Environmental Impact Assessment (Annex 16-Part 1)

May 2016

Bangladesh: Power System Expansion and Efficiency Improvement Investment Program (Tranche 3)
Ashuganj 400 MW Combined Cycle Power Plant (East)

Prepared by Ashuganj Power Station Company Limited (APSCL) for the Asian Development Bank. This is an updated version of the draft EIA posted in October 2015 available on http://www.adb.org/projects/documents/ashuganj-400mw-ccpp-east-updated-eia

Annexure-16

EIA of Associated Facility

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF POWER, ENERGY & MINERAL RESOURCES

POWER GRID COMPANY OF BANGLADESH LTD. (PGCB)

Report on

Environmental Impact Assessment (EIA)

for

ASHUGANJ – BHULTA 400 kV TRANSMISSION LINE PROJECT

Dhaka

May 29, 2014

Submitted by

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GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

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REPORT
ON
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

FOR

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Acknowledgements

The Centre for Environmental and Geographic Information Services (CEGIS), a Public Trust under the Ministry of Water Resources, Government of Bangladesh has been entrusted with the responsibility of conducting Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Studies for the "Ashuganj – Bhulta 400 kV Transmission Line Project" of the Power Grid Company of Bangladesh (PGCB) Limited. CEGIS expresses its gratitude to the PGCB Authority for entrusting CEGIS for the IEE and EIA studies. CEGIS is grateful to Masum-Al-Beruni, Managing Director, PGCB for giving it the scope to work with PGCB. CEGIS is also grateful to Engr. Chowdhury Alamgir Hossain, Executive Director (P&D), PGCB for his cordial cooperation for the study from very beginning. CEGIS is furthermore grateful to Engr. Kazi Ahsan Shafiq, Chief Engineer (P&D), and Engr. Farid Uddin Ahmed, Chief Engineer (Projects) in this regard. CEGIS gives special thanks to Engr. Md. Shafiqur Rahman the Superintending Engineer and Project Director (Addl. Charge) of Ashuganj – Bhulta 400 kV Transmission Line Project for coordinating the EIA study with due responsibility and diligence. The contributions of Engr. Bijoy Kumar Das, Executive Engineer (Addl. Charge), Engr. Md. Mamun Hasan, Executive Engineer, Kulaura-Sherpur Project of the PGCB are gratefully acknowledged in this regard.

Members of the EIA Team were impressed with the spontaneous response received from local people in providing data and information. Their contribution is also gratefully recognized by CEGIS. Special gratitude is expressed to the local people who had given their valuable time to respond to the EIA team during the different surveys, discussions and consultation meetings.

We also express our gratitude and thanks to the officials of Ashuganj Power Company Ltd. for their kind co-operation.

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Abbreviations

ARIPO	Acquisition and Requisition of Immovable Property Ordinance
AEZ	Agro-Ecological Zone
APCL	Ashuganj Power Company Limited
AP	Angle Point
BBS	Bangladesh Bureau of Statistics
BFD	Bangladesh Forest Department
BFIDC	Bangladesh Forest Industries Development Corporation
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BOOT	Build Own Operate and Transfer
BWDB	Bangladesh Water Development Board
CCPP	Combined Cycle Power Plant
CEGIS	Center for Environmental and Geographic Information Services
CITES	Convention on International Trade in endangered species
DEPC	Department of Environmental Pollution Control
DG	Director General
DIA	Direct Impact Area
DoE	Department of Environment
DoF	Department of Fisheries
DPP	Development Project Proforma
ECA	Environment Conservation Act
ECNEC	Executive Committee of the National Economic Council
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EQS	Environment Quality Standards
FAO	Food and Agricultural Organization
FWIP	Future- with- Project
FWOP	Future- without- Project
GIA	General Impact Area
GIS	Geographic Information Services
GoB	Government of Bangladesh
GO	Government Organization
GTCL	Gas Transmission Company Limited
HES	Health Environment and Safety
HH	Household
HYV	High Yielding Variety
IEC	Important Environnemental Component
IEE	Initial Environnemental Examination
IESC	Important Environmental and Social Component
IoL	Inventory of Losses
IUCN	International Union for Conservation for Nature
LLP	Low Lift Pump

kV	kilo Volt
MoEF	Ministry of Environment and Forest
MW	Mega Watt
NCA	Net Cultivated Area
NCS	National Conservation Strategy
NEMAP	National Environmental Management Action Plan
NGO	Non- Governmental Organization
NOC	No Objection Certificate
NWRD	National Water Resource Database
OMS	Operation Management System
PAPs	Project Affected Persons
PD	Project Director
PCP	Project Concept Paper
PPE	Personnel Protective Equipment
PGCB	Power Grid Company Bangladesh Ltd.
RAP	Resettlement Action Plan
RCC	Reinforced Cement Concrete
RoW	Right of Way
RS	Remote Sensing
SRDI	Soil Research Development Institute
TL	Transmission Lines
UNCED	United Nations Conference on Environment and Development
WARPO	Water Resources Planning Organization
WTO	World Trade Organization

Executive Summary

Background of the Project

The Power Grid Company of Bangladesh Ltd. (PGCB) is planning to supply more electricity to Dhaka city area from the upcoming Power Plants in Ashuganj area to fulfil increasing future demand. The PGCB has planned to construct a double circuit power transmission line from Ashuganj to Bhulta and has accordingly developed a project named "Ashuganj–Bhulta 400 kV Transmission Line and 400/230 kV Substation at Bhulta Project" for implementation.

Objectives of the Project

The main objective of the Ashuganj-Bhulta 400 kV T/L Project is to supply electricity from the upcoming Power Plants in Ashuganj area to Dhaka city via Bhulta area for increasing reliability of power supply of this Mega City. The specific objectives are:

I. To evacuate power to be generated in the upcoming 2X450 MW Combined Cycle Power Plant (CCPP) at Ashuganj and deliver power to the load centre (Dhaka);

II. To supply more power through the Rampura 230/132 kV Sub-Station to meet the rapidly growing demand of the eastern region of Dhaka City; and

III. To create power evacuation facilities for the future generating plants at Ashuganj.

Scope of work of the Project

The scope of the A-B 400 kV T/L Project is:

I. Construction of Ashuganj to Bhulta 400kV Double Circuit T/L of around 70 km.; and

II. Construction of a 400/230kV, 3X520MVA Sub-Station at Bhulta.

Physical Components of the Project

The major components of the Project are as follows:

I. Construction of 70 km 400 kV Double Circuit Transmission Line from Ashuganj to Bhulta,

II. Construction of a 400/230kV, 3X520MVA Sub-Station at Bhulta on 40 acre of privately owned land,

III. In-out of Ghorashal-Rampura 230kV line to Bhulta 400/230 kV Sub-Station, and

IV. In-out of Haripur-Rampura 230kV line to Bhulta 400/230 kV Sub-Station.

Study Area

The proposed Project is located in Dhaka and Chittagong administrative divisions of Bangladesh. The power transmission line will start from Ashuganj (Brahmanbaria district, Chittagong division) and end at Bhulta (Rupganj upazila of Narayanganj district, Dhaka

division). This line will cross Narsingdi Sadar upazila of Narsingdi district; Araihazar, Rupganj and Sonargaon upazilas of Narayanganj district; and Ashuganj, Brahmanbaria Sadar, Nabinagar and Banchharampur upazilas of Brahmanbaria district.

In selecting the best alternative route for the transmission line 'option-4' has been finalised by analyzing the latest RS images and by considering the least impact to the socio-economic features and settlements.

Environmental and Socio-Economic Baseline

The gross area of the Project is 704 ha. The RoW crosses the Meghna River, the Titas River and a minor river named Pagla. About 55% of the study area is covered by F_2 type land. The prominent cropping pattern of the study area is Fallow-T Aman-HYV Boro which is practiced on 46.4% of the Net Cultivable Area (NCA). In terms of total annual cropped area, rice covers 89.5% and non-rice crops cover 10.5% area. Total crop production is 4,595 tons of which cleaned rice is 3,221 tons and non-rice is 1,374 tons. The fisheries resource of the study area is rich and diversified with mainly fresh water fish habitats comprising of capture and culture types. The estimated total capture fish habitat area is 150 ha while culture fish habitat area is 2 ha in the study area. The estimated total fish production is 37 ton, of which 34 tons comes from capture fisheries and 3 tons from culture fisheries.

The proposed 400 kV transmission lines pass through different ecosystems such as paddy fields, homesteads, road-side vegetation and aquatic ecosystems. The study area falls under four bio-ecological zones of (i) Brahmaputra-Jamuna Floodplain, (ii) Major Rivers, (iii) Haor Basin and (iv) Meghna Floodplain.

The total population of the study area is 560,437 of which 278,616 are male and 281,821 are female. The household number in total is 114,002 and on average each households have 5 members. The literacy rate is about 48%. Considering the total population, household work is the main occupation (40%) followed by agricultural work (14%) and business (5%). In terms of economic return, a significant percentage (24%) of the population has no work in the study area. The EIA Team identified that 312 households are located within the project Right of Way (RoW) of which 208 falls on the left side (40m) and 55 falls on the right side (40m) of the General Impact Area (GIA) and 49 falls in the middle of the Direct Impact Area (DIA). About 57% of the house structures are made of tin, while 35% are semi-pucca houses. The study households mainly use tube well water (93%) for drinking purposes. Use of sanitary latrine is 70% of which 21% are water-sealed and 49% are non water-sealed.

Impacts of the Project

The EIA study has identified that the proposed Project will have some impact on almost all of the resources in both positive and negative ways. The projected adverse impacts on the physical, agricultural and fisheries resources will be insignificant, but the impacts will be significant to some extent on the social and ecological resources. The damages to plants at the proposed tower and substation sites will have some negative impacts. On the other hand, the households that will be affected due to land acquisition may be directly impacted, which is important for the Project.

Environmental Management Plan (EMP)

The Project is not likely to have any significant negative impact. Therefore, no major mitigation measures would be required. The minor impacts are within the allowable and tolerable limits of the local people. All the direct impacts would be overcome by paying necessary compensation to the Project Affected Persons (PAPs) for land, structures and

trees. The recommended mitigation measures are expected to bring back the affected social, ecological and agricultural resources to their original form through implementation of the proposed EMP. The proposed Project will have no residual adverse impact on the environment or the eco-system.

Compensation Plan

Compensation should be given to the legal owners for land, and structures including houses as well as the cultivators of crops and owners of trees falling within the RoW of tower sites and substation site. In this regard, separate Inventory of Losses (IoL) survey needs to be prepared for assessing compensation to be made by the Ashuganj-Bhulta 400 kV T/L Project Authority of PGCB.

Monitoring Plan

The monitoring plan, if properly implemented during pre-construction, construction and post-construction and/or operation phases, will ensure that corrective measures are taken.

Budget for the Environmental Management Plan (EMP)

For implementing the Environmental Management Plan (EMP), it is estimated that about **Tk. 330 lakh** will be required. The cost for preparation of Resettlement Action Plan (RAP) under the EMP Tk. 80 lakh for Bhulta Substation and implementation of the RAP Tk. 120 lakh are included with the EMP cost. This cost might change subject to recommendations of proposed RAP Study to be conducted under the Project Authority. The cost for monitoring plan is included in the EMP.

Public Consultation

The local stakeholders all along the route of the transmission line expressed interest in the Project even after recognizing the fact that they will not get electricity directly from the transmission line. Local people along the transmission line will be benefited, as the Project will also generate some employment opportunities for them during the pre-construction and construction phases. However, their main interest is that the overall development of the power sector would contribute to national development.

Recommendations

The EIA study reveals that the Ashuganj – Bhulta 400 kV Double Circuit Transmission Line and 400/230 kV Substation at Bhulta Project will have no major negative impact, but will contribute to the overall national development by improving the transmission of electricity. The EIA study team as well as the local stakeholders came up with some recommendations for the Project proponents, as narrated in the following:

- Necessary assessment of land acquisition and compensation needs to be done before implementing the Project;
- All the PAPs should be compensated properly for their land, structures and trees;
- The compensation money should not be given through the Union Parishad or Upazila Parishad, but through cheque to the PAPs' bank account;
- The contractor should be specifically instructed to employ local laborers as much as possible;
- Efforts should be made to avoid cutting of trees as much as possible;
- Clearing of vegetation and cutting of trees at the pre-construction and construction phases should be supplemented by appropriate mitigation measures;

- Cutting of some trees might be unavoidable in which case more number of trees should be replanted in surrounding areas for conservation of biodiversity. In this case, homestead gardening with fruit and rapid growing timber trees will be emphasized;
- Selection of season for carrying out the work should be synchronized with the cropping season so that there is minimum damage on standing crops;
- Proper compensation for all types of damages must be paid and the land should be brought back to its original form before being handed back to the owners;
- The constructed labor camps should be provided with proper ventilation, water supply and sanitation facilities. The workers should be apprised of the required hygienic practices;
- The transportation of heavy equipment should be done by avoiding agricultural land and using water ways as and where possible;
- The stores and equipment yards should be properly guarded so that all equipment remain safe; and
- The substation should be fully equipped with firefighting equipment.

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 Environmental Clearance to proceed with the works immediately.

1. Introduction

1.1 Background of the Study

The demand for electricity is growing very quickly throughout the country for meeting industrial and household requirements. To cope with this high demand for power, new power plants are planned to be installed by the Government of Bangladesh (GoB) for generating more electricity. The generated power requires sufficient transmission facilities for evacuation as well as for linking the existing and future power plants. Dhaka being a mega city has a faster growing demand for power than elsewhere due to its rapid urbanisation and industrialisation process. The Power Grid Company of Bangladesh Ltd. (PGCB), therefore, is planning to supply more electricity to Dhaka City area from the upcoming Power Plants in Ashuganj area to fulfil the future demand. The PGCB has planned to construct a 400 kV power transmission line from Ashuganj to Bhulta and accordingly developed a Project named "Ashuganj – Bhulta 400 kV Transmission Line Project" for implementation.

Within the scope of the Project a 400 kV Double Circuit Power Transmission Line (T/L) from Ashuganj to Bhulta (located under Rupganj upazila of Narayanganj district) will be constructed. The proposed double circuit T/L will be used to transmit power from Ashuganj to Bhulta area as well as from Bhulta to Ashuganj area. In addition to the line, one 400/230kV, 3X520MVA Sub-Station will be constructed at Bhulta, where around 40 acres of land will need to be acquired from the private land owners. The Project will be implemented on Build Own Operate and Transfer (BOOT) basis.

According to the 'Environment Conservation Act 1995', 'Environment Conservation Rules 1997' and their amendments, the proposed Project falls under the 'red category' of projects, which requires both Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA). Therefore, the PGCB is mandated to conduct IEE and EIA studies with the help of capable consultants. In order to meet the legal obligation, the PGCB has to prepare the IEE Report for obtaining 'site clearance' and thereafter, the EIA Report for obtaining 'environmental clearance' from the Department of Environment (DoE).

In this context, the Center for Environmental and Geographic Information Services (CEGIS), a Public Trust under the Ministry of Water Resources, experienced in environmental, social impact assessment and resettlement planning, has been assigned by the PGCB to provide consultancy services in preparing an 'Environmental Impact Assessment Report' for the proposed Ashuganj – Bhulta 400 kV Transmission Line Project.

1.2 Objectives of the Project

The main objective of the Ashuganj-Bhulta 400 kV T/L Project is to supply electricity from the upcoming Power Plants in Ashuganj area to Dhaka City via Bhulta area for increasing reliability of power supply to the Mega City. The specific objectives are:

i) To evacuate power to be generated in the upcoming 2X450 MW Combined Cycle Power Plant (CCPP) at Ashuganj and deliver power to the load centre (Dhaka);

ii) To supply more power through the Rampura 230/132 kV Sub-Station to meet the rapidly growing demand of the eastern region of Dhaka City; and

iii) To create power evacuation facilities for the future generating plants at Ashuganj.

1.3 Scope of work of the Project

The scope of the A-B 400 kV T/L Project is:

i) Construction of Ashuganj to Bhulta 400kV Double Circuit T/L of around 70 km.; and

ii) Construction of a 400/230kV, 3X520MVA Sub-Station at Bhulta.

1.4 Rationale of the Project

Considering the presence of the nodal point of natural gas distribution (by GTCL) and availability of gas with good pressure, a number of power plants are currently being implemented (e.g. 2X450 MW CCPP) as well as planned to be installed (223 MW CCPP) at Ashuganj by the Ashuganj Power Company Limited (APCL). It is a challenge to evacuate this huge amount of power in the future to areas where demand for power is growing rapidly. The demand from Dhaka city is increasing faster than other parts of the country, therefore, to feed the growing demand, necessary transmission line is required to be constructed between the generation and consumption points. After several case studies on load flow by the PGCB, it has been found that a dedicated double circuit 400 kV line from Ashuganj to Bhulta and a 400/230kV, 3X520MVA Sub-Station at Bhulta would be the best means of evacuating the upcoming power that would be generated at Ashuganj area. Therefore, construction of a new 400/230kV substation at Bhulta and a double circuit 400 kV T/L from Ashuganj to Bhulta has been planned to be implemented by the PGCB.

1.5 Objectives of the studies

The objectives of the studies have included the following:

i. To conduct an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) study for the Project; and

ii. To prepare an EIA Report and submit to the DoE for obtaining 'environmental clearance'.

1.6 Scope of the EIA Studies

The scopes of the EIA study are stated below:

a. Conduct an environmental baseline survey and select environmental and social components likely to be impacted by the Project;
b. Conduct detailed survey and impact analysis of specific environmental components (e.g. air, water, agriculture, plants, fisheries, socio-economic, etc.);
c. Conduct public consultation to obtain people's perceptions of the Project;
d. Prepare a detailed Environmental Management Plan (EMP);
e. Prepare an Environmental Impact Assessment (EIA) Report; and
f. Assist the client in presenting the EIA Report to the DoE for obtaining 'Environmental Clearance'.

1.7 Objectives of the EIA Study

In accordance with the 'DoE Guidelines for EIA of Industries, Power Plant and Electricity Distribution', the proposed project of construction or re-construction and/or extension work falls under the Red Category. The Red Category type of projects requires EIA

to be conducted preceded by IEE. As the proposed 'Ashuganj-Bhulta 400 kV T/L Project of PGCB' falls under the Red Category, it is required to undertake an EIA study for obtaining 'environmental clearance' from the DoE. The main objectives of the EIA study include:

i. To describe the existing environmental and social baseline of the proposed Project area;

ii. To identify important environmental and social components which may be impacted by the Project;

iii. To assess the potential environmental impacts, including any residual impacts of the proposed Project;

iv. To identify mitigation measures to minimize negative impacts;

v. To prepare an Environmental Management Plan (EMP) including a monitoring programme;

vi. To obtain 'environmental clearance' of the proposed Project by submitting the EIA Report to the DoE; and

1.8 Physical Components of the Project

The major components of the Project are as follows:

i. Construction of a 70 km 400 kV Double Circuit Transmission Line from Ashuganj to Bhulta,

ii. Construction of a 400/230kV, 3X520MVA Sub-Station at Bhulta on 40 acre of privately owned land,

iii. In-out of Ghorashal-Rampura 230kV line to Bhulta 400/230 kV Substation, and

iv. In-out of Haripur-Rampura 230kV line to Bhulta 400/230 kV Substation.

1.9 Study Area

The proposed project is located in Dhaka and Chittagong administrative divisions of Bangladesh. The power transmission line will start from Ashuganj (Brahmanbaria district) and end at Bhulta (Rupganj upazila of Narayanganj district). This line will cross Narsingdi Sadar upazila of Narsingdi district; Araihazar, Rupganj and Sonargaon upazilas of Narayanganj district; and Ashuganj, Brahmanbaria Sadar, Nabinagar and Banchharampur upazilas of Brahmanbaria district. **Table 1.1** presents the names of the districts, upazilas, unions and mouzas through which the transmission line will pass. The detailed locations of the EIA study areas are shown in **Map 1.1**.

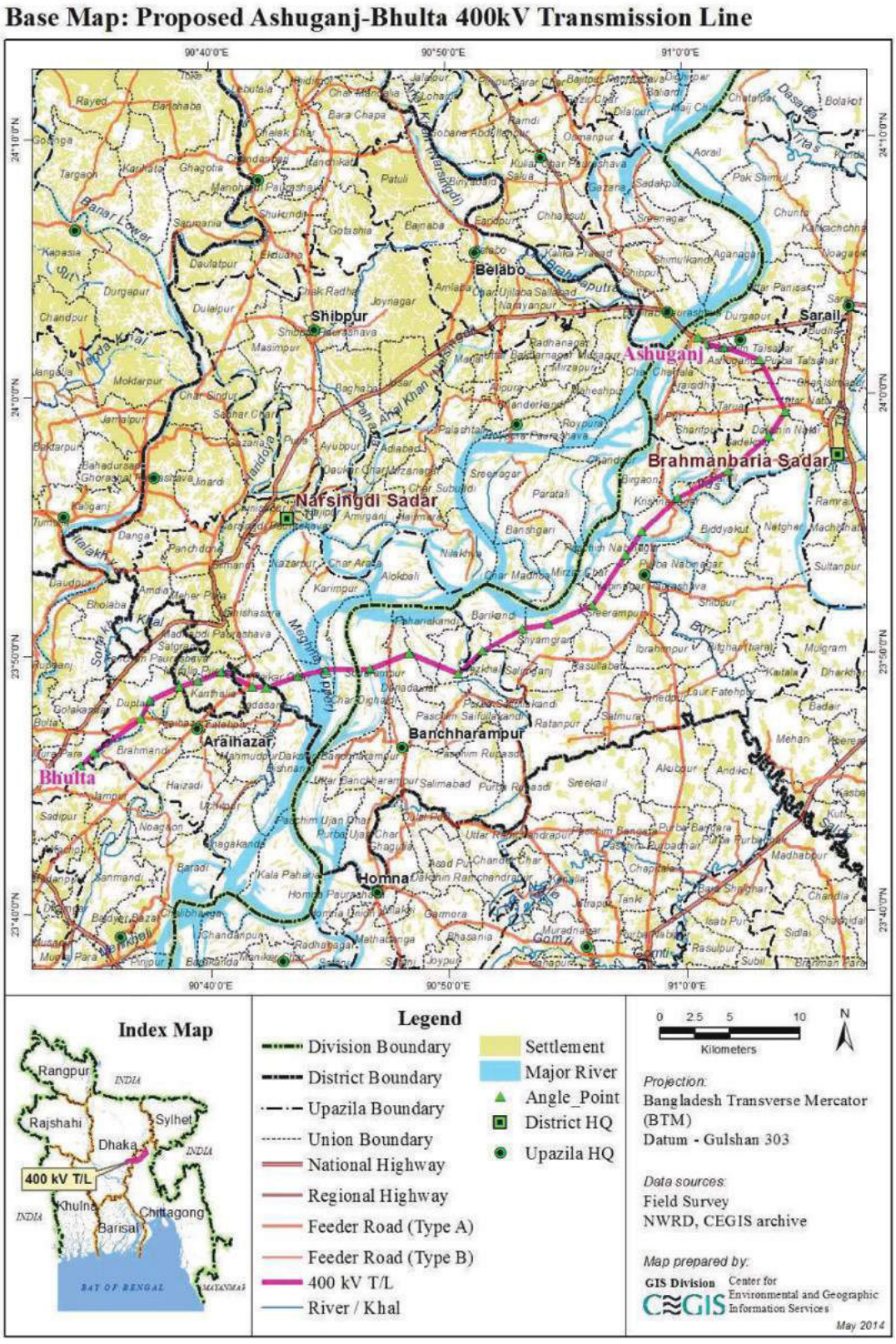
Table 1.1: Names of Administrative Areas within the RoW

Upazila and District	Union	Mauza
Narsingdi Sadar, Narsingdi	Karimpur	Char Line
	Char Dighaldi	Kholbandha
	Nurulla Pur	Algi (Kanda Para)
		Nurullahpur

Upazila and District	Union	Mauza
	Paikar Char	Bara Khamar Char
		Nareshwardi
		Paikar Char
		Char Bhasania
		Khadimer Char
		Baniar Char
	Kanthalia	Daukandi
		Bara Maishadi
		Rahimdi
		Dogharia (Fazurkandi)
Araihazar, Narayanganj	Sadasardi	Nagardaukadi
	Duptara	Panchgaon
		Duptara
		Satyabhandi
	Sadasardi	Pathanerkandi
		Lakshmibardi
	Araihazar	Kamrangir Char
	Brahmandi	Binair Char
		Bhati Gobindi
Rupganj, Narayanganj	Golakandail	Darikandi
		Darikandi Chak
		Chhota Darikandi
		Datterkandi
		Gabtali Hat
Sonargaon, Narayanganj	Jampur	Kahena
Ashuganj, Brahmanbaria	Ashuganj	Sonarampur
		Jatrapur
		Baratala
		Baikunthapur
	Paschim Talsahar	Talsahar
		Andidil
Brahmanbaria Sadar, Brahmanbaria	Purba Talsahar	Poothai
	Uttar Natai	Chhota Brahmanbaria
		Bhultara
	Dakshin Natai	Harankhola
		Narasingheswar
	Sadekpur	Damchail (Alakpur)
		Chilokut
		Sadekpur

Upazila and District	Union	Mauza
Nabinagar, Brahmanbaria	Barail	Barail
		Jalsuka
		Gonsaipur
		Char Gonsaipur
		Radhanagar
	Krishnanagar	Krishnanagar
		Dakshin Lakshmipur
		Ashrafpur
		Sitarampur
		Daulatpur
	Paschim Nabinagar	Fatehpur
	Paurashava	Alamnagar
	Sreerampur	Gopalpur
	Shyamgram	Nasirabad
	Barikandi	Jafrabad
	Shyamgram	Sahabazpur
		Sreeghar
	Salimganj	Barail
		Nilakhi
	Barikandi	Thollakandi
Banchharampur, Brahmanbaria	Dariadaulat	Daria Daulat
	Tezkhali	Akanagar
		Bishnurampur
	Pahariakandi	Pahariakandi
	Sonarampur	Char Dariadaulat (D. Rampur)
		Sonarampur
		Char Seaton

Source: GIS Database, CEGIS, 2013



Map 1.1: Base map of proposed Ashuganj – Bhulta 400 kV T/L Line Project

The transmission line has avoided major settlement areas and passes mostly over agricultural and fallow lands. A 100 meter wide Right of Way (RoW) covering a 40 meter buffer impact zone on each side (40m+40m) and 20 meter at the middle between the buffer zones have been defined as the General Impact Area (GIA), while the 20 meter at the middle of GIA has been defined as the Direct Impact Area (DIA) for the Project. In order to carry out the EIA study DIA have been evaluated in detail.

1.10 The EIA Study Team

The multi-disciplinary team comprising the following professionals conducted the EIA study.

Mr. Mujibul Huq, Environment Expert, Study Team Leader

Dr. Ahmadul Hassan, Water Resource Expert

Mr. Subrata Kumar Mondal, Socio- Economist

Mr. Quamruzaman, Ecologist

Mr. Shibly Sadik, Environmental Law Specialist

Mr. Hasan Tawfic Imam, Geologist/ Remote Sensing Specialist

Md. Sadiqur Rahman, Agronomist

Mr. Mobasher Bin Ansari, Junior Anthropologist

Mr. Md. Jafrul Alam, Junior Engineer

Mr. Shafiqul Islam, Junior Sociologist

Mr. Uzzal Kumar Saha, Junior Ecologist

In addition to the above, a number of professionals with multidisciplinary backgrounds helped the team in preparing the EIA Report. The additional professionals were:

Dr. Anil Chandra Aich, Agronomist

Mr. Ashok Kumar Das, Fishery Biologist

Mr. A T M Shamsul Alam, Sociologist

Dr. Ashraful Alam, Environmentalist

Mr. Md. Sharif Hossain Sourav, Ecologist

Mr. Md. Mosleh Uddin, Junior Agronomist

Mr. Fahad Khan Khadim, Junior Water Resources Engineer

Mr. Shafiul Alam, GIS/RS Technologist

Mr. Minhazur Rahman, Junior Sociologist

1.11 Structure of the Report

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

Chapter 1: Introduction: The introduction chapter presents a brief overview of the assignment along with its background, project objectives, study objectives, scope of work, study team and structures of reports etc.

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

Chapter 3: Approach and Methodology: Chapter Three describes the methodology of the conducting EIA study including EIA process, scooping, bounding, impact analysis, EMP and EMP cost estimation.

Chapter 4: Description of the Project: Chapter four describes the proposed interventions and activities of the project, background, project category, need for the project, location, size and magnitude of operation.

Chapter 5: Alternative Route Selection: Chapter Five presents the description of the alternatives sites and suitability analysis considering ownership and resentments issues of the proposed sites for selecting best route.

Chapter 6: Environmental and Social Baseline: Chapter Six presents the description of the environmental and social baseline situation of the project area.

Chapter 7: Public Consultation: Chapter Seven presents the public perceptions about the proposed project and their suggestions.

Chapter 7*: Important Environmental Social Components*: This chapter deals with the important IESCs and its rationales of the proposed project sites.

Chapter 8*: *Impact Assessment: This chapter deals with the environmental impacts of the proposed project and possible mitigation measures.

Chapter 9: Environmental Management Plan: The chapter mainly deals with the environmental management plan, which includes an implementation plan of mitigation measures and environmental monitoring program of the project. The EMP also includes specific compensation, monitoring and enhancement plan.

Chapter 10: Public Consultations: Chapter Ten presents the public perceptions about the proposed project and their suggestions.

Chapter 11: Conclusions and Recommendations: This chapter presents the findings, conclusion, and recommendations of the EIA study.

2. Policy and Legislations

2.1 Overview

Construction of the proposed transmission line and a substation under the Ashuganj-Bhulta 400 kV Double Circuit T/L Project to be implemented by the PGCB requires strict compliance with laws, rules and regulations pertinent to the environment. The Department of Environment (DoE) of the GoB is responsible for ensuring the application of environmental laws and issuance of necessary clearances for the proposed projects.

The procedures and requirements for Environmental Impact Assessment (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 under environmental legislation from the DoE.

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 Initial Environmental Examination (IEE) followed by a full EIA. Subject to a satisfactory review of the environmental assessment, the DoE issues an authorisation for the project to proceed further. The authorisation 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.

The PGCB, as project proponent, is responsible for carrying out IEE and EIA studies of the proposed Ashuganj-Bhulta 400 kV Double Circuit T/L Project. Therefore, it has the responsibility for administering necessary environmental assessment by engaging competent Consultants, review the findings, and submit the reports/documents to the DoE for their review for providing clearance.

A key requirement is to prepare an Environment Management Plan (EMP) within the IEE/EIA process for the projects classified in the Amber and Red categories. The function of the EMP is to enable the project proponent 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 the organisation 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.

Possession of "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 Initial Environmental Examination (IEE) Report

All industries and projects fall within the Red Category have to conduct IEE, which help the project proponent 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 IEE are:

i. Collection of baseline information in respect of the Project and the environmental setting of the project area and specific sites.

ii. Setting of boundaries of the IEE by identifying the significant issues.

iii. Impact assessment suggesting an Environment Management Plan (EMP), alternative sites or other project modifications, if any.

iv. In the event of IEE for the project or industry reveals that further investigation is to be carried out, therefore, the sponsors will have to conduct a detailed EIA.

2.2.2 Procedure for Obtaining Clearance

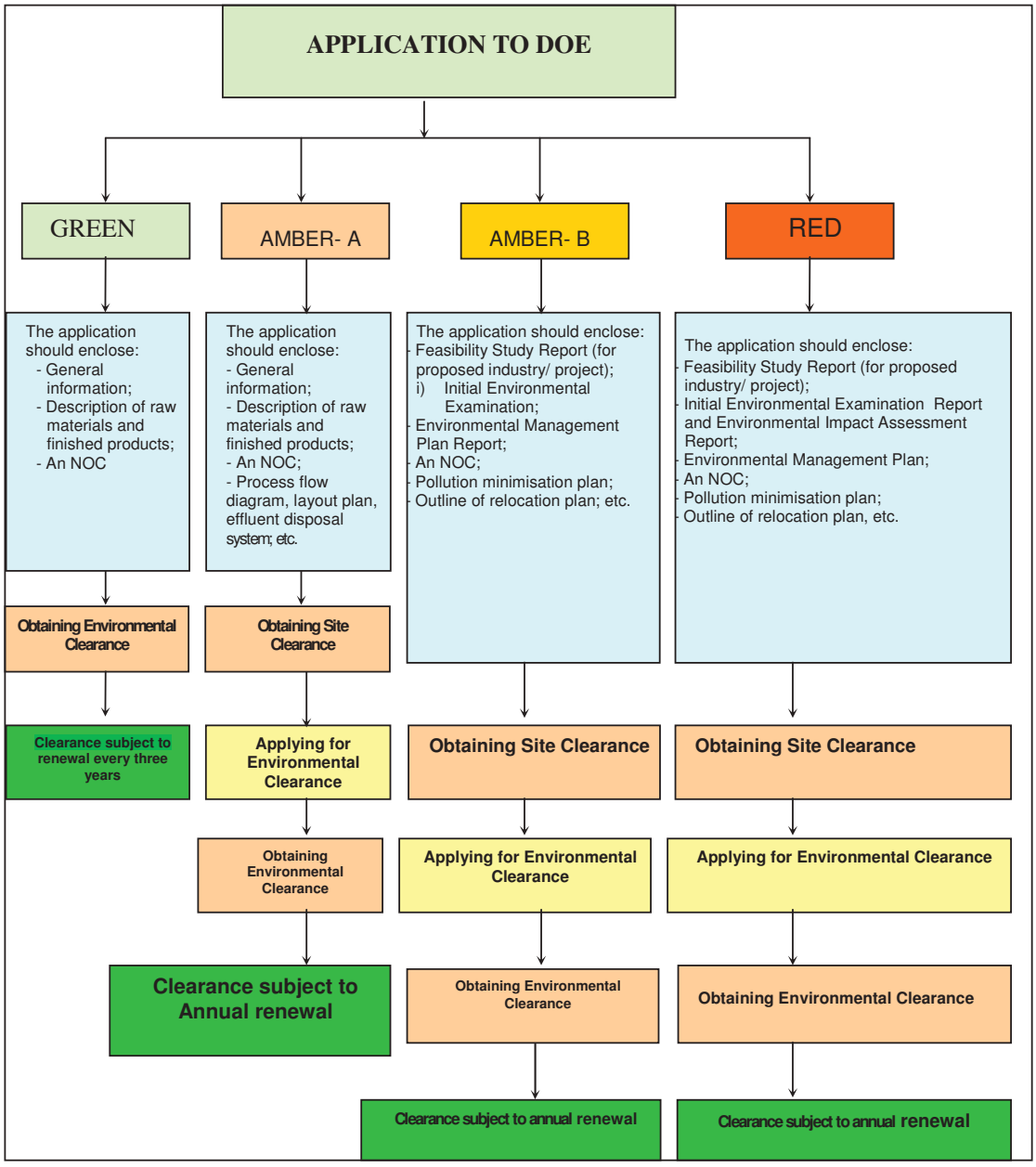
After completion of the IEE/EIA report the project proponent should apply to the DoE in the prescribed format for site/environmental clearance. The application for the site/environmental clearance for a project classified in the 'Red' category should be accompanied by the following documents:

I. For 'site clearance'
   a. Development Project Proforma (DPP);
   b. IEE Report;
   c. Detail Project Map;
   d. ToR of the EIA Study; and
   e. Initial NOC (No Objection Certificate) from the local authorities.

II. For 'environmental clearance'
   a. Feasibility Study Report;
   b. EIA Report;
   c. An NOC from the specific local authorities concerned;
   d. Pollution minimization plan including emergency plan for the mitigation of adverse environmental impacts;
   e. Outline of relocation plans (where applicable); and
   f. Other information as deemed necessary.

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.

As the proposed construction of the 70 km transmission line and a substation 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.



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

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 30 days for Orange A and within 60 days for Orange B and Red Category Projects.

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

Figure 2.1: DoE Environmental Clearance Procedures

2.3 Organization Related with Enforcement of Environmental Standards

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)

The Ministry of Environment and Forest (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 (ECNEC). 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)
- Bangladesh Forest Department (BFD)
- Bangladesh Forest Industries Development Corporation (BFIDC)

Department of Environment (DoE)

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.

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

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.

Bangladesh Forest Department

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 Bangladesh Forest Department officers are also responsible for the protection of wildlife in the forests.

Related Other Organizations

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

- Ministry of Power, Energy & Mineral Resources: Power Division
- Ministry of Land: Land Reform and Land Acquisition Directorate
- Ministry of Water Resource: Bangladesh Water Development Board (BWDB)
- Ministry of Shipping: Bangladesh Inland Water Transport Authority (BIWTA)
- Ministry of Fisheries and Livestock: Department of Fisheries

2.4 National Policies and Legislation Relevant to Environment

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 (ECA), 1995
- The Environment Conservation Rules (ECR), 1997
- The ECR, 1997 were adopted under the provision of the ECA, 1995.

Other relevant laws related with the environment include:

2.4.1 Bangladesh Wildlife Preservation Order (1973; amended to Act, 1974)

The Bangladesh Wildlife (Preservation) Order of 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)

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

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 lay 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.

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.

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)

Part III Power to place Telegraph Lines and posts

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

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.

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)

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)

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

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 (1992)

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)

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.

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 Convention on Wetlands of International Importance, Ramsar (1971)

The convention on Wetlands of International Importance, especially waterfowl habitat, which 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'.

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.

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 UNs Convention on the Law of the Sea, Montego Bay (1982)

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

2.6.5 Others (Conventions and Agreements)

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 The Building Construction Act.1990 and Building Construction Rules, 1996

The Building Construction Act dates back to the early fifties of the last century. Documents however, indicate the existence of the Government Buildings Act, 1899, which 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. The B.C. Act 1952 was conceived to enforce the activities towards streamlining planned development and beautification programmes of the government.

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 (Ordinance 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 unauthorised construction or to remove such construction, the authorised officer is empowered through this amendment so that he/she can take necessary action in this respect without intervention of the court.

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.

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.

2.8 Land Acquisition Rules and Regulations:

The Acquisition and Requisition of Immovable Property Ordinance (ARIPO), 1982 (subsequent amendments of it up to 1994) is the principal legal instrument governing land acquisition in Bangladesh. The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, and houses); and (ii) any other damages caused by such acquisition. The Ordinance provides certain safeguards for the owners and has provision for payment of “fair value” for the property acquired. The Ordinance, however, does not cover project-affected persons without titles or ownership record, such as informal settler/squatters, occupiers, and informal tenants and lease-holders (without document) and does not ensure replacement value of the property acquired. The act has no provision of resettlement assistance and transitional allowances for restoration of livelihoods of the non-titled affected persons.

The rules under ARIPO, 1982 (Ordinance No. II of 1982) spell out the procedural details required for the acquisition of immovable properties in the following subheads:

a) Proceedings for acquisition;
b) Notices under section 3, 6, and 7;
c) Declaration of acquisition and possession;
d) Declaration of abatement and revocation of proceedings;
e) Transfer of acquired land;
f) Assessment of compensation and;
g) Unutilized acquired property.

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.

2.9 Rules and Policies in Related Fields

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
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.
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.
1983	Agricultural Pesticides (Amendment) Ordinance	Revised Agricultural Pesticides Ordinance.
1985	The Pesticide Rules	Pesticide sale, 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.

3. Approach and Methodology

3.1 Overall Approach

The process followed in conducting the Environmental Impact Assessment (EIA) study of the proposed 400 kV transmission lines is shown in **Figure 3.1**.

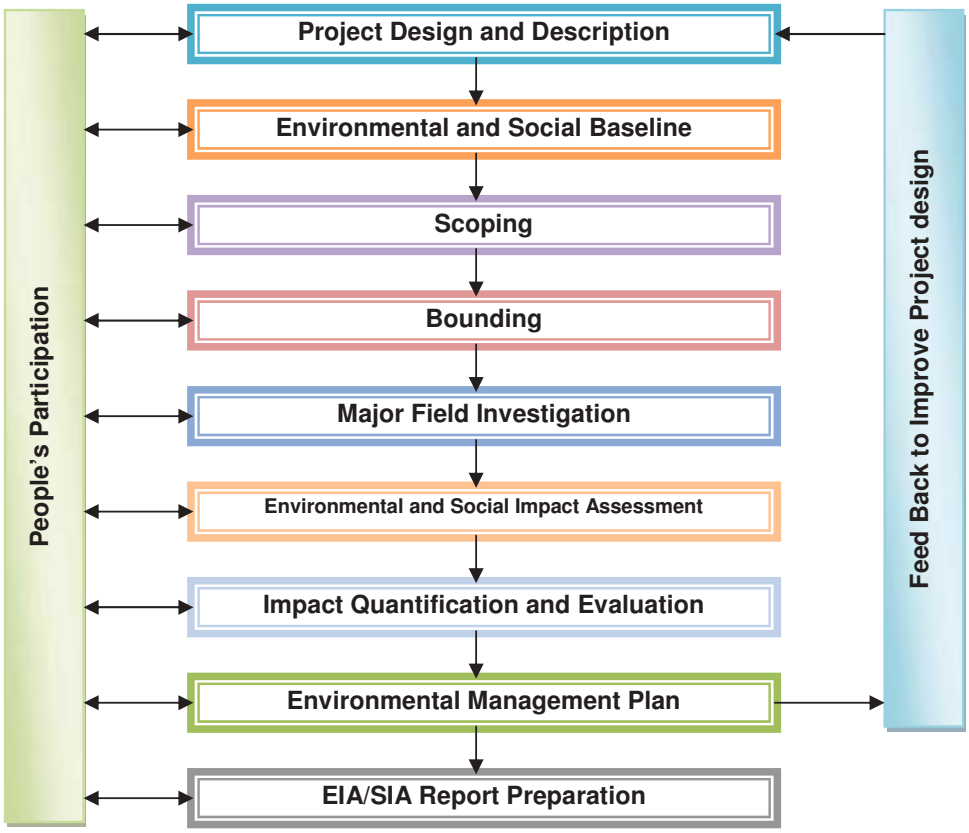


Figure 3.1: Process followed in the EIA study

3.2 Detailed Methodology

The methodology followed at each stage of the EIA study of the proposed transmission lines are briefly described below:

3.2.1 Project Design and Description

Detailed information on the proposed interventions of the proposed 400 kV transmission lines and the associated sub-stations were collected from the PGCB. The EIA team made reconnaissance field visits to these areas for obtaining first hand information on specific location where the Sub-stations would be established along with the alignment of the proposed transmission line with particular emphasis on the tower locations.

3.2.2 Environmental and Social Baseline

Field visits were made in the project area and later Rapid Rural Appraisals (RRA), Participatory Rural Appraisals (PRA), and Focus Group Discussions (FGD) were conducted. During the field visits, the multidisciplinary EIA team members made professional observations pertaining to their individual areas of expertise. The field teams used a structured questionnaire to record the information on different resources.

In order to generate qualitative and quantitative data and information, baseline surveys were carried out through applying different tools and techniques like RRA, FGDs and KII using appropriate instruments e.g. checklists and semi-structured formats.

Local knowledgeable persons including community representatives, traders, teachers, journalists and political leaders were interviewed individually.

All qualitative and quantitative data and information gathered from different surveys and secondary sources were used appropriately in preparing the environmental and socioeconomic baseline of the project and are presented in this report. All primary data and information contained in the report should be considered as expert estimations and opinions of local people and project stakeholders.

3.2.3 Scoping

A scoping process was followed for identifying Important Environmental and Social Components (IESCs), which are likely to be impacted by the 400 kV transmission lines. This was done in two stages. Individual professional EIA team members made a preliminary list of the components pertaining to their disciplines, which could be impacted by the project. The second stage included village-scoping sessions where stakeholder perceptions were obtained about the environmental and social components, which could be impacted by the project interventions. Professional judgment of the EIA team members as well the stakeholder opinions obtained in the village scoping sessions were considered in selecting the IESCs.

3.2.4 Bounding

The geographical boundary of the "General Impact Area - GIA" and the potential “Direct Impact Area - DIA” were delineated as a requirement of the environment assessment study. The GIA is the physical location of the proposed power transmission lines and sub-station of the project while the "DIA" covers the geographic extent of the environmental and socioeconomic impacts resulting from implementation of the proposed power transmission lines including pre-construction, construction and post-construction conditions. It is recognized that the benefits of the proposed 400 kV transmission lines will extend to the regional as well as national scale. For the EIA, the focus of the study was limited to areas where the impacts of the activity will be directly felt. A half km buffer along both sides of the power transmission lines and sub-stations sites were considered for environmental analysis. However, the major emphasis was given to the 40m RoW of the proposed transmission lines. A general socioeconomic profile was prepared for the administrative units over which the Power Transmission lines shall traverse.

3.2.5 Major Field Investigation

Data on the IESCs were collected through RRA, PRA, and informal discussion using checklists for water resource, agriculture, ecosystem and socio-economic components. Intensive consultation with the local people was carried out in each case for securing

people's participation. The multidisciplinary EIA team members also made professional observations during the field visits. This time the concentration was on the historical status of the IESCs and the possible condition of the same against the proposed interventions.

Information on individual households whose land and livelihood could be permanently or temporarily impacted was collected through a questionnaire survey which has developed and field-tested before conducting the actual survey.

3.2.6 Environmental and Social Impact Assessment

Environmental and social impacts of the proposed 400 kV transmission lines project on the IESCs was assessed through three different phases i.e. pre implementation, during implementation and post implementation phases were considered. In the post implementation phase or operation phase the Future-without-Project (FWOP) condition was generated through trend analysis and consultation with the local people. This reflected conditions of IESCs in the absence of the implementation plan. Changes expected to be brought about due to the proposed 400 kV transmission lines was assessed to generate the Future-with-Project and improvement (FWIP) condition. The difference between the FWOP and FWIP condition has been presented as the environmental and social impacts of the proposed transmission lines in operational phase. This included both positive and negative impacts which were considered in the preparation of the environmental management plan.

3.2.7 Impact Quantification and Evaluation

Attempts were made to quantify the impacts of the proposed 400 kV transmission lines project. But it was not possible to quantify all impacts, specially the impacts on some of the environmental and social components. In those cases, qualitative impacts were assessed and scores were assigned with (+) sign for positive impacts and (-) sign for negative impacts. Magnitudes of the impacts have been indicated in a scale of 1 to 10 for both positive and negative impacts.

3.2.8 Assessment Methodology

The assessment of effects and identification of residual impacts takes account of any incorporated mitigation measures adopted due to any potential impact of Project activities, and will be largely dependent on the extent and duration of change, the number of people or size of the resource affected and their sensitivity to the change. Potential impacts can be both negative and positive (beneficial), and the methodology defined below will be applied to define both beneficial and adverse potential impacts.

The criteria for determining significance are generally specific for each environmental and social aspect but generally the magnitude of each potential impact is defined along with the sensitivity of the receptor. Generic criteria for defining magnitude and sensitivity used for the Project are summarized below.

3.2.9 Magnitude

The assessment of magnitude has been undertaken in two steps. Firstly the key issues associated with the Project are categorized as beneficial or adverse. Secondly, potential impacts have been categorized as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the potential impact;
- Spatial extent of the potential impact;
- Reversibility;
- Likelihood; and
- Legal standards and established professional criteria.

The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in **Table 3.1**.

Table 3.1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Negligible/Nil
Duration of potential impact	Long term (more than 35 years)	Medium Term Lifespan of the project (5 to 15 years)	Less than project lifespan	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Baseline requires a year or so with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

3.2.10 Sensitivity

The sensitivity of a receptor has been determined based on review of the population (including proximity/numbers/vulnerability) and presence of features on the site or the surrounding area. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in **Table 3.2**.

Table 3.2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very High	Vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
High	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Medium	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low /Negligible	Vulnerable receptor with good capacity to absorb proposed changes or/and good opportunities for mitigation

3.2.11 Assigning Significance

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the potential impact significance matrix shown in **Table 3.3**.

Table 3.3: Assessment of Potential Impact Significance

Magnitude of Potential impact	**Sensitivity of Receptors**			
	Very High	**High**	**Medium**	**Low / Negligible**
Major	Critical	Major	Moderate	Negligible
Moderate	Major	Major	Moderate	Negligible
Minor	Moderate	Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

3.2.12 Mitigation Measures

Subsequent to the impact assessment discussed above, appropriate mitigation measures have been proposed to avoid, offset, mitigate/reduce, or compensate for the identified impacts. Generally, impacts having moderate to critical consequence significance per the Table 3.3 require appropriate avoidance/ mitigation/compensatory measures to reduce the significance. Impacts having low to negligible significance can be left alone not needing any mitigation measures.

Generally, preference is given to the avoidance of the impact with the help of options available for nature, sitting, timing, method/procedure, or scale of any Project activity. If avoidance is not possible, appropriate mitigation and control measures are proposed to reduce the consequence significance of the predicted impact. Finally, if impact reduction is not possible, compensatory measures are proposed.

3.2.13 Assessment of Residual Impact

The final step in the impact assessment process is determining the significance of the residual impacts, which essentially are the impacts which would be experienced even after implementing the mitigation/compensatory measures. Ideally, all of the residual impacts should be of negligible to low significance. For any residual impacts having moderate significance, monitoring mechanism is necessary to ensure that their significance does not increase. No residual impacts having major or critical significance are generally acceptable

3.2.14 Identification of Enhancement and Mitigation Measures

From literature survey, applying expert judgment and consultation with stakeholders, possible enhancement and mitigating measures were identified for beneficial and adverse effects respectively.

3.2.15 *Preparation of Environmental Management and Monitoring Plan*

An environmental management plan (EMP) for the proposed Project was prepared comprising the mitigation/ enhancement measures with institutional responsibilities, environmental monitoring plan, training and capacity building plan, and reporting and documentation protocols.

3.2.16 *EIA Report Preparation*

At the end of the study, the present report was prepared incorporating all the findings of the EIA.

4. Description of the Project

4.1 Introduction

It is evident that the demand of electric power in Dhaka City is growing faster in comparison with other parts of the country. Hence, it is a challenge to feed the demand of the city. Among the different locations of existing gas transmission systems, Ashuganj is considered to have some strategic importance. In recent years, several piping systems have been tied up at Ashuganj, especially the Bakharabad and GTCL installations, resulting in satisfactory gas pressure at the Ashuganj end. Bearing this, a program has been taken to install several new power plants at Ashuganj, such as the 223 MW combined cycle power plant and 2X450 MW combined cycle one. These proposed power plants are supposed to generate a substantial amount of power at Ashuganj and evacuating this amount to Dhaka City will not be possible with the existing transmission lines, especially considering the huge power carriage load which is to be generated due to the functioning of the proposed 2X450 MW combined cycle power plant. With this rationale PGCB has developed a project titled as "Ashuganj – Bhulta 400 kV Transmission Line and 400/230 kV Substation at Bhulta Project".

4.2 Project Component

A number of load flow studies have been carried out during the pre-feasibility stage of the project. The findings of these studies have revealed that the construction of a dedicated double circuit 400 kV line from Ashuganj to Bhulta and a 400/230 kV sub-station at Bhulta will be the best solution with optimal load flow. The scope of works to be carried out under the project mainly comprises the following two sets of activities:

a) 400 kV double-circuit three-phase transmission line on vertical formation double circuit lattice steel towers with 2 bundle ACSR (Finch) phase conductor and one ACSR (Dorking) earth wire and one equivalent OPGW from Ashuganj sub-station to 400/230 kV proposed Bhulta sub-station (approximate length: 70 km), and

b) Design, supply, delivery, installation, testing and commissioning of a new 400/230 kV Air Insulated Switchgear (AIS) sub-station. The configuration of the 400 kV and 230 kV bus-bars shall be 1 and ½ bus-bar scheme.

As the proposed transmission line will be required for evacuating power to be generated in the proposed 2X450 MW power plant (which is under construction by APCL in Ashuganj), the construction of the line would continue simultaneously with the construction works of the power plant.

The alignment of the proposed transmission line will pass through mainly agricultural and fallow lands avoiding major settlements. The alignment would cross the river Meghna at one location. The final alignment has been chosen among four alternative options, considering different technical as well as socio-economic factors.

4.3 Project Category

Under the criteria of the DoE the transmission line falls under Red Category that requires an Environmental Impact Assessment study. As per the EIA guidelines of the DoE, it is

mandatory to carry out an Initial Environmental Examination (IEE) for red category projects prior to conducting the EIA. Prior to EIA study, an IEE study for the proposed project has been carried and ToR for EIA study has been approved form the DoE. The EIA study should prepare a detailed environmental management and monitoring plan.

4.4 Project Location

The project area for the 'Ashuganj-Bhulta 400kV Transmission Line' has been developed considering 40 meter buffered distances on either side of the 70 km transmission line. The distance of 20 m between the two buffer zones therefore, results in a 100 meter wide boundary for the project area throughout its length. The project area for the environmental study has been estimated as 704 ha, which falls partly on both the Chittagong and Dhaka divisions, starting from the Ashuganj union of Ashuganj upazila at Brahmanbaria District (Chittagong Division) and ending at the Golakandail union (near Bhulta) at Rupganj Upazila, Narayanganj District (Dhaka Division) (**Table 1.1)**.

4.5 Physical Features of the Transmission Line and Sub-station

The major physical features of 400 kV transmission line and 400/230 kV sub-station is given in **Table 4.1** below. The transmission line will be double circuit and conductor materials will be ACSR Finch. The line supporting towers will be steel towers which are of two types– Tension and Suspension. Tension towers will be installed in angle points and suspension towers will be installed along the line as load bearing support. The average dimensions for base foundation of towers are considered as 15m x 15m (**Figure 4.1**). A disc type insulator will be used in the towers to bear the conductor.

Table 4.1: Physical Features of transmission line and substation

Sl. No.	Physical Features	Attribute
1	Voltage Rating for Transmission Line	400 kV
2	Voltage Rating for Substation	400/ 230 kV
3	Type of Transmission Line	Double Circuit
4	Width of T/L Right of Way	100 meters (40 m left + 20m DIA + 40 m right)
5	Type of Line Support	Steel lattice Towers
6	Conductor Material	ACSR Finch
7	Line Insulator	Disc type, Porcelain
8	Type of Connection	Approximately 36 months
9	Duration of Project Implementation	40 Acres
10	Land acquisition (for substation)	225 sqm
11	Average Area for Tower Foundations	400 kV
12	Funding Source	Public Private Partnership (PPP)

Source: PD, Ashuganj-Bhulta 400 kV project

Photo 4.1: Tower in the angle point

Photo 4.2 Suspension Tower.

4.6 Component of the Construction Works

The typical activities to be undertaken under the project are listed below:

- Construction of the 70 km 400 kV overhead transmission line
- Land acquisition (40 acre land will be required for sub-station site)
- 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
- Tower erection
- Conductor stringing
- Switchyard foundation of substation
- Equipment set up
- Equipment wiring

The proposed project has the following security measures:

a) Firefighting Equipment

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

b) First aid Materials

First aid boxes are to be kept at the installation.

c) Boundary Wall and Security

A boundary wall 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.

4.6.1 Civil Construction Works

a) Land development

Construction of the sub-station may need land development to raise the ground level up to required height by carrying earth by truck from nearby areas or by sand filling using dredgers.

b) Earth Work in Foundation

Construction of the sub-station needs earthwork for excavating the foundation up to the required depth. 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 local soil and sand.

c) Foundation Treatment

The foundation area will be investigated geo-technically. The test result will help in designing the foundations of the structures. 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.

d) RCC Work

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

Photo 4.3 Placing steel ring bunds

Photo 4.4: Welding of reinforcements

Photo 4.5 Striping the tower footing with steel

Photo 4.6 Providing detail reinforcements

Photo 4.7 Casting CC into tower foundation

Photo 4.8 Placing Tower on its foundation

e) Brick Work up to Plinth Level and Superstructure

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

f) *Back Filling with Local Sand*

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

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

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 of plastic painting will be done on the walls and roof of the building.

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

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

i) Sanitary Works

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

j) Water Supply System

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.

k) Boundary Fencing with Concrete Pillar and Barbed Wire

The project area will be protected from encroachment and unauthorized entrance of the public by fencing the boundary with a 8 to 10 feet high wall with barbed wire fitted with concrete pillars 3 meters apart.

4.6.2 Electrical Works

Installation of equipments will include transformers, circuit breakers, CTs, PTs, isolators, lightening arresters, panel boards, batteries and battery chargers etc. 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 material 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.

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.

a) Erection of Tower

The towers will be constructed to take the load of the tower, conductors, accessories as well as wind load and earthquake load. The towers in paddy fields will have proper clearance at the sag (lowest point on bottom conductor). At homesteads, if any, the sag will be above the canopy.

b) Stringing of Transmission Line

The transmission line will be strung keeping suitable clearance at all locations. The lowest sag point will be considered during stringing.

4.6.3 Testing and Commissioning of Equipment

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.

4.7 Construction Equipment

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.

4.8 Work Schedule

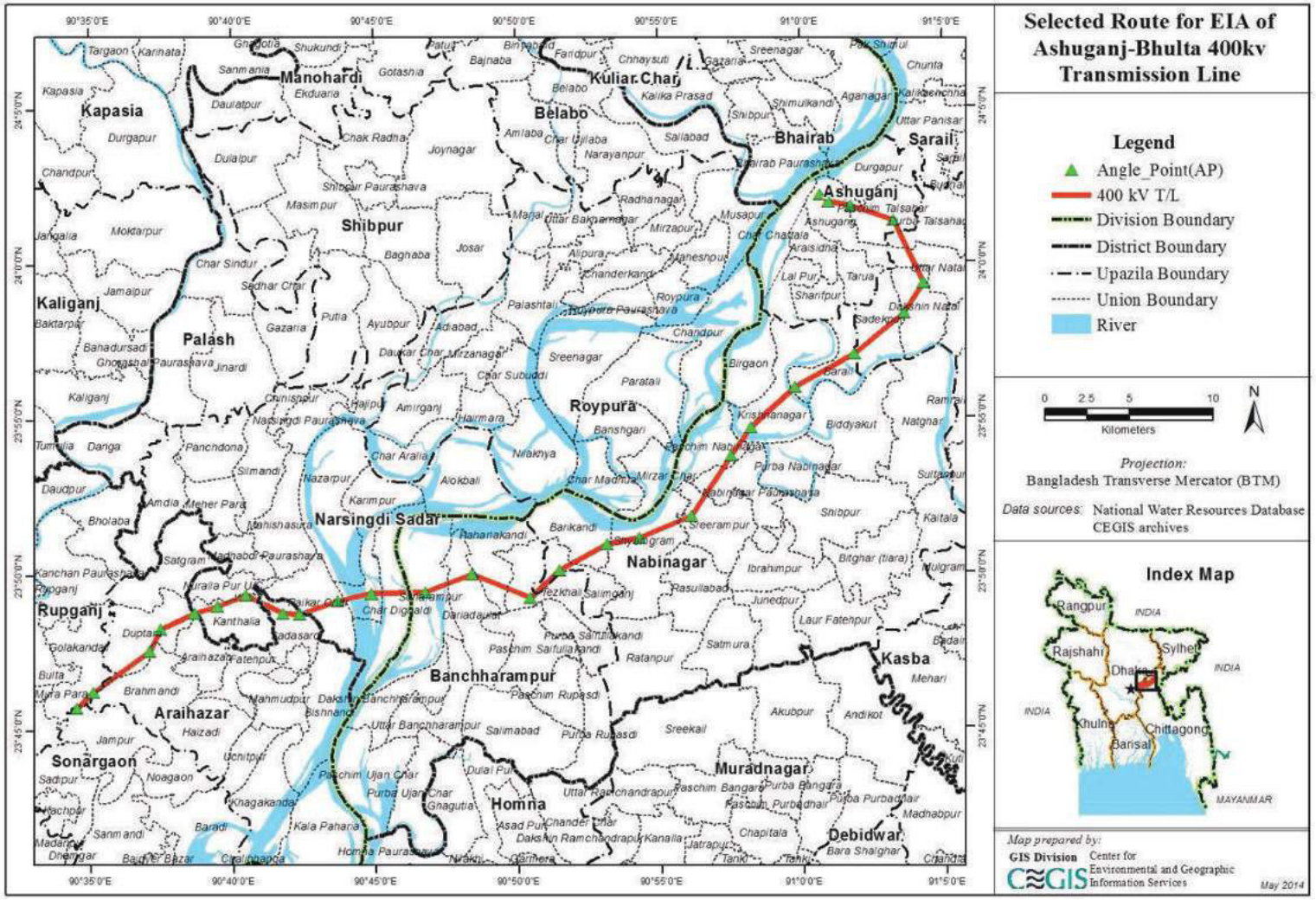
The completion of works will take approximately 36 months, starting from July, 2014 and ending on June, 2017.

5. Alternative Route Selection

5.1 Alignment Selection Factors

A number of factors are generally considered while selecting a final option from a set of alternatives, which are developed in different scenarios. In our study, the following criterion was considered as of having significant importance during the selection of the final alignment.

- Upcoming power plants near Ashuganj by 2015
- Power to be generated from the existing and upcoming power plants
- Upcoming transmission infrastructure around Ashuganj area by 2015
- Condition of existing substation at Ashuganj
- Capacity of existing transmission lines from Ashuganj
- Load Flow Study for different options.
- Best possible ways of power evacuation from Ashuganj
- Requirement of new transmission facilities for power evacuation.



Map 5.1: Selected Route for Construction of Ashuganj - Bhulta 400 kV T/L

5.2 Alternative Options

The load flow study was simulated using a total number of seven scenarios developed for the year 2015, to meet the national demand of 10300 MW (**Table 5.1**).

Table 5.1: Scenarios considered during the Load Flow study

Scenario	Consideration
1	The existing transmission facility is to be used for evacuating the upcoming 2X450 MW power without adding any new transmission infrastructure.
2, 3a and **3b**	For power evacuation, different new 230 kV transmission facilities will be built at 400 kV but energized at 230 kV
4	Considers different 400 kV transmission facilities for power evacuation.

Among the options listed in **Table 5.1**, "Scenario-4" is found to be the most suitable one (both technically and economically), and considering this as a 'base case' four more 'options' have been investigated in detail (**Table 5.2**).

Table 5.2: Options considered under 'Scenario-4'

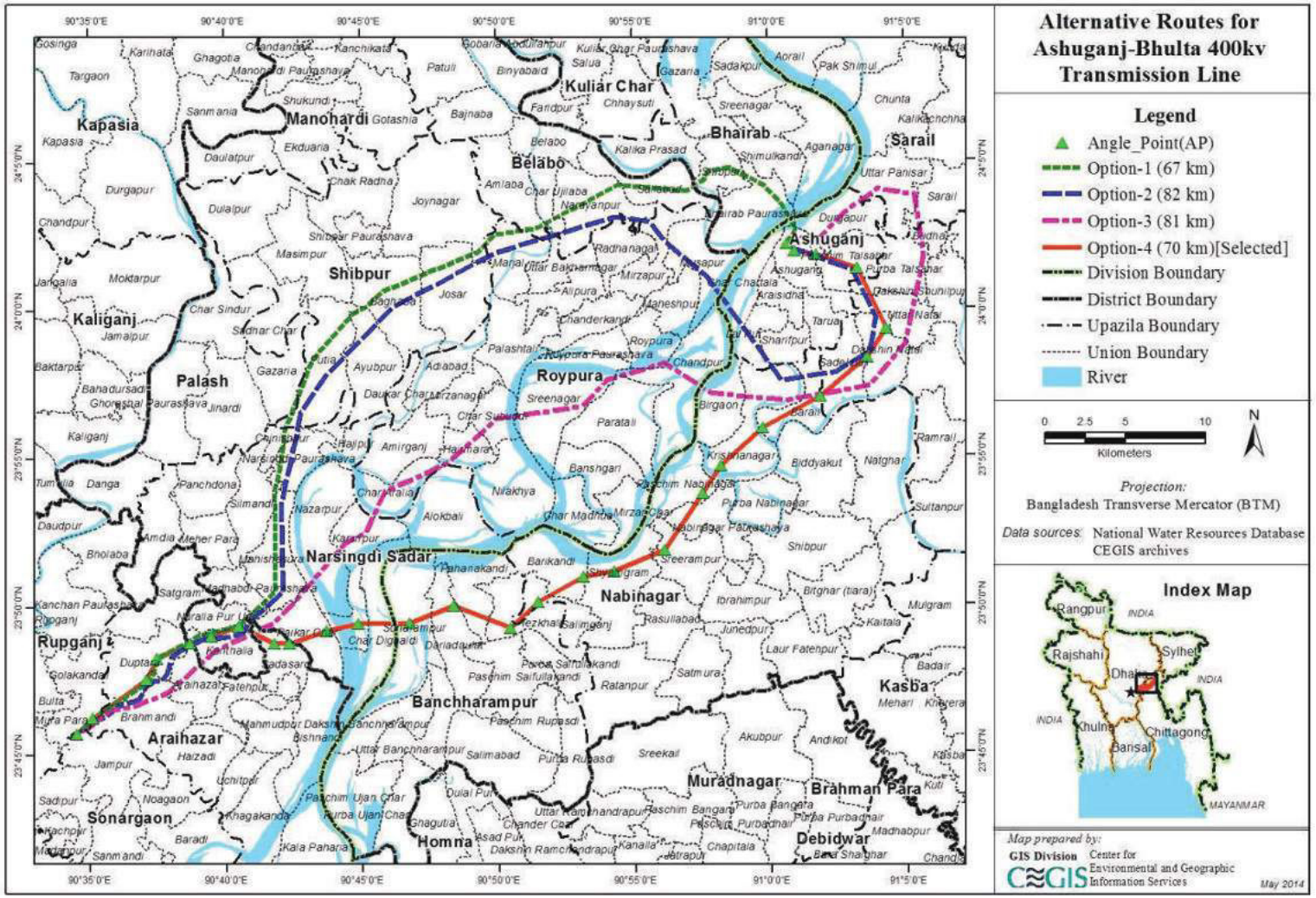
Option	Description
1	➔ 2X450 MW power from upcoming Ashuganj CCPP will be evacuated through a 400 kV double circuit Transmission Line from Ashuganj 400 kV substation to Bhulta 400/230 kV substation. ➔ The 230 kV Bus of Bhulta Substation will have an In-Out from Ghorashal-Rampura and Haripur-Rampura double circuit 230 kV lines. ➔ Rampura 230 kV Substation will have 4 nos. of 230 kV lines parallel from Bhulta 230 kV Bus. ➔ This facility will help to supply a bulk quantity of power (approximately 1200 MW) inside the city through Rampura substation.
2	➔ Ashuganj Power Station Company Ltd. (APSCL) will build 450 MW CCPP (North) by 2014. By this time 400 kV Ashuganj-Bhulta transmission line and Bhulta substation may not be possible to construct. ➔ Before the 400 kV system is commissioned, generated power will have to be evacuated through the existing 230 kV network, and for thus a 400/230 kV inter bus transformer can be installed under the scope of power plant project ➔ In scenario 4a1 and 4b1 full 2X450 MW power is considered to be evacuated rapidly to 400 kV Bhulta S/S and in scenario 4a2 and 4b2 the 400/230 kV Inter bus Transformer at Ashuganj is considered in operation. ➔ It appears that when some amount of power (143 MW in case of 4a2 and 122 MW in case of 4b2) flows from 400 kV to 230 kV bus of Ashuganj, it does not have much effect on the flow of 1st and 2nd EWI but a major portion of this power comes to Bhulta 230 kV bus through Ghorashal.
3	➔ APSCL is currently working on a 225 MW power plant which is planned to be connected at 132 kV bus of APSCL substation by decommissioning equal

Option	Description
	quantity of old power plants from the same bus. ➔ But at present due to the power shortage of the country APSCL is instructed to delay the decommissioning of older power plants. ➔ The 132 kV exits of Ashuganj substation in 2015 scenario is studied in details where the highly loaded Ashuganj-Ghorashal 132 kV line is observed. ➔ In scenario 4a1 and 4a2 the 225 MW plant is considered to be connected at 132 kV and in scenario 4b1 and 4b2 the 225 MW plant is considered to be connected at 230 kV bus. ➔ Scenario 4b1 and 4b2 is acceptable as the highly stressed 132 kV Ghorashal-Ashuganj Line is found to be reasonably loaded than in scenario 4a1 and 4a2.
4	➔ Since a number of new large power plants are going to be added at Ashuganj so the short circuit study has also been conducted as well. ➔ It is found that at 132 kV and 230 kV level maximum fault level will reach up to 40 kA, so the short circuit ratings of the existing equipments will have to be checked and replaced if needed. ➔ And also for selecting the new equipments the calculated short circuit level has to be taken into account.

Table 5.3 and **Map 5.2** below show the detail information for different alignment options. The 'option-4' has been finalized at last, predominantly because of the least impact it causes to settlements. The selection of best route was done through using the analysis of latest RS images and by considering the least impact to the socio-economic features and settlements.

Table 5.3: Information Matrix for suggested alternative alignment options

Alternatives	Total Length (km)	Settlement (ha)	Remarks
Option 1	67	264	Not Selected
Option 2	82	326	Not Selected
Option 3	81	177	Not Selected
Option 4	**70**	**97**	**Selected**



Map 5.2: Alternative Alignments considered for the Ashuganj – Bhulta 400 kV T/L

6. Environmental and Social Baseline

6.1 Project Bounding

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-station of the project while the Impact area covers the geographic extent of the environmental and socio-economic impacts resulting from implementation of the proposed power transmission line during pre-construction, construction and post-construction periods. It is recognized that the benefits of the proposed 70 km of 400 kV transmission line will extend to the regional as well as national scale. For the EIA of 400 kV T/L, 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 Direct Impact Area (DIA). A 40m buffer along both sides (i.e. 40m+40m=80m) of the power transmission line has been considered for environmental analysis as General Impact Area (GIA). So, for the EIA study total 100m RoW has considered for the baseline study area. A general socio-economic profile has been prepared for union-based administrative units over which the power transmission line shall traverse. The list of administrative area for the Project is shown in **Table 1.1**.

6.2 Physical Environment and Water

6.2.1 Climate

The projected area is located in a typical monsoon climate area within Bangladesh. It has three main seasons:

- Summer/pre-monsoon - March to May
- Rainy season/monsoon - June to October
- Winter season - November to February

The rainy season is hot and humid having about 80 percent of the annual rainfall. The winter is predominately cool and dry. The summer is hot and dry interrupted by occasional heavy rainfall. The Ashuganj-Bhulta 400 kV transmission line project lies in the South East and North Central hydrological regions of Bangladesh, where monsoon comes in the month of July and recedes in late October. The Bangladesh Meteorological Data (BMD) at Dhaka has been considered relevant for the meteorological analyses of rainfall, temperature, humidity, evaporation, wind speed and sunshine hours and as such meteorological information have been collected and summarized for the station from 1953 to 2008.

(a) Rainfall

The results of maximum and average monthly rainfall analyses are given in **Figure 6.1**. The pre-monsoon and monsoon periods undergo significant rainfall whereas the dry period experiences little or no rainfall.

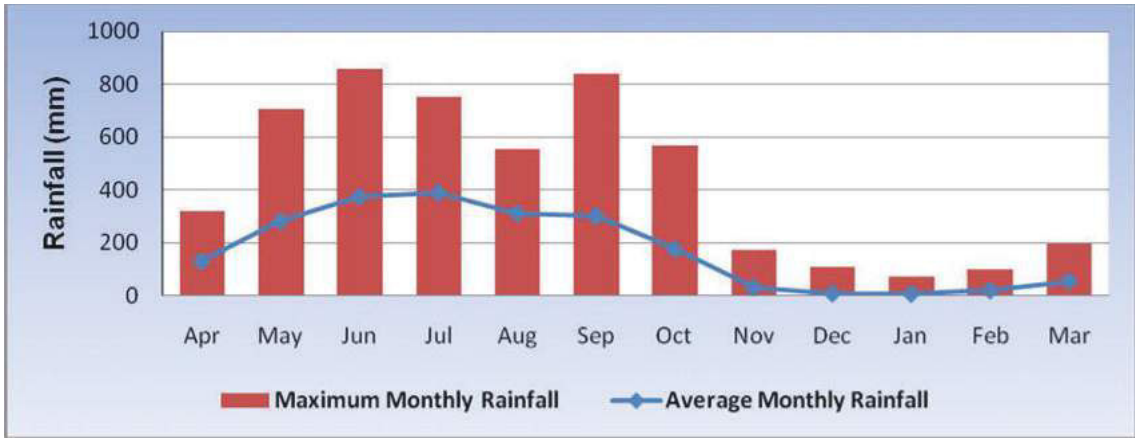


Figure 6.1: Maximum and Average monthly rainfall in Dhaka

(b) Temperature

The average values of maximum and minimum monthly temperature have also been studied for the Dhaka station (**Figure 6.2**). The warmest month is April, experiencing 34°C whereas January is the coolest month with around 12°C average temperature.

Figure 6.2: Average of maximum and minimum temperature in Dhaka

(c) Humidity

The range of average relative humidity is 62% to 85% (**Figure 6.3**). Humidity is highest during July-August (85%) and lowest in March (62%).

Figure 6.3: Monthly average humidity in Dhaka

(d) Evaporation

Mean evaporation rate varies within the range of 1.28 to 2.76 mm/day where the highest and lowest values are observed during the months of April and December. The results of mean monthly evaporation analysis are given in **Figure 6.4**.

Figure 6.4: Monthly average rate of evaporation in Dhaka

(e) Wind Speed

The monthly average wind speed in Dhaka region varies from 129 to 225 km/day. The variation of monthly average wind speed is shown **Figure 6.5** below. The figure shows that the average speed of wind is highest in April (225 km/day) and lowest in November (129 Km/day).

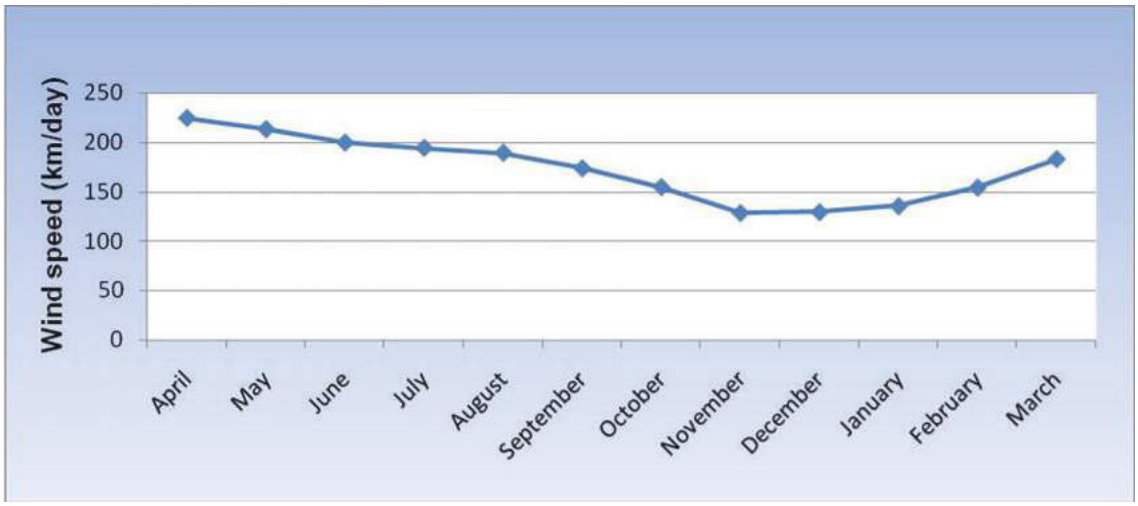


Figure 6.5: Monthly variation of average wind speed in Dhaka

(f) Sunshine Hour

The monthly average values of sunshine hours in Dhaka station vary from 4.5 to 8.3 hour/day. The average value of sunshine hours is highest in March (8.3 hr/day) and lowest in July (4.5 hr/day) (**Figure 6.6**).

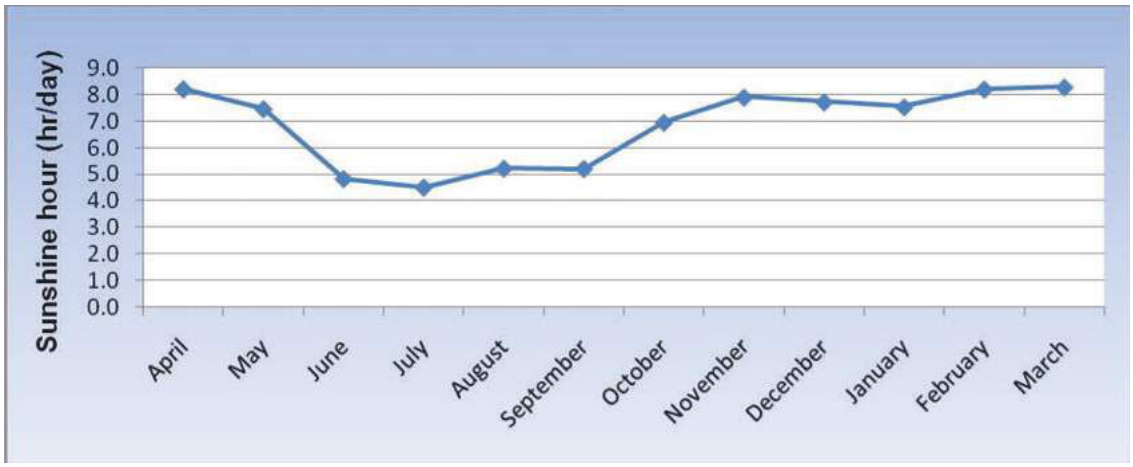


Figure 6.6 : Monthly average sunshine hours per day in Dhaka

6.2.2 Climate Change

The study area lies in the South East and North Central hydrological regions of Bangladesh. The climate of the area is tropical wet and dry, generally marked with monsoons, high temperature, considerable humidity and heavy rainfall. The hot season commences early in April and continues till August. The maximum temperature observed during April to June and the minimum temperature recorded in January. The highest rainfall is observed during monsoon.

In order to assess the change in climatic factors, trend of annual variations of the aforementioned meteorological parameters were analyzed. Historically, the major impact caused by climate change is rise in temperature. As per analyses made in the study, the average temperature is found to be gradually increasing in the area. In last 50 years, the

mean annual temperature has experienced a rise of about 0.013°C per year. The variation of mean annual temperature recorded at Dhaka station is shown in **Figure 6.7** below.

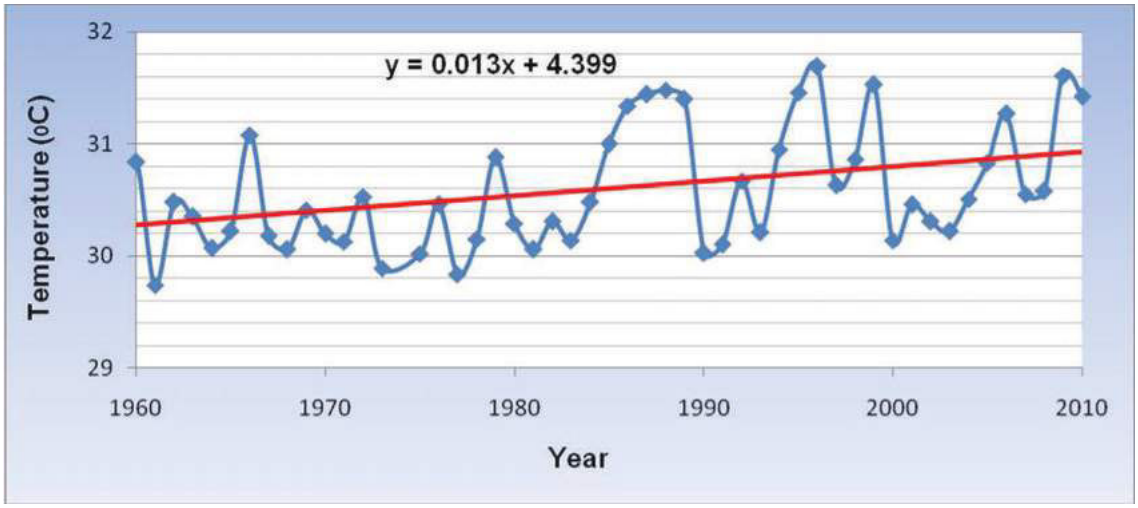


Figure 6.7: Annual Variation of Mean Temperature in Dhaka

The increase in mean annual temperature affects the rate of evaporation and thus rainfall intensities. The evaporation rates recorded at Dhaka station shows a decreasing trend (decreasing by 0.006 mm/day each year in last 25 years). The following figure (**Figure 6.8**) shows the decreasing trend in Evaporation rate. During this period, spring season has been shortened and monsoon has been shifting towards May. These days, monsoon starts from the month of May and lasts up to mid October. Due to such timing, water scarcity is often observed in the Boro season. This phenomenon affects the cropping patterns as well as the biodiversity and ecosystem of the study area. Now-a-days, farmers initiated hybrid cropping, which eventually improved their socio-economic status.

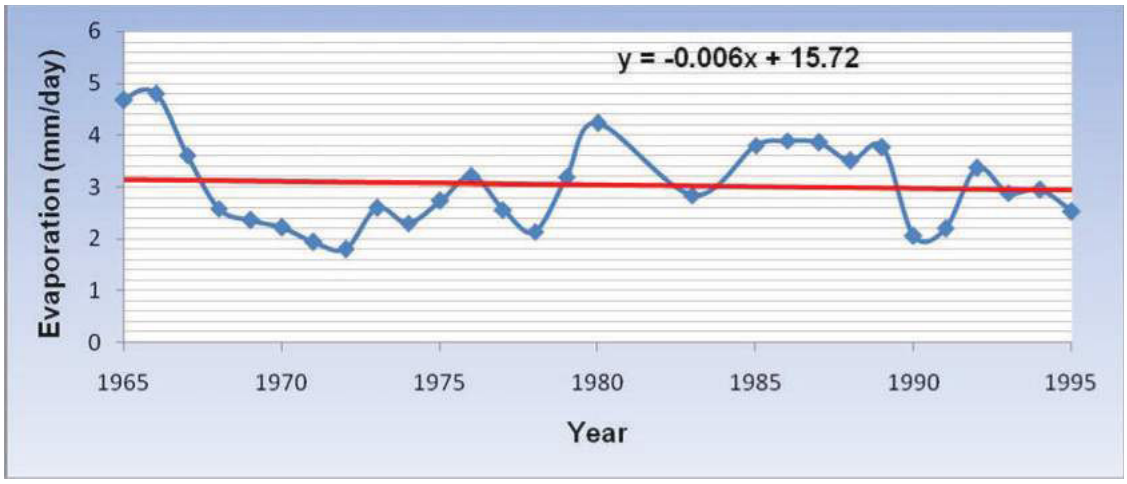


Figure 6.8: Annual Variation of Mean Evaporation in Dhaka

The rainfall intensities and patterns have also been changed and the extreme consequences of it are affecting the study area. In the last 55 years (from 1953 to 2008), the annual summation of rainfall has decreased by 0.328 mm per year at Dhaka. The annual variation of summation of rainfall recorded at BMD station of Dhaka is shown below in **Figure 6.9**.

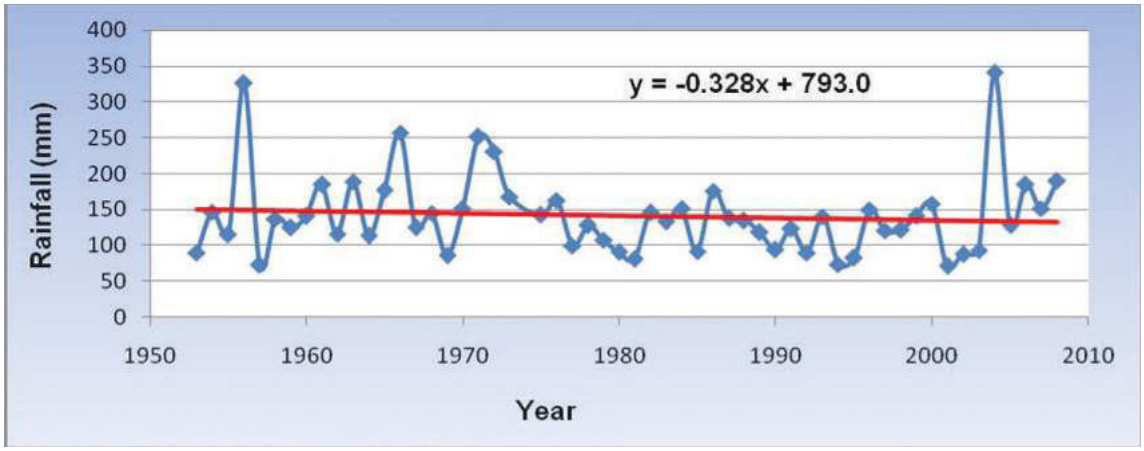


Figure 6.9: Annual Variation of Rainfall in Dhaka

The average humidity has also experienced minor changes in the last five decades. The magnitude of average relative humidity has decreased by 0.070% per year (**Figure 6.10**) at Dhaka. The following figure shows the annual variation of average relative humidity in Dhaka.

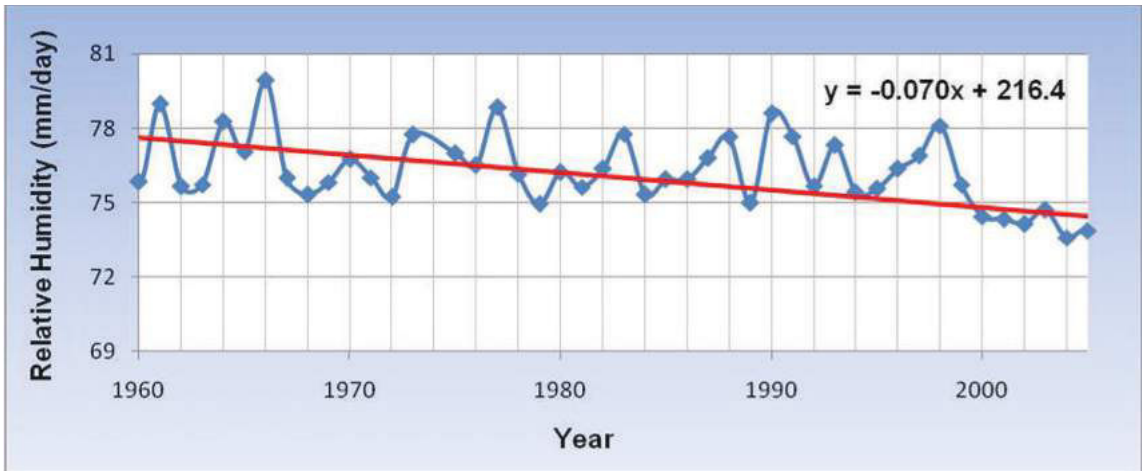


Figure 6.10: Annual Variation of Mean Relative Humidity in Dhaka

Apart from the meteorological changes discussed above, climate change also has important impacts on the frequency and intensity of natural disasters (Drought in particular) in the study area.

6.2.2 Water level/ flooding

For analyzing the flooding status using secondary information sources, two surface water level measuring stations at Bhairab Bazar and Nabinagar have been studied in detail. **Figure 6.11** below show a hydrograph showing the monthly average values of flood levels in the two aforementioned locations. The two stations almost depict hydrological identical situations, in which flood values rise typically in the monsoon, up to a value of around 6 m +PWD.

The transmission line will avoid rural and urban settlements. Since the proposed transmission line will not have any lasting impact on air quality, no data on air quality has been collected.

The main concern is suspended particulate matter (SPM), which is often higher in concentration than the national air quality standard during the pre-construction and construction period.

Heating is the main biological effect of the electromagnetic fields produced from the high voltage transmission line. To date, no adverse health effects from low level, long-term exposure to power frequency have been observed.

6.2.4 Ambient Noise Quality

The noise level has been analyzed in the field. The values of noise level in different locations are presented in **Table 6.3** below:

Table 6.3: Daytime noise levels of the study area

Sl. No.	Location	Maximum Noise level (dBA)
1	Singhab	48.1
2	Ashuganj	54.8
3	Talsahar	44.3
4	Nabinagar	49.2
5	Paikar Char	44.9
6	Daukandi	47.5
7	Krishnanagar	46.9
8	Choto Haran	49.8
9	Kalagachia	53.1
10	Bishnurampur	51.2

Source: CEGIS field survey, February 2014

Table 6.2 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 6.4**). The study area can be regarded as a residential area and the observed noise levels have been found to be exceeding the permissible limits for daytime at Ashuganj, Kalagachia and Bishnurampur. However, the average values do not exceed the standard noise pollution value.

Table 6.4: Standards of noise levels for different zones of Bangladesh

Zone Class	Limits in dB	
	Daytime	Nighttime
	(6 am – 9 pm)	(9 pm-6 am)
Silent zone	45	35
Residential zone	50	40
Mixed	60	50
Commercial zone	70	60
Industrial zone	75	70

Source: Bangladesh Gadget, 2006

6.2.5 Water availability and quality

Surface Water

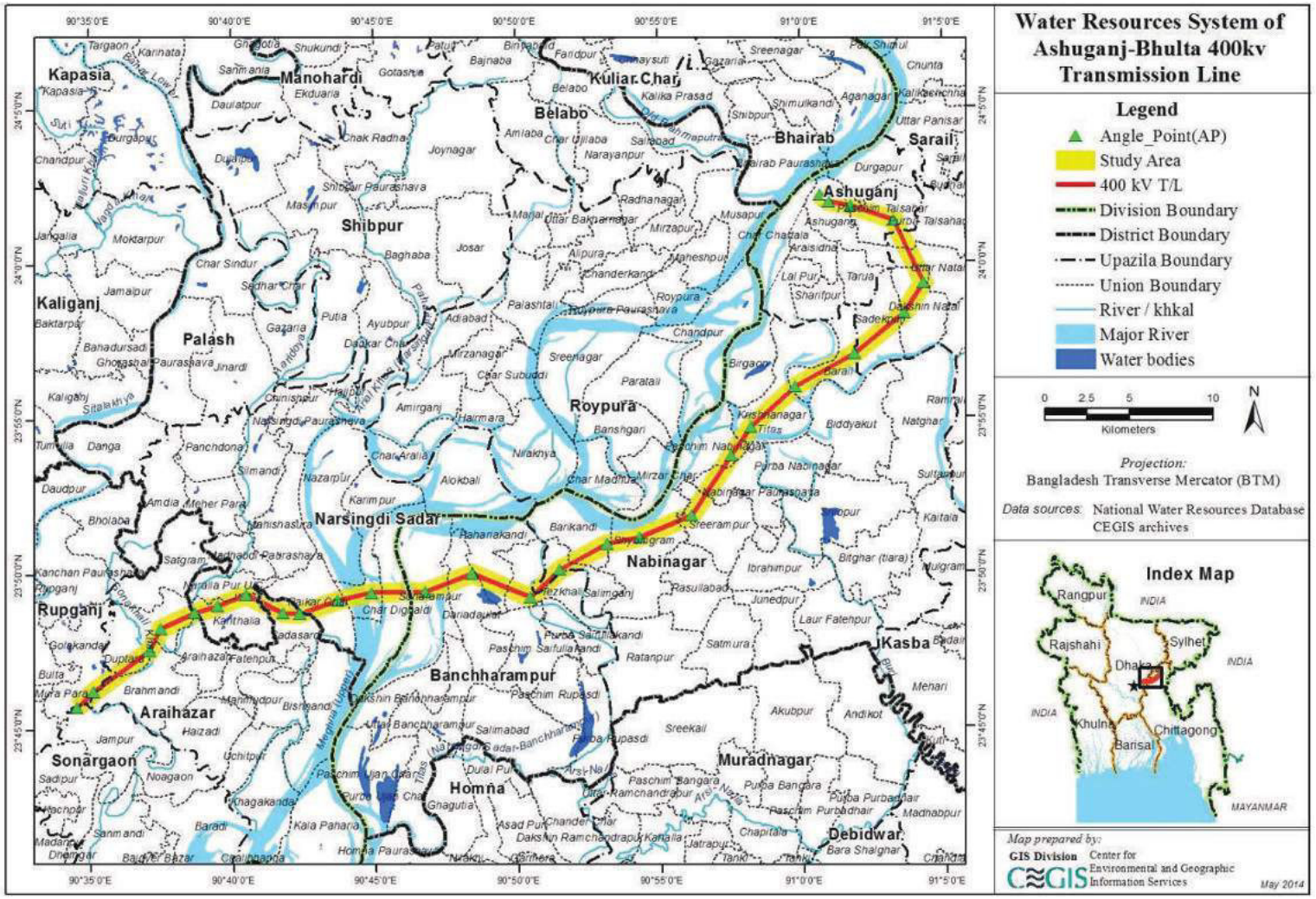
The Meghna river, Titas river and Gazipura river governs the hydrology of the project area. There are also a number of khals/ water bodies in the area as shown in **Map 6.1**. These existing rivers are used for navigation and other purposes and to carry runoff water from adjoining agricultural lands, which might contain pesticides and residual fertilizers. During site observation the water quality of these river were found very bad specially Gazipura river due to prevalence of significant dying industries at Narsingdi and Narayanganj. The Color, Odor and taste of the water of these rivers are declining tremendously in recent years. The water quality data of these rivers are given below. The standard values of the same set by DoE, Bangladesh have also been shown for comparison.

Table 6.5: Water Quality in Meghna River, Titas River and Gazipura River

River Name	Sample Location		Water Quality Parameters				
			Temperature (°C)	TDS (ppm)	EC (mS/cm)	DO mg/L	pH
Meghna River	Narsingdi Sadar		28.0	920	480	5.9	8.8
Titas River	Krishnanagar		29.0	1030	520	5.6	8.2
Gazipura River	Puran Char		28.5	1170	610	4.8	7.9
Standard value (Bangladesh)		Irrigation	20-30	-	-	5.0	7.0-8.5
		Fishing	20-30	-	-	4.0-6.0	6.7-9.5

Source: CEGIS field survey, February 2014

As the transmission line will not have any impact on water bodies, a further detailed analysis of the water quality was not required for the project.



Map 6.1: Water Resources System of Ashuganj-Bhulta 400 kV T/L Project area

Ground Water

As other parts of the country, the study area also receives sufficient amount of rainfall and there is good availability of groundwater used by hand pumps for drinking and domestic purposes. Some industries also use deep tube wells within their premises to meet the requirement of good quality water for various purposes. Groundwater level data are collected and analyzed from three different BDWB observation wells located at Araihazar, Narsingdi Sadar and Banchharampur. The monthly variation of mean ground water level at Araihazar (from 1971 to 2003), Narsingdi Sadar (from 1971 to 2003), and Banchharampur (from 1971 to 2003), are shown in **Figure 6.12** below.

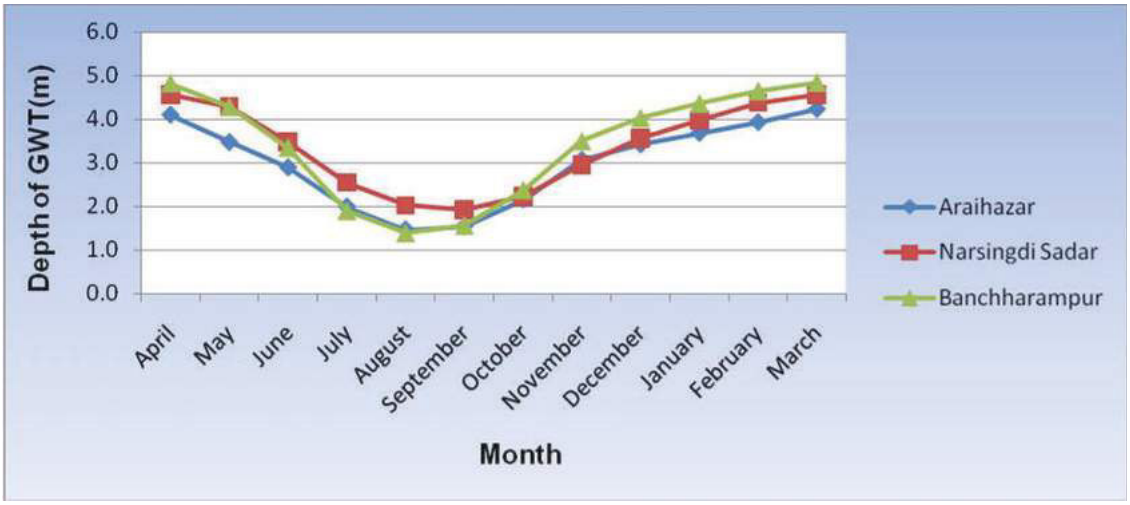


Figure 6.12: Ground Water Table (GWT) of the study area

The Ground Water Table (GWT) measured at the aforementioned locations at ten year intervals are shown in **Table 6.6**. Values are analyzed for the months of April (Considered as dry period) and September (considered as wet period). In the dry season, increased dependency of the local people on ground water lowers the GWT. During monsoon, the higher availability of surface water leads to higher recharge of ground water sources. **Table 6.6** shows that the GWT in the dry period and wet period differ significantly over the years.

Table 6.6: Ground Water Tables (GWT) shown at ten year intervals

New ID	Location	1970		1980		1990		2000	
		Apr	Sep	Apr	Sep	Apr	Sep	Apr	Sep
NAG 002	Araihazar	4.25	1.67	3.89	1.22	3.1	1.86	6.02	1.82
BRA 004	Banchharampur	3.94	1.32	4.84	1.55	4.25	2.09	5.49	2.69
NAR 004	Narsingdi Sadar	4.76	2.03	5.25	2.17	4.87	2.4	4.05	1.38

6.2.6 Natural Hazards

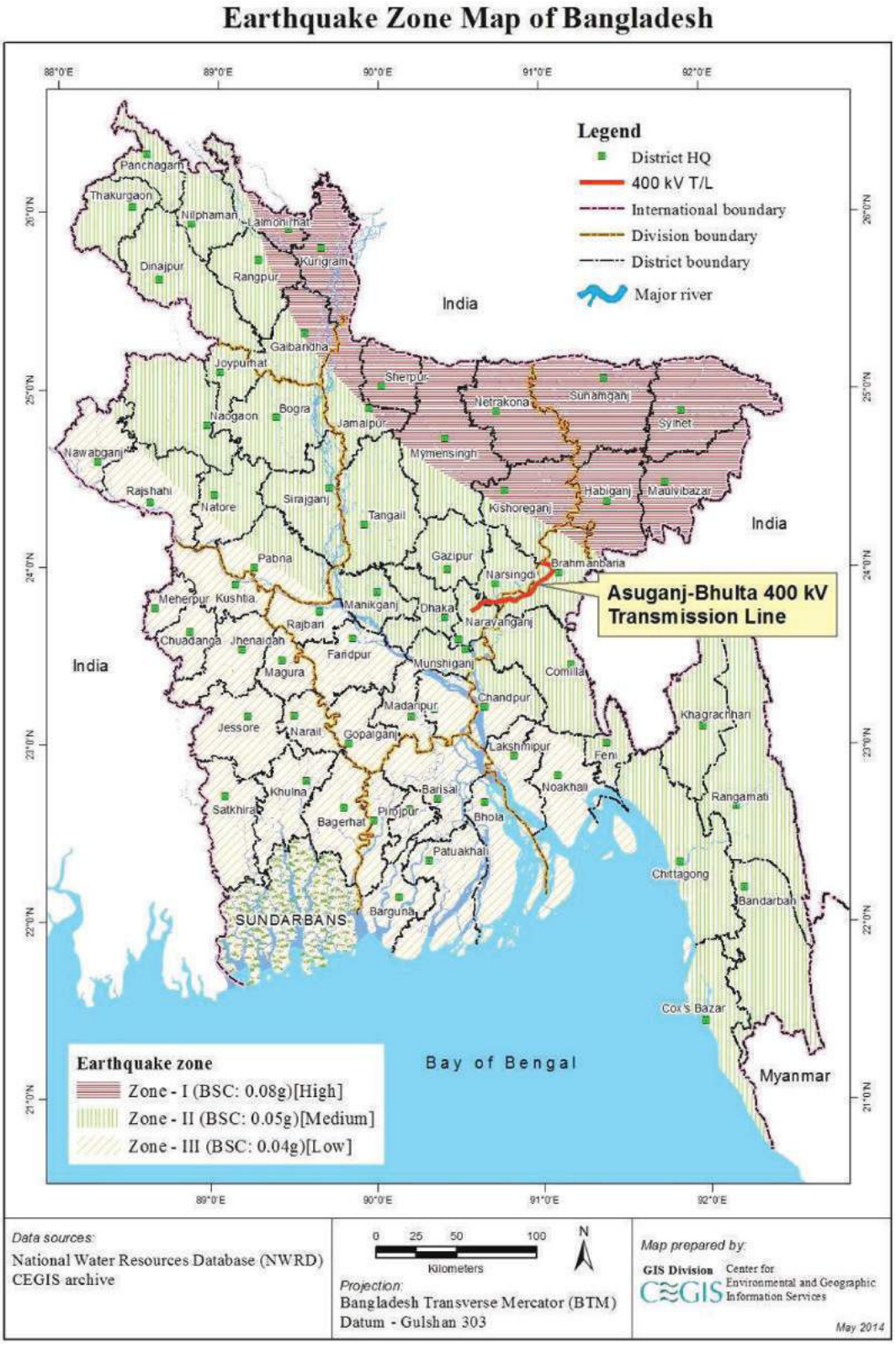
Seismicity

Bangladesh and northeast Indian states have long been one of the seismically active regions of the world, and have experienced numerous large earthquakes during the past 200 years at an average rate of one in every 30 years.

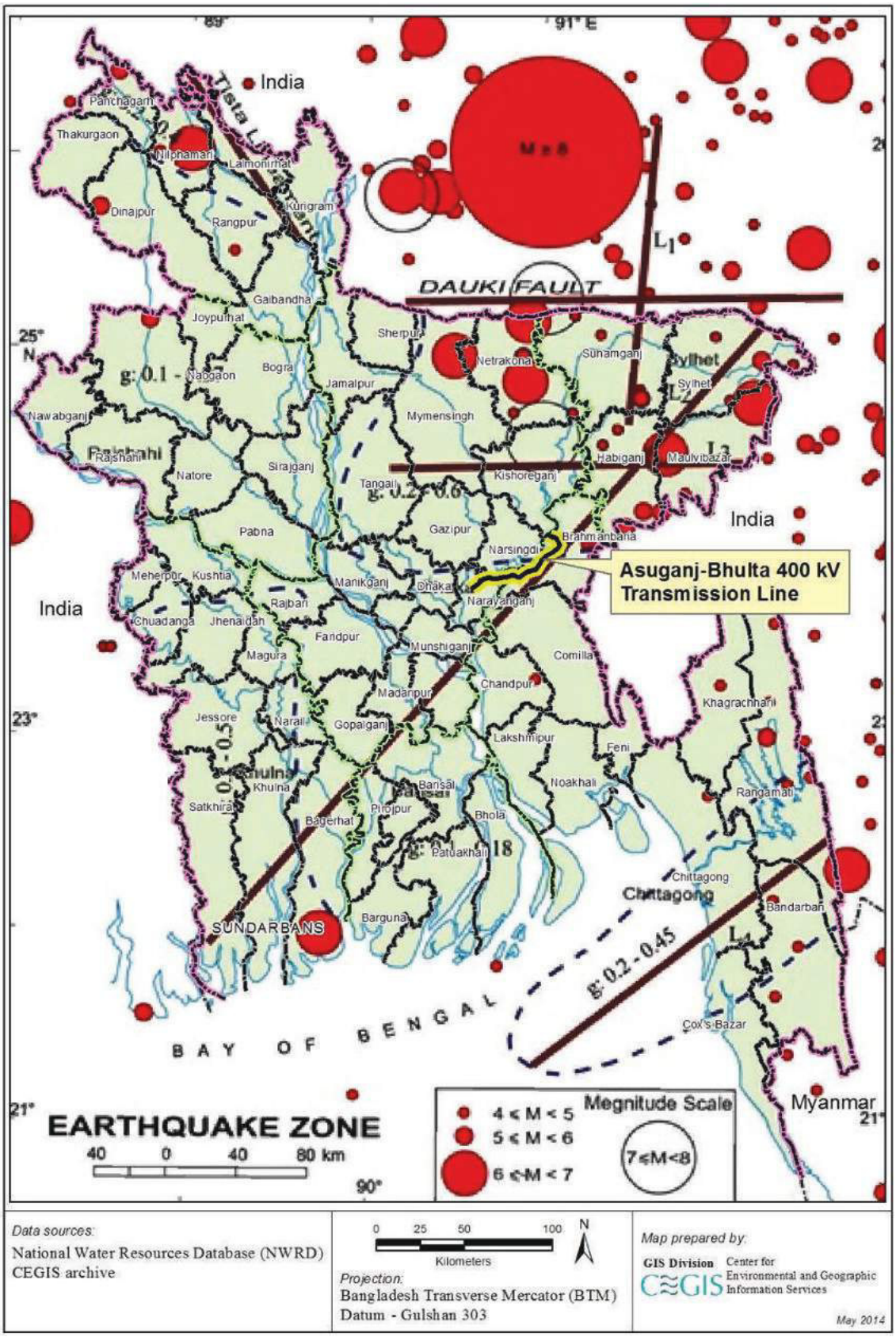
The catastrophic earthquakes of 1762 and 1782 are believed to have been partially responsible for the diversion of the Old Brahmaputra River from the west of its main Arial Khan distributary to the present Padma channel. Similarly it may have assisted the change of the Teesta, which formerly flowed southwards down the Atrai and Purnarbhaba courses to the Atrai basin and all the way to its present east-southeast course to the Brahmaputra-Jamuna at Ulipur. Since 1860 over 20 shallow and intermediate major earthquake epicenters have been recorded in Bangladesh and surrounding areas.

Seismotectonic studies have been undertaken by various workers in Burma comprising the Indo- Burma ranges and their western extension in the northern India. A complete list of references is provided in Haque, (1990), using data from various sources. A seismicity map of Bangladesh and its adjoining areas has also been prepared by Mominuddin (1991).

Bangladesh has been classified by BGS as a country that falls into 3 seismic zones: zone-I, zone-II and zone-III. According to this division, the study area falls under Zone-II, which is characterized by medium earthquake prone site and has a basic seismic coefficient of 0.05g (Map 6.2) respectively. There are also different geological faults in and around the country, as shown in Map 6.3. According to it, the maximum magnitude of earthquake is within the range of $4 \leq M < 5$ on the Richter scale in and around of the study area. The proposed project site and project area is in low earthquake prone as there is no fault line near the area (**Map 6.3**). The buildings and land-based structures for this project should be designed to withstand ground acceleration during earthquake.



Map 6.2: Seismic Map of Bangladesh showing the Project Area



Map 6.3: Fault lines of Bangladesh (Source: GSB)