THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

Power Grid Company of Bangladesh

Power Cell, Power Division

Ministry of Power, Energy and Mineral Resources

Government of the People's Republic of Bangladesh

Updated Initial Environmental Examination (IEE) for the Enhancement and Strengthening of Power Networking Eastern Region (ESPNER) Project of Bangladesh

Final Report

Prepared by:

Power Grid Company of India Limited (PGCIL)

In association with

IMEX, BANGLADESH

December, 2019

Table of Contents

List of Appendices

List of Tables

List of Figures

List of Maps

ABBREVIATIONS

AIS	Air Insulated Switchgear
BMD	Bangladesh Meteorological Department
BWDB	Bangladesh Water Development Board
BNBC	Bangladesh National Building Code
BRTA	Bangladesh Road Transport Authority
BIWTA	Bangladesh Inland Water Transport Authority
CHT	Chittagong Hill Tracts
CCORRP	Chitagong City Outer Ring Road Project
DC	Double Circuits
DOE	Department of Environment
DPHE	Department of Public Health Engineering
DOF	Department of Fisheries
ECC	Environmental Clearance Certificate
ECR	Environmental Conservation Rules
ECOP	Environmental Code of Practice
EHS	Environmental Health & Safety
IEE	Environmental Impact Assessment
EMP	Environmental Management Plan
ESMF	Environmental and Social Management Framework
ESPNER	Enhancement and Strengthening of Power Network in Eastern Region
EQS	Environmental Quality Standards
EPA	Environmental Protected Area
ESU	Environmental & Social Unit
FD	Forest Department
FGD	Focus Group Discussions
GOB	Government of Bangladesh
IDA	International Development Association
IEE	Initial Environmental Examination
IEF	Important Environmental Features
JICA	Japan International Cooperation Agency
kV	Kilo Volt
KMG	Kanchpur Meghna Gumti Project
LGED	Local Government of Engineering Department
LL	LiLo Line
LILO	Loop-In- Loop-Out
MOEF	Ministry of Environment and Forest
MOPEMR	Ministry of Power, Energy and Mineral Resources
OP	Operational Policy
OHS	Occupational Health & Safety
PAPs	Project Affected Persons
PDB	Power Development Board
PC	Power Cell
PCB	Polychlorinated Biphenyl
PBS	Palli Bidduyt Shamiti
PGCB	Power Grid Company of Bangladesh
PIU	Project Implementation Unit
PWD	Public Works Datum
REB	Rural Electrification Board
RHD	Roads and Highways Department
RAP	Resettlement Action Plan
SMP	Social Management Plan

SPIA	Subproject Influence Area
SS	Substation
TL	Transmission Line
TOR	Terms of Reference
WB	World Bank

EXECUTIVE SUMMARY

This IEE Report has been updated which was prepared and approved by the World Bank in May 2018. The IEE report is updated due to change of three substation location namely Chandina & Laksam at Cumilla district and Kosba at Brahmanbaria district. Census, IOL, market survey and consultation were conducted during updating of this IEE. The reasons of changed locations are:

- To avoid impacts on private land and due to availability of Government land, PGCB has changed the location of Chandina at Cumilla District.
- Land owners requested PGCB to change the project locations as initially proposed for the Laksham at Cumilla District and Koshba at Brahmanbaria district for sub-station location. PGCB has conducted several consultations with the APs and they did not agree to provide the land. So PGCB with the suggestions of DC office proposed new land adjacent to the previous location. New land owners are also consulted and agreed to provide land for the sub-station. Proposed new lands are adjacent to the previously selected land and so transmission line route is almost same for Laksham and Kosba and for Chandina transmission line route increased about 3.17 km (previously it was 9.83km and now 13.0 km).

1. INTRODUCTION

The Government of Bangladesh (GOB) has set long term goals for the power sector in the country. Providing access to affordable, reliable and quality supply of electricity to the majority of the people of Bangladesh by 2020 are the goals of the GOB to users the next millennium. In line with the above stated goals, the GOB is expected to obtain financial support from the International Development Association (IDA) for the proposed Enhancement and Strengthening of Power Network in Eastern Region (ESPNER) project to ensure reliable and quality supply of electricity to the rural and urban consumers in Bangladesh through improvements in technical efficiency of the distribution system. The proposed project is expected to construct sub-stations (SS), transmission lines (TL) and LILO lines of the PGCB under the Power Cell, Power Division, Ministry of Power, Energy and Mineral Resources (MOPEMR) of the GOB. Main components of the project include:

- Construction of new 230/132 kV two substations and new 132/33 kV 10 substations;
- Construction of new 288.642 kmlong 132 kV, 230kV and 400kV transmission lines (TL); and
- Construction of new LILO lines (LL);

The present power network in Greater Comilla, Noakhali and Chittagong areas of Bangladesh is aged and suffering numerous problems as system demand is growing rapidly. The greater Comilla and Noakhali areas are the second largest demand areas after the capital city of Dhaka. The greater Chittagong area is on the verge of massive industrialization as the government is taking initiatives to set up multiple economic zones, upgrade port facility and transportation network. Hence, the project was conceptualized with a rationale to expand the 230 kV transmission systems and to strengthen the 132 kV transmission systems in the project area, in order to, eliminate the operational bottlenecks caused due to inadequacy of the existing system. The project will also provide an adequate infrastructure for the future power sector development of the area.

The TOR has prepared to carryout IEE for the project in accordance with the relevant laws and regulations of the GOB and the WB. The specific environmental guideline for the power sector is not available in Bangladesh. However, the DOE environmental guidelines for the industries provide a general framework for conducting environmental study for the entire sector. Therefore, the

proposed IEE will be conducted following the DOE environmental guidelines. In addition, it is suggested to follow the Environmental & Social Management Framework (ESMF) of Rural Electricity Transmission and Distribution Project of PGCB and BREB as well as WB environmental guidelines for the power sector.

The scope of work of the IEE includes: (a) Review of relevant all documents/information/data from secondary sources, and identify gaps to be filled, relevant to the environmental screening needs from primary surveys. (b) Provide a description of the environment (such as baseline data on physical, biological and socio-economic characteristics of the subproject sites along with sub-project influence area (SPIA). (c) Represent the primary surveys where include baseline (air, water, noise, and riverbed) environmental quality monitoring at representative and sensitive locations, and identification of all macro-level environmental issues within the SPIA. (d)Survey the environmentally sensitive locations on and along the sub-projects and withinthe SPIA. (e)Arrange stakeholder consultation with the local people from all profession to find out their opinion within the subproject. (f) Analysis of alternatives to the proposed subprojects. (g) Identify and assessment of potential environmental impacts due to implementation of the subproject. (h) Formulation of Environmental Management Plan (EMP)

2. ENVIRONMENTAL POLICIES, RULES, REGULATIONS AND STANDARDS

Both the GOB and WB have formulated environmental regulatory framework and made provisions to implement them towards the protection and conservation of the environmental components from negative impacts of the project activities. Major GOB and WB environmental policies, rules, regulations and standards are as follows:

Relevant GOB Policies, Acts, Rules, Strategies and Guidelines: (1)Environmental Conservation Act (ECA), 1995 and Amendments; (2)Environment Conservation Rules (ECR), 1997 and Amendments; (3)Environmental Policy, 1992; (4)Environmental Action Plan, 1992 ; (5)National Environmental Management Plan (NEMAP), 1995; (6)Bangladesh Wildlife (Preservation) Order, 1973 (Amended in 1994) ;(7)National Water Policy, 1999; (8)National Water Management Plan, 2001 (Approved in 2004); (9)The National Fisheries Policy, 1999; (10)The Protection and Conservation of Fish Rules, 1985 (11)National Agricultural Policy, 1999; (12)The Embankment and Drainage Act, 1952; (13)Bangladesh Climate Change Strategy and Action Plan; (14)DOE's IEE/IEE including EMP Guidelines for Industry, 1997; (15) Environmental Code of Practices,; and (16) Electricity Act 1910 and Amendments.

World Bank's Relevant Environmental Safeguard Policy: (1) OP/BP 4.01 Environmental Assessment; (2) OP/BP 4.04 Natural Habitats; (3) OP/BP 4.11 Physical Cultural Resources; (4) OP/BP 4.36 Forestry; (5) OP/BP 4.12 Involuntary Resettlement; & (5) WB Group Environmental Health and Safety (EHS) Guidelines.

Applicable National/International Standards: There are environmental standards in operation in Bangladesh also promulgated under ECR of 1997 and these are for: water; ambient air; noise; odor; industrial effluent and emission discharges; and vehicular emissions, etc. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding. The international standard for heavy metals of soil of USA, EPA, 2000 has also been used.

Categories of Projects: Under the ECR, 1997, a classification system was established for development projects and industries on the basis of location, size and severity of potential environmental

pollutions. There are four categories of projects: green, orange A, orange B and Red with respectively no, minor, medium and severe environmental impacts. According to the guidelines, illustrated in ECR, 1997 of DOE, this project falls under the red category of projects. Therefore, for this project, it needs to prepare an Environmental Impact Assessment (IEE) in due course following prescribed format and be submitted to the DOE for getting the Environmental Clearance Certificate (ECC) of the project. According to WB and impact assessment as mentioned in ESMF, this project falls under category B and therefore needs to carry out the Initial Environmental Examination (IEE).

3. PROJECT DESCRIPTION

The project components such as 12 substations, 8 transmission and 8 LILO lines are located in the seven districts (such as Chittagong, Feni, Noakhali, Laxmipur, Comilla, Chandpur districts of Chittagong division and Munshiganj district (small part which is in Dhaka division) of the eastern region of PBCB's jurisdiction .

Main components of the project include:

- Construction of new 230/132 kV two substations and new 132/33 kV .10 substations;
- Construction of new 132 kV, 230kV and 400kV transmission lines (TL);and
- Construction of new Total 25.731 km LILO lines (LL);

Initially three sites have been selected for the proposed each substation and 3 routes for the proposed each transmission line which are located at different seven districts in Bangladesh. From these three sites, environmentally friendly one site for each substation and one route for each TL have been finally selected (Chapter 4) which is given in the following tabular form:

Sl. No.	Name of the NewSubstation(SS)	Name of the New Transmission Line (TL)
1	230/132 kV GIS Substation at Chowmuhoni	Chowmuhoni – Kachua 230 kV M/C Line- 49.05 km
2	230/132 kV GIS Substation at Kachua	Gazaria – Kachua 230 kV M/C Line - 45.09 km
3	132/33 kV GIS Substation at Muradnagar	LILO of Comilla (N) – Daukandi 132 kV D/C Line at Muradnagar – 0.5 km
4	132/33 kV GIS Substation at Laksham	Kachua- Laksham 132 kV D/C Line - 30.93 km
5	132/33 kV GIS Substation at Maijdee	Chowmuhoni – Maijdee 230 kV D/C Line- 20.55 km
6	132/33 kV GIS Substation at Patiya	LILO of Dohazari – Sikalbaha 132 kV D/C Line at Patiya – 1.16 Km
7	132/33 kV GIS Substation at Chandina	Comilla (N) – Chandina 132 kV D/C Line - km 13km
8	132/33 kV GIS Substation at New Mooring (Anand Bazaar)	LILO of Halishahar- Khulsi 132 kV S/C (ckt-1, 2&3) Line at New Mooring-0.630 km
9	132/33 kV GIS Substation at Basurhat	Two Ckt LILO from Feni – Chowmuhoni 132 kV D/C line at Basurhat – 2.74 km
10	132/33 kV GIS Substation at Laxmipur	Chowmuhoni – Laxmipur 132 kV D/C Line - 27.38 km
11	132/33 kV GIS Substation at Kosba	Muradnagar – Kosba 132 kV D/C Line- 22.79 km
12	400/230 kV GIS Substation at Korerhat	Korerhat- Chowmuhoni 230 kV M/C Line- 52.73 km
		LILO of Modunghat – Meghnaghat 400 kV D/C Line

Sl. No.	Name of the NewSubstation(SS)	Name of the New Transmission Line (TL)
		at Korerhat – 0.4 Km
		LILO of Comilla (N)/ Feni – BSRM/ Hathazari 230 kV D/C Line – 5.728 Km
		LILO of Feni/ Baroihat – Hathazari 132 kV D/C Line – 2.8 Km
		Extension of Mirsharai – BSRM 400 kV D/C Line to Korerhat – 11.314 Km

4. Analyses of Alternative for TL/Lilo Route and Substation Site Selection

For the selection of optimum route, the following points are taken into considerations: (i) The route of the proposed TL/Lilo does not involve any human rehabilitation. (ii) Any monument of cultural or historical importance is not affected by the route of the TL/Lilo. (iii) The proposed route of TL/Lilo does not create any threat to the survival of any community with special reference to Tribal Community. (iv)The proposed route of TL/Lilo does not affect any public utility services like playgrounds, schools, other establishments etc. (v)The line route does not pass through any sanctuaries, national park etc. (vi) The line route does not infringe with area of natural resources.

In order to achieve this, different alternatives were studied for all the major transmission lines with understanding that minor alterations often added to avoid environmentally sensitive areas and settlements at execution stage.

As a rule, alignments are generally cited 10-15 km away from major towns, whenever possible, to account for future urban expansion.Similarly, forests are avoided to the extent possible, and when it is not possible, a route is selected in consultation with the local Divisional Forest Officer, that causes minimum damage to existing forest resources. Alignments are selected to avoid wetlands and unstable areas for both financial and environmental reasons.

In addition, care is also taken to avoid Environmental Protective Areas (EPA), critical areas, forest area, homesteads, cultural sites etc. Keeping above in mind the routes of proposed lines under the project has been so aligned that it takes care of above factors. As such different alternatives were studied with the help of Google Earth and Survey of Bangladesh (SOB) topographical survey sheets etc. to arrive at most optimum route which can be taken up for detailed survey and assessment of environmental & social impacts for their proper management.

Three different route alignments were studied for the selection of TL/Lilowith the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey.

For substation site selection also analysis ofthree alternatives sites has been carried out based on environment and social aspects and technical requirements. Such analysis considers various site specific parameters that include availability of infrastructure facilities such as access roads, water routes, distance from railway lines, type of land (Government/private land/landuse); social impacts such as number of families getting affected; Common Property Resources (CPR) including feasibility of acquisition etc.. The finalization of substation land is done based on above analyses and site visit/verification. The social aspects are provided due weightage after technical requirement in decision making for selection/finalization of land for substation.

5. DESCRIPTION OF ENVIRONMENTAL BASELINE

The subproject areas of the substation and TL/Lilo lines of the project are located in a typical monsoon climate with three main seasons, summer (February to May), monsoon (June to September) and winter (October to January). The environmental baseline conditions and Important Environmental Features (IEFs) of each substation (SS) subproject, Transmission Line (TL) subproject and Lilo Lines are summarized in the following Table 1.

Table1: Environmental Baseline Data of the Subprojects of t5he Substations (SS) and Transmission Line (TL)and Lilo Lines

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW / SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
Substation Subprojects:																	
1	230/132 kV GIS at Chowmuhoni	Begumganj, Noakhali.	Partially 2 cropped agricultural land& partially fellow land	Yes	Flat Terrain	Zone-3	Dusty	65.32	No		sparrow, kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, bengal monitor, common house lizard, snakes, frog etc.	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
2	230/132 kV GIS at Kachua	Kachua, Chandpur	3 cropped agricultural land	Yes	Flat Terrain	Zone-2	Good	62.84	No		sparrow, kingstork, dove, crow, fox, mouse, grew musk, common house lizard, snakes, frog etc.	No	5	0	0	Mosque at about 200m east	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
3	132/33 kV GIS at Muradnagar	Muradnagar, Comilla	3 cropped agricultural land	Yes	Flat Terrain	Zone-2	Good	57.93	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, , bengal monitor, common house lizard, snakes, frog	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW / SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
4	132/33 kV GIS at Laksham	Laksham, Comilla	3 cropped agricultural land	Yes	Flat Terrain	Zone-2	Good	56.34	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, shrew, squirrel, , bengal monitor, common house lizard, snakes, frog etc.	No	2	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
5	132/33 kV GIS at Maijdee	Maijdee, Noakhali	2 cropped agricultural land	Not	Flat Terrain	Zone-3	Good	66.88	No		sparrow, kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, common house lizard, snakes, frog etc.	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
6	132/33 kV GIS at Patiya	Patiya, Chittagong	2 cropped agricultural land	Not	Flat Terrain	Zone-2	Dusty	67.23	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, shrew, back, bengal monitor, snakes, frog	No	5	0	.0	Mosque at 200m east of the SS	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
7	132/33 kV GIS at Chandina	Debidwar, Comilla	Govt. Barren land	No	Plain lands	Zone-2	Dusty	71.51	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, grew musk, squirrel, stripped keel	No	2	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW / SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
											back, common house lizard, snakes, frog etc.						
8	132/33 kV GIS at New Mooring/Anand Bazar	JL. 1, Mouza: Madha Halishahar, Thana: Bandar, District: Chittagong	2 cropped agricultural land	Not	Undulation	Zone-2	Dusty	57.55	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, , squirrel, common house lizard, snakes, frog	No	20	0	0	2 Mosques, and a School at ch 400	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
9	132/33 kV GIS at Bashurhat	Bashurhat, Daganbhuiyan, Noakhali	3 cropped agri. Land	Not	Flat terrain	Zone-2	Good	57.55	No	136	shalik, sparrow, dove, crow, fox, mouse, , squirrel, bengal monitor, common house lizard, snakes, frog etc.	No	2	0	0	Mosque at 100m east.	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
10	132/33 kV GIS at Laxmipur	Laksmipur Sadar, Laksmipur	2 cropped agricultural land	Yes	Flat Terrain	Zone-2	Dusty	68.35	No		shalik, sparrow, , fox, mouse, grew musk shrew, Bengal monitor, common house lizard, snakes, frog	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
11	132/33 kV GIS at Kosba	Kosba, Brahmanbaria	2 cropped agricultural land	Yes	Flat Terrain	Zone-2	Dusty	59.64	No		sparrow, kingstork, dove, crow, fox, mouse, grew musk shrew,	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW / SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
											squirrel, snakes, frog						
12	400/230 kV GIS at Korerhat	Korerhat, Mirsarai, Chittagong	2 cropped agricultural land	Not	Flat terrain	Zone-2	Good	70.57	Small seasonal Khal	2945	shalik, sparrow, , crow, fox, mouse, shrew, squirrel, , common house lizard, snakes, frog etc.	No	25	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
Transmission Line Subprojects:																	
1	Chowmuhoni – Kachua 230 kV Double Circuit TL	Started at Chowmohuni substation, UZ: Chowmohuni, Dt:Noakhali and ended at Kachua substation, UZ: Kachua, Dist.: Chandpur	Two to three cropped agricultural lands	Yes	Flat	Zone-3	Good	-	30Khals &10Ponds	2836	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, common house lizard, snakes, frog	No	149.42	0	0	A mosque at distance a ch 0+030	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
2	Kachua-Gazaria 230 kV TL	Started at Kachua substation, UZ: Kachua, Dt: Chandpur and ended Gazaria substation, UZ: Gazaria, Dist.: Munshiganj	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	12Khals & 7Ponds	2544	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, common house lizard, snakes, frog	No	132.00	0	0	o	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
3	Kachua-Laksham 132 kV TL	Started at Kachua substation, UZ: Kachua Dt: Chandpur	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	Khals &Ponds	2990	kingstork, dove, crow, fox, mouse, grew musk shrew,	No	101.46	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW / SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
		and ended at Laksham substation, UZ: Laksham, Dist.: Comilla									squirrel, stripped keel back, common house lizard, snakes, frog						etc.
4	Chowmuhoni – Maijdee 230 kV Double Circuit TL	Started at Chowmohuni substation, UZ: Chowmohuni, Dt:Noakhali and ended at Maidee substation, , UZ: Chowmohuni, Dt:Noakhali	- Two to three cropped agricultural lands	Yes	Flat	Zone-3	Good	-	6Khals &5Ponds	1795	kingstork, , crow, fox, mouse, grew musk shrew, squirrel, , common house lizard, snakes, frog .	No	63.04	0	o	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
5	Comilla – Chandina 132 KV DC TL	Started at Comilla (North) substation Dt:Comilla and ended at Chandina substation, UZ: Chandina, Dist.: Comilla	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	1 khal	No	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, bengal monitor, snakes, frog	No	33.49	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
6	Chowmuhoni – Laxmipur 132 kV Double Circuit TL	Started at Chowmohuni substation, UZ: Chowmohuni, Dt:Noakhali and ended at Laxmipur substation, Dist.: Laxmipur	- Two to three cropped agricultural lands	Yes	Flat	Zone-3	Good	-	12Khals &7Ponds	1740	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, bengal monitor, common house lizard, snakes, frog	No	94.56	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
7	Muradnagar –	Started at	Two to	Yes	Flat	Zone-2	Good	-	14Khals	337	kingstork,	No	68.95	0	0	0	trucks, buses,

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW / SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
	Kosba 132 KV DC TL	Muradnagar substation, UZ: Muradnagar, Dt: Comilla and ended at Kosba substation, UZ: Kosba, Dist.: B. Baria.	three cropped agricultural lands -						&4Ponds		dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, bengal monitor, common house lizard, snakes, frog						microbus, sedan cars, taxi, vans, motorbikes etc.
8	Korerhat-Chowmuhoni 230KV MC TL	Started at Korerhat substation, UZ: Mirersorai, Dt: CTG and ended at Chowmuhoni substation, UZ: Chowmuhoni, Dist.: Noakhali.	Two to three cropped agricultural lands -	Not	Flat	Zone-2 & 3	Good	-	30Khals &10Ponds	8010	kingstork, dove, crow, fox, mouse, shrew, squirrel, stripped keel back, bengal monitor, , snakes, frog	No	160.56	0	0	A mosque at 40m distance at ch 49+250 at R/S and a graveyard at 25 m distance at L/S at Ch 10+000.	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
Lilo Lines:																	
1	LILO of 132 KV DC Feni-Chowmuhani, L=2.915km,	0+000-2+915	Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	30Khals &10Ponds	No	dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, common house lizard, snakes, frog	No		0	0	A mosque at distance a ch 0+030	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
2	LILO of 230 KV DC Karerhat – Comilla,	0+000-5+191	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	12Khals & 7Ponds	No	kingstork, dove, crow, fox, mouse, grew musk shrew,	No		0	0	o	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW / SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
	L=5.735										squirrel, common house lizard, snakes, frog						etc.
3	LILO of 132 KV DC Karerhat-Hathaz4ari-F5eni 6	0+000-3+327	- Two to three cropped agricultural lands	Yes	Flat	Zone-1	Good	-	Khals &Ponds	No	dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, common house lizard, snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
4	.LILO of 8132 KV DC Dohazari-Shikalbaha	0+000-0+750	- Two to three cropped agricultural lands	Yes	Flat	Zone-1	Good	-	Seasonal ponds/khals	No	crow, fox, mouse, grew musk shrew, squirrel, , common house lizard, snakes, frog .	No		0	o	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
5	LILO of 132 KV DC Halishahar-Kulshi	0+000-1+105	- Two to three cropped agricultural lands	Yes	Flat	Zone-1	Good	-	Seasonal ponds/khals	No	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, bengal monitor, snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
6	LILO of 400 KV DC Korerhat-BSRM	0+000-11+850	- Two to three cropped agricultural lands	Yes	Undulated	Zone-2	Good	-	Seasonal ponds/khals	, small to medium size forest	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, common house lizard, snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW / SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
										trees (not densely) from ch 3+450 – 11+700							
7	.LILO of 132 KV DC Modhunagat-Meghnagat	000-0+775	Two to three cropped agricultural lands -	Yes	Flat	Zone-2	Good	-	Seasonal ponds/khals		kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, bengal monitor, common house lizard, snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
8	LILO of 400 KV DC Comilla(N)-Daudkandi)	0+000-0+424	Two to three cropped agricultural lands -	Not	Flat	Zone-2 & 3	Good	-	Seasonal ponds/khals		kingstork, dove, crow, fox, mouse, shrew, squirrel, stripped keel back, bengal monitor, , snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Source: Literature review, Topo Survey, SES & Environmental Survey in 2017.

6. ENVIRONMENTAL SCREENING/IMPACT ASSESSMENT OF THE SUBPROJECTS

The environmental impacts due to implementation of the subproject of Substations and Transmission Lines/LILO Lines during construction and operation stages have been identified through baseline environmental survey including environmental quality survey, public consultations and literature review. During the field visits, Environmental Screening/Assessment Checklist (Appendix-B: Substation, Form 2a and Transmission Line, Form 2b, of the ESMF Guidelines, 2013) has been filled up for the initially selected 3 sites of each proposed substation and 3 routes of Transmission Line to identify the potential environmental impacts. From these 3 sites (for substation) and routes (for TL), environmentally suitable site (for substation) and route (TL) have been finally selected.

Based on the environmental baseline data and environmental screening, potential environmental impacts assessment for the finally selected subprojects (Substations, Transmission Lines &LILOlines) have been done. Potential environmental impacts of the finally selected subproject of substation and TL have been categorized into: (i) general/common impacts, which are typical common impacts to be experienced in most subprojects and (ii) subproject specific impacts which are given below:

General/Common and subproject specific Impacts due to finally selected all 12Substation Subprojects are as follows (Table 2):

Table 2: Environmental Impacts of the Selected Substation Subprojects

Sl. No.	Subproject Site/Route	Selected Site	Common Environmental Impacts	Subproject Specific Impacts
1	230/132 kV GIS at Chowmuhoni, Noakhali	Site-1	**Pre-construction/Construction Phase:** i. Land Acquisition ii. Clearing of Vegetation iii. Disturbance of Fauna (wildlife) iv. Loss of Top Soil v. Hydrology/Drainage Congestion vi. Ground Water Pollution vii. Noise Pollution viii. Air and Dust Pollution ix. Soil Pollution x. Pollution due to Wastes xi. Traffic Congestion/Road Accident xii. Siting of Construction Camps xiii. Occupational Health and Safety xiv. Community Health and Safety xv. Employment Generation/Income **Operation Stage:** i. Hydrology/Drainage Congestion ii. Landscape iii. Community Health and Safety iv. Occupational Health and Safety v. Improvement of Social & Economic Life vi. Short Circuit/Accident	**insignificant**
2	230/132 kV GIS at Kachua, Chandpur	Site-1		**insignificant**
3	132/33 kV GIS at Muradnagar, Comilla	Site-1		**insignificant**
4	132/33 kV GIS at Laksham, Comilla	Site-1		**insignificant**
5	132/33 kV GIS at Maijdee, Noakhali	Site-1		Surface water (perennial pond at about 50m faraway)
6	132/33 kV GIS at Patiya, Chittagong	Site-1		**insignificant**
7	132/33 kV GIS at Chandina, Comilla	Site-1		Barren Government Khash Land
8	132/33 kV GIS at New Mooring/Anand Bazar, Chittagong	Site-1		**insignificant**
9	132/33 kV GIS at Bashurhat, Feni	Site-1		**Construction Stage:** i. 136 Trees Cutting ii. Loss of terrestrial habitat iii.Surface water

Sl. No.	Subproject Site/Route	Selected Site	Common Environmental Impacts	Subproject Specific Impacts
				(Perennial Pond at about 30m faraway) pollution iii. A mosque at 100m faraway at east side of the SS.
10	132/33 kV GIS at Laxmipur, Laksmipur	Site-1		**insignificant**
11	132/33 kV GIS at Kosba, Brahmanbaria	Site-1		**insignificant**
12	400/230 kV GIS at Korerhat, Chittagong	Site-1		**Construction Stage:** i. 2945 Trees Cutting ii. Loss of terrestrial habitat

General/Common and subproject specific Impacts due to finally selected 8 TLSubprojects are as follows (Table 3):

Table 3: Environmental Impacts of the Selected TL Subprojects

Sl. No.	kv	Subproject Site/Route	Selected Route	Environmental Impacts	Subproject Specific Impacts
1	230	Chowmuhoni – Kachua 230 kV Double Circuit TL	Route-01	**Pre-construction/Construction Phase:** i. Clearing of Vegetation ii. Disturbance of Fauna (wildlife) iii. Loss of Top Soil due to tower iv. Noise Pollution v. Air and Dust Pollution vi. Soil Pollution vii. Pollution due to Wastes viii. Aquatic Habitat ix. Traffic Congestion/Road Accident x. Siting of Construction Camps xi. Occupational Health and Safety xii. Community Health and Safety xiii. Employment Generation/Income	**Preconstruction/Construction Stage:** i. Surface water Pollution ii. 2806 Trees may be partially affected by trimming. ii. Loss of terrestrial habitat
2	230	Kachua-Gazaria 230 kV TL	Route-01		**Construction Stage:** i. Surface Water Pollution ii. 1740 Trees may be partially affected by trimming. ii. Loss of terrestrial habitat v. Disrubtion of boat movement and water pollution in the Meghna-Gumti River during construction of the TL along with tower at both river banks.
3	132	Kachua-Laksham 132 kV TL	Route-01		**Construction Stage:** i. Surface water Polluotion ii. 299 Trees may be partially affected by trimming. ii. Loss of terrestrial habitat
4	230	Chowmuhoni – Maijdee 230 kV Double Circuit TL	Route-01		**Construction Stage:** i. Surface water Pollution ii. 1795 Trees may be

Sl. No.	kv	Subproject Site/Route	Selected Route	Environmental Impacts	Subproject Specific Impacts
				Operation Stage: i. Landscape ii. Community Health and Safety iii. Occupational Health and Safety iv. Improvement of Social & Economic Life v. Short Circuit/Accident vi. Electro-Magnetic Field (EMF)	partially affected by trimming. ii. Loss of terrestrial habitat
5	132	Comilla (North) –Chandina 132 KV DC TL	Route-01		**Construction Stage:** i. Surface water Pollution. ii. Loss of terrestrial habitat
6	132	Chowmuhoni – Laxmipur 132 kV Double Circuit TL	Route-01		**Construction Stage:** i. Surface water Pollution ii. 2544 Trees may be partially affected by trimming. ii. Loss of terrestrial habitat
7	132	Muradnagar – Kosba 132 KV DC TL	Route-01		**Construction Stage:** i. Surface water Pollution ii. 377 Trees may be partially affected by trimming. ii. Loss of terrestrial habitat
8	230	Korerhat- Chowmuhoni 230KV MC TL	Route-01		**Construction Stage:** i. Surface water Pollution ii. 8010 Trees may be partially affected by trimining ii. Loss of terrestrial habitat v. Disrubtion of boat movement in the Feni River (perennial 3water body) during construction of the TL along with tower at both river banks. v. A mosque at 20m far away at R/S of the TL. vi. A grave yard at 25m faraway at L/S of the TL.

All Lilo lines have more or less same environmental impacts except Lilo line of 400 KV DC Korerhat-BSRM and therefore screening of impacts has been done for the 8 Lilo lines in the following same table except the Lilo of 400 KV DC Korerhat-BSRM and given in the following Table 4.

Table 4: Common/General & Subproject Specfic Environmental Impacts of the SelectedLilo Line Subprojects

Sl. No.	kv	Subproject Site/Route	Common Environmental Impacts
1			**Pre-construction/Construction Phase:** i. Clearing of Vegetation ii. Disturbance of Fauna (Wildlife) iii. Loss of Top Soil due to Tower iv. Noise Pollution v. Air and Dust Pollution vi. Soil Pollution vii. Pollution due to Wastes viii. Loss of Terrestrial Habitat ix. Traffic Congestion/Road Accident

Sl. No.	kv	Subproject Site/Route	Common Environmental Impacts
			x. Siting of Construction Camps xi. Occupational Health and Safety xii. Community Health and Safety xiii. Employment Generation/Income **Operation Stage:** i. Landscape ii. Community Health and Safety iii. Occupational Health and Safety iv. Improvement of Social & Economic Life v. Short Circuit/Accident vi. EMF
Sl. No.	kv	Subproject Site/Route	**Subproject Specific Environmental Impact**
1	400	LILO of 400 KV DC Korerhat-BSRM*	**Construction Phase:** i. Trimining of Trees (pocket hills with small to medium size forest trees (not densely) from ch 3+450 – 11+700; and ii. Disturbance of wildlife (specially birds)

Note: *Prior to start construction, permission from FD of Bangladesh is to be required.

7. ENVIRONMENTAL MANAGEMENT PLAN

Based on all the identified environmental impacts during preconstruction/construction and operation stages due to implementation of various subproject (Substation & TL) components/activities and associated development, Environmental Management Plan (EMP) has been prepared for the subprojects of the substation and TL.

Environmental Mitigation Plan: Environmental mitigation measures have been proposed for each of the identified impact of the subproject of the substations and TL/Lilo lines. Responsible institutions/departments for the implementation and supervision of each of the environmental issues have also been illustrated. Mitigation measures have been suggested based on the knowledge of the environmental specialist, suggestions of the stakeholders, collected during public consultation, and opinions from other relevant specialists (Table 4).

Table 5 : Mitigation Measures for the General/Common Impacts of the Substation Subprojects

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
(a) Preconstruction/Construction Stage				
Land acquisition/ requisition	▪ Loss of 86 acres land (mainly agricultural) permanently for twelve substation sites. ▪ Temporarily loss of land (requisition) for construction camps etc.	▪ Prior to commence construction activities, the owner of the affected land must be noticed and provided proper compensation in time as per GOB and WB guidelines; ▪ As per GOB & WB guidelines, RAP should be prepared for land acquisition/requisition/compensation and follow it. ▪ Use GIS instead of AIS in order to reduce land requirement.	DC	DSC/PGCB
Top soil	▪ Top soil loss (abpout 0.5m thick) due to	▪ Prior to start filling the site, collect and storage top soils (minimum 0.5m thick) for using on the surface of	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	construction of substation sites	the site boundary and access road side slopes for protection from side slope erosion. ▪ The topsoil, excavated from the proposed construction sites should be re-spread in areas to be landscaped. ▪ Follow ECOP-8		
Clearing of vegetation	▪ Loss of standing crops (if any), grass and bushes of substation sites and construction camp sites	▪ Prior to start clearing of vegetation; provide adequate compensation to the owners in time. ▪ Follow ECOP-18	Contractor	DSC/PGCB
Fauna (Wildlife)	▪ Disturbance of wildlife specially birds due to project activities such as earthworks, moving of project equipment & transports especially during night time.	▪ Prepare construction management plan (CMP) by the contractor and follow it properly. ▪ Follow GOB rules and regulations on noise. ▪ Project workers should not disturb or kill any wildlife. ▪ Follow ECOP-18	Contractor	DSC/PGCB
Construction Waste	▪ Generation of construction wastes from the construction materials.	▪ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time ▪ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements ▪ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials ▪ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste ▪ Use of construction materials containing recycled content when possible and in accordance with accepted standards. ▪ Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.	Contractor	DSC/PGCB
Drainage congestion and flooding	▪ Reducing floodplain storage area and increase local flooding ▪ Due to earth filling of substation sites and access roads above highest flood level (HFL). ▪ Drainage congestion if the surrounding the sites are blocked by	▪ Provide culvert in the access road of the substation; ▪ Ensure adequate monitoring, especially if construction works are carried out during the monsoon period. ▪ Provision for pumping of congested water, if needed; ▪ Consider of HFL during design of substations to avoid inundation. ▪ Follow ECOP-1.	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	the earth embankment.			
Noise level	▪ Noise pollution due to construction activities, generators and construction vehicle movement.	▪ Use of noise plug in heavy construction equipment; ▪ It is recommended that no construction should be allowed during night time (9 PM to 6 AM) ▪ Avoid using of construction equipment producing excessive noise at night; ▪ Construction activities should not be during night time ▪ Avoid prolonged exposure to noise (produced by equipment) by workers; and ▪ Regulate use of horns and avoid use of hydraulic horns in project vehicles. ▪ Generator should be placed within room (concrete walls with roof). ▪ Monitoring of noise level at construction site, construction camp as and when required.	Contractor	DSC/PGCB
Air quality & dust	▪ Air pollution and dust generation due to construction activities, generators and construction vehicle movement.	▪ All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) shall be well maintained and not emit dark or smoky emissions in excess of the limits described in the EQS. ▪ Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Drivers of vehicles used during construction will be under strict instructions to minimize unnecessary trips and minimize idling of engines. Dust suppression facilities (back pack water sprayer) shall be available where earth and cement works are required. ▪ Spray water on dry & loose surface of the construction sites regularly; ▪ Maintain adequate moisture content of soil during transportation, compaction and handling; ▪ Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins. ▪ Sprinkle and cover stockpiles of loose construction materials (e.g., fine aggregates, sand); ▪ Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter. ▪ Dust masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.	Contractor	DSC/PGCB
Soil quality	▪ Soil pollution	▪ Laboratory analysis of the river bed materials to be confirmed prior to start collection from the river; and ▪ Prevention of spillage and leakage of hazardous liquid	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		at construction site & camp. ▪ Ensure not to use transformer containing PCB to avoid soil & air pollution.		
Sitting of construction camps	▪ Removal of vegetation such as grass, standing crops (if any) and bushes. ▪ Environmental pollutions (such as air/dust, noise, water, wastes & soil) affecting nearby the settlements,	▪ Prior to start clearing of vegetation; provide adequate compensation to the owners in time. ▪ Locate construction camp away from residential settlements, cultural sites, water bodies etc (minimum 0.5km). ▪ Try to use fallow land to avoid crops damage ▪ Just after completion of the construction, hand over the camp sites to the owners as in earlier condition . ▪ Follow ECOP-7	Contractor/ DSC	PGCB
Traffic congestion/road accident	▪ Traffic congestion and road accident due to movement of construction vehicles.	▪ Follow Bangladesh Road Traffic Authority (BRTA) traffic rules and regulations; ▪ Schedule deliveries of materials/ equipment during off-peak hours ▪ Engage flagman specially at the entry of the substation sites and construction camps for traffic control ▪ Engage experienced drivers to drive project vehicles ▪ Arrange for signal light at night ▪ Prepare and follow proper traffic management; and ▪ Avoid stockpiling of materials specially at the road sides that could disturb traffic movement. ▪ Follow ECOP-14	Contractor	DSC/PGCB
Pollution due to wastes	▪ Pollution due to wastes (construction wastes from construction activities & general wastes from workers' camps)	▪ Solid wastes collection system will be essential, which should include separation and collection of solid wastes in the dustbins/waste containers throughout the work site, construction yard/labour camp. ▪ The wastes such as piece of rods and woods, newspapers, containers etc. can be sold to the venders and rest wastes can be dumped into the nearby road side waste containers/ waste bins from where will send these wastes to the nearest land fill dumping site by the Contractors. ▪ A log of the disposal of toxic and other waste materials is to be kept by the Contractors. ▪ Prior to start cpnstruction, contractor should prepare waste management plan (WMP) based on the EMP ▪ Follow ECOP-10	Contractor	DSC/PGCB
Community health and safety (H&S)	▪ Community H&S nearby the substation site	▪ Safety barrier and warning sign surrounding the construction site; ▪ Generators should be placed in the closed room ▪ Formulate and implement emergency risk	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		management plan by the contractor ▪ Follow ECOP-20.		
Occupational health and safety (H&S)	▪ Health & safety risks of construction workers.	▪ An experienced Health & Safety (H&S) Manager must be engaged by the contractor prior to start construction ▪ Only permitting trained and certified workers to work with any electrical equipment. ▪ Safety induction by the H&S Manager should be provided for the workers ▪ Prior to start work, tool box meeting should be arranged by the H&S Manager for the workers ▪ First Aid Box and personal protective equipment, PPE (such as safety helmets, safety shoes, eye protection glasses, ear plugs/muffs, waist belts, masks, hand gloves, body protective aprons and insulating boots) must be provided to the workers and ensure to use these PPE by the workers; ▪ Safety signs, health signs, prohibition sign, warning sign, mandatory sign, emergency escape sign, first-aid sign, information sign, signboard, supplementary signboard, safety collar, symbol, pictogram, illuminated sign, acoustic signal, verbal communication and hand signal must be fitted at the designated sites of the subproject areas. ▪ Follow ECOP-19.	Contractor	DSC/PGCB
Employment generation/income	▪ Employment opportunities for the local people especially for PAPs.	▪ Employ local people specially PAPs for the project activities as much as possible.	Contractor	DSC/PGCB
(b) Operation Stage:				
Tree replantation	▪ A total of 7000 various local tree species can be replanted at the access road side slope @ 2.50m interval. ▪ Among the planted saplings, some (about 10%) may be dead.	▪ Plantation of 7000 saplings to replace felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow ECOP-17.	FD	PGCB
Drainage congestion	▪ Drainage congestion will be occurred in the surface drains within the substation area if O&M is not done regularly.	▪ Clean the drains, specially during monsoon regularly; ▪ Ensure adequate monitoring.	PGCB	PGCB
Community health and	▪ Community H&S nearby the substation	▪ Safety barrier and warning sign surrounding the construction site;	PGCB	PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
safety	site	▪ Generators should be placed in the closed room; ▪ Follow ECOP-20		
Safety & Security of workers	▪ Risk to continuous power supply and even damage of substation	▪ Ensure security of substation in collaboration with law enforcing agencies. ▪ Keep complain book in the substation for recording of people's complains. ▪ Ensure availability of adequate safety gears for substation operations	PGCB	PGCB
Power Supply	▪ Due to adequate reliability of power supply, social life and economic condition of the people will be improved	▪ O&M of the substations should be done in time for adequate power generation. ▪ Follow ECOP-7	PGCB	PGCB
Short Circuit/Accident	▪ Due to short circuit of the substation, disruption of power and accident will be occurred.	▪ O&M of substations should be done in time by experienced personnel.	PGCB	PGCB

Table 6 : Mitigation Measures for the Specific Impacts of the Substation Subprojects

Substations	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
(a) Preconstruction/Construction Stage				
400 kV Korerhat Substation, Mirsarai, Chittagong	▪ Site clearance will be required and 2945 trees will need to be felled.	▪ Try to avoid tree cutting as many as possible; ▪ Replantation of minimum 5900 numbers of various local saplings along the access road slopes and other private land during monsoon period of operation stage . ▪ Follow ECOP-18 & 19	Contractors	DSC/PGCB
132/33 kV: Basurhat GIS 2x50/75 MVA Substation, Daganbhuiyan, Feni	▪ Site clearance will be required and 136 trees will need to be felled. ▪ Water of nearby pond will be polluted in case of dumping of project wastes into pond and washing of project vehicles. ▪ Due to earth	▪ Try to avoid tree cutting as many as possible; ▪ Replantation of minimum 272 numbers of various local saplings along the access road slopes during monsoon period of the operation stage ▪ Follow ECOP-18 & 19 ▪ Need to prepare waste management plan & follow it. ▪ All project vehicles must be washed in the designated project garage but not in the nearby pond. ▪ Dust should be controlled by watering regularly. ▪ Noise level should be minimised by noise barrier (by tin/polythene fence).	Contractors	DSC/PGCB

Substations	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	work, a mosque at about 100m far away will be affected specially by dust and noise.			
132/33 kV: Chandina GIS 2x50/75 MVA Substation, Debidwar, Comilla	▪ . ▪ ▪ It's a Government Land. Land is now in barren condition and ready for any construction.	▪ Need to prepare waste management plan & follow it. ▪	Contractors	DSC/PGCB
Maijdee Substation, Noakhali	▪ Nearby khal water will be polluted in case of dumping of project wastes into the khal and washing of project vehicles	▪ Need to prepare waste management plan & follow it. ▪ All project vehicles must be washed in the designated project garage.	Contractors	DSC/PGCB
(b) **Operation Stage:**				
400 kV Korerhat Substation, Mirsarai, Chittagong	▪ A total of 2945 various local tree species can be replanted at the access road side slope @ 2.50m interval. ▪ Among the planted saplings, some (about 10%) may be dead.	▪ Plantation of minimum 5900 saplings to replace felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow ECOP-17.	FD	PGCB
132/33 kV: Basurhat GIS 2x50/75 MVA Substation, Daganbhuiyan, Feni	▪ A total of 136 various local tree species can be replanted at the access road side slope @ 2.50m interval. ▪ Among the planted saplings, some (about 10%) may be	▪ Plantation of minimum 272 saplings to replace felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow ECOP-17.	FD	PGCB

Substations	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	dead.			
132/33 kV: Chandina GIS 2x50/75 MVA Substation, Debidwar, Comilla	▪ A total of 420 various local tree species can be replanted at the access road side slope @ 2.50m interval. ▪ Among the planted saplings, some (about 10%) may be dead.	▪ Plantation of minimum 840 saplings to replace felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow ECOP-17.	FD	PGCB

Table 7 : Mitigation Measures for the General/Common Impacts of TL/Lilo Line Subprojects

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
(a) Preconstruction/Construction Stage				
Clearing of vegetation	▪ 20252 trees will be partially affected by trimming as well as standing crops (if any) and bushes along the ROW also will be affected.	▪ Prior to start clearing of vegetation; provide adequate compensation to the owners. ▪ Follow ECOP-17	Contractor	DSC/PGCB
Land Requisition (Temporary loss of 804 acres land for the construction period of about 3 years)	▪ Loss of 804 acres land temporarily for the 884 nos. of tower bases of the TL/LILO lines	▪ Prior to commence construction activities, the owner of the temporarily affected land must be noticed and provided proper compensation as per GOB and WB guidelines; ▪ As per GOB & WB guidelines, RAP should be prepared for land acquisition/requisition/compensation and follow it. ▪ Use GIS instead of AIS in order to reduce land requirement.	DC	DSC/PGCB
Fauna (Wildlife)	▪ Disturbance of wildlife specially birds due to project activities such as moving of project	▪ Prepare construction management plan by the contractor and follow it. ▪ Follow GoB rules and regulations on noise. ▪ Project workers should not disturb or kill the birds. ▪ Follow ECOP-18	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	equipment & transports especially during night time.			
Construction Waste	▪ Generation of construction wastes from the construction materials.	▪ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time ▪ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements ▪ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials ▪ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste ▪ Use of construction materials containing recycled content when possible and in accordance with accepted standards. ▪ Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.	Contractor	DSC/PGCB
Noise level	▪ Noise pollution due to construction activities, generators and construction vehicle movement.	▪ Use of noise plug in heavy construction equipment; ▪ It is recommended that no construction should be allowed during night time (9 PM to 6 AM) ▪ Avoid using of construction equipment producing excessive noise at night; ▪ Construction activities should not be during night time ▪ Avoid prolonged exposure to noise (produced by equipment) by workers; and ▪ Regulate use of horns and avoid use of hydraulic horns in project vehicles. ▪ Generator should be placed within room (concrete walls with roof). ▪ Monitoring of noise level at construction site, construction camp as and when required.	Contractor	DSC/PGCB
Air quality & dust	▪ Air pollution and dust generation due to construction activities, generators and construction vehicle	▪ All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) shall be well maintained and not emit dark or smoky emissions in excess of the limits described in the EQS. ▪ Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Drivers of vehicles used during construction will be under strict instructions to minimize	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	movement.	unnecessary trips and minimize idling of engines. Dust suppression facilities (back pack water sprayer) shall be available where earth and cement works are required. ▪ Spray water on dry & loose surface of the construction sites regularly; ▪ Maintain adequate moisture content of soil during transportation, compaction and handling; ▪ Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins. ▪ Sprinkle and cover stockpiles of loose construction materials (e.g., fine aggregates, sand); and ▪ Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter. ▪ Dust masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.		
Soil quality	▪ Soil pollution	▪ Prevention of spillage and leakage of hazardous liquid at construction site & camp. ▪ Ensure not to use transformer containing PCB to avoid soil & air pollution.	Contractor	DSC/PGCB
Sitting of construction camps	▪ Temporarily loss of land for the construction camps etc. ▪ Clearing of standing crops if (any), grass and bushes ▪ Environmental pollutions (such as air, noise, water, wastes & soil) affecting nearby the settlements,	▪ Prior to commence construction activities, the owner of the temporarily affected land must be noticed and provided proper compensation as per GOB and WB guidelines; ▪ As per GOB & WB guidelines, RAP should be prepared for land acquisition/requisition/compensation. ▪ Prior to start clearing of vegetation; provide adequate compensation to the owners in time. ▪ Locate construction camp away from residential settlements, cultural sites, water bodies etc (minimum 0.5km). ▪ Try to use fallow land ▪ Just after completion of construction, hand over this camp site to the owners as in earlier condition. ▪ Follow ECOP-7.	Contractor/ DSC	PGCB
Traffic congestion/road accident	▪ Traffic congestion and road accident due to movement of construction	▪ Follow BRTA traffic rules and regulations; ▪ Schedule deliveries of material/ equipment during off-peak hours ▪ Engage flagman specially at the entry of the substation site and construction camps for traffic control ▪ Engage experienced drivers to drive project vehicles	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	vehicles.	▪ Arrange for signal light at night ▪ Proper traffic management; and ▪ Avoiding stockpiling of materials specially at the road sides that could hamper traffic movement. ▪ Follow ECOP-14		
Pollution due to wastes	▪ Pollution due to wastes (construction wastes from construction activities & general wastes from workers' camps)	▪ Solid wastes collection system will be essential, which should include separation and collection of solid wastes in the dustbins/waste containers throughout the work site, construction yard/labour camp. ▪ The wastes such as piece of rods and woods, newspapers, containers etc. can be sold to the venders and rest wastes can be dumped into the nearby road side waste containers/ waste bins from where will send these wastes to the nearest land fill dumping site by the Contractors. ▪ A log of the disposal of toxic and other waste materials is to be kept by the Contractors. ▪ Contractor should prepare waste management plan based on the EMP ▪ Follow ECOP-10	Contractor	DSC/PGCB
Community health and safety (H&S)	▪ Community H&S along the distribution line	▪ Safety barrier and warning sign surrounding the construction site; ▪ Generators should be placed in the closed room ▪ Formulate and implement emergency risk management plan by the contractor ▪ Follow ECOP-20	Contractor	DSC/PGCB
Occupational health and safety (H&S)	▪ Health & safety risks of construction workers.	▪ An experienced H&S Manager must be engaged by the contractor prior to start construction ▪ Only permitting trained and certified workers to work with any electrical equipment. ▪ First aid box and personal protective equipment, PPE (such as helmet, safety shoes, eye protection glass, ear plugs, waist belt, mask, hand gloves, body protective apron, ear muff and insulating boots) must be provided to the workers and ensure to use these PPE by the workers; ▪ Safety signs, health signs, prohibition sign, warning sign, mandatory sign, emergency escape sign, first-aid sign, information sign, signboard, supplementary signboard, safety collar, symbol, pictogram, illuminated sign, acoustic signal, verbal communication and hand signal must be fitted at the designated sites of the subproject area. ▪ Follow ECOP-19	Contractor	DSC/PGCB
Employment	▪ Employment	▪ Employ local people specially PAPs for the project	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
generation/income	opportunities for the local people especially for PAPs.	activities as much as possible.		
(b) Operation Stage:				
Community health and safety	▪ Community H&S along the distribution lines	▪ Safety barrier and warning sign surrounding the construction site; ▪ Generators should be placed in the closed room. ▪ Follow ECOP-20	PGCB	PGCB
Safety & Security of workers	▪ Risk to continuous power supply	▪ Ensure security of substation in collaboration with law enforcing agencies. ▪ Keep complain book in the substation for recording of people's complains. ▪ Ensure availability of adequate safety gears for substation operations	PGCB	PGCB
Power Supply	▪ Due to adequate reliability of power supply, social life and economic condition of the people will be improved	▪ O&M of substations should be done in time for adequate power generation.	PGCB	PGCB
Short Circuit/Accident	▪ Due to short circuit of the substation, disruption of power and accident will be occurred.	▪ O&M of substations should be done in time by experienced personnel.	PGCB	PGCB
EMF	▪ Due to EMF, human health may be affected	▪ To be checked and accordingly take n/a.	PGCB	PGCB

Table 8: Mitigation Measures for the Specific Impacts of the TL/Lilo line Subprojects

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
Preconstruction /Construction Stage:				
Subproject Name: 230kV D/C Korerhat – Chowmuhoni Transmission Line				
Requiremen	Crop production at	Adequate compensation will be provided to the	DC	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
t of land	the 163 tower sites will be disrupted.	affected people in time following RAP.		
Disruption of boat movement; and Disruption of 2 cultural sites (such as a mosque at about 20m far away from TL at ch 48+300 at R/S, and a graveyard at ch 10+000 at L/S (witin SPIA).	Disruptions of water transport movement during construction of transmission line over the Feni River at Ch 2+850. A mosque at about 20m far away from TL at ch 48+300 at R/S, and a graveyard at ch 10+000 at L/S (witin SPIA) may be affected .	▪ Follow BITWA rules and regulations on navigation. ▪ Transmission line should be about 15m above the HWL. ▪ Close monitor the river crossing site of the TL during construction to avoid accident. ▪ Try to construct the TL at the river crossing during night to avoid disruption of boat movement. ▪ Any waste should not be disposed into the river. ▪ River water should be tested quarterly during construction. ▪ Mosque and graveyard should not be affected by the project activities (such as by wastes, noise, dust etc.). Adequate size noise barrier/screen should be installed at the mosque and graveyard site for protecting noise and dust. ▪ No activities should be done during night (6:00 AM – 9:00PM).	Contractors	DSC/PGCB
Water pollution	Construction of transmission line across rivers, canals and other water bodies (total 15) could pollute water during construction stage;	▪ Discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ponds will be prevented; and ▪ During construction, washing of clothes, bathing and cleaning of project vehicle & equipment in the aquatic habitat (e.g. river, pond) will be prohibited; ▪ Surface water quality will be monitored twice in a year (during dry and wet seasons); and ▪ ECOP -12 for water bodies and water qualities respectively will be followed.	Contractor	DSC/PGCB
Aquatic Fauna	Due to water pollution by the construction of TL across the water bodies, aquatic fauna (fishes, frogs, snakes etc.) will be affected	▪ Discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ponds will be prevented; and ▪ During construction, washing of clothes, bathing and cleaning of project vehicle & equipment in the aquatic habitat (e.g. river, pond) will be prohibited; ▪ Project workers should not kill fishes & other fauna from the water bodies. ▪ ECOP- 11 and 12 for water bodies and water qualities respectively will be followed.	Contractor	DSC/PGCB
Subproject Name: 230kV D/C Kachua-Gazaria Transmission Line:				
Requiremen	Crop production at	Adequate compensation will be	DC	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
t of land	the 134 tower sites will be disrupted.	provided to the affected people in time following RAP.		
Disruption of boat communication	Disruptions of water transport movement during construction of transmission line over the Meghna-Gumti River at ch 33+500.	▪ Follow BITWA rules and regulations on navigation. ▪ Transmission line should be about 15m above the HWL. ▪ Close monitor the river crossing site of the TL during construction to avoid accident. ▪ Any waste should not be disposed into the river. ▪ Try to construct the TL at the river crossing during night to avoid disruption of boat movement. ▪ River water should be tested quarterly during construction	Contractors	DSC/PGCB
Water pollution	Construction of TL (along with tower on both river banks) across the Meghna – Gumti River at ch 33+500 will pollute river water;	▪ Discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ponds will be prevented; and ▪ During construction, washing of clothes, bathing and cleaning of project vehicle & equipment in the aquatic habitat (e.g. river, pond) will be prohibited; ▪ Surface water quality will be monitored twice in a year (during dry and wet seasons); and ▪ ECOP- 12 for water bodies and water qualities respectively will be followed.	Contractor	DSC/PGCB
Aquatic Fauna	Due to water pollution by the construction of TL across the water bodies, aquatic fauna (fishes, frogs, snakes etc.) will be affected	▪ Discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ponds will be prevented; and ▪ During construction, washing of clothes, bathing and cleaning of project vehicle & equipment in the aquatic habitat (e.g. river, pond) will be prohibited; ▪ Project workers should not kill	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		fishes & other fauna from the water bodies. ▪ ECOP-11 and 12 for water bodies and water qualities respectively will be followed.		
Subproject Name: Korerhat-BSRM LILO Line:				
Forest tress in the poket hilly area from ch 3+450-11+700	▪ Forest trees may be affected by trimming of trees along the ROW ▪ Wildlife specially birds will be disturbed	▪ Prior to start construction, written permission should be taken from the FD i(In case of trimming of forest trees), ▪ Follow ECOP- 16, 17 and 18.	Contractor	DSC/PGCB/FD

Environmental Monitoring Plan: The aim of the Environmental Monitoring Plan during the preconstruction/construction and operation stages of the subproject of substations & TL/Lilo is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of environmental components (e.g. water, soil, noise etc.) based on the national standards. A monitoring schedule has been drawn up based on the environmental components that may be affected during the preconstruction/construction and operation stages of the project. Since the project is likely to have impact on various components of the environment, a comprehensive monitoring plan: (i) for the substation subprojects covering land acquisition, vegetation clearance, tree felling/replantation, drainage congestion/flooding, air quality, water quality, soil quality, noise quality, fauna and health & safety as well as (ii) for the TL/Lilo subprojects covering temporary land requirement, vegetation clearance, tree trimming,disturbance of fauna, soil pollution,noise pollution and health & safety has been provided in the Monitoring Plan. Details of Monitoring Plan is given in the following Table 8.

Table 9 : Environmental Monitoring Plan for Substation Subprojects

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Preconstruction/Construction Stage							
Felling of trees and clearing of vegetation	▪ Checking whether proper compensation as mentioned in RP is received by PAPs.	DOE/FD	Inspection	Regular during tree felling and site clearing operations	Within ROW of substation & access road sites	Contractor /FD	DSC/PGCB
Fauna (Wildlife)	Checking whether wildlife is disturbing/killing by the workers	DOE/FD	Inspection	Weekly	ROW of Route	Contractor /FD	DSC/PGCB
Drainage	▪ Checking drainage	Hydrologic	Inspection	Regular	Substation site	Contractor	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Congestion /Flooding	congestion & top of substation site above HFL	a/Drainage study		during earthworks			
Noise Pollution	Ambient noise level	DOE Noise Pollution Control Rules, 2006	Measurement	As & when required	At construction sites & camps	Contractor	DSC/PGCB
Dust Pollution	▪ Dust should be controlled by water spraying regularly specially during dry period.	DOE guidelines	Inspection	Daily	SS sites	Contractor	DSC/PGCB
Surface Water Quality	pH, BOD_5, COD, NH_{3-N}, PO_4	DOE Standards	Sampling and Laboratory Analysis	Quarterly	Nearby 3 Water bodies	Contractor	DSC/PGCB
Ground Water/Drinking Water Quality	pH, Mn, Fe, As, TC, FC	DOE Standards	Sampling and Laboratory Analysis	Quarterly	At 3 construction camps (in Chittagong, Comilla & Noakhali)	Contractor	DSC/PGCB
Pollution due to Wastes	▪ Checkingcollection, storage, transportation, and disposal of hazardous waste; ▪ Waste from construction site to be collected and disposed safely to the designated sites; and ▪ Wastes from labour camp to be disposed properly at the designated sites.	DOE guidelines	Inspection	Weekly	Construction camps	Contractor	DSC/PGCB
Traffic Congestion /Road Accident	▪ Checking meeting point of existing road & access road	BRTA	Inspection	Daily	Meeting point of existing road & access road	Contractor	DSC/PGCB
Occupational health and safety	Checking health, use of PPE & 1st aid facilities, DWQ, sanitation and accommodation	DOE/IFC guidelines	Inspection & testing of DWQ	Daily	At construction sites and camps	Contractor	DSC/PGCB
Community health and safety	Awareness of local people and staying safely from the project activities	DOE/IFC guidelines	Inspection	Monthly	At construction site and camps	Contractor	DSC/PGCB
Operation Stage							
Tree replantation	Replanting of saplings and checking replacement of dead	FD	Inspection	As & when required	Access road side slopes	FD	PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
	saplings & nursing (watering & fertilizer) of saplings for 2 years						
Drainage congestion	Checking drainage congestion in the substation sites during monsoon	Hydrological/Drainage study	Inspection	As & when required during monsoon	Substation sites	PGCB	PGCB
Community health and safety	Community H&S nearby the substation site	DOE/IFC guidelines	Inspection	Monthly	Substation sites	PGCB	PGCB
Safety & Security of Substation & workers	Checking use of PPE & duty of security force	DOE/IFC guidelines	Inspection	Daily	Substation sites	PGCB	PGCB

Table 10: Environmental Monitoring Plan for TL/Lilo lines Subprojects

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Preconstruction/Construction Stage							
Requirement of land (Temporary requisition for 3 years)	▪ Ensure that PAPs get compensation as per RAP which needs to be prepared.	As per RAP	Inspection	As per RAP	ROW of the TL/LILOlilnes	DC	DSC/PGCB
Trimming of trees within ROW and clearing vegetation from the tower bases of the TL/LILO lines.	▪ Checking whether proper compensation as mentioned in RAP is received by PAPs.	DOE/FD	Inspection	Daily during tree felling and site clearing operations	Trimming of trees within ROW and clearing vegetation from the tower bases of the TL/LILO lines.	FD	DSC/PGCB
Noise Pollution	Ambient noise level	DOE standards	Measurement	As & when required	At adjacent subproject cultural sites & construction camps	Contractor	DSC/PGCB
Pollution due to Wastes	▪ Checking storage,	DOE guideline	Inspection	Daily	Constructi	Contractor	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
	transportation, handling, and disposal of wastes; ▪ Wastes from construction sites and camps to be disposed properly at the designated waste dumping sites.	s			on sites and camps		
Surface Water Quality	pH, BOD_5, COD, NH_3, PO_4	DOE Standards	Sampling and Laboratory Analysis	Quarterly	River Crossing Site of Meghna-Gumti & Feni River by TL	Contractor	DSC/PGCB
Ground Water /Drinking Water Quality	pH, Mn, Fe, As, TC, FC	DOE Standards	Sampling and Laboratory Analysis	Quarterly	3 Construction camps (in Chittagong, Commilla & Noakhali)	Contractor	DSC/PGCB
Traffic congestion/Road Accident	Checking road crossing points, road adjacent to towers etc.	BRTA	Inspection	Daily	At road/Rly. crossing points & road adjacent to towers	Contractor	DSC/PGCB
Cutural sites in SPIA (such as a mosque at R/S at about 20m distance at ch 48+300 and a gravegard at L/S at about 25m distance	Checking whether these two cultural sites are affected by the project activities such as by	DOE guidelines	Inspection	As & when required	A mosque at R/S at about 20m distance at ch 48+300 and a gravegard at L/S at about 25m	Contractor	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
from Korerhat-Choumohini TL.	noise, wastes etc.				distance from Korerhat-Choumohini TL.		
Occupational health and safety	Use of PPE, general health, water supply and sanitation	DOE/IFC guidelines	Inspection	Daily	At construction sites and camps	Contractor	DSC/PGCB
Community health and safety	Awareness of local people	DOE/IFC guidelines	Inspection	Monthly	At construction site and crossing of roads	Contractor	DSC/PGCB
Operation Stage							
Tall trees	Trimming of tall trees under the TL	ESMF	Inspection	Once every year and as directed by the relevant engineer of PGCB	Along the TL/LILO Lines	PGCB	PGCB
EMF	EMF level	ESMF	On site measurement	Twice a year	At populated area where TL/Lilio lines passes over	PGCB	PGCB
Short circuit/accident	Safety	DOE guidelines	Inspection	Daily	Along the TL/Lines	PGCB	PGCB
Occupational Health and Safety (OHS)	Use of PPE	As required	Inspection	Daily	Along the TL/LILO lines	PGCB	PGCB
Power Supply	Access to electricity in the rural area on priority basis.	DOE/PDB guidelines	Inspection	Whole project period	Along the TL/LILO lines	PGCB	PGCB

The EMP Implementation Schedule and Implementation Cost: The schedule of implementing the EMP has been prepared based on the environmental issues/parameters illustrated in the EMP which will be followed at the certain period of the project. However, this implementation schedule is subject to change depending on the existing situation. The estimated duration of the construction work is approximately 3 years. Approximate cost for the implementation of the EMP is about BDT 7.020 millions (approx. 83,000 USD). PGCB will use revenue budget for operational phase EMP at actual cost basis.

Environmental Code of Practises (ECOP): The ECOP is prepared as a guideline for environment management of different components of the substation and TL subprojects. The ECOP has designed to address all potential impacts during the construction of the substations, rehabilitation of the transmission lines, and construction of the new transmission lines. The ECOP will provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. The list of ECOP, prepared for the subprojects of ESPNER is given below: Project Planning and Design, Route Selection,Tower/Pole Erection, Overhead Power Cable Installation, Installation of Transformer on H-Pole, Substation Site Preparation,Construction Camps,Topsoil Salvage, Storage and Replacement, Borrow Areas, Land Reclamation, Waste Management, Water Bodies, Water Quality,Public Health and Safety, Material Storage, Transport & Handling, Cutting/triming of Trees, Vegetation Natural Habitats,Occupational Health and safety, Community Health and Safety.

8. INSTITUTIONAL ARRANGEMENT AND CAPACITY BUILDING

Institutional arrangements are essential to implement the suggested mitigation measures properly and to execute Monitoring Plan at different project stages. The implementation of the EMP also requires capacity building of the EMP implementation agency through training needs and plan. The structured institutional settings facilitate proper implementation of the environment safeguard requirements for the development of the project. The PGCB is the key authority to follow up all the relevant environmental safeguard requirements following institutional arrangement. In addition, the relevant organizations such as consultant, contractor, DOE and FD are also included. Enhancement of the capacity of the PGCB's ESU is required for the effective implementation of proposed mitigation measures and monitoring the resultant effect, some training programs and awareness workshop are also essential before and after starting of construction such as General environmental awareness, regulatory requirements, environmental impacts and mitigation, analysis of alternatives, environmental management (EMP and ECOP), Environmental assessment, monitoring activities and H&S.Grievance Redress Mechanism: The concern/grievances may come from the local/affected people related to inappropriate implementation of various components of EMP or the overall road upgrading itself. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach. A grievance redress mechanism will be established to receive, evaluate, and facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project. The GRM aims to provide a trusted way to voice and resolve concerns linked to the project, and to be an effective way to address affected people's concerns.

9. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

The aim of public consultation is to ensure that the people and the stakeholders living in the SPIA become aware about the project activities and the aim is also to ensure the acceptance of the

subprojects of Substation & TL/Lilo activities. Public consultation is important to collect baseline information and to identify potential impacts and mitigation measures. After conducting public consultation, it is also important to disclose information to the public in their own language regarding the decision and measures planned to be taken against different project activities. As a part of the environmental study, the environmental team conducted several stakeholders meeting with local administrative authority, businessmen, fermers, service holders, workers, drivers, shopkeepers, women as well as PAPs. A total of five stakeholders have been carried out during the preparation of the IEE of the project. The findings of the consultations are as follows: (i) main positive issues are: employmentopportunities; improvement of local and national economy; improvement of security and improvement of power generation etc. and main negative issues are: permanent (due to construction of SS) and temporay land loss (due to construction of TL/Lilo lines); losses/trimming of vegetation, air/dust pollution mainly due to construction of SS, noise pollution due to movement of project vehicles/equipment and accidents/injuries may be occurred during construction and operation stages of the project etc. The participants of the consultations also have suggested to enhance the positive issues/impacts and possible mitigation measures to minimize the negative impacts. The participants of the consultations are infavour of the project implementation.

The implementation of the EMP for the proper management of mitigation/enhancement measures of the project as document or report, should be publicly available in readable format to the local people. The project proponent (e.g. PGCB) should ensure information disclosure to the local people. and to the respective stakeholders of the respective subproject under the proposed project.

10. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The Government of Bangladesh (GOB) has set long term goals for the power sector in the country. Providing access to affordable, reliable and quality supply of electricity to the majority of the people of Bangladesh by 2020 are the goals of the GOB to users the next millennium. In line with the above stated goals, the GOB is expected to obtain financial support from the International Development Association (IDA) for the proposed Enhancement and Strengthening of Power Network in Eastern Region (ESPNER) project to ensure reliable and quality supply of electricity to the rural and urban consumers in Bangladesh through improvements in technical efficiency of the distribution system. The proposed project is expected to provide support for augmentation and rehabilitation of the transmission network of the Power Grid Company of Bangladesh (PGCB) under the Power Cell, Power Division, Ministry of Power, Energy and Mineral Resources (MOPEMR) of the GOB. Main components of the project include:

- Construction of new 230/132 kV two substations and new 132/33 kV 10 substations;
- Construction of new 288.642 long 132 kV, 230kVand 400kV transmission lines (TL); and
- Construction of new 8 LILO lines;

The present power network in Greater Comilla, Noakhali and Chittagong areas of Bangladesh is aged and suffering numerous problems as system demand is growing rapidly. The greater Comilla and Noakhali areas are the second largest demand areas after the capital city of Dhaka. The greater Chittagong area is on the verge of massive industrialization as the government is taking initiatives to set up multiple economic zones, upgrade port facility and transportation network. Hence, the project was conceptualized with a rationale to expand the 230 kV transmission systems and to

strengthen the 132 kV transmission systems in the project area, in order to, eliminate the operational bottlenecks caused due to inadequacy of the existing system. The project will also provide an adequate infrastructure for the future power sector development of the area.

The TOR has prepared to carryout IEE for the project in accordance with the relevant laws and regulations of the GOB and the WB. The specific environmental guideline for the power sector is not available in Bangladesh. However, the DOE environmental guidelines for the industries provide a general framework for conducting environmental study for the entire sector. Therefore, the proposed IEE will be conducted following the DOE environmental guidelines. In addition, it is suggested to follow the Environmental & Social Management Framework (ESMF) of Rural Electricity Transmission and Distribution Project of PGCB and BREB as well as WB environmental guidelines for the power sector.

The scope of work of the IEE includes: (a) Review of existing information (relevant all documents) from secondary sources, and identify gaps to be filled, relevant to the environmental screening needs from primary surveys. (b) Provide a description of the environment (such as baseline data on physical, biological and socioeconomic characteristics of the subproject site along with area of influence). (c) Represent the primary surveys where include baseline (air, water, noise, and riverbed) environmental quality monitoring at representative and sensitive locations, and identification of all macro-level environmental issues within the Sub-project's influence area. (d)Survey the environmentally sensitive locations on and along the Sub-projects as well as within the Sub-project's influence area. (e)Arrange stakeholders' consultations within the local people from all professions to find out their opinion within the subproject. (f) Analysis of alternatives to the proposed subproject. (g) Identify and assessment of potential environmental impacts due to implementation of the subproject. (h) Formulation of Environmental Management Plan (EMP)

Initially, 3 sites for each proposed substation and 3 routes for each proposed TL have been selected and environmental screening and assessment for these 3 substation sites and TL routes have been done for identifying the potential impacts based on the collected baseline information/data by the environmental specialist and survey team. From these 3 sites/routes, environmentally suitable substation site and TL have been finally selected. The potential impacts for the selected subprojects of the substation and TL/LILO Lines during pre-construction/ construction and operation stages of the subprojects are:

(a) For Substation Subprojects:

(i)General/Common Potential Impacts:

During Preconstruction/Construction: A total of 85.99 acres land acquisition, clearing of vegetation including 3501 trees , hydrology/ drainage congestion, top soils, and dust pollution, noise pollution, waste pollution , soil pollution, traffic congestion, occupational HS, community HS, and employment generation; and

During Operation: Drainage congestion, tree replantation (a total 7000 various trees), landscape, occupational HS, community HS, and improvement of social and economical life of the people.

(ii) Specific Impacts ofSubstations

During Preconstruction/Construction: 2,945 trees, 136trees & 420 trees need to be cut due to construction of Korerhat, Basurhat & Chandina substation respectfully. SW pollution of pond will be occurred due to construction of Maijdee, Basurhat& Chandina substation respectfully.

(b) For TL &LILO Lines Subprojects

(i) General/Common Impacts:

Pre-construction/Construction Phase: Trimming of 20,252 trees, Disturbance of Fauna (wildlife), Loss of Top Soil due to tower, Noise Pollution, Air and Dust Pollution, Soil Pollution, Pollution due to Wastes, Aquatic Habitat, Traffic Congestion/Road Accident, Siting of Construction Camps, Occupational Health and Safety Community Health and Safety, Employment Generation/Income
Operation Stage: Landscape, Community Health and Safety, Occupational Health and Safety Improvement of Social & Economic Life, Short Circuit/Accident, EMF (Electro-Magnetic Fields (EMF).

(ii) Specific Impacts

Preconstruction/Construction Phase: Disrubtion of boat movement in the Meghna- Gumti River during construction of the Kachua-Laksham TL and Disrubtion of boat movement in the Feni River; amosque due at 20m far away at R/S of the TL at ch 48+300 and a graveyard at 25m faraway at L/S of the TL dueto constructionof the Korerhat Choumohini TL.Pocket hilly areas with forest small to medium trees will be affected (trimming) due construction of Korerhat-BSRM LILO line.

The potential impacts during construction phase are short-term that can be avoided or eliminate to ed or reduced by adopting the mitigation measures properly. Therefore, the anticipated negative construction related impacts could be mostly controlled/minimized or eliminated by taking suggested mitigation measures and manage the implementation of the mitigation measures through the EMP including effective monitoring plan during pre-construction/construction and operation phases of the project.

The potential impacts during operation are long term and PGCB should ensure to mitigate these impacts through implementation of the EMP including monitoring plan properely. Approx.total budget for EMP is about BDT 7,124,000.

.

Recommendations

Based on the findings of the IEE study, the following can be recommended:

- Based on the EMP of the IEE, Construction Environmental Management Plan (CEMP) should be prepared by the contractor prior to start construction of the project and act accordingly during construction;
- The EMP will be included in the bid document of the civil works along with the EMP budget and eventually become part of the civil works contract (s);
- The mitigation measures for the negative impacts and enhancement measures for the positive impacts of the project as mentioned in the EMP must be implemented by the contractor (s) properly in schedule time; and
- The main tool for the successful implementation of the EMP is the environmental monitoring during various stages of the project, which must be carried out properly in time by the client/DSC/other relevant organisations.

1.INTRODUCTION

1.1 Background

The economy of Bangladesh has performed well over the past decade. Its Gross Domestic Product (GDP) has grown at an average of 6% per annum since 2010. In Fiscal Year 2014 (FY 14), the country moved up to a lower-middle income country (LMIC) status as per capita Gross National Income (GNI) of US$ 1,080 crossed the LMIC threshold of US$ 1,046. The country's per capita income soared to US$1,430 at the end of FY 2016. This sustained growth was achieved despite the negative impacts of the global recession, oil price rise, unrest in the Middle East and local natural disasters as well as political disturbance and has largely been dependent on a reliable and affordable supply of electricity. Bangladesh's economy could have performed better if the energy infrastructure had developed in line with the economic demands.

The supply of power in Bangladesh has not been able to keep pace with the rapid growth in demand and consumers experience frequent power outages. Current installed generation capacity in Bangladesh is 13,000 mega-Watts (MW), while available capacity is only 9,000 MW. The highest demand served in the country until November 2016 was 9,036 MW. On average, over 1,000 MW of load shedding occurs in the summer. Electricity demand is projected to grow by more than 10 percent per annum over the medium term. The Power Sector Master Plan 2016 has projected that demand will rise to more than 50,000 MW by 2041.

The shortage of electricity and poor quality of supply (aged and low capacity grid network) not only affect households, but also industry and services, which account for a major share of growth in the economy. According to the 2013 World Bank (WB) Enterprise Survey, Bangladeshi businesses on average suffered power outages for 840 hours per year, resulting in an output loss of approximately 3 % of GDP. The availability and reliability of power is hence a key constraint to job creation and poverty reduction.

The Government of Bangladesh (GOB) has set long term goals for the power sector in the country. Providing access to affordable, reliable and quality supply of electricity to the majority of the people of Bangladesh by 2020 are the goals of the GOB to users the next millennium. In line with the above stated goals, the GOB is expected to obtain financial support from the International Development Association (IDA) for the proposed Enhancement and Strengthening of Power Network in Eastern Region (ESPNER) project to ensure reliable and quality supply of electricity to the rural and urban consumers in Bangladesh through improvements in technical efficiency of the distribution system. The proposed project is expected to provide support for augmentation and rehabilitation of the transmission network of the Power Grid Company of Bangladesh (PGCB) under the Power Cell, Power Division, Ministry of Power, Energy and Mineral Resources (MOPEMR) of the GOB.

Main components of the project include:

- Construction of new 132 kV substations;
- Construction of new 132 kV transmission lines;
- Construction of new 230 kV transmission lines; and
- Construction of new LILO Lines.

The present power network in Greater Comilla, Noakhali and Chittagong areas of Bangladesh is aged and suffering numerous problems as system demand is growing rapidly. The greater Comilla and Noakhali areas are the second largest demand areas after the capital city of Dhaka. The greater Chittagong area is on the verge of massive industrialization as the government is taking initiatives to set up multiple economic zones, upgrade port facility and transportation network. Hence, the project was conceptualized with a rationale to expand the 230 kV transmission systems and to strengthen the 132 kV transmission systems in the project area, in order to, eliminate the operational bottlenecks caused due to inadequacy of the existing system.

In order to strengthen Dhaka-Chittagong Transmission Backbone System, establishment of 400/230kV & 400/132kV substation at Korerhat through LILO of Modunaghat-Meghnaghat 400kV D/C line has been planned which will improve system stability and reduce losses. For dispersal of power from Korewrhat to nearby load centers, LILO of Comilla (N) /Feni-BSRM/Hathazari230kV D/C line & LILO of Feni /Bariorhat -Hathazari 132kV D/C line have been planned. In future few more 230 kV substations in & around this economic zone are also expected to be fed directly from 230 kV bus of Mirsharai 400/230kV substation.Further, establishment of 132/33kV substations at New Mooring (Anadabazar) along with reconditioning of Sikalbaha -Patya-Dohazari-Cox'sbazar 132kV D/C line section with high capacity conductor has been planned. In addition, renovation of Halishahar substation along with augmentation of transformation cqapacity and upgradation from AIS to GIS substation has been planned to improve reliability of power supply in the vicinity of Halishahar. For strengthening of transmission system in Noakhali and Comilla area, korerhat -Chowmuhini -Kachua -Gazaria 230 kV high capacity corridor along with establishment of 230 /130kV substations at Chowmuhini and Kachua has been planned.

The TOR has prepared to carryout detailed IEE for the project in accordance with the relevant laws and regulations of the GOB and the WB. The specific environmental guideline for the power sector is not available in Bangladesh. Howeverthe Department of Environment's (DOE) environmental guidelines for the industries/projects provide a general framework for conducting environmental study for the entire sector. Thereforethe proposed IEE will be conducted following the DOE environmental guidelines. In addition, it is suggested to follow the Environmental & Social Management Framework (ESMF) of Rural Electricity Transmission and Distribution Project of PGCB and BREB as well as WB environmental guidelines for the power sector.

The IEE report is updated due to change of three substation location namely Chandina & Laksam at Cumilla district and Kosba at Brahmanbaria district. Census, IOL, market survey and consultation were conducted during updating of this IEE. The reasons of changed locations are:

- To avoid impacts on private land and due to availability of Government land, PGCB has changed the location of Chandina at Cumilla District.
- Land owners requested PGCB to change the project locations as initially proposed for the Laksham at Cumilla District and Koshba at Brahmanbaria district for sub-station location. PGCB has conducted several consultations with the APs and they did not agree to provide the land. So PGCB with the suggestions of DC office proposed new land adjacent to the previous location. New land owners are also consulted and agreed to provide land for the sub-station. Proposed new lands are adjacent to the previously selected land and so transmission line route is almost same for Laksham and Kosba and for Chandina transmission line route increased about 3.17 km (previously it was 9.83km and now 13.0 km)

1.2 Expected Benefits of the Project

The project is expected to positively influence the environmental, social and economic profile of the project area. The expected benefits are described below:

I. ***Environmental Benefits:*** Replacing the electricity from Diesel Generator (DG) sets with Grid power will result in saving of millions of liters of fossil fuel and reduction in pollution level of the Project area. Expected environmental benefits include reduction in the level of Particulate Matters, SOx, NOx and Green House Gases (GHG).

II. ***Social Benefits:*** It is expected that about 194,000 new residential consumers and about 11,500 new agricultural consumers would be supplied power through the systems proposed under the project. Additionally, about 4,200 small scale industries and 2 large scale industries could be supplied power through the schemes proposed under the project, which in turn, is expected to generate direct employment for about 85,000 people and a significant number of indirect employments. Further, the new agricultural connections will boost the agricultural output of the area.

III. ***Economic Benefits:*** Considering the fact that the difference between charges of electricity from off-Grid sources and that from grid is around 15 Taka (Tk), there will be significant cost saving to end users. It is expected that the initial value of savings will be 4760 Million Taka, which will gradually increase to 7070 Million Taka.

Power being an enabler sector often results in the overall growth and development of the area. Income level of the general population tends to generally increase in the areas where electricity makes an inroad or where the existing power infrastructure is improved.

1.3 Legislative Requirements

The main components of the Environment Conservation Act(ECA), 1995 are (GOB, 1995, pages 613–621):

a) "Declaration of ecologically critical areas, and restriction on the operation and process, which can be carried or cannot be initiated in the ecologically critical area.
b) Regulation in respect of vehicle emitting smoke harmful for the environment.
c) Environmental clearance for all industrial units and projects.
d) Regulation on the industries and other development activities — discharge permit.
e) Promulgation of standards for quality of air, water, noise and soil for different purposes.
f) Promulgation of standard limit for discharging and emitting waste.
g) Formulation and declaration of environmental guidelines.
h) Penal measures for non-compliance."

The major requirements of the Environment Conservation Rules (ECR),1997 are (GOB, 1997, pages 1303–2346):

a. "National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc.
b. Requirements and procedures to obtain environmental clearance.
c. Requirement for Initial Environmental Examination (IEE)according to categories of industrial and other development interventions."

For preparation of the IEE report, therefore, the following legislative procedure will be followed:

- Collection and review of relevant information regarding environmental legislation, statutory orders, by-laws, etc. connected to preparation and approval of the IEE report by the Department of Environment (DOE), and draft the memo. The memo will also consider the requirements of WB Guidelines.
- Conduction of meetings with the DOE, the Ministry of Environment and Forest (MOEF), and the Local Government Engineering Department (LGED). During these meetings appropriate legal and administrative procedures will be discussed. Review of other relevant environmental laws, regulations, Norms, and Standards on Air, Noise, Water, Waste, Wildlife, and etc.
- Conduction of discussion meeting with the DOE particularly for "Environmental Clearance Certificate" in accordance with the ECA, 1995 and ECR, 1997 of Bangladesh.

Besides this, WB has its own environmental and social safeguard policies. According to the policies set by WB "an IEE level study" is a study that includes the analysis of alternative plans, the prediction and assessment of environmental impacts, and the preparation of mitigation measures and monitoring plans based on detailed field surveys." Also basic principles of considering environmental and social impacts, the following WB guidelines will be followed:

1. "A wide range of impacts must be addressed. The types of impacts addressed by WB cover a wide range of environmental and social issues.
2. Measures for environmental and social considerations must be implemented from an early stage to a monitoring stage.
3. WB asks stakeholders for their participation. WB incorporates stakeholder opinions into decision-making processes regarding environmental and social considerations by ensuring the meaningful participation of stakeholders in order to have consideration for environmental and social factors and to reach a consensus accordingly. WB replies to stakeholders' questions. Stakeholders who participate in meetings are responsible for what they say.
4. WB discloses information. WB itself discloses information on environmental and social considerations in collaboration with project proponents etc., in order to ensure accountability and to promote the participation of various stakeholders."

1.4 Main Objectives of the IEE

The implementation of the subprojects' activities has both negative and positive impacts on the surrounding environment. These impacts will be on the physic-chemical, biological/ecological and socio-economic environment. Hence, to prevent and/or to reduce the negative environmental impacts at an acceptable level and to enhance the positive environmental impacts linked with the implementation of the subproject activities of the project; an IEE is to be required.

Based on the above requirement, the environmental consultant employed for this project will carry out the IEE and contribute to bidding document for incorporation of EMP cost.

1.5 Extent of the Study

This IEE is carried out based on the approved terms of reference (TOR) (Annex A) against the IEE Study TOR (Annex B) submitted to the Department of Environment for approval. The influence of impact has been defined as 1 Km on each side from the substation subprojects location and along the rights of way (ROW) for transmission lines. However, the study area has been extended beyond

5 Km area if any major environmental significant area is found and might have impact due to the project. Geographical Information System (GIS) techniques have also been used based on recent satellite imageries of the project area for above purposes. Assessment is carried out on the following environment components: terrestrial and aquatic ecology, soil, water, air, noise, and socio economic aspects. The impacts on ecologically sensitive areas (e.g. wildlife sanctuaries, biosphere reserve, and protected places) within 5 Km of the project areas have been assessed.

1.6 Scope of Work

The scope of work of the IEE includes:

a) Review of relevant all documents and data/information from secondary sources, and identify gaps to be filled, relevant to the environmental screening needs from field surveys.
b) Provide a description of the environmental baseline (such as baseline data on physical, biological/ecological and socio-economic characteristics of the subproject site along with area of influence).
c) Represent the field surveys where include baseline (air, noise, surface water and ground/drinking water) environmental quality monitoring at representative and sensitive locations, and identification of macro-level environmental issues within the Sub-project's influence area.
d) Collect information on environmentally sensitive locations on and along the sub-projects as well as within the sub-project's influence area.
e) Arrange consultation with the local people specially project affected persons (PAPs)to find out their opinions about the sub-projects.
f) Analysis of alternatives to the proposed sub-projects.
g) Identify and assessment of potential environmental impacts due to implementation of the sub-projects.
h) Conduct preliminary analysis of impacts and management measures of the nature, scale and magnitude of the impacts that the sub-project is likely to cause on the environment and classify the same using established methods.
i) Develop Environmental Management Plan (EMP) including Monitoring Plan for successfully implementing the mitigation/enhangement measures.
j) Assess PGCB's institutional capacity to execute and monitor the EMP and recommend necessary institutional capacity building including additional professionals for environmental management.
k) Prepare an IEE report in accordance with theDOE and WB safeguard policies and guidelines.

1.7 IEE Content

The report fulfils the requirements of IEE under ECR, 1997 and has been prepared in accordance with the TOR. This IEE report is also consistent with the GOB guidelines and other relevant international laws and treaties to the project. The report contains ten chapters and the chapter details are discussed below:

Chapter 1: Introduction

This chapter consists of the background of the project along with the objectives, scope of work and the methodology of preparing the IEE report. This chapter also includes the organization of the total IEE report.

Chapter 2: Environmental policies, laws, regulations and standard

In this chapter the national and international laws and policies are described which are relevant to the environmental and social aspects of the project. The relevant guidelines of the DOE, WB and other national and international laws are described.

Chapter 3: Project description

This chapter includes the proposed project and project area description. The location of the project and proposed projectinterventions are described here. In total, this chapter gives a detailed idea about the project.

Chapter 4: Route selection approach

In this chapter the alternative options of the proposed project are analyzed. It starts from no project alternative and ends at analyzing all the possible alternatives. This chapter concludes with declaring the proposed project as the best solution after analyzing all the other alternatives.

Chapter 5: Description of the environmental baseline

This chapter gives idea about the environmental baseline condition of the subproject areas with its surroundings. It describes the physical, biological/ecological and socio-economic environment.

Chapter 6: Environmental screening/assessment of the subprojects

In this chapter, the impacts likely to be occurred during pre-construction, construction and operational phases are discussed.

Chapter 7: Public Consultation

In this chapter, the consultation process, consultation meetings details and the outcomes are described.

Chapter 8: Environmental management plan

This chapter includes the Environmental Management Plan (EMP) which includes the mitigation measures for the negative impacts/enhancement for the positive impacts and Environmental Monitoring Plan (MP) to implement the mitigation/enhancement measures during pre-construction stage, construction stage and operational stages.

Chapter 9: Institutional arrangement and capacity building

This chapter depicts the institutional arrangements of the executing company for successful implementation of the EMP.

Chapter 10: Conclusions and recommendations

The conclusions and recommendations are suggested here about the proposed project.

1.8 Methodology

1.8.1 Approach

The study has been conducted in accordance with ECR, 1997, GOBIEE Guidelines, 1997, and other relevant international laws and treaties to the proposed project. The route map of this IEE preparation is given in the following Figure 1.1. The IEEstudy has been prepared based on the secondaryand primary data/information. The secondary data includes collection and review of the all relevant documents and data/information of the various relevant government and non government organizations, websites etc..The primary data/information includes data/informationcollected from the field surveys, inspections, observations and discussions with stakeholders including community representatives and PAPs at important locations of the project and Project Influence Area (PIA). The main purpose of this approach was to obtain a fair impression on the people's perceptions of the project and its environmental impacts and possible mitigation.

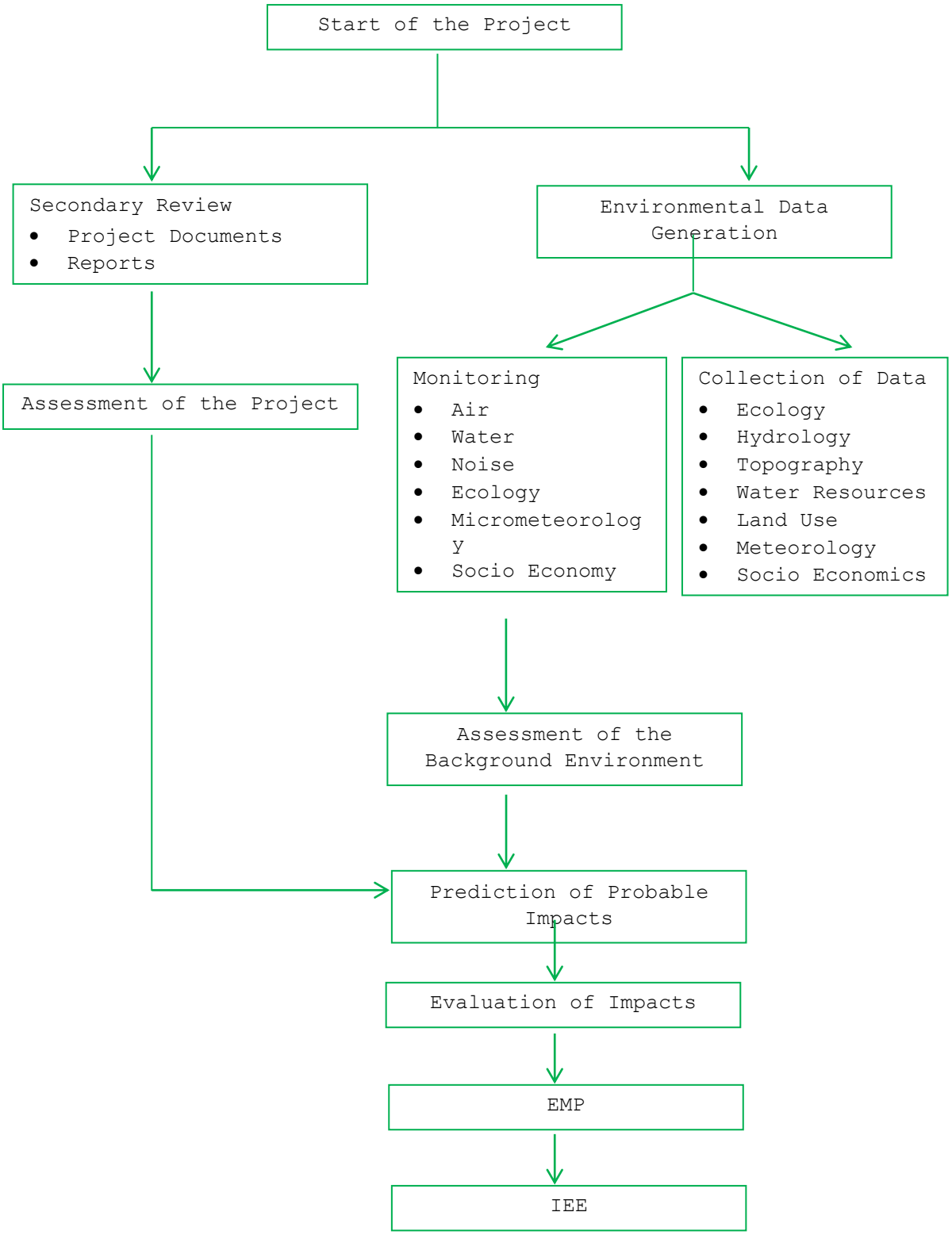


Figure 0-1: Route Map of Environmental Impact Assessment (IEE)

1.8.2 Methodology

The following methodology was adopted for carrying out the IEE of the proposed project:

(i) Orientation

Meetings and discussions were held among the members of the IEE Team. This activity was aimed at achieving a common ground of understanding of various issues of the study.

(ii) Data/Information Collection Plan

Subsequent to the concept clarification and understanding obtained in the preceding step, a detailed data/information collection plan was developed for the internal use of the IEE Team. The plan included identification of specific data requirements and their sources; determined time schedules and responsibilities for their collections and indicated the logistics and other supporting need for the execution of the data/information collection plan.

(iii) Data/Information Collection

In this step, secondary and primary data/information were collected from relevant organizations and published materials, field surveys, inspections and observations to establish environmental baseline profile for physical, ecological/biological and socio-economic environmental conditions. Following activities were performed for data/information collection:

- Site Reconnaissance;
- Analysis of Maps and Plans;
- Literature Review;
- Desk Research;
- Field Surveys, Inspection, Observations and Studies;
- Laboratory Analysis; and
- Public Consultations.

(iv) Secondary Data Collection

Collection and literature review of all available relevant documents, data/information were conducted for the IEE studyof the Project. The review of secondary sources and informal initial field investigations were undertaken in order to prepare a preliminary assessment of the physical and social environment, biodiversity, and conservation significance of the identified study area. This preliminary literature review also assisted in identifying data gaps which would require collection of additional primary information through physical field survey. The following secondary data collection activities were carried out for the Project:

- Relevant data/information were collected from the various relevant government/non governmentorganozations specially related to site aspects, climate (weather), topography, earthquake, soils, waterbodies, surface/ground water quality, ecology/biology, socio-economic etc. and assessed;
- Previous environmental site studies, where available, were reviewed as well as relevant scientific journal articles and web sites; and
- Thereafter, an information gap analysis was undertaken to identify the areas where further primary/field data collection would be required to complete the IEE.

Further detail regarding the titles of the relevant literature, policies, acts and other regulations and guidelines reviewed and applied during the course of this process can be found in legal section of this report.

(v) Primary Data Collection

The primary data/information of the following physical, biological/ecological and socio-cultural environment were collected during January- August 2017 by Topo Survey, SES & Environmental Survey Teams to comprehensively evaluate the existing project area environmental baseline conditions.

(a) Physical Environment

Information/data were collected on the existing physical environment, particularly as related to topography/geology/soils, hydrology/drainage, water (surface and ground/drinking) quality, air quality and noise.

Geology, Topography, and Soils

Data related to geology, topography and soil was collected to establish theenvironmental baseline of the project area and further to find out the impacts of the project mainly during the construction and operational phases.

Hydrology and Drainage

Data related to hydrology and drainage was collected to identify the elements of the flooding and water logging that are likely to have impacts on the project and the possible impacts that the project could have on the regime. Field assessments mainly oninundation and drainage issues of the subproject areas were carried out by interviews with the stakeholders including PAPs.

Environmental Quality Survey (EQS)

The EQS (such measurement of air quality & noise level, sampling of surface water and groundwater/drinking water at the fields) has been carried out at the various locations of the subproject areas during 25-29 August 2017 by EQMS (EQS Organization, Bangladesh).

Air Quality Monitoring

Ambient air quality measurements are essential to provide a description of the existing conditions, to provide a baseline against which changes can be measured and to assist in the determination of potential impacts of the proposed construction on air quality conditions. To monitor ambient air quality; SPM, carbon monoxide (CO), Carbon dioxide (CO_2) Sulphur-di-oxide (SO_2), Oxides of Nitrogen (NOx) and Particulate Matter (PM_{10} and $PM_{2.5}$) have been included for ambient air quality monitoring for two hours. LATA Envirotech APM 250 with Combined PM_{10}/$PM_{2.5}$ Sampler was used for the measurement and monitoring of particulate matters and for gaseous pollutants.

Noise Level Measurement

The noise monitoring was performed by a trained specialist, using a calibrated Sound Level Meter (SLM) set to A-weighting, fast response and statistical analysis settings. The SLM was mounted facing in the direction of the apparent predominant noise source. The SLM was programmed to record statistical noise levels for 15 minutes at each location and was calibrated before and after the survey; no significant drift was detected. Noise quality measurements were observed various locations of the Project site during day time.

Ground /Drinking Water Quality

Sampling and analysis of ground/drinking water has been carried for the following parameters: pH, Chloride (Cl^-), Iron (Fe), Manganese (Mn), Arsenic (As), Total Coliforms (TC), and Fecal Coliforms (FC).

Surface Water Quality

Sampling and analysis of surface water quality has been carried out for the following parameters: pH, Dissolved Oxygen (DO), Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD5), Phosphate (PO_4), and Ammonia Nitrogen (NH_3-N).

Biological/Ecological Environment

The status of the flora and fauna of the project area were determined by the reviewing of the literatures relevant to the area, observations and survey at the subproject areas.

Flora

The tree counting at the subproject sites within the Right of Way (ROW) was carried out by the social survey team. Identification of the dominant tree species, assessment of stage of growth (mature or sapling) and assessment of canopy cover was carried out.

Fauna

Information on fauna was gathered from existing literature on reported species as well as observations in the field.

Socio-Cultural Environment

The Consultants have been utilized a combination of desk researches, field investigations, census data, structured interviews, maps, reports to generate the data required for description of the existing social environment and assessment of the potential impacts due to the construction of the subprojects. Data/information was collected during June-July 2017 by the SES team on the following aspects given below: Demographics; Livelihoods; Education, Health, Community Facilities, Cultural Sites etc.

(vi) GIS Mapping

The Geographical Information Systems (GIS) was used as a specialized analysis and presentation tool. Before commencing field investigations, spatial analysis of satellite imagery was used to identify present administrative areas and other boundaries/constraints to be considered for both the environmental and social assessments. For example, the administrative boundaries of Local Government areas were defined, and transport routes, settlement areas and drainage networks were identified. It also supports more detailed on-ground survey, particularly spatial features (for example vegetation and ephemeral waterways) that may be directly or indirectly influenced by sub-project activities.

Detailed on-ground validation of spatial information – particularly land use was undertaken using a hand-held, non-differential GPS as well as an internet and GPS enabled tablet phone. The spatial data acquisition team undertook detailed transect walks through the Project area in order to identify various land use types and confirm the findings of the satellite imagery analysis. The extensive ground-truthing exercise both validated the land use mapping and identified additional sensitive areas to include within the environmental fieldwork for sampling.

The collected data/information has been demonstrated by means of the numerous GIS mapping figures found throughout this report.

(vii) Public Consultation

The Public consultation is an important component of the IEE preparation activities. The Local knowledge about the ecosystem and problems associated with the project activities were carefully recorded and used in impact assessment and develop mitigation plan. Formal public consultation, in randem with opportunistic informal ones involving local villagers, and people whose livelihood depends on these project areas, were executed during 25 August to 30 August 2017.

2 ENVIRONMENTAL POLICIES, LAWS, REGULATIONS AND STANDARDS

2.1 General

Transmission project activities by their inherent nature and flexibility have negligible impacts on environmental and social attributes. The Bangladesh laws relating to environmental and social issues have strengthened in the last decade both due to local needs and international commitments. All activities under the project shall be within the purview of these laws keeping in mind appropriate international obligations and directives and guidelines with respect to environmental and social considerations of Funding Agencies.

The proposed project will be implemented in compliance with the applicable environmental laws and regulations, Bangladesh and WB. Bangladesh has an environmental legal framework that is conducive to both environmental protection and natural resources conservation. This environmental legal framework applies to the proposed project. In addition, there are several laws and regulations related to environmental issues in Bangladesh. Many of these are cross-sectoral and partially related to environmental issues. This section presents an overview of the major national environmental laws and regulations that are relevant and may apply to activities supported by the project, institutional arrangement and national and sub-national level, and WB safeguard policies.

According to the national environmental legislation of Bangladesh all development projects are governed by some legal and institutional requirements. As such, assessment of relevant legal provisions, policies, strategies and institutional issues are very important for any project proponent or developer before execution of a program or plan. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary.

Before initiating any development project, it is hence required to obtain environmental clearance from Department of Environment (DOE), under the Ministry of Environment and Forests (MOEF) is the regulatory body responsible for enforcing the environmental laws and regulations like ECA'95 (amended in 2010) and ECR'97 (amended in December 2017) .

The need to comply with the requirements of the IEE Regulations ensures that decision makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimized or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the IEE Regulations to provide the competent authority with sufficient information in order for an informed decision to be made. The following activities have been carried out under the IEE study:

- Identification of national legal obligations in relation to the interventions which will be required to review under the IEE study of the proposed project;
- Exploration of the national legislative provisions and policy guidelines on environmental sectors;
- Identification of the international legal obligations and relevant provisions of multilateral environmental agreements related to the renewable energy project;
- Exploration of national and international legal provisions on energy sector; and

- Identification of the standard guidelines at regional and international level related to the project.

2.2 Applicable Policies in Bangladesh

2.2.1 Relevant National Legislations

2.2.1.1 Environmental Policy, 1992

The concept of environmental protection through national efforts was first recognized and declared with the adoption of the Environmental Policy, 1992 and the Environmental Action Plan, 1992. The importance of policies in beefing up the environmental regime is recognized in a number of international instruments including the World Conservation Strategy in 1980 and the Brundtland Commission Report, 1987. Paragraph 14 of Chapter 8 of Agenda 21 underscored the necessity of formulation of national policies as well as laws for environmental protection and sustainable development. The major objectives of Environmental Policy are to:

(i) Maintain ecological balance and overall development through protection and improvement of the environment;
(ii) Protect country against natural disaster;
(iii) Identify and regulate activities, which pollute and degrade the environment;
(iv) Ensure environmentally sound development in all sectors; and
(v) Ensure sustainable, long term and environmentally sound base of natural resources; and
(vi) Actively remain associate with all international environmental initiatives to the maximum possible extent.

According to this policy the proposed project needs full environmental assessment. The proposed interventions are required to comply with all the policy directives emphasizing particularly on reducing adverse environmental impacts. The IEE studies are required to address the potential impacts and propose mitigation measures. In compliance to the policy detail IEE is prepared.

2.2.1.2 Environmental Action Plan, 1992

The National Environmental Action Plan,1992 recommended sector specific action plan to achieve the objectives and implement the policy recommendations of the National Environment Policy. The followings are water resources key recommended actions:

- Environmental audit on an emergency basis will be conducted for water resources development, flood control and irrigation projects. Steps to mitigate the adverse impact on the environment identified in the audit will be taken through appropriate modification of these projects.
- Environmental Impact Assessment will be incorporated in all new projects. Adverse impacts will be prevented through proper steps and adequate investments.
- Operation and maintenance will be ensured subsequent to execution of projects related to water resources development and management. Regular monitoring will be conducted to evaluate the impact of all projects.

2.2.1.3 National Environment Policy (NEP), 1992

The National Environment Policy (NEP) is one of the key policy documents of the Government. The policy addresses 15 sectors in all, in addition to providing directives on the legal framework and institutional arrangements.The NEP sets out the basic framework for environmental action together with a set of broad sectoral guidelines for action. Major elements of the policy are as follows:

a. Maintaining of the ecological balance for ensuring sustainable development;
b. Protection of the country against natural disasters;
c. Identifying and controlling activities which are polluting and destroying the environment;
d. Ensuring environment-friendly development in all sectors;
e. Promoting sustainable and sound management of natural resources; and
f. Active collaboration with international initiatives related to the environment.

With regard to the project, the environmental policy aims at prevention of pollution and degradation of resources caused by electricity transmission project. The policy mentions that the IEE should be conducted before projects are undertaken.

2.2.1.4 National Environmental Management Action Plan (NEMAP), 1995

The National Environmental Management Action Plan (NEMAP) builds on the NEP and was developed to address specific issues and management requirements during the period 1995-2005. The plan includes a framework within which the recommendations of a National Conservation Strategy (NCS) are to be implemented. The NEMAP was developed with the following objectives:

- To identify key environmental issues affecting Bangladesh;
- To identify actions to halt or reduce the rate of environmental degradation;
- To improve management of the natural environment;
- To conserve and protect habitats and bio-diversity;
- To promote sustainable development; and
- To improve the quality of life.

2.2.1.5 Environmental Conservation Act (ECA), 1995

The ECA is currently the main legislation relating to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement.

The main objectives of ECA are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main focuses of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried out/ initiated in the ecologically critical areas (ECA);
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;
- Regulation of industries and other development activities' discharge permits;

- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines.

Before any new project can go ahead, as stipulated under the ECA, the project promoter must obtain Environmental Clearance from the Director General (DG), DOE. An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 5 years imprisonment or a maximum fine of Tk.100, 000 or both. The DOE executes the Act under the leadership of the DG.

The IEE study is prepared following guidelines of this Act. In accordance with the Act, the dredging project will need DoE's clearance prior to the commencement of the project. Also, the Ecologically Critical Areas, defined by DoE under this act, will be considered while planning and designing of the project interventions.

- **Environmental Conservation Act (Amendment 2000)**

The Bangladesh Environment Conservation Act Amendment 2000 focuses on ascertaining responsibility for compensation in cases of damage to ecosystems, increased provision of punitive measures both for fines and imprisonment and the authority to take cognizance of offences.

- **Environmental Conservation Act (Amendment 2002)**

The 2002 Amendment of the ECA elaborates on the following parts of the Act:

- Restrictions on polluting automobiles;
- Restrictions on the sale, production of environmentally harmful items like polythene bags;
- Assistance from law enforcement agencies for environmental actions;
- Break up of punitive measures; and
- Authority to try environmental cases.

- **Environmental Conservation Act (Amendment 2010)**

This amendment of the act introduces new rules & restriction on:

- No individual or institution (Gov. or Semi Gov, / Non-Gov. / Self Governing) cannot cut any Hill and Hillock. In case of national interest; it can be done after getting clearance from respective the department
- Owner of the ship breaking yard will be bound to ensure proper management of their hazardous wastes to prevent environmental pollution and Health Risk
- No remarked water body cannot be filled up/changed; in case of national interest; it can be done after getting clearance from the respective department; and
- Emitter of any activities/incident will be bound to control emission of environmental pollutants that exceeds the existing emission standards.

2.2.1.6 Environmental Conservation Rules (ECR), 1997 and Amendments

Environment Conservation Rules (ECR) 1997 has provided categorization of industries and projects and identified types of Environment assessments needed against respective category of industries or projects. Among other things, these rules set (i) the National Environmental Quality Standards for

ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc., (ii) requirement for and procedures to obtain environment clearance (iii) requirement for IEE/IEE according to categories of industrial and other development interventions. In the ECR 1997, there is a section on ecologically critical area. This is Section 3, 'Declaration of ecologically critical area' and reads, "(1) The Government will take the following into consideration in order to declare any area as Ecologically Critical area vide Section 5(1) of the Act (ECA 1995):

- Human settlement
- Ancient monument
- Archaeological site
- Forest sanctuary
- National Park
- Game reserve
- Wildlife habitat
- Wetland
- Mangrove
- Forest area
- Biodiversity area
- Similar other areas.

The activities or processes which cannot be continued or initiated in Ecologically Critical area shall be specified by the Government as per standards described in following Rules 12 and 13 of the ECR '97.

According to the rules, any project/development intervention of the Red Category is to obtain environmental clearance in two steps - first to obtain site/location clearance (based on the application along with necessary papers, including the Initial Environmental Examination (IEE) which will contain the scope of work of the proposed IEE, if required, and then to obtain Environmental Clearance (by submitting the application along with necessary papers including the IEE).

- **Environmental Conservation Rules 1997 (Amendment in December 2017)**

This amendment of the act introduces new rules. Among them, the project related amended is as follows:

- The transmission lines (TL) above 50km in length falls under Category Orange-B. Noted that earlier it was under Red Category.

2.2.1.7 National Agriculture Policy, 1999

This policy aims to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable and secure food system for all. One of the objectives of this Act is to preserve and develop land productivity. The policy particularly stresses on research and development of improved varieties and technologies for cultivation in water-logged and salinity affected areas. The policy also recognizes that adequate measures should be taken to reduce water-logging and salinity and provide irrigation facilities for crop production.

Adequate measures should be taken to reduce water-logging and hamper of irrigation system due to construction of the transmission lines and substations.

2.2.1.8 National Land Use Policy, 2001

The National Land Use Policy was adopted by Bangladesh government in 2001, setting out guidelines for improved land-use and zoning regulations. The main objectives of this policy is to ensure criteria based uses of land and to provide guidelines for usage of land for the purpose of agriculture, housing, afforestation, commercial and industrial establishments, rail and highway and for tea and rubber gardens. Overall, this policy promotes a sustainable and planned utilization of land.

The main contents of this policy are:

- Stopping the high conversion rate of agricultural land to non-agricultural purposes;
- Utilizing agro-ecological zones to determine maximum land use efficiency;
- Adopting measures to discourage the conversion of agricultural land for urban or development purposes;
- Improving the environmental sustainability of land-use practices.

The proposed project must adhere to this policy so that environmental sustainability of land-use practices is assured.

2.2.1.9 The Electricity Act, 1910

The primary objective of this act is to amend the laws relating to the supply and use of electrical energy in Bangladesh. This act comprises of guidelines related to licenses, works, and supply for the supply of energy. It also includes guidelines related to supply, transmission and use of energy by non-licensees. A licensee is a person authorized by the Government to supply energy in any specified area and permitted to lie down or place electric supply lines for the conveyance and transmission of energy. In Part II of this act, guidelines are provided for carrying out works for the supply of energy. This act includes guidelines related to the execution of any works involved in placing of any infrastructure in, under, over, along or across any street, part of a street, railway, tramway, canal or waterway. Also, information on lying of electric supply lines, aerial lines, or other works near sewers, pipes or other electric supply-lines or works is provided in Part II of the act. According to this act a licensee shall, in exercise of any of the powers conferred by or under this act, cause as little damage, detriment and inconvenience as may be, and shall make full compensation of any damage, detriment and inconvenience caused by him or by any one employed by him. In Part IV of this act, Protective Clauses are provided for protection of railways and canals/waterways, docks, wharves and piers, telegraphic, telephonic and electric signaling lines. Part IV also includes guidelines for occurrences of any criminal offences such as dishonest abstraction of energy, installation of artificial means, malicious wasting of energy or injuring works, theft of line materials, tower members, equipment etc. and subsequent procedures to follow up that criminal offence.

2.2.1.10 Electricity (Amendment) Act, 2012 (Draft)

This act is an amendment to The Electricity Act, 1910. In addition to the guidelines provided in the original act (The Electricity Act, 1910), this act includes more specific instruction relating to obligation on licensee to supply energy. According to section 22A (Sub section 1) of this act: a person authorized by a license, or exempted from the requirement to obtain a license, to generate, transmit, distribute or supply electricity – (a) shall, in generating, transmitting, distributing or supplying electricity, have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings

and objects of architectural, historic or archaeological interest; and (b) shall do what the person reasonably can to mitigate any effect which such generation, transmission, distribution or supply would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects. In section 22A (Sub- section 2) it is mentioned that, without prejudice to the provisions of Sub- section (1), a person authorized by a license, or exempted from the requirement to obtain a license, to generate, transmit, distribute or supply electricity and the Commission shall, in generating, transmitting, distributing or supplying electricity, or as the case may be, in the discharge of the Commission's functions, avoid, so far as reasonably practicable, causing injury to fisheries or to the stock of fish in any waters. section 22A (Sub- section 3 and 4) of this act also mentions that a generation licensee shall, in circumstances specified by the Commission, be entitled to construct, subject to conditions specified by the commission in consultation with the relevant water authority, water ways and pipelines, and to use water for its licensed activities and the relevant water authority shall not unreasonably deny such right. For this purpose, the 'relevant water authority' means such authority, as the Commission shall determine.

2.2.1.11 Bangladesh National Building Code (BNBC)

The main purpose of the BNBC is to establish minimum standards for design, construction, quality of materials, use and occupancy, location and maintenance of all buildings within Bangladesh in order to safeguard, within achievable limits, life, limb, health, property and public welfare. The installation and use of certain equipment, services and appurtenances related, connected or attached to such buildings are also regulated herein to achieve the same purpose.

Chapter-3, part -7 of the BNBC has clarified the issue of safety of workmen during construction and with relation to this, set out the details about the different safety tools of specified standard. In relation with the health hazards of the workers during construction, this chapter describes the nature of the different health hazards that normally occur in the site during construction and at the same time specifies the specific measures to be taken to prevent such health hazards. According to this chapter, exhaust ventilation, use of protective devices, medical checkups etc. are the measures to be taken by the particular employer to ensure a healthy workplace for the workers.

Chapter-1, part-7 of the BNBC, states the general duties of the employer to the public as well as workers - "All equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run way, barricade, chute, lift etc. shall be substantially constructed and erected so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them".

Chapter -1, Part-7 of the BNBC clearly sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen. According to section 1.2.1 of chapter 1 of part 7; "in a construction or demolition work, the terms of contract between the owner and the contractor and between a consultant and the owner shall be clearly defined and put in writing. These however will not absolve the owner from any of his responsibilities under the various provisions of this BNBC and other applicable regulations and bye-laws. The terms of contract between the owner and the contractor will determine the responsibilities and liabilities of either party in the concerned matters, within the provisions of the relevant Acts and Codes (e.g.) the Employers' Liability Act, 1938, the

Factories Act 1965, the Fatal Accident Act, 1955 and Workmen's Compensation Act 1923". (After the introduction of the Bangladesh Labor Act, 2006, these Acts have been repealed).

To prevent workers falling from heights, the BNBC in chapter 3 of part 7 sets out the detailed requirements on the formation and use of scaffolding. According to section 11.2 of the same chapter, "every temporary floor openings shall either have railing of at least 900 mm height or shall be constantly attended. Every floor hole shall be guarded by either a railing with toe board or a hinged cover. Alternatively, the hole may be constantly attended or protected by a removable railing. Every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides except at entrance to stairway. Every ladder way floor opening or platform shall be guarded by a guard railing with toe board except at entrance to opening. Every open sided floor or platform 1.2 meters or more above adjacent ground level shall be guarded by a railing on all open sides except where there is entrance to ramp, stairway or fixed ladder. The precautions shall also be taken near the open edges of the floors and the roofs".

2.2.1.12 Other Relevant National Policies, Act, Rules, Laws and Ordinances

Considerable number of national policy documents has been prepared during recent years and these have been accepted by the GOB. These policy initiatives, strategies and plans all emphasize consideration of the environment and natural resources in order to achieve sustainable development. A summary of the key relevant policy documents prepared is mentioned in Table 2.1.

Table 2.1: Relevant Key Policies

Policy	Brief Description	Responsible Agency
The National Water Policy (1999)	▪ Protection and restoration of water resources; ▪ Protection of water quality including strengthening regulations concerning agro-chemicals and industrial effluents; ▪ Sanitation and potable water;	MOWR
National Land use Policy (2001)	The policy deals with land uses for several purposes including agriculture, housing, forestry, industrialization, railways and roads. The plan identifies land use constraints in these sectors.	Ministry of Land (MOL)
National Fisheries Policy, 1998	Preservation and management of inland open water fisheries	MOFL
National Forest Policy and Forest Sector Review (1994, 2005)	▪ Afforestation of 20% land; ▪ Bio-diversity of the existing degraded forests; ▪ Strengthening of agricultural sector; ▪ Control of global warming, desertification, control of trade in wild birds and animals; ▪ Prevention illegal occupation of the forestlands, tree felling and hunting of wild animals.	MOEF
National Biodiversity Strategy and Action Plan (2004)	▪ Conserve, and restore the biodiversity of the country; ▪ Maintain and improve environmental stability of ecosystems; ▪ Ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations; ▪ Guarantee safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country; ▪ Stop introduction of invasive alien species, genetically modified organisms and living modified organisms.	MOEF

Policy	Brief Description	Responsible Agency
Bangladesh Climate Change Strategy and Action Plan (2008)	Establishment of six strategic pillars for action, including: (1) food security, social protection and health, (2) disaster management, (3) protective infrastructure, (4) research and knowledge management, (5) decreased carbon development, and (6) capacity building and institutional strengthening.	MOEF
National Land-use Policy, 2001	The Government of Bangladesh has adopted national Land use Policy, 2001. The salient features of the policy objectives relevant to the proposed are as follows: • To prevent the current tendency of gradual and consistent decrease of cultivable land for the production of food to meet the demand of expanding population; • To ensure that land use is in harmony with natural environment; • To use land resources in the best possible way and to play supplementary role in controlling the consistent increase in the number of land less people towards the elimination of poverty and the increase of employment; • To protect natural forest areas, prevent river erosion and destruction of hills; • To prevent land pollution; and • To ensure the minimal use of land for construction of both government and nongovernment buildings.	

Table 2.2 presents an outline of the other national legal instrument that will have relevance to the project with respect to the social and environment considerations. The IEE is prepared in compliance with these national policies.

Table 2.2: Other Relevant National Act, Rules, Laws and Ordinances

Act/Rule/Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features-Potential Applicability
Environment Court Act, 2000 and subsequent amendments in 2002	Ministry of Environment and Forest	The aim and objective of the Act is to materialize the Environmental Conservation Act, 1995 through judicial activities. This Act established Environmental Courts (one or more in every division), set the jurisdiction of the courts, and outlined the procedure of activities and power of the courts, right of entry for judicial inspection and for appeal as well as the constitution of Appeal Court.
Public Procurement Rule (PPR), 2008	Ministry of Public Works (MOPW)	This rule shall apply to the Procurement of Goods, Works or Services by any government, semi-government or any statutory body established under any law. The rule includes the adequate measure regarding the "Safety, Security and Protection of the Environment' in the construction works. This clause includes mainly, the contractor shall take all reasonable steps to (i) safeguard the health and safety of all workers working on the Site and (ii) protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or

Act/Rule/Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features-Potential Applicability
		others.
The Brick Burning (Control) Act, 1989 The Brick Burning (Control) Amendment Act, 1992 and 2001	Ministry of Environment and Forest	▪ Control of brick burning; ▪ Requires a license from the MOEF for operation; ▪ Restricts brick burning with fuel wood.
Water Supply and Sanitation Act, 1996	Ministry of Local Government, Rural Development and Cooperatives	Management and control of water supply and sanitation in urban areas.
Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft)	Ministry of Environment and Forests (MOEF)	Restricts people from damaging or destroying vegetation in wildlife sanctuaries and hunting and capturing of wild animals
National Forest Policy and Forest Sector Review (1994, 2005)	Forest Department (FD), MOEF	▪ Afforestation of 20% land; ▪ Bio-diversity of the existing degraded forests; ▪ Strengthening of agricultural sector; ▪ Control of global warming, desertification, control of trade in wild birds and animals; and ▪ Prevention illegal occupation of the forest lands, tree felling and hunting of wild animals.
The Forest Act 1927,Amendment 2000 (Protected, village Forests and Social Forestry)	FD, MOEF	▪ Declare any forests land or wasteland as protected forests; ▪ May stop public or private way or watercourse in the interest of preservation of the forest; ▪ Declare a reserved forest area as village forests; and ▪ Declare an area as Social forests or launch a social forestry programme in Govt. land or private land with permission.
Bangladesh Climate Change Strategy and Action Plan (2008)	MOEF	Establishment of six strategic pillars for action, including: 1. food security, social protection and health 2. disaster management 3. protective infrastructure 4. research and knowledge management, 5. decreased carbon development, andcapacity building and institutional strengthening.
Wetland Protection Act 2000	MOWR	▪ Advocates protection against degradation and resuscitation of natural water-bodies such as lakes, ponds, beels, khals, tanks, etc. affected by man-made interventions or other causes; ▪ Prevents the filling of publicly-owned water bodies and depressions in urban areas for preservation of the natural aquifers and environment; and ▪ Prevents unplanned construction on riverbanks and indiscriminate clearance of vegetation on newly accreted land.
Vehicle Act 1927 and Motor vehicle ordinance 1983	Bangladesh Road Transport Authority (BRTA)	▪ Road/traffic safety; ▪ Vehicular air and noise pollutions; and ▪ Fitness of vehicles and registration.

2.3 Categories of Projects

Under the Environmental Conservation Rules (ECR) of the DOE, Bangladesh (1997), a classification system was established for development projects and industries on basis of the location, the size and the severity of potential pollution. There are four categories of projects: green, orange A, orange B and Red with respectively no, minor, medium and severe environmental impacts. As mentioned earlier in Subchapter 2.2.1.6, according to the guidelines illustrated in the ECR 1997 (Ammended in December 2017), this project falls under the Orange BCategory of projects.

"Orange-B Category: According to IEE Guidelines for Industriesand projects of DOE fall under Orange BCategory and Orange-BCategory project needs to conduct IEE and submit the IEE report to DoE for the ECC."

Therefore, for this project, it needs to prepare an IEEin due course following prescribed format and be submitted to the DOE for getting the ECC of the project. The IEE should include the prediction, evaluation and mitigation of environmental impacts and an EMP. Noted that according to the WB and impact assessment as mentioned in ESMF, this project falls under category B and therefore needs to carry out the IEE.

2.4 International Treaties

Bangladesh has signed most international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation and climate change, including the Ramsar Convention, the Bonn Convention on migratory birds, the Rio de Janeiro Convention on biodiversity conservation and the Kyoto protocol on climate change. An overview of the relevant international treaties and conventions signed by GOB is shown in Table2.3.

Table 2.3: Relevant International Treaties, Conventions and Protocols Signed by Bangladesh

Treaty or Convention	Year	Brief description	Responsible Agency
On protection of birds (Paris)	1950	Protection of birds in wild state	DOE/DOF
Occupational hazards due to air pollution, noise and vibration (Geneva)	1977	Protect workers against occupational hazards in the working environment	Ministry of Health and Family Welfare (MOHFW)
Occupational safety and health in working environment (Geneva)	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	MOHFW
Occupational health services (Geneva)	1985	To promote a safe and healthy working environment	MOHFW
International convention on climate changes (Kyoto Protocol)	1997	International treaty on climate change and emission of greenhouse gases	DOE/MOEF

2.5 World Bank Environmental and Social Safeguard Policies

The objective of these policies is to prevent and mitigate undue harm to people and their environment in the development process. Safeguard policies provide a platform for the participation of stakeholders in project design, and act as an important instrument for building ownership among local populations. The effectiveness and development impact of projects and programs supported by

the Bank has substantially increased as a result of attention to these policies. The WB's relevant environmental, social, and legal safeguard policies are given below:

Environmental Policies:

- OP/BP 4.01 Environmental Assessment
- OP/BP 4.04 Natural Habitats
- OP/BP 4.11 Physical Cultural Resources
- OP/BP 4.36 Forests

Social Policies:

- OP/BP 4.10 Indigenous Peoples
- OP/BP 4.12 Involuntary Resettlement

Legal Policies:

- OP/BP 7.50 International Waterways
- OP/BP 7.60 Disputed Areas

Operational Policies (OP) are the statement of policy objectives and operational principles including the roles and obligations of the Borrower and the Bank, whereas Bank Procedures (BP) is the mandatory procedures to be followed by the Borrower and the Bank. Apart from these, the IFC guidelines for Environmental Health and safety have been adopted by the World Bank Group which is also relevant for environmental protection and monitoring. In addition to that the Policy on Access to Information of World Bank also relates to environmental safeguard. The environmental safeguard and access to information policy as well as the IFC guidelines are discussed below:

I. OP/BP 4.01 Environmental Assessment

This policy is considered to be the umbrella safeguard policy to identify, avoid, and mitigate the potential negative environmental and social impacts associated with Bank lending operations. In World Bank operations, the purpose of Environmental Assessment (EA) is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted. The borrower is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements. The Bank classifies the proposed project into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts:

- *Category A:* The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.
- *Category B:* The proposed project's potential adverse environmental impacts on human population or environmentally important areas-including wetlands, forests, grasslands, or other natural habitats- are less adverse than those of Category A projects. These impacts are site specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than Category A projects.

- *Category C:* The proposed project is likely to have minimal or no adverse environmental impacts.

II. OP/BP 4.04 Natural Habitats

The conservation of natural habitats is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

III. OP/BP 4.11 Physical Cultural Resources

Physical cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Their cultural interest may be at the local, provincial or national level, or within the international community. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements. The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment process.

IV. OP/BP 4.36 Forests

Forest is defined as an area of land of not less than 1.0 hectare with tree crown cover (or equivalent stocking level) of more than 10 percent that have trees with the potential to reach a minimum height of 2 meters at maturity in situ. A forest may consist of either closed forest formations, where trees of various stories and undergrowth cover a high proportion of the ground, or open forest. The definition includes forests dedicated to forest production, protection, multiple uses, or conservation, whether formally recognized or not. The definition excludes areas where other land uses not dependent on tree cover predominate, such as agriculture, grazing or settlements. In countries with low forest cover, the definition may be expanded to include areas covered by trees that fall below the 10 percent threshold for canopy density, but are considered forest under local conditions. The Bank's forests policy recognizes the importance of forests to reduce poverty in a sustainable manner integrates forests effectively in economic development, aims to reduce deforestation, promote afforestation and enhance the environmental contribution of forested areas. The Bank assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and economically viable forest plantations to help meet growing demands for forest goods and services.

V. OP/BP 4.12 Involuntary Resettlement

This policy is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary

resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. It promotes participation of displaced people in resettlement planning and implementation, and its key economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement.The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to Bank appraisal of proposed projects.

VI. OP 4.10 Indigenous People

The term "Indigenous Peoples" is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees:

- self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
- collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and
- an indigenous language, often different from official language of the country/ region.

The Bank provides project financing only where free, prior, and informed consultation results in broad community support to the project by the affected Indigenous Peoples. Such Bank-financed projects include measures to (a) avoid potentially adverse effects on the Indigenous Peoples' communities; or (b) when avoidance is not feasible, minimize, mitigate, or compensate for such effects. Bank-financed projects are also designed to ensure that the Indigenous Peoples receive social and economic benefits that are culturally appropriate and gender and inter-generationally inclusive.

VII. OP/BP 7.50 Projects on International Waterways

The WB recognizes the issues involving projects in international waterways and attaches importance to the riparian's making appropriate agreements or arrangements for the entire waterway, or parts thereof.In the absence of such agreements or arrangements, the Bank requires, as a general rule, that the prospective borrower notifies the other riparian's of the project. The Policy lays down detailed procedures for the notification requirement, including the role of the Bank in affecting the notification, period of reply and the procedures in case there is an objection by one of the riparian's to the project.

VIII. OP/BP 7.60 Projects in Disputed Areas

The World Bank finances projects in disputed areas when either there is no objection from the other claimant to the disputed area, or when special circumstances of case support Bank financing, notwithstanding the objection. The policy details those special circumstances.

2.5.1 IFC Environmental, Health and Safety Guidelines

The Environmental, Health and Safety (EHS) Guidelines of the World Bank Group (WBG)/International Finance Corporation (IFC), 2008 is the safeguard guidelines for environment, health and safety for the development of the industrial and other projects. They contain performance levels and measures that are considered to be achievable in new facilities at

reasonable costs using existing technologies. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

2.5.2 World Bank Policy on Access to Information

In addition to the safeguard policies, the Access to Information Policy also relates to safeguards. To promote transparency and facilitate accountability, Bank Access to Information Policy supports decision making by the Borrower and Bank by allowing the public access to information on environmental and social aspects of projects in an accessible place and understandable form and language to key stakeholders. The Bank ensures that relevant project-related environmental and social safeguard documents, including the procedures prepared for projects involving subprojects, are disclosed in a timely manner before project appraisal formally begins. The policy requires disclosure in both English and Local language and must meet the WB standards.

2.6 GOB Environmental Clearance Procedure

Formal IEE guidelines in Bangladesh are set out in “Rules and Regulations under the 1995 Environmental Protection Acts” as published in the official Gazette on August 27, 1997. Any proponent planning an industrial project is currently required under Paragraph 12 of the Environmental Protection Acts, 1995 to obtain “environmental clearance letter:” from the Department of Environment.

As mentioned earlier in Subchapter 2.2.1.6, steps to be followed for obtaining the ECC for this electricity transmission project are shown in Figure 2.1 as the project is under ‘Category Orange-B ’ and to prepare and submit to DOE an IEE report prior to implementation of such project for approval.

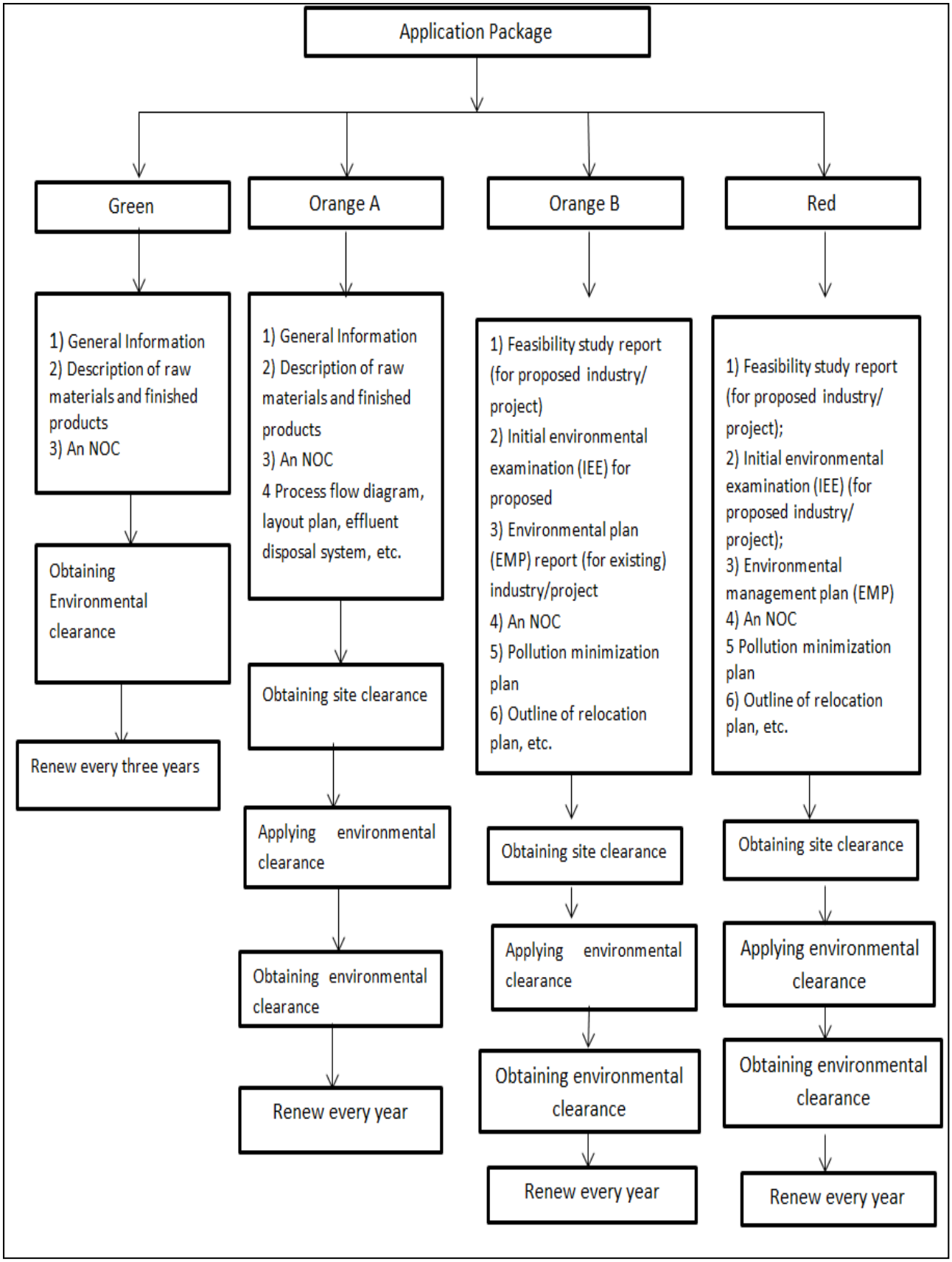


Figure 2-1: Flow Chart for Category Orange B as well as for Category Green, Orange A and Red.

The first to obtain environmental clearance is for the project proponent to complete & submit an application form which may be obtained from the appropriate DOE regional offices as per the category mentioned in Figure 2.1. The application is accompanied by other supporting documents (i.e. project profile, lay-out plan, NOC from local authority, Government fees etc.) reviewed by the divisional and district offices of DOE who has the authority to request supporting documents as applicable. The divisional office has the power to take decision on Green and Amber-A & B category projects and the Red category projects are forwarded to head office for approval. The proposed project will receive an environmental site clearance at the beginning and the environmental clearance subject to the implementation of the project activities and all mitigation measures suggested in the IEE report or in the application.

2.7 Applicable Environmental Quality Standards

2.7.1 National Environment Quality Standards

Details of the environmental standards applicable in Bangladesh are described in ECR. Regulated Areas spread to all industries, and regulated items are air quality, water quality (surface water, drink water), noise (boundary, source), emissions from motor vehicles or ships, odor, sewage discharge, waste from industrial units and industrial effluents or emissions. Items and standards, which are related to the construction and operation of access road, are listed below. Tables and annotations of environmental regulation are described as textual description of ECR.

The ECR is currently in the process of amendment. There is a possibility that the environmental regulation of the following items will be amended, but the current regulation is applied until the amendment process is completed.

At present there are environmental standards in operation in Bangladesh also promulgated under the ECR of 1997. There are standards prescribed for varying water sources; ambient air; noise; odor; industrial effluent and emission discharges; and vehicular emissions, etc. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding. The Bangladesh standards for ambient air, noise, odor, sewage, industrial effluent and emission are furnished hereinafter (Table 2.4-2.11). These are all in an authentic translation from original Bengali citing the specific source.

2.7.1.1 Air Quality

Table 2.4 shows the air quality standard in Bangladesh. Air quality standard adhere to World Health Organization (WHO) guidelines is also mentioned in Table 2.4.

Table 2.4: Bangladesh Standards for Ambient Air Quality Schedule-2, Rule 12, Environment Conservation Rules of 1997

No.	Parameter	Concentration(mg/m^3)	ExposureTime
a)	CarbonMono-oxide (CO)	10	8hours
		40	1hour
b)	Lead(Pb)	0.5	Year
c)	NitrogenOxide (NO2)	0.1	Year
		-	1hour
d)	SuspendedParticulate Matter(SPM)	0.2	8hours
e)	Particulate Matter 10µm(PM_{10})	0.05	Year
		0.15	24hours

f)	Particulate Matter 2.5µm($PM_{2.5}$)	0.015	Year
		0.065	24hours
g)	Ozone(O3)	0.235	1hour
		0.157	8hours
h)	SulfurDioxide (SO2)	0.08	Year
		0.365	24hours

Source: DOE. Schedule-2, Rule 12, ECR of 1997 (Page 3123, Bangladesh Gazette, 28 August 1997).

Notes:

(1) Sensitive area includes national monuments, health resorts, hospitals, archaeological sites, educational institutions and other government designated areas (if any).

(2). Any industrial unit located not in a designated industrial area will not discharge such pollutants, which may contribute to exceed the ambient air quality above in the surrounding areas of category 'Ga' and 'Gha'.

(3). Suspended particulate matters mean airborne particles of diameter of 10 micron or less.

2.7.1.2 Water Quality

Table 2.5 shows ambient water quality standard (inland surface water), and Table 2.6 shows environmental water quality standard (drinking water).

Table 2.5: National Standard for Inland Surface Water

No.	BestPractice BasedClassification	pH	BOD mg/1	Dissolved Oxygen (DO),mg/l	TotalColiform Bacteria quantity/ml
a)	Potablewatersourcesupplyafter bacteria freeingonly	6.5-8.5	2orless	6orabove	50orless
b)	Water usedforrecreationpurpose	6.5-8.5	3orless	5orabove	200orless
c)	PotablewatersourcesupplyafterConventionalprocessing	6.5-8.5	3orless	6orabove	5000orless
d)	Water usedfor pisci-culture	6.5-8.5	6orless	5orabove	5000orless
f)	Waterusedfor irrigation	6.5-8.5	10orless	5orabove	1000orless

Source: DOE.

BOD = biological oxygen demand, mg/l = milligram per liter, pH = negative decimal logarithm of the hydrogen ion activity in a solution

Notes:

(1). In water used for pisiculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.

(2). Electrical conductivity for irrigation water – 2250 µmhoms/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

Table 2.6: National Standard for Drinking Water

No.	Parameter	Unit	StandardLimit	WHO Guidelines
1	Aluminum	mg/l	0.2	0.2
2	Ammonia(NH_3)	mg/l	0.5	-
3	Arsenic	mg/l	0.05	0.01
4	Barium	mg/l	0.01	0.7
5	Benzene	mg/l	0.01	0.01
6	BOD_5 20^0C	mg/l	0.2	-

No.	Parameter	Unit	StandardLimit	WHO Guidelines
7	Boron	mg/l	1.0	0.5
8	Cadmium	mg/l	0.005	0.003
9	Calcium	mg/l	75	-
10	Chloride	mg/l	150-600	-
11	ChlorinatedAlkanes			-
	Carbon Tetrachloride	mg/l	0.01	-
	1.1Dichloroethylene	mg/l	0.001	-
	1.2Dichloroethylene	mg/l	0.03	-
	Tetrachloroethylene	mg/l	0.03	-
	Trichloroethylene	mg/l	0.09	-
12	Chlorinated Phenols			-
	Pentachlorophenol	mg/l	0.03	-
	2.4.6Trichlorophenol	mg/l	0.03	-
13	Chlorine (residual)	mg/l	0.2	-
14	Chloroform	mg/l	0.09	0.3
15	Chromium(hexavalent)	mg/l	0.05	-
16	Chromium(total)	mg/l	0.05	0.05
17	COD	mg/l	4	-
18	Coliform(fecal)	n/100ml	0	-
19	Coliform(total)	n/100ml	0	-
20	Color	Huyghens unit	15	-
21	Copper	mg/l	1	-
22	Cyanide	mg/l	0.1	-
23	Detergents	mg/l	0.2	-
24	DO	mg/l	6	-
25	Fluoride	mg/l	1	1.5
26	Hardness (as $CaCO_3$)	mg/l	200-500	-
27	Iron	mg/l	0.3-1.0	-
28	Nitrogen(Total)	mg/l	1	-
29	Lead	mg/l	0.05	0.01
30	Magnesium	mg/l	30-35	-
31	Manganese	mg/l	0.1	0.4
32	Mercury	mg/l	0.001	0.006
33	Nickel	mg/l	0.1	0.07
34	Nitrate	mg/l	10	3
35	Nitrite	mg/l	Lessthan1	-
36	Odor		Odorless	-
37	Oil&Grease	mg/l	0.01	-
38	pH		6.5-8.5	-
39	Phenoliccompounds	mg/l	0.002	-
40	Phosphate	mg/l	6	-
41	Phosphorus	mg/l	0	-
42	Potassium	mg/l	12	-
43	Radioactive Materials(gross alpha activity)	Bq/l	0.01	-
44	Radioactive Materials(grossbeta activity)	mg/l	0.1	-
45	Selenium	mg/l	0.01	-
46	Silver	mg/l	0.02	-
47	Sodium	mg/l	200	-
48	Suspended particulate matters	mg/l	10	-
49	Sulfide	mg/l	0	-

No.	Parameter	Unit	StandardLimit	WHO Guidelines
50	Sulfate	mg/l	400	-
51	Total dissolved solids	mg/l	1000	1000
52	Temperature	℃	20-30	-
53	Tin	mg/l	2	-
54	Turbidity	JTU	10	-
55	Zinc	mg/l	5	-

Source: DOE.

BOD = biological oxygen demand, mg/l = milligram per liter, ml = milliliter

Notes: In coastal area 1000. Reference: Bangladesh Gazette, Addendum, August 28, 1997.

2.7.2 Noise

As for noise, the standard limit is set for every category of zone class. Table 2.4 shows the Noise standard in Bangladesh.

Table 2.7: Bangladesh Standards for Noise

No	Zone Class	LimitsindBA	
		ECR	
		Day	Night
a)	SilentZone	45	35
b)	ResidentialZone	50	40
c)	MixedZone (this area is used combining residential, commercial and industrial purposes)	60	50
d)	CommercialZone	70	60
e)	IndustrialZone	70	70

(Source: The Environmental Conservation Rules, 1997; IFC Environmental Health and Safety Guidelines, 2008)

Note:

(1) The day time is considered from 6 a.m. to 9 p.m. and the night time is from 9 p.m. to 6 p.m.

(2) From 9 at night to 6 morning is considered night time.

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

2.7.3 International Standards

The international standards for heavy metals of the river bed materials are given in Table 2.8.

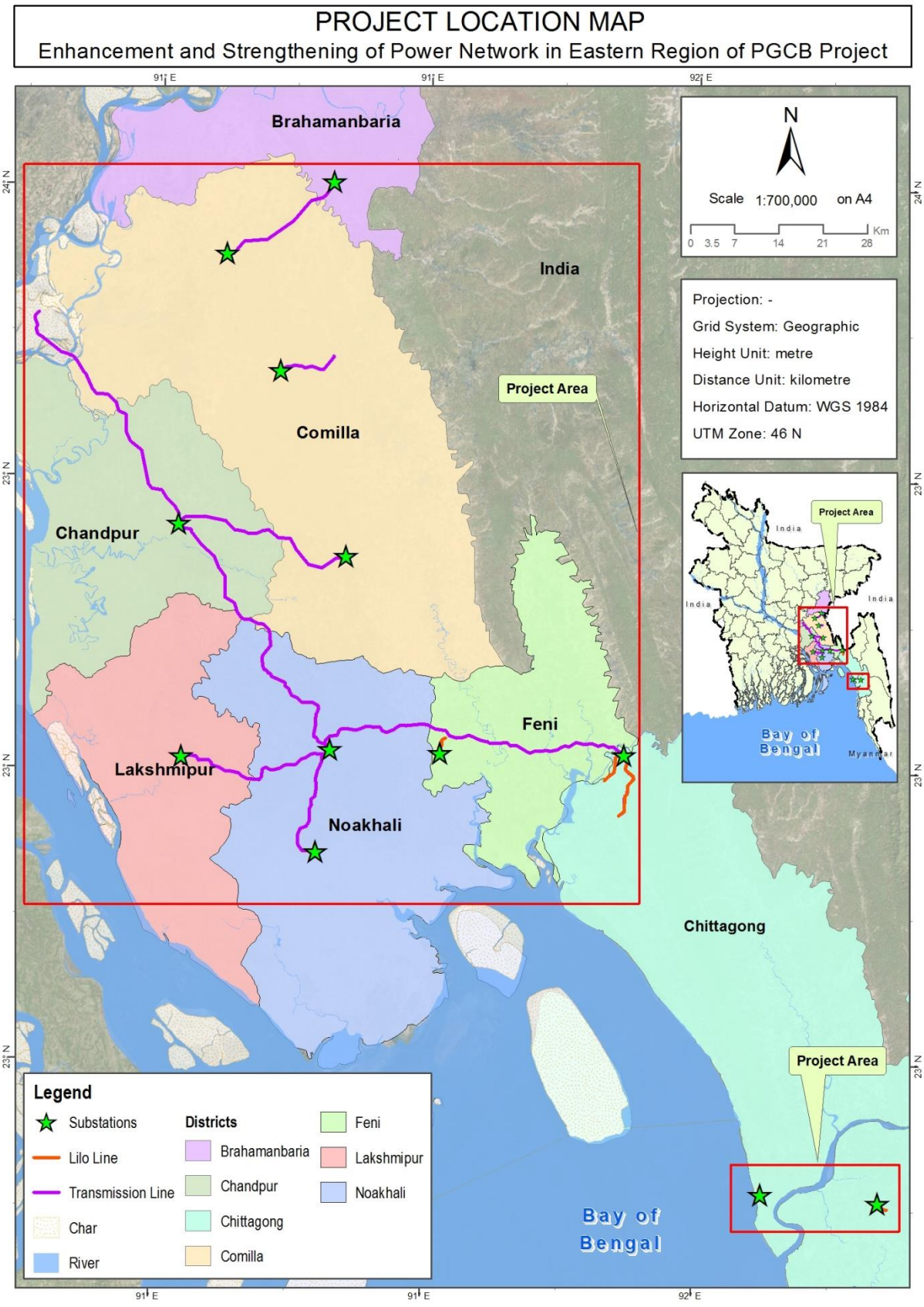
Table 2.8: USA EPA, 2000 Standard Value of Heavy Metals of River Bed Materials (Sand)

Parameters	Unit	Standard Values	Remarks
Lead (Pb)	mg/kg	128	
Cadmium (Cd)	mg/kg	4.98	
Chormium (Cr)	mg/kg	111	
Copper (Cu)	mg/kg	144	
Zinc (Zn)	mg/kg	459	
Manganese (Mn)	mg/kg	-	
Arsenic (As)	mg/kg	33	
Mercury (Hg)	mg/kg	1.06	
Selenium (Se)	mg/kg	-	

3 PROJECT DESCRIPTION

3.1 Project Location

The project components such as substations (12 numbers), transmission lines (total length is 283.64 km) and 11 LILO lines (toatal 44 km) are located in the 7 districts of Bangladesh. Among them six districts (such as Chittagong, Feni, Noakhali, Laxmipur, Comilla and Chandpur district) are in Chittagong division of the eastern region of PBCB's jurisdiction and Munshiganj district (small part of 45.09km long Gazaria (Munshiganj)-Kachua (Chandpur) TL is in Dhaka division (Figure 3.1). There are 12 subprojects of the substations, 8 subprojects of the TL and 8 subprojects of the LILO lines.



Map 3:1: Project Location Map

3.2 Project Components/Subprojects

The proposed project will have three components with the following estimated cost: 1) enhancement and strengthening of power network in eastern region (US$440 million); 2) Technical assistance for institutional development and implementation support (US$5 million); and 3) Equipment and tools for improved maintenance practice (US$10 million). However, thisIEE report is only for the first component of the main project and can be described as below.

This component will cover the following activities:

1. Two nos. of 230/132kV substations and nine (9) nos. of 132/33kV substations will be built. 230/133kV substations are Chowmuhoni and Kachua. 132/33 kV substations are Kosba, Muradnagar, Chandina, Laksham, Laxmipur, Bashurhat, Maijdee, Patiya and New Mooring. Keeping in mind the scarcity of land in the project areas (due to high population density), all these substations are planned with GIS configuration. The 132/33kV New Mooring substation to be built on the western side of Chittagong City will become a 400/230/132/33kV power hub in future. The 132/33kV part will be built by this project but the land acquisition and layout planning will incorporate the future 400/230/132kV design. Some other 132/33kV substations will also be designed keeping provisions for upgradation to 230kV in future.

1 The only substation that will be replaced under this project is the Halishahar 132/33kV air insulated substation (AIS). This substation is one of the oldest substations of PGCB and will be replaced by advanced gas insulated substation (GIS) after the commissioning of the New Mooring substation. This will require modification and extension of local 33kV and 11 kV network so that load at Halishahar can be fed from New Mooring S/S during replacement works at Halishahar.

2 A 230kV high capacity four circuit backbone transmission line (with twin Finch conductor per phase and only two circuits will be stringing now) has been planned through greater Comilla region (Korerhat– Chowmuhoni – Kachua-Gazaria) to make it the primary transmission backbone of this area for future. This line will supplement the existing 230kV double circuit line which is a low capacity (300 MW per circuit) line currently acting as the main transmission backbone between Comilla and Chittagong. Four (4) short distance 132kV double circuit lines are planned to be built to connect the new 132/33kV substations to the existing ones in Comilla and Noakhali area. Summary of the proposed scope of works under this project is given below (Table 3.1):

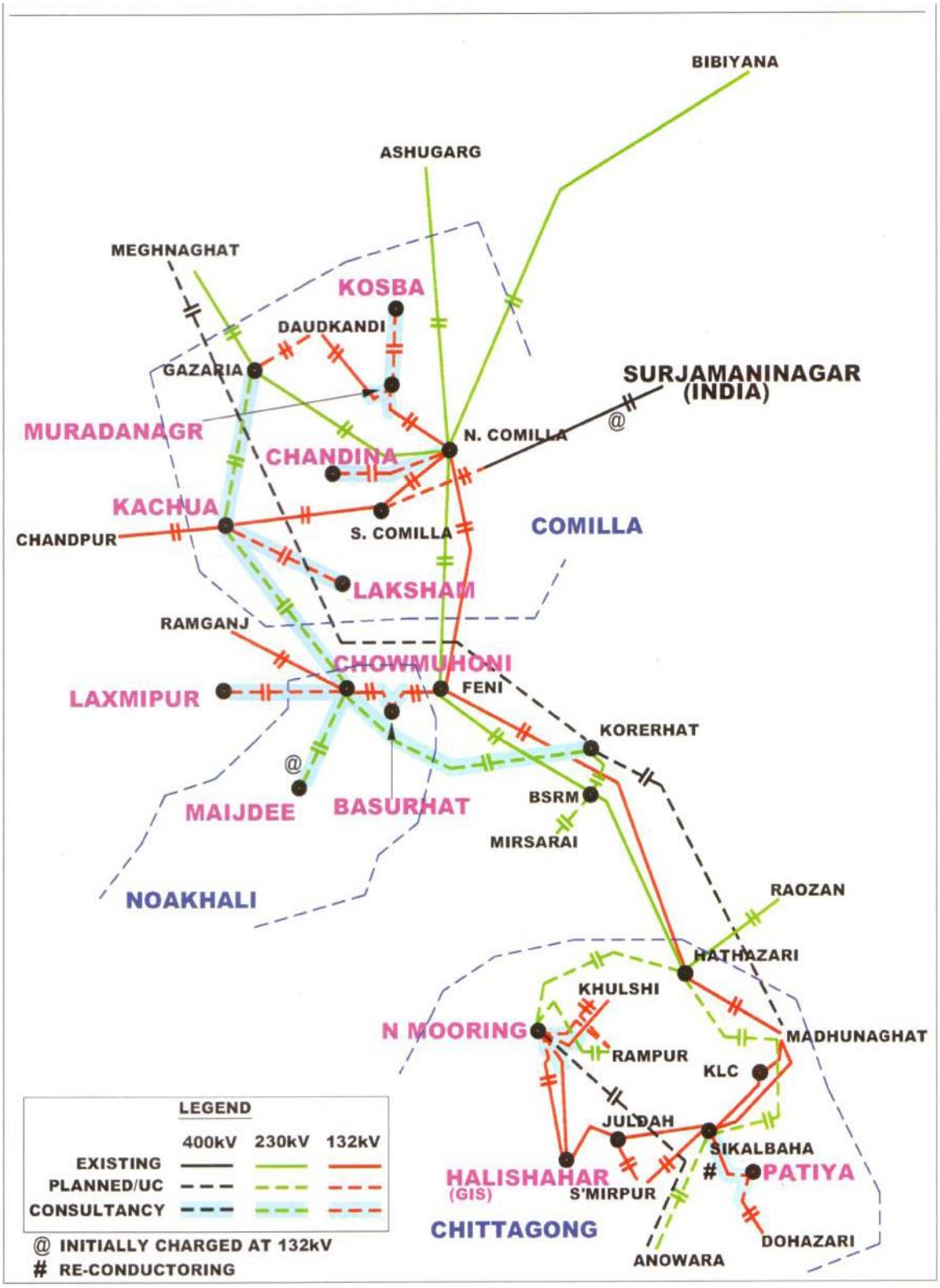
Table 3.1: Summary of Proposed Scope of Works

Transmission Lines		Substations	
Voltage level	Circuit Km	Voltage Level	No of S/S
230kV	386	230/132kV	2
132kV	266	132/33kV	10

About 283.642 km new transmission line (TL) involved with proposed 12 new substations.The following transmission systems are proposed under the project.The diagrammatic representation of the proposed transmission system is shown in Map 3.2.

Table 3.2: Details of the Proposed Project Components/Subprojects

Sl. No.	Name of the NewSubstations	Name of the Transmission Lines and LILO Lines
1	230/132 kV GIS Substation at Chowmuhoni	Chowmuhoni – Kachua 230 kV M/C Line- 49.05 km
2	230/132 kV GIS Substation at Kachua	Gazaria – Kachua 230 kV M/C Line - 45.09 km
3	132/33 kV GIS Substation at Muradnagar	LILO of Comilla (N) – Daukandi 132 kV D/C Line at Muradnagar – 0.5 km
4	132/33 kV GIS Substation at Laksham	Kachua- Laksham 132 kV D/C Line - 30.93 km
5	132/33 kV GIS Substation at Maijdee	Chowmuhoni – Maijdee 230 kV D/C Line- 20.55 km
6	132/33 kV GIS Substation at Patiya	LILO of Dohazari – Sikalbaha 132 kV D/C Line at Patiya – 1.16 Km
7	132/33 kV GIS Substation atChandina	Comilla (N) – Chandina 132 kV D/C Line - 13km
8	132/33 kV GIS Substation at New Mooring (Anand Bazaar)	LILO of Halishahar- Khulsi 132 kV S/C (ckt-1, 2&3) Line at New Mooring-0.630 km
9	132/33 kV GIS Substation at Basurhat	Two Ckt LILO from Feni – Chowmuhoni 132 kV D/C line at Basurhat – 2.74 km
10	132/33 kV GIS Substation at Laxmipur	Chowmuhoni – Laxmipur 132 kV D/C Line - 27.38 km
11	132/33 kV GIS Substation at Kosba	Muradnagar – Kosba 132 kV D/C Line- 22.79 km
12	400/230 kV GIS Substation at Korerhat	Korerhat- Chowmuhoni 230 kV M/C Line- 52.73 km
		LILO of Modunghat – Meghnaghat 400 kV D/C Line at Korerhat – 0.4 Km
		LILO of Comilla (N)/ Feni – BSRM/ Hathazari 230 kV D/C Line – 5.728 Km
		LILO of Feni/ Baroihat – Hathazari 132 kV D/C Line – 2.8 Km
		Extension of Mirsharai – BSRM 400 kV D/C Line to Korerhat – 11.314 Km



Map 3:2: Diagrammatic Representation of the proposed Transmission System

4 DESCRIPTION OF ENVIRONMENTAL BASELINE

4.1 General

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

Information of baseline environmental status of the project area is useful for impact assessment process of assessing and predicting the environmental consequences of the significant actions. Based on the existing environmental scenario, potential impacts of subprojects associated will be identified and accordingly management plan will be proposed in forthcoming sections. The baseline environmental conditions will help in comparing and to monitor the predicted negative and positive impacts resulting from the project during pre-construction, construction and operation phases. Significant action depicts direct adverse changes caused by the action and its effect on the health of the biota including flora, fauna and human being, socio-economic conditions, current use of land and resources, climate change aspects, physical and cultural heritage properties and biophysical surroundings. Baseline data generation of the following environmental attributes is essential in IEE studies.

Data/information was collected from secondary sources for the macro-environmental setting like climate (temperature, rainfall, humidity, and wind speed), topography, geology, soils etc. Firsthand information have been collected to record the micro-environmental features within and adjacent to the project corridor. Collection of primary/field data/information includes extrapolating environmental features on proposed subprojects design, tree inventories, location and measurement of socio-cultural features adjoining proposed subprojects. Ambient air, noise quality, surface water and ground/drinking water quality have been assessed based on measurement/testing as well as visual inspection to prepare a baseline database. Consultation was another source of information and to explain local environmental conditions, impacts, and suggestions, etc.

The following section describes the baseline environment in three broad categories:

- Physical Environment- factors such topography, geology, earthquake, climate and hydrology/drainage, environmental pollution, ;
- Biological Environment- factors related to life such as flora, fauna and ecosystem; and
- Socio-economic Environment- anthropological factors like demography, income, land use, land requirement and infrastructure.

As mentioned earlier in chapter 3, all the subprojects under the Enhancement and Strengthening of Power Network in Eastern Region (ESPNER) project of PGCB are located in six districts of Chittagong division one district of Dhaka Division. The environmental baseline chapter is described according to the classification, nature and primary observation during field survey. The subproject specific Environmental Baseline data of Substations (SS),Transmission Lines(TL) andLILOlines (LL) are given in the following Table 4.1.

Table 4.1: Environmental Baseline Data/Information of the Subprojects of SS and TL

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW/ SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
Substations:																	
1	230/132 kV GIS at Chowmuhoni	Begumganj, Noakhali.	Partially 2 cropped agricultural land& partially fellow land	Yes	Flat Terrain	Zone-2	Dusty	65.32	No		sparrow, kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, bengal monitor, common house lizard, snakes, frog etc.	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
2	230/132 kV GIS at Kachua	Kachua, Chandpur	3 cropped agricultural land	Yes	Flat Terrain	Zone-2	Good	62.84	No		sparrow, kingstork, dove, crow, fox, mouse, grew musk, common house lizard, snakes, frog etc.	No	5	0	0	Mosque at about 200m east	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
3	132/33 kV GIS at Muradnagar	Muradnagar, Comilla	3 cropped agricultural land	Yes	Flat Terrain	Zone-2	Good	57.93	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, , bengal monitor, common house lizard, snakes, frog	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
4	132/33 kV GIS at Laksham	Laksham, Comilla	3 cropped agricultural land	Yes	Flat Terrain	Zone-2	Good	56.34	No		shalik, sparrow, kingstork,	No	2	0	0	0	trucks, buses, microbus, sedan cars, taxi,

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW/ SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
											dove, crow, fox, mouse, shrew, squirrel, , bengal monitor, common house lizard, snakes, frog etc.						vans, motorbikes etc.
5	132/33 kV GIS at Maijdee	Maijdee, Noakhali	2 cropped agricultural land	Not	Flat Terrain	Zone-2	Good	66.88	No		sparrow, kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, common house lizard, snakes, frog etc.	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
6	132/33 kV GIS at Patiya	Patiya, Chittagong	2 cropped agricultural land	Not	Flat Terrain	Zone-1	Dusty	67.23	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, shrew, back, bengal monitor, snakes, frog	No	5	0	.0	Mosque at 200m east of the SS	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
7	132/33 kV GIS at Chandina	Debidwar, Comilla	Govt Land	Not	Plain lands	Zone-2	Dusty	71.51	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, grew musk, squirrel, stripped keel back, common house lizard, snakes,	No	2	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW/ SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
											frogetc.						
8	132/33 kV GIS at New Mooring/Anand Bazar	JL. 1, Mouza: Madha Halishahar, Thana: Bandar, District: Chittagong	2 cropped agricultural land	Not	Undulation	Zone-1	Dusty	57.55	No		shalik, sparrow, kingstork, dove, crow, fox, mouse, , squirrel, common house lizard, snakes, frog	No	20	0	0	2 Mosques, and a School at ch 400	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
9	132/33 kV GIS at Bashurhat	Bashurhat, Daganbhuiyan, Noakhali	3 cropped agri. land	Not	Flat terrain	Zone-2	Good	57.55	No	136	shalik, sparrow, dove, crow, fox, mouse, , squirrel, bengal monitor, common house lizard, snakes, frog etc.	No	2	0	0	Mosque at 100m east.	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
10	132/33 kV GIS at Laxmipur	Laksmipur Sadar, Laksmipur	2 cropped agricultural land	Yes	Flat Terrain	Zone-2	Dusty	68.35	No		shalik, sparrow, , fox, mouse, grew musk shrew, Bengal monitor, common house lizard, snakes, frog	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
11	132/33 kV GIS at Kosba	Kosba, Brahmanbaria	2 cropped agricultural land	Yes	Flat Terrain	Zone-2	Dusty	59.64	No		sparrow, kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, snakes, frog	No	5	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
12	400/230 kV GIS at Korerhat	Korerhat, Mirsarai, Chittagong	2 cropped agricultural land	Not	Flat terrain	Zone-2	Good	70.57	Small seasonal Khal	2945	shalik, sparrow, , crow, fox,	No	25	0	0	0	trucks, buses, microbus, sedan cars, taxi,

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW/ SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
											mouse, shrew, squirrel, , common house lizard, snakes, frog etc.						vans, motorbikes etc.
Transmission Line																	
1	Chowmuhoni – Kachua 230 kV Double Circuit TL	Started at Chowmohuni substation, UZ: Chowmohuni, Dt:Noakhali and ended at Kachua substation, UZ: Kachua, Dist.: Chandpur	Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	30Khals &10Ponds	2836	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, common house lizard, snakes, frog	No	149.42	0	0	A mosque at distance ach 0+030	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
2	Kachua-Gazaria 230 kV TL	Started at Kachua substation, UZ: Kachua, Dt: Chandpur and ended Gazaria substation, UZ: Gazaria, Dist.: Munshiganj	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	12Khals & 7Ponds	2544	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, common house lizard, snakes, frog	No	132.00	0	0	o	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
3	Kachua-Laksham 132 kV TL	Started at Kachua substation, UZ: Kachua Dt: Chandpur and ended at Laksham substation, UZ: Laksham, Dist.: Comilla	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	Khals &Ponds	2990	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, common house lizard, snakes, frog	No	101.46	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
4	Chowmuhoni –	Started at	- Two to	Yes	Flat	Zone-2	Good	-	6Khals	1795	kingstork, ,	No	63.04	0	o	0	trucks, buses,

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW/ SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
	Maijdee 230 kV Double Circuit TL	Chowmohuni substation, UZ: Chowmohuni, Dt:Noakhali and ended at Maidee substation, , UZ: Chowmohuni, Dt:Noakhali	three cropped agricultural lands						&5Ponds		crow, fox, mouse, grew musk shrew, squirrel, , common house lizard, snakes, frog .						microbus, sedan cars, taxi, vans, motorbikes etc.
5	Comilla – Chandina 132 KV DC TL	Started at Comilla (North) substation Dt:Comilla and ended at Chandina substation, UZ: Chandina, Dist.: Comilla	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	1 khal	No	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, bengal monitor, snakes, frog	No	33.49	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
6	Chowmuhoni – Laxmipur 132 kV Double Circuit TL	Started at Chowmohuni substation, UZ: Chowmohuni, Dt:Noakhali and ended at Laxmipur substation, Dist.: Laxmipur	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	12Khals &7Ponds	1740	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, bengal monitor, common house lizard, snakes, frog	No	94.56	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
7	Muradnagar – Kosba 132 KV DC TL	Started at Muradnagar substation, UZ: Muradnagar, Dt: Comilla and ended at Kosba substation,	Two to three cropped agricultural lands -	Yes	Flat	Zone-2	Good	-	14Khals &4Ponds	337	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, bengal monitor,	No	68.95	0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW/ SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
		UZ: Kosba, Dist.: B. Baria.									common house lizard, snakes, frog						
8	Korerhat-Chowmuhoni 230KV MC TL	Started at Korerhat substation, UZ: Mirersorai, Dt: CTG and ended at Chowmuhoni substation, UZ: Chowmuhoni , Dist.: Noakhali.	Two to three cropped agricultural lands -	Not	Flat	Zone-2	Good	-	30Khals &10Ponds	8010	kingstork, dove, crow, fox, mouse, shrew, squirrel, stripped keel back, bengal monitor, , snakes, frog	No	160.56	0	0	A mosque at 40m distance at ch 49+250 at R/S and a graveyard at 25 m distance at L/S at Ch 10+000.	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
LILO Lines:																	
1	LILO of 132 KV DC Feni-Chowmuhani, L=2.915km,	0+000-2+915	Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	30Khals &10Ponds	No	dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, common house lizard, snakes, frog	No		0	0	A mosque at distance a ch 0+030	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
2	LILO of 230 KV DC Karerhat – Comilla, L=5.735	0+000-5+191	- Two to three cropped agricultural lands	Yes	Flat	Zone-2	Good	-	12Khals & 7Ponds	No	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, common house lizard, snakes, frog	No		0	0	o	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
3	LILO of 132 KV DC Karerhat-Hathaz4ari-F5eni	0+000-3+327	- Two to three cropped agricultural lands	Yes	Flat	Zone-1	Good	-	Khals &Ponds	No	dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW/ SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
	6										back, common house lizard, snakes, frog						
4	.LILO of 8132 KV DC Dohazari-Shikalbaha	0+000-0+750	- Two to three cropped agricultural lands	Yes	Flat	Zone-1	Good	-	Seasonal ponds/khals	No	crow, fox, mouse, grew musk shrew, squirrel, , common house lizard, snakes, frog .	No		0	o	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
5	LILO of 132 KV DC Halishahar-Kulshi	0+000-1+105	- Two to three cropped agricultural lands	Yes	Flat	Zone-1	Good	-	Seasonal ponds/khals	No	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, bengal monitor, snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
6	LILO of 400 KV DC Korerhat-BSRM	0+000-11+850	- Two to three cropped agricultural lands	Yes	Undulated	Zone-2	Good	-	Seasonal ponds/khals	, small to medium size forest trees (not densely) from ch 3+450 –	kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, common house lizard, snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Sl. No.	Subproject Site/Route	Location	Type of Land	Inundation during HFL	Topography	Earthquake Zone	Air	Av. Noise Level (dB)	Water Bodies in & crossing ROW	Trees in ROW	Major Fauna (mainly in SPIA)	EPA in ROW/ SPIA	Affected Land in ROW (acre)	Family (Nos)	CS in ROW of SS	Cultural Sites in SPIA	Traffic Cond. on nearby Roads
										11+700							
7	.LILO of 132 KV DC Modhunagh at-Meghnaghat	000-0+775	Two to three cropped agricultural lands -	Yes	Flat	Zone-2	Good	-	Seasonal ponds/khals		kingstork, dove, crow, fox, mouse, grew musk shrew, squirrel, stripped keel back, bengal monitor, common house lizard, snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.
8	LILO of 400 KV DC Comilla(N)-Daudkandi)	0+000-0+424	Two to three cropped agricultural lands -	Not	Flat	Zone-2 & 3	Good	-	Seasonal ponds/khals		kingstork, dove, crow, fox, mouse, shrew, squirrel, stripped keel back, bengal monitor, , snakes, frog	No		0	0	0	trucks, buses, microbus, sedan cars, taxi, vans, motorbikes etc.

Source: Literature Review, Top survey, SES& Environmental Survey in 2017.

4.2 Chittagong Division

Chittagong Division area 33771.18 sq km, located in between 20°43' and 24°16' north latitudes and in between 90°32' and 92°41' east longitudes. It is bounded by Dhaka and Sylhet divisions on the north, Bay of Bengal and Arakan (Myanmar) on the south, Mizoram, Tripura states of India and Chin state of Myanmar on the east, Dhaka and Barisal divisions on the west. There are many lofty hills in Rangamati, Khagrachhari, Bandarban and in the eastern part of Chittagong districts. A map of Chittagong division is shown is Figure 4.1.

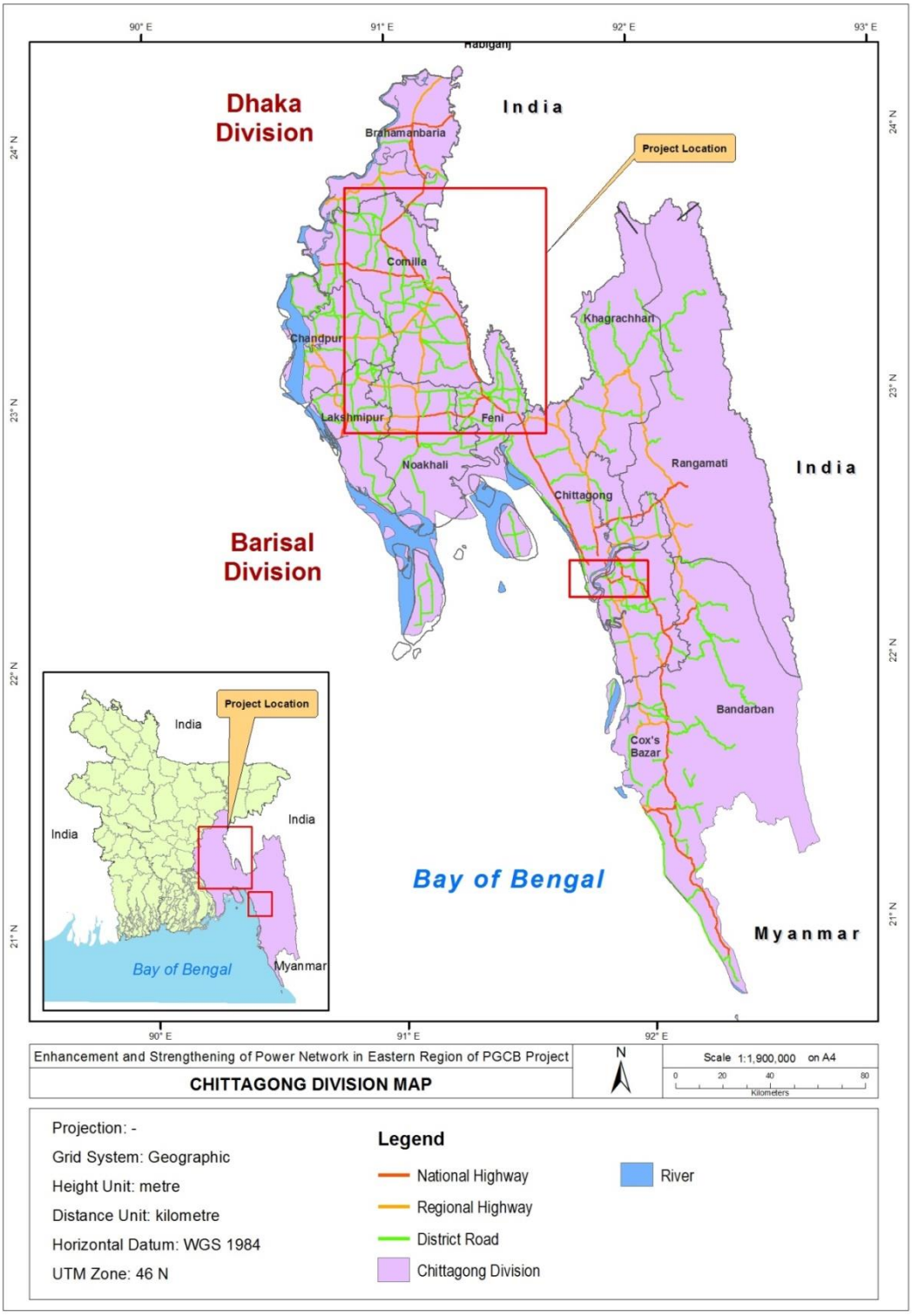


Figure 4-1: Map of Chittagong Division and the Subprojects Location

4.3 Physical Environment

4.3.1 Climate

The Project area has a tropical monsoon climate with four seasons: dry or winter season (December–February); pre-monsoon or hot season (March–May); monsoon or rainy season (June–September); and post–monsoon or autumn season (October–November). Although less than half of Bangladesh lies within the tropics, the presence of the Himalaya mountain range has created a tropical macroclimate across most of the east Bengal land mass. Bangladesh can be divided into seven climatic zones. According to the classification, the project areas are located in the south-central and south-eastern region climatic zones (Figure 4.2).

South-Central Zone: In this zone rainfall is abundant, being above 1,900 mm. The range of temperature is, as can be expected, much less than to the west, but somewhat more than in South-eastern zone. This is a transitory zone between the South-eastern, North-western and South-western zones and most of the severe hail storms, nor'westers and tornadoes are recorded in this area.

South-Eastern Zone: It comprises the Chittagong sub-region and a strip of land extending from southwest Sundarbans to the south of Comilla. The hills over 300m in height have north-eastern zone climate. The rest of the area has a small range of temperature, rarely goes over a mean of 320 °C and below a mean of 130 °C. Rainfall is heavy, usually over 2,540 mm. In winter dew fall is heavy.

Like other parts of the country, the project areas are heavily influenced by the asiatic monsoon, and it has these three distinct seasons:

- Pre-monsoon hot season (from March to May),
- Rainy monsoon season (from June to October), and
- Cool dry winter season (from November to February).

The pre-monsoon hot season is characterized by high temperatures and thunderstorms. April is the hottest month in the country with mean temperatures ranging from 27°C in the east and south, to 31°C in the west-central part of the country. After April, increasing cloud-cover reduces the temperature. Wind direction is variable during this season, especially during the early part. Rainfall, mostly caused by thunderstorms, at this time can account for 10 to 25 percent of the annual total.

The rainy monsoon season is characterized by southerly or south-westerly winds, very high humidity, heavy rainfall and long periods of consecutive days of rainfall. The monsoon rain is caused by a tropical depression that enters the country from the Bay of Bengal. About 90% of the annual precipitation occurs during the five-month monsoon season from May to September.

The cool dry season is characterized by low temperatures, cool air blowing from the west or northwest, clear skies and meager rainfall. The average temperature in January varies from 17°C in the south west and south-eastern parts of the country to 20°C to 21°C in the coastal areas. Minimum temperatures in the extreme in late December and early January reach even in between 7°C to 8°C.

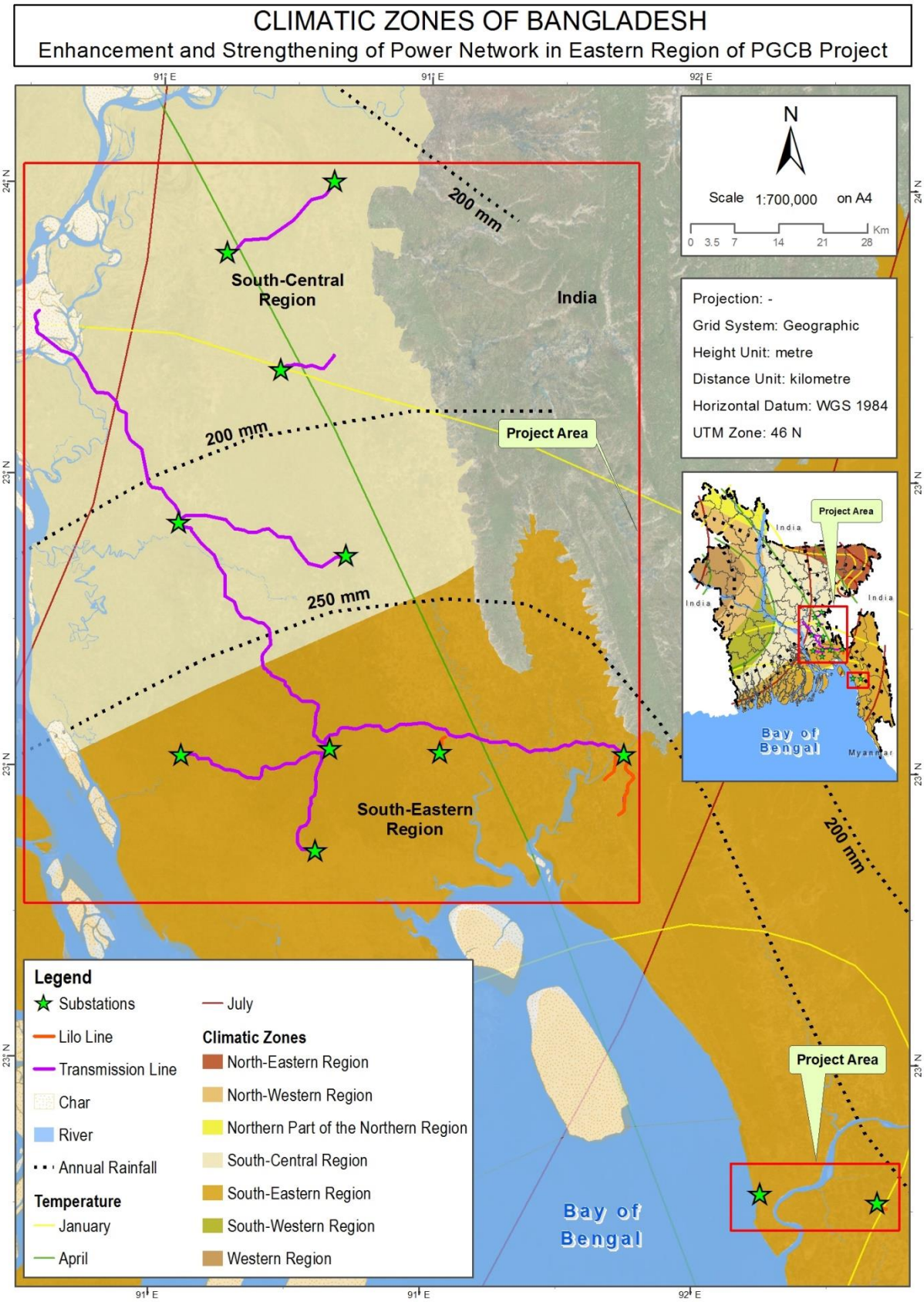


Figure 4-2: Climatic Zones of Bangladesh

To define meteorological conditions in and around the proposed construction area of the Project, temperature, rainfall, humidity and wind data were collected. Long-term average climatic data (1961-2016) collected from Comilla, Feni and Sitakunda Weather Stations of the Bangladesh

Meteorological Department (BMD) reflect the expected South-Central and South-Eastern Zone weather pattern as outlined below in tabular form.

	Comilla	Feni	Sitakunda
Average Annual Maximum Temperature (1961-2015)	31.07 (^{0}C)	30.80 (^{0}C)	31.2 (^{0}C)
Average Annual Minimum Temperature (1961-2015)	17.50(^{0}C)	18.20 (^{0}C)	18.80 (^{0}C)
Average Annual Rainfall (1961-2015)	170.09 mm	216.90mm	261.88 mm
Average Annual Relative Humidity (1961-2015)	79.74%	79.20%	78.48%

Temperature -Bangladesh has warm temperatures throughout the year, with relatively little variation from month to month (BMD). Figure 4.3 to Figure 4.5 shows the mean maximum and minimum air temperature (during 1961-2015) of Comilla, Feni and Sitakunda. As temperature record shows, May is the warmest month with average temperatures of 32.5, 32.1 and 32.2^{o}C respectively these three locations. Although in short spell, there exists a winter season in Bangladesh from December to February. The average winter maximum temp is 30.1^{o}C and minimum is 11.8^{o}C. As recorded, January is the coolest month in Comilla, Feni and Sitakunda with temperatures averaging near 12.0, 12.4, and 11.8^{o}C respectively.

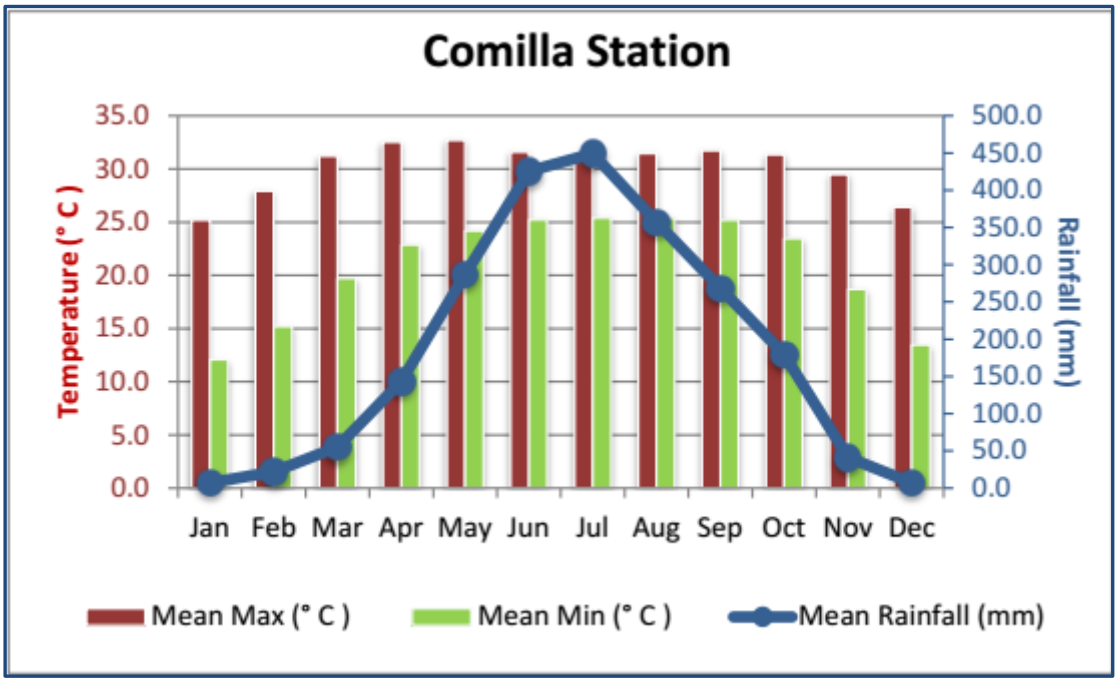


Figure 4-3: Mean Monthly Maximum & Minimum Temperature and Total Rainfall in Comilla Station (1961-2015)

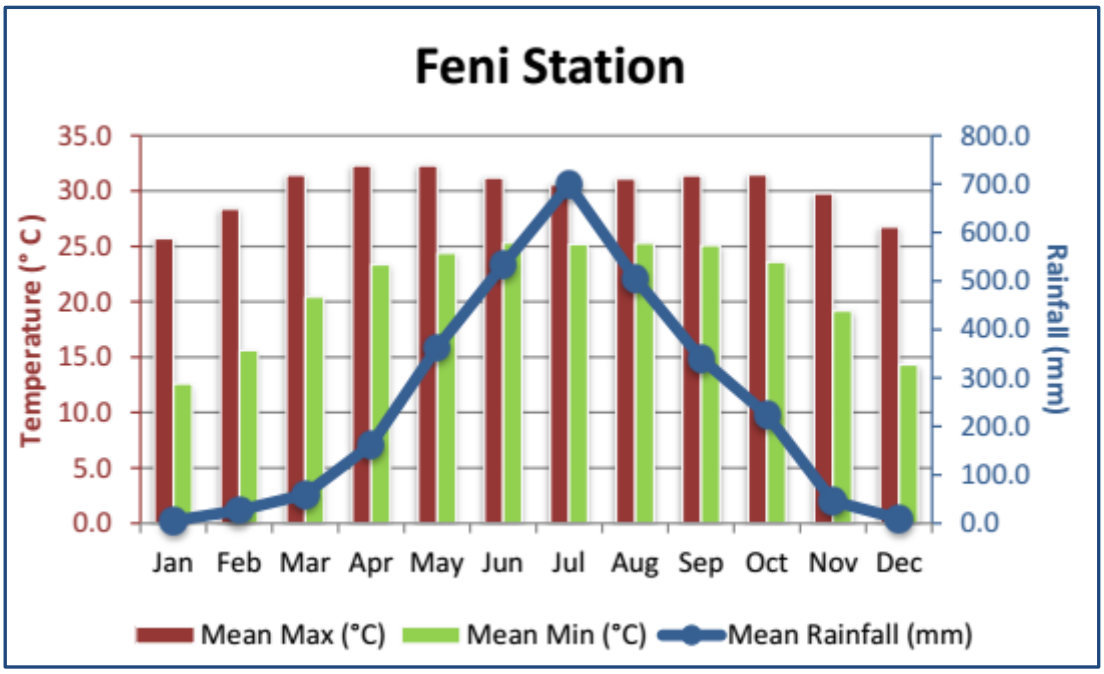


Figure 4-4: Mean Monthly Maximum & Minimum Temperature and Total Rainfall in Feni Station (1973-1915)

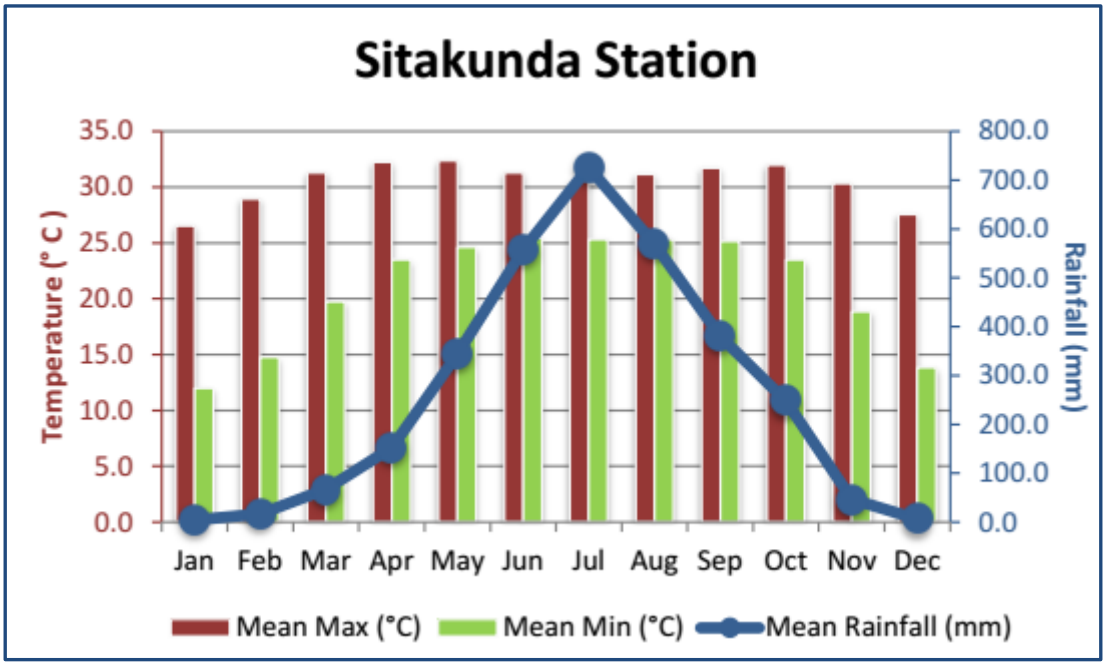


Figure 4-5: Mean Monthly Maximum & Minimum Temperature and Total Rainfall in Sitakunda Station (1961-2015)

Rainfall -Heavy rainfall is characteristic of Bangladesh frequently causing flood across the country or at local scale. With the exception of the relatively dry western region of Rajshahi, where the annual rainfall is about 1,600 mm, most parts of the country receive at least 2,300 mm of rainfall per year. About 80% of Bangladesh's rain falls during the monsoon season. Maximum rainfall occurs during May to September and the lowest rainfall occurs in November to February during winter season. Figure 4.3 to Figure 4.5 show that July wettest month according to records in Comilla, Feni and Sitakunda with average rainfall of 449.1mm, 698.8mm and 726.3 mm. No or minimum rainfall were recorded during the months of November, December and January. About 88% rainfall occurs during the period from May to October; of which about 36% pours during June – July.

Relative Humidity -Humidity levels are consistently very high during the monsoon season, and drop significantly for a relatively short period at the end of the dry season. Sunshine levels are low during

the monsoon, but from November to May are consistently high. In the project area the relative humidity is the lowest (69%) during December to March, and from April there is a steady increase till July (Figure 4.6).

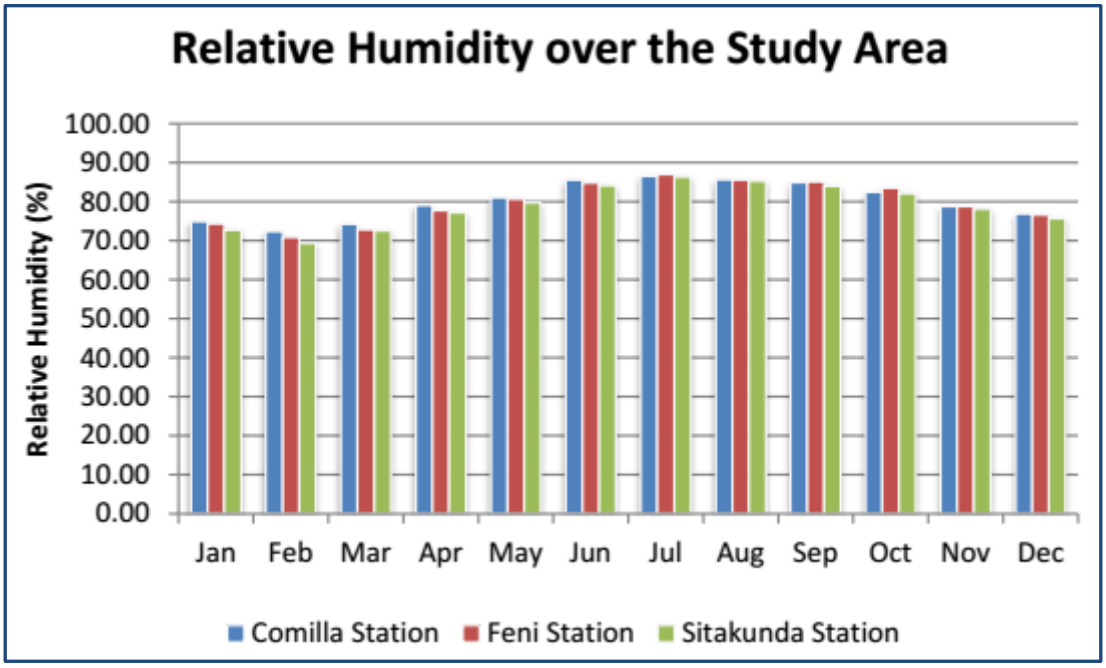


Figure 4-6: Mean Monthly Relative Humidityover the Study Area (1961-2016)

Wind Speed and Wind Direction -Wind could be the biggest and most influential weather fact. So it is extremely important to know the direction and velocity. The Wind Rose model is used to understand wind factors. Monthly prevailing wind data (wind speed and wind directions) were collected from Comilla, Feni and Sitakundasubstations for the period of 1961-2012 and analysed to determine the distribution of windforce within the study area. These data were then used to formulate the wind rose (Figure 4.7 to Figure4.9) which provides an overview of prevailing wind conditions within the survey area.

Historical wind data (wind speed, wind direction) shows that the wind speed is at a maximum in the early part of the monsoon, but drops substantially by the beginning of the dry season and is assumed to reflect the Project corridor conditions.

In Comilla (Figure 4.7), the long arrows or petal indicates the wind blows more frequently with a speed range between 0.5-11.1m/s from south to north direction and comprises nearly 65percent wind of the data period. It is recorded that the prevailing wind speeds mostly remain in the range of 1.7-9.4m/s. But in the winter months it remains in the range of 1.6-3.6m/soccasionally rising up to 10.8m/s. The highest speed is recorded as 14m/sin the month of April, 1977among the data period of 1961-2012 blowing from south direction.

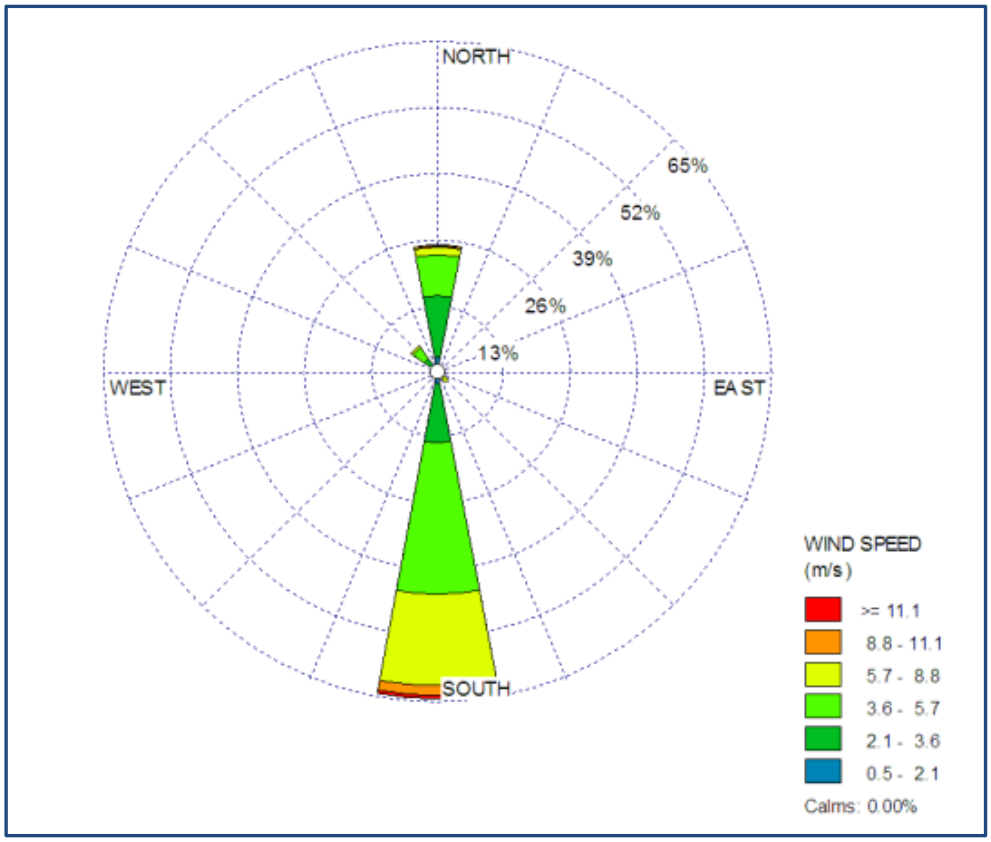


Figure 4-7: Comilla Meteorological Substation

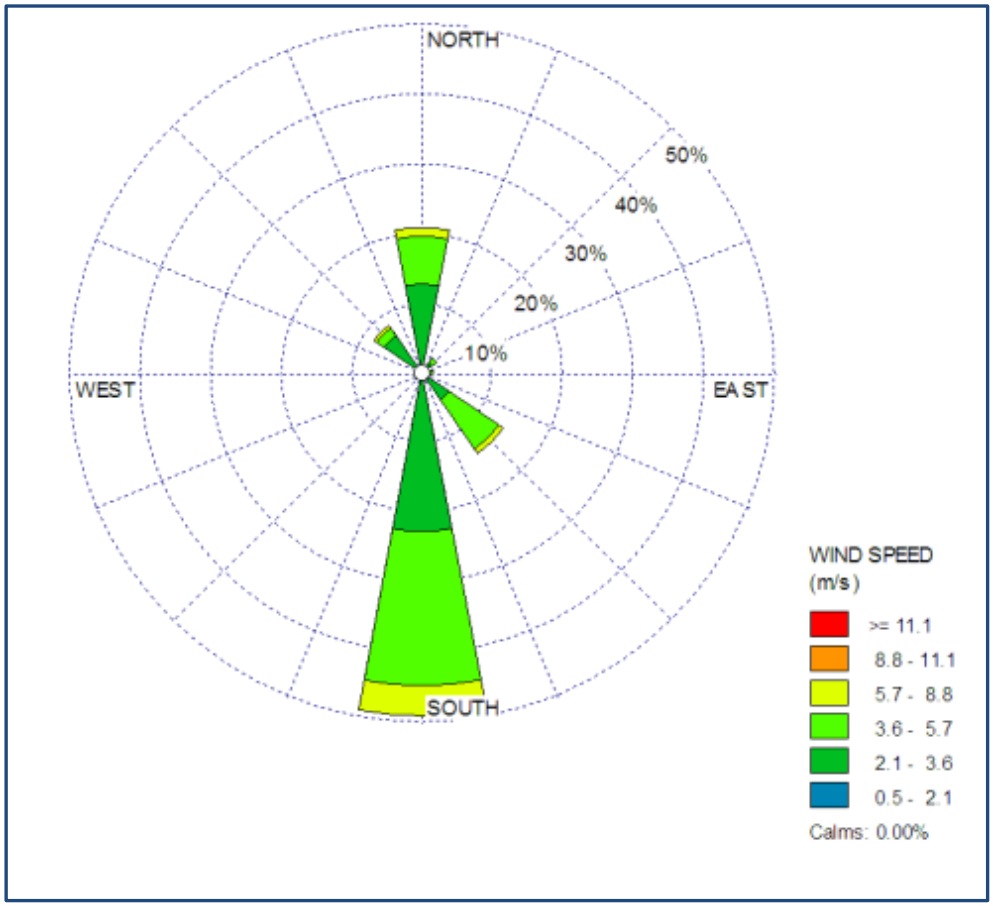


Figure 4-8: Feni Meteorological Substation

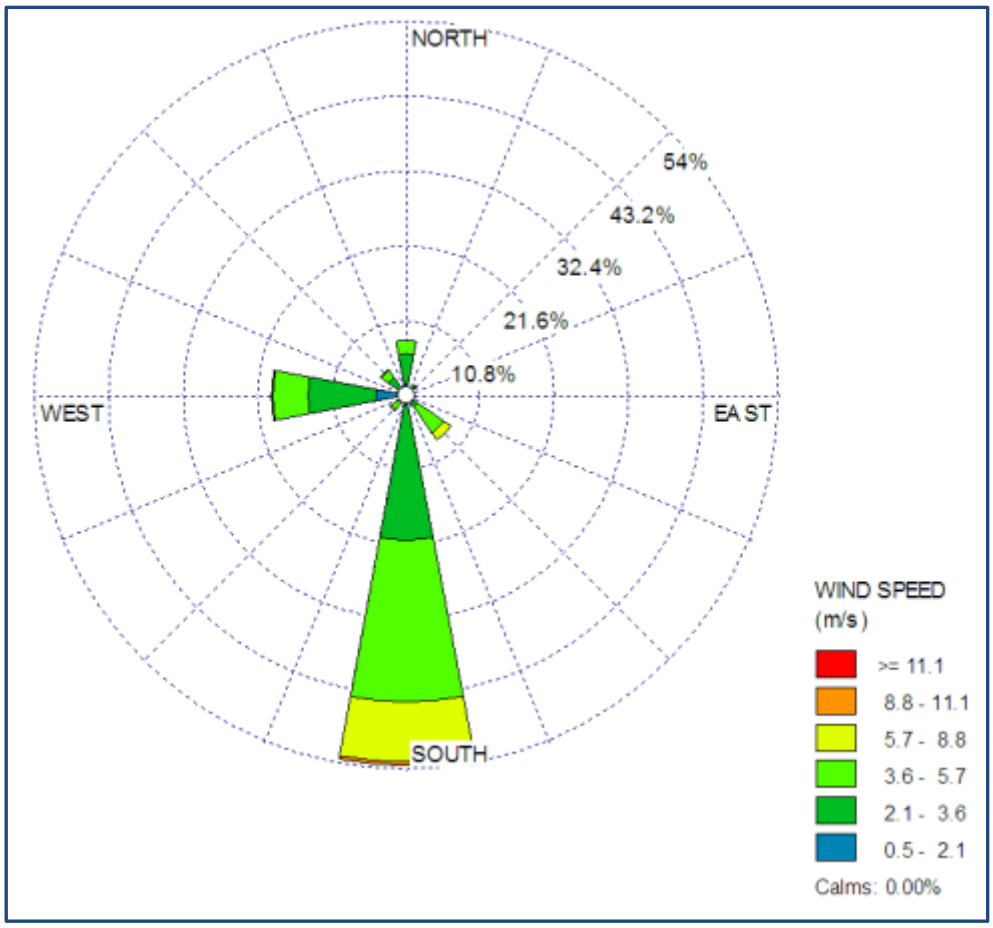


Figure 4-9: Sitakunda Meteorological Substation

In Feni the long arrows or petal indicates that wind blows mostly 2.1-8.8m/s from south to north direction comprising nearly 50percent wind of the data period (Figure 4.8). It is recorded that the wind speeds mostly remain in the range of 2.2-5.7m/s. But in the winter months it remains in the range of 2-2.8m/s occasionally rising up to 7.6m/s. The highest speed is recorded as 7.6m/s in the month of February, 1993 among the data period of 1973-2012 blowing from south direction.

For Sitakunda station,the long arrows or petal indicates that wind blows more frequently with a dominant speed range between 2.1-11.1m/s from the south direction and which comprises nearly 54percent wind of the data period(Figure 4.9). It is recorded that the wind speeds mostly remain in the range of 1.8- 7.2m/s. But in the winter months it remains in the range of 1.3-2.9m/s occasionally rising up to 6.4m/s. The highest speed is recorded as 9.8m/s in the month of May, 1977among the data period of 1977-2012 blowing towards south and southeast directions.

4.3.2 Physiographic Features

The Chittagong division as well as the subproject areas of the SS, TL& LL in this division comprises the following physiographic units within the project areas(Figure 4.6).

Middle Meghna Floodplain- The floodplain of this river occupies a low-lying landscape of broad islands and many broad meandering channels which formed part of the Brahmaputra before it abandoned this channel when it changed course into the Jamuna two centuries ago. The Meghna sediments are mainly silty and clays and sandy Brahmaputra sediments occur at the surface on some ridges in the north. The seasonal flooding from the Meghna is mainly deep. The basin sites are submerged early and drain late.

Old Meghna Estuarine Floodplain- The landscape in this extensive unit is quite different from that on river and tidal floodplains. The relief is almost level, with little difference in elevation between ridges and basins. Natural rivers and streams are far apart in the southern part and drainage is provided by a network of man-made canals (khal). The sediments are predominantly deep and silty, but a shallow clay layer in some basin centres overlies them. Seasonal flooding is mainly deep, but it is shallow in the southeast. Some basin centres stay wet throughout the dry season. Virtually everywhere, this flooding is by rainwater ponded on the land when external rivers flow at high levels; the exceptions are the narrow floodplains alongside small rivers (such as the Gumti) which cross the unit from adjoining hill and piedmont areas.

Young Meghna Estuarine Floodplain- This sub-unit occupies almost the level land within and adjoining the Meghna estuary. It includes both island and mainland areas. New deposition and erosion are constantly taking place on the margins, continuously altering the shape of the land areas. The sediments are deep silts, which are finally stratified and are slightly calcareous. In many, but not all parts, the soil surface becomes saline to varying degrees in the dry season. Seasonal flooding is mainly shallow, but fluctuates tidally, and is caused mainly by rainwater or non-saline river water. Flooding by salt water occurs mainly on the lamed margins and during exceptional high tides during the monsoon; also when storm surges associated with tropical cyclones occur.

Chittagong Coastal Plain- The plain along the coast extends from the Feni River to the mouth of the Matamuhuri delta, a distance of 121 km. It comprises gently sloping piedmont plains near the hills, river floodplains alongside the Feni, Karnafuli, Halda and other rivers, tidal floodplains along the lower courses of these rivers, a small area of a young estuarine floodplain in the north, adjoining sub-regional young Meghna estuarine floodplain, and sandy beach ridges adjoining the coast in the south. Sediments near the hills are mainly silty, locally sandy, with clays more extensive in floodplain basins. The whole of the mainland area is subjected to flash floods. Flooding is mainly shallow and fluctuates in depth with the tide (except where this is prevented by river or coastal embankments). The average daily rise in the tide is about two metres. Some soils on tidal and estuarine floodplains become saline in the dry season.

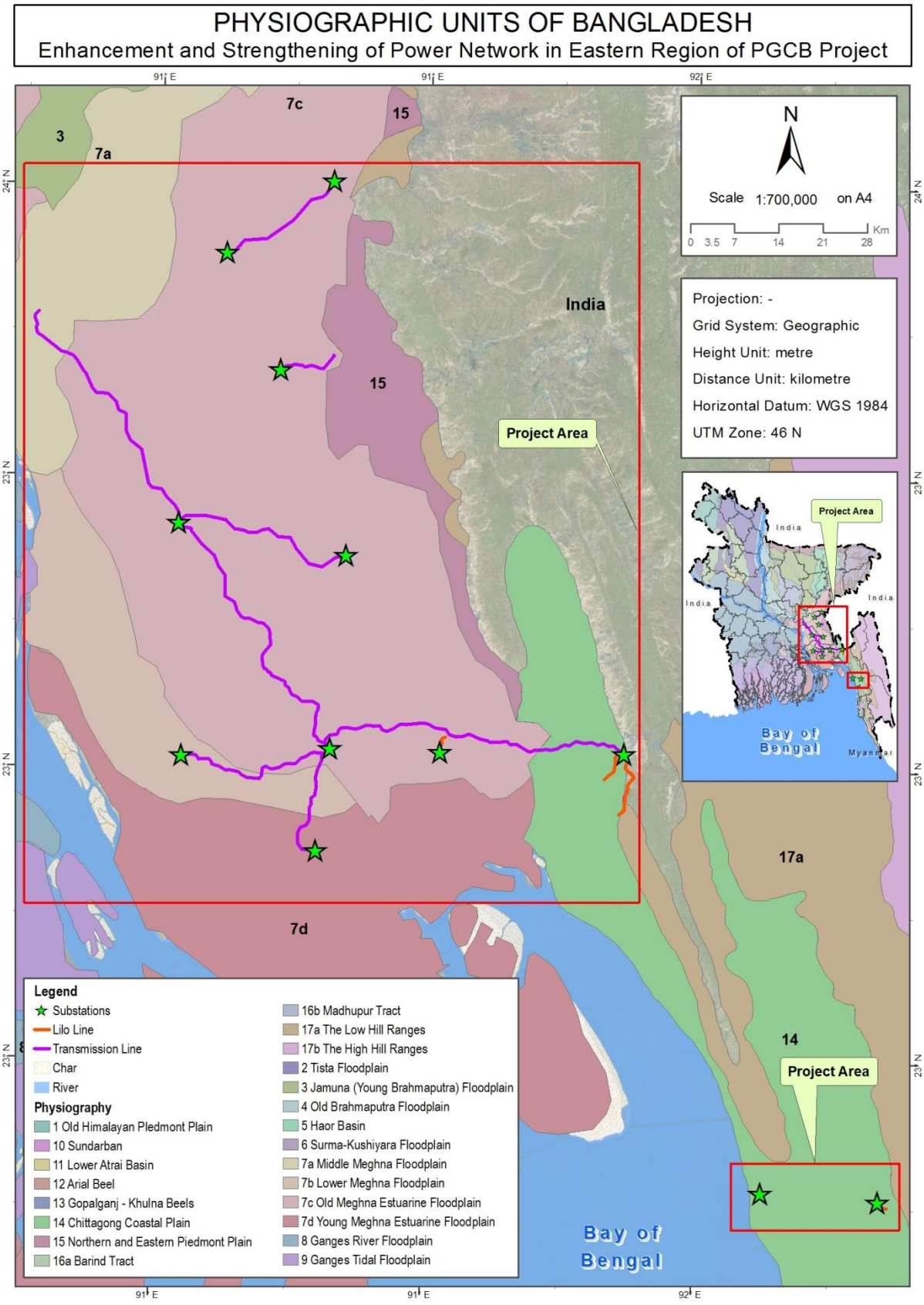


Figure 4-10: Physiographic Units of Bangladesh and the Subprojects Locations

Northern and Eastern Piedmont Plains- Generally sloping piedmont plains border the northern and eastern hills. These plains, which comprise coalesced alluvial fans, mainly have silty or sandy deposits near to the hills, grading into clays in the basin adjoining the neighboring floodplains. The

whole area is subject to flash floods during the rainy season. On the higher parts, flooding is mainly intermittent and shallow; but it is moderately deep or deep in the basin.

Low Hill Ranges- Comparatively low hill ranges occur between and outside the high hill ranges. They are mainly formed over unconsolidated sandstone and shale. Their summits generally are <300m above MSL. Most areas are strongly dissected, with short steep slopes, but there are some areas with rolling to early-level relief (eg in the best tea-growing areas of Sylhet region). In the Sylhet region, there are four main hillocks in the northern zone and six hill ranges project into the south of Sylhet district from the Indian state of Tripura. These six ranges, which project into the plains from the south, are, from east to west, Patharia, Harargaj, Rajkandi-Ita, Bhanugach, Tarap and Raghunandan.

In the Chittagong region, this unit includes the Sitakunda and Mara Tong ranges and the complex of hills to the south and east of Ramgarh, including the eastern part of the middle Feni river valley. The Sitakunda range has 32-km long ridge in the middle, which reaches 352m at Sitakunda peak. To the north, the high peaks on this range are Rajbari Tila (274m) and Sajidhala (244m). To the south, there is an abrupt fall and Chittagong city heights are less than 92m. In the Mara Tong range a height of only 113m is reached. Further northeast the hills are higher. The topography is deeply eroded and rounded; the valleys are curved and almost isolated hillocks are common. At the Sitakunda peak, there are several hot springs. There are five broken ranges of hills between Karnafuli River and the southern tip of Bangladesh. South of Bakkhali River the hills reach the sea at Cox's Bazar. Thereafter the main mass of hills goes down the Teknaf peninsula as the Teknaf range. There is a slight break in the west along the Rejukhal valley. In its northern part, the Teknaf range is comparatively low (61 to 91m). From Whykong a high ridge runs south; its main peaks are Baragong (119m), Taunganga (268m), and Nytong (168m). The southwestern end of this range ends at a village called Noakhali where there are a series of impressive cliffs, some 30m in height. The range ends at Teknaf Bazar. South of Gorjania (northeast of Teknaf peninsula) these hills continue into Myanmar. The Rejukhal valley is an important component of this broken-up landscape.

4.3.3 Topography

Most of Bangladesh is situated onthe river deltas. The Chittagong coastal region to the southeast has a narrow attachment to the bulk of the country. Small hill regions in the northeast and southeast are the only variations of the land's flat alluvial plains (flatlands containing deposits of clay, silt, sand, or gravel deposited by running water, such as a stream or river). The topography of Chittagong division is much diversified. In general, the ground elevationof the Chittagong division varires about 5mPWD to 300mPWD.

A topographic map of the subproject areasis shown in Figure 4.11. From this figure and topo survey in 2017, it is known that the ground elevation of the project area varies from 3mPWD to 10mPWD.The region comprises plane, costal, semi-hilly and hilly areas. The soil condition of the subproject areas specially New mooring site & Lilo of 400 KV DC TL (Korerhat-BSRM) consists of silty clay soil and therefore stable.The subproject site specific topography has given in earlier Table 4.1.

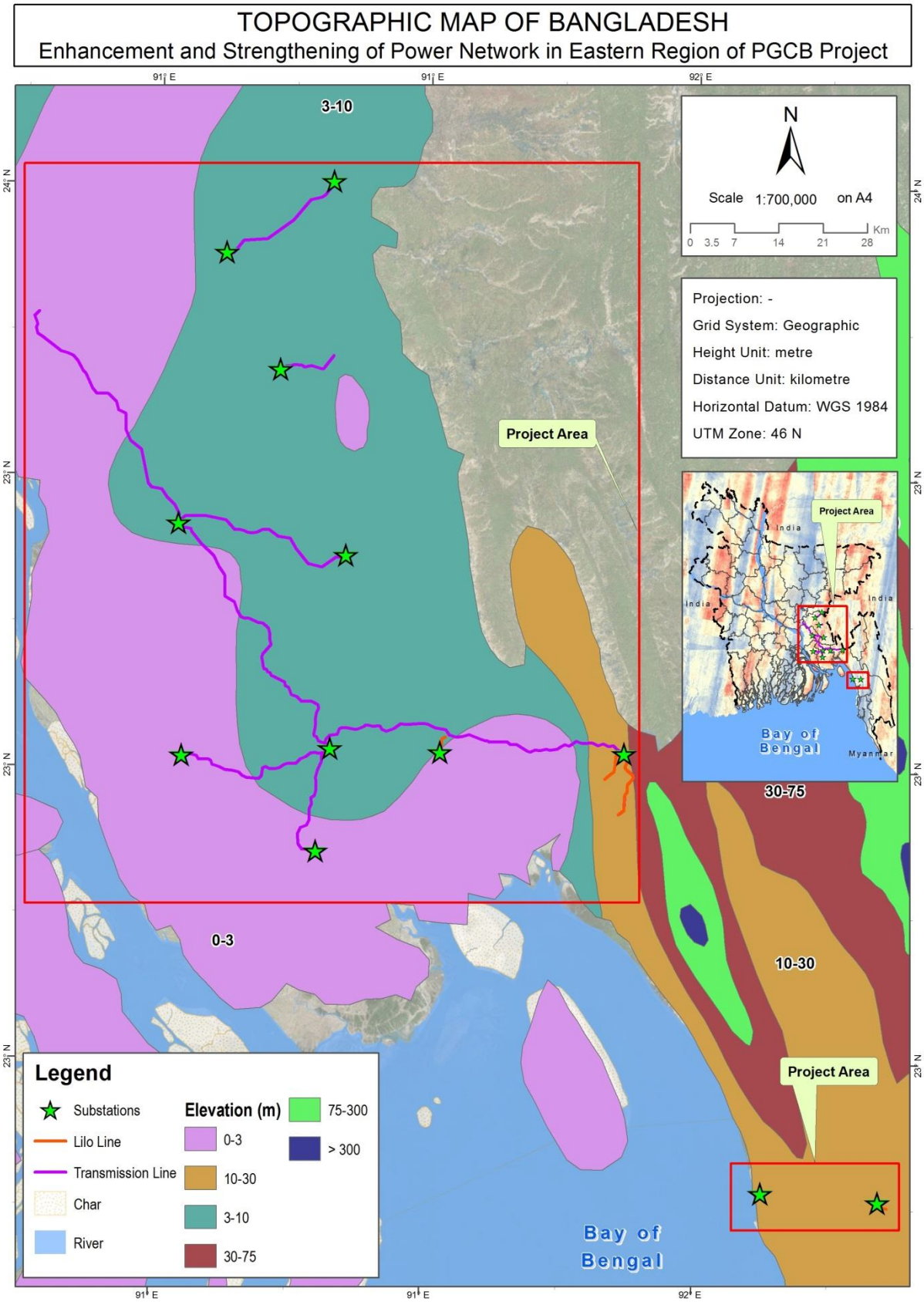


Figure 4-11: Topography of Bangladesh and the Project Area

4.3.4 Geology

Bangladesh is situated to the east of the Indian sub-continental plate. Nearly 85% of Bangladesh is underlain by deltaic and alluvial deposits of the Ganges, Brahmaputra, and Meghna river systems. The project area consists of Holocene alluvial deposits flood plain and predominantly consisting of fine sand, silts and clay. The site is on deep Cainozoic deposits that overlie Precambrian basement rock. The Precambrian rocks form the basement of all geological formations of Bengal Basin and shield areas. The materials deposited are a mixture of sediments transported by the old Brahmaputra and by the Jamuna (Brahmaputra) River. The generalized geological features of the project area are shown in the geological map of Bangladesh (Figures 4.12). The majority areas of the subprojects are under the Barisal GravityHigh. However, some portions are also under the Hatia Trough and Barisal Gravity High.

4.3.5 Soil

The subprojects' areasfall in to the ten different soil formation zones (Figure 4.13). The general soil types of the Chittagong division predominantly include the following:

I. *Calcareous Alluvium Soils (saline):* The properties of this type of soil are similar to acid sulphate soils.
II. *Non-calcareous Dark Grey & Grey Floodplain Soils*: They have a cambic B-horizon, non-calcareous dark grey topsoil and subsoil. They occur extensively on the Old Brahmaputra and old Meghna estuarine floodplain. Silt loam and silty clay loam are predominant on the Meghna estuarine floodplain and in the Tista meander floodplain, whereas silty clays and heavy clays are extensive on the Old Brahmaputra floodplain. The majority of these soils are Eutric Gleysols.
III. *Non-calcareous Grey Floodplain Soils:* Generally, comprise a grey topsoil and a cambic B-horizon in the subsoil with a grey matrix or grey gleans. They extensively occupy Tista, Karatoya-Bangali, Jamuna, middle Meghna and eastern Surma-Kushiyara floodplains. However, there are considerable regional differences in the proportions occupied by individual soil textures. Silt loam texture is dominant in the Tista meander floodplain whereas silty clays are predominant in the Ganges tidal floodplain and in the Surma-Kushiyara floodplain. But the Jamuna floodplain has a more even distribution of silt loam, silty clay loam and silty clays. Most of these soils have been included in Eutric Gleysols.
IV. *Acid Sulphate Soils:* Occur predominantly on the Chittagong coastal plain and in minor areas of the Ganges tidal floodplain. These soils contain sulphidic material, which turns extremely acid if exposed to air. The soils, which are under Mangrove Forest and flooded by saline tidal water, are finely stratified soft muddy sediments. But where it has been embanked to prevent flooding with saline water, the soils of these areas have developed profiles similar to non-calcareous grey and dark grey floodplain soils with extremely acidic horizon. They are either Thionic Fluvisols or Thionic Gleysols.

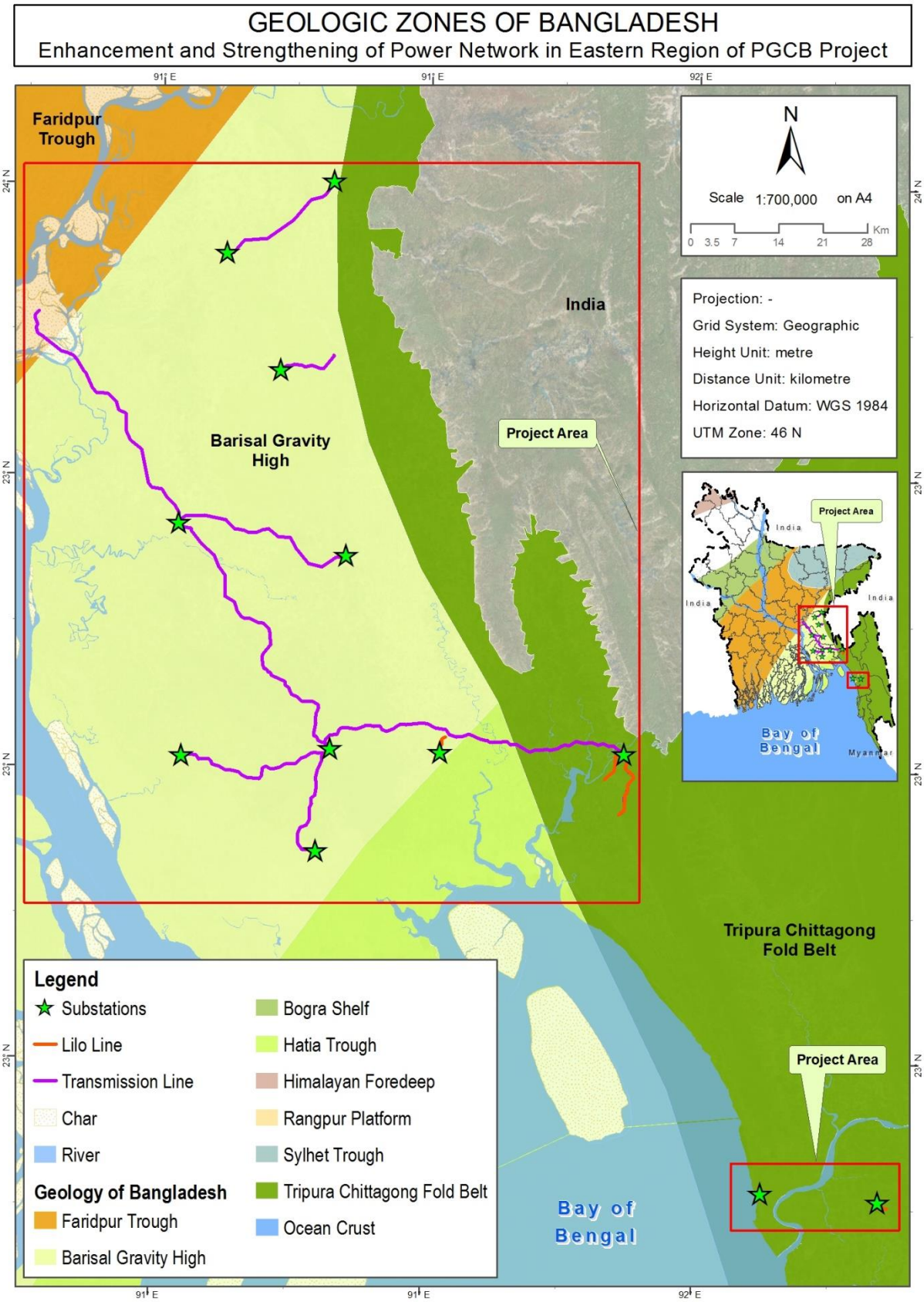


Figure 4-12: Geology of Bangladesh and the Project Area

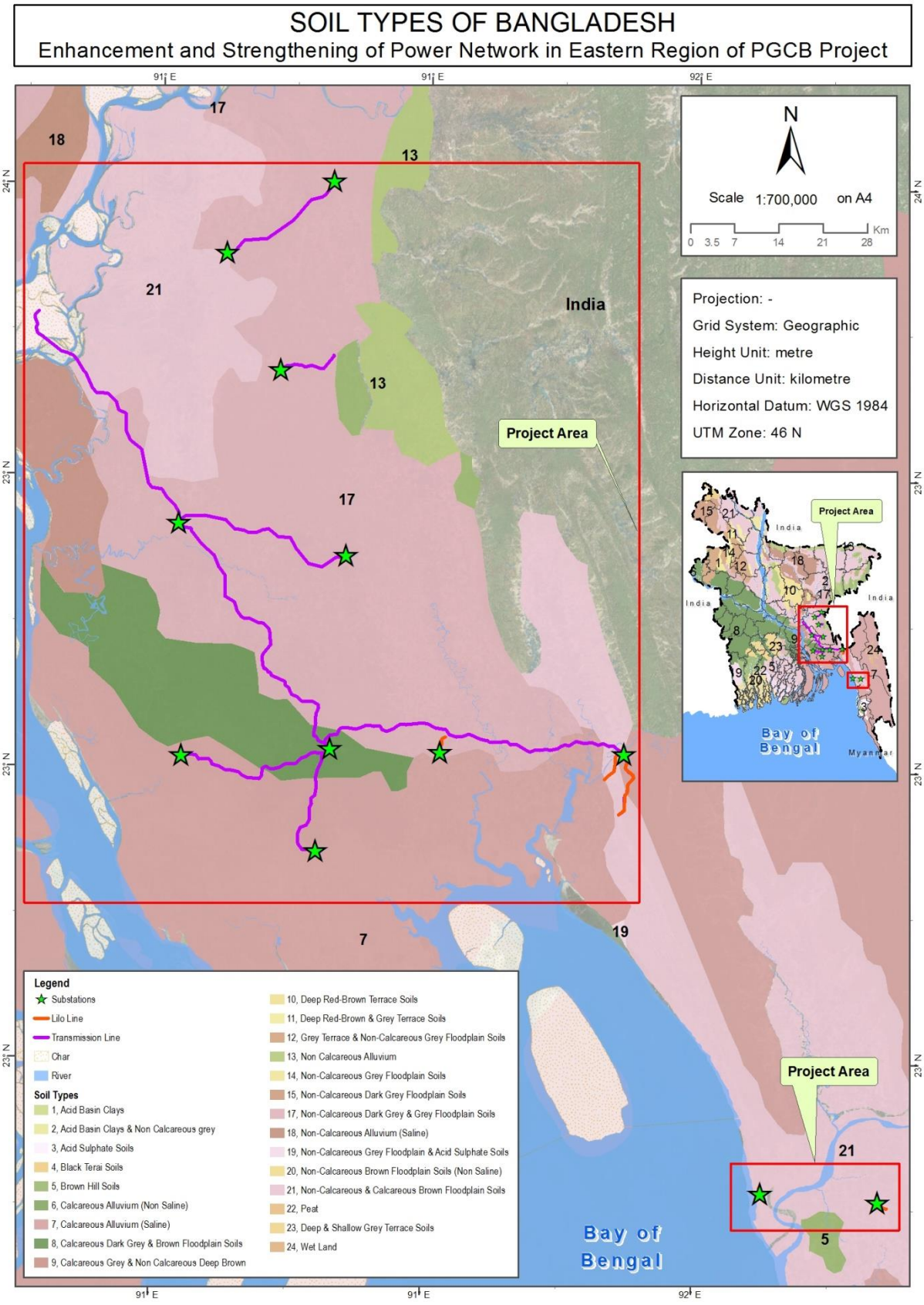


Figure 4-13: Soil Types of Bangladesh and the Project Area

4.3.6 Agro-ecological Zones

A 1988 study carried out by the United Nations Development Program (UNDP) classified Bangladesh into a series of Agro-ecological Zones (AEZs) based on an assessment of commonalities in characteristics such as physiography, soil types, climate and drainage. In total, 34 regions were identified and characterized, however this information has been updated and further refined on numerous occasions since the original study was undertaken.

The purpose of assessing the AEZs within the project area is to establish a broad overview of expected soil conditions which can be compared against more detailed, upazila-level data sources.

The most recent assessment was completed by the Soil Resource Development Institute (SRDI), 1998 which classified Bangladesh into 30 AEZs. The subproject areas contain the following major AEZ (Figure 4.14):

I. ***Lower Meghna River Floodplain*** **-** This area occupies the transitional area between the middle Meghna river floodplain and the young Meghna estuarine floodplain. Soils of this area are relatively uniform, silt loams occupy relatively higher areas and silty clay loams occupy the depressions. Non-calcareous dark grey floodplain and calcareous grey floodplain soils are major components of general soil types. Topsoils are moderately acidic and subsoils neutral in reaction. General fertility level is medium to high with low to medium organic matter status and K-bearing minerals.

II. ***Young Meghna Estuarine Floodplain***- This region occupies young alluvial land in and adjoining the Meghna estuary. The major soils are grey to olive, deep calcareous silt loam and silty clay loams, and are stratified either throughout or at shallow depth. Calcareous alluvium and non-calcareous grey floodplain soils are the dominant general soil types. Topsoils and subsoils of the area are mildly alkaline. General fertility is medium but low in N and organic matter.

III. ***Old Meghna Estuarine Floodplain***- This region occupies a large area, mainly low-lying land between the south of the Surma-Kushiyara floodplain and the northern edge of the young Meghna estuarine floodplain. Silt loam soils predominate on highlands and silty clay to clay on lowlands. Organic matter content of the soils is moderate. Topsoils are moderately acidic, but subsoils neutral in reaction. General fertility level is medium.

IV. ***Northern and Eastern Piedmont Plains***- This is a discontinuous region occurring as a narrow strip of land at the foot of the northern and eastern hills. The region comprises merging alluvial fans which slope gently outward from the foot of the northern and eastern hills into smooth, low-lying basins. Grey piedmont soils and non-calcareous grey floodplain soils are the major general soil types of the area. Soils of the area are loams to clays, slightly acidic to strongly acidic in reaction. General fertility level is low to medium.

V. ***Chittagong Coastal Plain***- This region occupies the plain land in greater Chittagong district and the eastern part of Feni district. It is a compound unit of piedmont, river, tidal and estuarine floodplain landscapes. The major problem in these soils is high salinity during the dry season (October to May). Grey silt loams and silty clay loam soils are predominant. Acid sulphate soils occur in mangrove tidal floodplains. General fertility level of the soils is medium, but N and K are limiting. Organic matter content is low to moderate.

VI. ***Northern and Eastern Hills***- This region includes the country's hill areas. Relief is complex. Hills have been dissected to different degrees over different rocks. In general, slopes are very steep and few low hills have flat summits. Brown hill soils are the predominant general soil type of the area. Organic matter content and general fertility level are low.

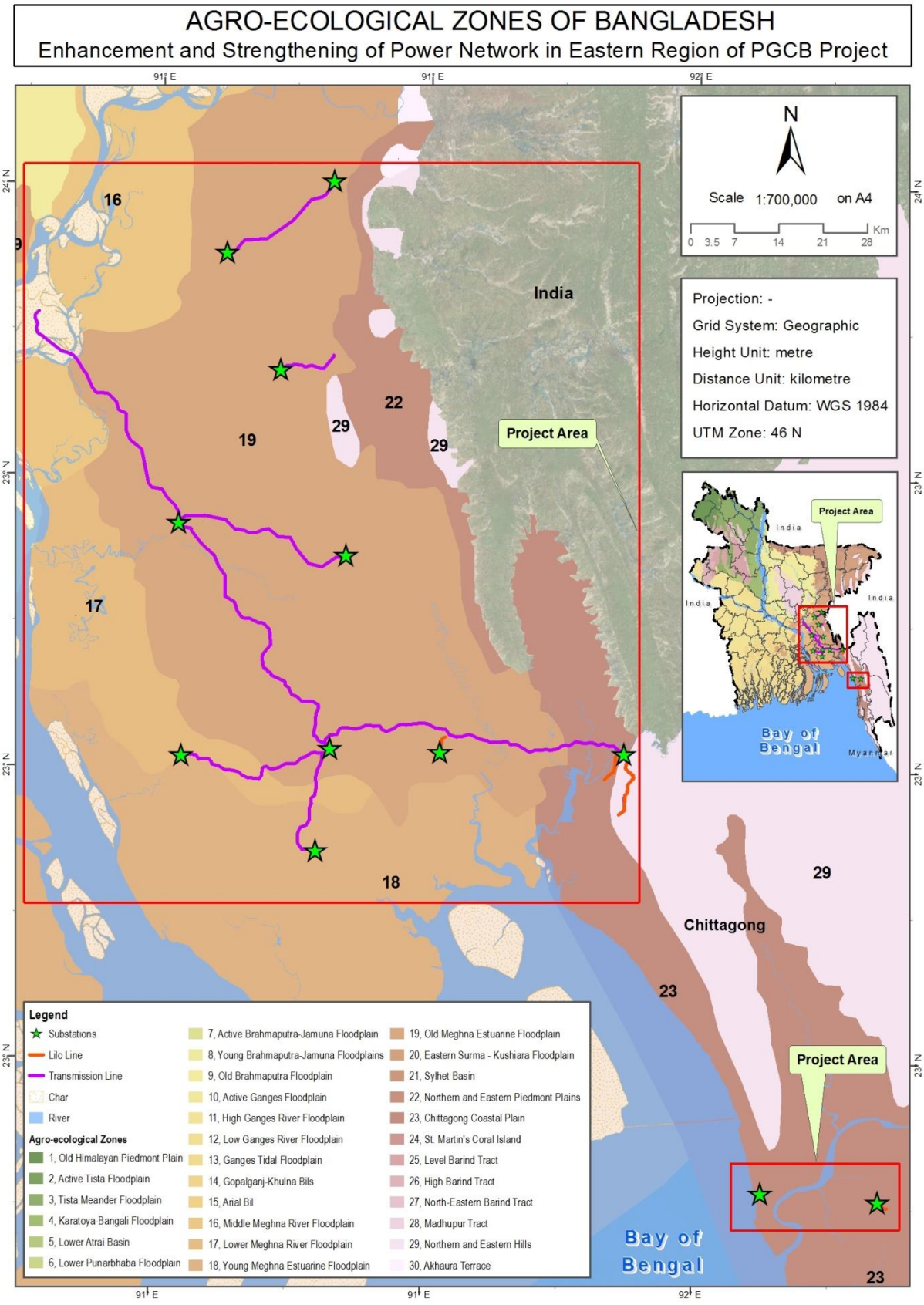


Figure 4-14: Agro-ecological Zones of Bangladesh and the Project Area

4.3.7 Hydrology/Drainage

The Chittagong division forms with several notable river systems. The Meghna, Matamuhuri, Titas, Dakatia, Gumti, Feni, Karnafuli, Halda, Bagkhali and Sangu are the major rivers of this division. Some of the rivers are among the longest river systems in the country and drains significant water of this area. These rivers are used extensively by the local population as a transport route, irrigation and for other livelihood activities.

The hydrology of this division is dominated by the Sangu, Bagkhali, Matamuhuri, and Tributary of the Matamuhuri Rivers, all originating in India and Myanmar. These rivers, especially the Bagkhali, Matamuhuri and Sangu exhibit flash flooding during heavy monsoon rains. The Bagkhali, Matamuhuri and Sangu and its tributaries have no or less than 10% of normal flow during the dry season (November–April), due to withdrawal of water for irrigation by low-lift pumps. Generally, ponds remain unchanged from year to year due to rejuvenation during the rainy season.

Most of the areas of this division are not flood-prone. However, the area adjacent to the other divisions is affected to flood every year during monsoon from severe to normal flooding. A flood map focusing the sub-projects areas is shown in Figure 4.15 and the inundation of the sub-project sites for the last 30 years (from 1987-2017) has presented in Table 4.1.

An overview of the surface water bodies and catchments within the Chittagong division is provided in the following Figure 4.16.

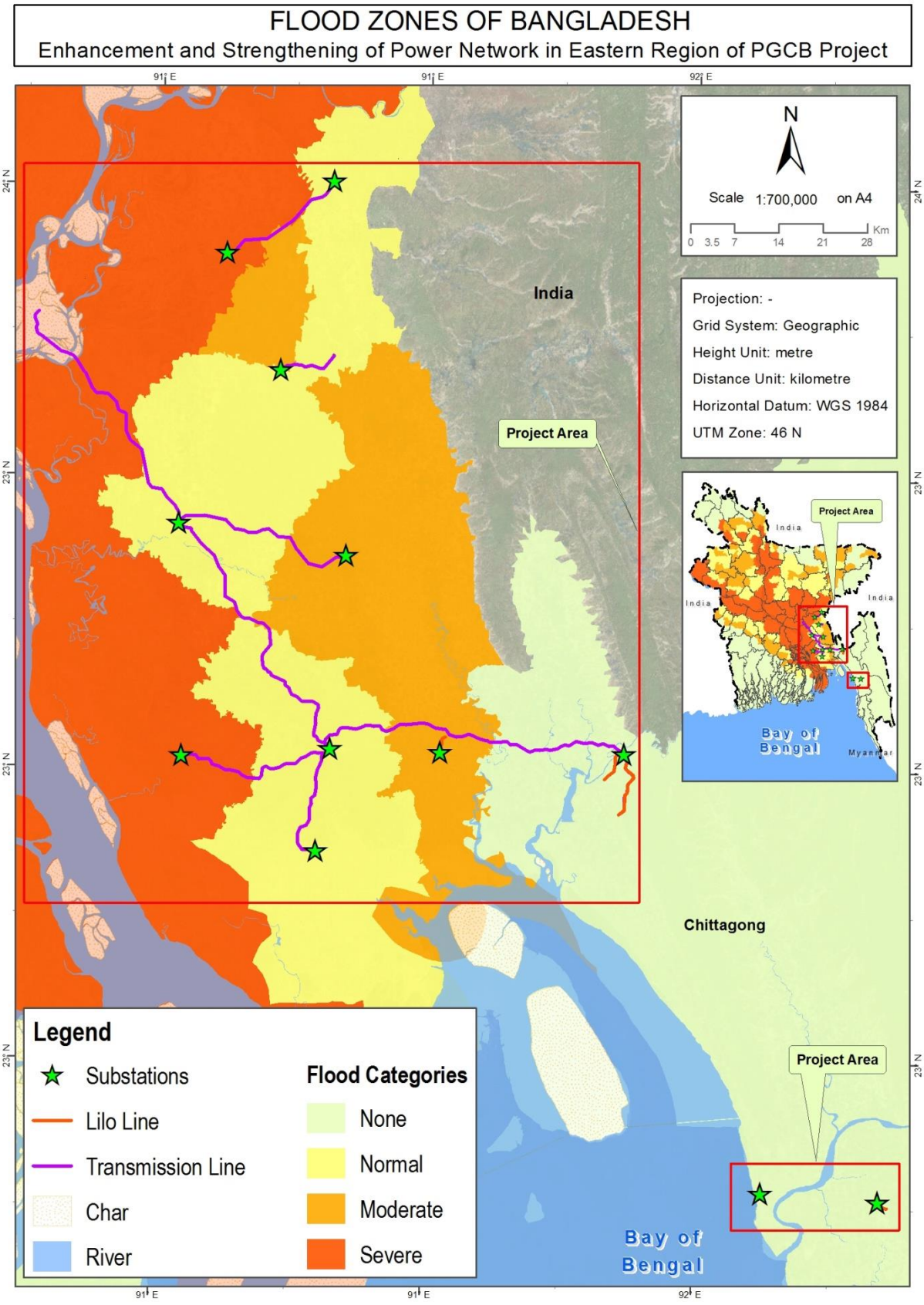


Figure 4-15: Floods of Bangladesh Map, also showing the floods severity in the subproject areas

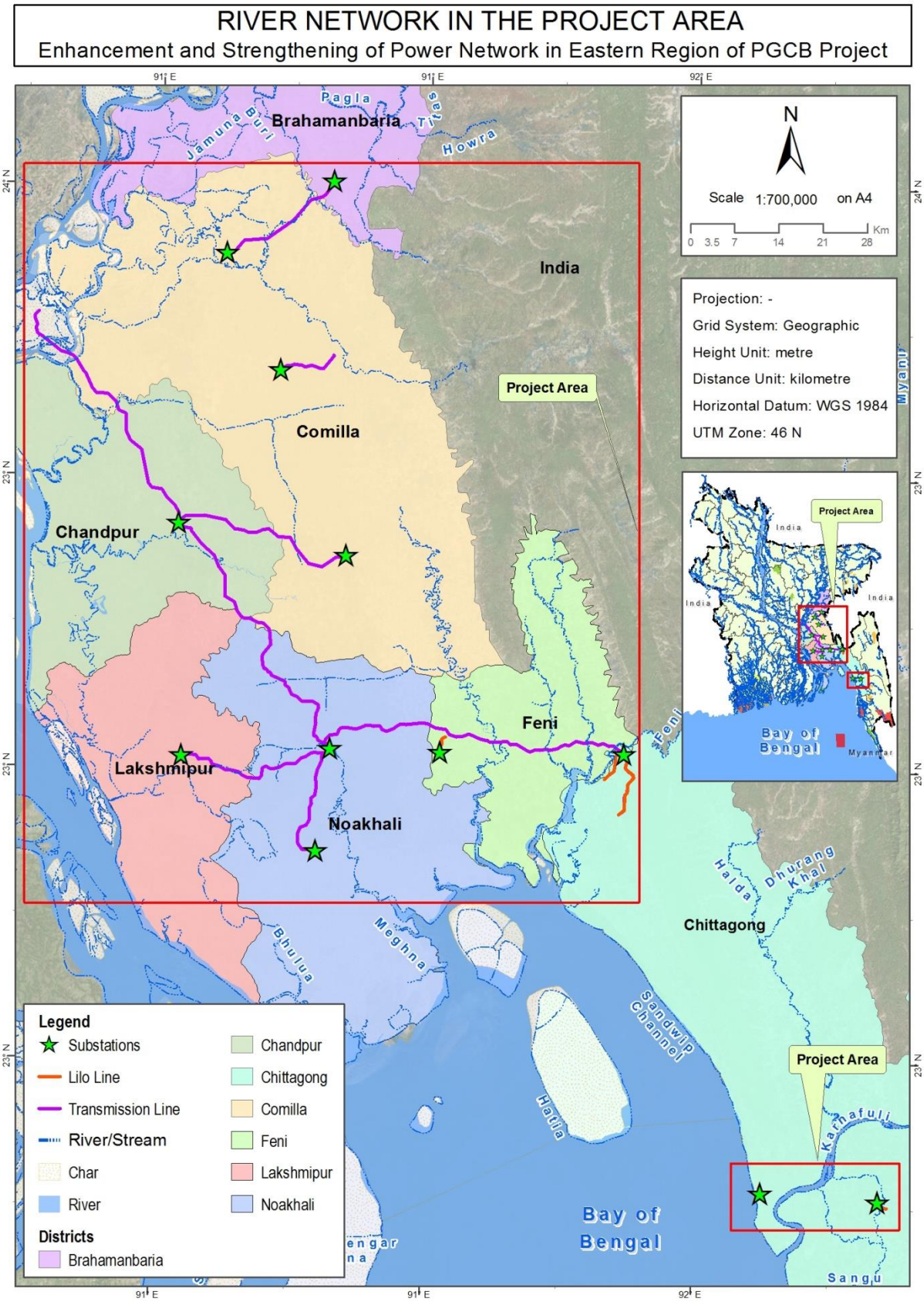
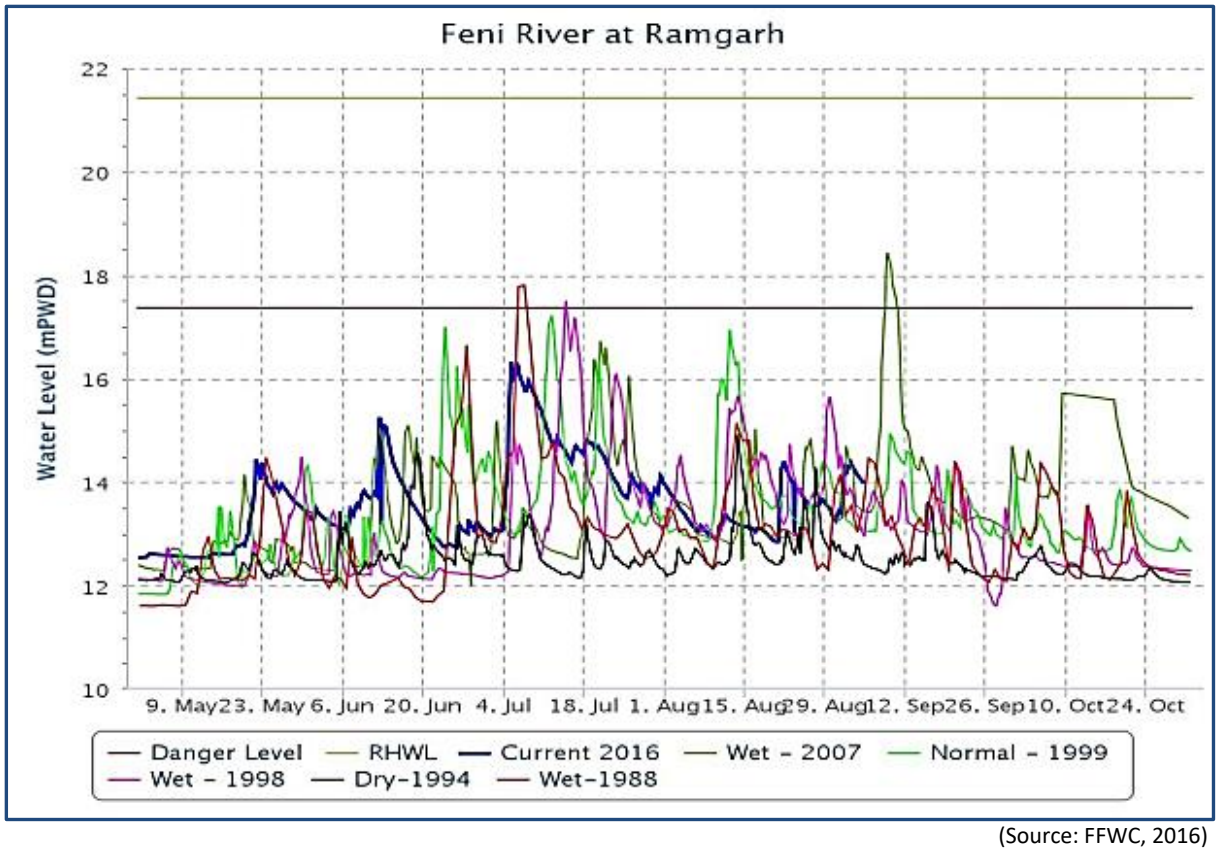


Figure 4-16: Rivers Of Bangladesh Map, Also Showing the Major Rivers in the Subproject Areas

In Bangladesh, rainfall and trans-boundary river flows are the main sources of surface water. According to Banglapedia, Bangladesh has an average annual surface flow of approximately 1,073

million acre feet (MAF), of which about 870 MAF (93%) is received from India as inflow, and the remaining 203 MAF (7%) as rainfall. This magnitude of water is sufficient to cover the whole of Bangladesh to a depth of 9.14m. Approximately132 MAF (65% of rainfall and 12% of total) is lost in evaporation (114.30 cm) and the remainder, approximately 5million cubic feet (MCF) flows out to the Bay of Bengal that includes sediment load of 1.5-2.4 MCF. A brief description on the main rivers found in the study areas is given below.

Feni River: The Feni River is a trans-boundary river originated from Tripura, India. The river, after entering Bangladesh, flows towards south-west direction dividing Chittagong and Noakhali before meeting with the Bay of Bengal after traversing 116 kilometers. During the monsoon season when there are heavy rains in the region, it does not lack the water quantity but when there is excessive rains the river gains more energy and creates whirling eddies and currents at its sharp turns. The water level difference between high tide and low tide is maximum 1.2 m. The Feni is a perennial river, but has tidal influence, when it is fully inflated during the monsoon months (July to September) and measured flow rate is 10,800 m^3/s (at Kaliachari) at that time. The flow is decreased in the months of February to April and the flow rate identified at that time 1.35 m^3/s (at Kaliachari). The course of this river is meandering and the flood flow slope is nearly 15 cm/km. Water level of the Feni River is considered as NTWL (Non-tidal Water Level) at Ramgar & Kaliachari and TDWL (Tidal Water Level) at Dhumghat & Sonapur (Islam, Mokhlessuzzaman, & Chowdhury, 2011). Hydrograph of the Feni River at Ramrarh gauge station is given below (Figure 4.17).

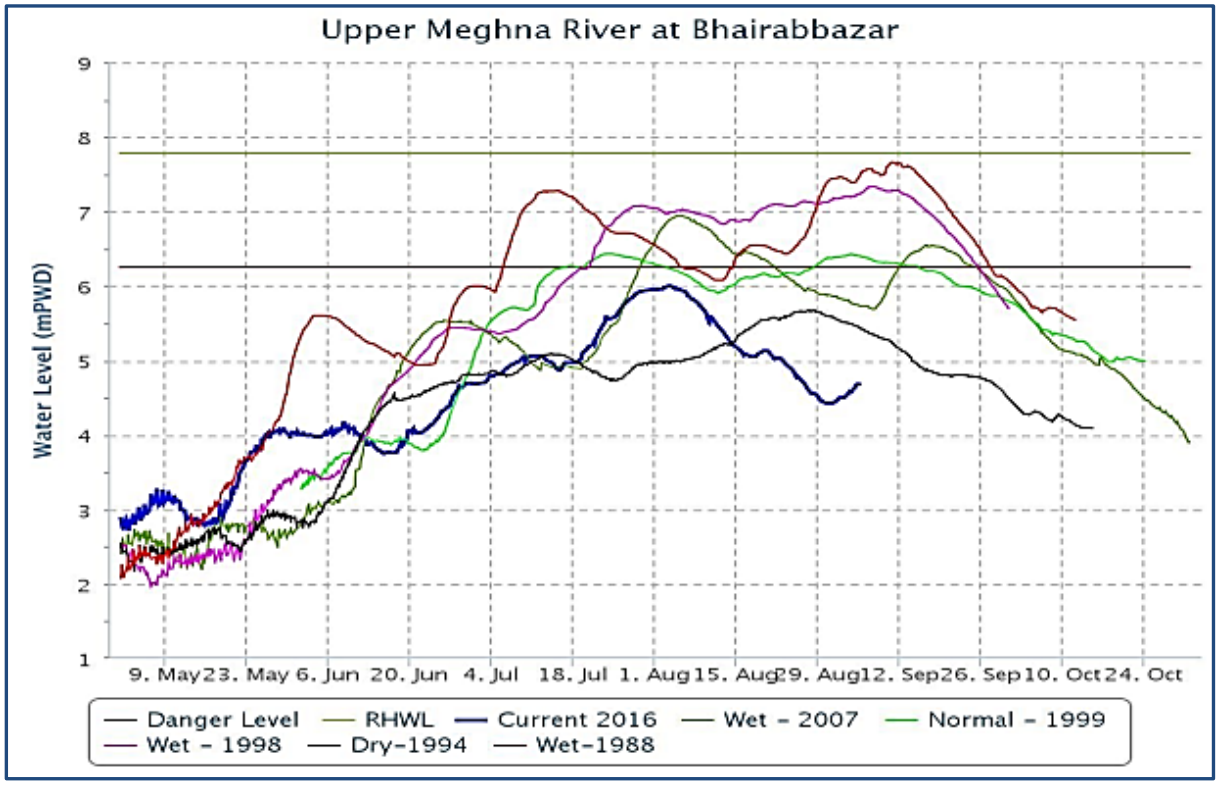


(Source: FFWC, 2016)

Figure 4-17: Hydrograph of Feni River at Ramgarh Gauge Station

Meghna River: The Meghna is formed inside Bangladeshwith the joining of the Surma and Kushiyara rivers originating from the hilly regions of eastern India. The Meghna has two distinct parts. The Upper Meghna from Kuliarchar to Shatnol is a comparatively small river. The Lower Meghna below Shatnol is one of the largest rivers in the world because of its wide estuary mouth. The Lower Meghna is at times treated as a separate river. The upper Meghnariver which is major consideration

for Dhaka-Chittagong Expressway Project receives old Brahmaputra near Bhairab Bazar. The upper Meghna forms several off shoots which later rejoins with Meghna after long bends and meandering through lowland areas of northeastern areas Bangladesh. Among off shoots Titas, Pagli, Kathalia, Dhonagoda, Matlab and Udhamdi are important. The Meghna and these offshoots receive water of a number of hilly streams from the Tripura Hills. The important hill streams are the Gumti, Kakrai, Kagni, Dakatia, Hawrah, Sonaiburi, Harimangal, Pagli, Kurulia, Balujuri, Sonaichhari, Handachora, Jangalia and. All of these are liable to flash floods. The Gumti, Kakrai and Hawrah are the most destructive rivers. They have silted their beds to the extent that they now flow above the mean level of the land when brimful. Bangladesh Water Development Board (BWDB) constructed numbers of embankments to protect adjacent crops fields, small towns from flash floods.



(Source: FFWC, 2016)

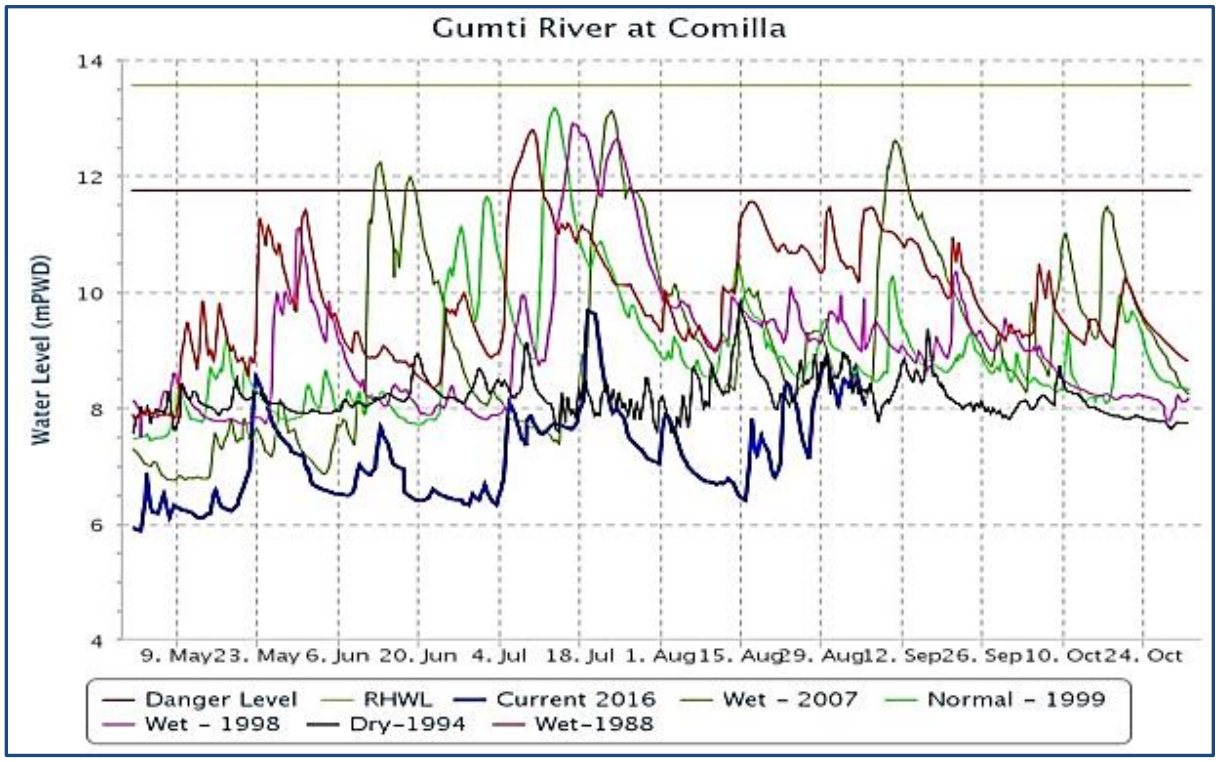
Figure 4-18: Hydrograph of Upper Meghna River at Bhairabbazar Gauge Station

The historical flood analysis shows that every other year one or the other of these streams overflows and causes considerable damage to crops, livestock and homestead.The Meghna River is a perennial river in nature; it is fully inflated during the monsoon months (July to September) and measured flow rate is 19900 m^3/s (at Bhairab Bazar Station) at that time. The flow is decreased in the months of February to April and the flow rate identified at that time 2 m^3/s (at Bhairab Bazar Station). Water level of the Meghna River is considered as TDWL (Tidal Water Level) at Ostogram, Bhairab Bazar, Narshingdi, Baiddarbazar, Meghna Ferry Ghat and Satnal. Hydrograph of Upper Meghna River at Bhairab Bazar gauge station is given below (Figure 4.18).

Gumti River: The Gumti River originates from Dumur in the northeastern hilly region of Tripura state of India. The Gumti is about 135 km long within Bangladesh. The Gumti River is a perennial river in nature; it is fully inflated during the monsoon months (July to September). Mainly the water level for Gumti River is considered as NTWL (Non-tidal Water Level) at Bibir Bazar, Comilla, Solanal, Gobindapur, Kongshanagor, Jibanpur (Gumti Bridge), and Jibanpur (BuriNadi) and TDWL (Tidal Water Level) at Daudkandi. The Dakatia is one of the important tributaries of the Gumti and the Buri River is its distributary. Being a hilly river, the Gumti has strong current and tendency of flash flood. Its

flow varies from 2.83 to 566 m^3/s at Comilla. During the monsoon, its average breadth is about 100m (Wikipedia, 2016). The flood flow slope is nearly 9 cm/km of this river. Hydrograph of Gumti River at Comilla gauge station is given below (Figure 4.19). Noted that Meghna & Gumti rivers at downstream of the Meghna & Gumti bridges meet together and follow toward downstream.

Other than the above mentioned major rivers, the TL passes over the small rivers, khals, ponds.



(Source: FFWC, 2016)

Figure 4-19: Hydrograph of Gumti River at Comilla Gauge Station

4.3.7.1 Riverbed Materials

The riverbed materials are an integral component of the aquatic ecosystem providing habitat and a source of food for key components of the food web. The sediment often becomes a catchment for natural and anthropogenic toxic substances that bind to particles and settle from the water column to the riverbed. The toxicity from the build-up of these contaminants may threaten the sediment-dwelling benthic organisms, vegetative communities, and the aquatic food web that depend on them. Organisms and plants, particularly those living in the sediment, can acquire and accumulate toxic substances through epidermal contact, respiration, or by ingestion of toxins.

The riverbed materials of the Meghna -Gumti River will be used for the filling of the proposed substations, located in Comilla, Chandpur, Noakhali, Munshiganj and Feni Diststricts. Therefor for knowing the quality of heavy metals, river bed materials have been tested. The riverbedmaterials of the Meghna -Gumti River have been tested (tested parameters were: Lead (Pb), Cadmium (Cd), Chromium (Cr), Copper (Cu), Zinc (Zn), Manganese (Mn), Arsenic (As), Selenium (Se) and Mercury (Hg)) in DPHE laboratory, Dhaka during January 2016under the KMG Project(Kanchpur, Meghna & Gumti Bridge funded by JICA) and test results are shown in the following Table 4.2.From this table it is understood that none of the parameters are exceeded the standards. Noted that the location of the collected sample of the Meghna-Gumti River at the TL crossing point is atabout one km downstream of the Meghna and Gumti bridges on the Dhaka-Chittagong four Lanes Highway.

The riverbed materials of the Bay of Bengal (sea), nearby (about 1km far) will be used for the filling of the proposed substations, located inChittagong District. Therefor for knowing the quality of heavy metals, river bed materials have been tested. The riverbedmaterials of the Bay of Bengal have been tested duringDecember 2017 under the Chittagong City Outer Ring Road Project (CCORRP) also funded by JICA. The location of the collected sample of the sea bed materials is about 1km west from the proposed substation (Anandobazar), Bandar,CTG. The collected bed materials' samples of the Meghna-Gumti River & sea were analysed for Pb, Cd, Cr, Copper Cu, Zinc Zn, Manganese Mn, As, Se, Hg and the laboratory test results are given in the following Table 4.2. From this table, it is understood that none of the parameters are exceeded the USA standards.Noted that the Environmental Specialist of the ESPNER project is working as Environmental Expert of the above mentioned KMG (Three Bridges) project &CCORRP project, funded by JICA and participated in the sampling and testing of heavy metals of bed materials.

Table 4.2: Test Results of River Bed & Sea Bed Materials

Sl. No.	Parameters	Concentration Present (mg/kg)			
		Megna-Gumti River* 23°31'45.4"N 090°42'03.8"E	Sea Bed-1**	Sea Bed-2**	US EPA Standard, 2000
1	Lead (Pb)	5.3	3.28	3.98	128
2	Cadmium (Cd)	<2.0	BDL	BDL	4.98
3	Chromium (Cr)	8.1	8.73	8.21	111
4	Copper (Cu)	6.3	6.13	6.98	144
5	Zinc (Zn)	32.7	28.12	27.99	459
6	Manganese (Mn)	162.4	-	-	-
7	Arsenic (As)	2.51	1.09	1.20	33
8	Selenium (Se)	ND	ND	ND	-
9	Mercury (Hg)	BDL	BDL	BDL	1.06

Source: KMG Project; ** January 2016, CCORRP; December 2017; BDL=Below Detection Limit; ND=Not Detected, US EPA,2000- United Stated, Environmental Protected Authority, 2000.

4.3.8 Surface Water Quality

Surface water is abundant in the wet season in Bangladesh. An estimated 795,000 million cubic meter (Mm^3) of surface water is discharged through the Ganges-Brahmaputra system, in the downstream of the confluence of the Ganges and the Brahmaputra. This is equivalent to 5.52 m deep water over a land area of 144,000 km^2. There are other rivers discharging surface water into the Bay of Bengal. An average annual rainfall of 2.40 m within the country partly replenishes surface water sources. Each year about one-third of Bangladesh is submerged in a normal flood, and the area submerged may increase to about two-thirds during severe floods. In the dry season water scarcity persists in many areas. In this period surface water is only available in part of the 22,155 km of major rivers, 1,922 km^2 major standing water bodies and about 1,475 km^2 of ponds in the country. Surface water irrigation systems in the country compete for this available water in the dry season. The perennial water bodies are decreasing with the use of more and more surface water.

Traditionally, before and during the early stages of tube wells installation, rural water supply was largely based on protected ponds. There are about 1,288,222 ponds in Bangladesh having an area of 0.114 ha per pond and 21.5 ponds per mauza (BBS, 1997). About 17% of these ponds are derelict and probably dry up in the dry season. The biological quality of water in these ponds is extremely poor due to unhygienic sanitary practices and absence of any sanitary protection. Many of these ponds are chemically and bio-chemically contaminated for fish culture. If one pond per mauza could

be protected from contamination, it would provide a source of drinking water with minimal treatment and water for other domestic uses without treatment. The Government of Bangladesh has greatly emphasized the development of protected pond-based water supply systems. The protected ponds should not receive any surface discharge and should only be replenished by rain and groundwater infiltration.

The overall quality of surface water around the project site and its surroundings varies throughout the year. Typically water quality improves during the monsoon due to the influx of fresh rainwater, and worsens during the dry season as water evaporates and the concentration of contaminants increases.

During 25 to 29 August 2017, surface water samples were collected by the environmental survey team from different locations of the subproject areas(Figure 4.20)& preserved in the ice box and tested in the EQMS laboratoryThe result of the surface water sample and the GoB standards for fishing water (ECR, 1997) are shown in Table 4.3. The concentration levels of all the parameters for surface water were within the acceptable limit set by the DoE, GoB, according to the best practiced based classification.

Photo4.1: Collection of Surface Water Sample from the Feni River & Meghna-Gumti River on 20 and 21 August 2019.

Photo: 4.1.1.Site for Chandina

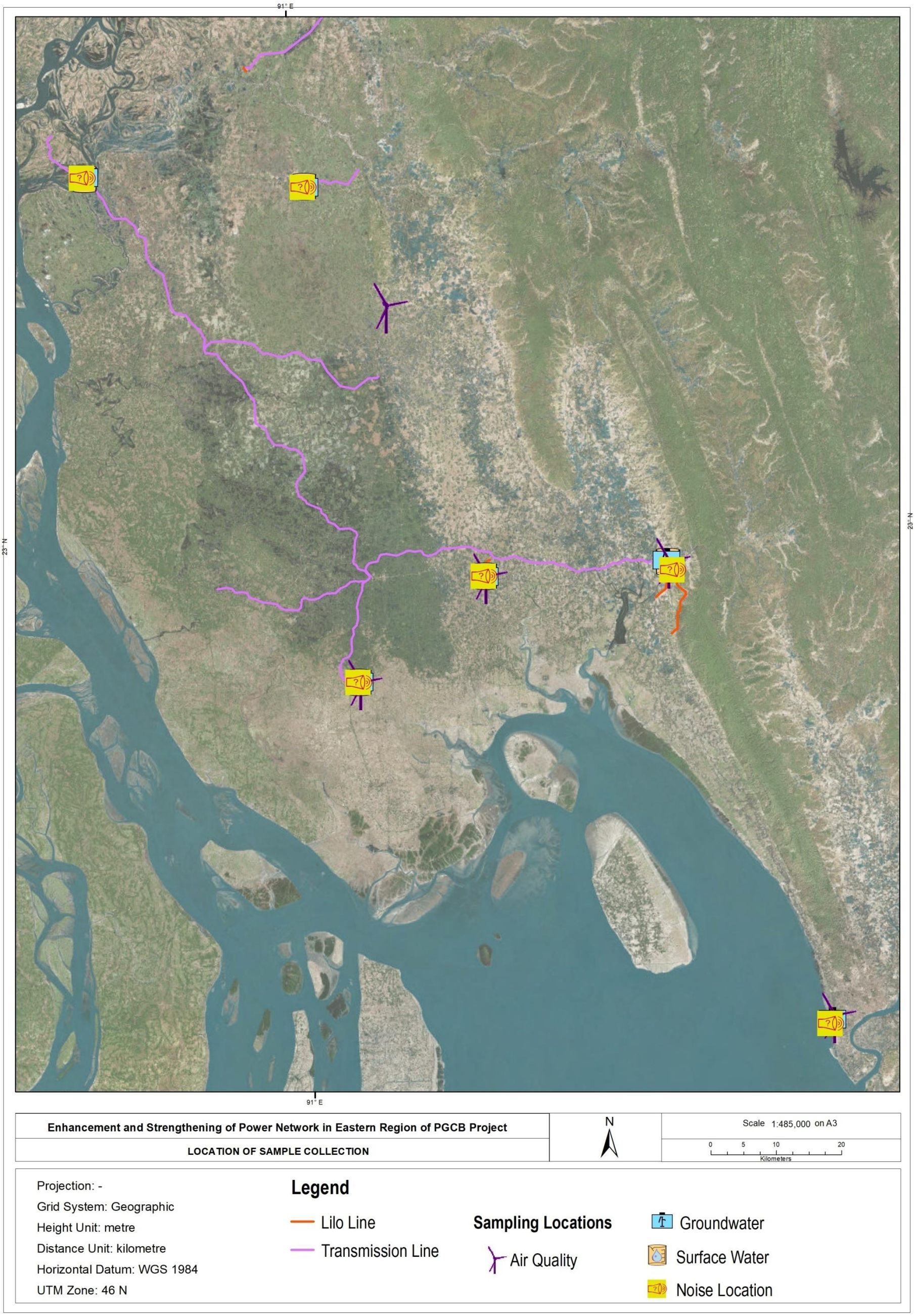


Figure 4-20: Sample Collection Location Map

Table 4.3: Test Results of Surface Water Quality Analysis

Parameter	Unit	ConcentrationPresent					Bangladesh Standards
		Feni River 22°57'16.6"N 91°32'47.3"E	Maijdee,Noakhali 22°48'02.0"N 91°04'57.1"E	Basurhat, Feni 22°56'31.10"N 91°16'25.10"E	Chandina, Comilla 23°29'13.06"N 91° 1'14.19"E	Meghna-Gumoti River 23°30'19.65"N 90°41'31.30"E	
pH	--	6.35	6.86	6.89	6.35	7.14	6.5-8.5
Ammonia (NH3)	mg/l	0.26	0.41	0.26	0.17	0.11	0.50
Dissolved Oxygen (DO)	mg/l	6.4	5.7	6.4	6.2	6.5	5 or more
Chemical Oxygen Demand (COD)	mg/l	3.2	2.8	2.6	2.1	2.3	4.0
Biological Oxygen Demand (BOD) 5 days	mg/l	<2	<2	<2	<2	<1	2
Potassium	mg/l	3	1	3.9	2.7	2	12

Source: EQMS Laboratory, August 2017

4.3.9 Ground/DrinkingWaterQuality

Groundwater is the most important source of water supply in Bangladesh. Except for few hilly regions Bangladesh is entirely underlain by water-bearing aquifers at depths varying from zero to 20 m below ground surface. The soil is mostly stratified and formed by alluvial deposits of sand and silt, having occasional lenses of clay. The main constituent of the aquifer materials is the medium-grained sand deposited at the lower reach by the mighty rivers - the Ganges, the Brahmaputra and the Meghna with their tributaries. Groundwater can be easily abstracted by installation of wells for the development of water supply systems. The water abstracted for various purposes is replenished in the monsoon.

Physically groundwater is generally clear, colorless with little or no suspended solids and has a relatively constant temperature. Groundwater is also free from disease-producing micro-organisms which are normally present in large numbers in surface waters. The slow filtering action of fine-grained soil through which the surface water percolates to join the groundwater removes almost all suspended impurities. Moreover, the lack of oxygen and nutrients in groundwater makes it an unfavorable environment for disease-producing micro-organisms to survive, grow or multiply. On the other hand, being a universal solvent, water dissolves many of the minerals present in earth's crust during its slow travel through the ground. Anaerobic conditions in soils in some flood plains, and the presence of organic acids and carbon dioxide increase the solubility of groundwater. As a result, groundwater may contain minerals in varying concentrations depending on soil conditions. Arsenic contamination of groundwater is believed to be the result of such reactions in the adverse geo-environment.

In the context of high prevalence of diarrheal diseases in Bangladesh, groundwater received priority as a source of water supply because it is generally free from pathogenic micro-organisms. Almost all rural water supplies and most of urban water supplies are groundwater based. Groundwater collected by tube wells is fit for consumption. Groundwater abstracted from shallow aquifers by hand tube wells has received acceptance in rural areas for drinking purposes, but due to its high iron content, hardness, etc. people do not want to use hand tube well water for other domestic purposes like cooking, bathing and washing. The high iron in groundwater makes the cooked food blackish in color and produces stains on utensils.

Arsenic is a problem in large part of Bangladesh ground water. The project areas particularly in Chandpur and Lakshmipur havehigh level of Arsenic in ground water. The acceptable quantity of arsenic in potable water is 0.05 mg per liter under the Department of Environment standard and 0.01 mg per liter under the WHO standards (Figure 4.21).

Based on field observations and interviews with local residents it was found that groundwater in the area is used as a drinking water source in many instances, as well as for irrigation purposes. Water is generally extracted via hand pump (tube wells) from the shallow regions of the composite aquifer, and via machine-driven pumps (deep tube wells) which draw from the deeper main aquifers. The ground water reservoir usually recharges from rainfall, floods and river. In summer season, the water table slightly goes down and goes up in rainy season.

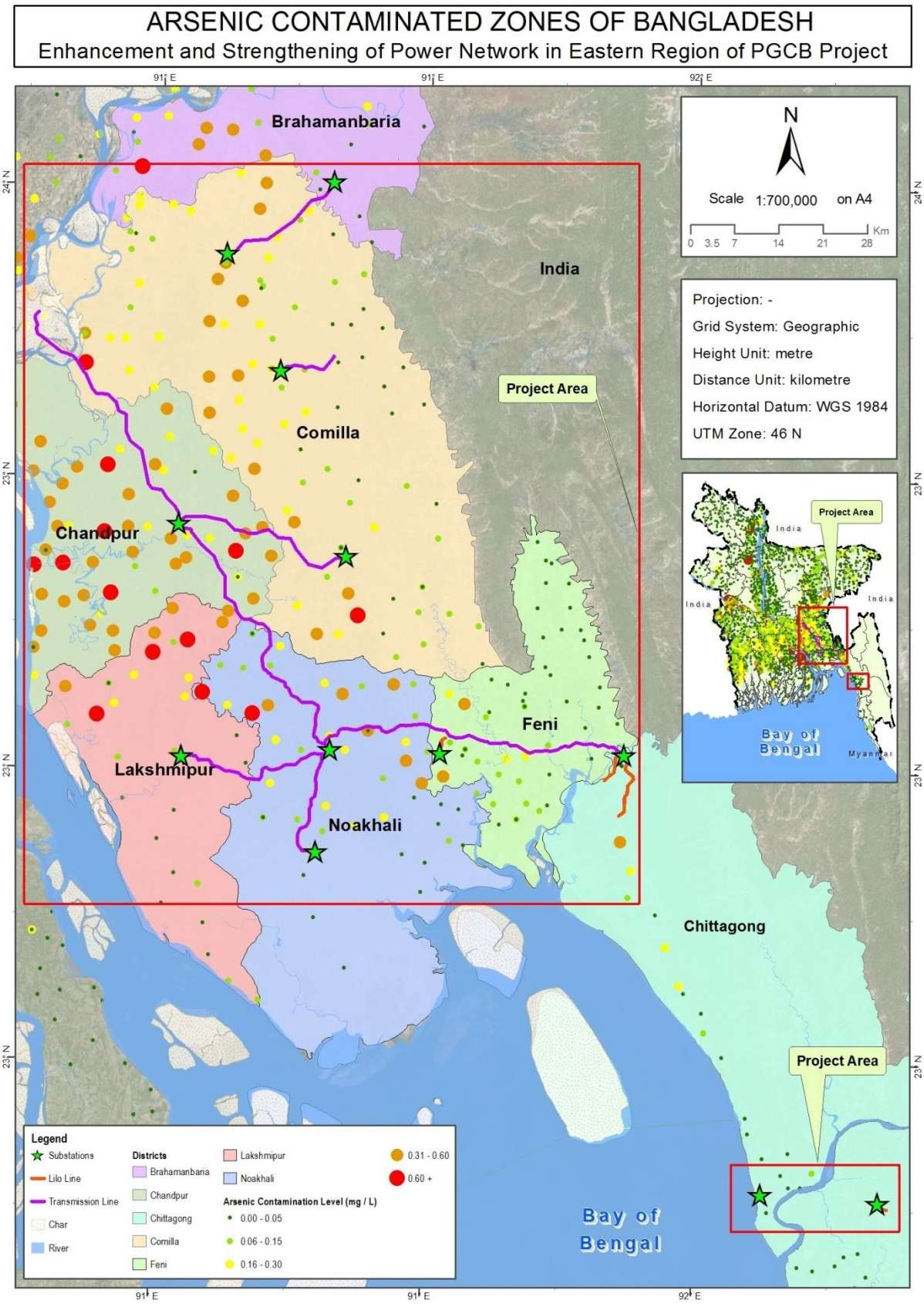


Figure 4-21: Arsenic Contamination in Bangladesh and the Project Area

During 25-29 August 2017, groundwater samples were collected by the environmental survey team from different locations (Figure 4.20) of the project area and preserved in the ice box. The result of the ground/drinking water sample and the DOE standards for drinking water (ECR, 1997) are shown in Table 4.4. The concentration levels of all the parameters for groundwater were within the acceptable limit for drinking water quality standard set by the DoE, GoB except the concentration of Chlorine at Chandina, Comilla. The ground /drinking water quality of the DTW, located at about 0.5km farway from the New Mooring Substation, CTG, tested by the CCORRP project during April 2017 is also included in Table 4.4.

Photo4.2: Collection of Groundwater Samples from HTW at the proposed Basurhat & Chandina Substation sites.

Table 4.4: Test Results of Groundwater Quality Analysis

Parameter	Unit	ConcentrationPresent						Bangladesh Standards
		Hossain Ali House, Mirsarai, Chittagong 22°57'24.95"N 91°32'40.13"E	Mofiz Mia House, Maijdee,Noakhali 22°48'03.2"N 91°04'56.5"E	Shatota Filling Station, Basurhat, Feni 22°56'29.55"N 91°16'23.46"E	Shahid Dealer House, Chandina, Comilla 23°29'09.3"N 91°01'15.6"E	Kader Mia House, Gozaria, Munshiganj 23°30'26.91"N 90°41'31.32"E	Anandabazar, Chittagong 22°18'58.6"N 91°46'10.3"E	
pH	--	5.88	6.57	6.60	6.50	6.70	6.7	6.5-8.5
Iron (Fe)	mg/l	0.03	0.01	0.06	0.02	0.06	2.9	0.3-1
Arsenic (As)	mg/l	0.001	<0.03	0.001	<0.05	<0.01	0.001	0.05
Manganese (Mn)	mg/l	0.7	0.7	0.7	0.6	0.5	0.03	0.10
Total Coliform (TC)	n/100 ml	0	0	0	0	0	0	Nil
Faecal Coliform (FC)	n/100 ml	0	0	0	0	0	0	Nil
Chlorine	mg/l	0.01	0.01	<0.02	**0.06**	<0.01	-	0.02
Salinity	ppt	-	-	-	**-**	-	0.25	

Source: EQMS Laboratory, August, 2017, CCORRP, April, 2017.

4.3.10 Ambient Air Quality

Within Bangladesh there are two major sources of air pollution: industrial emissions and vehicular emissions. Industrial sources include power generation, fertilizer factories, mills (sugar, paper, jute and textile), brick kilns, tanneries, chemical and pharmaceutical industries and the burning of solid waste. Emissions from these various sources contribute to the formation of the smog that regularly shrouds the major cities (Rahman et al, 2005).

Pollutants emitted from industrial sources include hydrogen sulfide, ammonia, and chlorine; all of which can result in health complaints such as skin irritation, headaches and nausea. Sustained exposure to these pollutants can result in other severe health effects such as severe respiratory health issues and birth defects (Rahman et al, 2005). In Bangladesh – where some 89% of the population use solid fuel – air-quality related deaths were estimated to be over 56,000 in 2007 alone (WHO, 2007). With increasing rates of urbanization, it is anticipated that vehicular ownership and usage will also increase, leading to a continued decline in air quality. DoE has identified two-stroke engines as a major polluter, and now discourages their use within Dhaka (Rahman et al, 2005).

Within the rural areas of Bangladesh, the main sources of air pollution are brick kilns and domestic heating and cooking – with wood, coal, diesel and biofuel (often manure) used as sources of energy (UNEP, 2002). It is therefore likely in rural areas that the principal air contaminants are particulate matter and volatile organic compounds (VOCs). Rural areas often also experience problems, particularly in the dry season, with dust generation due to construction, transport and agricultural activities such as tilling, threshing and plowing.

Ambient air quality measurements are essential to provide a description of the existing conditions or the baseline against which changes can be measured and to assist in the determination of potential impacts of the proposed project. Two hours air quality measurement (except CO) has been conducted during 25 to 29 August 2017at the various locations of the subprojects by using LATA ENVIROTECH PM 250 (Combined P10/P2.5 Sampler) as an air pollution monitoring equipment (Figure 4.20) and an analysis of parametrs was done by EQMS Environmental Laboratory. The measurement results are given in the below Table 4.5-. According to Bangladesh National Ambient Air Quality Standards from the Environmental Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005; any of the measures parameter of the local ambient air does not exceed Bangladesh standard.The air quality measurement at Anandabazar under CCORRP, located at about 0.5km farway from the New Mooring Substation, CTG, mearued by the CCORRP project during April 2017 is also included in Table 5.5 and found that except CO, all parameters were within DOE standards. The measurement value of CO exceeded due to nearby (about 200m) location of CTG central waste dumping site and industires/factories.

Table 4.5: Measurement Results of Ambient Air Quality

Parameter	Unit	Duration	ConcentrationPresent					Bangladesh Standards (ECR, 1997 Standard (Schedule-2))
			Balur Ghat, Korerhat ,Mirsarai,Chittagong 22°57'20.23"N 91°32'46.83"E	Maijdee,Noakhali Sadar, Noakhali 22°48'02.1"N 91°04'57.2"E	Basurhat, Daganbhuiyan, Feni 22°56'31.18"N 91°16'24.45"E	Chandina, Debidwar, Comilla 23°29'10.5"N 91°01'10.8"E	Anandabazar, Chittagong 22°19'17"N 91°46'16"E	
PM_{10}	µg/m^3	2 hr	67.20	62.25	59.29	73.22	37.7	150
$PM_{2.5}$	µg/m^3	2 hr	16.26	18.28	14.19	26.12	15.2	65
SO_2	µg/m^3	2 hr	5.10	4.16	4.41	7.10	5.7	365
NOx	µg/m^3	2 hr	11.29	12.29	11.73	13.36	19	100
CO	µg/m^3	1 hr	<1	<2	<1	<1	<1	9

Source: Field Survey, August 2017 and CCORRP, April, 2017

Photog 4.3: Air Quality Measurement at the proposed Maijdee and Korerhat substation site.

4.3.11 Noise Level

Excessive noise is a potential issue for both human and biological receivers and can potentially cause a range of negative issues, from mild annoyance and moderately elevated levels of aggression to significant disturbance of behavioral patterns and in severe cases temporary or permanent hearing loss. According to World Health Organization's Guidelines for Community Noise (1999), daily sound pressure levels of 50 decibels (dB) or above can create discomfort amongst humans, while ongoing exposure to sound pressure levels over 85 dB is usually considered the critical level for temporary hearing damage.

The noise level of the surroundings of the project area is insignificant. The proposed site is presently using for agriculture and the anthropogenic disturbance is less. However, there is sound pollution from the traffic movement on the nearby road. Noise level has been monitored for 15 minutes at the various locations of thesubproject sites(Figure 4.20) during day time of 25-29 August 2017. Results of the noise level monitored along with details of the measurement locations have been showed in Table 4.5. The results show that time weighted average value of the noise monitored at the project area exceeded the standard fixed for the respective areas except NM-05& NM-06.The noise level measurement at Anandabazar under CCORRP, located at about 0.5km farway from the New Mooring Substation, CTG, measured by the CCORRP project during April 2017 is also included in Table 4.6.

Photo4.4: Measurement of Noise Level at Gazari, Munshiganj and Balurghat (Korerhat) Sites

Table 4.6: Noise Level Measurement Results at Different Subproject Sites

ID	Location	Zone	GPS Location	Time	Noise Level dB(A)	Bangladesh Standard at Day Time dB (A)**	Remarks
NM-01	Balur Ghat, Korerhat , Mirsarai, Chittagong	Silent	22°56´35.8" N 91°33´16.6" E	3.20-3.35 pm	70.57	55	Exceeded the BD standard due to road traffics
NM-02	Maijdee, Noakhali Sadar, Noakhali	Mixed	22°48´02.1" N 91°04´57.2" E	10.25-10.40 am	66.88	60	Exceeded the BD standard due to road traffics
NM-03	Basurhat, Daganbhuiyan, Feni	Mixed	22°56´31.3" N 91°16´24.5" E	2.40-2.55 pm	57.55	60	Not exceeded the BD standard
NM-04	Chandina, Debidwar, Comilla	Mixed	23°29´10.5" N 91°01´10.8" E	10.00-10.15 am	71.51	60	Exceeded the BD standard due to road traafics
NM-05	Gozaria, Munshiganj	Silent	23°30´23.59" N 90°41´22.08" E	1.15-1.30 pm	55.55	55	Not exceeded the BD standard
NM-06	Anandabazar, Chittagong	Mixed	22°18'37.3"N 91°46'05.3"E	12.25-12.40 pm	53.7	60	Not exceeded the BD standard

Source: Field Survey, August 2017 and CCORRP, April, 2017

Seismology: From the seismic zoning map of the subproject areas (Source: Bangladesh National Building Code (BNBC),1993) which is prepared based on distribution of earthquake epicentres and morphotectonics behaviour of different tectonic blocks of Bangladesh, it is seen that the proposed subproject areas and its SPIA are located in Zone 2. Zone 1 represents the most active zone, Zone 2 represents intermediate seismic activity zone, and Zone 3 represents seismically relatively quiet zone (Figure-3.5). There isevidence of major earthquakes (like 1991 in Chittagong area) in the subproject areas.

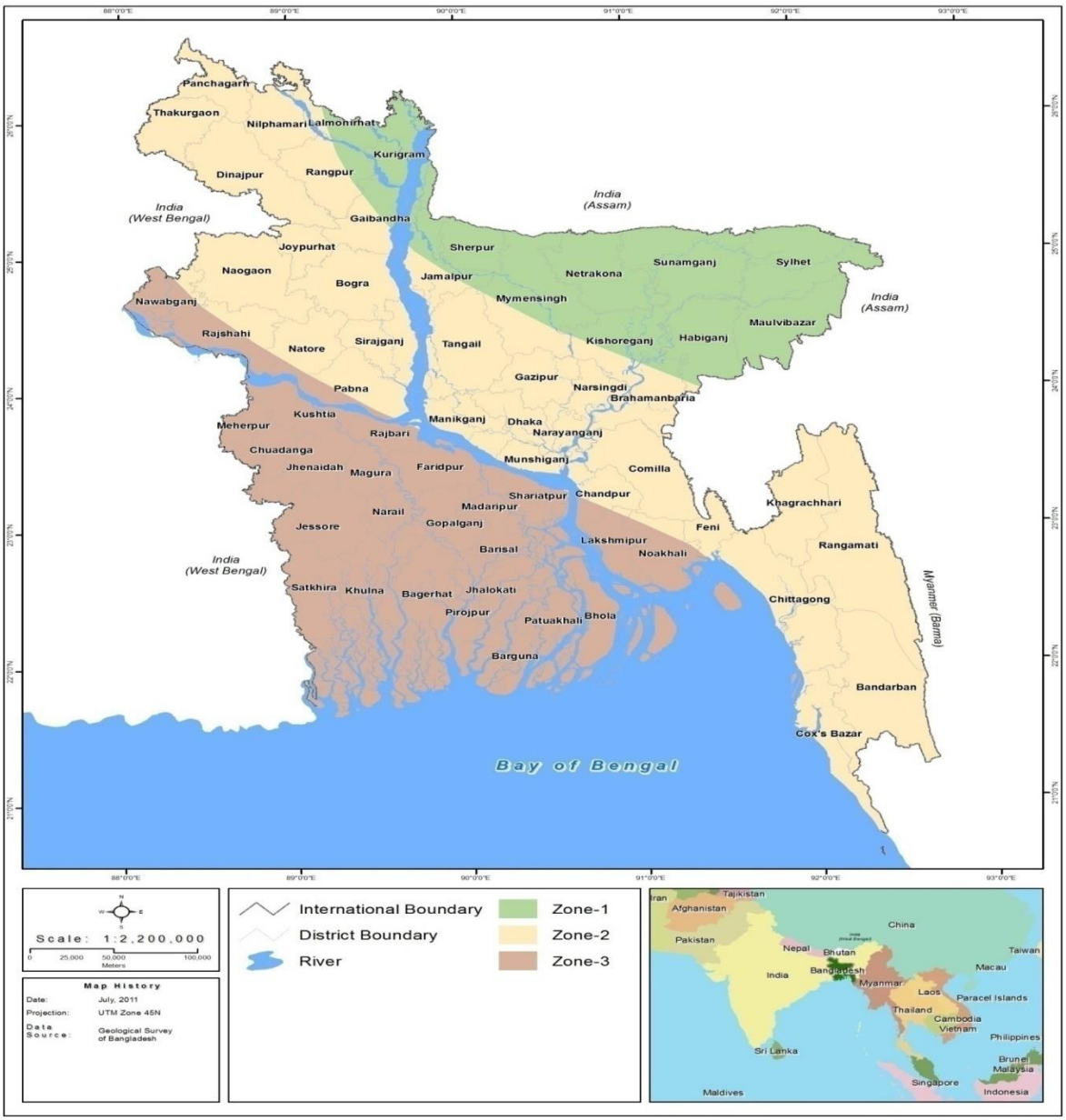


Figure 4-22: Earthquake Zones of Bangladesh also showing in which zone, subproject is located

4.4 Biological/Ecological Environment

4.4.1 Bio-ecological Zones

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

Each of the ecosystems has many sub-units with distinct characteristics as well. IUCN Bangladesh in 2002 classified the country into twenty five bio-ecological zones (Figure 4.22). The project area falls below the bio-ecological zone.

I. ***Meghna Floodplain:*** A major part of the Meghna floodplain was created by the deposition of sediments brought in by the old Brahmaputra River, before it changed its course. The rest of the sediments were laid down principally by the Meghna River itself and by some minor rivers draining from Tiperrah hills. The floodplain is characterized by many broad meandering channels, char and low lying landscape and is mostly affected by seasonal flooding while river bank erosion is occurred commonly. The luxuriant growth of palm trees is the dominant characteristic feature of the vegetation type of this zone. The Betel nut “Supari” (Areca catechu) is most visible as the dominant species in the western portion of this region. This zone also abundance in several varieties of cane, a good deal of bamboo and thatching grass. Faunal diversity is richer in here than other part of the country. In mammalian species, different species of cats, bats, otters, pangolins, and raptorial birds are found (IUCN, 2002f).

II. ***The Coastal Plains:*** The coastal plains are underlain by heavy marine or tidal clays but these have been buried under by more sand or silty deposits near the foot of the hills and along the courses of rivers and streams, which run across the plains. The eastern coastline, extending from the mouth of the Feni River to the southern tip of mainland along Chittagong, is regular and unbroken and protected along the sea by mud-flats and submerged sands. This zone is important for a wide variety of waterfowls (IUCN, 2002f).

III. ***Meghna Estuarine Floodplains:*** A huge newly accreted mudflat is the main physiographic feature of the Meghna estuarine floodplains, which is situated at the southern part of the Southeast region. Deposition and erosion are constantly taking place on the land margins. In many places during the dry season, part of the zone and surface becomes saline in varying degrees. Urighash (*Portaresia coarctata*) is the pioneer plant species in the new land formation whereas the luxuriant growths of Palms are the dominant. All the accreted inter-tidal lands are important wintering grounds for migratory waterfowls.

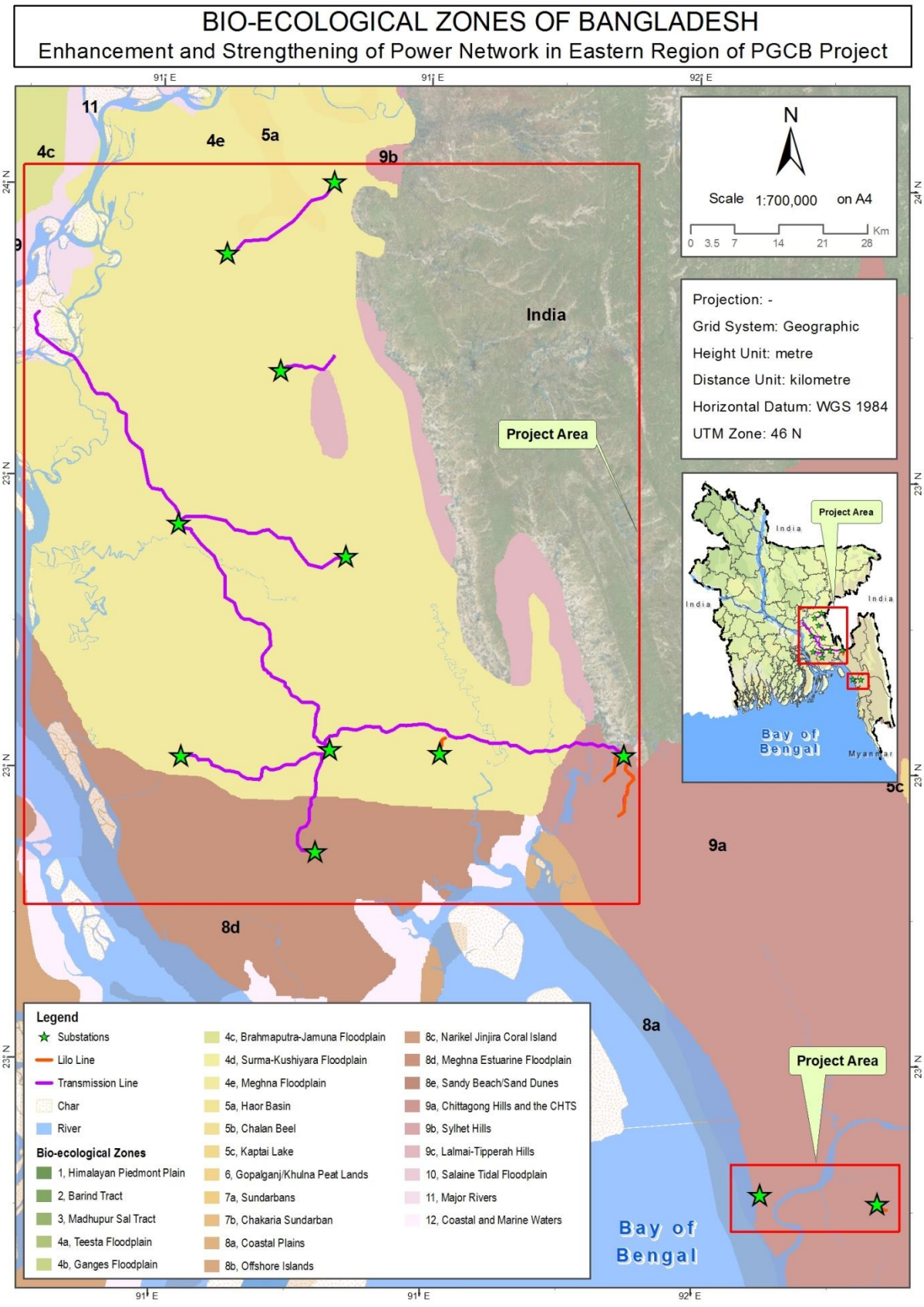


Figure 4-23: Bio-ecological Zones of Bangladesh and the Project Area

I. ***Chittagong Hills and the CHTs:*** The south-eastern hill range of the country is composed of tropical evergreen and semi evergreen forest, which are important watershed areas of the

country. The majority of the species in the lower canopy are evergreen, and the upper canopy of the forest is deciduous type. Tropical evergreen forest is found in the valleys of this zone. Knowledge on the diversity of reptiles and amphibians of this zone is rather rudimentary, as few surveys of these animals have been made. This zone possesses richest avifauna population of the country mostly marine and shore birds (IUCN, 2002f).

4.4.2 Diversity of Floral and Faunal Species

The sub-project influence area (SPIA) is mixed with different vegetation. Crops, vegetables are cultivated at the surrounding mainly include rice, wheat, rabi crops and variety of homestead vegetables. A sizeable number of fruit trees with economic value have been observed in the SPIA. The fruit trees include jackfruit, mangoes, litchi, banana, coconut, blackberry etc. and timber trees include mehegoni, neem, epil-epil, koroi etc. Considerable number of trees and bushes in the SPIA site provide habitat for birds and other animals. The composition of plant community includes low growing grasses, trees, herbs and shrubs. The data collected from the field survey and suggests that the predominant species are those of cultivated vegetables and trees. .

The Project will require removal of trees of various sizes and species. The census and IOL survey during 2017 found varieties of trees on acquisition and transmission line area. Total numbers of affected trees on acquisition and transmission line area together in the Project area by category are presented in the following Table 4.7. Total numbers of affected trees are 23,753. The highest number of trees is found under timber (9305) category followed by fruit trees (7503) and bamboo (6836) in the Project area. Out of the total number of affected trees, 12055 are large, 5900 are medium, 4641 are small, and 1157 are saplings. Size of trees has been determined based on the girth category by considering species but the Forest Department (FD) will further assess it during land acquisition process. All the PAPs will receive compensation for the trees and fruits. Also, they will be able to take away the timber. PAPs will get also additional compensation for fruit bearing trees.

Table 4.7: Lose of trees by category

Type of trees	No	Percentage	Large	Medium	Small	Sapling	Total
Fruit bearing	7503	31.59	4437	1517	939	610	7503
Timber	9305	39.17	2257	3408	3093	547	9305
Firewood	97	0.41	68	13	16	0	97
Medicinal	12	0.05	9	0	3	0	12
Bamboo	6836	28.78	5284	962	590	0	6836
Total:	**23753**	**100**	**12055**	**5900**	**4641**	**1157**	**23753**

A detailed list of terrestrial floral species found in the SPIA of sub-projects is given in the following Table 5.8.

Table 4.8: List of Terrestrial Flora available in the SPIA

Scientific Name	Local Name (English Name)	Habit	Habitat	Status
• **Timber/Wood Trees**				
Swietenia mahagoni	Mehogoni	T	RS, HS	C
Azadirachta indica	Neem	T	HS	C
Albizzia procera	Koroi	T	RS, HS	C
Eucalyptus citriodora	U-caliptas	T	RS, HS	C
Dalbergia sisoo	Shishu	T	RS, HS	C
Bambosa spp.	Bash (Bamboo)	S	HS	C
Samanea saman	Raintree	T	RS, HS	C
Bombax ceiba	Shimul (Cotton Tree)	T	RS, HS	LC
Ficus infectoria	Pakur	T	HS	LC
Polyalthia longifolia	Debdaru	T	RS	LC
Acacia aurculiformios	Akashmoni	T	RS, HS	C
Tectona grandis	Shegun	T	RS, HS	LC
Teominalia arjunna	Arjun	T	HS,RS	LC
• **Fruit Trees**				
Musa sapientum	Kalagash (Banana)	H	HS	C
Psidium guajava	Piara (Guava)	T	HS	LC
Cocos nucifera	Narikel (Coconut)	T	HS	C
Moringa oleifera	Sajna	T	HS	LC
Zizyphusm auritiana	Boroi	T	HS	LC
Citrus grandis	Jambura/Badam	S	HS	C
Aegle marmelos	Bel	T	HS	C
Feronia limonia	Kodbel	T	HS	LC
Phoenix sylvestris	Date Tree (Khejur)	T	HS,RS	C
Areca catechu	Supari (Betel Nut/Nut)	T	HS	C
Carica papaya	Pepe (Papya)	T	HS	C
Citrus aurantifolia	Labu (Lemon)	S	HS	C
Annona reticulate	Atafal	T	HS	C
Averrhoa carambola	Kamranga	T	HS	C
Punica granatum	Dalim	S	HS	LC
Manilkara sapota	Sobeda	T	HS	LC
Dellenia indica	Chalta	T	HS	LC
• **Fruit cum Timer Trees**				
carpus heterophyllus	Kathal (Jackfruits)	T	HS	LC
Mangifera indica	Aam(Mango)	T	HS	C
Syzygiumcumini	Jam(Blackberry)	T	HS	C
Tamerindusindica	Tetul (Tamarind)	T	HS	C
Borassusflabellifer	Tal (Palm Tree)	T	RS	LC
Elaeocarpus robustus	Jolpai (Olive)	T	HS	LC
Diospyros peregrina	Gub	T	HS,RS	LC
• **Medicinal Trees**				
Azadirachta indica	Neem	T	HS	C
Teominalia arjunna	Arjun	T	HS,RS	LC
	Bohera	T	HS	LC

Scientific Name	Local Name (English Name)	Habit	Habitat	Status
	Tejpata	T	HS	LC
Ocimum canum	Tulshi	H	HS	LC
Coccinea cordifolia	Telakachu	S	HS	C
• **Fuel Trees**				
	Paiya	T	HS	C
Ficus benghalensis	Bot(Banyan Tree)	T	RS	LC
Acacia nilotica	Babla	T	HS	C
Ricinus communes	Venna	T	HS	C
Lannea coromandelica	Ziga	T	HS, RS	C
	Bonziga	T	HS	C
Ficushispida	Dumoor	T	RS	C
Anthocephalus cadamba	Kadom	T	HS	C
	Shewra	T	HS	C
	Bakul	T	HS	LC
• **Aesthetic**				
Delonix regia	Krisnochura	T	HS	LC
Cassia fistula	Sonalu	T	HS	LC
Codiaeum variegatum	Patabahar	S	HS	LC
Lawsenia inermis	Mehendi	S	HS	C
Gardenia coronaria	Gandha raj	S	HS	C
Casuarina littorea	Jaw	T	HS	LC
Nymphaea nouchalli	Shapla	H	WL	C

Source: *Field level survey,2017.* ***Note:*** *C-Common, LC- Less Common, UC- Uncommon, CU- Cultivated Habit: T=Tree, H= Herb, S=Shrub, G=Grass; Habitat: HS=Homestead, RS-Road side*

While most of the aquatic plant species of the subproject areas are subject to seasonal water level fluctuations, the abundance of wetlands supports a wide variety of aquatic biota. The common aquatic plants are Helencha (Enhydrofluctuans) Kalmi (Ipomoea aquatica), DholKalmi (Ipomaoafistulosa), Cheicha (Scirpusarticulatus), Kochuripana (Eichorinacrassipes), Shapla (Nymphaeanouchali), Ducbweed (Spiredella sp.), Khudipana (Lemna minor), and Topapana (Pistia stratiotes).

The diversified habitat and ecosystem in the project area support various types of wildlife as given in Table 4.9. Primary and secondary mode was adopted for identification of fauna. Most of the funal spieces such as (Avians, Amphibians, Reptiles and Mammals) were identified in the SPIA of the subproject areas by using books and description of the local people during the field survey which are given in the following Table 4.9.

Table 4.9: List of Funal Species Available in the SPIA of the Subprojects

Scientific Name	English Name	Local Name	Local Status
Class: Amphibia			
Bufo melanostictus	Common Toad	Kuno bang	NO
Rana temporalis	Bull Frog	Kola bang	NO
R. pipens	Grass Frog	Sona bang	NO
Class: Reptilia			

Scientific Name	English Name	Local Name	Local Status
Hemidactylus flaviviridis	Common House Lizard	Tiktiki	NO
Calotes versicolor	Common Garden Lizard	Rokto-chosha	NO
Varanus bengalensis	Bengal monitor	Gui shap	VU
Varanus salvator	Ring lizard	Kalo gui	EN
Xenochrophis piscator	Checkered keelback	Dhora shap	NO
Amphiesma stolata	Stripped keelback	Dora shap	NO
Enhydris enhydris	Common smooth water snake	Paina shap	NO
Coluber mucosus	Rat snake	Daraj shap	VU
Ahaetulla nasutus	Common vine snake	Laodoga shap	VU
Atretium schistosum	Olive keelback	Maitta shap	NO
Naja naja	Monocellate cobra/ Spectacled cobra	Khoia gokhra	EN
Class: Aves			
Ardeola grayii	Indian pond heron	Kani bok	NO
Casmerodius albus	Great egret	Sada bok	NO
Egretta intermedia	Intermediate egret	Mazla bok	NO
Egretta garzetta	Little egret	Choto bok	NO
Nycticorax nycticorax	Black-crowned night heron	Nishi bok	NO
Ixobrychus cinnamomeus	Cinnamon Bittern	Lal bok	NO
Anastomus oscitans	Asian Openbill	Shamuk-khol	NO
Haliastur indus	Brahminy kite	Shankho chil	NO
Milvus migrans	Black kite	Bhubon chil	NO
Actitis hypoleucos	Common sandpiper	Kada Khocha	--
Streptopelia chinensis	Spotted dove	Tila Ghughu	NO
Streptopelia decaocto	Eurasian collared dove	Raj Ghughu	NO
Psittacula krameri	Rose-ringed parakeet	Tia	NO
Amaurornis phoenicurus	White-breasted waterhen	Dahuk	NO
Eudynamys scolopacea	Asian cuckoo	Kokil	NO
Centropus sinensis	Greater coucal	Kanakua	NO
Cuculus micropterus	Indian cuckoo	Bou-kotha-kao Pakhi	NO
Athene brama	Spotted owlet	Khuruley Pencha	NO
Alcedo atthis	Common kingfisher	Choto Maachranga	NO
Halcyon smyrnensis	White-throated kingfisher	Sada buk Maachranga	NO
Ceryle rudis	Pied kingfisher	Pakra Maachranga	NO
Megalaima haemacephala	Coppersmith barbet	Choto Basanta Bauri	NO
Oriolus xanthornus	Black-headed oriole	Holdey Pakhi	NO
Corvus splendens	House crow	Pati Kak	NO
Dicrurus macrocercus	Black drongo	Fingey	NO
Copsychus saularis	Oriental magpie robin	Doel	NO
Acridotheres fuscus	Jungle myna	Jhuti Shalik	NO
A. tristis	Common myna	Bath Shalik	NO
A. ginginianus	Bank myna	Gang Shalik	NO
Sturnus contra	Asian pied starling	Gobrey Shalik	NO
S. malabaricus	Chestnut-tailed starling	Kath Shalik	NO
Pycnonotus cafer	Red-vented bulbul	Bulbuli	NO
Turdoides striatus	Jungle babbler	Satbhai	NO

Scientific Name	English Name	Local Name	Local Status
Orthotomus sutorius	Common tailorbird	Tuntuni	NO
Passer domesticus	House sparrow	Charui	NO
Ploceus philippinus	Baya weaver	Babui	NO
Upupa epops	Eurasian Hoopoe	Hudhud Pahkhi	
Class: Mammalia			
Pteropus giganteus	Flying Fox	Badur	NO
Pipistrellus coromandra	Indian Pipistrelle	--	NO
Megaderma lyra	Greater False Vampire	Badur	NO
Herpestes edwarsi	Common Mongoose	Bara benji	VU
H. auropunctatus	Small Indian Mongoose	Benji	NO
Vulpes bengalensis	Bengal Fox	Khek shial	VU
Rattus rattus	Common House Rat	Indur	NO
Bandicota indica	Bandicoot Rat	Bara indur	NO
B. bengalensis	Lesser Bandicoot Rat	Indur	NO
Mus musculus	House Mouse	Nengri indur	NO
Suncus murinus	House Shrew	Chicka	NO

Source: Baseline Environmental Survey, August 2017 and Literature Review and IUCN Red Data Book (2003).
Notes: EN – Endangered, VU – Vulnerable, NO – Not Threatened

Fish is the most important aquatic fauna of the subproject areas, along with other groups. The aquatic fauna includes Prawns (Macrobrachium spp.), crabs, snails (Pila, Vivipara, Lymna etc.), freshalater mussels (Lamellidens sp.) etc. Kolabang (Rana tigrina); Guishap (Varanusbengalensis) and Matia sap (Enhydrisenhydris) are common. The aquatic birds are – Pancowri (Phalacrocoraxcarto), Kanibok (Ardeolagrayii), Sadabok (Egrettagarzetta), Borobok (Egrettaalba), Machranga (Halcyon pileata), Dahuk (Gallicrexcinerea), and winter migratory birds – Balihash (Dendrocygnajavanica) and Chakha (Tadornaferruginea).

Table 4.10: Common Fish Species in the SPIA of the Subprojects

Sl. No.	Local Name	Scientific Name	English Name	Local Status
1	Tengra	Batasio batasio	Tista Batasio	NO
2	Pabda	Ompok pabo	Pabo catfish	EN
3	Puti	Puntius sophore	Spotfin Swamp Barb	NO
4	Darkina	Esomus danricus	Flying barb	DD
5	Dhela	Osteobrama cotio	Cotio	EN
6	Chela	Salmostoma acinaces	Silver Razorbelly Minnow	DD
7	Rui	Labeo sp.		DD
8	Catla	Catla catla	Catla	NO
9	Mrigal	Cirrhinus mrigala	Mrigal	NO
10	Ayre	Aorichthus aor	Longwhiskered Catfish	VU
11	Chital	Notopterus chitala	Humped Featherback	EN
12	Boyal	Wallago attu	Freshwater	NO
13	Pungus	Pangasius pangasius	Pungas	CR
14	Elish	Tenualosa ilisha	Hilsha	NO
15	Bele	Awaous gutum		NO
16	Foli	Notopterus notopterus	Grey featherback	VU
17	Koi	Anodontosoma chachunda	Chachunda	NO
18	Mola	Amblypharyngodon mola	Pale carplet	NO
19	Chapila	Gonialosa manmina	Ganges River	NO

20	Baim	Mactacembalus armatus	Tire truck spineel	EN
21	Gajar	Channa marulius	Giant snakehead	EN
Note: EN= Endangered, VU= Vulnerable, CR= Critically Endangered, NO= Not Threatened, DD= Data Deficiet				

Source: Baseline Environmental Survey, August 2017 and Literature Review and IUCN Red Data Book (2003)

4.4.3 Biodiversity/Environmentally Sensitive and Protected Areas

Many wildlife species are in stress in Bangladesh. The status of faunal species in Bangladesh has been published by IUCN (2000). According to the IUCN findings this country has lost 10% of its mammalian fauna, 3% avifauna and 4% reptiles over the last 100 years. More than 50 species are presently critically endangered in Bangladesh of which 23 species are already declared as endangered in the Red Data Book of IUCN. In addition, 83 species are commercially threatened and are included in the appendices of Convention on International Trade in Endangered Species (CITES). Among the most endangered species are: elephant, tiger, wild Cat, Leopard or wild goat, serao, dolphin; birds: white-winged duck, comb duck, stork, carne, pheasant, partridge, and crocodile, python, monitor, lizard, tiger terrapin, roofed turtle, soft turtle, and marine turtles.

In the 1 km SPIA, some wildlife species were identified as locally vulnerable. The name of these vulnerable species are Bengal monitor, Rat snake, Common vine snake, Crested Serpent-eagle, Yellow-footed green pigeon, Common mongoose, Bengal fox, Small Indian Civet. Some species were also identified as locally endangered and these are Ring lizard, Monocellate cobra, and Jungle cat. Any construction must consider impacts on the rate of deforestation, loss of habitat, habitat fragmentation, and interruption of wildlife migration patterns. Figure 4.23 shows the environmental sensitive/protected areas (EPA) within Chittagong division. From the Table 4.1, Figure 4.24 and local people, it is known that no EPA is located within ROW, SPIA and even within 10km from the subprojects.

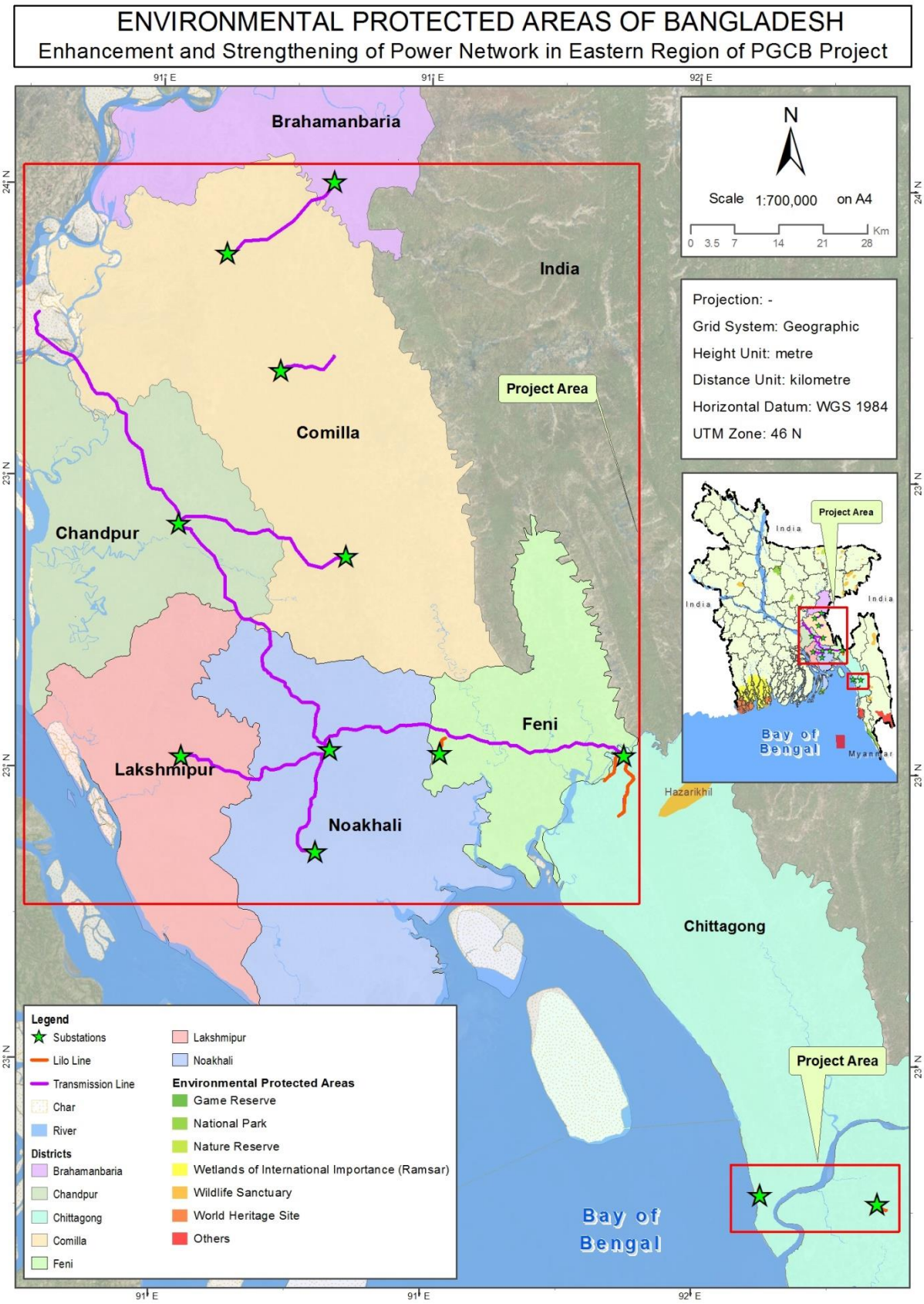


Figure 4-24: Environmental Protected Areas of Bangladesh and the Project Area

4.5 Socio-Economic Environment

4.5.1 Demography

According to socio-economic survey (SES) during 18 June-27 July 2017, the total household (HH) number is 650 who have lands (mainly agricultural lands) within the ROW of the sub-projects. The total number of PAPs is 2027 out of which 1309 persons (64.58%) aremale and718 persons(35.42%) are female. This ratio is much lower than the national male-female ratio (109:100) because the social survey couldn't always reach the residence of the affected households since they are losing agricultural lands and/or trees. In some cases land owners are not readily available at ground and neighbors have provided information of the HHs. The household size among the PAPs is 3.12. It is noted that there is no ethnic minority in the project area. Besides, all of the affected households in the project area recognized as Bengali. No housing structures will be affected due to the ROW of the subprojects. Affected households and population within the ROW of the sub-project areas is given in the following Table 4.11

Table 4.11: Affected Households and Population within the ROW of the sub-project areas

Area	HH	Male		Female		Total Population		HH Size	Sex Ratio
	No	No.	%	No.	%	No.	%		
Total Alignment	650	1,309	64.58	718	35.42	2,027	100	3.12	548

Source: SES during 18 June-27 July 2017.

Percentage of male headed households (92%) is higher than that of female headed households (7%). In Bangladesh men are predominantly the head of the household. Female-headed households will be eligible for a special grant as per the policy of the RAP.

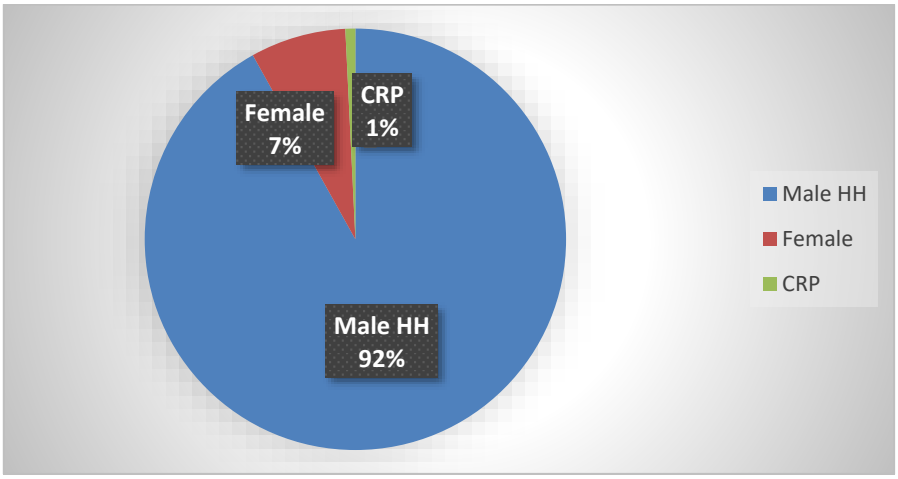


Figure 4-25: Sex-wise distribution of household heads

4.5.2 Age Composition

According to national demography there are 109 males for every 100 females in Bangladesh (BBS 2011). This area is also following the regular trend of Bangladesh and male population is higher in

almost all age groups. Eight percent of the people (7.10% male and 1.23% female) were recorded as being over 60 years old, which is higher than the national percentage of 5.74% (BBS 2011).

Table 4.12: PAPs Age Composition by Sex

Age Group	Male		Female		Total	
	No	%	No	%	No	%
Age (1 - 10)	94	4.64	86	4.24	180	8.88
Age (10 - 20)	235	11.59	158	7.79	393	19.39
Age (21 - 30)	231	11.40	123	6.07	354	17.46
Age (31 - 40)	207	10.21	145	7.15	352	17.37
Age (41 - 50)	215	10.61	116	5.72	331	16.33
Age (51 - 60)	183	9.03	65	3.21	248	12.23
Age (60+)	144	7.10	25	1.23	169	8.34
Total	**1309**	**64.58**	**718**	**35.42**	**2027**	**100**

Source: SES during 18 June-27 July 2017

4.5.3 Marital Status

The following figure shows the marital status of population (HH members) 18 years old & above. It is found that 64% are married, 35% are unmarried and only 1% are widow/widower. The marriage rate of female is higher than male.

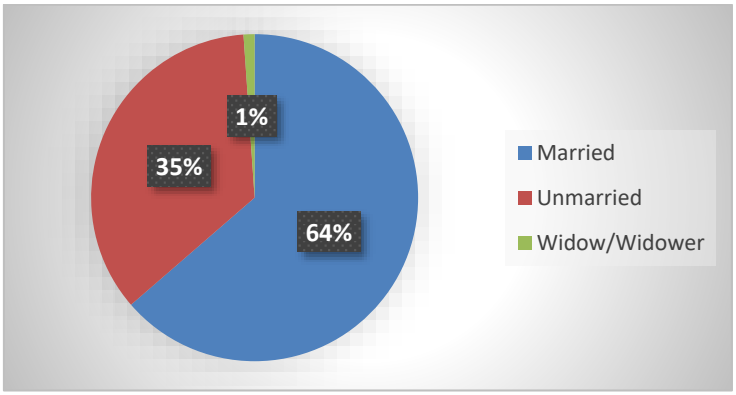


Figure 4-26: Marital status of population (HH members) 18 years old & above

4.5.4 Household by Religion

The following figure shows the distribution of households by religious category. It is found that Islam is the predominant religion in the study area (98%). The percentages of Hindu households are minimal (2%).

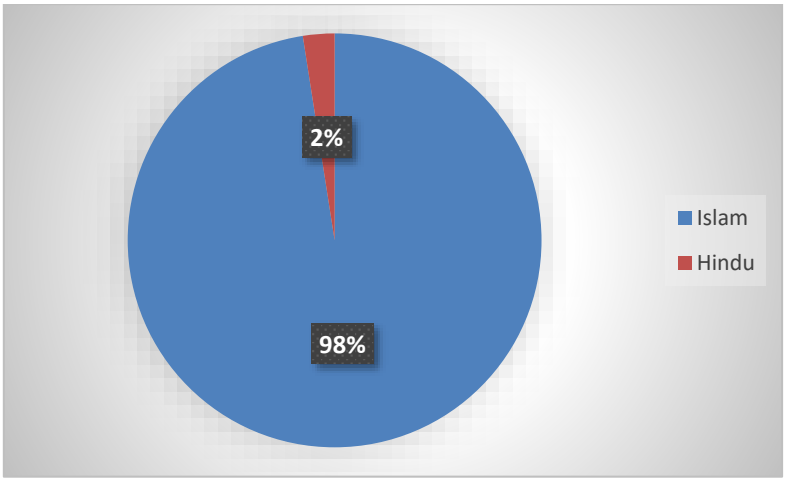


Figure 4-27: Affected households and population by religion

4.5.5 Education

The education level in the sub-project affected area is higher than the national average (62.7, Bangladesh Economic review, 2017). The SE survey suggested that only 4.74% (male 2.27% and female 2.47%) of all PAPs were illiterate. The survey also identified that the education level at and above the basic university (graduate) level is very minimal.

Table 4.13: Education level of the PAPs

Education	Male		Female		Total	
	No	%	No	%	No	%
Illiterate	46	2.27	50.00	2.47	96	4.74
Can sign only	33	1.63	55.00	2.71	88	4.34
Can read and write	34	1.68	23.00	1.13	57	2.81
Primary School	292	14.41	209.00	10.31	501	24.72
Below SSC	355	17.51	196.00	9.67	551	27.18
SSC	204	10.06	102.00	5.03	306	15.10
HSC	181	8.93	48.00	2.37	229	11.30
Graduate	134	6.61	18.00	0.89	152	7.50
Above	30	1.48	17.00	0.84	47	2.32
Total	**1309**	**64.58**	**718.00**	**35.42**	**2027**	**100**

Source: SESduring18 June-27 July 2017

4.5.6 Income and Expenditure of HHs

Based on Bangladesh Bureau of Statistics (BBS, 2011) and yearly inflation (average 6.50% per year) as of 2017, the poverty line income of the affected HHs has been considered up to BDT 6391 per month for the HHs size of 3.12 people. There are only six HHs are below the poverty in terms of income. These HHs will be eligible for special support as per RPF of the project.

Table 4.14: Income and expenditure ration of HHs

Income Range (Monthly)	Income		Expenditure		Remarks
	Income	Percent	Frequency	Percent	
Upto 10000	102	15.7	105	16.2	Only 6 HHs are below poverty line (6391 BDT)
10001 - 20000	312	48.0	382	58.8	

Income Range (Monthly)	Income		Expenditure		Remarks
	Income	Percent	Frequency	Percent	
20001 - 30000	145	22.3	118	18.2	
30001 - 40000	49	7.5	15	2.3	
40001 - 50000	14	2.2	3	.5	
Above 50000	28	4.3	27	4.2	
Total	**650**	**100.0**	**650**	**100.0**	

Source: SES during 18 June-27 July 2017

4.5.7 Occupation Pattern

Among the affected people, businesses and services appear to be the main occupations (26.74%). Among the male population, most of the eligible and capable members are involved in income generating activities. Female are mostly housewife and also involved in allied activities focusing on maintaining the home and families. As per the survey 2.27 % male and 1.23 % female are found to be totally unemployed. Income and livelihood restoration program can enhance capacity of the people particularly female and vulnerable people for doing more income generating activities.

Table 4.15: Principal occupation of the affected population in the Project area

Sl. No	Occupation	Male		Female		Total		Employed	Unemployed
		No	%	No	%	No	%		
1	Service	241	11.89	-	-	241	11.89	241	-
2	Business	301	14.85	-	-	301	14.85	301	-
3	Day Labor	56	2.76	-	-	56	2.76	56	-
4	Agriculture	137	6.76	-	-	137	6.76	137	-
5	Boatman	-	-	-	-	-	-	-	-
6	Motor driver	25	1.23	-	-	25	1.23	25	-
7	Carpenter	3	0.15	-	-	3	0.15	3	-
8	Mason	5	0.25	-	-	5	0.25	5	-
9	Electrician	1	0.05	-	-	1	0.05	1	-
10	Housewife	-	-	468	23.09	468	23.09	-	468
11	Unemployed	46	2.27	25	1.23	71	3.50	-	71
12	Student	337	16.63	101	4.98	438	21.61	-	438
13	Medical practitioner	3	0.15	-	-	3	0.15	3	-
14	Layer	1	0.05	-	-	1	0.05	1	-
15	Others	65	3.20	-	-	65	9.43	65	-
16	Child	80	3.94	124	6.14	204	3.85	-	204
17	Disabled	8	0.39	-	-	8	0.39	-	8
	Total	**1,309**	**64.56**	**718**	**35.44**	**2,027**	**100.00**	838	1,189
								41.34	58.66

Source: SES during 18 June-27 July 2017

4.5.8 Economic Activities of HHs

The survey identified that business/shop keeping and agriculture are the main economic sources of the HHs. On the other hand the figure below shows that share cropping and agriculture are the allied/secondary economic income sources of HH as women mostly connected to such activities along with household activities.

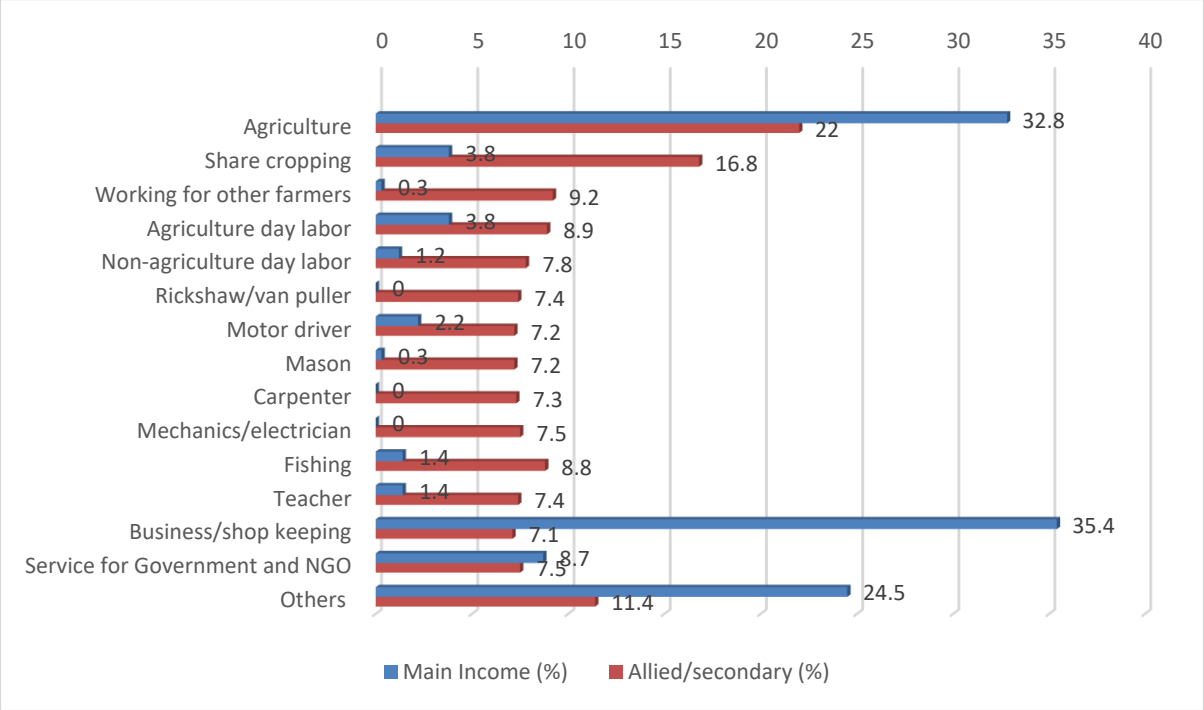


Figure 4-28: Economic Activities of Eligible PAPs

4.5.9 Poverty and Gender

4.5.9.1 Overview

The socioeconomic survey revealed that no women is engaged in any ingenerating activities particularly rather allied activities. Housewife is the main occupation in case of capable women (more than 18 years). Since the project alignment crosses mostly rural area, the income opportunities of women are very low. It was found during survey that male household members remain reluctant to have adult female household members engage in outside work and services.

4.5.9.2 Vulnerable Groups

The census data show that 184 households and 8 people with disability are within the vulnerable category. Out of vulnerable households, 48 are particularly female headed HHs, 130 are elderly (>60 yrs.) male-headed HHs, six are under poverty line of male HHs. As defined in this RAP, the vulnerable HHs will be eligible for special resettlement benefits in order to help maintain their livelihoods once the project work begins.

Table 4.16: Type of Vulnerability

Type of Vulnerable household	Number	Percentage
Female headed household	48	25.00
Elderly age 60+ Male headed household	130	67.71
Male headed under poverty line	6	3.13
Number of people with disability	8	4.17
Total	**192**	**100.00**

4.5.9.3 Health Status of the Local People

During stakeholder consultations at the project sites it was gathered that overall health status of the project areas is good. However the people in the project areas are affected by the following common diseases such as stomach diseases, skin disesas, fever etc. In addition,people in the project areas are affected by contagious diseases such as flu, sexually transmitted diseases, Hepatitis A and Hepatitis B but insignificantly. Noted thatcommon contagious diseases in the world are: CRE,Ebola, Enterovirus D68, Flu, Hantavirus, Hepatitis A, Hepatitis B, HIV/AIDS, Measles, MRSA, Pertussis, Rabies, Sexually Transmitted Diseases, Shigellosis, Tuberculosis, West Nile Virus andZika.

4.5.10 Land Acquisition and Requisition

4.5.10.1 Overview

Census and IOL were conducted to determine the overall impact of the project. Private lands are to be acquired mainly for the 12 substation subprojectsof the project. For the erection of total 884 no. towers of the eight TLs & eight LLs of the project, lands also will be required but temporarily. The project avoided physical displacement during planning of the project. In case of impact on premises, local PAPs were consulted to find alternative place to elude avoid physical displacement and impacts on any structures.

4.5.10.2 Land Acquisition & Temporary Requirement

According to SES, the project will require acquisition of 86 acres of private land for the 12 substations. The proposed lands for acquisition are longed in null category as are being used for agricultural purpose. Compensation of the private land and government land has been provisioned in theResettlement Action Plan (RAP). By law, the Deputy Commissioner (DC) will pay compensation for all categories of land to be permanently acquired or temporarily taken for the project following the ARIPO 1982. A Property Valuation Advisory Team (PVAT) will determine the final replacement value for acquired land during implementation of the RAP. The RAP includes replacement costs based on tax roll data and market survey, for the amounts shown in Table 4.17.

According to SES, a total 804 acres of land for the erection of the total 884 towers of the eight TLs& 8 LLs will be taken temporarily and only crop compensation will be provided for the standing crops (if any) of cropping period if the civil construction makes a bar to cultivate the land during cropping time.

Table 4.17: Land by GIS Locations; permanently acquired (in Acre)

Sl. No.	District Name	Substation Name	Area (Acre)	Percentage
1	Noakhali	230/132 kV: Chowmuhoni GIS 3x250/350 MVA	5	6%
2	Chandpur	230/132 kV: Kachua GIS 2x250/350 MVA	5	6%
3	Comilla	132/33 kV: Muradnagar AIS 2x50/75 MVA	5	6%
4	Comilla	132/33 kV: Lakhsam GIS 2x50/75 MVA	2	2%
5	Noakhali	132/33 kV: Maijdee GIS 2x50/75 MVA	5	6%
6	Chittagong	132/33 kV: Patiya GIS 2x50/75 MVA	5	6%
7	Comilla	132/33 kV: Chandina GIS 2x50/75 MVA	2	2%
8	Chittagong	132/33 kV: Anandabazar (New Mooring) GIS 3x80/120 MVA (Future 400kV Provision)	20	23%
9	Noakhali	132/33 kV: Basurhat GIS 2x50/75 MVA	2	2%
10	Laxmipur	132/33 kV: Laxmipur GIS 2x50/75 MVA	5	6%

11	Brahmanbaria	132/33 kV: Kosba GIS 2x50/75 MVA	5	6%
12	Chittagong	400 kV Korerhat	25	29%
Total			**86**	

Note: Mirsharai Substation in located in newly raised char land which is still not included into government records.

4.5.10.3 Cultural Sites

From the toposurvey, SES and environmental survey of the project, it is understood that no cultural sites (such as mosque, school, madrasha, graveyard, monument and eidgah) are located within the ROW of the SS, TL& LL. It is known that there is a mosque 200m on east side of the Kachua substation and a mosque 100m on east side of Bashurhat substation . It is also known that a mosque is 20m away at ch 48+300 and a school 40m at 49+250 from the boundary line of Korerhat-Chowmuhi TL.

5 ANALYSES OF ALTERNATIVES

5.1 Analyses of Alternatives forTL &LILO Route Selection - (Assessment & Management Process)

Activities like construction of transmission lines and its subsequent operation and maintenance are non-polluting in nature and its environmental impact are also negligible and are restricted to Right of Way (ROW only. Another feature which is also very crucial in making this statement is the inherent flexibility available in routing of power transmission lines and locating substations, which help to the great extent in avoiding environmentally sensitive areas such as fragile ecosystems with their inherent biodiversity, and also dense human habitats and areas of cultural significance.

Generally, speaking all the potential environmental impacts of transmission lines can be avoided or mitigated through careful route and site selection as explained above. Keeping this aspect in mind due consideration has been provided in deciding the route alignment including study of different alternatives for proposed transmission lines under the scope of two projects. During route alignment all possible efforts are made to avoid the forest area involvement completely or to keep it to the barest minimum, whenever it becomes unavoidable due to the geography of terrain or heavy cost involved in avoiding it.

5.2 Study of Alternatives

5.2.1 Environmental Criteria for TL and LILO Route Selection

For selection of optimum route, the following points are taken into considerations:

i) The route of the proposed transmission lines does not involve any human rehabilitation.
ii) Any monument of cultural or historical importance is not affected by the route of the transmission line.
iii) The proposed route of transmission line does not create any threat to the survival of any community with special reference to Tribal Community.
iv) The proposed route of transmission line does not affect any public utility services like playgrounds, schools, other establishments etc.
v) The line route does not pass through any sanctuaries, National Park etc.

vi) The line route does not infringe with area of natural resources.

In order to achieve this, different alternatives were studied for all the major transmission lines with understanding that ***minor alterations often added to avoid environmentally sensitive areas and settlements at execution stage***.

- As a rule, alignments are generally cited 10-15 km away from major towns, whenever possible, to account for future urban expansion.
- Similarly, forests are avoided to the extent possible, and when it is not possible, a route is selected in consultation with the local Divisional Forest Officer, that causes minimum damage to existing forest resources.
- Alignments are selected to avoid wetlands and unstable areas for both financial and environmental reasons.

In addition, care is also taken to avoid National parks, sanctuaries, eco-sensitive zones, and conservation reserves etc. Keeping above in mind the routes of proposed lines under the project has been so aligned that it takes care of above factors. As such different alternatives were studied with the help of Google Earth and Survey of Bangladesh (SOB) Topographical survey sheets etc. to arrive at most optimum route which can be taken up for detailed survey and assessment of environmental & social impacts for their proper management.

5.2.1.1 Evaluation of Alternative Route Alignments of 230kV D/C Korerhat – Chowmuhoni Transmission Line

Three different alignments were studied (refer Map 5. 1) with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of proposed line are as follows:

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
1.	**Route particulars**			
	i) Length in Kms	52.727	53.778	52.900
	ii) Terrain(Km)- Plain/ Hilly	Plain	Plain	Plain
2.	**Environmental impact**			
	i) Towns in alignment	Chowmuhoni	Chowmuhoni	Chowmuhoni
	ii) Forest involvement	Nil	Nil	Nil
	iii) Historical/Cultural monument	Nil	Nil	Nil
	iv)Endangered species, if any	Nil	Nil	Nil
3.	**Major Crossings:**			
	i) River (Nos.)	2	2	2
	ii) Power line (Nos.)	4	4	5
	iii) Railway line(Nos.)	1	1	1
	iv) National Highway(Nos.)	1	1	1
	v) Khal (Nos.)	11	14	13
4.	**Construction problems**	Shortest line length and line route passing mostly through agricultural field. Better approachability with	Longest line length and involvement more number of khal crossings	Longer line length and involvement of more number of khal crossings & Power line crossings. Also

		lesser number of khal crossings		closer to habitation area.
5.	**O&M problems**	O&M shall be comparatively easier due to better accessibility of line route	Moderate accessibility to line route	Moderate accessibility to line route

Conclusion and Recommendation:

- **Khal Crossing:** The alternative -1 is most optimum as it has minimum number of khal crossing and river crossings having minimum span as compared to other alternatives.
- **Forest:** The forest involvement in all three alternatives is nil.
- **Terrain Condition & Accessibility:** All the three alternatives are passing through plain area. However, Alternate-1 has full accessibility (Roads, cart-tracks) for construction and maintenance purpose in comparison to other routes.

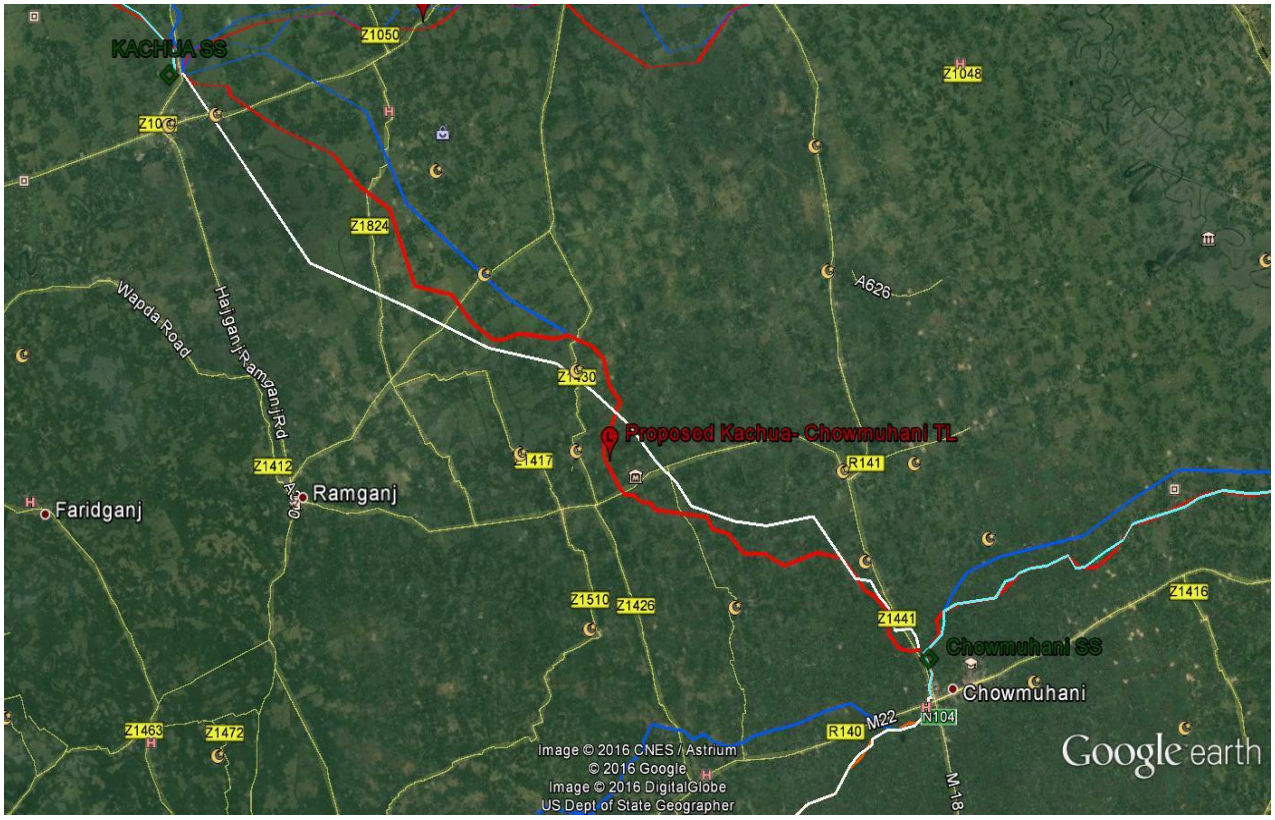
Based on above analysis, **Alternative-I** has been found to be most optimum alignment and recommended for detailed survey.

Map 5:1: Three alternative route alignments for 230 kV D/C Korerhat – Chowmuhoni TL

5.2.1.2 Evaluation of Alternative Route Alignments of 230kV D/C Chowmuhoni- Kachua Transmission Line

Three different alignments were studied (refer Map 5.2) with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of proposed line are as follows:

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
1.	**Route particulars**			
	i) Length in Kms	49.05	48.58	50.12
	ii) Terrain (Km)- Plain/ Hilly	Plain	Plain	Plain
2.	**Environmental impact**			
	i) Towns in alignment	Chowmuhoni	Chowmuhoni	Chowmuhoni
	ii) Forest involvement	Nil	Nil	Nil
	iii) Historical/Cultural monument	Nil	Nil	Nil
	iv)Endangered species, if any	Nil	Nil	Nil
3.	**Major Crossings:**			
	i) River (Nos.)	1	1	3
	ii) Power line (Nos.)	1	2	1
	iii) Railway line(Nos.)	Nil	Nil	Nil
	iv) National Highway(Nos.)	2	2	2
	v) Khal (Nos.)	33	36	37
4.	**Construction problems**	Though relatively longer line length than Alt. 2, but the route passing mostly through agricultural field avoiding habitation areas and involving fewer khal crossings.	Shortest line length but involves more khal crossings and line route passing close to habitation area.	Longest line length & involving relatively more khal crossings.
5.	**O&M problems**	O&M shall be comparatively easier due to better accessibility of line route as compared to other two alternatives.	Moderate	Moderate



Map 5:2: Three alternative route alignments for 230 kV D/C Chowmuhoni - Kachua TL

Conclusion and Recommendation:

- **Khal Crossing:** The alternative -1 is most optimum as it has minimum number of khal crossing in comparison to other alternatives.;
- **Forest:** There is no forest involvement in all three alternatives studied;
- **Terrain Condition & Accessibility:** All the three alternatives are passing through plain area. However, Alternate-1 mostly passing through agricultural paddy field and easy accessibility (through roads, cart-tracks) for construction and maintenance purpose in comparison to other routes.

Based on above analysis, **Alternative-I** has been found to be most optimum alignment and recommended for detailed survey.

5.2.1.3 Evaluation of Alternative Route Alignments of 230kV D/C Gazaria – Kachua Transmission Line

Three different alignments were studied (refer Map5.3) with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of proposed line are as follows:

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
1.	**Route particulars**			
	i) Length in Kms	45.088	44.264	45.30
	ii) Terrain (Km)- Plain/ Hilly	Plain	Plain	Plain
2.	**Environmental impact**			

	i) Towns in alignment	Gazaria, Suhilpur	Gazaria, Suhilpur	Gazaria, Suhilpur
	ii) Forest involvement	Nil	Nil	Nil
	iii) Historical/Cultural monument	Nil	Nil	Nil
	iv)Endangered species, if any	Nil	Nil	Nil
3.	**Major Crossings:**			
	i) River (Nos.)	3	3	3
	ii) Power line (Nos.)	1	2	1
	iii) Railway line(Nos.)	Nil	Nil	Nil
	iv) National Highway(Nos.)	2	2	4
	v) Khal (Nos.)	30	30	35
4.	**Construction problems**	Though relatively longer line length than Alt. 2, but line route has easy approachability and involves lesser tree felling as compared to other alternatives.	Shortest line length but involves more tree felling	Longest line length & involving relatively more khal crossings and river crossing span is more.
5.	**O&M problems**	O&M shall be comparatively easier due to better accessibility of line route as compared to other two alternatives.	Moderate	Moderate

Conclusion and Recommendation:

- **River & Khal Crossing:** The alternative -1 is most optimum as it has minimum number of khal crossing and river crossing span is minimum as compared to other alternatives;
- **Forest:** There is no forest involvement in all three alternatives studied;
- **Terrain Condition & Accessibility:** All the three alternatives are passing through plain area. However, Alternate-1 mostly passing through agricultural paddy field involving less tree felling and easy accessibility (through roads, cart-tracks) for construction and maintenance purpose in comparison to other routes.

Based on above analysis, **Alternative-I** has been found to be most optimum alignment and recommended for detailed survey.

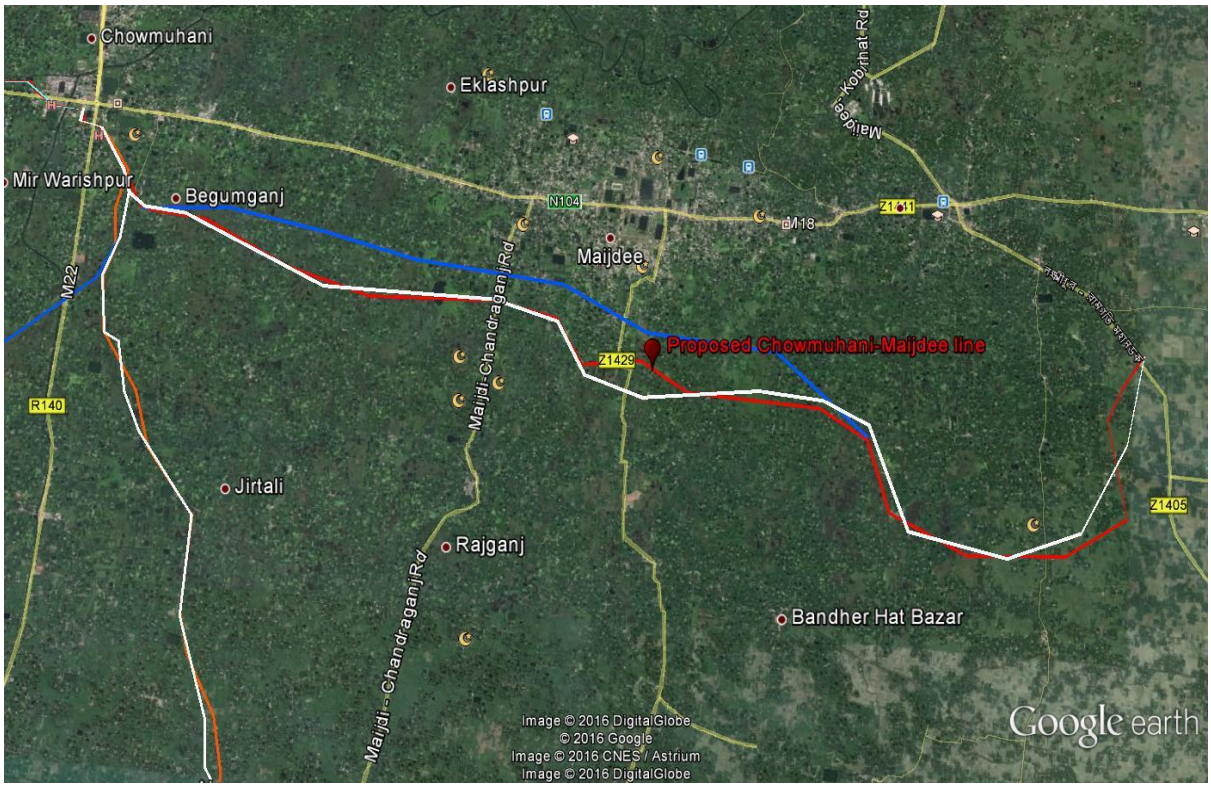
Map 5:3: Three alternative route alignments for 230 kV D/C Gajaria - Kachua TL

5.2.1.4 Evaluation of Alternative Route Alignments of 230 kV D/C Chowmuhoni - Maijdee Transmission Line

Three different alignments were studied (refer Map5.4) with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of proposed line are as follows:

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
1.	**Route particulars**			
	i) Length in Kms	20.55	20.43	21.23
	ii) Terrain Plain/Hilly	Plain	Plain	Plain
2.	**Environmental impact**			
	i) Towns in alignment	Chowmuhoni	Chowmuhoni	Chowmuhoni
	ii) Forest involvement	Nil	Nil	Nil
	iii) Historical/Cultural monument	Nil	Nil	Nil
	iv)Endangered species, if any	Nil	Nil	Nil
3.	**Major Crossings:**			
	i) River (Nos.)	Nil	Nil	Nil
	ii) Power line (Nos.)	Nil	Nil	Nil
	iii) Railway line(Nos.)	Nil	Nil	Nil
	iv) NH (Nos.)	1	2	1
	v) Khal (Nos.)	11	15	13
4.	**Construction problems**	Though relatively longer line length than Alt. 2,	Shortest line length but involves more	Longest line length & involving relatively

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
		but involves lesser nos. of khal crossings and lesser nos. of tree felling as compared to other alternatives.	tree felling and also more nos. of khal crossings	more nos of khal crossings.
5.	**O&M problems**	O&M shall be comparatively easier due to better accessibility of line route as compared to other two alternatives.	Moderate	Moderate



Map 5:4: Three alternative route alignments for 230 kV D/C Chowmuhoni - Maijdee TL

Conclusion and Recommendation:

- **Khal Crossing:** The alternative -1 is most optimum as it has minimum number of khal crossings as compared to other alternatives;
- **Forest:** There is no forest involvement in all three alternatives studied;
- **Terrain Condition & Accessibility:** All the three alternatives are passing through plain area. However, Alternate-1 is passing through mostly agricultural paddy field involving lesser extent of tree felling and easy accessibility (through roads, cart-tracks) for construction and maintenance purpose in comparison to other routes.

Based on above analysis, **Alternative-I** has been found to be most optimum alignment and recommended for detailed survey.

5.2.1.5 Evaluation of Alternative Route Alignments of 132kV D/C Kachua-Laksham Transmission Line

Three different alignments were studied (refer Map5.5) with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of proposed line are as follows:

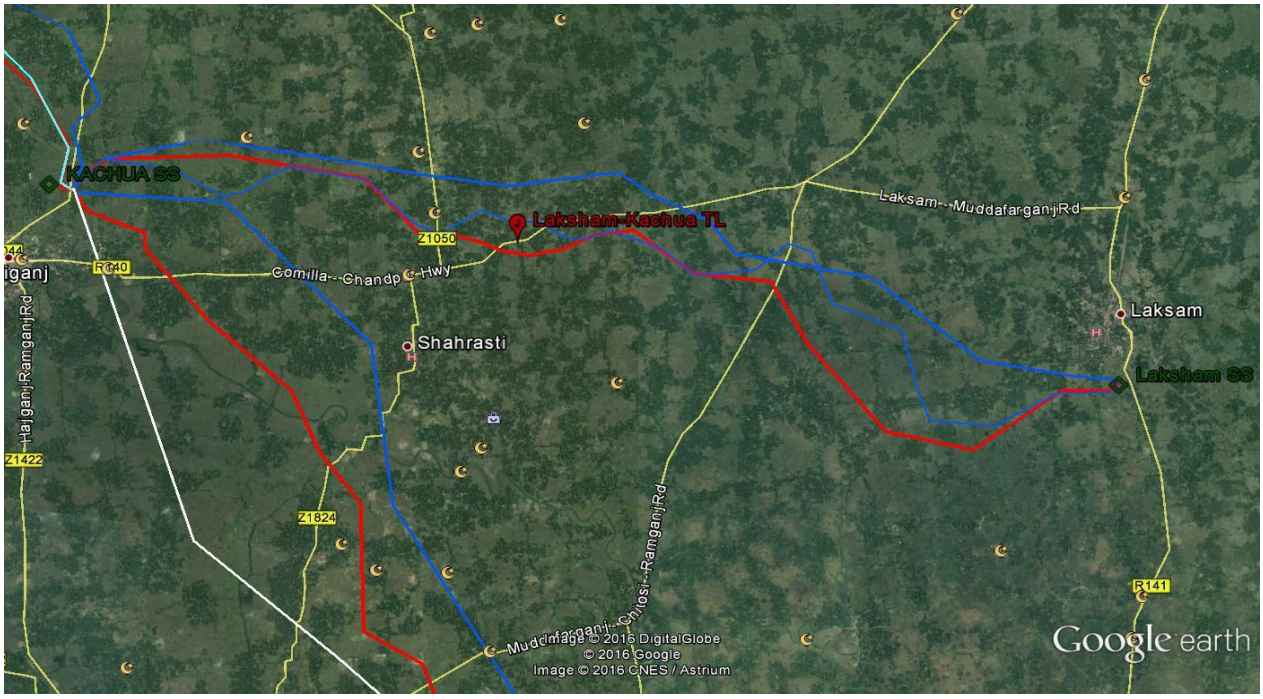
Sl.	Description	Alternative-I	Alternative-II	Alternative-III
1.	**Route particulars**			
	i) Length in Kms	30.933	32.19	29.30
	ii) Terrain– Plain/Hilly	Plain	Plain	Plain
2.	**Environmental impact**			
	i) Towns in alignment	Nearby township is Laksham	Nearby township is Laksham	Nearby township is Laksham
	ii) Forest involvement	Nil	Nil	Nil
	iii) Historical/Cultural monument	Nil	Nil	Nil
	iv)Endangered species, if any	Nil	Nil	Nil
3.	**Major Crossings:**			
	i) River (Nos.)	Nil	Nil	Nil
	ii) Power line (Nos.)	2	3	2
	iii) Railway line(Nos.)	Nil	Nil	Nil
	iv) NH(Nos.)	1	2	1
	v) Khal (Nos.)	22	26	29
4.	**Construction problems**	Though relatively longer line length than Alt. 3, but involves fewer khal crossings and lesser tree felling as the route is passing mostly through paddy fields compared to other alternatives.	Longest line length, involves more tree felling and more nos. khal crossings.	Shortest line length but line route is passing mostly through vegetation area requiring more tree felling. The route also involves more khal crossings.
5.	**O&M problems**	O&M shall be comparatively easier due to better accessibility of line route as compared to other two alternatives.	Moderate	High

Conclusion and Recommendation:

- **Khal Crossing:** The alternative -1 is most optimum as it has minimum number of khal crossings as compared to other alternatives;
- **Forest:** There is no forest involvement in all three alternatives studied;
- **Terrain Condition & Accessibility:** All the three alternatives are passing through plain area. However, Alternate-1 mostly passing through mostly agricultural paddy field which involve

less tree felling and easy accessibility (through roads, cart-tracks) for construction and maintenance purpose in comparison to other routes.

Based on above analysis, Alternative-I has been found to be most optimum alignment and recommended for detailed survey.



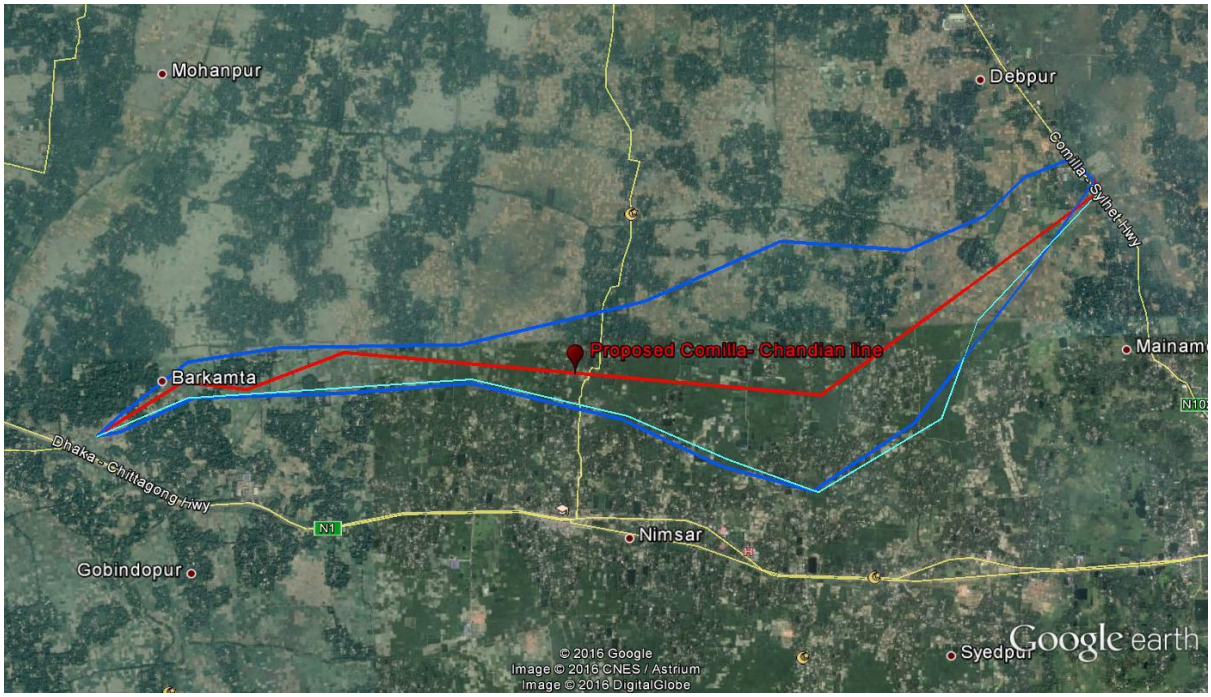
Map 5:5: Three alternative route alignments for 132 kV D/C Kachua - Laksham TL

5.2.1.6 Evaluation of Alternative Route Alignments of 132kV D/C Comilla North- Chandina Transmission Line

Three different alignments were studied (refer Map5.6) with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of proposed line are as follows:

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
1.	**Route particulars**			
	i) Length in Kms	13	9.03	9.90
	ii) Terrain (Km)- Plain/ Hilly	Plain	Plain	Plain
2.	**Environmental impact**			
	i) Towns in alignment	Nearby town is Chandina	Nearby town is Chandina	Nearby town is Chandina & Nimsar
	ii) Forest involvement	Nil	Nil	Nil
	iii) Historical/Cultural monument	Nil	Nil	Nil
	v)Endangered species, if any	Nil	Nil	Nil
3.	**Major Crossings:**			
	i) River (Nos.)	Nil	Nil	Nil
	ii) Power line (Nos.)	Nil	Nil	Nil
	iii) Railway line(Nos.)	Nil	Nil	Nil

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
	iv) NH (Nos.)	1	2	1
	v) Khal (Nos.)	1	2	1
4.	**Construction problems**	Though relatively longer line length than Alt. 2, but line route is passing mostly through paddy field avoiding habitation area.	Shortest in line length but line route is passing mostly through vegetation area causing more tree felling	Longest line length and the route also involves more khal crossings.
5.	**O&M problems**	O&M shall be comparatively easier due to better accessibility of line route as compared to other two alternatives.	Moderate	High



Map 5:6: Three alternative route alignments for 132 kV D/C Comilla North - Chandina TL

Conclusion and Recommendation:

- **Khal Crossing:** The alternative -1 is most optimum as it has minimum number of khal crossings as compared to other alternatives;
- **Forest:** There is no forest involvement in all three alternatives studied;
- **Terrain Condition & Accessibility:** All the three alternatives are passing through plain area. However, since, Alternate-1 is passing mostly through agricultural field; it involves fewer tree felling and easy accessibility (through roads, cart-tracks) for construction and maintenance purpose in comparison to other routes.

Based on above analysis, **Alternative-I** has been found to be most optimum alignment and recommended for detailed survey.

5.2.1.7 Evaluation of Alternative Route Alignments of 132kV D/C Muradnagar – Kosba Transmission Line

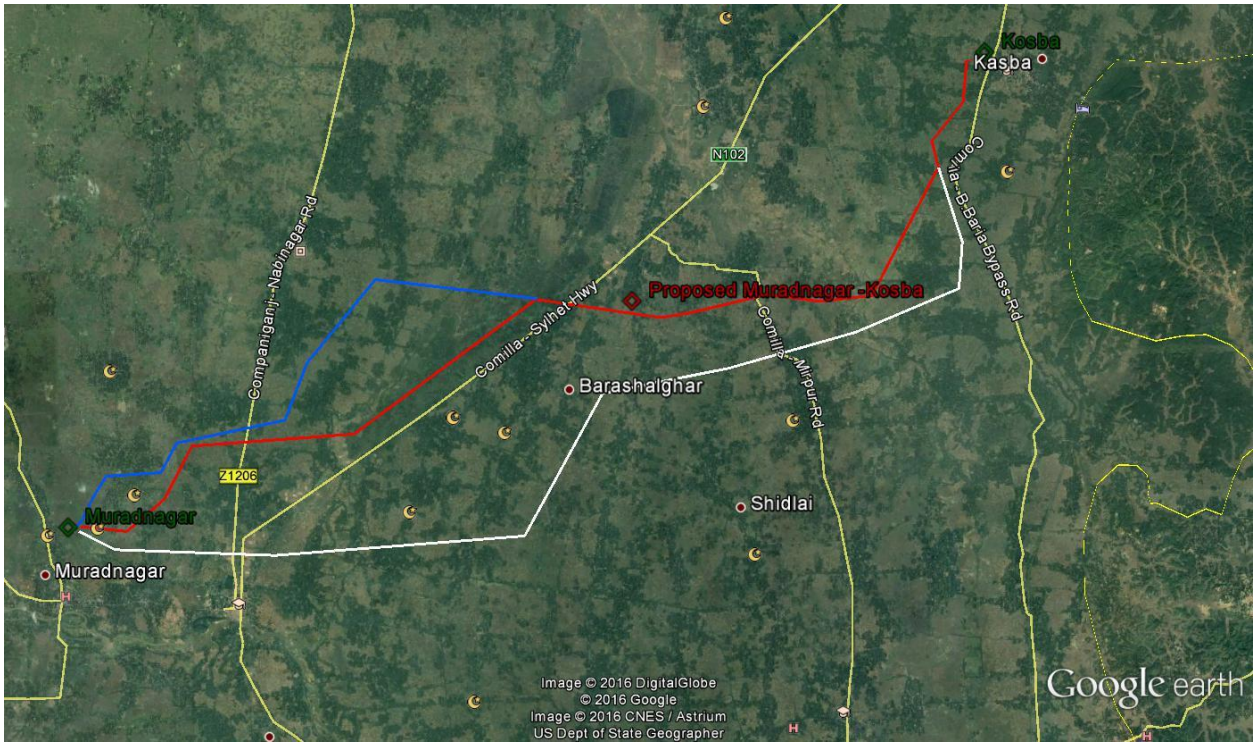
Three different alignments were studied (refer Map5.7) with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of proposed line are as follows:

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
1.	**Route particulars**			
	i) Length in Kms	26.24	27.02	27.27
	ii)Terrain-Plain/ Hilly	Plain	Plain	Plain
2.	**Environmental impact**			
	i) Towns in alignment	Nearby towns are Muradnagar & Kasba	Nearby towns are Muradnagar & Kasba	Nearby towns are Muradnagar & Kasba
	ii) Forest involvement	Nil	Nil	Nil
	iii) Historical/Cultural monument	Nil	Nil	Nil
	iv) Endangered species, if any	Nil	Nil	Nil
3.	**Major Crossings:**			
	i) River (Nos.)	Nil	Nil	Nil
	ii) Power line (Nos.)	Nil	Nil	Nil
	iii) Railway line(Nos.)	Nil	Nil	Nil
	iv) NH (Nos.)	1	1	1
	v) Khal (Nos.)	24	23	26
4.	**Construction problems**	Shortest line length and line route is passing mostly through paddy field avoiding habitation area and easy accessibility from existing road network.	Relatively longer line length and line route is passing close to habitation area.	Longest line length and line route is passing close to habitation area.
5.	**O&M problems**	O&M shall be comparatively easier due to better accessibility of line route as compared to other two alternatives.	Moderate	High

Conclusion and Recommendation:

All the three alternatives are passing through plain area. However, Alternate-1 is shortest in line length and passing mostly through paddy field and has easily accessibility from the existing road

networks as compared to other alternatives. Moreover, Alt.-1 avoids habitation area and vegetation area and therefore, has negligible environmental & social impacts like tree felling, RoW issues etc. Hence, Alternative - I is considered as the most optimized route and recommended for detailed survey.



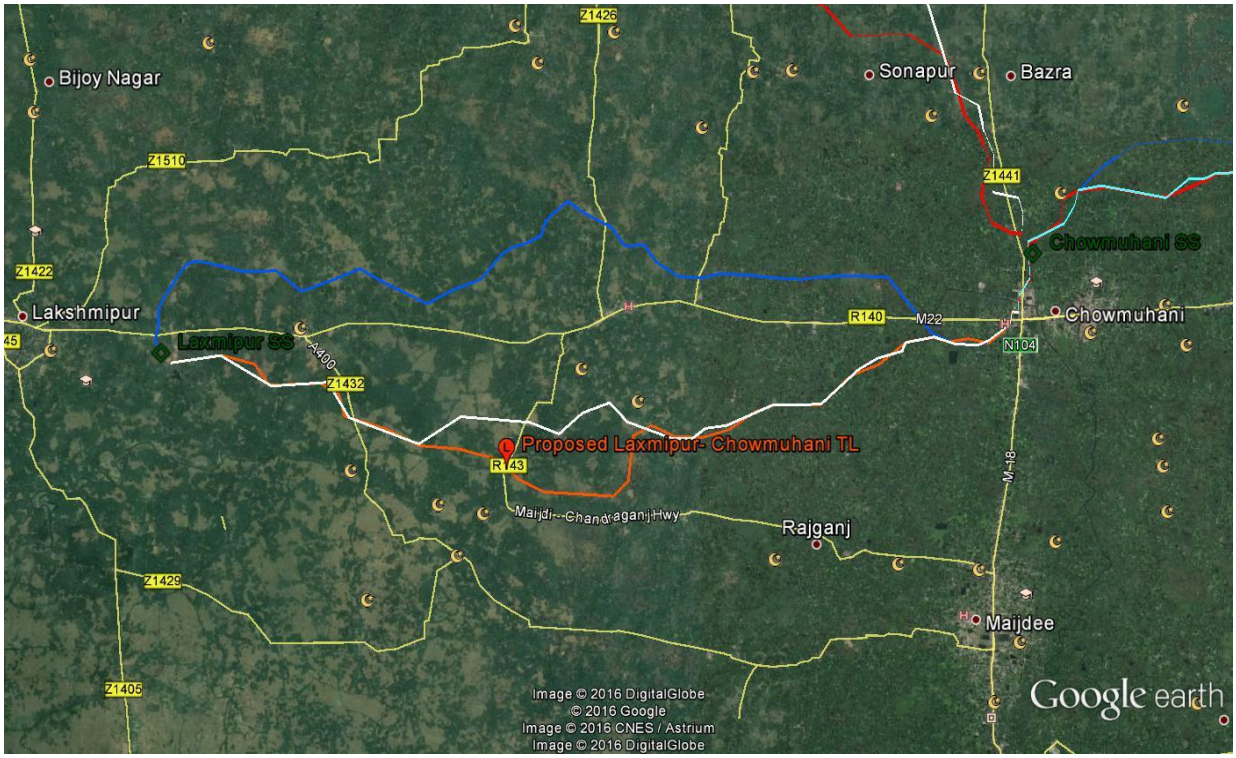
Map 5:7: Three alternative route alignments for 132 kV D/C Muradnagar - Kosba TL

5.2.1.8 Evaluation of Alternative Route Alignments of 132kV D/C Chowmuhoni - Laxmipur Transmission Line

Three different alignments were studied (refer Map5.8) with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of proposed line are as follows:

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
1.	**Route particulars**			
	i) Length in Kms	27.38	26.60	27.90
	ii) Terrain-Plain/ Hilly			
2.	**Environmental impact**			
	i) Towns in alignment	Chowmuhoni	Chowmuhoni	Chowmuhoni
	Ii Forest involvement	Nil	Nil	Nil
	iii) Historical/Cultural monument	Nil	Nil	Nil
	iv)Endangered species, if any	Nil	Nil	Nil
3.	**Major Crossings:**			
	i) River (Nos.)	Nil	Nil	Nil
	ii) Power line (Nos.)	Nil	Nil	Nil
	iii) Railway line(Nos.)	Nil	Nil	Nil

Sl.	Description	Alternative-I	Alternative-II	Alternative-III
	iv) National Highway	1	1	1
	v) Khal (Nos.)	22	20	24
4.	**Construction problems**	Though relatively longer line length than Alt. 2 but the line route avoids habitation area as well as also vegetation area as compared other alternatives.	Shorter in line length line route is passing through some habitation area.	Longer line length and line route is passing through vegetation area and also very closed to habitation area.
5.	**O&M problems**	O&M shall be comparatively easier due to better accessibility of line route as compared to other two alternatives.	Moderate	High



Map 5:8: Three alternative route alignments for 132 kV D/C Chowmuhoni - Laxmipur TL

Conclusion and Recommendation:

All the three alternatives are passing through plain area without involvement of any forest & protected area. Alternative-1 is having relatively longer line length than Alt.-2 but line route is passing mostly through agricultural field with minimum vegetation and away from habitation area and hence minimum tree felling & RoW issues anticipated as compared to other two alternatives. Hence, **Alternative - I** is considered as the most optimum route and recommended for detailed survey.

5.2.1.9 Evaluation of Alternative Route Alignments of LILO of 132 kV D/C Comila (N) - Daudkandi Transmission Line

The line length of the proposed transmission line is 0.5 Km, which is quite short. Due to the short line length, the associated environmental and social impacts will be negligible. Hence, the evaluation of alternative route alignment for this line was not conducted.

5.2.1.10 Evaluation of Alternative Route Alignments of LILO of 132 kV D/C Dohazari - Sikalbaha Transmission Line at Ratiya

The line length of the proposed transmission line is 0.586 Km, which is quite short. Due to short line length, the associated environmental and social impacts will be negligible. Hence, the evaluation of Alternative Route Alignment for this line was not conducted.

5.2.1.11 Evaluation of Alternative Route Alignments of Two Ckt LILO of 132kV D/C Feni - Chowmuhoni Transmission Line at Basurhat

The line length of the proposed transmission line is 2.74 Km, which is quite short. Due to short line length, the associated environmental and social impacts will be negligible. Hence, the evaluation of Alternative Route Alignment for this line was not conducted.

5.2.1.12 Evaluation of Alternative Route Alignments of LILO of 132 kV D/C Halishahr-Khulsi Transmission Line

The line length of the proposed transmission line is 0.63 Km, which is quite short. Due to short line length, the associated environmental and social impacts will be negligible. Hence, the evaluation of Alternative Route Alignment for this line was not conducted.

5.2.1.13 LILO of 400 kV D/C Modhunaghat- Meghnaghat Transmission Line at Korerhat

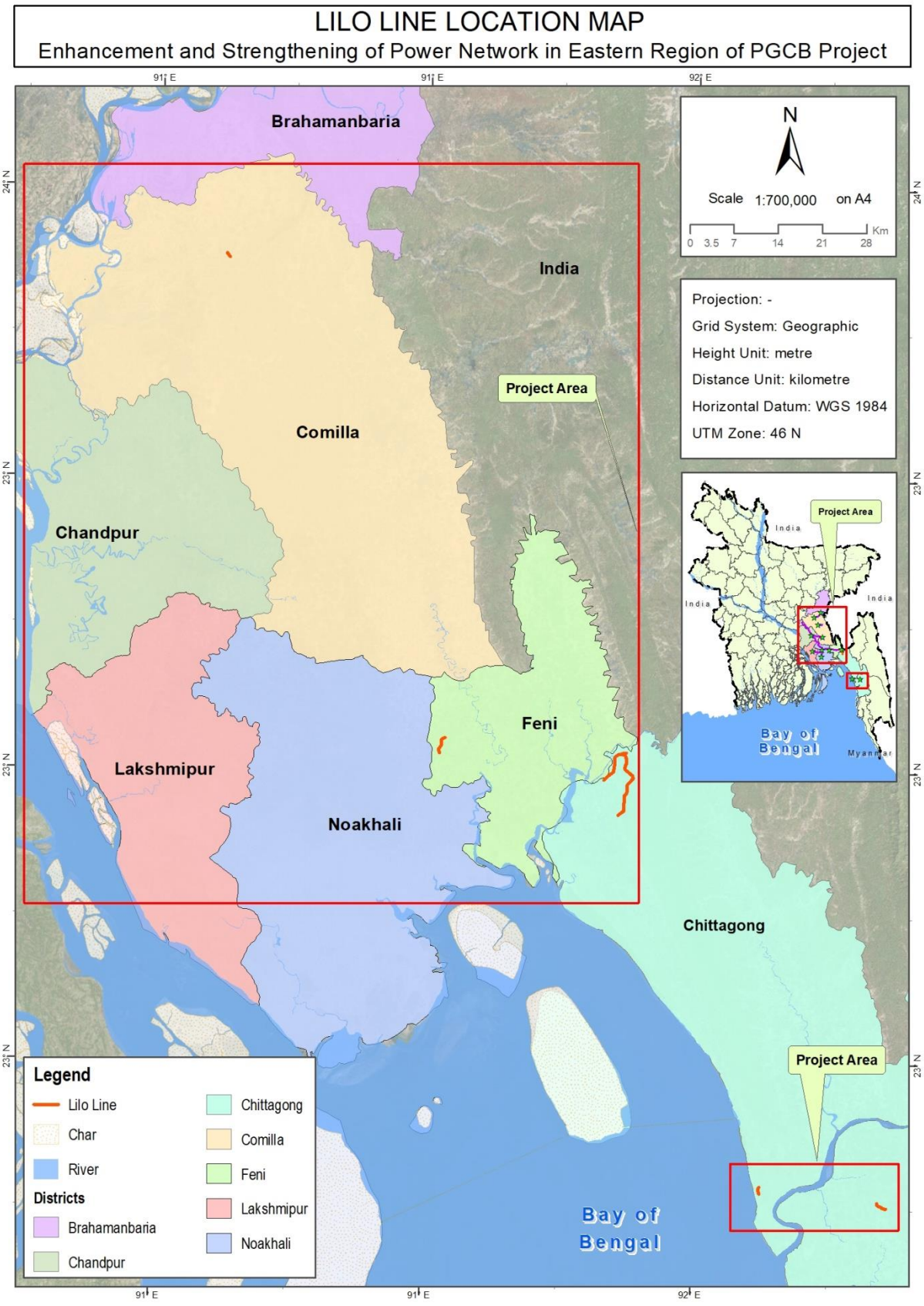
The line length of the proposed transmission line is 0.4 Km, which is quite short. Due to short line length, the associated environmental and social impacts will be negligible. Hence, the evaluation of Alternative Route Alignment for this line was not conducted.

5.2.1.14 LILO of 230 kV D/C Comilla (N) - Hathazari Transmission Line

The line length of the proposed transmission line is 5.73 Km, which is quite short. Due to short line length, the associated environmental and social impacts will be negligible. Hence, the evaluation of Alternative Route Alignment for this line was not conducted.

5.2.1.15 LILO of 132 kV D/C Feni- Hathazari Transmission Line

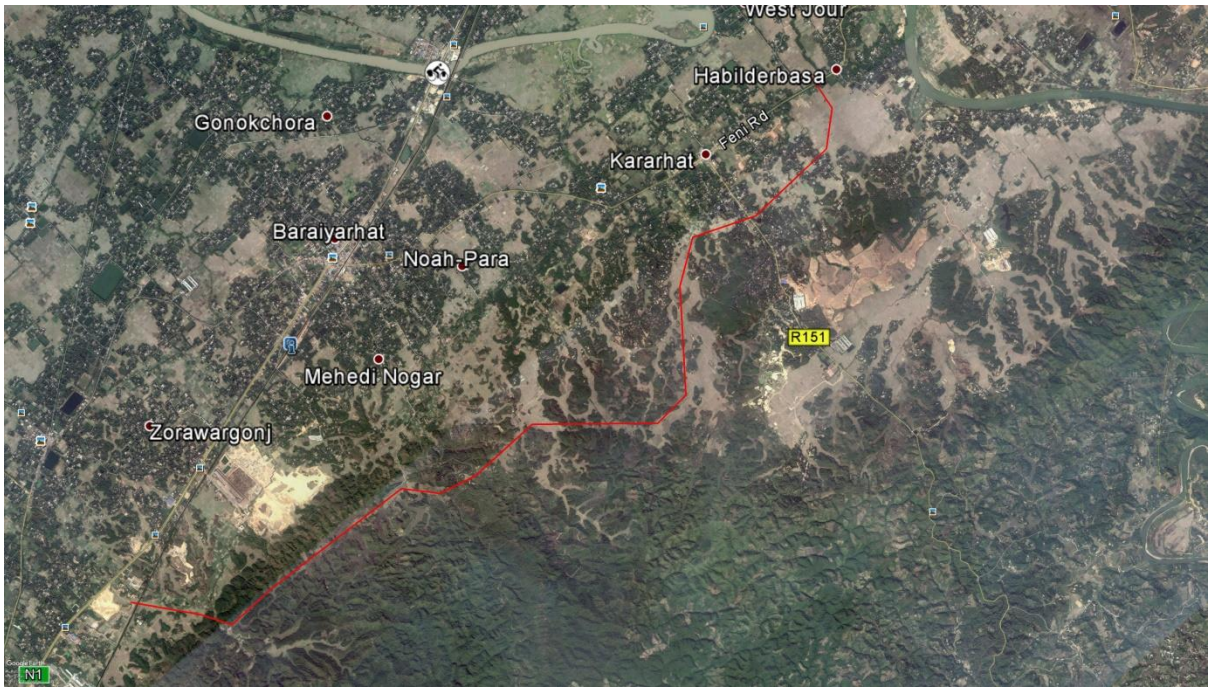
The line length of the proposed transmission line is 2.80 Km, which is quite short. Due to short line length, the associated environmental and social impacts will be negligible. Hence, the evaluation of Alternative Route Alignment for this line was not conducted.



Map 5:9: Location Map of LILO Line Subprojects

5.2.1.16 Extension of Alternative LILO of 400 kV D/C Mirsharai – BSRM Transmission Line to Korerhat

The line length of the proposed transmission line is 11.33 Km. this line will cross some hilly areas and need to trim few forest trees on the hill slopes. However, the associated environmental and social impacts will be insignificance. Hence, the evaluation of Alternative Route Alignment for this LILO line was not conducted.



Map 5:10: Route of LILO of 400 kV D/C Mirsharai – BSRM Transmission Line to Korerhat

5.2.2 Analyses of Alternativefor Selection of Substations

For substation site selection, initially PGCB has been selected 3 alternatives sites based on environment and social aspects and technical requirements. Such analysis considers various site specific parameters that include availability of infrastructure facilities such as access roads, water, distance from railheads, type of land (Government/private land); social impacts such as number of families getting affected; Common Property Resources (CPR) including feasibility of acquisition.

For proper environmental assessment, it is important that each substation sub-project is clearly described by the project proponent (PGCB). The key information required for describing a particular subproject would vary depending on the type of sub-project (i.e., substation). According to ECR 1997, a project proponent is required to apply to the Department of Environment (DoE) for environment clearance or site clearance certificate in a prescribed form (Form 3 of ECR 1997), furnishing key project information. Following the format of the "DoE Form 3", Sub-project Description screening forms been developed for documenting description of sub-projects to be implemented under the proposed project. Once a sub-project description is prepared by the PGCB, it will be easier to carry out environmental/social screening of the sub-project and to subsequently complete the "DoE Form 3" during submitting application for environmental/ site clearance certificate.
By considering certain issues during project formulation, it is often possible to reduce or eliminate some of the possible negative environmental impacts during both construction and

operational phases of a project. For example, efforts to avoid, where possible, critical homestead areas or crossing of rivers/hills/bamboo groves on the substation subprojects could greatly reduce negative impacts during construction and operational phases. Such considerations at the project formulation stage could greatly reduce negative impacts and facilitate proper environmental management of a project. A number of such environmental and social issues to be considered for substation subprojects are identified and given below as bullet form. These issues should be adequately addressed during the project formulation stage, as a part of overall environmental management.

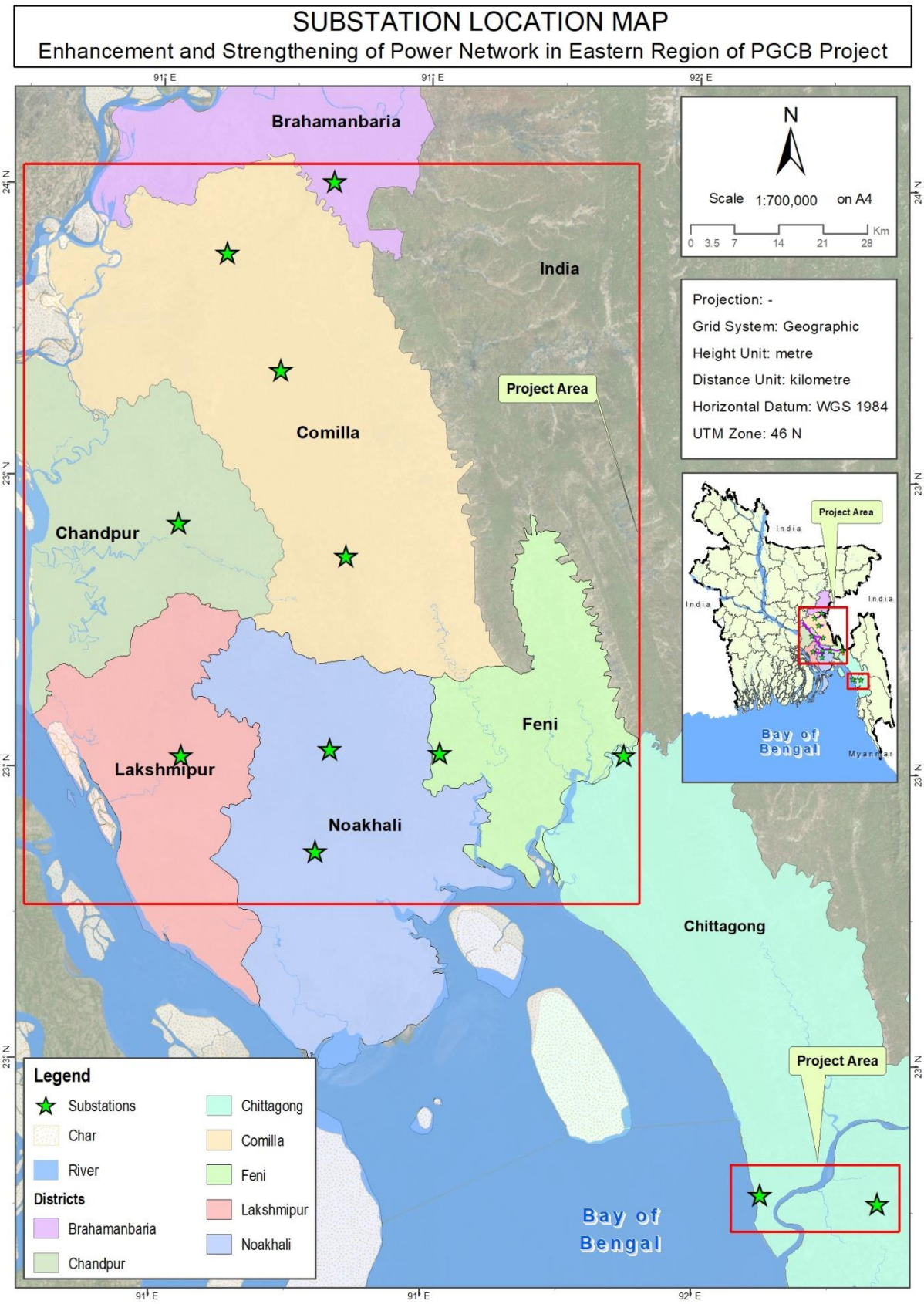
- Use of government-owned land or vacant/fallow (non-productive) land for construction of substation, where possible.
- Use of land located at close proximity to existing power lines/load centers, and road network (for easier transportation of material and equipment), where available.
- Avoiding lands that are susceptible to inundation/ storm surge.
- Avoiding ecologically and socially critical areas while selecting land for substations.
- Use of Gas Insulated Switchgear (GIS) instead of Air Insulated Switchgear (AIS), in order to reduce land requirement for substation and avoid possible generation of toxic fumes in control building due to flashover inside AIS (especially under high humidity and saline conditions).
- Ensuring purchase and installation of PCB free new transformers.
- Treating PCB contained in old transformers available technologies; namely, super critical oxidation, electro-chemical oxidation, solvated electron technology, chemical reduction method, dehalogenation process, and thermal desorption using pyrolysis, catalyzed dehalogination and vitrification before disposal.
- Designing substations considering maximum flood level, and considering wind speed and earthquake load suggested in the Bangladesh National Building Code (BNBC).

Considering the above issues and site inspection/verification, the proposed substation subproject land has been selected and finalized.. The selected location for the substation subprojects is given in below Map 5.11. The social aspects are provided due weightage after technical requirement in decision making for selection/finalization of land for substation. The details of the selected site for proposed substations along with are given below in tabular form:

Sl. No.	Name of Substation	Area (acre)	Location	Current Land use	Remarks
1	230/132 kV GIS at Chowmuhoni, Noakhali	5	Nazirpur 22°56'47.93"N 91°06'11.02"E	Agriculture	Fellow land not available, but nearby road & no houses on or nearby the SS.
2	230/132 kV GIS at Kachua, Chandpur	5	Toraghat 23°21'21.75"N 90°53'11.93"E	Agriculture	Same as above
3	132/33 kV GIS at Muradnagar, Comilla	5	Paschim Bhabanipur 23°39'13.62"N 90°56'02.75"E	Agriculture	Same as above
4	132/33 kV GIS at Laksham, Comilla	2	Gaziramura 23°19'99.41"N 91°13'24.96" E	Agriculture	Same as above
5	132/33 kV GIS at Maijdee,	5	Noakhali	Agriculture	Same as above

Sl. No.	Name of Substation	Area (acre)	Location	Current Land use	Remarks
	Noakhali		22°47'57.88"N 91°04'59.06"E		
6	132/33 kV GIS at Patiya, Chittagong	5	Allai 22°17'56.55"N 91°57'56.23"E	Agriculture	Same as above
7	132/33 kV GIS at Chandina, Comilla	2	Chandina 23°29'37.67"N 91°58'29"E	Govt. Barren land	Same as above
8	132/33 kV GIS at New Mooring/Anand Bazar, Chittagong	20	Madha Halishar 22°18'57.67"N 91°46'21.46"E	Agriculture	Same as above
9	132/33 kV GIS at Bashurhat, Daganbhuiyan, Feni	2	Sekandarpur 22°56'23.72"N 91°16'22.70"E	Agriculture	Same as above
10	132/33 kV GIS at Laksmipur, Lksmipur	5	Atiatalai 22°56'05.03"N 90°52'25.62"E	Agriculture	Same as above
11	132/33 kV GIS at Kosba, Brahmanbaria	5	Kaliara 23°45'37.96"N 91°12'51.44" E	Agriculture	Same as above
12	400/230 kV GIS at Korerhat, Chittagong	25	Baria 22°56'34.91"N 91°33'26.84"E	Agriculture	Same as above

Source: ESMF report,2013 of Power Cell& Site Inspection in 2017.



Map 5:11: Location Map of the Substation Subprojects

6 ENVIRONMENTAL SCREENING/ASSESSMENT OF THE SUBPROJECTS

6.1 General

The location and scale of the works are very important in predicting the environmental impacts. This process of impact prediction is the core of the IEE process and it is critical that the recommendations and mitigation measures are carried out according to the conditions on the ground in the affected areas in the spirit of the environmental assessments process. In this chapter, the potential environmental impacts are reviewed. If impacts are predicted to be significant enough to exceed accepted environmental standards, mitigation is proposed in order to reduce residual impact to acceptable levels and achieve the expected outcomes of the project being implemented. Therefore, it is essential that a proper analysis is carried out during the project planning period. In this regard, the impact prediction plays a vital role as these predictions are used for developing mitigation measures and any alternative options, if appropriate. When the detailed designs are completed the impacts and mitigation measures will need to be further reviewed to take account of how the contracts are set up and in the light of any fine tuning of the sub-projects.

6.2 Screening of Environmental Impacts for Substations (SS)

The environmental impacts due to implementation of the proposed substations during pre-construction/construction and operation stages have been identified through baseline environmental survey including environmental quality survey, public consultations and literature review. During the field visits, Environmental Screening/Assessment Checklist (Appendix-B: Substation, Form 1a, of the ESMF Guidelines, 2013) has been filled up for the initially selected site of each proposed substation to identify the environmental impacts. From the threealternative sites (discussed in chapter 4), environmentally suitable site has been finally selected based on the impacts and given in the following Table 6.1 and in the Chapte:r'Analysis of Alternatives'. The Judgment of the environmental specialist along with the environmental screening/assessment checklist Form 2a of ESMF has also been applied to select environmentally suitable site for the proposed substations. The local people including PAPs and the different stakeholders in the area were consulted to identify the environmental impacts and their opinions regarding the possible mitigation measures have been noted and incorporated in the IEE report. Based on the identified environmental impacts from the screening/assessment checklists, possible mitigation measures for the substation have been proposed.Table 6.1: Environmental Impacts of the Selected Substation (SS) Subprojects

Sl. No.	Subproject Site/Route	Selected SiteCommon	Common/General Impacts	Subproject Specific Impacts
1	230/132 kV GIS at Chowmuhoni, Noakhali	Site-1	**Pre-construction/Construction Phase:** xvi. Land Acquisition xvii. Clearing of Vegetation xviii. Disturbance of Fauna (wildlife) xix. Loss of Top Soil xx. Hydrology/Drainage Congestion xxi. Surfaceand Ground/Drinking Water Pollution xxii. Noise Pollution xxiii. Air and Dust Pollution xxiv. Soil Pollution	
2	230/132 kV GIS at Kachua, Chandpur	Site-1		
3	132/33 kV GIS at Muradnagar, Comilla	Site-1		
4	132/33 kV GIS at Laksham, Comilla	Site-1		

Sl. No.	Subproject Site/Route	Selected SiteCommon	Common/General Impacts	Subproject Specific Impacts
5	132/33 kV GIS at Maijdee, Noakhali	Site-1	xxv. Pollution due to Wastes xxvi. Traffic Congestion/Road Accident xxvii. Siting of Construction Camps xviii. Occupational Health and Safety xxix. Community Health and Safety xxx. Employment Generation/Income **Operation Stage:** vii. Hydrology/Drainage Congestion viii. Landscape ix. Community Health and Safety x. Occupational Health and Safety xi. Improvement of Social & Economic Life xii. Short Circuit/Accident	Surface Water Pollution (perennial pond at about 50m faraway).
6	132/33 kV GIS at Patiya, Chittagong	Site-1		
7	132/33 kV GIS at Chandina, Comilla	Site-1		**Construction Stage:** Government Barren Land
8	132/33 kV GIS at New Mooring/Anand Bazar, Chittagong	Site-1		
9	132/33 kV GIS at Bashurhat, Feni	Site-1		**Construction Stage:** i. 136 Trees Cutting. ii. Loss of terrestrial habitat. iii.Surface Water (Perennial Pond at about 30m faraway) pollution. iv.A Mosque (at 100m faraway at east side of the SS).
10	132/33 kV GIS at Laxmipur, Laksmipur	Site-1		
11	132/33 kV GIS at Kosba, Brahmanbaria	Site-1		
12	400/230 kV GIS at Korerhat, Chittagong	Site-1		**Construction Stage:** i. 2945 Trees Cutting. ii. Loss of terrestrial habitat.

6.3 Screening of Environmental Impacts for Transmission Lines(TL)

The environmental impacts due to implementation of the TL during pre-construction/construction and operation stages have been identified through baseline environmental survey including environmental quality survey, public consultations and literature review. During the field visits, Environmental Screening/Assessment Checklist (Appendix-C: Power Line, Form 2b, of the ESMF Guidelines, 2013) has been filled up for the initially selected site of each proposed TL to identify the environmental impacts. From the threealternative sites (discussed in chapter 4), environmentally suitable site has been finally selected based on the impacts and given in the following Table 6.2. The Judgment of the environmental specialist along with the environmental screening/assessment checklist has also been applied to select environmentally suitable site for the proposed TL. The local people including PAPs and the different stakeholders in the area were consulted to identify the environmental impacts and their opinions regarding the possible mitigation measures have been noted and incorporated in the IEE report. Based on the identified environmental impacts from the environmental screening/assessment checklist , possible mitigation measures for the TL have been proposed.

Table 6.2: Environmental Impacts of the Selected TL Subprojects

Sl. No.	kv	Subproject Site/Route	Selected Route	Common/GeneralImpacts	Subproject Specific Impacts
1	230	Chowmuhoni – Kachua 230 kV Double Circuit TL	Route-01	**Pre-construction/Construction Phase:** i. Clearing of Vegetation (specially due to Tower) ii. Disturbance of Wildlife (specially Birds) iii. Noise Pollution iv. Air and Dust Pollution v. Soil Pollution vi. Pollution due to Wastes vii. Aquatic Habitat viii. Traffic Congestion/Road Accident ix. Siting of Construction Camps x. Occupational Health and Safety xi. Community Health and Safety xii. Employment Generation/Income **Operation Stage:** i. Landscape ii. Community Health and Safety iii. Occupational Health and Safety iv. Improvement of Social & Economic Life v. Short Circuit/Accident vi. Electro-Magnetic Fields (EMF).	**Construction Stage:** i. 2806 Trees(onlyTrimming). ii. Loss of Terrestrial Habitat
2	230	Kachua-Gazaria 230 kV TL	Route-01		**Construction Stage:** i. Surface Water Pollution ii. 1740 Trees(only Trimming). ii. Loss of terrestrial habitat ii. Disruption of Boat Movement in the Meghna- Gumti River during installationof the TL over the river and construction of tower at river banks.
3	132	Kachua-Laksham 132 kV TL	Route-01		**Construction Stage:** i. 299 Trees(only Trimming). ii. Loss of Terrestrial Habitat
4	230	Chowmuhoni – Maijdee 230 kV Double Circuit TL	Route-01		**Construction Stage:** i. 1795 Trees(only Trimming). . i. Loss of Terrestrial Habitat
5	132	Comilla (North) –Chandina 132 KV DC TL	Route-01		
6	132	Chowmuhoni – Laxmipur 132 kV Double Circuit TL	Route-01		**Construction Stage:** i. 2544 Trees(only Trimming). ii. Loss of Terrestrial Habitat
7	132	Muradnagar – Kosba 132 KV DC TL	Route-01		**Construction Stage:** i. 377 Trees (only Trimming). ii. Loss of Terrestrial Habitat
8	230	Korerhat- Chowmuhoni 230KV MC TL	Route-01		**Construction Stage:** i. Surface Water Pollution ii. 8010 Trees(only Trimining) ii. Loss of Terrestrial Habitat v. Disrubtion of Boat Movement in the Feni River during installation of TL and constructionof the toer at river banks. v. A mosque at 20m far away at R/S of the TL. vi. A grave yard at 25m faraway at L/S of the TL.

6.4 Screening of Environmental Impacts for the LiloLines

All Lilo lines have more or less same environmental impacts except Lilo line of 400 KV DC Korerhat-BSRM and therefore screening of impacts has been done for the 8 Lilo lines in the following same table except the Liloof 400 KV DC Korerhat-BSRM and given in the following Table 6.3.

Table 6.3: Environmental Impacts of the Selected LILOLine Subproject

LILO Line	Chainage (Location)	Common/General Impacts	Subproject Specific Impacts
1.LILO of 132 KV DC Feni-Chowmuhani, L=2.915km,	0+000-2+915	**Pre-construction/Construction Phase:** i. Clearing of Vegetation (due to Towers' base) ii. Loss of Top Soil due to towers iii. Noise Pollution iv. Pollution due to Wastes v. Trimining of Trees vi. Loss of terrestrial habitat vii. Occupational Health and Safety viii. Community Health and Safety ix. Employment Generation/Income **Operation Stage:** i. Landscape ii. Community Health and Safety iii. Occupational Health and Safety iv. Improvement of Social & Economic Life v. Short Circuit/Accident vi. EMF	
2.LILO of 230 KV DC Karerhat – Comilla, L=5.735	0+000-5+191		
3. LILO of 132 KV DC Karerhat-Hathazari-Feni	0+000-3+327		
4.LILO of 132 KV DC Dohazari-Shikalbaha	0+000-0+750		
5.LILO of 132 KV DC Halishahar-Kulshi	0+000-1+105		
6..LILO of 132 KV DC Modhunaghat-Meghnaghat	000-0+775		
7..LILO of 400 KV DC Comilla(N)-Daudkandi)	0+000-0+424		
8.LILO of 400 KV DC Korerhat-BSRM	0+000-11+850		<u>Pre-construction/Construction Phase:</u> i.Trimining of Forest Trees (pocket hills with small to medium size forest trees (but not densely) from ch 3+450 – 11+700. ii.Disturbance of wildlife (specially birds) iv.Loss of terrestrial habitat (specially for birds)

6.5 Impact Assessment

Based on the environmental baseline data, given in chapter 4 and environmental screening, impacts assessment for the above finally selected subprojects (Substations, Transmission Lines and LILO lines) have been done and presented in the following subchapters. Potential environmental impacts have been categorized into: (a) general/common impacts, which are typical common impacts to be experienced in all the subprojects and (b) subproject specific impacts.

6.5.1 General/Common Impacts due to Substation Subprojects

6.5.1.1 Pre-construction/Construction Phase

Land Acquisition: As mentioned earlier in chapter 4, due to construction of the proposed substations, a total of 86acre (around 34.82 ha for total 12 substations) of private agricultural land will be acquired. As a result, permanent land loss and crop loss will be occurred. In addition, a small quantity of land will be required temporarily for the construction camp of each substation site.

Clearing of Vegetation: Prior to start construction, the substations sites need to be cleared and as a result, standing vegetation (e.g. crops, grass, bushes etc.) loss will be occurred.

Disturbance of Wildlife (Specially Birds): As mentioned in Chapter 4 due to project activities such as earthworks, movement of project heavy equipment & transports with noise especially during night time, wildlife specially birds will be disturbed.

Loss of Top Soil: Filling of the proposed substations area will cause loss of top clay silt soil of the site (thickness about 0.5m) which is suitable for the boundary slope protection of the substation site. There are possibilities of soil erosion occurring during the construction of the proposed substations especially during rainy and windy seasons. The impact will however be minimal as area to be filled, is very small.

Hydrology/Drainage Congestion: During monsoon period due to filling of the substation subproject sites by earth and construction of temporary earth embankment surrounding the site to keep the site dry as well as reduction of flood prone area, rising of local flood level and drainage congestion will be occurred. Changes in surface hydrology alter the flow of water through the landscape. Construction of impervious surfaces such as parking lots, roads and buildings increase the volume and rate of runoff, resulting in habitat destruction, increased pollutant loads, and flooding.During monsoon period due to intensive rainfall, drainage congestion will be occurred around the substation areas if adequate drainage facilities are not provided in the connecting access road in between exiting roads and substations.

Ground Water Pollution: Contaminated soil or ground water in the path of the project could be disturbed by excavation resulting in a potential transfer of the contamination to surface water. Oil spills during construction could introduce contaminants into subsurface which may end-up into ground water. Development activities such as substations development as well as the spill-over effects of development such as increased demand for water use and increased auto use can impact water quality by contributing sediment, nutrients, and other pollutants to limit water supplies, increasing the temperature of the water, and increasing the rate and volume of runoff.

Noise Pollution: The proposed areas are relatively rural areas. Generation of noise pollution will be occurred from the construction activities for the substation sites such as earth filling, crushing of bricks and stones, concrete mixing plant, movement of heavy construction vehicles, functioning of generators and as result, local community, project workers, wildlife and other lives will be affected specially during night time.

Air and Dust Pollution: Exhaust emissions are likely to be generated by the construction equipment during the construction phase of proposed substations. Motor vehicles that will be used to carry construction materials would cause air quality impact by emitting pollutants through exhaust emissions. But the impacts will not be significant.

Particulate matter pollution is likely to occur during the site clearance, excavation and spreading of the topsoil during construction of proposed substations. There is a very small possibility of PM_{10} suspended and settleable particles affecting the site workers and even neighbors' health, it is minimal given the construction method of minimum excavation and nil cart away of soil.

Soil Pollution: The carried river bed materials (if contain heavy metals) from the nearby river for the filling of the substation site will contaminate the soil of the nearby agricultural land and as a result, crop production and biodiversity will be affected. In addition, during construction, due to accidental spillage and leakage of oil and toxic chemical (if falls on the soil surface) will also pollute the local soil.

Pollution due to Wastes: Generation of construction wastes (such as solid wastes: electric wire, pipes, stones, woods, rods etc., and liquid waste: paint, oil, bitumen etc.,) from the construction camp and general wastes (solid wastes: papers, containers, residues of food, fruits etc., and liquid waste: waste water from bathroom and kitchen etc.) from workers' camp will impact on H&S of the local community and workers as well as on aesthetic beauty of the area, air and soil if inadequate arrangements exist for the disposal of wastes.

Traffic Congestion/Road Accident: The heavy construction vehicles will be required for carrying of construction materials and equipment. Vehicles such as trucks, buses, jeeps, microbuses, cars, rickshaw vans, votvoti, motor bikes, bicycles as well as students and local people walk on the roads and as a result, traffic jams occur specially during morning and evening times as observed during field survey. The construction vehicles will add more traffic and as a result, traffic congestion and road accident will be increased. Traffic congestion also will be occurred, if the stock piling of construction materials will be at the road sides.

Siting of Construction Camps: The precise locations for construction camps for the proposed substations will be decided by the PGCB in consultation with the project contractors. However, the siting of the camps may cause a number of issues such as loss of plantation and vegetation, permanent physical and visual impact on the area, siltation and pollution risks if construction materials are collected from the river bed. The construction process will take minimum 3 years, with the result that the camps will take on a semi-permanent appearance. The people and the changes they bring can have significant impacts on the local communities and social structures. Substantial numbers of workers will inhabit the area in temporary camps loading local infrastructure and causing ambient social influence. Most important aspects are: pollution risk of soil and surface water due to sanitation of the labour camps and wastes from the camps.

Occupational Health and Safety: Construction workers are more likely to face occupational health hazards such as minor or major injuries due to lack of general safety requirements and precautions applicable while working at construction sites, and handling with machines and equipment, use of equipment and driving vehicles and so on. Poorly designed temporary labour camp and sanitation facilities may pose a health threat and nuisance to the workers. Uncontrolled vending of food and drinking water at the work site may also pose a risk with respect to the transmission of contagious diseases like Typhoid, Diarrhea, Malaria, and Dengue in particular. Although presently, total ratio of the affected people in Bangladesh by HIV/AIDS is far less than 0.1%, however this % is slowly being increased due to injection drug users and overseas migrant workers returned to Bangladesh. Construction workers will be required to handle hazardous materials such as cement, bitumen, chemicals, fuels, and so on which will increase health risks of the workers if personal protective equipment are not used.

Community Health and Safety: Improper health and safety policy maintained at the site may lead to outbreak of different diseases to the surrounding communities/public through the sick construction workers. From the traffic survey, it is known that all types of motorized transports such as trucks, buses, oil tankers, jeeps, pick up, cars, auto rickshaws, tempo and motor cycles move on the roads and as a result, traffic jams occur frequently specially during 8:00 to 10:00 and 17:00 to 21:00 on these roads which will affect the health of the local community.

Employment Generation/Income: During construction a considerable quantity of workers (both male & female) will be required for the construction of the substation. Conflict between male & female may be arisen if women workers are deprived. Some local people may also involve themselves in small businesses (e.g. tea stall, grocery shop etc.). Local people can be involved in the project construction work as per their skill.

6.5.1.2 Operation Stage

Drainage Congestion: During monsoon period due to intensive rainfall, drainage congestion will be occurred inside the substation area if proper drainage facilities are not provided. Drain will be blocked due to disposal of solid waste in to the drain if proper maintenance is not done regularly.

Landscape: Due to construction of substation in the rural areas, the natural landscape in rural areas will be changed but not significantly.

Community Health and Safety: A total of 41 people are killed per year in Bangladesh due to short circuit. Short circuit may be occurred if large trees come in contact with the substation during storm and as a result, accident may be happened.

Occupational Health and Safety: Workers specially engaged with the operation of transformers and other electrical equipment will be affected. Short circuit may be occurred if large trees come in contact with the substation during storm and as a result, accident may be happened.

Improvement of Social & Economic Life: Due to increase of power generation and the reliability of power supply, social life and economic condition of the people will be improved.

Short Circuit/Accident: Due to short circuit of the substation, disruption of power and accident will be occurred.

6.5.2 Substation Subproject Specific Impacts

6.5.2.1 Pre-construction/Construction Stage

Subproject specific impacts are as follows:

Substation	Potential Impacts
400 kV Korerhat Substation, Mirsarai, Chittagong	Tree Cutting: At the selected location 2,945 different sizes trees are present. During the construction period site clearance will be required and these trees will need to be felled.
132/33 kV: Basurhat GIS 2x50/75 MVA Substation, Daganbhuiyan, Feni	Tree Cutting: At the selected location 136 different sizes trees are present. During the construction period site clearance will be required and these trees will need to be felled. SW Pollution: Due to disposal of general and construction wastes into the nearby pond water, water will be contaminated. Due to washing of project vehicles, equipment etc. pond water also will be polluted. Cultural Site: Due to earth work, a mosque at about 100m faraway will be affected specially by dust and noise.
132/33 kV: Chandina GIS 2x50/75 MVA Substation, Debidwar, Comilla	Tree Cutting: At the selected location 420 different sizes trees are present. During the construction period site clearance will be required and these trees will need to be felled. SW Pollution: Due to disposal of general and construction wastes into the nearby pond water, water will be contaminated. Due to washing of project vehicles, equipment etc. pond water also will be polluted.
132/33 kV GIS atMaijdeeSubstation, Noakhali.	SW Pollution: Due to disposal of general and construction wastes into the nearby khal water, water will be contaminated. Due to washing of project vehicles, equipment etc. khal water also will be polluted.

6.5.3 General/Common Impacts due to TL and Lilo Lines Subprojects

6.5.3.1 Pre-construction/ Construction Phase

Clearing of Vegetation: As mentioned earlier , a total of 20,252 trees will be partially affected by trimming during construction of the eight TLs. The proposed TLs stretch approximately 210.762 Km will require clearance of ROW and will result in temporarily loss of vegetation. Out of the 8 LILO lines, only 11.334 Korerhat –BSRM line is passing over the pocket of hilly area (upto 6m ht) with forest trees from ch 3+450-11+700 which need to be trimming (if required). However, most of the trees need to be trimmed instead of cutting and thus the impact will be medium significant. In general vegetation destruction shall result in reduction of biodiversity as valuable trees such as those of medicinal importance, wild fruits, and endangered species may be negatively impacted upon. Fauna (wildlife) providing habitat for most birds, snakes and other predators may also be affected, as vegetation cover of the understory is reduced. Disturbaning to flora will lead to reduction in biodiversity.

Disturbance of Fauna: As mentioned in Chapter 5 due to project activities such as earthworks for towers of the TL &LILO lines, movement of project heavy equipment & transports with noise especially during night time, wildlife specially birds will be disturbed.

The way leave for the proposed TL & LL lines could open or truncate some migratory routes for wild animals. However, open areas under the way leave could provide new browsing grounds for various animals. The presence of the construction workers in the project area may induce poaching. Leftover aluminum conductors from construction works may give rise to snare wire that poachers eventually

use to trap animals. Tower foundation works could disturb habitats for smaller mammals such as rodents and rats.

Negative impacts may arise, from erected transmission lines, through accidental ramming of large birds into the power lines during their normal or regional and seasonal migratory flights. All vegetation layers, emergent, canopy and under-storey, allows for birds' habitat and nesting and therefore, the removal of vegetation may impact negatively on these activities.

Loss of Top Soil:For the construction of tower base for the TL &LILO lines approximately 804 acres (325.50 ha) land will be temporarily used. Construction of the lines might open up areas that could be exposed to soil erosion. The variability in soil texture in the study area entails that certain sections of the route could be exposed without any serious threat to water induced erosion. For instance, clayey top soils are highly prone to water induced erosion once exposed. The impact will however be minimal as the area to be disturbed is small.

Noise Pollution: The proposed areas are relatively tranquil. Noise shall be created during construction especially since heavy-duty equipment shall be used in excavating, stringing and tower erection. Noise pollution shall, however, be limited to the construction and routing maintenance period. As a result, local community, project workers, wildlife and other lives will be affected specially during night time.

Air and Dust Pollution: Exhaust emissions are likely to be generated by the construction equipment during the construction phase of proposed transmission line. Motor vehicles that will be used to ferry construction materials would cause air quality impact by emitting pollutants through exhaust emissions. The impacts will not be significant.

Particulate matter pollution is likely to occur during the site clearance, excavation and spreading of the topsoil during construction of proposed substations. There is a very small possibility of PM10 suspended and settleable particles affecting the site workers and even neighbors' health, it is minimal given the construction method of minimum excavation and nil cart away of soil.

Soil Pollution: Due to accidental spillage and leakage of oil and toxic chemical (if falls on the soil surface) will pollute the local soil.

Pollution due to Wastes: Generation of construction wastes (such as solid wastes: electric wire, pipes, stones, woods, rods etc., and liquid waste: paint, oil, bitumen etc.,) from the construction camp and general wastes (solid wastes: papers, containers, residues of food, fruits etc., and liquid waste: waste water from bathroom and kitchen etc.) from workers' camp will impact on H&S of the local community and workers as well as on aesthetic beauty of the area, air and soil if inadequate arrangements exist for the disposal of wastes.

Traffic Congestion/Road Accident: The heavy construction vehicles will be required for carrying of construction materials and equipment. Vehicles such as trucks, buses, jeeps, microbuses, cars, rickshaw vans, votvoti, motor bikes, bicycles as well as students and local people walk on the roads and as a result, traffic jams occur specially during morning and evening times as observed during field survey. The construction vehicles will add more traffic and as a result, traffic congestion and road accident will be increased. Traffic congestion also will be occurred, if the stock piling of construction materials will be at the road sides.

Siting of Construction Camps: The precise locations for construction camps for the proposed project will be decided by the PGCB in consultation with the project contractors. However, the siting of the camps may cause a number of issues such as loss of plantation and vegetation, permanent physical and visual impact on the area. The construction process will take several years, with the result that the camps will take on a semi-permanent appearance. The people and the changes they bring can have significant impacts on the local communities and social structures. Substantial numbers of workers will inhabit the area in temporary camps loading local infrastructure and causing ambient social influence. Most important aspects are: pollution risk of soil and surface water due to sanitation of the labour camps and wastes from the camps.

Occupational Health and Safety: Construction workers are more likely to face occupational health hazards such as minor or major injuries due to lack of general safety requirements and precautions applicable while working at construction sites, and handling with machines and equipment, use of equipment and driving vehicles and so on. Poorly designed temporary labour camp and sanitation facilities may pose a health threat and nuisance to the workers. Uncontrolled vending of food and drinking water at the work site may also pose a risk with respect to the transmission of contagious diseases like Typhoid, Diarrhea, Malaria, and Dengue in particular. Although presently, total ratio of the affected people in Bangladesh by HIV/AIDS is far less than 0.1%, however this % is slowly being increased due to injection drug users and overseas migrant workers returned to Bangladesh. Construction workers will be required to handle hazardous materials such as cement, bitumen, chemicals, fuels, and so on which will increase health risks of the workers if personal protective equipment are not used.

Community Health and Safety: Improper health and safety policy maintained at the site may lead to outbreak of different diseases to the surrounding communities/public through the sick construction workers. From the traffic survey, it is known that all types of motorized transports such as trucks, buses, oil tankers, jeeps, pick up, cars, auto rickshaws, tempo and motor cycles move on the roads and as a result, traffic jams occur frequently specially during 8:00 to 10:00 and 17:00 to 21:00 on these roads which will affect the health of the local community.

Employment Generation/Income: During construction a considerable quantity of workers (both male & female) will be required for the construction of the substation. Conflict between male & female may be arisen if women workers are deprived. Some local people may also involve themselves in small businesses (e.g. tea stall, grocery shop etc.). Local people can be involved in the project construction work as per their skill.

6.5.3.2 Operation Stage

Landscape: Due to construction of transmission line in the rural areas, the natural landscape will be changed but not significantly.

Collision of Birds with Overhead Earth Wire: Collision of birds with overhead earth wire has been identified as one of the most significant impacts on avifauna for the project. Mitigation in the form of route selection and earth wire marking will reduce the impact to Medium. The preferred route passes through habitat areas should be avoided in order to reduce the chances of collisions. The open patches of grassland however would attract species such as storks, which could be at risk of collisions.

Community Health and Safety: A total of 41 people are killed per year in Bangladesh due to short circuit. Short circuit may be occurred if large trees come in contact with the substation during storm and as a result, accident may be happened.

Occupational Health and Safety: Workers specially engaged with the operation of transformers and other electrical equipment will be affected. Short circuit may be occurred if large trees come in contact with the substation during storm and as a result, accident may be happened.

Improvement of Social & Economic Life: Due to increase of power generation and the reliability of power supply, social life and economic condition of the people will be improved.

Short Circuit/Accident: Due to short circuit of the substation, disruption of power and accident will be occurred.

EMF: Health concerns over exposure to EMF are often raised when a new TL is proposed. To date the research has not been able to establish a cause and effect relationship between exposure to magnetic fields and human disease, nor a plausible biological mechanism by which exposure to EMF could cause disease. Rehabilitation of existing power lines is unlikely to increase EMF but new lines may induce EMF. Although any TL/Lilo lines do not pass over the housing areas/popuplated areas however health may be affected however inspection of existing EMF along the selected routes of the existing and new Transmission and Distribution lines and around the Substation sites would be necessary, as a part of carrying out IEE/IEE (by the consultant engaged for this purpose).

Corona Effect:The effects of the corona are are as follows: (i) The glow appear across the conductor which shows the power loss occur on it; (ii) The audio noise occurs because of the corona effect which causes the power loss on the conductor; (iii) The vibration of conductor occurs because of corona effect; (iv) The corona effect generates the ozone because of which the conductor becomes corrosive; (v) The corona effect produces the non-sinusoidal signal thus the non-sinusoidal voltage drops occur in the line; (vi) The corona power loss reduces the efficency of the line; and (vii) The radio and TV interference occurs on the line because of corona effect.

6.5.4 TL/Lilo Line Subproject Specific Impacts

6.5.4.1 Preconstruction/Construction Stage

Subproject specific impacts are as follows:

Subproject	Potential Impacts
230kV D/C Korerhat – Chowmuhoni Transmission Line	Disruption of boats (such as non engine and engine country boats and trallers) movement in the Feni River (perennial water body) during installation of TLs over the river and construction of the TL's tower on both the river banks. SW Pollution: Due to disposal of general and construction wastes into the nearby pond water, water will be contaminated. Due to washing of project vehicles, equipment etc. pond water also will be polluted.
230kV D/C Gazaria – Kachua Transmission Line	Disruption of boats (such as non engine and engine country boats, trallers, launches, bulkhead sand boats, speed boats and vessels) movement in the Meghna-Gumti River(perennial water body) during installation of TLs over the river and construction of the TL's tower on both the river banks .

Subproject	Potential Impacts
	SW Pollution: Due to disposal of general and construction wastes into the nearby pond water, water will be contaminated. Due to washing of project vehicles, equipment etc. pond water also will be polluted.
Korerhat-BSRM LILO Line	Pocket hilly area (upto 6mht) with small to medium forest tress from ch 3+450-11+700 will be affected. Wildlife specially birds will be disturbed due to installation of LILO lines and construction of tower base for the LILO lines.

6.6 Category of Subproject

Based on the environmental screening/assessment as well as ESMF, DOE (ECR 1997 amended in 2017) and WB guidelines, the category of the subprojects has been established and given in the following Table 6.4 and 6.5.

Table 6.4: Category of the Substation Subprojects

Sl. No.	Name of the Subproject	Category	
		DOE Guideline	WB Guideline
1	230/132 kV: Chowmuhoni GIS 3x250/350 MVA, Begumganj, Noakhali	Orange-B Category	B Category
2	230/132 kV: Kachua GIS 2x250/350 MVA, Haziganj, Chandpur	Orange-B Category	B Category
3	132/33 kV: Muradnagar AIS 2x50/75 MVA, Muradnagar, Comilla	Orange-B Category	B Category
4	132/33 kV: Lakhsam GIS 2x50/75 MVA, Lakhsam, Comilla	Orange-B Category	B Category
5	132/33 kV: Maijdee GIS 2x50/75 MVA, Noakhali Sadar, Noakhali	Orange-B Category	B Category
6	132/33 kV: Patiya GIS 2x50/75 MVA, Patiya, Chittagong	Orange-B Category	B Category
7	132/33 kV: Chandina GIS 2x50/75 MVA, Debidwar, Comilla	Orange-B Category	B Category
8	132/33 kV: Anandabazar (New Mooring) GIS 3x80/120 MVA (Future 400kV Provision), Bandar, Chittagong	Orange-B Category	B Category
9	132/33 kV: Basurhat GIS 2x50/75 MVA, Daganbuiyan, Feni	Orange-B Category	B Category
10	132/33 kV: Laksmipur GIS 2x50/75 MVA, Laksmipur, Laksmipur	Orange-B Category	B Category
11	132/33 kV: Kosba GIS 2x50/75 MVA, Kasba, Brahmanbaria	Orange-B Category	B Category
12	400 kV Korerhat, Mirsarai, Chittagong	Orange-B Category	B Category

Table 6.5: Category of the Transmission Line Subprojects

Sl. No.	Name of the Subproject	Category	
		DoE Guideline	WB Guideline
1	230kV D/C Korerhat – Chowmuhoni Transmission Line	Orange-B Category	B Category
2	230kV D/C Chowmuhoni- Kachua Transmission Line	Orange-B Category	B Category

Sl. No.	Name of the Subproject	Category	
		DoE Guideline	WB Guideline
3	230kV D/C Gazaria – Kachua Transmission Line	Orange-B Category	B Category
4	230 kV D/C Chowmuhoni - Maijdee Transmission Line	Orange-B Category	B Category
5	132kV D/C Kachua-Laksham Transmission Line	Orange-B Category	B Category
6	132kV D/C Comilla North- Chandina Transmission Line	Orange-B Category	B Category
7	132kV D/C Muradnagar – Kosba Transmission Line	Orange-B Category	B Category
8	132kV D/C Chowmuhoni - Laxmipur Transmission Line	Orange-B Category	B Category

Table 6.6: Category of the LILO Line Subprojects

Sl. No.	Name of the Subproject	Category	
		DoE Guideline	WB Guideline
1	Feni-Chowmuhini	Orange-B Category	B Category
2	Korerhat-Hathazari-Comilla	Orange-B Category	B Category
3	Korerhat-Hathazari-Feni	Orange-B Category	B Category
4	Dohazari-Sikalbaha	Orange-B Category	B Category
5	Halishahar-Khulshi	Orange-B Category	B Category
6	Korerhat-BSRM	Orange-B Category	B Category
7	Modhunaghat-Meghnaghat	Orange-B Category	B Category
8	Comilla-Daudkandi	Orange-B Category	B Category

7 PUBLIC CONSULTATION

7.1 Objectives

The Public Consultation (PC) was undertaken as a part of the IEE in order to obtain the views of members of the immediate community and interested and project affected persns (PAPs) within the site's immediate area of influence. The consultations were done with randomly selected people in the neighborhood of the proposed sites and involved use of a semi-structured public participation form. In general, the project is acceptable and no objections were raised concerning the development as proposed by the local people.

The Public Consultation has been conducted during August 2017 through Stakeholder Consultations (SC),& individual during the environmental study of the proposed project in conformity with the WB's and DOE's environmental guidelines to achieve the following objectives:

- To share information(such as existing environment, sio-economic , health status etc.) on the subprojects (SS,TL and LILO lines) of the proposed project;
- To understand stakeholders' including PAPs' concerns regarding various aspects of the proposed project including existing power supply facilities/system and expected potential environmental impacts along with possible mitigation measures during construction & operation stages of the proposed project;
- To identify the conflict issues in advance & to find acceptable solutions; and
- To gather local knowledge before decision making of the proposed project;

7.2 Categories of Stakeholders

Consultations have been carried out with the following stakeholders at different venues:

- Project related government and non government officials (such as PC, PGCB, Union Parishad Office, WB etc .);
- Project Affected Persons (PAPs):
  - People (direct PAPs) who will lose their lands permanently and temporarily due to implementatyion of the proposed project;
  - Shopkeepers who have even temporarily shops within the ROW of the project
  - People (indirect PAPs) living in the proposed subproject influence area (SPIA).
- Local beneficiaries;
- Villagers;
- Urban people;
- Businessmen; and
- General public.

These public consultations have been provided key inputs for the identification of the potential environmental impacts along with possible mitigation measures for the negative impacts and enhancement for the positive impacts due to implementation of the subprojects of proposed project.

7.3 Consultation Process

The consultation locations at the subproject sites were selected based on the criterias which are as follows:

- The environmental, social and cultural importance of the subproject area;
- All the selected locations are at the human settlement areas, at the local authority (such as union parishad) which are located nearby the subproject sites; particularly at the junction of substation and transmission line and in some cases Lilo line also. So, the consultants were able to discuss on the project features, environmental and social impacts due to the implementation of the subprojects along with mitigation measures with the local people specially PAPs. Moreover, the selected locations are rich in terms of availability of surface water sources, vegetation, agricultural land, cultural sites etc.

The consultants held meeting with the stakeholders. The stakeholder consultationswere held at the PC, PGCB, Union Parishad office and WB offices, subprojects' sites and SPIA (within about 1km far from the subproject sites). A map, showing the locations of consultations is given in Figure 7.1.

At the starting of the consultations, the consultants described about the subproject & its activities including environment & following these, detailed discussions were held. In the meetings, the participants shared their valuable questions, opinions & suggestions with the consultants which were noted & incorporated in the report. The consultation with Individual person in the subproject areas were also held.

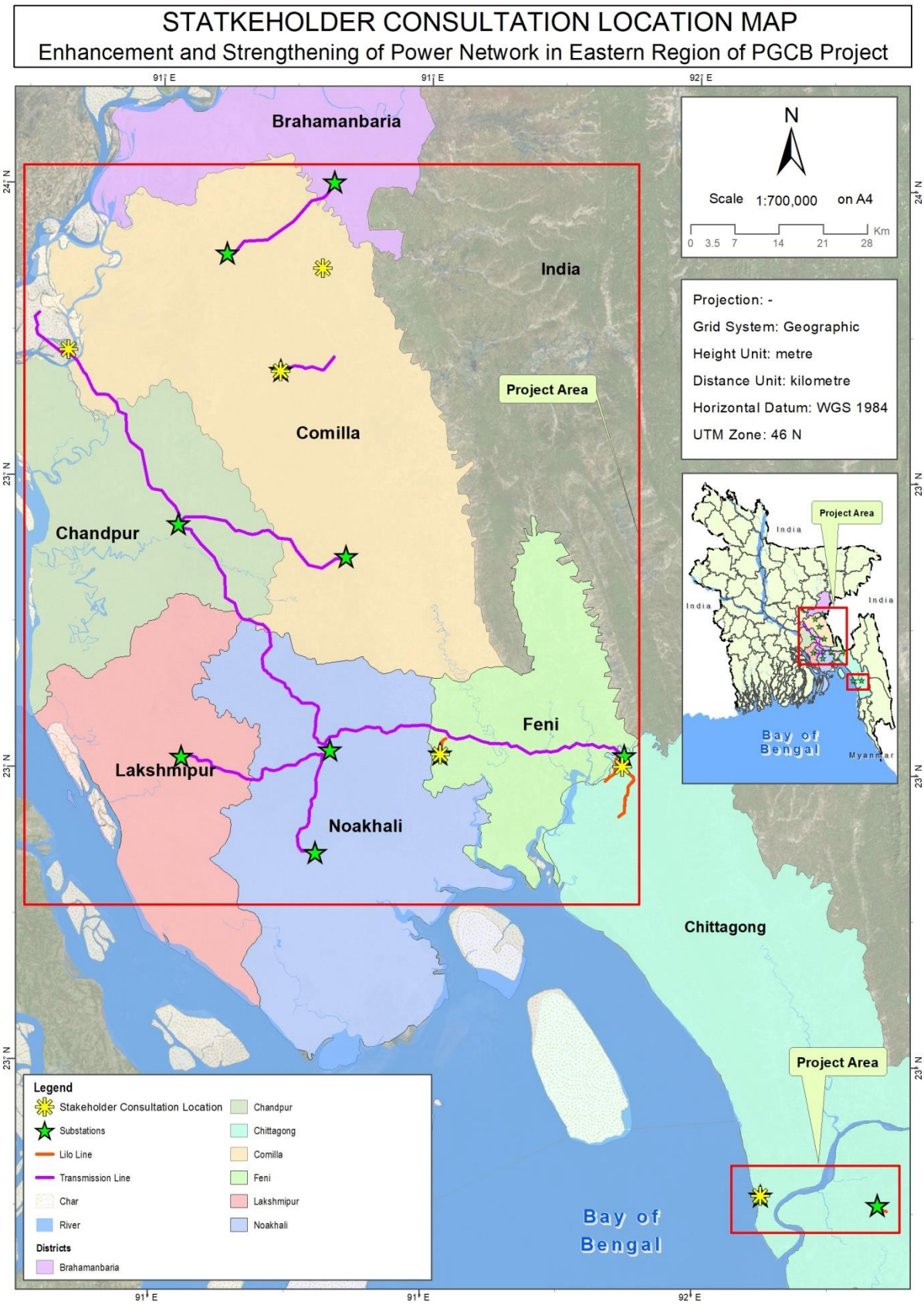


Figure 7-1: Stakeholder Consultations Location Map

7.4 Details of the Consultations

The findings of these consultations are summarized below in chapter 7.5..

Figure 7-2: Photographs of Stakeholder Consultations at Different Subproject Sites (such as at Anandabazar SS, CTG, Basurhat SS, Noakhali, Chandina SS and Gajaria-Kachua TL at Meghna-Gumti River Crossing Site.

7.5 Findings of the Consultations

The following issues were raised by the proposed project neighbours who were interviewed during public participation of the proposed rural electrification, transmission and distribution project. Most comments were of a similar nature.

7.5.1 Positive Issues

7.5.1.1 Employment Opportunities

Most neighbours close to the proposed project sites especially expected the project to create casual and permanent employment opportunities during the proposed project construction work, operation and decommissioning phases. The employment opportunities could be either directly in the project or indirectly through associated businesses. One of the main positive impacts during projects construction phase will be the availability of job opportunities especially to casual workers and several other specialized workers.

Employment opportunities are of benefit both economically and in a social sense. In the economic sense it means abundant unskilled labour will be used in construction hence economic production and circulation of money. In the social sense the young and energetic labour force will be engaged in productive employment other than remaining idle which may lead them into social ills such as drug abuse and criminology. Several workers including casual labourers, masons, carpenters, joiners, electricians and plumbers are expected to work on the site for a period that the project will start to the end. Apart from casual labour, semi-skilled and unskilled labour and formal employees are also expected to obtain gainful employment during the period of construction.

7.5.1.2 Improvement of Local and National Economy

Through the use of locally available materials during the construction phase of the proposed subprojects will contribute towards growth of the economy by contributing to the gross domestic product. The procurement of substation construction materials and the eventual increased consumption of electricity will attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of raw materials will be payable directly to the producers.

7.5.1.3 Boosting of the Informal Sector

During the construction, operational and decommissioning phase of the proposed subprojects, it is expected that the other businesses in the informal sector will flourish. These include activities such as food vending who will be benefiting directly from the construction, operational and decommissioning staff members who will be buying food and other commodities from them. This will promote the informal sector in securing some temporary revenue and hence livelihood.

7.5.1.4 Improvement of Health, Safety and Security (HSS)

HSS within the proposed project site will be enhanced by employment of guards so as to make the subprojects equipment and facilities more secure from theft/vandalism. Security lights will be installed at the Sub-stations, thus lighting up the general area.

7.5.1.5 Improved of Electricity Supply

The project aims to provide improved distribution and retail of electricity. The neighbours were optimistic that power outages will be minimized and that they will not be subjected to power rationing. They were also optimistic that power fluctuation/surges will be a thing of the past. With this additional reliable electricity in the national grid, the country and the local area are expected to attract more investments.

7.5.2 Negative Issues

7.5.2.1 Loses of lands(permanently & Temporary) and Existing Vegetation

The construction of the proposed subprojects will involve the loses of land permanently (SS) and temporary (TL/Lilo lines) and clearing of the existing vegetation cover.

7.5.2.2 Increasing of Emissions (Air Pollution)

During construction and decommissioning phase of the proposed subprojects, there will be undesirable emissions that will be emitted especially from heavy machines that could be used for construction and decommissioning. Dust will be emitted during construction and decommissioning phases. Neighbours asked for air pollution control measures to be put in place, especially during construction.

7.5.2.3 Increasing of Noise Level and Vibration

There was concern over the possibility high noise and vibration levels in the project site as a result of construction works. However, the proponent will have to take appropriate steps to minimize noise production by ensuring that all construction equipment is well maintained.

7.5.2.4 Accidents during Construction

Some neighbours thought that there workplace accidents could occur during construction, implementation and decommissioning of the project. However, they expected accident prevention measures to be put in place. During construction there could be road accidents on the adjacent road as vehicles entering or leaving the site area could experience blind corner spots. The transporters to the project sites will be encouraged to adhere to road safety measures and to be more vigilant.

7.5.2.5 Site Specific Risks

- For Substation:

Sl. No.	Name of the NewSubstations	Possible Risks
1	230/132 kV GIS Substation at Chowmuhoni	Thundering
2	230/132 kV GIS Substation at Kachua	Thundering, flooding
3	132/33 kV GIS Substation at Muradnagar	Thundering, flooding
4	132/33 kV GIS Substation at Laksham	Thundering, flooding
5	132/33 kV GIS Substation at Maijdee	Thundering
6	132/33 kV GIS Substation at Patiya	Thundering, cyclone & tidal surge
7	132/33 kV GIS Substation atChandina	Thundering, flooding
8	132/33 kV GIS Substation at New Mooring (Anand Bazaar)	Thundering cyclone & tidal surge
9	132/33 kV GIS Substation at Basurhat	Thundering

Sl. No.	Name of the NewSubstations	Possible Risks
10	132/33 kV GIS Substation at Laxmipur	Thundering
11	132/33 kV GIS Substation at Kosba	Thundering
12	Korer hat	Thundering, cyclone.

- **For Transmission Lines**

Sl. No.	Name of the Transmission Lines and LILO Lines	Possible Risks
1	Chowmuhoni – Kachua 230 kV M/C Line- 49.05 km	Thundering, flooding, accident
2	Gazaria – Kachua 230 kV M/C Line - 45.09 km	Thundering, flooding, accident
3	LILO of Comilla (N) – Daukandi 132 kV D/C Line at Muradnagar – 0.5 km	Thundering, flooding
4	Kachua- Laksham 132 kV D/C Line - 30.93 km	Thundering, flooding, accident
5	Chowmuhoni – Maijdee 230 kV D/C Line- 20.55 km	Thundering, accident
6	LILO of Dohazari – Sikalbaha 132 kV D/C Line at Patiya – 1.16 Km	Thundering, cyclone & tidal surge
7	Comilla (N) – Chandina 132 kV D/C Line - 13 km	Thundering, , accident
8	LILO of Halishahar- Khulsi 132 kV S/C (ckt-1, 2&3) Line at New Mooring-0.630 km	Thundering, cyclone & tidal surge
9	Two Ckt LILO from Feni – Chowmuhoni 132 kV D/C line at Basurhat – 2.74 km	Thundering
10	Chowmuhoni – Laxmipur 132 kV D/C Line - 27.38 km	Thundering, accident
11	Muradnagar – Kosba 132 kV D/C Line- 22.79 km	Thundering, accident
12	Korerhat- Chowmuhoni 230 kV M/C Line- 52.73 km	Thundering, cyclone, accident
	LILO of Modunghat – Meghnaghat 400 kV D/C Line at Korerhat – 0.4 Km	Thundering
	LILO of Comilla (N)/ Feni – BSRM/ Hathazari 230 kV D/C Line – 5.728 Km	Thundering
	LILO of Feni/ Baroihat – Hathazari 132 kV D/C Line – 2.8 Km	Thundering, cyclone & tidal surge
	Extension of Mirsharai – BSRM 400 kV D/C Line to Korerhat – 11.314 Km	Thundering, cyclone, tidal surge and accident

7.5.3 Information Disclosure

All the subprojects, environmental impacts due to the subprojects along with proposed possible mitigation/enhancement measures and EMP for the management of mitigation/enhancement measures of the project as document or report should be publicly available in readable format to the local people. The respective authority of the project (e.g. PGCB) should ensure information disclosure to the local people and to the respective stakeholders of the respective subproject under the proposed project.

8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 General

The primary objective of the Environmental Management Plan (EMP) is to avoid or eliminate or reduce the negative environmental impacts by possible mitigation measures and to enhance the positive impacts by enhancement measures. It would also address any unexpected or unforeseen impacts that may arise during construction and operation stages of the subprojects. The aim of the EMP is to ensure implementation of the recommended mitigation and enhancement measures effectively. The mitigation measures are designed either to prevent impacts or by mitigating those to reduce the negative impacts to an acceptable level that complies with the environmental guidelines of the DOE and WB.

The EMP is an integrated part of the project planning and implementation. The EMP should be a part of the contract document for all subprojects (substations and TLs/LILO lines) under the project. The main components of the EMP are:

- Mitigation Plan;
- Monitoring Plan;
- EMP budget; and
- Institutional arrangement for implementation of the EMP.

8.2 Environmental Mitigation Plan

As mentioned earlier in chapter 6, the overall impact assessment of the subprojects of the SS and TLs/LILO lines) shows that most of the negative impacts could be eliminated or minimized by adopting appropriate mitigation measures as well as positive impacts could be enhanced by taking enhancement measures. The mitigation/enhancement measures for the potential impacts due to subprojects (substations and TL/Lilo lines) have been formulated and given in the following tables 8.1-8.4. Responsible agency for the implementation and supervision of each of the environmental issues/impacts has also been given in this table. Mitigation measures have been suggested based on the knowledge of the environmental specialist, suggestions of the stakeholders including PAPs, gathered during public consultation as well as opinions from the other relevant specialists.

The mitigation measures will be considered as successful when it complies with the Environmental Quality Standards (EQS), policies, legal requirements set by DOE and other relevant GOB organizations and WB. In absence of DOE's own EQS, other relevant international or other recognized organization's quality standard will have to be followed:

Table 8.1: Mitigation Measures for the General/Common Impacts of the Substation Subprojects

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
(c) Preconstruction/Construction Stage				
Land acquisition/ requisition	▪ Loss of 86 acres land (mainly agricultural) permanently for twelve substation sites. ▪ Temporarily loss of land (requisition) for construction camps etc.	▪ Prior to commence construction activities, the owner of the affected land must be noticed and provided proper compensation in time as per GOB and WB guidelines; ▪ As per GOB & WB guidelines, RAP should be prepared for land acquisition/requisition/compensation and follow it. ▪ Use GIS instead of AIS in order to reduce land requirement.	DC	DSC/PGCB
Top soil	▪ Top soil loss (abpout 0.5m thick) due to construction of substation sites	▪ Prior to start filling the site, collect and storage top soils (minimum 0.5m thick) for using on the surface of the site boundary and access road side slopes for protection from side slope erosion. ▪ The topsoil, excavated from the proposed construction sites should be re-spread in areas to be landscaped. ▪ Follow ECOP-8	Contractor	DSC/PGCB
Clearing of vegetation	▪ Loss of standing crops (if any), grass and bushes of substation sites and construction camp sites	▪ Prior to start clearing of vegetation; provide adequate compensation to the owners in time. ▪ Follow ECOP-18	Contractor	DSC/PGCB
Fauna (Wildlife)	▪ Disturbance of wildlife specially birds due to project activities such as earthworks, moving of project equipment & transports especially during night time.	▪ Prepare construction management plan (CMP) by the contractor and follow it properly. ▪ Follow GOB rules and regulations on noise. ▪ Project workers should not disturb or kill any wildlife. ▪ Follow ECOP-18	Contractor	DSC/PGCB
Construction Waste	▪ Generation of construction wastes from the construction materials.	▪ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time ▪ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		▪ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials ▪ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste ▪ Use of construction materials containing recycled content when possible and in accordance with accepted standards. ▪ Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.		
Drainage congestion and flooding	▪ Reducing floodplain storage area and increase local flooding ▪ Due to earth filling of substation sites and access roads above highest flood level (HFL). ▪ Drainage congestion if the surrounding the sites are blocked by the earth embankment.	▪ Provide culvert in the access road of the substation; ▪ Ensure adequate monitoring, especially if construction works are carried out during the monsoon period. ▪ Provision for pumping of congested water, if needed; ▪ Consider of HFL during design of substations to avoid inundation. ▪ Follow ECOP-1.	Contractor	DSC/PGCB
Noise level	▪ Noise pollution due to construction activities, generators and construction vehicle movement.	▪ Use of noise plug in heavy construction equipment; ▪ It is recommended that no construction should be allowed during night time (9 PM to 6 AM) ▪ Avoid using of construction equipment producing excessive noise at night; ▪ Construction activities should not be during night time ▪ Avoid prolonged exposure to noise (produced by equipment) by workers; and ▪ Regulate use of horns and avoid use of hydraulic horns in project vehicles. ▪ Generator should be placed within room (concrete walls with roof).	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		▪ Monitoring of noise level at construction site, construction camp as and when required.		
Air quality & dust	▪ Air pollution and dust generation due to construction activities, generators and construction vehicle movement.	▪ All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) shall be well maintained and not emit dark or smoky emissions in excess of the limits described in the EQS. ▪ Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Drivers of vehicles used during construction will be under strict instructions to minimize unnecessary trips and minimize idling of engines. Dust suppression facilities (back pack water sprayer) shall be available where earth and cement works are required. ▪ Spray water on dry & loose surface of the construction sites regularly; ▪ Maintain adequate moisture content of soil during transportation, compaction and handling; ▪ Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins. ▪ Sprinkle and cover stockpiles of loose construction materials (e.g., fine aggregates, sand); ▪ Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter. ▪ Dust masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.	Contractor	DSC/PGCB
Soil quality	▪ Soil pollution	▪ Laboratory analysis of the river bed materials to be confirmed prior to start collection from the river; and ▪ Prevention of spillage and leakage of hazardous liquid at construction site & camp. ▪ Ensure not to use transformer containing PCB to avoid soil & air pollution.	Contractor	DSC/PGCB
Sitting of construction	▪ Removal of vegetation such as	▪ Prior to start clearing of vegetation; provide adequate compensation	Contractor/DSC	PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
camps	grass, standing crops (if any) and bushes. ▪ Environmental pollutions (such as air/dust, noise, water, wastes & soil) affecting nearby the settlements,	to the owners in time. ▪ Locate construction camp away from residential settlements, cultural sites, water bodies etc (minimum 0.5km). ▪ Try to use fallow land to avoid crops damage ▪ Just after completion of the construction, hand over the camp sites to the owners as in earlier condition. ▪ Follow ECOP-7		
Traffic congestion/road accident	▪ Traffic congestion and road accident due to movement of construction vehicles.	▪ Follow Bangladesh Road Traffic Authority (BRTA) traffic rules and regulations; ▪ Schedule deliveries of materials/ equipment during off-peak hours ▪ Engage flagman specially at the entry of the substation sites and construction camps for traffic control ▪ Engage experienced drivers to drive project vehicles ▪ Arrange for signal light at night ▪ Prepare and follow proper traffic management; and ▪ Avoid stockpiling of materials specially at the road sides that could disturb traffic movement. ▪ Follow ECOP-14	Contractor	DSC/PGCB
Pollution due to wastes	▪ Pollution due to wastes (construction wastes from construction activities & general wastes from workers' camps)	▪ Solid wastes collection system will be essential, which should include separation and collection of solid wastes in the dustbins/waste containers throughout the work site, construction yard/labour camp. ▪ The wastes such as piece of rods and woods, newspapers, containers etc. can be sold to the venders and rest wastes can be dumped into the nearby road side waste containers/ waste bins from where will send these wastes to the nearest land fill dumping site by the Contractors. ▪ A log of the disposal of toxic and other waste materials is to be kept by the Contractors. ▪ Prior to start cpnstruction, contractor should prepare waste	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		management plan (WMP) based on the EMP ▪ Follow ECOP-10		
Community health and safety (H&S)	▪ Community H&S nearby the substation site	▪ Safety barrier and warning sign surrounding the construction site; ▪ Generators should be placed in the closed room ▪ Formulate and implement emergency risk management plan by the contractor ▪ Follow ECOP-20.	Contractor	DSC/PGCB
Occupational health and safety (H&S)	▪ Health & safety risks of construction workers.	▪ An experienced Health & Safety (H&S) Manager must be engaged by the contractor prior to start construction ▪ Only permitting trained and certified workers to work with any electrical equipment. ▪ Safety induction by the H&S Manager should be provided for the workers ▪ Prior to start work, tool box meeting should be arranged by the H&S Manager for the workers ▪ First Aid Box and personal protective equipment, PPE (such as safety helmets, safety shoes, eye protection glasses, ear plugs/muffs, waist belts, masks, hand gloves, body protective aprons and insulating boots) must be provided to the workers and ensure to use these PPE by the workers; ▪ Safety signs, health signs, prohibition sign, warning sign, mandatory sign, emergency escape sign, first-aid sign, information sign, signboard, supplementary signboard, safety collar, symbol, pictogram, illuminated sign, acoustic signal, verbal communication and hand signal must be fitted at the designated sites of the subproject areas. ▪ Follow ECOP-19.	Contractor	DSC/PGCB
Employment generation/income	▪ Employment opportunities for the local people especially for PAPs.	▪ Employ local people specially PAPs for the project activities as much as possible.	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
(b) Operation Stage:				
Tree replantation	▪ A total of 7000 various local tree species can be replanted at the access road side slope @ 2.50m interval. ▪ Among the planted saplings, some (about 10%) may be dead.	▪ Plantation of 7000 saplings to replace felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow ECOP-17.	FD	PGCB
Drainage congestion	▪ Drainage congestion will be occurred in the surface drains within the substation area if O&M is not done regularly.	▪ Clean the drains, specially during monsoon regularly; ▪ Ensure adequate monitoring.	PGCB	PGCB
Community health and safety	▪ Community H&S nearby the substation site	▪ Safety barrier and warning sign surrounding the construction site; ▪ Generators should be placed in the closed room; ▪ Follow ECOP-20	PGCB	PGCB
Safety & Security of workers	▪ Risk to continuous power supply and even damage of substation	▪ Ensure security of substation in collaboration with law enforcing agencies. ▪ Keep complain book in the substation for recording of people's complains. ▪ Ensure availability of adequate safety gears for substation operations	PGCB	PGCB
Power Supply	▪ Due to adequate reliability of power supply, social life and economic condition of the people will be improved	▪ O&M of the substations should be done in time for adequate power generation. ▪ Follow ECOP-7	PGCB	PGCB
Short Circuit/Accident	▪ Due to short circuit of the substation, disruption of power and accident will be occurred.	▪ O&M of substations should be done in time by experienced personnel.	PGCB	PGCB

Table 8.2: Mitigation Measures for the Specific Impacts of the Substation Subprojects

Substations	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
(a) Preconstruction/Construction Stage				
400 kV Korerhat Substation, Mirsarai, Chittagong	▪ Site clearance will be required and 2945 trees will need to be felled.	▪ Try to avoid tree cutting as many as possible; ▪ Replantation of minimum 5900 numbers of various local saplings along the access road slopes and other private land during monsoon period of operation stage. ▪ Follow ECOP-18 & 19	Contractors	DSC/PGCB
132/33 kV: Basurhat GIS 2x50/75 MVA Substation, Daganbhuiyan, Feni	▪ Site clearance will be required and 136 trees will need to be felled. ▪ Water of nearby pond will be polluted in case of dumping of project wastes into pond and washing of project vehicles. ▪ Due to earth work, a mosque at about 100m faraway will be affected specially by dust and noise.	▪ Try to avoid tree cutting as many as possible; ▪ Replantation of minimum 272 numbers of various local saplings along the access road slopes during monsoon period of the operation stage ▪ Follow ECOP-18 & 19 ▪ Need to prepare waste management plan & follow it. ▪ All project vehicles must be washed in the designated project garage but not in the nearby pond. ▪ Dust should be controlled by watering regularly. ▪ Noise should be reduced by noise barrier (by tin/polythene fence).	Contractors	DSC/PGCB
132/33 kV: Chandina GIS 2x50/75 MVA Substation, Debidwar, Comilla	▪	▪ Replantation of various local saplings along the access road slopes during monsoon period of operation stage . ▪ Follow ECOP-11, 18 & 19 ▪ Need to prepare waste management plan & follow it. ▪ All project vehicles must be washed in the designated project garage.	Contractors	DSC/PGCB
Maijdee Substation, Noakhali	▪ Nearby khal water will be polluted in case of dumping of project wastes into the khal and washing of project vehicles	▪ Need to prepare waste management plan & follow it. ▪ All project vehicles must be washed in the designated project garage.	Contractors	DSC/PGCB
(d) **Operation Stage:**				
400 kV Korerhat	▪ A total of 2945 various local	▪ Plantation of minimum 5900 saplings to replace felled trees on the	FD	PGCB

Substations	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
Substation, Mirsarai, Chittagong	tree species can be replanted at the access road side slope @ 2.50m interval. ▪ Among the planted saplings, some (about 10%) may be dead.	side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow ECOP-18 .		
132/33 kV: Basurhat GIS 2x50/75 MVA Substation, Daganbhuiyan, Feni	▪ A total of 136 various local tree species can be replanted at the access road side slope @ 2.50m interval. ▪ Among the planted saplings, some (about 10%) may be dead.	▪ Plantation of minimum 272 saplings to replace felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow ECOP- 18 .	FD	PGCB
132/33 kV: Chandina GIS 2x50/75 MVA Substation, Debidwar, Comilla	▪ A total of 420 various local tree species can be replanted at the access road side slope @ 2.50m interval. ▪ Among the planted saplings, some (about 10%) may be dead.	▪ Plantation of minimum 840 saplings to replace felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow ECOP-18 .	FD	PGCB

Table 8.3: Mitigation Measures for the General/Common Impacts of TL&LILO Line Subprojects

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
(b) Preconstruction/Construction Stage				
Clearing of vegetation	▪ 20252 trees will be partially affected by trimming as well as standing crops (if any) and bushes along the ROW alsowill be affected.	▪ Prior to start clearing of vegetation; provide adequate compensation to the owners. ▪ Follow ECOP-18	Contractor	DSC/PGCB
Land	▪ Loss of 804 acres land	▪ Prior to commence construction activities, the owner of the	DC	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
Requisition (Temporary loss of 804 acres land for the construction period of about 3 years)	temporarily for the 884 nos. of tower bases of the TL/LILO lines	temporarily affected land must be noticed and provided proper compensation as per GOB and WB guidelines; ▪ As per GOB & WB guidelines, RAP should be prepared for land acquisition/requisition/compensation and follow it. ▪ Use GIS instead of AIS in order to reduce land requirement.		
Fauna (Wildlife)	▪ Disturbance of wildlife specially birds due to project activities such as moving of project equipment & transports especially during night time.	▪ Prepare construction management plan by the contractor and follow it. ▪ Follow GoB rules and regulations on noise. ▪ Project workers should not disturb or kill the birds. ▪ Follow ECOP-17	Contractor	DSC/PGCB
Construction Waste	▪ Generation of construction wastes from the construction materials.	▪ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time ▪ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements ▪ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials ▪ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste ▪ Use of construction materials containing recycled content when possible and in accordance with accepted standards. ▪ Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.	Contractor	DSC/PGCB
Noise level	▪ Noise pollution due to construction activities, generators and construction	▪ Use of noise plug in heavy construction equipment; ▪ It is recommended that no construction should be allowed during night time (9 PM to 6 AM)	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	vehicle movement.	▪ Avoid using of construction equipment producing excessive noise at night; ▪ Construction activities should not be during night time ▪ Avoid prolonged exposure to noise (produced by equipment) by workers; and ▪ Regulate use of horns and avoid use of hydraulic horns in project vehicles. ▪ Generator should be placed within room (concrete walls with roof). ▪ Monitoring of noise level at construction site, construction camp as and when required.		
Air quality & dust	▪ Air pollution and dust generation due to construction activities, generators and construction vehicle movement.	▪ All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) shall be well maintained and not emit dark or smoky emissions in excess of the limits described in the EQS. ▪ Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Drivers of vehicles used during construction will be under strict instructions to minimize unnecessary trips and minimize idling of engines. Dust suppression facilities (back pack water sprayer) shall be available where earth and cement works are required. ▪ Spray water on dry & loose surface of the construction sites regularly; ▪ Maintain adequate moisture content of soil during transportation, compaction and handling; ▪ Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins. ▪ Sprinkle and cover stockpiles of loose construction materials (e.g., fine aggregates, sand); and ▪ Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter. ▪ Dust masks should be provided to all personnel in areas prone to dust	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		emissions throughout the period of construction.		
Soil quality	▪ Soil pollution	▪ Prevention of spillage and leakage of hazardous liquid at construction site & camp. ▪ Ensure not to use transformer containing PCB to avoid soil & air pollution.	Contractor	DSC/PGCB
Sitting of construction camps	▪ Temporarily loss of land for the construction camps etc. ▪ Clearing of standing crops if (any), grass and bushes ▪ Environmental pollutions (such as air, noise, water, wastes & soil) affecting nearby the settlements,	▪ Prior to commence construction activities, the owner of the temporarily affected land must be noticed and provided proper compensation as per GOB and WB guidelines; ▪ As per GOB & WB guidelines, RAP should be prepared for land acquisition/requisition/compensation. ▪ Prior to start clearing of vegetation; provide adequate compensation to the owners in time. ▪ Locate construction camp away from residential settlements, cultural sites, water bodies etc (minimum 0.5km). ▪ Try to use fallow land ▪ Just after completion of construction, hand over this camp site to the owners as in earlier condition. ▪ Follow ECOP-7, 21	Contractor/DSC	PGCB
Traffic congestion/road accident	▪ Traffic congestion and road accident due to movement of construction vehicles.	▪ Follow BRTA traffic rules and regulations; ▪ Schedule deliveries of material/ equipment during off-peak hours ▪ Engage flagman specially at the entry of the substation site and construction camps for traffic control ▪ Engage experienced drivers to drive project vehicles ▪ Arrange for signal light at night ▪ Proper traffic management; and ▪ Avoiding stockpiling of materials specially at the road sides that could hamper traffic movement. ▪ Follow ECOP-2	Contractor	DSC/PGCB
Pollution due to wastes	▪ Pollution due to wastes	▪ Solid wastes collection system will be essential, which should include	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	(construction wastes from construction activities & general wastes from workers' camps)	separation and collection of solid wastes in the dustbins/waste containers throughout the work site, construction yard/labour camp. ▪ The wastes such as piece of rods and woods, newspapers, containers etc. can be sold to the venders and rest wastes can be dumped into the nearby road side waste containers/ waste bins from where will send these wastes to the nearest land fill dumping site by the Contractors. ▪ A log of the disposal of toxic and other waste materials is to be kept by the Contractors. ▪ Contractor should prepare waste management plan based on the EMP ▪ Follow ECOP-11		
Community health and safety (H&S)	▪ Community H&S along the distribution line	▪ Safety barrier and warning sign surrounding the construction site; ▪ Generators should be placed in the closed room ▪ Formulate and implement emergency risk management plan by the contractor ▪ Follow ECOP-21	Contractor	DSC/PGCB
Occupational health and safety (H&S)	▪ Health & safety risks of construction workers.	▪ An experienced H&S Manager must be engaged by the contractor prior to start construction ▪ Only permitting trained and certified workers to work with any electrical equipment. ▪ First aid box and personal protective equipment, PPE (such as helmet, safety shoes, eye protection glass, ear plugs, waist belt, mask, hand gloves, body protective apron, ear muff and insulating boots) must be provided to the workers and ensure to use these PPE by the workers; ▪ Safety signs, health signs, prohibition sign, warning sign, mandatory sign, emergency escape sign, first-aid sign, information sign, signboard, supplementary signboard, safety collar, symbol, pictogram, illuminated sign, acoustic signal, verbal communication and hand	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		signal must be fitted at the designated sites of the subproject area. ▪ Follow ECOP-20		
Employment generation/income	▪ Employment opportunities for the local people especially for PAPs.	▪ Employ local people specially PAPs for the project activities as much as possible.	Contractor	DSC/PGCB
(b) Operation Stage:				
Community health and safety	▪ Community H&S along the distribution lines	▪ Safety barrier and warning sign surrounding the construction site; ▪ Generators should be placed in the closed room. ▪ Follow ECOP-21	PGCB	PGCB
Safety & Security of workers	▪ Risk to continuous power supply	▪ Ensure security of substation in collaboration with law enforcing agencies. ▪ Keep complain book in the substation for recording of people's complains. ▪ Ensure availability of adequate safety gears for substation operations	PGCB	PGCB
Power Supply	▪ Due to adequate reliability of power supply, social life and economic condition of the people will be improved	▪ O&M of substations should be done in time for adequate power generation.	PGCB	PGCB
Short Circuit/Accident	▪ Due to short circuit of the substation, disruption of power and accident will be occurred.	▪ O&M of substations should be done in time by experienced personnel.	PGCB	PGCB
EMF	▪ Due to EMF, human health may be affected	▪ Once there is no BD guidelines/Standard, so to be followed the Australian standard for the safety of the power lines. For housing structures clearance between TL and roof top is 6.5m-8m and for river crossing it will 14.6m-15.9m. Noted that no houses will be directly affected by the TL/Lilo lines.	PGCB	PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
Corona Effect	The effects of the corona are are as follows: (i) The glow appear across the conductor which shows the power loss occur on it; (ii) The audio noise occurs because of the corona effect which causes the power loss on the conductor; (iii) The vibration of conductor occurs because of corona effect; (iv) The corona effect generates the ozone because of which the conductor becomes corrosive; (v) The corona effect produces the non-sinusoidal signal thus the non-sinusoidal voltage drops occur in the line; (vi) The corona power loss reduces the efficency of the line; and (vii) The radio and TV interference occurs on the line because of corona effect.	Corona decreases the efficiency of transmission lines. Therefore, it is necessary to minimize corona. The following factors may be considered to control corona: (i)Conductor diameter – For reducing corona loss, this method of increasing conductor diameters is very effective. The diameters of conductors can be increased by using hollow conductors and by using steel-cored aluminum conductors(ACSR) conductors; (ii)The voltage of the line – Voltage of transmission lines is fixed by economic considerations. To increase the disruptive voltage the spacing of the conductors is to be increased, but this method has some limitations; and (iii)Spacing between conductors – If the space between conductors increases, then the voltage drops between them also increases due to increase in inductive reactance.	PGCB	PGCB

Table 8.4: Mitigation Measures for the Specific Impacts of the TL&LILO line Subprojects

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
Preconstruction /Construction Stage:				
Subproject Name: 230kV D/C Korerhat – Chowmuhoni Transmission Line				
Requirement of land	Crop production at the 163 tower sites will be disrupted.	Adequate compensation will be provided to the affected people in time following RAP.	DC	DSC/PGCB
Disruption of boat movement; and Disruption of 2 cultural sites (such as a mosque at about 20m far away from TL at ch 48+300 at R/S, and a graveyard at ch 10+000 at L/S (witin SPIA). .	Disruptions of water transport movement during construction of transmission line over the Feni River at Ch 2+850. A mosque at about 20m far away from TL at ch 48+300 at R/S, and a graveyard at ch 10+000 at L/S (witin SPIA) may be affected.	▪ Follow BITWA rules and regulations on navigation. ▪ Transmission line should be about 15m above the HWL. ▪ Close monitor the river crossing site of the TL during construction to avoid accident. ▪ Try to construct the TL at the river crossing during night to avoid disruption of boat movement. ▪ Any waste should not be disposed into the river. ▪ River water should be tested quarterly during construction. ▪ Mosque and graveyard should not be affected by the project activities (such as by wastes, noise, dust etc.). Adequate size noise barrier/screen should be install at the mosque and graveyard site for protecting noise and dust. ▪ No activities should be done during night (6:00 AM – 9:00PM).	Contractors	DSC/PGCB
Water pollution	Construction of transmission line across rivers, canals and other water bodies (total 15) could pollute water during construction stage;	▪ Discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ponds will be prevented; and ▪ During construction, washing of clothes, bathing and cleaning of project vehicle & equipment in the aquatic habitat (e.g. river, pond) will be prohibited; ▪ Surface water quality will be monitored twice in a year (during dry and wet seasons); and ▪ ECOP -11, 12, 13 for water bodies and water qualities respectively will be followed.	Contractor	DSC/PGCB
Aquatic Fauna	Due to water pollution by the construction of TL across the water bodies , aquatic fauna (fishes, frogs, snakes etc.) will be affected	▪ Discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ponds will be prevented; and ▪ During construction, washing of clothes, bathing and cleaning of project vehicle & equipment in the aquatic habitat (e.g. river,	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		pond) will be prohibited; ▪ Project workers should not kill fishes & other fauna from the water bodies. ▪ ECOP- 11,12 & 13 for water bodies and water qualities respectively will be followed.		
Subproject Name: 230kV D/C Kachua-Gazaria Transmission Line:				
Requirement of land	Crop production at the 134 tower sites will be disrupted.	Adequate compensation will be provided to the affected people in time following RAP.	DC	DSC/PGCB
Disruption of boat communication	Disruptions of water transport movement during construction of transmission line over the Meghna-Gumti River at ch 33+500.	▪ Follow BITWA rules and regulations on navigation. ▪ Transmission line should be about 15m above the HWL. ▪ Close monitor the river crossing site of the TL during construction to avoid accident. ▪ Any waste should not be disposed into the river. ▪ Try to construct the TL at the river crossing during night to avoid disruption of boat movement. ▪ River water should be tested quarterly during construction	Contractors	DSC/PGCB
Water pollution	Construction of TL (along with tower on both river banks) across the Meghna –Gumti River at ch 33+500 will pollute river water;	▪ Discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ponds will be prevented; and ▪ During construction, washing of clothes, bathing and cleaning of project vehicle & equipment in the aquatic habitat (e.g. river, pond) will be prohibited; ▪ Surface water quality will be monitored twice in a year (during dry and wet seasons); and ▪ ECOP- 10, 12 for water bodies and water qualities respectively will be followed.	Contractor	DSC/PGCB
Aquatic Fauna	Due to water pollution by the construction of TL across the water bodies, aquatic fauna (fishes, frogs, snakes etc.) will be affected	▪ Discharge of fuel, lubricants, chemicals, and wastes into adjacent rivers/ponds will be prevented; and ▪ During construction, washing of clothes, bathing and cleaning of project vehicle & equipment in the aquatic habitat (e.g. river,	Contractor	DSC/PGCB

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
		pond) will be prohibited; ▪ Project workers should not kill fishes & other fauna from the water bodies. ▪ ECOP-11 and 12 for water bodies and water qualities respectively will be followed.		
Subproject Name: Korerhat-BSRM LILO Line:				
Forest tress in the poket hilly area from ch 3+450-11+700	▪ Forest trees may be affected by trimmingof trees along the ROW ▪ Wildlife specially birds will be disturbed	▪ Prior to start construction, written permission should be taken from the FD i(In case of trimming of forest trees), ▪ Follow ECOP- 16,18, 19	Contractor	DSC/PGCB/FD

8.3 Environmental Monitoring Plan

The Environmental Monitoring Plan (MP) is one of the important tools/key components of the EMP for implementing the mitigation plan for the Project. The main objectives of the Monitoring Plan are to:

- Monitor changes in the environment during various stages of the project life cycle with respect to baseline conditions; and
- Manage environmental issues arising from construction works through closely monitoring their actual/potential environmental impacts.

A monitoring mechanism is developed for each identified impact and proposed mitigation measures. It includes:

- Location of monitoring (near the Project activity, sensitive receptors or within the Project influence area);
- Means of monitoring, i.e. methods of monitoring (visual inspection, consultations, interviews, surveys, field measurements, sampling and analysis);
- Frequency of monitoring (daily, weekly, monthly, seasonally, annually or during implementation of a particular activity); and
- Implementing agencies for monitoring.
- Contractor will provide compliane monitoring report quarterly as per EMP.

The monitoring program will also include regular monitoring of construction activities for their compliance with the environmental requirements as per relevant standards, specifications and EMP; The purpose of such monitoring is to assess the performance of the undertaken mitigation measures and to immediately formulate additional mitigation measures and/or modify the existing ones aimed at meeting the environmental compliance as appropriate during the construction stage. The Monitoring Plan is presented in the following Tables 8.5-8.6 and Monitoring Checklist during construction to monitor the implementation of mitigation measures is given in following sub-section-.

The environmental parameters that may be qualitatively and quantitatively measured and compared are selected as 'explicit indicators' and recommended for monitoring during project implementation and O/M stages. These monitoring indicators will be continuously monitored (Table 8.5-8.6) to ensure compliance with the national or other applicable standards and comparison with the baseline conditions established during the preconstruction/design stage. The list of indicators and their applicable standards to ensure compliance are given below:

- Air quality (PM_{10}, $PM_{2.5}$, SPM, SO_2, NOx, CO) – EQS, Bangladesh;
- Noise levels – EQS, Bangladesh;
- Groundwater Quality (pH, As, Mn, Fe, TC, FC) - EQS, Bangladesh;
- Surface Water Quality (pH, NH_3-N, DO, BOD, COD and PO_4) – EQS, Bangladesh, and
- River-Bed Materials (Sand): Metals (As, Cu, Pb, Hg, Cr, Cd and Zn) – USEPA Standards

8.3.1 Environmental Monitoring System

The aforementioned environmental monitoring plan will be implemented following an Environmental Monitoring System. PGCB as an organization (entrepreneur of the project) is solely

responsible to ensure proper environmental monitoring of the project during pre-construction, construction and operation phases. Environmental monitoring system will follow interlinked Plan-Do-Check-Action procedure. Identified environmental impacts will be mitigated following mitigation measures along with ECOP outlined in the ESMF. The implementation and operation of EMP depends on several factors which are as follows:

- Clear understanding and identification of relevant environmental aspects and impacts;
- Objectives and targets to be achieved;
- Resources (technical, man power, financial etc.);
- Competence, training and awareness;
- Communication (internal & external);
- Documentation; and
- Emergency, preparedness and response.

During the three years construction and one-year defect & liabilities period the ESU of PGCB will ensure proper implementation of the environmental monitoring system. Among the resources required competence, training and awareness will be built up following Training Plan among the engaged personnel of PGCB and contractors. Environmental performance will be checked, documented and will be taken corrective actions and communication will be maintained by the responsible personnel of the project. Budget for the environmental monitoring during pre-construction, construction and operation phases has been included in the EMP. Cost of environmental monitoring after operation phase will be provided from the in-house allotted fund of PGCB. Environmental monitoring system and Requirement for the Implementation and Operation of the Environmental Monitoring System are shown in the following Figure 8.1 and 8.2 respectively.

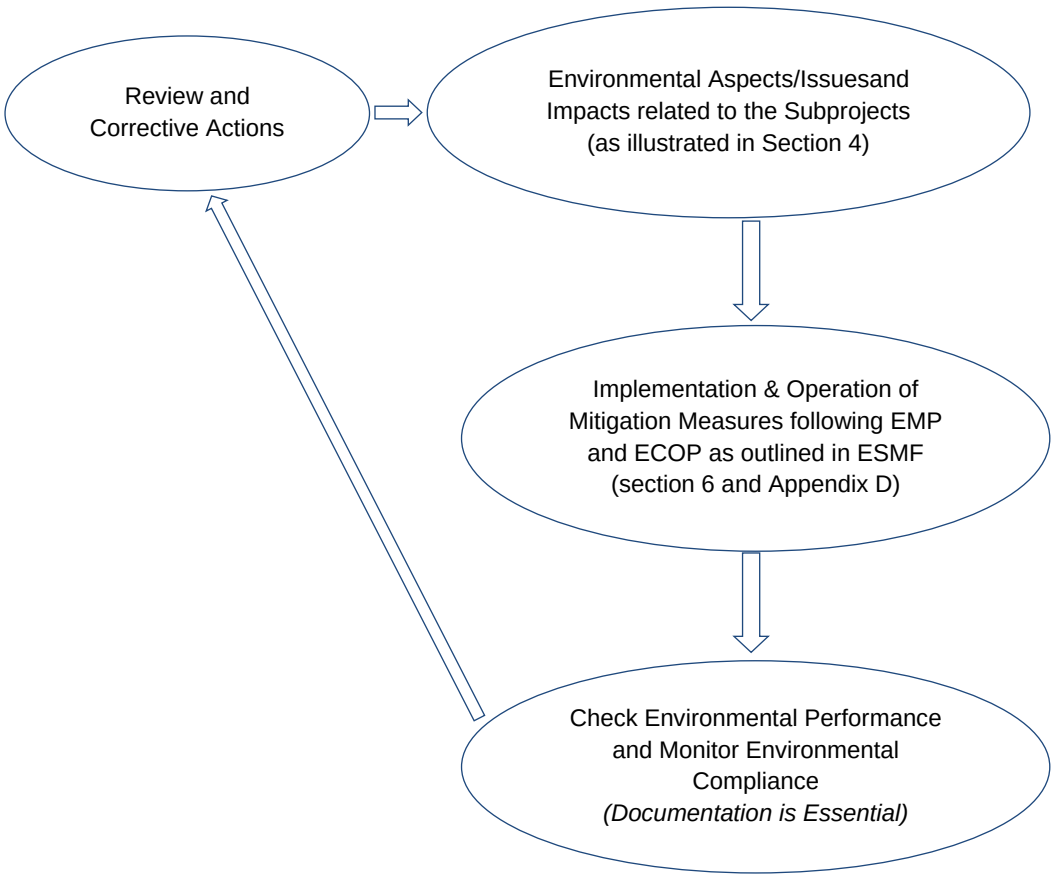


Figure 8-1: Environmental monitoring system

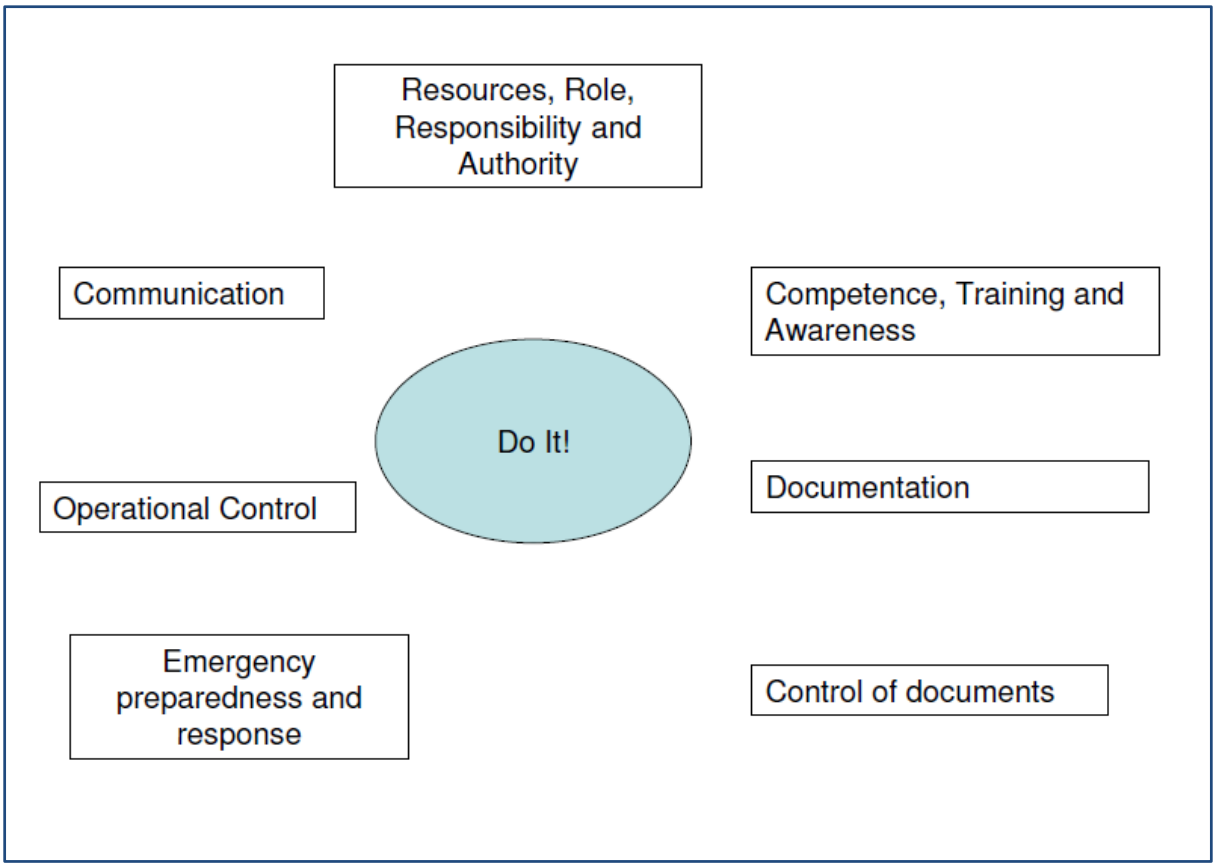


Figure 8-2: Requirement for the Implementation and Operation of the Environmental Monitoring System

Table 8.5: Environmental Monitoring Plan for Substation Subprojects

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Preconstruction/Construction Stage							
Felling of trees and clearing of vegetation	▪ Checking whether proper compensation as mentioned in RP is received by PAPs.	DOE/FD	Inspection	Regular during tree felling and site clearing operations	Within ROW of substation & access road sites	Contractor/FD	DSC/PGCB
Fauna (Wildlife)	Checking whether wildlife is disturbing/killing by the workers	DOE/FD	Inspection	Weekly	ROW of Route	Contractor/FD	DSC/PGCB
Drainage Congestion/Flooding	▪ Checking drainage congestion & top of substation site above HFL	Hydrologica/Drainagel study	Inspection	Regular during earthworks	Substation site	Contractor	DSC/PGCB
Noise Pollution	Ambient noise level	DOE Noise Pollution Control Rules, 2006	Measurement	As & when required	At construction sites & camps	Contractor	DSC/PGCB
Dust Pollution	▪ Dust should be controlled by water spraying regularly specially during dry period.	DOE guidelines	Inspection	Daily	SS sites	Contractor	DSC/PGCB
Surface Water Quality	pH, BOD_5, COD, NH_{3-N}, PO_4	DOE Standards	Sampling and Laboratory Analysis	Quarterly	Nearby 3 Water bodies	Contractor	DSC/PGCB
Ground Water/Drinking Water Quality	pH, Mn, Fe, As, TC, FC	DOE Standards	Sampling and Laboratory Analysis	Quarterly	At 3 construction camps (in Chittagong, Comilla & Noakhali)	Contractor	DSC/PGCB
Pollution due to Wastes	▪ Checkingcollection, storage, transportation, and disposal of hazardous waste; ▪ Waste from construction site to be collected and disposed safely to the designated sites; and ▪ Wastes from labour camp to be disposed properly at the designated sites.	DOE guidelines	Inspection	Weekly	Construction camps	Contractor	DSC/PGCB
Traffic	▪ Checking meeting point of existing road	BRTA	Inspection	Daily	Meeting point	Contractor	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Congestion/Road Accident	& access road				of existing road & access road		
Occupational health and safety	Checking health, use of PPE & 1st aid facilities, DWQ, sanitation and accommodation	DOE/IFC guidelines	Inspection & testing of DWQ	Daily	At construction sites and camps	Contractor	DSC/PGCB
Community health and safety	Awareness of local people and staying safely from the project activities	DOE/IFC guidelines	Inspection	Monthly	At construction site and camps	Contractor	DSC/PGCB
Operation Stage							
Tree replantation	Replanting of saplings and checking replacement of dead saplings & nursing (watering & fertilizer) of saplings for 2 years	FD	Inspection	As & when required	Access road side slopes	FD	PGCB
Drainage congestion	Checking drainage congestion in the substation sites during monsoon	Hydrological/Drainage study	Inspection	As & when required during monsoon	Substation sites	PGCB	PGCB
Community health and safety	Community H&S nearby the substation site	DOE/IFC guidelines	Inspection	Monthly	Substation sites	PGCB	PGCB
Safety & Security of Substation & workers	Checking use of PPE & duty of security force	DOE/IFC guidelines	Inspection	Daily	Substation sites	PGCB	PGCB

Table 8.6: Environmental Monitoring Plan for TL/Lilo lines Subprojects

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Preconstruction/Construction Stage							
Requirement of land (Temporary requisition for 3 years)	▪ Ensure that PAPs get compensation as per RAP which needs to be prepared.	As per RAP	Inspection	As per RAP	ROW of the TL/LILOlilnes	DC	DSC/PGCB
Trimming of trees within ROW and clearing vegetation	▪ Checking whether proper compensation as mentioned in RAP is received by PAPs.	DOE/FD	Inspection	Daily during tree felling and site clearing	Trimming of trees within ROW and	FD	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
from the tower bases of the TL/LILO lines.				operations	clearing vegetation from the tower bases of the TL/LILO lines.		
Noise Pollution	Ambient noise level	DOE standards	Measurement	As & when required	At adjacent subproject cultural sites & construction camps	Contractor	DSC/PGCB
Pollution due to Wastes	▪ Checking storage, transportation, handling, and disposal of wastes; ▪ Wastes from construction sites and camps to be disposed properly at the designated waste dumping sites.	DOE guidelines	Inspection	Daily	Construction sites and camps	Contractor	DSC/PGCB
Surface Water Quality	pH, BOD_5, COD, NH_3, PO_4	DOE Standards	Sampling and Laboratory Analysis	Quarterly	River Crossing Site of Meghna-Gumti & Feni Riverby TL	Contractor	DSC/PGCB
Ground Water /Drinking Water Quality	pH, Mn, Fe, As, TC, FC	DOE Standards	Sampling and Laboratory Analysis	Quarterly	3 Construction camps(in Chittagong, Commilla & Noakhali)	Contractor	DSC/PGCB
Traffic congestion/Road Accident	Checking road crossing points, road adjacent to towers etc.	BRTA	Inspection	Daily	At road/Rly. crossing points & road adjacent to towers	Contractor	DSC/PGCB
Cutural sites in SPIA (such as a mosque at R/S at about 20m distance at ch 48+300 and a gravegard at L/S at	Checking whether these two cultural sites are affected by the project activities such as by noise, wastes etc.	DOE guidelines	Inspection	As & when required	A mosque at R/S at about 20m distance at ch 48+300 and a gravegard at L/S at about 25m	Contractor	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
about 25m distance from Korerhat-Choumohini TL.					distance from Korerhat-Choumohini TL.		
Occupational health and safety	Use of PPE, general health, water supply and sanitation	DOE/IFC guidelines	Inspection	Daily	At construction sites and camps	Contractor	DSC/PGCB
Community health and safety	Awareness of local people	DOE/IFC guidelines	Inspection	Monthly	At construction site and crossing of roads	Contractor	DSC/PGCB
Operation Stage							
Tall trees	Trimming of tall trees under the TL	ESMF	Inspection	Once every year and as directed by the relevant engineer of PGCB	Along the TL/LILO Lines	PGCB	PGCB
EMF	Checking of clearance of TL & top of houses (for housing structires) and for river crossing clearance from HFL to TL	Australian Standard for the safety of power lines (No BD standard & no device available in BD)	Inspection	As & when required	At populated /housing area where TL/Lilio lines passes over	PGCB	PGCB
Short circuit/accident	Safety	DOE guidelines	Inspection	Daily	Along the TL/Lines	PGCB	PGCB
OccupationalHealth and Safety (OHS)	Use of PPE	As required	Inspection	Daily	Along the TL/LILO lines	PGCB	PGCB
Power Supply	Access to electricity in the rural area on priority basis.	DOE/PDB guidelines	Inspection	Whole project period	Along the TL/LILO lines	PGCB	PGCB

8.4 Environmental Code of Practice

The design, construction, installation and rehabilitation of electricity works shall take into consideration environmental issues and concerns. Factors to consider include, but are not limited to:

- the promotion of energy efficiency,
- the efficient use of non-renewable resources,
- the use of renewable resources,
- the social impact of new projects, and community concerns,
- the minimization of environmental damage, including visual impacts,
- tree management programs, and
- a reduction in and the correct disposal of waste products.

A Standard Environmental Code of Practice (ECOP) is prepared as a guideline for environment management of different components of the following subprojects:

I. Construction of Sub-stations, and
II. Construction of Transmission Lines/LILO Lines.

The main objective of an ECOP is to manage construction activities in harmony with the environment in an effort to contribute to the well-being of the community and the environment by: (a) Minimizing pollution, (b) Sustaining eco-systems, (c) Conserving cultural heritage, and (d) Enhancing amenity. The ECOP has designed to address all potential impacts during the construction of the substations, rehabilitation of the transmission/distribution cable, and construction of the new transmission/distribution lines by the PGCB and REB. The ECOP will provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. This ECP could be annexed in the general conditions of all the contracts carried out for the subprojects of the project. The list of ECOP, prepared for the subprojects of project is given below and the ECOP are given in Appendix A -.

ECOP-1: Project Planning and Design,
ECOP-2: Route Selection,
ECOP-3: Tower/Pole Erection,
ECOP-4: Overhead Power Cable Installation,
ECOP-5: Installation of Transformer on H-Pole,
ECOP-6: Substation Site Preparation,
ECOP-7: Construction Camps,
ECOP-8: Topsoil Salvage, Storage and Replacement,
ECOP-9: Borrow Areas,
ECOP-10: Slope Stability and Erosion Control,
ECOP-11: Waste Management,
ECOP-12: Water Bodies,
ECOP-13: Water Quality,
ECOP-14: Drainage,
ECOP-15: Electromagnetic Field,
ECOP-16: Public Health and Safety,
ECOP-17: Material Storage, Transport & Handling,
ECOP-18: Vegetation Management

ECOP-19: Natural Habitats,
ECOP-20: Occupational Health and safety, and
ECOP-21: Community Health and safety.

It is recommended that all major contractors to be procured under the Project will be a compliant of ISO 14001. This will be done by the PGCB imposing the requirements of ISO certification during prequalification of contractors. These Contractors should prepare a 'Construction Environmental Management Plan' (CEMP) demonstrating the manner in which they will comply with the requirements of ECP and the mitigation measures proposed in the EMP. The CEMP will form the part of the contract documents and will be used as monitoring tool for compliance. Violation of the compliance requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractors.

8.5 Approximate EMP Budget

Cost estimates are prepared for all the mitigation and monitoring measures proposed in the EMP. The details of the cost estimates and the budget during construction stage and first year of the operation stage for the mitigation measures are given in Table 8.7.

The cost estimates also includes the budget for environmental monitoring, consultants for EMP implementation, institutional strengthening and capacity building of PIU and environmental enhancement/compensation measures. The total budget for EMP implementation during pre-construction/construction stages is estimated to be BDT 7,020,000. PGCB will use revenue budget for operational phase EMP at actual cost basis.

Table 8.7: Approximate EMP Budget for the Project during Preconstruction/Construction stage

Sl. No.	Environmental Components	Items	Unit	Quantity	Rate (BDT)	Amount (BDT)
A. Substation Subprojects						
1	Waste Management	Handling, storage and disposal in the designated area of the construction camp	Lump-sum			800,000
2	Noise Level	Purchase Noise Meter and do monitoring as prescribed in the monitoring plan	Lump-sum			50,000
3	Surface Water Quality	Sampling and testing of water quarterly/year for 3 years at nearby 3 waterbodies)	No.	36	10,000	360,000
4	Ground Water/Drinking Water Quality	Sampling and testing of water quarterly/year at 3 construction camp sites	No.	36	10,000	360,000
6	Occupational and Health and Safety (H&S)	H&S measures for workers (such as PPE, Fast Aid Boxes etc.)	Lump-sum			1,000,000
7	Replantation of saplings	Replantation of trees with nursing and fence at the end of construction or starting of operation (preperably during monsoon period)	No.	7,000	200	1400,000

Sl. No.	Environmental Components	Items	Unit	Quantity	Rate (BDT)	Amount (BDT)
8	Training		Lump-sum			100,000
9	Contingency		Lump-sum			100,000
Total:						4,170,000
B. TL/Lilo Lines Subprojects						
1	Waste Management	Handling, storage and disposal in the designated area of the Construction Camp	Lump-sum			1,000,000
2	Noise Level	Purchase Noise Meter and do monitoring as prescribed in the monitoring plan	Lump-sum			50,000
3	Surface Water Quality	Sampling and testing of water quarterly/year for 3 years at Feni and Meghna-Gumti river crossing sites of the TL.	No.	24	10,000	240,000
4	Drinking/Ground Water Quality	Sampling and testing of water quarterly/year for 3 years at 3 const. camps	No.	36	10,000	360,000
5	Occupational Health and Safety (H&S)	H&S measures for workers (such as PPE, Fast Aid Boxes etc.)	Lump-sum			1,000,000
6	Training	LS				100000
7	Contingency	LS				100000
Total:						2,850,000
Grand Total (A+B):						7,020,000

9 INSTITUTIONAL ARRANGEMENT AND CAPACITY BUILDING

9.1 General

Institutional arrangement is essential to implement the suggested mitigation measures and to execute monitoring plan at different project phases as illustrated in chapter 8 under EMP. The implementation of the EMP also requires capacity building of the EMP implementation agency through training needs and plan. The structured institutional settings facilitate proper implementation of the environment safeguard requirements for the project. The PGCB is the key authority to follow up all the relevant environmental safeguard requirements following institutional arrangement.

Environmental & Social Unit (ESU) under the Technical Services Wing of PGCB headed by Superintending Engineer and supported by Executive Engineer, Sub-division Engineer, Assistant Engineer and Sub Assistant Engineer is the responsible unit to monitor that environmental safeguard requirement is being properly followed for the project. Figure 9.1 represents the proposed organizational structure to implement the EMP for the project which is a part of institutional arrangement. The selected contractor(s) for the subprojects will be responsible to implement the suggested mitigation measures and monitoring plan during the construction and operation stages of the project and the Design and Construction Supervision Consultant (DSC), engaged for the subprojects will be responsible to monitor and supervise the contractor(s) environmental activities to ensure that relevant environmental safeguard requirement is being properly followed or not. The DSC will report to Project Implementing Unit (PIU) and then PIU will maintain reporting, information management and liaison with ESU of PGCB Head Quarter and Project Director (PD) in time and following structured procedures.

9.2 Institutional Arrangement and Responsibilities

9.2.1 Power Grid Company of Bangladesh (PGCB)

The PGCB has already created an Environment and Social Unit (ESU) in the regular organogram. The ESU of PGCB under the leadership of the Superintending Engineer (SE), Planning Division. In addition, PGCB will hire an individual consultant for safeguard management of the project. He will review the environment screening/assessment report and do the periodic supervision of EMP implementation. The organogram for the proposed ESU of the PGCB for the project, as shown below in Figure 9.1:

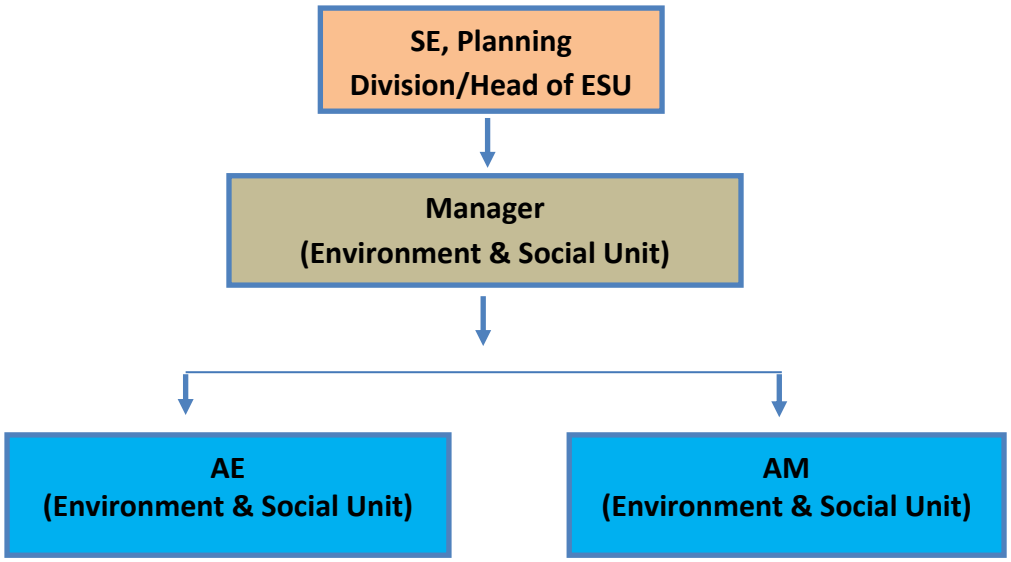


Figure 9-1: - Organogram of ESU, PGCB

The ESU will be responsible for overall environmental and social management of sub-projects to be implemented under the proposed project. The PGCB field level staff will carry out "Environmental and Social Screening" and "Analysis of Alternatives" of sub-projects with the support from individual consultant for first year and onward, following the guidelines contained in the ESMF.

Further ESA will be carried out by the unit or individual consultant to be hired by PGCB. The PGCB ESU will review the documents and be responsible for implementation of EMP (as well as RAP, TPP) and preparation of quarterly reports. The PGCB will hire an NGO with requisite experience in implementing resettlement programs and working in tribal areas and issues for the field level implementation of the RAP and TPP under the direct supervision of the ESU and in close coordination with the contractors. Figure 9.2 shows activities and institutional responsibilities for overall implementation of the proposed project by the PGCB.

Activity	Responsibility
Identification of sub-project/ project activities. Prepare/ complete: • Subproject Description (Form-1) • Environmental/social Screening (Form-2) • Analysis of Alternatives (Form-3)	Individual Consultant of Power Cell with PGCB field level staff
⇩	
Review of project documents, including Forms-1, 2 and 3 and Screening / assessment	Individual Consultant of project and ESU, PGCB
⇩ Additional Environmental/ Social Assessment (ESA)	
Carry out: (a) IEE and EMP or (b) full scale ESIA (including RAP, TPP, if needed); following the ESMF	Independent consultant
⇩	
(1) Review of ESA by PGCB (2) Obtainingnecessary environmental clearance from the DOE and WB	Individual Consultant of project and ESU, PGCB
⇩	
Implementation of EMP/RAP/TPP/ ECOP during "construction phase" of project components.	The RAP and TPP will be implemented by an NGO hired by the client under the direct supervision of the ESU and in coordination with the Contractor. EMP Implemented by the Contractor and Supervised by PGCB's field staff. Periodic monitoring by Individual Consultant and ESU, PGCB
⇩	
Preparation of quarterly progress and monitoring reports	Social safeguard report by the contracted NGO. One Environment report prepared by the Contractor. Another report prepared by Individual Consultant and ESU, PGCB.
⇩	
Implementation of EMP/ SMF during "operational phase" of project components, including monitoring and quarterly reporting	NGO and PGCB's field staff with supports from ESU, PGCB

Figure 9-2: Institutional set up, including major activities and assignment of responsibility for their execution, for implementation of proposed project by the PGCB

9.2.2 Department of Environment (DOE)

The designated institution for overseeing environmental management in Bangladesh is the Department of Environment (DOE). The DoE is responsible for ensuring that the IEE is carried out following the requirements of the Environmental Conservation Act (1995) and Rules (1997). Unfortunately the DOE is a relatively new institution and has been poorly resourced in the past. It has an institutional presence only down to divisional level (six offices in Bogra, Sylhet, Chittagong, Rajshahi, Khulna, Comilla plus a combined headquarters in Dhaka). It thus falls to each of the

government line agencies to ensure that their work abides by the environmental laws, rules and procedures, with overall direction given by the DOE.

9.2.3 Forest Department (FD)

The Forest Department (FD) sometimes requires authorization for the cutting of trees, especially if they are in specially planted areas under their jurisdiction. To obtain the correct clearance documentation can be time consuming, although with the proposed project tree planting programs there will be far more tree cover as a result of the project. It is thus vital to ensure that adequate time is made available to obtain the required clearance. As for the FD, it is vital to ensure that adequate time is made available in the program for obtaining any such clearance that may be required. It is noted that due to running of 11.334 km longKorerhat-BSRM LILO line over the pocket hilly area (max. 6m ht)with forest trees (from ch 3+450-11+700), prior to start construction need clearance from the Forest Department (FD) of Bangladesh.

9.2.4 Design and Supervision Consultants (DSC)

The proposed framework for implementation of the project shall utilize consultancy services from both international and national companies for the overall design, management and supervision of construction works of the subprojects under the project.

9.2.5 Contractors

The tender for the construction of the subproject would be national/international competitive bidding contractors. There will be a need for environmental awareness rising, particularly as it relates to directly construction impacts and especially site health and safety issues. The need to develop self-regulation of the contractors will have to be emphasized, with the consultants supervising role being to check on conformity with the relevant clauses in construction contracts as well as national and WB legislation and regulations.

In these regards, the following clauses can be incorporated in the project contract document:

- The contractor shall take all reasonable steps to protect the environment and avoid damage and nuisance arising because of his construction activities/operations.
- The contractor shall comply with all statutes and regulations concerning the execution of works as mentioned in DOE and WB environmental guidelines.
- The contractor shall be responsible for familiarizing himself with all legislation elating to environmental protection that is relevant to his activities. Reference to national environmental quality guidelines should be made.
- The contractor shall be responsible for the costs of cleaning up any environmental pollution resulting from his activities if methods for doing so are available and effective.
- In case of surface water pollution from contractor activities, the contractor shall take adequate preventive measures for not doing so and in case of pollution if occurred the contractor shall be responsible to make the water to its original quality especially where the surface water has potential use. Cost including for the tests and the purification shall be to the contractor's own costs.
- Where abstraction from a borehole by the contractor results in adverse effects on groundwater, which at the time of commencement of the contract was being used by the

local people, the contractor shall arrange supplies of equivalent quality and quantity to that previously.

- The contractor shall, at all times, maintain all sites under his control in a clean and tidy condition and shall provide appropriate and adequate facilities for the temporary storage of all wastes before disposal.
- The contractor shall be responsible for the safe transportation and disposal of all wastes generated because of his activities in such a manner as to not cause environmental pollution or hazards to health in any form. In the event of any third party being employed to dispose of wastes, the contractor shall be considered to have discharged his responsibilities under this clause from the time the wastes leave sites under his control, providing that he has exercised due diligence in ascertaining that the proposed transport and disposal arrangements such as to not cause pollution or health hazards.
- The contractor shall not allow waste oils or other petroleum derived wastes to be used as dust suppressants and that all reasonable precautions shall be taken to prevent accidental spillage of petroleum products, their contact with soil or discharge into water courses.
- The contractor shall be responsible for the provision of adequate sanitary facilities for the construction workforce (including those employed under subcontracts) at all construction and camp sites. The contractor shall not knowledgably allow the discharge of any untreated sanitary wastes to groundwater or surface water. Before mobilization of the construction workforce, the contractor shall provide details of sanitary arrangements to the Engineer for approval. The detail should include maintenance and operation plants and generally be sufficient to allow the Engineer to assess whether the proposed facilities are adequate.
- All vehicles and plant operated by the Contractor (including subcontractors) shall be maintained according to the original manufacturers' specifications and manuals, with particular regard to the control of noise and/or smoke emissions. The Engineer shall have the right to require the contractor to replace or rectify any vehicle or plant that he thinks emits excessive noise and/or smoke, within 48 hours of notice in writing.
- The contractor shall make every reasonable effort to reduce noise nuisance caused by construction activities, including siting of crusher and ancillary plant in locations where the distance between them and residential areas such it results in attenuation of noise at existing residential areas is.
- In case of any traffic disruption by the construction activities of the contractor (or his appointed subcontractors), the contractor shall be responsible to provide alterative road access to the full operational use for the vehicles. The facilities in this regard shall be such that either party is not disturbed.
- In case of any existing infrastructure/properties, damaged by the contractor (or his appointed subcontractor), the contractor shall notify the Engineer of it and at his own cost shall repair the road to its original condition.
- Upon completion of the construction works, the contractor shall remove all equipment, surplus material, wastes and temporary works of every kind, and the site in clean condition to the satisfaction of the Engineer.

In addition of Contractor's general arrangement to continue the construction and rehabilitation work under the project, contractor must hire at least one environment, health and safety supervisor/engineer for each subproject before the commencement of work. The Contractor/Subcontractor shall abide by the rules of regulation of the Occupational health and safety as stipulated in the Labour Act-2006 and BNBC codes of Bangladesh. The contractor shall also

abide by the clauses of health and safety in the clauses at General Condition and subsequent Particular Condition of the bid document.

Role of Environment, Health and Safety Supervisor/Engineer: Primary role is to monitor the movement of people, workers and equipment, give timely warnings of any risk or non-compliance with safe work procedures and, where necessary, stop work if a risk situation escalates or cannot be minimized as well as look the potential environmental issues (air pollution, noise level, water quality, waste management etc.).

The tasks of environment and safety supervisor/manager include the following:

- Ensure first aid facilities and PPE as mentioned in Table 6.1 and 6.2 for workers at the sites.
- Provide orientation to workers before start of the subproject activities.
- Warn the workers of any imminent or deteriorating risk situation that could result in an accident, and instruct when it is safe to proceed
- Ensure restrain from undertaking any other tasks that may distract the workers focus on the work, mainly, work on or near live overhead conductors, work on transmission and communication towers.
- Stop the work, if necessary, safety would not be ensured.
- Pause the work while the safety observer changes position.
- Ensure special safety during elevated work platform work or crane operations on or near live conductors.
- Ensure proper collection and disposal of solid wastes within the construction site.
- Ensure proper infrastructure facilities, water supply and sanitation facilities for all workers.

The contractor will prepare a monitoring report on environment and safety for each subproject at every month during the construction/rehabilitation of transmission line and substation.

The proposed overall organizational structure of the implementation arrangement of the EMP of the project is shown in the Figure 9.3.

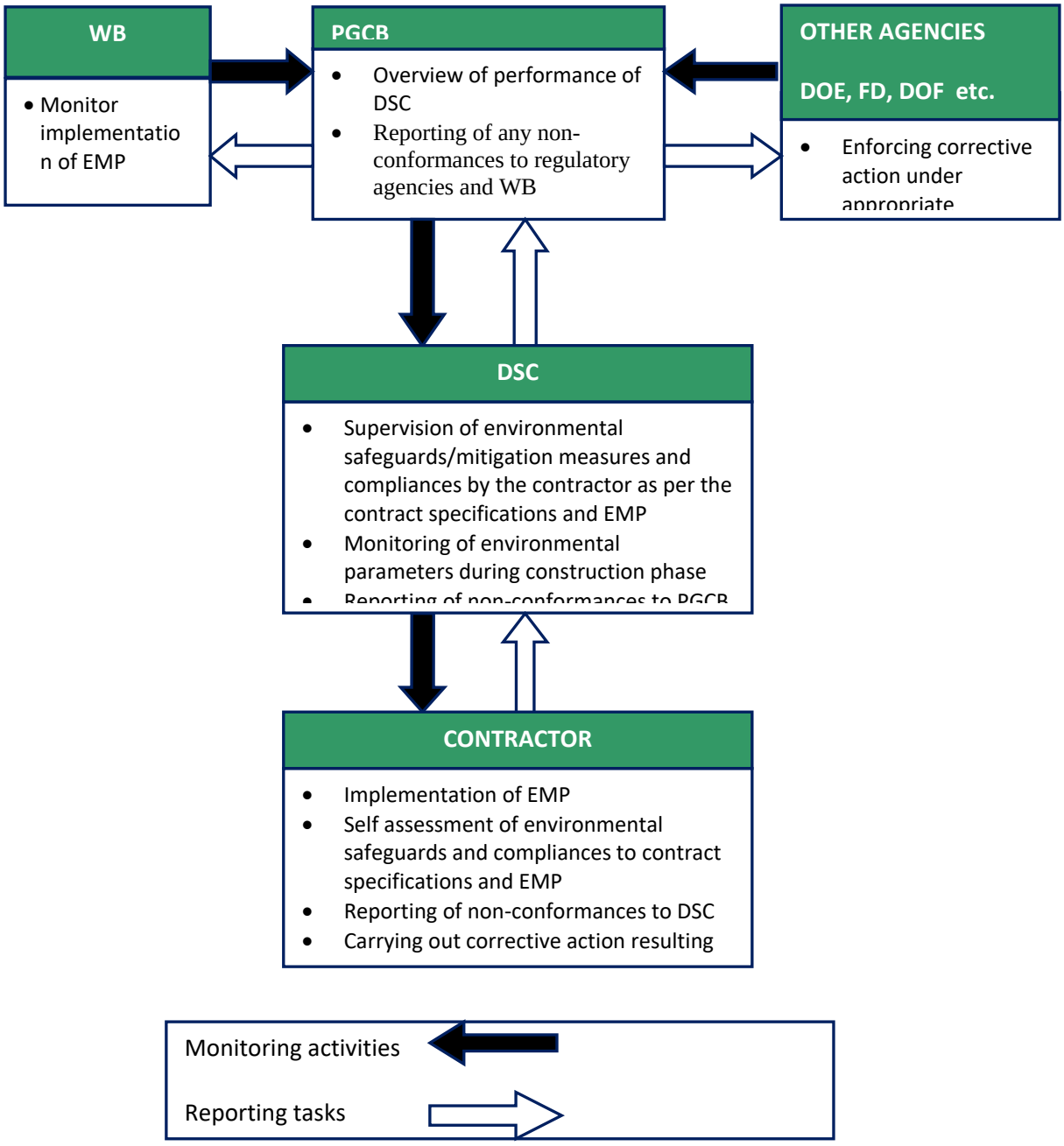


Figure 9-3: Organogram for the EMP Implementation of the Project

9.3 Capacity Building and Training Requirements

As a part of the "overall environmental and social assessment", existing environmental practices in recently completed and ongoing projects and capacities of PGCB have been evaluated through analysis of organizational set up and interviewing officials/ engineers. Details of the evaluation are presented under "Overall Environmental Assessment". It appears that the engineers at the PGCB have limited exposure to environmental/social assessment and management. As discussed above, the PGCB will be responsible for carrying out "environmental/social screening" and "analysis of

alternatives", and guidelines have been provided in the ESMF for carrying out these activities. However, basic training on regulatory requirements, environmental impacts, and environmental assessment and management would greatly improve the capability of relevant PGCB engineers/officials in carrying out their responsibilities under the proposed project.

The PGCB will employ individual/supervision/DSM consultant, who would support PGCB in overall environmental/social management. However, since the overall responsibility of environmental management lies with the PGCB, they need to ensure that the consultants are carrying out their responsibilities properly. For this purpose, it is important that the PGCB engineers/officials receive advanced training on environmental management and monitoring. Such training will assist them in properly overseeing the activities of the consultant engaged in environmental management of the proposed project, following the ESMF.

During the implementation of the project, the PGCB will develop their own organizational environment and occupational health & safety strategy and guidelines for their regular development work.

The training requirements of the PGCB staff are summarized in Table 9.1. It is also advised to provide the basic training for key personnel on regulatory requirements, environmental impacts, and environmental assessment and management in home or abroad. It may be mentioned that cost of training and capacity building is included in the project resources.

Table 9.1: Training Plan for the Proposed Project

Target Group	Subject(s)	Method	Time Frame
Project relevant engineers/officers of PGCB, contractors	General environmental awareness, regulatory requirements, environmental impacts and mitigation, analysis of alternatives, environmental management (EMP and ECOP) and H&S	Workshop/Seminar	Prior to start the construction activities of the subprojects
Project relevant engineers/officers of PGCB, contractors	Environmental assessment, environmental management (EMP, ECOP), monitoring activities, H&S.	Workshop /Seminar	Just after starting the construction of subprojects

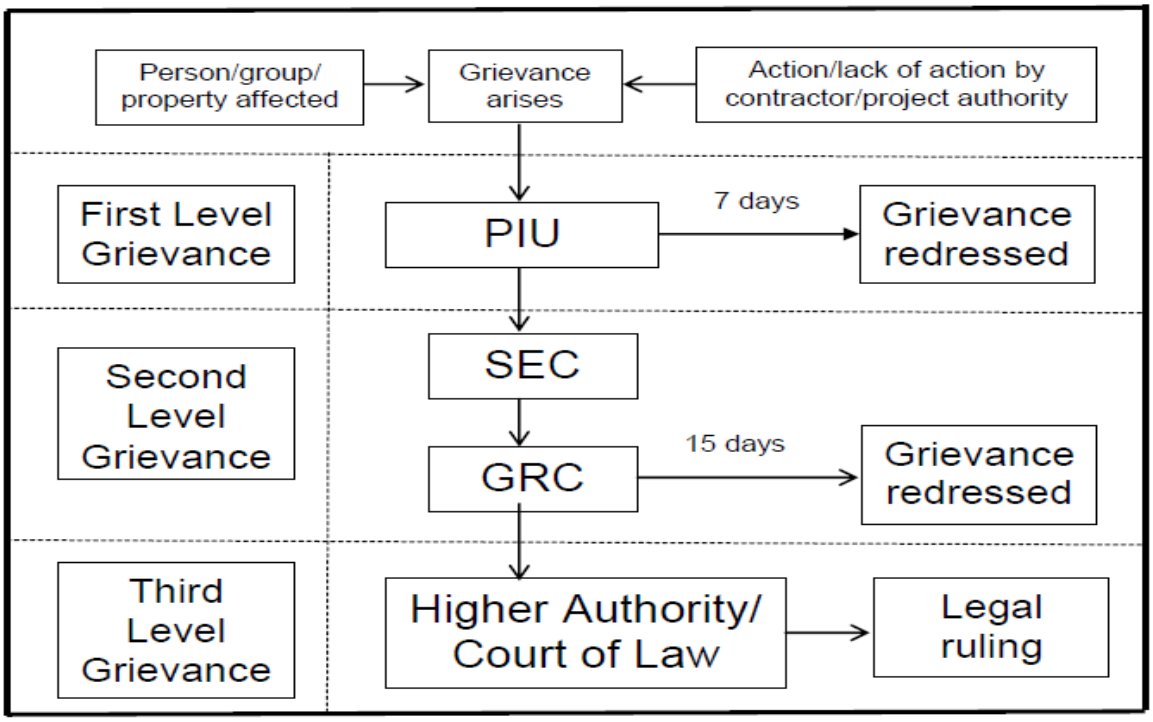
It would be essential to understand the legislative framework and enhance capacity of ESU of PGCB and Field Officer (Environment) for analysing the applicability of various environmental legislations and clearances, approvals and compliance monitoring requirements. An environmental legislation applicability matrix framework has already been given in Chapter 2 of this report for ready reference.

9.4 Grievance Redress Mechanism

The concern/grievances from local/affected people may come up related to inappropriate implementation of various components of EMP or the overall components/activities of the subproject itself. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach. A Grievance Redress Mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project. The GRM aims to

provide a trusted way to voice and resolve concerns linked to the project, and to be an effective way to address affected people's concerns.

The ESU of the PGCB shall make the public aware of the GRM through public awareness campaigns. The contact phone number of the respective ESC will serve as a hotline for complaints, and shall be publicized through the media and placed on notice boards outside their offices and at construction sites. The project information brochure will include information on the GRM and shall be widely disseminated through the project area by the Environmental Specialist/Engineer in the ESC, with support from the NGOs and communication firm. Grievances can be filed in writing or by phone with any member of the ESC. Figure 9.4 represents how GRM will be implemented for the project.



GRC=Grievance Redress Mechanism, PIU= Project Implementation Unit, SEC= Soci Environmental Circle

Figure 9-4: Proposed GRM for the Project

First Tier of GRM: The Superintending Engineer (SE), SEC of PGCB (member of CC of PGCB, HQC) shall be the designated person as the key specialist for grievance redress (1st tier). Resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

- Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); and

- Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed off.

The updated register of grievances and complaints will be available to the public at the SEC office, construction site, and other key public offices along the project area. Should the grievance remain unresolved, it will be elevated to the second tier.

Second Tier of GRM: Adl. CE of MSW of PGCB, will activate the second tier of GRM by referring the unresolved issue (with written documentation). The GRC shall be established by the SEC of PGCB before commencement of site works. The GRC will consist of the following persons: (i) project director; (ii) representative of city ward; (iii) representative of the affected persons; (iv) representative of the local deputy commissioner's office (land); and (v) representative of the Department of Environment (DOE) for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his or her concerns and issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's judicial or administrative remedies.

The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues, including dust, noise, utilities, power and water supply, waste disposal, traffic interference, and public safety, as well as social issues such as land acquisition, asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them, and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC. The SE, SEC will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

Third Tier of GRM: In the event that a grievance cannot be resolved directly by the PIU (first tier) or GRC (second tier), the affected person can seek alternative redress through the city ward committees or in appropriate courts. The PIU or GRC will be kept informed by the city corporation authority. The grievance redress mechanism and procedure has depicted in Figure 9.4. The monitoring reports of the EMP and the resettlement plan implementation shall include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification (I.D.) with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending).

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

The proposed Enhancement and Strengthening of Power Network in Eastern Region (ESPNER) project, funded by WB is expected to provide support for the construction of the substations and TLs/LILOlines of thePGCB of Bangladesh. Main components of the project include:

- Construction of new 230/132 kV two substations and new 132/33 kV 10 substations;
- Construction of eight new 288.642 km long 132 kV, 230kVand 400kV TL; and
- Construction of new eightLILO lines ;

The present power network in Greater Comilla, Noakhali and Chittagong areas of Bangladesh is aged and suffering numerous problems as system demand is growing rapidly. The greater Comilla and Noakhali areas are the second largest demand areas after the capital city of Dhaka. The greater Chittagong area is on the verge of massive industrialization as the government is taking initiatives to set up multiple economic zones, upgrade port facility and transportation network. Hence, the project was conceptualized with a rationale to expand the 230 kV transmission systems and to strengthen the 132 kV transmission systems in the project area, in order to, eliminate the operational bottlenecks caused due to inadequacy of the existing system. The project will also provide an adequate infrastructure for the future power sector development of the area.

The TOR has prepared to carryout detailed IEE for the project in accordance with the relevant laws and regulations of the GOB and the WB. The specific environmental guideline for the power sector is not available in Bangladesh. However the DOE environmental guidelines for the industries/projects provide a general framework for conducting environmental study for the entire sector. Therefore the proposed IEE will be conducted following the DOE environmental guidelines. In addition, it is suggested to follow the ESMF of Rural Electricity Transmission and Distribution Project (RETDP) of PGCB and BREB as well as WB environmental guidelines for the power sector.

The scope of work of the IEEincludes: (a) Review of relevant information/data/documents from secondary sources, and identify gaps to be filled, relevant to the environmental screening needs from primary surveys. (b) Provide a description of the environment (such as baseline data on physical, biological/ecological and socio-economic characteristics of the subproject sites along with SPIA). (c) Represent the primary surveys where include baseline (air, water, noise, and riverbed) environmental quality monitoring at representative and sensitive locations, and identification of all macro-level environmental issues within the SPIA. (d)Survey the environmentally sensitive locations on and along the sub-projects and within the SPIA. (e)Arrange stakeholder consultations/individual consultations within the local people from all professions to find out their opinions on the subprojects. (f) Analysis of alternatives to the proposed subproject. (g) Identify and assessment of potential environmental impacts due to implementation of the subproject. (h) Formulation of Environmental Management Plan (EMP)

Initially, 3 sites for each proposed substation and 3 routes for each proposed TL have been selected and environmental screening and assessment for these 3 substation sites and TL routes have been done for identifying the potential impacts based on the collected baseline information/data by the environmental specialist and survey team . From these 3 sites/routes, environmentally suitable

substation site and TL have been finally selected. The potential impacts for the selected substation sites and TL routes during preconstruction/construction and operation stages of the subprojects are:

(a) For Substation Subprojects:

General/Common Potential Impacts:

(i) During Preconstruction/Construction: A total of 86.62 acres land acquisition, clearing of vegetation including 3,501 trees , hydrology/ drainage congestion, top soils, and dust pollution, noise pollution, waste pollution , soil pollution, traffic congestion, occupational H&S, community H&S, and employment generation; and

(ii) During Operation: Drainage congestion, tree replantation (a total 7000 various trees), landscape, occupational H&S, community H&S, and improvement of social and economical life of the people.

Specific Impacts ofSubstations

(i) During Preconstruction/Construction: 2945 trees, 136 trees & 420 trees need to be cut due to construction of Korerhat, Basurhat & Chandina substation respectfully. SW pollution of waterbodies will be occurred due to construction of Maijdee, Basurhat& Chandina substation respectfully.

(b) For Subproject: TL&LILO Lines

General/Common Impacts:

(i) Pre-construction/Construction Phase: Trimming of 20,252 trees, disturbance of fauna (wildlife), loss of top soil due to tower, noise pollution , air/dust pollution , soil pollution, pollution due to wastes, aquatic habitat , traffic congestion/road accident , siting of construction camps, occupational H&S, community H&S and employment generation/income

(ii) Operation Stage: Landscape, community HS&, Occupational H&S, improvement of social & economic life, short circuit/accident, electro-magnetic fields (EMF).

Specific Impacts

(i) Preconstruction/Construction Stage: Disrubtion of boat movement and water pollurion in the Meghna- Gumti River at ch 33+500 due to construction of the Kachua-Gazaria TL and disrubtion of boat movement and water pollution in the Feni River at ch 2+850 due to Korerhat-Chowmuhini TL; a mosque due at 20m far away at R/S of the TL at ch 48+300 and a graveyard at 25m faraway at L/S of the TL due to construction of the Korerhat- Choumohini TL.Pocket hilly areas with forest small to medium trees will be affected by trimming due construction of Korerhat-BSRM LILO line.

The potential impacts during construction stage are short-term that can be avoided or eliminate to ed or reduced by adopting the mitigation measures properly. Therefore, the anticipated negative construction related impacts could be mostly controlled/minimized or eliminated by taking suggested mitigation measures and manage the implementation of the mitigation measures through the EMP including effective monitoring plan during pre-construction/construction and operation phases of the project.

The potential impacts during operation are long term and PGCB should ensure to mitigate these impacts through implementation of the EMP including monitoring plan properely. Total approximatebudget for EMP is about BDT7,124,000.

10.2 Recommendations

Based on the findings of the IEE study, the following can be recommended:

- Based on the EMP of the IEE, Construction Environmental Management Plan (CEMP) should be prepared by the contractor prior to start construction of the project and act accordingly during construction;
- The EMP will be included in the bid document of the civil works along with adequate EMP budget and eventually become part of the civil works contract (s);
- The mitigation measures for the negative impacts and enhancement measures for the positive impacts of the project as mentioned in the EMP must be implemented by the contractor (s) properly in schedule time; and
- The main tool for the successful implementation of the EMP is the environmental monitoring during various stages of the project, which must be carried out properly in time by the client/DSC/other relevant organisations.

11. REFERENCES

1.Bangladesh Bureau of Statistics (BBS). 2011. *Population and Housing Census*. Dhaka, Bangladesh: Bangladesh Bureau of Statistics.

2.Bangladesh Centre for Advanced Studies (BCAS). 1999. Guide to the Environmental Conservation Act 1995 and Rules 1997. Dhaka: BCAS.

3.Bangladesh Meteorological Department (BMD), Ministry of Defense, Government of the People's Republic of Bangladesh, 2016.Climatic Database: Rainfall, Temperature, Relative Humidity and Wind Speed for Comilla, Feni and Sitakundo station, 2061-2015. Dhaka: BMD.

4.Graphosman, World Atlas, January 1996.

5.Brammer, H., 1996. The Geography of the Soils of Bangladesh. Dhaka: University Press Limited.

6.Department of Environment (DOE), Ministry of Environment and Forest, Government of the People's Republic of Bangladesh, 1997.IEE Guidelines for Industries. Dhaka: DOE.

7.Environmental Conservation Rules 1997. (Schedule 3), Dhaka: Ministry of Law and Justice, Government of the People's Republic of Bangladesh.

8.Farooque, M. & Hasan, S. R., 2004. Laws Regulating Environment in Bangladesh. Dhaka: Bangladesh Environmental Lawyers Association (BELA).

9.International Union for Conservation of Nature (IUCN), 2000a.Red Book of Threatened Animals of Bangladesh. Dhaka: IUCN-Bangladesh.

10.International Union for Conservation of Nature (IUCN), 2000b.Red Book of Threatened Birds of Bangladesh. Dhaka: IUCN-Bangladesh.

11.International Union for Conservation of Nature (IUCN), 2000c.Red Book of Threatened Amphibians and Reptiles of Bangladesh. Dhaka: IUCN-Bangladesh.

12.International Union for Conservation of Nature (IUCN), 2003.Threatened Animals of Bangladesh. Dhaka: IUCN-Bangladesh.

13.Rashid, H., 1977. Geography of Bangladesh. Dhaka: University Press Limited.

14.Soil Resource Development Institute (SRDI), 1997. Physiography of Bangladesh. Dhaka: SRDI, Ministry of Agriculture.

15.Soil Resource Development Institute (SRDI), 1998. Agro-ecological regions of Bangladesh. Dhaka: SRDI, Ministry of Agriculture.

16. Topographical Survey of the SS and TL/Lilo Lines Subproject Area, 2017

17. Socio-Economic Survey of the ESPNER Project, June-July, 2017.

18. TOR of the proposed ESPNER Project, 2017.

19. Monthly Environmental Progress Report of the KMG Project under RHD , funded by JICA, January 2016.

20. Monthly Environmental Progress Report of the CCORRP Project under CDA, Funded by JICA, May 2017.

APPENDIX – A: ENVIRONMENTAL CODE OF PRACTICE (ECOP)

The Environmental Code of Practice (ECOP) is a guideline for eliminate or reducing environment impacts/risks due to construction of the subprojects under RETDP of PGCB (construction of substations, construction of 33kV /132kV Transmission Lines). The relevant ECOP of the ESPNER under PGCB are as follows:

ECOP 1.0: Planning and Design Phases of a Project

1.1 General

This ECOP details the factors to be considered during project preparation to avoid/address environmental concerns through modifications in project design and incorporation of mitigation measures.

1.2 Compliance to Legal Requirements

The bid document shall include the various applicable clearances pertaining to environmental management and shall contain the necessary procedures for compliance of the same.

ECOP 2.0: Route Selection

2.1 Selection and Finalization of Alignment/Project Location

Adequate consultations with the communities to identify the concerns and preferences need to be taken up during selection of the alignment of the Transmission Lines (TL).

Alignment shall conform to the natural topography as far as possible to avoid excessive cut and fill.

Special care should be taken to align the routes along the hillside, which is stable and where cutting on hillside causes least disturbance.

Consultations with the local communities are to be conducted to obtain their suggestions and incorporate their concerns to address the potential environmental impacts.

Selection of site for substations should be done in consultation with the local communities addressing the environmental as well as social issues so as to cause least possible adverse impacts.

In case of flood prone areas and/or areas with very flat slopes, hydrological surveys have to be conducted before alignment finalization.

ECOP 3.0: Tower/Pole Erection

3.1 General

Erection of poles/towers for installation of 33kV/132kV power transmission lines of the PGCB involves:

Informing the local community about the installation schedule;

Marking and clearance of the designated locations for installation/replacement of SPC poles/Steel tower. Scope of this ECoP includes only the measures to address environmental concerns expected during the Pole erection process.

3.2 Pole/Tower Erection Activities by PGCB

Informing the community and local city/village councils about the likely schedule of erection;

After obtaining the consent of the community PGCB shall be responsible to stake out the designated locations.

3.3 Pole/Tower Erection Activities by the Contractor

The contractor shall submit the schedules and methods of operations for various items during the Pole/Tower erection operations to the PGCB for approval.

The clearance of sites shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures:

To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed.

In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.

The disposal of wastes shall be in accordance with the provisions of ECOP 11.0, “Waste Management”.

3.4 River Crossing Towers

All regulatory clearances shall be obtained before actual start of work. River Crossing Towers are very high electric towers specially designed to cross large rivers. Tower construction for river crossing will require proper protective measures against bank collapse. Sheet-Piling or Shore protection measures should be ensured while laying the foundation of the tower near the river bank or in the river bed. Pre-cast piles should be driven in with extreme care so as to expose the workers to the least possible danger.

Foundation should be checked for damages or uneven settlement following construction.

Proper safety measures should be ensured prior to river crossing jobs.

The work plans should be submitted by the contractor/engineer prior to commencement of the erection work. The work plan should provide detailed steps of foundation works in the river. River traffic movement should not be obstructed t any stage.

Proper protective measures should be adopted to prevent or minimize river water pollution.

Using of vibratory hammer for pile work is oreferable to reduce impact on acuatic habitat

Installation of underwater enclosures to minimize sound.

Use signage and construct fender(if necessary) to prevent collision with vessel

ECOP 4.0: Overhead Power Cable Installation

4.1 General

Installation of 33kV/132kV power distribution/transmission lines of the PGCB involves:

Informing the local community about the installation schedule;

Marking and clearance of the designated routes for installation/rehabilitation of overhead power lines. Scope of this ECOP includes only the measures to address environmental concerns expected during the power cable installation process.

4.2 Overhead Distribution/Transmission Cable Installation Activities by PGCB

Informing the community and local city/village councils about the likely schedule of installation;

After obtaining the consent of the community PGCB shall be responsible to stake out the designated route.

4.3 Overhead Distribution/Transmission Cable Installation Activities by the Contractor

The contractor shall submit the schedules and methods of operations for various items during the overhead power cable installation/rehabilitation operations to the PGCB for approval.

The clearance of sites shall involve the removal of all materials such as trees, bushes and rubbish. Towards this end, the Contractor shall adopt the following measures:

To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works, if any, shall be removed.

The disposal of wastes shall be in accordance with the provisions of ECOP 11.0, “Waste Management”.

All regulatory clearances shall be obtained before actual start of work.

ECOP 5.0: Installation of Transformers on H-Pole

5.1 General

Installation of Transformers on H-Poles along the route:

Informing the local community about the installation schedule;

Marking and clearance of the designated locations for installation of transformers on H-poles Scope of this ECOP includes only the measures to address environmental concerns expected during the power cable installation process.

5.2 Activities Involved in Transformer Installation on H-Pole by PGCB

Informing the community and local city/village councils about the likely schedule of installation;

After obtaining the consent of the community PGCB shall be responsible to stake out the designated locations.

5.3 Activities Involved in Transformer Installation on H-Pole by the Contractor

The contractor shall submit the schedules and methods of operations for various items during the installation operations of the transformers on H-Pole to the PGCB for approval.

The clearance of sites shall involve the removal of all materials such as trees, bushes and rubbish. Towards this end, the Contractor shall adopt the following measures:

To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works, if any, shall be removed.

The disposal of wastes shall be in accordance with the provisions of ECOP 7.0, "Waste Management".

All regulatory clearances shall be obtained before actual start of work.

ECOP 6.0: Site Preparation for Substations

6.1 General

The preparation of site for construction of electrical substations involves:

Marking and clearance of the required project area of all encroachments by the PGCB prior to mobilization of Contractor;

Informing the local community about construction schedule; and

Site preparation by the contractor prior to commencement of construction. Scope of this ECOP includes only the measures to address environmental concerns expected during the site preparation.

2.2 Site Preparation Activities by the PGCB

Informing the community and local village councils about the likely schedule of construction

After obtaining the consent of the community the PGCB shall be responsible to stake out the substation locations and boundary.

2.3 Site Preparation Activities by the Contractor

The contractor shall submit the schedules and methods of operations for various items during the construction operations to the PGCB for approval.

The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures:

To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed.

In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.

The disposal of wastes shall be in accordance with the provisions of ECOP 11.0, "Waste Management".

All regulatory clearances shall be obtained before actual start of work.

ECOP 7.0: Construction Camps

7.1 General

This ECOP provides guidelines on the selection, development, maintenance and restoration of construction camp sites in order to avoid or to mitigate against significant adverse environmental effects, both transient and permanent.

7.2 Construction Camp Location

During planning of the works consideration shall be given to the location of construction camps for the field implementation of the project. Construction camps and areas identified that may be suitable for the development of such camps shall be selected in consultation with the Engineer of the REB/PGCB. Areas which are not suitable for reasons such as environmental, cultural or social sensitivity shall also be identified. Wherever possible, construction camps shall be planned in areas that will have minimal adverse environmental effects. In identifying such areas particular care shall be taken to evaluate the adverse affects on water, noise and air pollution, which, although transient, will preclude the use of some areas as construction camp sites. The contractor shall consult with the local community in selecting the location of the construction camp. It should be ideally in a distant location from the community so that the regular day-to-day activities of the communities are not disturbed due to the construction camps.

Construction camp sites shall be located such that permanent adverse environmental effects can be avoided or mitigated against and transient adverse environmental effects are minimized. Camp sites shall not be located in areas identified during the planning stage as unsuitable for such use. The site or sites shall be selected such that mitigation measures stipulated in this ECOP can be implemented with reasonable facility.

7.3 Private Land

Where construction camps are to be located on land outside the road reserve the contractor shall obtain the approval of the landowner to establish the camp site on such land and pay agreed compensation as per the Resettlement and Rehabilitation Framework. Environmental protection measures established by this ECoP shall apply to all land regardless of ownership.

7.4 Construction Camp Facilities

The construction camp shall be provided with the following minimum facilities:

A perimeter security fence at least 1.5m in height constructed from appropriate materials.

Ablution block with a minimum of one water closet toilet or Pota-cabin, one urinal and one shower for personnel engaged either permanently or temporarily on the project. Pota-cabins or separate toilet and wash facilities shall be provided for male and female employees.

A sickbay and first aid station.

Areas for the storage of fuel or lubricants and for a maintenance workshop. Such an area shall be bounded and have a compacted/impervious floor to prevent the escape of accidental spillage of fuel and or lubricants from the site. Surface water drainage from bounded areas shall be discharged through purpose designed and constructed oil traps. Empty fuel or oil drums may not be stored on site.

Storm water drainage system to discharge all surface run off from the camp site to a silt retention pond which shall be sized to provide a minimum of 20 minutes retention for storm water flow from the whole site that will be generated by a 20 year return period rainfall having a duration of at least 15 minutes. The run-off coefficient to be used in the calculation of the silt pond volume shall be 0.9. Silt ponds shall be maintained in an efficient condition for use throughout the construction period with trapped silt and soil particles being regularly removed and transported and placed in waste material disposal areas as per ECOP 11.0.

All discharge from the silt retention pond shall be channeled to discharge to natural water via a grassed swale at least 10 meters in length with suitable longitudinal gradient.

All camp facilities shall be maintained in a safe clean and or appropriate condition throughout the construction period.

7.4.1 Construction Camp Development Plan

A development plan of the construction camp shall be prepared describing the following:

Perimeter fence and lockable gates

Workshop

Accommodation

Ablutions

Water supply

Wastewater disposal system

Bounded fuel storage area

Proposed power supply

Proposed all weather-surfaced areas.

7.5 Site Restoration

At the completion of the construction work, all construction camp facilities shall be dismantled and removed from the site and the whole site restored to a similar condition to that prior to the commencement of the works or to a condition agreed to with the owner of the land. All oil or fuel contaminated soil shall be removed from the site and transported and buried in waste soil disposal areas.

ECOP 8.0: Topsoil Salvage, Storage and Replacement

8.1 General

Loss of topsoil will be a long-term impact along the process of construction of substations, installation or rehabilitation of the overhead power cables by the PGCB due to,

Site clearance and excavation for temporary road, substation, protective embankment, etc.

Development of borrow areas

Temporary construction activities as material storage locations, diversion routes, etc.

Scope of this ECoP includes removal, conservation and replacement of topsoil.

8.2 Pre-construction Stage

The arrangements for temporary usage of land, borrowing of earth and materials by the Contractor with the land owner shall include the conservation/preservation of topsoil.

8.3 Construction Stage

The stockpiles for storing the topsoil shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile is restricted to 2m.

In cases where the topsoil has to be preserved for more than a month, the stockpile is to be stabilized within 7 days. The stabilization shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control.

After spreading the topsoil on disturbed areas, it must be ensured that topsoil is seeded, and mulched within 30 days of final grading.

During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses.

The Contractor shall preserve the stockpile material for later use on slopes or shoulders.

8.4 Post-construction Stage

The topsoil shall be re-laid on the area after taking the borrow earth to maintain fertility of the agricultural field, finishing it to the required levels and satisfaction of the farmer.

All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material.

ECOP 9.0: Borrow Areas

9.1 General

In general transmission line will pass over the agrituaral land, low lying area. A high level temporary access may be required for tower foundation or mobilization of equipment and vehicles. Embankment or filling material, if needed, is to be procured from borrow areas designated for the purpose. The scope of this ECOP extends to measures that need to be incorporated during borrow area identification, material extraction and rehabilitation with regard to environment management.

9.2 Pre-construction Stage

The contractor shall identify the borrow area locations in consultation with the owners, after assessing the suitability of the material. The suitable sites shall be selected and finalized in consultation with PGCB.

9.3 Construction Stage

The contractor should adopt the following precautionary measures to minimize any adverse impacts on the environment:

Borrow pits situated less than 0.5 km (if unavoidable) from villages and settlements should not be dug for more than 30 cm after removing 15cm of topsoil and should be drained.

The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation.

In case the borrow pit is on agricultural land, the depth of borrow pits shall not exceed 45 cm and may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside.

In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood.

9.4 Post-construction Stage

It needs to be ensured that all reclamation has been carried out in accordance with the restoration plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that “the land is restored to his satisfaction”. The final payment shall be made after the verification by the PGCB.

ECOP 10.0: Slope Stability and Erosion Control

10.1 General

Stability of slopes is a major concern in hill areas and locations of high embankment.

Soil erosion is consequent to high runoff on hill slopes, high wind velocities cause erosion of embankments made up of cohesion-less sandy soils.

Embankments made up of silty and sandy soils are eroded, in the absence of vegetative cover, when the slopes are steep, say more than 20 degrees.

Erosion control is provided to prevent soil damage done by moving water.

The scope of this ECoP includes measures to minimize the adverse environmental impacts on slope stability and soil erosion due to the construction of embankments. The adverse environmental impact can be:

damage to adjacent land,

silting of ponds and lakes disturbing the aquatic habitat

erosion of rich and top fertile top layer of soil

contamination of surface water bodies and

reduction in road formation width due to erosion of shoulders/berms.

10.2 Pre-construction Stage

Interceptor ditches are constructed in hill areas to protect the road bench and hillside slope from erosion due to heavy rainfall and runoff.

Interceptor ditches are very effective in the areas of high intensity rainfall and where the slopes are exposed.

10.3 Construction Stage

The vegetative cover should be planted in the region where the soil has the capacity to support the plantation and at locations where meteorological conditions favors vegetative growth.

On side slopes in hills, immediately after cutting is completed and debris is removed, vegetative growth has to be initiated by planting fast growing species of grass.

In regions of intensive rainfall, locations of steep slopes, regions of high soil erosion potential and regions of short growing seasons, erosion control matting should be provided.

Adequacy of drainage for erosion control

10.4 Post-construction Stage

All the exposed slopes shall preferably be covered with vegetation using grasses, bushes etc. Locally available species possessing the properties of (i) good growth (ii) dense ground cover and (iii) deep root shall be used for stabilization.

ECOP 11.0: Waste Management

11.1 General

This code of practice describes procedures for handling, reuse and disposal of waste materials during construction of the substations, rehabilitation of the existing substations/transmission or distribution lines. The waste materials generated can be classified into

Construction Waste;

Domestic waste;

Discarded conductors from rehabilitated power lines; and

Discarded switchboxes, bus-bars, transformers, etc. from rehabilitated substations.

11.2 Pre-construction Stage

The contractor shall identify the activities during construction that have the potential to generate waste and work out measures for the same in the construction schedule.

The Contractor shall educate his workforce on issues related to disposal of waste, the location of disposal site as well as the specific requirement for the management of these sites.

11.3 Construction Stage

The contractor shall either re-use or dispose the waste generated during construction depending upon the nature of waste.

The contractor shall dispose off wastes that could not be re-used safely.

The waste management practices adopted by the Contractor shall be reviewed by PGCB during the progress of construction.

Discarded conductors resulting from the rehabilitation of power lines should be recycled under the guidance PGCB.

Discarded transformers should be properly disposed of as per the guidelines of PGCB so as to minimize environmental pollution.

The old transformers may contain hazardous chemicals such as PCB which should be handled as per the national/international Hazardous Waste Management guidelines. However, the more recent transformers do not contain such hazardous oil. Therefore, such non-hazardous oil should be discarded following the waste disposal guidelines as stipulated in ECR ’97. Therefore, during the substation rehabilitation process the old transformers containing PCB should be discarded following available technologies; namely, super critical oxidation, electro-chemical oxidation, solvated electron technology, chemical reduction method, dehalogenation process, and thermal desorption using pyrolysis, catalyzed dehalogination and vitrification. (ECOP 22.0)

The waste generated from the discarded switchgears, bus-bars, etc. following the rehabilitation process should be handled as per the guidelines for E-waste management specified in ECR ’97.

11.4 Post-construction Stage

After decommissioning of construction sites, the Contractor shall hand over the site after clearing the site of all debris/wastes to the PGCB.

In case of disposal of wastes on private land, certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction".

ECOP 12.0: Water Bodies

12.1 General

Water bodies may be impacted when the infrastructure development project activities are adjacent to it or the runoff to the water body is affected by change of drainage pattern due to construction of embankment. The following activities are likely to have an adverse impact on the ecology of the area:

Earth moving

Removal of vegetation

Waste disposal from construction works

12.2 Pre-Construction Stage

When there is interruption to regular activities of the inhabitants near water body due to construction or rehabilitation work, following are the Contractor's responsibilities:

Restriction on use of water during construction, if any, should be intimated to the community in advance.

Alternate access to the water body is to be provided in case there is interruption to use of exiting access.

If the water body affected is a drinking water source for a habitation, alternate sources of water are to be provided to the users during the period for which its use is affected.

12.3 Construction Stage

It should be ensured by the contractor that the runoff from construction site entering the water body is generally free from sediments.

Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated.

Cutting of embankment reduces the water retention capacity and also weakens it, hence:

The contractor should ensure that the decrease in water retention should not lead to flooding of the construction site and surroundings causing submergence and interruption to construction activities.

Any perceived risks of embankment failure and consequent loss/damage to the property shall be assessed and the contractor should undertake necessary precautions as provision of toe protection, erosion protection, sealing of cracks in embankments. Failure to do so and consequences arising out

of embankment failure shall be the responsibility of the contractor. The PGCB shall monitor regularly whether safe construction practices near water bodies are being followed.

Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body.

Movement of workforce shall be restricted around the water body, and no waste from construction sites shall be disposed into it.

12.4 Post-construction Stage

The zones of the water body have to be left clean and tidy with the completion of construction.

Engineers of PGCB will check if drainage channels of adequate capacity have been provided for the impacted water body.

ECOP 13.0: Water Qualities

13.1 General

Construction of the substations, small-scale access road construction and small-scale embankment construction may affect the aquatic environment, by lowering or raising water levels, and decreasing water quality.

Deterioration of water quality and disturbance of aquatic environment by lowering or rising of water levels.

13.2 Pre-construction Stage

Following measures are to be undertaken by the contractor prior to the commencement of construction:

Base line data of the water quality is necessary.

In addition, the availability of enough water during the lean season needs to be assessed as part of the baseline data collection.

13.3 Construction Phase

Improper disposal of solid and liquid waste including excreta generate from sites will pollute the water quality and proper prevention measure should be taken.

Wastewater and toxic chemicals disposal, sanitation/latrines may have positive cumulative effects on human health, but if not properly implemented may affect ground and surface and ground water quality; the contractor should give proper attention on it during construction stage.

Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers.

13.4 Post-construction Phase

Inspection of water quality shall be done regularly.

ECOP 14.0: Drainage

14.1 General

Drainage is designed for temporary access roads to direct surface or subsurface flow away to a safe outfall without damage to the structure, adjoining property or agricultural fields.

14.2 Pre-construction Stage

Following measures are to be undertaken by the contractor prior to the commencement of construction:

The downstream as well as upstream user shall be informed one month in advance

The contractor shall schedule the activities based on the nature of flow in the stream while constructing the substations and access roads.

The contractor should inform the concerned departments about the scheduling of work. This shall form part of the overall scheduling of the civil works to be approved by REB/PGCB.

All the safety/warning signs are to be installed by the contractor before start of construction

In case of utilization of water from the stream, for the construction, the contractor has to take the consent from the concerned department.

14.3 Construction Phase

Temporary drainage at construction site shall be provided at the earliest to ensure proper compaction

In hill areas sub-surface drains, if required, shall be provided immediately after cutting the slopes and forming the roadbed (sub grade).

Safety devises and flood warning signs to be erected while working over streams and canals.

14.4 Post-construction Phase

Inspection and cleaning of drain shall be done regularly to remove any debris or vegetative growth that may interrupt the flow.

Temporary structures constructed during construction shall be removed before handing over to ensure free flow through the channels.

ECOP 15.0: Electromagnetic Field

15.1 General

Electromagnetic Field during the rehabilitation of the existing transmission or distribution lines may be a cause of concern. Thus, appropriate protective measures should be adopted during the implementation phase.

Electric and magnetic fields (EMF) are invisible lines of force emitted by and surrounding any electrical device (e.g. power lines and electrical equipment). Electric fields are produced by voltage and increase in strength as the voltage increases. Electric field strength is measured in volts per meter (V/m). Magnetic fields result from the flow of electric current and increase in strength as the current increases. Magnetic fields are measured in units of gauss (G) or tesla (T), where 1T equals 10,000G. Electric fields are shielded by materials that conduct electricity, and other materials, such as trees and building materials. Magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields decrease rapidly with distance. Power frequency EMF typically has a frequency in the range of 50 – 60 Hertz (Hz), and is considered Extremely Low Frequency (ELF). Although there is public and scientific concern over the potential health effects associated with exposure to EMF (not only high voltage power lines and substations, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern. Recommendations applicable to the management of EMF exposures include: Evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure. Considering siting new facilities so as to avoid or minimize exposure to the public. Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices),should be avoided;

If EMF levels are confirmed or expected to be above the recommended exposure limits, application of engineering techniques should be considered to reduce the EMF produced by power lines, substations, or transformers. Examples of these techniques include:

o Shielding with specific metal alloys

o Burying transmission lines

o Increasing height of transmission towers

o Modifications to size, spacing, and configuration of conductors

15.2 Post Construction :

During the Post-construction phase, PGCB should monitor the EMF around the substations and under the Distribution/Transmission lines on a regular basis.

Construction of residential buildings and/or small households should only be allowed ensuring the safe distance as specified in the Code.

ECOP 16.0: Public Health and Safety

16.1 General

The safety and health of the public is impacted due to the hazards created during the construction period. This code of practice describes the measures that need to be taken to mitigate the impacts.

16.2 Pre-construction Phase

In order to incorporate public health and safety concerns, PGCB and the Contractor shall disseminate the following information to the community:

Location of project activities,

Borrow areas,

Extent of work

Time of construction

Involvement of local labors in the construction

Health issues - exposure to dust, communicable diseases etc.

16.3 Construction Phase

The Contractor shall schedule the construction activities , such as:

Sowing of crops

Harvesting

Local hindrances such as festivals, etc.

Availability of labor during particular periods

Proper safety/warning signs are to be installed by the contractor to inform the public of potential health and safety hazard situations during the construction phase in the vicinity of the project.

The PGCB shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per this ECOP.

16.3 Post-construction Phase

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and users. During operation phase (especially during reglar maintenance) following issues should be addressed:

Regular patrolling along the power lines to identify the need for regular and immediate maintenance operation.

Inspection immediately after a major storm/rainfall event

Regular cutting and trimming of trees around power lines.

Provision for shutting down of line in case of snapping of line.

Regular monitoring of power lines to prevent electricity pilferage especially when Axially Bundled Cables (ABC) are used which may lead to accident.

No temporary/permanent shops underneath the H-pole to be allowed

No Dumpster to be allowed underneath the H-Pole.

ECOP 17.0: Material Storage, Transport and Handling

17.1 General

Activities related to materials storage, handling, and transfer that are considered to potentially have negative environmental effects include:

Transportation, storage, handling and of construction materials;

Storage, handling, and transfer of petroleum, oil, and lubricant (POL) products;

Application of asphaltic concrete and asphalt binder;

Storage and handling of hazardous materials other than POL products; and

Storage and application of transformer oil.

Some materials used during implementation of projects may have potentially hazardous effects on the environment if not properly stored and handled.

17.2 Transportation, Handling and Storage of Cement and Aggregates

The Contractor shall be responsible for ensuring that all trucks and carriers are clean and dry prior to loading them with cement or aggregates. All trucks and carriers for transporting cement/aggregates shall be equipped with weather proof closures on all openings.

All cement/aggregates that will be brought to the site shall be kept free from contact with deleterious matter.

All cement/aggregates shall be placed on impervious mat spread over the storage area to prevent direct contamination of top soil in the storage area. Stockpiling of cement/aggregates should be limited to minimum space and should be covered with weatherproof closures.

Stockpiles shall be built up in horizontal or gently sloping layers. Overlap of different materials shall be prevented by suitable walls of ample distance between stockpiles.

The Engineer shall approve the site for the storage of all aggregates.

The Engineer shall approve the methods of handling aggregates and the equipment used.

17.3 Environmental Concerns with Materials used for Construction and Maintenance of Infrastructure Development Projects. Concerns are related to accidental releases into the environment, such as spills, refueling losses, and leakage from equipment that could result in contamination of soil, groundwater, or surface waters.

Groundwater may transport the contaminants off-site to down-gradient aquifers or water supplies, or discharge them into surface waters. Therefore, release of potential contaminants on the ground surface could have significant environmental impacts that could ruin groundwater (well supplies).

17.3.1 Petroleum, Oil, Lubricants and Transformer Oil

The toxic effect of a petroleum product in the aquatic environment varies considerably due to the different chemical composition of each petroleum product. The toxicity of petroleum products is related largely to its solubility in water. Petroleum pollution from accidental spills may affect aquatic birds, fish and vegetation. The effect of oil on birds' feathers (loss of insulation) is an important cause of death. Oil polluting the water may also be toxic to birds if they ingest it. Plants in marshes or in wetlands (haor, baor, ponds and others) and steams may die off for short periods. Long-term impacts of spilled petroleum products are associated with the portion, which sinks and becomes incorporated into bottom sediments. This causes the petroleum products to degrade very slowly and they may persist for many years.

Petroleum products can stick to the gills of fish and interfere with normal respiration. Under relatively mild pollution, fish may produce mucus as a defensive mechanism to remove the oil. However, in heavy pollution, this mechanism is inefficient and the oil tends to accumulate on the gills and smother the fish. Petroleum products contain soluble materials, which can be ingested by fish. The flavor of the fish flesh may, therefore, become tainted, or if ingested in enough quantity, may become lethal. Groundwater sources contaminated with petroleum products may have potentially toxic effects on consumers.

17.3.2 Asphalt Products

Environmental concerns with tack asphalt binder, and asphaltic concrete are also related to the hydrocarbon components, which are toxic to aquatic life, wildlife, and humans. As mentioned above, if these materials sink to the bottom, they may destroy the fish's source of food supply and smother the eggs or emerging fry.

17.3.3 Other Hazardous Materials

The following hazardous materials are likely to be generated in construction, rehabilitation or maintenance activities of substation and power lines and have potential environmental concerns:

Paints;

Solvents;

Transformer Oil; and

Fresh concrete and admixtures.

Paint materials, which are lead – or oil-based, may affect aquatic life if significant amounts enter a watercourse. Specific concern exists with lead, as this compound may have a direct toxic effect on young fish. Toxins can accumulate over time in aquatic fish, bugs, and plants. Upon consumption by animals such as birds and small mammals, some metals could be transferred to the consumer and affect their health.

Some solvents used for cleaning purposes may contain components, which are toxic to aquatic life, wildlife, and humans. If solvents enter a watercourse/water supply, and significant concentrations occur in the water, this could be harmful to users.

Concrete, which is typically made up of aggregates, cement, water, and possibly admixtures, is very alkaline because of its calcium (lime) content. If concrete enters a watercourse in significant amounts, the pH of the water may be affected locally over the short-term. If the pH of the receiving water is altered, this may cause physiological stress in fish, which may result in death.

When a power line (Transmission and/or Distribution) is re-conductored the old conductors are discarded. Recylcing of these metal conductors should be practiced to reduce waste generation.

The old transformers contained transformer oil which is hazardous to the human and environment.

17.4 Storage, Transport and Handling of POL Products

Care must be taken with the storage, transfer, handling of POL products to prevent potential environmental damage. All empty containers and drums shall be returned to the maintenance depot. It shall be ensured that all drums and containers are closed and not tipped over and all waste oil, lubricants, and solvents shall be stored in closed containers.

17.4.1 Storage

Any container, drum, or tank that is dented, cracked, or rusted will probably eventually leak. Make sure all containers, drums, and tanks that are used for storage are in good condition. Check for leakage regularly to identify potential problems before they occur.

The proper storage of materials will greatly reduce the risk of accidental spills or discharges into the environment.

For temporary outdoor storage, put containers and drums in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area should preferably slope or drain to a safe collection area in the event of a spill. Tanks should have appropriate secondary containment (i.e. double-walled or surrounded by a dyke) that will collect spilled material in case of a leak. Permanent storage areas for containers or drums should be on an impermeable floor that slopes to a safe collection area in the event of a spill or leak.

17.4.2 Transport and Handling

At all times when products are being handled or transported, care must be taken to prevent any product from being spilled, misplaced, or lost and possibly entering and contaminating the soil or a natural waterway. When equipment and vehicle maintenance or repair is required in the field, it should be undertaken at least 30 m away from any watercourse. Minimize the potential for entry of hydraulic fluids or oil into a watercourse by using sorbent materials to collect spilled petroleum products. Return all used sorbent materials to the appropriate storage yards for safe disposal.

Return all diesel or fuel used to wash asphalt emulsion pumps to the maintenance depot for safe storage or disposal. Also return all solvents used to wash spray-painting or other equipment to the appropriate storage yards for safe disposal.

Wash equipment in maintenance areas equipped with oil/water separators so that any petroleum products can be removed prior to discharge of the wastewater. Oil/water separators are only effective if they are properly maintained. At sites without oil/water separators, minimize the amount

of wash water used and wash in areas where the potential for entry of wash water into a waterway is minimized by proper grading or curbing.

Tankers should not be washed near watercourses. Wash out should be done in places where proper grading or curbing minimizes the potential for entry of wash water into a waterway. Re-fuelling or servicing of equipment and vehicles to be done at least 30 m away from any watercourse. Re-fuelling over liner material with an absorbent pad (e.g. sand bed) will help to contain potential spills. If re-fuelling is done from a bulk tanker, the hose/nozzle assembly should be replaced to its proper position upon completion.

17.5 Spills and Spill Cleanup

Quick action in the event of a spill of hazardous materials is important in order to prevent environmental damage.

Things to do when a spill occurs:

Identify the material Involved and make a quick assessment:

How extensive is the spill?

Are there any watercourses nearby?

Are the watercourses down gradient from the spill?

Are there drainage systems down gradient from the spill, which lead toa nearby watercourse?

Stop the flow of product, if it can be done safely.

Notify the Engineer and Authorities immediately.

Control and contain spilled product until expert help arrives, if it can be done safely.

17.5.1 How to Control and Contain a Spill

When a limited oil spill occurs on level land, scoop up the affected soil and dispose at a site approved by the Engineer and the Department of Environment. When an extensive oil spill occurs on level land, dig sump hole and pump excess oil into a temporary container. The remaining contaminated soil must be scooped up and disposed of at a site approved by the Engineer and the Department of Environment.

When an extensive spill occurs on a slope or hillside, a trench can be dug downhill from the spill to intercept the spilt material.

Should petroleum products reach a watercourse, several temporary spill containment measures can be sued to help stop the spreading of products.

17.6 Storage and Handling of Dangerous Materials

Workers may be at risk from exposure to dust particles or toxic fumes from chemicals used in road works and materials testing.

Specific measures to reduce risks include limiting time of exposure to dust particles, chemicals and noise; enhancing safety and inspection procedures; and improving materials safe handling.

ECOP 18.0: Vegetation Management

18.1 General

Besides improving aesthetics and ecology of the area, the vegetation provide fuel wood, act as noise barriers, provide visual screen for sensitive areas and also generate revenue by sale of its produce.

This code of practice elaborates on the approach towards planting trees. Emphasis has been laid on a greater involvement of communities in planting and maintenance of trees.

18.2 Project Planning and Design Phase

During alignment of transmission line finalization, due consideration shall be given to minimize the loss of existing tree cover

Tree felling, if unavoidable, shall be done only after compensatory plantation of at least two saplings for every tree cut is done.

The species shall be identified in consultation with officials of forest department/local community, giving due importance to local flora, preferably same species as cut. It is recommended to plant mixed species in case of both avenue or cluster plantation.

Design of plantation of fruit bearing trees and other suitable trees.

It should be ensured that plantation is carried out only in areas where water can be made available during dry seasons and the plant can be protected during the initial stages of their growth.

18.3 Post-construction Phase

During the operational phase regular trimming of trees along the route, PGCB personnel may become essential to prevent accidents due to over-growth onto the power lines. However, his activity should be conducted with minimal damage to the existing vegetation.

The project proponents would take up the planting of fruit bearing and other suitable trees, on both sides of the roads or other infrastructure development projects location from their own funds

ECoP 19.0: Natural Habitats

19.1 General

The activities associated with construction a transmission line through or along the edge of Natural habitat areas may destroy and degrade the habitat. The activities can have impacts on the number, health, and survival of interior Native Plant and animal species, many of which are rare.

The code of practice envisages measures to be undertaken during implementation of the proposed subprojects by the PGCB near natural habitats. These measures shall be undertaken in addition to the measures laid down in the other ECOP.

As per the World Bank OP 4.04, the conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. A precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development has been adopted for the project.

19.2 Main features of the Bank's Natural Habitats Policy (OP 4.04)

The policy on natural habitats contains two major provisions with respect to biodiversity conservation and EA. Firstly, it prohibits Bank involvement in projects, which involve significant conversion or degradation of critical natural habitats. These include: existing protected areas and adjoining or linked areas or resources (such as water sources) on which the protected areas depend; and sites identified as meriting protection. Secondly, where natural habitats out-side protected areas are within a project's area of influence, the project must not convert them significantly unless:

There are no feasible alternatives

The EA demonstrates that benefits substantially outweigh the costs

Mitigation measures acceptable to the Bank are implemented, which would normally include support for one or more compensatory protected areas that are ecologically similar to, and no smaller than, the natural habitats adversely affected by the project

19.3 Project Planning and Design

Proper line route selection, appropriate timing of operations and proper construction and maintenance of the development of the transmission line can ensure that terrestrial, riparian and aquatic habitat values and fish and wildlife populations are protected from the adverse impacts. Following issues should be considered in Project Planning and Design stage.

A detailed inventory of ecological features along the proposed rural road shall be prepared with the help of experts and the nature and type of impact on natural habitats shall be identified.

Avoid concentrations of wildlife, areas of high value wildlife habitat and/or rare plant communities, when determining locations and routes for transmission line. A biologist or ecologist specialized in the discipline of concerns must be retained to identified and asses such areas of concern.

In areas of continuous high value habitat, consider not developing the project or determine an alternative routing, if feasible.

Adjusting pole placement and span length to minimize the impacts;

19.4 Pre-construction Phase

Contractor in consultation with local expert or any other concerned authority shall prepare a schedule of construction within the natural habitat. Due consideration shall be given to the time of migration, time of crossing, breeding habits and any other special phenomena taking place in the area for the concerned flora or fauna.

No Construction Camps, Stockyards, Concrete Batching or Hot Mix Plants shall be located within the natural habitat or within 500m from its boundary.

19.5 Construction Phase

Collection of any kind of construction material from within the natural habitat shall be strictly prohibited.

In the event that concentrations of wildlife species are present in the proposed construction area, consider re-scheduling construction and maintenance activities until such time when the numbers of animals present are reduced or absent from the worksite.

When removing vegetation from right of ways, workspaces etc., featheredge the cut to ensure that line of site and cover (both security and thermal protection) issues are addressed.

No water resources within the natural habitat shall be disturbed.

During construction, prevent human disturbance and ecosystem impacts on sensitive areas adjacent to projects by using temporary fencing or flag off area to restrict travel to construction zones, right of ways and workspaces.

Disposal of construction waste within the natural habitat shall be strictly prohibited.

19.6 Post-construction Phase

The infrastructure development projects near the natural habitat shall be declared as a silence zone.

Allowing tree and shrub species that reach heights of 12 to 15 feet to grow within the ROW, which may control to trespassing and vandalism;

Compensatory tree plantation within the project area shall be done.

The PGCB must ensure maintenance of drainage structure as per ECOP 14.0.

ECOP 20.0: Occupational Health and Safety1

Most occupational health and safety issues during the construction, operation, maintenance, and decommissioning of electric power distribution projects are common to those of large industrial facilities, and their prevention and control is discussed in the General EHS Guidelines. These impacts include, among others, exposure to physical hazards from use of heavy equipment and cranes; trip and fall hazards; exposure to dust and noise; falling objects; work in confined spaces; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery.

Occupational health and safety hazards specific to electric power transmission and distribution projects primarily include:

Live power lines

Working at height

1 IFC Environmental.Health and Safety Guidelines for Electric Power Transmission and Distribution

Electric and magnetic fields.

Live Power Lines

Workers may be exposed to occupational hazards from contact with live power lines during construction, maintenance, and operation activities. Prevention and control measures associated with live power lines include:

Only allowing trained and certified workers to install, maintain, or repair electrical equipment;

Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines;

Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards. Qualified or trained employees working on transmission or distribution systems should be able to achieve the following:

Distinguish live parts from other parts of the electrical system

Determine the voltage of live parts

Understand the minimum approach distances outlined for specific live line voltages

Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system

Workers should not approach an exposed energized or conductive part even if properly trained unless:

The worker is properly insulated from the energized part with gloves or other approved insulation; or,

The energized part is properly insulated from the worker and any other conductive object; or,

The worker is properly isolated and insulated from any other conductive object (live-line work).

Where maintenance and operation is required within minimum setback distances, specific training, safety measures, personal safety devices, and other precautions should be defined in a health and safety plan.

Workers not directly associated with power transmission and distribution activities who are operating around power lines or power substations should adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities;

Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface.

Working at height on poles and structures

Workers may be exposed to occupational hazards when working at elevation during construction, maintenance, and operation activities. Prevention and control measures for working at height include:

Testing structures for integrity prior to undertaking work;

Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;

Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point;

Installation of fixtures on tower components to facilitate the use of fall protection systems;

Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached;

Hoisting equipment should be properly rated and maintained and hoist operators properly trained;

Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident;

When operating power tools at height, workers should use a second (backup) safety strap;

Signs and other obstructions should be removed from poles or structures prior to undertaking work;

An approved tool bag should be used for raising or lowering tools or materials to workers on structures.

Electric and magnetic fields

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

Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities; A 1994 study estimated the average exposure of electrical workers (including jobs in electric utilities and other industries) in Los Angeles, California to be 9.6 milligauss (mG), compared to 1.7 mG for workers in other fields (S. J. London et al., 1994). 35 Although detailed studies of workplace exposure to EMF in the United States, Canada, France, England, and several Northern European countries have found no conclusive link or correlation between typical occupational EMF exposure and adverse health effects, some studies have identified a possible association between occupational exposure to EMF and cancer,

such as brain cancer (U.S. National Institute of Environmental Health Sciences 2002) indicating there is evidence to warrant limited concern.

Training of workers in the identification of occupational EMF levels and hazards;

Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;

Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE). Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.

ECoP 21.0: Community Health and Safety

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

Electrocution

Electromagnetic interference

Visual amenity

Noise and Ozone

Aircraft Navigation Safety

Electrocution

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

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

Grounding conducting objects (e.g. fences or other metallic structures) installed near power lines, to prevent shock.

Electromagnetic Interference

The corona of overhead transmission line conductors and high frequency currents of overhead transmission lines may result in the creation of radio noise. Typically, transmission line rights-of way and conductor bundles are created to ensure radio reception at the outside limits remains normal. However, periods of rain, sleet or freezing rain sharply increases the streaming corona on conductors and may affect radio reception in residential areas near transmission lines.

Visual Amenity

Power transmission and distribution are necessary to transport energy from power facilities to residential communities, but may be visually intrusive and undesirable to local residents. To mitigate the visual impact of power distribution projects, the following mitigation measures should be implemented:

Extensive public consultation during the planning of power line and power line right-of-way locations;

Accurate assessment of changes in property values due to power line proximity;

Siting power lines, and designing substations, with due consideration to landscape views and important

environmental and community features;

Location of high-voltage transmission and distribution lines in less populated areas, where possible;

Burying transmission or distribution lines when power must be transported through dense residential or commercial areas.

Noise and Ozone

Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Ozone, a colorless gas with a pungent odor, may also be produced. Neither the noise nor ozone produced by power distribution lines or transformers carries any known health risks. The acoustic noise produced by transmission lines is greater with high voltage power lines (400-800 kilo volts [kV]) and even greater with ultra-high voltage lines (1000 kV and higher). Noise from transmission lines reaches its maximum during periods of precipitation, including rain, sleet, snow or hail, or as the result of fog. The sound of rain typically masks the increase in noise produced by the transmission lines, but during other forms of precipitation (e.g. snow and sleet) and fog, the noise from overhead power lines can be troubling to nearby residents. Measures to mitigate this impact may be addressed during project planning stages to locate rights-of-way away from human receptors, to the extent possible. Use of noise barriers or noise canceling acoustic devices should be considered as necessary.

Aircraft Navigation Safety

Power transmission towers, if located near an airport or known flight paths, can impact aircraft safety directly through collision or indirectly through radar interference. Aircraft collision impacts may be mitigated by:

Avoiding the siting of transmission lines and towers close to airports and outside of known flight path envelopes;

Consultation with regulatory air traffic authorities prior to installation;

Adherence to regional or national air traffic safety regulations;

Use of buried lines when installation is required in flight sensitive areas.

APPENDIX-B: ENVIRONMENTAL MONITORING ACTIVITIES DURING CONSTRUCTION

For Substation Subproject :

CONTRACT NO &

LOCATION:

MONITOR (S) NAME:

CONTRACTOR NAME:

MONITORING DATES: _____ START:_____, FINISH:_____

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
Drainage Congestions & Flooding	Drainage congestion & flooding due to earth filling of substation sites and access roads above HFL.	Drainage congestion should not be occurred due to subproject activities (such as earth work, stockpiling of materials etc.)				
		Proper compensation to the PAPs for damaging of standing crops (if any) due to subproject activities should be done in time.				
Traffic Congestions/ Road Accident	Vehicles used for material transport will have impacts on traffic congestion & road accident	Engage flagman (Guard) for traffic management.				
		Road safety measures (signage, marking, signals etc.) are provided properly at the entry & exist location of the access road.				
		Engage experienced drivers for all construction vehicles.				
		Control traffic congestion and interruption of public traffic.				
		Hazards from construction traffic due loading and unloading construction				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		materials.				
Air pollution/Dust Generation	Air pollution by construction vehicles, equipment , asphalt plant and dust generated from earthworks, and material stockpiling.	Construction equipment will be maintained to a good standard and idling of engines will be discouraged.				
		Equipment & vehicles causing excessive pollution (e.g., visible smoke) will be banned from construction sites.				
		All vehicles used for material transport should be properly covered.				
		Construction materials will be stored away from the residential areas and will be properly covered.				
		Asphalt plants will be located about minimum 500m away from the settlements to avoid direct impact of emissions on local settlements.				
		Dust suppression measures should be adopted like spraying of water twice daily for dust generating sources.				
Noise pollution	Noise and vibrations from construction activities	Construction workers to be provided with ear-plugs.				
		Noise inspection will be done before construction equipment enter into construction site. All equipment shall fulfill the noise control requirements of the project. Special attention shall be taken to regular maintenance of construction equipment for their best working condition.				
		Construction is taking place at <500 m from the houses or within 150m of cultural sites such as school, mosque, health center, construction				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		will be stopped from 21:00 to 06:00. (<50dB for residential areas).				
		Noise should be maintained to DOE (Department of Environment) noise.				
Soil pollution	Soil pollution / disruption from construction activities	Proper disposal of solid and liquid wastes from the construction sites and labour camps				
		Proper storage and handling of construction materials and chemicals				
		Rain cuts, fills, erosion of slopes of boundary & access road side slopes				
		Monitoring by testing of river sand prior to start earth filling				
Pollution due to Waste	Impacts on local environment	Collection of solid waste should be in separate waste bin at source				
		Organic waste should be dump in the earth hole for composting or dump in the nearest designated dumping area of municipality				
Community H&S	Impacts on health and safety of the local community	Construction camp should be min. 500m far from the houses & cultural sites				
		Construction camp should be bounded by temporary wall.				
		Local community should not be disturbed by the workers				
Occupational health &safety (H&S)	Impacts on health and safety of workers	Engage a Health, Safety and Environmental Manager (EHSM) to monitor workers' health, safety and hygiene for entire construction period				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		Provide PPE (helmet, safety shoes, hand gloves etc.) to all construction workers & ensure to use these PPE.				
		Provide "First Aide Box" including all necessary medicines & equipment in site offices & camps.				
		Proper treatment of workers in case of accident during works at the site.				
		Provide safe drinking water (DW) for workers. DW quality should be confirmed by testing of pH, Mn, As, Fc, Cl, NH4-N.				
		Place signboard with mentioning "Safety First" at all working sites in Bangla & English languages.				
		Make sure that there is good drainage at all construction camps (specially labor camps).				
		Provide adequate sanitation at construction sites. According to BNBC 1 no. of toilet for 10 persons at construction site/camp.				
		Provide temporary security boundary wall (by tin or other) surrounding the labor camp.				

For LILO/Transmission Line Subproject:

CONTRACT NO &

LOCATION:

MONITOR (S) NAME:

CONTRACTOR NAME:

MONITORING DATES: _____START:_____, FINISH:_____,

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
Surface Water Pollution	Water pollution by waste/vehicles/equipment	Any waste should not be discharged into the river				
		Project vehicle or equipment should not be washed into the river.				
Traffic Congestions/ Road Accident	Vehicles used for material transport will have impacts on traffic congestion & road accident	Engage flagman (Guard) for traffic management.				
		Road safety measures (signage, marking, signals etc.) are provided properly at the crossing point of the roads and railway lines.				
		Engage experienced drivers for all construction vehicles.				
		Control traffic congestion and interruption of public traffic.				
		Hazards from construction traffic due loading and unloading construction materials.				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
Air pollution	Air pollution by construction vehicles, equipment , asphalt plant and dust generated from earthworks, and material stockpiling.	Construction equipment will be maintained to a good standard and idling of engines will be discouraged.				
		Equipment & vehicles causing excessive pollution (e.g., visible smoke) will be banned from construction sites.				
		All vehicles used for material transport should be properly covered.				
		Construction materials will be stored away from the residential areas and will be properly covered.				
		Asphalt plants will be located about minimum 500m away from the settlements to avoid direct impact of emissions on local settlements.				
		Dust suppression measures should be adopted like spraying of water twice daily for dust generating sources.				
Noise pollution	Noise and vibrations from construction activities	Construction workers to be provided with ear-plugs.				
		Noise inspection will be done before construction equipment enter into construction site. All equipment shall fulfill the noise control requirements				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		of the project. Special attention shall be taken to regular maintenance of construction equipment for their best working condition.				
		Construction is taking place at <500 m from the houses or within 150m of cultural sites such as school, mosque, health center, construction will be stopped from 21:00 to 06:00. (<50dB for residential areas).				
		Noise should be maintained to DOE (Department of Environment) noise.				
Soil pollution	Soil pollution / disruption from construction activities	Proper disposal of solid and liquid wastes from the construction sites and labour camps				
		Proper storage and handling of construction materials and chemicals				
		Rain cuts, fills, erosion of slopes of boundary & access road side slopes				
		Monitoring by testing of river sand prior to start earth filling				
Pollution due to Waste	Impacts on local environment	Collection of solid waste should be in separate waste bin at source				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		Organic waste should be dump in the earth hole for composting or dump in the nearest designated dumping area of municipality				
Community H&S	Impacts on health and safety of the local community	Construction camp should be min. 500m far from the houses & cultural sites				
		Construction camp should be bounded by temporary wall.				
		Local community should not be disturbed by the workers				
Occupational ealth & safety (H&S)	Impacts on health and safety of workers	Engage a Health, Safety and Environmental Manager (EHSM) to monitor workers' health, safety and hygiene for entire construction period				
		Provide PPE (helmet, safety shoes, hand gloves etc.) to all construction workers & ensure to use these PPE.				
		Provide "First Aide Box" including all necessary medicines & equipment in site offices & camps.				
		Proper treatment of workers in case of accident during works at the site.				
		Provide safe drinking water (DW) for workers.				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		DW quality should be confirmed by testing of pH, Mn, As, Fc, Cl, NH4-N.				
		Place signboard with mentioning "Safety First" at all working sites in Bangla & English languages.				
		Make sure that there is good drainage at all construction camps (specially labor camps).				
		Provide adequate sanitation at construction sites. According to BNBC 1 no. of toilet for 10 persons at construction site/camp.				
		Provide temporary security boundary wall (by tin or other) surrounding the labor camp.				

For LILO Subprojects:

CONTRACT NO &

LOCATION:

MONITOR (S) NAME:

CONTRACTOR NAME:

MONITORING DATES: _____START:_____, FINISH:_____,

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
Surface Water Pollution	Water pollution by waste/vehicles/equipment	Any waste should not be discharged into the river				
		Project vehicle or equipment should not be washed into the river.				
Traffic Congestions/ Road Accident	Vehicles used for material transport will have impacts on traffic congestion & road accident	Engage flagman (Guard) for traffic management.				
		Road safety measures (signage, marking, signals etc.) are provided properly at the crossing point of the roads and railway lines.				
		Engage experienced drivers for all construction vehicles.				
		Control traffic congestion and interruption of public traffic.				
		Hazards from construction traffic due loading and unloading construction materials.				
Air pollution	Air pollution by construction vehicles, equipment, asphalt plant and dust generated from earthworks, and material stockpiling.	Construction equipment will be maintained to a good standard and idling of engines will be discouraged.				
		Equipment & vehicles causing excessive pollution (e.g., visible smoke) will be banned from construction sites.				
		All vehicles used for material transport should				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		be properly covered.				
		Construction materials will be stored away from the residential areas and will be properly covered.				
		Asphalt plants will be located about minimum 500m away from the settlements to avoid direct impact of emissions on local settlements.				
		Dust suppression measures should be adopted like spraying of water twice daily for dust generating sources.				
Noise pollution	Noise and vibrations from construction activities	Construction workers to be provided with ear-plugs.				
		Noise inspection will be done before construction equipment enter into construction site. All equipment shall fulfill the noise control requirements of the project. Special attention shall be taken to regular maintenance of construction equipment for their best working condition.				
		Construction is taking place at <500 m from the houses or within 150m of cultural sites such as school, mosque, health center, construction will be				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		stopped from 21:00 to 06:00. (<50dB for residential areas).				
		Noise should be maintained to DOE (Department of Environment) noise.				
Soil pollution	Soil pollution / disruption from construction activities	Proper disposal of solid and liquid wastes from the construction sites and labour camps				
		Proper storage and handling of construction materials and chemicals				
		Rain cuts, fills, erosion of slopes of boundary & access road side slopes				
		Monitoring by testing of river sand prior to start earth filling				
Pollution due to Waste	Impacts on local environment	Collection of solid waste should be in separate waste bin at source				
		Organic waste should be dump in the earth hole for composting or dump in the nearest designated dumping area of municipality				
Community H&S	Impacts on health and safety of the local community	Construction camp should be min. 500m far from the houses & cultural sites				
		Construction camp should be bounded by temporary				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		wall.				
		Local community should not be disturbed by the workers				
Occupational ealth & safety (H&S)	Impacts on health and safety of workers	Engage a Health, Safety and Environmental Manager (EHSM) to monitor workers' health, safety and hygiene for entire construction period				
		Provide PPE (helmet, safety shoes, hand gloves etc.) to all construction workers & ensure to use these PPE.				
		Provide "First Aide Box" including all necessary medicines & equipment in site offices & camps.				
		Proper treatment of workers in case of accident during works at the site.				
		Provide safe drinking water (DW) for workers. DW quality should be confirmed by testing of pH, Mn, As, Fc, Cl, NH4-N.				
		Place signboard with mentioning "Safety First" at all working sites in Bangla & English languages.				
		Make sure that there is good drainage at all construction camps				

Issue	Potential Environmental Impacts	Proposed Mitigation measures	Complies (Yes / No)	Reason	Follow up needed	Action
		(specially labor camps).				
		Provide adequate sanitation at construction sites. According to BNBC 1 no. of toilet for 10 persons at construction site/camp.				
		Provide temporary security boundary wall (by tin or other) surrounding the labor camp.				

APPENDIX – C: NOC FROM LOCAL AUTHORITY (To be included).