

Initial Environmental Examination

September 2015

BAN: Power System Expansion and Efficiency Improvement Investment Program – Tranche 3 (Output 2: Transmission System and Up-gradation; Output 3: Demand Side Energy Efficiency Improvement)

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CURRENCY EQUIVALENTS

(as of 21 June 2015)

Currency unit	-	taka (Tk.)
Tk.1.00	=	\$ 0.013
\$1.00	=	Tk. 77.74

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ABBREVIATIONS

ADB	-	Asian Development Bank
AEZ	-	Agro Ecological Zone
AIS	-	Air Insulated Switchgear
AP	-	Angle Point
ASA	-	Association for Social Advancement
BBS	-	Bangladesh Bureau of Statistics
BEZ	-	Bio- Ecological Zone
BMD	-	Bangladesh Meteorological Department
BPDB	-	Bangladesh Power Development Board
BRAC	-	Bangladesh Rural Advancement Committee
BWDB	-	Bangladesh Water Development Board
CEGIS	-	Center for Environmental and Geographic Information Services
CITES	-	Convention on International Trade in endangered species
CHT	-	Chittagong Hill Tracts
DC	-	Deputy Commissioner/ Double Circuit
DEPC	-	Department of Environmental Pollution Control
DG	-	Director General
DGM	-	Deputy General Manager
DIA	-	Direct Impact Area
DoE	-	Department of Environment
EA	-	Executive Agency
EC	-	Electrical conductivity
ECA	-	Environment Conservation Act
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EQS	-	Environment Quality Standards
FD	-	Forest Department

FGDs	-	Focused Group Discussions
FIDC	-	Forest Industries Development Corporation
FWIP	-	Future- with- Project
FWOP	-	Future- without- Project
GIA	-	General Impact Area
GIS	-	Geographic Information Services
GIS	-	Gas Insulated Switchgear
GOB	-	Government of Bangladesh
GRC	-	Grievances Redress Committee
HES	-	Health Environment and Safety
HHs	-	Households
HTW	-	Hand Tube well
HYV	-	High Yielding Variety
IDB	-	Islamic Development Bank
IEC	-	Important Environmental Component
IEE	-	Initial Environmental Examination
IESC	-	Important Environmental and Social Component
IUCN	-	International Union for Conservation for Nature
JICA	-	Japan International Cooperation Agency
KII	-	Key Informant Interview
Km	-	Kilometer
kV	-	kilo Volt
LGED	-	Local Government Engineering Department
LILO	-	Line in Line Out
MoEF	-	Ministry of Environment and Forest
MVA	-	Mega Voltage
MW	-	Mega Watt
NCA	-	Net Cultivated Area
NCS	-	National Conservation Strategy
NEMAP	-	National Environment Management Action Plan

NGOs	-	Non- Governmental Organizations
NOC	-	No Objection Certificate
NWRD	-	National Water Resource Database
OCR	-	Ordinary Capital Resources
OMS	-	Operation Management System
PAPs	-	Project Affected Peoples
PD	-	Project Director
PDB	-	Power Development Board
PCP	-	Project Concept Paper
PGCB	-	Power Grid Company Bangladesh Ltd.
PRA	-	Participatory Rural Appraisal
PWD	-	Public Works Department
PVC	-	Poly Venial Chloride
P&D	-	Project and Development
RAP	-	Resettlement Assessment Plan
RCC	-	Reinforced Cement Concrete
REB	-	Rural Electricity Board
RoW	-	Right of Way
RRA	-	Rapid Rural Appraisal
RS	-	Remote Sensing/Route Survey
SES	-	Socio Economic Survey
SIA	-	Social Impact Assessment
SMEs	-	Small and Medium Scale Enterprises
SPM	-	Suspended Particulate Matter
SPS	-	Safeguard Policy Statement
SRDI	-	Soil Research Development Institute
ToR	-	Terms of Reference
UNCED	-	United Nations Conference on environment and Development
UNO	-	<i>Upazila Nirbahi Officer</i>
WB	-	World Bank

WEIGHTS AND MEASURES

°C	-	degree Celsius
dB(A)	-	decibel acoustic
GWh	-	giga watt hour
ha	-	hectare
km	-	kilometer
km/h	-	kilometer per hour
kWe	-	kilowatt-electric
kV	-	Kilo volt(s)
kVA	-	kilo Volt-Amps
m	-	meter
mm	-	millimeter
m ³	-	cubic meter
m ³ /hr	-	cubic meters per hour
mg/l	-	milligrams per liter
m/s	-	meters per second
MTPA	-	metric tons per annum
MW	-	megawatt
ppm	-	parts per million
ppt	-	parts per thousand
rpm	-	revolutions per minute
µg/m ³	-	microgram per cubic meter
mG	-	milli guss

GLOSSARY

Adverse impact: An impact that is considered undesirable.

Ambient air: Surrounding air.

Aquatic: Growing or living in or near water.

Bangla: Bengali language.

Baseline (or existing) conditions: The 'baseline' essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the project, i.e. the 'No-development Option'.

Bazar: Market.

Beel: A 'back swamp' or depression can be either perennial or seasonal.

Beneficial impacts: Impacts, which are considered to be desirable and useful.

Biological diversity: The variety of life forms, the different plants, animals and micro organisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity.

Char: Newly accreted land: Land, sometimes islands, within main river channels and nearby mainland or in the estuary, subject to erosion and accretion.

Ecosystem: A dynamic complex of plant, animal, fungal and microorganism communities and associated non-living environment interacting as an ecological unit.

Emission: The total amount of solid, liquid or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, for e.g., in grams per cubic meter of gas or by a relative measure, upon discharge from the source.

Endangered species: Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from immediate danger of extinction.

Environmental effects: The measurable changes, in the natural system of productivity and environmental quality, resulting from a development activity.

Environmental Impact: An estimate or judgment of the significance and value of environmental effects for natural, socio-economic and human receptors.

Environment Management Plan (EMP): A Plan to undertake an array of follow-up activities which provide for the sound environmental management of a project/ intervention so that adverse environmental impacts are minimized and mitigated; beneficial environmental effects are maximized; and sustainable development is ensured.

Environmental Management: Managing the productive use of natural resources without reducing their productivity and quality.

Erosion: Process in which wind and water removes materials from their original place; for instance, soil washed away from an agricultural field.

Evaluation: The process of looking back at what has been really done or accomplished.

Fauna: A collective term denoting the animals occurring in a particular region or period.

Field Reconnaissance: A field activity that confirms the information gathered through secondary sources. This field study is essentially a rapid appraisal.

Flora: All of the plants found in a given area.

Habitat: The natural home or environment for a plant or animal.

Household: A household is identified as a dwelling unit where one or more persons live and eat together with common cooking arrangement. Persons living in the same dwelling unit having separate cooking arrangements constitute separate household.

Important Environmental Component (IEC): These are environmental components of biophysical or socio-economic importance to one or more interested parties. The use of important environmental components helps to focus the environmental assessment.

Khal: Small Channel, canal.

Land use: Types include agriculture, horticulture, settlement, pisciculture and Industries

Mauza: A Bangla word for the smallest government administrative area corresponding to village revenue unit.

Mitigation: An action, which may prevent or minimize adverse impacts and enhance beneficial impacts.

Negative Impact: Negative change from the existing situation due to the project.

Public involvement / Public consultation: A range of techniques that can be used to inform, consult or interact with stakeholders affected / to be affected by a proposal.

Reversible impact: An environmental impact that recovers either through natural process or with human assistance (e.g. cutting off fish migration by an embankment might be reversible at a later stage if a proper regulator is built).

Stakeholders: Those who may be potentially affected by a proposal, e.g., local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or to take an interest in it.

Taka: Unit of Bangladeshi currency.

Terrestrial: Living on land.

Thana: Sub-district level of government administration, comprising several unions under district.

Union: Smallest unit of local self government comprising several villages.

Upazila: Sub-district name. Upozila introduced in 1982.

Zila: Bengali word of district.

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Executive Summary

Power Grid Company of Bangladesh Ltd. (PGCB) is planning to construct and rebuild transmission lines in different segments of Chittagong division including 4 sub-stations. Two new 132/33 kV sub-stations will be constructed and two 132/33 kV sub-stations will be upgraded in this proposed project. The proposed transmission lines will be 132kV double circuit which will be used to transmit power in different districts of Chittagong Division of Bangladesh. ADB may give financial assistance for the project. PGCB wants to prepare the Initial Environmental Examination (IEE) report for DoE site clearance, Environmental Impact Assessment (EIA) report for the Department of Environment (DoE) environmental clearance.

The demand of electricity is going up regularly throughout the country. In consistence with this higher demand of power, new power plants need to be installed. But it will not be possible to transmit the power output from the existing and the future power plants unless and until the sufficient transmission facilities are built-up. PGCB is planning to supply power from and to these areas to fulfill the demand sufficiently.

In order to improve the demand-side energy efficiency, Rural Electrification Board (REB) of Bangladesh will replace 700,000 of analog post-paid meters at Dhaka Division with pre-paid meters.

According to the Environment Conservation Act 1995 and Environment Conservation Rules 1997, the transmission line projects fall under 'Red Category' projects which requires IEE and EIA to get 'Site Clearance' and 'Environmental Clearance' respectively from DoE. Therefore, PGCB intends to conduct environmental impact assessment and social safeguard study with the help of consultants. Since the REB sub-project won't have adverse environmental impacts, DoE has exempted REB from preparing the IEE. Therefore, this IEE study is mainly focused on PGCB sub-project.

- Scope of work for IEE study:

No	Activities	Length/area/No. (km/acre)	IEE report for
Transmission Line			Chittagong Division
1	Re-building of 132 kV Comilla - Chandpur double circuit transmission line(only change the conductor).	65	
2	Construciton of 132 KV double circuit Madunaghat-Kalurghat underground transmission line	7	
	Route Survey (RS), IEE and EIA of 2 transmission lines	72 km	
Sub-stations			
1	Upgrading of existing 132/33 kV GIS substation at Madunaghat	_*	
2	Upgrading of existing 132/33 kV substation at Comilla (S) from AIS to GIS	_*	
3	Construction of 132/33 kV GIS substation at Kalurghat	_*	
4	Construction of 132/33 kV AIS substation at Kachua	5 acre	
	RS, IEE and EIA of adjacent 4 substations	5.0 acre	
Pre-paid e-Metering in Dhaka			

1	Replacement of existing analog meters in Dhaka Division with pre-paid meters	700,000	Dhaka Division
		*land exists	

People all along the route of the transmission line expressed keen interest in the sub-project even after recognizing the fact that they will not get electricity directly from the transmission line. Their main interest is that the overall development in the power sector would contribute to the national development. Local people along the transmission line alignments will be benefited, as the project will generate some employment opportunities for them during the pre-construction and construction phases.

People involved in the proposed REB sub-project were also supportive to the project since it will provide the customers to use modern technology and aware them to economize in the use of electricity. Moreover, it will make them hassle free from travelling, save travel time and expense for payment of electricity bill, no fear of electric line disconnection, stop illegal connection and meter tempering, and ensure accurate payment as per consumption. The e-metering system will have positive benefits through consumer empowerment and financial strengthening of respective utilities, reduce losses, enhance the power transmission, and upgrade distribution networks.

The route of existing 65km Comilla to Chandpur 132kV transmission line was passed over the agricultural land. The 7km Madunaghat to Kalughat 132kV Transmission line is underground cable laying along the road. This has been reconfirmed by the IEE team members who walked along the entire length of the alignment.

Minor negative impacts of the project will be felt during the pre-construction and construction phases which may involve removal of vegetation and cutting of trees for carrying construction materials to the sites and stringing of conductor on towers and construction of the transmission line. These problems would be overcome by paying compensation and bringing back these lands to their original form before handing them over to the owners after the construction. Crop production lost due to these activities during the pre-construction and construction phases will have to be compensated as well.

The project is not likely to have any significant negative impact; therefore no major mitigation is required. The minor impact of noise and increase in traffic are within the existing level experienced by the local people. The stringing wire and the line installed under expert supervision. The contractor will be under specific orders for providing personal protective equipment (PPE) to the workers engaged for the job.

The monitoring plan, if properly implemented during the pre-construction, construction and post-construction and operation phases will ensure taking corrective measures.

The proposed project will have no residual adverse impact on the environment or the eco-system.

The PGCB is required to take site clearance from the DoE for implementing the transmission line and other ancillary works. The IEE report has been prepared with this end in view.

The IEE study reveals that the 132 kV transmission lines have no major negative impact, but will contribute to national development by improving the supply of electricity. Local people will have employment opportunities during pre-construction, construction and operation phase. The contractor should be specifically instructed to employ local laborers as much as possible.

Minor negative impacts like clearing of vegetation and cutting of trees at the pre-construction and construction phases should be taken care of by taking proper mitigation measures. Efforts should be made to avoid cutting of trees as much as possible. Cutting of some trees might be unavoidable in which case(s) one or more number of trees should be planted in the surrounding area for conservation of biodiversity. In this case, homesteads gardening will be emphasized with fruit and rapid growing timber trees in the surrounding area. Selection of the season for carrying out the work should be made by adjusting with the cropping season so as to inflict minimum damage to field crops. In both cases, proper compensation for all types of damages must be paid and the land should be brought back to its original form before they are handed back to the owners.

The construction labour camps should be provided with water supply and sanitation facilities. The workers should be apprised of hygienic practices. The transportation of heavy equipments should be done by river craft where wheeling is not feasible. The stores and equipment yards should be properly guarded so that all equipments remain safe. The sub-stations should be fully equipped with fire fighting equipments.

There will be no adverse environmental impact of the REB sub-project. The replaced old post-paid analog meters will be auctioned (if damaged) and re-used in other areas of Bangladesh.

Finally, on proper examination it is observed that the project has been proposed to be implemented safely and in an environment friendly manner. So it is recommended that the project may be given site clearance to proceed with the works immediately.

1. Introduction

1.1 Background of the Study

1. PGCB is planning to construct and re-build transmission lines in different segments Chittagong division including 4 sub-stations. Two 132/33 kV sub-stations will be constructed and two 132/33 kV sub-stations will be upgraded in this proposed project. The proposed transmission lines will be 132 kV double circuits which will be used to transmit power in Chittagong Division of Bangladesh. ADB may give financial assistance for the project

2. PGCB contracted the Center for Environmental and Geographic Information Services (CEGIS), a public Trust under the Ministry of Water Resources, to prepare the IEE of some subprojects included in Tranche 2 following the requirements of DOE to obtain the site clearance and ECC. Initially ADB planning to financed this project through Power System Expansion and Energy Efficiency Improvement Investment Program-Tranche 2. Due to fund issues the project is shifted to Tranche 3 (vide AM-FFM July 14, 2013). PGCB submitted IEE Report and EIA Report to DOE as a Tranche 2 Project for site clearance and environmental clearance. Initially PGCB decided to remove 65km Comilla-Chandpur transmission line completely (i.e., demolition of foundation of old Transmission line) and construct new one along the same route. Now considering the social issues, PGCB decided to replace only old conductor which have reduced current carrying capacity due to old age. 7 km Madunaghat-Kalurghat Transmission is new line, which will be underground cable along the road.

3. The demand of electricity is going up regularly throughout the country. In consistence with this higher demand of power, new power plants need to be installed. But it will not be

possible to transmit the power output from the existing and the future power plants unless and until the sufficient transmission facilities are built-up. PGCB is planning to supply power from and to these areas to fulfill the demand sufficiently.

4. In order to improve the demand-side energy efficiency, Rural Electrification Board (REB) of Bangladesh will replace 700,000 of analog post-paid meters at Dhaka Division with pre-paid meters.

5. According to the Environment Conservation Act 1995 and Environment Conservation Rules 1997, all transmission line projects fall under 'Red Category' projects, which requires IEE and EIA to get 'Site Clearance' and 'Environmental Clearance' respectively from DoE. Therefore, PGCB intends to conduct EIA and social safeguard study with the help of consultants.

6. In this context, Center for Environmental and Geographic Information Services (CEGIS), a public trust under the Ministry of Water resources, having vast experience of environmental, social impact assessment study and resettlement planning, intends to provide services of EIA and resettlement study for the proposed transmission line.

7. PGCB intends to construct 7 km 132 kV and re-build (only replacement of conductor) 65 km transmission lines in Chittagong Division of Bangladesh. PGCB wants to prepare the IEE report for ADB loan/DoE site clearance, EIA report for DoE environmental clearance.

8. This draft IEE was prepared based on some of the findings of IEE of CEGIS, social survey conducted May 2015, several time discussion with Executing Agency.

1.2 Main Objectives of the project

9. The objects of the Project are:

- To supply power from among and within Chittagong division;
- To increase the power supply reliability to different area mentioned above;
- To reduce the transmission loss to some extent;
- To improve the demand-side energy efficiency.

1.3 Scope of work of the project

10. Since the REB sub-project won't have adverse environmental impacts, DoE has exempted REB from preparing the IEE. Therefore, this IEE study is mainly focused on PGCB sub-project. The scope of works will have IEE will be conducted for Chittagong division. The following table 1.1 shows the detail scope of works.

Table 1.1: 132 KV Grid Network Development Project: Chittagong Division

No	Objective	Length/area (km./acre)	IEE report for
Transmission Line			Chittagong Division
1	Re-building of 132 kV Comilla - Chandpur double circuit transmission line(only replacement of conductor)	65	
2	Construction of 132 KV double circuit Madunaghat-Kalurghat underground transmission line (underground	7	

	cable)		
	RS, IEE and EIA of 4 transmission lines	72 km	
	Sub-stations		
1	Upgrading of existing 132/33 kV GIS substation at Madunaghat	_*	
2	Upgrading of existing 132/33 kV substation at Comilla (S) from AIS to GIS	_*	
3	Construction of 132/33 kV GIS substation at Kalurghat	_*	
4	Construction of 132/33 kV AIS substation at Kachua	5 acre	
	RS, IEE and EIA of adjacent 4 substations	5.0 acre	
		*land existing	

Source: PBCG, Planning and Design unit

1.4 Rationale of the Projects

11. Chittagong is connected to the national transmission network at Comilla (north) with the only 230/132 kV substation located at Hathazari, having 4X150 MVA capacity, despite being the second load center of the country. Looking forward, power demand in Chittagong area is expected to increase by 10% per annum for the period from 2011 to 2015. As such, the power supply system in Chittagong is and will be in a vulnerable position until new 230 kV substation facilities are incorporated to accommodate the growing power supply and demand in the area. Therefore, construction of new 230/132 kV substations as well as extension of the existing Madunaghat, Kalurghat substations with associated transmission lines will be required.

12. REB sub-project comprises replacement of analog meters with pre-paid digital meters for 700,000 customers in the Dhaka. Each existing analog meter at retail customer premises currently used for post-paid service will be replaced with the new digital meter, with a pre-payment facility. The replacement will be mandatory. The replaced old meters will be auctioned and re-used in other areas of Bangladesh.

1.5 Objectives of the studies

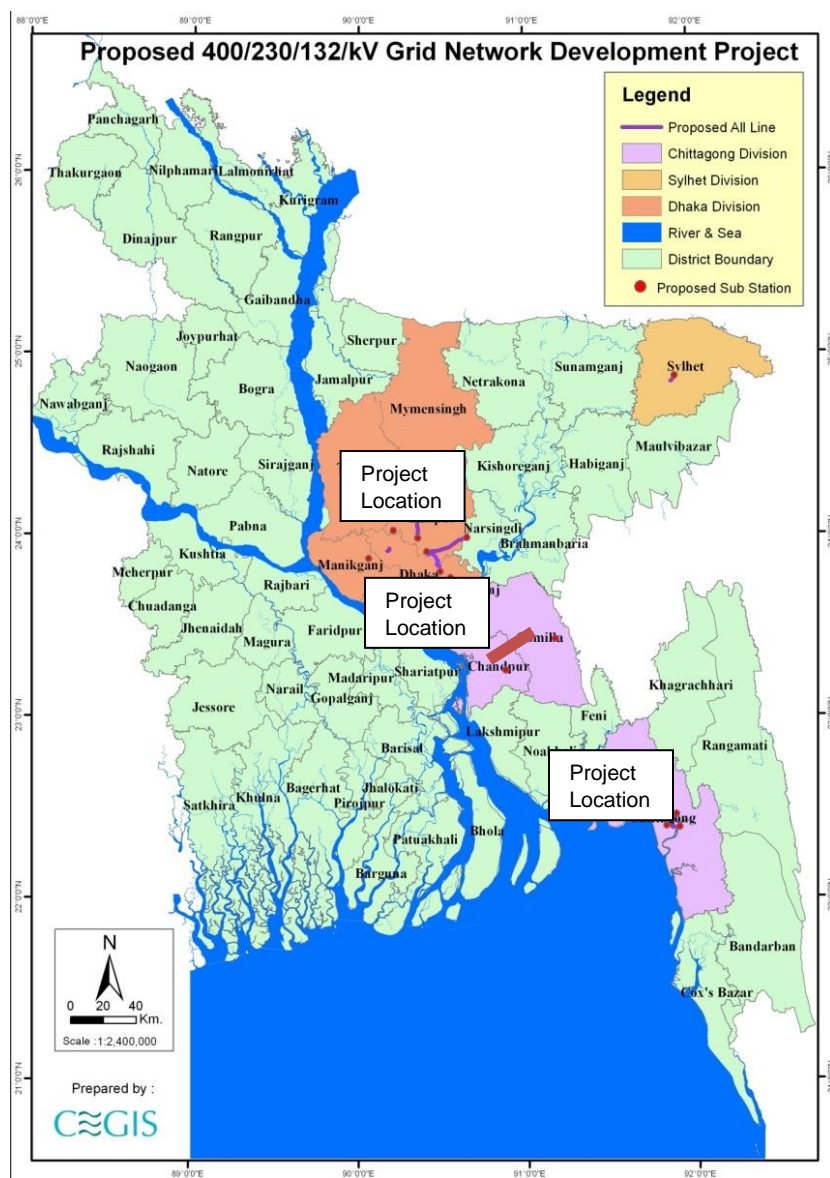
13. According to the Environment Conservation Act 1995 and Environment Conservation Rules 1997, power transmission line projects falls under 'Red Category' projects which requires IEE and EIA to get 'Site Clearance' and 'Environmental Clearance' respectively from DoE. Therefore, the objects of the studies are:

- To conduct RS for the proposed transmission lines;
- To conduct IEE study for DoE site clearance as well as loan clearance;
- To conduct EIA studies for DoE environmental Clearance from the DoE.

1.6 Study Area

14. The proposed project is located in Chittagong Division of Bangladesh. The locations are shown in the following Map 1.1.

15. The existing Comilla – Chandpur transmission line avoided major settlements and passes mostly over agricultural and fallow lands. For the 132kV transmission line, the RoW will be 80 meter. Around 20 meter wide path of the line is defined as the Direct Impact Area (DIA). As per baseline information, a 30 meter buffer impact zone on both sides (30m+ 30m=60m) for 132 kV line have been considered to be the General Impact Area (GIA). Both the DIA and GIA have been evaluated in this IEE study and only DIA will be estimated for the EIA study. The new Modunaghat-Kalurghat 7 km underground transmission line will pass along the existing road.



Map 1.1: Proposed location of transmission lines & sub-stations in Chittagong Division and pre-paid e-metering system in Dhaka Division

1.7 Scope of the study

16. The scope of the IEE study includes:

- Alternative site analysis;
- Environmental baseline survey;
- Selection of environmental and social components likely to be impacted by the project;
- Initial assessment and evaluation of impacts;
- Preparation of IEE report;
- Assist in obtaining 'Site Clearance' and 'ToR of EIA' from DoE;
- Conduct public consultation to obtain people's perception on the project;
- Preparation of initial Environmental Management Plan (EMP).

1.8 Objectives of the IEE

17. As noted earlier, according to the EIA guidelines for industries of the DoE, power plant and electricity distribution, construction/re-construction/extension fall under the Red Category. Red Category projects require EIAs that should be preceded by IEEs. As this project falls under the Red Category, it is required to undertake an IEE which is a pre-condition for obtaining environmental clearance by the DoE.

18. As per Asian Development Bank (ADB)'s Safeguard Policy Statement (SPS) 2009, this project is classified as category B, which requires an IEE to avoid adverse project impacts to both the environment and affected people, and minimize, mitigate and compensate for adverse project impacts.

19. Hence, the PGCB has carried out an IEE through an Environment Impact Assessment Consultant to fulfill the requirements of ADB and DoE. The main objectives of the IEE study included:

- Describing the existing environmental and social baseline of the area;
- Identifying important environmental and social components which may be impacted for the project;
- Assessing the potential environmental and social impacts, including any residual impact of the proposed project;
- Identifying mitigation measures to minimize the impact;
- Preparing an Environmental Monitoring Program and;
- Preparing a ToR for an EIA study.

1.9 Physical Components of the Project (PGCB)

20. The project has two major components which are:

1.9.1 Transmission Lines and Sub-stations under Chittagong division

- Construction of 7 km 132 kV double circuit Modunaghat-Kalurghat underground transmission line;
- Re-conducting of 65 km 132 kV Comilla – Chanpur double circuit transmission line;

- Upgrading of 132/33 kV GIS sub-station at Madunaghat;
- Upgrading of 132/33 kV sub-station at Comilla(S) from AIS to GIS;
- Construction of 132/33 kV GIS sub-station at Kalurghat;
- Construction of 132/33 kV AIS Sub-station at Kachua.

21. The IEE is providing information on the baseline environmental condition (physical, biological and social environment) of the project area. Following DoE and ADB guidelines, the IEE helps to identify potential impacts of the proposed project activity on the environment in the project area. It has also been used as a basis to prepare the EIA and the EMP against adverse impacts. The EMP also includes an Environmental Monitoring Plan and institutional arrangements for future monitoring.

1.10 Methodology

22. IEE is an initial examination for estimating potential environmental impacts of a proposed project, done within a very short time based on preliminary information at hand or information which can be readily acquired through an environmental reconnaissance. The IEE study specifically followed the steps (Figure 1.1) described below.

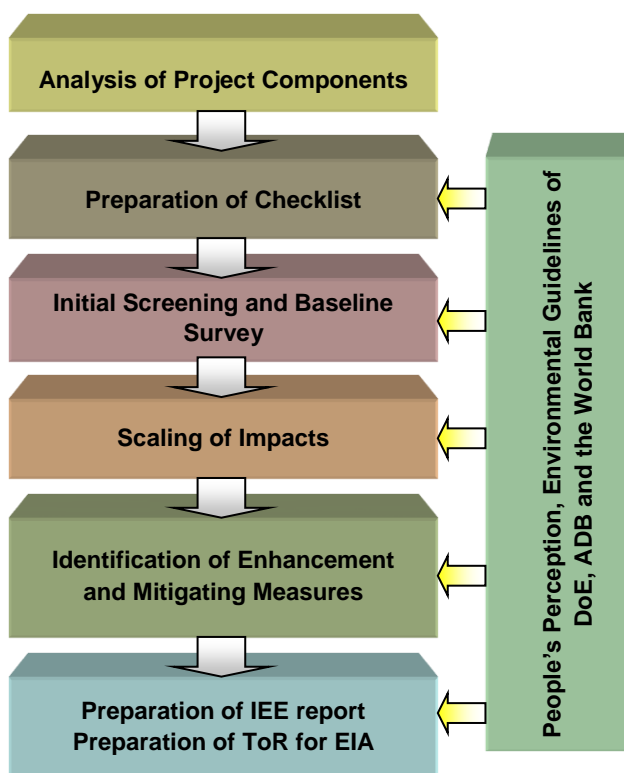


Figure 1.1: Steps of IEE

1.10.1 Analysis of the Project Components

23. All the components of the selected proposed alternative industrial set-up in the transmission line, sub-stations, like construction works, resettlements, have been examined rigorously before development of checklist for reconnaissance survey.

1.10.2 Preparation of Potential Environmental Parameters

24. Comprehensive potential environmental parameters have been selected based on various guidelines of different agencies such as DoE, ADB and the World Bank. Also - conduct reconnaissance survey.

1.10.3 Initial Screening and Baseline Survey

25. Not all the parameters selected in previous step may be significant for the project; hence the first activity was to shorten to concentrate on significant effects through a reconnaissance survey. Also available data was collected from all possible secondary sources. Environmental and socio-economic data from different sources (Bangladesh Bureau of Statistics (BBS), DoE, Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), Agro-climatic survey of Bangladesh and other IEE reports) of the proposed project area were collected to prepare the baseline environmental and socio-economic profile of the study area. The Consultant's multi-disciplinary team of experts made reconnaissance visits to observe the condition of the project site and its surroundings and to identify alternate sites for investigation.

1.10.4 Scaling of Impacts

26. Short descriptions of existing physical, social and environmental condition of the project sites have been prepared. Then the impacts of project intervention on the physical, environmental and social components were graded qualitatively (eg. high, medium, low) in order to identify important environmental components.

1.10.5 Identification of Enhancement and Mitigating Measures

27. From literature survey and applying expert judgment, enhancement and mitigating measures for beneficial and adverse effects respectively was prepared. The magnitude of change in impact, if the measures are adopted, has been indicated.

1.10.6 Preparation of IEE Report

28. IEE report was prepared following standard chapter outlines.

1.10.7 Structure of the Report

29. The report has been structured in compliance with the requirement of the ToR.

Chapter 1: Introduction: The introduction chapter presents a brief overview of the assignment along with its background, objectives, scope of work, study area, methodology etc.

Chapter 2: Policy and Legislation: Chapter Two outlines the Policy and Legislation on environmental issues.

Chapter 3: Project Description: Chapter Three describes the proposed interventions including alternative options suggested by the project, background, project category, need for the project, location, size and magnitude of operation.

Chapter 4: Description of Environmental Baseline: Chapter Four presents a description of the environmental baseline condition (socioeconomic, physical and biological) of the project area.

Chapter 5: Prediction of Impacts: This chapter deals with the environmental impacts of the proposed project and possible mitigation measures. Opinions of the local people have also been elaborated in this chapter.

Chapter 6: Environmental Management Plan: The chapter mainly deals with the environmental management plan of the project.

Chapter 7: Information Disclosure, Consultation and Participation: This chapter mainly describes the public opinion of the project as well as the major problems, impacts and probable solutions recommended by the project.

Chapter 8: Findings Conclusion and Recommendations: This chapter presents the findings, conclusion, and recommendations of the IEE study.

2. Policy and Legislations

2.1 Overview

30. The construction transmission line facilities and sub-stations of the proposed project to be implemented by the PGCB require strict compliance with laws, rules and regulations pertinent to the environment. The DoE is responsible for ensuring the application of environmental laws and issuance of necessary clearances.

31. The procedures and requirements for EIA under the power sector are dictated by the Environment Conservation Act of 1995, which introduced a requirement for any proposed "industrial unit or project" to obtain prior approval from the DoE.

32. The Environment Conservation Act has classified projects to be assessed (by the DoE) in four categories (Green, Amber A, Amber B, and Red). The power development projects are allocated to the red category, which triggers an automatic requirement for an IEE followed by a full EIA. Subject to a satisfactory review of the environmental assessment, the DoE issues an authorization for the project to proceed. The authorization consists of two parts: a "site clearance", which gives approval to the site proposed for the project and "environmental clearance", which approves the content of the project.

33. The PGCB, as project proponent, is responsible for carrying out IEE and EIA studies of the proposed project. Therefore, it has the responsibility for administering the environment assessment process with the consultants, review the findings, and submit the documents to the DoE for review.

34. A key requirement of the IEE/EIA for projects classified in the Amber and Red categories is an EMP. The function of the EMP is to enable the project proponent PGCB to show the DoE

how it will deliver the environmental performance assessed in the IEE/EIA (for which DoE approval is sought). The EMP must describe in detail organization and management responsibilities, give details of how mitigation measures identified in the IEE/EIA will be implemented and explain how monitoring will be carried out.

35. Possession of a "clearance" from the DoE does not relieve the developer of a project from the requirement to comply with other environmental regulations. In particular, the Bangladesh national Environment Quality Standards (EQS) for industrial effluent have been set and compliance is mandatory. In addition, there are statutory instruments applicable to power development projects, which are not primarily environmental but which influence environmental impacts. Compliance with such statutory instruments is mandatory.

2.2 Procedure for Obtaining Site/Environmental Clearance

2.2.1 Requirement for IEE Report

36. All industries and projects in the Red category have to conduct IEEs, which help in understanding the potential extent of environmental changes and finding ways to mitigate negative impacts by considering available information, past experience or standard operating practices. The steps for conducting IEEs are:

- Collection of baseline information in respect of a project and the environmental setting of the project and its site.
- Setting of boundaries of an IEE by identifying the significant issues.
- Impact assessment suggesting mitigation measures EMP, alternative sites or other project modifications.
- In the event the IEE of the project or industry reveals that further investigation is to be carried out, the sponsors will have to conduct a detailed EIA.

2.2.2 Procedure

37. After completion of the EIA report the project proponent should apply to the DoE in the prescribed format for site/environmental clearance. The application for the environmental clearance for a project classified in the 'Red' category should be accompanied by the following documents:

- Feasibility Study Report of the project;
- EIA report;
- An NOC (No objection Certificate) from the local authorities concerned;
- Pollution minimization plan including emergency plan for the mitigation of adverse environmental impacts;
- Outline of relocation plans (where applicable) and
- Other information as deemed necessary

38. It is also mentioned in the Environment Conservation Rules, 1997 that the Director General of the DoE can issue environmental clearance directly without issuing any site

clearance to any industry or project if he (the Director General) finds appropriate reasons for doing so.

39. As the proposed construction of the sub-stations including transmission line facilities Project falls under the "Red" category, all necessary requirements mentioned above have been adopted for the project. Figure 2.1 shows the activities involved in obtaining environmental clearance from the DoE.

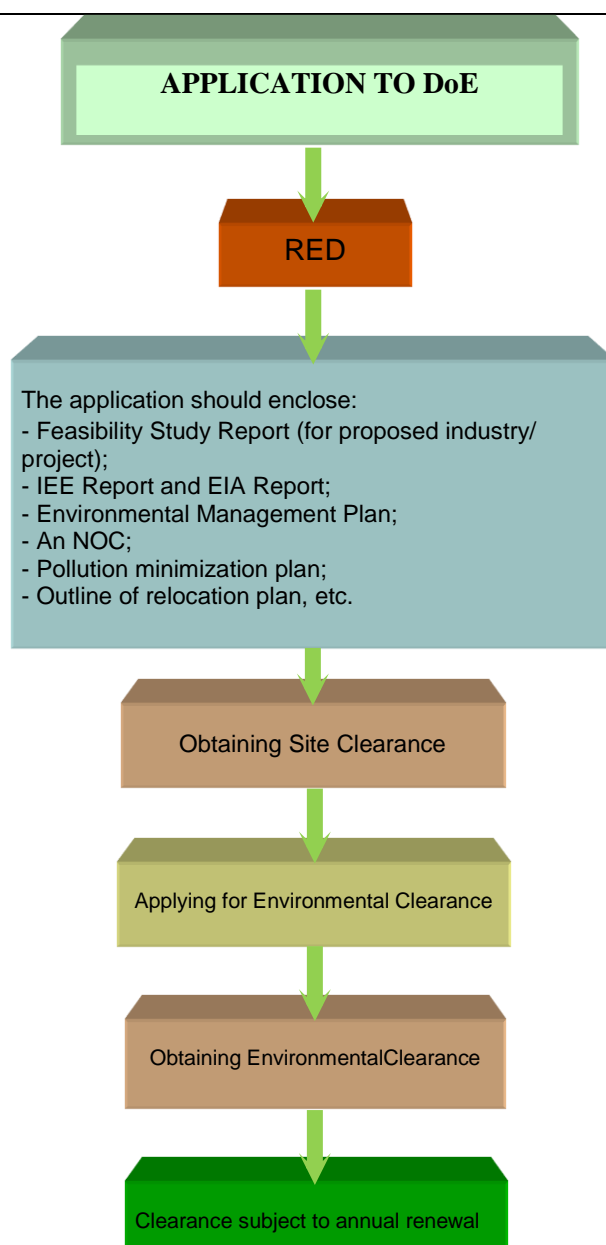


Figure 2.1: DoE Environmental Clearance Procedures

NOC = No Objection Certificate, usually obtained from local government.

- Note:
1. These requirements vary from those of the DoE (1997) in requiring EMPs for proposed, as well as current, projects.
 2. Procedure of obtaining Environmental Clearance: for Green Category Projects the gestation period for granting Environmental Clearance has been fixed at within 15 days; for Orange A, Orange B and Red Category Projects at first Location Clearance and thereafter Environmental Clearance will be granted. The gestation period for Location Clearance is within 30days for Orange A, and within 60days for Orange B and Red Category Projects.

Source: Adapted from the Environmental Guidelines for Industry (DoE, 1997)

2.3 Organizations Related with Enforcement of Environmental Standards

40. The roles and responsibilities of different ministries and departments related with enforcement of environmental requirements are described below in brief:

2.3.1 Ministry of Environment and Forest (MoEF)

41. MoEF is the key government institution in Bangladesh for all matters relating to national environmental policy and regulatory issues. Realizing the ever-increasing importance of environmental issues, the MoEF was created by replacing the Ministry of Agriculture and Forest in 1989 and is at present a permanent member of the Executive Committee of the National Economic Council. This group is the major decision-making body for economic policy issues and is also responsible for approving all public investment projects. The MoEF oversees the activities of the following technical/implementing agencies:

- Department of Environment (DoE)
- Forest Department (FD)
- Forest Industries Development Corporation (FIDC)

Department of Environment (DoE)

42. In order to expand the scope of environmental management and to strengthen the power for achieving it, the Government adopted the Environmental Pollution Control Ordinance in 1977. The ordinance provided for the establishment of an Environmental Pollution Control Board, which was assigned with the responsibility of formulating policies and proposing measures for their implementation. In 1982, the Board was renamed as the Department of Environmental Pollution Control (DEPC). Six divisional offices were established in Dhaka, Chittagong, Khulna, Barisal, Sylhet and Rajshahi.

43. A special presidential order again renamed the DEPC as the Department of Environment (DoE) and placed it under the newly formed MoEF in 1989.

44. The DoE is a department of the MoEF and is headed by a Director General (DG). The DG has complete control over the DoE. The power of the DG, as given under the Act, may be outlined as follows:

- The DG has the power to close down activities considered harmful to human life or the environment. The operator has the right to appeal and procedures are in place for this. However, if the incident is considered an emergency, there is no opportunity for appeal.
- The DG has the power to declare an area affected by pollution as an ecologically critical area. The DoE governs the type of work or process, which can take place in such an area.
- Before undertaking any new development project, the project proponent must take an Environmental Clearance from the DoE. The procedures to take such clearance are in place.
- Failure to comply with any part of the Environment Conservation Act (ECA) 1995 may result in punishment by a maximum of 5 years imprisonment or a maximum fine of Tk. 100,000, or both.

Forest Department

45. This Department under the MoEF is responsible for the protection and management of all Reserve Forests of the country. The personnel of the department extend down to the union level in areas where there are Reserve Forests. It has recently started some agro forestry programs. The Forest Department officers are also responsible for the protection of wildlife in the forests.

Related Other Organizations

46. There are several other organizations, which are related with certain social and environmental functions. These organizations include:

- Ministry of Land: Land Reform and Land Acquisition Directorate
- Ministry of Water Resource: Bangladesh Water Development Board (BWDB)
- Ministry of Fisheries and Livestock: Department of Fisheries

2.4 Relevant National Policies and Legislations Relevant to Environment

47. National Strategies, Policies, Acts and Rules related to the environment include the following:

- The Environment Pollution Control Ordinance, 1977.
- The Environmental Quality Standards for Bangladesh, 1991
- The National Conservation Strategy (NCS), 1992
- The Environment Policy, 1992
- The National Environment Management Action Plan (NEMAP), 1995
- The Environment Conservation Act, 1995
- The Environment Conservation Rules, 1997
- The 1997 Rules were adopted under the provision of the ECA, 1995.

48. Other relevant laws related with the environment include:

2.4.1 The Bangladesh Wildlife Preservation Order

49. The Bangladesh Wildlife (Preservation) Order of 1973 and amended to Act in 1974 provides for the preservation, conservation and management of wildlife in Bangladesh. The earlier legislations on wildlife preservation, namely, the Elephant Preservation Act, 1879, the Wild Bird and Animals Protection Act, 1912, and the Rhinoceros Preservation Act, 1932 have been repealed and their provisions have been suitably incorporated in this law.

2.4.2 The National Forest Policy (1994)

50. The National Forest Policy of 1994 is the amended and revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major target of the policy is to conserve the existing forest areas and bring about 20% of the country's land area under the forestation program and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

2.5 Policy Related with Energy Development

2.5.1 The Electricity Act, 1910

51. The Electricity Act was enacted in 1910 to amend the laws relating to the supply and use of electrical energy. Under this Act, any person can get a license to supply energy and to lie down or place electric supply lines for the conveyance and transmission of energy. The licensee can open and break up the soil and pavement of any street, railway or tramway and can lay down any line or do other work near other utility services (like gas, T&T, water, sewer, etc.), provided prior permission is taken from the respective authority, as stated in Section 12 – 18 of this Act.

52. According to Section 19 (1) of this Act, the licensee shall give full compensation for any damage, detriment or inconvenience caused by him or by anyone employed by him.

53. Sub- section (1) of Section 51 of the Electricity Rules, 1937; advise that the licensee should take precautions in laying down electric supply lines near or where any metallic substance or line crosses in order to avoid electrocution.

2.5.2 The Telegraph Act (1885)

54. Part III Power to place Telegraph Lines and posts.

55. Under the Act 10- 19, the government can build towers on public land without giving any land compensation.

2.5.3 The Power Policy, 1995

56. Like the Petroleum Policy, this is presently an integral part of the National Energy Policy 1996. It has different policy statements on demand forecast, long- term planning and project implementation, investment and lending terms, fuels and technologies, power supply to the west zone, isolated and remote load centers, tariff, captive and stand by generation, system loss reduction, load management and conservation, reliability of supply, system stability, load dispatching, institutional issues, private sector participation, human resource development, regional/international cooperation, technology transfer and research program, environment policy and legal issues.

57. As the proposed project is a Power Transmission Project, all necessary requirements mentioned above will be adopted for the project.

2.5.4 The Energy Policy (1996)

58. The National Energy Policy provides for the utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy source and environmentally sound sustainable energy development programmes. The policy highlights the importance of protecting the environment by requiring an EIA for any new energy development project, or introduction of economically viable and environment friendly technology.

2.5.5 The Industrial Policy (1999)

59. The National Industrial Policy, 1999 aims to ensure a high rate of investment by the public and private sectors, a strong productive sector, direct foreign investment, development of labor intensive industries, introduction of new appropriate technology, women's participation, development of small and cottage industries, entrepreneurship development, high growth of export, infrastructure development and environmentally sound industrial development. WTO guidelines have been proposed to be followed in the Industrial Policy.

2.6 Compliance with International Requirements

60. Bangladesh has acceded to, ratified or signed a number of major international treaties, conventions and protocols related to environment protection and conservation of natural resource.

2.6.1 Rio Declaration

61. The 1992 United Nations Conference on Environment and Development (UNCED) adopted the Global Action Program for sustainable development called 'Rio Declaration' and 'Agenda 21'. Principle 4 of The Rio Declaration, 1992, to which Bangladesh is a signatory along with a total of 178 countries, states, "In order to achieve sustainable development, environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it".

2.6.2 Convention on Biological Diversity, (1992)

62. The Convention on Biological Diversity, 1992 was adopted on 05 June 1992 and entered into force on 29 December 1993. Bangladesh ratified the Convention on 20 March 1994. This is the overarching framework for biodiversity and the signatories are required to develop a National Biodiversity Strategy and Action Plan that incorporates the articles of the convention into national statutes.

63. The obligations have been placed on state parties to provide for environmental impact assessments of projects that are likely to have significant adverse effects on biological diversity.

2.6.3 Wetlands of International Importance as Waterfowl Habitat, (1971)

64. Convention of Wetlands of International Importance as Waterfowl Habitat (1971) is a convention that is also known as the Ramsar Convention. It was adopted on 02 February 1971 and entered into force on 21 December 1975. Bangladesh ratified the Convention on 20 April 2002. This provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resource. There are 127 Parties with 1085 wetland sites designated as 'Wetlands of International Importance'.

65. This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetland habitats. Obligations for Contracting Parties include the designation of wetlands to the 'List of Wetlands of International Importance', the provision of wetland considerations within their national land use planning, and the creation of Natural reserves.

66. Bangladesh has two Ramsar sites-Parts of the Sundarbans Reserved Forest (Southwest of Bangladesh) and Tanguar Haor (Northeast of Bangladesh). The proposed project will not have any effect on these two Ramsar sites.

2.6.4 United Nations Convention on the Law of the Sea, (1982)

67. This Convention was adopted on 10 December 1982 at Montego Bay, Jamaica. Bangladesh has ratified this Convention.

2.6.5 Others (Conventions and Agreements)

68. The following conventions and agreements may include provisions relevant to different aspects of oil and gas operations for environmental management, nature protection, and biodiversity conservation:

- Convention relative to the Preservation of Fauna and Flora in their Natural State 1933; International Convention for the Protection of Birds, Paris, 1950;
- International Plant Protection Convention, Rome, 1951;
- Convention concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972 has been ratified by 175 states. This defines and conserves the world's heritage by drawing up a list of natural and cultural sites whose outstanding values should be preserved for all humanity. Of the 730 total sites, there are currently 144 natural, 23 mixed and 563 cultural sites that have been inscribed on the World Heritage List (distributed in 125 State parties). These are the 'Jewels in the Crown' of conservation;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 (Popularly known as CITES): This provides a framework for addressing over harvesting and exploitation patterns, which threaten plant and animal species. Under CITES governments agree to prohibit or regulate trade in species which are threatened by unsustainable use patterns; and
- Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 (Amended 1988): This provides a framework for agreements between countries important to the migration of species that are threatened.

2.7 Compliance with ADB Safeguard Policy Statement, 2009

69. ADB has issued Safeguard Policy Statement in June 2009 (SPS, 2009). According to the ADB SPS 2009, the proposed power grid connection project and associate sub- substation projects fall in category “B”, which requires IEE only. The present study was carried out considering the ADB guidelines along with Bangladesh rules and regulations which are almost the same as the present SPS, 2009, ADB.

2.7.1 Overarching Statement on ADB's Policy and Principles

70. The goal of the SPS, 2009 is to promote the sustainability of project outcomes by protecting the environment and people from projects' potential adverse impacts.

71. The objectives of ADB's safeguards are to: (i) avoid adverse impacts of projects; (ii) minimize, mitigate, and/or compensate for adverse project impacts; and (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

72. By adhering to its social and environmental safeguards, ADB enhances the predictability, transparency, and accountability of its actions and decision making; helps borrowers/clients manage social and environmental impacts and risks; and promotes the long-term sustainability of investments.

73. Key safeguard areas: (i) environmental, (ii) involuntary resettlement, & (iii) Indigenous Peoples.

74. ADB adopts a set of specific safeguard requirements that borrowers/clients are required to meet in addressing environmental and social impacts and risks.

75. ADB will not finance projects that do not comply with its safeguard policy statement, nor will it finance projects that do not comply with the host country's social and environmental laws and regulations.

76. This safeguard policy statement applies to all ADB- financed and/or ADB- administered sovereign and non- sovereign projects, and their components regardless of the source of financing.

2.7.2 Environmental Safeguards: Policy Principles

1. Use a screening process for each proposed project, as early as possible.
2. Conduct an environmental assessment for each proposed project. Assess potential trans-boundary and global impacts, including climate change.
3. Examine alternatives to the project's location, design, technology, and components.
4. Avoid/minimize, mitigate, and/or offset adverse impacts. Prepare an environmental management plan (EMP)
5. Carry out meaningful consultation with affected people and facilitate their informed participation.
6. Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.
7. Implement the EMP and monitor its effectiveness. Document and disclose monitoring results.
8. Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area.

9. Apply pollution prevention and control technologies and practices consistent with international good practices such as the World Bank Group's Environmental, Health and Safety Guidelines.
10. Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease.
11. Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys.

2.8 Compliance with Islamic Development Bank (IDB) policy

77. IDB project financing is carried out with reference to the strategic framework of the IDB Group. The fight against poverty which is the overriding objective of the IDB Group requires a multi-pronged approach. As a general rule of thumb, high and sustained economic growth is a pre-requisite to reducing poverty, assuming that such growth (The level of economic growth required to reduce poverty by a half by the year 2015 (as per the MDGs) is estimated at a robust 7.4% for IDB member countries in Africa for the period 2000- 2015.) is matched with a 'fair' re-distribution of wealth and deliberate moves by governments to target the poor segments in society. This 'targeting' may include labor-intensive growth strategies, investment in human capital (for the poor) and safety nets for the vulnerable groups. Studies in the Middle East and North Africa have revealed that for every 1 percent growth in real GDP, the number of poor people declines by 4- 5 percent (*Dr. ViviAlatas, "Poverty Reduction, a Main Challenge in Islamic World" (The International Conference of Islamic Scholars, Jakarta, Indonesia 23- 25, 2004).*

78. Against this backdrop, a project or program is deemed pro-poor if it aims to create a critical mass of beneficiaries- cum- consumers that will, in the long run, support and sustain the local economy (hence the direct link between economic growth and poverty reduction). It also implies that any intervention by IDB and the international donor community at large must occur in areas or sectors that benefits or uplifts a greater majority of people. These 'broad- based growth approaches' are the very basis of the Complex's sector and thematic priorities.

79. Considering that poverty in the majority of member countries is a rural phenomenon, investment in the agricultural sector, in which the bulk of the population depends for its livelihood, is an obvious target for any poverty reduction program. It's imperative that the Bank's assistance in agriculture is targeted in high- value addition sub- sectors such as agro- processing, irrigation and crop development, marketing and storage facilities, micro- credit schemes etc. Agro- processing is one area that has a high value- addition especially in Africa, and therefore, higher impact on improving the living conditions of the most vulnerable groups in society.

80. In addition to agriculture, other broad-based growth sectors are health and education (or collectively referred to as human development). Human development is a major contributor to economic growth and well- being, as experience everywhere has shown. Taking into account the specific needs and priorities of individual member countries, the Operations Complex will broadly concentrate on the basic education and health care in the low- income countries, and on research and technology in the middle and high- income countries.

81. Water supply, sanitation, transport and power supply fall under the thematic group of infrastructure. It is common knowledge that infrastructure plays a multi- purpose role in any

economy as it has a direct bearing on the well- being of the population, hence its positive contribution to poverty alleviation. Transport facilitates the movements of goods and services within and between production and market centers, and is of great economic significance to rural communities. Power supply offers a variety of economic and income- generating opportunities, hence an impact on the living standards. Equally crucial is water, which has many uses. The availability of clean and safe water for instance, improves the health status of the population, as many diseases afflicting the poor countries are related to unsafe, dirty and contaminated water supplies. Recently, telecommunications has been playing a vital role in energizing several economic sectors and benefiting various social groups in the member countries.

82. Both the Ordinary Capital Resources (OCR) and those mobilized from the market will be utilized to finance infrastructure. A large share of the OCR will finance infrastructure projects in low- income countries and regional groupings. Resources generated from the market will be invested mainly in the middle- income and high- income countries. Given the dynamism and competitiveness of the operating environment in the middle-income and high-income countries, the Operations Complex will continuously assess the market conditions in these countries with the view to enhance its niche and strategic position.

83. With the introduction of the market raised resources, private sector financing, including big- ticket leasing and large infrastructure projects, has assumed great significance in the daily workload of the Operations Complex.

84. In addition, small and medium scale enterprises (SMEs), which are the traditional domain of the private sector, will continue to be supported by the Operations Complex (mainly through lines of financing), in view of its high income and employment generation potential, particularly in urban areas. Unlike rural poverty which is more sensitive to broad- based economic growth and the provision of social services, urban poverty is more responsive to 're-distribution' factors, of which wage employment is perhaps the most important.

85. The Operations Complex is carrying out the above strategy while keeping in mind the following concerns:

- To be country/client focused and service oriented.
- To achieve high development impact/ effectiveness.
- To contribute to the income and financial soundness of the Bank.
- To harness a strategic partnerships, co- financing and other forms of cooperation.
- To build capacity and enhance professionalism in the Operations Complex

86. The EIA guideline of the IDB are reported to be under preparation and yet to be published. However the IDB has expressed its support for the harmonized safeguard policies applicable to the project.

2.9 Compliance with PGCB HES Requirements

87. Compliance with PGCB HES Requirements will be ensured for this project.

88. The PGCB has its own policy and requirements to ensure compliance relating to environment, health and safety issues for its operations. The company is committed to managing its

operations in a safe, efficient and environmentally responsible manner. The PGCB's HES manuals, guidelines, procedures and plans are important tools of their commitment. HES manuals include:

- Environmental Impact Assessment Module
- Guideline on Integrated Impact Assessment
- Health Impact Assessment Module, and
- Social Impact Assessment Module

In addition, their requirement for impact assessment is affirmed in the PGCB's Statement of General Business Principles. The PGCB is committed to:

- Pursuing the goal of no harm to people
- Protecting the Environment, and
- Managing Health Environment and Safety (HES) as any other critical business activity.

89. The mandatory company Operations Management System (OMS), Environmental Care Element/ Standards, issued in March 1997, makes reference to Environmental Assessment as "Environmental Impact Assessment (including a consideration of social impacts) shall be conducted prior to all new activities and facility developments, or significant modifications of existing ones'.

2.10 Building Construction (Amendment) Act, 1990 and Rules ' 96

90. The Building Construction (B.C.) Act dates back to the early fifties of the last century. Documents however, indicate the existence of the Government Buildings Act, 1899, which is to provide for the exemption from the operation of municipal building laws of certain building and lands, which are the property or in the occupation, of the Government and situated within the limits of a municipality. The provision of Municipal Building Laws to regulate the creation, recreation, construction, alteration or maintenance of buildings within the limits of any municipality has been superseded by this Act. Subsequently, the need to provide for the prevention of haphazard construction of buildings was felt by the East Bengal Legislative Assembly in 1952. Accordingly the "Building Construction Act, 1952" was promulgated on 21 March 1953 as the East Bengal Act II of 1953.

91. The B.C. Act 1952 was conceived to enforce the activities towards streamlining planned development and beautification programmes of the government.

92. Since its promulgation in 1953 the Act was in force with very little or no amendment up to 1986 when a very important modification of far- reaching consequence was added through proclaiming an Ordinance titled, "the Building Construction (Amendment) Ordinance, 1986 (Ordi No. LXXII of 1986)" by the then government. Later in 1987, the National Assembly in its March session adopted the ordinance for enactment as "The Building Construction (Amendment) Act, 1987 (Act No. 12 of 1987)". The preamble to state the objectives of the amendment reveals that "although the trial court has the power to order removal of unauthorized construction after passing the order of conviction under section 12, this power has been found to be insufficient, as a criminal case can not normally be finally disposed of quickly, besides even after disposal of the criminal case by the trial court, the prosecution is lingered by way of appeals". In order to take steps to prevent unauthorized construction or to remove such construction, the authorized officer is empowered through this amendment so that he/she can take necessary action in this respect without intervention of the court.

93. The Act was subjected to another amendment in 1990 allowing some power to the A/O issuing limited sanction to cut down or raze any hill within the area to which this Act applies.

94. To support the implementation of the provisions laid down in the B.C. Act, 1952, the Government made the B.C. Rules, 1953. This was superseded by the Imarat Nirman Bidhimalas, 1984. Later in 1996 the Government framed the Imarat Nirman Bidhimala, 1996 (Building Construction Rules, 1996). The Rules are more comprehensive for taking care of the present day circumstances and issues of building construction and other related development activities.

2.11 Land Acquisition Rules and Regulations

95. The acquisition of Immovable Property Rules, 1982 (No. S. R. O. 172- U82): The Government made these rules in exercise of the powers conferred upon by section 46 of the Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ord. No. II of 1982). The rules spell out the procedural details required for the acquisition of immovable properties in the following subheads:

- Proceedings for acquisition;
- Notices under section 3, 6, and 7;
- Declaration of acquisition and possession;
- Declaration of abatement and revocation of proceedings;
- Transfer of acquired land;
- Assessment of compensation and;
- Unutilized acquired property.

96. Forms A, B, C, D, E, F, G and H, which need to be appended to these rules, have also been specified. Consequent upon these rules the Ministry of Lands has issued several circulars to regulate the land acquisition process. The circular No. 4/95 issued on 14/03/1995 specifies some actions required to be taken to process land acquisition cases.

2.12 Rules and Policies in Related Fields

97. In addition to the policies, rules and regulations related to the environment and energy, the following rules and regulations, listed in Table 2.1, are to be checked for compliance for maintaining a sustainable environment.

Table 2.1: Environmental Laws, Regulations and Standards of Bangladesh

Year	Title	Objectives
1885	The Telegraph Act (Act XIII of 1885)	Under the law sections 10- 19, Government built transmission line through the country.
1910	The electricity Act (Act IX of 1910)	Under the law section 51, Government built transmission line through the country.
1950	East Bengal Protection and Conservation of Fish Act	Protection and conservation of fish in Bangladesh.
1985	The Protection and Conservation of Fish rules	Prevention of harming fisheries resource and fisheries habitat in coastal and inland waters.
1953	Town Improvement Act	Improvement and development of Dhaka City.

Year	Title	Objectives
1958	Antiquities Act	Protection and preservation of archaeological and historical artifacts
1960, 1966	Port rules, shipping operation	Control of discharges in ports; waterway rules.
1965	Factories Act	Industrial workers' health and working conditions.
1971	Pesticide Ordinance	Pesticide use, production, selection and importation.
1976	Antiquities (Amendment) Ordinance	Protection and prohibition export of archaeological artifacts.
1977	Municipal ordinance	Municipal activities in health, sanitation, water supply, drainage, etc. in the city.
1979	Factory Rules	Disposal of wastes and effluents.
1980	Agricultural Pesticides (Amendment) Act	Selection, use and handling of pesticides in the agricultural sector.
1982	Municipal Act	Drainage, sewerage, water supply and sanitation.
1982	Acquisition and Requisition of Immovable Property Ordinance	The Acquisition of Immovable Property Rules, 1982 (No. S. R. O. 172- U82) The Government adopted these Rules in exercise of the powers conferred upon by Section 46 of The Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance No. II of 1982).
1983	Agricultural Pesticides (Amendment) Ordinance	Revised Agricultural Pesticides Ordinance.
1985	The Pesticide Rules	Pesticide selling, use and safety measures.
1990	Bangladesh standard specification for drinking water.	Formulation and revision of national standards.
1860	The Penal Code	This contains several Articles related with environmental protection and pollution management.
1996	Building Construction (Amendment) Act and Building Construction Rules	The Rules are more comprehensive for taking care of the present day circumstances and issues of building.

3. Description of the Project

3.1 Major Components of the Project

98. PGCB is planning to construct and re-build (only replacement of conductor) transmission lines in different segments Chittagong division including 4 sub-stations. Two 132/33 kV sub-stations will be newly constructed and two 132/33 kV sub-stations will be upgraded in this proposed project. The demand of electricity is going up regularly throughout the country. In consistence with this higher demand of power, new power plants need to be installed. But it will not be possible to transmit the power output from the existing and the future power plants unless and until the sufficient transmission facilities are built-up. PGCB is planning to supply power from and to these areas to fulfill the demand sufficiently. Two new 132/33 kV substations will be constructed and two will be upgraded under this proposed project.

99. In order to improve the demand-side energy efficiency, Rural Electrification Board (REB) of Bangladesh will replace 700,000 of analog post-paid meters at Dhaka Division with pre-paid meters.

100. The main activities under the projects are given in the following table 3.1.

Table 3.1: Sub- projects, length and activities for the transmission lines and substations in Chittagong Division

Name of Division	Length (km) and nos.	Land to be needed (acre)	Sub-projects activities
	7		Construction of 132 KV double circuit Modunaghat-Kalurghat underground transmission line. Upgrading Modunghat substation and constructing of Kalughat substation.
	65	5	Re-conducting of 132 kV Comilla (S)- Chandpur double circuit transmission line. Upgrading Comilla substation and constructing Kochua substation.
	72	5	

Source: PGCB, Project Office

101. The alignment of the proposed transmission lines, one will change the conductors of 65 km of existing line which passed through mainly agricultural and fallow lands avoiding major settlements and other 7km is underground cable, which will pass along the road. The alignment of new sub-station (Kachua sub-station) has been chosen out of three alternative options. The criteria considers open agricultural land, the distance of which from connecting roads should not be far away from rural and regional road crossings, avoiding settlements and urban areas as much as possible. The alignment has been fixed considering these issues.

However, the line crossed rural and regional roads. The right of way (ROW) is mainly agricultural land dominated by double and triples cropped area. During tower foundation crop of (20mX20m = 400m²) 0.09 acre land affected. During new wire stringing period crops of 20m widen area will be affected. Crop value has decided by Department of Agriculture (DAE), Government of Bangladesh GOB). Crop compensation should be given by contractors to the land owners during foundation and stringing period.

3.2 Project Category

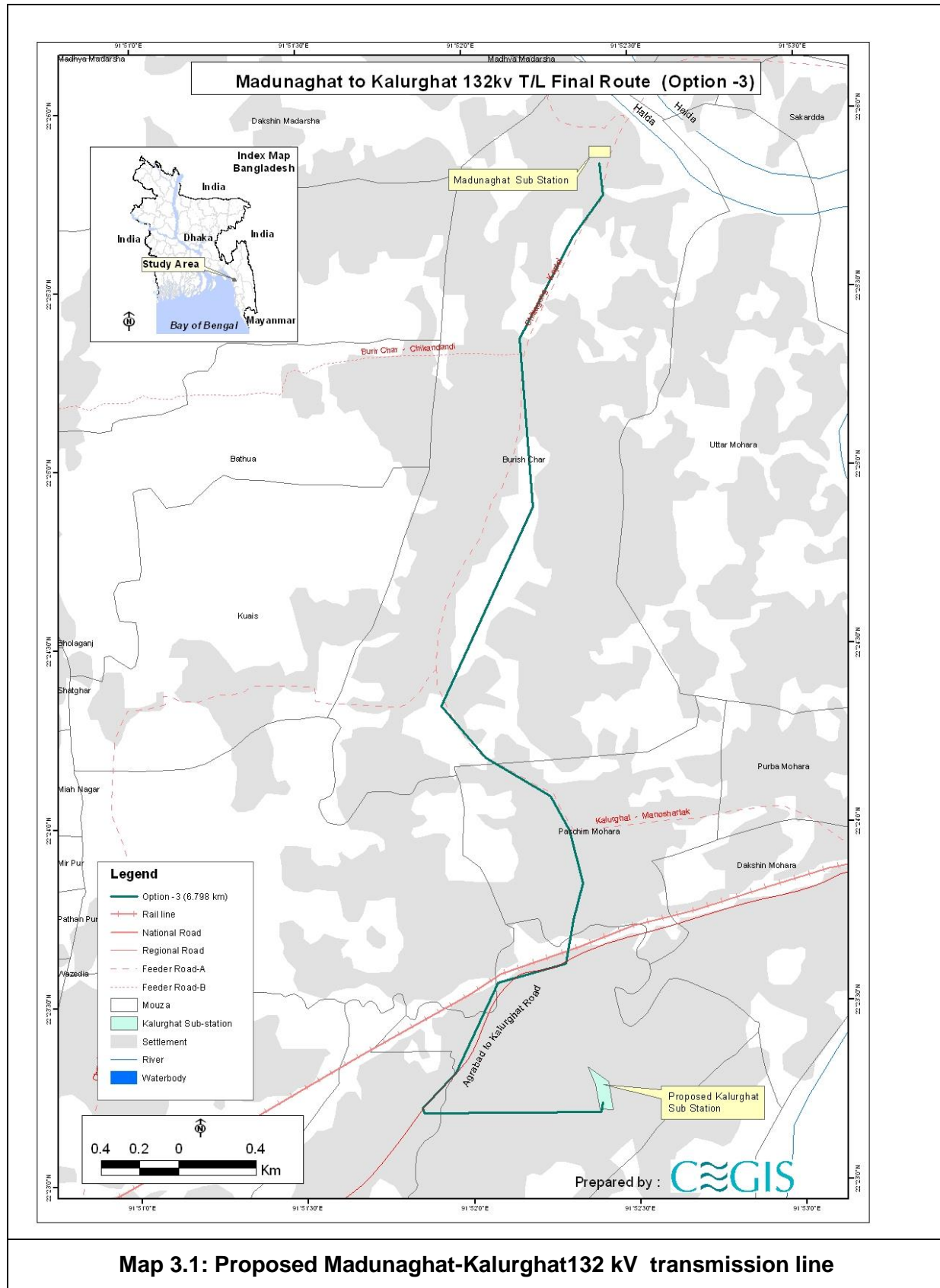
102. Under the criteria of the DoE, the Government of Bangladesh, the power transmission line falls under red category and that requires an EIA. As per the EIA Guidelines of the DoE, it is mandatory to carry out an IEE for red category projects prior to conducting EIA. The IEE report should be submitted to get environmental site clearance. Therefore, this report has been prepared to fulfill the requirement of the IEE. But as per ADB SPS 2009 requirements, the proposed project falls under Category “B” and requires only IEE.

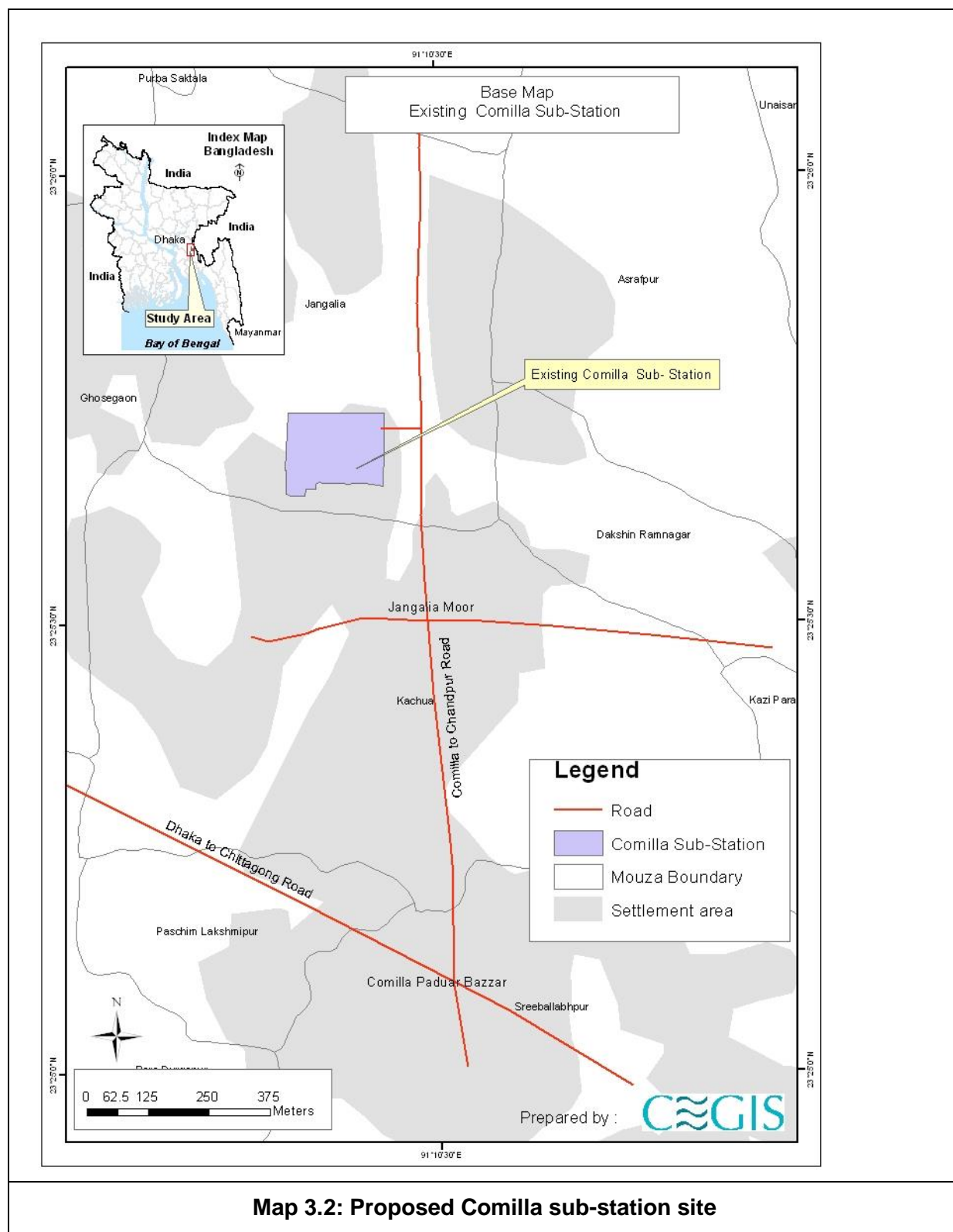
3.3 Project Location and sites

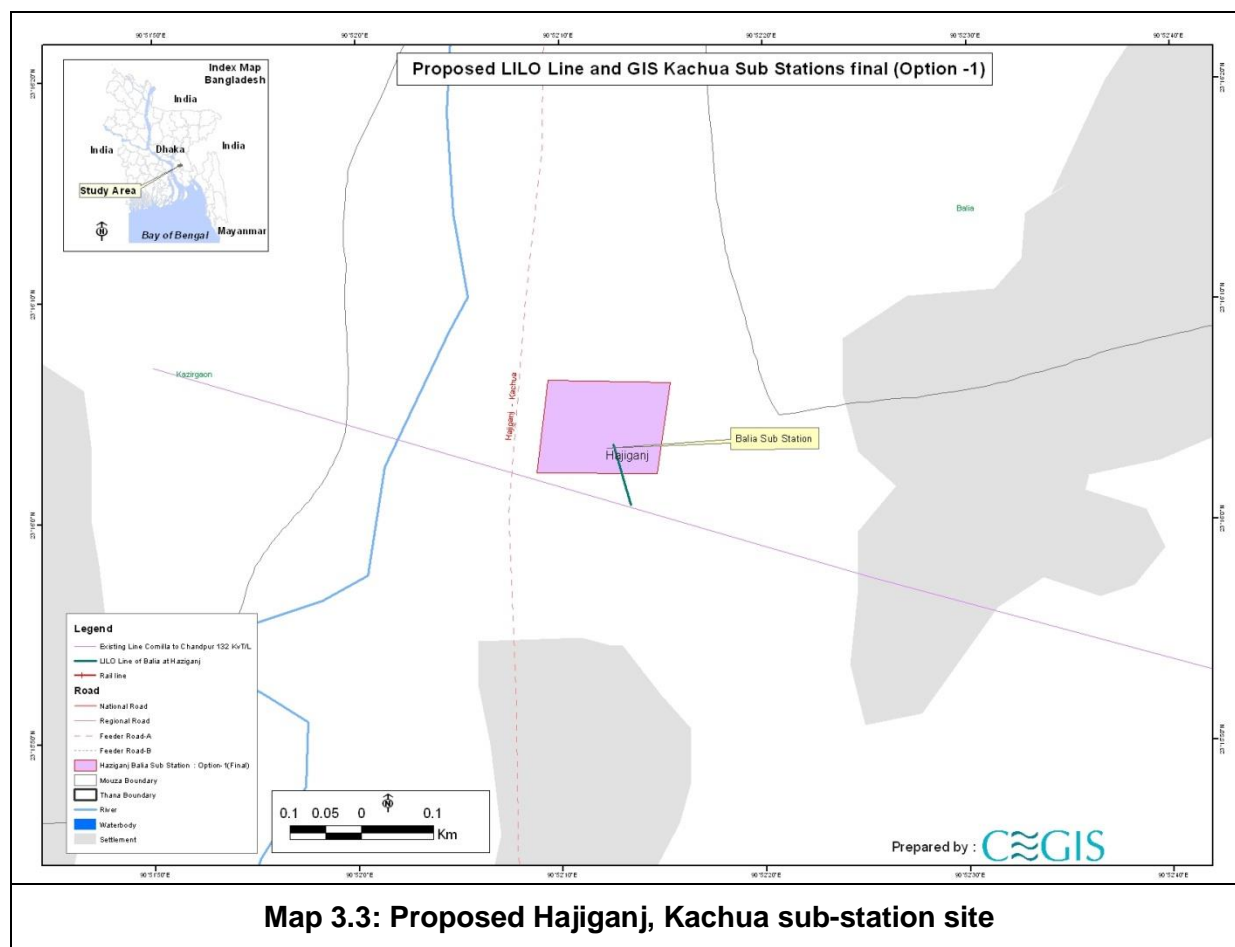
103. The project for transmission lines and substations is located in Chittagong division in Bangladesh. The locations of the project within Bangladesh are shown in Map 1.1., Map 3.1 to Map 3.3. Some relevant pictures are also presented in this sub-section. The REB sub-project is located in Dhaka Division.



Picture 3.1: Sub-station Sites at Madunaghat, Chittagong







3.4 Alternative Sites and Routes

3.4.1 Alignment Selection Factors for Substations

104. The following criteria were considered for selecting the alignment of the routes:

- Consider open agricultural land
- Distance from connecting road should be as per as possible within 1 km
- Avoid settlement areas as much as possible
- Avoid urban areas as much as possible
- Avoid water bodies
- Location of Grid Transmission Line

105. The land of three sub-stations named Comilla, Kalurghat and Madunaghat are owned by PGCB. So no alternative sites have searched for those sub-stations. But Kachua sub-station site is new which will be needed selection through alternative site consideration. The new site was selected through consulting local people, stakeholders like REB, PDB, maps & satellite images and a comparative suitability analysis.

3.4.2 Alignment Suitability

106. Based on the comparative analysis the final alignment for all the areas, one option is found to be the most suitable. This option may require the least land acquisition. Heavy equipment may easily be transported to the location while disturbance to the host community will be the least and no important site will be affected. Good communication to the proposed transmission line will allow immediate completion of the project. The alternative routes and sub-station maps are also shown in Map 3.4 to Map 3.5.

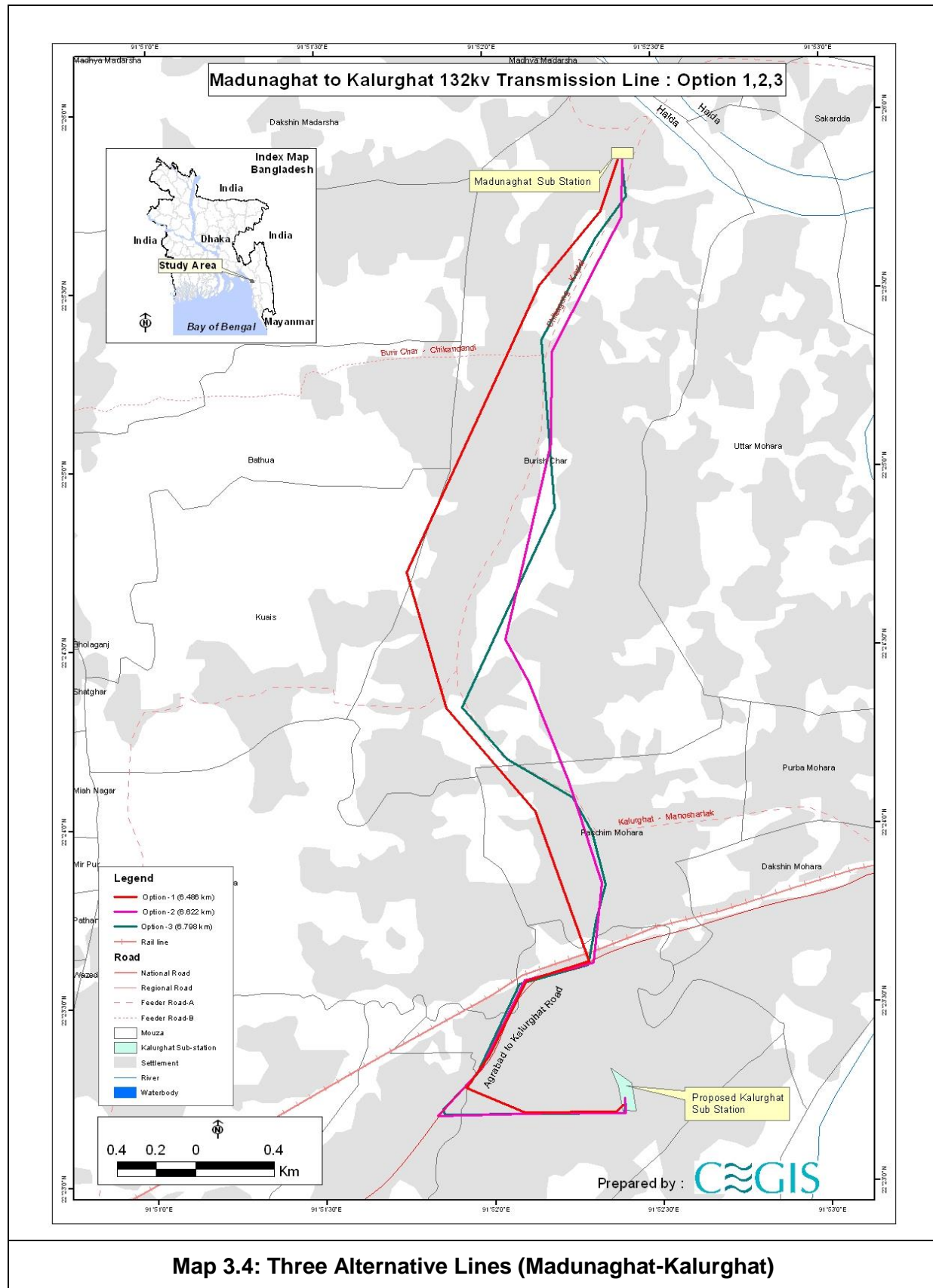
3.5 Physical Features of the Transmission Line

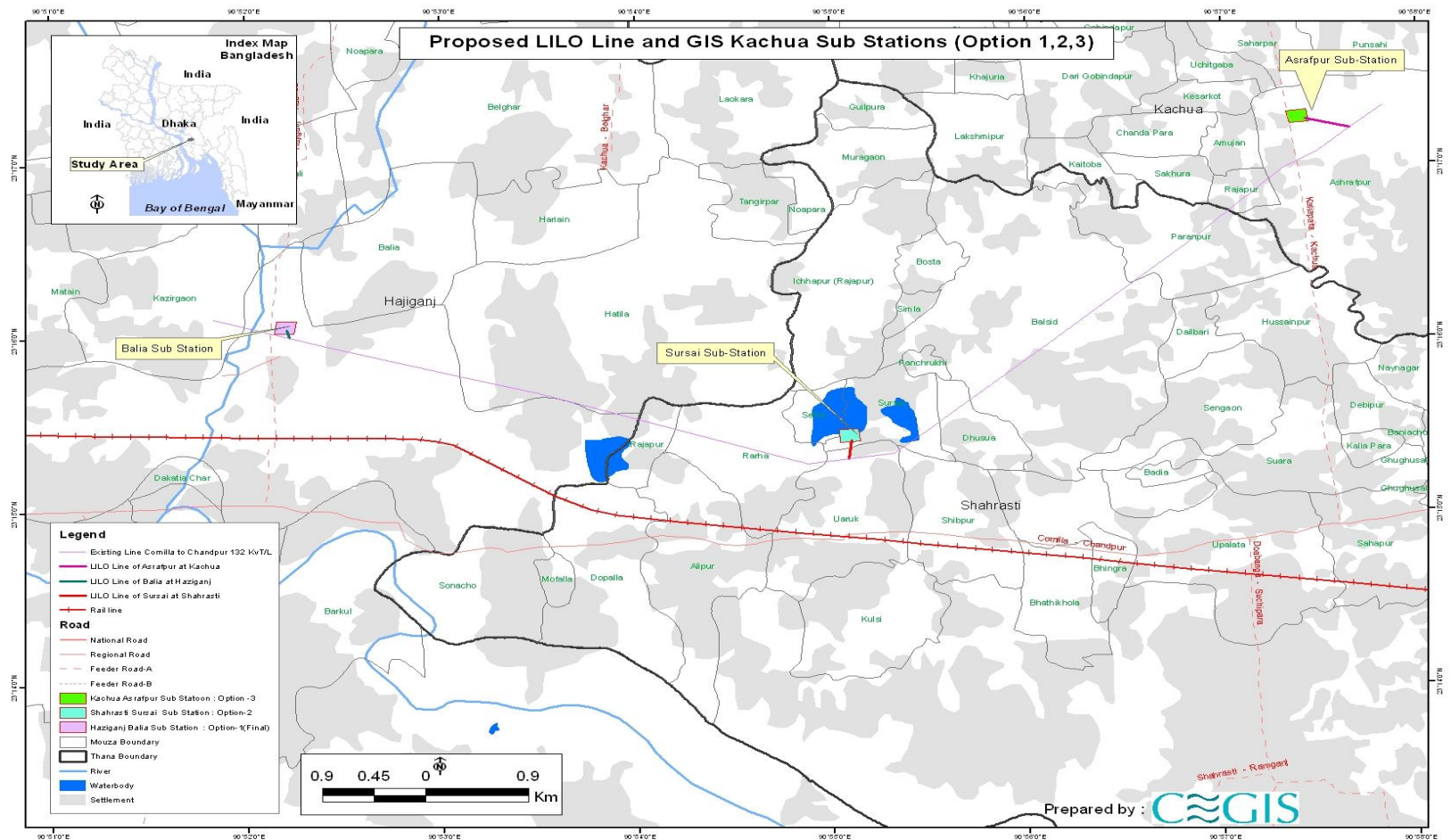
107. The major physical features of 132 kV transmission lines are given in Table 3.2. The transmission line will be double circuit, made of Alluminium Alloy conductor materials. The line supporting towers will be steel towers which are of two types – Tension and Suspension. Tension towers will be installed in angles (Picture 3.2) and suspension towers will be installed along the line (Picture 3.3) as load bearing support. A disc type insulator will be used in the towers to bear the wire (Picture 3.4 and Picture 3.5).

Table 3.2: Physical Features of 132 kV transmission line

Sl. No.	Physical Features	Attribute
1	Voltage Rating	132 kV
2	Type of Transmission Line	Double Circuit
3	Width of T/L Right of Way	80 meters (30 m left + 20m DIA + 30 m right)
4	Type of Line Support	Steel lattice Towers
5	Conductor Material	Alluminium alloy
6	Line Insulator	Disc type, Porcelain
7	Type of Connection	Sub- stations
8	Duration of Project Implementation accordingly	As accordance with approved DPP

Source: PGCB





Map 3.5: Proposed Kachua Substation sites, Hajiganj, Chandpur



Picture 3.2: Tension tower in the angle points for 230 kV line



Picture 3.3: Suspension towers along the transmission line for 230 kV line



Picture 3.4: Disc Insulators for 230 kV line



Picture 3.5 : Disc Insulators for 230 kV line

3.6 Physical Features of the sub-stations

108. The sub-stations have electrical specifications for voltage, switchgear, circuit breaker, transformer, and protection systems. The key physical features of the sub-stations are given in

Table 3.3 to Table 3.6. All four sub-stations will be newly constructed and upgraded in different area of Chittagong division of Bangladesh.

Table 3.3: Physical Features of the Kalurghat GIS Sub-station

Features	Specification
Type	Proposed
Land ownership	2.5 acre land owned by BPDB
Scheme	Main Bus bar scheme
No & Capacity	2 X25/41 MVA sub- station
Voltage	132/33 kV
Switchgear Type	Air-insulated
Insulation Medium Power Circuit Breaker	Gas Insulated Substation (GIS)
Transformer	Oil insulated
Protection System Description	Auto fire extinguisher

Source: PGCB

Table 3.4: Physical Features of the Madunaghat GIS Sub-station (up-gradation)

Features	Specification
Type	Proposed
Land ownership	Exists
Scheme	Main Busbar scheme
No & Capacity	2 X25/41 MVA sub-station
Voltage	132/33 kV
Switchgear Type	Air-insulated
Insulation Medium Power Circuit Breaker	Gas Insulated Substation (GIS)
Transformer	Oil insulated
Protection System Description	Auto fire extinguisher

Source: PGCB

Table 3.5: Physical Features of the Comilla GIS Sub-station (Up-gradation)

Features	Specification
Type	Proposed
Land ownership	Exists
Scheme	Main Bus bar scheme
No & Capacity	2 X25/41 MVA sub-station
Voltage	132/33 kV
Switchgear Type	Air-insulated
Insulation Medium Power Circuit Breaker	Gas Insulated Substation (GIS)
Transformer	Oil insulated
Protection System Description	Auto fire extinguisher

Source: PGCB

Table 3.6: Physical Features of the Kachua AIS Sub-station

Features	Specification
Type	Proposed
Land ownership	5 acre land to be acquired
Scheme	Main Bus-bar scheme
No & Capacity	2 X25/41 MVA sub-station
Voltage	132/33 kV
Switchgear Type	Air-insulated Sub-station (AIS)
Insulation Medium Power Circuit Breaker	Gas Insulated Substation
Transformer	Oil insulated
Protection System Description	Auto fire extinguisher

Source: PGCB

3.7 Component of the Construction Works

109. The activities of the transmission line are almost similar. The activities to be undertaken include:

- Re-conducting(only replacement of conductor) of 65 km 132 kV overhead transmission line and construction of 7km 132kV underground cable
- Clearing of RoW
- Establishment of temporary access tracks
- Establishment of material storage areas and work sites
- Transport of materials and equipment to site
- Establishment of construction camps for workers
- Conductor stringing

Transformer installation

- Land acquisition and clearing (partially required)
- Transport of materials and equipment to site
- Equipment installation
- Testing and commissioning of equipment

Safety Measures

The proposed projects have the following safety measures:

Firefighting Equipment

As the sub-stations are vital installations, firefighting equipment of appropriate specification will be procured and installed.

First aid Materials

First aid boxes are to be kept at the installation.

Boundary Wall and Security

110. A boundary of reasonable height will be constructed and protection wire will be put up on the walls for all sub-stations sites. Trained security guards will also be provided.

3.8 Civil Construction Works

Earth Work in Foundation

111. Construction of the sub-station needs earthwork for excavating the foundation up to the required depth and for 7km underground cable also need earth work excavation for cable laying. The excavated earth should be kept in a nearby vacant place and after finishing the foundation work, back filling of the excavated area will be done with the major portion of excavated soil and sand. The residual excavated soil of earthwork will be disposed to designated place of PGCB.

Foundation Treatment

112. The foundation area will be investigated geo-technically. The test result will help in designing the foundations of the structures of Substations as well as stability of existing foundation tower. It will help to identify if foundation treatment is required. The type of treatment like pre-cast RCC piling or in situ concrete piling, removal of peat or loose soil will be suggested after geo-technique investigation.

Reinforced Cement Concrete (RCC) Work

113. The RCC works would be required for roof, column, beam, floor, foundation of transformer, circuit breaker and steel structure etc of substation.

Brick Work up to Plinth Level and Superstructure

114. Brickwork will be done for constructing the substation building with first class bricks and coarse sand and cement up to roof level.

Back Filling with Local Sand

115. Back filling of the excavated area of the foundation and floor of the building will be done with local sand.

Plastering and Finishing (electric wiring, distemper or plastic paint)

116. Concealed electric wiring of good quality and proper size is to be done and bulbs and switchboards are to be provided. Plastering of walls inside and outside as well as the roof of the building will be done accordingly and curing works will be done for at least three weeks. After that distemper or plastic painting will be done on the walls and roof of the building.

Wood Works/Thai Aluminum for Doors and Windows and Glass Fittings

117. Wood/Thai aluminum works are to be done on door shutters and windows of the building along with glass fittings.

Sanitary Works

118. Sanitary works such as laying of sewerage line (either PVC or RCC), installation, fittings and fixing of toilet accessories will be done in the building.

Water Supply System

119. The water supply system where available will be activated for the workers and staff of the back to back station. In places where there is no supply system, tube wells will be set up.

Boundary Fencing with Concrete Pillar and Barbed Wire

120. The project area will be protected from encroachment and unauthorized entrance of the public by fencing the boundary either with a six feet high wall with barbed wire fitted with concrete pillars 3 meters apart.

3.9 Electrical Works

121. Installation of equipment (transformers, circuit breakers, isolators, lightening arresters, panel boards, batteries and battery chargers etc.)

122. After completion of the building, all equipment will be installed at the sub-station (outdoor and indoor) as per specification and standard. For this project all substation materials will be procured from foreign countries. Therefore, domestic resource utilization will be minimum; only local materials like bricks, sand, cement, rods, etc. will be utilized for the installation works.

123. Transformers are heavy equipment. The transportation of such equipment may require grading of river embankment and skidding through open field. The landowners may be required to be paid compensation.

Re-conducting of Tower

124. The towers in paddy fields have proper clearance at the sag (lowest point on line). At homesteads, the existing sag of conductor are safe clearance above the canopy.

Drawing of Transmission Line

125. The exiting transmission line was keep suitable clearance at all locations. The lowest sag point was considered in drawing stringing.

3.10 Testing and Commissioning of Equipment

126. After installation (outdoor and indoor), each and every equipment will be tested as per specification and standard. If all the tests are successful the sub-stations will be commissioned accordingly.

3.11 Construction Equipment

127. For this project all equipment to be installed will be procured from foreign countries. Therefore, domestic resource utilization in the project will be minimum; only local materials such as bricks, sand, cement, rods, etc. will be utilized for installation/construction works.

3.12 Construction Activities of Output 2

128. The construction activities associated with Output 2 include the stringing of the 132kV transmission line, laying of 132kV underground cable and construction of the substations. Some activities include the following:

- Land acquisition for the substation (if needed)
- Land/vegetation clearing along the right-of-way (ROW) and in substation sites
- Determine the requirements for temporary access roads/tracks
- Establish the required areas for material storage and work sites

- Determine if constructions camps for workers will be required
- Move the equipment and materials required to the work sites or storage areas
- Foundation works for substations
- Stringing of transmission line
- Underground cable laying
- Construction of a three story building (the foundation is designed for a five-story building and a basement) to house the gas insulated switchgear (GIS) control room;
- Creation of a security boundary wall and barbed wire fencing to protect the substation;
- Installation of surface drainage and construction of cable trench, covered storage and warehouse/stockroom;
- Laying of gravel for the switchyard with associated civil and electrical works and boundary lighting;
- Setting up of security/sentry post;
- Construction of transformer blast wall, septic tank, and rain water harvesting unit;
- Installation of solar system for grid substation;
- Equipment installation, testing, and commissioning of equipment, and,
- Other miscellaneous tasks needed to complete the works.

129. The substations will be equipped with safety measures such as fire-fighting equipment, first aid kits, and property boundary wall/fence with trained security personnel.

3.13 Work Schedule

130. The completion of works will take approximately 30 months from the date of start.

4. Environmental Baseline Condition

4.1 Project Boundary

131. The geographical boundary of the "Project Area" and the potential "Impact Area" is delineated as a requirement of the environment assessment study. The project area is the physical location of the proposed power transmission line and sub-stations of the project, while the impact area covers the geographic extent of the environmental and socioeconomic impacts resulting from implementation of the proposed project during pre-construction, construction and post-construction periods. It is recognized that the benefits of the proposed 72 km 132 kV transmission line will extend to the regional as well as national scale. For the IEE of 132 kV transmission line, the focus of the study will be limited to the area where the physical impacts of the activity will be directly felt. A 20m area through the RoW has been defined as the directly impacted area (DIA). A 30 m buffer along both sides (i.e. 30m+30m=60m) of the power transmission line has been considered for environmental analysis as general impact area (GIA) for 132 kV transmission line. So, for the IEE study total 80m RoW has considered for the baseline study area for 132 kV transmission line. A general socioeconomic profile has been prepared for union-based administrative units over which the power transmission line shall

traverse. The list of administrative area for the two 132 kV transmission lines are shown in Table 4.1.

Table 4.1: Administrative units traversed by the Comilla-Chandpur transmission line & substations

Division	District Name	Upazila Name	Union Name	Mauza Name
Chittagong	Comilla	Comilla Sadar	Bijoypur	Jangalia
				Kachua
				Bara Durgapur
				Paschim Lakshmipur
				Uttar Bijoypur
		Barura	Bhabanipur	Purba Padua
				Sikarpur
			Uttar Shilmuri	Purba Nalua
				Dighalgaon
				Joykanta
				Lizala
				Gamarua
				Jogi Pukuria
				Jibanpur
				Arai
			Paurashava	Kamedda
			Dakshin Shilmuri	Sailcho
			Galimpur	Danishwar
				Sakpur
				Beki
				JorPukuria
				Tara Pukharia
				Kaiani
			Deora	Fenua
			Adra	Cho-Ori
				Perpeti
				Narendrapur
				Ganak Khuli
				Herpeti
				Kakairtala
				Harishpur
	Comilla	Barura	Adda	Bhateshwar
				Pushkarinirpar
				Nagirpar
				Manduk
				Paschim Padua

Division	District Name	Upazila Name	Union Name	Mauza Name
	Chandpur	Kachua	Ashrafpur	Sonaimuri
				PaschimSatbaria
				Punsahi
				Masnigachha
				Rampur
				Ashrafpur
			Dakshin Gohat	Amujan
				Rajapur
		MatlabDakshin	Dakshin Upadi	Gonsaipur
				Sreepur
				Karbanda
				Kotrabanda
				Dhaniatali
				Bakra
			HatilaPurba	Hatila
				Balia
		Hajiganj	Hajiganj	Matain
				Kazirgaon
				Satbaria
				Sreenarayanpur
				Subidpur
				Betia Para
				Sudhaia
			Dakshin Rajargaon	Uttar Sreepur
				Radhasar
				Phulchua
		Hajiganj	Dakshin Kalocho	Sidla
			Dakshin Kalocho	Kordi
			Paurashava	Paurasava
		Shahrasti	Tamta	Paranpur
				Balsid
				Panchrukhi
				Dhusua
				Sursai
	Chandpur		Tamta Paschim	Setra
				Rarha
				Rajapur
				Uaruk
				Alumura
		Chandpur Sadar	Shah Mahmudpur	Mandari
				Kumardugi

Division	District Name	Upazila Name	Union Name	Mauza Name
				Ketua
				Krishnapur
			Ashikati	Ashikati
				Sengaon
				Hapania
			Maishadi	Maishadi
				Hamankardi
				Mirzapur
			Tarpur Chandi	Bishnudi (Part)
				Gunrajdi
				Tarpur Chandi

Source: CEGIS initial survey, August, 2013

4.2 Water resources

4.2.1 Data Source

132. The baseline condition prevailing in the study area has been established by collecting data from secondary as well as primary sources. The secondary sources included BWDB, NWRD, Department of Public Health Engineering (DPHE), and BMD. Primary data were collected during field visits in the study area.

4.2.2 Physical Environment: Meteorology

133. Meteorological information on different parameters i.e. rainfall, temperature, relative humidity, wind speed, evaporation and sun shine hours have been collected from NWRD for the BMD station at Sitakundu and Comilla. The following sections provide a clear understanding on the meteorology of the study area.

Rainfall

134. Values of monthly maximum and monthly average rainfalls were collected from the BMD station at Sitakundu, Chittagong (1977-2008). The collected data are shown below. The figures show significant rainfall during the months of May to October. On the other hand, very little rainfall or no rain occurs during the period of November to January. Historical rainfall data shows maximum average monthly rainfall in the month of July (711.31mm) whereas the maximum rainfall ever recorded in the area is 1450 mm (August 1983) (Figure.4.1).

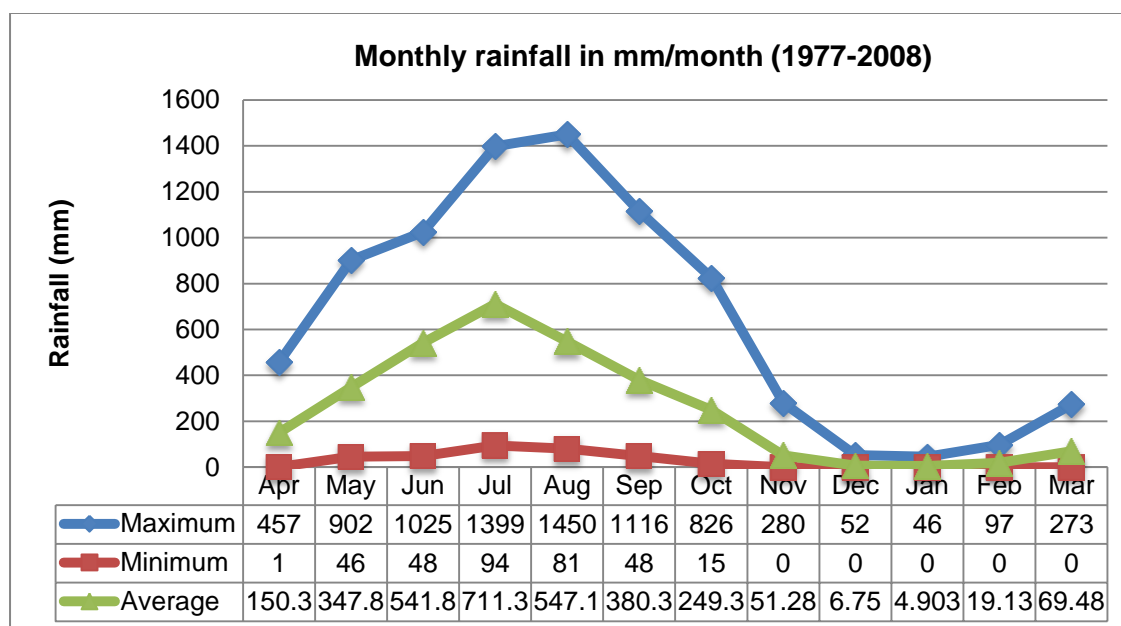


Figure 4.1: Monthly Maximum, Minimum and Average Rainfall at Sitakundu, Chittagong

135. Values of monthly maximum and monthly average rainfalls were collected from the BMD station at Comilla (1948-2008). The collected data are shown in Figure 4.2 below. The figures show significant rainfall during the months of May to October. On the other hand, very little rainfall or no rain occurs during the period of November to January. Historical rainfall data shows maximum average monthly rainfall in the month of July (458.88 mm). Whereas the maximum rainfall ever recorded in the area is 1045 mm (July 1948) (Figure.4.2).

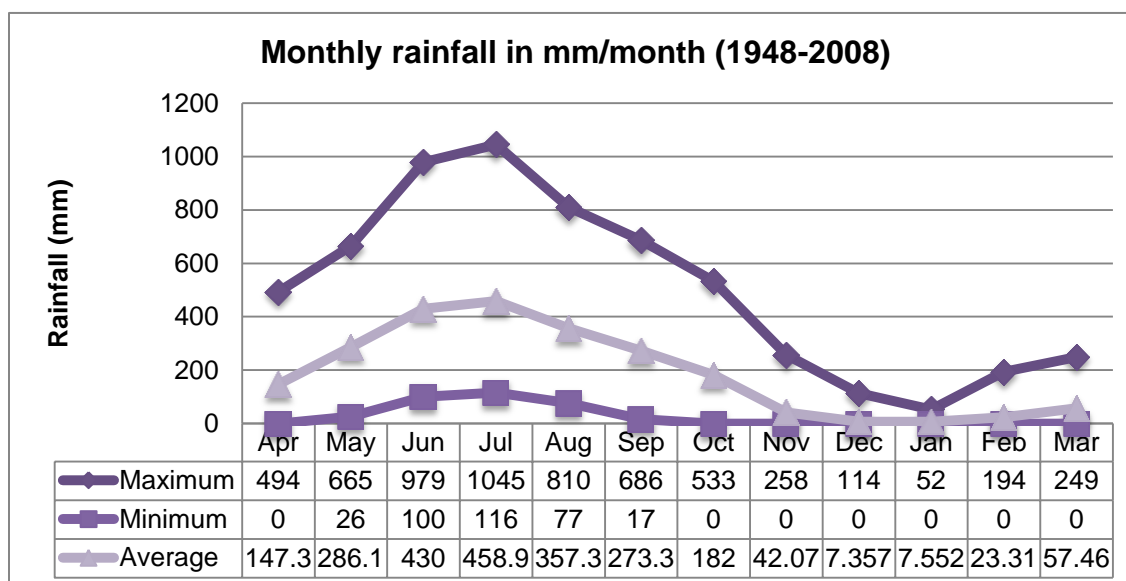


Figure 4.2: Monthly Maximum, Minimum and Average Rainfall at Comilla

Temperature

136. Last 34 years data (1977-2011) shows that the monthly maximum temperature varies from 28.25°C to 34.79°C and the monthly minimum temperature varies within the range of 9.77°C to 24.74 °C. The highest average monthly temperature is found as 34.79°C (April) whereas the lowest average monthly temperature is 9.77°C (January). The monthly variations of maximum and minimum average temperatures are shown in Figure 4.3below.

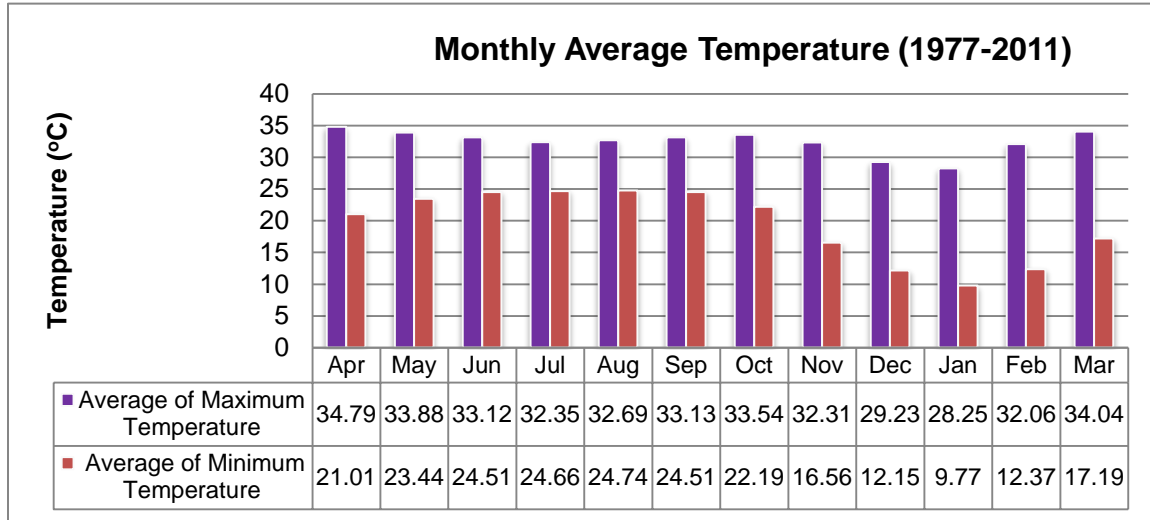


Figure 4.3: Maximum and minimum of average temperature at Sitakundu, Chittagong

137. Last 63 years' data (1948-2011) shows that the monthly maximum temperature varies from 28.27°C to 36.03°C and the monthly minimum temperature varies within the range of 9.89°C to 24.3 °C. The highest average monthly temperature is found as 36.03°C (April) whereas the lowest average monthly temperature is 9.89°C (January). The monthly variations of maximum and minimum average temperatures are shown in Figure 4.4below.

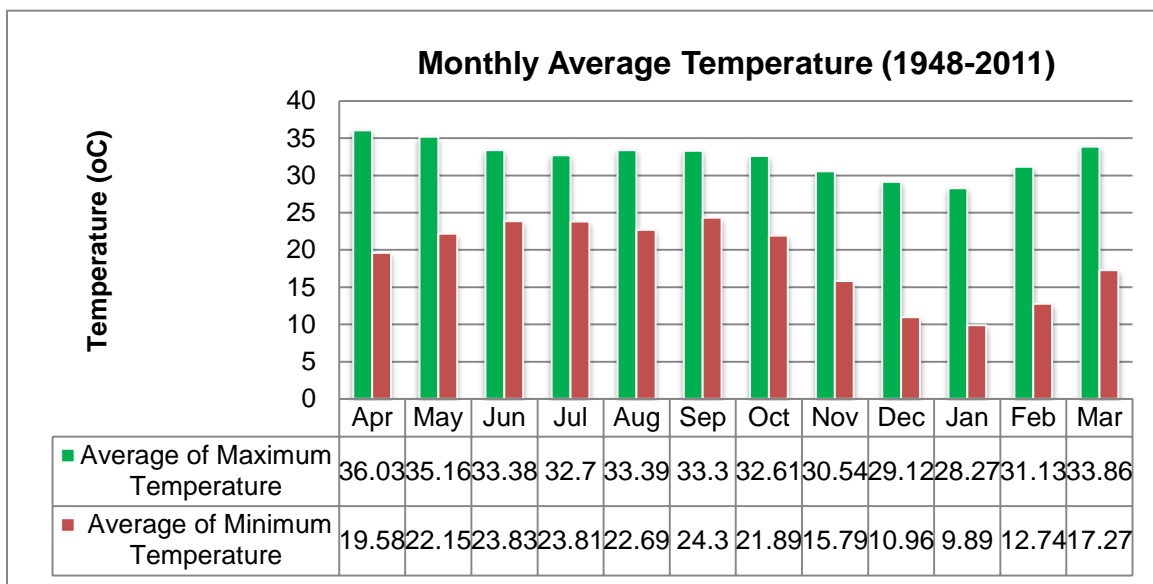
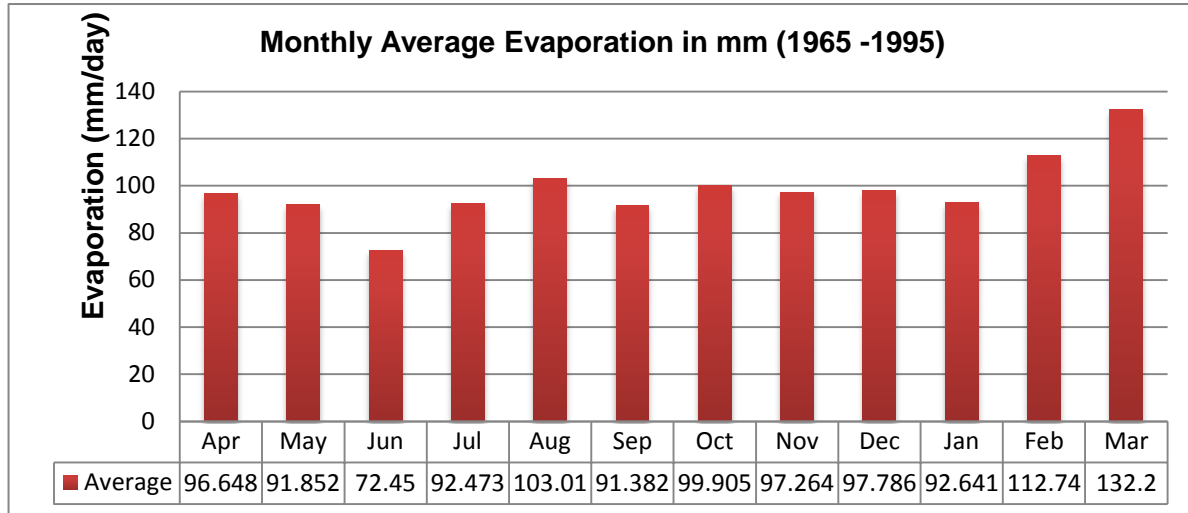


Figure 4.4: Maximum and minimum of average temperature at Comilla**Evaporation**

138. The available evaporation data from the year 1965 to 1995 are presented in a column diagram below. It shows that February, March, August and October are the months when average monthly evaporation rate is higher which varies from 99.9 mm/month to 132.2 mm/month. On the other hand May, June, July and September shows lower average monthly values which varies from 72.45 mm/month to 92.47 mm/month range. The results of monthly average evaporation analysis are given in Figure 4.5.

**Figure 4.5: Monthly Average Evaporation at Chittagong**

139. The available evaporation data from the year 1986 to 2011 are presented in a column diagram below. It shows that March, April and May are the months when average monthly evaporation rate is higher which varies from 123.82 mm/month to 143.19 mm/month. On the other hand November, December, January and February shows lower average monthly values which varies from 69.71 mm/month to 93.05 mm/month. The results of monthly average evaporation analysis are given in Figure 4.6.

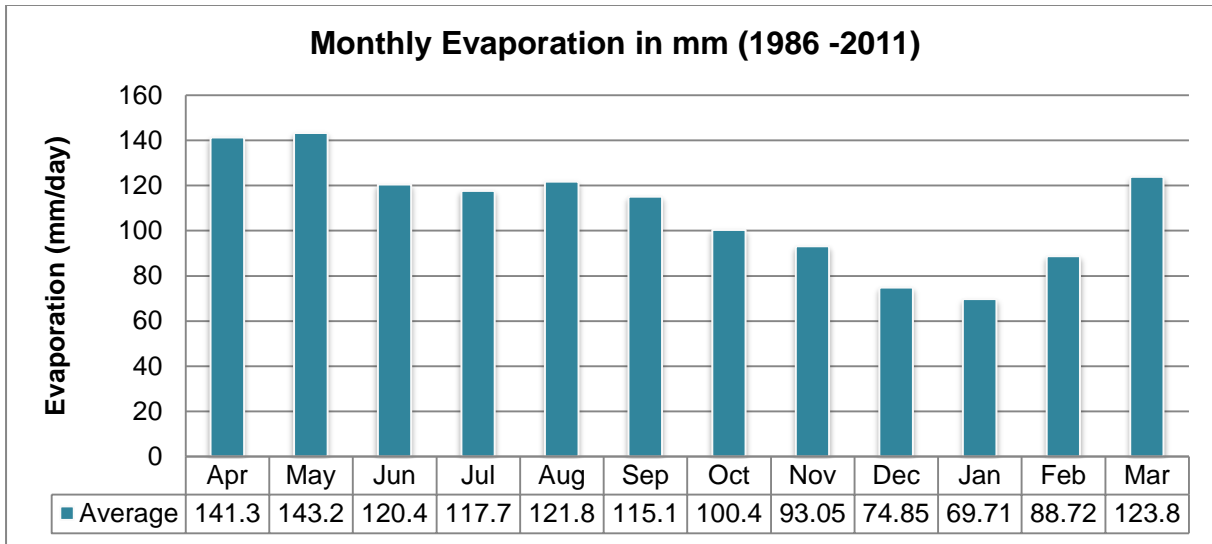


Figure 4.6: Monthly Average Evaporation at Comilla

Humidity

140. Humidity, being a climate variable interacts with the other climatic variables. The humidity is affected by winds and by rainfall. The humidity data collected from BMD, Sitakundu, Chittagong station is plotted in a graph and shown below. From the graph it is observed that June, July, August, September and October are the most humid months when average monthly relative humidity varies from 82.73 % to 87.35%. The minimum average humidity occurs in the period from January to March which is in the range 70.25 % to 73.50 %. The monthly average relative humidity for the last 34 years (1977-2011) is shown in Figure 4.7 below.

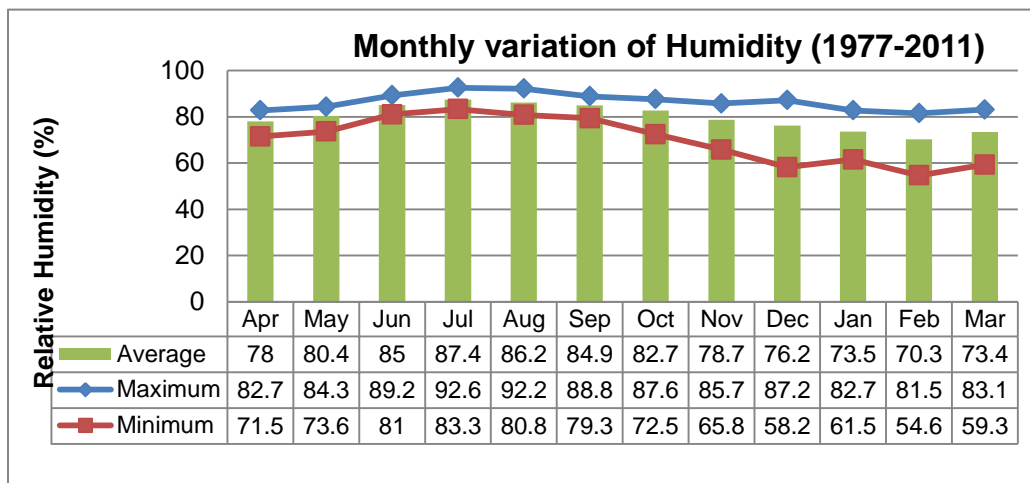


Figure 4.7: Monthly Maximum, Minimum and Average Humidity at Sitakundu, Chittagong

141. Humidity, being a climate variable interacts with the other climatic variables. The humidity is affected by winds and by rainfall. The humidity data collected from BMD, Comilla station is plotted in a graph and shown below. From the graph it is observed that June, July,

August, September and October are the most humid months when average monthly relative humidity varies from 83.83 % to 87.58 %. The minimum average humidity occurs in the period from January to March which is in the range 72.95 % to 76 %. The monthly average relative humidity for the last 63 years (1977-2011) is shown in Figure 4.8 below.

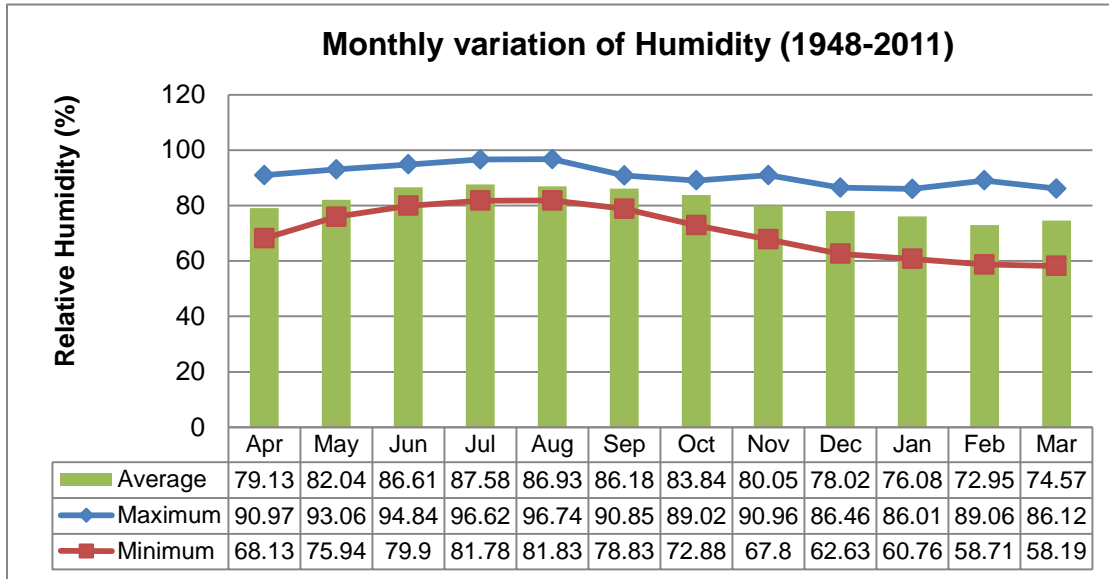


Figure 4.8: Monthly Maximum, Minimum and Average Humidity at Comilla

Wind Speed

142. Historical data on wind speed for the last 31 years (1977-2008) has been collected from the BMD station at Sitakundu. The monthly average wind speed in Chittagong region varies from 115.21 to 208 km/day. The variation of monthly average wind speed is shown Figure 4.9 below. The figure shows that the average speed of wind is highest in April (208 km/day) and lowest in December (115.21 km/day).

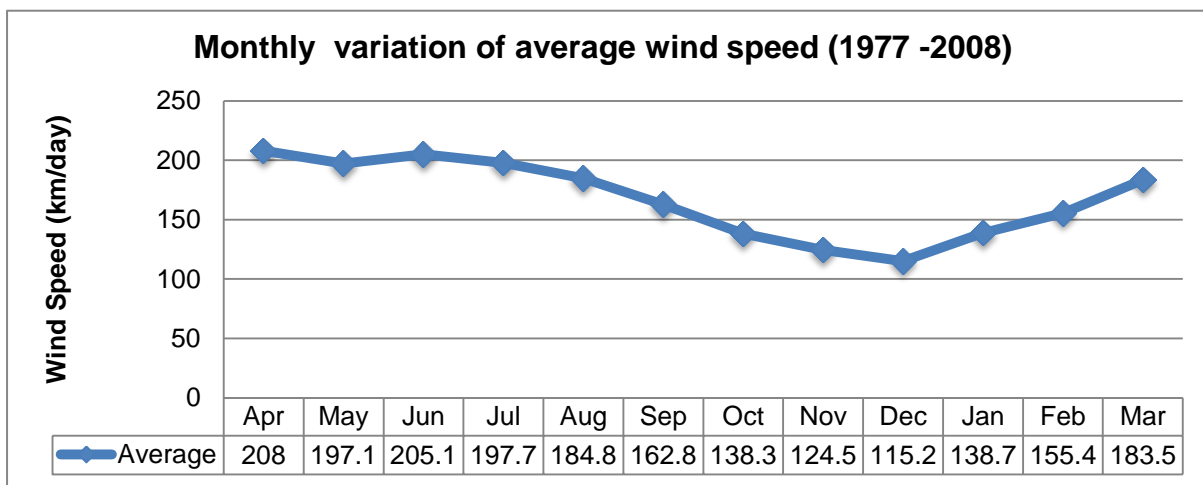


Figure 4.9: Monthly variation of average wind speed at Sitakundu, Chittagong

143. Historical data on wind speed for the last 60 years (1948-2008) has been collected from the BMD station at Comilla. The monthly average wind speed in Comilla region varies from 140.36 to 262.51 km/day. The variation of monthly average wind speed is shown Figure 4.10 below. The figure shows that the average speed of wind is highest in April (262.51km/day) and lowest in December (140.36 km/day).

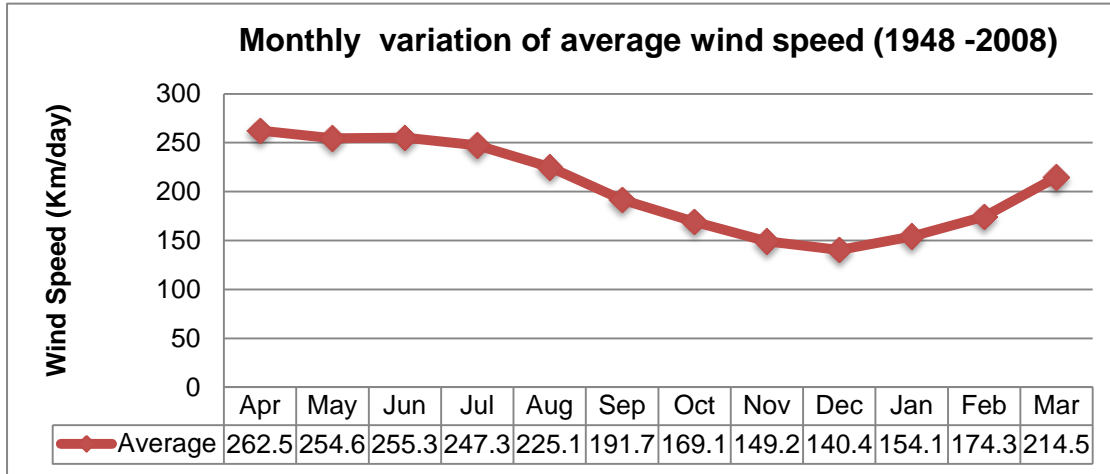


Figure 4.10: Monthly variation of average wind speed at Comilla

Sunshine Hour

144. The data for sunshine hours for the last 31 years (1977-2008) has been collected from the BMD station at Sitakundu the monthly average values of sunshine hours in Chittagong vary from 3.40 to 7.20 hour/day. The average value of sunshine hours is highest in March (7.20 hr/day) and lowest in July (3.40 hr/day) (Figure 4.11).

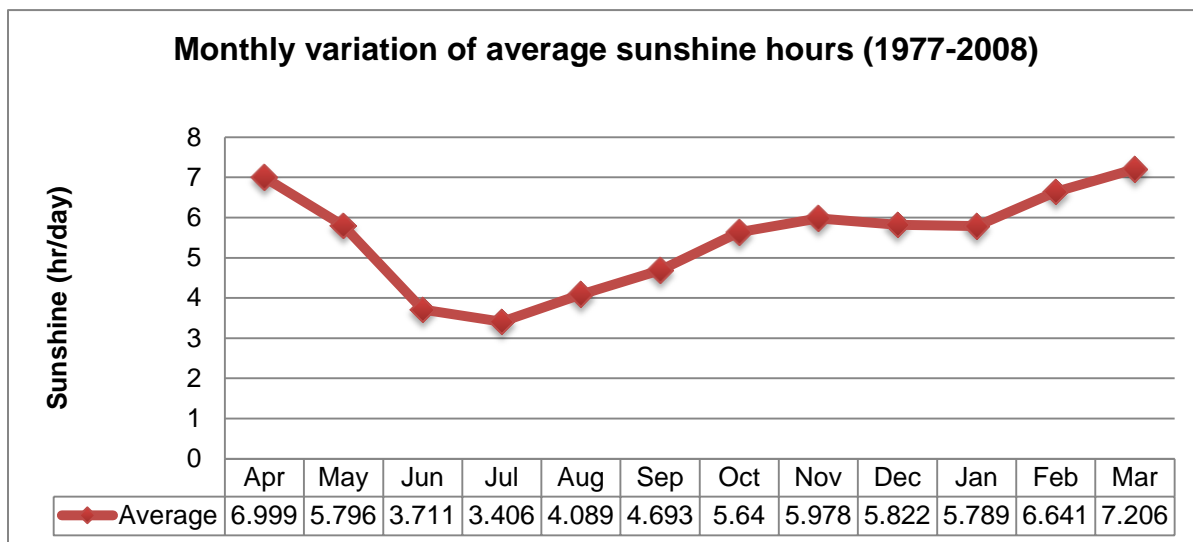


Figure 4.11: Monthly average sunshine hours per day at Sitakundu, Chittagong

145. The data for sunshine hours for the last 27 years (1981-2008) has been collected from the BMD station at Comilla. The monthly average values of sunshine hours in Comilla vary from

4.37 to 7.91 hour/day. The average value of sunshine hours is highest in March (7.91 hr/day) and lowest in July (4.37 hr/day) (Figure 4.12).

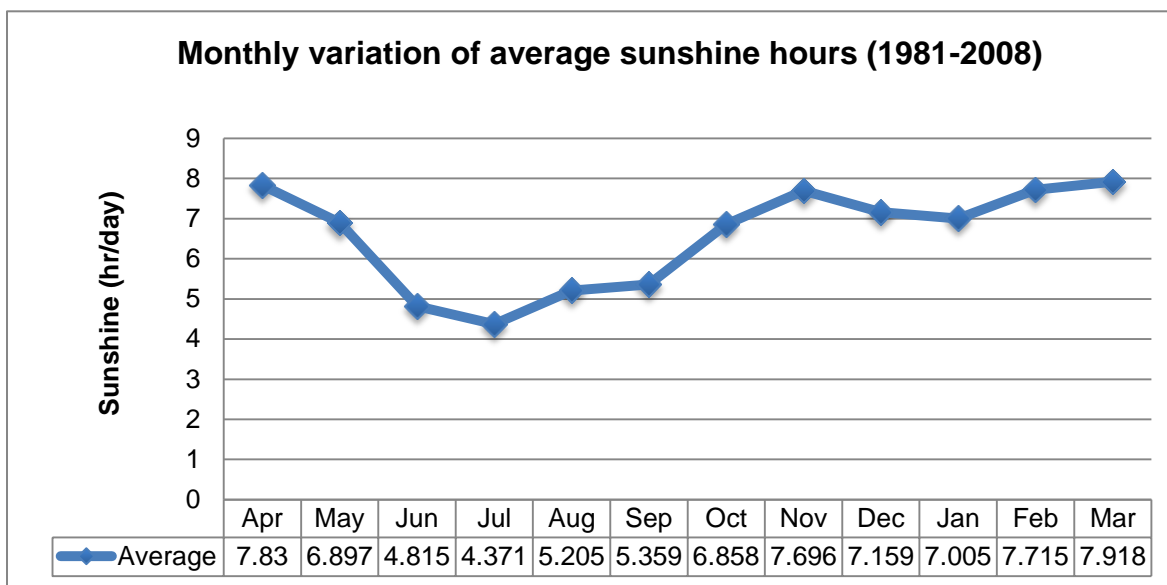
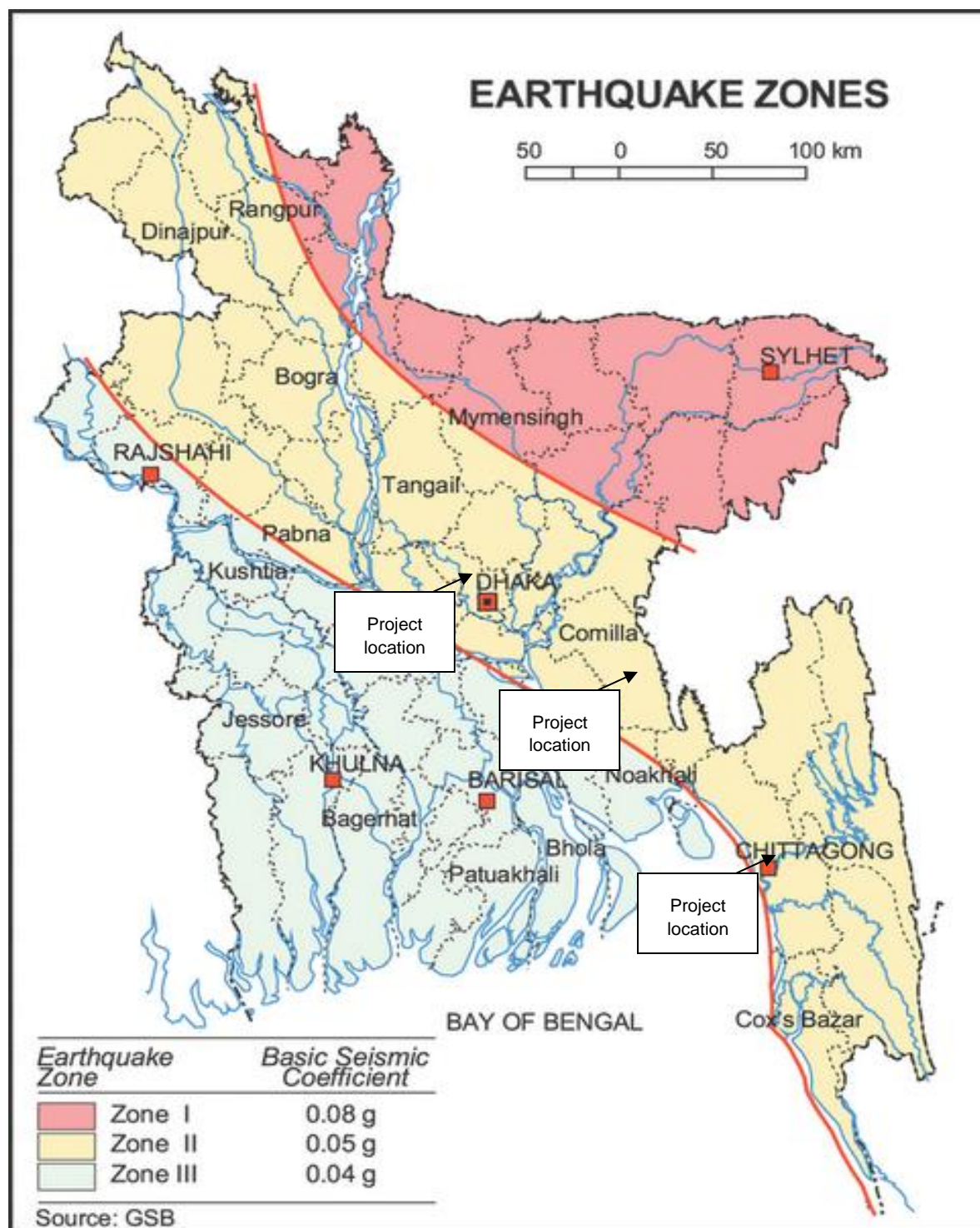


Figure 4.12: Monthly average sunshine hours per day at Comilla

4.2.3 Physical Environment: Seismicity

146. Depending on the geological structure, Bangladesh has been classified into three seismic zones (Map.4.1). According to which, the proposed study area falls under the Zone –II. Zone-II is characterized by relatively low tendency of earthquakes with a basic seismic coefficient of 0.05g.



Map 4.1: Location of the study area within the seismic zones of Bangladesh

4.3 Environmental Quality

147. This section provides standards limit on the environmental indicators i.e. air quality, water quality and noise level of Bangladesh. The values of the aforementioned environmental

parameters were collected and analyzed considering secondary information from different sources.

148. **(a) Noise.** Noise level is an important parameter for evaluating environmental quality. Table 4.2 shows the standard values for noise in Bangladesh. Noise levels exceeding 80dB is usually considered as noise pollution in Bangladesh. However, the permissible limits for Bangladesh are less.

Table 4.2: Standards of noise levels for different zones of Bangladesh

Zone Class	Limits in dB*		IFC EHS guideline (one hour dBA)	
	Daytime	Night time	Day time	Night time
	(6 am – 9 pm)	(9 pm-6 am)	7:00 – 22:00	22:00 – 7:00
Silent zone	45	35	55	45
Residential zone	50	40	55	45
Mixed	60	50	--	--
Commercial zone	70	60	70	70
Industrial zone	75	70	70	70

Source: *Bangladesh Gazzete, 2006

The values of observed sound level and the standard sound level are shown in **Table 4.3**.

Table 4.3: Sound Levels for different locations in the project area

Administrative Location	GPS Location	Sound Level (dB)	Standard level
Kalurghat at Chittagong	22°23'15.9"N 91°52'13.1"E	41	50 dB (day time residential Zone)
Madunaghat at Chittagong	22°25'54.9"N 91°52'10.5"E	43	
Jangalia, Comilla	23°25'43.4"N 91°10'12.5"E	44	
Bolia, Chandpur	23°16'5.1"N 90°51'57.4"E	49	

Source: CEGIS field survey, September 2014, N.B.: All values were collected during day time.

149. **(b) Air Quality.** The main concern is suspended particulate matter (SPM) during the pre-construction and construction periods. The solid dust particles would come from the earth works on site. As there will not be any huge earthwork, particulate matter emission due to project intervention will be insignificant. The only possible source will be from the transportation of material by vehicles.

The standard values of ambient air for the area of different categories are shown in the following Table 4.4.

Table 4.4:- Standards of Ambient Air Quality

Area	Categories	Concentration $\mu\text{g}/\text{m}^3$ -			
		SPM	SO ₂	CO ₂	NO _x
A	Industry	500	120	5000	100

B	Commercial	400	100	5000	100
C	Residential and rural area	200	80	2000	80
D	Sensitive	100	30	1000	30
World Bank Standard		---	125	---	70
Ambient Condition ¹		To be done prior construction start			

Source: Environmental Conservation Rules, DoE 1997

150. Heat from the electromagnetic fields produced from the high voltage transmission line could have biological effects. To date, no adverse health and biological effects from low level, long-term exposure to power frequency fields have been confirmed. So heat from the transmission line will not be a great concern of this project.

4.4 Land Resources

4.4.1 Agro-ecological zones

151. An agro-ecological zone (AEZ) is a zone or region which has unique combination of physiographic, soil, hydrological and agro-climatic characteristics. Thirty agro-ecological regions and 88 sub-regions have been identified by adding successive layers of information on the physical environment which are relevant for land use and assessing agricultural potential. These layers are (i) Physiography (land forms and parent materials), (ii) Soils and their characteristics, (iii) Depth and duration of seasonal flooding, (iv) Length of the rain feed Kharif and Robi growing periods, (v) Length of the pre-Kharif period of unreliable rainfall, (vi) Length of the cool winter period and frequency of occurrence of extremely low (below 0.4°C) winter temperature and (vii) Frequency of occurrence of extremely high (>40°C) summer temperature (FAO, 1988). Fertility status of these regions varies considerably. Individual farmers have fragmented the land into small pieces causing wide variation in the management of each and every piece of land. This leads to the large variation in the fertility levels even between adjacent plots. Realizing the difficulties of generalization of fertility level, only an indicative status of the fertility levels of each agro-ecological region is given here which serves as a ground for AEZ based fertilizer recommendations for cropping patterns. However, for fertility data of a specific area soil samples should be collected for detailed analysis (BARC, 1988).

The study area comprises:

Chittagong Division

152. Three agro-ecological regions are suited in the study area under Chittagong Division (see Map 4.2). These are (i) Old Meghna Estuarine Floodplain, (ii) Chittagong Coastal Plain; and (iii) Northern and Eastern Hills.

- Old Meghna Estuarine Floodplain (AEZ-19)

¹ Air quality data has not collected in IEE study due to time constraint. It is requested to Implementing Agencies to established air quality baseline before implementation started. As commented by S.Kumar Mondal of CEGIS on 7/12/15

153. This region occupies a large area, mainly low-lying between south of the Surma-Kushiyara Floodplain and northern edge of the Young Meghna Estuarine Floodplain. It comprises smooth, almost level, floodplain ridges and shallow basins. Seasonal flooding occurs due to accumulated rainwater. It is moderately deep or deep in the north and west, but it is shallow in the south east. Silt loam soils predominate on highlands and silty clay to clay in low lands. Non calcareous Dark Grey Floodplain soils are the only general type of the area. Organic matter content of the soils is moderate. Moisture holding capacity is medium. Top-soils are moderately acidic, but sub-soils are neutral in reaction. General fertility level is medium.

154. Some physico-chemical properties of soils of Old Meghna Estuarine Floodplain (AEZ-19) are cited below.

Table 4.5:- Some physio-chemical properties of soils of AEZ-19

Major land type	Soil pH	Soil OM	Nutrients status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Medium high land	4.4-7.8	L-M	VL-L	L-M	L-M	L-M	Opt	Opt	L-M	L-M	Opt
Medium lowland	5.5-7.7	M	VL-L	L-M	L-M	L-M	Opt	Opt	L-M	L-M	Opt
Lowland	5.7-6.9	M	L	L-M	L-M	L-M	Opt	Opt	L-M	L-M	Opt

OM=Organic matter; VL=Very low; L=Low; M=Medium; Opt=Optimum; H=High; VH=Very high

155. Chittagong Coastal Plains (AEZ- 23)

156. This region occupies the plain land in greater Chittagong district and the eastern part of Feni District. It is a compound unit of piedmont, river, tidal and estuarine floodplain landscapes. The major problem in these soils is high salinity during dry season (October to May). Grey silt loams and silty clay loam soils are predominant. Acid Sulphate soils which are potentially extremely acidic occur in mangrove tidal floodplains. Non calcareous Grey Floodplain soils, Non calcareous Alluvium and Acid Sulphate soils are the major components of the General Soil Types of the area. General fertility level of the soils is medium, and N and K are limiting. Status of S is high.

157. Some physico-chemical properties of soils of Chittagong Coastal Plains (AEZ- 23) are cited briefly below:

Table 4.6:- Some physio-chemical properties of soils of AEZ-23

Major land type	Soil pH	Soil OM	Nutrients status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland	4.3-6.0	L-M	L	VL-L	L-M	M-Opt	L-M	L-M	L-M	L-M	M
Medium highland	4.4-6.2	L-M	L	VL-L	L-M	M-Opt	L-M	L-M	L-M	L-M	M
Medium lowland	4.6-6.0	M	L	VL-L	L-M	M-Opt	L-M	L-M	L-M	L-M	M

OM=Organic matter; VL=Very low-Low; M=Medium; Opt=Optimum;

Northern and Eastern Hills (AEZ 29).

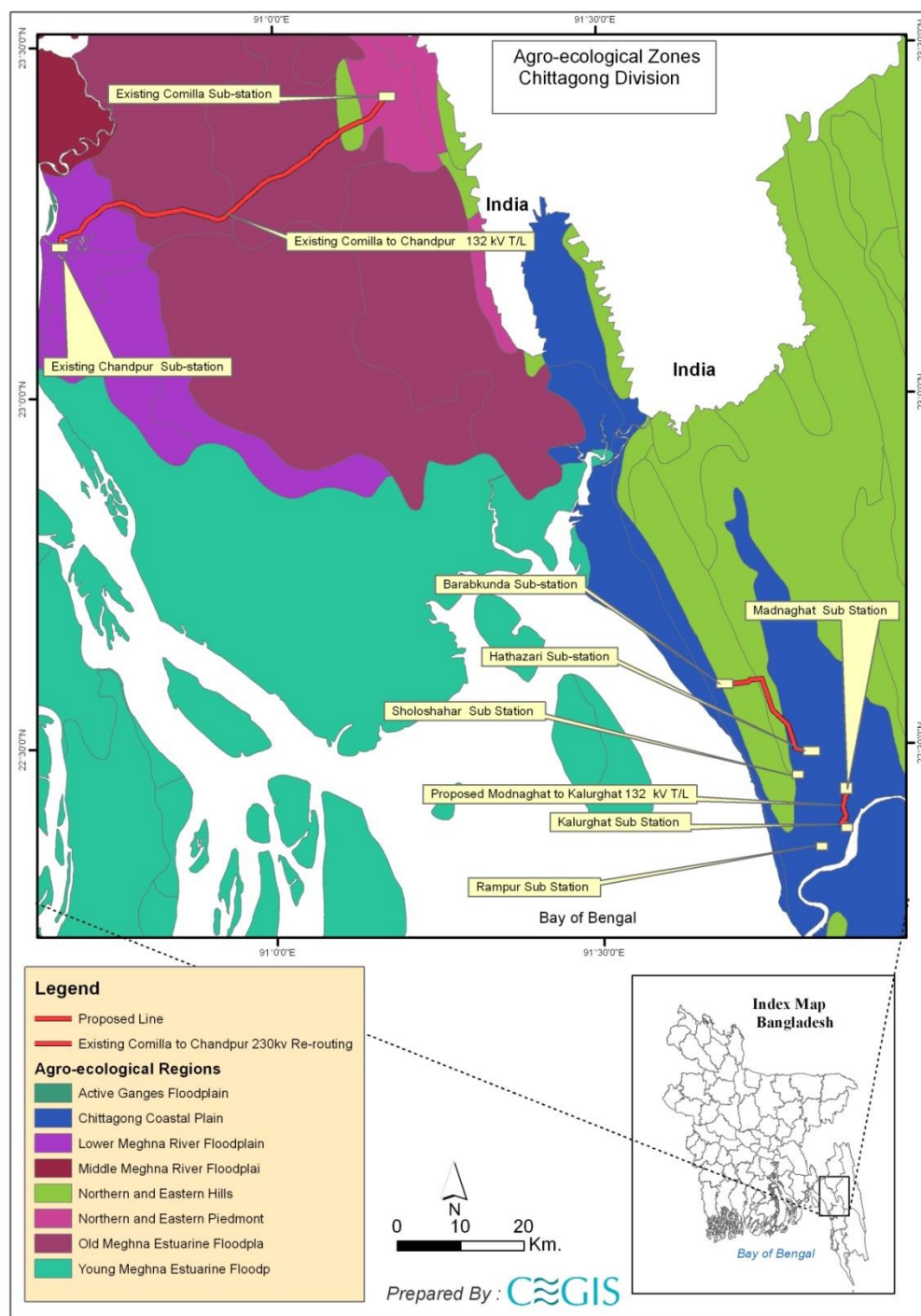
158. This region includes the country's hill areas. Relief is complex. Hills have been dissected to different degrees over different rocks. In general, slopes are very steep and few low hills have

flat summits. The major hill soils are yellow-brown to strong brown, permeable, friable, loamy; very strongly acidic and low in moisture holding capacity. However, soil patterns generally are complex due to local differences in sand, silt and clay contents of the underlying sedimentary rocks and in the amount of erosion that has occurred. Brown Hill soils are the predominant General Soil Types of the area. Organic matter content and general fertility level are low. Some physic-chemical properties of soils of Northern and Eastern Hills (AEZ 29) is given below:

Table 4.7-: Some physio-chemical properties of soils of AEZ 29

Major land type	Soil pH	Soil OM	Nutrients status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland	4.1-7.1	L-M	VL-L	L	L-M	L-M	L-M	L-M	L-M	L-M	L-M

OM=Organic matter; VL=Very low; L-Low; M=Medium;



Map: 4.2: Agro-ecological zones in Chittagong Division

4.5 Agriculture Resources

4.5.1 Cropping pattern

159. The agricultural lands fallen under the (RoW) of 132kV power transmission line are intensively used for agricultural crops. The area is dominated by double or triple cropping pattern. Major cropping within the buffer area of RoW is T Aus-T Aman-Boro, Fallow-T Aman-Boro and Fallow-T Aman-Fallow. During EIA study it will be explored details.

4.5.2 Cropping pattern of Sub-station

160. Most of the substations are situated on own land of the PGCB (Comilla, Modunaghat, and Kalurghat) and which are mainly fallow land. Only Kachua substation, Hajiganj, Chandpur is mainly T Aus (HYV) followed by T Aman (HYV) crop. In minor areas, single T Aman crop is grown. During EIA study, it will be explored in detail.

4.5.3 Crop Production

161. Average yield rate of T Aus and T Aman crops are about 3.5 ton and 4.0 ton per ha respectively and. The Boro crop has higher yield rate of about 5.0 ton to 6.0 ton per ha. The yield rate of both (RoW) of transmission line and substation areas are mostly equal. During EIA study it will be explored details.

4.5.4 Agricultural Input

162. Farmers are applying fertilizers for all the crops grown of the (RoW) transmission line and substation areas. Application of unbalanced dose of fertilizer with Urea, TSP and MP have been noticed for almost all the major crops grown in these areas. They apply fertilizers both for T HYV Aus and HYV Aman crop at the rate of 150-100-50 kg of urea, TSP and MP respectively. In HYV Boro crop, they use Urea, TSP and MP fertilizer at the rate of 200-150-75 kg respectively. Application of pesticides have been noticed for 1-2 times to control pest and diseases for the rice crops grown in the areas. Farmers in general, apply liquid pesticides with the help of sprayer but sometime they mix granular pesticides with the fertilizers and then apply to the fields.

4.6 Ecology

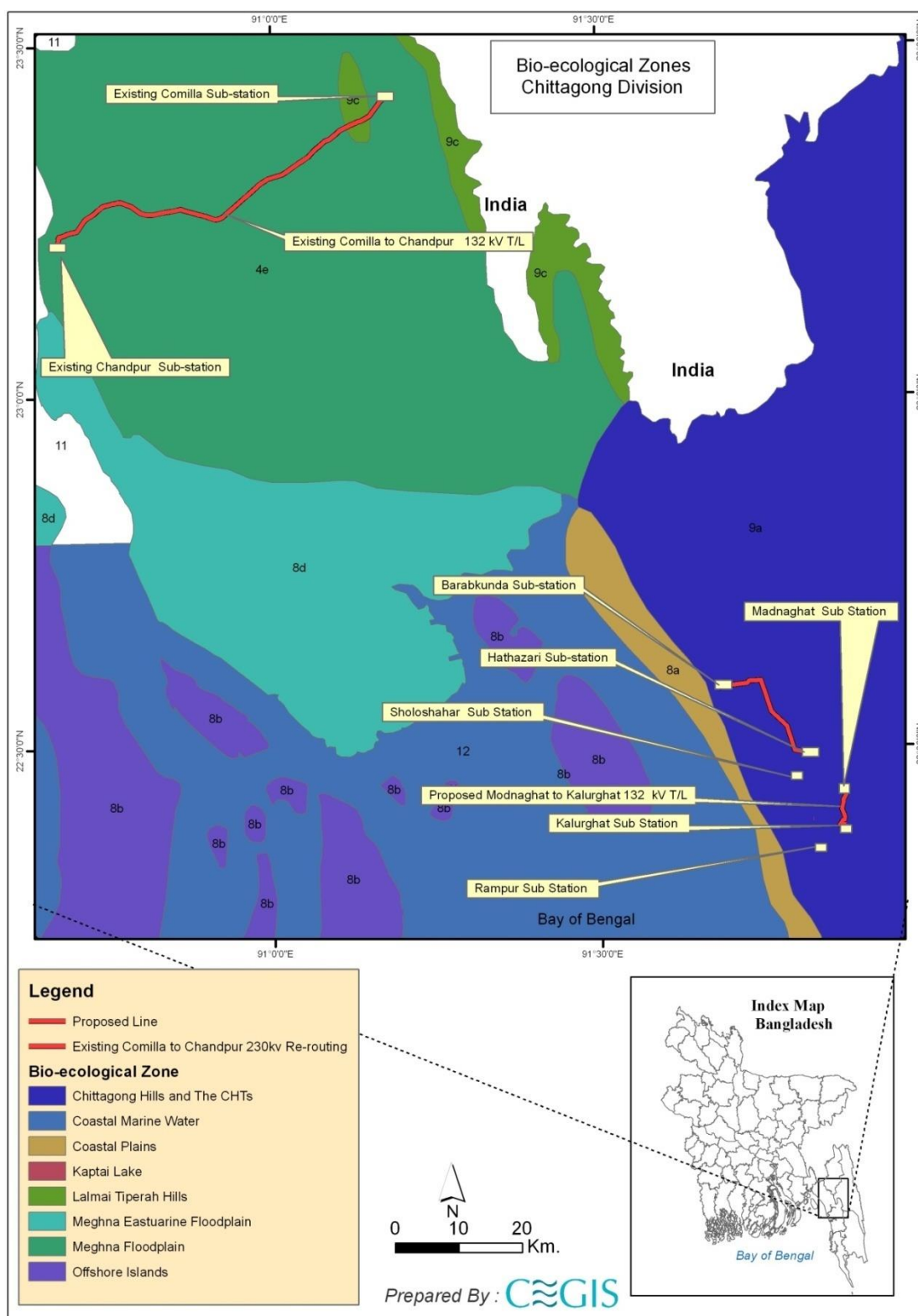
163. The entire project area is consisting of different districts of Chittagong division and southeast regions of the country are namely, Chittagong, Comilla and Chandpur. The entire area holds various landforms from hill to plain land as well as floodplains those contribute diverse ecological resources (flora and fauna) to facilitate ecosystem functions properly.

4.6.1 Bio-Ecological Zone

164. IUCN-The World Conservation Union have identified 25 Bio-ecological Zones in Bangladesh based on physiography, climate, soil type, flooding depth and biodiversities (IUCN, 2002). The present study falls under the Chittagong Hills and the CHTs as well as Old Meghna Flood plain Bio-ecological Zone (Map 4.5), brief description of which is presented below.

Chittagong Hills and CHTs

165. This zone is composed of tropical evergreen and semi-evergreen forest. While the hills are not very high generally about 600m are rigged and often steep. These hill forests are the most important watershed areas of the country. The tropical evergreen and semi-evergreen forest are not very distinct, and are often intermingled and merged into one another in this zone. The majority of the species in the lower canopy are evergreen, and the upper canopy of the forest is deciduous type. Some of these deciduous tree species shed their leaves in the winter while other does it in the monsoon, so the forests appear evergreen. Tropical evergreen forest is found in the valleys of this zone. The predominant species are; Civit (*Swintonia floribunda*), Garjan (*Dipterocarpus* Sp.), Chapalish (*Artocarpuschaplasha*), Chundul (*Tetramelesnudiflora*), Telshur (*Hopeaodorata*). In the lower canopy important species like the Pitraj (*Aphanamixispolystachys*), Toon (*Toonaciliata*), Nageshwar (*Mesuaferrea*), Uriam (*Mangiferasylvetica*) and various *Ficus* species can be found. The undergrowth is usually a tangle of shrubs, in which cane, bamboo and wild banana are the prominent species. Knowledge on the diversity of reptiles and amphibians of this zone is rather rudimentary, as few surveys of these animals have been made. This zone possesses richest avifauna population of the country mostly marine and shore birds. Out of 66 families of birds occurring in the country, as many as 55 are represented in this zone. Mammalian species represented by Asian elephant (*Elephasmaximus*), Smabar (*Cervus unicolor*), Slow loris (*Nycticebuscoucang*), Leopard (*Pantherapardus*), Asiatic wild dog (*Cuonalpinus*).



Map: 4.3: Bio-ecological zones in Chittagong Division

4.7 Ecosystem

166. Primarily the entire ecosystem is divided into two major divisions namely terrestrial and aquatic ecosystems.

4.7.1 Terrestrial Ecosystem

167. The findings from the current study can be represented into two groups: terrestrial flora and terrestrial fauna on the basis of the land use and characteristics of the organisms.

Terrestrial Flora

168. In this subcategory vegetation observed during the field survey are particularly (a) homestead vegetation, (b) hill vegetation, (c) cropland vegetation and (d) roadside vegetation.

- a. **Homestead vegetation** occurs within the home territory and/or adjacent to home boundary. This type of vegetation is cultivated by home owners for their benefits. So, benefits are different in accordance to their needs. In most cases, this vegetation supports primarily for earning cash by producing different fruit, timber and fire wood and followed by medicinal vegetation in some locations. On the other hand, some vegetation is not cultivated traditionally but they have a great contribution to retain ecosystem due functioning are called self-propagating vegetation. The available species noted as common are Mango (*Mangifera indica*), Jackfruit (*Artocarpus heterophyllus*), Litchi (*Litchi chinensis*), Banyan (*Ficus bengalensis*), Tamarind (*Tamarindus indica*), Koroi (*Albizia procera*), Simul (*Bombax ceiba*) and Aswath (*Ficus religiosa*).
- b. **Hill vegetation**, the project area considered under different types of hilly landform-hillock to high hills in the southeast region especially in Chittagong zone. The vegetation holds diverse characteristics in their natural life forms like germination constraints compared to other vegetations. Frequently visited hill vegetations are Garjan (*Dipterocarpus* Sp.), Chapalish (*Artocarpus chaplasha*), Chundul (*Tetrameles nudiflora*), Telshur (*Hopea odorata*), Civit (*Swintonia floribunda*), Pitraj (*Aphanamixis polystachys*), Nageshwar (*Mesua ferrea*), Uriam (*Mangifera sylvatica*) and Toon (*Toonaciliata*).
- c. **Cropland vegetation** refers vegetation those grow along the periphery and/or in-between crops in croplands. This type of vegetation is generally called weeds. The available weed species observed in the study area are Binna ghash (*Vetiveria zizanioides*).
- d. **Roadside vegetation** are more or less similar throughout the study area where fast growing flora are usually planted to protect soil degradation. This type of plantation in most cases consider for public-private partnership afforestation. In slopes, lower portion is occupied with marginal vegetation like Bhat, DholKolmi, Biskantali include Murta (*Clinogynedichotoma*) and Jalibet (*Calamus tenuis*) in the region.

Terrestrial Fauna

169. The proposed transmission lines across different type of vegetative areas, of them the hills are rich fauna. Terrestrial fauna especially wildlife species are described briefly here in accordance to their hierarchy below.

170. Of the **amphibians** Common Toad (*Bufomelanostictus*), Painted Balloon Frog (*Kaloulataprobatica*), Annadale Tree Frog (*Chiromantissimus*) and Balloon Frog (*Uperodonglobulosus*) frequently observed within the study area.

171. Among **reptiles** Common Skunk (*Mabuyacarinata*), Garden Lizard (*Calotesversicolor*), both monitor lizards (*Varanusflavescens*, *Varanusbengalensis*) are frequently seen species. The latter two species still have robust population. Snakes are not very rich in terms of diversity and population due to a vast open landscape has limited access of suitable habitat.

172. Of **birds** the resident species occur throughout the study area. The Pied Myna (*Sturnus contra*), Black Drongo (*Dicrurusmacrocerus*), Common Tailorbird (*Orthotomussutorius*), Spotted Dove (*Streptopeliachinensis*), Fulvous-breasted Woodpecker (*Dendrocoposmacei*), Red Jungle fowl (*Gallus gallus*), Paddyfield Pipit (*Anthusrufulus*), Black-hooded Oriole (*Oriolusxanthornus*) and Oriental White-eye (*Zosteropsalpebrosus*) have seen available in the study area. Brahmini Kite (*Haliastur Indus*), Black Kite (*Milvusmigrans*) and Crested Serpent Eagle (*Spiolornischilla*) are common birds of prey.

173. The **mammals** are magnificent and attract hunters. As a consequence, they are vanishing very rapidly compared to other groups. Causes behind mammal extinction are habitat destruction and hunting pressures. The habitat cover is still as forest patches where the magnificent species are roaming, but sizes of patches are shrinking quickly. Available mammals within the study area are: Jungle Cat (*Falischaus*), Fishing Cat (*Faliviverrina*), Bengal Fox (*Vulpesbengalensis*), Small Indian Civet (*Viverriculaindica*), Common Mongoos (*Herpestesedwardsi*) and Bats.

4.7.2 Aquatic ecosystem

174. The aquatic ecosystem of the current study area holds river, canal, stream and ditches. These wetlands have important role to flourish vegetation as well as nourishment to organisms like bird, fishes and invertebrates. The aquatic ecosystem is composition of aquatic flora and fauna those observed in this study area is described below.

Aquatic flora

175. The aquatic flora can be classified into five categories: submerged plants, free-floating plants, rooted-floating plants, sedges and meadows, and marginal/amphibian plants and are listing as follows.

Submerged plants: Jhanji (*Hydrillaverticilata*)

Free-floating plants: Kochuripana (*Eichhorniacrassipes*), Tentulpana (*Salvinia* Sp.), Kutipana (*Azolla* sp.) and Khudipana (*Lemna* Sp.).

Rooted-floating plants: Shapla (*Nymphaea*, *Nymphoides*Spp.), Keshordam (*Ludwigiarepens*), DholKolmi (*Ipomoea fistulosa*), etc.

Sedges and meadows: DholKolmi (*Ipomoea fistulosa*) and Chechur (*Monochoriahastata*)

Marginal/amphibian plants: Several species under family Cyperaceae is dominant and followed by the Amaranthaceae and Gramineae.

Aquatic Fauna

176. The project area covers a vast area where the main and major rivers criss-cross and provide nourishment to aquatic fauna. The aquatic fauna in this area are classified in accordance with hierarchy i.e. amphibian, reptilian, bird and mammal. The **amphibians** in their life-cycle pass both aquatic and terrestrial environment but those species in the time stay more time in aquatic environment considered as aquatic amphibians: Indian Bullfrog (*Hoplobatrachustigerinus*), Cricket Frog (*Fejervaryalimnocharis*) and Skipper Frog (*Euphlectiscyanophlytis*) have found frequently throughout the study area. Besides, the Common roof turtle (*Kachuga tecta*), Common aquatic snakes include the checkered keelback (*Xenocrophispiscator*), smooth water snake (*Enhydrisenhydris*) and Stripped Keelback (*Amphiasmastolata*) have commonly seen reptiles. Of **birds** Common Moorhen (*Gallinulachloropus*), White-breasted Waterhen (*Amaurornisphoenicurus*), Ruddy Shelduck (*Tadorna ferruginea*) and Little Cormorant (*Phalacrocorax niger*) are common in all divisions.

4.7.3 Substations wise ecological information

Kachua Substation, Hajiganj (Option-1), Mauza: Baliya, Union: Hajiganj Sadar; District: Chandpur

177. The proposed site is double cropped plain agricultural land. Mainly two types of crops are cultivated in a year. In kharif-1 agriculture production is absent due to having water submerge. The Rabi season is a notable time for this area of farmers. The farmers are facilitated to cultivate two varieties of crops in this season i.e. paddy and vegetables. There is no terrestrial flora and fauna affected by project activity as defined by the World Conservation Union's Red List of Threatened Species or as defined in the national legislation. The site 1 is a proper place to set up substation than that of 2 & 3.

- Madunaghat Substation, Mouza: Burish Char, Union: Burish Char, Upazilla: Hathazari District: Chittagong.

178. As many numbers of trees will smash due to establishment of a substation. Besides, filling of homestead ponds is a great concern to ecosystem degradation. There is no terrestrial flora and fauna affected by project activity as defined by the World Conservation Union's Red List of Threatened Species or as defined in the national legislation. A list of plants those would be cut is given below.

Table 4.8: Information (Flora) in Madunaghat Substation, Hathazari

Sl. No.	Flora	Scientific Name	Quantity	Height (ft)
1	Aam	<i>Mangifera indica</i>	10	25
2	Kanthal	<i>Artocarpus heterophylla</i>	12	20
3	Goraneem	<i>Melia azadirachta</i>	2	15
4	Amra	<i>Spondias pinnata</i>	2	20
5	Peyara	<i>Psidium guajava</i>	10	10
6	Kola	<i>Musa Spp.</i>	50	8
7	Narikel	<i>Cocos nucifera</i>	1	20
8	Kul	<i>Zizyphus mauritiana</i>	5	12
9	Lichu	<i>Litchi chinensis</i>	2	5
10	Bilimbo	<i>Averrhoa bilimbi</i>	1	10
11	Khejur	<i>Phoenix sylvestris</i>	1	15

12	Jalpai	<i>Oleaeuropaea</i>	3	20
14	RendiKoroi	<i>Samaneasaman</i>	1	50

Source: IEE study, CEGIS

- Kalurghat Substation, Mouza: Char Rangamatia, Ward: 5, Upazilla: Chandgaon, District: Chittagon.

179. The proposed location for establishment of a substation is habitats for some tiny birds, insects and aquatic biota. Installation of substation would damage ecosystem of the above mentioned project area. There is no terrestrial flora and fauna affected by project activity as defined by the World Conservation Union's Red List of Threatened Species or as defined in the national legislation. A list of plants is presented below.

Table 4.9: Information (Flora) in Kalurghat Substation, Kalurghat

Sl. No.	Flora	Scientific Name	Quantity	Height (ft)
1	Kola	<i>Musa Spp.</i>	40	6
2	RendiKoroi	<i>Samaneasaman</i>	3	25
3	Bansh	<i>Bambusatulda</i>	20	20
4	Kul	<i>Zizyphusmouritiana</i>	10	10
5	Narikel	<i>Cocosnucifera</i>	1	15
6	Mahogani	<i>Swieteniamahagoni</i>	5	12

Source: IEE study, CEGIS

4.8 Socio-Economic Condition

180. In order to assess the socio-economic situation of the region, sampled household level socio-economic survey has been carried out for households. At this stage, the exact location and boundaries of the subproject area is not yet set and the affected land and assets as well as their owners are not yet fully identified. The data from the sample survey has been processed and presented in the RP. Observations, transact walk and field visit were made in the month of May 2015 along the proposed substation sites and transmission lines, tower locations as well as villages. Routes visited on sample basis for 65 km existing line and 100% for new transmission line based on the current alignments of PGCB.

181. **Survey:** It can be seen from the following table that the number of male respondents was 79% while female respondents were 21% (Table4.10).

Table 4.10: Respondent of households surveyed

Sub projects ²	Number of respondent		
	Male	Female	Total
7 km new transmission line from Madunaghat to Kalurghat	7	0	7
Refurbishment of 65 km transmission line	5	2	7

²Other component of sub-project Comilla (S) SS, Madunaghat SS and Kalurghat SS sites, the land areas owned by PGCB

Kachua S/S, Hajiganj, Chandpur	11	4	15
<i>Total</i>	23	6	29
%	79%	21%	100%

Source: Socio Economic Survey May 2015

182. **Demographic Data:** According to survey data the total population in the sub projects area is 205 in number of which 48% are male and 52% are female. Female population is found highest for the Hajigong subproject accounted for 26.34% for females while it is 24.39% for males (Table4.11).

Table4.11: Demographic data of the surveyed households

Item	Male	Female	Total
7 km new transmission line from Madunaghat to Kalurghat	24 (11.70%)	23 (11.2%)	47 (23%)
Refurbishment of 65 km transmission line	24 (11.70%)	30 (14.63%)	54 (26.34%)
Kachua S/S, Hajiganj, Chandpur	50 (24.39%)	54 (26.34%)	104 (50.73%)
<i>Total</i>	98	107	205
%	48%	52%	100%

Source: Socio Economic Survey May 2015

183. **Age distribution of family members:** The average household size is found to be 7 persons per household which is higher than the national average of 4.5. The total population in the sub project area is 205 in person. Population 0-6 years constitutes nearly 14%, male and female represent 6.83% and 7% respectively. Population of this age group is found highest in Hajigong sub project area estimated at 8% followed by 4% for 65 km TL subproject area. Population aged 6 + & 15 years constitutes 18.5%, female population of this age group is higher accounted for 11.7% in the study area. Among the subproject areas population of this age group is found highest in Hajigong subproject accounted for 7.3%. Population above 15 years constitutes 67% of which male 34% and female 33% among the surveyed households. The highest population of this age group is found at Hajigonj estimated to be 35% (table4.12).

Table 4.12: Distribution of family members by Age and Sex

Item	7 km new transmission line			Refurbishment of 65 km transmission line			Kachua substation, Hajiganj			Grand Total		
	M	F	T	M	F	T	M	F	T	M	F	T
Up to 6 Years	2	1	3	4	4	8	8	10	18	14	15	29
%			1.2%			4%			8%	6.83%	7.3%	14%
6 + & 15 Years	5	6	11	5	7	12	4	11	15	14	24	38
%			5.4%			5.8%			7.3%	7%	11.7%	18.5%

Item	7 km new transmission line			Refurbishment of 65 km transmission line			Kachua substation, Hajiganj			Grand Total		
15 years and above	17	16	33	15	19	34	38	33	71	70	68	138
%			16%			16.5%			35%	34%	33%	67%
Total	24	23	47	24	30	54	50	54	104	98	107	205
%	51%	48%	100%	44%	56%	100%	48%	52%	100%	48%	52%	100%

Source: Socio Economic Survey May 2015

184. **Marital Status:** Married population aged above 15 years in the study area is found to be 130 persons, of them male population is accounted for 53% for male and female 47% which is found highest in Hajiganj subproject followed by 26% for 65 km refreshment of TL subproject. Percentage of unmarried population is accounted for 19.6%, of them male population estimated at 15% and females 6%. Of the total population widow constitutes 7% while abandoned is found to be 0.7% in the study area (Table4.13).

Table 4.13: Marital Status of Surveyed Household Members aged above 15 Years

Item	7 km new transmission line			Refurbishment of 65 km transmission line			Kachua substation, Hajiganj			Grand Total		
4.8.1	M	F	T	M	F	T	M	F	T	M	F	T
None	9	2	11	2	1	3	9	5	14	20 15%	8 6%	28 19.6%
Married	9	6	15	13	14	27	27	23	50	49 37.7%	43 (33%)	92 (71%)
Widow	0	1	1	0	4	4	0	4	4	0	9 (7%)	9 (7%)
Abandoned	0	1	1	0	0	0	0	0	0	0	1 (0.7%)	1 (0.7%)
Total	18	10	28	15	19	34	36	32	68	69	61	130
4.8.2	14 %	7.6 %	21.5 %	11.5 %	14.6 %	26%	27.7 %	24.6 %	52%	53%	47%	(100%)

Source: Socio Economic Survey May 2015

185. **Educational Status:** Among the households members 20% is found illiterate of which female constitute 12% and male 8% followed by 7% for 65 km line and 6.3% or 7 km new line. Approximately 41% population of the same age group read up to high school of which male and female constitutes 24% and 16% respectively. Details for the educational status of household members aged above 15 years are presented in table4.14 below.

Table 4.14: Educational Status of Surveyed Household Members aged above 15 Years

Item	7 km new transmission line			Refurbishment of 65 km transmission line			Kachua Substation, Hajiganj			Grand Total		
	M	F	T	M	F	T	M	F	T	M	F	T

Item	7 km new transmission line			Refurbishment of 65 km transmission line			Kachua Substation, Hajiganj			Grand Total		
	M	F	T	M	F	T	M	F	T	M	F	T
None	6	3	9 (6.3%)	3	7	10 (7%)	3	7	10 6.99%	12 (8.4%)	17 (12%)	29 (20%)
Primary	1	3	4 (2.7%)	0	2	2 (1%)	7	7	14 (9.6%)	8 (5.6%)	12 (8.4%)	20 (14%)
High School	10	4	14 (9.8%)	7	5	12 (8%)	18	14	32 (23.3%)	35 (24.5%)	23 (16%)	58 (41%)
SSC	2	3	5 (3.5%)	4	3	7 (4.9%)	6	8	14 (9.8%)	12 (8.4)	14 (9.8%)	26 (18%)
College	0	0	0 (0%)	2	2	4 (2.8%)	3	3	6 (4.2%)	5 (3.5%)	5 (3.5%)	10 (7%)
Total	19	13	32	16	19	35	37	39	76	72	71	143
%	13%	29%	22%	11%	13%	24.4%	26%	27%	53%	50%	50%	100

Source: Socio Economic Survey May 2015

186. **Occupation of household members:** According to survey data nearly 29% of the household members are housewives and all are female. Only two women, besides their household work are involved in home based cottage industry for their survival. The second highest population is old age retired accounted for 12%. Therefore it can be said that nearly 41% population are not involved in any economic activities in the study area. On the other hand 12% are involved in agriculture work either at their own land or as agriculture day labor which is found highest in the subproject of Hajiganj substation. Another 12% is found are students. Slightly higher than 5% are involved in hotel and tea stall which is dominant in 7km subproject in the urban area. Involvement with other occupations is insignificant. Table 4.15 is presenting the details.

Table 4.15: Distribution of Household Members by Occupation and Sex aged above 15 Years

Occupation	7 km new transmission line			Refurbishment of 65 km transmission line			Kachua substation, Hajiganj			Grand Total		
	M	F	T	M	F	T	M	F	T	M	F	T
Agriculture work/ Day labor	0	0	0	5	2	7	10	0	10	15	2	17
%			0%			4.9%			7%	11%	1.4%	12%
Open Snack/Tea stall	7	1	8	0	0	0	0	0	0	7	1	8
%			5.7%			0%			0%	2%	0.7%	5.7%
Tiny hotel	2	0	2	3	2	5	0	0	0	5	2	7
%			1.4%			3.5%			0%	3.5%	1.4%	5%
Construction	2	0	2	3	0	3	8	0	8	13	0	13
%			1.4%			2%			5.7%	9.2%	0%	2%
Painting	0	0	0	0	0	0	3	0	3	3	0	3
%			0%			0%			2%	2%	0%	2%
Driver	0	0	0	0	0	0	1	0	1	1	0	1

Occupation	7 km new transmission line			Refurbishment of 65 km transmission line			Kachua substation, Hajiganj			Grand Total		
	M	F	T	M	F	T	M	F	T	M	F	T
%			0%			0%			1.4%	0.7%	0%	0.7%
Welding	0	0	0	0	0	0	2	0	2	2	0	2
%			0%			0%			1.4%	1.4%	0%	1.4%
Garments	1	2	3	0	0	0	0	0	0	1	2	3
%			2%			0%			0%	0.7%	1.4%	2%
Computer shop	2	0	2	0	0	0	0	0	0	2	0	2
%			1.4%		0%	0%			0%	1.4%	0%	1.4%
Cane & bamboo, Kantha making	0	0	0	0	0	0	0	2	2	0	2	2
%			0%		0%			1.4%		0%	1.4%	1.4%
House wife	0	7	7	0	10	10	0	24	24	0	41	41
%			5%			7%			17%	0%	29%	29%
Poultry rearing	0	0	0	0	2	2	0	0	0	0	2	2
%			0%			1.4%				0%	1.4%	1.4%
House Maid	0	0	0	0	2	2	0	0	0	0	2	2
%			0%			1.4%			0%	0%	1.4%	1.4%
Service	1	0	1	1	0	1	4	0	4	6	0	6
%			0.7%			0.7%			2.8%	4.2%	0%	4.2%
Student	4	2	6	1	2	3	5	3	8	10	7	17
%			4.3%			2%			5.7%	7%	4.9%	12%
Old Aged Retd.	0	0	0	1	1	2	3	3	6	4	4	8
%			0%			1.4%			4.3%	2.3%	2.8%	5.6%
Unemployed	0	0	0	1	1	2	3	0	3	4	1	5
%			0%			1.4%			2%	2.8%	0.7%	3.5%
Business	0	0	0	2	0	2	0	0	0	2	0	2
%			0%			1.4%			0%	1.4%	0%	1.4%
<i>Total</i>	<i>19</i>	<i>12</i>	<i>31</i>	<i>17</i>	<i>22</i>	<i>39</i>	<i>39</i>	<i>32</i>	<i>71</i>	<i>75</i>	<i>66</i>	<i>141</i>

Source: Socio Economic Survey May 2015

187. **Children Activities age between 6+ and 15 Years:** As per survey data total number of children age between 6-15 years are found 30 in number. Among them 100% is school going. None of them are involved in any activities. Table 4.16 is presenting the details.

Table 4.16: Education-age between 6+ and 15 Years

Activity	7 km new transmission line		Refurbishment of 65 km transmission line		Kachua substation, Hajiganj		Grand Total		
	Male	Female	Male	Female	Male	Female	Male	Female	Total

Goes to School and also work	0	0	0	0	0	0	0	0	0
Goes to School Only	3	5	5	7	2	8	10	20	40 100%
Work Only	0	0	0	0	0	0	0	0	0
Neither work nor goes to school	0	0		0	0	0	0	0	0
Total	3	5	5	7	2	8	10	20	40
%	7.5%	12.5%	12.5%	17.5%	5%	20%	25%	50%	100%

Source: Socio Economic Survey May 2015

188. **Disabled Member in the Family:** Among all the household members 2.4% are found disabled. Percentage of disabled members is found in the subprojects of 7 km new transmission line and Hajigonj substation. Table 4.17 presents the details.

Table4.17: Number of Disabled Member in the Family of the surveyed households

7 km new transmission line			Refurbishment of 65 km transmission line			Kachua substation, Hajiganj			Grand Total
Male	Female	Total	Male	Female	Total	Male	Female	Total	
2	0	2	0	0	0	1	2	3	5
0.10%		0.10%	0%	0%	0%	0.5%	0.10%	1.5%	2.4%

Source: Socio Economic Survey May 2015

189. **Crops production:** According to survey data paddy is the dominant crop followed by Oil seed in study area. Crop production varies according location, fertility, as well as farm inputs. The estimated average production of paddy per decimal³ is about 1 -1.4 mound and the selling price is 550.00 taka per mound⁴. Per mound of oil seed is sold at 1500.00 taka. Table4.18 deals with the details of crop production.

Table4.18: Type of crops produced in last year (Crops in Mound) in the acquired land by the surveyed Households

Monsoon season	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua substation, Hajiganj	Total
Paddy	0	4	80.87	84.87
Jute	0	0	0	0
Others	0	0	0	0
Winter				
Potato	0	0		0
Oil Seed	0	0	36.18	36.18
Lentil	0	0	15	15
Grams	0	0	0	0
Vegetables	0	0	0	0
Others	0	0	0	0

Source: Socio Economic Survey May 2015

³ 100 decimal=1 acre

⁴ 1 mound =37.3Kgs

190. **Type of Housing Structure:** In the study area none of the APs live in shanty house. More than half of APs (51.7%) are living in katcha house, 31% in semi pucca house and remaining 14% do not have house. Of the four respondent as no house, one of them live in rented house at Hajigonj pourashava and three others are living with parent. These three APs purchased land for construction of house on the land which is going to be acquired for substation (table 4.19).

Table 4.19: Type of Housing

Type of House	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua Substation, Hajiganj	Total	% of Total
Jhupri	0	0	0	0	0%
Katcha	3	4	8	15	51.7%
Semi-pucca	4	3	2	9	31%
Concrete	0	0	1	1	3.44%
No house	0	0	4	4	14%
Total	7	7	15	29	100%

Source: Socio Economic Survey May 2015

191. **Source of drinking water:** In the study area approximately 96.5% general households get the facility of drinking water from tube-well, 3.5% from piped supply those who are living at upazila level (table4.20).

Table 4.20: Source of drinking water

Source of Drinking Water	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua Substation, Hajiganj	Total
Piped supply	0	0	1	1 (3.5%)
Tube well	7	7	14	28 (96.5%)
Pond	0	0	0	0
River	0	0	0	0
Irrigation canal	0	0	0	0
Total	7	7	15	29 (100%)

Source: Socio Economic Survey May 2015

192. **Sanitation:** Approximately 62% of the household use latrine made with ring slab. Nearly 34.48% has sanitary latrine belong to better off family and 3.4% use pit latrine (table4.21).

Table 4.21: Quality of sanitation

Sanitation facility	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua substation, Hajiganj	Total	% of Total
Sanitary	2	4	4	10	34.48%
Ring slab	5	3	10	18	62%
Pit latrine	0	0	1	1	3.45%
Total	7	7	15	29	100%

Source: Socio Economic Survey May 2015

193. **Access to Electricity:** In all subproject area 89% have electricity, 7% use kerosene and 3.4% use solar power for lighting (table 4.22).

Table 4.22: Access to Electricity

Source of Lighting	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua substation, Hajiganj	Total	% of Total
Electricity	6	6	14	26	89%
Kerosene	0	1	1	2	7%
Candle	0	0		0	0%
Solar Power	1	0	0	1	3.4%
<i>Total</i>	<i>7</i>	<i>0</i>	<i>15</i>	<i>29</i>	<i>100%</i>

Source: Socio Economic Survey May 2015

194. **Use of Energy:** Approximately 89.65% of the household in the survey area use wood for cooking. Many of them use dung and straw as well. Only 10% in the pourashava area use gas (table 4.23).

Table 4.23: Use of Energy

Source of Cooking	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua substation, Hajiganj	Total	% of Total
Gas	0	1	2	3	10%
Electricity	0	0	0	0	0%
Kerosene	0	0	0	0	0%
Wood	7	6	13	26	89.65%
Dung	7	6	13		
Straw	7	6	13		
<i>Total</i>				<i>29</i>	<i>100%</i>

Source: Socio Economic Survey May 2015

195. **Monthly Income:** The gross monthly income for 29 households are found to be taka8,88,201 derives from the source of small business run by APs at Kalurghat urban area followed by remittance accounted for taka 208,000 which is dominant among the APs at Hajigong substation. The third largest source of income is wages which is again highest among the APs at Hajigonj substation followed by farming estimated at taka 42,000. It is revealed from survey data that the people of Hajigonj are more agriculture oriented. Some of their household members are involved in construction and painting works in abroad (table4.24).

Table4.24: Source and Estimated monthly Gross Income per month in BD Taka

Source of income	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua Substation, Hajiganj	Total
Farming	0	1,333	40,768	42,101
Service	5,000	20,000	0	25,000
Wage	18,000	17,000	41,400	76,400
Remittance	0	27,000	1,81,000	208,000
Sales of Animals	9,000	6,800	8,900	24,700

Rental of Properties	0	0	0	0
Forest Product sale	0	2,000	0	2,000
Fishing	0	8000	0	8000
Small business	3,62000	0	5,000	367,000
Large Dealership		1,00,000	0	100,000
Help from Others	0	14,000	4,000	18,000
Pension		3000	0	3000
Rent from structure	0	0	8000	8,000
Home based cottage industry	0	3000	3000	6,000
Total	3,94,000	2,02,133	2,92,068	8,88,201

Source: Socio Economic Survey May 2015

196. **Estimated monthly expenditure:** Total monthly expenditure of the surveyed household is accounted for taka 784,170. Major expenses spent on food item that cost taka 323,000 per month followed by taka 177,000 on hotel and tea stall investment in urban area at Kalurghat. Monthly investment on education is estimated at taka 73,100.00 and for medical expense is taka 63,000.00. Details of the monthly expenditure of the surveyed households are presented in table 4.25.

Table4.25: Estimated monthly Expenditure in BD Taka

Expenditure Source	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua substation, Hajiganj	Total
Food	79,000	89,000	155,000	323,000
Education	15,900	16,200	41,000	73,100
Medical	13,000	13,500	37,000	63,500
Housing	32,200	8,000	3,000	43,200
Clothing, shoes and other personal effect	10,000	17,700	27,500	55,200
Hotel and tea stall investment	177,000	0	0	177,000
Bank loan	0	49,170	0	49,170
Total	327,100	193,570	263,500	784,170

Source: Socio Economic Survey May 2015

197. **Awareness about HIV AIDS:** Among all the APs in study area approximately 65.5% of respondent said they know about HIV AIDS and their family members as well while 34.5% do not aware of it (table4.26).

Table 4.26: Awareness about HIV/ AIDS

	7 km new transmission line		Refurbishment of 65 km transmission line		Kachua substation, Hajiganj		Total		% of Total	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Awareness of HHH	4	3	4	3	11	4	19	10	65.5%	34.5%
Awareness of other family members	4	3	4	3	11	4	19	10	65.5%	34.5%

Source: Socio Economic Survey May 2015

198. **Opinion regarding development:** For this question each respondent answered more than one. Among all the answers unemployment is found the top most priority problem in the survey area accounted for 31% followed by electricity accounted for 24%. The electricity problem relates to load shedding. The third problem is about the lack of educational facilities mostly mentioned at Hajigonj. It was mentioned by the APs at Hajigonj that there are no school within 1.5 km at Hajigonj pourashava area. Table 4.27 represents the details of the local problems in the study area.

Table 4.27: Problems of local development-Opinion

⁵ Type of Problems	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua substation, Hajiganj	Total and %
Lack of Electricity	2 (3.63%)	0 (0%)	11 (22%)	13 (24%)
Unemployment and poverty	5 (9%)	7 (12.7%)	5 (9%)	17 (31%)
Poverty	0 (0%)	3 (5.5%)	0 (0%)	3 (5%)
Natural calamity	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Lack of educational facilities and other social services	0 (0%)	2 (3.63%)	9 (16.34%)	11 (20%)
Roads and other infrastructure	0 (0%)	0 (0%)	1 (1.8%)	1 (1.8%)
Lack of sanitation	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Lack of Gas	0 (0%)	0 (0%)	4 (7.27%)	4 (7.2%)
Lack of water supply	0 (0%)	0 (0%)	4 (7.27%)	4 (7.2%)
Physical ailment	0 (0%)	0 (0%)	2 (3.63%)	2 (3.6%)
<i>Total</i>	<i>7</i>	<i>12</i>	<i>36</i>	<i>55 (100%)</i>

Source: Socio Economic Survey May 2015

199. **Awareness of Power System Efficiency Improvement Project:** About 72% of the respondents said that they are not aware of Power System Efficiency Improvement Project, 17% said they are little aware and 10% is medium aware (table 4.28).

Table 4.28: Awareness of Power System Efficiency Improvement Project

Type of Problems	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua substation, Hajiganj	Total and %
Highly aware	0	0	0	0 (0%)
Medium Aware	1	2	0	3 (10%)
Little aware	2	0	3	5 (17%)
Not Aware	4	5	12	21 (72%)
<i>Total</i>	<i>7</i>	<i>7</i>	<i>15</i>	<i>29 (100%)</i>

Source: Socio Economic Survey May 2015

⁵One respondent answered more than one according to their priority

200. **Development due to Power System Efficiency Improvement Project:** Each respondent answered more than one against the question. Among all the answers 30% answer was in favor of better income followed by 20% for local industrial development while the 22.5% answers were having no idea. Table 4.29 is presenting the details on the anticipated development due to Power System Efficiency Improvement Project.

Table 4.29: Development due to Power System Efficiency Improvement Project

⁶ Type of Development	7 km new transmission line	Refurbishment of 65 km transmission line	Kachua substation, Hajiganj	Total and %
Agriculture development	0	0	0	0 (0%)
Local industrial development	5	1	2	8 (20%)
Access to higher education	2	1	2	5 (12.5%)
Better income	5	2	5	12 (30%)
Better health	0	1	0	1 (2.5%)
Create scope for employment	0	0	3	3 (7.5%)
No development	0	2	7	9 (22.5%)
Do not know	0	2	0	2 (5%)
<i>Total</i>	<i>12</i>	<i>9</i>	<i>19</i>	<i>40 (100%)</i>

Source: Socio Economic Survey May 2015

⁶One respondent answered more than one according to their priority

5. Prediction of Impacts

5.1. Introduction

201. It is predicted that some environmental and social components may be impacted by project interventions. The environmental and social components likely to be impacted by project interventions are termed as an Important Environmental and Social Components (IESCs). IESCs, to be impacted by the construction of the electricity transmission lines have been selected based on the rationale presented against each IESC in the following section.

5.2. Selection of IESCs and its Rationale

5.2.1. Water and Physical Environment

202. Important Environmental Components (IECs) for water and physical resource and the rationale are described in table 5.1 below.

Table 5.1: Important IESC on water and physical environment and its rationale

IECs	Rationale for selection
Drainage congestion	Due to construction work in sub-station sites, some drainage congestion may occur during construction and post construction phase. Existing 65km transmission line, where only stringing work undertaken and there is no drainage congestion. For 7km underground cable laying also there will be no drainage congestions.
Ambient air quality	The construction of substations and stringing of overhead transmission line will generate minor amounts of air pollution from fuel combustion (light fuel oil) used for supplying lorries and equipment. These may impact air ambient quality.
Noise	Noise level will increase at the project site during construction phase.
Construction waste at sub-station sites and underground cable	Construction wastes in the sub-station and underground cable site may create hazard to the surroundings. Therefore, this was considered as IEC.

5.2.2. Soil and Agriculture

203. IECs for the soil and agriculture resource and the rationales for their selection are presented in table 5.2.

Table 5.2: Important IEC on Soil, agriculture and its rationale

IECs	Rationale for selection
Land use	The present land use practice will be changed in the substation areas. For this reason, land use has been considered as one of the IEC.
Crop production	During construction period, crops grown in the areas will be affected. Under this condition, crop production has been considered as an IEC.
Intercultural operation	In the tower site intercultural operation will be hampered. For this reason it has been considered as an IEC

Soil and Water Contamination	Different types of effluents, solid waste and hazardous material may contaminate the water and soil resources of the Area. For this reason it has been considered as an IEC
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5.2.3. Biological Environment

204. IECs for the biological environment and its rationales have been described in the table 5.3.

Table 5.3: IEC on Biological environment and its rationale

SI No.	Important Environmental Component	Rationale for selection
1	Terrestrial vegetation	Construction of proposed substations along with transmission lines leads vegetation damage by cutting and/pruning especially in the ROW. All trees and marginal plants under wires need to be dwarf. In addition, any tall trees are prohibited under the transmission wires. Therefore, impacts have been anticipated in any intact environment either positive and/negative. Hence, terrestrial vegetation has been identified as an IEC.
2	Wildlife species	The wildlife species are considered to be impacts due to construction of new substations and stringing transmission line through ROW. Therefore, impacts can be positive and/negative. So, wildlife species has been considered as an IEC.

5.2.4. Socio- Economic Environment

205. IESCs for the socio-economic environment and its rationales have been described in the table 5.4.

Table 5.4: Important IESC on socio-economic environment and its rationale

IESCs	Rationale for selection
Land compensation	Land acquisition is needed for one sub-station from private owners. So, land compensation is an important issue for the study.
Involuntary migration of household	Normally, people in the area reside without any encroachment in their households. Intervention through power line stringing causes: (i) immediate effect on their staying in existing households to allow for stringing of wire requiring resettlement and (ii) medium (five years span) long run (beyond 5 years) effect on their health due to ultimate threats of radiation and other pollutions. These have implications for involuntary migration of households.
Land price	Land price increases normally as a result of increasing demand and scarcity effect. As a result of power line encroachment through present land under cultivation, future productivity of land is most likely to decline. This could revert the trend of decrease of price of land.
Employment	Unemployment of unskilled labor is a problem in the area.

IESCs	Rationale for selection
opportunities during construction (technical and non- technical)	Temporary employment of unskilled and skilled labor may be a component for impact analysis due to transmission line construction activities.
Agricultural income per capita	Decrease of productivity of land under cultivation due to power line construction is directly correlated with its return to the farmers.
Regional as well as national economic development	The present trend of extension of urban installations into the rural area is related locally to the proposed power line which inhibits population immigration due to anticipated health hazards and threats of accidents.
Training for livelihood restoration	Training will be helpful for restoration of their livelihood for the displaced people.
Human safety	Movement of people in the potential DIAs is free now. Physical and biological implications of high power transmission lines in future will have correlation with human safety.
Interference with road crossing	There may be interference in crossing points of rural roads and regional highways during stringing the transmission lines.
SF ₆ gas	SF ₆ is odorless, colorless, tasteless, and nontoxic in its pure state. It can, however, exclude oxygen and cause suffocation. If the normal oxygen content of air is reduced from 21 percent to less than 13 percent, suffocation can occur without warning.
Potential exposure to electric and magnetic fields	May be linked to a variety of health problems including leukemia, lymphoma, brain and nervous system cancers, melanoma, breast cancer, miscarriage, birth defects, Alzheimer's disease, Lou Gehrig's disease, depression and suicide

5.3. Potential Environmental Impacts (Pre, during & post-construction)

5.3.1. Drainage congestion

206. The sub-stations sites are may be drainage path of this area. So, the civil work may cause significant drainage congestion for the area during construction and post construction phase.

5.3.2. Ambient Air Quality

207. Air quality may deteriorate slightly due to transport of materials to the tower. Further deterioration may occur due to soil digging, concrete works at substation and underground cabling sites.

5.3.3. Construction Waste at underground cabling and Substation Sites

208. During construction period it may create disturbance to the surrounding urban and rural communities.

5.3.4. Noise Level

209. Noise level may increase due to construction of transmission lines and substations.

5.3.5. Total Crop Production

210. In the RoW, and sub-station sites it is predicted that crops will be lost during implementation period.

5.3.6. Intercultural Operation or Cropping pattern

211. At present the intercultural operation or cropping pattern is traditional. During implementation period and under post-project condition, it will be partially impacted.

5.3.7. Soil Erosion

212. Presently no soil erosion was observed in the tower site as well as sub-station site. But during construction period, top soil may be eroded at sub-station site and underground cable laying site.

5.3.8. Soil and Water Contamination

213. Different types of effluents, solid waste and hazardous material may contaminate the water and soil resources of the area. Untreated wastewater and other effluents from the construction activities may contaminate the water resources of the area. Hazardous materials and non-hazardous waste if disposed off into the surrounding may contaminate the soil and water resources of the area.

214. If the run off contains visible quantities of oil and grease and contains silt above the DoE's Environmental Quality Standard (EQS) levels or if it flows towards the community. Any EQS and IFC non-compliant effluent is released to the environment. If any person is exposed to hazardous waste generated from project related activities and disposal of waste outside designated areas. Following precaution will be maintained during construction:

- Use of spill prevention trays and impermeable sheets to avoid soil contamination,
- Storage of fuels, chemicals and lubricants in bounded areas with impervious flooring and secondary containment of 110% capacity,
- Emergency Response plan will be developed for hazardous substances, Equipment and material containing asbestos, poly-chlorinated biphenyls (PCBs), and ozone depleting substances(ODSs) will not be used Material Safety Data Sheet (MSDS) will be maintained.

5.3.9. Traffic Hazard

215. The proposed construction activity can potentially be a safety hazard for the community. In particular, the increase in construction related traffic on the proposed project access road. A significant community hazard will also be considered, if a condition is created during the construction activity that would be considered a safety hazard in a standard occupational and safety health assessment. The following precaution should be undertaken during construction period:

- A public safety plan will be developed,
- A speed limit of 10 km/h will be maintained on the proposed access road,
- Night time driving of project vehicles will be limited where possible,

- Community complaint register and other means will be adopted for the community to complain about non-adherence of project traffic to speed limits, safe driving and other safety-related concerns,
- Work areas outside the proposed project site, especially where machinery is involved will be roped off and will be constantly monitored to ensure that local people, especially children stay away.

5.3.10. Cultural Resources

World Bank Policy (Cultural Property OP 4.11)

216. Physical cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above ground, underground, or underwater. The Bank seeks to assist countries to manage their physical cultural resources and to avoid or mitigate adverse impact of development projects on these resources. This policy is triggered for any project that requires an EA.

Project Activity

217. No known remarkable archeological or historically important structure or sites are reported in the project area. During earthwork excavation in the substation sites and 132kV cable laying site, if any antique found during excavation then immediately stop the work. Inform respective supervisor, the supervisor will then inform the project authority. The project authority will communicate with Archeological Department if necessary, after the investigation of Archeological Department the cable laying may be re-routed and the substation plan layout may be need to rearranging.

5.3.11. Quality of Land

218. Construction waste (i.e. cement, brick, metal things etc.) may create disturbance in the surrounding land, and settlements. The impact on agriculture land may continue for long time.

5.3.12. Terrestrial and Aquatic Flora

219. The vegetation required to be cut during construction especially on ROW and tower sites here Aam (*Mangifera indica*), Kanthal (*Artocarpus heterophyllus*), Kola (*Musa* Sp.), Mehogany (*Swietenia mahagoni*), RendiKoroi (*Samanea saman*) and Narikel (*Cocos nucifera*) exist. Most of the proposed substations are in or near to the homestead locations having different types of fruiting trees. There is no terrestrial flora and fauna affected by project activity as defined by the World Conservation Union's Red List of Threatened Species or as defined in the national legislation. The negative impacts especially habitat destruction in the construction sites are removal of vegetation (detail in table 5.5).

Table 5.5: Impacts on the trees

Local Name	Scientific Name	Socio-economic value	Ecological value
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Aam	<i>Mengifera indica</i>	Fruit, Timber, Firewood	Nesting, feeding and Sheltering element of bird and mammals
Pepey	<i>Carica papaya</i>	Fruit	Feeding resources for terrestrial wildlife
Lichu	<i>Litchi chinensis</i>	Fruit	Feeding and nesting for small wildlife
Kul	<i>Zizyphus mauritiana</i>	Fruit, firewood	Nesting, feeding for flying wildlife
Narikel	<i>Cocos nucifera</i>	Fruit, Timber, Fiber	Nesting, feeding and Sheltering element of bird, Snake and mammals
Khejur	<i>Phoenix sylvestris</i>	Fruit, Timber and Fiber	Nesting, feeding and sheltering elements for terrestrial wildlife
Kanthal	<i>Artocarpus heterophyllus</i>	Fruit, Timber	Nesting, feeding and Sheltering element of bird, Snake and mammals,
Kola	<i>Musa Sp.</i>	Fruit	Feeding element of bird and flying mammals
RendiKoroi	<i>Samanea saman</i>	Timber, Firewood	Nesting and Sheltering element of birds
Mahogany	<i>Swietenia mahagoni</i>	Timber, Firewood	Nesting and Sheltering element of bird.

Source: Survey Team CEGIS

5.3.13. Wildlife Population

220. The wildlife species belongs to different habitats from undergrowth to upper canopies in the proposed power substations along with transmission lines. Majority of wildlife species predicted to be impacts negatively are birds and bats. The others are amphibians and reptiles. Through removing of different trees along with other vegetation will trigger to demolish habitats of wildlife species. As a consequence, Bengal Monitor, Checkered keel back, Common Garden Lizard, Cantor's Kukri Snake, Monocellate Cobra, Indian Black Turtle, Spotted Flap Shell Turtle, Rose-ringed Parakeet (*Psittacula krameri*), Oriental Magpie Robin (*Copsychus saularis*), Spotted Dove (*Streptopelia chinensis*), Red-vented Bulbul (*Pycnonotus cafer*), Rufous Treepie (*Dendrocitta vagabunda*), Common Myna (*Acridotheres tristis*), Asian Koel (*Eudynamis scolopacea*), Common Hawk Cuckoo (*Hierococcyx varius*), Black-hooded Oriole (*Oriolus xanthornus*) and White-throated Kingfisher (*Halcyon smyrnensis*) would be affected when the construction and other activity will run.

221. **Impact on aerial wildlife:** The evidence of bat colony was found in the proposed project area. It is a flying mammal of Bangladesh. Some flying mammals would be impacted due to the transmission line. Greater short nosed fruit bat, Greater False vampire, Indian pipistrelle also would be impacted after completion of the transmission line. Flying mammals may be affected by electric wire. It would also create disturbance to free movement of the bat and some other birds.

5.3.14. Involuntary Migration

222. Private land of the proposed sub-station site will be acquired due to sub-station and the owner will be properly compensated from the project.

223. According to the electricity rule 1910, power division, Bangladesh does not give any compensation money for the land of tower site. But crop compensation will be given to the owner for the tower site land. During construction period for the stringing of conductor, the owner of RoW's and tower sites will be also paid compensation for standing crops and trees.

224. There is no households under RoW will be dismantled due to grid line during change of conductor and for construction work of underground cable the RoW will be selected along the road for avoiding households.

5.3.15. Land Price

225. The sale value of different type of land will be declined under pre, during and post project situation. The sale value of different type of land will be reduced drastically during project implementation.

5.3.16. Employment Opportunities (Technical and Non-Technical)

226. Construction of the grid line as well as sub-station requires both skilled and non-skilled laborers and thus will create employment opportunities for poor people in the vicinity of the proposed area and outside proposed area. A lot of civil works will also be done in this area, which will create employment opportunities. Besides, some other livelihood opportunities like trade and small business will be created in the project site in addition to those opportunities. Transportation, loading and unloading of goods/materials will also create employment opportunities for the poor people.

227. Continuous power supply will create employment opportunities in different sectors, i.e. in agricultural sectors, industries sectors, garments sector, business sectors and other sectors. So, this project will create nationwide employment opportunities.

5.3.17. National Economic Development

228. In Bangladesh, at present the power is estimated as deficit. So, regional as well as national development works would be hampered severely. All type of development sectors i.e. irrigation sector in agriculture development, industries sector, garments sectors will be ensured continuous power supply. As such our regional as well as national development will be continued, which will reduce poverty and thus, Bangladesh will be a middle stage income earning country in the world in near future.

5.3.18. Training for Livelihood Restoration

229. The project would be responsible for institutional arrangements for implementation of the infrastructures as well as arrangement of training for rehabilitation of the displaced people. Some local or national NGOs may help in this context. The NGO should have training programme for the displaced people for their livelihood restoration. This type of training works may help displaced people directly to remove their poverty.

5.3.19. Human Safety

230. During implementation of the project, the safety of human is most important thing. Different type of construction materials as well as different type of heavy vehicle may become a cause for the human safety. Proper contingency measures will be needed for the human safety.

5.3.20. Interference with Road Crossing

231. The road crossing sites will be temporary impacted while stringing wires through the towers.

5.3.21. Fugitive emissions from SF₆ handling equipment

232. SF₆ is used as an insulator and electric arc arrestor in electrical equipment such as lightning arrester, high voltage circuit breakers, transformers, and switches/switchgears. Aside from being a potent greenhouse gas (i.e., global warming potential is 23,900 times compared to CO₂), SF₆ is an inorganic, non-toxic gas that may be an occupational safety concern due to possible asphyxiation (i.e., death due to lack of oxygen) if it is not used in a well-ventilated areas. There is potential for SF₆ to leak during the operation phase and its decomposition byproducts may pose a risk to occupational exposure of workers. Given its global warming potential, release or leakage of SF₆ into the atmosphere should be minimized and monitored.

233. Sources of gas leak may potentially come from losses due to poor gas handling practices and equipment installation and maintenance, and leakage from SF₆-handling equipment. Leak sources will be identified in a timely manner using handheld leak detector and monitoring of SF₆ level will be monitored regularly. To determine the baseline concentration, data on existing SF₆ containing equipment being used will be collected in an annual inventory. Monitoring of SF₆ level will improve the preventative maintenance procedures in PGCB facilities and will enhance awareness of staff to potential sources of GHG emissions.

234. As part of the operating procedures, the operators of the 3 GIS substations will provide information annually on the number of purchased and consumed SF₆-containing cylinders. The inventory will be continuously updated upon purchase and retirement of these cylinders and equipment in order to track the movement of SF₆ in and out of the GIS substations. As part of the inventory, the following will be reported:

- Start of the year – the number of fully-charged cylinders (not equipment) and the amount of SF₆ contained in each cylinder; and
- End of the year – the number of fully-charged cylinders (not equipment) and the amount of SF₆ contained in each cylinder.
- Monthly purchases and acquisitions of SF₆ – includes purchases of cylinders and equipment with SF₆ within the equipment, and SF₆ returned for off-site recycling (i.e., the supplier receipts and QA/QC certificates will be the basis of the amount of SF₆ (in kg) entering the substation)
- Sale and disbursements of SF₆ – includes those sold and disposed cylinders and equipment (if any) with residual SF₆ contained within the equipment, and SF₆ sent for off-site recycling
- Change in equipment nameplate capacity – the nameplate capacities of retired and new equipment will recorded.

5.3.22. Earthing Zone from the center line of RoW

235. Existing 132kV transmission line from Comilla to Chandpur, there is an earthing/OPGW at the top of the tower, which act as lightning arrester and protect the conductor and insulator, damaging from the electricity caused by thunder. The earthing conductor/OPGW are selected based upon a Isokeraunic level of eighty (80) i.e., eighty thunder day per year. The height of earth conductor is about 30meter from the ground. The half of the tower height in each side of tower is termed as earthing zone if the earthing wire is on the top of the tower i.e., if earth wire is at 30 meter above the ground level then earthing zone is 15 meter from the centerline of the RoW each side. Within this zone if any structure build below the earth-wire/OPGW then that structure will be safe against thunder lightning. The house/structure no need extra lightning arrester. The clear distance of canopy of the house/structure and the conductor must be greater than 4.6meter vertically and that of clear distance must be greater than 2.9 meter horizontally. There is no house/structure identified that require lightning arresters need to be provide by PGCB.

5.3.23. Potential exposure Electric and Magnetic Fields (EMF)

236. Electric and magnetic fields (EMF) are invisible lines of force emitted by and surrounding any electrical device (e.g. power lines and electrical equipment). Electric fields are produced by voltage and increase in strength as the voltage increases. Electric field strength is measured in volts per meter (V/m). Magnetic fields result from the flow of electric current and increase in strength as the current increases. Magnetic fields are measured in units of gauss (G) or tesla (T), where 1T equals 10,000G. Electric fields are shielded by materials that conduct electricity, and other materials, such as trees and building materials. Magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields decrease rapidly with distance. Power frequency EMF typically has a frequency in the range of 50 – 60 Hertz (Hz), and is considered Extremely Low Frequency (ELF).

237. There is continuing concerns about potential risks of cancer from exposure to electric and magnetic field from overhead transmission lines and substations. Electric utility workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines. For electric power transmission and distribution activities include the minimum safe working distances for trained employees listed in Table 5.5 and the ICNIRP exposure limits for occupational exposure to electric and magnetic fields listed in Table 5.6.

Table 5.5. Alternating Current - Minimum Working Distances for Trained Employees^a

Voltage Range (phase to phase – Kilovolts)	Minimum Working and Clear Hot Stick Distance (meters)
2.1 to 15	0.6
15.1 to 35	0.71
35.1 to 46	0.76
46.1 to 72.5	0.91
72.6 to 121	1.01
138 to 145	1.06
161 to 169	1.11
230 to 242	1.5

345 to 362	2.13 ^b
500 to 552	3.35 ^b
700 to 765	4.5 ^b
a OSHA b NOTE: From 345-362 kv., 500-552 kv., and 700-765 kv., the minimum working distance and the minimum clear hot stick distance may be reduced provided that such distances are not less than the shortest distance between the energized part and a grounded surface	

Source: IFC Guidelines

Table 5.6. ICNIRP exposure limits for general public exposure to electric and magnetic fields

Frequency	Electric Field (V/m)	Magnetic Field (μT)
50 Hz	5000	100
60 Hz	4150	83
Source: ICNIRP (1998) : "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).		

Source: IFC Guidelines

238. The electric and magnetic fields of the projects of PGCB will not be expected to exceed the limits set by the International Commission on Non-Ionizing Radiation Protection (ICNRP) which is 4.15 kV/m for electric field and 83 mG for magnetic field. Thus, the substations, power transmission and distribution lines will not pose health risks to the public. Substations will be fenced and security staff will be assigned to prevent public access.

5.3.24. Work on Live Power Lines

239. PGCB intent to replace old conductor of 132kV Comilla-Chandpur transmission line by kept one circuit live for continuous power transmission. At that period workers will exposed to occupational hazards from contact with live power lines during stringing activities. Prevention and control measures associated with live power lines include:

- Only allowing trained and certified workers for stringing;
- Deactivating and properly grounding live power transmission line in close proximity, to the lines;
- Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards. Qualified or trained employees working on transmission should be able to achieve the following:
 - Distinguish live parts from other parts of the electrical system
 - Determine the voltage of live parts
 - Understand the minimum approach distances outlined for specific live line voltages
 - Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system
- Workers should not approach an exposed energized or conductive part even if properly trained unless:
 - The worker is properly insulated from the energized part with gloves or other approved insulation; or,
 - The energized part is properly insulated from the worker and any other conductive object; or,

- The worker is properly isolated and insulated from any other conductive object (live-line work).
- Where maintenance and operation is required within minimum setback distances, specific training, safety measures, personal safety devices, and other precautions should be defined in a health and safety plan. (as specified in ICNIRP) ;
- Workers not directly associated with power transmission activities who are operating around power lines should adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities;
- Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface.

5.3.25. Working at height on Towers and structures

240. Working at elevation during construction, maintenance, and operation activities, need prevention and control measures for working at height include:

- Testing structures for integrity prior to undertaking work;
- Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;
- Establishment of criteria for use of 100 percent fall protection. The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point;
- Installation of fixtures on tower components to facilitate the use of fall protection systems;
- Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached;
- Hoisting equipment should be properly rated and maintained and hoist operators properly trained;
- Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident;
- When operating power tools at height, workers should use a second (backup) safety strap;
- Signs and other obstructions should be removed from structures prior to undertaking work;
- An approved tool bag should be used for raising or lowering tools or materials to workers on structures.

5.3.26. Occupational Exposure to Electric and Magnetic Fields

241. Electric utility workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines. Occupational EMF exposure should be prevented or minimized through the preparation and implementation of an EMF safety program including the following components:

- Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities;

- Training of workers in the identification of occupational EMF levels and hazards;
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
- Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by ICNIRP, and IEEE. Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.

5.3.27. Exposure to chemicals

242. Occupational exposures to chemicals in this sector primarily include handling of pesticides (herbicides) used for right-of-way maintenance, and exposure to PCB in transformers and other electrical components. In PGCBs 132kV transmission line. There is no use of pesticides, old substations may use PCB.

- **Polychlorinated biphenyl (PCB)**

243. Polychlorinated biphenyl (PCB) is a synthetic chemical that is widely used for industrial and commercial use as dielectric fluid in transformers and capacitors because of its high resistance to decomposition, low electrical conductivity, low flammability and high heat capacity. PCBs are toxic, bio accumulative and persistent, thus, posing risks to health and the environment. PCBs are linked to chronic effects, gastric disorders, and skin lesions in laboratory animals and are suspected human carcinogen. Direct exposure to PCBs such as inhalation and skin contact could lead to serious headaches, drowsiness and skin irritation. The most common signs of exposure to PCBs are chlor-acne and elevation of liver enzymes increasing concern over health risks posed by PCBs. PCBs are classified as POPs and banned of the manufacture, processing, and distribution in commerce. The retro-filling of transformer involves draining of oil, rewinding of the transformer coil and refilling of dielectric fluid. The dielectric fluid may either be the same oil, which was from the transformer but filtered or it may be substitute dielectric oil, such as silicones, synthetic hydrocarbons, and ester-based materials.

244. With the wider recognition of the perceived risks and hazards associated with PCBs, the use of PCB- contaminated equipment is diminishing but PCB wastes will continue to be generated for many years from the gradual phase-out of existing PCB-contaminated and retro-filled equipment.

- **Personal Protective Equipment (PPE)**

245. Workers should eliminate risk of exposure to PCBs by utilizing the following personal protective equipment or proven equivalent measures.

- Coveralls (Tyvek jumpsuit) with hood
- Protective boot covers
- Full-face respirator
- Protective gloves

- Heavy duty gauntlets or ductile taping of pant's ankles to boot covers, and wrists to gloves
- Hard hat for overhead dangers and head protection
- Goggles for eye protection

- **Safety Procedures**

246. Preference should be given to the use of disposable protective clothing due to difficulty in decontamination. Contaminated protective clothing should be promptly removed and the area of skin contaminated with PCBs should be washed with or rinsed immediately. Hands must be washed after handling PCBs (even if wearing full protection) before eating, drinking, smoking or using toilet facilities initially with waterless hand cleaners and paper towels, which shall then be disposed off.

5.3.28. Community Health and Safety

247. Community health and safety impacts during the construction and decommissioning of transmission and distribution power lines are common and in addition to occupational health and safety standards code of practices, the operation of live power distribution lines and substations may generate the following industry-specific impacts:

- Electrocution
- Electromagnetic interference
- Noise and Ozone

5.3.29. Electrocution

248. Hazards most directly related to power transmission and distribution lines and facilities occur as a result of electrocution from direct contact with high-voltage electricity or from contact with tools, vehicles, ladders, or other devices that are in contact with high-voltage electricity. Recommended techniques to prevent these hazards include:

- Use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment;
- Grounding conducting objects (e.g. fences or other metallic structures) installed near power lines, to prevent shock.

5.3.30. Electromagnetic Interference

249. The corona of overhead transmission line conductors and high frequency currents of overhead transmission lines may result in the creation of radio noise. Typically, transmission line rights-of way and conductor bundles are created to ensure radio reception at the outside limits remains normal. To mitigate the visual impact of power transmission projects, the following mitigation measures should be implemented:

- Extensive public consultation during the planning of power line and power line right-of-way locations;
- Accurate assessment of changes in property values due to power line proximity;

- Sitting power lines, and designing substations, with due consideration to landscape views and important environmental and community features;
- Location of high-voltage transmission lines in less populated areas, where possible;
- Burying transmission or distribution lines when power must be transported through dense residential or commercial areas.

5.3.31. Noise and Ozone

250. Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Ozone may also be produced. Neither the noise nor ozone produced by power distribution lines or transformers carries any known health risks. Corona generally generates audible and radio-frequency noise, particularly near electric power transmission lines. In built-up areas this can cause annoyance. Corona also represents a power loss, and their action on atmospheric particles along with associated ozone and NO_x production is disadvantageous. Therefore, power transmission equipment is designed to minimize the formation of corona discharge.

- Corona is enhanced by irregularities on the conductor surface
- Irregularities include: dust, insects, burrs and scratches and water drops present on new conductors.
- Corona will generally be greater on new conductors and will decrease to a steady-state value over a period of approximately one year in-service.
- Corona is significantly increased in foul weather.

251. Measures to mitigate this impact may be addressed during project planning stages to locate rights-of-way away from human receptors, to the extent possible. Use of noise barriers or noise canceling acoustic devices should be considered as necessary.

5.3.32. Danger Trees

252. The main job of the maintenance team is regular patrolling along the power lines to identify the need for regular and immediate maintenance operation. During the process of patrolling, care is taken to trim the overgrown trees falling on to the transmission line conductor/or extending into the danger zone (regarded as “danger tree”). It is also imperative to clear the fallen trees following storm or heavy rainfall events.

253. During the operational phase regular trimming of trees along the route PGCB personnel may become essential to prevent accidents due to over-growth onto the power lines. However, this activity should be conducted with minimal damage to the existing vegetation. The project proponents would take up the planting of fruit bearing and other suitable trees, on both sides of the roads or other infrastructure development projects location from their own funds. There is no hard rule about clearance from the power line, monthly investigation and trimming the tree branch avoiding accident.

5.3.33. List of maintenance activities in the RoW

254. Regular patrolling along the power lines to identify the need for regular and immediate maintenance operation are as follows:

- Inspection immediately after a major storm/rainfall event;
- Regular cutting and trimming of trees around power lines;

- Taking appropriate protective measures against accidental fall from elevated height during regular maintenance operations (e.g. using body harness, waist belts, secured climbing devices, etc.);
- Provision for shutting down of line in case of snapping of line;
- Regular monitoring of power lines to prevent electricity pilferage;
- Only allowing trained and certified workers to maintain, or repair electrical equipment
- Taking appropriate protective measures against accidental fall from elevated height during regular maintenance operations (e.g. using body harness, waist belts, secured climbing devices, etc.);
- Deactivating and properly grounding live power lines before work is performed on, or in close proximity, to the lines;
- Proper Personal Protective Equipment (PPE) for all workers and others associated with work;
- Training of workers in the identification of occupational EMF levels and hazards;
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure;

255. Use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas) and education / public outreach to prevent public contact with potentially dangerous equipment.

5.3. Impact Matrix

256. Potential environmental impacts on the IESCs during pre-construction, construction as well as post- construction and operation stages of the proposed transmission lines and substations are presented below in a matrix form (Table 5.6).

Table 5.6: Impact matrix for proposed transmission lines and substations

IESCs	Baseline Condition	Impact of the interventions during		
		Pre- construction	Construction	Post- construction
Drainage congestion	The proposed substations and underground transmission line site is a seasonal water path for land run off	No impact	Minor drainage congestion would be created.	If the civil and earth work not cleared by the contractor or power authority then it would be created difficulty on land run off.
Noise level	Normal	Noise quality may deteriorate slightly due to transport of materials to the tower/substation sites.	Further deterioration may occur due to soil digging; concrete works at substation sites.	Gradual improvement.
Ambient air quality	Minor pollutants have been found due to industrialization of the Chittagong city.	Air quality may deteriorate due to transport of materials to the tower sites	Further deterioration may occur due to soil digging, concrete works	Gradually degraded due to industrialization.

IESCs	Baseline Condition	Impact of the interventions during		
		Pre- construction	Construction	Post- construction
Interference with road crossing	No impact	No impact	Temporary impact while stringing wires	No Impact
Construction waste at and substation sites	None	No impact	May create disturbance to the surroundings urban and rural communities.	No impact
Soil Potential	Moderately potential for agricultural crops	No impact	Impacted in substation location	Moderately impacted in substation location
Land use in the substation area	All substation proposed on agriculture land	Partially Non agriculture land	Non Agriculture land	Non Agriculture land
Crop production in RoW areas	Yield rate of HYV Aus, Aman and Boro crop is about 3.5 ton/ha, 4.0 ton/ha and 5.5 ton/ha respectively.	Partially impacted	Partially impacted along RoW, loss of crop production in RoW location	Moderately impacted only in tower location
Terrestrial vegetation	- Vegetations falls under ROW and transmission lines are homestead and croplands -Tall trees like Aam, Narikel, Jaam, etc, exist in the ROW Herbs and shrubs in some proposed tower sites	Terrestrial vegetation need to be shaved due to stockpiling construction materials	-Plants are needed to remove from substation sites -Tall trees on the ROW needs to be cut Existing marginal flora would damage due to run vehicles	Restriction for planting large trees on the ROW and will not grow up to expected height due to regular pruning.
Wildlife species	Species found mainly in homestead habitats	Wildlife of the proposed construction sites would leave from habitat due to stockpiling	The proposed substation locations are home to many rats and tiny birds. They will lose habitat during construction works.	- Restoration of damage habitat at post construction phase -Transmission lines wires and towers will provide resting facilities to birds
Crop production in substation areas	The yield rate of both (RoW) of transmission line and substation areas are mostly equal.	Partially loss of crop production	Total loss of crop production in substation	Total loss of crop production in substation
Intercultural operation in RoW	Traditional	Partially impacted	Partially impacted along RoW, fully	Moderately impacted only in tower location

IESCs	Baseline Condition	Impact of the interventions during		
		Pre- construction	Construction	Post- construction
			impacted in tower location	
Land Compensation	No compensation needed	Impacted ⁷	no impact	no impact
Involuntary migration of household	nil	nil	nil	Due to proper compensation payment they will be able to rebuild their houses
Land price (in taka/acre):		Sale value of different type of land will be reduced	Sale value of different type of land will be reduced drastically	Sale value of different type of land will be reduced. With time, people may gradually be interested to buy land, but at a much lower price.
Homesteads land	20,000,000 taka/acre			
Agricultural land	8,000,000 taka/acre			
Floodplains	500,000 taka/acre			
Commercial land (high land for industries, school, playground etc.)	35,000,000 taka/acre			
Employment opportunities during construction (technical and non-technical)	Moderate	No impact	Positive impact due to employment facilities in technical and non-technical sector	Positive impact indirectly power supply will help growth of our national economy. Then employment opportunities will be increased.
Agricultural income per capita	Normal	No impact	Income will be reduced	Income will be reduced to some extent
Regional as well as national economic development	Low	No impact	No impact	Regional as well as national economic development will be ensured.
Training for livelihood restoration	No training	No training	Training will be included	Training for livelihood restoration will be helpful for further development.
Human safety	Good	No impact	May be negatively	Due to mitigation and

⁷ Hajiganj/Kachua AIS S/Will be constructed in the private land of 5 acres (2.02 hectares) at Hajiganj Pourashava..The 2.02 hector land already acquired from 15 private land record holders. PGCB already deposited an amount of BDT 102.91 million in favour of revenue department. (Source: PGCB).

IESCs	Baseline Condition	Impact of the interventions during		
		Pre- construction	Construction	Post- construction
			impacted	contingency measures safety will be ensured.
SF ₆ gas handling equipment	Nil	No Impact	No Impact	-Fugitive emissions from SF ₆ handling equipment -SF ₆ is a potent GHG -Occupational hazards of exposure to fugitive emissions of SF ₆ gas
Exposure of EMF	Nil	No Impact	No Impact	Potential exposure to electromagnetic radiation
Earthling Zone from the center line of RoW	N/A	N/A	N/A	Houses/structures that required lightning arresters to be provided by –PGCB if there is no earth wire in transmission line
Soil and Water Contamination due to spillage of hazardous liquid waste	Nil	Nil	Different types of effluents, solid waste and hazardous material contaminate the water and soil resources of the area. Hazardous materials and no-hazardous waste if disposed off into the surrounding ,contaminate the soil and water resources of the area	
Traffic hazard during construction	Nil	Minor	Construction activity can potentially be a safety hazard for the community	
Physical and cultural resources during excavation activities			Underground physical cultural resources may be damaged	
Working with live power lines				May causes occupational safety problem
Working at height	Nil	Nil	Working at elevation during construction may causes accident	Working at elevation during maintenance, and operation activities may cause accident
Exposure to PCB in transformers and other electrical components.	Nil	Nil	None	May causes occupational health and safety problem
Hazards from electrocution	Nil	Nil	None	Community hazards result of electrocution from direct contact with high-voltage electricity or from contact with tools, vehicles, ladders,

IESCs	Baseline Condition	Impact of the interventions during		
		Pre- construction	Construction	Post- construction
				or other devices that are in contact with high-voltage electricity
Electromagnetic interference	Nil	Nil		The corona of high frequency currents of overhead transmission lines may result in the creation of radio noise
Noise and Ozone				Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Ozone may also be produced
Danger Tree	Nil	Nil	Nil	During the process of patrolling, care is taken to trim the overgrown trees falling on to the transmission line conductor/or extending into the danger zone (regarded as "danger tree"). It is also imperative to clear the fallen trees following storm or heavy rainfall events.

Source: IEE study, CEGIS and IFC guideline.

6. Environmental Management Plan

6.1. Mitigation, Compensation and Contingency Plan

Table 6.1: Mitigation, Compensation and Contingency Plan

Impact	Mitigation/Compensation	Enhancement	Contingency	EMP cost (lack taka)	Responsible Agency	Monitoring Agency
Drainage congestion	Local drainage system will need to be developed surrounding the substation sites during construction period.	-	-	4 SS @ 4.5 lack = 18	PGCB design unit and contractor	Project Director, PGCB
Ambient air quality and noise level	Water spray on roads, carrying construction materials at night and temporary fencing at construction sites All vehicles, equipment and machinery to be used should comply with the relevant ECR norms and other rules. -All vehicles used on site for this purpose should carry currently valid fitness certificates issued by the BRTA.	-	-	Lumpsum= 2 lack	PGCB	Project Director, PGCB
Construction waste at substation sites	Collect garbage of civil works and send it to proper assigned places.	-	-	Lumpsum= 2 lack	By Contractor	Project Director, PGCB
Loss of soil potential	During the construction period, carefully dig the hole for erecting the tower. The excavated soils should be properly stacked and the hole should be refilled with the stacked soil by maintaining the sequence of the profile (i.e substratum – Subsoil – Topsoil). The loosened topsoil on the surface must be compacted well so that no erosion can take place. Adequate compensation for crop loss should be paid to the actual landowners/ sharecroppers.	-		Lumpsum= 3 lack	DC's Office, Contractor, Consultants and PGCB	Project Director, PGCB
Change of land use in the substation		After the construction of the sub-stations, garden crops should be grown in the fallow	-	-	DAE, Consultant	Project Director, PGCB

Impact	Mitigation/Compensation	Enhancement	Contingency	EMP cost (lack taka)	Responsible Agency	Monitoring Agency
		areas of the sub-station compound. Also fruit trees of low height like mango, guava and lemon can be grown				
Loss of crop production	The mobilization and construction work of the project should be carried out carefully, so that standing crop is not damaged unnecessarily. The project work may be delayed for allowing the farmers to harvest their crop. The work should not be continued through the ripened crop fields.	–	Not need	Lumpsum= 10 lack	–	PGCB, Contractor
Difficult intercultural operation in tower location		Trained up the farmer mainly in tower location	-	-	-	PGCB
Land compensation	Land should be compensated properly. Land acquisition should be done through project money. So it is excluded from EMP cost.	-	-	-	–	Project Director, PGCB
Involuntary Migration from Right of Way and sub-station	-	Proper cash compensation should be provided to the households that would have to be shifted from the RoW. Proper compensation should be provided to the actual landowners at the present market value for the substation site. Tower sites might be acquired in the future when such law is enforced for power projects.	A contingency fund should be created to meet emergency situations caused by accidents during line construction	Lumpsum= 10 lack	PGCB, DC office and Contractor	
Impact on Human safety	To ensure human safety awareness and motivational programmes should be participatory with adequate discussions, meetings, display of signboards and posters at the	-	A contingency fund should be created for construction laborers and	Lumpsum= 5 lack	PGCB and Contractor	

Impact	Mitigation/Compensation	Enhancement	Contingency	EMP cost (lack taka)	Responsible Agency	Monitoring Agency
	construction sites.		public in case of accidents during construction of the transmission lines, towers and sub-station.			
Interference with road crossing,	<ul style="list-style-type: none"> - Nets should be placed over the crossing points of roads while stringing wires. Danger signs and public awareness are also required. - Additional traffic signals would be provided on road point during construction of civil works. 	-	Ensure contingency cash in the project sites to resolve the unexpected situation.	Lumpsum= 3 lack	By Contractor	Project Director, PGCB
Traffic hazard of heavy equipment	<ul style="list-style-type: none"> - A public safety plan will be developed - A speed limit of 10 km/h will be maintained on the proposed access road, - Night time driving of project vehicles will be limited where possible - Community complaint register and other means will be adopted for the community to complain about non-adherence of project traffic to speed limits, safe driving and other safety-related concerns - Work areas outside the proposed project site, especially where machinery is involved will be roped off and will be constantly monitored to ensure that local people, especially children stay away. 			Include in the construction/operation cost	Contractor	PD, PGCB
SF ₆ Gas Handling	<ul style="list-style-type: none"> -Regular monitoring of SF₆ through pressure gauges -Use of handheld leak detectors to monitor leaks -Prepare annual inventory checklist of SF₆ consumption, purchase, and losses to track emissions 			Include in operation cost	PGCB	PGCB

Impact	Mitigation/Compensation	Enhancement	Contingency	EMP cost (lack taka)	Responsible Agency	Monitoring Agency
	-Provide training to staff on proper handling of SF6					
Exposure to EMF	<ul style="list-style-type: none"> Electric and magnetic field from the 132 kV overhead transmission line and 75 MVA transformers are expected to be way below the limits set by ICNRP of 4.15 kV/m for electric field and 83 mG for magnetic field. Substations will be fenced and security staff assigned to prevent public access. Information and education campaign will be conducted to local people to create awareness on safety practices. 			Include in operation cost	PGCB	PGCB
Earthing Zone from the center line of RoW		Provide earth wire at the top of Tower		Include in construction cost	Contractor	PGCB
Soil and water contamination due to spillage of hazardous liquid waste	<ul style="list-style-type: none"> Use of spill prevention trays and impermeable sheets to avoid soil contamination, Storage of fuels, chemicals and lubricants in bounded areas with impervious flooring and secondary containment of 110% capacity, Emergency Response plan will be developed for hazardous substances, Equipment and material containing asbestos, poly-chlorinated biphenyls (PCBs), and ozone depleting substances (ODSs) will not be used Material Safety Data Sheet (MSDS) will be maintained. 			Include in construction cost	Contractor	PGCB
Physical and cultural resources during excavation activities	<ul style="list-style-type: none"> Immediately stop the work. Inform respective supervisor, the supervisor will then inform the project authority. The project authority will 			Include in construction cost.	Contractor/ PGCB	PGCB/ Department of Archeology

Impact	Mitigation/Compensation	Enhancement	Contingency	EMP cost (lack taka)	Responsible Agency	Monitoring Agency
	communicate with Archeological Department if necessary, after the investigation of Archeological Department re-routing cable laying and the substation plan layout rearranging.					
Working with live power lines	<ul style="list-style-type: none"> Only allowing trained and certified workers for stringing; Deactivating and grounding live power lines; Ensuring work conducted by trained workers and should be able to achieve the following: <ul style="list-style-type: none"> Distinguish live parts from other parts of the electrical system Determine the voltage of live parts Understand the minimum approach distances outlined for specific live line voltages Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system The worker is properly insulated from the energized part with gloves or other approved insulation 			Include in construction cost	Contractor	PGCB
Work at height on towers and structures	<ul style="list-style-type: none"> Testing structures for integrity; Training in climbing techniques and use of fall protection measures; Installation of fixtures on tower components to facilitate the use of fall protection systems; Hoisting equipment should be properly rated and maintained and hoist operators properly trained; Safety belts should be of not less than 16 millimeters (mm) (5/8 			Include in construction/operation cost	Contractor	PGCB

Impact	Mitigation/Compensation	Enhancement	Contingency	EMP cost (lack taka)	Responsible Agency	Monitoring Agency
	inch) two-in-one nylon <ul style="list-style-type: none"> When operating power tools at height, workers should use a second (backup) safety strap; An approved tool bag should be used for raising or lowering tools or materials to workers on structures. 					
Exposure to PCB in transformers and other electrical components	<ul style="list-style-type: none"> Coveralls (Tyvek jumpsuit) with hood Protective boot covers Full-face respirator Protective gloves Heavy duty gauntlets or ductile taping of pant's ankles to boot covers, and wrists to gloves Hard hat for overhead dangers and head protection Goggles for eye protection 			Include in construction/operation cost	Contractor	PGCB
Hazards from electrocution	<ul style="list-style-type: none"> Use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment; Grounding conducting objects (e.g. fences or other metallic structures) installed near power lines, to prevent shock. 			Include in construction/operation cost	Contractor	PGCB
Electromagnetic interference		<ul style="list-style-type: none"> Extensive public consultation during the planning of power line right-of-way locations; Accurate assessment of changes in property values 		Include in construction/operation cost	Contractor	PGCB

Impact	Mitigation/Compensation	Enhancement	Contingency	EMP cost (lack taka)	Responsible Agency	Monitoring Agency
		due to power line proximity; • Sitting power lines, and designing substations, with due consideration to landscape views and important environmental and community features; • Location of high-voltage transmission lines in less populated areas, where possible; • Burying transmission lines when power must be transported through dense residential or commercial areas.				
Noise and Ozone	<ul style="list-style-type: none"> To mitigate this impact may be addressed during project planning stages to locate rights-of-way away from human receptors, to the extent possible. Use of noise barriers or noise canceling acoustic devices should be considered as necessary 			Include in construction/operation cost	Contractor/PGCB	PGCB
Danger Tree	<ul style="list-style-type: none"> Regular trimming of trees along the route. Prevent accidents due to over-growth onto the power lines. Activity should be conducted with minimal damage to the existing vegetation. Planting of fruit bearing and other suitable trees, on both sides of the 			Include in construction/operation cost	Contractor	PGCB

Impact	Mitigation/Compensation	Enhancement	Contingency	EMP cost (lack taka)	Responsible Agency	Monitoring Agency
	roads or other infrastructure development projects location.					

** amount may be changed subjected to ESIA study*

6.2. Compensation Plan

257. Compensation should be given to the actual owners for land, crops and settlement at the RoW, tower sites and sub-station site. The detailed compensation plan under SIA in the resettlement plan.

6.3. Grievance Redress Mechanism

258. PGCB will ensure that local people will have the opportunity to express their legitimate grievance or file a complaint about the project by establishing a process to address the issues raised. This can be achieved by careful implementation of the EMP, continuing consultation and communication with stakeholders during implementation by the Project Management Unit (PMU), PGCB, Contractor(s), and local government authorities. Contact details of the PMU for filing complaints will be posted in the project areas.

259. A grievance redress committee (GRC) at the union level will be setup by PGCB as soon as the project commence and will ensure equal representation of women in the members of GRC. Figure shows the organization of the GRC.

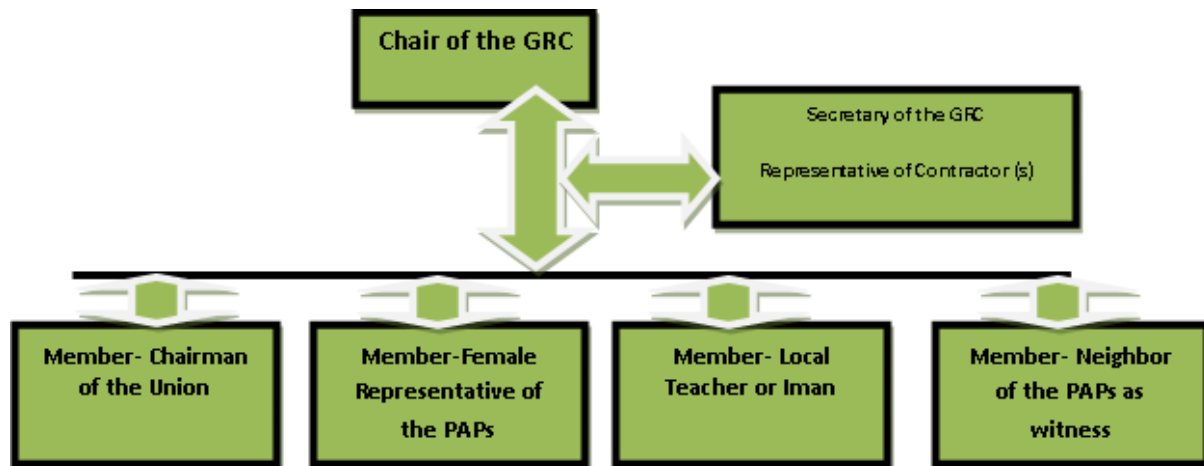


Figure: 6.1: Grievance Redress Committee

260. GRC will convene twice in a month and will keep a record of the grievances, classify, prioritize, and provide the solution(s) within 30 days from the date of the complaint. The record will include the contact details of the complainant, date the complaint was received and the nature of the complaint, agreement on corrective actions and the date it was enforced, and the final outcome. All complaint-related documentation such as minutes of the meeting and decisions will be summarized and become part of the semi-annual monitoring report submitted to ADB. The GRC will report to the complainant(s) about the developments regarding their grievances and the decisions of the GRC. If the grievance is not addressed, the complainant can seek legal redress of the grievance in the appropriate courts.

6.4. Institutional Requirements and Monitoring Plan

6.4.1. Implementation Arrangements

261. EARF detected that an Investment Program Coordinating Committee (IPCC) led by the Ministry of Power, Energy and Mineral Resources (MPEMR) will be set up to oversee the implementation of the Investment Program and will be responsible in ensuring that the EAs prepare the environmental assessment reports according to the EARF, Schedule 4 and Schedule 5 of the FFA, SPS 2009 and the applicable national environmental laws and regulations.

262. A PMU headed by a Project Director (PD) will be established in PGCB and will consist of technical, financial, and procurement staff. Safeguards staff (i. e., Environment and Social Development) will be recruited as and when required reports to the Managing Director of PGCB to support the PMU in complying with the safeguards requirements of ADB. The environment staff (or a Consultant) will prepare the required environmental assessment depending on the environment category following the procedures outlined in Section 4.0 of the EARF, SPS 2009 and all applicable environmental regulations. The environment staff will report to the PD, PMU who will act as oversight in ensuring compliance to ADB's environmental safeguard requirements, implementation of the EMP, monitoring and reporting.

6.4.2. Responsibilities during Implementation

263. The environment staff (or recruited Consultant) of the PMU in PGCB will be responsible in the preparation of the IEE or EIA according to this EARF, SPS 2009, and applicable national environmental laws and regulations. Aside from this, the environment staff will ensure that all environmental clearances are obtained in a timely manner as required by the DOE.

264. During implementation, the environment staff will ensure that the EMP and the environmental monitoring plan are followed and will provide technical support to PD, PMU in dealing with environmental issues related to the project and in continuing public consultation, will coordinate with relevant government agencies on environmental matters, will prepare environmental monitoring reports to be submitted to ADB, and draft any updates/revision to the IEE or EIA and corrective action plan in case of unanticipated environmental impacts resulting from change in design, location, etc.

265. ADB will review the IEE or EIA, and the environmental monitoring reports. ADB will ensure that the IEE or EIA and the environmental monitoring reports are posted in its website, as required by SPS 2009 and Public Communications Policy 2011.

- **Responsibilities of PGCB**

266. **Pre-construction and Design-**(i)Screen and review subprojects based on the EARF and Schedule 4 and Schedule 5 of the FFA, (ii) Prepare the rapid environmental assessment (REA) checklists specific to the project component(s) and submit to ADB for review and approval,(iii) Together with the completed REA checklists, propose environment category based on this EARF and SPS 2009, (iv) Prepares the IEE or EIA depending on ADB-approved environment category according to this EARF, SPS 2009, and applicable national environmental requirements, (v) Submits draft IEE or EIA to ADB for review and approval, (vi) Revises draft IEE or EIA incorporating ADB comments, (vii) Posts the approved IEE or EIA to their website, (viii) Secures/obtains all required environmental clearance from DOE prior to construction stage, and (x) Incorporates relevant EMP requirements to bid documents.

267. **Construction Phase-** (i) Implements EMP and monitoring plan, (ii) Updates/revises IEE or EIA if unanticipated environmental impacts occur during implementation, and prepare corrective action plan, (iii) Conducts consultation as and when needed, (iv) Monitors compliance of Contractor(s) to specific environmental provisions, (v) Provides relevant documents and information needed by ADB during review missions, (vi) Submits semi-annual monitoring reports to ADB, and (vii) Posts monitoring reports to PGCB website.

268. **Operation Phase-** (i) Submits annual monitoring report to ADB, (ii) Prepares summary of compliance to environmental loan covenants as part of annual monitoring report, and (iii) Posts monitoring report to PGCB website

6.4.3. Executing Agency Capacity-building Needs

269. To ensure that the PMU of PGCB comply with the requirements of ADB in a timely manner, the institutional capacity needs to be strengthened. PGCB lacks the capacity in terms of designated environmental staff. The environmental management and monitoring program will be undertaken by engaging environment consultant from outside until appointing environmental staff. During construction period management supervision consultant (MSC) will take care of all environmental related activities.

Staff Development:

- Familiarization with SPS 2009 and training on how to incorporate environmental and social safeguards consideration in project development, implementation and operation;
- Formulation of manual and training on information disclosure and public participation associated with power projects;
- Formulation of manual, and training on handling and resolving complaints and disputes arising from power project development and operation;
- Course on impact avoidance and minimization in the planning, implementation and operation of power projects;
- Training on procurement using ADB procedures; and,
- Training on and assistance for awareness-raising and information campaign targeting households living and working close to transmission lines to avoid risks.

Institutional and Policy Enhancement:

- Enhancement of the process and arrangement for tree replacement/reforestation and compliance monitoring on the use of reforestation compensation given to other Government units; and
- Assistance in the creation of Safeguard Officer position in PGCB and on corresponding capability building requirement including the handling of gender concerns.

270. The environmental capacity-building will be mainstreamed in all these areas incorporating the needs identified above on staff development and institutional and policy enhancement.

Table 6.2: Monitoring Plan (Pre-Construction Phase)

Measure/Indicator	Locations	Frequency	Monitoring Agency
Proper compensation for landowners, crops and properties.	Sub-station site and two RoW sites	Every month	Project Director, PGCB and Contractor

Measure/Indicator	Locations	Frequency	Monitoring Agency
Soil samples need to be tested in the laboratory. Test results will be checked with previous soil report.	Every tower site and sub-station site	Once before construction	Project Director, PGCB and Contractor
Loss in crop production, Notify farmers well ahead of time. Provide adequate compensation.	Sub-station site and tower sites	Every month	Project Director, DC office, and Contractor
Un-hygienic condition for workers including water supply and sanitation	Labor shade in site	Every month	Project Director, PGCB and Contractor
Conflict with local community to use as much as possible local labors for avoiding cultural problems	Sub-station site and tower sites	Every month	Project Director, PGCB, and Contractor
Preparation of approach roads for transportation of heavy equipment.	Sub-station site and tower sites	Once before construction.	Project Director and Contractor
Vegetation	Proposed transmission lines and tower sites	Each week	PGCB and Contractors
Species richness	Under transmission lines and tower sites	Each week	PGCB and Contractors
Electromagnetic interference	Transmission line and substation sites	Each week	PGCB and Contractors
Noise and Ozone	Transmission line and substation site	Each week	PGCB and Contractors

Source: IEE study CEGIS.

Table 6.3: Monitoring Plan (Construction Phase)

Measure/Indicator	Locations	Frequency	Monitoring Agency
Monitoring air and noise quality, spray water before movement of vehicles by contractors	RoW sites as well as sub-station sites	Every day	Project Director (PD), PGCB, and Contractor
Transportation of materials by truck should be done at night by contractors	RoW sites as well as sub-station sites	Every day	PD, PGCB, and Contractor
Preparation of sanitary waste disposal site for solid and liquid waste.	RoW sites as well as sub-station sites	Every week	PD, PGCB and Contractor
Adequate drains to carry storm water runoff	Sub-station sites	Once a month	PD, PGCB and Contractor
Adequate compensation for trees	RoW and sub-station sites	Once a month	PD, PGCB and Contractor
Avoid killing of animals so that they can, at least, move to another place.	RoW and sub-station sites	Every day	PD, PGCB and contractor
Crop compensation for the affected land	RoW and sub-station sites	Every crop season	PD, PGCB, and contractor
Placement of adequate signs and posts warning people	RoW and sub-station sites	Once a month	PD, PGCB and contractor
Announcements using mike to make communities aware about the risks of accidental events	RoW and sub-station sites	Every week	PD, PGCB and Contractor
Fire fighters with materials	RoW and sub-	Every day	PD, PGCB and

Measure/Indicator	Locations	Frequency	Monitoring Agency
	station sites		contractor
Awareness of workers about hazardous materials and proper handling methods. Warning signs, labels and signals. Provide helmets, safety shoes and other PPE for workers in accordance with accident prevention and work safety procedures	RoW and sub-station sites	Every day	Project Director, PGCB, and Contractor
Soil and water contamination due to spillage of hazardous liquid waste	RoW of UG cable and substation site	Every day	PD, PGCB, and Contractor
Physical and cultural resources during excavation activities	RoW of UG cable and substation site	Every day	PD, PGCB, Department of Archeology and Contractor
Work at height on Towers and structures	Transmission line tower and substation	Every day	PGCB, Contractor

Source: IEE study CEGIS

Table 6.4: Monitoring Plan (Post-Construction/Operation Phase)

Measure/Indicator	Locations	Frequency	Monitoring Agency
Land recovery after waste removal by contractor	Labor shade	Once after implementation	PGCB and Contractor
Failure of tower and accident by electrocution	Tower sites and sub-station sites	Every month	PGCB and Contractor
Accident and power failure	Tower sites and sub-station sites	Every month	PGCB and Contractor
Vegetation growing under the transmission line with regular pruning.	Tower sites and sub-station sites	Every three months	PGCB and Contractor
Pilferage with proper security measures	Tower sites and substation sites	Every three months	PGCB and Contractor
Vegetation	Transmission lines and tower sites	Quarterly	PGCB and DoE
Species richness	Transmission lines and tower sites	Half-yearly	PGCB and DoE
Inventory of SF6	Substations	Half-yearly	PGCB
EMF measurement	Substations and Transmission Line	Half-yearly/Specially dry season	PGCB
Earthling Zone from the center line of RoW	Transmission line	Quarterly/specially after thunder storm	PGCB
Working with live power lines	Transmission line tower	Every day	PGCB
Work at height on towers and structures	Transmission line tower and substation	Every day	PGCB

Measure/Indicator	Locations	Frequency	Monitoring Agency
Exposure to PCB in transformers and other electrical components	Substation site	Every day during cleaning and refilling electrical components	PGCB
Hazards from electrocution	Substation and transmission line	Immediately any accident occur and quarterly inspection of sign board, danger plate missing	PGCB
Danger Tree	Transmission line	Immediately after a tornado hit	PGCB

Source: IEE study CEGIS

6.5. Budget for the Environmental Management Plan (EMP)

271. The World Bank Group's Environmental, Health and Safety Guidelines for Electric Power transmission and Distribution will be followed for the environmental management and monitoring of the project.

272. For implementing the Environmental Management Plan (EMP), about **Tk. 155lack** will be required (Table 6.5) as a whole. The major cost will be for land acquisition of the sub-station site and crop compensation in the RoW. The detailed estimate of the compensation will be needed another study i.e. compensation assessment study which will be needed further to execution the implementation work.

Table 6.5: Budget for the Environmental Management Plan

Item	Qty	Rate	Total Taka (lack)
Mitigation, compensation Plan		LS	40
Enhancement plan and contingency		LS	20
Training of professionals and worker about accidental cases and safety measures		LS	15
Sub total			75
Monitoring Plan	From revenue budget		
Consultant (for monitoring)	30 person-month	Tk. 200,000 per month	60
Transport (for monitoring team)	150 days	Tk.10000 per day	15
Sub Total			75
Reporting		LS	5
Total EMP Cost *			155

**This amount is excluding the land acquisition cost*

7. Information Disclosure, Consultation and Participation

Consultation and Participation

273. To inform local level stakeholders about the project, informal consultations were done during the preparation of the IEE and the walk-over survey.⁸ Consultations aim to provide information about the concept of the project, temporary problems or inconvenience associated with the project during the walk-over survey and construction stage, and the mitigation or solutions to these associated problems to minimize the effects.

274. Informal consultations and discussion meetings with local people were carried out by the Survey Team of the Center for Environmental and Geographic Information Services (CEGIS), contracted by PGCB, during the walk-over surveys for the RoW (August 2013 and September 2013). The meeting venues are shown in Table 7.3. and list of participants are in Table 7.4. During these consultations, people raised questions/issues and facilitators from CEGIS took notes and provided response to the issues raised.

275. A summary of the concerns raised during the consultations done by CEGIS are given below:

Perceptions of the local people

- They are already aware that a proposed transmission line will be put up in their area from high officials of PGCB and the local administration.
- PGCB staff frequently visited the project sites to talk to local people about the project.
- Since the route survey has been done, people within the RoW are also aware about the proposed route alignment for the transmission line but they are not aware of when the project will actually commence and how much time will be required to complete the project.

Concerns identified by local people

- Some farmers may not be able to cultivate the land due to the tower basement.
- Potential difficulty in cultivating the land under the power lines and transmission towers as well as cattle rearing particularly during the rainy season. In the events of severe thunderstorms, the high voltage line may be dangerous and may be safety risks.

Suggestions from local people

- People who would be affected in terms of loss of land should be compensated with land and properly resettled, if possible;
- People who would lose their livelihood such as sharecroppers and leaseholders should be compensated with cash; and,
- For displaced people, if any, they should be accommodated for employment in the project depending on academic qualifications.

Agreement on overall proposed recommendations

⁸Department of Environment requires both an IEE and an EIA for projects classified as Red category such as power transmission. The IEE is required for site clearance after which an EIA will be conducted to secure the environmental clearance certificate. Formal public consultations of the affected people will be conducted during the EIA preparation

- All APs should be properly compensated for their standing crops and trees that may be damaged;
- Compensation money should not be given directly to the APs in the presence of Chairman/Member of the Union Parishad or Upazila Parishad but be transferred through their bank accounts;
- Proper compensation rate should be determined for different crops;
- No work for the project will commence until proper compensation is given to the displaced people; and,
- A third party of neutral monitoring agency should be engaged to monitor the compensation process to ensure that displaced people are properly compensated.

276. Overall, local people along the transmission line route expressed their support to the project and are optimistic of the potential employment opportunities from the project.

277. Additional consultations were done by the project preparatory technical assistance Consultants in the form of consultation meetings, socioeconomic surveys, and interviews.⁹ Consultation meetings with the on-site project stakeholders and affected people were held from March and May 2015.

278. . Consultation meetings with the on-site project stakeholders and affected people were held from March and May 2015. The following information about the project was disclosed in these consultations:

- proposed line route;
- scope of resettlement impacts;
- compensation and entitlement;
- project schedule; and
- institutional arrangement and responsibilities.

279. The salient discussions points are presented in Table 7.1. The attendance sheets and photographs of the FGDs are presented in Pictures 7.1 to 7.4. During consultations with potentially affected persons the information regarding sub-project details and the benefit was in detail briefed by the team. The likely loss and mitigation measures including compensation, compensation calculation, and compensation payment process etc. was also discussed. In general people were happy and welcomed the sub project as the completion of the project will improve the quality of electricity supply. The better quality of electricity supply will have positive cascading impact on other sector like education, small scale industry, agriculture etc. In turn the anticipated impact of improvement in quality of electricity supply will help to reduce poverty.

280. A summary sheet containing relevant project information will be made available by PGCB at their offices in Dhaka, at the Madunaghat Substation, Kalurghat Substation, Comilla (S) Substation and Kachua Substation as well as in its field offices in Comilla, Chandpur and Chittagong. Once accepted by ADB, the IEE will be posted in the PGCB website as required by

⁹ Consultation meetings and key informant interviews carried out during the preparation of Resettlement Plan (RP) following SPS 2009.

ADB's SPS 2009 and Public Communications Policy 2011. Consultation with key project stakeholders in varying degree will continue throughout the life of the project.

Table 7.1: Stakeholders' Participatory Consultation – Abstracts

Place and Date:	Participants	Issue discussed	Opinion and consensus about the project
Barahmmanhat Union: Dakshin Madrasa Upazila: Hathazari (PGCB) 8/5/2015	15 PGCB representatives, representatives of business persons, residents of DakshinMadrasha union (farmers, students, day labor)	1. Details of the project 2. Five Top most problems and mitigation measures 3. Current power situation 4. Proposed future improvement due to transmission line 5. Employment opportunity and future potential 6. Compensation payment	<p>It was noted with satisfaction that introduction of 7 km 132/33 kv new transmission line and 65 Km of refurbishment of transmission line will provide more stable power supply. More than 200 industries including garments, factories, residential hotels, restaurants, workshops mostly located at city corporation area at Kalurghat (the heavy industrial area of City Corporation) and Bohaddarhat, 300 small and medium scale business centers, offices and the residence of Madunaghat and Kalurghat will receive the benefit. Stable power supply will provide students to concentrate more on their education and facilitate to have better health irrespective of all age groups people. Due to constant fluctuation of power with low voltage for more than 4-5 hours a day affect the industries like fabrics, plastic manufacture, electronic goods manufacture, burger paint, medicine factories, steel meal, cement factory, spare parts manufacturer in this area. As an alternate power supply all industries and factories and other business centers use generator which is costly and create noise pollution which is harmful for the people in this area.</p> <p>According to them improved power supply will facilitate to establish more industries and more people will be employed and income level will increase.</p> <p>The villagers opined that improved power supply will reduce the fluctuation and provide proper power supply in winter time for crop cultivation which will in turn help better and higher agricultural productivity.</p> <p>However, the participants expect that</p>

Place and Date:	Participants	Issue discussed	Opinion and consensus about the project
			<p>the transmission line will be underground cabling along the existing road.</p> <p>The payment of compensation was discussed at great length. The people were informed about the entitlement matrix and compensation payment.</p>
<p>REB</p> <p>Dighircala,</p> <p>Gazipur</p> <p>Chowrasta</p> <p>4/4/2015</p>	<p>Participants: 9</p> <p>Representatives from REB, business person, service holders</p>		<p>The consultation included stakeholders from public entity as well as community people of different professions whom expressed their interest for implementation of the proposed project. Although the local people were not so much aware about the proposed project, discussions at different levels during field visit provided them clear understanding about the Project, its impacts and implementation modalities. According to their views, the proposed sub project will provide the customers and their grown up members in the family to use the modern technology and aware them to economize in the use of electricity. Moreover, it will make them hassle free from travelling, save travel time and expense for payment of electricity bill, no fear of electric line disconnection, stop illegal connection, meter tempering, ensure accurate payment as per consumption.</p> <p>They emphasized on the assurance of issuing genuine and accurate prepaid meter card with accurate id number of the customer (no duplicate/false card) also to ensure that the prepaid card recharging vendors/ units/ stations are within their reach. Moreover, they repeatedly pronounced to give the customers some reasonable friendly hours during weekend, public holidays in case of 0 (zero) balance.</p>
Community consultation	Participants: 17		Community consultation is part of the Social Safeguard requirements was

Place and Date:	Participants	Issue discussed	Opinion and consensus about the project
REB: Gazipur Jugitala, Nutun Bazar, gazipur City 4/4/2015	Representatives from REB, local business person, service holders		<p>carried out amongst the population surrounding the particular sub project area to achieve the customers' level of awareness about the proposed project and its' potential impact. Community consultation was carried out with two different groups at two different locations namely Gazipur Chourasta and Bangladesh Rice Research Institute where an approximate number of 27,9446 and 13,5663 prepaid meters will be installed respectively under Gazipur PBS. The consultation included stakeholders from public entity as well as community people of different professions whom expressed their interest for implementation of the proposed project. Although the local people were not so much aware about the proposed project, discussions at different levels during field visit provided them clear understanding about the Project, its impacts and implementation modalities. According to their views, the proposed sub project will provide the customers and their grown up members in the family to use the modern technology and aware them to economize in the use of electricity. Moreover, it will make them hassle free from travelling, save travel time and expense for payment of electricity bill, no fear of electric line disconnection, stop illegal connection, meter tempering, ensure accurate payment as per consumption.</p> <p>They emphasized on the assurance of issuing genuine and accurate prepaid meter card with accurate id number of the customer (no duplicate/false card) also to ensure that the prepaid card recharging vendors/ units/ stations are within their reach. Moreover, they repeatedly pronounced to give the</p>

Place and Date:	Participants	Issue discussed	Opinion and consensus about the project
			customers some reasonable friendly hours during week end, public holidays in case of 0 (zero) balance. The list participants attended the consultation meetings and photographs is attached in the latter section of the report



Picture 7.1: Consultation with Executive Engineer PDB at Kalurghat S/S (PGCB)



Picture 7.2: Consultation at Brahmanhat, Dakhin Madrasha (PGCB)



Picture 7.3: Consultation at Digircala, Gazipur Chowrasta (REB)



Picture 7.4: Consultation at Jugitata Notun Bazar , Gazipur (REB)

Table 7.3: Meeting venue, participants and date

SI	Venue	Total participants*	Meeting date
1	Hajiganj	11	26/08/2013
2	Kalughat	6	27/08/2013
3	Madunaghat	6	27/08/2013
4	PGCB, Head office	11	11/9/2013
		34	

Table 7.4: List of Officials Consulted

SI. No.	Name	Occupation	Age	Village/office	Mobile no.	Date
1	Engr.AKM Sumsuddin Chowdhary	General Manager	55	REB, PBS, Hajiganj	01769400016,	26.08.13
2	Engr.Md. Shajahan	AGM,	50	REB, PBS	1769400326	26.08.09
3	Engr.Md. Pabar Ali	Advisor	62	REB,	1711402838	26.08.09
4	Md. Hasem Ali	Farmer	45	Hajiganj	-	26.08.13
5	Engr. Ruhul Kuddus	A. Manager	35	PGCB	1711422373	26.08.13
6	Lutfor Rahman	Business	50	Hajiganj	-	26.08.13
7	Md. Kasem Mollah	Farmer	35	Hajiganj	-	26.08.13
8	Md. Jaonal Abedin	Day laborer	45	Hajiganj	-	26.08.13
9	Md. Sukur Mia	Day laborer	35	Hajiganj	-	26.08.13
10	Md. Hekmat	Business	42	Hajiganj	-	26.08.13
11	Md. Billal	Business	33	Hajiganj	-	26.08.13
12	Engr. Md. Anisur Rahman	Asst. Engineer	34	BPDB, Kalurghat	1818995510	27.08.13
13	Md. Mizan Mia	Day laborer	35	Kalurghat	-	27.08.13
14	Md. Hekmat Ali	Van puller	35	Kalurghat	-	27.08.13
15	Md. Nader Ali	Rickshaw p.	28	Kalurghat	-	27.08.13
16	Md. Hazrat Ali	Rickshaw p.	25	Kalurghat	-	27.08.13
17	Engr. Swapan K. Das	Manager	55	PGCB	1711809079	27.08.13

Sl. No.	Name	Occupation	Age	Village/ office	Mobile no.	Date
18	Md. Siraj	Day laborer	33	Madnaghat	-	27.08.13
19	Md. Kamal	Business	45	Madnaghat	-	27.08.13
20	Md. Julu Mia	Day laborer	35	Madnaghat	-	27.08.13
21	Md. Didar Ali	Business	48	Madnaghat	-	27.08.13
22	Md. Akkas Ali	Farmer	35	Madnaghat	-	27.08.13
23	Engr. Quamrul Hasan	DGM	55	PGCB	1711644857	11.09.13
24	Engr. Arun Kumar Saha	DGM	50	PGCB	1714022883	11.09.13
25	Engr. Shahidul Islam	Manager	45	PGCB	1755637649	11.09.13
26	Engr. Shafiullah	Manager	45	PGCB	1730029317	11.09.13
27	Engr. Sahadat Hossain	Manager	40	PGCB	-	11.09.13
28	Engr. Munir Hossain	D.M.	32	PGCB	-	11.09.13
29	Engr. Arefin Nobel	D.M.	30	PGCB	1730016096	11.09.13
30	Engr. Kawsar	A.M.	33	PGCB	-	11.09.13
31	Engr. Aminul	A.M.	28	PGCB	-	11.09.13
32	Engr. Palash Das	A.M.	28	PGCB	-	11.09.13
33	Saidur Rahman	Business	40	Noyapara	-	17.09.13
34	Alam Sarkar	Business	50	Noyapara	-	17.09.13

8. Conclusions and Recommendations

8.1. Conclusions

281. People all along the route of the transmission line expressed keen interest in the sub-project even after recognizing the fact that they will not get electricity directly from the transmission line. Their main interest is that the overall development in the power sector would contribute to the national development. Local people along the transmission line alignments will be benefited, as the project will generate some employment opportunities for them during the pre-construction and construction phases.

282. High resolution Remotely Sensed (RS) images have been used in selecting the route of the transmissions line avoiding settlements and ecologically sensitive areas. This has been reconfirmed by the IEE team members who walked along the entire length of the alignment. Observations of the team members suggest that the route finally selected passes mostly through agricultural crop fields, not through settlement or ecologically sensitive areas.

283. Minor negative impacts of the project will be felt during the pro-construction and construction phases which may involve removal of vegetation and cutting of trees for carrying construction materials to the sites and erection of towers and construction of the transmission line. These problems would be overcome by paying compensation and bringing back these lands to their original form before handing them over to the owners after the construction. Crop production lost due to these activities during the pre-construction and construction phases will have to be compensated as well.

284. The project is not likely to have any significant negative impact; therefore no major mitigation is required. The minor impact of noise and increase in traffic are within the existing level experienced by the local people. The tower will be erected and the line installed under expert supervision. The contractor will be under specific orders for providing PPE to the workers engaged for the job.

285. The monitoring plan, if properly implemented during the pre-construction, construction and post-construction and operation phases will ensure taking corrective measures.

286. The proposed project will have no residual adverse impact on the environment or the eco-system.

287. PGCB is required to take clearance from the DoE for implementing the transmission line and other ancillary works. The IEE report has been prepared with this end in view.

8.2. Recommendations

288. The IEE study reveals that 132 kV transmission lines have no major negative impact, but will contribute to national development by improving the supply of electricity. Local people will have employment opportunities during pre-construction, construction and operation phase. The contractor should be specifically instructed to employ local laborers as much as possible.

289. Minor negative impacts like increasing noise level and air pollution, clearing of vegetation and cutting of trees at the pre-construction and construction phases should be taken care of by taking proper mitigation measures. Efforts should be made to avoid cutting of trees as much as possible. Cutting of some trees might be unavoidable which or more should be replanted in surrounding area for conservation of biodiversity. In this case, homesteads gardening will be emphasized with fruit and rapid growing timber trees in the surrounding area. Selection of the season for carrying out the work should be made by adjusting with the cropping season so as to inflict minimum damage to field crops. In both cases proper compensation for all types of damages must be paid and the land should be brought back to its original form before they are handed back to the owners.

290. The construction labour camps should be provided with water supply and sanitation facilities. The workers should be apprised of hygienic practices. The transportation of heavy equipments should be done by river craft where wheeling is not feasible. The stores and equipment yards should be properly guarded so that all equipments remain safe. The sub-stations should be fully equipped with fire fighting equipments.

291. Finally, on proper examination it is observed that the project has been proposed to be implemented safely and in an environment friendly manner.