Indigenous Peoples

There are no indigenous people's settlements in the affected area of the project. Therefore, no permanent or temporary and direct or indirect impacts on indigenous people's communities are anticipated. The project has taken necessary steps to avoid the indigenous people's communities and their properties and other social and cultural activities from the areas identified for project implementation.

4.4.2 Gopalganj to Shibchar

The socio-economic profile of the affected HHs is presented following demographic profile of the HHs. A total of 71 HHs comprising 333 people will be affected by the project with average HH size 4.7 which is higher than the national average (4.3) according to BBS (2011).

Table 4-25: General Profile of Affected Population

Number of total affected households	71
Number of total populations	333
Average HH size	4.7

Source: EQMS census and IOL survey, February 2022

4.4.2.1 Demographic Information

A total 68 household will be impacted due to tower putting in the designated land of household head owners. Total 333 people were found among the 68 households, from which 195 male and 138 female consist of those households. Following **Table 4-26** shows the number of populations by gender.

Table 4-26 Population distribution by gender

Male No	%	Female No	%	Total
195	58.6	138	41.4	333

Source: EQMS survey, 2022

4.4.2.2 Marital Status

Marital status of the people from surveyed households are distributed by married, unmarried and widow as the survey did not find any separated person during the survey. Among 333 people a total 195 people were found married, 122 people unmarried and 16 widow. **Table 4-27** shows the distribution of marital status among surveyed people from the affected households.

Table 4-27 Marital Status

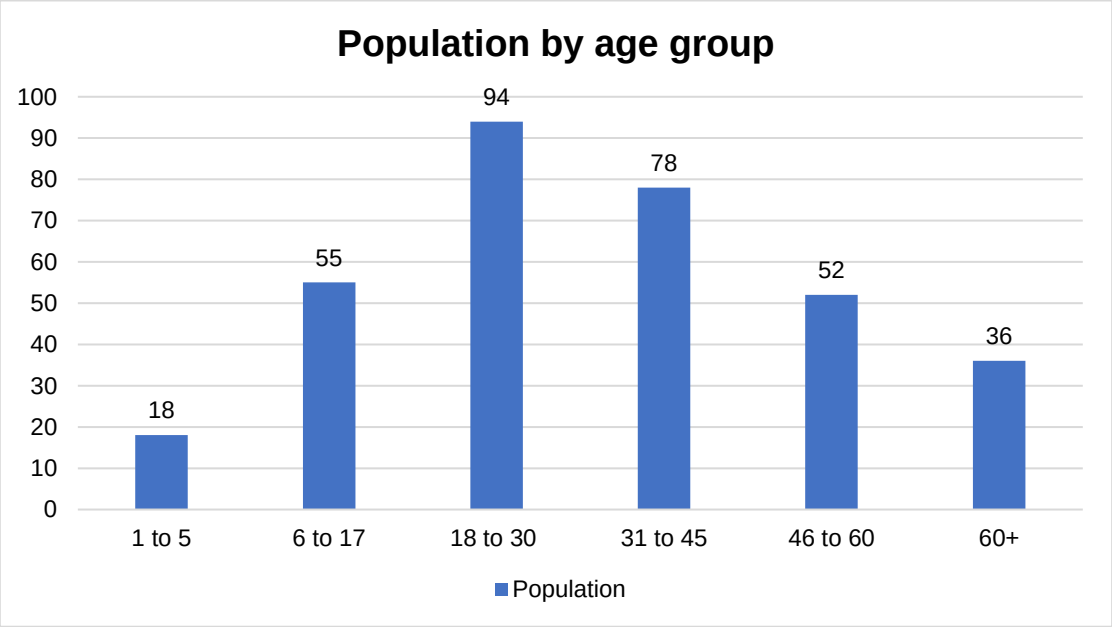
Married No	%	Unmarried No	%	Widow No	%	Total
195	58.6	122	36.6	16	4.8	333

Source: EQMS survey, 2022

4.4.2.3 Age Distribution

Population distribution by age group from the survey shows that, highest number of populations from age group 18-30 and second highest population group from 31-45 while lowest age group is 1-5.

Figure 4-28: Population distribution by age group



Source: EQMS survey, 2022

4.4.2.4 Education status

Education status among the surveyed households have been identified and assessed as last performed status of education class. Among surveyed male population highest number were from the SSC group while female represents Primary group. As per the consultation and site visit, no educational institution was found under the transmission lines. Survey team found some schools and Madrasas which are distanced from the line approximately within 400 meters. No playgrounds were found under the transmission line and also no transmission towers were constructed on playgrounds. Two playgrounds named Deora High School playground and Haji Baser playground were found on average of 400 meters distanced from the transmission towers. **Table 4-28** shows the educational status of surveyed people gender wise.

Table 4-28 Gender wise education status

Education	Male No	%	Female No	%	Total
Primary	49	47.6	54	52.4	103
SSC	66	70.2	28	29.8	94
HSC	23	79.3	6	20.7	29
Graduate	16	66.7	11	33.3	27
Post Graduate	3	59.3	4	40.7	7
Religious	2	42.9	1	57.1	3
Children	9	42.9	2	57.1	1
Uneducated	21	42.9	28	57.1	49
Total	**189**	**56.8**	**144**	**43.2**	**333**

Source: EQMS survey, 2022

4.4.2.5 Employment Status

Employment status of the people from survey of transmission tower putting area are presented in the Table 4-29. Based on the survey data the highest number of people (women) from housewife and second highest number of people were involved in agriculture from the working group. A total 78 were found from student.

Table 4-29: Employment status

Employment	Number	Percentage
Agriculture	66	19.8
Business	14	4.2
Service	1	0.3
Driver	5	1.5
Mason	18	5.4
Remittance	15	4.5

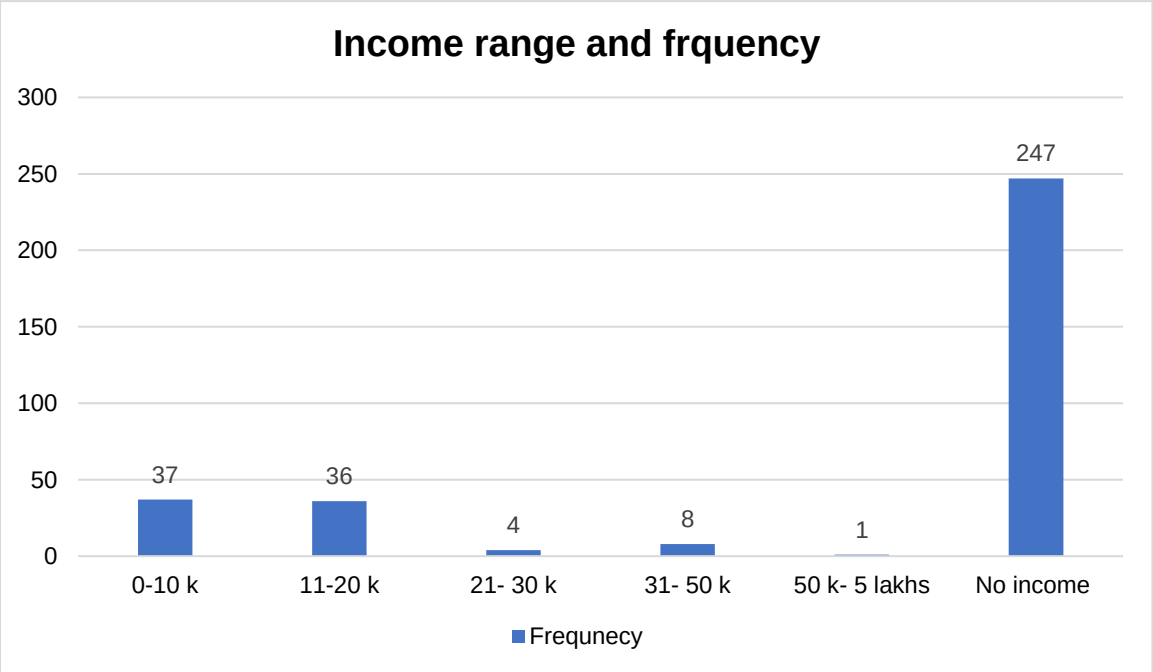
Employment	Number	Percentage
Student	78	23.4
Elderly	18	26.1
Unemployed	31	5.4
Housewife	87	9.3
Total	**333**	**100.00**

Source: EQMS survey, 2022

4.4.2.6 Income range

Figure 4-29 shows income range as per the employment status from survey data conducted by EQMS, where it is seen that majority of the people found with zero income and most of the people belongs to 0-10 thousand income range and 11-20 thousand income range.

Figure 4-29: Income range of the HH



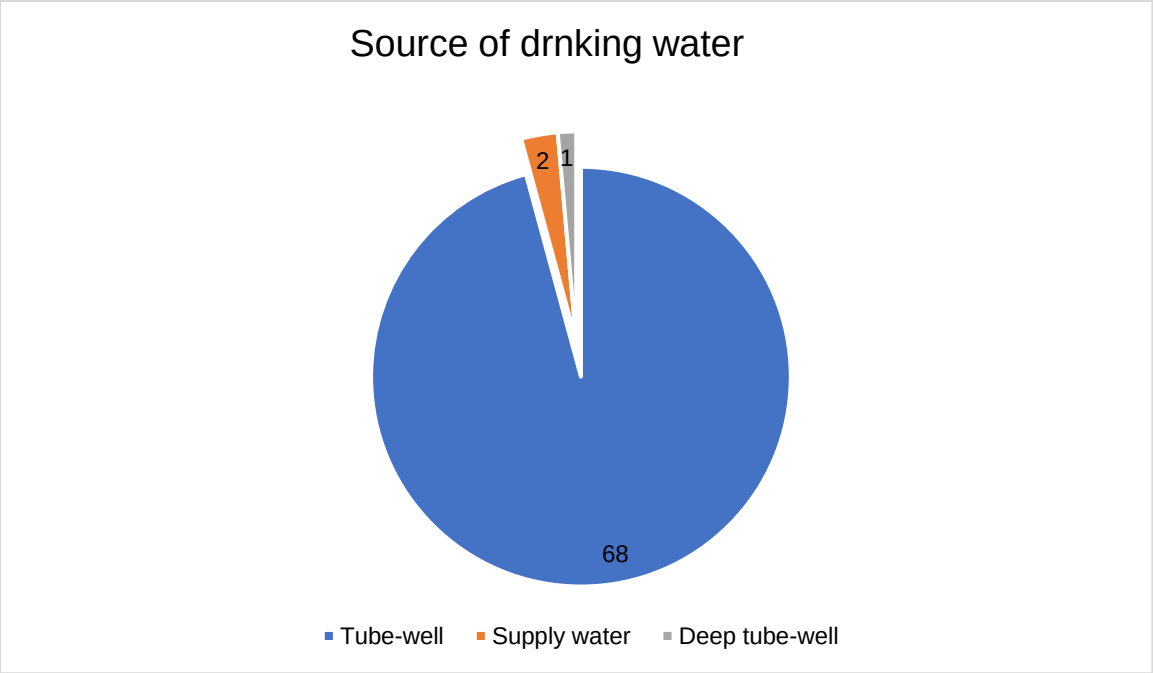
Source: EQMS survey, 2022

4.4.2.7 Basic amenities at household level

4.4.2.7.1 Source of Water

Survey data shows that, most of the household collects water from tube well; supply and deep tube well is negligible in number. According to the site visit and socioeconomic survey of the consultants, a total of 68 households collect water from tube well, 2 from supply water and 1 from deep tube well for their domestic usage. During the site visit and consultation with the local community, landowners and the women group; no tube wells (shallow/deep) were identified under the transmission line /in the ROW. Number of the households that collect water from the sources are presented in the **Figure 4-30**.

Figure 4-30: Source of water by household number

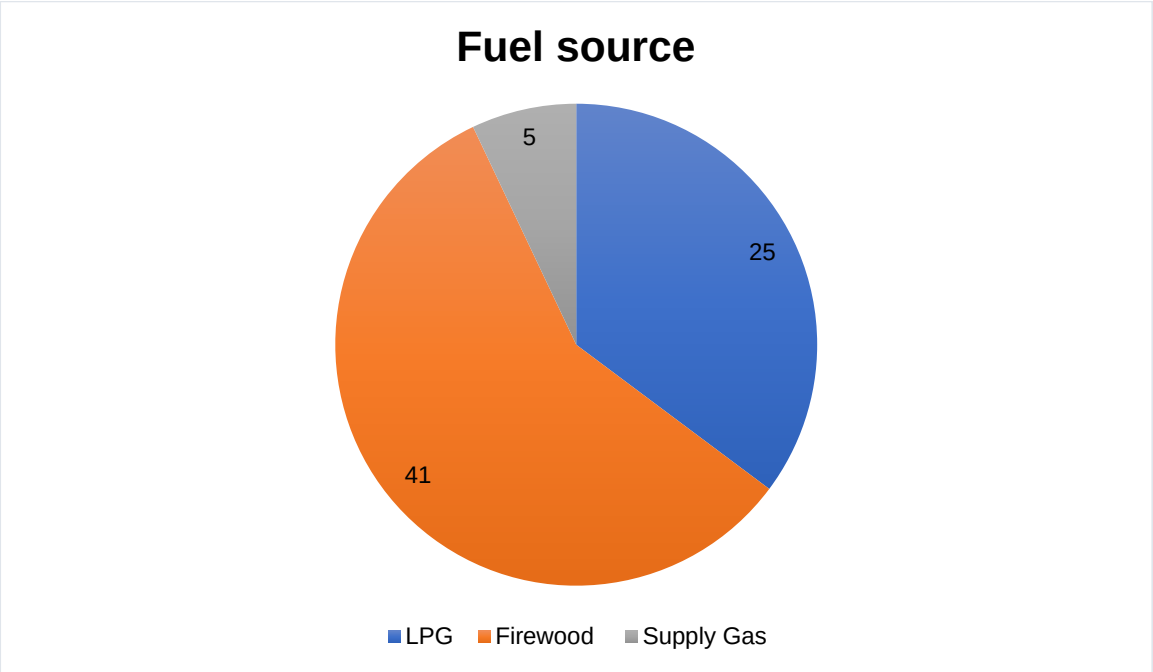


Source: EQMS survey, 2022

4.4.2.7.2 Source of cooking fuel and lighting

Survey found that 100% households are under electricity coverage, no other source of lighting rather than the rural electricity were found during the survey. Cooking fuel source also assessed from three source. Most of the households use firewood as cooking fuel and LPG is the second highest source of cooking fuel. Following **Figure 4-31** shows the households based on fuel use for cooking.

Figure 4-31: Source of cooking fuel

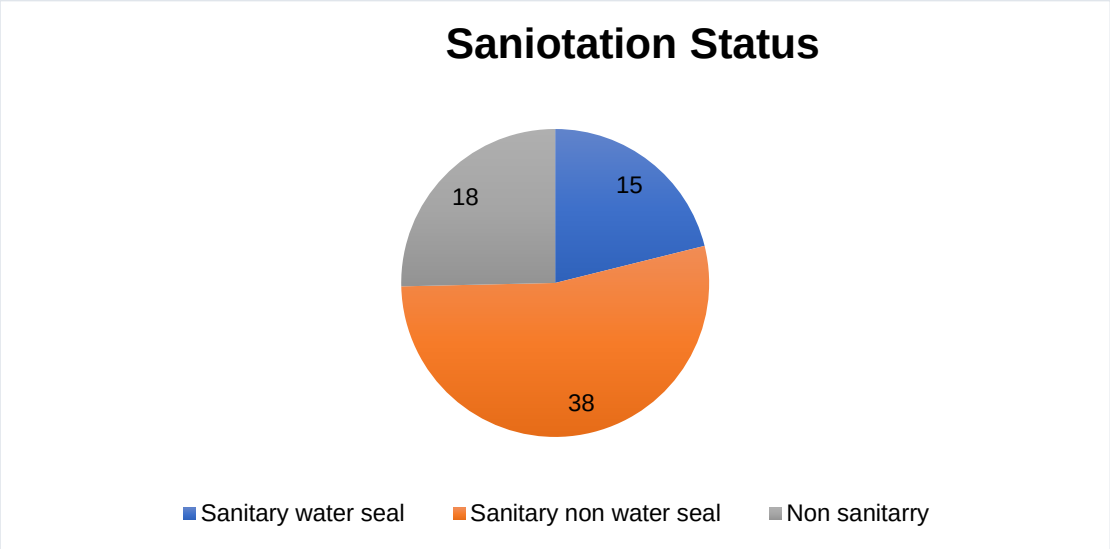


Source: EQMS survey, 2022

4.4.2.7.3 Sanitation Status

Sanitation status of the surveyed households are assessed thorough three categories in terms of usage and category. Most of the households were found using sanitary latrine without water supply inside. No open defecation found during the survey. Following **Figure 4-32** shows the sanitation status of the households.

Figure 4-32: Sanitation Status of the Household



Source: EQMS survey, 2022

4.4.2.8 Religion of PAHs

The religious background of the affected HHs is entire population from survey were found as Muslim. No Hindu or other religious groups were found during the survey of affected household. Therefore, there is no opportunity for religious discrimination through this project.

4.4.2.9 Health and Services

No major chronic illnesses are reported from the subproject affected areas. However, incidence of water borne diseases and skin ailments were frequently reported during consultations. People approach multiple institutions for medical care and treatment. Despite the presence of several health and medical service institutions, access to them from rural areas is rather remote. Distance from the households to such institutions varies from 2 km to 10 km across the project affected areas. Medical services at private clinics are expensive and unaffordable to many families. Government hospitals in local areas lack enough medicine, diagnostic facilities and staff. Patients must wait in long queues. For serious illnesses, people must go to Dhaka for treatment. People sometimes travel more than 100 km to get their medical tests done.

4.4.2.10 Transportation and Communication

The proposed transmission line will cross Bhanga -Barishal highway (N 8) road. The average distance of transmission towers from the Highway Road will be 100 meters. The transmission line will also cross the village internal road communications such as the Noyakandi road, Bhabnatola road, Shariyatpur Road and Madaripur road. Most of these internal communication roads are Semi metaled and Kutcha roads. During the site visit and socio-economic survey, the consultants could not find any towers on the road which may affect the transportation system of the local people and vehicles.

The proposed transmission line from Madaripur, Shibchar to Moksedpur, Gopalganj crosses a river named Arial Khan in between towers no. 11/0 to 12/0. The average distance from the river side of the

towers in both side is approximately 800 to 1000 meters where there will be no such impact in towers as well as river side.

4.4.2.11 Common Properties Resources (CPR)

4.4.2.11.1 Religious Institution

During the site visit and consultation with local community people, no religious institutions were found under the transmission line/ in ROW. Some religious institutions were found within on average of 500 meters from the proposed transmission line which will not be hampered for the transmission towers and transmission line.

4.4.2.11.2 Hat - Bazar

There is only one local market named Deora Bazar found in the nearest location of proposed transmission line. It is around 400 meters distanced from the transmission tower. The regular activities of local market will not be hampered for the construction of transmission tower.

4.4.2.12 Role of Women and Gender Issues

Women in the project affected areas are engaged in multiple activities. Apart from their household roles such as household cooking, cleaning, fetching water, feeding children, helping in children's studies and looking after the in-laws (particularly those living in extended families), women across the project areas also make a significant contribution to the household economy

Despite strong pressures from the families to dissuade women finding employment, they take a lead role in livestock farming and take care of the feeding of their cattle, goats and poultry. Home gardening is another important economic activity of women, produce of which is used for both household consumption and marketing. Other forms of economic activities conducted by women include agricultural labor work, dressmaking, handicraft-making, employment in apparel industries etc. Educated women are employed in both government and private sector jobs. Women's earnings are mainly used for children's education and clothing, to supplement the households' consumption needs, and to repay the past debts. Some women would also save some money to be used in emergencies or for their children's future. In some communities, however, it has been reported that women must hand over their earnings to husbands or else get prior consent of the husband to spend their earnings. Women also participate in the activities of NGOs like BRAC and Grameen Bank to access micro-credit which they would use to buy cattle, goats and poultry.

Household level decision-making is largely vested with the husband. A few instances of joint decision making by both men and women were reported. Women also perform a significant role in managing household assets despite the key immovable assets like land and house are owned by men. Physical assets such as land and jewelry received by women as part of their dowry remain in her possession but in some occasions, they are transferred to the ownership of men as part of matrimonial agreements. Women are discouraged from participating in social and political activities mostly by their male counterparts. However, many women struggle to change this situation.

4.4.2.13 Indigenous Peoples

There are no indigenous people's settlements in the affected area of the project. Therefore, no permanent or temporary and direct or indirect impacts on indigenous people's communities are anticipated. The project has taken necessary steps to avoid the indigenous people's communities and their properties and other social and cultural activities from the areas identified for project implementation. During the consultation and site visit of the consultants, it was revealed that there were no physical cultural resources situated within ROW.

5 IMPACT ASSESSMENT AND EVALUATION

Assessment of potential impacts are based on activities that will be involved in the implementation of the project, nature and extent of the proposed activities, and present environmental setting of the project area.

The section 5 of the original IEE (Table 9.3 of the original IEE) remains as applicable for impact evaluation of the project.

This section evaluates additional potential impacts based on activities that will be involved in construction and operation phase of the two proposed transmission lines: (i) Satkhira-Manirampur transmission line and (ii) Gopalganj (N) – Shibchar double circuit transmission line and compares them with the original IEE.

5.1 Impact Assessment Methodology

The impact assessment has involved the prediction, evaluation, and mitigation of impacts and report on impacts including residual impacts and cumulative impacts. The impact assessment methodology of this addendum follows the methodology of the original IEE (section 5.2 of the original IEE).

5.2 Impact Identification

The potential impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the project have been considered with respect to their potential to interact with environmental and social resources or receptors.

The interaction matrix enables a methodical identification of the potential interactions each project activity may have on the range of resources/receptors within the area of influence i.e., the study area of the project. The interaction matrix for the project activities and likely impacted resources/receptors is presented in Table 5-1.

Table 5-1: Potential environmental impacts on the IECs during the Phases and Comparison with Addendum-1

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
Pre-construction Stage					
Physical Environment					
Ambient air quality	Vehicular emissions: dust from excavation works, land clearing, and material stockyards may affect ambient air quality.	Medium	Minor	Minor Adverse	Same as previous
Ambient noise	Noise level may increase due to mobilization of vehicles and unloading of materials.	Medium	Minor	Minor Adverse	Same as previous
Quality of surface and groundwater	The quality of surface water of the water bodies close to the project construction sites may deteriorate if erosion products and silt reach water bodies, especially during rains	Medium	Moderate	Moderate Adverse	Same as previous
Soil	During the pre-construction period, site clearance work will be done accordingly. Site clearance will impact the fertile top soils that are enriched with nutrients	Low	Minor	Minimal Adverse	Same as previous
Land and Agricultural Resources					
Land use	Would be partially impacted in RoW	Low	Minor	Minimal Adverse	Minimal Adverse/ Same as previous
Crop production	Would be highly impacted, at tower foundation areas and substation lands	Medium	Moderate	Moderate Adverse	Same as previous
Fisheries Resources					
Fish habitat	Fish habitat quantity and quality will be changed.	Medium	Moderate	Moderate Adverse	Same as previous

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
Fish production	Production reduced due to waterbody loss	Low	Minor	Minimal Adverse	Same as previous
Socioeconomic Resources					
Land price	Reduced near RoW and substation lands, increase away from transmission lines and substations due to availability of electricity	Low	Minor	Minimal Adverse	Same as previous
Employment opportunities	Temporary or minimal opportunities at this stage.	Medium	Moderate	Moderate Beneficial	Same as previous
Human health and safety	Ensure proper Health and safety for workers involved for site clearance. Road traffic safety with number of trucks for fill import.	Low	Minor	Minimal Adverse	Same as previous
Road/ river/ canal/ water body crossings	Minimal impacts	Low	Minor	Minimal adverse	Same as previous
PCRs	Proper chance find procedures will also be implemented in case of a chance find.	Low	Minor	Minimal Adverse	Same as previous
Construction Stage					
Physical Environment					
Ambient air quality	Suspended particulate matter from excavation works and land clearing, including vehicular emissions, may affect workers and community.	Medium	Moderate	Moderate Adverse	Monitoring results were found well within the limits of national standards for both the alignments.

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
Ambient noise	Mobilization of heavy equipment and machinery, use of construction vehicles, transport of materials, pile driving, and construction activities may increase ambient noise level. Exposure to high level ambient noise may cause anxiety and disturbance to workers and community.	Medium	Moderate	Moderate Adverse	Monitoring results were found well within the limits of national standards.
Quality of surface and groundwater	Potential for siltation due to construction works near pond or river.	Medium	Moderate	Moderate Adverse	Monitoring results were found well within the limits of national standards.
Riverbank erosion	Potential erosion due to ground movements along the riverbank.	Medium	Major	Moderate Adverse	Same as previous
Soil	During construction, top soil at the tower footings may be eroded during excavation. Construction wastes like metal scraps and wooden packing material, and polythene may create a disturbance to the surrounding land, settlements, and the communities; Domestic wastes from labor camp.	Medium	Major	Moderate Adverse	Same as previous
Land and Agricultural Resources					
Land use	Would be partially impacted as agricultural land may be permanently lost due to the tower footings.	Medium	Moderate	Moderate Adverse	Same as previous

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
Crop production	May be moderately affected due to crop loss at the tower footings and in the clearing for RoW.	Medium	Moderate	Moderate Adverse	Same as previous
Intercropping	Maybe affected due to the erection of towers	Low	Minor	Minimal Adverse	Same as previous
Change in topography/terrain	Excavation and erection work for the transmission towers may affect topography.	Low	Minor	Minimal Adverse	Same as previous
Impairment of visual aesthetics	Transmission towers partially visible on the skyline.	Low	Minor	Minimal Adverse	Same as previous
Fisheries Resources					
Fish habitat	Few lands selected for substations having water bodies, permanent loss of fish habitats in substation lands. Construction activities may temporarily affect nearby fish habitats.	Medium	Minor	Minor Adverse	Same as previous
Fish production	Lands earmarked for 2 substations contain 3-acre waterbodies. These waterbodies might be filled for the construction of substations. This will affect the fish production.	Medium	Moderate	Moderate Adverse	Same as previous
Terrestrial Resources (Flora and Fauna)					
Terrestrial vegetation	Vegetation clearing/ tree cutting is required at the tower footings and RoW.	Medium	Moderate	Medium Adverse	In these two alignments, tree cutting due to tower footings and RoW will be less than the

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
					previous count
Wildlife habitat and their disturbance	Route will be mainly in urban or peri-urban areas. Habitat in the areas affected may not host wildlife.	Medium	Moderate	Medium Adverse	Same as previous
Socioeconomic Resources					
Compensation for crop damage	Standing crops at the tower footings and RoW may be damaged.	Medium	Moderate	Moderate Adverse	Crop compensation status has been incorporated in the updated RAP
Land price	Value of land may be temporarily affected.	Medium	Moderate	Moderate Adverse	Same as previous
Temporary employment opportunity	Both technical and non-technical laborers will be required	Medium	Moderate	Moderate Beneficial	Same as previous
Human health and safety	The safety and health of the public may be impacted due to the hazards created during the construction period, e.g. movement of heavy equipment, vehicles, and machineries. Damages to structure within RoW. Workers may be exposed to occupational health risks and safety hazards, mostly working with electricity and working at height.	Medium	Minor	Minor Adverse	Moderate Adverse. Occupational health risk observed in both the alignments due to lack of general safety requirements and precautions while working at these two construction sites

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
Road/ river/ canal/ water body crossings	Road use for construction activities as haulage of construction materials, spoil, and equipment, river bank and Soil erosion	Medium	Moderate	Moderate Adverse	Same as previous
PCRs	Proper chance find procedures will also be implemented in case of a chance find.	Low	Minor	Minimal Adverse	Same as previous
Regional and national development	May create development opportunities in anticipation of stable power supply.	Medium	Moderate	Moderate Beneficial	Same as previous
Operation Stage					
Physical-Chemical Environment					
Ambient air quality	Climate change from fugitive emission (negligible) of SF6	Low	Minor	Minimal Adverse[6]	Same as previous
Ambient noise	Noise in the form of buzzing or humming can often be heard around transformers or power lines producing corona. Outside of RoW will be negligible.	Low	Minor	Minimal Adverse	Same as previous
Quality of surface and groundwater	Transformer oil spill and leakage	Low	Minor	Minimal Adverse	Same as previous
Riverbank erosion	No or minimal impact	Low	Minor	Minimal Adverse	Same as previous

[6] Due to high global warming potential, SF_6 may contribute to the man-made greenhouse-effect, if it is released into the atmosphere. However in electrical switchgear the SF_6 gas is always used in gas-tight compartments, greatly minimizing leakage. This makes the real impact on greenhouse effect negligible. As per ECOFYS, Sina Wartmann, Dr. Jochen Harnisch, June 2005, “Reductions of SF_6 Emissions from High and Medium Voltage Equipment in Europe” study, the contribution to the greenhouse effect in Europe is estimated to 0.05 %.

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
Soil/Land contamination	Potential for spill or improper disposal of mineral oil used as insulating oil in transformers. No use of PCB or PCB-containing material will be allowed.	Low	Minor	Minimal Adverse	Same as previous
Land and Agricultural Resources					
Land use	No impact (changes will have occurred in construction phase).	Low	Minor	Minimal Adverse	Same as previous
Crop production	Tower footings may have minor impact on crop production due to permanent loss of agricultural land.	Medium	Minor	Minor Adverse	Same as previous
Change in surface topography/ terrain	Transmission towers will have minimal impact on topography.	Low	Minor	Minimal Adverse	Same as previous
Impairment of visual aesthetics	Transmission towers visible on the skyline.	Low	Minor	Minimal Adverse	Same as previous
Fisheries Resources					
Fish habitat	No change expected	Low	Minor	Minimal Adverse	Same as previous
Fish production	No change expected	Low	Minor	Minimal Adverse	Same as previous
Terrestrial Resources (Flora and Fauna)					
Terrestrial vegetation	Restriction of vegetation height below the transmission line.	Low	Minimal	Minimal Adverse	Same as previous
Wildlife habitat and their disturbance	Natural forest, Protected areas or ecologically sensitive areas are not present in the proposed substation lands or along the transmission line routes	Low	Minimal	Minimal Adverse	Same as previous
Socioeconomic Resources					

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
Compensation	Ongoing permanent loss of land at the tower footings (but occurred at the construction stage).	Medium	Moderate	Moderate Adverse	Same as previous
Land price	No land value at the tower footings (compensation already paid); development restrictions below the transmission line and between towers may affect land value.	Medium	Moderate	Moderate Adverse	Same as previous
Employment opportunity	Jobs will be created directly due to the project and indirectly through businesses and development resulting from the availability of power supply.	Medium	Minor	Minor Beneficial	Same as previous
Human health and safety	• Occupational and community safety risks (project maintenance); • There is public and scientific concern over the potential health effects associated with exposure to EMF.	Medium	Minor	Moderate Adverse	• Same as previous • As per the final alignment and confirmation from PGCB, there are no housing or school structures directly lies underneath these two lines. • PGCB confirms that consultations with the nearby residents undertaken to discuss the health

IECs/Issues	Potential Impacts	Sensitivity	Magnitude	Significance Prior to Mitigation	Potential Impacts during Addendum-1
					and safety implications, with education program for residents and communities on how to minimize the risks involved.
Road/ river/ canal/ water body crossings	No disturbances to vehicular traffic	Low	Minor	Minimal Adverse	Same as previous
Regional and national development	Availability of a stable and reliable power supply may improve productivity and national development.	Medium	Moderate	Moderate Beneficial	Same as previous

5.3 Potential Impacts during Addendum- 1

5.3.1 Terrestrial Resources (Flora and Fauna)

5.3.1.1 Clearing of Vegetation during Construction Phase

As per the original IEE, 2019, a significant number of big trees were estimated to be cleared in Satkhira to Manirampur transmission line and in the RoW of the Gopalganj (N)-Shibchar 230 kV Transmission Line. However, as per the primary survey of EQMS during this addendum, the total number of trees to be cut were counted less. The comparison of tree count is given in Table 5-2 .

Table 5-2: Comparison of tree count

SN	Sub-projects	Counted during original IEE, 2019	Counted during Addendum-1, 2022*
1.	Satkhira to Manirampur 132 kV transmission line	1,597 (>5 m in height)	1,149 (>5 m in height)
2.	Gopalganj (N)-Shibchar 230 kV Transmission Line	1,525 (>5 m in height)	1,453 (>5 m in height)

*Source: https://www.adb.org/projects/documents/ban-51137-003-iee and EQMS Survey 2022

Most of the trees in the RoW of these two lines need to be trimmed rather than cut, and thus the impact will be only moderately significant. Both the transmission alignment falls inside paddy fields/ floodplain areas, so tree felling will mostly be restricted to settlement areas.

Mitigation Measures

- Vegetation clearance should be minimum within the designated areas.
- Workers should be aware of the importance of natural resources and should not unnecessarily clear any area or break branches, twigs, flowers, etc. of adjacent vegetation.
- Crops and plant health monitoring should be conducted.
- A detailed bird survey will be conducted along the transmission line focused on the major river crossings to confirm the findings of the IEE that it does not have a significant impact on their route and staging.

As the project impact will be for long term in a local extent within the adjacent areas of the project site, potential impact on Terrestrial Flora can be reduced to Very Low by following proper mitigation measures.

5.3.1.2 Occupational health and safety during Construction Phase

The construction of civil works such as transmission towers poses an inherent risk of injury to workers from accidents and hazardous working environments. Unsafe working conditions could place workers at risk of injury or death. Such conditions could be caused by vehicles and equipment that do not meet safety standards (seat belts, horns, lights, tires, etc.), unprotected access to dangerous locations (unmarked excavations), poor practices and equipment for lifting operations, poor electrical safety (untrained workers, inadequate tools, etc.), inadequate safeguards on tools and equipment (unprotected saws, etc.), and other poor practices.

During the survey of this addendum, it was observed that lack of general safety requirements and precautions prevails at these two lines construction yards. This non-compliance will trigger the possibility of risk of injury to workers. Also, sanitation facility of the workers was observed in poor conditions at the construction yards of these two alignments.

Inadequate water and/or sanitation can affect workers' health, contaminate soil and surface water, and lead to worker illness or disease. Contractors will also have to provide sanitary facilities, including portable toilets in remote areas, and to enforce the Code of Conduct's prohibition on using the non-pit latrine.

Mitigation Measures

- Provide preventive and protective measures, including modification, substitution, or elimination of hazardous conditions, with particular attention to live power lines, working at height, working above water, high noise levels.
- Provide measures for the management and appropriate disposal of hazardous wastes to ensure protection of the workforce and the prevention and control of releases and accidents.
- Provide for the provision of appropriate fire extinguishers and fire response plans and appropriately trained first aid response staff.
- Provide for the provision of appropriately stocked first-aid equipment and stations at both work sites and temporary construction camps, including appropriately trained first-aid staff on site and provision of adequate transport facilities for moving injured persons to the nearest hospital.
- Provide for the provision of appropriate personal protective equipment (PPE) to minimize risks, such outerwear, boots, and gloves; eye protectors; ear plugs safety helmets, etc.
- Provide training for workers and establish appropriate incentives to use and comply with health and safety procedures and utilize PPE; Include procedures for documenting and reporting occupational accidents, diseases, and incidents; Include emergency prevention, preparedness, and response arrangements in place.

6 ENVIRONMENTAL MANAGEMENT PLAN

The primary objective of the Environmental Management Plan (EMP) is to avoid or eliminate or reduce the negative environmental impacts by possible mitigation measures and to enhance the positive impacts by enhancement measures. It would also address any unexpected or unforeseen impacts that may arise during construction and operation stages of the subprojects.

The aim of the EMP is to ensure implementation of the recommended mitigation and enhancement measures effectively. The mitigation measures are designed either to prevent impacts or by mitigating those to reduce the negative impacts to an acceptable level that complies with the environmental guidelines of the DOE and ADB.

The section EMP of the original IEE (Table 9.3 of the original IEE) remains as applicable management plan that depicts possible mitigation measures to avoid or eliminate or reduce the negative impacts and to enhance the positive impacts.

The additional mitigation measures under this addendum for Satkhira to Manirampur 132 kV transmission line and Gopalganj (N)-Shibchar 230 kV Transmission Line are incorporated in the Table 6-1. The environmental and social monitoring plan of the original IEE and update till this addendum has been incorporated in Table 6-2.

Table 6-1: Mitigation Measures for the Impacts of Transmission Lines of during Addendum-1

Environmental Issues/ Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
(a) Pre-construction/Construction Stage				
Tree cutting, Clearing of vegetation	2, 602 trees (>5 m in height) will be directly affected by cutting and trimming along the RoW of Satkhira to Manirampur 132 kV transmission line and Gopalganj (N)-Shibchar 230 kV Transmission Line	• Prior to the start of clearing of vegetation, provide adequate compensation to the owners. • Tree cutting and vegetation clearance should be done within the designated areas. • A compensatory tree plantation program should be adopted. Tree plantation will be carried out with a ratio of 1:3. The contractor will be responsible for the plantation and maintenance (replacing losses) of the trees for at least 3 years under the supervision of PGCB. These plantations would be the part of 75,000 trees that are already included in the EMP for the operational stage in the original IEE. • Trees should be checked for nests and holes before cutting. Active nests, eggs, hatchling must be safeguarded. • A detailed bird survey will be conducted along the transmission line focused on the major river crossings to confirm the findings of the IEE that it does not have a significant impact on their route and staging.	Contractor	DSC/ PGCB
Occupational health and safety (H&S)	Health and safety risks of construction workers.	• Site H&S Manager must be engaged on each alignment. • Only permitting trained and certified workers to work with any electrical equipment. • Before access to site granted, contractor to prepare H$S plan based on risk assessment for approval by PGCB following national and EHS guideline	Contractor	DSC/ PGCB

		requirements. • Safety instruction by the E&H Manager should be provided for the workers and visitors before they will be allowed to access the site. • First aid box and personal protective equipment, PPE (such as helmet, safety shoes, eye protection glass, ear plugs, waist belt, mask, hand gloves, body protective apron, ear muff and insulating boots, as needed) must be provided to the workers, and ensure their use by workers. • Safety signs as needed at the tower sites. • Provide for the provision of appropriate fire extinguishers and fire response plans and appropriately trained first aid response staff. • The EPC Contractor will be required to provide affordable group medical and accident insurance to their workers or arrange with the local health facilities to aid in the event of emergency; • Noise barrier will be installed in areas and equipment with high level noise • EPC Contractor will provide workers with sanitary facilities, safe drinking water, wash area, adequate water for washing purposes, fire-fighting unit, etc.		

6.1 Environmental Monitoring

Table 6-2: Environmental Monitoring Plan for TL/LILO Line Subprojects

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency	Update until Addendum-1
Pre-construction/Construction Stage								
Requirement of land	Ensure that PAPs get compensation as per RP	As per RP	Inspection	As per RP	RoW of the TL/LILO lines	DC	DSC/PGCB	Same as previous
Trimming of trees within RoW and clearing vegetation from the tower bases of the TL/LILO lines.	Checking whether proper compensation as mentioned in RP is received by PAPs.	DoE/FD	Inspection	Regular during tree felling and site clearing operations	Trimming of trees within RoW and clearing vegetation from the tower bases of the TL/LILO lines.	FD	DSC/PGCB	Same as previous
Ambient Air Quality Parameters	SPM, PM10, PM2.5, SOx, NOx, CO & Pb- 24hr monitoring	DoE standards	Sampling/ laboratory analysis	Before construction, then quarterly	At representative tower construction sites	Contractor	PGCB	Monitoring conducted for two alignments under this addendum.
Noise Pollution	Ambient noise level	DoE standards	Measurement	Regularly during construction at the locations with sensitive receptors and during piling works if any.	At adjacent subproject cultural sites and construction camps	Contractor	DSC/PGCB	Monitoring conducted for two alignments under this addendum.
Pollution due to Wastes	Checking storage, transportation, handling, and disposal of wastes. Wastes from construction sites and camps to be disposed properly at the designated waste dumping sites.	DoE guidelines	Inspection	Regular	Construction sites and camps	Contractor	DSC/PGCB	
Surface Water Quality	pH, BOD5, COD, NH3-N, PO4, TPH and coliforms	DoE Standards	Sampling and Laboratory Analysis	At all river crossings within 500m of waterbodies before and after works	River Crossing Sites near towers	Contractor	DSC/PGCB	• Monitoring conducted for two alignments (Satkhira to Manirampur 132 kV transmission line and Gopalganj (N)-Shibchar 230 kV Transmission Line) under this addendum. • NH_3-N, PO_4, TPH and coliforms were missing parameters during the surveys of Addendum-1. These parameters will be from now on in the quarterly monitoring. • Also, the below parameters will be monitored from now on in the quarterly monitoring: Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), Dissolved Oxygen

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency	Update until Addendum-1
								(DO), Electrical Conductivity (EC), pH, Salinity, Temperature (T), Hardness, Total Dissolved Solid (TDS).
Groundwater /Drinking Water Quality	pH, Mn, Fe, As, TC, FC, TPH	DoE Standards	Sampling and Laboratory Analysis	Quarterly at all tube wells within 500m	At representative tower construction sites	Contractor	DSC/PGCB	• Monitoring conducted for two alignments (Satkhira to Manirampur 132 kV transmission line and Gopalganj (N)-Shibchar 230 kV Transmission Line) under this addendum. • Mn, Fe, As, TC, FC, TPH were missing parameters during the surveys of Addendum-1. These parameters will be from now on in the quarterly monitoring. • Also, the below parameters will be monitored from now on in the quarterly monitoring: Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Electrical Conductivity (EC), pH, Salinity, Temperature (T), Hardness, Total Dissolved Solid (TDS).
Traffic congestion/ Road Accident	Checking road crossing points, roads adjacent to towers.	BRTA	Inspection	Regular	At road/railway. crossing points and roads adjacent to towers	Contractor	DSC/PGCB	Monitoring conducted for two alignments under this addendum.
Cultural sites (such as a mosque)	Checking whether cultural sites are affected by the project activities such as noise, wastes, etc.	DoE guidelines	Inspection	As and when required		Contractor	DSC/PGCB	
Physical Cultural Resources	Chance find procedure to be developed	DoE/IFC guidelines	Inspection	Regular	At construction site	Contractor	DSC/PGCB	
Occupational health and safety	Use of PPE, general health, water supply and sanitation. Record of all occupational H&S incidents, any people lost time or fatal must be reported to ADB within 48hrs with corrective action plan.	DoE/IFC guidelines	Inspection	Regular	At construction sites and camps	Contractor	DSC/PGCB	

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency	Update until Addendum-1
Community health and safety	Awareness of local people. Record of all community H&S incidents, any people lost time or fatal must be reported to ADB within 48hrs with corrective action plan.	DoE/IFC guidelines	Inspection	Regular	At tower construction sites and crossing of roads	Contractor	DSC/PGCB	
Operation Stage								
Tree replantation	Replanting of saplings and checking replacement of dead saplings, and watering and fertilizing of saplings for 3 years	FD	Inspection	Quarterly	Access road side slopes	FD	PGCB	
Tall trees	Trimming of tall trees under the transmission line	FD	Inspection	Once every year and as directed by the relevant engineer of PGCB	Along the TL/LILO Lines	PGCB	PGCB	
EMF	Checking of clearance of transmission line and tops of houses (for housing structures) and for river crossing clearance from HFL to TL	Australian Standard for the safety of power lines (No BD standard and no device available in BD)	Inspection	As and when required	At populated /housing areas where TL/LILO lines pass over	PGCB	PGCB	
Short circuit/ accident	Safety	DoE guidelines	Inspection	Regular	Along the TL/LILO lines	PGCB	PGCB	
Occupational and Community Health and Safety	Use of PPE. Record of all occupational and community H&S incidents, any people lost time or fatal must be reported to ADB within 48hrs with corrective action plan.	As required	Inspection	Regular	Along the TL/LILO lines	PGCB	PGCB	
Power Supply	Access to electricity in the rural area on priority basis.	DoE/PDB guidelines	Inspection	Whole project period	Along the TL/LILO lines	PGCB	PGCB	

As = arsenic, BD = Bangladesh, BOD5 = five-day biochemical oxygen demand, BRTA= Bangladesh Road Traffic Authority, COD = chemical oxygen demand, DC = Deputy Commissioner, DoE = Department of Environment, DSC = Design and Supervision Consultants, EMF = electromagnetic field, FC = faecal coliform, Fe = iron, HFL = highest flood level, IFC = International Finance Corporation, LILO = line-in line-out, m = meter, Mn = manganese, NH3-N = ammonia nitrogen, OHS = Occupational Health and Safety, PAP = project affected person, PDB = Power Development Board , PGCB = Power Grid Company of Bangladesh, PO4 = phosphate, PPE = personalprotective equipment, RoW = right of way, RP = Resettlement Plan, TC = total coliform, TL = transmission line.

7 GRIEVANCE REDRESS MECHANISM

A Grievance Redress Mechanism (GRM), consistent with the requirements of ADB's SPS 2009 has been established by PGCB to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. A three-tire GRM has been established to deal with and resolve complaints and grievances faster and thus enhance project performance standards in terms of environmental and social management. The detailed grievance mechanism and resolution procedure has been incorporated in the original IEE, 2019.

Until the date of addendum 1, no grievance has been reported with respect to environmental and social issues.

8 PUBLIC CONSULTATION AND DISCLOSURE

The public consultation was conducted in Satkhira and Gopalganj in January and February 2022 through stakeholder consultations, and individual meetings during the environmental study of the proposed project in conformity with the DoE's environmental guidelines to achieve the following objectives:

- To share information on the subprojects (substations, transmission lines) of the proposed project.
- To understand stakeholders, including PAPs, concerns regarding various aspects of the proposed project including existing power supply facilities/system and expected potential environmental impacts along with possible mitigation measures during the construction and operation stages of the proposed project.
- To identify the conflict issues in advance and to find acceptable solutions; and,
- To gather local knowledge before decision making on the proposed project.

Also, the consultations followed the below requirements of ADB SPS 2009 requirements for meaningful consultations.

- The consultation begins early in the project preparation stage and carried out on an ongoing basis throughout the project cycle;
- The consultation provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
- The consultation is undertaken in an atmosphere free of intimidation or coercion;
- The consultation is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and
- The consultation enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

8.1 Focus Group Discussions

Focus group Discussion (FGD) is a small, but demographically diverse group of people and whose reactions are studied about a proposed project or something else to determine the reactions that can be expected from a larger population. It is a form of qualitative study consisting of interviews in which groups of people are asked about their perceptions, opinions, beliefs, and attitudes towards the project, service, concept, advertisement, idea, or packaging. Questions are asked in an interactive group setting where participants are free to talk with other group members. During the study, six FGDs with various groups including women and affected people were conducted using local language (Bengali) for easy understanding of the opinions for both the transmission lines.

Discussion was held with the local people at near the proposed project site. Date, location, and the number of participants of each discussion is listed in **Table 8-1** and **Table 8-2.**

Table 8-1: Location and number of participants at FGDs (Transmission Line)

SL.NO.	Name of Transmission line	Venue	No. of Male (M)/ Female(F)		Total Participants	Date
			M	F		
1.	Satkhira- Manirampur	Keshabpur	6	2	8	January 2022
2.		Patkelghata	5	0	5	
3.	Shibchar-Gopalganj	Moksedpur	7	2	9	February 2022
4.		Rajoir	0	6	6	

Table 8-2: Locations and Number of Participants at FGDs (Substation)

SL. NO.	Name of Substation	Venue	Sub district	District	No. of Male (M)/ Female (F)		Total Participants	Date
					M	F		
1.	Satkhira	Taltola Eidgah Intersection	Satkhira Sadar	Satkhira	5	0	5	January 2022
2.	Shibchar	Maler Kandi	Shibchar	Madaripur	6	0	6	February 2022

8.1.1 Summary of Focus Group Discussion with Local Community and Affected Persons (Transmission Line)

- Participants are appreciated the project after knowing that, the objective of the Project is to increase the supply of electricity.
- The Average landholding size is 1 to 3 acres.
- The average land holding is reported to 20 to 30 decimals. The land ownership system for women is as per the Muslim Inheritance Law.
- The major crops grown are vegetables Rice like. Eri and Amon paddy is grown in the region. Rice is cultivated twice in a year.
- Most people of the community will lose their land for the cultivating during the construction period. However, they demanded the proper compensation for the damaged crops and the losses of crops production during the harvesting time.
- There will be a possibility of some environmental impacts on the area at the construction period and most of the people are mostly concerned about it. The survey team explained those impacts will be temporary and can be mitigated to minor level.

- People of that area think that the project will develop the electricity condition of the area. Moreover, it will also increase the possibility of building Mills and Factories in the area which can improve their lifestyle.

8.1.2 Summary of Focus Group Discussion with Women Group

- Women are mostly involved in household work, collecting firewood from homestead.
- Some of the women reported assisting men in agriculture. During lean season, few men migrate (seasonal) for daily labour work to Dhaka and other districts. The migration period is 30-60 days. Women mostly do not go out for work outside their villages. However, few women do work as agricultural labour in other's field, but very significant number would migrate outside their villages for work. Reportedly 2-3 girls have gone to Dhaka and work in the garment industry.
- The daily activities of women start from 6 AM to 7.00 AM in the morning, involves in cooking and cleaning, collection of firewood, taking care of children, feeding the cattle and other livestock etc. Post, which they go to the agriculture field to assist men in cultivation, weeding, sowing etc. Between 12 PM to 1 PM the women would get back to their home for lunch and this is the only time where they would get time to relax.
- Their work resumes from 2 PM which includes household work, cooking, feeding the livestock, taking care of their children, elders etc. At 10.00 P.M women normally go to sleep.
- The age of marriage among girls is between 17-21 yrs.
- There are also cases of domestic violence and one case of rape has been reported.
- In the case of finance and access to banking, none of the women have bank account in their name. Some of them reported that they have mobile banking system like Bkash, Nagad ect. which is easier to operate and manage.
- They don't have any land parcel of their own name in the proposed project area.
- Most of them demanded the crops compensation for the losses.

8.1.3 Summary of Focus Group Discussion with Local Community (Substation)

- People of these areas are mostly concerned about various things such as land, trees, river and overall environment which can be impacted by the project.
- The major livelihood activity in the area is agriculture, followed by services, agri business, daily labour and migrant labour.
- About 30% of the households have taken land on contract for farming. These are mainly the small and marginal farmers.
- People requested proper compensation for the land, trees and structures, if affected. The survey team informed them that the funds have been allocated to pay compensation for structures and replanting of trees.
- There are a lot of trees which save the locality during the cyclone and such natural disasters. Due to the construction of transmission towers, some of these trees can be cut down. People of these area have raised the issue of cutting a large number of trees which will have an impact on environment. Therefore, the project should provide them additional compensation to plant trees. The survey team informed that cutting of trees will be confined to about 12 m width.

- People wanted to make sure that tower construction does not create any negative impacts on river flow or fish migration. The survey team informed that the distance between the tower foundation and the riverbank would be minimum 150 m. Therefore, soil erosion to river would not take place.
- Awareness of child labor issues and the contractors' obligation to adhere to core labor standards will be further strengthened through trainings together with HIV/AIDS awareness improvement trainings.
- The rate for each land parcel depends on the type of land.

9 CONCLUSION AND RECOMMENDATIONS

This addendum report to original IEE[7] study has been conducted based on the final surveyed alignments of the two transmission line routes: Satkhira to Manirampur 132 kV transmission line and Gopalganj (N)-Shibchar 230 kV transmission line, where the main scope was to update the baseline condition, impact assessment and suggest environmental management plan. As per the impact assessment it has been found that many of the impacts are localized and short-term or temporary in nature and can be mitigate as suggested in the EMP of the original IEE and this addendum. The Project received favorable support from local people and other stakeholders during consultations. Stakeholders appreciated that in addition to providing a reliable power supply to the region, the Project will have several other benefits such as supporting economic growth in the region by opening avenues for further development, employment (direct and indirect) and improving local infrastructure.

Satkhira to Manirampur 132 kV transmission line was increased to 33 km due to some deviation considering less impacts e.g., damage to community structures, tree cutting etc. in the original route. The final route avoided all the settlements and structures within the RoW. The protected or environmentally sensitive areas, forest, scrublands or wildlife reserves are not found along the line route. There are no springs or deep wells/tubewell other common and individual properties situated underneath this line. During the consultation and site visit of the consultants, it was revealed that there were no physical cultural resources situated within ROW. The major waterbodies covered are rivers and gher, however, the transmission line will not pose any risk to seasonal habitats/wetlands. Due to the slight deviation towards the end for the final route, a less number of trees to be cut in this alignment than the original route.

Gopalganj (N)-Shibchar 230 kV transmission line is estimated at 21.7 km by the PGCB. After the field surveys the length of the line has been increased to 25 km due to some deviations considering less impacts e.g., damage to community structures, tree cutting etc. to the original line route. There are no settlements, structures, common and individual properties situated underneath this line. There are no protected areas, ecologically critical areas, reserve forests and other wildlife reserves are found within the RoW. A smaller number of trees to be cut in this alignment than the original route.

A detailed birds survey/migratory birds surveys for these two alignments are suggested to be conducted in order to eliminate any potential threat to their route and staging.

In conclusion, there will be some minor negative impacts caused by the project during implementation. Compensation will be paid for loss of land, trees, and crops. The impacts identified in the original IEE and this addendum can be mitigated with implementation of the EMP and monitoring measures.

[7] https://www.adb.org/projects/documents/ban-51137-003-iee

APPENDIX

APPENDIX A: COORDINATES OF FINAL ALIGNMENTS OF TRANSMISSION AND LILO LINES OF DWZTGEP COMPONENT 2

Manirampur- Satkhira 132 kV Transmission Line

Line Length: 33.0 km

No	Coordinates (Decimal Degrees)		Elevation (m)	Name and Angle
	Latitude	Longitude		
1	22.74479	89.09222	2	Start Point
2	22.75662	89.09381	5	AP -1 (11 degrees - LT)
3	22.76044	89.09359	3	AP -2 (10 degrees - RT)
4	22.78193	89.09601	4	AP -3 (14 degrees - LT)
5	22.78953	89.09503	3	AP -4 (40 degrees - RT)
6	22.81435	89.11052	5	AP -5 (29 degrees - RT)
7	22.81714	89.11538	5	AP -6 (17 degrees - RT)
8	22.82049	89.13004	3	AP -7 (8 degrees - RT)
9	22.82162	89.14112	7	AP -8 (18 degrees - LT)
10	22.82411	89.14695	6	AP -9 (25 degrees - LT)
11	22.82835	89.15083	7	AP -10 (35 degrees - RT)
12	22.83036	89.15962	6	AP -11 (50 degrees - LT)
13	22.83657	89.16283	5	AP -12 (14 degrees - LT)
14	22.84297	89.16442	8	AP -13 (40 degrees - RT)
15	22.8436	89.16527	7	AP -14 (48 degrees - LT)
16	22.84482	89.16538	8	AP -15 (27 degrees - LT)
17	22.84563	89.16508	8	AP -16 (35 degrees - RT)
18	22.84827	89.16573	6	AP -17 (33 degrees - RT)
19	22.86505	89.18335	5	AP -18 (23 degrees - LT)
20	22.87952	89.18977	3	AP -19 (31 degrees - LT)
21	22.88899	89.18869	7	AP -20 (35 degrees - RT)
22	22.90105	89.19502	5	AP -21 (47 degrees - LT)
23	22.90314	89.1943	3	AP -22 (22 degrees - RT)
24	22.91351	89.19466	5	AP -23 (55 degrees - RT)
25	22.91581	89.19807	5	AP -24 (21 degrees - LT)
26	22.92798	89.20663	2	AP -25 (16 degrees - RT)
27	22.94393	89.22609	2	AP -26 (9 degrees - RT)
28	22.94906	89.23455	7	AP -27 (59 degrees - LT)
29	22.95205	89.23456	7	AP -28 (17 degrees - LT)
30	22.954	89.23399	7	AP -29 (39 degrees - RT)
31	22.95712	89.23527	8	AP -30 (24 degrees - RT)
32	22.95875	89.23693	10	AP -31 (66 degrees - LT)
33	22.96646	89.2341	9	AP -32 (10 degrees - RT)
34	22.97097	89.23325	5	AP -33 (22 degrees - LT)
35	22.97597	89.23009	4	End Point

No	Coordinates (Decimal Degrees)		Elevation (m)	Name and Angle
	Latitude	Longitude		
36	22.82681	89.14928	8	Home Gardens/ plantation
37	22.82983	89.15765	6	Home Gardens/ plantation
38	22.84678	89.16538	7	Home Gardens/ plantation
39	22.84775	89.16561	7	Home Gardens/ plantation
40	22.91541	89.19727	9	Home Garden
41	22.94787	89.23254	8	Home Garden
42	22.94828	89.23331	9	Home Garden
43	22.95841	89.23667	10	Home Garden
44	22.96241	89.23554	7	Home Garden
45	22.95883	89.23693	9	Home Garden
46	22.84455	89.16541	6	Home Garden
47	22.84661	89.16531	7	Home Garden
48	22.82607	89.14882	10	Road (Tertiary)
49	22.95259	89.2345	8	Road (Katcha)
50	22.95669	89.23509	8	Road (Katcha)
51	22.95444	89.2342	7	Road (Pucca)
52	22.962	89.23573	6	Road (Katcha)
53	22.9657	89.23433	8	Road (Katcha)
54	22.94699	89.23118	9	Road (Pucca)
55	22.84337	89.16505	7	Road (Katcha)
56	22.82087	89.13314	4	Road (Secondary)
57	22.91568	89.1979	9	Road (Tertiary)
58	22.94474	89.22753	3	Road (Highway)
59	22.97136	89.23301	4	Road (Tertiary)
60	22.92074	89.20162	8	Road (Secondary)
61	22.91642	89.1985	6	Road (Secondary)
62	22.90424	89.19433	6	Road (Secondary)
63	22.8895	89.18894	8	Road (Tertiary)
64	22.87577	89.18807	6	Road (Tertiary)
65	22.86896	89.18521	4	Road (Secondary)
66	22.8424	89.16427	6	Road (Tertiary)
67	22.8276	89.1501	9	Road (Tertiary)
68	22.82493	89.14781	7	Road (Tertiary)
69	22.82111	89.13606	5	Road (Tertiary)
70	22.81779	89.11822	5	Road (Secondary)
71	22.81753	89.11607	4	Road (Tertiary)
72	22.78324	89.09625	2	Road (Tertiary)
73	22.75883	89.09361	6	Road (Tertiary)
74	22.75791	89.09361	4	Road (Tertiary)
75	22.75542	89.09369	5	Road (Secondary)

No	Coordinates (Decimal Degrees)		Elevation (m)	Name and Angle
	Latitude	Longitude		
76	22.74881	89.09278	4	Road (Highway)
77	22.75841	89.09366		River (Betna)
78	22.82977	89.15704		River (Kopotakkho)
79	22.89571	89.19218		Canal
80	22.94872	89.23392		Canal
81	22.95781	89.23599		Canal
82	22.90357	89.19433	3	Canal
83	22.93216	89.21183	4	Canal
84	22.96936	89.23351	6	Canal
85	22.94708	89.2314	8	Pond
86	22.84254	89.16427	6	Pond
87	22.7486	89.09264	2	D/T Line
88	22.82123	89.13517	4	D/T Line
89	22.8348	89.16193	8	D/T Line
90	22.83607	89.16252	6	D/T Line
91	22.84235	89.16429	6	D/T Line
92	22.86378	89.18209	6	D/T Line
93	22.89468	89.19167	9	D/T Line
94	22.8908	89.18969	10	D/T Line
95	22.91381	89.19513	5	D/T Line
96	22.95439	89.2341	7	D/T Line
97	22.81718	89.11518	5	D/T Line

Gopalganj(N) - Shibchar 230 kV

Line Length: 25 km

No	Coordinates (Decimal Degrees)		Elevation (m)	Name and Angle
	Latitude	Longitude		
1	23.27795	90.01242	5	Start Point
2	23.28297	90.03283	5	AP - 1 (17 degrees - LT)
3	23.28801	90.04141	5	AP - 2 (4 degrees - RT)
4	23.29309	90.05133	8	AP - 3 (41 degrees - LT)
5	23.30537	90.05642	6	AP - 4 (36 degrees - RT)
6	23.31214	90.06747	7	AP - 5 (28 degrees - LT)
7	23.3294	90.07791	7	AP - 6 (41 degrees - RT)
8	23.33145	90.08422	6	AP - 7 (30 degrees - RT)
9	23.32969	90.09273	6	AP - 8 (12 degrees - RT)
10	23.32534	90.10268	9	AP - 9 (11 degrees - LT)
11	23.32246	90.1153	8	AP - 10 (43 degrees - RT)

12	23.31647	90.1195	8	AP - 11 (31 degrees - LT)
13	23.31377	90.12537	5	AP - 12 (52 degrees - LT)
14	23.31955	90.1366	8	AP - 13 (38 degrees - RT)
15	23.31504	90.16102	7	AP - 14 (14 degrees - LT)
16	23.31525	90.16585	8	AP - 15 (51 degrees - LT)
17	23.33134	90.17796	10	AP - 16 (25 degrees - RT)
18	23.33242	90.17997	8	AP - 17 (20 degrees - LT)
19	23.33714	90.1842	10	AP - 18 (16 degrees - RT)
20	23.3405	90.18936	10	AP - 19 (49 degrees - LT)
21	23.34408	90.18988	10	AP - 20 (47 degrees - LT)
22	23.35082	90.18449	9	AP - 21 (40 degrees - RT)
23	23.35412	90.18457	8	End Point
24	23.27999	90.02065	6	Road (Secondary)
25	23.35396	90.18457	8	Road (Secondary)
26	23.35381	90.18471	9	Road (Tertiary)
27	23.3411	90.18928	10	Road (Tertiary)
28	23.34007	90.18871	10	Road (Secondary)
29	23.33719	90.18407	10	Road (Secondary)
30	23.33169	90.1786	10	Road (Secondary)
31	23.33169	90.1786	10	Road (Secondary)
32	23.31502	90.16185	7	Road (Secondary)
33	23.31652	90.15322	7	Road (Tertiary)
34	23.31746	90.14796	6	Road (Secondary)
35	23.3186	90.14195	9	Road (Secondary)
36	23.31868	90.14172	9	Road (Tertiary)
37	23.31434	90.12409	5	Road (Tertiary)
38	23.31582	90.12089	9	Road (Tertiary)
39	23.31976	90.11715	8	Road (Tertiary)
40	23.31976	90.11715	8	Road (Tertiary)
41	23.32265	90.11482	8	Road (Secondary)
42	23.3258	90.10162	8	Road (Secondary)
43	23.31976	90.11715	8	Road (Tertiary)
44	23.32265	90.11482	8	Road (Secondary)
45	23.3258	90.10162	8	Road (Secondary)
46	23.33002	90.09111	6	Road (Secondary)
47	23.33043	90.08104	7	Road (Tertiary)
48	23.3181	90.07119	5	Road (Secondary)
49	23.31805	90.07096	5	Road (Secondary)
50	23.31122	90.06606	10	Road (Tertiary)
51	23.31024	90.06417	10	Road (Tertiary)
52	23.3064	90.05769	7	Road (Tertiary)
53	23.3045	90.05605	6	Road (Tertiary)

54	23.2919	90.04901	3	Road (Tertiary)
55	23.28246	90.03109	6	Road (Secondary)
56	23.28094	90.02475	6	Road (Secondary)
57	23.2783	90.01335	6	Road (Highway)
58	23.28908	90.04362	6	D/T Line
59	23.3406	90.18936	10	D/T Line
60	23.31531	90.16529	8	D/T Line
61	23.31531	90.16529	8	D/T Line
62	23.31507	90.16194	7	D/T Line
63	23.3255	90.1023	7	D/T Line
64	23.33283	90.18034	8	Canal
65	23.33152	90.17843	10	Canal
66	23.31557	90.12141	7	Canal
67	23.32578	90.10182	8	Canal
68	23.33002	90.09101	6	Canal
69	23.31794	90.07106	5	Canal
70	23.31853	90.07125	8	Canal
71	23.30466	90.05615	4	Canal
72	23.28092	90.02453	5	Canal
73	23.28092	90.02453	5	Canal
74	23.33842	90.18609	8	Pond
75	23.3513	90.18453		River (Ariyal Khan)
76	23.31503	90.16179		River (Ariyal Khan)
77	23.31691	90.15073		River (Ariyal Khan)
78	23.31793	90.13344		River (Ariyal Khan)
79	23.3166	90.13089		River (Ariyal Khan)
80	23.31068	90.06501		River (Kumar)
81	23.34241	90.1897	11	Home Gardens/ plantation

APPENDIX B: Photographs of the Existing Environment and Public Consultations

Existing Environment

Manirampur- Satkhira 132 kV Transmission Line

AP 02

AP 03

AP 05

AP 06

AP 07	AP 08
	
AP 09	**AP 10**
	
AP 11	**AP 13**
	
AP 14	**AP 15**

Gopalganj (N) - Shibchar 230 (KV) Transmission Line

	
AP 01	**AP 04**
	
AP 08	**Proposed tower- 02**
	
AP 11	**AP 13**

	
AP 14	**End Point**

The safeguard consultation photographs (January- March 2022)

	
Public Consultation during safeguard consultation mission- Satkhira	**Public Consultation 2**

Public Consultation during safeguard consultation mission- Gopalganj

	
Public Consultation 3	**Public Consultation 4**

	
Public Consultation 5	**Public Consultation 6**

APPENDIX C: Attendance of Consultations

Dhaka & Western Zone Transmission Grid Expansion Project

FOCUS GROUP DISCUSSION
ATTENDANCE SHEET

Location: Rajnagar, Shatkhira Sadar, Satkhira
Date: 18/01/22 Time: 11:45

Sl.	Name of Participant	Age	Occupation	Phone Number	Signature
1	Md Fazlur Rahman	25	Mason	01741-067384	
2	S.M. Shariful Alam	59	Farmer	01739-131069	
3	Nazem Ali Sarder	64	"	01799-057345	
4	Babul Sarder	45	Service	01798-316275	
5	Abdus Salam	33	Farmer	01741-353399	
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Dhaka & Western Zone Transmission Grid Expansion Project

FOCUS GROUP DISCUSSION
ATTENDANCE SHEET

Location: Rajoir, Madaripur

Date: 20/02/22 Time: 11:30 A.m.

Sl.	Name of Participant	Age	Occupation	Phone Number	Signature
1	Asia Begum	65	Housewife	0173 3-011083	আছিয়া
2	Firoza Sharmin	42	"	01928-297376	ফিরোজা
3	Kahinun Akon	55	Housewife	01310374285	কহিনুর
4	Amela Begum	60	"	01715-479191	আমেলা
5	Bilkis Begum	35	"	01710-590703	বিলকিস
6	Arifa Khanom	40	"	01307-840139	আরিফা
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Dhaka & Western Zone Transmission Grid Expansion Project

FOCUS GROUP DISCUSSION
ATTENDANCE SHEET

Location: Maksudpur, Gopalganj

Date: 18/02/2022 Time: 10:50 AM

Sl.	Name of Participant	Age	Occupation	Phone Number	Signature
1	Abdul Jalil Mumbi	72	Farmmer	01614200479	
2	Firoza Begum	55	~~0170~~ House wife	01707 - 199185	
3	Awlid Khan	32	Service	01726 - 161859	Awlid
4	Afin Matubban	52	Farmmer	017 49-157008	
5	Emayet Hossen	50	Service	01715- 972072	
6	Shahidul Islam	45	Farmmer	01727-829754	
7	Saiful Islam Firoz	45	11	01717-441287	
8	Graffan Mumbi	55	11	01716-418832	
9	Mst. Amena	60	Housewife	01724-021379.	
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Dhaka & Western Zone Transmission Grid Expansion Project

FOCUS GROUP DISCUSSION
ATTENDANCE SHEET

Location: Katakhali, Patkelghata, Satkhira.

Date: 15/01/2022 Time: 10:45 AM

Sl.	Name of Participant	Age	Occupation	Phone Number	Signature
1	AKM Milton Mia	40	Farmer	01772831957	
2	Abdul Matin	47	"	01724469935	
3	Shafiqul Islam	64	"	01712190390	
4	Mohashin Sheikh	52	"	01737733589	
5	Amjad Ali	58	"	01767602949	
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Dhaka & Western Zone Transmission Grid Expansion Project

FOCUS GROUP DISCUSSION
ATTENDANCE SHEET

Location:	Jhikra, Keshabpur, Jashore.
Date: 16/01/2022	Time: 11:30 AM

Sl.	Name of Participant	Age	Occupation	Phone Number	Signature
1	মোজাহার মোড়ল	৪৬	কৃষক	০১৯২৬৭০৮৭৯	
2	মোঃ আব্দুল আলিম	৬৫	কৃষক (অবঃ)	০১৭৬৩৪২৬৯০০	
3	মোঃ আতাউর রহমান	৫৫	ব্যবসা	০১৭৪৬৯০২২৩০	
4	মোঃ ইউনুছ আলি	৬২	চাকুরী	০১৭৫৪২৯৬২৬৪	
5	আলেয়া খাতুন	৪৭	গৃহিনী	"	
6	মোজাফফর রহমান	৫০	কৃষক	০১৭৫৮৪৬২৯৬	
7	শফিকুল ইসলাম	৫২	কৃষক	০১৭৩৯৪৭৯২২০	
8	আফিনা বেগম	৪৬	গৃহিনী	০১৭৪৮২৬৬২৭০	
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Dhaka & Western Zone Transmission Grid Expansion Project

FOCUS GROUP DISCUSSION
ATTENDANCE SHEET

Location: Shibchar, Madaripur

Date: 22/02/22 Time: 10:50

Sl.	Name of Participant	Age	Occupation	Phone Number	Signature
1	Rajab Ali	74	Farmer	01779-007789	
2	Azizul Fakir	38	"	01790-520712	
3	Kabul Mallik	56	Service	01712-971436	Kabul
4	Md. Ibrahim	31	Business	01720-177778	
5	Md. Abdul Haigh	75	Farmer	01763-182781	
6	Manik Munshi	50	"	01775-337693	
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