SFG2805

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF POWER, ENERGY & MINERAL RESOURCES

Power Grid Company of Bangladesh Ltd (PGCB)

Draft Final

Environmental and Social Management Framework (ESMF) of upgradation of Existing Transmission Lines by Reconductoring with Higher Capacity Conductors & Introduction of Approximate 800MV Ar SVC (Static VAR Compensation) to Critical Points of the National Grid



Dhaka

19 December, 2016

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF POWER, ENERGY & MINERAL RESOURCES

Power Grid Company of Bangladesh Ltd (PGCB)

Draft Final

Environmental and Social Management Framework (ESMF) of upgradation of Existing Transmission Lines by econductoring with Higher Capacity Conductors & Introduction of Approximate 800MV Ar SVC (Static VAR Compensation) to Critical Points of the National Grid

Dhaka

19 December, 2016

Acknowledgements

The Environmental and Social Management Framework (ESMF) has been prepared by The Center for Environmental and Geographic Information Services (CEGIS), a public Trust under the Ministry of Water Resources, Bangladesh. CEGIS has been entrusted with the responsibility of preparing Environmental and Social Management Framework (ESMF) for the proposed project. CEGIS expresses its gratitude to the PGCB, especially to Mr. Masum-Al-Beruni, Managing Director, PGCB for entrusting the responsibility.

CEGIS is also grateful to Engr. Chowdhury Alamgir Hossain, Executive Director (P&D), PGCB for his cordial cooperation for the study from very beginning. CEGIS is furthermore grateful to Engr. Farid Uddin Ahmed, Chief Engineer (Projects) and Engr. Arun Kumar Saha, Chief Engineer (P&D), for preparing the ESMF study with due responsibility and diligence. The contribution of Engr. Mrinal Kanti Paul, Superintending Engineer and Project Director of the study is gratefully acknowledged in this regard. Beside this, support of Engr. Md. Enamul Haque, Executive Engineer, PGCB (Projects) is acknowledged for his spontaneous support in conducting survey activities.

Along with PGCB officials CEGIS is also grateful to Dr. Masud Karim (consultant) for reviewing the ESMF report and provide his valuable feedback. At the same time CEGIS is also acknowledges World Bank and especially to Nadia Shamin, Sabah moyeen, M. Iqbal and Iqbal Ahmed for their time to time cordial feedback to CEGIS.

Members of the ESMF Team were impressed with the impulsive response received from the local people in providing information. Their contribution is gratefully recognized by CEGIS. Special mention must be made of the people who had given time to respond to the different types of surveys like Rapid Rural Appraisal (RRA), Key Informant Interview (KII), Public Consultation Meeting (PCM) and Stakeholder Consultations (SC).

Table of Contents

List of Tables

List of Maps

List of Figures

Abbreviations

AIS	Air Insulated Switchgear
RoW	Right of Way
ABC	Axially Bundled Cables
TL	Transmission Line
BDT	Bangladesh Taka
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BOD5	5-day Biochemical Oxygen Demand
BRTC	Bureau of Research Testing and Consultation
BUET	Bangladesh University of Engineering and Technology
COD	Chemical Oxygen Demand
DG	Director General
DoE	Department of Environment
EA	Environmental Assessment
ECA	Ecologically Critical Area
ECoP	Environmental Code of Practice
ECR	Environment Conservation Rules
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
ESA	Environmental and Social Assessment
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
FGD	Focus Group Discussion
GIS	Gas Insulated Switchgear
ESU	Environmental and Social Unit
GAAP	Governance and Accountability Action Plan
GoB	Government of Bangladesh
GRC	Grievance Redress Committee
IDA	International Development Association
IEE	Initial Environmental Examination
IEF	Important Environmental Features
MoEF	Ministry of Environment and Forests

NGO	Non Government Organization
OHS	Occupational Health and Safety
OP	Operational Policy
PAP	Project Affected Person
PPE	personal protective equipment
PCAIP	Public Consultation and Access to information Plan
PBS	Palli Bidduyt Shamiti
PD	Project Director
PGCB	Power Generation Company of Bangladesh
PM	Particulate Matter
PM2.5	Particulate Matter with aerodynamic diameter ≤ 2.5 micrometers
PM10	Particulate Matter with aerodynamic diameter ≤ 10 micrometers
PMO	Project Management Office
RCC	Reinforced Cement Concrete
SECs	Special Environmental Clauses
SIA	Social Impact Assessment
SMF	Social Management Framework
SMP	Social Management Plan
SPM	Suspended Particulate Matter
TDS	Total Dissolved Solids
TPP	Tribal People Plan
ToR	Terms of Reference
WB	World Bank

Executive Summary

Background

The Power system in Bangladesh has evolved rapidly over the last five years. The generation capacity has nearly doubled over this period to cross 11,000 MW in 2015. However, country's demand for electricity has also been increasing and peak demand has increased from 4,530 MW in 2010 to 8,348 MW on April 09, 2016. During the last year, demand has grown by more than 1,000 MW implying that there is significant amount of suppressed demand in the system. Demand is therefore expected to further accelerate over the coming years. The demand forecasts that are considered for the ongoing Power System Master Plan 2015 shows projected gross peak demand to reach 13,620 MW by 2020, close to 20,000 MW by 2025 and close to 50,000 MW by 2040. The power system in therefore expected to double again over the next five years.

The proposed project requires carrying out an Environmental and Social Assessment in accordance with the Environment Conservation Act 1995 (Amended in 2000, 2002 and 2010), the Environment Conservation Rules 1997, and the World Bank Safeguard Policies. However, the exact routes of transmission lines and substation locations are not identified at this stage. Therefore a framework approach has been adopted for environmental and social assessment (ESA) of the proposed project. This volume provides Environmental and Social Management Framework (ESMF) part of the assessment.

Policy and legal Framework and Applicability to Project Components

Bangladesh has an environmental legal framework that is conducive to both environmental protection and natural resources conservation. In addition, a wide range of laws and regulations related to environmental and social issues are in place in Bangladesh. Many of these are cross-sectoral and partially related to environmental issues. The EMSF report presents an overview of the major national laws and regulations that are relevant and may apply to activities supported by the project, institutional arrangement and national and sub-national level. The report also discusses the relevant World Bank safeguard policies and their applicability to the proposed project.

Sub-project Categories

The sub-projects to be implemented under the proposed rural electricity transmission and distribution project do not appear to pose risk of significant adverse environmental impacts. Accordingly, the overall project could be classified as a "Category B" project, according to WB project classification (OP 4.01). In accordance with the ECR 1997, certain sub-projects are categorized (e.g., Reconductoring of transmission lines) and the ESIA requirements of these projects are also clearly spelled out in the ECR 1997. Sub-projects category according to ECR 1997 is shown in the Table E1. However, environmental/social screening of all sub-projects will be carried out first (see 4.4.6), based on which the ESIA requirements will be determined. In general, the environmental/social screening process identifies what impacts will be generated and what type of mitigation measures will be required for the sub-projects.

Table E-1: Classification of sub-projects according to ECR 1997 (GoB, 1997)

Project Component/Sub-projects	Project/Sub-project Category according to ECR 1997	Likely Project/Sub-project Category
Re-conductoring/Upgradation of 132 kV lines	Not specifically listed	May be classified as "Orange A" or "Orange B" depending on assessment of potential impact
Re-conductoring /Upgradation of 230 kV line	Not specifically listed	May be classified as "Orange A" or "Orange B" depending on assessment of potential impact
Up-gradation of Substations by Installing SVC/Capacitor Bank	Not specifically listed	May be classified as "Orange A" or "Orange B" depending on assessment of potential impact

Notes: *(1) According to ECR 1997, "power distribution line laying/relaying/extension" projects fall under "Red" category; i.e. Category is designated on the nature of project not the anticipated impact*

(2) Proposed rural electricity transmission and distribution project could be classified as "Category B" on the expected impact according to WB OP4.01.

Environmental/Social Screening

A screening checklist was used to evaluate the potential environmental impacts of the proposed activities. Environmental/Social Screening matrices, Form 2a (for substation) and Form 2b (for power transmission line) presented in Appendix C are used. Based on the outcome of these screening matrices, key environmental issues that are to be managed during planning, construction and operation of substations and reconductoring of transmission lines are described in the following categories and impacts and mitigation measures for each of these categories are discussed.

Environmental and Social Baseline

For proper environmental assessment, it is very important to define the "environmental baseline" against which environmental impacts of a particular sub-project would be subsequently evaluated. For systematic recording of data, the baseline environment is usually classified into physical environment, biological environment, and socio-economic environment; and important features/parameters under each category are identified and measured/ recorded during baseline survey. Chapter 4 presents a sample environmental and social baseline which could be use as a guideline for collection of primary and secondary data on physicochemical and biological parameters respectively for sub-projects to be implemented under the proposed project.

Environmental and Social Management Guideline Plan

Various environmental and social management plans will be prepared during preparation of EA for the subcomponents. Suggestive plans to be prepared and tasks to be carried during subcomponent works are presented in the table E-2 which will be revisited during the preparation of the EA.

Table E-2: Management Plans/ Additional Tasks

Sl	Plan/Task	Responsibility			Timing
		Plan Preparation	Plan Review/ Approval	Implementation	
Documents or Plans prepared / to be prepared by PGCB / its Consultants					
1	Preparation of detailed TORs for the ESA studies for Subcomponents	ESU	PGCB/ WB	Independent Environmental Consultant	ToR for Independent ESAservices is already prepared (Appendix A).
2	ESA/RAP study for subcomponents	Independent ESA Consultant	PGCB/ WB	ESU, Independent Environmental Consultant	During first year of project implementation (2017-2018)
3	Mitigation and Compliance Monitoring Plans	Independent ESA Consultant	PGCB /WB	PGCB through contractors	Preliminary plans are prepared (Table 6.3), but will be updated during detailed ESA studies of subprojects
4	Environmental Code of Practices (ECoPs)	Independent ESA Consultant	PGCB /WB	PGCB through contractors	Preliminary draft prepared (Appendix F)
5	Inclusion of environmental clauses in bid documents for various contracts	ESU	PGCB/WB	CSC	2017-2018
	Plans to be prepared by contractors				
6	Construction Environmental Action Plan	Contractor	PIUand CSC	Contractor	Within one month of mobilization and prior to any initiation of construction works
7	OHS Plan	All contractors	PIU and CSC	Contractor	Within one month of mobilization and prior to any initiation of construction works
8	Pollution Prevention Plans (related to air, noise, soil, water resources)	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
9	Waste Disposal and Effluent Management Plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
10	Drinking Water Supply and Sanitation Plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
11	Traffic Management Plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
12	Construction Camp Management Plan	Contractor	CSC and PIU	Contractor	Before mobilization of

Sl	Plan/Task	Responsibility			Timing
		Plan Preparation	**Plan Review/ Approval**	**Implementation**	
					each contractor
13	Fuels and hazardous substances management plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
14	Emergency Preparedness Plan (for construction phase)	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
Plans to be prepared for O&M Phase					
15	O&M Phase Environmental Code of Practices	ESU (through consultants)	-	PGCB	Prior to completion of construction
16	Environmental Management (waste disposal, air and noise quality, etc.)	ESU (through consultants)	-	PGCB	Prior to completion of construction
17	Occupational health and Safety Management (OHS Management)	ESU (through consultants)	-	PGCB	Prior to completion of construction

Assessment and Prediction of Impacts and Mitigation Measures

The potential environmental impacts during construction and operation phase of sub-projects could be categorized into: (a) biological impacts; (b) physical impacts; and (c) socio-economic impacts. The impacts (both general and component-specific) and suggested probable mitigation measures are summarized in Tables E-3 to E-4.

Table E-3: Typical "general impacts" during construction phase of sub-projects and corresponding mitigation and enhancement measures

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
Location of Substation	• There may be a requirement of land acquisition for substations • Temporary land acquisition and compensation for construction work • Damages of undergrowth vegetation at the equipment storage area	• All substations will be upgraded within PGCB land and no additional land is expected. • However, in case of any additional land required, provide compensation in accordance with 'resettlement policy framework (RPF)' presented in Chapter 6. • Temporary land acquisition and compensation will be paid based on the RPF and RAP prepared during independent ESA study. • Establish Monitoring Unit (if needed) involving 3 parties (PGCB, WB, and PAPs) for monitoring purposes. • Use barren land as much as possible	PGCB	WB
Realignment of Transmission Lines	• High-voltage transmission line may pose serious threat to population living underneath the lines. • Felling of trees and damages of cropfield and other undergrowth vegetation at the RoW • Relocation of wildlife from the RoW due to vegetation damage	• During the detailed study possibility of realignment of these lines should be considered by PGCB, hence, protect the health of the population • Avoid vegetated land as much as possible to align the transmission line • Give chance to the land owners to harvest the crops before starting the project activities (If possible) • Arrange proper compensation to the land owners against tree felling and crop damage • Aware labour and local people about wildlife conservation so that minimize vegetation damage as well as safe relocation of wildlife at nearer habitats and dwell safely there	PGCB	PGCB/WB/IM
Design of Reconductoring of Transmission	• Improper design and placement of conductors may cause electrocution of birds.	• A minimum of 200 cm horizontal/diagonal spacing and 100 cm vertical spacing between electrically conductive points on the power line.	PGCB	PGCB/WB/IM

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
Lines				
Mobilization of Equipment and Material	• Physical damages to local road network • Damages of additional vegetation at the access way	• Effective traffic management plan by PGCB authorized contractor • Use of existing path/access roads for movement of labour and carrying vessels • No other measure is needed as the vegetation is seasonally grown and will re-vegetated naturally in next year	Contractor	PIU/IM
Employment opportunity	• Proposed project would require workers for construction, accessories supplies etc. • During construction period employment opportunities for both skilled and unskilled labor may have improved	• Make a list of directly affected people who lose their tree/ agricultural crops are interested to work during construction phase. • Ensure local people's engagement and give the priority offering working facilities in project activity.	Contractor	PIU/IM
Loss of Crop Production	• Possibility of standing crops in the field might be affected • Crop production might be reduced to some extent	• Working schedule would be prepared carefully so that standing crop would not be damaged • If not possible, proper crop compensation should be paid to the land owner for standing crops damage • The farmers should be informed well ahead (before start of cropping season) about the construction activities • Proper care should be taken during construction	Contractor	PIU/IM
Air Quality	• Air quality may deteriorate slightly for transportation of materials, land filling, foundation, RCC woks • Exhaust emission from the concrete equipment machines	• Ensure that all project vehicles are in good operating condition. • Spray water on dry surfaces/ unpaved roads regularly. • Maintain adequate moisture content of soil during transportation, compaction and handling. • Sprinkle and cover stockpiles of loose materials	Contractor	PIU/IM

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
		(e.g., fine aggregates). • Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.		
Noise Impacts	• Noise level may exceed the standard limit due to the mobilization of vehicles; transportation and unloading of materials • Noise level will create discomfort to the workers as well as the surrounding receptors	• Use of noise suppressors in heavy construction equipment like concrete batching and mixers etc. • Avoid using of construction equipment producing excessive noise besides sensitive places like educational institutions and hospitals etc. Peak time of the institutions close to the project area should also be concerned to the project implementing agency. • Avoid prolonged exposure to noise (produced by equipment) by workers. • Regulate use of horns and avoid use of hydraulic horns in project vehicles.	Contractor	PIU/IM
Soil Quality in angle point and sub-station area	• Soil quality as well as soil characteristics might be deteriorated due to mishandling and disposing of wastes during implementation of the project	• The activities should be limited within stipulated area • Proper storage of chemicals on site • The installation of natural or synthetic liners beneath chemical storage tanks • Minimization of on-site water and chemical usage (oil, lubricants and fuel) • Limiting the exposure of the soil to accidental releases of pollutants • Use of non-toxic and readily biodegradable chemicals on-site • Generated wastes should be dumped in a stipulated area by appropriate manner	Contractor	PIU/IM
Impact on Vegetation	• Damages of undergrowth vegetation at the equipment storage area	• Use barren land as much as possible • Avoid vegetated land as much as possible to align	Contractor	PIU/IM

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
	• Felling of trees and damages of cropfield and other undergrowth vegetation at the RoW for stringing of cable • Damages of additional vegetation at the access way due to Mobilization of Equipment and Material	the transmission line • Arrange proper compensation to the land owners against tree felling • Use of existing path/access roads for movement of labour and carrying vessels • No other measure is needed as the vegetation is seasonally grown and will re-vegetated naturally in next year		
Impacts on wildlife	• Relocation of wildlife from the RoW due to vegetation damage	• Aware labour and local people about wildlife conservation • Minimize vegetation damage as well as safe relocation of wildlife at nearer habitats	Contractor	PIU/IM
Interference with Road Crossing (Traffic Congestion and Safety)	• Deteriorate the volume capacity of the existing road.	• Scheduled deliveries of material/ equipment during off-peak hours. • Depute flagman for traffic control as well as provision of signal light at night. •	Contractor	PIU/IM
Storage of Materials and Solid and Liquid Wastes	• Might cause a disturbancein agricultural land • Congestion of adjacent water bodies during and after construction period. • Contamination of water bodies during construction.	• Cleanup must be initiated immediately along with constructing a suitable septic tank system. • Erection of “no litter” sign, provision of waste bins/cans, where appropriate	Contractor	PIU/IM
Occupational and Public Health and Safety	• The safety and health of the public may be impacted due to the hazards created during the construction period • Risk of accidents during the construction period is moderate due to the operation and movement of heavy equipments, vehicles and	• Need contingency fund for affected neighboring people to address accidental issues during implementation period • Need proper danger signs/ posters to avoid accident at construction site • Proper awareness program about possible accidents should be ensured for the neighboring people	Contractor	PIU/IM

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
	machineries • Probability of accidental risk for labors and accident during replacing the conductor by fall down into the locality	• Ensuring rigorous standards for occupational health and safety are in place • Contractor will establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal • Provide health insurance for employees for the duration of their contracts • Provide insurance for accidents resulting in disabilities or death of employees for the duration of their contracts • Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system		

Table E-4: Typical "general impacts" during operation phase of sub-projects and corresponding mitigation and enhancement measures

Operation Phase			
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Agency**
Maintenance of transmission/ distribution lines	• Impact on crop production • Partial impact on intercultural operation	• Imparted training to the farmers for creation of awareness on avoiding any possible accident for proper intercultural operation in the tower locations	PGCB
Regular maintenance of cables	• Disturb and increase risk of death to flying mammals and birds while passing through the TL • Create transmission tower as	• Aware local people to planted medium high trees to maintain plant diversity in the area. • Covered transmission line should be used to avoid the impact on aerial wildlife. • Use adequate color bands/flags with transmission wires so that the	PGCB and contractors

Operation Phase			
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Agency**
	resting habitat of some birds whose are depend on floodplains	flying animals will aware while pass through the line.	
Pruning of tree top for regular maintenance of cables	• Limiting tree height under the RoW of transmission line	• Aware local people to planted medium high trees to maintain plant diversity in the area.	PIU/IM
Collision and electrocution of birds and flying mammals	• Disturb and increase risk of death to flying mammals and birds while passing through the TL	• Covered transmission line should be used to avoid the impact on aerial wildlife. • Use adequate color bands/flags with transmission wires so that the flying animals will aware while pass through the line. • Use warning lamps on AP towers at different height during night	PIU/IM
Health and Safety	• Live power lines • Working at height • Electric and magnetic fields • Exposure to chemicals • Exposure to electrical hazards from the use of tools and machinery.	• Only allowing trained and certified workers to maintain, or repair electrical equipment; • Taking appropriate protective measures against accidental fall from elevated height during regular maintenance operations (e.g. using body harness, waist belts, secured climbing devices, etc.) • Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines; • Proper Personal Protective Equipment(PPE) for all workers and others associated with work • Training of workers in the identification of occupational EMF levels and hazards.	PGCB
Safety and risks due to land use under the transmission line	• Fall of live conductor on human/animals/any conducting substance may cause short circuit and that may cause life loss	• Avoid settlement under the transmission line • Proper maintenance of the transmission line	PGCB

Operation Phase			
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Agency**
	• Sudden flashover that may cause life loss	• Use of proper protection equipments like circuit breaker, relay etc.	
Electricity Supply and Regional Development	-	• Improved power supply to various parts of Bangladesh, which will increase the potential for development of economy. • Integration into national power grid and increased reliability of power supply throughout Bangladesh.	PGCB

Monitoring Plan

As one of the key elements of the ESMP, a two-tier monitoring program has been proposed comprising compliance monitoring of mitigation measures and effects monitoring of various parameters. The main purpose of these monitoring programs are to ensure that the various tasks detailed in the ESMP, particularly the mitigation measures are implemented in an effective manner, and also to evaluate project's impacts on the key environment and social parameters. Various types of monitoring are presented in the following sections. Table E-5 present guidelines for monitoring of specific environmental and social parameters during construction and operation phases of different sub-projects.

Table E-9: Compliance Monitoring of Mitigation Measures

Sl.No.	Key Points of Mitigation Measures	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
						Monitoring	Supervision
1.	**Compliance Monitoring during Construction Phase**						
1.1.	Ambient Noise	Day time (6:00 – 21:00) and Night time (21:00 – 6:00) L10, L90	7 locations in and around GPS as mentioned in Figure 11-1	Twice Weekly	Three Sample during day time and one sample during night, 15 min sampling each time.	Contractor	OE, PGCB
1.2.	Ecosystem and Biodiversity	Tree felling	At the angle point towers	Monthly	Direct Counting	Contractor	OE, PGCB
1.3.	Agricultural	Crop Production Loss	At the angle point	Monthly following	Agricultural Survey	Contractor	OE

Sl.No.	Key Points of Mitigation Measures	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
						Monitoring	Supervision
	Production		towers	cropping patterns			
1.4.	Exposure to Electro-magnetic Field[1]	Electrical Field, Magnetic Field	Outside the safety fence of Substation, Power evacuation bay, along HV line	Quarterly	One time sampling using EMF meter	Contractor	OE
1.5.	Health and Sanitation	Availability of Potable Water, Drinking water quality, Availability of Hygienic Toilet	Labor shed	Monthly	Inspection and interview of labor, project personnel	Contractor	OE
1.6.	Vegetation Clearance	No. of tree feling and area of undergrowth vegetation clearance	Base of each AP, STRIPS OF SRINGING RoW, and storage locations	Once every month, and as directed by the Project Engineer	Direct counting for tree and physical observation for undergrowth vegetation	IM	OE, PGCB
1.7.	Community Health, Safety and Security	Implementation of ESMP	As specified in the ESMP	Monthly	Inspection and interview of labor, project personnel followed by a checklist	Contractor	OE
2.	**Compliance Monitoring during Operation Phase**						
2.1.	**Ecosystem and Biodiversity**						
2.1.1.	Incidence of bird electrocution and collision with transmission line	Species Composition and occurrence of incidence	All the RoW	Monthly	During the project lifetime	PGCB	PGCB
2.2.	**Occupational Health and Safety**						
2.2.1.	Exposure to Electro-magnetic Field	Electrical Field, Magnetic Field	Inside the Substation, Power evacuation bay,	Quarterly	Measurement by EMF Meter Inspection of workers' roster shifting hours etc.	PGCB	Independent Monitor/ PGCB

[1]See Annex 11-2 for the standards related to electro-magnetic field.

Sl.No.	Key Points of Mitigation Measures	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
						Monitoring	Supervision
2.2.2.	Worker Health	General Health Condition, Hearing health, skin disease, etc.	Workers involved in the substation and transmission line maintenance	Yearly	Health Check up	IM	PGCB
2.3.	Labor and Working Condition						
2.3.1.	Health and Sanitation	Availability of Potable Water	Labor Shed	Monthly	Visual Inspection and Record Checking	IM	PGCB
		Availability of Hygienic Toilet	Labor Shed	Monthly	Visual Inspection	IM	PGCB
2.4.	Community Safety and Security						
2.4.1.	Safety and Security	Emergency Preparedness and Response of PGCB	N/A	Two times in a year	Visual Inspection and Record Checking	IM	GPS/ BPDB

Environmental Code of Practice (ECoP)

The ECoP outlines activities on different issues related to project implementation. The ECoP developed will address the following issues related to the above project components: (1) Project Planning and Design, (2) Overhead Power Cable reconductoring, (3) Substation Site Preparation, (4) Construction Camps, (5) Topsoil Salvage, Storage and Replacement, (6) Waste Management, (7) Water Bodies, (9) Water Quality, (10) Electromagnetic Field, (11) Public Health and Safety, (12) Material Storage, Transport & Handling, (13) Cutting of Trees, , Vegetation (14) Natural Habitats, (15) Occupational Health and safety, (16) community Health and safety,

Influx Impact and Management Plan

Labor influx for construction works can lead to a variety of adverse social and environmental risks and impacts. The list below provides a guideline of typical adverse social and environmental impacts, but is not exhaustive. While many of these impacts could have been already present or might occur regardless of the labor influx, they are likely to be exacerbated by it. The actual type and degree of impact varies significantly depending on the characteristics of the project, community and incoming workforce. It may be difficult to separate some impacts from non-project related factors, specifically if the project area experiences broader social, economic and cultural change during the project period,which may be difficult to assess or predict as part of the ESIA.

Institutional Arrangement and Responsibility

The Project implementation will be led by the Project Implementation Unit (PIU) that will be established within PGCB. The PIU will be responsible for procurement of consultants for carrying out the EA and engineering designs for the proposed sub components. The PIU will be headed by the Project Director (PD). An Environment and Social Unit (ESU) has been established under the PIU and recruitment of qualified environmental and social staffs are underway. This ESU will assist the PIU on issues related to environmental and social management and oversee the Construction Supervision Consultant (CSC) and contractors and will compile quarterly mitigation and monitoring reports on EMP compliance, to be sent to the Project Director and also shared with the World Bank, throughout the construction period. The ESU will also provide trainings to the PGCBfield personnel responsible for monitoring of environmental compliance during both construction and O&M phases of the project. The organogram of PIU is shown in Figure E-1.

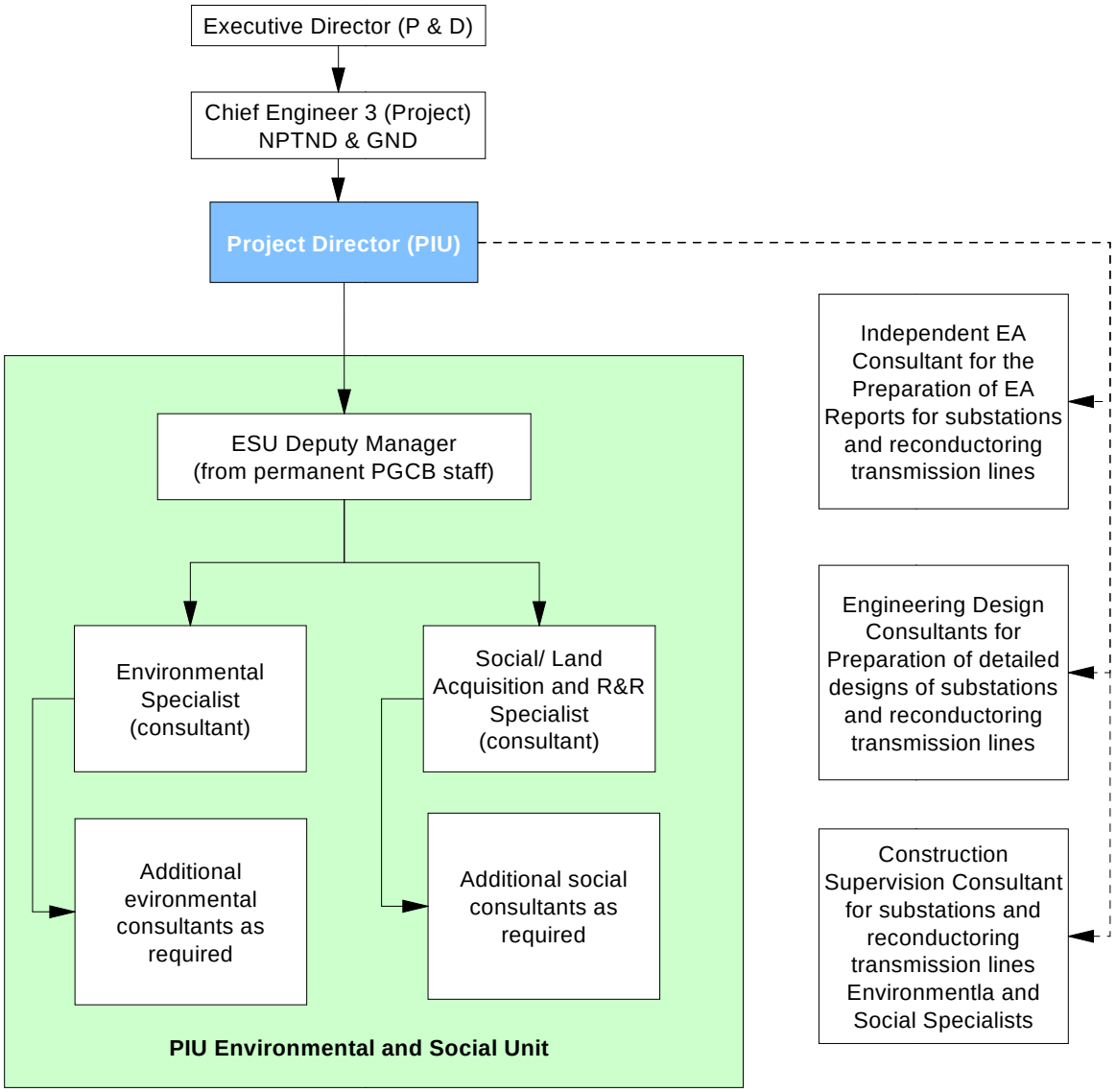


Figure E-1: Institutional set up, including major activities and assignment of responsibility for their execution, for implementation of proposed project by the PGCB

Table E-6: Institutional set up, including major activities and assignment of responsibility for their execution, for implementation of proposed project by the PGCB

Organizations	Responsibilities
PIU	• Ensure that all project activities are well-managed and coordinated. • Recruitment of consultants for ESA and engineering designs; and obtain approval of ESA from the DOE • Procurement of works and goods. • Payment of compensation to the project affectees • Recruitment and supervision of Construction Supervision Consultants (CSC)
ESU within PIU	• Responsible for screening and determining scope of EA work required for subprojects and studies, assisting PD with developing TORs and hiring of consultants to carry out any required environmental assessment work, reviewing consultant's deliverables related to environmental assessment, reviewing bid documents for inclusion of ESMP measures, supervising construction activities, producing periodic monitoring reports, • Ensuring inclusion of ESMP in bidding documents • Providing training on ESMP principles and requirements to PGCB and NLDC

Organizations	Responsibilities
	field staffs, and others as needed to ensure effective implementation of ESMP • Supervising CSC for the implementation of ESMP • Closely coordinate with other concerned agencies, local governments and communities to support implementation of ESMP • Preparation of progress reports on implementation of ESMP. • Ensure effective implementation of ESMP components not directly tasked to the contractor including components dealing with indirect, induced and cumulative effects, as well as operations and maintenance stage plans and measures. • Commissioning and oversight/review of consultant reports for EIAs/EMPs to be developed for the subcomponents of the Project
ESA Consultants	• Carrying out an independent EA studies in compliance with the GoB and World Bank guidelines following this ESMF • Preparing EMP for inclusion in the bid documents
CSC	• Supervise civil works, ensuring compliance with all design parameters including quality requirements • Supervising contractors for EMP implementation • Prepare monthly reports and submit to PIU • CSC will have dedicated environmental, occupational health and safety and social staffs
Contractor	• Responsible for implementation of mitigation and monitoring measures proposed in the EMP • Each contractor will recruit Environmental, Health, and Safety Manager, who will be responsible for implementing the contractors' environmental, health and safety responsibilities, and liaising with government agencies. S/he will have adequate number of staffs to support him/her for these tasks.

Grievance Redress Mechanism

A GRC will be formed for each sub-project, headed by the Chairman / Mayor of relevant area. Members will be taken to represent the communities and other stakeholders including representative of local administration, school teachers, local NGOs, women and ward level elected representatives. The GRC will be a forum where people will exercise their rights of participation in the project cycle through suggestions and complains. GRCs will also be para-legal court of the project to address local problems and complaints related to social and environmental impacts. GRM focal points and the case record management are shown in flow diagram at Figure E-2.

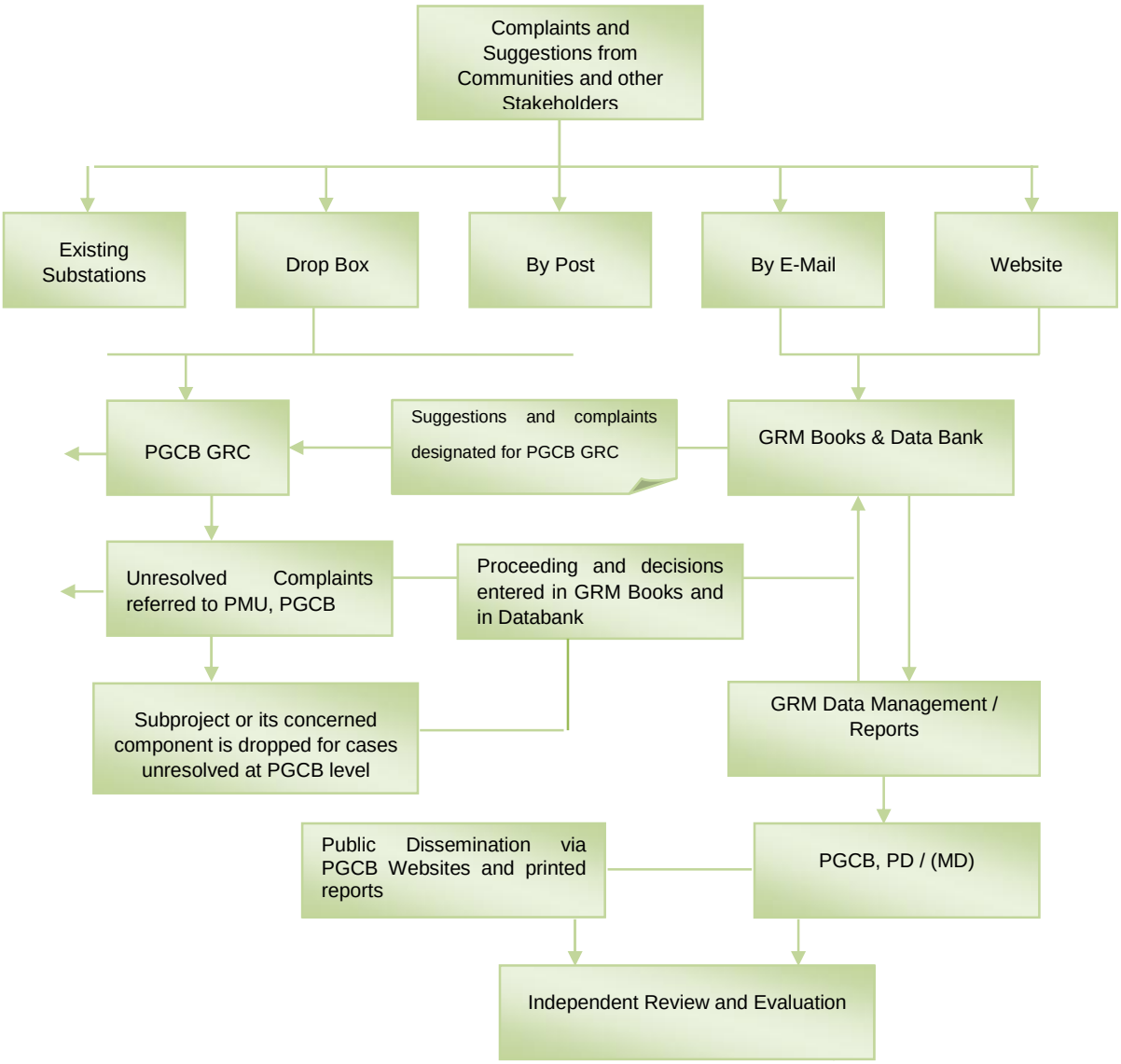


Figure E-2: GRM Institution and Focal Points

Method for Estimation of Cost of ESMP

Cost estimates will need to be prepared for all the mitigation and monitoring measures to be proposed in the subproject ESA. The cost estimates for some of the mitigation measures to be identified in the ESMP will be part of civil works contract. Tentative cost estimates of independent ESA study and ESMP implementation (beyond civil works contract) is given in Table E-7. Further detailed estimates will be made during independent ESA study.

Table E-7: ESMP Cost Estimates

Item	Cost in million, USD
Independent ESA Study	0.25
Contractor's Budget (for development of CEAP. OHS plans, staffs, training, equipment, etc.)	1.50
Water, soil, air and noise quality monitoring during construction (quarterly for 3 years)	0.25
CSC Environmental Staff	1.00
ESU Staffs (Consultants)	0.35
Capacity building and training	0.25
Total	**3.60**

Land requirement and RAP

The project approach discourages acquisition of private lands and displacement of people for project purpose. However, certain sub-projects (e.g., reconductoring of transmission lines) may require temporary acquisition of private land. Once it is determined through the social screening that a sub-project will require land temporarily, involve population displacement or loss of livelihoods, a Resettlement Action Plan (RAP) needs to be prepared. Chapter 7 presents detail guideline for preparation of RAP. It presents a discussion on major issues concerning temporary land acquisition and resettlement; it presents impact mitigation objectives and principles, eligibility for compensation/assistance and principles for providing compensation/assistance. Appendix H (a)/(b)/(c)/(d) provides detail description of land acquisition process, and processes for preparation and implementation of sub-project specific RAP. It presents a method for market price survey, and a compensation and entitlement matrix.

Public/Stakeholder Consultation

Consultation and community participation will be undertaken at subproject identification, planning, design, implementation and evaluation stages. Consultation and participation involves communities and other stakeholders, which will take place through interpersonal communications, focused group discussions (FGDs) and small and large community meetings. Chapter 8 presents a guideline for carrying out public consultations at different stages of a sub-project cycle.

1. Introduction

1.1 Background

1. The Power system in Bangladesh has evolved rapidly over the last five years. The generation capacity has nearly doubled over this period to cross 11,000 MW in 2015. However, couintry's demand for electricity has also been increasing and peak demand has increased from 4,530 MW in 2010 to 8,348 MW on April 09, 2016. During the last year, demand has grown by more than 1,000 MW implying that there is significant amount of suppressed demand in the system. Demand is therefore expected to further increaseover the coming years. The demand forecasts that are considered for the ongoing Power System Master Plan 2015 shows projected gross peak demand to reach 13,620 MW by 2020, about 20,000 MW by 2025 and about 50,000 MW by 2040, respectively. The power system in therefore expected to double again over the next five years.

2. There are many challenges that would need to be overcome not the least of which is Bangladesh's dwindling gas reserve and hence increased reliance on imported fuel, especially oil in the short to medium term. The second challenge is to equip the system so that it cannot merely grow in terms of MW capacity but is reliable to ensure capacity is available when needed, secure i.e., can prevent major outages through proper frequency and voltage management, and resilient to recover from any contingency (e.g., sudden outage of a generator or a major line). It is critical to start putting in place measures that ensure power can be supplied for a much larger demand at a reasonable cost maintaining an acceptable quality standard. The proposed project will address the following fundamental measures that must be put in place so that the power system can be operated in a secure and economic manner in line with the longer term goals to deliver much greater quantum of power:

i) Introduction of automatic frequency regulation from National Load Despatch Centre(NLDC) by implementing primary governor control to at least 15 nos. of power generators. This will enhance system stability.

ii) Integration of power generators to NLDC network and necessary up-gradation of Supervisory Control and Data Acquisition (SCADA)/ Energy Management System (EMS) core to modernize the dispatch system. Capacity building and training of NLDC staffs. This will lead to reliable andeconomic system operation of Bangladesh National Grid.

iii) Introduction of Dynamic Line Rating (DLR) for critically loaded transmission lines of PGCB. This will ensure safe and economic operation of the national grid.

iv) Introduction of some Mega Volt Ampere Reactive (MVAr) andStatic VAR Compensation (SVC)to critical points of the national grid. This will enhance voltage stability and reduce system loss.

v) Up-gradation of 230 kV Sirajgonj- Bogra transmission line's capacities by reconductoring with higher capacity conductor.

1.2 The proposed Project

3. The proposed 'Bangladesh Power System Reliability and Efficiency Improvement Project'(the Project) of the Power Grid Company of Bangladesh Ltd. (PGCB) will

upgradeexisting transmission lines by reconductoring with higher capacity conductors and introduceapproximate 800MVAr SVC to critical points aims to improve the power system by securingoperation and economic transmission. The major components of the proposed project include the following:

Component A: Grid network strengthening by reconductoring existing transmission line

4. The component will support the reconductoring existing transmission line with higher capacity conductor in Bangladesh (Dhaka, Chittagong, Rajshahi and Barisal Divisions). The proposed investment will reduce systems losses while improving the reliability and quality of supply. The proposed physical targets under the component are summarized in Table 1.1.

Table 1.1: Works under component A of the proposed project

Sl. No.	Reconductoring of Transmission line	Length (km)
1.	Reconductoring 230 kV D/C TL	114
2.	Reconductoring 132 kV D/C TL	80
Total		**194**

Component B: Enhance voltage stability and reduce system loss by installing SVC (Static Var Compensator)/ Capacitor Bank

5. To enhance system security and economics, the power system needs priority investments in certain areas including trials to new technologies. After analyzing the grid network, it is recommended that SVC is trailed in some areas to see their efficacy to manage reactive power on a permanent basis. System planning of PGCB recommends the exact location and number of MVAr to be installed based on their power flow and reactive compensation analysis. PGCB has recently started adopting reactive compensation through capacitor banks on transformer deltatertiary. SVCs are also typically connected to the deltatertiary of auto transformers and ajudicious mix of capacitor banks and SVCs can be deployed to minimize overall cost. PGCB also recommended some location for installing Capacitor Bank where SVC installation is not technically feasible.

1.3 Project Cost and Financing

6. The preliminary cost estimates for the proposed Project is as below.

Estimated Cost in lakh taka	
GoB	12978.90 (16.66 m USD)
PGCB	6068.49 (7.79 m USD)
PA	50628.50 (65.00 m USD*)

1 USD = 77.89 BDT as on 22th December, 2015

Source: PDPP, PGCB

1.4 The Environment and Social Safeguard Instrument of the Project

7. The exact routes of transmission lines and substation locations are not identified at this stage. Therefore a framework approach has been adopted for environmental and social assessment (ESA) of the proposed project. PGCB has engaged CEGIS to carry out an Environmental and Social Assessment (ESA) and prepare an Environmental and Social

Management Framework (ESMF) of the proposed project to ensure that the proposed infrastructure takes environmental and social concerns into account.

8. In summary, the Environment and Social Management Framework (ESMF)has been developed to:

(a) ensure all relevant environmental and social issues are mainstreamed into the design and implementation of the proposed subcomponents or subprojects,

(b) consider in an integrated manner the potential environmental and social risks, benefits and impacts of the proposed subprojects and identify measures to avoid, minimize and manage risks and impacts while enhancing benefits,

(c) ensure compliance with national and World Bank requirements, and

(d) guide conducting the independent environmental and social assessment (ESA) of the subprojects when required.

(e) Informal discussions were held with people living and working in the surrounding areas.

1.5 Objectives of ESMF

9. This ESMF presents detailed guidelines for the major activities to be carried out for independent ESA (including ESMP) of specific components that have not yet been fully designed and planned during the project preparation stage, and for which construction will only get underway or beyond of project implementation. These guidelines include: (i) Environment Screening (identification of possible impacts) (ii) Description of surrounding environment (establishment of “baseline condition” against which impacts of the proposed components would be evaluated) after identifying influence area for different components; (iii) analysis of alternatives; (iv) identification of major sub-project activities during both construction and operational phases; (v) assessment, prediction and evaluation of impacts of project activities on the baseline environment; (vi) carrying out public consultations; (vii) preparation of environmental codes of practice (ECoPs); and (viii) identification of mitigation measures and preparation of impact specific environmental management plans (EMP) including monitoring requirements

10. The ESMF is intended to provide general policies, guidelines and procedures to be integrated into the design and implementation of all components or sub-projects under the proposed project. PGCB will adopt the ESMF, which lays out the guideline for conducting the environmental and social impact assessment once the line routes and substation locations will be identified. Its overall objective is to assist PGCB to ensure that:

- Project components (i.e., transmission line, SVC/ capacitor bank) are formulated considering potential environmental and social issues, especially of those people who would be directly benefited or impacted by the proposed project;
- Project components are designed considering unique socio-cultural and environmental situation prevailing at the areas where the specific project component would be implemented;
- Possible environmental and social impacts of subprojects activities during both construction and operational phases are identified during project formulation and design, and appropriate mitigation/ enhancement measures are devised and monitoring plan prepared, as a part of the overall environmental and social management plans;

- Environmental Management Plan (EMP), Social Management Plan (SMP) and Environmental Code of Practices (ECoP) are properly followed; and
- Project activities comply with the relevant policies, rules and regulations of the GoB (e.g., Environmental Conservation Rules 1997) and safeguard policies of the WB. The PGCB will also be responsible for getting necessary environmental clearance from the Department of Environment (DoE).

11. In general, the ESMF will be a guiding document for project-component specific:

- Environmental screening;
- Assessment of impacts (both positive and negative);
- Environmental and Social Assessment;
- Public consultation and disclosure;
- Environmental and Social Management Plans (EMP, SMP);
- Implementation of EMP, SMP and ECoP; and
- Monitoring and reporting.

1.6 ESMF Study Methodology

12. The ESMF has been prepared through participatory process mainly based on open ended discussions, formal and informal interaction with stakeholders that lead to an understanding of the existing system from the perspectives of all the stakeholders. The work has been performed in close cooperation with the project team. This included collection of secondary data, related literatures, field surveys, public/stakeholder consultations, and desk studies.

13. In order to prepare the ESMF, relevant secondary source of information were reviewed and limited field investigation has been carried out to explain the environmental concerns related to different subprojects.

14. The specific tools and methods used to meet the desired scope of work are highlighted below:

a) Environmental review of overall program and preparation of preliminary baseline of the project.

15. In order to meet the above scope, the following strategies have been adopted:

- Review of program details available at the time of assessment;
- Collection of secondary information (periodic plans of participating districts, situation analysis of pre-feasibility study and its conformity with interaction with stakeholders); and
- Sample of different subproject of baseline information at larger stage by field visit to the different districts.

b) Review of relevant plan, policies and legislations of GOB and WB:

16. In order to meet the above scope, the following strategies were adopted:

- Review of plan, policies, government directives and legislations related to environment in the context of Bangladesh;

- Identification of environmental provisions that is applicable to the present project;
- Review of the World Bank's environmental safeguard policies and identifies provisions/requirements that need to be met by this project; and
- Review of similar documents being used in similar type of programs.

c) Review of existing environmental management practices of PGCB/WB.

17. In order to meet the above scope, the methodologies adopted are as follows:

- Review of current environmental requirements and practices followed by PGCB/WB;
- Study of the effectiveness of environmental provisions applied to similar project activities in Bangladesh;
- Discussion with PGCB about their existing environmental management practices existing environmental problems;
- Review and "on the ground" verification of environmental management practices and its effectiveness followed by PGCB including review and record of good and bad environmental practices followed; and
- Environmental Practices in other projects (WB funded, etc.).

d) Institutional and capacity assessment

18. The following methodologies were adopted by the consultant to meet and its objectives:

- Review of institutional mechanisms for environmental management of institutional involved in proposed program and their environmental management practices. The assessment will be made to find out the institutional capacity in terms of existence of environmental management unit, environmental staff & work load, existence of environmental management practices, resources (manpower, budget, and equipment facilities), mandate, roles and responsibility of staff in environmental management, currently ongoing environmental programs and its effectiveness;
- The system, process, procedures in complying environmental mandate, guideline, framework and its effectiveness, (tools if any, such as screening format, checklist etc.); and
- Assessment of participating institutions in terms of their capacity with regard to their existing mandates, functions, human, and financial resources available for environmental management functions as well as assessment of their capacity considering incremental workloads from the proposed program.

19. Based on the above, the consultant has developed the necessary institutional and capacity building activities.

e) Stakeholder analysis, consultation and disclosures

20. The following methodologies were adopted to meet the above scope and its objectives:

- Plan for the stakeholder consultations at the district level with respect to the program and its environmental management. Based on the outcomes of the

stakeholders analysis, policy review and capacity assessment, institutional mechanism for environmental management the project program should be developed;

- Share in PGCB during the interaction about the likely environmental issues, environmental requirements of GOB and WB;
- During the preparation of ESMF, interactions were also held with PGCB office, and private sector for their views with regards to their opinions, their roles and responsibilities in the project; and
- Assessment of stakeholder's impressions on environmental issues, causes, and in exploring ways to address it.

1.7 Structure of the Report

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

Chapter 1: Introduction: The introduction chapter presents a brief overview of the assignment along with its background, proposed project, project cost and financing, environmental and social assessment, objectives and study methodology etc.

Chapter 2: Environmental Policy and Legislations: Chapter Two outlines the Environmental Rules and Regulations, Policy and Legislation on environmental issues.

Chapter 3: Description of the Project: Chapter Three describes the proposed interventions for the project, background, project category, need for the project, size.

Chapter 4: Environmental and Social Baseline: Chapter Four presents an example based description of the environmental baseline condition (socioeconomic, physical and biological) that should be followed for the future ESIA report of the project area.

Chapter 5: Screening of Potential Environmental and Social Impact and Mitigation Measures: Chapter five presents the potential environmental impact and mitigation measures.

Chapter 6: Environmental and Social Management Plan: This chapter deals with the frame works of environmental managemnetr plan.

Chapter 7: Guideline of Preparation of RAP: This chapter deals with the guideline of preparation of RAP.

Chapter 8: Public Consultation and Disclosure: This chapter mainly describes the public opinions of the project as well as the major problems, impacts and probable solutions recommended by the project and discloser methods.

2. Policy and Legislation

2.1 Overview

22. The proposed Bangladesh Power System Reliability and Efficiency Improvement Project requirescompliance with several environmental policies and legislation promulgated by GOB, particularly, the Environment Conservation Act, 1995 (as amended in 2000, 2002 and 2010) and the Environment Conservation Rules, 1997 (including amendments of 2002, 2003, and 2005). The Department of Environment (DoE) under the Ministry of Environment and Forest, Government of the People's Republic of Bangladesh is responsible for ensuring application of environmental laws and issuance of necessary clearances.

23. This report is prepared by considering several legislation and policies which has relevance to power transmission activity in Bangladesh. Apart from national laws and policies, compliance with the guidelines and safeguard policies of World Bank are also considered, asthis project will be financed by IDA.

24. All of these regulations are aimed at the conservation and protection of the environment and an overview of these legislation and policies are presented in this chapter.

25. The Environment Conservation Rules, 1997 place activities of power plant into the Red category. This requires submission of IEE (for location clearance) and EIA (for environmental clearance) to the DoE. The administrative procedure and checklist of necessary documents are also described in this chapter.

2.2 National Legislation

2.2.1 Environment Conservation Act 1995

26. The national environmental legislation is known as Environmental Conservation Act (ECA), 1995 (and subsequent amendments) is currently the main legislative document relating to environmental protection in Bangladesh, which repealed the earlier environment pollution control ordinance of 1997 and has been promulgated in 1995. The main objectives of ECA 1995 are:

- Conservation and improvement of environment, and
- Control and mitigation of pollution of environment.

27. The main strategies of the act can be summarized as:

- Declaration of ecologically critical areas, and restriction on the operation and process, which can be carried, out or cannot be initiated in the ecologically critical areas.
- Regulation in respect of vehicles emitting smoke harmful for the environment.
- Environmental clearance.
- Regulation of the industries and other development activities – discharge permit.
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes

- Promulgation of standard limit for discharging and emitting waste.
- Formulation and declaration of environmental guidelines.

28. Bangladesh Environmental Conservation Act (Amendment 2000) focuses on: (1) ascertaining responsibility for Compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

29. Bangladesh Environmental Conservation Act (Amendment 2002) elaborates on: (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases.

30. Bangladesh Environmental Conservation Act (Amendment 2010) elaborates on (1) demarcation of wetlands and water bodies, (2) Hazardous waste import, transportation, storage etc., (3) Cutting of hills, mountains (4) Ecologically Critical Areas.

31. Failure to comply with any part of the Environment Conservation Act 1995 may result in punishment to a maximum of 5 years imprisonment or a maximum fine of Tk. 100,000, or both.

2.2.2 Environment Conservation Rules, 1997 (including amendments of2002, 2003, and 2005)

32. A set of the relevant rules have been promulgated to implement the ECA 1995. There have been three amendments to the Rules until now in February and August 2002,April 2003, and July 2005, respectively. The Rules mainly consist of:

- The national Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;
- Categorization of industries, development projects and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities.
- Procedure for obtaining environmental clearance;
- Requirement for undertaking IEE and EIA as well as formulating EMP according to categories of industries/development projects/activities;
- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

Categorization of Projects or Industrial Units

33. The Rules incorporate "inclusion lists" of projects requiring varying degrees of environmental investigation. Projects are screened as Green, Orange-A, Orange-B and Red based on their location and environmental burden. A list of industries is given in the Rules under each of the category which aid the proponent on choosing the correct administrative procedures. A description pf each category is below:

34. **Green List** projects are those with positive environmental impacts or negligible negative impacts such as plantation and nursery. Clearance for these is obtained on the basis of project description, initial screening and “No Objection Certificate” (NOC) by the local authority.

Orange List projects fall into two categories:

35. **Orange A** projects are those with minor and mostly temporary environmental impacts for which there are standard mitigation measures, such as the installation of tube wells, pond sand filter (PSF), tank/reservoir, sanitary latrines etc. Application for DOE's environmental clearance requires general information, a feasibility report, a process flow diagram and schematic diagrams of facilities, environmental screening form, NOC from local authority.

36. **Orange B** projects are those with moderately significant environmental impacts for which mitigation measures are easily identified, such as construction/re-construction of earthen roads, culverts, community center, office building for general services, re-excavation of canal, repairing embankment, and school field, etc. These require Environmental Clearance Certificate from DOE, for which an Initial Environmental Examination (IEE) report, Environmental Management Plan, along with the information and papers specified for Category A projects.

37. **Red List** projects are those which may cause 'significant adverse' environmental impacts such as the construction of bridge, industrial factories, flood shelter, embankment, water control structure, etc. They require IEE report to obtain the Site Clearance Certificate, and subsequently a full EIA report for ECC, along with the information required for other Categories. A good number of sectoral EIA guidelines have been prepared to assist the EIA process.

38. **Environmental Quality Standards**in operation in Bangladesh was also promulgated under the Environment Conservation Rules 1997 (as amended in 2005). There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges, vehicular emission etc.

39. The Bangladesh standards intend to impose restrictions on the volume and concentrations of wastewater/solid waste/gaseous emission etc. discharged into the environment. In addition a number of surrogate pollution parameters like Biochemical Oxygen Demand, or Chemical Oxygen Demand; Total Suspended Solids, etc. are specified in terms of concentration and/or total allowable quality discharged in case of waste water/solid waste. Additionally, specific parameters depending on the manufacturing process are specified such as phenol, cyanide, copper, zinc, chromium etc. Air emission quality standards refer mostly to concentration of mass emission of various types of particulate, sulphur dioxide, and oxides of nitrogen and in some cases volatile organic compounds and other substances.

40. The Bangladesh standards, in general, are less stringent compared to the developed countries. This is in view to promote and encourage industrialization in the country. The Bangladesh standards are not for any specific period of time. There is no provision for partial compliance too.

2.2.3 Electricity (Amendment) Act 2012

41. This aim of this Act is to amend the previous laws relating to the supply & use of electrical energy, which first enacted in 1910 and then amendment came in 2012. The Act provides guidelines for energy supply, electricity generation, transmission and distribution including protective and safety clauses. Under this Act, any person can get a license to supply energy and to lie down or place electric supply lines for the conveyance and transmission of energy.

- The licensee can open and break up the soil and pavement of any street, railway or tramway and can lay down any line or do other work near other utility services

(like gas, T&T, water, sewer, etc.), provided that prior permission is taken from the respective authority, as stated in section 12 – 18 of this Act.

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

42. Following the amendment of this Act in 2012, the obligation towards preservation of environment has made under the section 22A, that a person authorized by a license, or exempted from the requirement to obtain a license, to generate, transmit, distribute or supply 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
- 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.

2.2.4 Environment Court Act 2010

43. The Environment Court Act 2010 is the mechanism for the establishment of environment courts and matters incidental relating to environmental pollution and incidental matters. The environment court enjoys the exclusive jurisdiction for trial of an offence or for compensation falling under the Environment Conservation Act 1995 (amended 2010). This Act allows government to take necessary legal action against any parties who creates environmental hazards/ damage to environmentally sensitive areas as well as human society.

44. According to this Act, government can take legal actions if any environmental problem occurs due to this proposed power system improvement project interventions.

2.2.5 Acquisition and Requisition of Immovable Property Ordinance 1982

45. The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance, 1982 and subsequent amendments during 1993 - 1994. The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, and houses) and (ii) any other damages caused by such acquisition. The Ordinance provides certain safeguards for the owners and has provision for payment of “fair value” for the property acquired.

46. Deputy Commissioners (DC) will pay compensation for the land to be acquired based on Land Acquisition Proposals to be submitted by the requiring body. DCs, in all the cases, determine market value of acquired assets on the date of notice of acquisition (notice under section 3 of the Ordinance). The DCs then adds 50% premium on the assessed value for cash compensation under law (CCL) of all acquired assets except standing crops due to compulsory acquisition. The CCL paid for land is generally less than the “current market price” as owners customarily report undervalued land transaction prices in order to pay lower stamp duty and registration fees. If the land acquired has standing crops cultivated by tenant (bargadar) under a legally constituted agreement, the law requires that part of the compensation money be paid in cash to the tenants as per the agreement. Places of worship, graveyard and cremation grounds

are not to be acquired for any purpose. The law requires that the salvaged materials upon payment of compensation will be auctioned out by the government. Under the 1982 Ordinance, the Government is obliged to pay compensation only for the assets acquired.

47. However, the provisions under this law are not adequate to cope with the adverse effects related to land acquisition and involuntary resettlement, nor do they do fully match the requirements of the WB's Operational Polices (OP 4.12) or international standards. Some of such gaps in existing land acquisition law of the country are:

- Existing GOB laws recognize title owners only; informal settlers are not covered
- Consultation with affected community not legally required
- No support or program for income and livelihood restoration.

48. In light of addressing these shortcomings, the Government of Bangladesh is working on preparation of a **national policy on involuntary resettlement**, which is consistent with the general policy of the Government that the rights of those displaced by development projects shall be fully respected, and persons being displaced shall be treated with dignity and assisted in such a way that safeguards their welfare and livelihoods irrespective of title, gender, and ethnicity. The Government will undertake further work towards legislative changes to safeguard resettlement rights by law once the draft policy is approved in the Cabinet.

49. This proposed project does not require acquiring new land because the installation of SVC will happen within the existing boundaries of the existing power stations. However, land will be used in temporal basis for SVC substation installation during the construction phase as part of the purposes like material storage, workers camps construction, and transportation of materials and equipment to the site etc. Land requisition will be done following the procedure mentioned in this Act.

2.2.6 Bangladesh National Building Code 2006

50. The Bangladesh National Building Code (BNBC) was first published in 1993 and revised in 2006 which is the code of practice for construction sector in Bangladesh. The provisions of this Code is applicable to the design, construction, use or occupancy, alteration, moving, demolition and repair of any building or structure and to any appurtenances installed therein or connected or attached with the building/structure. The Code also 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 during construction. With relation to this, the Code set out the details about the different safety tools of specified standard. The general duties of the employer to the public as well as workers are also stipulated in the BNBC.

51. The implication of this legal binding in this proposed project arises from the safety of public and workers in relation to the up-gradation of the transmission lines and construction of 26 SVC substations which are regarded as the expansion of existing national grid.

2.2.7 Bangladesh Labour Act 2006

52. Bangladesh Labour Act was promulgated in 2006. The legislation pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions. The amendment in 2013 has introduced a good number of important items like workers' welfare, rights and safety and industrial safety and expansion of the industry are particularly relevant for this proposed study.

53. This Act applies to the proposed project as it falls under the industry which is responsible for transformation, generation, conversion, transmission, or distribution of electrical energy. The occupation health and safety of the workers is covered under this Act. It is mandatory for every factory to keep its workers abreast of work risk(s) through providing all personal protection equipments. Factory owners have to ensure secured power system and ensure that the exit paths are unlocked and the staircases/paths in the factories are kept open during the working hours to meet any emergency.

54. In 2015, Bangladesh government has introduced the Bangladesh Labour Rules. Some of the relevant points of this Rules are health and fire safety, prescribe from for filling case in Labour Court, and approval of factory plan and any extension among others.

2.2.8 Disaster Management Act (2012)

55. The Act Disaster Management Act 2012 aims to make the activities about disaster management coordinated, object oriented and strengthened and to formulate rules to build up infrastructure of effective disaster management to fight all types of disaster. Disastermeans any such incidents created by nature or human.

56. Disaster (to certain degree) may occur in present project if any harmful situation occurs during the normal work or construction activity. Therefore, appropriate management plan should have to be taken by the project proponent to prevent any unwanted disaster in the plant.

57. This Act is particularly relevant to avoid accidental hazard both in construction and operation and maintenance phase. The relevance of this act for this proposed project arises as following:

- To make a disaster management plan for rehabilitation to bring back any infrastructure, life, livelihood and working environment damaged by disaster to previous condition or better condition.
- To create effective disaster management infrastructure to fight disaster and to make the public concerned and strengthened to face the disasters.
- To ensure no obstacle is created in playing fire brigade and rescue vehicles during a fire broke out, earthquake, building slide or other disaster.

2.3 Relevant national policies

2.3.1 Environmental Policy 1992

58. Bangladesh National Environmental Policy was approved in May 1992, and sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. Key elements of the policy are:

- Maintenance of the ecological balance and overall progress and development of the country through protection and improvement of the environment.
- Protection of the country against natural disasters
- Identification the regulation of all types of activities which pollute and degrade the environment
- Ensuring sustainable utilization of all natural resources
- Active association with all environmentally-related international initiatives

59. Environmental policy contains the following specific objectives with respect to the industrial sector:

- To adopt corrective measures in phases in industries that causes pollution.
- To conduct Environmental Impact Assessments for all new public & private industries.
- To ban the establishment of any industry that produces goods cause environmental pollution, closure of such existing industries in phases and discouragement of the use of such goods through the development and/or introduction of environmentally sound substitutes.
- To ensure sustainable use of raw materials in the industries to prevent their wastage.

2.3.2 National Environmental Management Action Plan 1995

60. National Environmental Management Action Plan (NEMAP) is a wide-ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements during the period 1995 to 2005 and sets out the framework within which the recommendations of the National Conservation Strategy are to be implemented.

61. NEMAP has the broad objectives of:

- Identification of key environmental issues affecting Bangladesh;
- Identification of actions necessary to halt or reduce the rate of environmental degradation;
- Improvement of the natural and built environment;
- Conservation of habitats and biodiversity;
- Promotion of sustainable development;
- Improvement in the quality of life of the people.

62. One of the key elements of NEMAP is that sectoral environmental concerns are identified. In outline, the environmental issues of the industrial sector include the following:

- Pollution arising from various industrial processes and plants throughout the country causing varying degrees of degradation of the receiving environment (Air, Water, and Land).
- There is a general absence of pollution abatement in terms of waste minimization and treatment.
- Low level of environmental awareness amongst industrialists and entrepreneurs.
- Lack of technology, appropriate to efficient use of resources and waste minimization leading to unnecessary pollution loading in the environment.
- Economic constraints on pollution abatement and waste minimization such as the cost of new technology, the competitiveness of labor, and intensive production methods as compared to more modern methods.

- Concentration of industry and hence pollution in specific areas which exacerbate localized environmental degradation and exceed the carrying capacity of the receiving bodies.
- Unplanned industrial development has resulted in several industries located within or close to residential areas, which adversely affects human health and quality of human environment.
- Establishment of industries at the cost of good agricultural lands and in the residential areas.
- Lack of incentives to industrialists to incorporate emission/discharge treatment plant in their industries.

2.3.3 National Energy Policy 2005

63. The National Energy Policy (NEP) of Bangladesh was formulated in 1996 by the Ministry of Power, Energy and Mineral Resources to ensure proper exploration, production, distribution and rational use of energy resources to meet the growing energy demands of different zones, consuming sectors and consumers groups on a sustainable basis. With rapid change of global as well as domestic situation, the policy was updated in 2005.

64. The objectives of the updated National Energy Policy (NEP) are outlined as follows.

- To provide energy for sustainable economic growth so that the economic development activities of different sectors are not constrained due to shortage of energy.
- To ensure optimum development of all the indigenous energy sources.
- To meet the energy needs of different zones of the country and socio-economic groups.
- To ensure sustainable operation of the energy utilities
- To ensure rational use of total energy sources.
- To ensure environmentally sound sustainable energy development programmes, with due importance to renewable energy, causing minimum damage to environment.
- To encourage public and private sector participation in the development and management of the energy sector.
- To integrate energy with rural development to boost rural economy.
- To bring entire country under electrification by the year 2020.
- To ensure reliable supply of energy to the people at reasonable and affordable price.
- To develop a regional energy market for rational exchange of commercial energy to ensure energy security.

2.3.4 National Land-use Policy 2001

65. 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.

66. This proposed project interventions have minimal affect on agricultural land. The construction of sub-station will take place on fallow land already under the ownership of power companies. The extent of activities that will affect the land will ensure that the existing national land use policy is adhered.

2.4 World Bank Safeguard Policies

67. The World Bank has developed a number of Safeguard Policies to ensure that all possible impacts are considered and mitigation measures are spelled out prior to the implementation of any proposed project. These policies ensure that the quality of operations is uniform across different settings worldwide. If the decision is taken that a Safeguard Policy should be applied, mitigation measures and plans must be developed and in place before the implementation of a proposed project.

68. The Bank requires environmental screening and classification for all investment projects proposed for Bank financing, to help ensure that they are environmentally and socially sound and sustainable. Screening and classification take into account the natural environment (air, water, and land); human health and safety; social aspects (including especially involuntary resettlement and presence of Indigenous Peoples); cultural property; and trans-boundary and global environmental aspects.

69. The objectives of environmental screening and classification are: to evaluate the environmental risks associated with a proposed operation; to determine the depth and breadth of Environmental Assessment (EA); and to recommend an appropriate choice of EA instrument(s) suitable for a given project. The Bank recognizes that environmental screening and classification is not absolute and involves professional judgment on a case by case basis. When screening, careful consideration needs to be given to potential environmental impacts and risks associated with the proposed project. Judgment is exercised with reference to the policy expectations and guidance; real impacts on the ground; and established regional and Bank-wide precedence and good practice.

70. The applicable WB safeguard policies are described below. In the following section, a table is provided indicating how each policy applies to the proposed investments:

2.4.1 OP/BP 4.01 Environmental Assessment

71. EA requirement. The World Bank requires environmental assessment (EA) of projects proposed for Bank support to ensure that they are environmentally sound and sustainable, and thus to improve decision making. The Bank Policy OP/BP 4.01 considers that EA is a process

whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. EA takes into account the natural environment (air, water and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples and physical cultural resources); and trans-boundary and global environmental aspects. The Bank Policy also envisages that the borrower Government is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements.

72. The present ESMF has been prepared in compliance with this OP/BP.

73. EA classification. The World Bank classifies the proposed project into one of the four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. These categories are defined below.

Category A: A proposed project is classified as Category A if it 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: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary (FI), in subprojects that may result in adverse environmental impacts.

2.4.2 OP/BP 4.04 Natural Habitats

74. The Policy highlights the importance of conservation of natural habitats, like other measures that protect and enhance the environment, 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 also supports, and expects borrowers to apply a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank- promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

2.4.3 OP/BP 4.10 Indigenous Peoples

75. This policy contributes to the Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights,

economies, and cultures of indigenous peoples. For all projects that are proposed for Bank financing and affect indigenous peoples, the Bank requires the borrower to engage in a process of free, prior, and informed consultation.

76. A project proposed for Bank financing that affects indigenous peoples requires:

- Screening by the Bank to identify whether indigenous peoples are present in, or have collective attachment to, the project area
- A social assessment by the borrower
- A process of free, prior, and informed consultation with the affected indigenous peoples' communities at each stage of the project, and particularly during project preparation, to fully identify their views and ascertain their broad community support for the project
- The preparation of an indigenous peoples planning framework; and
- Disclosure of the draft indigenous peoples planning framework.

2.4.4 OP/BP 4.11 Physical Cultural Resources

77. This policy addresses physical cultural resources, which 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. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

78. 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.

2.4.5 OP/BP 4.12 Involuntary Resettlement

79. The WB's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.[2]

80. The overall objectives of the Policy are given below.

81. Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.

[2] Excerpts from WB OP 4.12.WB Operational Manual. December 2001.

82. Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.

83. Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

2.4.6 OP/BP 4.36 Forests

84. This Policy recognizes the need to reduce deforestation and promote sustainable forest conservation and management in reducing poverty. The Bank believes that forests are very much essential for poverty reduction and sustainable development irrespective of their location in the world. The Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank also 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. The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical natural habitats. Furthermore, the Bank does not finance projects that contravene applicable international environmental agreements.

2.4.7 OP/BP 7.50 Projects on International Waterways

85. Projects on international waterways may affect the relations between the World Bank and its borrowers, and between riparian states. Therefore, the Bank attaches great importance to the riparian making appropriate agreements or arrangements for the entire waterway, or parts thereof, and stands ready to assist in this regard. A borrower must notify other riparian of planned projects that could affect water quality or quantity, sufficiently far in advance to allow them to review the plans and raise any concerns or objections.

2.4.8 OP/BP 7.60 Projects in Disputed Areas

86. Projects in disputed areas may raise a number of delicate problems affecting relations not only between the Bank and its member countries, but also between the borrower and one or more neighboring countries. In order not to prejudice the position of either the Bank or the countries concerned, any dispute over an area in which a proposed project is located is dealt with at the earliest possible stage.

87. The Bank may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed for country A should go forward without prejudice to the claims of country B.

2.4.9 Environmental, Health and Safety Guidelines

88. The Environment, Health, and Safety (EHS) Guidelines[3]contain the performance levels and measures that are generally considered to be achievable in new facilities or project by existing technology at reasonable costs. In addition, there are also industry specific EHS guidelines. The guidelines that are relevant to the Project are: EHS Guidelines for Electric Power Transmission and Distribution[4].

2.4.10 Applicable World Bank Policies on the Proposed Project

89. 71. The applicable World Bank policies for subprojects are given in Table 2.1.

Table 2.1: Triggering the World Bank Policies for Project Components

Directive	Policy	Applicability for Subprojects
Environmental Assessment	OP/BP 4.01	Triggered. Subcomponents of the project fall in to Category B because of limited scope of work and site specific impacts. A simplified ESA to be carried out for reconductoring and enhancing voltage stability and reduce system loss by installing SVC, in accordance with this ESMF document
Involuntary Resettlement	OP 4.12	Triggered. Project subcomponents may require temporary land acquisition and construction activities may affect standing crops for which compensation needs to be paid the affected population.

2.5 Public consultation and disclosure requirements by World Bank

90. 'Public Consultation' and 'Disclosure' are the two common requirements of environmental assessment of the World Bank policy. The safeguards ensure that environmental and social issues are evaluated in decision making, help reduce and manage the risks associated with a project or program, and provide a mechanism for consultation and disclosure of information.The normal World Bank Policy for Environmental Assessment is guided by Operational Policy/Bank Procedure (OP/BP) 4.01 and consists of seven basic elements:

- Screening
- Environmental assessment (EA) documentation requirements
- Public consultation
- Disclosure
- Review and approval of EA documentation
- Conditionality in loan agreements
- Arrangements for supervision, monitoring, and reporting

91. The table below outlines the requirements for 'consultation' and 'disclosure' elements.

[3] EHS Guidelines available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines

[4] http://www.ifc.org/wps/wcm/connect/66b56e00488657eeb36af36a6515bb18/Final%2B-%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&id=1323162154847

Table 2.2: Requirements for 'consultation' and 'disclosure' elements

EA policy element	Policy requirement	Comment
Consultation	Category A At least two consultations Category B At least one consultation	Consultations are conducted to receive input from local affected groups on their views of important environmental issues
Disclosure	Category A At the World Bank Infoshop (English) In-country, accessible to local affected groups (local language) Category B In-country, accessible to local affected groups (local language) Category FI Framework disclosed at the World Bank Infoshop and appropriate in-country Web site (e.g. Ministry of Environment). Individual subproject disclosure requirements defined in Framework	

92. The Bank reaffirms its recognition and endorsement of the fundamental importance of transparency and accountability to the development process. Accordingly, it is Bank's policy to be open about its activities and to welcome and seek out opportunities to explain its work to the widest possible audience. This is why the Access to Information Policy also relates to safeguards.

93. In addition, consultations have been held while preparing this ESMF. Public consultations were held in Sirajganj, Narshindi, and Jhenaidah on 19th and 20th October 2016. Community-level focus group discussions and meetings were also held at various substation locations. A summary of consultations held and key issues raised is presented in Chapter 7.

94. The ESMF has been disclosed in country on PGCB and NLDC websites and hard copies will be made available in locally accessible locations in the project area, including PGCB ad NLDC offices. These documents have also been disclosed on WB InfoShop.

2.6 Administrative Procedures for Obtaining Location/Environmental Clearance

95. The proposed power system improvement project intervention has legislative bases for environmental assessment in Bangladesh which are the Environmental Conservation Act 1995 and the Environmental Conservation Rules 1997. According to the ECA 1995, the proponent must need to obtain an Environmental Clearance Certificate from the Director General of DoE in the manner prescribed by the Rules. The Department of Environment (DoE) under the Ministry of Environment and Forest (MoEF) is the agency responsible for environmental planning, management and monitoring.

96. Environmental clearance has to be obtained in two steps: first location clearance and thereafter environmental clearance. Environmental Clearance Certificate is issued to all existing and proposed industrial units and projects falling in the Green category, but it is required to obtain a Location Clearance Certificate for industrial units and projects falling in the Orange – A, Orange – B and Red categories, and then the Environmental Clearance Certificate will be issued. According to the categorization, all construction/up-gradation of power plant industry

falls under the Red Category. Therefore, the power system reliability and efficiency improvement project falls under the 'Red' category and hence necessitates a full-scale ESIA.

97. The procedure to obtain an Environmental Clearance Certificate for this "Red" category project requires submission of following documents along with the application:

- Feasibility Report for the Project (where applicable)
- Environmental Impact Assessment (EIA) Report
- Environmental Management Plan (EMP)
- No Objection Certificate from relevant Local Authority (where applicable)
- Other necessary information, (where applicable)

98. Like all other projects, this project also needs to meet the requirement of the DOE. Public participation or consultation is not a condition in the ECR 1997 and or EIA Guidelines, however, DoE prefers the proponent to engage in public participation and put conditions while providing site clearance or during the approval of the EIA TOR. DOE is headed by a Director General (DG). The DG has complete control over the DoE.

99. The power of the DG, as given in the Act, may be outlined as follows:

- The DG has the power to close down the activities considered harmful to human life or the environment. The operator has the right to appeal and procedures are in place for this. However, if the incident is considered an emergency, there is no opportunity for appeal.
- The DG has the power to declare an area affected by pollution as an ecologically critical area. The DoE governs the type of work or process, which can take place in such an area.
- Before undertaking any new development project, the project proponent must take an Environmental Clearance from the DoE. The procedures to take such clearance are in place.

100. Steps to be followed for obtaining Environmental Clearance Certificate (ECC) in connection with the power plant industry (under Red Category) from DOE is outlined in **Figure 2.1**.

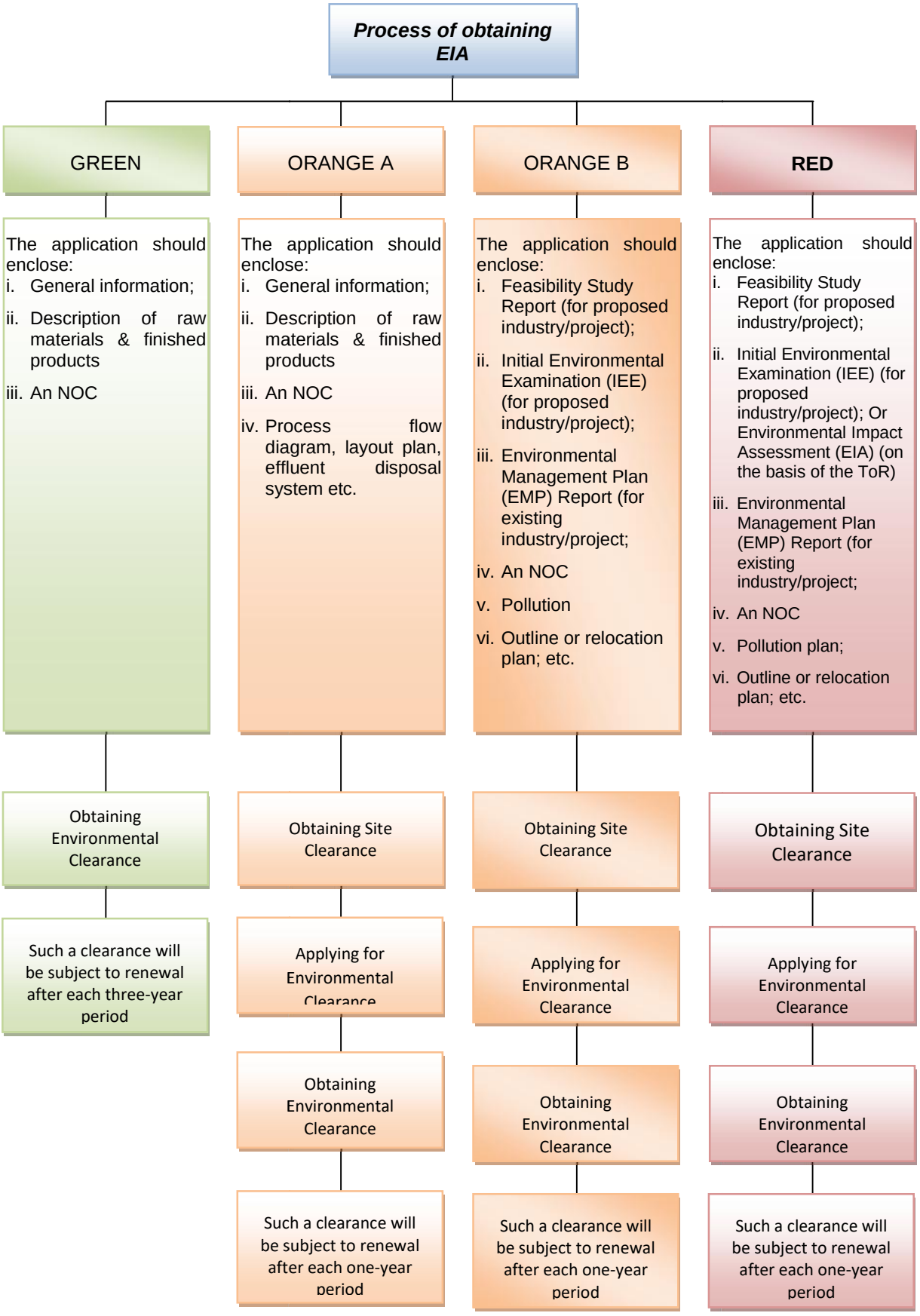


Figure 2.1: Steps Involved in Environmental Clearance following DoE Guidelines

3. Description of the Project

3.1 Reconductoring Existing Transmission lines

101. The proposed project has two major components:

- Reconductoring existing transmission lines
- Installation of SVC/ capacitor bank in existing substations

102. In transmission system of Power Grid Company of Bangladesh, there are old 132 kV and 230 kV lines of more than 30 years, feeding power to old 132/33 kV and 230/132 kV Substations. Due to aging, the capacity of the conductors is less than the rated value and the sag of the conductors is increased. The old conductors need to be replaced by higher capacity conductors.This reconductoring procedure will quite different from conventional stringing process. Stringing work will be done from angle point (AP) tower to angle point (AP) tower. New high capacity conductor will be stick together with the existing conductor of an existing AP tower. Tensioners puller, which is situated at another end, will pull the existing conductor and the abandoned conductors will roll in reels. Thus, the existing conductors will replace by the new ones. The major activities involved in the reconductoring of transmission lines include:

- Detailed survey of existing 132 kV/230 kV lines;
- Mobilization of materials, including procurement of conductors, earth wire and line materials;
- Stringing of higher size conductors by replacing old ones;
- Clearing right of way by cutting/ trimming trees; and
- Testing and commissioning.

3.1.1 Disposal of existing line components

103. The existing conductors and steel material will be removed from the structures and recycled, where possible. These are all direct embed structures which will be extracted by cranes and removed from the ROW for proper recycling or disposal as per PGCB' s waste minimization and disposal practices. Equipment typically used during the removal and disposal of existing line components includes cranes and bucket trucks. Dump trucks will be used to remove materials from the work site for recycling or disposal at PGCB approved facilities.Requirements for conductor and/or insulator removal, recovery and recycling/disposal work will include:

- Safe work and site management processes
- Any requirement for diagnostic inspection of abandoned conductors
- Appropriate site reinstatement processes
- Appropriate environmental responsibility of scrap disposal and recycling processes.
- Recycle elements of conductors and insulators, where feasible.
- Abandoned conductors also can be sold as scrap metal.

3.2 Installation of SVC/ Capacitor Bank in existing Substations

3.2.1 Physical Features of SVC

104. SVCs are required to regulate the voltage on the transmission system, particularly where there are contingencies that can cause a sudden and large drop in voltage. Based on a high level assessment of the Bangladesh power system in conjunction with Power Grid Corporation of Bangladesh (PGCB) transmission planners, the requirement of SVCs was confirmed on the 230 kV network and several locations. The rating of these SVCs has not yet been determined. Typically, the rating will depend on the reactive requirement following the largest contingency. PGCB were proposing to undertake this work but there is not yet any indication of the required SVC size.

105. Based on consultant (appointed by PGCB) experience, the expected range of SVCs is +300 to -200 MVAr – upper limit on size

- +150 to -100 MVAr – more typical size

106. The consultant had looked at the SVC reference locations for a number of SVCs from several manufacturers and determined the approximate dimensions.

107. For transmission SVCs at 230 kV, it is expected that a site dimension of at least 60 x 40 m will be required. The height of the structures within the site will vary depending on requirements but would typically be 4-5m around the transformers(s) and the reactors.

108. There is typically a margin required around the site to limit exposure to magnetic fields arising from the air-cored thyristor controlled reactors (TCRs). This could add a further 3-5m but the actual requirement will depend on the layout of plant within the site. A typical dimension of SVC is given in Figure 3.1.

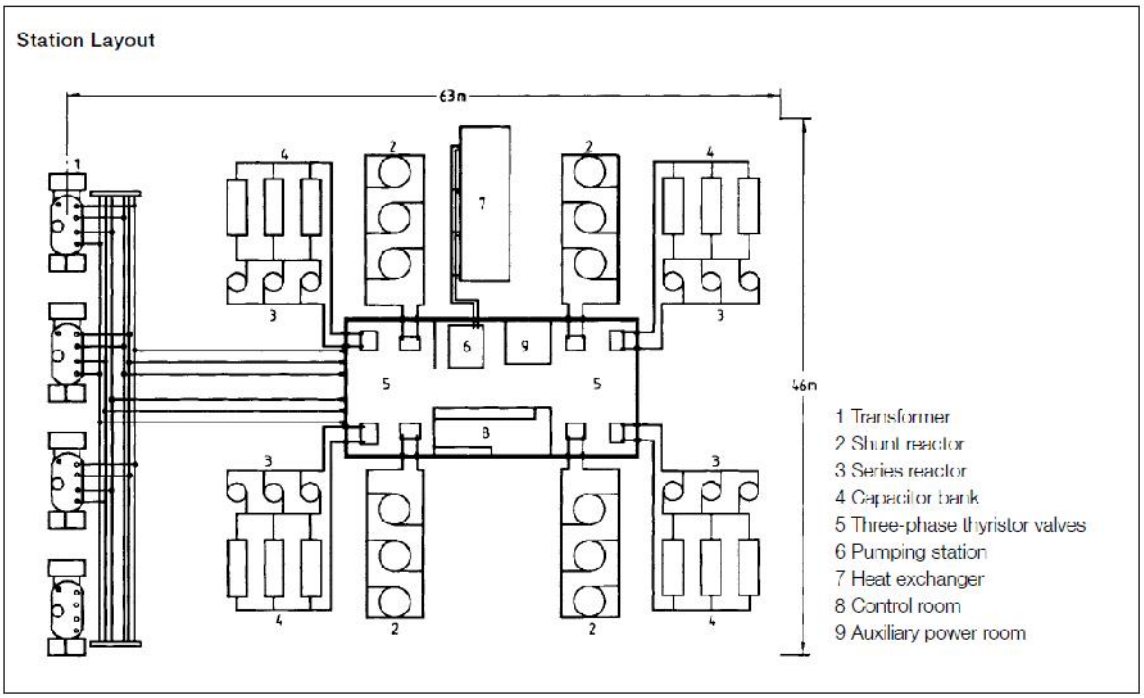


Figure 3.1: Typical SVC dimension

3.2.2 Physical Features of Capacitor Bank

109. A Capacitor Bank is a group of several capacitors of the same rating that are connected in series or parallel with each other to store electrical energy. The resulting bank is then used to counteract or correct a power factor lag or phase shift in an alternating current (AC) power supply. They can also be used in a direct current (DC) power supply to increase the ripple current capacity of the power supply or to increase the overall amount of stored energy. Acording to Power Grid Company of Bangladesh (PGCB) transmission planners, the requirement of Capacitor Banks was confirmed on the 230 kV network and several locations. The rating of these Capacitor Banks has not yet been determined. Typically, the rating will depend on the reactive requirement following the largest contingency. PGCB were proposing to undertake this work but there is not yet any indication of the required Capacitor Banks size. PGCB generally use Capacitor Banks in most of the existing substations.

3.2.3 Major activities involved in the installation work

- Detailed survey of existing substation to find available land; materials;
- Mobilization of materials, including procurement of conductors, earth wire and line
- Civil construction work;
- Installation of the electrical equipments
- Testing and commissioning.

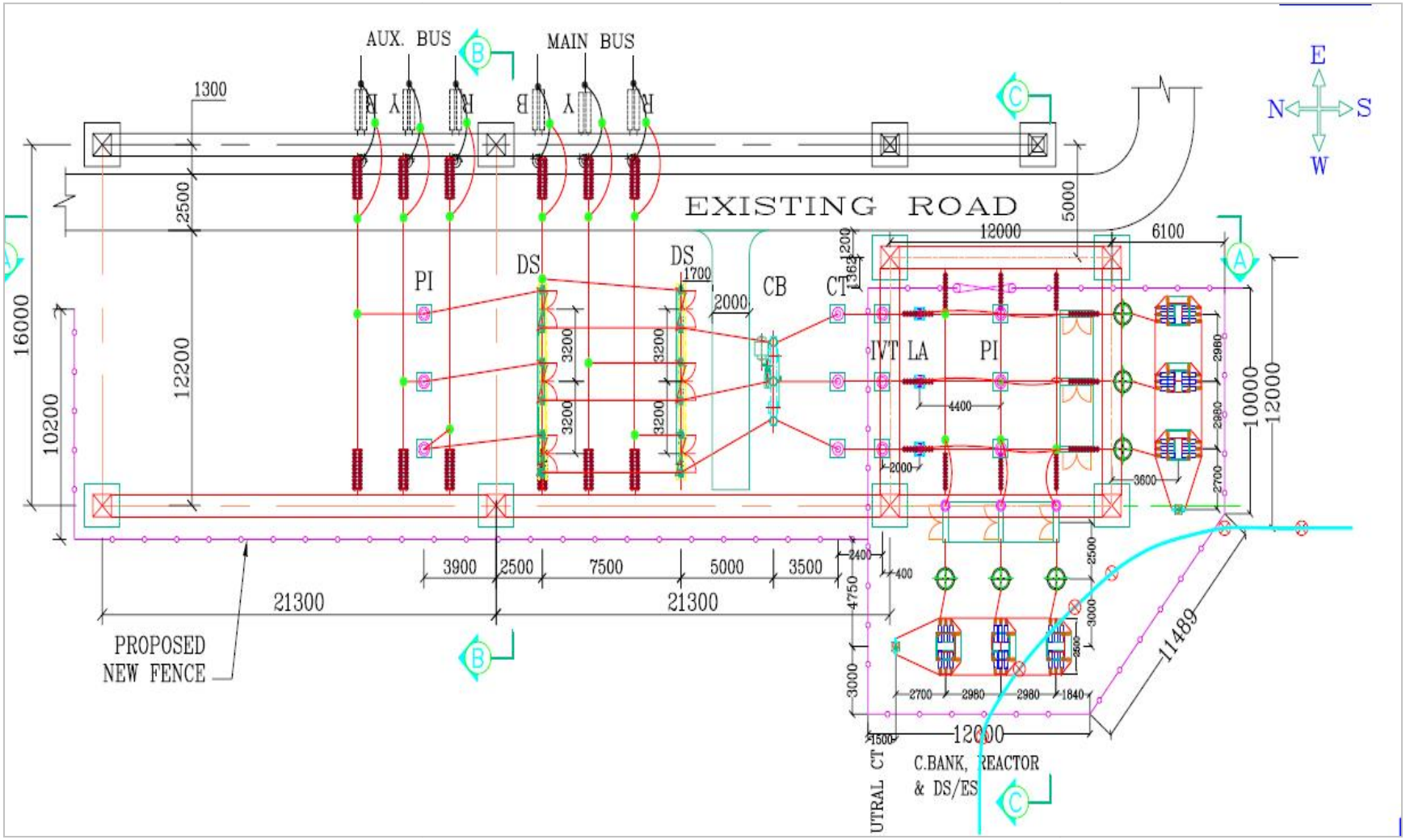


Figure 3.2: Layout Plan of a typical Substation that use Capacitor Bank

4. Environmental and Social Baseline

4.1 Introduction

110. For preparing this ESMF of the proposed project, a number of potential transmission line corridor and sub-station sites were visited by the study team. Based on the information collected during the field visits and secondary data this Chapter was drafted to guide the independent ESA team to establish the environmental and social baseline of the specific components of the Project.

4.2 Physical Environment

111. Physical environment refers to the physical and chemical features of an area. It includes the meteorological and all other natural resources within the area. The following sections provide analyses on different physical environmental features of the study area.

4.2.1 Meteorology

112. Meteorological information of the study area has been collected from the Barisal, Bogra and Faridpur station of BMD which is the nearest station in the area. Data on meteorological parameters such as Rainfall, Temperature, Relative Humidity, Wind Speed and Sun shine hour are gathered from the NWRD-CEGIS archive and synchronized at district level for the study area. Summary of the analysis of metrological parameters are given in the following sections:

(a) Rainfall

113. Rainfall intensity is a crucial parameter for the study area. May to October are the wettest months having highest rainfall intensity while November to February are the driest part of the year with almost negligible rainfall. The record of last 30 years (1984-2013) shows that the district received the maximum 1025 mm rainfall in **July 1984**. No rainfall or very little rainfall is recorded in the month of November to January. The monthly maximum and average rainfall is shown in Figure 4.1.The analysis of annual rainfall of last 30 years (1984-2013) showsa declining trend (Figure 4.2). The historical maximum annual rainfall of Barisal station was recorded as 3748 mm in 1984.

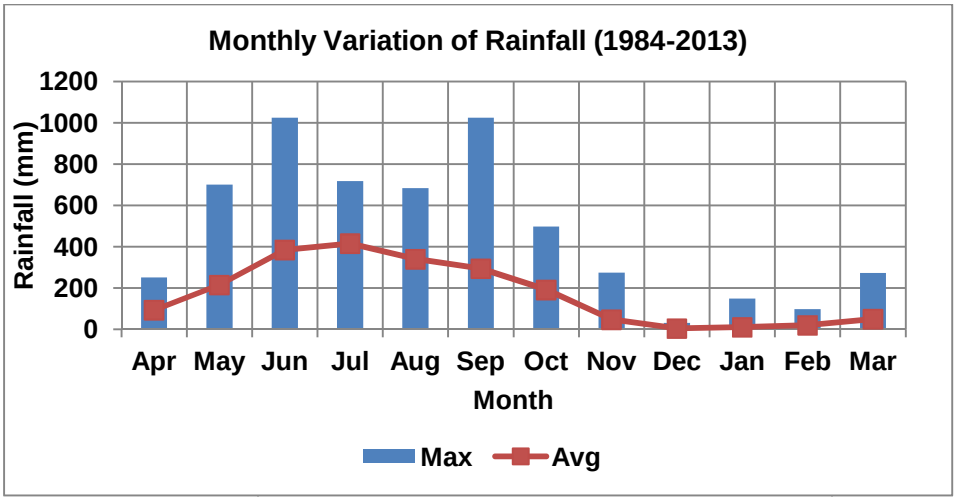


Figure 4.1: Monthly variation of Rainfall at Barisal BMD station

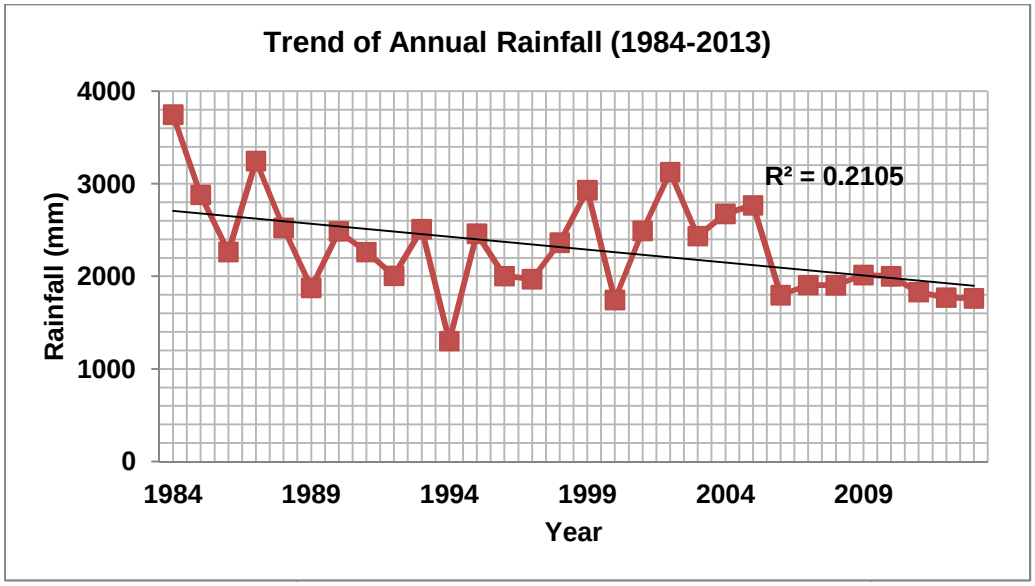


Figure 4.2: Trend of annual rainfall at Barisal BMD station

114. Rainfall intensity is a crucial parameter for the study area.May to October are the wettest months having highest rainfall intensity while November to February are the driest part of the year with almost negligible rainfall. The record of last 30 years (1984-2013) shows that the district received themaximum 756 mm rainfalls in **July 1988**. No rainfall or very little rainfall is recorded in the month of November to January. The monthly maximum and average rainfall is shown in Figure 4.3.The analysis of annual rainfall of last 30 years (1984-2013) shows a declining trend (Figure 4.4).The historical maximum annual rainfall of Bogra station wasrecorded as 2601 mm in 1984.

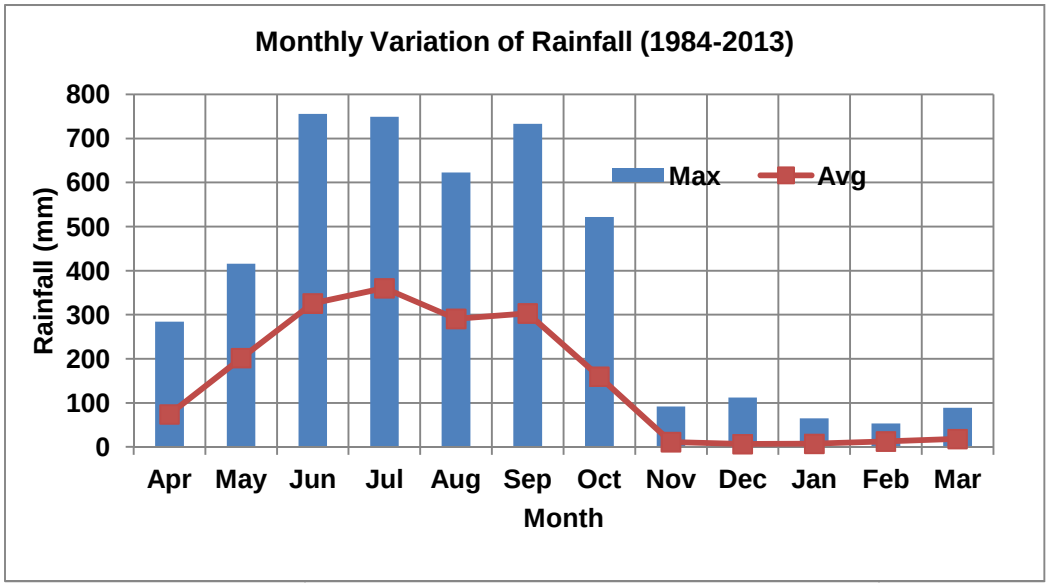


Figure 4.3: Monthly variation of Rainfall at Bogra BMD station

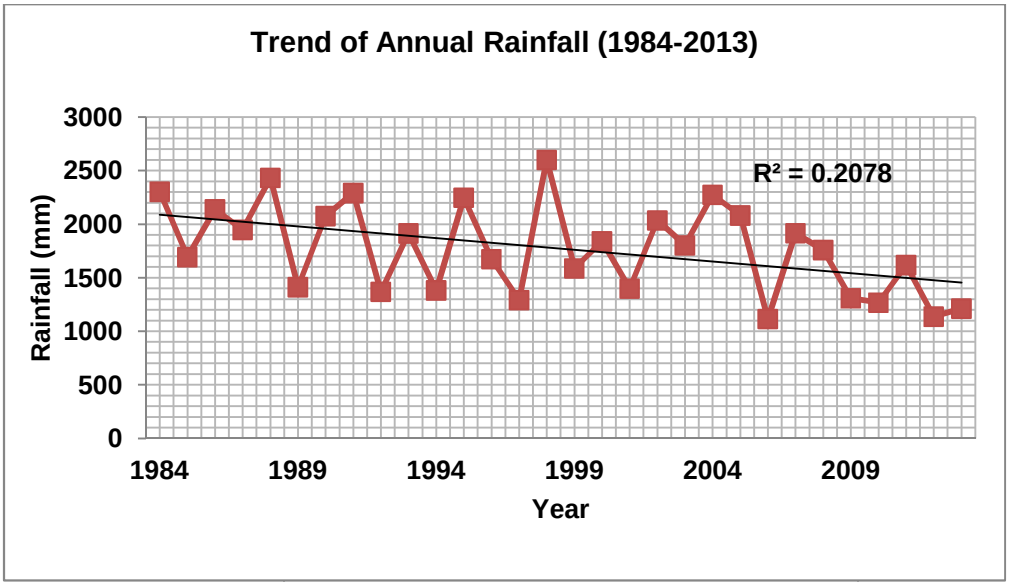


Figure 4.4: Trend of annual rainfall at Bogra BMD station

115. Rainfall intensity is a crucial parameter for the study area. May to October are the wettest months having highest rainfall intensity while November to February are the driest part of the year with almost negligible rainfall. The record of last 30 years (1984-2013) shows that the district received themaximum 831 mm rainfalls in **July 1986**. No rainfall or very little rainfall is recorded in the month of November to January. The monthly maximum and average rainfall is shown in Figure 4.5.The analysis of annual rainfall of last 30 years (1984-2013) shows a declining trend (Figure 4.6). The historical maximum annual rainfall of Faridpur station was recorded as 2544 mm in 1984.

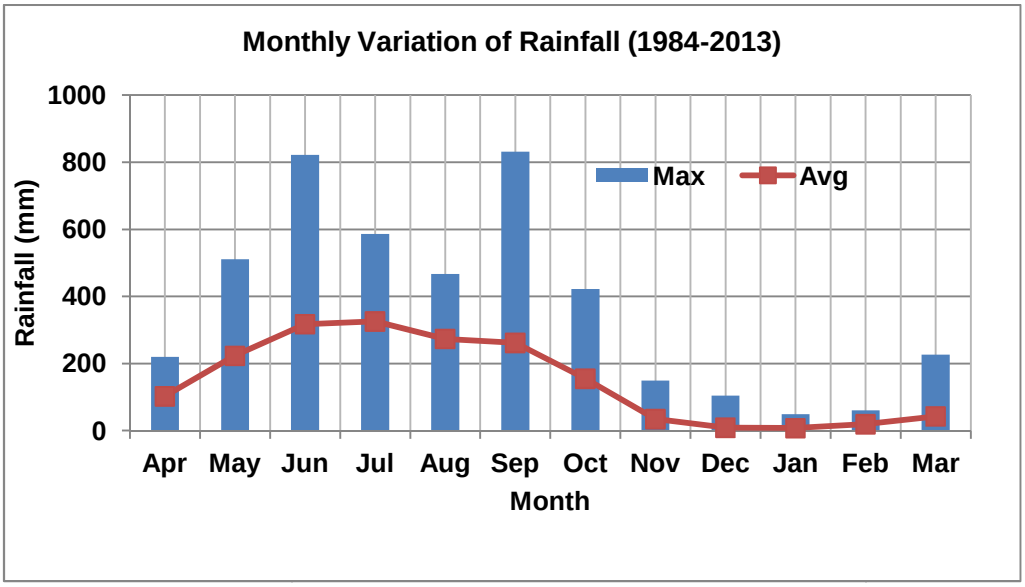


Figure 4.5: Monthly variation of Rainfall at Faridpur BMD station

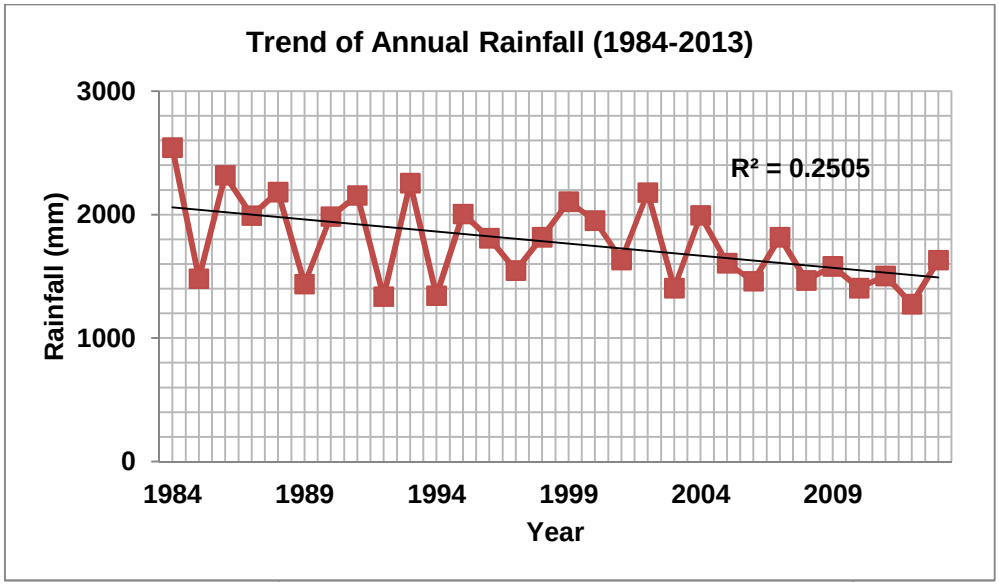


Figure 4.6: Trend of annual rainfall at Faridpur BMD station

(b) Temperature

116. Temperature is very prominent in this study area in comparison to the other region of the country. Monthly average of last 30 years data (1986-2015) shows that the maximum temperature varies from 27°C to 35°C and April is the warmest month while the minimum temperature varies from of 10°C to 25°C and January is the coolest month in the study area. The monthly variations of average maximum and minimum temperature are shown in Figure 4.7 below.

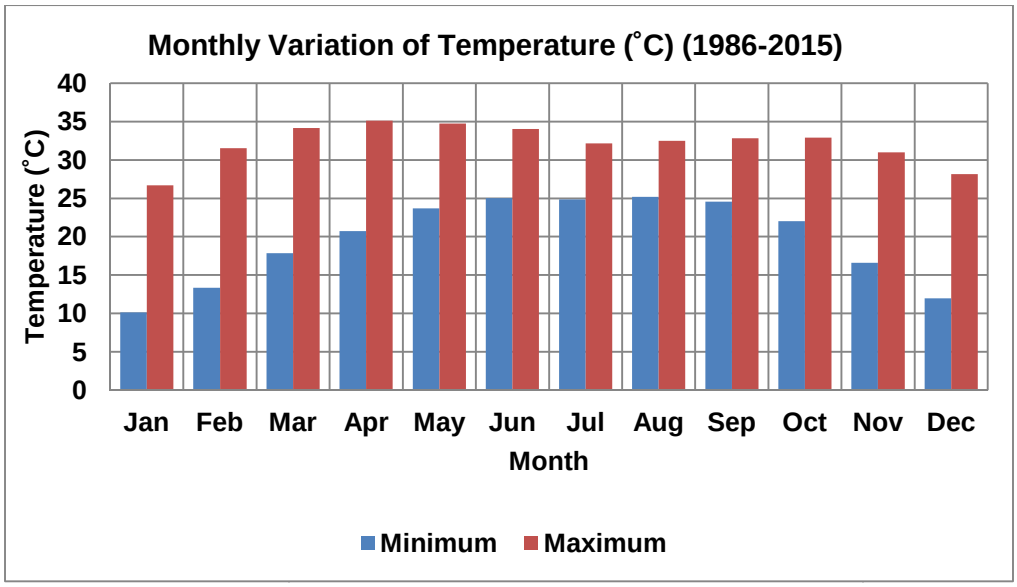


Figure 4.7: Monthly variation of Temperature at Barisal BMD station

117. Temperature is very prominent in this study area in comparison to the other region of the country. Monthly average of last 30 years data (1986-2015) shows that the maximum temperature varies from 27°C to 36°C and April is the warmest month while the minimum temperature varies from of 9°C to 26°C and January is the coolest month in the study area. The

monthly variations of average maximum and minimum temperature are shown in Figure 4.8below.

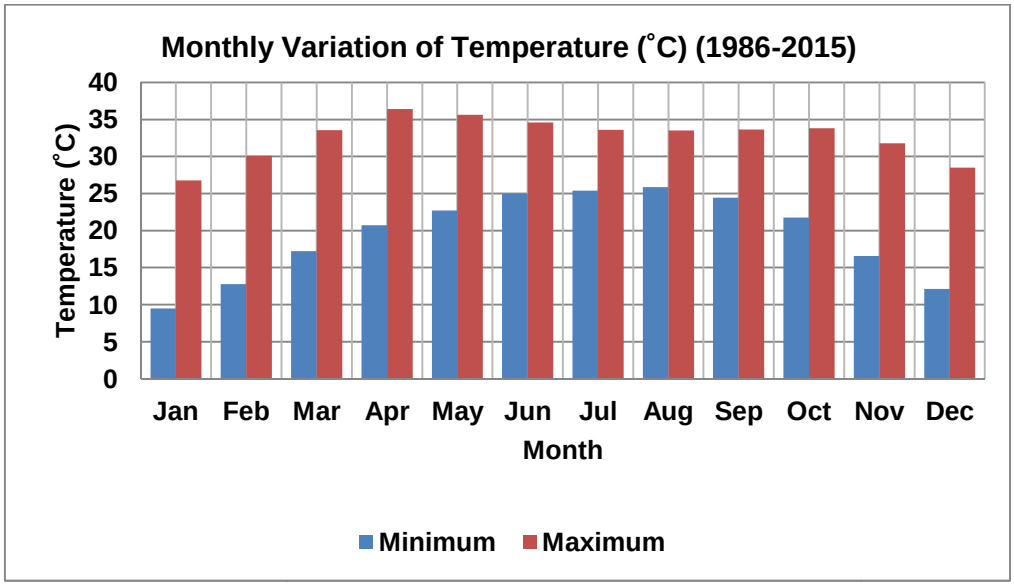


Figure 4.8: Monthly variation of Temperature at Bogra BMD station

118. Temperature is very prominent in this study area in comparison to the other region of the country. Monthly average of last 30 years data (1986-2015) shows that the maximum temperature varies from 27°C to 36°C and April is the warmest month while the minimum temperature varies from of 9°C to 26°C and January is the coolest month in the study area. The monthly variations of average maximum and minimum temperature are shown in Figure 4.9 below.

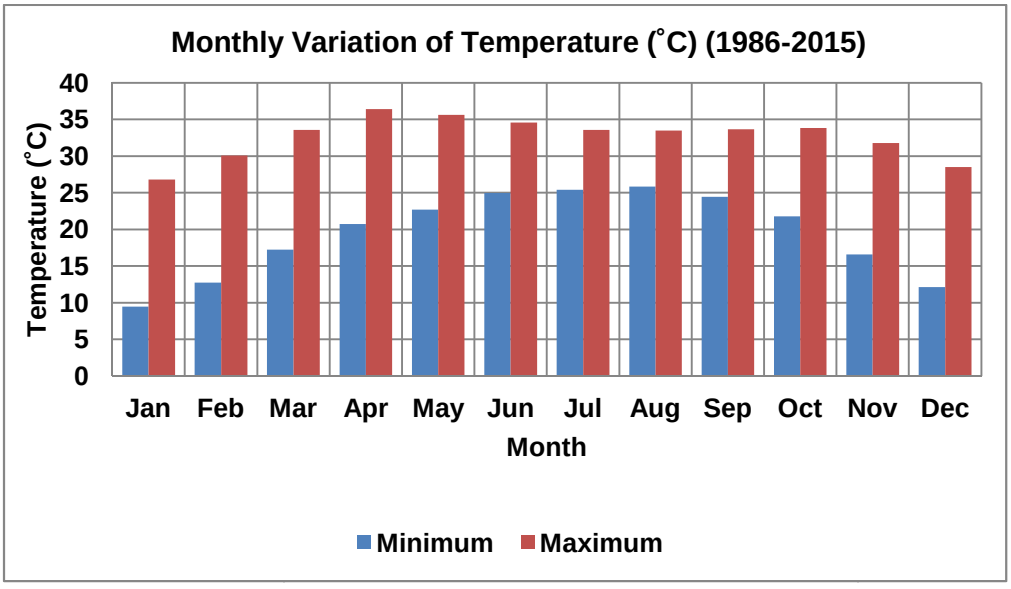


Figure 4.9: Monthly variation of Temperature at Bogra BMD station

119. Temperature is very prominent in this study area in comparison to the other region of the country. Monthly average of last 30 years data (1986-2015) shows that the maximum temperature varies from 24°C to 35°C and April is the warmest month while the minimum temperature varies from of 12°C to 26°C and January is the coolest month in the study area.

The monthly variations of average maximum and minimum temperature are shown in Figure 4.10 below.

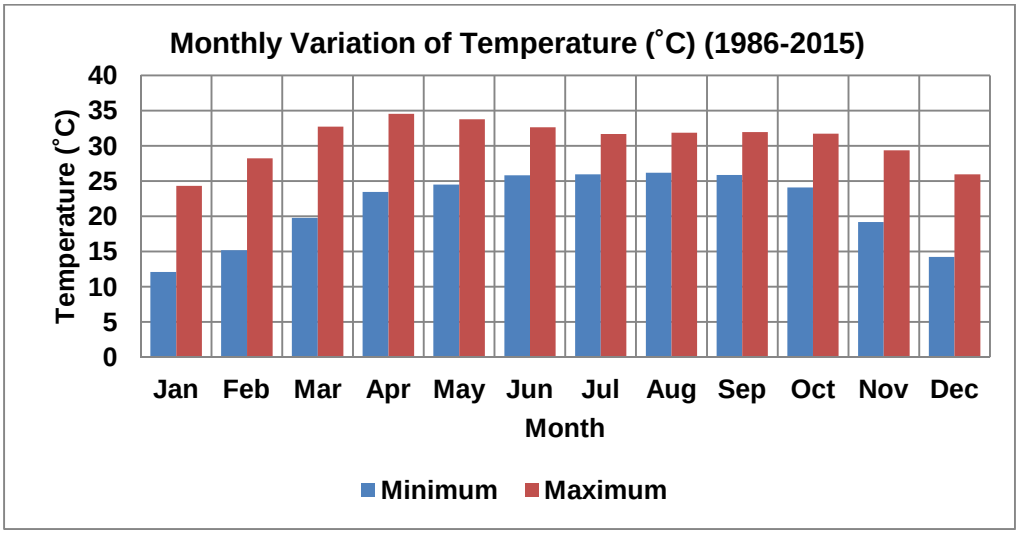


Figure 4.10: Monthly variation of Temperature at Faridpur BMD station

(c) Relative Humidity

120. Relative humidity is a proportional measure of moisture in the atmosphere and expressed as a percentages of the maximum amount the air could hold at the given temperature. Figure 4.12 shows the monthly relative humidity in the study area. It reveals that the Relative Humidity and it indicates to vary seasonally from 76% (March) to 90% (July).The most humid months are June to October (relative humidity greater than 85%) while during February to March it remains within the range of 76 to 78 %. The graph of average relative humidity demonstrates that it increases from April due to the increase in atmospheric water vapors coupled with temperature rise and starts decreasing from post monsoon season. The average monthly relative humidity data collected from BMD station of Barisal for the last 30 years (1986-2015) is shown in Figure 4.11.

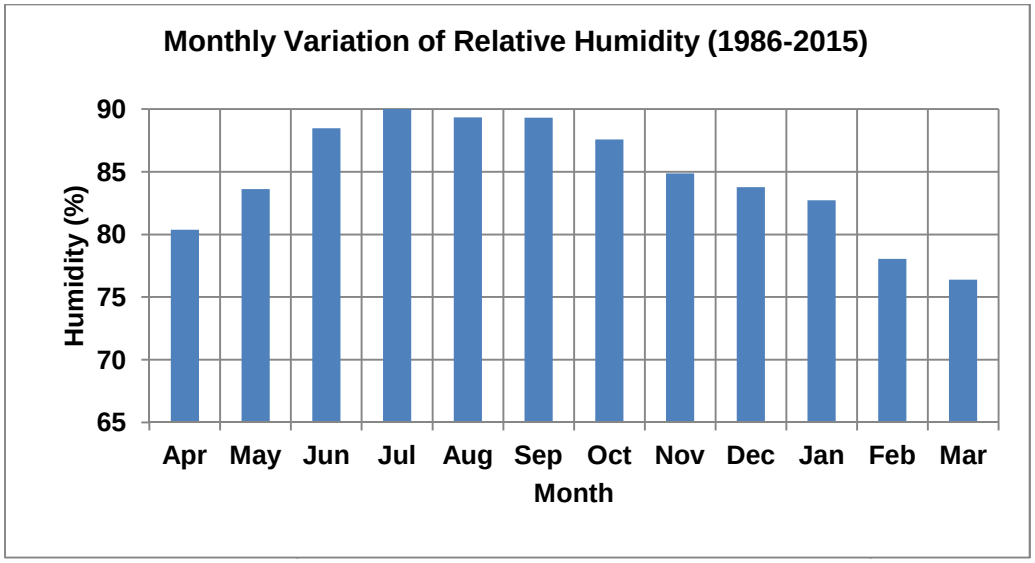


Figure 4.11: Monthly variation of relative Humidity at Barisal BMD station

121. Figure 4.11 shows the monthly relative humidity in the study area. It reveals that the RH and it indicates to vary seasonally from 67% (March) to 85% (July).The most humid months are June to October (relative humidity greater than 80%) while during February to March it remains within the range of 67 to 71 %. The graph of average relative humidity demonstrates that it increases from April due to the increase in atmospheric water vapors coupled with temperature rise and starts decreasing from post monsoon season. The average monthly relative humidity data collected from BMD station of Bogra for the last 30 years (1986-2015) is shown in Figure 4.12.

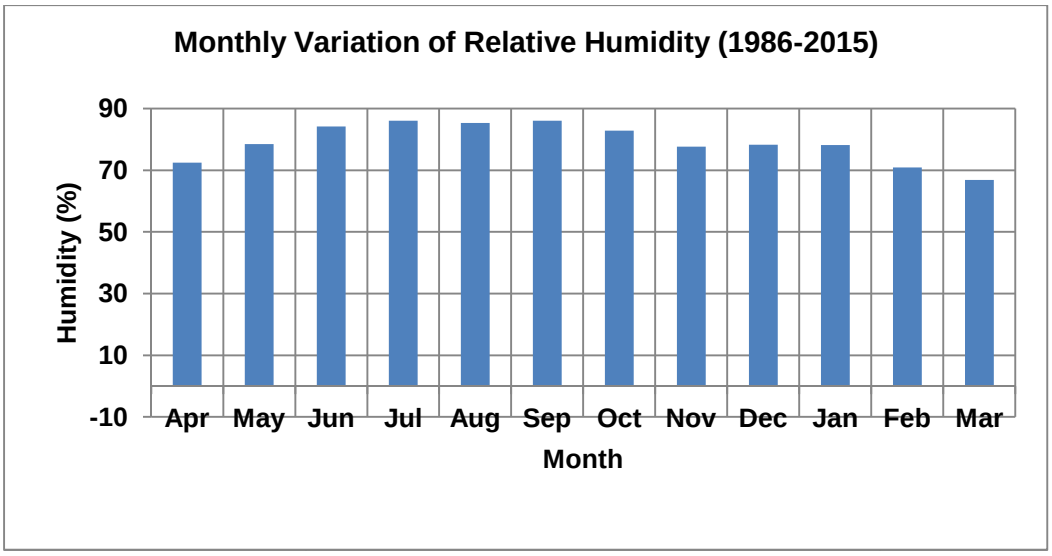


Figure 4.12: Monthly variation of relative Humidity at Bogra BMD station

122. Figure 4.13 shows the monthly relative humidity in the study area. It reveals that the RH vary seasonally from 67% (March) to 87% (July).The most humid months are June to October (relative humidity greater than 80%) while during February to March it remains within the range of 67 to 72 %. The graph of average relative humidity demonstrates that it increases from April due to the increase in atmospheric water vapors coupled with temperature rise and starts decreasing from post monsoon season. The average monthly relative humidity data collected from BMD station of Faridpur for the last 30 years (1986-2015) is shown in Figure 4.13.

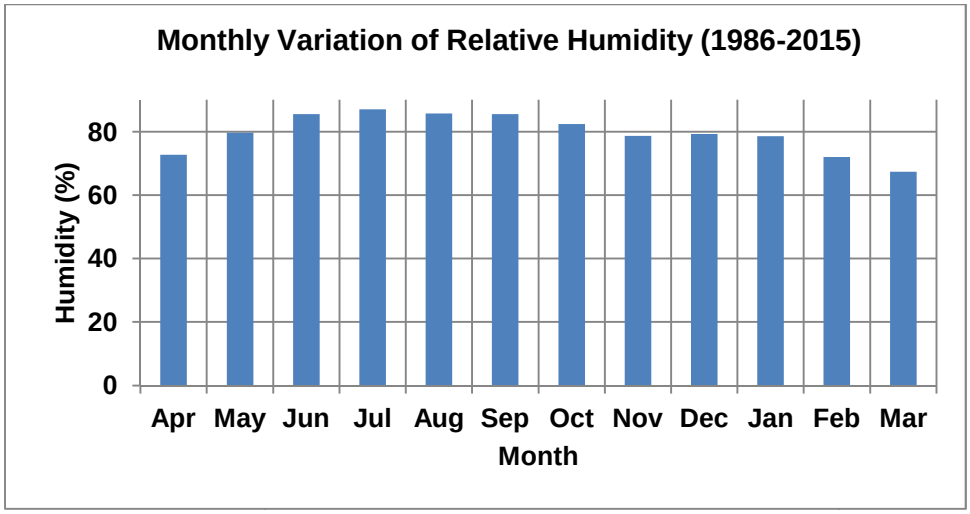


Figure 4.13: Monthly variation of relative Humidity at Faridpur BMD station

(d) Wind Speed

123. Winds in the area are mostly characterized by Southerly wind from the Bay of Bengal during monsoon and northwesternly wind from Himalaya during winter. The average of last 30 years (1986 to 2015) data shows that the monthly maximum wind speed in Barisal region varies from 14 to 128 km/day in a year and the maximum. The monthly maximum wind speed occurs in the month of April. Figure 4.14 shows the average monthly variation of wind speed at Barisal BMD station.

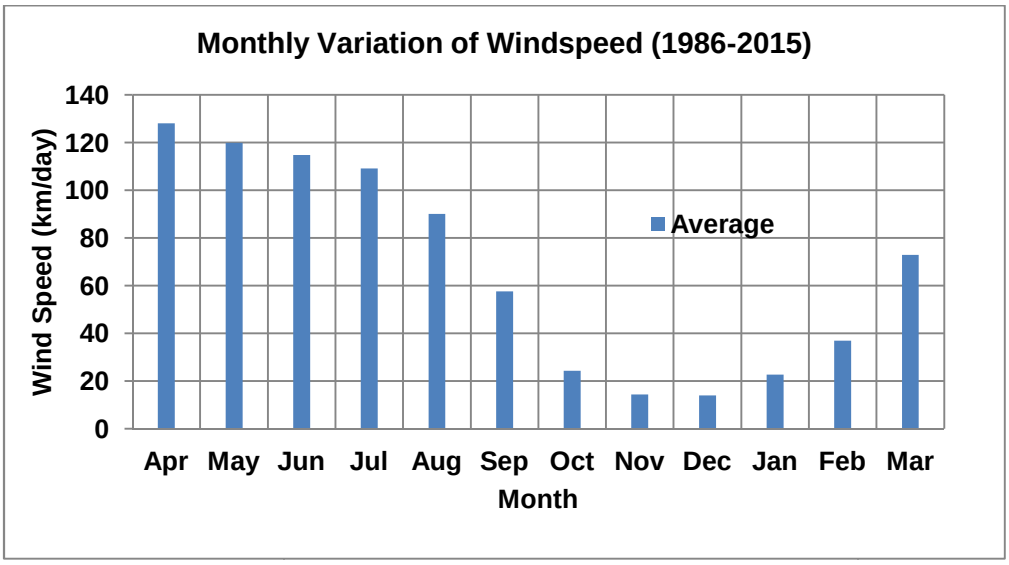


Figure 4.14: Monthly variation of wind speed at Barisal BMD station

124. Winds in the area are mostly characterized by Southerly wind from the Bay of Bengal during monsoon and northwesternly wind from Himalaya during winter. The average of last 30 years (1986 to 2015) data shows that the monthly maximum wind speed in Bogra region varies from 35 to 133 km/day in a year and the maximum. The monthly maximum wind speed occurs in the month of April. Figure 4.15 shows the average monthly variation of wind speed at Bogra BMD station.

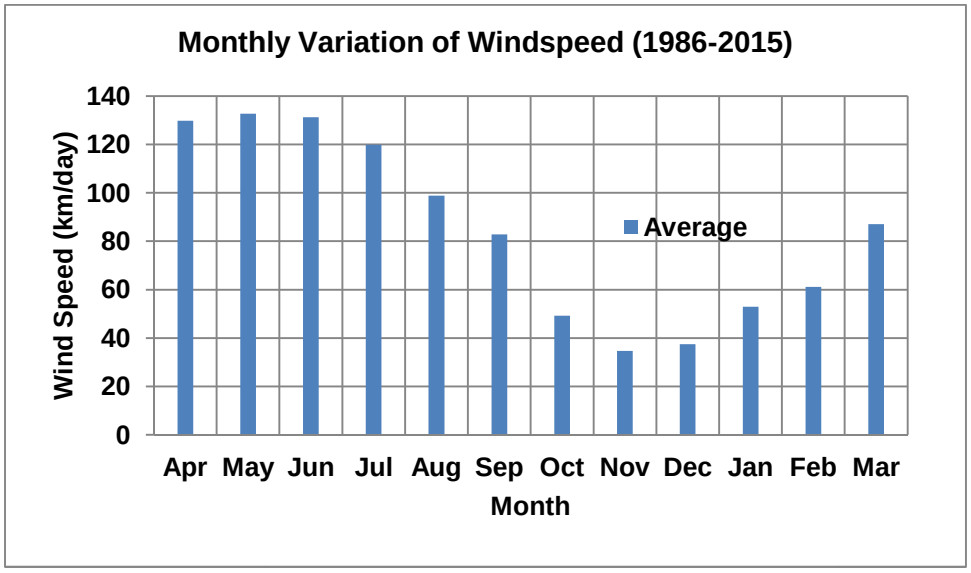


Figure 4.15: Monthlyvariation ofwind speed at Bogra BMD station

125. Winds in the area are mostly characterized by Southerly wind from the Bay of Bengal during monsoon and northwesternly wind from Himalaya during winter. The average of last 30 years (1986 to 2015) data shows that the monthly maximum wind speed in Faridpur region varies from 49 to 179 km/day in a year and the maximum. The monthly maximum wind speed occurs in the month of April. Figure 4.16 shows the average monthly variation of wind speed at Faridpur BMD station.

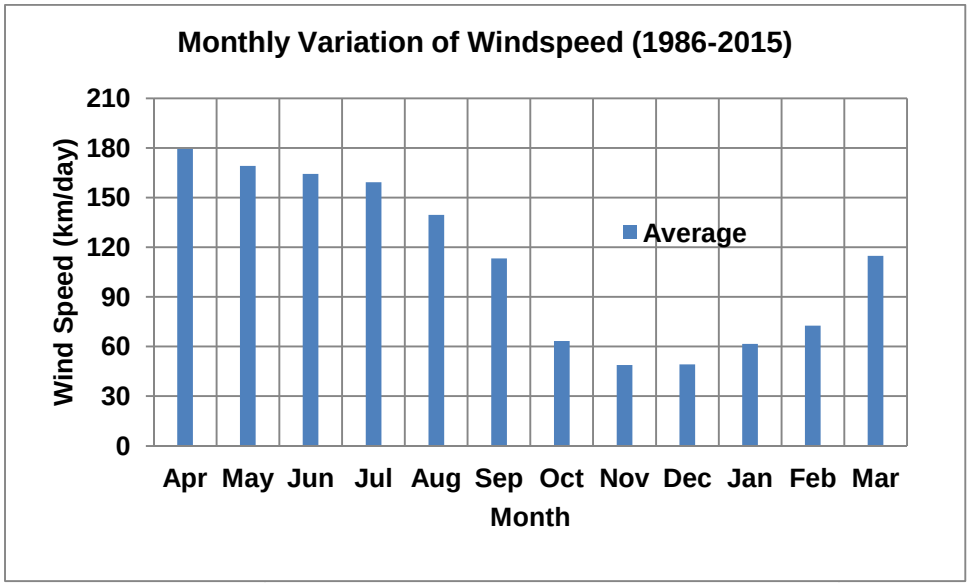


Figure 4.16: Monthly variation of wind speed atFaridpur BMD station

(e) Sunshine

126. The data of sunshine hours for the last 30 years (1986-2015) has been collected from the BMD station at Barisal. The average monthly value of sunshine hours vary from 4 to 8 hour/day and is highest in Februaryto April (8 hr/day) and lowest in June to August (8 hr/day) but the maximum sunshine hours is the highest in May to June (13 hr/day). Figure 4.17 shows the average monthly sunshine hours at the Barisal BMD station.

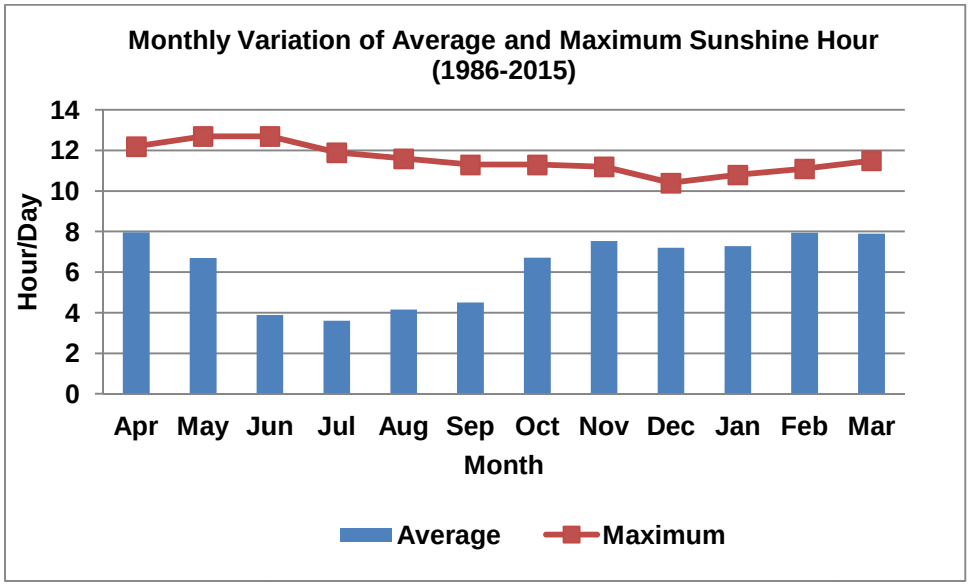


Figure 4.17: Monthly variation of maximum and average sunshine hours at Barisal

Station

127. The data of sunshine hours for the last 30 years (1986-2015) has been collected from the BMD station at Bogra. The average monthly values of sunshine hours vary from 4 to 8 hour/day but the maximum sunshine hours is the highest in May to August (13 hr/day). Figure 4.18 shows the average monthly sunshine hours at the Bogra BMD station.

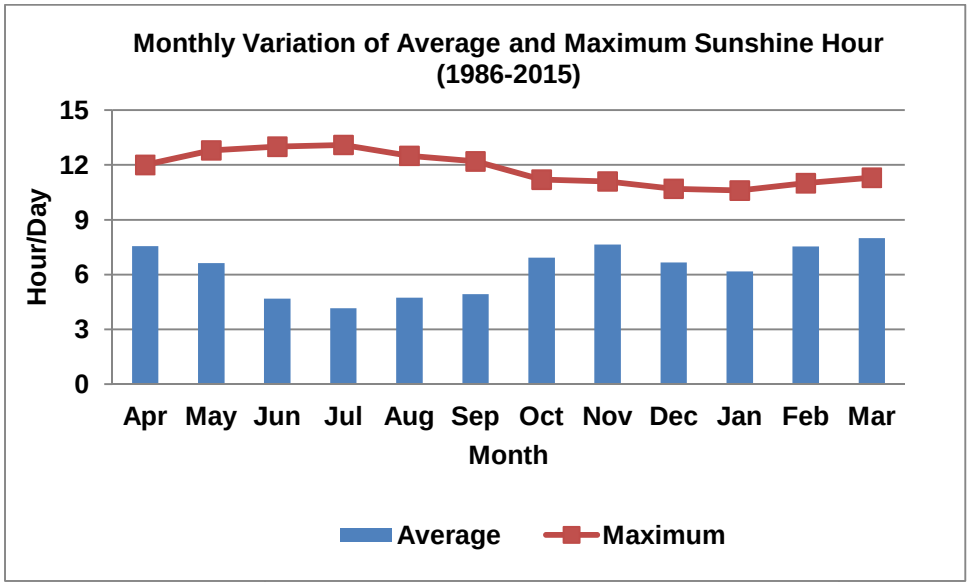


Figure 4.18: Monthly variation of maximum and average sunshine hours at Bogra Station

128. The data of sunshine hours for the last 30 years (1986-2015) has been collected from the BMD station at Faridpur. The average monthly value of sunshine hours varies from 4 to 8 hour/day but the maximum sunshine hours is the highest in May to July (13 hr/day). Figure 4.19 shows the average monthly sunshine hour at the Faridpur BMD station.

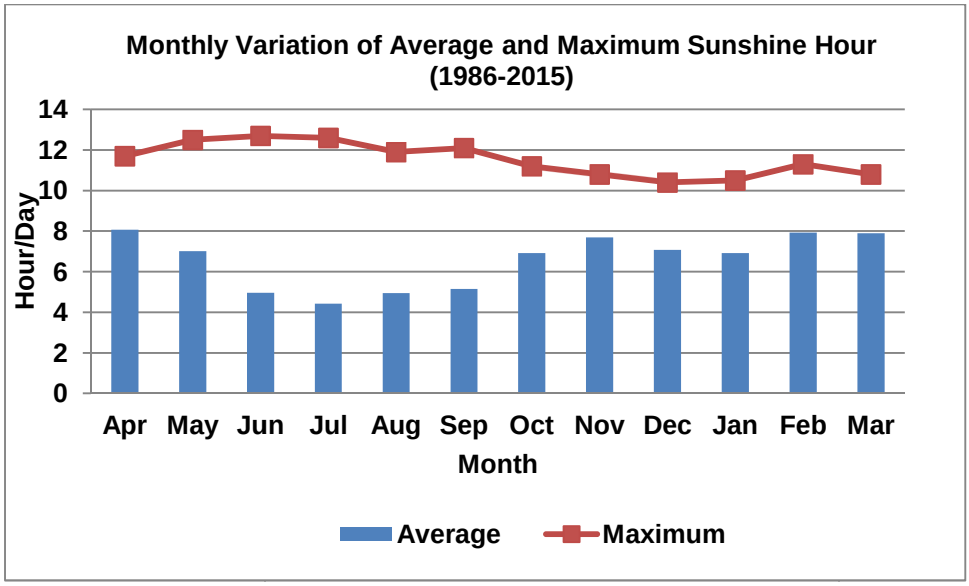


Figure 4.19: Monthly variation of maximum and average sunshine hours at Faridpur Station

4.2.2 Water level/ flooding

129. The proposed transmission line has crossed five rivers namely Kumar, Upper Meghna, Nabagonga, Pangasia and Fuljor River. For analyzing the surface water level using the secondary data, three surface water level measuring stations at Kumar river,Upper Meghna river and Nabaganga river are available and has been studied in detail. Figure 4.20below shows a hydrograph of the monthly average values of surface water level at Bhairab bazar, Faridpur and Jhenaidah station. The hydrograph shows a typical pattern of raising the surface water level in monsoon up to almost 6.48 m and lowering the level in dry season at February up to 1.09 m.

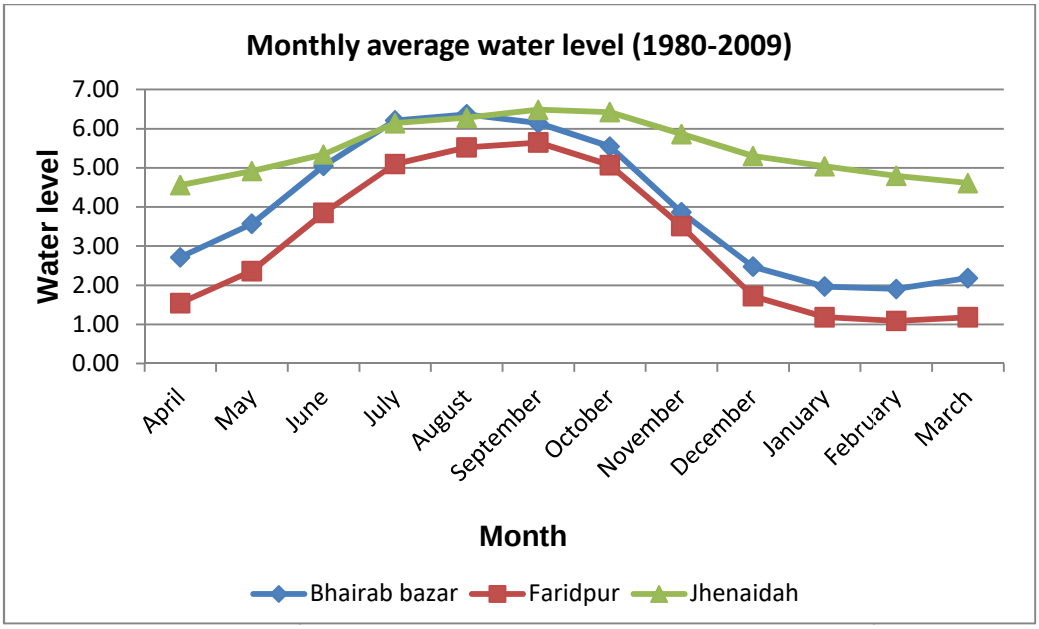


Figure 4.20: Monthly average of water level at Bhairab bazar, Faridpur and Jhenaidahstation

130. **Table 4.1** below shows the synopsis of a flood frequency analysis at **Faridpur** station **Bhairab bazar station** and **Jhenaidah station** for different return periods.

Table 4.1: Water level at different return periods

Return Period (Years)	Water Level (m+ PWD) at Faridpur station	Water Level (m+ PWD) at Bhairab bazar station	Water Level (m+ PWD) at Jhenaidah station
	Kumar river	Upper Meghna river	Nabaganga river
2.33	5.6	6.3	6.4
5	6.1	6.9	7.0
10	6.6	7.5	7.6
20	7.1	8.0	8.1
50	7.6	8.6	8.4
100	8.2	9.3	8.9

Source: BWDB

4.2.3 Air Quality

131. Air pollution is a primary social and environmental concern for health and sustainability of the ecosystem. When the presence of solid particles, liquid droplets or gaseous compounds

in the air is higher than normal, it becomes harmful to living organisms and the air becomes polluted.

132. There are five primary pollutants which together contribute more than 90% of global air pollution. These are: CO_2, NOx, HC, SOx, and PM. The standard values of ambient air for the area of different categories are shown in the following table 4.2.

Table 4.2: Concentration of micrograms per meter cube in the air

Area	Categories	Concentration micrograms per meter cube			
		SPM	SO_2	CO_2	NOx
A	Industry	500	120	5000	100
B	Commercial	400	100	5000	100
C	Residential and rural area	200	80	2000	80
D	Sensitive	100	30	1000	30

Source: Environmental Conservation Rules, 1997, DoE

133. Since the proposed transmission line will not have any long term impact on air quality, no data on air quality has been collected.

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

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

4.2.4 Ambient Noise Quality

136. The noise level has been analyzed in the field. The values of noise level in different locations are presented in Table 4.3 below:

Table 4.3: Daytime noise levels of the study area

Sl. No.	Location	Maximum Noise level (dBA)
1	Kaijuri	45.1
2	Majchar	49.8
3	Alampur	46.3
4	Chandpur	47.2
5	Saidabad	44.9
6	Mirzapur	44.5
7	Musapur	48.9
8	Alipura	47.8
9	Ashugang	48.1
10	Asekpur	44.2

Source: CEGIS field survey, October 2016

137. Table 4.4 shows the standard values for noise in Bangladesh. The study area can be regarded as a residential area and the observed noise level has been found within the permissible limits for daytime.

Table 4.4: Standards of noise levels for different zones of Bangladesh

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

Source: Bangladesh Gadget, 2006

4.2.5 Water availability and quality

Surface Water

138. The transmission line crosses number of rivers namely Kumar, Upper Meghna, Nabagonga, Pangasia and Fuljor River. Quality of water of these rivers are in good condition and People use surface water for various purposes.Table 4.5presents the values of the surface water quality parameters measured in above mentioned rivers. The standard values of the same set by DoE, Bangladesh have also been shown for comparison.

Table 4.5: Water Quality in Surma River

River Name	Water Quality Parameters					
	Temperature (°C)	TDS (ppm)	EC (mS/cm)	Salinity (ppt)	DO (mg/L)	pH
Kumar	28.8	60	0.06	0	6.9	8.0
Upper Meghna	27.6	66	0.04	0	6.5	7.7
Nabagonga	29.0	30	0.09	0	7.4	7.2
Pangasia	28.6	46	0.02	0	6.3	7.4
Fuljor	29.1	35	0.05	0	7.0	7.1
DoE Standard Value (Bangladesh)	20-30	2100	0.2-0.7	-	4.5-8.0	6.0-9.0

Source: CEGIS field survey

139. The hydrogen ion concentration of water is expressed by its pH value. A pH value of 7 indicates the neutral condition, neither alkaline nor acidic. The pH values found during field investigation are higher than neutral scale (pH=7) which means that water in these locations are alkaline in nature. All of the pH values found during field investigation satisfy the DoE standard (pH=6 to 9) for surface water.

140. According to DoE, the highest range of Total Dissolved Solids (TDS) concentration for surface water is 2100 ppm. The values of TDS found during field investigation ranged between 30-66 ppm (Table 4.5), which completely satisfy the DoE standard.

141. Temperature of water bodies affects the fish habitats and their oxygen holding capacity. The temperature of the water bodies in the study area is found to vary from 27.6°C to 29.1°C, which complies with DoE standard (20°C-30°C) for irrigation and fishing.

142. DO is an essential parameter for the metabolic process that produces energy for growth and reproduction of fishes and other aerobic aquatic habitats. Decrease in DO values below the critical level of 3 mg/l causes death of most of the fishes and other aerobic aquatic organisms.

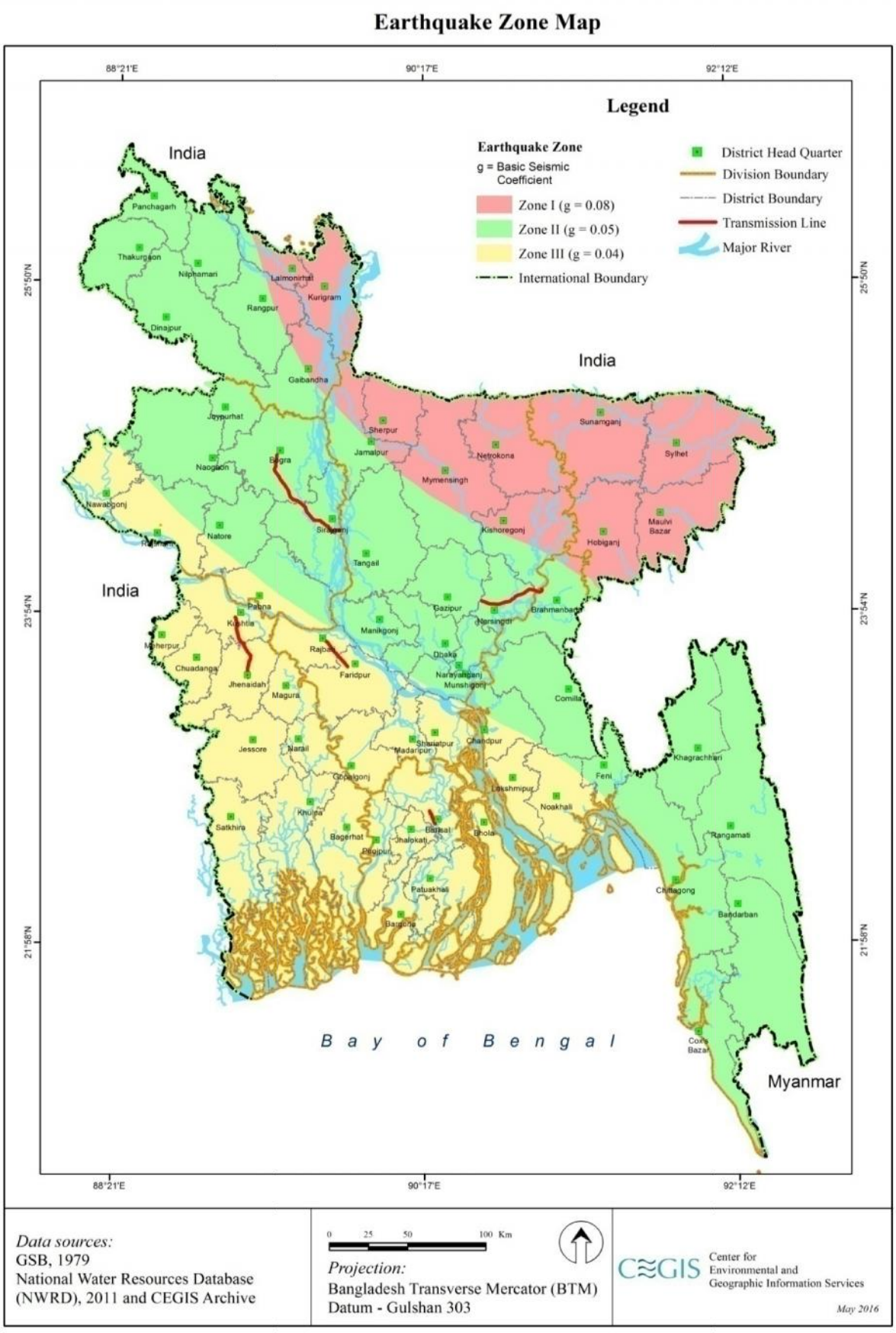
Generally DO remain relatively low in dry season than that of wet season. The values of DO found during field investigation range between 6.3 to 7.4 mg/L which are favorable to all aquatic organisms. DoE standard of Dissolved Oxygen (DO) for surface water is 4.5-8 mg/L. All of the values obtained during field investigation satisfy this standard.

143. Electric Conductivity (EC) is another useful water quality indicator for estimating the amount of minerals, assessing the effect of diverse ions on chemical equilibrium, physiological effects on plants or animals and corrosion rates. DoE standard of Electric Conductivity (EC) for drinking water is 1.2 mS/cm and for irrigation water is 0.20 – 0.7 mS/cm. The values of EC found during field investigation are ranges between 0.02 – 0.09 mS/cm which satisfy this standard.

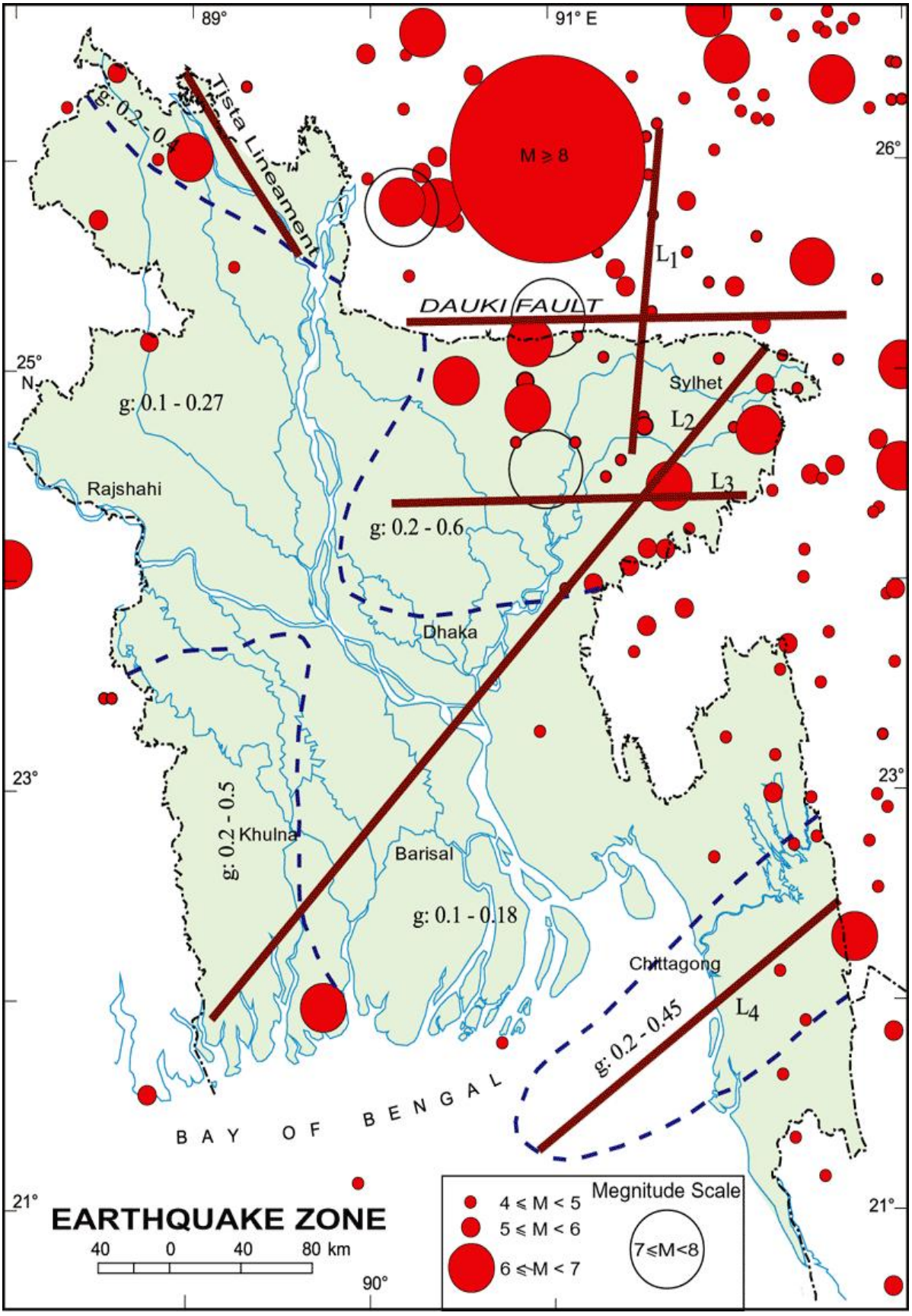
4.3 Natural Hazards

4.3.1 Seismicity

144. Geographical location of Bangladesh has made it ideal suited for natural disasters like earthquake. Tectonic framework of Bangladesh and adjoining areas indicate that Bangladesh is suited adjacent to the plate margins of India and Eurasia where devastating earthquakes have occurred in the past. Depending on the geological structure, Bangladesh has been divided into three generalized seismic zones: zone-I, zone-II and zone-IIIwhere Zone-I is the most and Zone-III is the least vulnerable to seismic risks. According to this division, the study area of Ashuganj-Ghorashal and Sirajganj-Bogra transmission line falls under Zone-II, which is characterized by medium earthquake prone site and has a basic seismic coefficient of 0.05g (Map 4.1). Rest of the transmission line Kushtia-Jhenaidah, Faridpur-Rajbari and Barisal-Kaladema falls under Zone-III, which are characterized by lowearthquake prone site and has a basic seismic coefficient of 0.04g (Map 4.1) respectively. There are also different geological faults in and around the country, as shown in Map 4.2. According to which, the maximum magnitude of earthquake is within the range of 4≤M<5 on the Richter scale in and around the study area.



Map 4.1: Seismic Map of Bangladesh showing the study Area



Map 4.2: Fault lines of Bangladesh (Source: GSB)

4.3.2 Erosion and flooding

145. As the transmission line will not have any significant impact on erosion and flooding, a detailed analysis was not required for the project.

4.3.3 Storm

146. There are some evidences of local seasonal storms, popularly known as nor'westers *(Kalbaishakhi).* Severe nor'westers is generally associated with tornadoes. The frequency of nor'westers usually reaches maximum in April, whereas it is low in May and minimum in March. Nor'westers and tornadoes are more frequent in the afternoon. Nor'westers may occur in late February due to early withdrawal of winter from the Shillong Plateau of India.

147. There could be effect of tornados on the towers of the transmission line. However, proper design could protect the towers from accidents.

4.4 Biological Environment

148. The study area encompasses different ecological features as the proposed transmission line traverse through different landforms. The general biological features of each transmission line have been presented as follows.

4.4.1 Ashuganj to Ghorashal 230 KV Line

149. This transmission line passes over three of the Bio-ecological Zones of Bangladesh namely JamunaFlooplains), MeghnaFlooplains and Major Rivers (IUCN Bangladesh, 2002).

150. General ecological features of the proposed transmission line can be divided as Terrestrial Ecosystems and the Aquatic Ecosystems. Each of the ecosystems composed with different flora and fauna which have been described below.

Terrestrial Flora

151. Terrestrial vegetation of this area is dominated with different trees, shrubs and herbs. Among the trees, Rain Tree *(Albiziasaman),* Mehagony *(Swieteniamahagoni),* Eucalyptus *(Eucalyptus sp),* Chambol *(Albiziarichardiana)* etc are represent top canopy of the vegetation those heights are varied from 15-30m. Another associate species are Ipil Ipil *(Leucaunalaucocephalata),* Jackfruit *(Artocarpusheterophyllus), Mango (Mangiferaindica), Akashmoni (Acacia moniliformis)* those are usually followed on homesteads and other settlements.

152. Shrubs and herbs are found on village grooves, graveyards, fallow lands and roads slopes. Among this type, Dumur (Ficushispida), Shewra (Streblus asper), Vant (Cleorodendrumviscosum), Amaranthusspinosus, Dentellarepens, Acalyphaindica, Cynodondactylonare frequently found. This type of plant species is grown naturally and usual heights are not exceeding over than 15m.

Aquatic Flora

153. Presence of aquatic body like ponds, ditches, khals and rivers, aquatic flora are successively grown on it. Major aquatic floras of this area are divided with four major categories; i.e.: submerged, free floating rooted floating and marginal. *Hydrillapaniculata, Potamogeton, Najas. Sp*are common submerged plant whereas water lily *(Nymphaea spp)* and *Nymphoides*sp. are the rooted floating. Water hyacinth *(Eichhorniacrassipes)* and Water Lettuce *(Pistiasp)* are dominated among all the free floating communities. Marginal aquatic

plants are mainly composed with different grass species. All the aquatic plants of this area are naturally grown and their diversity and populations are found high during the monsoon.

154. Detail List of Tree species along the RoW have been attached in Table 4.7.

Faunal Communities

155. This area contains different landforms those support numerous species of wildlife and fishes both terrestrial and aquatic ecosystems. Birds are the large populated groups among all other wildlife. Existence of homestead forest, vast floodplains and cropfields support good number of avian species. Common Myna, Asian Pied Starling, Black Drongo, Spotted Dove, Brown Shrike, Jungle Myna, Bank Myna, Rock pigeon, House crow, House Sparrow, Large-billed crow, Long tailed Shrike, are Common terrestrial bird species in the area are. Brahminy Kite, Black-winged Kite, Crested Serpent Eagle are the referable birds of prey survive well in the area whose flying height is above the top canopy of vegetation of this region. In addition, Barn Owl (*Tytoalba*), Grey-headed Fish Eagle (*Ichthyophagaichthyaetus*) etcare found within the project area has been listed in the Schedules of the Convention on International Trade in Endangered Species of Flora and Fauna (CITES).

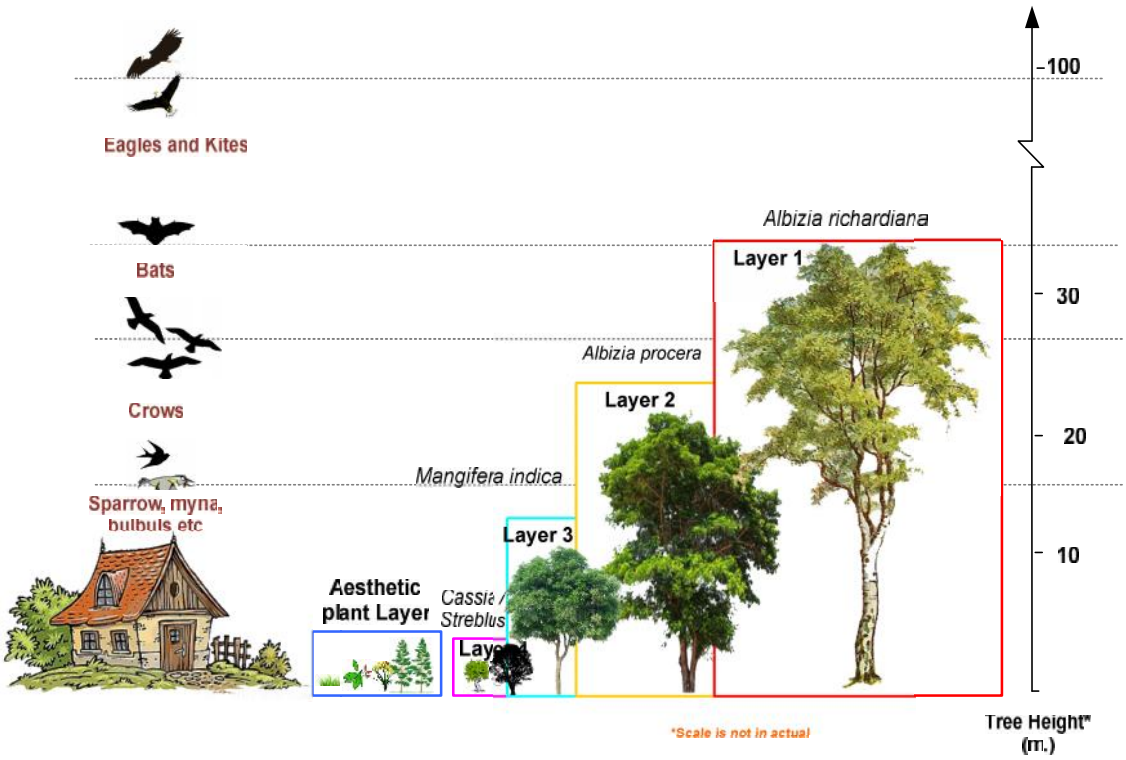


Figure 4.21: Typical tree canopy heights and common birds flying heights of the study area

156. Floodplains and other wetlands of this area support a number of aquatic avifauna like India Pond Heron, Cinnamon Bittern, Purple Swamp hen, Water Cock, Cotton Pigmy Goose, Little cormorant, White breasted Water Hen, Stock-billed Kingfisher, White-throated Kingfisher, and Pied Kingfisher. Flying height of the most local birds are limited within the vegetation canopy range of this area and this height are usually confined within 50m.

157. Among thelarge wildlifegroup as well as mammals, Mole Rat (*Bandicotabengalensis*), Northern Palm Squirrel, Bandicot Rat (*Bandicotaindica*), House Shrew (Suncusmurinus), Field Mouse (Mus booduga), House Mouse (*Mus musculus*), House Rat (*Rattusrattus*), Small Indian

Mongoose (*Herpestesautopunctatus*), Golden Jackal (*Canis aureus*) etc are referable. Short-nosed Fruit Bat (*Cynopterus sphinx*), Indian Flying fox, and Indian Pipistrelle (*Pipistrelluscoromandra)* are other flying mammals. *Ganges* River dolphin (*Platanistagangetica*) and the Common otter *(Lutralutra)* are two aquatic mammals those are listed in IUCN Redlist of threatened animalsaquatic mammals are rarely occurred within the study area.

158. Amphibians and reptilians are the major components of their respective biological ecosystems, both as predator and prey. The Indian roofed turtle (Pangshura tectum), Median Roofed Turtle (P*angshura tentoria*) and Brown Roofed Turtle (*Pangshurasmithii*) is rarely occurred in large river along this area. Most of the turtle species are susceptible to accidental capture in different fishing gear.Amphibians like, theCommon Toad (*Duttaphrynusmelanostictus*) Indian Bull frog (*Hoplobactrachustigerinus*) Indian Tree Frog (*Polypedatesmaculatus*) Cricket Frog (*Fejervaryalimnocharis*), and Skipper Frog (Euphlyctiscyanophylctis)etc also exist within the site and their abundance are limited within cropfields,bamboo grooves and charlands. Many lizards and skinks were seen during the survey. Lizards are frequently found in homesteads gardens and human habitation. Among this type, Brook's House Gecko (Hemidactylusbrookii), Common House Gecko (Hemidactylusfrenatus), Keeled grass skinks*(Mabuyacarinata)* and Common garden lizard (Calotes versicolor) etc are exists within low-lying vegetation, leaf litter, grassy areas, bushes, river banks, under logs and burrows. Bengal monitor (Varanusbengalensis) is a large reptile among this region is usually observed in solitary places or inside the village grooves. These species are categorized as Near Threatened (NT) in the IUCN Red list category for Bangladesh. Snakes are occurred this area are as the Common Wolf Snake (*Lycodonaulicus*), Checkered Keelback (*Xenochropispiscator*), Striped Keelback (*Amphiesmastolatum*), Indian Rat Snake (*Ptyasmucosus*), and OliveKeelback (*Atretiumschistosum*) etc. The Common Krait (*Bungaruscaeruleus*), Spectacled Cobra (Najanaja) and Monocled Cobra (*Najakaouthia*) are rarely seen, which are also recorded in the IUCN Red List for Bangladesh.

159. Fishes are another aquatic animal group found im all types of wetlands and floodplains of this area. The most common fish species of this area are Indian River Shad *(Gudusiachapra),*Thick-lipped Gourami *(Trichogasterlabiosus)*, Mottled Nandus*(Nandusnandus)*, One-stripe Spinyeel*(Macrognathusaculeatus)*, Swamp Barb *(Puntius chola)*, Gagora catfish *(Arius gagora)*, Magur*(Clariusbatrachus)*, Stinging Catfish *(Heteropneustesfossilis)*, Tank Goby *(Glossogobiusgiuris*), Spotted Snakehead *(Channa punctatus)*, Asiatic Snakehead *(Channaorientalis)*, Bumblebee Goby *(Brachygobiusnunas)*, Indian Threadfish*(Polydactylusindicus)*, TengraMystus*(Mystustengara)*, Indian Threadfish*(Polydactylusindicus)*, Rosy Barb *(Puntius conchonius)*, Indian Carplet*(A. microlepis)*, Rice Eel *(Pisodonophisboro)*, Climbing Perch (*Anabas testudineus)*, Rohu (*Labeorohita*), Catla*(Catlacatla)*, Tire-trak Spiny eel *(Mastacembelusarmatus)*, Mrigal(*Cirrhinusmrigala*), Soldier Catfish (*Osteogeneiosusmilitaris*), Spotted Snakehead (*Channa punctatus*), etc.

4.4.2 Barisal TL

160. Barisal TL traverse over one of the Bio-ecological Zone namely Ganges Floodplains (IUCN Bangladesh, 2002)is the active meandering floodplain of the Ganges River. The floodplain mainly comprises of a smooth landscape of ridges basins and old channels.This region is enriched with good floral composition for having different landforms like homesteads, settlements, cropfields, rivers, canals, ponds and others. The general ecological features as well as flora and faunal composition are as follows.

Terrestrial Flora

161. Homesteads and settlements are the main habitats for most of the terrestrial flora. This are Betel Nut (Areca catechu), Coconut (*Cocos nucifera*), Amra (*Spondiuspinnata*), Rain Tree *(Albiziasaman),* Chambol*(Albiziarichardiana),* Guava *(Psidiumguajava)* etc.Coconut, Rain tree and Chambol represent the top canopy of homestead vegetation that limit within 40m. In addition, numerous species of herbs and shrubs are vegetated with under canopy like as Kul Boroi *(Zizyphusmauritiana)*, Shewra *(Streblus asper), Terminalia catappa, Mikaniascandense, Ficushispida, F. heterophylla, Physalis minima etc.*

Aquatic Flora

162. Numerous khals, ponds and other depressions of this area are vegetated with high density of aquatic flora. At the species level, *Eichhorniacrassipes, Pistiasrateotes, Lemna*sp are the dominated free floating and different species of water lily are representing the rooted floating community. The submerged, marginal plants and sedges are also dense in all types of wetlands. *Typha*is a representative species of this area exclusively grown along the mudflats of rivers and marshy peripheries of cropfields and ponds.

Faunal Communities

163. Homestead forest, cropfields and canals are the major habitats of faunal groups. Birds are the largest class of higher vertebrates those dwell inside most all types of terrestrial habitats. This area supports one or more species of Myna, Bulbuls, Magpie, Egrets, Herons, Tailor bird, shrikes, kites, woodpeckers and bats. Most of the species are similar to thespecies as described in Ashuganj-Ghorashal TL site.

164. Among the mammals, Jackal, Mongoose, mice are referable. Amphibians are abounding near water and this area supports common toad, skipper frog, cricket frog and bull frog. Green frog is also found in ditches and ponds.

4.4.3 Kustia to Jhenaidh TL

165. Kustia to Jhenaidh TL passes over one of the Bio-ecological Zone namely Ganges Floodplains (IUCN Bangladesh, 2002)is the active meandering floodplain of the Ganges River. The floodplain mainly comprises a smooth landscape of ridges basins and old channels. General Biological features as well as flora and faunal composition of this area have been described below.

Terrestrial Flora

166. Population of terrestrial flora of this area is mainly centered on settlement and roadsides. Species composition of human influenced vegetation is nearly similar to other portions of the country. Dominated tree species are Rain Tree *(Albiziasaman),* Mehagony *(Swieteniamahagoni),* Jackfruit *(Artocarpusheterophyllus),* Chambol *(Albiziarichardiana)* etc. Among the monocot plant, Date Palm *(Phoenix sylvestris)* and Coconut *(Cocos nucifera)* are commonly took place in each homesteads and rural roadsides. Herbs and shrubs are quite common in most of the rural settlements. Among this, Bon Croton *Crotonbonplandianum, Cleorodendrumviscosum, Cassia tora, Mikaniascandense, Leonurussibiricus*are observed. All the floral species are not possess the canopy height more than 30m.

Aquatic Flora

167. Common aquatic flora of this area are *Nympheanouchali, Trapabipinosa, Eicchorniacrassipes, Nymphoidesindicum*etc are grown in all the wetlands like canals, homesteads ponds, floodplains and ditches.

168. Detail List of Tree species along the RoW have been attached in Table 4.8.

Faunal Communities

169. Birds are the larger group of wild fauna in terms of diversity and population. Common resident birds are: Asian Pied Starling, Common Myna, Magpie Robin, Red Vented Bulbul, House Sparrow, House Crow, Asian Koel, Common Kingfisher, Green Bee-eater etc are territories within the homestead forest and cropfields. Brahminy Kite, Crested Serpent Eagle, Black Winged Kite are the prey birds those are flying within 100m above the ground. Aquatic birds are dwelling within floodplains and other wetlands are Little Egret, Indian Pond Heron, Great Egret, Little Cormorant etc. Evidence of migratory bird is rare through this area for lack of favorable wetland and extensive crop cultivation in most of the depressed area.

170. Other wildlife groups like Mammals, reptiles, fishes and amphibians species composition are relatively similar asAshugonj-Ghorashal area.

4.4.4 Faridpur to Rajbari

171. Faridpur-Rajbari proposed transmission line also passes over the Bio-ecological zone namely Ganges Floodplains. This river derived area has been enriched with various flora and fauna those have comprised with smooth landscape of ridges basins and old channels. General Biological features as well as flora and faunal composition of this area have been described below.

Terrestrial Flora

172. This area has wide varieties of terrestrial flora with different canopy heights. Albiziasaman and A. richardiana is the tallest tree species of this area are followed very commonly at all types of settlements. Other dominated species of this area are Mango (Mangiferaindica), Jaam (Syzigiumcumini), Mahagoni (Swieteniamahagoni), Date Palm (*Phoenix sylvestris*), Hijal (Barringtoniaacutangula), Barun (Crataevanurvala) are another referable floral species. Palm *(Borassusflabellifer)* is a remarkable monocot that is exclusively found all over the area and contribute to providence of molasses and fuel. Average top canopy height of this area not exceed than 40m. Herbs and shrubs are quite common and species are similar to above mentioned species. Among this type , Hantisur (Heiotropiumindicum), Bon dhoney (Scopariadulcis), Durba (Cyperusrotundus), Bon jhal (Croton bonplandianum), Shetdrone (Leucasaspera),Kantanotey (Amaranthusspinosus), Chenopodiumambrosoides, Cotulahemispherica, Oxalis corniculata, Amaranthusspinosus, Cyperuscephalotesetc are dominaded in all the fallow area, road slopes or even in margines of cropfields.

Aquatic Flora

173. Vast area of seasonal floodplains and peat land support good numbers of aquatic flora in this area. Among the submerged plants, Hydrilla and Sagittaria are dominated and the water lily (Nymphaea nouchali and N. stellata), Kolmi (Ipomoea aquatica), Hogla (Typhaelephantina) etc are the common aquatic species.

Faunal Communities

174. Faunal communities as well as wildlife of this area dwell inside homestead forest, village grooves, wetlands and agricultural fields.

175. Common birds species in the area are: Common Mynah (Acridotherestristis), Jungle Myna (Acridotheresfuscus), Asian Pied Starling (Gracupica contra), Magpie Robin (Copsychussaularis), Common Tailor bird (Orthotomussutorious), Black Drongo (Dicrurusmacrocercus) Black headed oriole (Oriolusxanthornus), Black-rumpedFlameback

(Dinopiumbenghalense), Fantail flycatcher (Pripidusaaureola), Spotted Dove (Streptopeliachinensis), House sparrow (Passer domesticus), Red-vented Bulbul (Pycnonotuscafer) etc .Among the bird of prey species Brahminy Kite (Haliasterindus) and Crested Serpent Eagle (Spilornischeela) are found and their territories are limited within 100m above the ground.

176. Mammals such as common mongoose (Herpestesedwardsi), house mouse (Mus musculus), Jackle (Canis aureus), Jungle cat (Felisviverrina), common house rat (Rattusrattus), Indian flying bat (Pteropusgiganteus), are the major species. Among the reptiles, Bengal Monitor (Veranusbengalensis), Olive keelback (Atretiumschistosum), Common green vine (Ahaetullanasutus) Russel's viper (Viperaruselli), Striped Keelback (Amphiesmastolatum), Monocled cobra (Najakaouthia), Common Wolf Snake (Lycodonaulicus) are known to occur in the area. The common lizards found within the Scheme area include house lizard (Hemidactylusfrenatus) and Garden Lizard (Calotes versicolor). Among other species that once were common but now are only occasionally seen are the Small Indian Civet (Viverriculaindica). Amphibian species, Common toad (Duttaphrynusmelanostictus) prefer the cool, damp habitat of the bamboo grooves.

177. Some of the species occured within the area are listed in the IUCN Redlist for Bangladesh. These species include Bengal fox (Vulpesbengalensis), Small Indian Civet (Viverriculaindica), Jungle cat (Felischaus). In addition, some species found within the Scheme area are listed in the Schedules of the Convention on International Trade in Endangered Species of Flora and Fauna (CITES). Those listed are, Common mongoose (Herpestesedwardsi), MonocelateKobra (Najakaouthia), Bengal monitor (Varanusbengalensis) etc.

178. This region is prominent for freshwater fishes. The fish species are mostly similar to above mentioned species. However, Climbing perch *(Anabas testudineus),* Spotted Snakehead *(Channapunctata)*, Clown Knife Fish *(Chitalachitala)* are prominent along this area.

4.4.5 Sirajgonj to Bogra TL

179. This TL crosses over three bioecological zones like Barind Tract, Teesta Floodplain and the Major Rivers (IUCN 2002). Each of the zone represent it ecological characteristics wit floral and faunal composition. General Biological features as well as flora and faunal composition of this area are as follows.

Terrestrial Flora

180. Major terrestrial floral species of this area are Palm (Borassusfiabellifer), Tamarind (Tamarindusindica), Date palm (Phoenix sylvestris), Kadam (Anthocephaluschinensis), Mahagoni (Swieteniamahagoni), Banana (Musa sapientum), Banyan tree (Ficusreligiosa), Bamboo (Bambusa sp.), Rain Tree (Samaneasaman), Mango (Mangiferaindica), Jackfruit (Artocarpusheterophyllus), Betel nut (Areca catechu) etc. Eucalyptus (Eucalyptus citriodora) is the most dominated exotic tree species found all over the area. This species are expanding quickly among this area for its early economic returns and higher rate of survival.

181. Undergrowth vegetation as well as herbs and shrubs are quite common and dominated with grass species like other areas which have been described in earlier.

Aquatic flora

182. Aquatic plants are categorized as submerged, free floating, rooted floating, sedges and meadows. Submerged plants are dominated both in permanent and seasonal wetland. Most of which comes from Aponogetonaceae, Hydrocharitaceae and Potamogetonacea and start

growing with the rise of water level and persist as long as water is present. *Hydrillaverticillata*, *Potamogetoncrispus* are most common in this vegetation type. Free floating plants are also common throughout the area. Eichhorniacrassipes is the single most dominant species followed by *Salvinia, Azolla* and *Lemna*. Rooted floating plants make one of the most dominant plant types and the Water Lily (*Nymphaea nouchali)* are the most common.

183. Sedges and meadows are amphibian plants and have the highest species diversity. At the species level Enhydrafluctuans, Ipomoea aquatica and Ipomoesfistulosa are common in all the beels as well as seasonal flood plains. Marginal plants composition depends on the degree of water fluctuation. Cyperaceae is the dominant family followed by Amaranthaceae and Gramineae. *Enhydrafluctuans, Ipomoea fistulosa, Scirpus articulates* represent this aquatic plant community.

Faunal Communities

184. Terrestrial birds have the largest population among all the wildlife groups and dwell along the dry land habitat such as homestead, open woodland, scrub and grass land. Birds of prey survive well in the area. Common birds species in the area are: Common Myna (*Acridotherestristis*), Asian Pied Starling (*Sturnus contra), Red Vented Bulbul (Pycnonotuscafer), Oriental Magpie Robin (Copsychussaularis), Spotted Dove (Streptopeliachinensis*), Blue Rock Pigeon (*Columbalivia*), Asian Koel (*Eudynamysscolopacea*), Coppersmith Barbet (*Megalaimahaemacephala*), Brown Fish Owl (Ketupazeylonensis), Rufous Treepie (*Dendrocittavagabunda*) etc. Crested Serpent Eagle (*Spilornischeela*), Brahminy Kite (*Heliasturindus*) are the prey birds roam over the floodplains, agricultural fields or even in homestead forests. Common Kingfisher (*Alcedoatthis*), White breasted Kingfisher (*Halcyon smyrnensis*), Little Egret (*Egrettagarzetta*), Little Cormorant (*Phalacrocoraxniger*), Indian Pond Heron (*Ardeolagrayii*) are common aquatic and water depended avifauna.

185. Small Indian Mongoose (*Herpestesauropunctatus*), Common House rat (*Rattusrattus)*, Irrawaddy Squirrel (*Callosciuruspyygerythrus*), Greater Short-nosed Fruit Bat (Cynopterus sphinx), Indian Pipistrelle (*Pipistrelluscoromandra*), are the major mammalian species. Among the reptiles, House gecko (*Hemidactylusfrenatus*), Keeled Grass Skink (*Mabuyacarinata*), Bengal Monitor (*Varanusbengalensis*), Tokay gecko (*Gekko gecko*), Spotted Flapshell Turtle (*Lissemyspunctata*), Checkered Keelback (*Xenochrophispiscator*), Striped Keelback (*Amphiesmastolatum*), Monocled Cobra (*Najakouthia*) are known to occur in the area. House gecko (*Hemidactylusfrenatus*), Keeled Grass Skink (*Mabuyacarinata*) is the common lizards found in homesteads and fallow lands. Turles are rare and now are only occasionally seen are the Indian Roofed Turtle (*Pangshura tectum*), Banded Krait (*Bungarusfasciatus*), and Spectacled Cobra (*Najanaja*). Amphibian species favor wetland areas and the marginal dried areas. Some species, Common Toad (*Duttaphrynusmelanostictus*), Asian Brown Tree frog (*Polypedatesleocomystax*), Cricket frog (*Fejervarya*Sp.), Ornate Microhylid frog (*Microhylaornata*) are prefer damp and cool habitats.

4.4.6 Existence of Ecological Important Area

186. There is no designated protected area like wildlife sanctuary or reserve forest or game reserve or eco-park etc falls along the RoW of proposed TL.

4.4.7 Existence of Designated Bird Flyways

187. Two migratory bird flyway has falls on Bangladesh (Figure 4.22). The Country has been a Partner since 2010 and is home to 5 Flyway Network Sites, designated under the specifications set by East Asian Australian Flyway Partnership (EAAFP). It is an important

country for non-breeding individuals of incredibly rare Spoon-billed Sandpiper, and is also part of the breeding range of the endangered Masked Finfoot, among many other waterbirds (Ref.: http://www.eaaflyway.net/about/countries-in-the-flyway/bangladesh/).These sites are:

188. TanguarHaor, HakalukiHaor, Hail Haor, NijhumDwip and Sonadia Island. All the designated sites are well distant from the proposed five transmission lines.

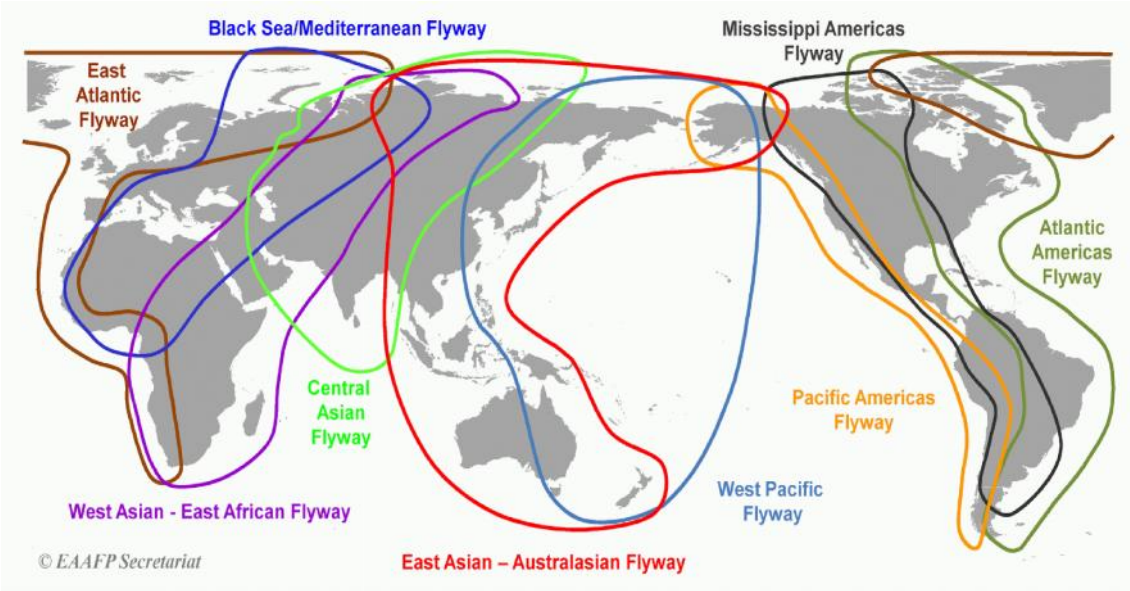
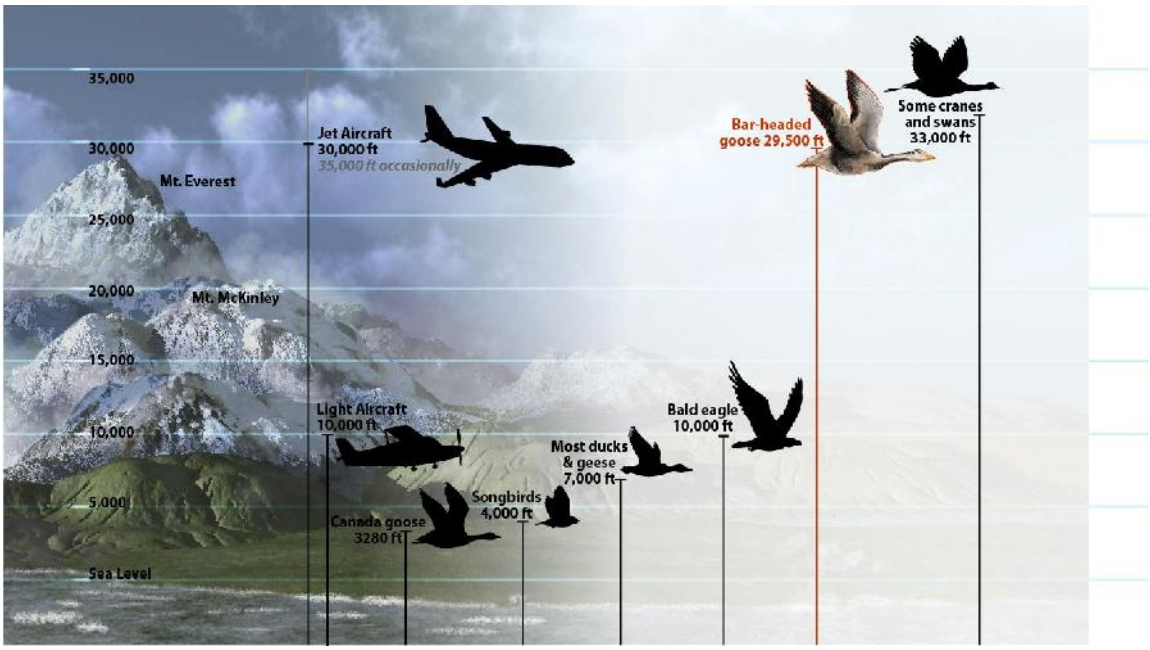


Figure 4.22: Global Migratory Bird Flyways (Source: http://www.eaaflyway.net)

189. It is difficult to identify the actual flying routes over the study area as the available maps provided by the EAAFP. The draw it in global aspects and for this reason the study area is very tiny comparing to each flying zone. There is lack of information about the minimum flying heights of different migratory birds. However, following figure (Figure 4.23) represents the maximum flying heights of some migratory bird groups.



(Source: http://beforeitsnews.com/newsletter/thank-you.php)

Figure 4.23: Flying heights of different migratory birds

4.5 Socioeconomic Resources

4.5.1 Cropping pattern and intensity

190. The agricultural lands under the RoW of re-conductoring of power transmission lines are intensively used for agricultural crops production in GIA. The single, double and triple cropped area is 21%, 54% and 25% of the NCA. The cropping intensity is about 204%. Detailed information on major cropping pattern in lines is presented in Table 4.6

Table 4.6: Present cropping pattern of the study area

Land type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (November-February)	Area(ha)	% of NCA
F_0	Sugarcane	Sugarcane	Sugarcane	10	4
	Banana	Banana	Banana	26	11
	Betel vine	Betel vine	Betel vine	5	2
	Turmeric	Turmeric	Turmeric	7	3
	Jute	HYV Aman	Wheat	5	2
	Vegetables	Vegetables	HYV Boro	7	3
	Vegetables	Fallow	Vegetables	5	2
			Sub-total	**65**	**27**
F_1	HYV Aus	HYV Aman	HYV Boro	12	5
	Fallow	HYV Aman	Chili	5	2
	Fallow	HYV Aman	Pulses	5	2
	Fallow	HYV Aman	HYV Boro	43	18
	Fallow	HYV Aman	Mustard-HYV Boro	36	15
	Fallow	HYV Aman	Potato	24	10
	Fallow	Lt.Aman	HYV Boro	48	20
			Sub-total	**173**	**72**
F_2	Fallow	Fallow	HYV Boro	2	1
			Sub-total	**2**	**1**
			Total	**240**	**100**
Cropping intensity(%)-204					

Source: CEGIS field survey; October, 2016

4.5.2 Crop production loss due to re-conductoring of transmission lines

191. Total agricultural land in the DIA is 10 ha. But 9 ha (90% of the NCA) of the NCA is being used for crop production and the rest area is occupied by settlement. It is assume that, total area requirement for each angle point is 0.04 ha. Therefore, crop production of angle point area has been calculated on the basis of crop yield against angle point area. Total crop production is 120.6 tons of which Lt.Aman: 1.22 tons, HYV Aman: 9.65 tons, HYV Boro: 12.14 tons, Bean: 6.48 tons, Vegetables: 6.24 tons, Banana: 19.24 tons, Chilli: 0.9 tons, Sugarcane: 33.6 tons, Wheat: 0.3 tons, Turmeric: 25.6 tons, Jute: 0.85 tons, Pulses: 0.168 tons, Betel vine: 2.0 tons and Mustard: 2.27 tons. This crop production would be lost for re-conductoring of transmission lines. Details are presented in **Table 4.7.**

Table 4.7: Detailed information on Angle Point of T/L

Angle Point (AP)	Land use	Observations/ Land use of angle point area(ha)	Observation/Production loss (tons)
Ashuganj to Ghorashal 230 kV line			
AP-1	Lt.Aman-HYV Boro	Each crop area = 0.04ha	Lt.Aman:0.072 tons, HYV Boro:0.152 tons
AP-2	Fallow land area	Fallow land	No impact
AP-3	Low Agricultural land- HYV Boro	Crop area=0.04ha	HYV Boro:0.152 tons
AP-4	SARK Garments building, 12 tin shade house, Banana tree Garden, Tin shade house-5	Non-agriculture land	No impact
AP-5	Two crops land, (Lt.Aman-HYV Boro)	Each crop area = 0.04ha	Lt.Aman:0.072 tons, HYV Boro:0.152 tons
AP-6	Tin shade house -20, Chambal tree-10 hight-35'-0", Mango tree -10 hight-25'-0"	Non-agriculture land	No impact
AP-7	Coconut tree-7, Bamboo tree-120, Mango tree -5 hight-20'-0"- 35'-0", Two Storied building-2, hight 20', Ramnagar School and College building hight-20'	Non-agriculture land	No impact
AP-8	Two crops(Lt.Aman-HYV Boro)	Each crop area = 0.04ha	Lt.Aman:0.072 tons, HYV Boro:0.152 tons
AP-9	Three crops(Lt.Aman-Mustad-HYV Boro),	Each crop area = 0.04ha	Lt.Aman:0.072 tons, Mustard: 0.048 tons, HYV Boro:0.152 tons
AP-10	Two crops(Lt.Aman-HYV Boro)	Each crop area = 0.04ha	Lt.Aman:0.072 tons, Boro:0.152 tons
AP-11	Three crops(HYV Aman-Mustard-HYV Boro)	Each crop area = 0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons, HYV Boro:0.152 tons
AP-12	Fallow land, Two storied building-2, Tin shade building-5, Tin shade building-5,	Fallow land	No impact
AP-13	Three crops land(HYV Aman-Mustard-HYV Boro)	Each crop area = 0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-14	Three crops(HYV Aman-Mustard-HYV Boro),	Each crop area = 0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-15	Poultry farm tin shade house-6, Tin shade house-3 Mango tree -5, Jackfruit tree-4, Rain tree-5 hight-35'-0", High vegetable land, Kalilabad village kacha road (by lane)	Non-agriculture land	No impact
AP-16	Agricultural land-HYV Boro	Crop area=0.04ha	HYV Boro:0.152 tons

Angle Point (AP)	Land use	Observations/ Land use of angle point area(ha)	Observation/Production loss (tons)
AP-17	Three crops (HYV Aman- Mustard-HYV Boro)	Each crop area = 0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-18	Three crops (HYV Aman-Mustard-HYV Boro)	Each crop area = 0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons,
AP-19	Two crops(HYV Aman-HYV Boro),	Each crop area = 0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-20	Two crops(HYV Aman-HYV Boro),	Each crop area = 0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-21	Banana Garden	Crop area=0.04ha	Banana:0.8 tons
AP-22	Two crops(HYV Aman-HYV Boro),	Each crop area = 0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-23	Two crops(HYV Aman-HYV Boro),	Each crop area = 0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-24	Banana tree Garden	Crop area=0.04ha	Banana:0.8 tons
AP-2	Tin shade house-7, toilet-1, Rain tree-10 hight 35'-0", Banana tree-10 hight-12'-0"	Non-agriculture land	No impact
AP-26	In side of Ghorashal Power station	Non-agriculture land	No impact
Sub-total=26		**Total 6.9 tons of which Lt.Aman:1.008 tons, HYV Aman:1.15 tons,HYV Boro:2.43 tons, Mustard:0.712 tons and Banana:1.6 tons**	
Sirajganj-Bogra 230 kV line			
Start point-AP01	Two cropped (HYV Aman-HYV Boro),	Each cro area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-1	Low Fallow Land	Fallow land	No impact
AP-2	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each cro area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-3	Low land	Fallow land	No impact
AP-04	Handloom house-1, Jomuna Bodhu River, Guava Tree -3 – 4ft, Mango tree - 4-10ft	Non-agricultural land	No impact
AP-05	Banana orchard	Crop area=0.0.4ha	Banana:0.8 tons
AP-06	Banana orchard	Crop area=0.0.4ha	Banana:0.8 tons
AP-07	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-08	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons

Angle Point (AP)	Land use	Observations/ Land use of angle point area(ha)	Observation/Production loss (tons)
AP-09	Three cropped land land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-10	Three cropped land land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-11	Three cropped land land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-12	Three cropped land land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-13	Three cropped land land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-14	Two cropped land (HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-15	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-16	Three cropped land (HYV Boro, HYV Aman, Mustard).	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-17	Two cropped land (HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-18	Two cropped land (HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-19	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-20	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-21	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-22	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-23	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-24	Two crops land (HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-25	Three crops land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-26	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons

Angle Point (AP)	Land use	Observations/ Land use of angle point area(ha)	Observation/Production loss (tons)
AP-27	Two crops land (HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-28	Three crops land(HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-29	Two crops land (HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, HYV Boro:0.152 tons
AP-30	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-31	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-32	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-33	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-34	Three crops land(HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-35	Three cropped land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP-36	Two crops land(HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-37	Two crops land(HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-38	Two crops land(HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-39	Two crops land(HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
AP-40	Boundry, Mango tree -4-7’	Non-agriculture land	No impact
Sub-total=40		**Total 12.32 tons of which HYV Aman: 4.35 tons, HYV Boro:5.16 tons, Mustard:1.2 tons and Banana:1.6 tons**	
Kushtia to Jhenaidah 132 kV line			
Start point – AP1	Three crop land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP – 1	Three crop land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP – 2	Three crop land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP- 3	Three crop land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048

Angle Point (AP)	Land use	Observations/ Land use of angle point area(ha)	Observation/Production loss (tons)
			tons,HYV Boro:0.152 tons
AP – 4	Betel vine field(Paan Baroj), Banana orchard, Three crop land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.02ha	Betel vine: 0.16 tons, Banana: 0.4 tons, HYV Aman:0.064 tons, Mustard:0.024 tons,HYV Boro:0.076 tons
AP – 5	Three crop land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP – 6	Betel vine field (Paan Baroj), Turmeric field(Holud Kheth)	Each crop area=0.04ha	Betel vine:1.6 tons,Turmeric:6.4 tons
AP – 7	Paak Darbar Sharif, Kobor 4, Tin Shade 2,Mehogoni 30pcs. – 25',15pcs. – 18',40pcs. – 10',Battle nut 10pcs. – 25', Pithraj 15pcs. – 15',Coconut 4pcs. – 25'	Non-agriculture land	No impact
AP – 8	Kaacha Road+ JK canal, Semi Pucca – 2,Tin Shade – 2,Khejur Tree- 7pcs. – 0',Banana 7pcs. – 12', Jiga Tree – 4pcs.- 14', Mehogoni – 4pcs. – 15, Coconut – 5pcs. – 8'	Non-agriculture land	No impact
AP-9	Two crop Land (HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, HYV Boro:0.152 tons
AP – 10	Banana orchard	Each crop area=0.04ha	Banana:8 tons
AP-11	Two crop Land (HYV Aman-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons,HYV Boro:0.152 tons
Ap 12	Bean field(Sim Kheth)	Crop area=0.04ha	Bean: 3.2 tons
AP – 13	Bean field(Sim Kheth) Three crops land(Turmeric, Chilli, Vegetables)	Each crop area=0.04ha	Bean: 3.2 tons,Turmeric:6.4 tons,Chilli:0.3 tons, Vegetables:0.8 tons
AP – 14	Semi Pucca 3, Pond, Mehogoni 12pcs. 25', 20pcs. 10' 11pcs. 18',Palm tree 4pcs. 25',Khejur tree3 Pcs. 15'	Non-agriculture land	No impact
AP – 15	Three crops land(Turmeric, Chilli, Vegetables)	Each crop area=0.04ha	Turmeric:6.4 tons, Chilli:0.3 tons, Vegetables:0.8 tons
AP – 16	Banana orchard	Crop area=0.04ha	Banana:8 tons
Ap-17	Three crop land (HYV Aman-Mustard-HYV Boro)	Each crop area=0.04ha	HYV Aman:0.128 tons, Mustard:0.048 tons,HYV Boro:0.152 tons
AP – 18	Sugar Cane field	Crop area=0.04ha	Sugarcane:16 tons
AP – 19	Betel vine field (Paan baroj), Three crop land HYV Boro, Vegetables, HYV Aman)	Each crop area=0.02 ha	Betel vine:0.08 tons, HYV Aman:0.56 tons, HYV Boro:0.7 tons,Vegetables:1 tons

Angle Point (AP)	Land use	Observations/ Land use of angle point area(ha)	Observation/Production loss (tons)
AP – 20	Betel vine field (Paan baroj), Bean field Three crop land (HYV Boro, Vegetables, HYV Aman)	Each crop area=0.02ha	Betel vine:0.08 tons, Bean:0.08 tons, HYV Aman:0.56 tons, HYV Boro:0.7 tons,Vegetables:1 tons
AP – 21	Three crop land (HYV Boro, Vegetables, HYV Aman)	Each crop area=0.02ha	HYV Aman:0.56 tons,HYV Boro:0.7 tons,Vegetables:1 tons
AP – 22	Three crop land (HYV Boro, Vegetables, HYV Aman)	Each crop area=0.02ha	HYV Aman:0.56 tons,HYV Boro:0.7 tons,Vegetables:1 tons
AP – 23	Pucca house 4, Semi Pucca house 7, Mango tree 4pcs. 12', Ziga tree 2pcs. 15', Mehogoni 2pcs. 18'	Non-agriculture land	No impact
AP – 24	Pucca house 2, Mehogoni 13pcs. 21, Sajna tree 2pcs. 15', Dumur 3pcs. 14'	Non-agriculture land	No impact
AP – 25	Mehogoni 5pcs 20', Fallow Land	Non-agriculture land	No impact
Sub-total=25		**Total 96.12 tons of which HYV Aman:3.2 tons, HYV Boro: 3.94 tons, Mustard:0.36 tons, Sugarcane:32 tons, Chilli:0.9 tons, Vegetables: 5.6 tons, Bean: 6.48 tons, Turmeric: 25.6 tons, Betel vine-2.0 tons and Banana:16.04 tons**	
D.Barisal to Barisal (N) 132 kV line			
AP - 1	Pucca house-4, Semi Pucca house-3, Coconut tree 1pcs. 20',Mehoguni 3pcs. 15'	Non-agriculture land	No impact
AP – 2	Land (HYV Boro)	Crop area=0.04ha	HYV Boro:0.152 tons
AP – 3	Tin Shade 3, Pucca Road Crossing, Pond, Mehogoni 5pcs. 12', Raintree 5pcs. 25',Akashmoni 4pcs. 18', Banana tree 6pcs. 10',Guava tree 5pcs. 8'	Non–agriculture land	No impact
AP – 4	Two crops land (HYV Boro, Lt.Aman)	Each crop area=0.04 ha	Lt.Aman:0.072 tons,HYV Boro:0.152 tons
AP – 5	Two crops land (HYV Boro, Lt.Aman)		Lt.Aman:0.072 tons,HYV Boro:0.152tons
AP – 6	Two crops land (HYV Boro, Lt.Aman),	Each crop area=0.04 ha	Lt.Aman:0.172 tons,HYV Boro:0.152 tons
Sub-total=6		**Total 0.824 tons of which Lt.Aman0.216 tons and HYV Boro:0.608 tons**	
D.Faridpur to Rajbari 132 kV line			
AP – 1	Tin Shade house– 1,Mehoguni 7pcs. 22', Karoi 3pcs. 18',Mango tree 2pcs. 8'	Non-agriculture land	No impact

Angle Point (AP)	Land use	Observations/ Land use of angle point area(ha)	Observation/Production loss (tons)
AP – 2	Three crops land (Wheat/Pulses & Vegetables, HYV Aman ,Jute) i)Jute-HYV Aman-Wheat ,ii) Jute-HYV Aman-Vegetables	Each crop area=0.02 ha	i)Jute:0.05 tons, HYV Aman:0.056 tons,Wheat:0.05 tons, ii)Jute:0.05 tons,HYV Aman:0.056 tons,Vegetables:0.16 tons
AP – 3	Three crops land (Wheat/Pulses & Vegetables, HYV Aman ,Jute) i)Jute-HYV Aman-Pulses, iii) Jute-HYV Aman-Vegetables	Each crop area=0.04 ha	i)Jute: 0.05 tons, HYV Aman:0.056 tons,Pulses:0.024 tons, ii)Jute:0.05 tons, HYV Aman:0.056 tons,Vegetables:0.16 tons
AP – 4	Pucca Masque, Pucca house –3, Semi Pucca house– 3,Tin Shade house– 2,Mango Tree 3pcs. 15', Juck fruit 1pcs. 12'	Non-agriculture land	No impact
AP – 5	Three crops land (Wheat/Pulses & Vegetables, HYV Aman ,Jute) i) Jute-HYV Aman-Wheat, ii) Jute-HYV Aman-Vegetables, iii)Jute-HYV Aman-Pulses,	Each crop area=0.04 ha	i)Jute:0.05 tons, HYV Aman:0.056 tons,Wheat:0.05 tons, ii)Jute:0.05 tons, HYV Aman:0.056 tons,Vegetables:0.16 tons, iii)Jute:0.05 tons, HYV Aman:0.056 tons, Pulses:0.024 tons
AP – 6	Three crops land (Wheat/Pulses & Vegetables, HYV HYV Boro ,Jute) i) Jute-HYV Aman-Wheat, ii)Jute-HYV Aman-Pulses,	Each crop area=0.04 ha	i)Jute:0.05 tons,HYV Aman:0.056 tons,Wheat:0.05 tons, ii)Jute:0.05 tons, HYV Aman:0.056 tons,Pulses:0.024 tons
AP – 7	Banana Tree 20pcs. 8', Palm Tree 3pcs. 9',Ber/Jujube Tree 2pcs. 8	Non-agriculture land	No impact
AP – 8	Suger cane field	Crop area=0.04 ha	Sugarcane:1.6 tons
AP – 9	Three crops land (Wheat/Pulses & Vegetables, HYV HYV Boro ,Jute) i)Jute-HYV Aman-Pulses, iii) Jute-HYV Aman-Vegetables	Each crop area=0.02 ha	i)Jute:0.05 tons, HYV Aman:0.056 tons,Pulses:0.024 tons, ii)Jute:0.05 tons, HYV Aman:0.056 tons,Vegetables:0.16 tons,
AP – 10	Three crops land (Wheat/Pulses & Vegetables, HYV HYV Boro ,Jute) i) Jute-HYV Aman-Wheat, ii)Jute-HYV Aman-Pulses,	Each crop area=0.02 ha	i)Jute:0.05 tons,HYV Aman:0.056 tons,Wheat:0.05 tons, ii)Jute:0.05 tons, HYV Aman:0.056 tons,Pulses:0.024 tons,
AP – 11	Mehogoni tree 7pcs. 22', Akashmoni 5pcs. 15' Three crops land (Wheat/Pulses & Vegetables, HYV HYV Boro ,Jute)	Each crop area=0.02 ha	i)Jute:0.05 tons,HYV Aman:0.056 tons,Wheat:0.05tons, ii)Jute:0.05 tons, HYV Aman:0.056 tons,Pulses:0.024 tons,

Angle Point (AP)	Land use	Observations/ Land use of angle point area(ha)	Observation/Production loss (tons)
	i) Jute-HYV Aman-Wheat, ii)Jute-HYV Aman-Pulses,		
AP 12 (End Point)	Three crops land (Wheat/Pulses & Vegetables, HYV HYV Boro ,Jute) i) Jute-HYV Aman-Wheat, ii)Jute-HYV Aman-Pulses,	Each crop area=0.02 ha	i)Jute:0.05 tons,HYV Aman:0.056 tons,Wheat:0.05tons, ii)Jute:0.05 tons, HYV Aman:0.056 tons,Pulses:0.024 tons,
Sub-total=12		Total 4.5 tons of which HYV Aman: 0.952 tons, Pulses:0.168 tons, Wheat:0.3 tons, Vegetables 0.64 tons, Jute: 0.85 tons and Sugarcane:1.6 tons	
Total AP=109		Total 120.6 tons of which Lt.Aman: 1.22 tons, HYV Aman: 9.65 tons, HYV Boro:12.14 tons, Bean: 6.48 tons, Vegetables: 6.24 tons, Banana:19.24 tons, Chilli: 0.9 tons, Sugarcane:33.6 tons, Wheat:0.3 tons, Turmeric:25.6 tons, Jute: 0.85 tons, Pulses: 0.168 tons, Betel vine: 2.0 tons and Mustard:2.27 tons	

Source: CEGIS field survey; October, 2016

Information on sub-station

192. There would no impact on agricultural point of view due to sub-station up-gradation. Details are presented in Table 4.8.

Table 4.8: Detailed information on sub station

Features/ SubstationName	Land Owner	Land Use	Terrestrial flora	Infrastructure	Observation
Dhaka division					
Ullan 132/33 kV SS	PGCB	Existing SS	-	A small one-stored building which is currently used as storeroom of the Substation is needed to be demolished.	There would no impact on agricultural point of view
Rampura 230/132/33 kV SS	PGCB	Guard shed and open store	Few numbers of trees like mango, coconut etc. is needed to be cut during the construction work.	A small one-stored building which is currently used as guard shed of the Substation need to be demolished.	Do
Aminbazar 230/132 kV	PGCB	Fallow land	N/A	N/A	Do

Features/ SubstationName	Land Owner	Land Use	Terrestrial flora	Infrastructure	Observation
SS					
Hasnabad 230/132/33 kV SS	PGCB	Combination of quarter buildings and open space	Few numbers of trees like Mango, Guava, Coconut, Jackfruit, Lemon, Palm etc. is exist in the space.	Among three buildings, one is abandoned and rest two are used as PGCB quarter, need to be demolished.	Do
		Switch yard and garden			
		Garden	Few numbers of ornamental and fruit trees are present there.		
Shyampur SS	PGCB	Developed land	-	-	Do
Chittagong division					
Hathazari 132/33 kV SS	PGCB	Fallow land	Some Shrub and few Sisu and Jhau trees are existing there	Boundary wall of PGCB	Do
BSRM 132/33 kV SS	BSRM	Fallow land	some shrub are present in this area	No infrastructure	Do
Feni 132/33 kV SS		Ansar Camp	Some shrubs and few numbers of fruits and wooden trees are available in this area.	Two tin shade building and a Kutcha house with gas line whish are using for Ansur Camp	Do
	BPDB	BPDB Colony	Shrubs, fruits and wooden trees are existing in the area	Four tin shade houses and kitchens and a building which are used as colony	
	PGCB	PGCB connecting Road and Pond side	Huge shrubs and some wooden trees	PGCB boundary wall and colony linking road	
Rangpur division					
Barapukuria 230/132/33 kV SS	PGCB	Fruit garden	Fruit tress like Mango , Guava, Jackfruit etc.	No infrastructure	Do

Features/ SubstationName	Land Owner	Land Use	Terrestrial flora	Infrastructure	Observation
			are in the place		
Rajshahi division					
Bogra (New) 132/230 kV SS	PGCB	Fallow land	-	Boundary wall of the substation is adjacent to the place and the wall will be removed for further activity which is under plan.	Do

Source: PGCB; 2016

4.5.3 Cropped area, yield and production

Crop area

193. Total cropped area is 491 ha of which rice and non-rice cropped areas are 339 ha (69%) and 152 ha (31%) of the total cropped area respectively. Detailed are presented in Table 4.9

Table 4.9: Cropped area, yield and production of the study area

Crop name	Study area			
	Crop area (ha)	Yield (ton/ha)	Production (tons)	% Contribution of production
HYV Aus	12	2.1	25	3
Lt. Aman	48	1.8	86	9
HYV Aman	130	2.8	363	36
HYV Boro	149	3.5	521	52
Total rice	**339**	**0**	**995**	**100**
Summer vegetables	19	10	192	10
Winter vegetables	5	12	58	3
Wheat	5	3	14	1
Pulses	5	1.2	6	0
Jute	5	2.5	12	1
Potato	24	20	480	24
Chili	5	3	14	1
Mustard	36	1	36	2
Turmeric	7	32	230	12
Banana	26	20	528	25
Betel vine	5	8	38	2
Sugarcane	10	40	384	19
Total non-rice	**152**	**0**	**1,992**	**100**
Total	**491**	**0**	**2,987**	**0**

*Source: CEGIS field survey; October, 2016 * Cleaned rice*

Crop production

194. Crop yield rates have been collectedfor the last consecutive 3 (three) years in consultation with farmers and average yield (ton/ha.) have been calculated. In the present study, it has been observed that there has been no crop damage for the last 3 (three) consecutive years. Therefore, crop production has been calculated on the basis of crop yield against crop area. Total crop production in the study area is 2,987 tons of which rice production is 995 tons and non-rice is 1992 tons respectively. The contributions of rice and non-rice crops are 33% and 67% of the total crop production respectively. The detailed existing crop production of the study area is presented in Table 4.9

4.5.4 Agricultural input use

195. Seed, labor, fertilizer, pesticides and irrigation are the major inputs for crop production.

Seeds, labor and varieties used

196. Selection of seeds should be considered on the basis of more than 85% germination rate, free from disease infestation, good shape and size and high yield potential need to be considered. According to the local farmers, Assistant Agriculture Extension Officer (AAEO) and Sub-Assistant Agriculture Officer (SAAO) of Department of Agriculture Extension (DAE) offices, , farmers are using different variety of seeds such as follows:

197. HYV Aus: BR12, BR15 and local improved variety, Lt. Aman: Sarna lata, Benapole, Sada mota, Lal mota, Jatai balam, Kanch kolom, Khaiya motor, Kumragore, Aman, Shail Aman, Dhekishail, Najirshail, Mainashail, Maloti, Ana Mia, Chinigura, Biron, HYV Aman: BR11(Mukta), BR23(Dishari),BRRI dhan39, BRRI dhan40, Haitta, HYV HYV Boro: BR10, BRRI dhan 28, BRRI dhan 29, Wheat: Kanchan, Bihari, Satabdi, Potato: Cardinal, Diamont, Multa, Petronaj, Mustard: Tori 7, BARI Sarisha 9, BARI Sarisha 14, Jute: Indian, CVL-1 and O-9897, Chili: Local improved variety, Lentil: Local improved, BARI lentil-4, Mung bean: Local improved variety, Kheshari-Local improved variety, Local improved variety, Tomato: Manik, Ratan and Hybrid, Sweet gourd: Hybrid, Bottle gourd: Hybrid and local improved variety, Bitter gourd: Local improved variety and hybrid variety, Pointed gourd: Local improved variety, Cucumber: Local improved variety of cucumber and hybrid variety, Sugarcane: Ishwardi-16, Ishwardi-18, Banana: BARI Kola-1, BARI Kola-2, BARI Kola-3, Sabri, Champa, Kabri, Amrita Sagar, Jahazi or Singapuri, Mehersagar, Aati Kola, Anazi Kola, Turmeric: Local improved variety, Betel vine:

198. Almost 65% of the cultural practices for crop production are being done manually. So, agricultural labor is considered to be one of the essential inputs for crop production. The labor requirement is not uniform throughout the year. The number of labor requirement varies from crop to crop. Average number of labor used per hectare and farmers are using seeds/ha is presented in Table 4.10.

Table 4.10: Seed and labor used in the study area

Crop Name	Seed Used (Kg/ha)	Labor(No/ha)
HYV Aus	45-50	160-170
Lt. Aman	50-60	160-170
HYV Aman	45-50	175-180
HYV Boro	45-50	180-190
Vegetables	2-3	160-170
Wheat	130-140	140-150
Pulses	50-60	100-110
Jute	8-10	150-160
Potato	1400-1,600	160-170
Chilli	0.80-1.00	120-130
Mustard	6-8	90-100
Turmeric	350-400 Rhizome	220-230
Banana	4000-4500 Sucker	180-200
Betel vine	27,000-30,000 cuttings	170-180
Sugarcane	25,000 30,000 three eye bud sets	140-150

Source: CEGIS field survey; October, 2016

Fertilizer and Pesticides

199. The rate of fertilizer use per hectare varies considerably from farmer to farmer depending on soil fertility, cropping pattern and financial ability. The major fertilizers used in this area are Urea, TSP, MP and Gypsum. The major insects as reported by the farmers are stem

borer, green leaf hopper, grass hopper, rice bug, vegetable fruit fly, vegetable fruit and shoot borer, pumpkin beetle, jute hairy caterpillar, jute semi looper, cut worm and aphid. Local farmer reported that they are using different types of pesticides such as Karate, Virthako, Fighter, Ocozem, Furadan, Basudin, Symbush, Superhit, Super power, Guli, Brifer 5G,Tido, Ronster, Regent, Entracol, Acamide, Sulphox, Thiovit, Kumulus and Flora etc. to prevent pest infestation in rice and non-rice crops cultivation. Liquid, granular and powder pesticides are being used for pest control. The fertilizer and pesticides using in the field is presented in Table 4.11.

Table 4.11: Fertilizer and Pesticides application in the study area

Crop Name	Fertilizer (Kg/ha)				Pesticides		
	Urea	TSP	MP	Other (Gyp)	No of Appli.	Liq. (ml/ha)	Gran./Pow. (Kg/ha)
HYV Aus	110-120	80-90	50-55	0	1-2	700-800	7-8
Lt. Aman	90-100	70-80	40-45	0	1-2	600-700	0
HYV Aman	110-120	80-90	50-55	0	1-2	700-800	7-8
HYV Boro	210-220	160-170	80-90	12-15	2-3	900-100	8-10
Vegetables	150-160	80-85	60-70	40-45	2-3	500-600	0
Wheat	200-210	40-50	20-25	0	1-2	500-600	0
Pulses	80-90	30-35	10-20	0	0	0	0
Jute	70-80	50-55	75-80	0	1-2	700-800	0
Potato	150-160	90-100	80-90	0	2-3	900-1000	0
Chilli	140-150	80-90	60-65	0	1-2	400-500	0
Mustard	160-170	50-60	40-45	0	0	0	0
Turmeric	120-130	20-25	30-40	7-8	1-2	400-500	0
Banana	500-650g/plant	250-400 g/plant	250-300g/plant	0	3-4	0	50-60
Betel vine	180-190	150-160	80-85	40-45	1-2	400-500	0
Sugarcane	220-230	120-125	50-500	0	3-4	500-600	0

Source: CEGIS field survey; October, 2016

Irrigated area by crop

200. Both surface and ground water are being used for irrigation purpose in the study area. Irrigation is provided to HYV Boro rice (62% of the NCA) during dry season. Brahmaputra, Turag, Bangshi, Sitalakhya, Nagor, Shib and Karatoya rivers are the major source of surface water irrigation. Ground water is being used by DTWs (Supported by Barind Multipurpose Development Authority and BADC) and surface water by LLPs and traditional modes. Supplementary irrigation is also provided to the fields of wheat, potato and mustard cultivation. Detailed irrigation information is presented in Table 4.12.

Table 4.12: Irrigated area by crop

Crop name	Irrigation (Surface water)			Irrigation (Ground water)		
	Area(ha)	% of NCA	Charge (Tk/ha)	Area (ha)	% of NCA	Charge (Tk/ha)
HYV Boro	65	27	8,500	84	35	10,500
Wheat	0	0	0	5	15	6,500
Winter vegetables	5	2	3,500	0	0	0
Potato	0	0	0	24	2	5,500
Banana	20	8	2,500	6	3	5,500

Crop name	Irrigation (Surface water)			Irrigation (Ground water)		
	Area(ha)	% of NCA	Charge (Tk/ha)	Area (ha)	% of NCA	Charge (Tk/ha)
Turmeric	0	0	0	7	3	4,500
Mustard	0	0	0	20	8	4,000

Source: CEGIS field survey October, 2016

4.5.5 Intercultural operation

201. Most of the intercultural operations are being done traditionally in the study area.

4.5.6 Main crop production constraints

202. According to local farmers lack of irrigation water in rabi season is the main problem. Siltation of river and different internal drainage channels is another problem. Khals are dried up in dry season (February to April). The cost of irrigation is higher due to diesel operated devices than that of electrical devices. For this reason, irrigation is being hampered in dry season.

4.5.7 Demographic Features of the Study Area

203. Our study area consists of 56 unios across the 18 upazilla in 9 districts where 1,710,817 people live including 854,732 (49.96%) male and 856,085 (50.04%) female.The sex ratio of male and female of these unions is 100, in which 100 are males and 100 are female.According to the Census2011data, areas of transmission line crossing Barisal to Barisal (N) contain the highest sex ratio which is 105.The average population density of the study area is 1290. In Ashuganj to Ghorashal region population density is highest e.g., 2169 person per square kilometer.

204. The following table 4.13 is generated based on latest BBS data published in 2012, the projected[5] population in 2015 is estimated to be 1,806,514 where 902,543 are male and 903,971 are female.

Table 4.13: Households and population by region in the study area

Region crossing the Transmission line	Population			Sex Ratio	Population density [sq. km]
	Both	Male	Female		
Barisal to Barisal (N)	37291	19109	18182	105	890
Faridpur to Rajbari	189308	92740	96568	96	881
Kushtia to Jhenaidah	370301	187432	182869	102	1114
Sirajganj to Bogra	644180	323051	321129	101	1395
Ashuganj to Ghorashal	469737	232400	237337	98	2169
Total/ Average	1710817	854732	856085	100	1290
Projected Population	1806514	902543	903971		

*Source: Population and Housing Census 2011, BBS, 2012 *Estimated to 2015*

Households Size

205. In the study area it is found that most of the households (26.3%) comprise of 4 persons, 19.7% comprises 3 persons, 19.3% comprises 5 members, 10.8% comprises 6 members and

[5] Projected Population = Present population *(1+ Growth Rate)^^{n} ,Growth Rate = 1.37%

the lowest 2.3% comprises of one person in each household. The average household size is 4.4 which are very close to national average of 4.4 (BBS 2011). Distribution of household size in the study area is shown in Table**4.14**.

Table 4.14: Distribution of household size in the study area

Region crossing the Transmission line	Percentage of Households comprising								Average size of Household
	1 person	2 persons	3 persons	4 persons	5 persons	6 persons	7 persons	8+ persons	
Barisal to Barisal (N)	2.3	8.2	18.1	25.7	20.5	12.2	5.8	7.1	4.6
Faridpur to Rajbari	2.8	10.0	19.8	26.9	20.0	10.3	4.9	5.3	4.3
Kushtia to Jhenaidah	2.3	11.1	22.3	29.5	18.8	8.6	3.7	3.8	4.2
Sirajganj to Bogra	3.0	11.4	22.7	27.7	17.6	9.0	4.2	4.5	4.2
Ashuganj to Ghorashal	3.1	9.1	15.8	21.7	19.7	14.0	8.0	8.6	4.7
Average	**2.7**	**10.0**	**19.7**	**26.3**	**19.3**	**10.8**	**5.3**	**5.9**	**4.4**

Source: Population Census, BBS, 2011 and estimated by CEGIS 2015

Age structure

206. In the study area the highest number of population (25%) belongs to age category of 30 to 49 years old. The lowest 2.8% population belongs in the 60 to 64 age group. Age groups of 0-14 years is defined as children, 15-24 years as early working age, 25-54 years as prime working age, 55-64 years as mature working age and 65 years and over as elderly people (source: World Fact Book, CIA[6]). This classification is important as the size of young population (under age 15) would need more investment in schools, while size of older populations (ages 65 and over) would call for more investment in health sector.

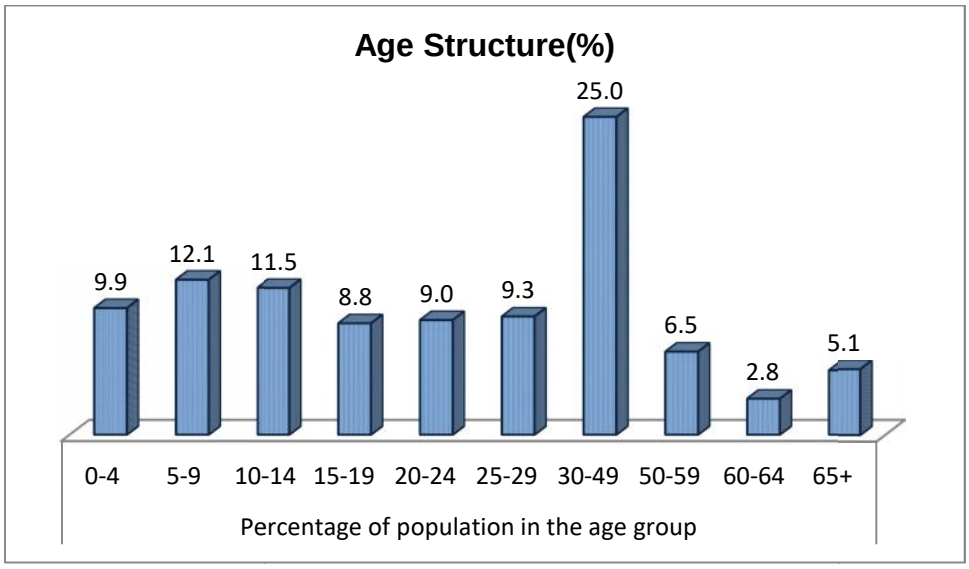
207. According to the international standards, the "economically active population" comprises of all persons of either sex who furnish the supply of labour for the production of goods and services as defined by the United Nations systems of national accounts and balances, during a specified time reference period (RaIf Hussmanns et. al, 19927). This definition is adopted by the International Labour Organization (ILO) and categorized population of 15 to 64 years category as labour force whereas as well as populations below 14 years and above 65 years are considered as dependent.

208. Therefore, the population data when analyzed to ascertain the size of (potentially) active working population then it appears that 61.4% percent population who are in the age bracket of 15-64 can be classified under this category. Conversely, there are 38.6% population who are defined as economically inactive comprising of elderly people (5.1%) and children (33.5%) (**Figure-4.24**)

[6] Retrieved on 19/3/2015 from https://www.cia.gov/library/publications/the-world-factbook/docs/notesanddefs.html

[7] RaIf Hussmanns et. al, 1992; *Surveys of economically active population, employment, unemployment and underemployment;*International Labour Office, Geneva.

209. Estimating total dependency ratio[8] it is found 62.87 in which child dependency ratio is 54.56 and aged dependency ratio is 8.30. It illustrates that total 61 persons are dependent on 100 labour forces in which 55 are children and 8 are elderly people.



Source: Population Census, BBS, 2011 and estimated by CEGIS 2015

Figure 4.24: Age Structure in the Study Area

4.5.8 Employment and Occupation

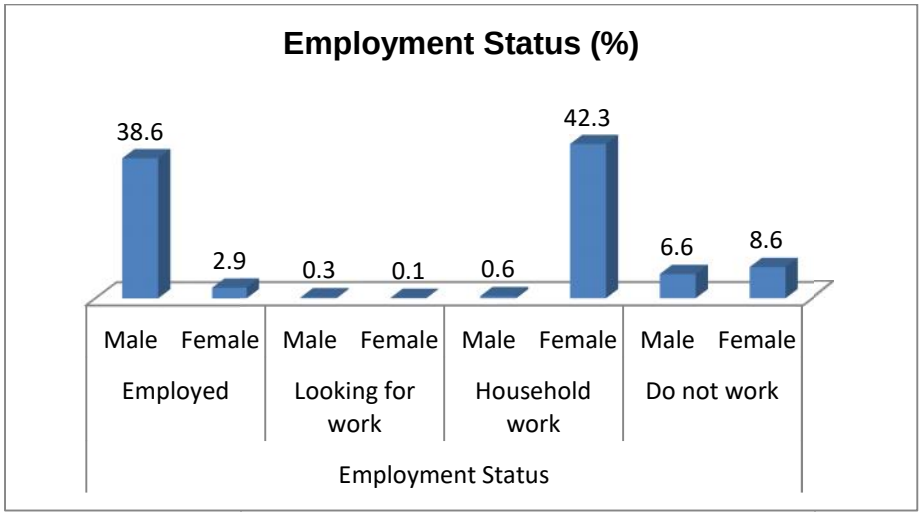
Employment

210. Employment status refers to the condition of peoples means of living by which they live by or source of income generation. It includes people from ages 7+ not attending school to the current working force. About 41.5% of total population (age 7+ not attending school) is employed in different sectors of which 38.6% are male and a negligible number of 2.9% are females (figure 4.25). About 42.3 % of female are engaged in household work. About 15.2% of total population (age 7+ not attending school) is not working. It is found that almost 0.40% of total population (age 7+ not attending school) including 0.30% male and 0.10 % female in the study area is looking for work. It seems that employment status in the study area is moderate as employment status indicates the income generation group (age 7+ not attending school to upward who earn money)

[8] Total dependency ratio=$\frac{number\ of\ people\ aged\ 0-14\ \&\ those\ 65\ and\ above}{number\ of\ people\ aged\ 15-64} \times 100$

Child dependency ratio= $\frac{number\ of\ people\ aged\ 0-14}{number\ of\ people\ aged\ 15-64} \times 100$

Aged dependency ratio= $\frac{number\ of\ people\ aged\ 65\ and\ above}{number\ of\ people\ aged\ 15-64} \times 100$

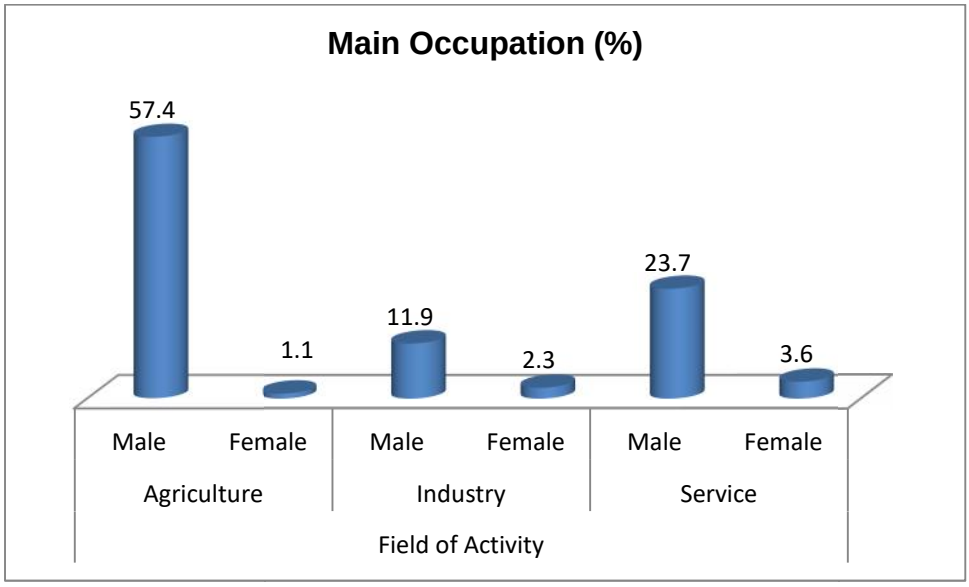


Source: Population Census, BBS, 2011 and estimated by CEGIS 2015

Figure4.25: Proportionate distribution of employment in the study area

Occupation

211. Main occupation of the people in study area is agriculture comprising of 57.4% male and 1.1% female (figure 4.26). Though industrialization is occurring rapidly, only 14.2% of working force (7+ not attending school and employed) are engaged in industrial work in our study area and rest 28.4% people are engaged in service. Here most important factor is that women are moving forward to income generation. Overall 7.0% women in our study area are getting involved in income generation including agricultural, industrial and service oriented jobs. Scope of employment in agricultural sectors is gradually decreasing as urbanization and industrial initiatives are tending to converting e.g. the farm lands into human settlements and industrial enterprises.



Source: Population Census, BBS, 2011

Figure 4.26: Proportionate distribution of population by field of activity

4.5.9 Labor Availability and Wage Rate

212. Data confirms that agriculture, industry and service are the sole sectors to generate employment for the local people. Field findings from different study of CEGIS in the study area documented that peoples who are not permanently employed tend to engage themselves in those sectors in the forms of agricultural laborers, fishers, brick field workers and earth related workers. In agricultural sectors, most of the laborers are supplied from the local villages.

213. The wage rate scenario of the study area is presented here. In summarizing this table it is found that wage rate is almost same to every region in our study area but in paurashava area wage rate is high due to be a sub-urban area . Another noticeable fact is that women don't get equal right till now. But the positive side is both male and female are working together as it is beneficial for development.

Table 4.15: Labour availability and wage rate of the study area

Region crossing the Transmission line	Male			Female		
	Labor	Average wage tk/day		Labor	Average wage tk/day	
	Availability	Max.	Min.	Availability	Max.	Min.
Bogra to Sirajgonj (230 kV)	High	400-500	250-300	Medium	300-350	200-250
Faridpur to Rajbari (132 kV)	High	350-400	250-300	Low	300-320	200-250
Kushtia to Jhenaidah (132 kV)	High	350-400	250-300	Low	300-350	200-250
Barisal to Barisal (N) (132 kV)	High	400-500	350-400	Medium	300-320	250-300
Ashuganj to Ghorashal 230 kV	High	450-500	300-350	Low	300-350	250-300

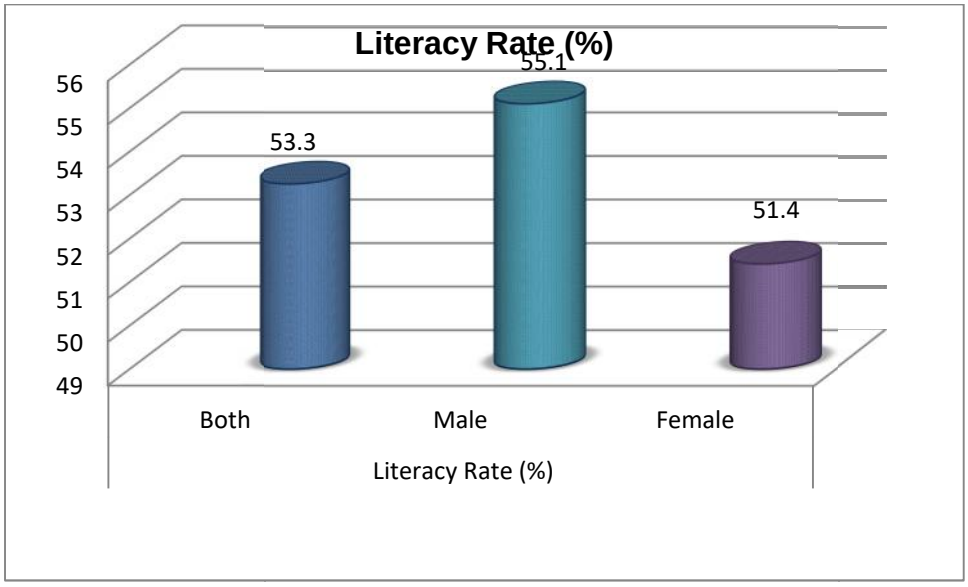
Source: CEGIS Field work 2016.

214. **Table 4.15** implies that male participation in agriculture sectors is higher than that of industry and service. But the industry and service employed people are out migrated people of the area. Field findings documented that during harvesting period, women take part in action with men in same agricultural field. The wage rate varies from region to region.

215. In the study area it is observed that mostly the non-farming activities are contractual and that non-farming activities require more labour than farming activities. The wage rate is higher for non-farming activities.

4.5.10 Education and literacy rate

216. Literacy rate, based on a definition "ability to write a letter in any language" is 53.3%, whereas male accounts to 55.1% and female 51.4% and the national literacy rate is both (male and female) 51.8% in which male are 54.1% and female are 49.4%. In this respect, it can be said that literacy rate of the study area is moderate in comparison with the national literacy rate. Figure 4.27 show the rate of literacy rate of male female in study area.

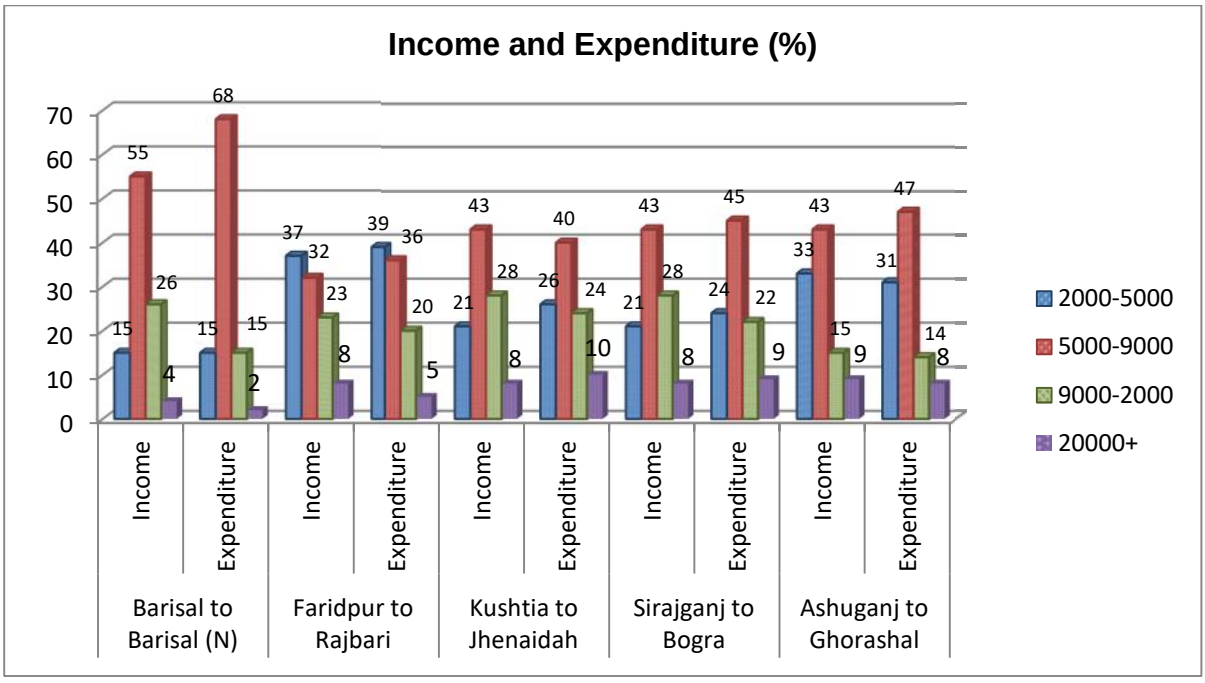


Source: Housing and Population Census BBS, 2011

Figure 4.27: Literacy rate of study area

4.5.11 Income and Expenditure

217. Household income and expenditure is an important indicator to measure the socio-economic condition of people. In the study area, it is found that the income and expenditure of most of the households varies from Tk. 5,000 to Tk. 9000 taka /month. The income and expenditure of the people <Tk. 2,000 are very rare. The percentage of income generation and expenditure more than 20,000 is very few. The scenario of income and expenditure shows following figure 4.28



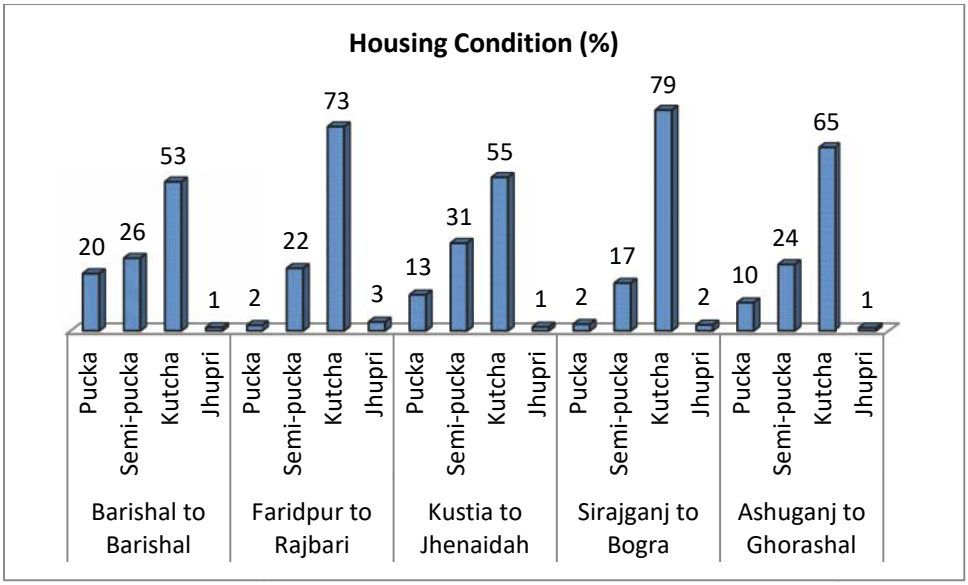
Source: CEGIS field work, 2016

Figure 4.28: Distribution of Household by income and Expenditure

4.5.12 Standard of living

Housing Condition

218. In the study area, overall housing condition is not satisfactory. Majority people of the study are dwelling in kutcha house. On an average only 7.4% households are pucka[9] and 24% households are [10]semi pucka while the highest 65% houses are kutcha[11]. Jhupri[12] is negligible. The scenario of housing condition is now changing with increasing income of the study area in Figure 4.29.



Source: Population and Housing Census 2011, BBS, 2012

Figure 4.29: Housing Condition in the Study Area

Drinking Water Facility

219. Drinking water is a major indicator of measuring social condition. Tube well is the main source of drinking water. In the study area, 95% people collect drinking water from tube well, where rest of the negligible portion collect drinking water from tap or other sources such as ponds, river etc. The figure 4.30 shows the percentage of tube-well coverage is significant.

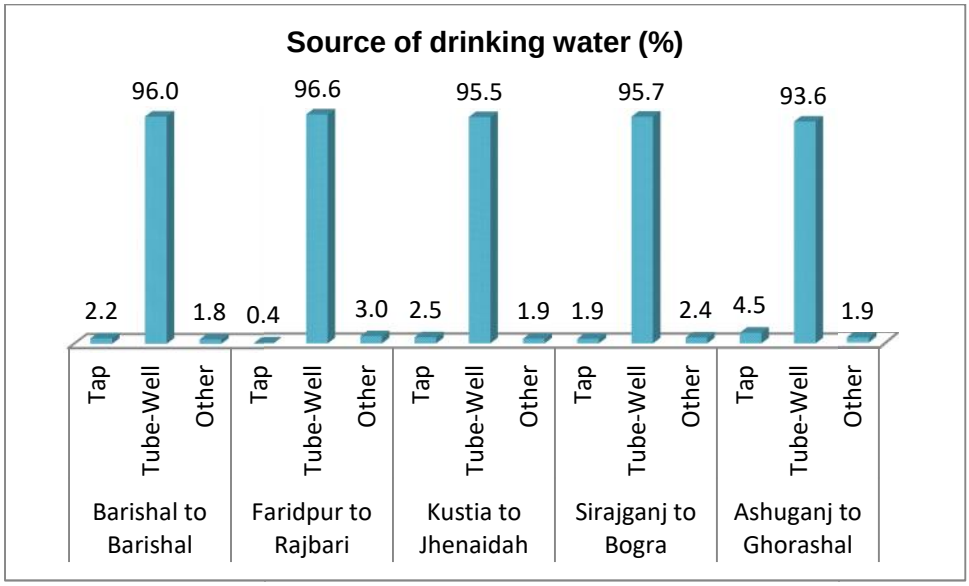
220. Field findings show that people are drinking fresh water though tube-well which is away from the household. In our study area there is no salinity and ground water quality is better than other regions of the country. Tube-well is the main source of drinking water whether it is individual or communal.

[9] Pucka: House which is made by fully concrete, cement, and iron.

[10] Semi-pucka: Walls: Bamboo mats, CI sheet, Timber or bamboo framing. In some areas wall are made by earth, sometimes part or full brick. Foundation: Earthen plinth; Brick perimeter wall with earth infill; Brick and concrete also use. Roof: CI sheet with timber or bamboo framing

[11] Kutcha: Walls: Organic materials like jute stick, catkin grass, straw, and bamboo mats. Split are bamboo framing. In some areas wall are made by earth. Foundation: Earthen plinth with bamboo or timber posts. Roof: Thatch-rice or wheat or maize straw, and catkin grass, with split bamboo framing;

[12] Jhupri: House which consist mud walls of 1.5 to 3.0 ft thickness, which carry the roof load. Earthen floor, thatch or CI sheets are used as roofing materials. . There is no monolithic joint between the wall and the roof.

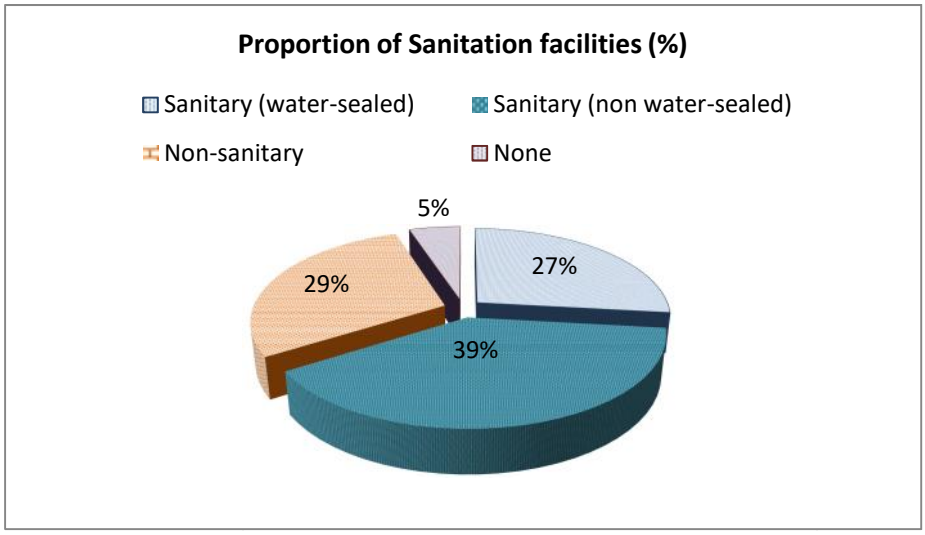


Source: Population and Housing Census 2011, BBS, 2012

Figure 4.30: Drinking Water Facility in the Study Area

Sanitation Facility

221. In the study area, 66% households reported that they have sanitary toilet facilities of which 27% are water-sealed and another 39% are non water-sealed, a large portion (29% household) of this study area has no sanitary toilet facility. It is matters of anxiety that still 5% household have no sanitation facility.

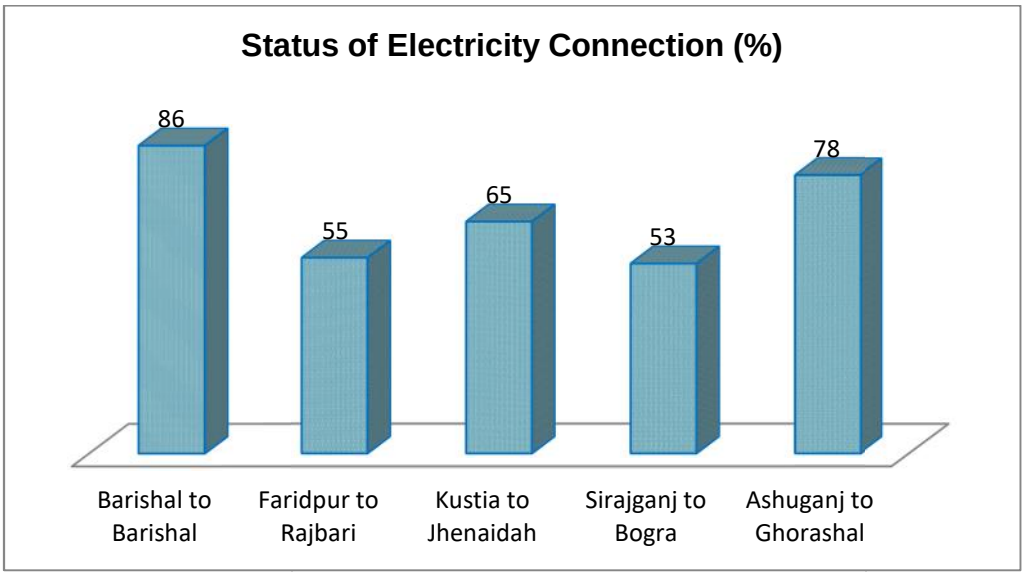


Source: Population and Housing Census 2011, BBS, 2012

Figure 4.31: Sanitation Facility in the Study Area

Access to Electricity

222. Electricity is footmark of modern evolution. It is an important indicator of measuring advancement of an area. In the following figure, electricity status of different region is presented. Amon them Barisal region contains the highest (86%) electricity facility, on the contrary Faridpur to Rajbari, Kushtia to Jhenaidah, Sirajganj and Ashuganj to Ghorashal contain 55%, 65%, 53% and 78% respectively and National coverage is 63.1% . In this regard it is found that some of the region has still lower coverage compared to the national coverage.



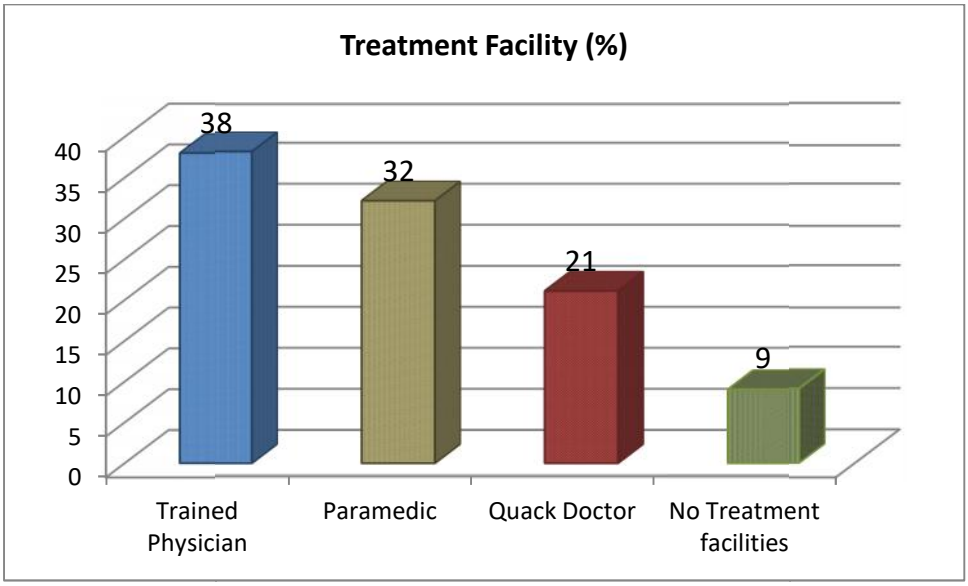
Source: Population and Housing Census 2011, BBS, 2012

Figure 4.32: Electricity Facility in Study Area

Access to health facilities

223. Health system of Bangladesh has gradually changing and Bangladesh achieved MDG goal in this sector. So, access to health services and facilities refer to availability and adequacy of supply, affordability, physical accessibility and socio-cultural acceptability. Secondary data shows that all most every districts of the study area has the same health facilities. Almost every district has primary, secondary and tertiary level health facilities which include Sadar/Zila Hospital, Upazila Health complexes and at union level community clinic and Union health and mother welfare centre. The existing services are accessible for rural poor people. In our study area, field findings show that Paramedic physician is providing services to 32% of the people and 38% of the people go to trained physician. On the other hand, People reported that people still have tendency to go to the [13]local healer (21%) for treatment. It is matter of anxiety that almost 9% people (mostly the poor) do not get any medical facilities. It is assumed that economic wellbeing will drive them toward receiving treatment facilities from trained physicians.

[13] A person in a primitivesocietywhouseslong-establishedmethodspasseddownfromonehealer to another to treat a personsufferingfromvariousillnesses,many of whichhavepsychologicalunderpinnings.Methodsused by traditionalhealersincludetheuse of roots,fetishdolls,voodoodolls,andthesmokingout of a possessingspirit or spell. [traditional healer]



Source: CEGIS, Field Study, 2016

Figure 4.33: Percentage of treatment facility in the study area

4.5.13 Safety and Security

224. Our study area consists of vast area throughout the country but it needs the proper monitoring for ensuring safety and security. It requires Reconductoring overhead 190 km transmission line, so safety and security is the major concern for the project location. Some safety measure is to be taken before construction work.

- ✓ To aware local people about the construction work.
- ✓ Fencing the construction avoiding accidental hazards.
- ✓ Using net below the line between the poles.
- ✓ Avoiding child labour.
- ✓ Avoiding disturbance of local people.
- ✓ Ensuring compensation for crop.
- ✓ Avoiding populated zone for construction work.
- ✓ Ensuring first aid and safety measurement.

4.5.14 Gender and susceptibility

225. Gender" is not the same as "sex" or "women"; it is about the relationship between men and women and therefore concerns men as much as it does women. Defined by societal norms and practices and supported by societal attitudes, this relationship is usually skewed in favor of men. Hence the focus of this chapter is on the situation of women. This approach to analyze gender relations does not negate the fact that men can also find themselves in a position of subordination; it recognizes that women are more often subordinated.

226. Gender relations in Bangladesh have been undergoing a process of considerable transformation over the last two decades as part of broader process of economic transition and social change. Although progress has been considerable in many spheres, women's changing roles have also given rise to a range of new challenges that require shifts in policy making and

program implementation as well as the various social and cultural values which have informed and shaped implicit societal understandings of women's roles and responsibilities. Bringing women into the mainstream economic activities and ensuring equal right for women is one of the major goals of MDG. Bangladesh is on the fulfillment of this goal as pursued by the government of Bangladesh. Although there has been steady progress, still there are some sector wise specific inequality like- in marriage relationship, , employment, etc. That's why gender inequality has been identified as one of the barriers of development.

227. According to UN Women and many other development partners, a standalone gender equality goal should be retained in parallel to the mainstreaming of gender equality in all other goals because gender equality is a prerequisite for achieving progress in other development goals, and achieving gender equality is an important human rights goal in itself. Three critical target areas have been identified for a stand-alone gender equality goal: freedom from violence against women and girls; gender equality in the distribution of capabilities; and gender equality in decision-making in all spheres of public and private life. This proposal is grounded in global commitments by UN Member States to gender equality and women's rights, and enshrined in international treaties and agreements.

228. This project intervention under Government to Government can be regarded as the stair of development in power sector. Gender concern is the prominent one due to fact that half of the total population consists of women in our study area where man and women ratio is 104.9:100. Women can participate in project interventions both directly and indirectly. This project intervention will enhance electricity generation that will reflect in production.

229. The most encouraging fact is that women are moving forward by overcoming all barriers in education and employment. They have become more conscious about their own right. As a result, the number of educated women is increasing though the ratio is still far behind. In garmenrs, women are the main working force which is the main source of earring foreign currency.

230. In this regard some initiatives can be taken for women so that gender equity can be ensured and women can participate in the development work as its mandatory for sustainable development. Both male and female participation in working force can accelerate the production as it may moves to the desired goal. Effective measures for gender equity are given below:

- Develop a shared vision and explicit consensus on gender equality objectives.
- Involve stakeholders from civil society in dialogue on objectives and activities.
- Make long term commitments to partner and activities.
- Assess and strengthen partner capacity for gender responsive and participatory analysis, planning and implementation.
- Ensure that gender strategies are practical, and based on quality gender analysis.
- Incorporate gender equality objectives into activity, programme or project objectives.

231. Social awareness is also getting better due to some motivational campaign by some development organization. Even attitude towards women are getting better. It must be mentioned that the no to early marriage have decreased in our study area. But dowry system still prevailed but varies with the passage of time in different format.

232.

233. As women consist of the half of the population, their proper participation in development and proper right is inevitable. Whatever the intervention, women should be engaged directly or indirectly. In this regard ensuring proper education and consciousness can lead them to the proper destination.

234. Thus the overall scenario of the study area regarding gender issues is on the way of onward for the time being. Women are now enjoying more rights and facilities than the previous time but the ultimate empowerment that we prefer to set as outstanding is still a long way to go.

5. Screening of Potential Environmental and Social Impacts and Mitigation Measures

235. Specific location of project subcomponents are yet to be confirmed, hence, identification of site specific impacts can not be determined. However, based on the Consultant experience, potential environmental and social issues in construction and operation of substations and reconductoring of transmission lines are presented in this chapter to guide the independent ESA team to identify valued environmental and social components and propose site specific mitigation measures.In general, construction and operation of substations and reconductoring of transmission lines include loss of crop production in RoW of towers and angle point location, deterioration of soil quality in angle points and sub-station area, interference with construction machinery and vehicles at the road crossings, deterioration of air quality, high noise levels, generation of solid and liquid wastes, interference with migration routes of winter (migratory) birds, and impacts due to electrocution and electromagnetic field. The general mitigation measures and best management practices to address the construction related impacts are given in Appendix D Environmental Code of Practices (ECoPs) which are prepared based on World Bank General EHS guidelines and experiences from other projects in Bangladesh. By inclusion of these ECoPs in general specifications of contractors bidding documents, most of the construction related impacts can be mitigated.

236. A screening checklist was used to evaluate the potential environmental impacts of the proposed activities. Environmental/Social Screening matrices, Form 2a (for substation) and Form 2b (for power transmission line) presented in Appendix B are used. Based on the outcome of these screening matrices, key environmental issues that are to be managed during planning, construction and operation of substations and reconductoring of transmission lines are described in the following categories and impacts and mitigation measures for each of these categories are discussed in the following subsections.

- Location of Substation
- Mobilisation of equipment and material
- Employment opportunity
- Loss of crop production
- Air quality
- Noise impacts
- Soil quality in angle points and sub-station area
- Impacts on wildlife
- Interference with road crossing (traffic congestion and safety)
- Storage of materials and handling solid and liquid wastes,
- Electrocution of birds
- Bird collisions with transmission lines
- Occupational and public health and safety
- Safety and risks due to landuse under the transmission line

- Electricity Supply and Regional Development

5.1 Location of Substation

237. There may be a requirement of land acquisition for substations and temporary land acquisition and compensation for construction work

Mitigation Measures

- All substations will be upgraded within PGCB land and no additional land is expected.
- However, in case of any additional land required, provide compensation in accordance with 'resettlement policy framework (RPF)' presented in Appendix H.
- Temporary land acquisition and compensation will be paid based on the RPF and RAP prepared during independent ESA study.
- Establish Monitoring Unit (if needed) involving 3 parties (PGCB, WB, and PAPs) for monitoring purposes.

5.2 Realignment of Transmission Lines

238. During the preparation of this ESMF, consultation with various communities indicates that right-of-way of some of the transmission lines passess through densely populated settlements. This high-voltage transmission line may pose serious threat to population living underneath the lines.

Mitigation Measures

- During the detailed study possibility of realignment of these lines should be considered by PGCB, hence, protect the health of the population.

5.3 Design of Reconductoring of Transmission Lines

239. Improper design and placement of conductors may cause electrocution of birds.

Mitigation Measures

- A minimum of 200 cm horizontal/diagonal spacing and 100 cm vertical spacing between electrically conductive points on the power line would eliminate risks to all known birds in the project area and hence recommended for adaptation for the design of transmission line during reconductoring.

5.4 Mobilization of Equipment and Material

240. For this project, all equipments like SVC, Capacitor bankplanned to be installed will be imported from foreign countries and transportedto the project site.Furthermore, local materials such as bricks, sand, cement, rods, etc. will be utilized for installation/ construction works. For reconductoring the transmission line pullers, tensioners, reel and drum elevators etc. equipments will be used. Therefore, transporting of large quantities of materials using heavy vehicles could exceed the carrying capacity of the road. This would lead to physical damages to local road network. Thus, it will be necessary to obtain consent from Public Works Department (PWD) to use local/national highway roads prior to transportation wherever applicable.

Mitigation Measures

- Effective traffic management plan by PGCB authorized contractor

5.5 Employment opportunity

241. In Bangladesh, the unemployment rate measures the number of people actively looking for a job as a percentage of the labour force. According to BBS database more than 50% of the population area unemployed. During construction period employment opportunities for both skilled and unskilled labor may have improved. So, proposed project would require workers for construction, accessories supplies etc. Some people will be got the chance of working with the proposed project.

Implementation plan

- Make a list of directly affected people who lose their tree/ agricultural crops are interested to work during construction phase.
- Ensure local people's engagement and give the priority offering working facilities in project activity.

5.6 Loss of crop production

242. During construction period, the standing crops in this area might be affected. So there might be possibility of change of crop production. Besides, heavy equipments are used to convey the materials from roads to construction area and extend the cable, which also make considerable loss to crop field as well as production.

Mitigation Measures

- Working schedule would be prepared carefully so that standing crop would not be damaged
- If not possible, proper crop compensation should be paid to the land owner for standing crops damage
- The farmers should be informed well ahead (before start of cropping season) about the construction activities
- Proper care should be taken during construction

5.7 Air Quality

243. During construction phase, air pollution may result from emissions from machines and equipment (e.g., drilling rig, mixing machines, generators) used for different sub-project activities and movement of vehicles (carrying material and equipment) to and from the site. However, for the proposed sub-projects, adverse impacts of air pollution are likely to be limited to the areas surrounding the sub-project sites.

Mitigation Measures

- Ensure that all project vehicles are in good operating condition.
- Spray water on dry surfaces/ unpaved roads regularly
- Maintain adequate moisture content of soil during transportation, compaction and handling.
- Sprinkle and cover stockpiles of loose materials (e.g., fine aggregates).

- Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.

5.8 Noise Impacts

244. Noise pollution could results from a wide range of construction activities, including movement of vehicles (carrying equipment/material to and from site), operation of construction equipment and generators. Demolition activities, if required, also generate noise. Such noise may cause discomfort to the people living in the surrounding areas at close proximity of the sub-project site, especially if such activities are continued during the night. Noise pollution is particularly important for sensitive establishment e.g., hospitals, educational/religious institutions.

Mitigation Measures

- Use of noise suppressors and mufflers in heavy construction equipment.
- Avoid using of construction equipment producing excessive noise at night.
- Avoid prolonged exposure to noise (produced by equipment) by workers.
- Regulate use of horns and avoid use of hydraulic horns in project vehicles.

5.9 Soil quality in Angle point and sub-station area

245. There is no sub-station and angle points would be constructed newly. Reconductoring of existing transmission lines and SVC would be installed in the sub-stations for this project in the study area. So, there is no requirement of soil samples collection for quality analysis for the transmission lines. At the same the SVC/Capacitor bank will be installed into the existing substations where the soil quality analysis has already done. So there is no need for soil quality measurement for this proposed project. Besides, soil quality as well as soil characteristics might be deteriorated due to mishandling and disposing of wastes during implementation of the project.

Mitigation Measures

- The activities should be limited within stipulated area
- Proper storage of chemicals on site
- The installation of natural or synthetic liners beneath chemical storage tanks
- Minimization of on-site water and chemical usage (oil, lubricants and fuel)
- Limiting the exposure of the soil to accidental releases of pollutants
- Use of non-toxic and readily biodegradable chemicals on-site
- Generated wastes should be dumped in a stipulated area by appropriate manner

5.10 Impact on Vegetation

246. The impacts on biological components (i.e. vegetation, wildlife, fishes etc.) are also negligible. There is a suspicion to damage vegetation while stringing the transmission cable from one AP to another AP. This impact would be minimum and the damage of flora limited within the base area of each angle point. Usually there exist undergrowth herbs and shrubs and no bigger trees within the base area of AP. Movement of labour and stringing machineries may cause this type of damage. Moreover, movement of cable/machineries vehicle from the nearer existing access roads to the base of each AP may cause additional damage of undergrowth

vegetation. Although most of the cases this would be damaged mainly crop field vegetation which have been addressed in agricultural impacts of this report. Storing of equipment and cables inside the SS premises also may cause vegetation damage at there. Except this, vegetation along the RoW of the TL is expected to no impact because the new cable will be stringed by the machineries from the base of each AP and the cable will be carried above the ground.

247. After completing of wire stringing works, all herbaceous plant is expecting to re-generate within few years. But there will be a restriction for planting large trees on the RoW and will not grow up to expected height due to regular pruning. For this reason, existing vegetation pattern would be changed along the proposed power transmission alignment in some extents.

Mitigation Measures

- Use barren land as much as possible
- Avoid vegetated land as much as possible to align the transmission line
- Arrange proper compensation to the land owners against tree felling
- Use of existing path/access roads for movement of labour and carrying vessels
- No other measure is needed as the vegetation is seasonally grown and will re-vegetated naturally in next year

5.11 Impacts on Wildlife

248. There is a possibility to disturb wildlife which is dwelling under the AP towers. Cleaning of vegetation in construction phase caused relocation of wild animals like mongoose, jackals, mouse and the avifauna those are nesting on the AP. But this disturbing is not such significant because there is vast area near to the angle points to resettle them.

249. The impacts are same and general in each TL sub-project and this are negligible in every cases. Hence, the possible impacts and its Mitigation/Enhancement Measures have been presented in one matrix for all sub-projects.

Mitigation Measures

- Aware labour and local people about wildlife conservation so that minimize vegetation damage as well as safe relocation of wildlife at nearer habitats and dwell safely there

5.12 Interference with Road Crossing (Traffic Congestion and Safety)

250. There will be no impact on interference in road crossing during pre-construction and post-construction phase of implementation. But while reconductoring wires there may be some interference with road crossing for temporal which will surely deteriorate the volume capacity of the existing road. After Reconductoring wires between towers the road communication will remain normal.

Mitigation Measures

- Schedule deliveries of material/ equipment during off-peak hours.
- Depute flagman for traffic control
- Arrange for signal light at night

5.13 Storage of Materials and Solid and Liquid Wastes

251. Construction wastes at substation site like sand, cement, stone, brick chips, brick etc. may create disturbance for agricultural land, water bodies during and after construction period. The non-inert substances in construction waste include bamboo, timber, vegetation, packaging waste and other organic materials. Both of these organic and inert materials will create some potential impacts on the surrounding environment. In addition, keeping old wires at tower site (after replacing by higher size conductors) may create hazard to the surroundings.

- Cleanup must be initiated immediately
- Construction of septic tank system.
- Erection of “no litter” sign, provision of waste bins/cans, where appropriate

5.14 Electrocution of Birds

252. Usually Birds have no problem sitting, unruffled, on the high-voltage single power lines due to not complete power cycle. But there is a potential risk of electrocution hazard to wild birds especially raptors, select power poles for perching, and, sometimes, for nesting. If a bird’s appendages bridge the gap between two energized parts or between an energized and a grounded metal part, electricity flows through the “bridge” that is filling the gap and the bird is electrocuted.Most commonly, birds are electrocuted where conducting wires (conductors) are placed closer together than the wingspan of birds that frequent the poles (Ref.: https://www.nwhc.usgs.gov/publications/field_manual/chapter_50.pdf). Maximum wingspan of common large birds (For the Pallas’s fish eagle Ref.: delHoyo, J.; Elliott, A.; Sargatal, J., eds. (1994), Handbook of the Birds of the World. 2, Barcelona: Lynx Edicions. ISBN 84-87334-15-6) those are available in Bangladesh and also use power transmission line as their resting place. According to tower design, minimum distance between two wires is more than the mentioned wingspan. So, there is no risk of electrocution of Birds by the transmission line.

5.15 Bird Collisions with Transmission lines

253. Flying birds may disturb while flying and crossing through the transmission line. Indian Flying-fox, Little Indian Bat and Greater Short-nosed Fruit Bat would be risk of death due to electrification. But frequencies of this type of incidence is expecting rare because there have vast area to free movement of them and the birds are already habituated in their movement because the proposed line would be established by replacing of existing line.

Mitigation Measures

- Covered transmission line should be used to avoid the impact on aerial wildlife.
- Use adequate color bands/flags with transmission wires so that the flying animals will aware while pass through the line.
- Use warning lamps on AP towers at different height during night

5.16 Occupational and Public Health and Safety

254. The safety and health of the public may be impacted due to the hazards created during the construction period. It is anticipated that the risk of accidents during the construction period is moderate due to the operation and movement of heavy equipments, vehicles and machineries. Besides during construction work there is a probability of accidental risk for labors and accident during replacing the conductor by fall down into the locality. All these are

significantly impact the health of the working personnel and the people living in the neighboring areas.

Mitigation Measures

- Need contingency fund for affected neighboring people to address accidental issues during implementation period
- Need proper danger signs/ posters to avoid accident at construction site
- Proper awareness program about possible accidents should be ensured for the neighboring people
- Ensuring rigorous standards for occupational health and safety are in place
- Contractor will establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal
- Provide health insurance for employees for the duration of their contracts
- Provide insurance for accidents resulting in disabilities or death of employees for the duration of their contracts
- Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system which provide workers with a safe and healthy work environment taking into account the inherent risks for this type of project.

5.17 Safety and risks due to landuse under the transmission line

255. The main risk under the transmission line is fall of the conductors and sudden flashover. Accidental falling down of the transmission line on human or any animals causes electric shock, arc and blast. Most hazards in the transmission line result due to ‘‘unsafe equipment orinstallation; unsafe environment; and unsafe work practices’’. Having identified the potential hazards, risk mitigation techniques areimplemented in order to control the frequency, severity and exposurelevel of injuries. This is typically accomplished by the use ofelectrical safety equipment (e.g., PPE, barriers); and safety proceduresand methods (e.g., grounding, de-energizing power lines)suggests measures such as insulatingconductors by the use of glass, mica, rubber, or plastic;guarding energized parts to avoid accidental contact; groundingof conductors and equipment to avoid voltage surges; use of circuitprotection; and other safety work practices. It is also preferable to avoid building settlement under the transmission lines.

Mitigation Measures

- Avoid settlement under the transmission line
- Proper maintenance of the transmission line
- Use of proper protection equipments like circuit breaker, relay etc.

5.18 Electricity Supply and Regional Development

256. The project will have very important positive impacts. These include:

- Improved power supply to various parts of Bangladesh, which will increase the potential for development of economy
- Integration into national power grid and increased reliability of power supply throughout Bangladesh.

6. Environmental and Social Management Plan

257. The primary objective of the environmental and social management plan (ESMP) is to record environmental impacts resulting from the sub-project activities and to ensure implementation of the identified “mitigation measures”, in order to reduce adverse impacts and enhance positive impacts. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operation phases of the sub-projects.

258. The specific objectives of the ESMP are to: (a)facilitate the implementation of the mitigation measures discussed earlier in the document, (b) maximize potential project benefits and control negative impacts, (c) draw responsibilities for PGCB, contractors, consultants, and other members of the project team for the environmental and social management of the Project, (d) define a monitoring mechanism and identify monitoring parameters in order to: (i) ensure the complete implementation of all mitigation measures, and (ii) ensure the effectiveness of the mitigation measures. (e) maintain essential ecological process, preserving biodiversity and where possible restoring degraded natural resources; and (f) assess environmental training requirements for different stakeholders at various levels.

259. The environmental management program should be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as a sub-project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected. For all sub-projects to be implemented under Proposed Power System Reliability and Efficiency Improvement project.

260. The ESMP will be managed through a number of tasks and activities and site specific management plans. One purpose of the ESMP is to record the procedure and methodology for management of mitigation identified for each negative impacts of the subproject. The management will clearly delineate the responsibility of various participants and stakeholders involved in planning, implementation and operation of the subproject.

6.1 Inclusion of Relevant components of EMP in Contract Document

261. The independent ESA to be prepared for subcomponents should include a clause on environmental obligations to be incorporated in the Bidding Document under Specification. This clause shall be aimed at ensuring that the Contractor carries out his responsibility of implementing the environment management plan (EMP), monitoring plan as well as other environmental and safety measures. Such clause may specify, for example, penalties for non-compliance as well as incentives to promote strong compliance. The contractors must be made accountable to implement the plans and mitigation measures which pertain to them through contract documents and/or other agreements of the obligations and importance of the environmental and social components of the project.

6.2 Institutional Arrangements

262. The Project implementation will be led by the Project Implementation Unit (PIU) that will be established within PGCB. The PIU will be responsible for procurement of consultants for carrying out the EA and engineering designs for the proposed sub components. The PIU will be headed by the Project Director (PD). An Environment and Social Unit (ESU) has been

established under the PIU and recruitment of qualified environmental and social staffs are underway. This ESU will assist the PIU on issues related to environmental and social management and oversee the Construction Supervision Consultant (CSC) and contractors and will compile quarterly mitigation and monitoring reports on EMP compliance, to be sent to the Project Director and also shared with the World Bank, throughout the construction period. The ESU will also provide trainings to the PGCBfield personnel responsible for monitoring of environmental compliance during both construction and O&M phases of the project. The organogram of PIU is shown in Figure 6.1.

263. The overall responsibility of environmental performance including ESMP implementation of the Project will rest with the PIU. Aside from their in-house environmental and social specialists, thePIU will engage construction supervision consultants (CSC) to supervise the contractors including on their execution of construction-related environmental and social managementrequirements and measures.The CSC will ensure adherence to the design parameters including quality requirements, as well as all EMP measures related to construction.

264. Two new positions consisting of environmental and social scientists/specialists forESUhas been approved and in the process of recruitment to maintain coordination and liaison with CSC for effective EMP implementation. Similarly, the CSC will also have environmental and social monitors who will supervise and monitor the contractors for effective EMP implementation. The contractors in turn will also have EHS supervisors who will ensure EMP implementation during construction activities and will be tasked to develop necessary detailed EHS plans (CEAP and OHS) as per this ESMP, and oversee their implementation.

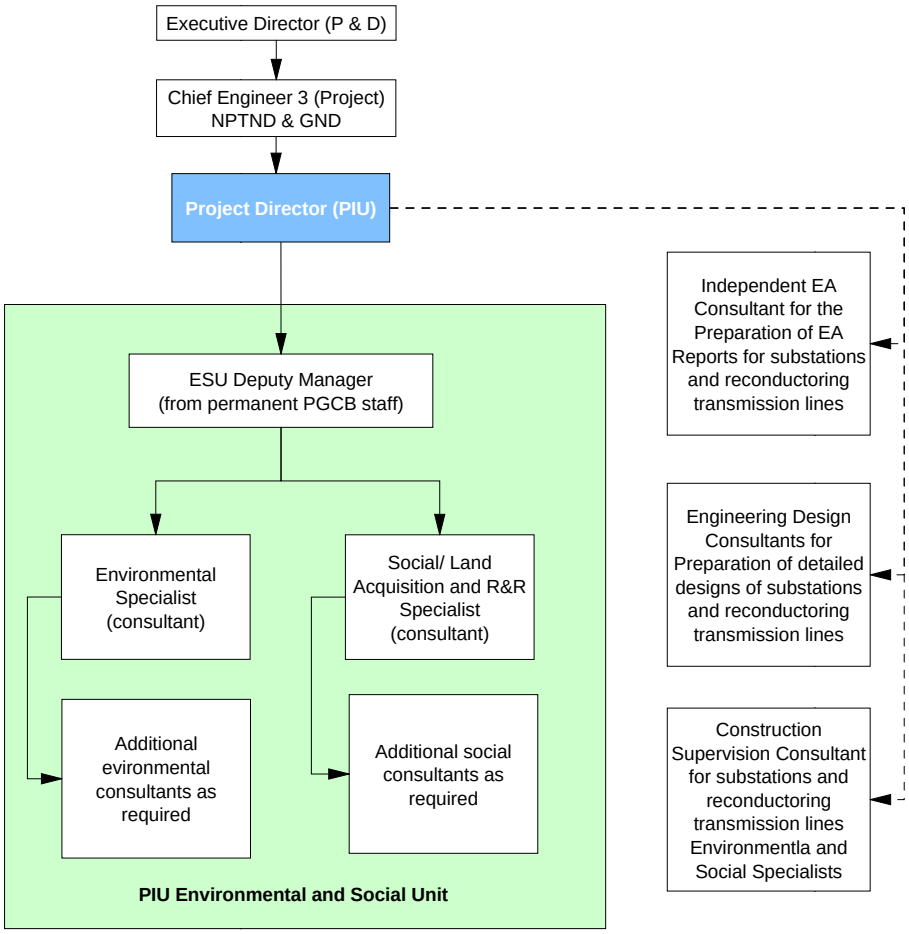


Figure 6.1: Organogram for Environmental and Social Management of the project

265. The roles and responsibilities of PIU and its consultants are presented inTable.

Table 6.1: Roles and Responsibilities for EMP Implementation

Organizations	Responsibilities
PIU	• Ensure that all project activities are well-managed and coordinated. • Recruitment of consultants for ESA and engineering designs; and obtain approval of ESA from the DOE • Procurement of works and goods. • Payment of compensation to the project affectees • Recruitment and supervision of Construction Supervision Consultants (CSC)
ESU within PIU	• Responsible for screening and determining scope of EA work required for subprojects and studies, assisting PD with developing TORs and hiring of consultants to carry out any required environmental assessment work, reviewing consultant's deliverables related to environmental assessment, reviewing bid documents for inclusion of ESMP measures, supervising construction activities, producing periodic monitoring reports, • Ensuring inclusion of ESMP in bidding documents • Providing training on ESMP principles and requirements to PGCB and NLDC field staffs, and others as needed to ensure effective implementation of ESMP • Supervising CSC for the implementation of ESMP • Closely coordinate with other concerned agencies, local governments and communities to support implementation of ESMP • Preparation of progress reports on implementation of ESMP. • Ensure effective implementation of ESMP components not directly tasked to the contractor including components dealing with indirect, induced and cumulative effects, as well as operations and maintenance stage plans and measures. • Commissioning and oversight/review of consultant reports for EIAs/EMPs to be developed for the subcomponents of the Project
ESA Consultants	• Carrying out an independent EA studies in compliance with the GoB and World Bank guidelines following this ESMF • Preparing EMP for inclusion in the bid documents
CSC	• Supervise civil works, ensuring compliance with all design parameters including quality requirements • Supervising contractors for EMP implementation • Prepare monthly reports and submit to PIU • CSC will have dedicated environmental, occupational health and safety and social staffs
Contractor	• Responsible for implementation of mitigation and monitoring measures proposed in the EMP • Each contractor will recruit Environmental, Health, and Safety Manager, who will be responsible for implementing the contractors' environmental, health and safety responsibilities, and liaising with government agencies. S/he will have adequate number of staffs to support him/her for these tasks.

6.3 Environmental and Social Management Guideline Plan

266. Various environmental and social management plans will be prepared during preparation of EA for the subcomponents. Suggestive plans to be prepared and tasks to be carried during subcomponent works are presented in the Table, which will be revisited during the preparation of the EA.

Table 6.2: Management Plans/ Additional Tasks

Sl	Plan/Task	Responsibility			Timing
		Plan Preparation	Plan Review/ Approval	Implementation	
Documents or Plans prepared / to be prepared by PGCB / its Consultants					
1	Preparation of detailed TORs for the ESA studies for Subcomponents	ESU	PGCB/ WB	Independent Environmental Consultant	ToR for Independent ESAservices is already prepared (Appendix A).
2	ESA/RAP study for subcomponents	Independent ESA Consultant	PGCB/ WB	ESU, Independent Environmental Consultant	During first year of project implementation (2017-2018)
3	Mitigation and Compliance Monitoring Plans	Independent ESA Consultant	PGCB /WB	PGCB through contractors	Preliminary plans are prepared (Table 6.3), but will be updated during detailed ESA studies of subprojects
44	Environmental Code of Practices (ECoPs)	Independent ESA Consultant	PGCB /WB	PGCB through contractors	Preliminary draft prepared (Appendix F)
5	Inclusion of environmental clauses in bid documents for various contracts	ESU	PGCB/WB	CSC	2017-2018
	Plans to be prepared by contractors				
6	Construction Environmental Action Plan	Contractor	PIUand CSC	Contractor	Within one month of mobilization and prior to any initiation of construction works
7	OHS Plan	All contractors	PIU and CSC	Contractor	Within one month of mobilization and prior to any initiation of construction works
8	Pollution Prevention Plans (related to air, noise, soil, water resources)	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
9	Waste Disposal and Effluent Management Plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
10	Drinking Water Supply and Sanitation Plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
11	Traffic Management Plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
12	Construction Camp Management Plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
13	Fuels and hazardous substances management plan	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor

Sl	Plan/Task	Responsibility			Timing
		Plan Preparation	Plan Review/ Approval	Implementation	
14	Emergency Preparedness Plan (for construction phase)	Contractor	CSC and PIU	Contractor	Before mobilization of each contractor
Plans to be prepared for O&M Phase					
15	O&M Phase Environmental Code of Practices	ESU (through consultants)	-	PGCB	Prior to completion of construction
16	Environmental Management (waste disposal, air and noise quality, etc.)	ESU (through consultants)	-	PGCB	Prior to completion of construction
17	Occupational health and Safety Management (OHS Management)	ESU (through consultants)	-	PGCB	Prior to completion of construction

6.3.1 Environmental Code of Practice (ECoP)

267. The design, construction and installation 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,
- A reduction in and the correct disposal of waste products, and
- The consideration of Electromagnetic Field (EMF) issues.

268. The Environmental Code of Practice (ECoP) is prepared as a guideline for environment management of different parts of the project, namely, i) Reconductoring of Transmission Lines ii)Intallation of SVC/Capacitor Bank at existing Substations; to be implemented by the PGCB. The main objective of an ECoP is to manage construction operations in harmony with the environment in an effort to contribute to the well-being of the community and the environment by:

- Minimizing pollution
- Sustaining eco-systems
- Conserving cultural heritage
- Enhancing amenity

269. The ECoPis designed to be used during reconductoring of the transmissionlines and installation of SVC/capacitor Bank at existing subsattions by the PGCB. The Code is also applicable to water supply and solid and hazardous waste management systems where management of minor construction activities, such as the substation and towers, is addressed.

The purpose of the Code of Practice is to ensure that construction activities are conducted in a manner that minimizes impacts on the environment. It promotes awareness and use of best practice in environmental management. ECoP is applicable to the construction sites and associated activities such as stockpile sites, disposal sites for clean excavated materials, etc. Responsibility lies with all the people involved in any given project to adopt environmentally responsible work practices. Best environmental management practice requires environmental awareness, and appreciation of one's environmental responsibilities. Measures taken to prevent environmental impacts are preferred to those designed to control the impact.

270. The Environmental Code of Practice (ECoP) includes a list of activities associated with the project by the PGCB. The ECoP outlines activities on different issues related to project implementation. The ECoP developed will address the following issues related to the above project components: (1) Project Planning and Design, (7) Construction Camps, (8) Topsoil Salvage, Storage and Replacement, (9) Borrow Areas, (11) Waste Management, (12) Water Bodies, (13) Water Quality, (14) Electromagnetic Field, (15) Public Health and Safety, (16) Material Storage, Transport & Handling, (17) Cutting of Trees, (18) Vegetation (19) Natural Habitats,(20) Occupational Health and safety, (21) community Health and safety, (22) PCB Waste Management

271. A particular sub-project may involve all or some of these issues. **Appendix F**presents the ECoPs and Table 4.17 (for PGCB) outlines applicability of different ECoP activities for different sub-projects to be implemented under for proposed project.

6.3.2 Mitigations and Compliance Monitoring Plans

272. The mitigations and compliance monitoring plans presented in Table 6-1 is organized around various project activities and includes various actions identified under the mitigation measures discussed in Chapter 5, define responsibilities for implementation as well as supervision of each action, and also indicate the timing of these actions. Should any changes to the Project design or methods of construction and operation take place, post this assessment stage, the impacts and mitigation measures discussed may need to be revised to reflect such changes to allow the environmental and social implications of these changes to be addressed.

Table 6.3: Mitigations and Compliance Monitoring Plans: Construction Phase

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
Location of Substation	• There may be a requirement of land acquisition for substations • Temporary land acquisition and compensation for construction work • Damages of undergrowth vegetation at the equipment storage area	• All substations will be upgraded within PGCB land and no additional land is expected. • However, in case of any additional land required, provide compensation in accordance with 'resettlement policy framework (RPF)' presented in Chapter 6. • Temporary land acquisition and compensation will be paid based on the RPF and RAP prepared during independent ESA study. • Establish Monitoring Unit (if needed) involving 3 parties (PGCB, WB, and PAPs) for monitoring purposes. • Use barren land as much as possible	PGCB	WB
Realignment of Transmission Lines	• High-voltage transmission line may pose serious threat to population living underneath the lines. • Felling of trees and damages of cropfield and other undergrowth vegetation at the RoW • Relocation of wildlife from the RoW due to vegetation damage	• During the detailed study possibility of realignment of these lines should be considered by PGCB, hence, protect the health of the population • Avoid vegetated land as much as possible to align the transmission line • Give chance to the land owners to harvest the crops before starting the project activities (If possible) • Arrange proper compensation to the land owners against tree felling and crop damage • Aware labour and local people about wildlife conservation so that minimize vegetation damage as well as safe relocation of wildlife at nearer habitats and dwell safely there	PGCB	PGCB/WB/IM
Design of Reconductoring of Transmission Lines	• Improper design and placement of conductors may cause electrocution of birds.	• A minimum of 200 cm horizontal/diagonal spacing and 100 cm vertical spacing between electrically conductive points on the power line.	PGCB	PGCB/WB/IM

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
Mobilization of Equipment and Material	• Physical damages to local road network • Damages of additional vegetation at the access way	• Effective traffic management plan by PGCB authorized contractor • Use of existing path/access roads for movement of labour and carrying vessels • No other measure is needed as the vegetation is seasonally grown and will re-vegetated naturally in next year	Contractor	PIU/IM
Employment opportunity	• Proposed project would require workers for construction, accessories supplies etc. • During construction period employment opportunities for both skilled and unskilled labor may have improved	• Make a list of directly affected people who lose their tree/ agricultural crops are interested to work during construction phase. • Ensure local people's engagement and give the priority offering working facilities in project activity.	Contractor	PIU/IM
Loss of Crop Production	• Possibility of standing crops in the field might be affected • Crop production might be reduced to some extent	• Working schedule would be prepared carefully so that standing crop would not be damaged • If not possible, proper crop compensation should be paid to the land owner for standing crops damage • The farmers should be informed well ahead (before start of cropping season) about the construction activities • Proper care should be taken during construction	Contractor	PIU/IM
Air Quality	• Air quality may deteriorate slightly for transportation of materials, land filling, foundation, RCC woks • Exhaust emission from	• Ensure that all project vehicles are in good operating condition. • Spray water on dry surfaces/ unpaved roads regularly. • Maintain adequate moisture content of soil during transportation, compaction and handling. • Sprinkle and cover stockpiles of loose materials (e.g.,	Contractor	PIU/IM

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
	the concrete equipment machines	fine aggregates). • Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.		
Noise Impacts	• Noise level may exceed the standard limit due to the mobilization of vehicles; transportation and unloading of materials • Noise level will create discomfort to the workers as well as the surrounding receptors	• Use of noise suppressors in heavy construction equipment like concrete batching and mixers etc. • Avoid using of construction equipment producing excessive noise besides sensitive places like educational institutions and hospitals etc. Peak time of the institutions close to the project area should also be concerned to the project implementing agency. • Avoid prolonged exposure to noise (produced by equipment) by workers. • Regulate use of horns and avoid use of hydraulic horns in project vehicles.	Contractor	PIU/IM
Soil Quality in angle point and sub-station area	• Soil quality as well as soil characteristics might be deteriorated due to mishandling and disposing of wastes during implementation of the project	• The activities should be limited within stipulated area • Proper storage of chemicals on site • The installation of natural or synthetic liners beneath chemical storage tanks • Minimization of on-site water and chemical usage (oil, lubricants and fuel) • Limiting the exposure of the soil to accidental releases of pollutants • Use of non-toxic and readily biodegradable chemicals on-site • Generated wastes should be dumped in a stipulated area by appropriate manner	Contractor	PIU/IM
Impact on Vegetation	• Damages of undergrowth vegetation at the equipment storage area • Felling of trees and	• Use barren land as much as possible • Avoid vegetated land as much as possible to align the transmission line • Arrange proper compensation to the land owners	Contractor	PIU/IM

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
	damages of cropfield and other undergrowth vegetation at the RoW for stringing of cable • Damages of additional vegetation at the access way due to Mobilization of Equipment and Material	against tree felling • Use of existing path/access roads for movement of labour and carrying vessels • No other measure is needed as the vegetation is seasonally grown and will re-vegetated naturally in next year		
Impacts on wildlife	• Relocation of wildlife from the RoW due to vegetation damage	• Aware labour and local people about wildlife conservation • Minimize vegetation damage as well as safe relocation of wildlife at nearer habitats	Contractor	PIU/IM
Interference with Road Crossing (Traffic Congestion and Safety)	• Deteriorate the volume capacity of the existing road.	• Scheduled deliveries of material/ equipment during off-peak hours. • Depute flagman for traffic control as well as provision of signal light at night.	Contractor	PIU/IM
Storage of Materials and Solid and Liquid Wastes	• Might cause a disturbancein agricultural land • Congestion of adjacent water bodies during and after construction period. • Contamination of water bodies during construction.	• Cleanup must be initiated immediately along with constructing a suitable septic tank system. • Erection of “no litter” sign, provision of waste bins/cans, where appropriate	Contractor	PIU/IM
Occupational and Public Health and Safety	• The safety and health of the public may be impacted due to the hazards created during	• Need contingency fund for affected neighboring people to address accidental issues during implementation period • Need proper danger signs/ posters to avoid accident at	Contractor	PIU/IM

Construction Phase				
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Parties**	
			Implementation	**Supervision**
	the construction period • Risk of accidents during the construction period is moderate due to the operation and movement of heavy equipments, vehicles and machineries • Probability of accidental risk for labors and accident during replacing the conductor by fall down into the locality	construction site • Proper awareness program about possible accidents should be ensured for the neighboring people • Ensuring rigorous standards for occupational health and safety are in place • Contractor will establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal • Provide health insurance for employees for the duration of their contracts • Provide insurance for accidents resulting in disabilities or death of employees for the duration of their contracts • Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system		

Table 6.4: Mitigations and Compliance Monitoring Plans: Operation Phase

Operation Phase			
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Agency**
Maintenance of transmission/ distribution lines	• Impact on crop production • Partial impact on intercultural operation	• Imparted training to the farmers for creation of awareness on avoiding any possible accident for proper intercultural operation in the tower locations	PGCB
Regular maintenance of cables	• Disturb and increase risk of death to flying mammals and birds while passing through the TL • Create transmission tower as	• Aware local people to planted medium high trees to maintain plant diversity in the area. • Covered transmission line should be used to avoid the impact on aerial wildlife. • Use adequate color bands/flags with transmission wires so that	PGCB and contractors

Operation Phase			
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Agency**
	resting habitat of some birds whose are depend on floodplains	the flying animals will aware while pass through the line.	
Pruning of tree top for regular maintenance of cables	• Limiting tree height under the RoW of transmission line	• Aware local people to planted medium high trees to maintain plant diversity in the area.	PIU/IM
Collision and electrocution of birds and flying mammals	• Disturb and increase risk of death to flying mammals and birds while passing through the TL	• Covered transmission line should be used to avoid the impact on aerial wildlife. • Use adequate color bands/flags with transmission wires so that the flying animals will aware while pass through the line. • Use warning lamps on AP towers at different height during night	PIU/IM
Health and Safety	• Live power lines • Working at height • Electric and magnetic fields • Exposure to chemicals • Exposure to electrical hazards from the use of tools and machinery.	• Only allowing trained and certified workers to maintain, or repair electrical equipment; • Taking appropriate protective measures against accidental fall from elevated height during regular maintenance operations (e.g. using body harness, waist belts, secured climbing devices, etc.) • Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines; • Proper Personal Protective Equipment(PPE) for all workers and others associated with work • Training of workers in the identification of occupational EMF levels and hazards.	PGCB
Safety and risks due to land use under the transmission line	• Fall of live conductor on human/animals/any conducting substance may cause short circuit and that may cause life loss • Sudden flashover that may cause life loss	• Avoid settlement under the transmission line • Proper maintenance of the transmission line • Use of proper protection equipments like circuit breaker, relay etc.	PGCB
Electricity Supply	-	• Improved power supply to various parts of Bangladesh, which	PGCB

Operation Phase			
Activity/Issues	**Potential Impacts**	**Proposed Mitigation and Enhancement Measures**	**Responsible Agency**
and Regional Development		will increase the potential for development of economy. • Integration into national power grid and increased reliability of power supply throughout Bangladesh.	

6.3.3 Construction Stage Site Specific Management Plans

273. **Construction Environmental Action Plan (CEAP)** will be prepared by contractor to demonstrate the manner in which they will comply with the requirements of ECoPs and the mitigation measures proposed in the ESMP of the ESMF and ESA Report. The CEAP 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.

274. **Pollution Prevention Plan** will be prepared and implemented by the contractors on the basis of the ECPs and WBG EHS Guidelines (2007) that will be part of the bidding documents. The Plan will be submitted to the CSC for their review and approval before contractor mobilization.

275. **Waste Disposal and Effluent Management Plan** will be prepared and implemented by the Contractor on the basis of the EMP, ECP, and WBG EHS Guidelines (2007), which will be part of the bidding documents. The Plan will be submitted to the CSC for their review and approval before contractor mobilization.

276. **Drinking Water Supply and Sanitation Plan**: Separate water supply and sanitation provisions will be needed for the temporary facilities including offices, labor camps and workshops in order not to cause shortages and/or contamination of existing drinking water sources. The Plan will be submitted to the CSC for their review and approval before contractor mobilization.

277. **Occupational Health and Safety (OHS) Plan** will be prepared and implemented by the contractor on the basis of the WBG EHS Guidelines (2007), ECPs, and other relevant standards. The Plan will be submitted to the CSC for their review and approval before contractor mobilization.

278. **Traffic Management Plan** will be prepared by each contractor after discussion with PGCB and other authorities responsible for roads and traffic. The Plan will be submitted to the CSC for their review and approval before contractor mobilization. The Plan will identify the routes to be used by the contractors, procedures for the safety of the local community particularly pedestrians, and monitoring mechanism to avoid traffic congestion.

279. **Construction Camp Management Plan** will be prepared by each contractor. The Plan will include the camp layout, details of various facilities including supplies, storage, and disposal. The Plan will be submitted to the CSC for their review and approval before camp establishment.

280. **Fuel and Hazardous Substances Management Plan** will be prepared by each contractor in accordance with the standard operating procedures, relevant guidelines, and where applicable, material safety data sheets (MSDS). The Plan will include the procedures for handling the oils and chemical spills. The Plan will be submitted to the CSC for their review and approval before contractor mobilization.

281. An **Emergency Preparedness and Response Plan** will be prepared by each contractor after assessing potential risks and hazards that could be encountered during construction. The Plan will be submitted to the CSC/PGCB for their review and approval before contractor mobilization.

6.4 Environmental and Social Management Monitoring Program

282. As one of the key elements of the ESMP, atwo-tier monitoring program has been proposed comprising compliance monitoringof mitigation measures andeffectsmonitoringof various parameters. The main purpose of these monitoring programsareto ensure that the various tasks detailed in the ESMP, particularly the mitigation measures are implemented in an effective manner, and also to evaluate project's impacts on the key environment and social parameters. Various types of monitoring are presented in the following sections.

6.4.1 Compliance Monitoring of Mitigation Measures

283. The purpose of the compliance monitoring is to ensure that the contractor implements the mitigation measures given in the ESMP are effectively and timely implemented. This monitoring will generally be carried out by the Contractor and CSC with the help of checklists prepared on the basis of the mitigation measures given in Chapter 5 and will be revisted during the independent ESA study.

6.4.2 Effects Monitoring during Construction

284. Effects monitoring is a very important aspect of environmental management to safeguard the protection of environment. The effects monitoring plan proposed for the subprojects is presented in**Error! Reference source not found.**;which will be revisited and revised during independent EA studies. The monitoring will comprise surveillance to check whether the contractor is meeting the provisions of the contract during construction and operation of the project including the responsible agencies for implementation and supervision.

Table 6.5: Compliance Monitoring of Mitigation Measures

Sl.No.	Key Points of Mitigation Measures	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
						Monitoring	Supervision
1.	**Compliance Monitoring during Construction Phase**						
1.1.	Ambient Noise	Day time (6:00 – 21:00) and Night time (21:00 – 6:00) L10, L90	7 locations in and around GPS as mentioned in Figure 11-1	Twice Weekly	Three Sample during day time and one sample during night, 15 min sampling each time.	Contractor	OE, PGCB
1.2.	Ecosystem and Biodiversity	Tree felling	At the angle point towers	Monthly	Direct Counting	Contractor	OE, PGCB
1.3.	Agricultural Production	Crop Production Loss	At the angle point towers	Monthly following cropping patterns	Agricultural Survey	Contractor	OE
1.4.	Exposure to Electro-magnetic Field[14]	Electrical Field, Magnetic Field	Outside the safety fence of Substation, Power evacuation bay, along HV line	Quarterly	One time sampling using EMF meter	Contractor	OE
1.5.	Health and Sanitation	Availability of Potable Water, Drinking water quality, Availability of Hygienic Toilet	Labor shed	Monthly	Inspection and interview of labor, project personnel	Contractor	OE
1.6.	Vegetation Clearance	No. of tree feling and area of undergrowth vegetation clearance	Base of each AP, STRIPS OF SRINGING RoW, and storage locations	Once every month, and as directed by the Project Engineer	Direct counting for tree and physical observation for undergrowth vegetation	IM	OE, PGCB
1.7.	Community Health, Safety and Security	Implementation of ESMP	As specified in the ESMP	Monthly	Inspection and interview of labor,	Contractor	OE

[14]See Annex 11-2 for the standards related to electro-magnetic field.

Sl.No.	Key Points of Mitigation Measures	Monitoring Indicators	Locations	Frequency	Type/Duration of Sampling	Implemented by	
						Monitoring	Supervision
					project personnel followed by a checklist		
2.	**Compliance Monitoring during Operation Phase**						
2.1.	**Ecosystem and Biodiversity**						
2.1.1.	Incidence of bird electrocution and collision with transmission line	Species Composition and occurrence of incidence	All the RoW	Monthly	During the project lifetime	PGCB	PGCB
2.2.	**Occupational Health and Safety**						
2.2.1.	Exposure to Electro-magnetic Field	Electrical Field, Magnetic Field	Inside the Substation, Power evacuation bay,	Quarterly	Measurement by EMF Meter Inspection of workers' roster shifting hours etc.	PGCB	Independent Monitor/ PGCB
2.2.2.	Worker Health	General Health Condition, Hearing health, skin disease, etc.	Workers involved in the substation and transmission line maintenance	Yearly	Health Check up	IM	PGCB
2.3.	Labor and Working Condition						
2.3.1.	Health and Sanitation	Availability of Potable Water	Labor Shed	Monthly	Visual Inspection and Record Checking	IM	PGCB
		Availability of Hygienic Toilet	Labor Shed	Monthly	Visual Inspection	IM	PGCB
2.4.	Community Safety and Security						
2.4.1.	Safety and Security	Emergency Preparedness and Response of PGCB	N/A	Two times in a year	Visual Inspection and Record Checking	IM	GPS/ BPDB

6.5 Influx Impact and Management Plan

285. Labor influx for construction works can lead to a variety of adverse social and environmental risks and impacts. The list below provides a guideline of typical adverse social and environmental impacts, but is not exhaustive. While many of these impacts could have been already present or might occur regardless of the labor influx, they are likely to be exacerbated by it. The actual type and degree of impact varies significantly depending on the characteristics of the project, community and incoming workforce. It may be difficult to separate some impacts from non-project related factors, specifically if the project area experiences broader social, economic and cultural change during the project period,which may be difficult to assess or predict as part of the ESIA.

6.5.1 Adverse Social Impacts

286. Social impacts are the most critical to address, as even a modest labor influx may have a negative impact on the host community. Any pre-existing social issues are very likely to be at risk of exacerbation by the influx of labor. There is a risk that Bank Task Teams fail to recognize the relationship of such pre-existing social issues to the project:

Risk of social conflict:

287. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other.

Increased risk of illicit behavior and crime:

288. The influx of workers and service providers into communities may increase the rate of crimes and/or a perception of insecurity by the local community. Such illicit behavior or crimes can include theft, physical assaults, substance abuse and trafficking. Local law enforcement may not be sufficiently equipped to deal with the temporary increase in local population.

Influx of additional followers"):

289. population ("Especially in projects with large footprints and/or which will span a longer timeframe, people can migrate to the project area in addition to the labor force. These can be family members of workers, as well as traders, suppliers and other service providers (including sex workers), particularly in areas where the local capacity to provide such goods and services is limited.

Impacts on community dynamics:

290. Depending on the number of incoming workers and related changes in the composition of the local community, community dynamics may change significantly. Pre-existing social conflict may intensify as a result of such changes.

Increased burden on public service provision:

291. The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, education and social services. This is particularly the case when the influx of workers is not accommodated by additional or separate supply systems.

Increased risk of communicable diseases:
292. Increased interactions between the incoming workforce and the local community may result in increasing rates of communicable diseases, including sexually transmitted diseases (STDs) and HIV/AIDS.

Gender-based violence:
293. Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and their normal sphere of social control. This can result is inappropriate behavior, such as sexual harassment of women and girls and illicit sexual relations with minors from the local community.

Child labor and school dropout:
294. Increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.

Local inflation of prices:

A significant increase in demand for goods and services due to labor influx may lead to local price hikes and/or crowding out of community consumers.

Increased pressure on accommodations and rents:
295. Depending on project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of local residents.

Increase in traffic and related accidents:
296. Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure.

6.5.2 Adverse Environmental Impacts

297. The environmental impacts listed below are more likely to be of relevance for projects that require a larger labor force, which results in a bigger project footprint:

Inadequate waste disposal and illegal waste disposal sites:
298. Large populations of workers generate increased amounts of waste, for which no sufficient local waste management capacities may exist, which would likely lead to improper disposal practices.

Wastewater discharges:
299. Project-related activities, along with workers' camps, and a lack of appropriate wastewater discharges may pollute nearby water resources.

Increased demand on freshwater resources:
300. The provision of clean drinking water and water for hygiene purposes can result in increased pressure on freshwater resources in the project or camp site area.

Camp related land use, access roads, noise and lights:
301. In ecologically sensitive areas, workers' camps can have impacts on the local wildlife. This may include disturbance of species, as well as illegal hunting. In the same context, new access routes for workers' camps may have impacts on natural habitats.

Increased deforestation, ecosystem degradation, and species loss:
302. Thesecanresult from forest or land conversion for worker housing and workers' agricultural subsistence activities.

Increased use of / demand for natural resources:
303. This caninclude logging for construction, fuel-wood collection, use of water resources, farming and grazing, hunting and fishing, trade in endangered species, potential introduction of invasive or non-native species, and land degradation.

6.5.3 Assessment and Management of Risks and Impacts

304. It is important to recognize the different roles and functions of the instruments to assess and mitigate project related risks: (i) the project ESIA and PESMP, which are reviewed and cleared by the Bank and which are part of the Bank's Financing Agreement with the Borrower, and (ii) the CESMP, which is part of the contract between the Borrower and the contractor. Contractually, the contractor must follow the CESMP.

305. Effective assessment and management of the potential impacts of labor influx on communities include the following steps, which are best undertaken in parallel with the respective stages of the project cycle:

- Screening and assessment of the type and significance of potential social and environmental impacts that may be generated by labor influx;
- Assessment of the contextual factors in the country and assessment of the policy and legal framework of the Borrower;
- Development of a management plan for social and environmental impacts;
- Implementation of appropriate mitigation and monitoring programs, which includes development and implementation of a stakeholder engagement program;
- Establishment of a grievance redress mechanism (GRM); and
- Monitoring and supervision, and, as needed, adaptive management actions.

6.6 Performance Indicators

306. For evaluating the performance of the environmental management and monitoring plan, performance indicators are identified for efficient and timely implementation of measures/actions proposed in ESMP. The indicators are defined both for implementation phase and for operation phase. CSC will be responsible for compiling the information on these indicators and report to PIU/PGCB.

307. To measure the overall environmental performance of the project, a list of performance indicators is given below; however a detailed list of indicators will be prepared during independent ESA study

- Number of inspections carried out by CSC per month
- Number of non-compliances observed by CSC or ESU.
- Availability of environmental specialists in ESU.
- Availability of environmental specialists in CSC.
- Availability of EHS specialists with contractors.

- Timely reporting of documents (as defined in ESMP and monitoring plan)
- Number of trainings imparted to stakeholders/other capacity building initiatives
- Timely disbursement of compensation of project affectees
- Number of grievances received.
- Number of grievances resolved.
- Number of construction related accidents.

6.7 Grievance Redress Mechanism

308. PGCB will establish a grievance redress mechanism (GRM) as a means to ensure social accountability and to answer to queries and address complaints and grievances about any irregularities in application of the guidelines adopted in this ESMF for assessment and mitigation of social and environmental impacts. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal actions. The procedure will however not pre-empt a person's right to go to the courts of law.

309. A GRC will be formed for each sub-project, headed by the Chairman / Mayor of relevant area. Members will be taken to represent the communities and other stakeholders including representative of local administration, school teachers, local NGOs, women and ward level elected representatives. The GRC will be a forum where people will exercise their rights of participation in the project cycle through suggestions and complains. GRCs will also be para-legal court of the project to address local problems and complaints related to social and environmental impacts. GRM focal points and the case record management are shown in flow diagram at Figure 6.2.

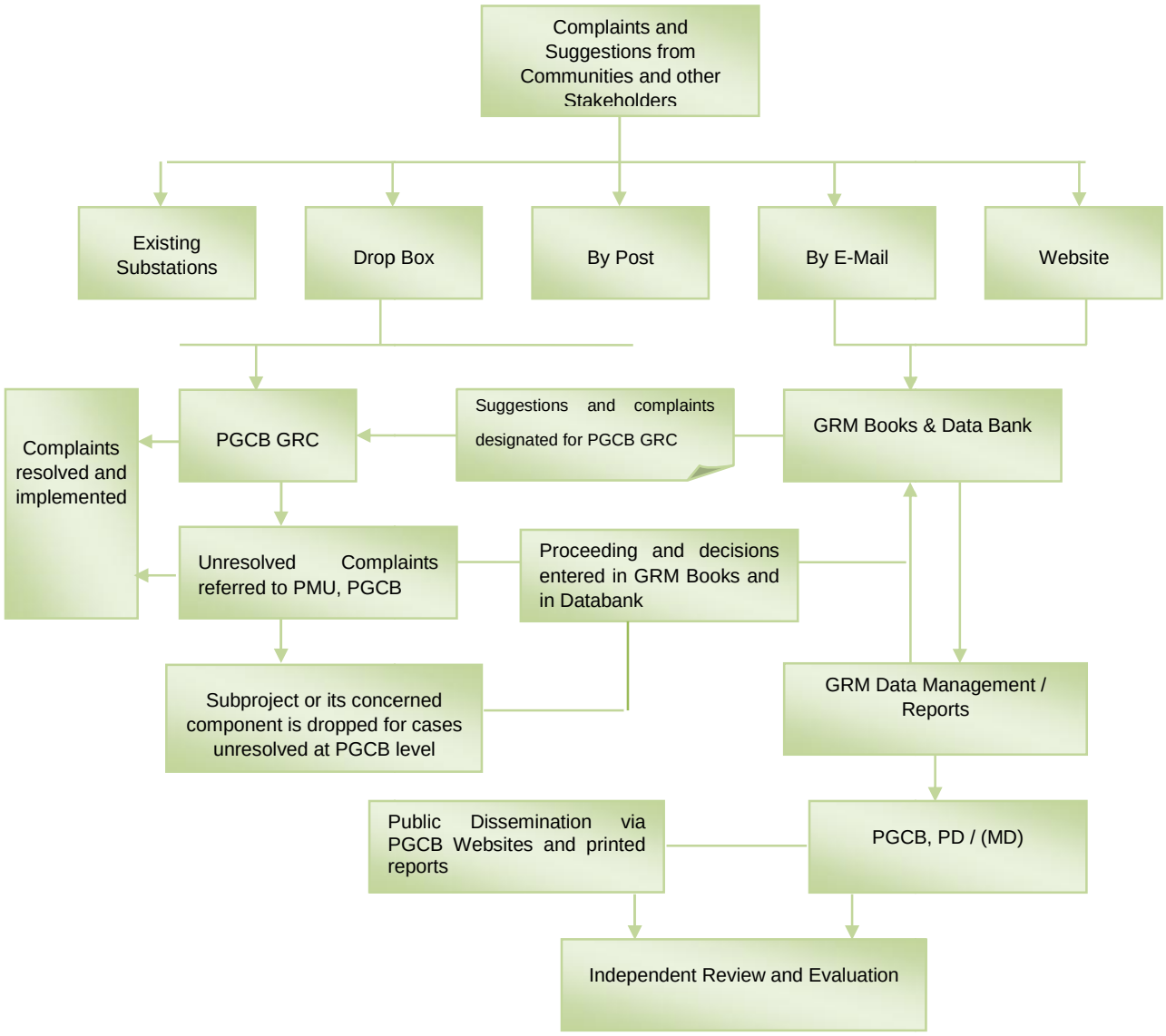


Figure 6.2: GRM Institution and Focal Points

6.8 Capacity Building

310. Capacity building for effective implementation of the environmental and social safeguard requirements is a key element of EA/EMP. Capacity building for environmental and social safeguard management will need to be carried out at all tiers of the project, including PGCB head and regional offices, ESU, CSC, and contractor. At the construction site, CSC will take the lead in implementing the capacity building plan, though the contractor will also be responsible to conduct trainings for their own staff and workers. The various aspects that are covered under the capacity building will include general environmental and social awareness, key environmental and social sensitivities of the area, key environmental and social impacts of the project, ESMP requirements, OHS aspects, and waste disposal. Table 6.5 provides a preliminary list of various aspects of the environmental and social trainings to be conducted at the construction site. This will be revised by indepdent EA consultantduring the EA study and ESU during the project implementation as required.

311. During the O&M phase of the project, these trainings will continue to be conducted by ESU staff for all relevant O&M personnel and community.

Table 6.6: Environmental and Social Trainings

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project influence area; Key findings of the EA; Mitigation measures; EMP; Social and cultural values of the area.	Selected staff of PGCB, CSC, and contractors	CSC	Prior to the start of the project activities. (To be repeated as needed.)
EMP; Waste disposal; OHS	Construction crew	Contractors	Prior to the start of the construction activities. (To be repeated as needed.)
Road safety;Defensive driving; Waste disposal; Cultural values and social sensitivity.	Drivers	Contractors	Before and during the field operations. (To be repeated as needed.)
Camp operation; Waste disposal; OHS; Natural resource conservation; Housekeeping.	Camp staff	Contractors	Before and during the field operations. (To be repeated as needed.)
Restoration requirements; Waste disposal.	Restoration teams	Contractors	Before the start of the restoration activities.

6.9 Documentation

The Contractor and CSC will produce the following environmental reports:

Environmental Mitigation and Monitoring Reports:

312. The environmental mitigation and monitoring reports will include a brief description of the project, construction activities, implementation status of environmental mitigation measures, environmental monitoring activities, details of monitoring methodology, equipment used, data collected, analysis of monitoring results particularly the non-compliances, recommended mitigation and corrective measures, environmental training conducted, environmental regulatory violations observed, details of incidents and accidents, and a brief list of activities for the following month. The environmental mitigation and monitoring reports will be submitted monthly and quarterly during the construction period and annually for three years after completion of construction.

Project Completion Environmental Report:

313. One year after completion of construction, the ESU will submit a Project Completion Environmental Report which will summarize the overall environmental impacts from the project.

6.10 Method for Estimation of Cost of ESMP

314. Cost estimates will need to be prepared for all the mitigation and monitoring measures to be proposed in the subproject ESA. The cost estimates for some of the mitigation measures to be identified in the ESMP will be part of civil works contract. Tentative cost estimates of independent ESA study and ESMP implementation (beyond civil works contract) is given in Table 6.. Further detailed estimates will be made during independent ESA study.

Table 6.7: ESMP Cost Estimates

Item	Cost in million, USD
Independent ESA Study	0.25
Contractor's Budget (for development of CEAP. OHS plans, staffs, training, equipment, etc.)	1.50
Water, soil, air and noise quality monitoring during construction (quarterly for 3 years)	0.25
CSC Environmental Staff	1.00
ESU Staffs (Consultants)	0.35
Capacity building and training	0.25
Total	3.60

7. Guideline for Preperation of RAP

315. The project approach discourages acquisition of private lands and displacement of people for project purpose. However, certain sub-projects (e.g., reconductoring of transmission lines) may require temporary acquisition of private land. Once it is determined through the social screening that a sub-project will require land temporarily, involve population displacement or loss of livelihoods, a Resettlement Action Plan (RAP) needs to be prepared.

316. RAPs are designed to ensure that impacts arising from temporary land acquisition, displacement and relocation are mitigated, managed and compensated and livelihoods of displaced persons are restored. The RAP focuses on people affected by temporary land acquisition, relocation and restriction of access, and defines a strategy for formalizing arrangements and responsibilities for mitigating impacts caused due to physical and economic displacements.

317. This chapter presents detail guideline for preparation of RAP. It presents a discussion on major issues concerning temporary land acquisition and resettlement; it presents impact mitigation objectives and principles, eligibility for compensation/assistance and principles for providing compensation/assistance. Appendix H (a)/(b)/(c)/(d) provides detail description of land acquisition process, and processes for preparation and implementation of sub-project specific RAP. It presents a method for market price survey, and a compensation and entitlement matrix.

7.1 Land Acquisition and Resettlement Issues

318. Involuntary resettlement issues are expected to arise where subprojects require additional lands temporarily or permanently and where subproject activities induce permanent or temporary displacement of people. Where expansion of existing land boundary of any infrastructure is a critical part of development to materialize expected benefits, the PGCB will use the following guidelines to obtain public and private lands.

- **Public Lands**. Where they are in use by well-off persons and stoppage of further use would be socioeconomically inconsequential, the PGCB and communities may persuade the users to relinquish occupancy of the lands and look for alternative lands, if they refuse. Where these lands are currently used for living and/or livelihood by the poor and vulnerable, the PGCB and beneficiaries can obtain them by offering socioeconomic rehabilitation measures acceptable to the affected persons. However, the current users will have the option to refuse to relinquish occupation of the lands without the fear of any adverse consequences. RAP will be prepared and implemented for compensation and livelihood restoration of the affected persons.
- **Private Land on 'Voluntary Contribution'.** If a small parcel or strip of land is required for a subproject intervention, the concerned land owner, if persuaded, may elect to contribute the lands without compensation. This method will be followed only for small amount of lands (less than one decimal) and the PGDB will ensure that,
- The contributions are voluntary;
- There are no encumbrances on the contributed lands;

- The contributions do not affect the livelihood of vulnerable persons and, if it does, the PGCB and community devise and implement mitigation measures acceptable to the affected persons;
- The affected persons/contributors are made aware of the grievance redress mechanism described.
- The contributors give up all claims on the lands and the titles are transferred to the recipient through the legal process in the country; and
- The contributions are documented through an MOU
- **Private Land on 'Direct Purchase or Exchange or contribution against compensation':** Lands are valuable and contributory to livelihoods of residential population. Voluntary contributions are seen more feasible where the landowners are well-off and they are very few in number. Contributions for activity at angle point grid towers involve a small to medium number of landowners - some of whom might be quite marginal and vulnerable. In such cases, the PGCB can offer to temporary land acquisition of the lands. Alternately, the owners may opt to provide the lands on contribution against compensation.
- **Private Land on 'Acquisition Using the Power of Eminent Domain":** In cases where voluntary contribution or direct purchase could not be initiated, but the land in question is a critical part of the proposed project, the PGCB may go for temporary acquisition of the land using legal system. The World Bank Operational Policy on Involuntary Resettlement (OP 4.12) will apply and RAP will be prepared and implemented. Temporary land acquisition process will be initiated in advance for timely implementation of subprojects requiring acquisition of lands.
- **Existing Lands with Formal Users***:* Certain project activities like reconductoring of wire in a existing transmission line may involve temporary relocation of existing individual / family / community. Special measures will be included in RAPs to identify these displaced persons / family, allow them to continue their livelihood at alternative locations arranged by the PGCB or compensated for the duration of the construction until when they will be returned to their previous sites. Open consultation will be conducted with general public and special consultation will be carried out with the APs for identification of options for their relocation and livelihood restoration.

319. In cases of voluntary contribution the PGCB will (i) ensure that landowners and communities are made fully aware of their rights and obligations; (ii) verify that contributions are truly voluntary; and (iii) that the contributors are the legitimate owners of the lands being obtained and there are no outstanding issues of taxes or any dispute over ownership.

7.2 Impact Mitigation Objectives

320. The principles and guidelines provided in this framework are to avoid or minimize adverse impacts on private landowners and public land users, mitigate the impacts that are unavoidable, and assist to improve, or at least restore, their living standards and income earning or production capacity to pre-project levels. To achieve the objectives, PGCB will adhere to the following strategic guidelines.

- Avoid or minimize displacement of persons/households who may have been using public lands for residential and livelihood purposes;

- Establish guidelines and procedures to ensure that private land contributions are voluntary and sought and accepted in transparent manners without causing unacceptable adverse impacts on the owners.
- Collectively decide on impact mitigation measures (meeting with the affected persons) where private lands are required for critical project works.

7.3 Impact Mitigation Principles

321. Where physical activities affect persons/households on public or private lands, PGCB will adhere to the following principles to avoid/minimize adverse impacts and adopt appropriate mitigation measures:

- As a first step toward mitigating adverse impacts, PGCB will always try to avoid adversely affecting persons/households who are socioeconomically vulnerable.
- Where adverse impacts are absolutely unavoidable, the PGCB will ensure that the affected persons / households are economically rehabilitated with measures acceptable to them.
- Where displacement of public land users is unavoidable, PGCB will assist the affected persons/households to relocate on available public lands in the vicinity.
- Where businesses are displaced, PGCB will assist them to relocate in the vicinity to ensure that they remain operational and do not lose income.
- Where private land is unavailable on voluntary contribution, temporary acquisition of land will be considered as the last resort, when all efforts fail.

322. RAP will be prepared following the guidelines and principles contained in this ESMF in the case that use of private lands or public lands from private uses could not be avoided. The PGCB will implement the RAP once the subproject is accepted for finance and implemented before receiving the funds.

7.4 Eligibility for Compensation/Assistance

323. The persons/households affected directly and indirectly by the physical activities under a subproject are eligible for compensation and assistance. The most likely eligible groups are:

- **Private Landowners:** Persons who have legal rights to the affected lands and other assets, such as houses/structures, trees, etc. built and grown on them.

  Compensation will be at replacement cost for loss of lands and additional transitional allowance when the loss is more than 20% of land holding or the remaining land is not economically viable for current use.
- **Squatters:** Persons/households who do not have legal rights to the affected lands, but use them for residential and livelihood purposes constructing structures on the lands. “Squatters” are persons who occupy/possesss and assesst without legal title.

  Squatters will not be entitled for compensation for lands but the structures and assets developed on it. They will be entitled for relocation and livelihood restoration assistance in addition to compensation for structures following the entitlement matrix.
- **Encroachers:** Persons/households who do not have legal rights to the affected lands attached to their own titled land, but encroach them for agricultural or other productive purpose with or without any construction. “Encroachers” are those owners of land adjacent to public property, who have illegally extended their land holdings or structures into public land.

Like the squatters, the encroachers will not be entitled for compensation for lands but the structures and assets developed on it. They will be entitled for relocation and livelihood restoration assistance in addition to compensation for structures following the entitlement matrix.

- **Tenants/Lease holder (Public or private land):** Persons/households who do not have legal title to the affected lands but rent or lease it in for agricultural, residential or commercial purposes.

  Compensation will be replacement value of gross harvest for one year (for agriculture land) or the remaining lease period whichever is higher.

  In case of commercial and residential lands, the compensation will be equivalent to three months' rent or for the remaining lease period, whichever is higher.
- **Tenants of affected structures:** Persons/households renting in affected structures for residential or commercial use.

  Affected tenants of structures will be assisted with cash compensation equivalent to 3 months' rent of the affected structure, transfer/shifting allowance and in finding out alternative rental accommodation.
- **Market traders:** Affected shop owners and operators displaced due to undertaking of project works for rehabilitation or improvement of a business center.

  Compensation will be transition allowance for the permanent loss of business, incomes & wages equivalent to the loss of income/wages for a period of 6 months for each affected members of households.

  In case of temporary relocation and temporary loss of business incomes, compensation will be wages equivalent to closure period OR alternative business site for continued income stream.

7.5 Compensation/Assistance Principles

324. Depending on an affected person's preference, PGCB may consider using both financial and material forms of compensation and assistance. PGCB will ensure delivery of the agreed compensation/assistance in a timely and transparent manner. Compensation for the affected assets will be according to the following principles:

- Replacement cost for an equal amount of land of same productive quality.
- Replacement cost of houses/structures at the current prices of same building materials, plus the current cost of labor to build them. Depreciation and value of the salvageable building materials will not be deducted while computing the compensation.
- Current market prices of trees that are to be felled (owners will retain ownership of un-felled trees).
- Other acceptable in-kind compensation.
- Compensation in cash will be made in public.

325. In case of temporary land acquisition, part of the replacement cost will be paid by the Deputy Commissioner (DC) as compensation under law. If compensation under law is less than the replacement cost determined by PGCB and approved by the project (Power Cell), the remaining amount will be directly paid by the PGCB to the affected land owners.

7.6 Consultation

326. Consultations will be inclusive of all stakeholders and used as a two- way communication strategy to provide information about the project and solicit support and agreements on the mitigations proposed. In addition to general consultation about the benefits and feasibility of specific physical activity, PGCB will make certain that the users of the required lands (with and without legal rights) are consulted very early in the subproject preparation process. Consultations will focus on the issue of land availability and the conditions under which they could be used for subprojects. In cases where the would-be affected persons are tribal or women, PGCB will arrange culturally appropriate or separate consultations. Community consultation process during project implementation is discussed in more detail at Chapter 7.

327. PGCB will prepare consultations minutes, indicating dates, venues, compensation issues discussed, and the details of the agreements reached. The affected persons will be provided with copies of the minutes signed by the affected persons and the PGCB. Copies of all such signed minutes will be kept by PGCB and will be made available for review by PGCB and the World Bank.

7.7 Temporary Land Acquisition Process

328. The PGCB with the assistance of the consultant and in-house resources will prepare temporary land acquisition proposals when exact ground locations of the required lands will be identified. The temporary acquisition will be decided once the options for voluntary donation failed. The temporary land acquisition proposal will include a land plan with layout of subproject design on cadaster maps, land schedule determining the amount of land, and other supporting documents as per requirement of the Deputy Commissioner's (DC) land acquisition (LA) 4.. The DC's LA 4.will process and complete temporary land acquisition in favor of the PGCB. The DC will assess the quantity of assets to be acquired and determine market price of the land and assets on it and prepare budget for compensation under law with 50% premium on the market prices. However, the PGCB will place funds with the DC within 60 days of fund request. The DC will make compensation payment in another 60 days to complete the land acquisition. The entire procedure may take about a year.

7.8 Preparation of Subproject RAP

329. The PGCB will carry out Inventory of Losses (IoL) and census of affected persons and establish cut-off date for recognition of structures for compensation and assistance. Temporary displacement of traders for project works will be included in the census. The end date IoL/Census will be will be cut-off date for recognizing losses for resettlement assistance. In case of temporary acquisition, the Deputy Commissioner will carry out joint on site verification of affected assets jointly with the PGCB and the date of service of notice under 4. 3 of the ARIPO 1982 will be the cut-off date for compensation for physical assets as per types recognized in the joint verification.

330. The PGCB and the landowners will jointly determine the replacement costs of land based on the most recent transactions made in the same or adjacent localities, in view of the land type, productive quality and accessibility. Current prices of other assets, such as building materials, trees, etc. will be in accord with those in the local markets. The PGCB will review the rates and approve through council resolution. The valuation process has been discussed in more detail at Appendix H(b).

331. Following the SIA, Census of affected persons and joint verification data available from the DC, the PGCB will prepare RAP for the subproject following this ESMF. A typical RAP will contain information, on the amount of land required from private and public ownerships, details of the impacts/losses and the number of land owners and other being affected, the alternatives considered to minimize displacement, review of the application of legal and policy framework, mitigation measures and an entitlement matrix, detailed budget, time schedule, arrangement for implementation and monitoring and evaluation. The RAP preparation process will seek active participation of the communities including the PBS and where available the CBOs. An eligibility and entitlement matrixes and outlines of RAP are given at Appendix H(c).

332. PGCB will document the impacts and affected persons/households, mitigation measures agreed with them, and verifiable evidence that the agreed measures have been implemented.

333. The cases of voluntary private land contributions and direct purchase will also be documented with appropriate evidence and will remain open to verification by PGCB, the World Bank and others interested in the project.

7.9 Implementation of RAP

334. The PGCB will forward the subproject RAP (where required) for review and approval from the relevant branch of the GoB. PGCB will submit the RAP to the Bank for review and clearance before allowing PGCB to implement on site. PGCB upon approval from the Bank and the GoB will implement the RAP with assistance from the consultants and the PGCB staff including the Executive Engineer, Assistant Engineers, Surveyors and Overseers. Individual payment plan will be prepared for each affected persons and mitigation plans including replacement of affected physical structures by the PGCB will be also be documented as a reference for future tracking. All declarations and agreements as per SMF will be executed before taking over land through voluntary contribution, direct purchase or exchange and disclosed for the public.

8. Consultation and Disclosure

8.1 Introduction

335. Consultations on the environmental and social aspects of the investments are required with diverse stakeholders including potentially affected peoples and communities, other local communities as well as NGOs, institutions, industry, academics and any others at least thrice once at the project project planning stage, project implementation stage and operation stage in accordance with OP 4.01. However, following international good practice, the investment specific studies to be commissioned will include a more comprehensive stakeholder engagement program.

336. Therefore this ESMF hereby specifies that each investment specific ESIA TOR shall be include a requirement for stakeholder indentification and mapping process and development of stakeholder consultation plans for purpose of ensuring effective, inclusive and culturally appropriate consultation and engagement throughoput the course of study of each specific investment.

337. Public Consultation is a major focus area for the WB (World Bank) and lot of importance is given to the issue of effective stakeholder involvement in ESIA through consultations, especially if indigenous people are affected. It has also a set of elaborate guidance for social impact assessment for people to be affected by a project.

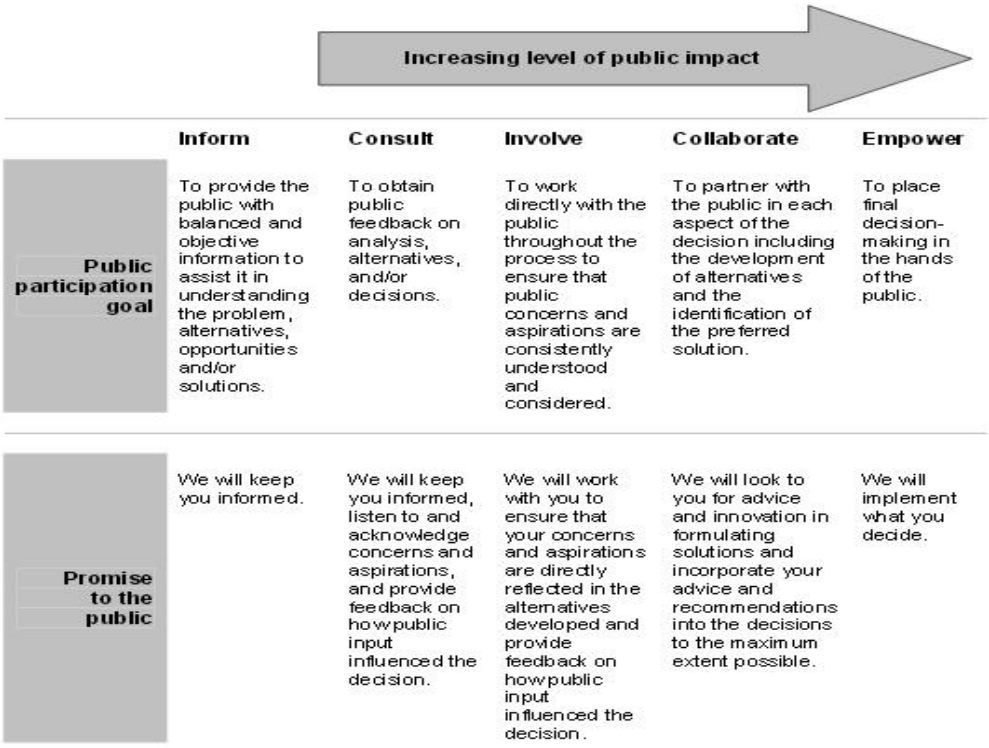


Figure 8.1: Public Consultation Spectrum (IAP2[15]'s spectrum)

[15] International Association for Public Consultation

338. During the consultation process the proposed project interventions and expected result as well as impact of the project must be discussed with local people. In the consultation process, the stakeholders must be involved with the study consultants in reforming/ developing the project interventions considering the local needs and aspirations in line with the problems and solutions suggested by them.

8.2 Objectives of Consultation

339. The following objectives could be followed for organizing public hearings as part of the ESIA process are:

- To provide a forum for the proponent to inform the entire community of the outcome of the Environmental Assessment of proposed undertakings;
- To verify the accuracy of the EIA findings in relation to the situation on the ground;
- To confirm that all the affected parties and stakeholders have been adequately consulted and have been part of the various decision-making processes;
- To offer the affected and interested parties, as well as other stakeholders, the opportunity to express their opinions on any issues considered outstanding; and
- To find solution for conflict resolution.

8.3 Approaches

340. Participatory approach need to follow for conducting the public/stakeholder consultation meetings to provide key Project information and create awareness among various stakeholders about project intervention:

- A checklist was used to maintain uniformity and relevancy in discussion and properly record the opinions and views of the participants;
- Socio-economic, agricultural, hydrological, fisheries, and ecological issues were discussed in detail, including potential impacts of the interventions on the environmental and social parameters;
- Institutional issues were also discussed regarding which the participants provided their opinions and suggestions freely.

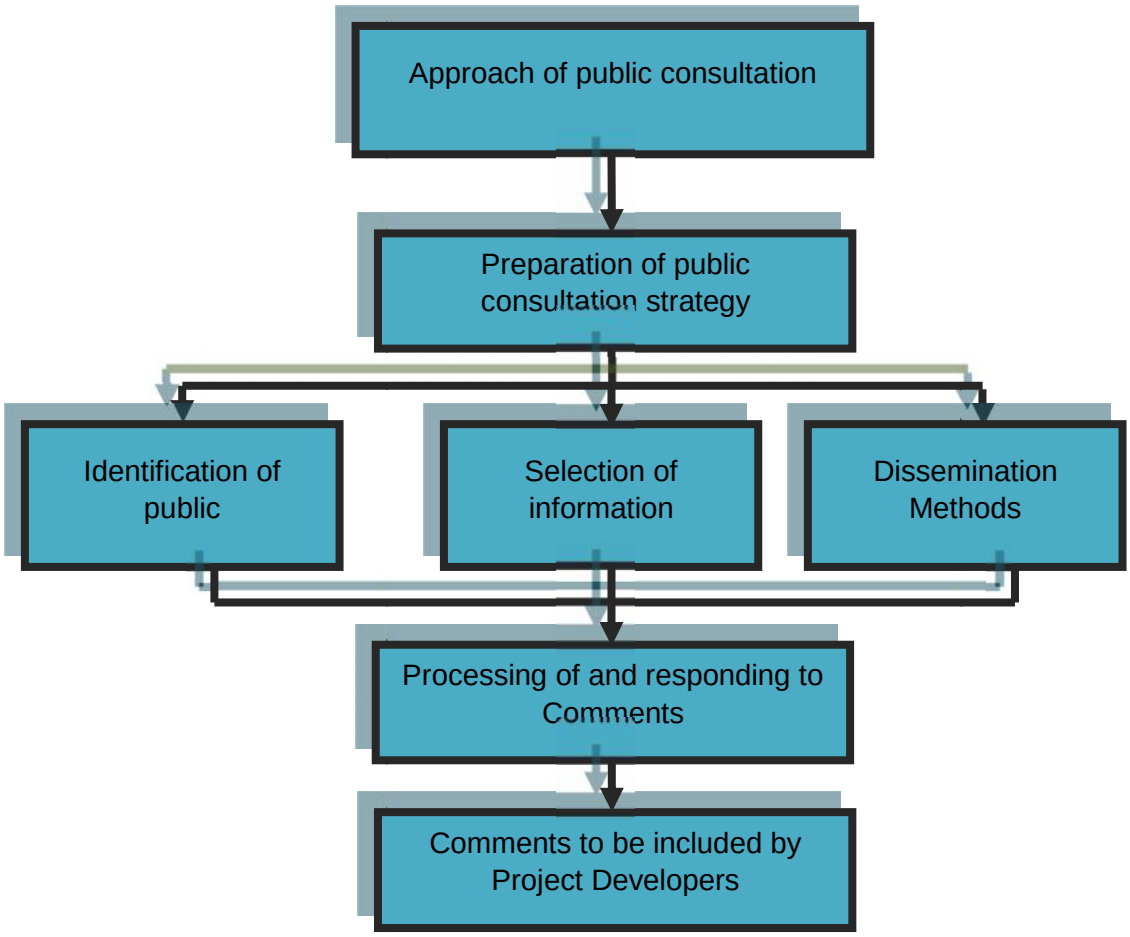


Figure 8.2: Approaches of Public Consultation

8.4 Methodology

341. The consultant team will prepare a checklist for the consultation meetings, RRA and informal interview with different stakeholders at different stage of the project. These issues of the overall project planning for intervention and probable impacts on environment, socio-economy and institution were incorporated in the checklist. The issues of discussion must be shared with implementing authority for their information and suggestions.

8.4.1 Consultation Checklist

342. The following checklist will be the guiding tool for carrying out consultation and enhance participation of stakeholders in a subproject cycle.

INFORM	CONSULT	ENGAGE	COLLABORATE	EMPOWER
Goal:	**Goal:**	**Goal:**	**Goal:**	**Goal:**
Promote stakeholder understanding of issues, problems, alternatives, opportunities and solutions through	Obtain feedback on analysis alternatives and decisions	Work directly with stakeholders to ensure that their concerns and aspirations are understood and considered	Stakeholders become partners in each aspect of the decision, including development of alternatives and identification of	Final decision-making in the hands of stakeholders

INFORM	CONSULT	ENGAGE	COLLABORATE	EMPOWER
Goal:	**Goal:**	**Goal:**	**Goal:**	**Goal:**
balanced and objective information			preferred solutions	
Commitment	Commitment	Commitment	Commitment	Commitment
Keep the stakeholders informed	Listen and acknowledge stakeholders concerns and expectations	Ensure that stakeholders concerns/aspirations are directly reflected in subproject design and appraise them how their input influenced the decision	Value stakeholders' advice and innovations in devising solutions and incorporate their advice and recommendations to the maximum extent	Implement the project as decided by the stakeholders
Techniques	Techniques	Techniques	Techniques	Techniques
✓ Fact sheets ✓ Briefings ✓ Open meetings ✓ Websites	✓ Public comment ✓ Focus groups ✓ Surveys ✓ Public meetings	✓ Meetings with communities/CBOs ✓ Workshops	✓ Participatory decision making ✓ Citizen committees (WLCC)	✓ Citizen juries ✓ Delegated decisions

343. A multi-disciplinary consultant team could be formed for the consultations with different groups of local people and collected /recorded their opinions and views.

8.5 Consultation Meetings and FGDs:

344. For preparing the ESMF report few consultation meetings and FGDs were conducted with different level of stakeholders. People's perspective about the project and their important opinion about the mitigation and management plan of the identified impacts during construction and operation phase have taken into consideration for preparing the ESMF. Consultation meetings and FGDs schedule, participant list with date need to present in the ESA report. The following table presents the consultation meeting schedules and the participants list along with photographs attached in Appendix G.

District	Upazilla	Union	Date
Sirajganj	Sirajganj Sadar	Soydabad	20/10/2016
Narshingdi	Palash	Ghorasal Paurashova	19/10/2016
Jhenaidah	Shoilokupa	Mizzapur	20/10/2016

8.6 Key Findings of the Consultations:

345. The key findigs of the consultation meetings must be presented in the final ESA report. A Multi disciplinary team consisting of different expert conducted consultation meeting for the preparation of this ESMF which key findings are presented here as an example for the final ESA study.

8.6.1 Major problems identified by local people

346. In PCM, Local people indentified that the proposed project may create some problems. The problems are given below

- In the agricultural sector some farmers will not be able to cultivate land due to existing suspension and angel tower. In many case it creates crop damage as well.
- Crop compensation is to be ensured for depreciated owners. Especially in Jhenaidah compensation for Betel leaf need to be revised due to its high market value.
- Compensation that was given for towers was very poor in amount.
- Existing right of way for transmission line may cross the densely populated zone specifically Sirajganj to Bogra 90 km overhead transmission line will cross several populated zone. People urged that if it is avoided that will decrease the possibility of accidental hazard.
- Due to increase the sag and reduce the clearance of the existing 230 kV transmission line from the ground, people felt EMF induction during the rainy days. Local people also heard noise especially in winter season because of corona effect.
- Height of existing transmission line is not enough to avoid accidental hazard.
- Their livelihood pattern may be hampered due to hampered production circle.

8.6.2 Suggested Solutions

- A ranking of affected people should be prepared.
- Real land owners and sharecroppers should be identified.
- All project affected people (PAPs) should be compensated.
- Proper compensation rate should be ensured for different crops.
- No work should be started for implementing the project until proper compensation is paid to the affected people.
- Revetment work should be done if the angel points placed on the bank of river.
- Ensuring proper safety and security of local people during projects activity.
- Before starting the project work community people should be informed for awareness.
- Reducing the loading capacity for transmission line.
- A neutral monitoring agency should be engaged for monitoring the compensation activities.
- There should be an option for local people to be engaged in the construction activities to create employment opportunity.

8.7 Framework for Future Consultation:

347. The stakeholder consultation is a continuous process, and should be maintained throughout the project. The consultations carried out during the present ESMF and reported in this Chapter are essentially a first step in this process. During the subsequent project phases as well, participation of the project stakeholders need to be ensured. In this regard a future framework for consultation has developed.

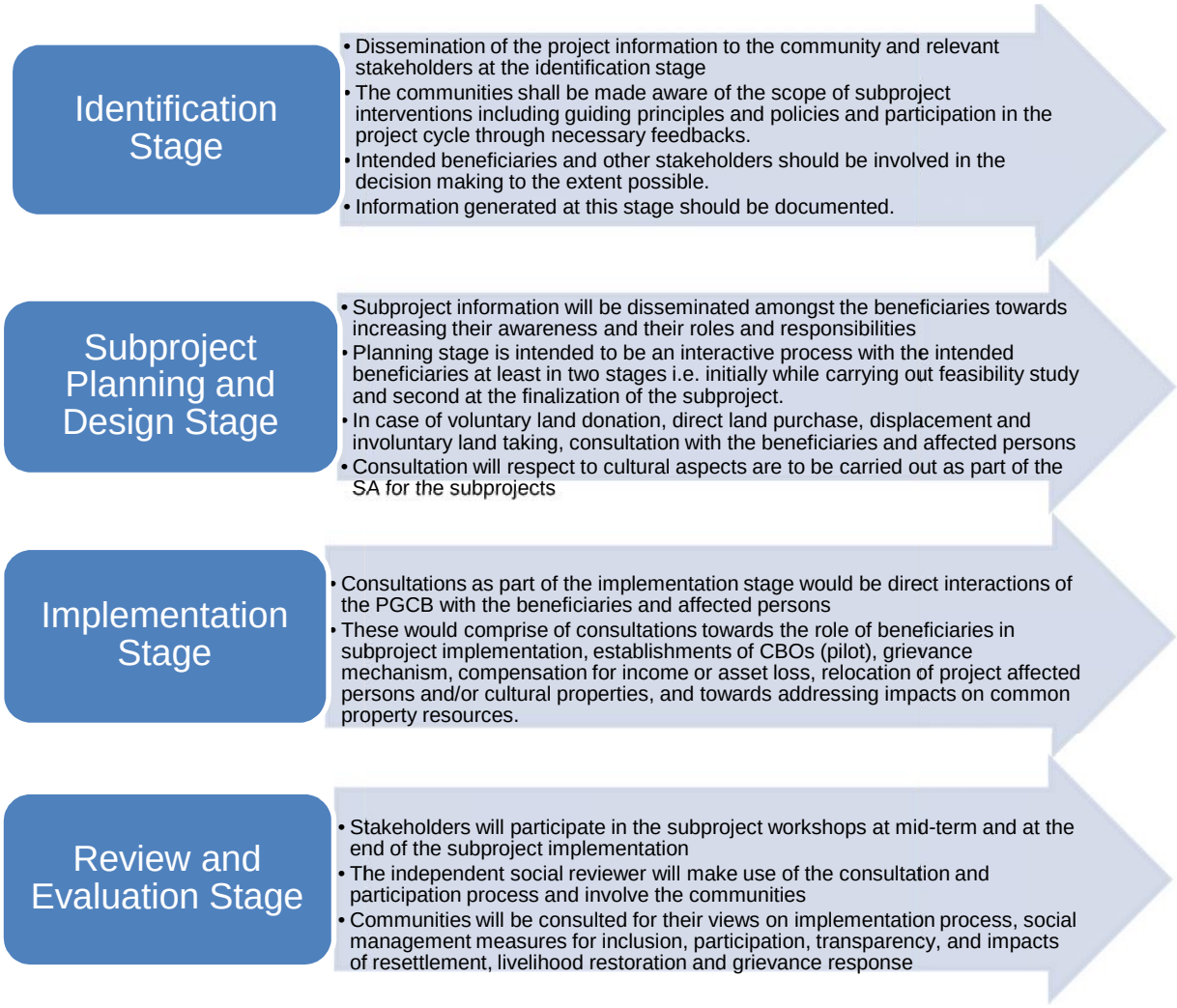


Figure 8.3: Future Consultation Framework

348. At every stage of the consultation and communication process the relevant stakeholders have to be identified, the entire consultation process (including methodology and approach) must be documented showing when and where the consultaions were held (participants list for consultations carried out for the purpose of this ESMF are annexed); the issues and topics discussed as well as responses, feedback and suggestions must be documented and incorporated in the ESMF as well as all other mitigation plans (RAPs, TPPs) when those are prepared

8.8 Access to Information:

349. Environmental/social screening of each sub-project and ESIA wherever required, are to be subject to review and clearance by the Bank. Whenever requested, PGCB will provide the Bank with copies of the filled out environmental/ social screening forms for all sub-projects to be implemented by PGCB.

350. All summary of all safeguard documents including the ESMF, ESIA and other social plans are to be translated into Bangla (local language) and disclosed locally and the English versions disclosed through the Bank's Info-shop. The PGCB are to upload the ESMF in their official websites along with a Bangla translation of the summary.

Appendix A: Terms of Reference of Independent Environmental and Social Assessment

1. INTRODUCTION

The power system in Bangladesh has evolved rapidly over the last five years. The generation capacity hasnearly doubled over this period to cross 1 1,000 MW in 2015. However, the peak demand has also grownfrom 4,530 MW in 2010 to reach 8,348 MW on April 09, 2016. Demand has grown by more than 1,000MW in the last year or so with significant suppressed demand still in the system. Therefore, the demandgrowth may be expected to further accelerate over the coming years. Indeed, the demand forecasts that areconsidered for the ongoing Power System Master Plan 2015 shows projected gross peak demand to reach13,620 MW by 2020, close to 20,000 MW by 2025 and close to 50,000 MW by 2040. The power systemis therefore expected to double again over the next five years.

There are many challenges that would need to be overcome not the least of which is Bangladesh'sdwindling gas reserve and hence increased reliance on imported fuel, especially oil in the short to mediumterm. The second challenge is to equip the system so that it cannot merely grow in terms of MW capacitybut is reliable to ensure capacity is available when needed, secure i.e., can prevent major outages throughproper frequency and voltage management, and resilient to recover from any contingency (e.g., suddenoutage of a generator or a major line). It is critical to start putting in place measures that ensure power canbe supplied for a much larger demand at a reasonable cost maintaining an acceptable quality standard.This project will address the following fundamental measures that must be put in place so that the powersystem can be operated in a secure and economic manner in line with the longer term goals to delivermuch greater quantum of power:

i) Introduction of automatic frequency regulation from NLDC by implementing primary governor control to at least 15 nos. of power generators. This will enhance system stability.

ii) Integration of power generators to NLDC network and necessary upgradation of SCADA/EMS core to modernize the dispatch system. Capacity building and training of NLDC staffs. This will lead to reliable &economic system operation of Bangladesh National Grid.

iii) Introduction of DLR (Dynamic Line Rating) for critically loaded transmission lines of PGCB. This will ensure safe and economic operation of the national grid.

iv) Introduction of some MVAr SVC (Static VAR Compensation) to critical points of the national grid. This will enhance voltage stability and reduce system loss.

v) Upgradation of 230 kV transmission lines's capacity by reconductoring with higher capacity conductor.

PGCB intends to hire a consulting firm (the Consultant) to cary out an Environmental and SocialAssessment (ESA) of the proposed project at the preparation stage to ensure that the proposedinfrastructure takes environmental concerns into account. The proposed project will be implemented overa period of three years starting July 2016.

2. EA AND SA REQUIREMENTS

The proposed project will be financed by IDA with GoB contribution. Since the IDA and GoB are thefinancing sources of the project, the EAs and SAs that will be prepared to comply with the policies andlegislative requirement of the World Bank and the GoB.

The Government's Environment Conservation Act (amended 2010) is currently the main legislationrelating to environment protection in Bangladesh. This Act is promulgated for environment conservation,environmental standards development and environment pollution control and abatement. EnvironmentConservation Rules (ECR), 1997 and Amendments provide categorization of industries and projects andidentify types of environmental assessment required against respective categories of industries or projects.In addition, the government has several other legislative instruments for urban area development. TheConsultant will also need to identify any other laws, regulations and guidelines both at national andregional levels related to environmental assessment.

In addition, the Bank will require environmental and social assessment (ESA) of projects selected forBank financing to ensure that they are environmentally and socially sound and sustainable, and thusdecision making. ESA will take into account the natural environment (air, water, and land), human healthand safety, physical cultural resources, trans-boundary and global environmental aspects. In addition theESA will take into account social aspects (involuntary resettlement, tribal peoples, and physical cultural resources).Social screening and assessment are mandated under Bank OP 4.01 Environmental Assessment and considersnatural and social aspects in an integrated way.The borrower is responsible for carrying out the ESA. Theproject is expected to be classified as Category 'B' project in accordance Bank's policy sincetransmission networking to be funded under the project may not have significant and irreversibleenvironmental and social impacts if design and implementation are planned and managed properly.

3. Objective

The main objective of the assignment is to carrying out site specific ESAs as well as site specific

Environmental Management Plans (EMPs), Resettlement Policy Framework (RPF) to ensure that neitherthe proposed activities nor the social and environmental aspects of the project area are compromisedthrough the project activities. The deliverables will be as acceptable by the World Bank and DOE. TheESA will be conducted for the following detail works:

Sl.No	Description of works	Length/Location
1	Upgradation of 230/132 kV D/C transmission lines's capacity byreconductoring with higher capacityconductor.	Need to Finalize
2	Introduction of approximate 800 MVArSVC (Static VAR Compensation) and Capacitor Bank tocritical points of the national grid	Substations need to finalize

4. Scope of the studies

In order to achieve the main objective, the specific scopes are to (i) evaluate the environment and socialbaseline (ii) assess the potential overall environmental and social impacts of the proposed projectactivities; (iii) conduct adequate public consultation (iv) suggest subproject specific standardEnvironmental Code of Practices (ECPs), Environment Management Plan (EMP) and ResettlementPolicy Framework (RPF) including costing; (v) identify the institutional barriers and capacity buildingneeds for environmental and social management; and agree on the institutional arrangement for theenvironmental and social management.

The detail scopes of consultant services include the following, but not necessarily be limited to:

Review of Relevant Policies and Legislation

i) Review current relevant policies, legislations, EIA procedures/practices and land acquisition procedure for transmission line of the Government of Bangladesh (GoB) related to the sustainable urban sector development and explain its implication to the proposed project;

ii) Review the relevant World Bank safeguard policies and explain its implication to the proposed project;

iii) Provide a Table with list of all necessary clearances, permissions and disclosure requirements of the World Bank and GoB.

Influence Area and Environmental and Social Baseline

i) Define the project influence area for different category subprojects;

ii) Define and identify the Important Environmental and Social Features within the project influence area; and present subproject specific environmental and social baseline and map in a way that information could be used for the purpose of environmental and social assessment andmonitoring,

Alternative Analysis

i) Identify and define alternatives on (a) technical methodologies; (b) analysis and evaluation from environmental, social and economic perspective; and (c) selection of the locally preferred alternative;

ii) Describe the key elements (noise and electromagnetic interference, biological diversity, visual aspects / effects, social issues etc.) in presenting findings and explanations of the alternative analysis; and

iii) Define the project approach to adopt the environmental and social sound alternative option.

Stakeholder Analysis, Consultation and participation

i) Identify key stakeholders of the proposed project and assess the power relationships as well asinfluence and interests of stakeholders involved in development of ihe project;

ii) Carryout a stakeholder analysis to categorize the most important actors for preparation, design, implementation and monitoring of the proposed project;

iii) Inform, consult, and be engaged in dialogue with stakeholders regarding proposed project design, likely impacts of the interventions (both positive and negative), environmental and social enhancement measures, possible measures for environmental mitigation/compensation, implementation and monitoring of mitigation/compensation measures, and specific recommendations regarding vulnerable groups, including significant common property that mayrequire adjustments in project design[16]

iv) Examine opportunities and conditions for the participation of the stakeholders includingvulnerable groups in the project cycle; and

v) Document the consultation process (photographs, signature of participants) and record the discussions including options and suggestions provided by the participants for consideration inthe project design, implementation and monitoring.

[16]Consultation must be carried out at baseline study area

Environmental and social screening, Assessment and Management plan

i) Develop environmental and social screening and assessment methodology for the subprojects, which will be applied to the proposed project;

ii) Describe in detail the potential impacts at the subproject level due to the project interventions through identification, analysis and evaluation on sensitive areas (natural habitats; sites of historic, cultural and conservation importance), settlements and villages/agricultural areas or Important Environmental and Social Features;

iii) Describe the feasible and cost effective mitigation/compensation measures for each impact predicted as above to reduce potentially significant adverse environmental and social impacts to acceptable levels;

iv) Provide guidance and necessary action to prepare the environmental and social screening and assessment report fulfilling the requirement of GoB and the world Bank;

v) Prepare Environmental Code of Practice (ECoP) for different types of activities related with augmentation and rehabilitation of transmission works.

vi) Describe in details the process for preparing site specific environmental and social management plan (EMP [17] and RAP) along with standard template for mitigation/compensation and monitoring;

vii) Describe how to estimate the costing of EMp, RAp and ECoP[18];

viii) Prepare occupational health and safety guidelines relevant to the proposed project;

ix) Describe the set of special environmental and social clauses (SECs)a to be included in the Technical Specification of the bidding documents.

x) Provide guidance and necessary action to prepare the environmental assessment report fulfillingthe requirement of GoB and obtaining the clearance from DoE;

Institutional Capacity and Responsibility

I) Evaluate the institutional and staff capacity of PGCB and carryout training needs assessment for environmental and social management;

II) Identify required staffing and consultant needs in PGCB for appropriate environmental and social management in the proposed project, prepare Terms of References (ToR) and estimate budget to be included in the project document;

III) Provide guidelines for required staffing, resources and training PGCB environmental and social staff;

IV) Define the roles and responsibilities of officials, staff, consultants and contractors of PGCB regarding environment and social management of the proposed project;

V) Ensure environmental and social considerations are properly addressed in final civil engineeringdesign and estimation:

Consultation, public awareness, disclosure and grievance redress

i) Translate in Bangla of the ESA document

[17]The EMP will have 2 (two) separate plans: environmental mitigation/compensation plan and environmental monitoring plan. Both plans should be for pre-construction, construction and operation phase.

[18]The cost of environmental mitigation/compensation for pre-construction and construction phase must be included in the bidding document as fixed budget.

ii) Fulfill disclosure requirement of environmental and social documents at different stage of project and subprojects so that the stakeholder consultation, full information on the designs and environmental and social mitigation measures will be disclosed and made accessible to commonpeople.

5. DURATION OF ASSIGNMENT

Time is an important essence for the assignment, which will be closely coordinated with the preparation of the project. The assignment shall be of 3 (three) months from the date of contract signing. However,the Consultant is required to submit an acceptable draft report for disclosure within 2 (two) months of thecontract signing.

Appendix B1: Sub-project Description: Instalation of SVC/Capacitor Bank at existing Substations

Form 1a: Sub-project Description: Instalation of SVC/Capacitor Bank at exixting Substations

(to be completed by PGCB)

(1) Name of Substation :
(2) Location of Substation :
(3) Local PGCB office :

(4) Location/layout of proposed Substation :
(Attach location map/ layout map)

(5) Ownership of sub-project land :
(a)Government owned (acre) :
(b)Private land (need acquisition) (acre) :
(c)Partly private/Partly Government owned:

(6) Brief description of proposed Substation site:
(Indicate the information on present landuse, HFL for last 30 years and Important Environmental Features[19] (IEFs) adjacent to the site)

(7) Brief information of environment within sub-project influence area[20]:
(Human settlement, tribal people, water body, flora, fauna, historical or culturally important sites, traffic)

(8) Key activities of sub-project :
(See4.4.9.3 of ESMF for typical sub-project activities)

(9) Estimated cost of sub-project :
(Mil BDT)

[19]Educational institutions, health care, pond, canal, river, utility infrastructure , park, green area etc

[20] Follow Table 3.4 of EMF for influence area.

(10) Schedule of implementation :

(a)Sub-project duration (months) :

(b)Tentative start date :

(c)Tentative completion date :

(11) Potential benefit from sub-project :

(Including estimated number of people benefited)

Prepared by :(Name, designation, mobile number, signature, date) ----------

Reviewed by:(Name, designation, mobile number, signature, date) ----------

Appendix B2: Form 1b: Sub-project Description: Reconductoring of Transmission Lines

(to be completed by PGCB)

(1) Name of Power Line Subproject :

(2) (a) Total Length (km) :

(b) Type of Line :

(c) Start/ End Point :

(3) Local PGCB office :

(4) Layout of proposed Power Line :
(attach layout map)

(5) Ownership of sub-project land :
(d)Government owned :
(e)Private land (need acquisition) (acre) :
(f) Partly private/Partly Government owned:

(6) Brief information of surrounding environment along power line influence area[21]:

(a) Characteristics of route of power line:

i. ….. % paddy/crop field; ….. % along road/highway; ….. % village/human settlement;

j. ….. % industrial area; ….. % forest; ….. % wetland/river; ….. % other (specify)

(b) Information on IEFs, human settlement, industrial/commercial establishments, tribal people, water body, flora, fauna, historical or culturally important sites, ecologically sensitive areas, traffic

(7) Key activities of sub-project :
(See4.4.9.3 of ESMF for typical sub-project activities)

(8) Estimated cost of sub-project :
(Mil BDT)

[21] Follow Table 3.4 of EMF for influence area.

(9) Schedule of implementation :

(d)Sub-project duration (months) :

(e)Tentative start date :

(f) Tentative completion date :

(10) Potential benefit from sub-project :

(Including estimated number of people benefited)

Prepared by :(Name, designation, mobile number, signature, date) ----------

Reviewed by:(Name, designation, mobile number, signature, date) ----------

Appendix C1:Sub-project Description: Reconductoring of Transmission Lines

Form 2a: Environmental/Social Screening: Instalation of SVC/Capacitor Bank at exixting Substations

(to be completed by PGCB following Guideline in ESMF)

Name of Substation :
Location of Substation :
Local PGCB office :

1) Potential Environmental Impact during Construction Phase:

(a) Ecological impacts:

• Felling of trees	Significant ☐	Moderate ☐	Minor ☐	Number of tress
• Clearing of vegetation	Significant ☐	Moderate ☐	Minor ☐	
• Potential impact on aquatic (i.e., water) habitat (adjacent water body, if any)	Significant ☐	Moderate ☐	Minor ☐	
• Presence of protected area, key biodiversity area along the route of power line	Yes ☐	No ☐		

Note: *If answer to the above question is "Yes", then a detail analysis of alternative routes would be carried out to identify possible route(s) that would eliminate/reduce risk to biodiversity, vegetation, habitat. If it is not possible to completely avoid such sensitive areas, then possible impact on biodiversity must be addressed as outlined in the ESMF.*

(b) Physicochemical impacts:

• Noise pollution	Significant ☐	Moderate ☐	Insignificant ☐
• Air pollution	Significant ☐	Moderate ☐	Insignificant ☐
• Drainage congestion/water logging	Very likely ☐	Likely ☐	Unlikely ☐
• Water pollution	Significant ☐	Moderate ☐	Insignificant ☐
• Pollution from solid/ construction waste	Significant ☐	Moderate ☐	Insignificant ☐

(c) General Socio-economic impacts:

• Traffic congestion	Very likely ☐	Likely ☐	Unlikely ☐
• Health and safety	Significant ☐	Moderate ☐	Insignificant ☐
• Impact on archaeological and historical	Significant ☐	Moderate ☐	Insignificant

• Employment generation	Significant □	Moderate □	Insignificant □

(d) Social impacts related to acquisition of land, tribal people:

(1) Acquisition of private land needed Yes □ No □

(2) Amount of private land to be acquired:

(3) Presence of tribal population in project surrounding areas Yes □ No □

Assessment of social impacts

• Loss of land	Significant □	Moderate □	Insignificant □
• Loss of Income	Significant □	Moderate □	Insignificant □
• Impact on tribal people (if applicable)	Significant □	Moderate □	Insignificant □

2) Potential Environmental Impact during Operational Phase: No significant adverse impact anticipated that cannot be addressed by routine O&M activities, and no such impacts are expected that could potentially affect nature of subsequent ESA.

3) Summary of possible environmental/social impacts of the subproject :
[mention overall nature of impacts, and mention if social safeguard issues (e.g., land acquisition, impact on tribal people) have been identified]

4) Category of sub-project : (follow Table 4.2 of EMF)

(a) According to ECR 1997 : Green / Orange A / Orange B / Red / Not Listed
[if "social safeguard issues (e.g., land acquisition, impact on tribal people) identified, likely category "RED"]
(b) According to WB classification : Category B

5) Proposed mitigation measure(follow Appendix H or Tables 4.10 - 4.12 of ESMF as appropriate)

6) Overall Comments:

Prepared by :(Name, designation, mobile number, signature, date) ----------

Reviewed by :(Name, designation, mobile number, signature, date) ----------

Appendix C2: Form 2b: Environmental/Social Screening: Reconductoring of Transmission Lines

(to be completed byPGCB following Guideline in ESMF)

Name of Power Line Subproject :
Total Length (km) :

Type of Line :

Start/ End Point :
Local PGCB office :

1) Potential Environmental Impact during Construction Phase:

(e) Ecological impacts:

• Felling of trees	Significant ☐	Moderate ☐	Minor ☐	Number of tress
• Clearing of vegetation	Significant ☐	Moderate ☐	Minor ☐	
• Potential impact on aquatic (i.e., water) habitat (esp. if power line is to be constructed over river/wetland)	Significant ☐	Moderate ☐	Minor ☐	
• Presence of protected area, key biodiversity area along the route of power line	Yes ☐	No ☐		

Note: *If answer to the above question is "Yes", then a detail analysis of alternative routes would be carried out to identify possible route(s) that would eliminate/reduce risk to biodiversity, vegetation, habitat. If it is not possible to completely avoid such sensitive areas, then possible impact on biodiversity must be addressed as outlined in the ESMF.*

(f) Physicochemical impacts:

• Noise pollution	Significant ☐	Moderate ☐	Insignificant ☐
• Air pollution	Significant ☐	Moderate ☐	Insignificant ☐
• Water pollution	Significant ☐	Moderate ☐	Insignificant ☐
• Pollution from solid/ construction waste	Significant ☐	Moderate ☐	Insignificant ☐

(g) General Socio-economic impacts:

• Traffic congestion	Very likely ☐	Likely ☐	Unlikely ☐
• Health and safety	Significant ☐	Moderate ☐	Insignificant ☐
• Impact on archaeological and historical	Significant ☐	Moderate ☐	Insignificant

• Employment generation	Significant □	Moderate □	Insignificant □
• Impact on tribal people (if applicable)	Significant □	Moderate □	Insignificant □

2) Potential Environmental Impact during Operational Phase: No significant adverse impact anticipated that cannot be addressed by routine O&M activities, and no such impacts are expected that could potentially affect nature of subsequent ESA.

3) Summary of Possible environmental/social impacts of the subproject :

k. [mention overall nature of impacts, and mention if social safeguard issues (e.g., impact on tribal people) have been identified]

4) Category of sub-project : (follow Table 4.2 of EMF)

(c) According to ECR 1997 : Green / Orange A / Orange B / Red / Not Listed
[if "social safeguard issues (e.g., land acquisition, impact on tribal people) identified, likely category "RED"]
(d) According to WB classification : Category B

5) Proposed mitigation measure(follow Appendix H or Tables 4.10 - 4.12 of ESMF as appropriate)

6) Overall Comments:

Prepared by :(Name, designation, mobile number, signature, date) ----------

Reviewed by:(Name, designation, mobile number, signature, date) ----------

Appendix D: Environmental/Social Screening

Criteria for Assessment of Ecological Impacts

Table D-1: Categories and definition of "Consequence" levels for ecological impacts

Category	Ranking	Definition
Critical	5	• Very serious environmental effects with impairment of ecosystem function. • Long-term, widespread effects on significant environment (e.g. habitat, national park) • Habitat restitution time >100 years and requiring extreme substantial intervention.
Major	4	• Serious environmental effects with some impairment of ecosystem function (e.g. displacement of species). • Relative widespread medium–long term impacts. • Habitat restitution time >10 years and requiring substantial intervention. • Potential for continuous non-compliance with environmental regulations
Moderate	3	• Moderate effects on biological environment but not affecting ecosystem function. • Moderate short-medium term widespread impacts • Habitat restitution time 1-5 years (possible limited and local areas up to 10 years) with potential for full recovery and limited or no intervention required. • Potential for short to medium term noncompliance with environmental regulations and/or company policy.
Minor	2	• Minor effects on biological environment. • Minor short-medium term damage to small area of limited significant • Full recovery in < 1 year without intervention required. • Any potential non-compliance with environmental regulations and/or company policy would be minor and short-term.
Low	1	• No lasting effect. • Low-level impacts on biological environment. • Limited damage to minimal area of low significant. • Compliance with environmental regulations and/or company policy at all times. • Possible beneficial effect or ecosystem improvement.
None	0	• No impact on ecosystem damage. • No compliance required for environmental regulations and/or company policy at all times. • Possible beneficial effect or ecosystem improvement.
Limited Positive	+	• Some beneficial improvement to ecosystem. • Benefits to specific flora and / or fauna.
Modest Positive	++	• Moderate beneficial improvement to ecosystem. • Medium benefits to specific flora and / or fauna.
Significant Positive	+++	• Major beneficial improvement to ecosystem. • Large scale benefits to specific flora and / fauna.

Table D-2: "Likelihood of occurrence" and corresponding rankings

Impact Likelihood	Ranking	Definition
Almost Certain (80 – 100%)	5	The activity will occur under normal operating conditions.
Very Likely (60 - 80%)	4	The activity is very likely to occur under normal operational conditions.
Likely (40 - 60%)	3	The activity is likely to occur at some time under normal operating conditions.
Unlikely (20 - 40%	2	The activity is unlikely to occur, but may occur at some time under normal operating conditions.
Very Unlikely (0 - 20%)	1	The activity is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances.

Table A-D: Example of estimating ecological impacts of typical sub-project activities

Potential Impacts Source / Project Activities	Impact	Ecological Receptor Type	Description	Likelihood	Consequence	Risk Rating
Material storage or placement	Habitat destruction of terrestrial flora (herb, shrub) and borrowing fauna; and disturbance in movement of terrestrial fauna (amphibia, reptile and mammal)	Flora and Fauna	• Direct, Negative • Short term, Local • Reversible	Likely	Low	Low
Vehicle movement	Impairment of terrestrial flora (herb and shrub), terrestrial fauna (amphibia, reptile & mammal)	Flora and Fauna	• Direct, Negative • Short term, Local • Reversible	Likely	Low	Low
Soil excavation	Habitat destruction of aquatic flora (herb, shrub) and movement disturbance / habitat destruction of terrestrial (burrow) fauna (amphibia, reptile, bird and mammal)	Flora and Fauna	• Direct, Negative • Short term, Local • Reversible	Unlikely	Minor	Low
Noise disturbance	Disturbance of terrestrial faunal livelihood (movement, foraging, breeding) (amphibia, reptile, bird and mammal)	Fauna	• Direct, Negative • Short term, Local • Reversible	Unlikely	Minor	Low
Exhaust from generators	Disturbance in movement of terrestrial fauna (e.g. aves)	Fauna	• Direct, Negative • Short term, Local • Reversible	Unlikely	Minor	Low

Appendix E: Impact Screening and Assessment Guideline forPhysical Cultural Resources (PCR)

(Ref: Physical Cultural Resources Safeguard Policy Guidebook, World Bank, 2009)

As stated in the World Bank PCR Safeguard Policy Guidebook, The PCR policy applies to projects having any one or more of the following three features:

(i) Projects involving significant excavations, demolition, movement of earth, flooding or other major environmental changes

(ii) Projects located within or in the vicinity of a recognized PCR conservation area or heritage site

(iii) Projects designed to support the management or conservation of PCR

The sub-projects under the proposed project will involve significant excavation works, movement of earth and temporary flooding. The Pourashavas and City Corporations have religious institutions (mosques, temples, Buddhist temples), few sites of archaeological importance, public libraries, cinema halls, community centers, which can be considered PCRs. However, the sub-project area of influence may or may not intersect these regions (since the sub-projects are generic in nature, actual locations of most of them still undetermined). Therefore a generic impact assessment of Physical Cultural Resources is outlined in this 4.

Guidance on identification of PCR

In the context of the proposed project, the probable examples of PCR may be the following:

1. Human made: Religious buildings such as temples, mosques, churches, exemplary indigenous or vernacular architecture Buildings, or the remains of buildings of architectural or historic interest, Historic or architecturally important townscapes Archaeological sites (unknown or known, excavated or unexcavated), Commemorative monuments

2. Natural: historic trees, natural landscapes of outstanding aesthetic quality

3. Combined man-made or natural: Sites used for religious or social functions such as weddings, funerals, or other traditional community activities (community centres), burial grounds, family graves, cultural landscapes

4. Movable: registered or unregistered artifacts in temples or mosques, paintings, statues of important historical figures, religious artifacts, cultural artifacts etc.

Assessment of probable impacts due to activities:

Below is a list of project activities or features under the context of the proposed project, which may commonly give rise to negative impacts on PCR, divided into two periods: construction phase and operational phase.

Construction phase:

1. Establishment of work camps:

- Vandalism, theft and illegal export of movable PCR, and of pieces of monumental PCR accessible directly or indirectly to migrant laborers,
- Desecration of sacred sites.

2. Excavation, construction and soil compaction:

- Direct physical damage to natural, manmade and buried PCR on site

3. Construction traffic:

- Vibration, soil, air and water pollution causing damage to natural or manmade PCR on site.
- Noise pollution can interfere with the use and enjoyment of PCR such as tourist destinations, historic buildings, religious establishments and cemeteries.

4. Mobilization of heavy construction equipment:

- Damage to natural or manmade PCR on site
- Soil compaction, damaging buried PCR (archaeological) onsite, and damaging pipelines and drains serving built PCR in the vicinity.

5. Flooding and Inundation:

- Submergence or destruction of human-made, natural or buried PCR.
- Barrier to access of all types of PCR.
- Raised water table can lead to damage to all types of PCR.
- Damage to aesthetics of scenic landscapes.

6. Waste disposal or landfill:

- Burial or damage to natural, buried or underwater PCR.

Operation phase:

1. New and upgraded Roads:

- Increased human traffic enjoying improved access to PCR of public interest leading to increased wear and damage, sacrilege of sacred sites, theft and vandalism of movable and, breakable PCR.
- New highways cutting off access to living-culture PCR by residents of settlements on other side of the highway.
- Increased air pollution and vibration from traffic causing damage to man-made PCR, particularly monuments and buildings.
- Increased noise pollution interfering with enjoyment of people in tourist destinations, historic buildings, religious establishments and cemeteries.
- In scenic areas, obtrusive highways having a negative visual impact on the landscape.
- Roads and bridges which themselves constitute PCR being damaged by increased traffic.

- Positive impacts may also occur, through the discovery of hitherto unknown sites and artifacts and generation of tourism.

2. Induced development:

- Induced development leading to increased wear and damage, sacrilege of sacred sites, theft and vandalism of movable and breakable PCR, and damage to the aesthetics of scenic landscapes and townscapes.

3. Urban development:

- Changes in demography or settlement patterns leading to decay of inner cities and abandonment and neglect of older residential areas containing built PCR such as vernacular architecture.
- Developments which are out-of-character with their surroundings diminishing the aesthetic value of the townscape, decline in property values and ultimately, neglect of built PCR in the area.
- Damage to the aesthetics of scenic landscapes and townscapes.

Guidelines for ToR for the PCR component:

In case of a sub-project which is not expected to have any impacts on PCR, it may be sufficient to include procedures for chance finds (Appendix H). In case of Category "B" project where there may be a likely impact on PCR due to activities carried out under any of the sub-projects, the ToR may be tailor-made to the specific requirements. The ToR is expected to include potential major PCR issues, the likely impacts on PCR, the PCR impact areas, which will set boundaries for collecting the PCR baseline data along with any specialized PCR knowledge or skills required. In projects such as the proposed project, since the subproject locations are not yet determined, it will not be possible at this stage to identify the PCR impact areas and the type of PCR data that should be collected. In such cases, the ToR should require the EA team to establish these parameters at the beginning of the assignment, and propose provisions for identifying and managing PCR during project implementation. The EA report for the corresponding sub-projects should be modified accordingly to incorporate the issues related to PCR in those cases. The investigations and findings with respect to PCR should form an integrated part of the EA report since OP 4.11 does not call for a separate report. Therefore the ToR for consultants for the generic EA assessment of sub-projects would still be valid with a few additional assignments on behalf of the consultants with respect to PCR:

- Regulatory environment: (Identification of any regulations and guidelines which will govern the conduct of the assessment) This 4.should also list any relevant national acts or regulations pertaining to the safeguarding of PCR
- Background information: (description of the physico-chemical, ecological and socioeconomic environment) All registered and unregistered, movable or immovable PCRs in the sub-project areas need to be identified in this part preferably using visual identification, consulting with local people. The report should have descriptions and visual illustrations of the PCRs.
- Impact assessment: (the consultant will identify the likely biophysical and social impacts in sufficient detail to be able to design suitable mitigation measures). Impacts on all types of PCR should be considered, both natural and man-made, registered and unregistered, movable an immovable.

- Analysis of alternatives: (the consultant will include PCR aspects when considering alternative projects or project locations)
- Environmental Management Plan including institutional arrangement for implementation and monitoring: (The ToR should state that mitigating measures arising from PCR impacts should be agreed to by the concerned and affected parties before they are submitted as recommendations in the ESMP.)
- Public Participation (The ToR should point out the importance of the consultative process for the physical cultural resources component)

Appendix F: Envoronmental Code of Practice

Environmental Code of Practice (ECoP)

The Environmental Code of Practice (ECoP) is a guideline for reduce or eliminate environment risk due to various activities associated with the Installation of SVC/Capacitor Bank and reconductoring of 230/132kV Transmission Lines of PGCB.

ECoP 1.0: Planning and Design Phases of a Project

1.1 General

This code of practice 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 4.0: Overhead Power Cable reconductorin

4.1 General

Reconductoring of 230kV/132kV transmission lines of the PGCB involves:

i. Informing the local community about the installation schedule;
ii. 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 Transmission Cable Reconductoring 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 Transmission Cable Reconductoring Activities by the Contractor

- The contractor shall submit the schedules and methods of operations for various items during the overhead power cable reconductoring 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 7.0: Construction Camps

7.1 General

ECoP 7.0 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 Siting

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 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.

7.3 Construction Camp Location

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.

7.4 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.

7.5 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 ECoP11.0.

- 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.

7.5.1 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.

7.6 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 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

i. Construction Waste;
ii. Domestic waste;
iii. Discarded conductors from rehabilitated power lines; and
iv. 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. (see also 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 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:

i. Earth moving
ii. Removal of vegetation
iii. 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:

i. Restriction on use of water during construction, if any, should be intimated to the community in advance.
ii. Alternate access to the water body is to be provided in case there is interruption to use of exiting access.
iii. 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:
  i. 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.
  ii. 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 15.0: Electromagnetic Field (EMF)

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:
  - Shielding with specific metal alloys

- Burying transmission lines21
- Increasing height of transmission towers
- 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:
  i. Location of project activities,
  ii. Borrow areas,
  iii. Extent of work
  iv. Time of construction
  v. Involvement of local labors in the construction
  vi. Health issues - exposure to dust, communicable diseases etc.

16.3 Construction Phase

- The Contractor shall schedule the construction activities , such as:
  i. Sowing of crops
  ii. Harvesting
  iii. Local hindrances such as festivals, etc.
  iv. 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) is 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.

17.3Environmental 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:

1. 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?
2. Stop the flow of product, if it can be done safely.
3. Notify the Engineer and Authorities immediately.
4. 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 ECoPs.
- 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 Safety[22]

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
- Electric and magnetic fields
- Exposure to chemicals

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,

[22]IFC Environmental.Health and Safety Guidelines for Electric Power Transmission and Distribution

- 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 toaddress occupational exposure may include limiting exposure time through work rotation, increasing thedistance 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

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 toprevent 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.

Health And Safety Requirements And Procedures

A. Personal Protective Equipment (PPE)

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

- Coveralls (Tyvek jumpsuit) with hood
- Protective boot covers
- Full-face respirator
- Protective gloves
- Heavy duty gauntlets or ductile taping of pant's ankles to boot covers, and wrists to gloves
- Hard hat for overhead dangers and head protection
- Goggles for eye protection

The main danger when handling liquids with high PCB concentrations is skin absorption. Careful consideration must be given to the selection of protective clothing including coveralls, boots or boot covers, gloves and eye protection. Clothing and footwear must be resistant against splash and spills. For major spill clean-up operations, a full suit of non-porous material is appropriate. Disposable coveralls and PCB resistant knee length safety boots shall be used.

Eye protection against liquid splashes is necessary. Goggles are adequate for this purpose. Chemical safety goggles face shield, or safety glasses with side shields are satisfactory. Working with hot fluid must be avoided since fumes may be generated when PCB fluids are heated above 55°C. Protective equipment must also be worn to prevent inhalation of fumes. A full-face respirator fitted with a cartridge suitable for PCBs shall be used and ventilation of the working area must be sufficient to dispose the generated vapors. If the respirator becomes slightly contaminated or clogged, wipe the respirator with a paper towel and kerosene. If the respirator becomes heavily contaminated, it shall be disposed of in accordance with this code of practice.

PCBs will penetrate most materials, but certain materials including natural rubber are particularly permeable to PCBs and are thus unsuitable for use as protective clothing. Chemical resistant fluorinated rubbers or elastomers are more suitable and laminated materials offer the best protection against PCBs. For continuous handling of PCB, resistant Viton, polyethylene, butyl rubber, nitrile rubber or neoprene gloves shall be used. No material is completely impervious to PCBs and therefore it is necessary to make certain that arrangements are in place to regularly change all PPE. The equipment supplier will normally provide details on the rate at which PCBs permeate protective equipment. This information

will be useful in estimating, for each task, the time it takes for PCBs to penetrate through the protective equipment. This is known as the breakthrough time. This will depend on the frequency and duration of contact of the protective equipment and clothing with PCBs and may vary from one task to the next. The supplier should be able to provide typical breakthrough times for the different applications and advise if

there is a need to reduce this time to allow for other factors such as abrasion. If rubber boots are used, the boots need to be regularly discarded. The foot protection reinforced by the use of disposable boot covers. For laboratory work, laboratory coats and suitable disposable gloves are necessary for protection against skin contact. If there is a danger of dust or fume formation (for example by heating) then the use of a fume hood is recommended. It will be necessary to treat all potentially contaminated protective equipment as PCB waste and dispose of it accordingly and decontamination and reuse is not allowed.

Safety Procedures

Preference should be given to the use of disposable protective clothing due to difficulty in decontamination. Contaminated protective clothing should be promptly removed and the area of skin contaminated with PCBs should be washed with or rinsed immediately. Level C PPE respirators must be worn. For work at normal temperatures, a suitable type is a full face-piece respirator with an appropriate cartridge. For high temperature or work in confined space, Level B PPE that includes a self contained breathing apparatus (SCBA) is required. Workers should be trained before they are allowed to use this type of breathing apparatus. If the respirators do not have eye protection, the chemical type goggles must be worn. Hands must be washed after handling PCBs (even if wearing full protection) before eating, drinking, smoking or using toilet facilities initially with waterless hand cleaners and paper towels, which shall then be disposed of in accordance with this code of practice.

The Cost Estimation of ECoPs

Some activities included in ECoPs have certain monetary involvement. The generic method of determining the cost of the ECoP is outlined below:

1. The Engineer of the PGCB will carry out a survey of the intended project site to identify appropriate locations and also identify sites unsuitable in terms of topography, proximity to water courses, and environmental sensitive areas such as forests, wetlands, or other sensitive area.
2. Survey and monitoring works must be carried out, by Engineer appointed by the PGCB authorities, throughout the pre-construction, construction, and post-construction phases to make sure the items and specifications (e.g. low cost sanitation facilities, top soil management, waste disposal, tree plantation, storm water drainage, etc.) provided in this ECoP are properly addressed and estimated the cost.

Appendix G: Participants Lists and Photographs

List of participants of Consultations

Participants List of Public Consultation Meeting (PCM)

Village/Mouza: Soydabad
Union: Soydabad Union Parishad
Upazilla: Sirajganj Sadar.
District:: Sirajganj
Date:

SL No	Name	Age	Occupation	Mobile No/Address	Signature
01.	মোঃ নজীবুল ইসলাম	৩৪	মেম্বার	01712351930	[illegible]
02.	মোঃ আমজাদ উদ্দিন	৬১	[illegible]	01717-051316	[illegible]
03.	মোঃ বেলাল হোসেন	44	কৃষক	01740561544	বেলাল
04.	মোঃ আঃ আজিজ	৫৬	ইউপি সদস্য	01725567730	আজিজ
05.	মোঃ [illegible]	৪০	ইউপি সদস্য	০১৭২৬-৯৮৬১২৮	[illegible]
06.	মোঃ [illegible] সরকার	৪৭	ইউপি সদস্য	[illegible]	[illegible]
07.	মোঃ আব্দুল মান্নান	[illegible]	ইউপি সদস্য	[illegible]	মান্নান
08	মোঃ [illegible] ইসলাম	৩০	ব্যবসা	[illegible]	[illegible]
09.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.	[illegible]	৩০	[illegible]	[illegible]	[illegible]
11.	মোঃ করিম	৫০	"	[illegible]	মোঃ করিম
12.	মোঃ [illegible]	৫৫	"	[illegible]	[illegible]
13.	" [illegible]	৫৫	"	[illegible]	[illegible]
14.	[illegible]	৬০	"	[illegible]	[illegible]
15.	মোঃ [illegible]	৪০	[illegible]	[illegible]	[illegible]
16.	মোঃ [illegible]	৩৪	[illegible]	01750936138	[illegible]
17.	মোঃ [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18.	মোঃ [illegible]	৪২	[illegible]	[illegible]	[illegible]
19.	মোঃ [illegible]	৩৮	[illegible]	[illegible]	[illegible]
20.	মোঃ [illegible]	৩৮	[illegible]		মোঃ [illegible]

Participant List for Sirajganj to Bogra -001

Participants List of Public Consultation Meeting (PCM)

Village/Mouza: Soydabad.
Union: Soydabad Union Parishad.
Upazilla: Sirajganj Sadar
District:: Sirajganj
Date:

SL No	Name	Age	Occupation	Mobile No/Address	Signature
01.	[illegible]	22	[illegible]	01878477506	[illegible]
02.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
03.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
04.	[illegible]	[illegible]	[illegible]		
05.	[illegible]	[illegible]	[illegible]	01729104115	[illegible]
06.	[illegible]	[illegible]	[illegible]		[illegible]
07.	[illegible]	[illegible]	[illegible]	01763-466387	
08	[illegible]			[illegible]	[illegible]
09.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					

Participant List for Sirajganj to Bogra -002

Participants List of Public Consultation Meeting (PCM)

Village/Mouza:
Union: Mirzapur
Upazilla: Shoilokupa
District:: Jhenaidah
Date: 20.10.16

SL No	Name	Age	Occupation	Mobile No/Address	Signature
01.	মোঃ আসাদুজ্জামান	৩৯	ইউপি সদস্য	০১৭১১৯৬২৫২৫৭	
02.	মোঃ সাহিদ হোসেন	৩০	ব্যবসা	০১৯৩৯-১৫২৪৬১	মোঃ সাহিদ হোসেন
03.	মোঃ আমিরুল ইসলাম	৪০	চাকরিজীবি	০১৭২৫-১৮৬৬১৫	20/10/16
04.	মো: নজরুল ইসলাম	৪৯	ব্যবসা	01994529560	
05.	মোঃ আনোয়ার হোসেন	৩৬	চাকুরি	01721-951655	Anwar
06.	মোঃ আতিক	৫০	সদস্য	01721-362654	মোঃ আতিক
07.	মোছা: রুলমা খাতুন	৩০	সদস্য	01929044937	রুলমা
08	মোছা: বিথি খাতুন	৩০	সদস্য	01736244837	বিথি
09.	মো: কামরুল	৪০	সদস্য	01789101028	[illegible]
10.	[illegible]	৬০	চাকুরী	01924-765433	[illegible] 20/10/16
11.	মো: কামরুজ্জামান	৩০	চাকরি	01710038598	20/10/16
12.	[illegible]	৪৯	[illegible]	01767849989	
13.	আয়েশা খাতুন	৩০	চাকুরী	01917461597	
14.	[illegible]	৪৫	চাকুরী	01706732126	
15.	[illegible]	৫৫	চাকুরী	01923858811	[illegible]
16.	মো: আনোয়ার হোসেন	৪৫	ব্যবসা	01718039929	আনোয়ার
17.	[illegible] খাতুন	৪০	গৃহিনী	01741752061	
18.	মোঃ [illegible]	৪৫	ব্যবসা	01720142371	[illegible]
19.	কাজী মনোয়ার	৫৬	[illegible]	01956-092804	মনোয়ার
20.	মোঃ [illegible]			01797183336	[illegible]

Participant List for Kushtia to Jhenaidah – 001

Participants List of Public Consultation Meeting (PCM)

Village/Mouza:
Union: Mirzapur
Upazilla: Shoilokupa
District:: Jhenaidah
Date: 20.10.16

SL No	Name	Age	Occupation	Mobile No/Address	Signature
01.	মোঃ আসাদুজ্জামান		ইউপি সদস্য	০১৭১৯৮৬২৫২৫৭	[illegible]
02.	মো: সাইফুর রহমান	৩৬	[illegible]	01716851222	[illegible]
03.	[illegible]	৩৫	কৃষি	01839724267	[illegible]
04.	হালিমা	৪০	গৃহিনী	—	হালিমা
05.	লিপি	৬০	গৃহিনী	—	[illegible]
06.	আনোয়ার	২০	কৃষি	01782036017	আনোয়ার
07.	বাদশা	৬৫	কৃষি	[illegible]	বাদশা
08	হাশেম আলী	১৮	কৃষি	[illegible]	হাশেম
09.	মোঃ আনিসুর রহমান	৫৯	[illegible]	[illegible]	[illegible]
10.	শেফালী রানী সরকার	৫৪	[illegible]	01740568354	[illegible]
11.	মোছা: [illegible] খাতুন	৩২	গৃহিনী	01770322381 ~~01770355581~~	[illegible]
12.	মো: শাকিল হোসেন	[illegible]	ছাত্র	[illegible]	শাকিল
13.	মো: সুমন হোসেন	১৮	ছাত্র	[illegible]	সুমন
14.	মো: সবুজ হোসেন	১৯	ছাত্র	01760188786	সবুজ
15.	মো; আল-আমিন	20	ছাত্র	01764525026	আল-আমিন
16.	আব্দুস সাত্তার	61	ইউপি সদস্য	01923240991	আব্দুস সাত্তার
17.	রেজাউল মোল্লা	৫৪	সদস্য	[illegible]	রেজাউল
18.	~~[illegible]~~	৫০			
19.	মো: [illegible] আলী	৬০	কৃষি	[illegible]	[illegible]
20.					

Participant List for Kushtia to Jhenaidah – 002

Participants List of Public Consultation Meeting (PCM)

Village/Mouza: Palash
Union: Ghorashal / ward-2
Upazilla: Palash
District:: Narsingdi
Date:

SL No	Name	Age	Occupation	Mobile No/Address	Signature
01.	Shamsun Uddin	65	Business	01728207407	
02.	Nazrul Islam	55	Business	01728207407	
03.	Santosh Satardhar	65	Mistri	01817593299	
04.	Md. Azhar Mia	43	Business	01992307703	
05.	Md. Ismail Hossain	29	Driver	01735312508	
06.	Jahanara Begum	40	Housewife	01963920466	
07.	Nilufa Akhtar	27	Housewife	01714212049	
08	Sobrata Dhar	50	Farmer	01724093187	
09.	Birendra Chandra	65	Farmer	01796463479	
10.	Narayan Chandra	55	Farmer	01712461447	
11.	Parimal Chandra	52	Business	01721233170	
12.	Niranjan Dhar	55	Teacher		
13.	Mohan Ali	55	Service Holder		
14.	Shapan Dt Nath	40	Farmer		
15.	Tapan Nath	22	Student	01756468764	
16.	Ibrahim Mia	40	Business		
17.	Jalal Uddin	70	Retired	01720 161163	
18.	Monjit Dhar	48	Farmer	01756883336	
19.	Titu Fakir	35	Farmer		
20.	Rani	30	Housewife	01732799922	

Participant List for Ashuganj to Ghorasal – 001

Participants List of Public Consultation Meeting (PCM)

Village/Mouza: Palash
Union: Ghorashal
Upazilla: Palash
District:: Narshingdi
Date:

SL No	Name	Age	Occupation	Mobile No/Address	Signature
01.	Abdul Latif	65	PDB Retired	01786069 36	
02.	Mizanur Rahman Tipu	46	Business	01711732083	
03.	Md. Babulmia	50	Business	01726292113	
04.	Mostafa Mia	60	Business	01726292113	
05.	Shahjahan Mia	65	Raj mistri	01728207407	
06.	Munir Hossain	45	Business	01917477004	
07.	Abdur Shobhan	25	Teacher	01938042138	
08	Md. Aliullah Mia	48	Farmer	01922783724	
09.	Almadan Hossain	42	Business	01963920666	
10.	Bashir Ahmad	45	Rickshaw Puller	01971306117	
11.	Momin Mia	45	Probashi	01726292113	
12.	Khorshed Alam	45	service Holder	01710023803	
13.	Hiron mia	60	Farmer	N/A	
14.	Abdul Aziz	75	Mistry	01980301993	
15.	Rawshan Ali	55	Rickshaw puller	01938042138	
16.	Mintu Mia	40	Driver	01721929609	
17.	Ziarul Haq	62	Laboon	01991089184	
18.	Aminun Islam Titu	55	Business	01716943399	
19.	Shumi	40	Probashi		
20.	Taslima	45	Housewife		

Participant List for Ashuganj to Ghorasal – 001

Some photographs of public consultation meeting during field visit are given below.

Public Consultation Meeting at Soydabad Union Parishad in Sirajganj

Public Consultation Meeting at Mirzapur Union Parishad in Jhenaidah

Public Consultation Meeting at local community in Palash under Narshingdi

Appendix H: Guideline for Preparation of RAP

Appendix H (a)

FORM 2: FORMAT FOR VOLUNTARY DONATION OF LAND

Voluntary Donation of Land

On a Tk. 300/- Stamp Paper

1. This deed of voluntary donation is made and executed on the ..... day of .....…… between Mr/Ms .....S/o W/o…….. Age…… Occupation …… resident of ..... herein after called the "Title holder" on one part. This expression shall mean and include his/her legal representatives, successors – in interest, heirs, assignees, nominees, and the like.

AND

Mr/Ms. ……..…… S/o …….. Aged……. Designation…… herein after called the "Recipient" which term denotes to "for and on behalf of the …….. ……. PGCB" on the other part and shall mean and include his/her official successors –in-office, nominees and assignees, etc.

2. Whereas, the details of the Location of the, land are given below:

Location Details	
Mauza	
Mahalla	
Road	
Title Holder	
Name of Title Holder	
Father/ Husband's Name of Title Holder	
Age occupation Residence	
Gender	
Schedule - Land Details/Structure	
Land in Question	
Area	
Location	
North Boundary	
East Boundary	
West Boundary	
South Boundary	

Note: Detailed Map to the scale is appended.

1. Whereas the Title Holder is presently holds the transferable right of the above mentioned piece of land at the location mentioned above.
2. Whereas the Title Holder testifies that the land is free of encumbrances and not subject to other claims/ claimants.
3. Whereas the Title Holder hereby voluntarily surrenders the land/structure without any type of pressure, influence or coercion what so ever directly or indirectly and hereby surrender all his/her subsisting rights in the said land with free will and intention. The title to the land so donated will be transferred to the PGCB in due course before award of project works contract.
4. Whereas the Recipient shall construct and develop urban infrastructure and take all possible precautions to avoid damage to adjacent land/structure/other assets and compensate any physical assets on the subject land at full replacement cost to the owner of the physical assets and take liability to rehabilitate the incumbent for livelihood restoration.
5. Whereas both the parties agree that the infrastructure so constructed/developed shall be for the public purpose.
6. Whereas the provisions of this agreement will come into force from the date of signing of this agreement.

Signature of Title Holder		Signature of Local Revenue Collector	
Name of Title Holder		Name of the Local Revenue Collector	
Date		Date	
Identified by			
1.			
2.			

Witnesses	
Signature of PBS Chairman	
PBS Chairman Name	
Signature of Chairman (Upazila) / Mayor (Urban)	
Name of the Chairman / Mayor	
Signature of Local NGO Representative	
Name of the NGO Representative	

Appendix H (b)

Suggested Methods for Market Price Surveys

In line with the proposed compensation principles, PGCB assisted by the consultants, will conduct market price surveys to determine the replacement costs of acquired lands, houses/structures and other replaceable assets and market prices of irreplaceable assets by using the methods suggested below.

Lands of All Kinds

The surveys will explicitly take into account the quality of the lands under acquisition. Quality will take into account current uses, cropping intensity and value of crops produced, accessibility from the existing roads, and any other characteristics that influence the lands' market value. The survey will be conducted on the following three groups of respondents:

- A random sample of 10-15 landowners in the mouza in which a subproject is located and in those adjacent to it;
- As many of most recent buyers and sellers of similar lands can be found in the same and adjacent mouzas; and
- Deed writers, as many can be found and agree for interviews, at the land registration offices, who recently handled transactions in the same or adjacent mouzas. (They will be asked about the actual prices, not those written in the deeds.)

Market value of the lands will be determined in the following manners:

- If variations in average prices reported by the three respondent groups are insignificant (or, are 10% or less), current value of the land will be fixed at the average of the prices reported by the three groups.
- In cases of significant differences (more than 10%), the current price will be negotiated in open consultations with the affected and other landowners, community leaders, CBOs/NGOs and the like.

Replacement cost will equal the market value, plus the registration cost or stamp duty. The registration cost will be calculated on the current market price.

Houses and Other Built Structures

Replacement costs will be based on the current prices of various building materials, labor and other cost items in the local markets. The costs of building materials, such as bricks, cement, steel, sand, bamboo, timber, GI sheet, roofing materials like straw, golpata, etc, and labor will be based on:

- Survey of current prices of different types of materials with five or so dealers/manufacturers in the local markets.
- The replacement cost of the house/structure will be based on the lowest quoted price for each type of material, plus their carrying costs to the sites.
- The current costs of labor with different skills will be determined by interviewing local contractors, assigned Upazila engineers, or local construction workers.

Replacement costs of any other items will be determined based on the current prices of materials, labor, etc. As and when required, PGCB will seek technical assistance of assign Upazila engineers and the project consultants for estimates of materials and labor for

particular structures.

Trees & Other Irreplaceable Assets

Current market price of trees will be determined based on (a) Net Present Value or (b) Current age, life span, productivity and current market price of output. Market prices of different varieties of trees will be determined by surveying the prevailing prices paid by five or so timber and fuel-wood traders in the local markets. The compensation for trees will be fixed at the highest prices offered by a trader.
Compensation for all other irreplaceable assets will also be based on survey of their prevailing prices with dealers/traders in the local markets.

Fruits and Other Crops

Compensation will be fixed at the harvest prices of the fruits and other crops. Harvest prices of different varieties of fruits and crops will be collected from a sample of 7-10 dealers in the local markets. The compensation for each type of fruit and crop will be fixed at the highest price offered by trader.

The market price surveys will begin as soon as locations of the required acquisitions (or lands obtained through other means) are identified on the ground. PGCB will document the replacement costs and market prices of various affected assets and make them available as and when asked for review by PGCB and WB.

Appendix H(c)

Compensation and Entitlement Matrixes

Matrix No.	Type of Loss	Application	Entitled Person	Compensation
M – 1	Arable land (public and private)	Less than 20% of land holding lost, the remaining land is economically viable	Titleholder (private)	• Cash compensation for lost land at replacement cost.
		More than 20 percent of land holding lost OR where less than 20% holding lost but the remaining land becomes economically unviable	Titleholder (private)	• Cash compensation at replacement cost. • Transition allowance equivalent to one year's cash return from the land.
			Tenant/lease holder (private / public)	• Cash compensation equivalent to the replacement value of gross harvest for one year or for the remaining period of tenancy agreement, whichever is greater.
			Agricultural labor (private/ public)	• Cash compensation equivalent to 6 months' wage and assistance in getting alternative employment.
			Squatter/ encroacher (private / public)	• Relocation assistance equivalent to one year's cash return from the land they occupy.
M – 2	Residential/ commercial land (public and private)	Less than 20% of land holding lost and remaining land viable for present use	Titleholder (private)	• Compensation in cash at replacement cost. • Relocation assistance as stipulated under matrix 3. • Restoration of pre-acquisition basic utilities (water supply & sanitation, electricity, etc.)
		Morethan20% holding affected OR where less than 20% holding affected but the remaining area becomes smaller than minimally accepted under the zoning laws and unviable for continued use	Titleholder (private)	• Compensation at replacement cost. • Transition allowance equivalent to one year's return from the land • Relocation assistance as stipulated under matrix 3. • Restoration of pre-acquisition basic utilities (water supply & sanitation, electricity, etc.)
			Tenant/ leaseholders (private / public)	• Cash compensation equivalent to the three months rent or for the remaining period of tenancy/lease agreement, whichever is greater.
M – 3	Structures on acquired land or affected on existing land	Structures partially affected but the remaining structure viable for continued use.	Owner with valid title to land or with valid lease deed for the land	• Compensation in cash for affected portion of the structure and other fixed assets at replacement cost, and • Assistance in restoration of the remaining structure • Repair Allowance, minimum 20% of compensation

Matrix No.	Type of Loss	Application	Entitled Person	Compensation
	vacated for project purpose (permanently or temporarily)		Squatters	• Compensation in cash for affected portion of the structure • Transfer/shifting allowance. • Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity.
			Tenants	• Cash compensation equivalent to 3 months' rental allowance • Transfer/shifting allowance • Assistance in alternate rental accommodation.
			Encroachers	• Early notice on the demolition • Technical advice in demolition, relocation and repairing of affected structure • Payment for repairing only those damages to structure resulting from demolition, if required • Transfer/shifting allowances, if required • Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity.
		Entire structure affected OR where structures partially affected such that the remaining structure is unviable for continued use.	Owner with valid title to land or with valid lease deed for the land	• Compensation in cash for entire affected structure and other fixed assets (wells, electric and water connections, etc.) at replacement cost, without depreciation. • Transfer/shifting allowance. • Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity.
			Tenant	• Cash compensation equivalentto3months' rental allowance • Transfer/shifting allowance • Assistance in alternate rental accommodation.
			Squatters	• Compensation in cash for affected structure • Transfer/Shifting allowance • Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity. • Early notice for eviction and demolition • Technical advice in demolition or repairing of affected structures
			Encroachers	• Early notice on the demolition before no less than 60 days. • Technical advice in demolition, relocation and repairing of affected structure

Matrix No.	Type of Loss	Application	Entitled Person	Compensation
				• Payment for repairing only those damages to structure resulting from demolition, if required • Transfer/shifting allowances • Transition allowance for three months' equivalent to the rent of similar structure in the same vicinity.
		Affected female headed households	Female head of household (titled or non-titled – squatters and encroachers)	• Female headed household affected with structures will be entitled for additional financial assistance equivalent to 3 months' subsistence cost for the incumbent household.
M – 4	Loss of business /income or employment due to displacement	Temporary or permanent loss of business/ incomes/ employment	Affected individuals (titled/non-titled)	• Employment in reconstructed enterprise or package for re-employment or starting business for affected employee. • Transition allowance for the permanent loss of business, incomes &wages equivalent to the loss of income/wages for a period of 6 months for each affected member of households. • In case of temporary relocation and temporary loss of business incomes, compensation will be wages equivalent to closure period OR Alternative business site for continued income stream. • Re-allocation of market corners or shops after construction to the original market trader.
M - 5.	Standing crops on affected lands	Crops affected by temporary acquisition/easement	Owner of affected crops(titled/non-titled)	• Compensation in cash at market value.
M – 6	Trees on affected lands	Trees lost	Owner of affected trees(titled/non-titled)	• Compensation in cash calculated on the basis of type, age and productive value of affected trees.
M - 7	Loss of public infrastructure	Infrastructure (electric water supply, sewerage &telephone lines; public health center; public water tanks)	Relevant agencies.	• Compensation in cash at replacement cost to respective agencies or restoration of affected assets.
M - 8	Unforeseen Losses	As identified	As identified	• Appropriate mitigation measures as determined to meet the objectives of this policy framework

Appendix H(d)

Outline of RAP

Resettlement Action Plan (RAP)

Project Background	Brief introduction about the project, description of project interventions and areas of jurisdiction of PGCB, description of project components causing resettlement, scope resettlement, an account of the alternatives considered to avoid and/or minimize the adverse impacts
Census and Socioeconomic Surveys	Identify all categories of PAP and their vulnerability, identify all categories of impacts (loss of property and assets, loss of livelihood; impacts on groups and communities, impact on physical cultural resources) An account of impacts by gender and vulnerability due to project and the special assistance that is to be provided
Participation and Consultation	An account of the disclosure of SMF and consultations with the project affected people/households about the mitigation measures and implementation procedure;
Legal and policy framework	Analysis of the legal framework for compensation, applicable legal and administrative procedures, gaps between local laws and the Bank's resettlement policy, and the mechanisms to bridge such gaps;
Compensation Entitlements	Description of compensation and other resettlement assistance that will be provided according to the principles and guidelines adopted in this SMF;
Relocation and Livelihood Restoration	Description of resettlement sites and programs for improvement or restoration of livelihoods and standards of living
Grievance redress mechanism	Describe specific arrangement and procedure for receiving and resolution of complaints and grievances from the PAP and their community
Resettlement Budget	Resettlement budget with breakdowns by loss categories and the number of persons entitled to compensation/assistance Specific compensation rates and standard of entitlements and EPs/households for different types of losses Fund flow and disbursement procedures
Implementation Arrangement	Institutional arrangement and management of preparation and implementation of resettlement activities, grievance resolution, property assessment and valuation, and implementation time schedule
Monitoring and Evaluation	Describe monitoring arrangement involving PMO and PGCB and mechanism for independent review and evaluation as well as reporting

Abbreviated RAP

Project Background and Impacts	Description of project interventions, assessment of land needs (private and public lands, including PGCB own) for the civil works in each polder, screening of physical cultural resources, a census survey of PAP, and valuation of the affected assets;
Legal and policy framework	Analysis of the legal framework for compensation, applicable legal and administrative procedures, gaps between local laws and the Bank's resettlement policy, and the mechanisms to bridge such gaps;
Compensation Entitlements	Description of compensation and other resettlement assistance that will be provided according to the principles and guidelines adopted in this SMF;
Participation and Consultation	An account of the consultations with the displaced persons/households about acceptable alternatives;
Grievance redress mechanism	Describe specific arrangement and procedure for receiving and resolution of complaints and grievances from the PAP and their community
Budget and Implementation Schedule	A resettlement budget with breakdowns by loss categories and the number of persons entitled to compensation/assistance, and an implementation schedule;
Monitoring and Evaluation	Describe monitoring arrangement involving PMO and PGCB and mechanism for independent review and evaluation as well as reporting