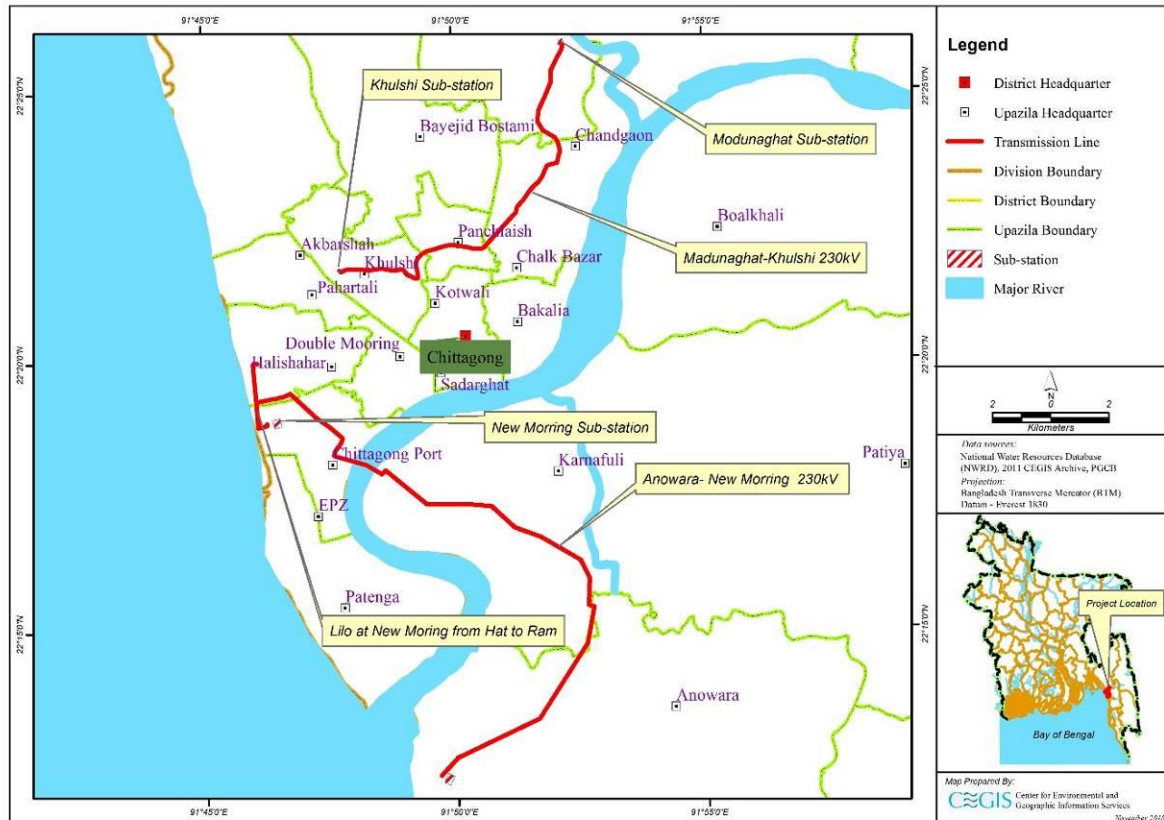


Bangladesh

Power System Upgrade and Expansion Project

Chattogram



Environmental and Social Impacts

Assessment (ESIA)

Power Grid Company of Bangladesh (PGCB)

March 2019

Executive Summary

The present Environmental and Social Impact Assessment (ESIA) has been conducted for the proposed Power System Upgrade and Expansion Project (PSUEP) in Chattogram (formerly, Chittagong), which is located in southeastern part of Bangladesh. The Government of Bangladesh (GoB) through the Power Grid Company of Bangladesh (PGCB) intends to undertake this project and seeks financial assistance from the Asian Infrastructure Investment Bank (AIIB) for this purpose.

Background

Chattogram is the second largest city in the country with a population of 2.84 million in the city center, and over 4.0 million in the metropolitan areas.¹ The region boasts vibrant residential, commercial and industrial sectors with robust and rapidly growing demand for electricity. Power supply in the region has not kept up with demand growth. Much of the growing demand in the region remains unserved due to power supply shortages and network failures. In addition to supply shortages, the reliability of power supply has also been rapidly deteriorating. A majority of manufacturing and service firms in the region identified shortage of reliable electricity as the most important constraint they face to smooth operations and expansion.

PGCB is currently the entity responsible for operating and developing power transmission networks in the country. PGCB has undertaken several projects to build new transmission lines and substations. The proposed Project is in line with PGCB's development plan and will construct 230kV and 400 kV double-circuit transmission lines with a total length of 46 km and associated substations/line bays in the Chittagong region. Upon Project completion, a better extended and more strengthened transmission network will make private sector participation in power generation much easier.

Project Overview

The proposed Project includes: (a) laying of a 20-km long Anowara to Anandabazar (New Mooring) 400 kV double-circuit overhead and underground transmission line; (b) a 3-km long Hathazari to Rampur 230 kV double-circuit underground cable; (c) laying of a 16-km long Madunaghat to Khulshi 230 kV double-circuit underground transmission line; (d) establishing a gas insulated switchgear (GIS) substation at Anandabazar (New Mooring) with two 350/450 mega-volt-ampere (MVA) transformers; (e) establishing a GIS substation at Khulshi with two 350/450 MVA (230/132kV) and three 80/120MVA (132/33kV) transformers; and (f) installing two bay extensions at GIS substation at Madunaghat. Upon completion, the transmission lines and associated substations will collectively provide 1,400 MVA transmission capacity at different voltage levels.

The key construction activities will include excavation for transmission line tower and substation building foundations, construction of substation buildings and installation of equipment, erection of lattice steel towers, stringing of conductors on these towers, excavation of trenches for underground cables and laying of cables in these trenches before backfilling. The contractor will establish temporary facilities including construction camp, machinery yard,

¹ Bangladesh Population Census 2011, Bangladesh Bureau of Statistics.

site office, and material storage area. These facilities are likely to be established inside the substation premises.

The key operation and maintenance (O&M) activities of the proposed substations and transmission lines would include routine inspection of transmission lines, repairing or replacing any faulty equipment at the substations, repairing or replacing any damaged transmission line tower, repairing or replacing any damaged conductor or underground cable, and attending to system faults.

Study Objectives

The present ESIA aims to address the potentially adverse impacts of the project on the physical and biological environment as well as on people – in order to make the project environmentally sustainable and socially acceptable. The ESIA has been carried out in accordance with: a) the Bangladesh national regulatory requirements specifically Environment Conservation Act, 1995 and Environment Conservation Rules (ECR), 1997, amended in 2017 as well as other related national and local laws and regulations; and b) the AIIB's Environmental and Social Policy and the Environmental and Social Standards.

Analysis of Alternatives

As part of the present ESIA, technical, financial, environmental, and social aspects were analyzed for the several project alternatives including 'no-project' alternative, substation technology, substation siting, transmission line types, and transmission line routes.

The 'no-project' alternative was rejected because without the project, the electricity network in the Chattogram region would not be able to support the rapidly growing commercial and industrial activities as well as residential areas, nor would any growth in the region's commercial and industrial activities be possible; and as a result, the Country will also not be able to sustain economic growth.

Two broad options for substation technologies were considered: conventional, air insulated switchgears (AIS); and technologically more advanced gas insulated switchgears (GIS). The AIS substations are generally lower in cost, however they need much larger area, in addition to posing greater electrocution risks to the maintenance workers as well as general public. The GIS system on the other hand can be established in much smaller area and being totally enclosed, poses far lesser electrocution risks to maintenance worker and general public. Also, the GIS systems offer a greater system reliability. In view of the smaller land requirements, greater safety against electrocution, and better system reliability, the GIS technology has been selected for the proposed project.

Several options were considered for the Khulshi substation siting. The first candidate site is located besides the existing substation building, belongs to Bangladesh Power Development Board (BPDB), and supports thick vegetation; the second site is located in front of the existing substation building and belongs to PGCB; while the third site is located over a hillock at a small distance from the existing substation and is owned by BPDB. The second candidate site has finally been selected, in view of the higher environmental impacts associated with vegetation clearance and land leveling associated with first and third candidate sites, respectively, as well as their higher cost of land (being owned by BPDB). For the New Mooring substation, a similar analysis was not carried out as part of the present ESIA, since the land of this facility has already been acquired under an earlier project.

Two broad alternatives were considered for the types of transmission lines: overhead and underground. The overhead transmission lines are generally used in rural/unpopulated areas,

require substantial construction works for the transmission line towers, restrict the land use and reduce the land value, and pose safety risks for the people, livestock, and wildlife. The underground transmission lines are generally used in congested urban areas where installation of overhead transmission line is quite difficult, are higher in initial cost, generally use existing right of way (RoW), and pose a smaller safety risk. For the proposed project, a combination of these two alternatives has been selected: overhead transmission lines have been selected for area under cultivation while underground transmission lines have been selected for congested urban areas.

Finally, the proposed transmission line routes have been selected keeping in view the availability of existing RoW (mostly, along the existing roads), distance from urban areas and settlements, river crossing, and distance from the coastline.

Baseline Conditions of the Project Area

The proposed project will be located in a combination of cultivated and urban, built-up area in Chattogram. The key aspects of the project area are summarized below.

Administratively, the project area is located in eight Upazilas (sub-districts) of Chattogram district. About 1.5 million people live in this area comprising about 287,000 households. The average literacy rate in the study area is 64.6 percent, higher than national average of 61.5 percent. About 45.8 percent of the population (age 7+ not attending school) is employed in different sectors. About 63.6 percent of the employed people, including 48.06 percent males and 15.54 percent females, are engaged in the service sector. Another 28.31 percent people, including 15.39 percent males and 12.92 percent female, are engaged in the industrial sector. A very small portion of people (8.1 percent) are engaged in the agricultural sector. About 56 percent of people are dependent on tube-well as their main source of drinking water. Availability of electricity in the area is more than 91 percent.

Topographically, Chattogram straddles the coastal foothills of the Chattogram Hill Tracts in southeastern Bangladesh. The Karnaphuli River runs along the southern banks of the city, including its central business district. The river enters the Bay of Bengal in an estuary located 12 km south-southwest of downtown Chattogram. Mount Sitakunda is the highest peak in Chattogram District, with an elevation of 351 meter (1,152 ft). Within the city itself, the highest peak is Batali Hill at 85.3 meter (280 ft).

Karnaphuli river is the major water source of the area, originating from the Lusai hill in the Assam state of India. It travels through Dighinala, Khagrachari, Kaptai, Boalkhali, Rangunia, Raozan, Patya, and Chattogram before falling into the Bay of Bengal in Chattogram district. Halda River, another water body of the Chattogram region originating from the Badnatoli hill in Khagrachori district travels through Fatikchhari, Hathazari, Chandgaon, and Rauzan before falling into the Karnaphuli River in Chattogram district.

The land use of the project area is dominated by agricultural land followed by urban, built-up area. About one-third of transmission line RoW is covered by built-up area, another about one-third is covered by cultivation fields, and about one-fifth by rural settlements. The substation sites are covered by cultivation fields and settlements.

Double cropping is practiced in most of the project area with triple cropping also being practiced in some areas. Hybrid *Aus* rice and summer vegetables are grown in Kharif-I and high yield varieties (HYV) of rice in Kharif-II, while HYV *Boro* rice and winter vegetables are

grown in Robi (also known as Rabi) season.^{2 3} The cropping intensity of the project study area is about 159 percent.

Air quality and noise in Chattogram are generally well within the acceptable limits prescribed by the national and international standards. Groundwater quality in the area is not very good with parameters such as dissolved oxygen, nitrites, and biological oxygen demand exceeding the acceptable limits; however no arsenic contamination in the groundwater is found in the area.

In terms of floral resources, the project area can be divided into three categories: homestead and settlement vegetation; crop-field vegetation; and roadside vegetation. This indicates that the original natural vegetation of the area has been greatly modified. Similarly, the natural habitat has been greatly modified because of the presence of human settlements and cultivation and only those faunal species are found in the area that have adapted to these conditions. None of the floral or faunal species found in the area have any significant conservational value.

Six wildlife protected areas exist in Chattogram area but none are within or in close proximity of the project area; the nearest one being about 22 km away. An important bird area (IBA) is situated at Patenga, about five kilometers away from the project area.

Potential Impacts

The potential impacts of the project's construction phase on physical and biological environment could include soil erosion particularly close to rivers and *khals*; dust emissions caused by operation of machinery and running vehicles on earthen tracks within the RoW and along the access routes; gaseous emissions from construction vehicles, machinery, and generators; release of waste effluents and solid wastes from construction areas and camps causing soil and water contamination; loss of natural vegetation and trees in the RoW; natural habitat destruction and fragmentation caused by vegetation clearance and felling of trees; disturbance to wildlife species; hunting, trapping, and or catching of wild species by the project personnel at the site; and finally, occupational health and safety (OHS) hazards for the construction staff and other project site personnel. The key potential impacts of the transmission lines and substations during the operation and maintenance stage include occupational health and safety risks for the maintenance workers, electrocution and collision of birds, electromagnetic radiation, radio interference, and solid waste generation.

The most significant social impacts of the project pertain to the resettlement issues including land acquisition, devaluation land, damage to crops, trees, and building structures that exist in the RoW. Other potential impacts of the project's construction phase on the local communities include temporary blockage of local routes, loss of livelihood, project-related traffic on local roads, noise generation causing nuisance and disturbance to local population, safety hazards caused by construction activities and project-related vehicular traffic, social conflict or cultural issues caused by labor influx – some of them may be from other parts of the country, additional pressure on local resources such as water and fuel, damage to sites of cultural and or religious significance such as graveyards and shrines, and disturbance to women activities. The potential impacts of the project's operation and maintenance activities on the local communities could include risk of electrocution and occasional crop damage.

²*Aus*, *Aman*, and *Boro* are rice varieties cultivated in Bangladesh. *Aus* is generally cultivated in July-August; *Aman* in December-January; and *Boro* in March-May cropping seasons.

³The *kharif* cropping season is from July to October and the *rabi* cropping season is from October to March.

Mitigation

To address the potentially negative environmental impacts of the project, appropriate mitigation measures have been included in this ESIA. These include water sprinkling to suppress dust emissions particularly near the settlements, using properly tuned vehicles and machinery to minimize exhaust emissions; ensuring that no untreated waste effluents are released to the environment and using appropriate treatment mechanism for this purpose; preparing and implementing waste management and pollution control plans; enforcing ‘no hunting, no trapping, no catching’ policy for the wildlife; and preparing and implementing an OHS plan. To address the risk of bird collision and electrocution, PGCB will consider attaching visible spheres to the upper wire of the overhead transmission line section that crosses the Karnaphuli River, contingent to technical viability. Furthermore, the spacing between transmission line conductors will be kept in a manner to avoid electrocution of birds found in the area (including migratory birds) owing to the size of their wing span.

To address the resettlement impacts described earlier, compensation and assistance will be paid to the project-affected persons (PAPs). Provisions have also been made to compensate vendors who will be impacted temporarily (in terms of their livelihood) in urban areas due to laying of the underground cable in Chittagong city. For the remaining potential impacts of the project on the people and communities, appropriate mitigation measures have been included in the present ESIA and will be included in the contractual obligations of the contractor. These mitigation measures include maintaining liaison with the local community during the construction phase to ensure that local routes are not blocked in the first place, however if it is unavoidable, then alternate routes are identified in consultation with the affected community. For mitigating the impacts of noise generation, the contractor will use machinery and vehicles equipped with standard noise reduction arrangements (such as silencer and canopy), will avoid nighttime work to the extent possible, and will maintain liaison with the communities. For increased traffic on local roads, the contractor will prepare and implement a traffic management plan. The contractor will also prepare and implement a safety management plan to ensure that safety hazards for the communities are minimized. To address the Environmental, Social, Health and Safety (ESHS) issues, a code of conduct and Construction Environmental and Social Management Plan (CESMP) will be prepared and all site personnel will be required to follow that. The contractor will be required to obtain supplies such as water, fuel and other commodities in a manner that the local communities are not negatively affected; liaison with the local community will also be maintained for this purpose in addition to establishing a grievance redress mechanism. The contractor will also be required to avoid any damage to places such as graveyards and shrines. Finally, to protect privacy of women, the code of conduct described above will be enforced at the site.

Environmental and Social Management Plan

An Environmental and Social Management Plan (ESMP) has been prepared as part of the present ESIA in order to define the implementation mechanism for the above-described mitigation measures. The ESMP includes description of institutional arrangements, a mitigation plan, a monitoring plan, a training and capacity building plan, documentation protocols, and a grievance redress mechanism (GRM).

The overall responsibility of environmental and social performance of the project and effective ESMP implementation will rest with PGCB. PGCB will establish the Project Implementation Unit (PIU) to lead the Project implementation. The PIU will be headed by the Project Director (PD). An Environment and Social Unit (ESU), comprising qualified environmental and social development staff, will be established under the PIU. The PIU will engage construction

supervision consultants (CSC) to supervise the construction contractors in order to ensure design compliance and quality assurance of the construction activities. The CSC will also supervise the contractors for ESMP implementation. For this purpose, CSC will engage environmental and social development specialists.

The environmental and social management of the project will be achieved through implementation of a number of plans: a) Environmental Codes of Practice (ECPs); b) mitigation plan; and c) Construction Environmental and Social Management Plan (CESMP). The ECPs provide generic guidelines and control measures to address negative impacts encountered during construction phase. The mitigation plan, prepared on the basis of impact assessment carried out during the present ESIA, provides project-specific mitigation measures and assigns implementation and supervision responsibilities for these measures. The CESMP will be prepared by the construction contractor based upon the ESMP included in the present ESIA and will comprise a number of sub-plans including pollution prevention plan, waste management plan, traffic management plan, camp management plan, OHS plan, and others.

As one of the key elements of the ESMP, a two-tier monitoring program has been proposed comprising compliance monitoring and effects monitoring. The main purpose of this monitoring program is 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.

Capacity building for effective implementation of the environmental and social requirements is a key element of the ESMP. This capacity building will need to be carried out at all tiers of the project, including PGCB, PIU, CSC, and contractors. At the construction site, CSC will take the lead in implementing the capacity building plan, though the contractors will also be responsible to conduct training for their own staff and workers.

For implementing the present ESMP, about **197 million Bangladesh Taka (BDT)** (about 2.35 million US Dollars) will be required. The major components of this cost include about 180 million BDT for resettlement and rehabilitation (R&R) costs, 9.5 million BDT for mitigations and trainings, and 7.8 million BDT for monitoring and other costs.

Grievance Redress Mechanism

PGCB will establish a grievance redress mechanism (GRM) to ensure social accountability and to answer queries and address complaints and grievances about any irregularities during the project implementation. The GRM will help 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 or deny a person's right to go to the courts of law.

Under the GRM, grievance redress committees (GRCs) will be established locally at Project sites and centrally at the Project level to receive as well as settle grievances from the affected persons and other local stakeholders. The two-tier GRM will be composed of local GRCs (LGRC) at the union/municipal level as the first tier, and Project GRC (PGRC) at the central level as the second-tier. Most of the grievances will be resolved at the local-level GRC, but those cases that cannot be resolved at the local level will be forwarded to PGRC. The LGRC will be constituted with representation of the local Union Parishad Chairman and affected people ensuring women's representation. The PGRC will be constituted with representation from the PIU, Implementing NGO/Agency (INGO/IA) and one independent person from the civil society having knowledge about land acquisition/ requisition law of Bangladesh and involuntary resettlement.

Stakeholder Consultations

An extensive consultation process was undertaken during the present ESIA, in accordance with the national regulatory and AIIB policy requirements. The key objectives of these consultations included informing the stakeholders particularly the local communities about the proposed interventions and soliciting their views, concerns, and recommendation concerning project and its impacts.

A participatory approach was adopted to conduct consultations particularly with the communities. A checklist was used to maintain uniformity and relevancy in discussion and in properly recording the opinions and views of the participants. During the consultations, the socioeconomic, 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. During the present ESIA study, nine consultation sessions were held with the stakeholders. A total of 93 persons participated in these sessions.

The key concerns shared by the stakeholders during these consultations included payment of compensation for all losses caused by the project, managing traffic congestion caused by the construction activities, maintaining liaison and coordination with other departments and entities, minimizing blockage of access particularly for essential facilities such as hospitals, removal of excavated soil and other debris from the construction sites, and provision of employment opportunities to the local population.

Disclosure

The draft ESIA document has been disclosed at the website of PGCB since December 10, 2018.⁴ The final ESIA will also be disclosed in a similar fashion. The executive summary of the ESIA will be translated in Bangla language and placed on the same website, in addition to being available locally at the project site (project office, contractor's office).

⁴ For more details, please refer to the website: <https://pgcb.org.bd/PGCB/?a=pages/esia.php>

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List of Acronyms

AEZ	Agro-ecological Zone
AIIB	Asian Infrastructure Investment Bank
AIS	Air Insulated Switchgear
AP	Angle Point
BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
BEZA	Bangladesh Economic Zones Authority
BEZ	Bio-ecological Zone
BMD	Bangladesh Meteorological Department
BNH	Bangladesh National Herbarium
BOD	Biological oxygen demand
BoQ	Bill of quantities
BPDB	Bangladesh Power Development Board
BTCL	Bangladesh Telecommunication Company Limited
BWDB	Bangladesh Water Development Board
CCC	Chattogram City Corporation
CCL	Cash Compensation under Law
CDA	Chattogram Development Authority
CESMP	Construction Environmental and Social Management Plan
CGA	Chattogram Gas Authority
CEGIS	Center for Environmental and Geographic Information Services
CHT	Chattogram Hill Tracts
CMP	Current market price
COD	Chemical Oxygen Demand
CSC	Construction supervision consultants
CWASA	Chattogram Water Supply and Sewerage Authority
DAE	Department of Agricultural Extension
dB	Decibels
DC	Deputy Commissioner
DC	Double Circuit
DG	Director General
DIA	Direct Impact Area

DO	dissolved oxygen
DoE	Department of Environment
DoF	Department of Fisheries
DoF	Department of Forest
DPHE	Department of Public Health Engineering
DPP	Development of Project Proforma
EC	Electrical Conductivity
ECA	Environment Conservation Act
ECC	Environmental clearance certificate
ECP	Environmental code of practice
ECR	Environment Conservation Rules
EHS	Environmental, health and safety
EIA	Environmental Impact Assessment
EMF	Electro-magnetic field
EMP	Environmental Management Plan
EPC	Engineering, procurement and construction
EPZ	Export Processing Zone
ERP	Emergency Response Plan
ESF	Environmental and Social Framework
ESIA	Environmental and social impact assessment
ESMP	Environmental and Social Management Plan
ESMPF	Environmental and Social Management Planning Framework
ESS	Environmental and Social Standards
ESU	Environmental and Social Unit
EQS	Environment Quality Standards
FGD	Focused Group Discussion
FS	Feasibility Study
FY	Fiscal Year
GBV	Gender Based Violence
GHG	Greenhouse gas
GIA	General Impact Area
GIS	Geographic Information Services
GIS	Gas Insulated Switchgear
GO	Government Organization

GoB	Government of Bangladesh
GRC	Grievance redress committee
GRM	Grievance redress mechanism
GSB	Geological Survey of Bangladesh
HSE	Health, Safety and Environment
HIV/AIDS	Human immunodeficiency virus / infections / Acquired Immune Deficiency Syndrome
HRG	House Reconstruction Grant
HYV	High Yielding Variety
IBA	Important Bird Area
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	Important Environmental Component
IEE	Initial Environmental Examination
IESC	Important Environmental and Social Component
IFC	International Finance Corporation
ILO	International Labor Organization
IUCN	International Union for Conservation for Nature
KAFCO	Karnaphuli Fertilizer Company
KII	Key Informant Interview
kg	Kilogram
KGDCL	Karnaphuli Gas Distribution Company Limited
Km	Kilometer
KMZ	Keyhole Marked up Zipped (Files)
kV	kilo Volt
LC	Least Concern
LILO	Line-In-Line-Out
LGED	Local Government Engineering Department
LGRC	Local grievance redress committee
LNG	Liquefied natural gas
LTW	Line transect walk
mm	millimeter
MoEF	Ministry of Environment and Forest
MoU	Memorandum of Understanding
MSDS	Material Safety Data Sheet

MTBF	Mean time between failures
MW	Mega Watt
MVA	Mega Volt Ampere
NCA	Net Cultivated Area
NEMAP	National Environmental Management Action Plan
NEP	National Energy Policy
NGO	Non-Governmental Organization
NOC	No Objection Certificate
NT	Near Threatened
NWRD	National Water Resource Database
O&M	Operation and maintenance
OCR	Ordinary Capital Resources
OHS	Occupational health and safety
OHTL	Overhead transmission line
OP	Operational Policies
PAP	Project Affected Person
PD	Project Director
PGCB	Power Grid Company of Bangladesh
PGRC	Project grievance redress committee
PIU	Project Implementation Unit
PPE	Personal Protection Equipment
PRA	Participatory Rural Appraisal
PSMP	Power System Master Plan
PSUEP	Power System Upgrade and Expansion Project
PVC	Polyvinyl Chloride
PWD	Public Works Department
R&R	Resettlement and rehabilitation
RCC	Reinforced Cement Concrete
RH	Relative humidity
RoW	Right of Way
RP	Resettlement Plan
RPF	Resettlement planning framework
RRA	Rapid Rural Appraisal
RS	Remote Sensing

SCC	Site Clearance Certificate
SE	Sexual Exploitation
SPM	Suspended Particulate Matter
SRDI	Soil Resource and Development Institute
SOP	Standard Operating Procedure
STW	Shallow Tube Well
TDS	Total dissolved solids
TL	Transmission line
ToC	Table of Content
ToR	Terms of Reference
TS	total solids
TSS	Total suspended solids
UGTL	Underground transmission line
USD	United States Dollar
WARPO	Water Resources Planning Organization
WB	World Bank
WHO	World Health Organization

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1. Introduction

The Government of Bangladesh (GoB) through the Power Grid Company of Bangladesh (PGCB) intends to undertake the Power System Upgrade and Expansion Project (PSUEP) in Chattogram⁵ area and seeks financial assistance from the Asian Infrastructure Investment Bank (AIIB) for this purpose. In order to address the adverse environmental and social impacts of this project and in compliance with the national regulatory and AIIB policy requirements, PGCB has conducted the present environmental and social assessment (ESIA) of the project.

1.1 Project Background

Located in south-eastern part of Bangladesh, Chittagong (now Chattogram) is the second largest city in the country with a population of 2.84 million in the city center, and over 4.0 million in the metropolitan areas⁶. Chittagong contributes to about 40 percent of the country's industrial output, 80 percent of its international trade and 50 percent of its governmental revenue. The region boasts vibrant residential, commercial and industrial sectors with robust and rapidly growing demand for electricity. Important economic establishments, such as the Chittagong Sea Port, Chittagong Eastern Refinery, Chittagong Export Processing Zone (EPZ), Karnaphuli EPZ, and Korean EPZ are operating in or around the city, and more similar economic and commercial establishments have been planned and will come out soon.

Power supply in the region has not kept up with demand growth. Much of the growing demand in the region remains unserved due to power supply shortages and network failures. For example, during the period of fiscal-year (FY) 2013-2017, power supply in Chittagong only grew at a modest pace of 4.2 percent, while national average in the same period was around 10.9 percent.⁷ In spite of a suite of demand-side management measures in place, daily load shedding in Chittagong stands as high as 11.5 percent.⁸ On top of supply shortages, the reliability of power supply has also been rapidly deteriorating. Due to lack of investment and inadequate maintenance, the aging and inadequate transmission and distribution systems impose severe constraints on power delivery to consumers. Majority of manufacturing and service firms in the region identified a shortage of reliable electricity as the most important constraint they face to smooth operations and expansion.

The Power Division under the Ministry of Power, Energy and Mineral Resources is the apex governmental office responsible for overall power sector operations in Bangladesh. Established in 1996, the Power Grid Company of Bangladesh (PGCB) is currently the entity responsible for operating and developing power transmission networks in the country. PGCB has undertaken several projects to build more than 3,000 km of new transmission lines and 106 new substations by 2020 and plans to add 3,000 km of transmission lines and 90 substations by 2025. To improve the system performance, many of these transmission lines and substations will be constructed at higher voltage levels. The proposed Project is in line with PGCB's development plan and will construct 46 km of 400 kV double-circuit transmission lines and associated substations/line bays in the Chittagong region. Upon Project completion, a better extended and more strengthened transmission network will make private sector participation in power generation much easier.

⁵ Chattogram was formerly known as Chittagong.

⁶ Bangladesh Population Census 2011, Bangladesh Bureau of Statistics.

⁷ Bangladesh Power Development Board Annual Reports (FY2013-FY2017).

⁸ Bangladesh Power Development Board, 2018. <http://www.bpdb.gov.bd/ctg/index.php/user/english/4/8>.

1.2 Project Overview

Under the PSUEP, transmission lines will be constructed to connect three new substations at Anowara, New Mooring and Khulshi in the Chittagong region. Upon completion, the transmission lines and associated substations will collectively provide 1,400 MVA transmission capacity at different voltage levels. The proposed Project includes the construction of the following transmission lines and substations, covering:

- Anowara to Anandabazar (New Mooring) 400 kV double-circuit transmission line: 20 km long overhead transmission line and 7 km long underground cable.
- Hathazari to Rampur 230 kV double-circuit transmission line: 3 km long underground cable.
- Madunaghat to Khulshi 230 kV double-circuit transmission line: 16 km long underground cable.
- 230/132 kV GIS substation at Anandabazar (New Mooring) with two 350/450 MVA transformers.
- 230/132/33 kV GIS substation at Khulshi with two 350/450 MVA (230/132kV) and three 80/120MVA (132/33kV) transformers.
- Two bay extensions at 230 kV GIS substation at Madunaghat.

The project area and components are shown in **Figures 1.1** and **1.2**. More details on the proposed project are presented later in the document.

1.3 Regulatory and Policy Framework

According to the Bangladesh national regulatory requirements specifically Environment Conservation Act, 1995 and Environment Conservation Rules (ECR), 1997, amended through ECR, 2017, all transmission lines and substations require an Initial Environmental Examination (IEE) to be carried out and the Site Clearance Certificate (SCC) to be obtained from the Department of Environment (DoE). The site clearance certificate from the DoE has been received on 04/03/2018 vide the office *Memo No: 22.02. 0000. 018. 72. 29. 18. 110* (see **Annex A**).

In addition, according to the AIIB's Environmental and Social Policy and the Environmental and Social Standards, an Environmental and Social Impact Assessment (ESIA) needs to be carried out for the proposed project.

The present assessment has been carried out in response to the above requirements. More details of these regulatory and policy requirements are provided later in the document.



Figure 1.1: Project Location

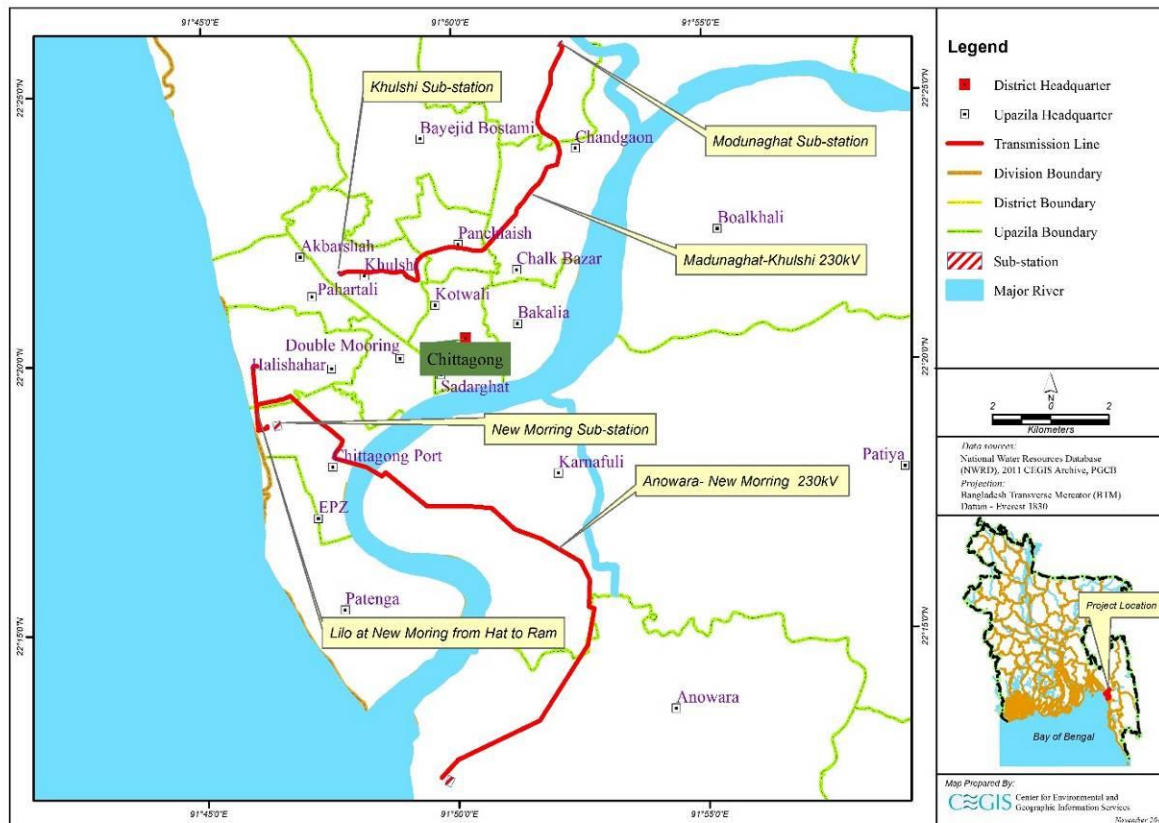


Figure 1.2: Project Components and Study Area

1.4 ESIA Study

1.4.1 Objective and Scope of ESIA Study

The present ESIA aims to address the potentially adverse impacts of the project and its activities (see **Section 1.2**) on the physical and biological environment as well as on people – in order to make the project environmentally sustainable and socially acceptable. The present study has been carried out in response to the requirements defined by the national regulations as well as AIIB policies. The key objectives of this ESIA study include:

- Determining the current environmental and social baseline conditions of the area;
- Identifying important environmental and social components which may be impacted by the project;
- Assessing the potential environmental impacts, including any residual impact of the proposed project;
- Identifying mitigation measures to minimize the adverse impact;
- Preparing Environmental and Social Management Plan (ESMP) and
- Preparing an Environmental Monitoring Plan.

The study scope includes design, construction as well as operation and maintenance (O&M) phases of the proposed project.

1.4.2 Study Area

As part of the present ESIA, areas around the project components described in **Section 1.2** was studied for their environmental, biological and socioeconomic conditions. This is the area where most of the potential impacts of the project and its activities are likely to take place. This area is shown in **Figure 1.2**.

1.4.3 Study Methodology

The process followed in conducting the present ESIA study of the proposed project is shown in **Figure 1.3**.

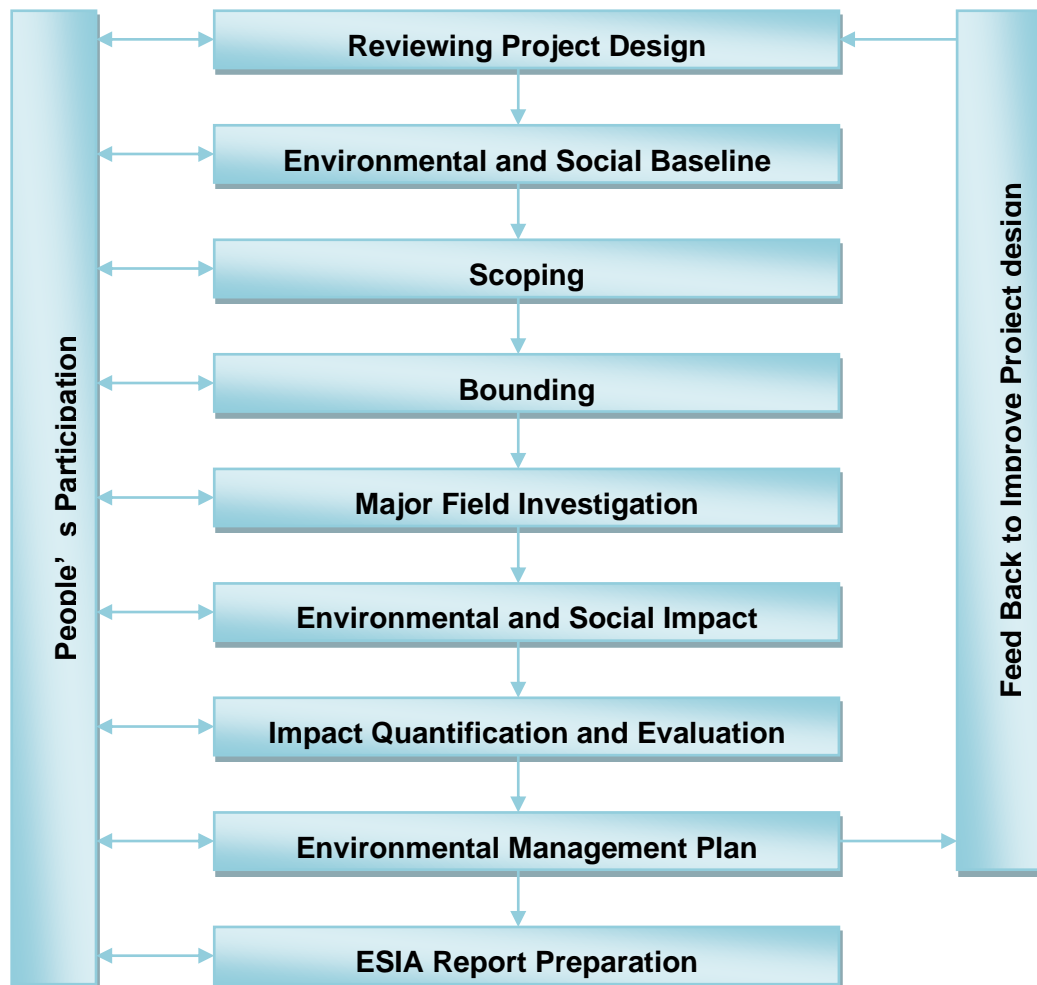


Figure 1.3: Process Followed for ESIA Study

The activities at each stage of the ESIA study of the proposed transmission lines are briefly described below.

Reviewing Project Design

Detailed information about project was collected from PGCB by the multi-disciplinary ESIA team members for gaining a thorough understanding of the proposed interventions and their possible environmental and social consequences. This information helped in designing data

collection programs. The following issues have been included in the brief description of the project:

- Location of the project and its accessibility;
- Use of natural resources i.e. water and its sources;
- Use of power and its sources;
- Use of raw materials, fuels and chemicals, their quantities, characteristics, arrangements for transport to site, and storage facilities;
- Products and by-products, their storage and transport;
- List of main equipment and machinery, built-in pollution control equipment, description of detailed manufacturing process (temperature and pressure conditions of each unit operation);
- Information on solid, liquid and gaseous waste generated, and their points of generation;
- Noise level produced by equipment and machinery at source and capital and operating costs of pollution control;
- Layout maps showing key project components.

Scoping

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

Bounding

The geographical boundary of the General Impact Area (GIA) and the potential Direct Impact Area (DIA) were delineated as a requirement of the environment assessment study. The GIA is the physical location, ie, the footprint of the various components of the proposed project while the DIA covers the geographic extent of the environmental and socioeconomic impacts resulting from implementation of the proposed activities during the pre-construction, construction and post-construction phases. For the ESIA, the focus of the study was mostly limited to areas where the impacts of the activity will be directly felt. Generally, a corridor of 80 meters along both sides of the 230 KV transmission lines and 100 m for the 400 KV transmission was considered for environmental analysis. For the substations, in addition to the actual site, a corridor of 100-m width around it was considered as DIA. However, some environmental as well as social impacts of the proposed activities- such as air and water quality deterioration and issues related to influx of workforce- will potentially extend beyond the DIA. Therefore, most of the environmental and social/socioeconomic baseline conditions have been studied for a much broader area as shown in **Figure 1.2** and hence this area can be considered as the Area of Influence for the proposed project. Similarly, a general socioeconomic profile was prepared for the administrative units over which the power transmission lines will traverse and where the substation will be located.

Environmental and Social Baseline Survey

The environmental and social baseline conditions of the proposed project area have been determined by collecting relevant data from primary and secondary sources. Under the ESIA study, available data on climate, geology, seismicity, water resources, land resources, soil properties, agriculture, fisheries, ecology and socio-economic components have been collected from secondary sources followed by primary data collection. Environmental and socio-economic data was collected from different sources, including Bangladesh Bureau of Statistics Survey (BBS), DoE, Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), Agro-climatic Survey of Bangladesh and others.

The study team conducted the baseline survey with the help of the keyhole marked up zipped (KMZ) files and Google Earth maps of the proposed area to determine the exact routes and locations of various project components. Ground truthing was also carried out to verify the various features visible on the maps.

All the parameters selected in previous step were not significant for the project; hence a reconnaissance survey was carried out to shorten this list to concentrate on significant environmental and social aspects. The ESIA study team made site visits to observe the condition of the project area and its surroundings and to identify various sites for investigations.

Subsequent to the above, final checklists were prepared and environmental and social baseline survey was conducted with the relevant checklist in hand to identify the key environmental and socioeconomic resources of the area.

The study team made a number of field visits to the proposed sites and collected primary data on environmental and social components using a variety of techniques. During the field visits, the multidisciplinary ESIA team members made professional observations pertaining to their individual areas of expertise. Local knowledgeable persons and community representatives were also interviewed.

All qualitative and quantitative information have been gathered from different surveys and secondary sources and used appropriately in preparing the environmental and socio-economic baseline of the project area.

Physical Environment

The professional observations of the multi-disciplinary team members backed by feedback from the local people during field visits were the main tools for determining the physical environmental of the area. The determination of the physical environmental conditions was backed by secondary data, high resolution recent satellite images and field observation. In general, the physical environmental data collection and survey has been carried out by a composite method of investigation including remote sensing image analysis, observation, and public consultation. Analysis has been carried out with world standardized tools and the result presented with GIS interface.

The geological and seismic issues have been investigated using secondary information and field observations. The general geological features and the seismicity of the project and its surrounding areas have been collected from available secondary literature and the Geological Survey of Bangladesh. The lithology of the project area has been collected from the National Water Resources Database (NWRD).

The meteorological data such as rainfall, evapo-transpiration, temperature, sunshine hours, humidity, and wind speed and wind direction have been collected from BMD stations at Patenga and Ambagan, both of which are located near the proposed project sites.

Water Resources

Information on water resources have been collected from secondary sources. The Karnaphuli River and Sangu river systems have been selected for hydrological data collection for the study area. Data on specific fields of interest on special hydrological events such as drainage congestion, water logging, erosion – sedimentation etc. have been collected.

Water resources data under four broad headings namely river hydrology, groundwater hydrology, ground and surface water quality and use have been collected from secondary sources.

Land Resources

The baseline for land resources has been developed by considering the criteria of Agro-Ecological Zone (AEZ), land type with net cultivable area (NCA), land use and soil texture. The identification and development of baseline condition has been carried out through the following process:

The AEZ of the proposed project area has been identified using information from secondary sources (BARC, 2012). Information on land type, soil texture, and soil nutrient status has also been collected from different publications of Soil Resource and Development Institute (SRDI).

The secondary data on these parameters have been verified at field level through physical observations as well as during consultation with the local people and officials of the Department of Agriculture Extension (DAE) during field visits.

Field surveys have been conducted for ground-truthing of remote-sensing data on current land use/ land cover, and soil texture. Finally, maps of the land use/land cover, and soil texture have been produced through digital classification with the help of ground-truthing.

Agricultural Resources

Data collected on agricultural resources include existing cropping patterns, crop variety, crop calendar, crop yield, crop damage and agricultural input used. Agriculture data have been collected from primary sources through extensive field survey by developing questionnaires and in consultation with local people and relevant agricultural officials. Data on agricultural resources have also been collected from secondary sources (Upazila Agriculture Extension office of the DAE).

Fishery Resources

Fisheries data have been collected for this study by considering the seasonal variance of dry and wet seasons. Prior to data collection, a checklist/ questionnaire was developed. The checklist included all kinds of information which should be looked into in the context of existing and potential structures of the project. A combination of survey techniques was used for data collection. The survey techniques included sampling site selection, data collection, data analysis and reporting.

Ecological Resources

Ecological data have been collected from primary and secondary sources. The primary sources were mainly Line Transect Walks (LTWs) and Key Informant Interviews (KIIs); the secondary sources were from Forest Department, International Union for Conservation of Nature (IUCN), Bangladesh Asiatic Society's Encyclopedia of Flora and Fauna of Bangladesh, Bangladesh National Herbarium (BNH) and other relevant sources through literature review. In addition, the Bio-Ecological Zone (BEZ) classification of Bangladesh by IUCN-Bangladesh (2002) has been used for the bio-ecological zoning of the study area.

Based on information from the project site map, a field survey has been conducted to list the available flora and fauna as well as habitats in the study area. The surveys included LTWs (50-meter distances from both sides of the RoW) within the study area covering all major habitats. The status of the threatened species has been mentioned in this report in reference to IUCN-Bangladesh Red List 2015.

Socio Economic Resources

To establish a baseline for this ESIA study, data have been collected from different sources which can be grouped into two categories:

Primary sources: Data have been collected from the project area and concern unions and Municipalities of Chattogram districts through questionnaire survey, rapid rural appraisal (RRA), consultation meetings, and informal interviews.

Secondary sources: To prepare the baseline situation of the study area, information on some important socio-economic parameters has been collected from the reports of the Bangladesh Bureau of Statistics (BBS), 2011 and estimated for 2016.

Technique of data collection

Different techniques have been used to gather relevant information on the existing socio-economic condition of the study area. Quantitative and qualitative data have been collected from secondary and primary sources. Quantitative data have been collected through literature review, Survey, focus group discussions (FGDs) and key informant interviews (KIIs), informal interviews and consultation meetings (**Table 1.1**).

Table 1.1: Variables and Associated Data Collection Techniques

Variables	Techniques
Demographic and household information	Literature review
Quality of life	RRA, Survey
Safety net & poverty reduction measures	RRA, informal interview
People's perception	Consultation meetings, RRA

The data collected from consultation meetings, RRAs and informal interviews have been analyzed using appropriate statistical tools and instruments. The sum and percentage of total values have been used to specify the percentage of households containing different values on different variables.

Prediction of Probable Impacts

The project implementing periods i.e. pre, during and post construction situations were considered for the impact assessment. At this stage, professional assessment and opinion of key experts in the study team were considered; in addition, local community's opinions and views were also obtained duly considered. The potential impacts of the proposed interventions on the key environmental and socioeconomic resources have been assessed through several sets of activities. The status of the key environmental and socioeconomic resources under baseline conditions has been determined followed by considering the possible changes to these resources under pre, during and post construction situations.

The differences found between the two conditions have been considered as the impacts of the proposed interventions on the environment and people. Changes expected to be brought about due to the implementation of the project have been assessed using professional judgment of the

multi-disciplinary study team members based on information collected during the field investigation and feedback received through intensive stakeholder consultation to generate in the future condition.

Assessment of Potential Impact

Once the potential impacts are identified, each potential impact is described in terms of its various relevant characteristics (e.g. type, scale, duration, frequency, extent).

The potential impacts are qualitatively assessed based on the above characteristics to determine whether it is potentially significant or not.

The significance of potential impacts was assessed using the risk assessment methodology that considers impact magnitude and sensitivity of receptors, described below.

Impact Magnitude

The potential implications of the project have been categorized as major, moderate, minor or nominal based on consideration of the parameters such as i) duration of the effect; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria.

The magnitude of each potential impact of the Project has been identified according to the categories outlined in **Table 1.2**.

Table 1.2: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Minimal
Duration of potential impact	Long term (beyond the project life)	Medium Term Lifespan of the project (within the project life span)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond next project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Environmental or social parameter needs a year or so with some responses to come back to baseline	Baseline returns naturally or with limited response within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but violates international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable

Parameter	Major	Moderate	Minor	Minimal
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Happens under worst case (negative consequences) or best case (positive impact) working conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to happen

Sensitivity of Receptor

The sensitivity of a receptor has been determined based on a review of the population (including proximity/numbers/vulnerability) and the presence of features on the site or the surrounding area. For each potential impact of the project, sensitivity of the related receptor was determined using the criteria outlined in **Table 1.3**.

Table 1.3: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very Severe	Vulnerable receptor with little or no ability to absorb proposed changes or minimal opportunities for mitigation.
Severe	Vulnerable receptor with little or no ability to absorb proposed changes or limited opportunities for mitigation.
Mild	Vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation
Low	Vulnerable receptor with good ability to absorb proposed changes or/and excellent opportunities for mitigation

Assigning Significance

Following the assessment of impact magnitude and determining the quality and sensitivity of the receiving environment or potential receptor, the significance of each potential impact was established using the impact significance matrix shown in **Table 1.4**.

Table 1.4: Criteria for Determining Impact Significance

Magnitude of Impact	Sensitivity of Receptors			
	Very Severe	Severe	Mild	Low
Major	Critical	High	Medium	Negligible
Moderate	High	High	Medium	Negligible
Minor	Medium	Medium	Minor	Negligible
Minimal	Negligible	Negligible	Negligible	Negligible

Identification of Mitigation and Enhancement Measures

Once the significance of potential impact has been characterized, the mitigations and enhancement measures were suggested. For this purpose, mitigation strategies adopted during earlier projects of similar nature were reviewed in addition to relying upon experts' judgment. Subsequently, residual impacts – impacts that are likely to take place even after the implementation of mitigation measures – and their significance was assessed.

Environmental and Social Management Plan

The environmental and social management plan (ESMP) was compiled once the impact assessment was completed and mitigation measures were identified. During the ESMP compilation, institutional arrangements for environmental and social management of the project were recommended, mitigation and monitoring plans were formulated, documentation and reporting protocols were defined, training needs were assessed, and cost of ESMP implementation estimated.

Public Consultation

Public consultation is necessary for identifying the problem and solution across the intervention by following participatory approach. This starts from environmental and social baseline stage when data and information on baseline conditions is collected from the directly and indirectly project impacted people. Their perceptions were considered in the selection of important environmental and social components through the scoping process.

Some formal consultation was carried out during ESIA study and some consultation meetings were conducted after completing detailed survey for project affected person. The ESIA team arranged a formal consultation meeting with project affected people at Khulshi. Along with this, the study team also communicated with local government authority to inform them and to pick their perception regarding this project. A participatory approach was followed during consultation meetings.

1.4.4 ESIA Study Team

The present ESIA study was carried out by the following key professionals:

- Mr. Mujibul Huq, Environmental Planner, ESIA Study Team Leader
- Mr. Jalal Ahmed Chaudhury, Electrical Engineer, Advisor, ESIA Team
- Dr. Dilruba Ahmed, Sociologist
- Mr. Md. Sarfaraz Wahed, Water Resource Expert
- Mr. Md. Ebrahim Akanda, Agricultural expert
- Mr. Subrata Kumar Mondal, Socio-Economist
- Mr. Ashoke Kumar Das, Ecologist
- Mr. Md. Firoj Alam, GIS Specialist
- Mr. Abid Kamal, GIS Specialist
- Mr. Md. Mobasher Bin Ansari, Anthropologist
- Mr. Mohammad Kamruzzaman, Ecologist
- Mr. Md. Shakil Ahmed, Civil Engineer
- Mr. Md. Zahid Hossain Dhali, Soil and Agricultural
- Ms. Suriya Nasrin, Fisheries Biologist

A group of field workers from different discipline helped the EIA team by collecting data and gathering information from the field.

- Mr. Md. Shakil Ahmed, Water Resource Engineer
- Mr. Abdul Kadir, Water Resource Engineer

- Mr. Md. Nazmul Kabir, Water Resource Engineer
- Ms. Engr. Bilkish Sultana, Electrical Engineer
- Dr. Abdul Halim Farhad Sikder, Agronomist
- Mr. Md. Ashraful Alom, Fisheries Biologist
- Mr. Mohammad Kamruzzaman, Ecologist
- Mr. Tanvir Ahmad Rifat, Sociologist

1.4.5 Structure of ESIA Report

Chapter 2 reviews the prevailing national and provincial regulatory requirements and AIIB policies and standards relevant to environmental and social assessment. **Chapter 3** presents a simplified description of the project, its various components and other salient information relevant for environmental and social assessment. Analysis of alternatives considered during project planning and design are explained in **Chapter 4**. Description of the environmental and biological baseline conditions is presented in **Chapter 5**. **Chapter 6** describes the consultations that were carried out with the stakeholders during the ESIA study. Potential impacts of the project on environment and people as well as their appropriate mitigation measures have been discussed in **Chapter 7** and **8**. Analysis of Associated Facilities is covered in **Chapter 9**. Finally, **Chapter 10** presents the environmental and social management plan (ESMP).

2. Review of Policy and Regulatory Frameworks

This Chapter provides an overview of the national legislation and regulations as well as the related institutional frameworks relevant to environment and social assessment of the proposed project. Also discussed are the AIIB environmental and social policies and standards relevant to the proposed project.

2.1 National Legislative Framework

There are several environmental policies and legislations which have direct and indirect relevance for the proposed project, particularly, the Environment Conservation Act (ECA), 1995 (amended in 2010) and the Environment Conservation Rules (ECR), 1997 (amended in December 2017). 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.

The ECR, 1997 (Amendment 2017) assigns activities of power network development projects into the Orange-B category (categories are discussed later in the Chapter). The Orange B category projects require submission of an Initial Environmental Examination (IEE) report along with an Environmental Management Plan (EMP) for site clearance certificate (SCC) and environmental clearance certificate (ECC) from the DoE. However, when this project was initiated, it fell under Red Category which required a full IEE and subsequently, an EIA (Environmental Impact Assessment) for SCC and ECC.

2.1.1 Environment Conservation Act, 1995 (Amendment 2010)

The main objectives of ECA, 1995 include conservation of the natural environment, improvement of environmental standards, and control and mitigation of environmental pollution. The main functions and 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.

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.

2.1.2 Environment Conservation Rules, 1997 (Amendments in 2002, 2003, 2017)

A set of the relevant rules has been promulgated to implement the ECA. There have been four amendments to the Rules until now in February and August 2002, April 2003 and December 2017. 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; and
- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

2.1.3 Categorization of Projects or Industrial Units

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, type 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. Brief description of each category is below:

Green 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 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, 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.

Orange B projects are those which may cause 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, school field etc. These require ECC from the DoE, for which an IEE with an EMP along with the information and papers specified for Orange A Category projects are needed.

Red projects are those which may cause significant adverse environmental impacts such as the construction of bridges, industrial factories, flood shelters, embankments, water control structures, power plants etc. Red categorized projects require an IEE report to obtain an SCC, and subsequently a full EIA report for ECC, along with the information required for all other categories.

Environmental Quality Standards in operation in Bangladesh are also promulgated under the ECR, 1997. There are standards prescribed for varying water sources, ambient air, noise, industrial effluents and discharges, vehicular emissions etc.

The Bangladesh standards intend to impose restrictions on the volume and concentrations of waste-water/ solid waste/ gaseous emissions discharged into the environment. In addition, a number of surrogate pollution parameters like Biochemical Oxygen Demand (BOD), or Chemical Oxygen Demand (COD); and Total Suspended Solids (TSS) 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, sulfur dioxide, and oxides of nitrogen and in some cases volatile organic compounds and other substances.

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.

2.1.4 Environment Court Act, 2010

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

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

2.1.5 The Electricity Act, 2018

The Electricity Act, 2018 repeals the previous laws relating to the supply and use of electrical energy, which was first enacted in 1910. The Electricity Act, 2018 provides clear guidelines for energy supply, electricity generation, transmission and distribution including protective and safety clauses. Under this Act, any 'Person' may obtain license to supply electrical energy and/or lay down or place electric supply lines over or under land (Section 13 – Right of Way) or by acquiring land (Section 14 – Land Acquisition) for the conveyance of electrical energy. For such purposes, the Licensee shall give considerable amount of time and written notification to owners along the RoW (Section 13) or acquire the land following land acquisition laws (Section 14) from the land owners.

As per the provision of this Act, the Licensee shall have the following responsibilities/obligations:

- The Licensee shall obtain permission from appropriate personnel or authorities to open and break up the soil and/ or pavement of any or part of road, street, railway, tramway, etc. to lay down any line on either side of, underneath or above the aforementioned facilities; the same shall apply in case of laying of line on either side of, submerged in, inside of or above canals, tunnels and/or waterways or do other works following appropriate procedures as stated in Section 6 of this Act;
- The Licensee shall take prior 'Permissions' from the respective authorities in case of works near other utility services (such as gas, water, sewerage, etc.) as well as providing 'Notice' of commencement of work bar emergency situation as stated in Section 8 of this Act;
- The Licensee shall be responsible for any repair-works of road, street, pavement, sewerage, etc., including refilling of excavated soil and disposal of generated waste as a direct result of their interventions as stated in Section 9 of this Act;
- The Licensee will be responsible for providing 'Notice' to any Telecommunication and /or Internet Service provider to commence any work related to electrical activities that share their service space whether they are new works or repairing of existing works bar emergency situation. However, the Licensee shall provide a 'Notice' after completion

of emergency work to the aforementioned service providers as stated in Section 10 of this Act;

- The Licensee can construct Overhead (Aerial) Lines along or crossing the roads, rail-lines, canals or waterways with prior permission from the Government as stated in Section 11 of this Act; and
- The Licensee shall make full compensation for any damage, detriment or inconvenience caused by them or by anyone employed by them as stated in Section 12 of this Act.

2.1.6 Acquisition and Requisition of Immovable Property Act, 2017

Land acquisition in Bangladesh is governed by a) the Acquisition and Requisition of Immovable Property Act, 2017 (henceforth, the 2017 Act) which repealed the Acquisition and Requisition of Immovable Property Ordinance 1982 (with subsequent amendments of the latter up to 1994; henceforth 1982 Ordinance) and b) the East Bengal State Acquisition and Tenancy Act (1950) revised in 1994. The 2017 Act provides certain safeguards for the owners and has provision for payment of “fair value” for the property acquired. The 2017 Act also gives the right to the land owner to appeal against land acquisition within 15 (fifteen) days of notice (Section 5 of the 2017 Act). The appropriate procedure for such appeals is in place. The 2017 Act, however, does not cover project affected persons (PAP) without titles or ownership record, such as informal settler/ squatters, occupiers, and informal tenants and lease-holders (without document) and does not ensure replacement value of the property acquired. The Act has no provision of resettlement assistance and transitional allowances for restoration of livelihoods of the non-titled affected persons.

The 2017 Act requires that compensation be paid for the followings: (a) land and assets permanently acquired including house, (b) loss of standing crops and trees; (c) loss of property value due to partial acquisition; (d) loss of other immovable or movable assets or source of income; and (e) relocation of living place or business and the cost incurred for such.

The Deputy Commissioner (DC) in all cases, determine “market value” of acquired assets on the date of notice of acquisition (notice under Section 9 of the 2017 Ordinance). The assessment of this market value is done considering the average price of immovable properties of the same class, with similar facilities and within the vicinity of the “to be” permanently acquired land and assets. The DC then adds 200 percent and 300 percent premium of the assessed value for cash compensation under law (CCL) of the land and assets including house for government and non-governmental acquisitions respectively. For any other losses as specified above, i.e. from (b) to (e), the DC adds 100 percent premium of the assessed value to pay as compensation. The CCL paid for land is generally less than the “market value” as owners customarily report lower values during registration to avoid or pay fewer taxes. If land acquired has standing crops cultivated by tenant (bargadar)⁹ under a legally constituted written agreement, the law requires that part of the compensation money be paid in cash to the tenants as per the agreement. If there is a dispute regarding the amount of compensation, there is an option for arbitration and the procedures for such is in place. Places of worship, graveyard and cremation grounds are not to be acquired for any purpose, unless the acquisition of these places is deemed unavoidable for the best of interest of the people. The proponent will be allowed to acquire such areas given that it funds the replacement and rebuilding of such places. The law requires that the salvaged materials upon payment of compensation will be auctioned out by the Government.

⁹ Bargadar is a person who, under the system generally known as adhi, barga, or bhag, cultivates the land of another person on condition of delivering a share of produce of such land to that person.

The DC processes land acquisition under the 2017 Act and pays compensation to the legal owners of the acquired land. The Ministry of Lands (MoL) is authorized to deal with land acquisition through the DCs. *Khas*¹⁰ lands should be acquired first when a project acquires both *khas* and private land. If a project acquires only *khas*, the land will be transferred through an inter-ministerial meeting following the preparation of acquisition proposal submitted to DC/MoL.

2.1.7 East Bengal State Acquisition and Tenancy Act, 1950

The land owner has to establish ownership by producing a record-of-rights in order to be eligible for compensation under the law. The record of rights prepared under Section 143 or 144 of the State Acquisition and Tenancy Act 1950 (revised 1994) are not always updated and as a result, legal land owners have faced difficulties to “prove” ownership. The PAPs must also produce rent receipt or receipt of land development tax, but this does not assist in some situations when a person is exempted from payment of rent if the area of his land is less than 25 bighas (3.37 hectare).

2.1.8 Bangladesh Water Act, 2013

The Water Act 2013 is based on the National Water Policy, and designed for integrated development, management, extraction, distribution, usage, protection and conservation of water resources in Bangladesh.

As per this Act, all forms of water (e.g. surface water, ground water, sea water, rain water and atmospheric water) within the territory of Bangladesh belong to the government on behalf of the people. The private landowners will be able to use the surface water inside their property for all purposes in accordance with the Act. A worthwhile initiative is the requirement for permits/licenses for large scale water withdrawal by individuals and organizations beyond domestic use. Without prior permission issued by the Executive Committee, no individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor they will be allowed to build any structure that impede the natural flow of rivers and creeks.

Construction of the substation and transmission lines may deteriorate the water quality. However, it should be ensured that water usage for other purposes in surrounding areas are not hampered by taking mitigation measures.

2.1.9 Wildlife (Conservation and Security) Act, 2012

The Bangladesh Wildlife (Conservation and Security) Act, 2012 provides the conservation and safety of biodiversity, forest and wildlife of the country by repealing the previous laws i.e. Wildlife (Preservation) Act of 1973. The Department of Forest (DoF) has the primary responsibility for implementing this Act. The key features of this Act are:

- Prohibition made in relation to wild animals and plants that no person can hunt any wild animal without a license or willfully pick, uproot, destroy or collect any plant;
- Determination of vulnerable, endangered and critically endangered species of wild animals and plants;
- Declaration of sanctuary for the conservation of forest and habitat of wildlife and prohibitions made on such sanctuary;

¹⁰ Khas land means government owned fallow land, where nobody has property rights. It is a land which is deemed to be owned by the government and available for allocation according to government priorities.

- Requirement of license to cultivate, extract, manufacture, rear, export or import any wild animal or part of its body, meat, trophy, uncured trophy or any plant; and
- Restriction on import, export and re-export of wild animals and plants.

This Act is applicable for this project because under this Act ‘biodiversity’ means genetic and species diversity of all species or sub-species of flora and fauna living in aquatic, terrestrial and marine ecosystems or diversity of their ecosystems. Wildlife species and their habitats would be damaged or disturbed due to the proposed activities for which mitigation measures need to be implemented.

2.1.10 The Protection and Conservation of Fish Act, 1950 and Rules, 1985

This Act and Rule cover all types of aquatic species including fish, prawn, shrimp, amphibians, tortoises, turtles, crustaceans, mollusks, echinoderms and frogs at all stages in their lifecycle and all types of water bodies. The Act specifies a number of useful fisheries management rules for sustainable fish culture and conservation in the country. These include use of appropriate fishing gear (net, cage, trap, explosives) and building water management structures (dams, weirs, bunds and embankments). It also specifies the fishing and non-fishing seasons and the size of fish below which any prohibited species cannot be killed or sold. This Act is revised and included the banning of ‘jatka¹¹’ of hilsa and use of synthetic mesh (locally known as ‘current jal’¹²) in 2011.

2.1.11 Noise Pollution (Control) Rules, 2006

According to the Environment Protection Act, 1995, the government formulated the noise pollution Rules in 2006. The Rules has been improved through ECR 1997 (Amendment 2017). The ECR, 1997 (Amendment 2017) addresses the sound levels to be no more than 45dB in quiet areas¹³ at daytime (6 am to 9 pm) and 35 dB at night-time (9 pm to 6 am). In residential areas these levels are 50 dB and 40 dB, immixed area¹⁴ 60 dB and 50 dB, in commercial areas 70 dB and 60 dB and in industrial areas 75 dB and 70 dB for daytime and night-time, respectively.

2.1.12 Disaster Management Act, 2012

The 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. Disaster means any such incidents created by nature or human.

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.

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:

¹¹ Any young fish returning to the sea are known as Jatka in Bangladesh. Jatka of hilsa refers to any hilsa smaller than or equal to nine inches in length;

¹²“ Current Jal” means fishing net made of monofilament synthetic nylon fibre of different mesh sizes;

¹³ The area within 100 meters from hospital, academic institutions or places identified/identifiable by the government;

¹⁴ An area, which is primarily a residential area with either or both commercial and industrial parts in it.

- 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.

2.1.13 Bangladesh Labor Act, 2006 and Rules, 2015

Bangladesh Labor 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.

This Act applies to the proposed project as it is under the industry which is responsible for transformation, generation, conversion, transmission, or distribution of electrical energy. The occupational 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 equipment (PPE). 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.

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

The Bangladesh Labor Act, 2006 consolidated and repealed 25 previous labor related laws including the Dock laborers Act, 1934, the Factories Act, 1965 among others.

2.2 Relevant National Policies and Plans

2.2.1 Environmental Policy, 1992

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 and promulgating regulation for all types of activities which pollute and degrade the environment;
- Ensuring sustainable utilization of natural resources;
- Active association with all environmentally-related international initiatives;

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 and private industries;
- To ban the establishment of any industry that produces goods which 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; and
- To ensure sustainable use of raw materials in the industries to prevent their wastage.

2.2.2 National Environmental Management Action Plan 1995

National Environmental Management Action Plan (NEMAP), 1995 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.

NEMAP has the following broad objectives:

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

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.

2.2.3 National Energy Policy, 2005

The National Energy Policy (NEP), 2005 of Bangladesh was first 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.

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 programs, 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.

2.2.4 Summary of Legislation/Policies and their Applicability for Proposed Project

Applicability of various laws and policies discussed above is summarized in **Table 2.1**.

Table 2.1: Applicability of Laws and Policies on Proposed Project

	National Legislation/Policies	Applicability/ Requirements for proposed project
	Environment Conservation Act, 1995 (amendment 2010)	Implementation of this project will have interaction with the environment. Thus, this act is applicable for this project.
	Environment Conservation Rules, 1997 (amendments in 2002, 2003, 2017)	ECR dictates the standard of environment to be maintained as per ECA. Thus, it is applicable.
	Environment Court Act, 2010	This act will be applicable if the project activities hamper the environment though pollution irreversibly.

	National Legislation/Policies	Applicability/ Requirements for proposed project
	The Electricity Act, 2018	This act is applicable for any infrastructure development activities for electricity in Bangladesh. As the scope of the project involves activities related to electricity infrastructure development in Bangladesh, this act is applicable.
	Acquisition and Requisition of Immovable Property Act, 2017	Tower footings of the transmission line will require acquisition of land, therefore this act is applicable for this project.
	East Bengal State Acquisition and Tenancy Act, 1950	Any land acquisition will be done through compensation process where the owners will have to establish their ownership to receive compensation. As land acquisition (tower footing) and compensation will be required under this project, this act is applicable.
	Bangladesh Water Act, 2013	This act protects and conserves water resources in Bangladesh. Any project that will have interaction with the water resources will have to abide by the act. As overhead transmission lines will over pass Karnaphuli River, a pond and <i>khals</i> , under this act, the project must establish that the water resources will not be affected. Thus, this is applicable.
	Wildlife (Conservation and Security) Act, 2012	Chattogram area is renowned for wild life habitats due to geographical locations. Any project in Chattogram area must show that it wouldn't impact to these wildlife habitats. Thus, this is applicable.
	The Protection and Conservation of Fish Act, 1950 and Rules, 1985	As the Overhead transmission line will cross Karnaphuli River, partial portion of a pond and khals, this act will ensure any sort of fish resources will not be hampered due to this project. Thus, it is applicable.
	Noise Pollution (Control) Rules, 2006	The proposed construction activities will generate noise. Thus, this Act is applicable for the project.
	Disaster Management Act, 2012	Any construction project, irrespective of magnitude and location should have proper disaster management plan as to how any common disaster would be managed. Thus, this is applicable.
	Bangladesh Labor Act, 2006 and Rules, 2015	This act ensures laborers' safety and good working condition. This construction project will engage labor force. Thus, it is applicable for this project.
	Environmental Policy, 1992	This policy provides an overall environmental guideline on how environmental issues will be

	National Legislation/Policies	Applicability/ Requirements for proposed project
		addressed for any development project. Thus, this is applicable for this project.
	National Environmental Management Action Plan 1995	This is an extension of Environmental policy, 1992. Thus, it is applicable.
	National Energy Policy, 2005	As this project is supposed to contribute to the national grid of Bangladesh, therefore this policy advocates bringing entire country under electrification by the year 2020. Thus, it is applicable.

2.3 Administrative Procedures for Obtaining Location/Environmental Clearance

The legislative bases for environmental assessment for the proposed power system network development project intervention are the ECA, 1995 (with subsequent amendments) and the ECR, 1997 (with subsequent amendments). According to the ECA, 1995, the proponent must obtain an ECC from the DoE in the manner prescribed by the Rules.

Environmental clearance has to be obtained in two steps: firstly, a site clearance and thereafter, an environmental clearance. An ECC is issued to all existing and proposed industrial units and projects falling under the Green category as identified in the ECR, 1997. For all other categories and SCC is required prior to obtaining the ECC.

Like all other projects, the proposed project also needs to meet the requirement of the DoE. An environmental assessment study needs to be undertaken for obtaining the environmental clearance. The procedure to obtain an Environmental Clearance Certificate for the proposed Project which falls under the ‘Orange B’ category requires submission of the following documents along with the application for clearance certificates:

- feasibility study report;
- Initial Environmental Examination;
- Environmental Management Plan (EMP);
- no objection certificate from the local authority;
- emergency plan relating to adverse environmental impact and plan for mitigation of the effect of pollution;
- outline of the relocation, rehabilitation plan (where applicable);
- any other necessary information (where applicable).

The steps followed to obtain the ECC for this Project from the DoE are outlined in **Figure 2.1**.

Public participation or consultation is not a condition in the ECR 1997 and/or EIA Guidelines; however, DoE prefers the proponent to conduct public consultation during the assessment and puts condition for it while providing site clearance or during the approval of the EIA’s Terms of Reference (ToR).

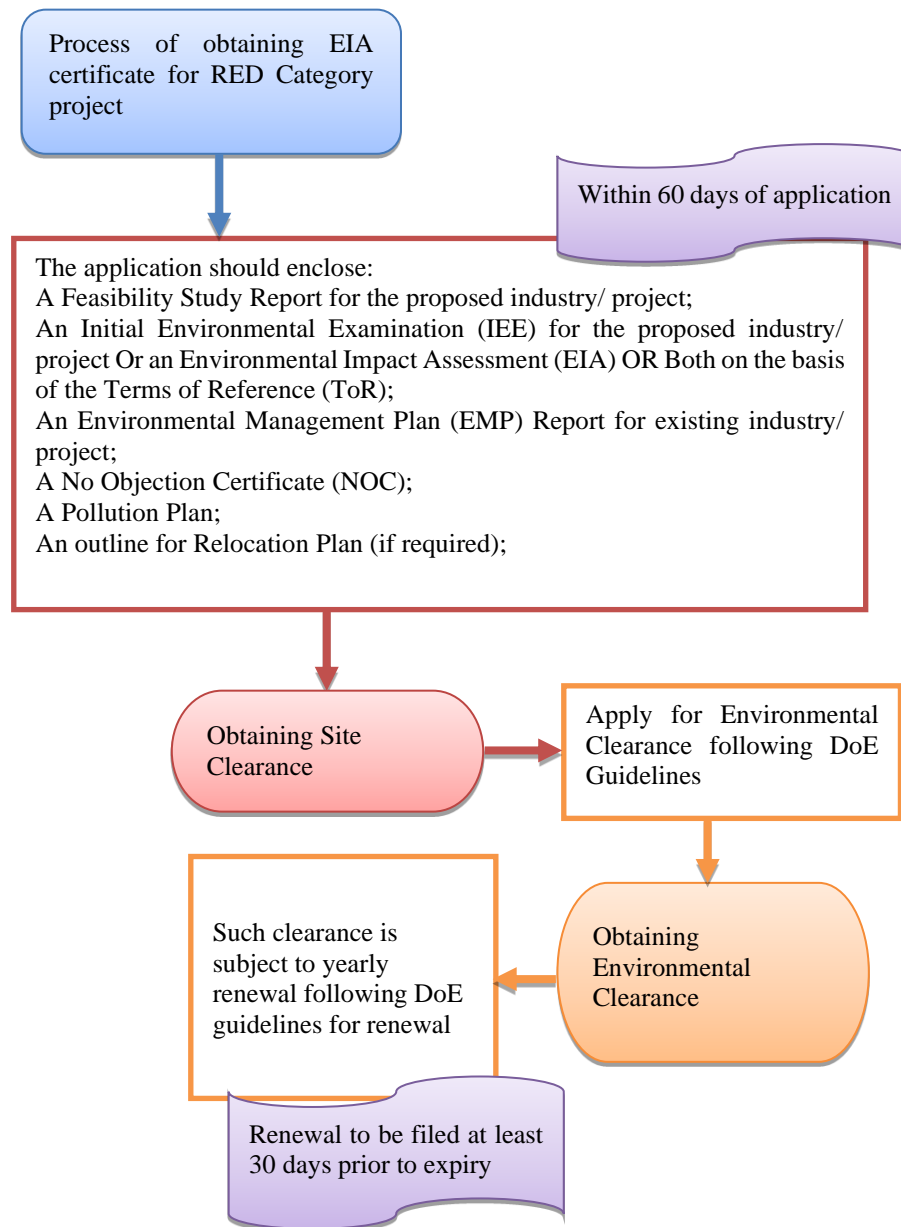


Figure 2.1: Steps Involved in Environmental Clearance following the DoE Guidelines

Organization Related to Enforcement of Environmental Standards

The Department of Environment (DoE), the technical arm of the Ministry of Environment and Forest (MoEF), is the regulatory body and the enforcement agency of all environmental related activities. It is the responsible body for reviewing and approving the reports required for obtaining SCC and ECC in Bangladesh.

The DoE is headed by a Director General (DG). The DG has complete control over the DoE. The power of the DG, as given in the Act, may be outlined as follow:

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 obtain an SCC and an ECC from the DoE when required (based on the category the project falls under). The procedures to take such clearance are in place.

Failure to comply with any part of ECA 1995 (amendment 2010) may result in punishment by a maximum of 10 years imprisonment or a maximum fine of BDT 1,000,000 (approximately USD 12,222)¹⁵ or both.

2.4 Comparison with WBG EHS Standards and Justifications of their Requirements

Air, water and noise have been identified as the environmental components that will be impacted due to the Project intervention on-site and the surrounding areas of the Project. As such, the existing national regulations and World Bank Group (WBG) Environmental, Health and Safety (EHS) Guidelines for these components have been compared in this section. Subsequently, justifications have been provided as to why these standards would need to be followed for each of the respective components.

2.4.1 Air Quality

The air quality is usually measured based on the average concentration in micrograms (μg) per cubic meter (m^3) within a specified timeframe of the following five components in the air: Nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), particulate matters less than 10 micron in diameter (PM_{10}), particulate matters less than 2.5 micron in diameter ($\text{PM}_{2.5}$) and Ozone (O_3). **Table 2.1** presents the comparison of national and WBG EHS Guidelines for air quality.

Table 2.2: Air Quality Standard Comparison

Component	Standard	Yearly ($\mu\text{g}/\text{m}^3$)	24 hours ($\mu\text{g}/\text{m}^3$)	8 hours ($\mu\text{g}/\text{m}^3$)	1 hour ($\mu\text{g}/\text{m}^3$)
NO_2	National	100	-	-	-
	WBG	40	-	-	200
SO_2	National	80	365	-	-
	WBG	-	125 (IT-1)		
PM_{10}	National	50	-	-	-
	WBG	50 (IT-2)	150 (IT-1)	-	-
$\text{PM}_{2.5}$	National	15			
	WBG	25 (IT-2)	75 (IT-1)	-	-
O_3	National			157	235
	WBG	-	-	160	-

Sources: National Standard: ECR, 1997 (Amendment 2017) and WBG: Environmental, Health, and Safety Guidelines - General EHS Guidelines: Environmental: 1.1 Air Emissions and Ambient Air Quality (2007) which is based on WHO/SDE/PHE/OEH/06.02; IT=Interim Target (See guideline for IT details.)

¹⁵ 1 United States Dollar = 81.8217 BDT (Bangladesh Taka) on March 5, 2018.

Table 2.1 above clearly identifies that WBG Standards for concentrations of NO₂ and SO₂ are more stringent than the national requirements. On the other hand, concentrations of PM₁₀, PM_{2.5} and O₃ are more stringent in the national rules. The national 'Rules' identifies the concentrations of lead (Pb), Carbon monoxide (CO) and suspended particulate matter (SPM) in the air in addition which makes it more broadly applicable as a tool for air quality guideline.

This Project will involve construction works which will significantly increase the concentration of PM₁₀, PM_{2.5} levels in the air unless they are mitigated or minimized through appropriate measures; thus, the national rules for air quality will be more appropriate for this Project.

2.4.2 Water Quality

The ECR, 1997 (Amendment 2017) has more detailed water quality guideline in comparison to the WBG EHS Guidelines. The ECR, 1997 (Amendment 2017) clearly specifies the water quality based on usage, such as drinking purpose, entertainment purpose, cooling purpose, fish culturing purpose, and irrigation purpose. It also clearly identifies significant number of components compared to the WBG Guidelines. The ECR, 1997 (Amendment 2017) covers a wide range of components – from the concentration of dissolved oxygen to the level of poisonous and radioactive materials. As a more detailed quality measurement guide, ECR 1997 (amendment 2017) is given priority by the DoE.

The comparison of the national standards and WBG Guidelines is presented in **Tables 2.3** and **2.4**.

Table 2.3: Comparison of Water Quality Standards

Pollutants	Units	National Values (ECR 1997, Amendment 2017)	WBG Guideline Value
pH	pH	-	6-9
Bio-chemical Oxygen Demand (BOD)	mg/l	40	30
Chemical Oxygen Demand (COD)	mg/l	-	125
Total Nitrogen	mg/l	-	10
Nitrate	mg/l	250	-
Total Phosphorus	mg/l	-	2
Phosphate	mg/l	35	-
Oil and Grease	mg/l	-	10
Total Suspended Solids (TSS)	mg/l	100	50
Total Coliform Bacteria (TCB)	Most Probable Number (MPB)/ 100ml	1000	400

Table 2.4: Water Quality Standards

Water Quality Parameters	Unit	Bangladesh Standards	WHO Guideline Value, 1993
1. Arsenic	mg/l	0.05	0.01
2. BOD at 20°C	ppm	0.2
3. Chloride	mg/l	150-600*	250
4. Free Chlorine	mg/l	nil	0.6-1.0
5. Electric Conductivity (EC)	μ Scm-1	500	500
6. Turbidity	NTU	5.0	5.0
7. Dissolved oxygen (DO)	ppm	6.0	
8. Hardness (as CaCO ₃)	mg/l	200-500
9. Iron	mg/l	0.3-1.0	0.3
10. Nitrate	mg/l	40-50	50
11. Nitrite	mg/l	<1	0.2-5
12. Odor	mg/l	Odorless	Odorless
13. PH	-	6.5-8.5	6.5-8.5
14. Total dissolved solids (TDS)	mg/l	1000	500
15. Temperature	"C	20-30	20-30
16. Coliform (faecal)	CFU/100ml	Nil	Nil
17. Coliform (total)	CFU/100ml	Nil	Nil
18. E. coli		absent	absent
19. Vibrio Cholerae		absent	absent
20. Salmonellaspp.		absent	absent
21. Shigella spp.		absent	absent
22. Total Viable Count	CFU/ml	100000/ml	100000/ml

Source: Ahmed and Rahman, 2003.

2.4.3 Noise Quality

The noise levels are more stringent in the national rules, i.e. in the ECR, 1997 (Amendment 2017), in comparison to the WBG EHS Guidelines. The DoE uses the ECR, 1997 (Amendment 2017) as a basis to identify noise pollution due to the project intervention. **Table 2.5** below will allow to have a quick glimpse on the noise levels of ECR 1997, ECR 1997 (Amendment 2017) and the WBG Guidelines.

Table 2.5: Noise Quality Standard Comparison

Component	Time Period	ECR, 1997	ECR 1997 (Amended 2017)	WBG2007
Quiet Area (QA)	Daytime	50 dBA	45 dBA	-
	Night-time	40 dBA	35 dBA	-
Residential Area (RA)	Daytime	55 dBA	50 dBA	55 dBA
	Night-time	45 dBA	40 dBA	45 dBA
Mix Area (MA)	Daytime	60 dBA	60 dBA	-
	Night-time	50 dBA	50 dBA	-
Commercial Area (CA)	Daytime	70 dBA	70 dBA	70 dBA
	Night-time	60 dBA	60 dBA	70 dBA
Industrial Area (IA)	Daytime	75 dBA	75 dBA	70 dBA
	Night-time	70 dBA	70 dBA	70 dBA

Sources: National Standard OLD: ECR, 1997 National Standard NEW (ECR Amendment 2017) and WBG Standard: Environmental, Health, and Safety Guidelines - General EHS Guidelines: Environmental: 1.7 Noise Management (2007); MA: Primarily an RA combined with CA and/ or IA.

Notes: Area up to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.

Daytime is defined between 600 and 2100 hrs. in national rules; For IFC, this is between 700 and 2200 hrs.; Night-time is defined between 2100 and 600 hrs. in national rules; For IFC, this is between 2200 and 700 hrs.

This Project was initiated before the amendment of ECR, 1997 in December 2017; thus, the EIA used the ECR 1997 noise levels to obtain clearance certificates from the DoE.

Any construction activity will generate noise. Thus, noise quality will be compromised due to this Project intervention. As the national standards for noise quality is better defined and more stringent, these standards have been used for this Project.

2.5 AIIB Environmental and Social Framework

The proposed project is being financed by AIIB and therefore its Environmental and Social Framework will be applicable to the project.

2.5.1 Objectives of AIIB's Environmental and Social Framework

The objectives of the AIIB's environmental and social framework (ESF) are:

- Reflect institutional aims to address environmental and social risks and impacts in Projects.
- Provide a robust structure for managing operational and reputational risks of the Bank and its shareholders in relation to Projects' environmental and social risks and impacts.
- Ensure the environmental and social soundness and sustainability of Projects.
- Support integration of environmental and social aspects of Projects into the decision-making process by all parties.

- Provide a mechanism for addressing environmental and social risks and impacts in Project identification, preparation and implementation.
- Enable Clients to identify and manage environmental and social risks and impacts of Projects, including those of climate change.
- Provide a framework for public consultation and disclosure of environmental and social information in relation to Projects.
- Improve development effectiveness and impact to increase results on the ground, both short- and long-term.
- Support Clients, through Bank financing of Projects, to implement their obligations under national environmental and social legislation (including under international agreements adopted by the member) governing these Projects.
- Facilitate cooperation on environmental and social matters with development partners.

2.5.2 Key Elements of Environmental and Social Framework

Overarching Policy. The objective of this overarching policy is to facilitate achievement of these development outcomes, through a system that integrates sound environmental and social management into Projects. The overarching policy comprises Environmental and Social Policy (ESP), and Environmental and Social Standards (ESSs).

Environmental and Social Policy

The ESP sets out mandatory requirements for the Bank and its Clients relating to identification, assessment and management of environmental and social risks and impacts associated with Projects supported by the Bank.

Environmental and Social Standards

The environmental and social standards (ESSs) set out more detailed mandatory environmental and social requirements, as described below.

Environmental and Social Standard 1 (ESS 1). The ESS-1 aims to ensure the environmental and social soundness and sustainability of Projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. The ESS 1 defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the Bank.

Environmental and Social Standard 2 (ESS 2). The ESS 2 is applicable if the Project's screening process reveals that the Project would involve Involuntary Resettlement (including Involuntary Resettlement of the recent past or foreseeable future that is directly linked to the Project). Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers such displacement whether such losses and involuntary restrictions are full or partial, permanent or temporary. The ESS 2

defined detailed requirements of resettlement planning of the projects involving involuntary resettlement.

Environmental and Social Standard 3 (ESS 3). The ESS 3 is applicable if Indigenous Peoples are present in, or have a collective attachment to, the proposed area of the Project, and are likely to be affected by the Project. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (b) collective attachment to geographically distinct habitats or ancestral territories in the Project area and to the natural resources in these habitats and territories; (c) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and (d) a distinct language, often different from the official language of the country or region. In considering these characteristics, national legislation, customary law and any international conventions to which the country is a party may be taken into account. A group that has lost collective attachment to geographically distinct habitats or ancestral territories in the Project area because of forced severance remains eligible for coverage, as an Indigenous People, under ESS 3. The ESS 3 defines the detailed requirements of People planning, in case such groups are present in the project area and are likely to be affected by the project.

2.5.3 Applicability of ESF for Proposed Project

The applicability of ESP and ESSs for the proposed project is presented in **Table 2.6**.

Table 2.6: Environmental and Social Standards (ESS) for AIIB

Environmental and Social Standards		Applicability	Triggering Status
ESS 1	Environmental and Social Assessment and Management	ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both)	Yes, since the proposed project is likely to have negative environmental and social impacts. The present ESIA has been conducted in response to the ESS 1.
ESS 2	Involuntary Resettlement	ESS 2 is applicable if the project is likely to cause involuntary resettlement impacts.	Yes. The project involves disruption of economic activities during the construction phase in the underground section of the transmission line which are temporary and reversible in nature. Some impacts on structures are also envisaged in the overhead section of the transmission line. Given such impacts, though low intensity in nature, ESS 2 is triggered.
ESS 3	Indigenous Peoples	ESS 2 is applicable if Indigenous People are present in the project area and they are likely to be affected by the project.	No, since no Indigenous people, as defined in the ESS 3 are present in the project area.

2.5.4 Screening and Categorization Requirements

All AIIB-financed projects are required to be screened and categorized in order to determine the nature and level of the required environmental and social reviews and assessment, type of information disclosure and stakeholder engagements for the respective project. The project's category is determined by the category of the project's component that presents the highest environmental or social risk, including direct, indirect, cumulative and induced impacts, as relevant, in the project area. AIIB assigns each proposed project to one of the four categories as described in **Table 2.7** below.

Table 2.7: Screening and Categorization of AIIB Projects

Category		Applicability for the Proposed Project
Category A	A project is categorized as 'Category A' if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented.	Not applicable
Category B	A project is categorized as 'Category B' when it has a limited number of potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are limited to the project area; and can be successfully managed using good practice in an operational setting.	Considering the potential negative and positive environmental and social impacts of this proposed project and their management, it is appropriate to fit the Project into Category B under AIIB ESF categorization. This is because most of the impacts are temporary, reversible and bound to occur in the Project area and the impacts are manageable with proposed mitigation and monitoring measures.
Category C	A project is categorized as 'Category C' when it is likely to have minimal or no adverse environmental and social impacts.	Not applicable
Category FI	A Project is categorized FI if the financing structure involves the provision of funds to or through a financial intermediary (FI) for the project, whereby the Bank delegates to the FI the decision-making on the use of the Bank funds, including the selection, appraisal, approval and monitoring of Bank-financed sub-projects.	Not applicable

For Category B Projects, AIIB determines the appropriate environmental and social assessment documentation required on a case-by-case basis. Since the proposed project falls under the Orange B Category according to the national law (ECR 1997, Amendment 2017), an IEE was prepared to meet the condition of the national law and clearance certificate (see **Annex A**) was obtained from the DoE. Later, AIIB determined to update the original IEE to an ESIA in compliance with its ESF and hence the present document was prepared.

3. Project Description

This Chapter presents a simplified description of the proposed project, its components, and various activities to be carried out during its various phases. Also provided in this Chapter is an overview of the temporary facilities needed during the construction phase, human resource requirements, and types and estimated quantities of the key construction materials. A more detailed description is available in the AIIB's Project Description Document.

3.1 Background

The existing and proposed 400 kV, 230 kV and 132 kV grid networks in Bangladesh are presented in the **Figure 3.1**. The PGCB engineers have carried out a study of the whole transmission network. The study shows that a considerable number of existing grid substations and transmission lines in the Chattogram area are going to fall short of capacity when the new electricity generation will be added to the national grid. It can be envisaged that to address the increasing demand and to ensure reliable electricity supply to concerned urban and sub-urban areas, some new substations and associated transmission lines are required. This will not only increase the operating contingency of the system but will also overcome the limitations of supplying quality and uninterrupted electricity to the end users. Considering the present and future demand of the area, the proposed PSUEP is being undertaken under the overall Power System Master Plan (PSMP)-2016 and the Prioritized Investment Plan for transmission network in the Year 2015-2020.

PSUEP has been proposed to be included in the Seventh Five Years Plan. After analyzing the grid network and load demand forecast of the new/ upgraded substations and bay extension works, the interventions under the proposed project have been finalized. The proposed substations and associated transmission lines will contribute 1800 MVA transformer capacity at 230 kV level and 360 MVA of transformer capacity at 132 kV level.

3.2 Major Components of the Project

Major components of the projects are given below:

- Anowara to Anandabazar (New Mooring) 400 kV double-circuit transmission line: 20 km long overhead transmission line and 7 km long underground cable.
- Hathazari to Rampur 230 kV double-circuit underground cable at Anandabazar (New Mooring): 3 km long.
- Madunaghat to Khulshi 230 kV double-circuit underground cable: 16 km long.
- 230/132 kV GIS substation at Anandabazar (New Mooring) with two 350/450 MVA transformers.
- 230/132/33 kV GIS substation at Khulshi with two 350/450 MVA (230/132kV) and three 80/120MVA (132/33kV) transformers.
- Two bay extensions at 230 kV GIS substation at Madunaghat.

The salient features of the above interventions are given in **Table 3.1**.

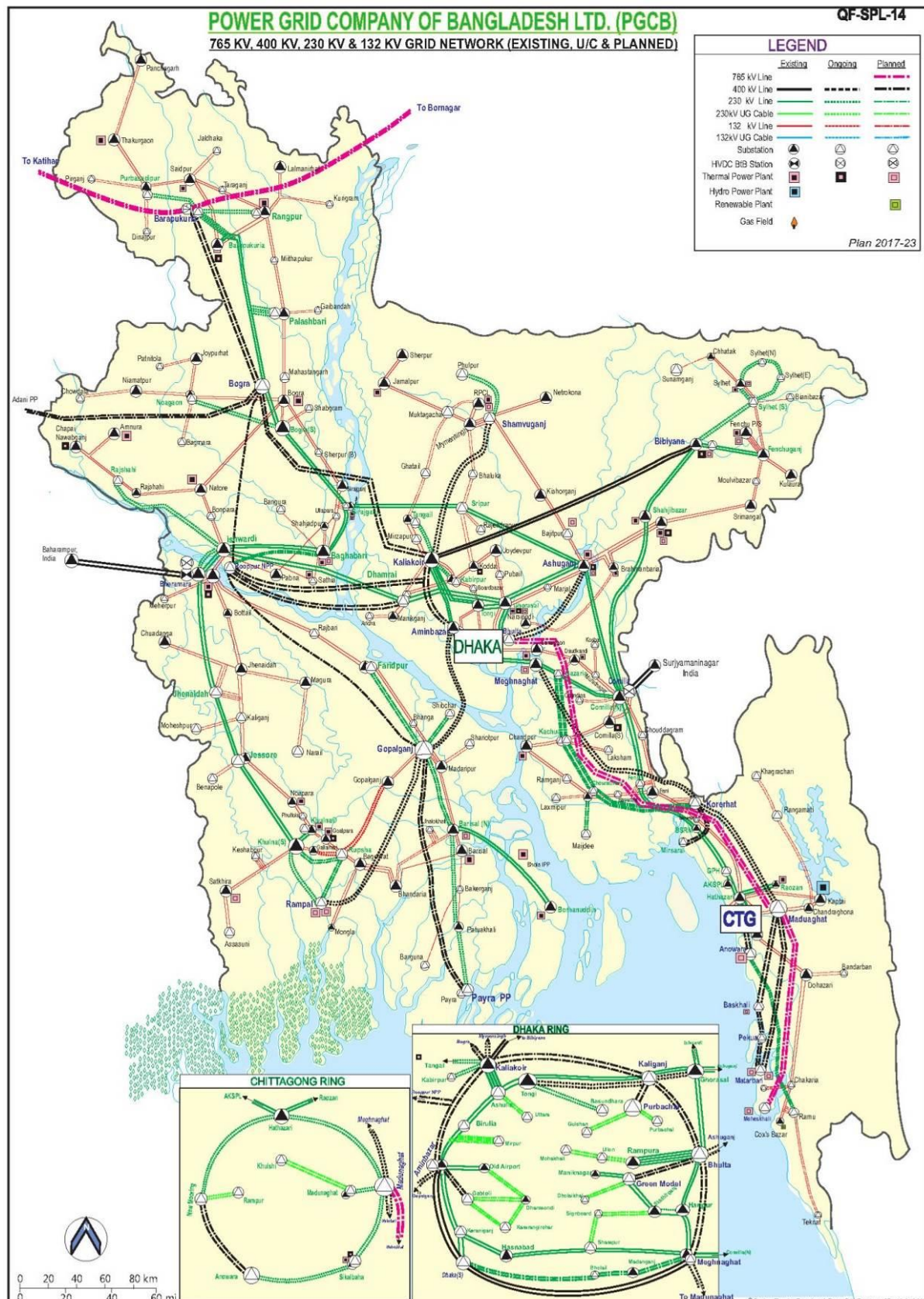


Figure 3.1: Existing and Proposed 400kV, 230kV and 132kV Grid Network of PGCB in Bangladesh

Table 3.1: Interventions under the Project

	Substation Location and Type	Capacity	Associated Transmission Line ^a	Bay Extension	Required Land	Type
1	New Mooring 230/132 kV GIS Substation ^b	2x350/450 MVA	Anowara-New Mooring 400 kV double circuit line:25.182 km long (overhead 19.932km and underground 5.25km); LILO of Hathazari-Rampur 230 kV at New Mooring: 2.66 km long double circuit underground cable	-	18 Acres (72843.4 m ²)	Indoor (GIS)
2	Khulshi 230/132/33 kV GIS Substation	2x350/450 (230/132 kV) and 3x80/120 (132/33 kV)	Madunaghat to Khulshi 230 kV double circuit underground cable transmission line: 14.56km long	2 x 230 kV GIS Bay at Madunaghat	Existing Land	Indoor (GIS)
	Total		42.402 Km			

^a Length of the proposed transmission line is provided based on the route survey.

^b 132/33kV New Mooring Substation will be constructed under another Project in which 18 acres of land would be acquired and under this project 230/132 kV substation will be constructed inside aforementioned land (because there is enough land after constructing the 132/33 kV GIS substation).

Source: PGCB, System Planning, 2016.

3.3 Project Location

The Project is located in Chattogram covering south-eastern zone of Bangladesh (**Figure 1.1**). The study area covers 25 Unions belonging to eight Upazilas/ Thanas in Chattogram district. Locations of various project interventions are shown in **Figures 3.2 to 3.4**.

3.4 Salient Features of Substations

In GIS based systems, all the live components are enclosed in a grounded metal enclosure, and then the whole system is housed in a chamber full of gas. GIS based substations primarily use sulfur hexafluoride (SF₆) gas as the primary insulator. SF₆ is non-toxic, maintains atomic and molecular properties even at high voltages have high cooling and superior arc quenching properties.

SF₆ has superior dielectric properties compared to other gases; thereby providing favorable insulation for the phase to phase and phase to ground moderation. In the substation setup, the gas is contained in a grounded metal enclosure containing the conductors, current and voltage transformers, circuit breaker interrupters, switches, and lightning arrestors.

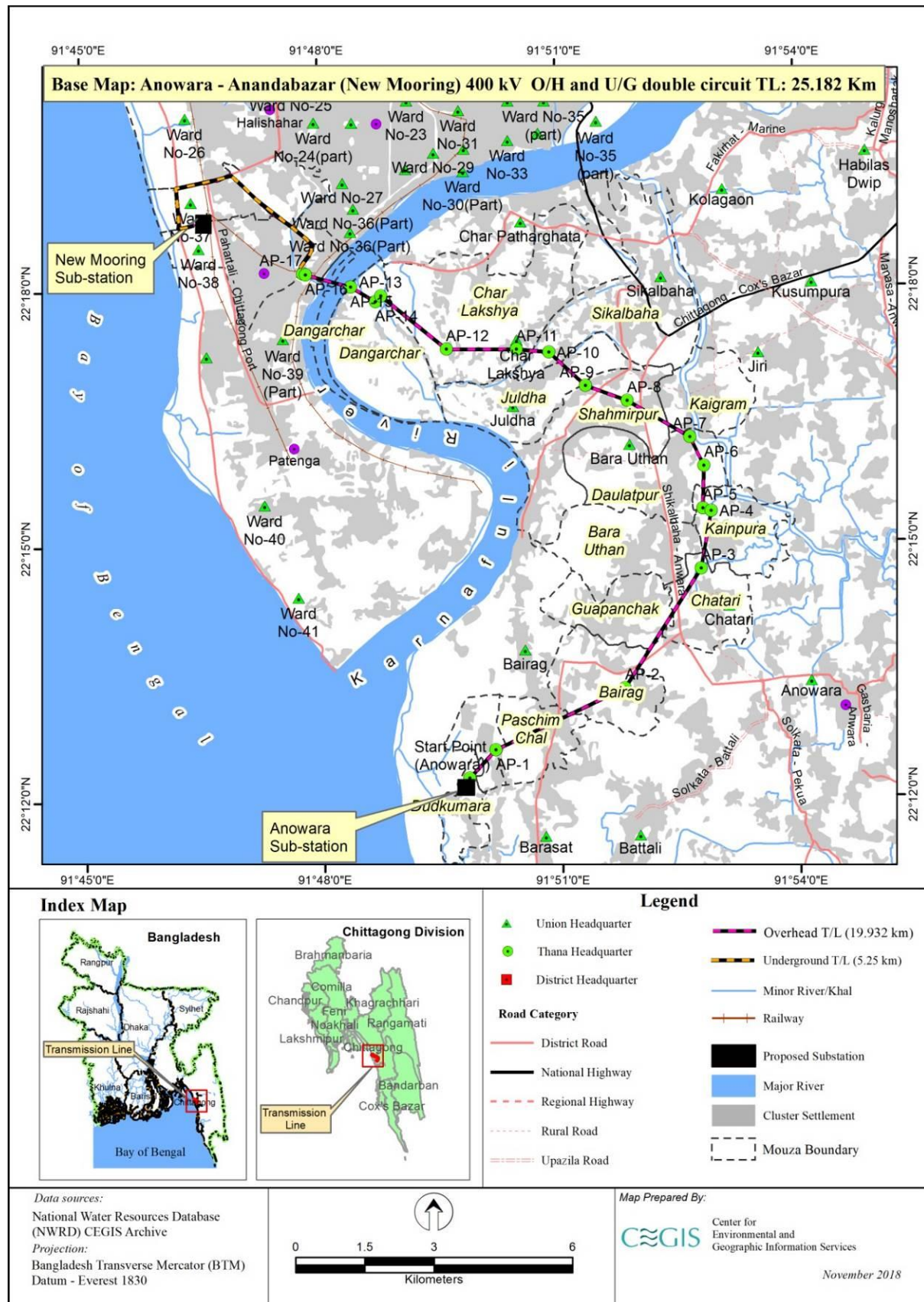


Figure 3.2: Anandabazar (New Mooring) and Anowara Substations and Adjoining Transmission Line

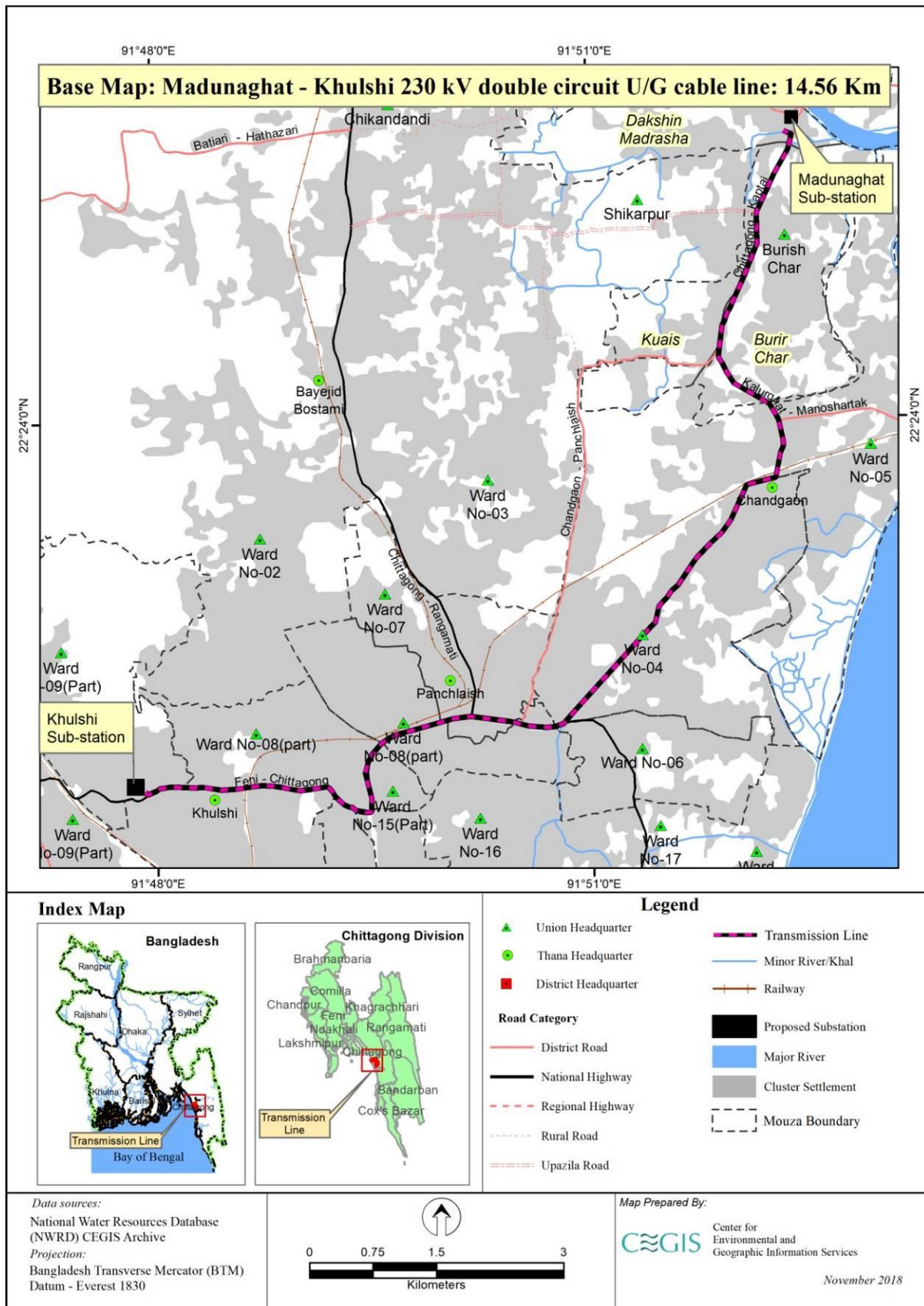


Figure 3.3: Madunaghat and Khushi Substations; Adjoining Transmission Line

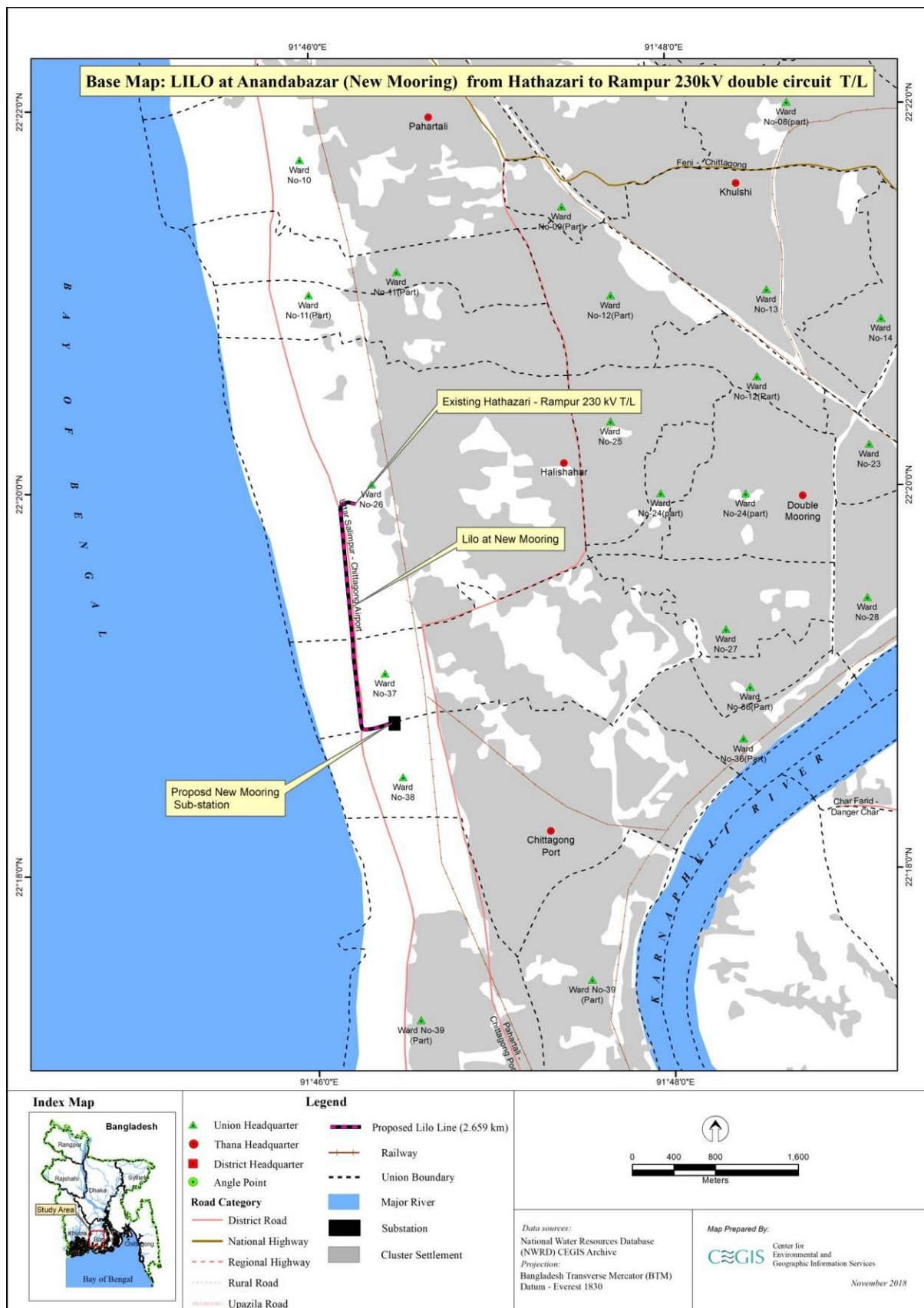


Figure 3.4: Anandabazar (New Mooring) to Hathazari Transmission Line

The substations have electrical specifications for voltage, switchgear, circuit breaker, transformer, and protection systems. The key features of the substations are given in **Tables 3.2** and **3.3** below.

Table 3.2: Salient Features of New Mooring 230/132 kV GIS Substation

Features	Specification
Type	GIS (Indoor)
Land Ownership	18 acres of land already acquired by PGCB
Voltage Levels	230/132 kV
Transformer Full Capacity	2 x 300/450 MVA
Insulation Medium Power Circuit Breaker	SF ₆ Gas
Transformer Insulation	Gas Insulated
Control System	Both manual and automation
Communication System	Optical fiber communication
Fault Detector	Relays
Fire Protection System	Auto Fighting Water Spray System
Duration of Project Implementation	Approximately 30 months form the contract signing

Source: PD Office, PGCB

Table 3.3: Salient Features of Khulshi 230/132/33 kV GIS Substation

Features	Specification
Type	GIS (Indoor)
Land Ownership	Pre-owned by PGCB
Voltage Levels	230/132 kV
Transformer Full Capacity	2x350/450 (230/132 kV) 3x80/120 (132/33 kV)
Insulation Medium Power Circuit Breaker	SF ₆ GAS
Transformer	Gas Insulated
Control System	Both manual and automation
Communication System	Optical fiber communication
Fault detector	Relays
Fire Protection System	Auto Fighting Water Spray System
Duration of Project Implementation	Approximately 30 months form the contract signing

Source: PD Office, PGCB

3.5 Proposed Substations and Bay Extension Works

3.5.1 Khulshi Substation

The existing Khulshi 132kV substation may be upgraded by total replacement of the existing 132kV AIS switching facility with an indoor 7-bay 230kV GIS and a 12-bay 132kV GIS, in a 25m x 25m building, and installing two new 300MVA, 230/132kV auto-transformers outdoor, a new control room and high voltage cable spread room is to be provided at ground floor. The interconnection between the existing 132 kV AIS and proposed 132 kV GIS through underground cable should be done circuit by circuit in such a way that each circuit connection can be completed in a day avoiding power shut down of that area for more than a day. Otherwise alternative arrangement of power supply should be found out.

The aforesaid proposal was examined. It appears that a space of about 2000 cubic meters is required to implement the proposed work. Since this space is not available at the existing substation premises, hence the existing garden area at the south-east corner of the substation along with the adjacent feeder road has been taken into consideration to accommodate the proposed components. A feeder road alternative to the existing one has also been proposed for uninterrupted communication/access.

3.5.2 New-Mooring Substation

The selected site is located just beside Abdul Gafur Road (Ananda bazar to Sea Beach road) (N 22° 20' 08" E 091° 46' 01") under Chattogram Port Thana. PGCB will acquire and develop 18 acres of land under a separate Project where a 132/33 kV GIS Substation will be constructed and the remaining vacant space will be used in some other purposes. In this project a 230/132 kV GIS Substation will be built inside the aforementioned acquired and developed land. Adequate land will be available for 230/132 kV GIS substation after the construction of 132/33 kV GIS substation.

3.5.3 Bay Extension Work of Madunaghat Substation

The existing 132/33 kV AIS substation at Madunaghat is one of the oldest substations under PGCB. The substation is going to be upgraded into a 230/132/33 kV GIS Substation along with two 230 kV bays and other facilities under a separate project. Two more bays will be needed to connect the substation with the proposed Khulshi 230/132 kV substation through Khulshi to Madunaghat 230 kV underground transmission line which is proposed under the proposed Project. The proposed bays under this project will be constructed inside the 230 kV GIS building which would be constructed under the other project mentioned above. Sufficient space would be available inside the substation for the construction work.

3.6 Salient Features of Transmission Lines

The proposed transmission lines will be a combination of overhead and underground transmission lines. The salient features of 400 kV overhead transmission line and underground cables are given in **Tables 3.4** and **3.5**. The transmission lines will be double circuit with aluminum alloy conductor. The transmission line supporting structures will be steel lattice towers of two types – tension and suspension. Tension towers will be installed in angles (See **Figure 3.5**) and suspension towers will be installed along the line (See **Figure 3.6**) as load bearing support. The towers will be using disc type porcelain insulators to hold the conductors (See **Figure 3.7**).

Table 3.4: Salient Features of 400 kV Transmission Line

	Salient Features	Attribute
1	Voltage Rating	400 kV
2	Type of Transmission Line	Double circuit
3	Width of T/L Right of Way (RoW)	100 meters (40 m left + 20m DIA + 40 m right)
4	Type of Line Support	400 kV double circuit steel towers
5	Conductor (tentatively)	Quad finch
6	Line Insulator	Disc type, Porcelain
7	Type of Connection	Substations
8	Tentative Number of Towers	56
9	Total land requires for installing a typical Tower	400 m ² (20mx20m) {per footing area 27.04 m ² (5.2mx5.2m)}
10	Standard Distance between phase to phase conductors (approx.)	8 m
11	Duration of Project Implementation	Approximately 30 months

Table 3.5: Salient Features of Underground Cable

	Features	Specifications
1	Voltage Rating	400 kV and 230 kV
2	Conductor Size (approx.)	2000 mm ²
3	Diameter of complete cable (approx.)	131 mm
4	Weight of complete cable (approx.)	18 kg/m
5	Cable Insulation Type	XLPE
6	Standard formation of the cable	Trefoil (Triangle)
7	Type of earthing	System neutral effectively grounded



Figure 3.5: Angle Tower (Tension Tower)



Figure 3.6: Suspension Tower



Figure 3.7: Insulators for Transmission Line

Figure 3.8 shows typical drawings of 400kV transmission towers as provided by PGCB. The specifications are for bidding purposes only and PGCB acknowledges that these drawings may be changed by the contractor to better fit the project needs if deemed required.

Figure 3.9 shows a typical cross-section of a cable used for underground transmission line, whereas **Figure 3.10** shows typical arrangement of underground cables.

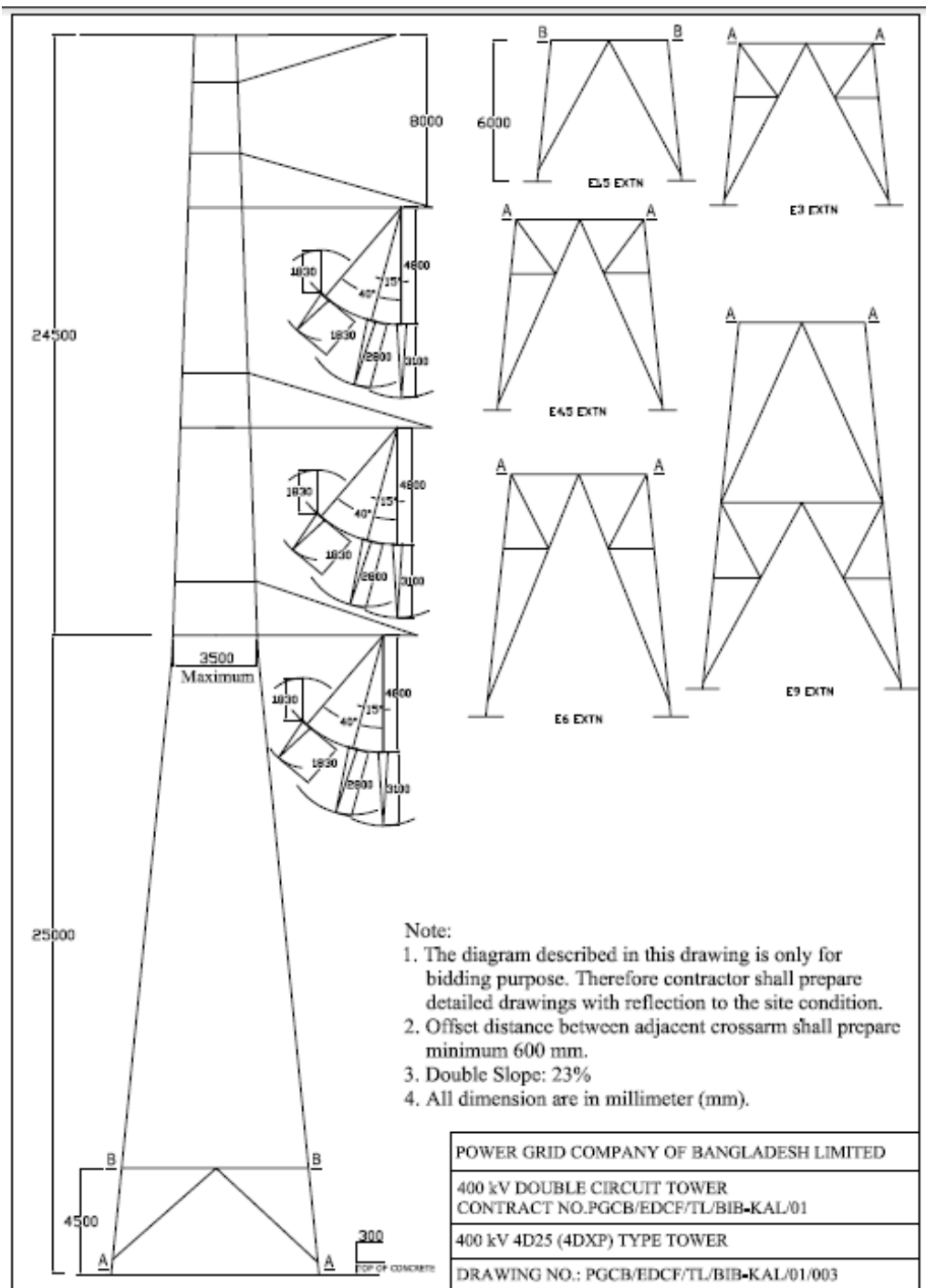


Figure 3.8: Drawings of 400 kV Tower

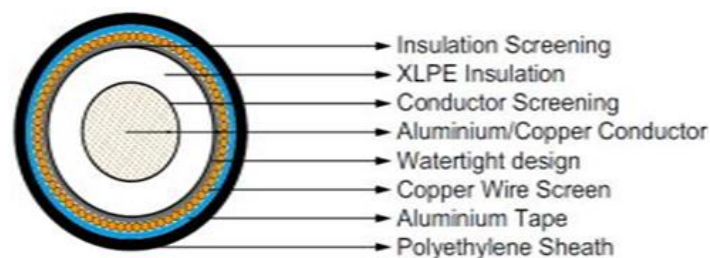


Figure 3.9: Typical Cross-section of Underground Cable

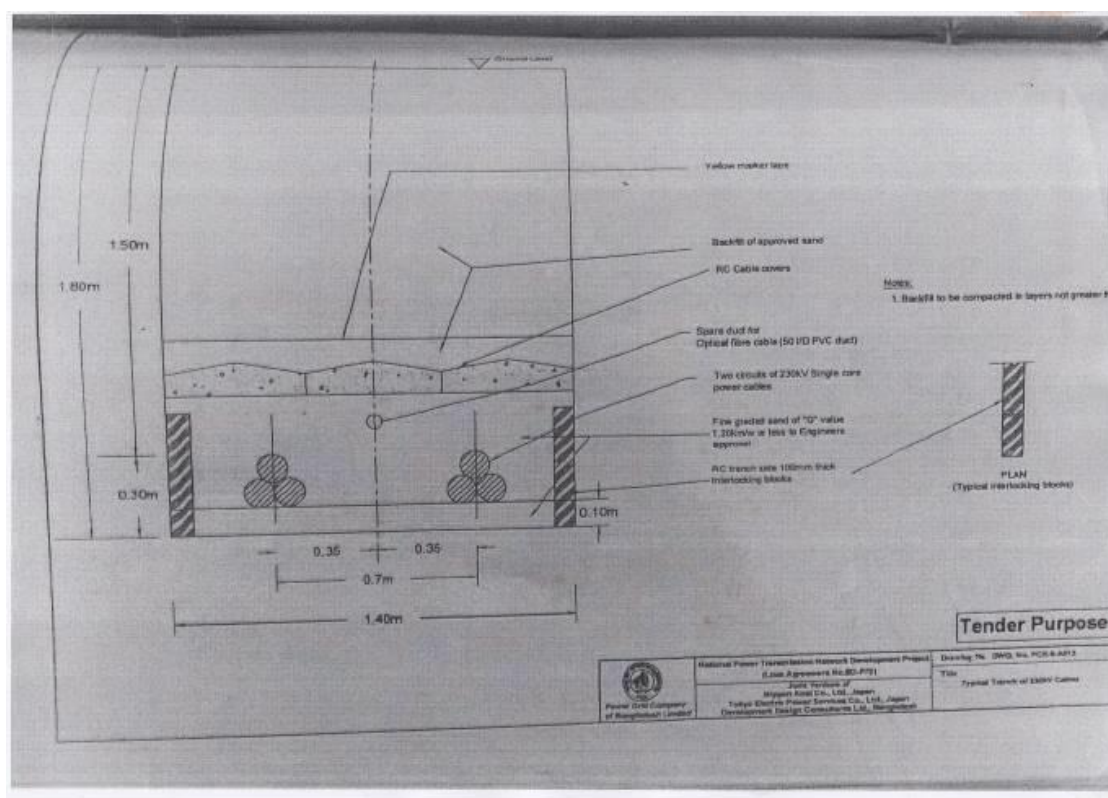


Figure 3.10: Typical Layout of Underground Cables

3.7 Construction Activities

The phase-wise major construction activities for transmission line and substations are presented in the Table 3.6.

Table 3.6: Phase-wise Construction Activities

Components	Activities		
	Pre-construction	During Construction	Post Construction/ Operation Period
Overhead Transmission Line (OHTL)	Route Survey for OHTL;	Contractor and manpower recruitment;	Regular clearing of RoW
	Tender Documents preparation for OHTL;	Establishment of construction camps for workers and transportation to work site (if required);	Operation and Maintenance (O&M) of OHTL
	Plans for OHTL construction activities such as tower erection, conductor stringing, connection to substation;	Establishment of temporary access tracks;	Dealing with accidental hazard related to O&M of OHTL

Components	Activities		
	Pre-construction	During Construction	Post Construction/ Operation Period
		Clearing of RoW of OHTL route;	
		Establishment of temporary material storage areas and work sites for OHTL components and construction equipment;	
		Transport of materials and equipment to tower site;	
		Civil works (foundation works, reinforced cement concrete (RCC) works etc.);	
		Tower erection;	
		Overhead conductor stringing;	
		Connecting OHTL with substations using Overhead Line Entry	
		Dealing with accidental hazards during tower erection, conductor stringing and connecting to substations;	
Underground Transmission Line (UGTL)	Route Survey for UGTL	Contractor and manpower recruitment;	Operation and Maintenance (O&M) of the UGTL;
	Tender Documents preparation	Establishment of construction camps for workers and transportation to worksite (if required);	Dealing with accidental hazard of UGTL during O&M;
	Plans for UGTL construction activities such as trenching, tunneling, vertical shafts, laying of cables, connection to substations	Requisition of temporary access tracks using the existing roads for construction activities;	
		Establishment of material storage areas and worksites for UGTL;	
		Transport of materials and equipment to trenching and tunneling sites;	

Components	Activities		
	Pre-construction	During Construction	Post Construction/ Operation Period
		Civil works related to underground cable trenching, tunneling, vertical shafts, and backfilling, etc.	
		Underground cable laying;	
		Connecting UGTL with substations using Vertical Shaft Entry;	
		Dealing with accidental hazards during tunneling, trenching etc., cable laying and connecting to substations;	
Substations	Topographical Survey	Contractor and manpower recruitment;	Operation and Maintenance (O&M) of the substation;
	Land acquisition (if required)	Establishment of construction camps for workers (if required);	Dealing with accidental hazard during O&M of the substation site;
	Tender Documents preparation	Land development (if required);	
	Plans for construction activities	Establishment of temporary access tracks to the worksite (i.e. substation site);	
		Establishment of material storage areas and work sites;	
		Clearing substation site;	
		Transport of materials and equipment to substation site;	
		Civil works (land filling, foundation works, RCC works etc.)	
		Equipment installation and connection;	
		System integration, testing and commissioning;	
		Dealing with accidental hazard;	

Source: ESIA study. CEGIS

3.7.1 Construction Related Works for Transmission Lines

- Contractor and worker (manpower) recruitment
- Establishment of construction camps for the workers

- Establishment of temporary access tracks
- Clearing of RoW
- Establishment of material storage areas and work sites
- Transport of materials and equipment to the sites
- Civil works for tower foundation
- Tower erection
- Underground cable trenching
- Conductor stringing and cable laying
- Testing and commissioning.

Underground Cabling. The underground cable along the road way is usually done by open trench method which will be applied to this project. The process below is applicable for two circuits. The trench will be 1.2m wide and 1.7m deep. As practiced normally, the wearing surface of the road will be cut along the trench line by diamond cutter. After removing the wearing layer, an excavator will be used to dig up soil up to the required depth. No retaining wall would be required for this process.

Interlocking reinforced cement (RC) trench blocks will be placed at the bottom of the trench vertically. The height of the trench blocks will be about 350mm. Fine graded soil will be placed on the trench bed.

Two circuits of power cables will be placed over the sand bed. These are normally trefoil. The parallel distance between the circuits is 700mm. Optical fiber cables are placed along the centerline of the trench.

A sand layer will be placed with clearance height of 200mm of the cables. RCC covers will be placed over the sand layer. A layer of 300mm of soil is placed over it. A yellow tape is placed over this soil layer. Finally, the rest of the space is backfilled with specified material.

Transmission line towers. The basement of lattice towers will be pile foundation (see **Figures 3.11 to 3.19**). There will be piles and at the top, a pile cap in each leg of the tower. For piling work, a boring will be made in the soil using drilling rig. Bentonite slurry or steel tube will be used to stabilize the bore holes. Reinforcement cage will be placed and consequent concrete casting will be performed. For pile foundation, at least three piles and mostly four piles are cast in general. The number and depth of pile will depend on the results of geo-technical investigation.

After the completion of piling work, the top soil of the piles will be excavated up to specified depth. The excavation work could be done using local instrument or using excavator.

At the finishing of excavation, top and bottom reinforcements will be placed. Then concreting of pile cap will be performed. The pile cap transfer load to the sub soil through the piles.

The steel sections of the tower will be joined by bolt to erect the tower. Crane may be used to lift the steel sections at different elevation.



Figure 3.11: Placing steel ring bunds



Figure 3.12: Welding of reinforcements



Figure 3.13: Tower pilling work



Figure 3.14: Pile cap reinforcement



Figure 3.15: Striping the tower footing with steel



Figure 3.16: Providing detail reinforcements



Figure 3.17: Casting concrete cement into tower foundation



Figure 3.18: Placing tower on its foundation

Installation of equipment will include circuit breakers, transformers, lightning arresters, panel boards, batteries and battery chargers, insulators, current transformers, potential transformers, and relays. After completion of the building, all equipment will be installed at the substation as per design specification and standard. For this project, all substation materials will be procured from foreign countries. Therefore, use of domestic materials will be less; only local materials like bricks, sand, cement, rods etc. will be used for the installation works.

Transformers are heavy equipment. Therefore, the transportation of such equipment may require grading of river embankment and skidding through open field. Compensation may be provided to the land owners who would be affected.

The towers will be constructed to take the load of the tower itself, conductors, accessories as well as wind load and earthquake load. The towers in paddy fields will have proper clearance to maintain sag (lowest point on line). At homesteads, if any, the sag will be maintained as per standards.



Figure 3.19: Tower erection works

The transmission line conductor will be drawn keeping suitable clearance (as per design) at all locations. During stringing work, the lowest sag point will be maintained as per the approved drawing and design following appropriate safety precautions and standards. Generally, tension

stringing method is used for conductor stringing in Bangladesh. A pulling line is initially pulled into the travelers which is then used to pull the conductor from the reel stands using specially designed tensioners and pullers (see **Figure 3.20**). This process is almost similar in overland and river crossing portion. If the span of the river crossing portion is large, then a water vehicle is used to carry the puller through the river.



Figure 3.20: Conductor stringing

After installation of all the indoor and outdoor equipment, each and every equipment will be tested as per specification and standard. If all the tests are successful, the substations will be commissioned accordingly.

After installation, proper grounding of all instruments and line will be done. It is necessary for safe working place.

3.7.2 Construction Related Works for Substations

- Land acquisition (if required)
- Contractor and worker (manpower) recruitment
- Establishment of construction camps for the workers
- Land development (if required)
- Establishment of temporary access tracks
- Establishment of material storage areas and work sites
- Transport of materials and equipment to the sites
- An upgrade of a substation to be constructed
- Dismantling of old building and facilities
- Transport of materials and equipment to site
- Civil works
- Equipment installation
- Testing and commissioning of equipment.

Construction of the substation needs earthwork excavating for the foundation up to the required depth. The excavated earth should be kept in a suitable vacant place. After completion of foundation work, back-filling of the excavated area will be done with excavated soil and local sand.

Geo-technical investigation will be conducted to assist in designing foundations of the structures as it will help to identify whether or not foundation treatment would be required. The type of treatment like pre-cast RCC piling or in-situ concrete piling, removal of peat or loose soil will be suggested as per the results of geo-technical investigation. Pilling will be done between 9 to 20 meters depth varying with soil type.

Back filling of the excavated area of the foundation and floor of the building will be carried out primarily with local sand and compacted excavated soil.

The RCC works will be required for column, beam, floor, equipment foundation structures, steel structures etc.

Brickwork will be done for the construction of substation buildings with first class bricks, coarse sand and cement up to roof level.

Plastering of walls inside and outside as well as the roof of the building will be done in accordance with proper curing for at least three weeks. Following that, distemper or plastic painting will be applied on the walls and roof of the buildings.

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

Sanitary works such as laying of sewerage line of either polyvinyl chloride (PVC) or RCC, installations, fittings and fixtures of toilet accessories will be done in the buildings.

The water supply system, where available, will be activated for the staff and the workers of the substation site during and after the construction. Tube -wells will be set up where there is no water supply system.

The substation areas will be protected from any unauthorized entrance of public by fencing the boundary using six feet high walls having concrete pillars three meters apart with barbed wire fitted on top.

3.8 Construction Equipment and Materials

Equipment required for construction of the proposed transmission lines will include bulldozer, motorized water truck, boring machine, sand carrying truck, concrete mixing truck, crane, fork lift, cable drum, trailer, boom truck, drum puller, sagging dozer, static wire reel, trailer and dump truck.

Construction equipment requirements for substations are auger, backhoe front loader, concrete truck, water truck, dump truck, excavator, trailer, crew truck/car hauler, skid steer loader, batching plant, drill rig truck with trailer, compressor, construction fork loader, vibrating roller, light pickup, crane, bucket truck, boom truck, trailer, fork lift, and overhead line rig.

The construction materials required for sub-station and transmission line construction include cement, coarse and fine aggregates, sand, reinforcement steel, rough sawn timber, bellies and steel-bar, checker-plate, anchor-bolts, and electric cables.

3.9 Construction Waste and Hazardous Materials Disposal

Hazardous materials and waste produced during construction works need proper storage, handling, in accordance with local regulations. In order to ensure the proper management of

these materials, a certain place within the project boundary will be selected where the materials would be deposited temporarily and then moved within the shortest possible time. Basically, the dumping zone will be selected near the boundary line where the main project entrance would be located for easy transport of these materials away from the site. Dumping site near the entrance assures easy loading and unloading of those disposed materials into the disposal carrying vehicles. In case of the project boundary being comparatively small and therefore, not having the available space for waste disposal, then disposal site should be selected beside the project location with the approval of the appropriate authority.

3.10 Construction Manpower

PGCB usually construct the transmission line and substation through engineering, procurement and construction (EPC) contractors. The EPC contractor will engage skilled manpower as per their requirements to complete the work within given timeline. During different phases of construction work, excavators, pile-workers, foundation and superstructure laborers, carpenters, electricians, heavy equipment operators, ironworkers, masons, plasterers, plumbers, pipefitters, sheet metal workers, steel fixers, and welders will be engaged whenever necessary. The technical staff will include civil engineers, electrical engineers, supervisors, and technicians of various trades.

3.11 Temporary Facilities

The contractor's temporary facilities including construction camp, labor camp, material storage yard, and machinery/yard are established by the contractor within the substation premises. Construction of a substation is a complicated and time-consuming work (generally it takes 2-3 years) therefore site engineers and construction workers engaged by the EPC contractor have to stay close to the construction site. Camp with all necessary facilities like sanitation, safe water supply, and power supply are established for the workers. The same facilities will be used for the transmission lines works as well.

3.12 O&M Activities for Substation

The substation sites will be kept tidy at all times. Maintenance of the substation is essential for ensuring its reliability and safety. An annual review/inspection is generally conducted and maintenance is carried out as required. The life of a substation is about 40 to 50 years. Replacement and refurbishment work may need to be done from time-to-time. This may involve replacing some aging equipment over several days or weeks, or rebuilding certain sections of the substation which could take several months. Maintenance work can be classified as daily, weekly and yearly maintenance. Transmission lines and substation equipment like transformers with associated bay equipment, bus bar coupler, capacitor banks, battery and battery chargers, relays, and underground cables need to be regularly monitored and maintained after substation commissioning. Measurement of leakage in line current and neutral current of transmission lines, air cooler servicing and maintenance, refilling and maintenance of firefighting equipment, gardening, plantations, water supply and sanitation are also considered necessary for sound operation of substation.

3.13 O&M Activities for Transmission Lines

Operation and Maintenance (O&M) activities of transmission lines are largely dependent on built-in monitoring system of the overhead and underground cables which allows detecting short circuit or open circuit conditions. Short circuit generally occurs when cable insulation and or cable splice works are compromised and the conductors get exposed. Open circuit occurs in case of breaking of end connections, splice or conductor itself.

Presently, advanced technology allows automatic disconnection of the faulty line(s) from the system within few milliseconds. Once the disconnection occurs, the next step followed is to determine the trigger of the fault (whether it is a false trigger or not), location of the fault (by sending and receiving signals) and mobilizing personnel after identifying the location and cause of the fault.

Fault maintenance works for UGTL include reopening the trench and/ or vertical shaft to have access to the cable to replace or carryout repair works. For OHTL, fault maintenance works include replacing or repairing the damaged conductor, insulator, or any other component.

Below is the list of O&M works usually conducted for transmission lines:

- Evacuation/ transmission or distribution of electric power from power plants/ substations to substations/ load centers in controlled manner;
- Monitoring of the transmission line from the control room of associated power plants/ substations;
- Periodical (for example, quarterly) visual inspection of transmission line routes;
- Fault detection in case of any occurrence of faults;
- Fault correction through replacement or repair works;
- In case of emergency works, commence work immediately following safety procedures and notify authorities immediately upon completion of work (Electricity Act, 2018);
- In case of regular schedule maintenance works, commence work following safety procedures only after notifying authorities before commencement of work (Electricity Act, 2018);
- Complete any civil works after completion of repair/ replacement works such as refilling, leveling and or rebuilding (excavated roads, sidewalks, pavements, and manholes) to the pre-repair/replacement work conditions.

4. Analysis of Alternatives

This chapter describes the alternatives considered during project planning and design phase and analyzes their social and environmental and consequences.

4.1 Without Project Alternative

The ‘without project’ or ‘no project’ alternative would imply that no transmission lines would be added and no substation would be established that are envisaged under the PSUEP. This would imply that the current electricity network in the Chittagong area will not be expanded and its capacity will not be enhanced.

The advantages of such a scenario would include no environmental and social impacts associated with the establishment of substations and construction activities, laying of transmission lines and associated activities. Similarly, the capital investment required for the project would also be not needed, nor would any O&M activities need to be carried out.

The main disadvantage of the ‘no project’ scenario would be the development of severe capacity constraint in the electricity network of the area. The network would not be able to handle the additional electricity generation nor would it be able to meet the increasing demand in the area.

As described in **Section 1.1**, the Chittagong is an important area with respect to the industrial output, exports, and government revenues - significantly contributing towards the economic development of the Country. The area hosts important economic and industrial establishments including sea port, oil refinery, export processing zones, in addition to the residential areas. These establishments have generated rapidly growing demand for electricity, however the power supply in the region has not kept up with this demand growth.

The proposed project has been envisaged to address the above-described growth in electricity demand. If this project is not implemented, the electricity network would not be able to support the rapidly growing commercial and industrial activities as well as residential areas, nor would any growth in the region’s commercial and industrial activities be possible; and as a result, the Country will also not be able to sustain economic growth. Therefore the ‘no project’ scenario is not a viable option and therefore it is rejected.

4.2 Substation Technology Alternatives

There are generally two technology options for the substations: more conventional air insulated switchgear (AIS); or technologically more advanced gas insulated switchgear (GIS). The technical, financial, economic, environmental and social aspects of these alternatives are presented in **Table 4.1**.

Table 4.1: Comparative Analysis of GIS Vs. AIS Substations

	Description	GIS	AIS
	Technical Aspects		
1.	Fault Occurrence/ outage	GIS are modern and more regulated, so the chances of faults occurring is extremely low; The extremely low mean time between failures (MTBF) means there is very low outage as well.	AIS are archaic and not as much as regulated in comparison to GIS, so the chances of faults occurring is significantly high. The relatively high MTBF means there will be more outages during its lifecycle; More MTBF also is

	Description	GIS	AIS
			translated to more man-hour spent in repair/ replacement works during the lifecycle of an AIS.
2.	Reliability	Compartmentalized enclosure of the live parts in GIS makes for a very reliable system due to reduced disruption of the insulation system;	Open air components so the reliability is compromised in AIS system;
3.	Assembling	Quick assembly due to extensive pre-assembly; compact nature of the components mean they can be shipped assembled;	Slow assembly process due to dismantled shipment of heavy and oversized components;
4.	Replacement and Repair Works	Although very unlikely, if faults/ failures occur, it requires extensive and time consuming works; the advanced nature of the system also means highly adept technicians are required to conduct the replacement and repair works; and more often than not, GIS based systems are required to be dismantled and sent out to designated facilities to conduct such works; these translates to longer out of service, expensive repair works, added burden of transportation etc.	AIS based systems are more prone to faults/ failures; however, the repair/ replacement work can be carried out by any regular technician because of the simplicity of the systems; the detection of faults/ failures is much easier as the components are exposed and visible observation is sometimes more than enough to identify the faults. The repair works usually do not take long and can be done in-house, i.e. within the substation's facility so no added burden of transportation;
5.	Regular maintenance works	Extremely low; the first and only comprehensive maintenance work may not be required before 15 to 20 years; Under normal O&M, very low maintenance requirements due to expedient design and protection against external elements;	Very high; the first comprehensive maintenance work may be required within 3 to 5 years of commissioning and then every year after that; under normal O&M, high maintenance requirements due to the exposed nature of the AIS system;
6.	Procurement	Procurement and supply of SF ₆ gas can be a problem especially in rough terrain and offsite locations; thereby further increasing the costs;	No such procurement required for AIS substation;
7.	Structures	Small and compact components can be placed in a housing; not much foundation work is required;	Large and heavy components are placed under open area; a lot of foundation works is required to mount the switchyard components and the transformers;
	Economic and Financial Aspects		
8.	Initial Expense	GIS based substations of similar functions/ capacities tend to be 1.1 to 1.4 times higher in cost	AIS based substations of similar functions/ capacities tend to cost between 70~90% compared to

	Description	GIS	AIS
		compared to AIS based systems. However low land requirements can offset this difference.	GIS based substation. However high cost of land can be quite significant particularly in urban areas.
9.	Life span	GIS based system has much longer lifespan. A GIS based substation can operate up to 40 years with extremely low maintenance requirements	AIS based system has much shorter lifespan; An AIS based substation can operate up to 15~20 years with considerably high maintenance requirements that tend to increase at the latter stage of the lifecycle.
	Environmental considerations		
10.	Occupational Health and Safety and Public Safety	The earthed metal enclosure allows a safe working environment for the attending personnel and also for nearby communities	The open/ exposed live components safety risk for workers as well as general public; AIS needs to be completely disconnected and discharged before conducting scheduled cleaning activities.
11.	Fire safety	Lower risk of fire as the system operates in the presence of non-flammable, high cooling, arc quenching SF ₆ gas	AIS based system do not have the arc quenching property of SF ₆ , thus, it has higher chance of fire accidents
12.	Construction related impacts (such as dust, noise, air emissions, and waste effluents)	Low since construction activities are not very extensive. Most parts of GIS come in compact and modular form requiring limited extent of on-site installation/construction works	Extensive since large equipment need to be installed
13	Risk of bird electrocution and bird hits	No risk since all the live parts are totally sealed and encapsulated.	Open to air live parts of the substation pose risks of bird electrocution and bird hits.
	Social Considerations		
14.	Land Requirements	Requires about 20% of the land compared to the conventional AIS substation	Requires large area of land that can be difficult to arrange and can be quite expensive particularly in urban settings.
15.	Construction related impacts (such as community disturbance and labor issues)	Low since construction activities are not very extensive. Most parts of GIS come in compact and modular form requiring limited extent of on-site installation/construction works	Extensive since large equipment need to be installed
16.	Locality Preference	More suitable to urban and suburban areas where land	More suitable for rural and unpopulated areas where land is

	Description	GIS	AIS
		availability and cost are significant issues.	available easily at reasonable costs.

Though the cost of GIS substations is substantially higher compared to the AIS system, GIS substations have been selected for the proposed project primarily in view of the smaller land requirements since availability of large land parcel could be quite difficult and expensive in the Chittagong area. In addition, GIS systems are more reliable, safer to operate and maintain, pose minimal safety risks to the communities, and easier to install – as explained in **Table 4.1** above.

4.3 Types of Transmission Lines

Two types of transmission lines have been considered for the proposed project: overhead transmission lines using bare conductors; and underground transmission lines using insulated cable. The technical, financial, economic, environmental and social aspects of these alternatives are presented in **Table 4.2**.

Table 4.2: Comparative Analysis of Overhead Vs. Underground Transmission Lines

	Attributes	Overhead Transmission Line (OHTL)	Underground Transmission Line (UGTL)
	Technical Aspects		
1.	Construction activities	Extensive, requiring tower foundation construction, erection of towers, conductor stringing, and installation of insulators and other devices.	Less extensive, involving trench excavation, laying of cables, laying of sand over cables, and covering the trench,
2.	Fault Occurrence/ outage	Very high due to the exposed nature.	Very low due to the concealed nature.
3.	Fault Detection	Relatively easy as it is exposed and can be visibly identified;	Relatively difficult due to the concealed nature of the line;
4.	Replacement and Repair Works	Easy replacement and repair works; can be completed within 24 hours and less expensive;	Difficult to do replacement and repair works as it would require careful excavation, breaking of road/ pavements, sidewalks etc.; may take several weeks to complete and more expensive;
5.	Regular maintenance works	More, typically every year, maintenance is significantly high	Very low. Typically, once in every 5-10 years, low maintenance expenses, usually visual inspections, marking
6.	Terrain Preference	Flat terrain is preferred; however, can be implemented in hilly terrain as well;	Flat terrain is preferred; not recommended for hilly terrain which would add more cost in tunneling and trenching works.
7.	Water bodies	Easy to implement in case of stringing over water bodies; for wider water bodies, a few	Extremely difficult to implement in case of passing a water body as it would require very high

	Attributes	Overhead Transmission Line (OHTL)	Underground Transmission Line (UGTL)
		numbers of towers can be erected on the water to string TLs.	intervention and thus usually avoided when tower erection is possible.
8.	Insulation	It usually uses porcelain discs for insulation between the conductor and the towers, and air gap from conductor to conductor which are less expensive;	The buried cables come with expensive insulation compounds covering the conductors; the insulations are also covered by jackets/braids/ sheath/ screens to avoid damage and thus they are more expensive;
9.	Interference	Due to the exposed nature of the conductors, OHTL introduces significant interference to receivers/ antennas, disrupts mobile or internet communication networks.	Due to the buried/sheathed nature of the UGTL, it does not introduce any interference to receivers/ antennas, and thus does not disrupt mobile or internet communication networks.
	Economic and Financial Aspects		
10.	Implementation expenditure	Significantly low compared to UGTL, usually only 10-20% of the expenditure of the same capacity and length;	Very high, typically 5-10 times for same capacity and length;
	Environmental Aspects		
11.	Safety (Public)	Due to the fact that OHTL are exposed, they pose higher public safety risks; OHTL are more prone to accidents for the same reason.	UGTL are buried and as a result they are inaccessible and thus do not pose safety issues; UGTL are thus less prone to accidents.
12.	Safety (Maintenance)	Most of the OHTL maintenance work such as replacement of insulators, clearing of vegetation etc. involve working in significantly alleviated height (25m+) resulting in higher safety risks for the maintenance crew.	UGTL maintenance works are carried out at ground level or in shallow depth (2~3m) and as such it poses lower safety concerns.
13.	Natural Calamity	Can be affected by thunderstorms, lightning, cyclones, floods, mudslide and earthquakes.	Can be affected by floods, mudslides and earthquakes.
14.	Vegetation	OHTL allows vegetation under certain height underneath the RoW.	UGTL does not allow vegetation of any types (irrespective of voltage ratings) above the buried cables along the route; UGTL is not recommended for fallow lands.
15.	Threat to wildlife	Although very rare, climbing mammals can be electrocuted by	Shielding (sheath and screen) protects earth excavating

	Attributes	Overhead Transmission Line (OHTL)	Underground Transmission Line (UGTL)
		bridging live conductors with the steel towers.	animals such as rodents to enter live conductors.
16.	Threat to birds	Overhead transmission lines pose risks of electrocution and also bird hits.	Underground transmission lines pose no such risks.
	Social Aspects		
17.	Land Requirement	Requires land acquisition of the tower footings, which can be significant depending on the size (governed by voltage ratings, terrain type, soil quality etc.) and type of the tower (suspension, angular).	Public roadside space, under the sidewalks or pavements are usually selected for UGTL thus it normally does not require land acquisition.
18.	Structures	OHTL allows public and private structures under it up to a certain height; sometimes to allow existing structures to be under the Right of Way (RoW), tower heights are increased.	UGTL only allows limited public structures such as roads, pavements and sidewalks above it.
19.	Locality Preference	Rural areas with fallow lands have low height structures and crop fields thus OHTL is more suited for these areas.	Urban and suburban areas have more roads that are suitable for UGTL and more taller structures that can be avoided if UGTL is used, thus UGTL is preferable for such localities.
20.	Visual Preference	Erected towers, danger signs posted, and strung conductors affect the visual aesthetics of the area.	Buried nature of the UGTL means that they are out of sight and hence no aesthetic issues.

In view of the above considerations, the underground cables have been used under the proposed project primarily where the availability of space is an issue because of the congested urban setting; for all other locations, overhead transmission lines have been used.

4.4 Substation Siting Alternatives

Siting options for various substations considered under the proposed project are discussed below.

4.4.1 Siting Options for Khulshi Substation

The newly proposed 230kV substation will be built primarily in a three storied building with a control room, GIS based switchyards and switchyard cables, with transformers being placed outdoor.

Option1. This is one of the three options considered for Khulshi substation. The existing Khulshi substation will be upgraded to a 230kV substation in step by step manner with as little interruption as possible. This place is situated beside the existing substation (N 22° 11' 42" E 091° 47' 46"). The land belongs to Bangladesh Power Development Board (BPDB). The

available land is fully covered by thick vegetation (see **Figures 4.1**), requiring land clearing work for the new construction. Besides, land filling will be required. The existing towers will have to be relocated in order to build the upgraded substation.



Figure 4.1: Khulshi Substation Option-1

Option 2. The second option considered for Khulshi substation upgrade is a piece of land at the south-east corner of the existing substation. Currently, this space is covered by a flower garden owned and managed by PGCB (see **Figure 4.2**). Underneath this garden, there are two 33kV lines that run through the middle. There are also underground cables that are placed along the perimeter of this garden. If this site is chosen, the existing underground cables will have to be relocated.



Figure 4.2: Khulshi Substation Option-2

Option 3. The proposed substation will be established beside the BPDB wireless tower (N 22° 21' 46" E 091° 47' 44"). This land belongs to BPDB. The land is completely fallow, adjacent to a hillock (see **Figure 4.3**). As a result, excavation cost will be very high.



Figure 4.3: Khulshi Substation Option-3

The locations of the above-described siting options are shown in **Figure 4.4** while the technical, financial, economic, environmental and social aspects of these alternatives are presented in **Table 4.3**.

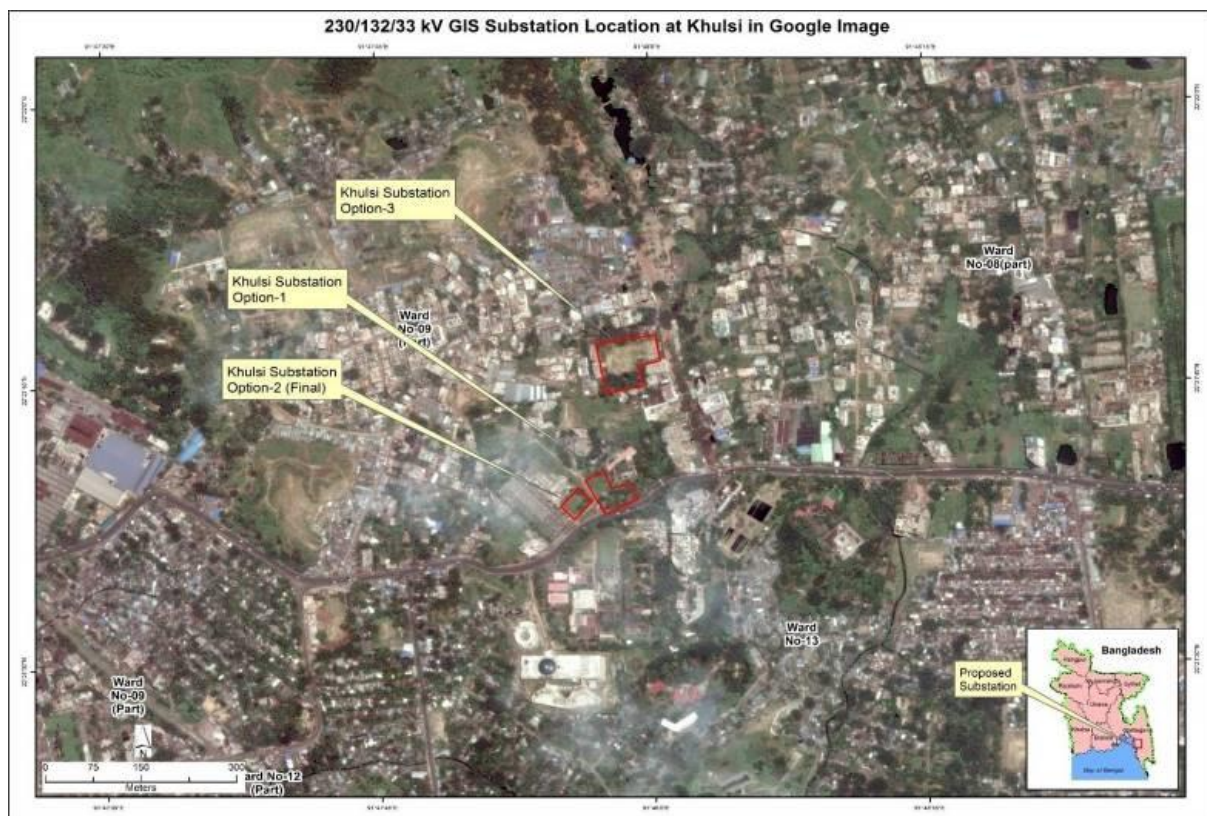


Figure 4.4: Locations of Three Siting Options at Khulshi

Table 4.3: Comparative Analysis of Substation Site Selection at Khulshi

Attributes	Option-1	Option-2	Option-3
Technical Aspects			
Land Use	Fallow land	Un-used area and flower garden	Fallow land
Road Condition	Very Good	Very Good	Very Good

Attributes	Option-1	Option-2	Option-3
Transmission line shifting Required	Yes (Khulshi to Madunaghat 132kV TL 02)	Yes 33 kV underground cable stadium to Khulshi	Yes (Khulshi to Madunaghat 132kV TL 01)
Land leveling work	Medium	Low	High
Scope of future Expansion	No	No	Yes
Land ownership	BPDB	PGCB	BPDB
Complexity Level of Acquisition	High	N/A	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	High since land will need to be procured and land will need to be cleared and leveled.	Medium since land will not need to be procured and land leveling requirements are low.	High since land will need to be procured and land will need to be cleared and leveled.
Environmental Aspects			
Construction related impacts	High since land leveling and clearing will need to be carried out	Medium since limited leveling and clearing will need to be carried out.	High since land leveling and clearing will need to be carried out
Nearby Water Body	No	No	No
Loss of vegetation	High	Medium	Medium
Noise	High since land leveling and clearing will need to be carried out	Medium since limited leveling and clearing will need to be carried out.	High since land leveling and clearing will need to be carried out
Social Aspects			
Involuntary resettlement	Not needed	Not needed	Not needed

Source: ESIA Study, June 2018, CEGIS

Conclusion. In view of the lower cost and less significant environmental and social issues as shown in **Table 4.3** above, the Option 2 is the preferred option and therefore it has been selected.

4.4.2 Siting Options for New Mooring Substation

Since the site for New Mooring substation has already been selected under an earlier project (see **Table 3.2**), hence no siting options were considered under the proposed project and therefore no options have been described in the present ESIA either.

4.5 Alternative Transmission Line Routes

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

- Existence of open agricultural land;
- Distance from connecting road not to be more than 1 km;
- Avoiding settlement areas as much as possible;
- Avoiding urban areas as much as possible;
- Avoiding river crossings;
- Avoiding water bodies;
- Considering the existing power distribution line;
- Location of Air-Insulated Switchgear (AIS) and Gas-Insulated (GIS) substation.

Three alternatives transmission line routes are considered each of the proposed new transmission lines. For these alternate routes, technical, financial, economic, environmental, and social aspects were considered through consultation with local stakeholders, analyzing of maps and underground utilities, satellite images, traffic condition. After detailed route survey and analysis, most suitable route has been selected considering the technical and financial aspects as well as environmental and social issues/impacts.

4.5.1 Alternative Routes for Madunaghat to Khulshi Transmission Line

The routing options for the Madunaghat to Khulshi underground transmission line are analyzed in **Table 4.4** below.

Table 4.4: Routing Options for Madunaghat to Khushi Transmission Line

Attributes	Option-1	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	13.06 km	14.6 km	15.21 km
Difficulty of Implementation with respect to. trenching/ excavations	High	Medium	High
Crossing of any other existing or proposed transmission lines	Yes 1) 33 kV underground cable stadium to Khulshi 2) 132kV Madunaghat to Kalurghat T/L	Yes 1) 33 kV underground cable stadium to Khulshi 2) 132kV Madunaghat to Kalurghat T/L	Yes 33 kV underground cable stadium to Khulshi
Existing Important Infrastructure	No	No	No

Attributes	Option-1	Option-2	Option-3
Meet Present Demand	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Implementation Expense	High	Moderate	High
Environmental and Social Aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	Moderate	Moderate
River crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Bird Habitat and Declared IBA	No	No	No
River Erosion	No	No	No
Impact on Settlements	No	No	No
Involuntary Resettlement Impacts	No	No	No

Source: ESIA Study, CEGIS

Conclusion: Although Option-1 offers the shortest route length for the underground line however based on the route survey, it is identified that Option-2 will have the least difficulty with respect to excavation and trenching related activities due to its alignment and location of nearby structures; all other environmental and social issues are quite similar for all options. Therefore, Option-2 has been selected for Madunaghat to Khushi underground transmission line.

The routing options for Madunaghat to Khulshi transmission line are shown in **Figure 4.5**.

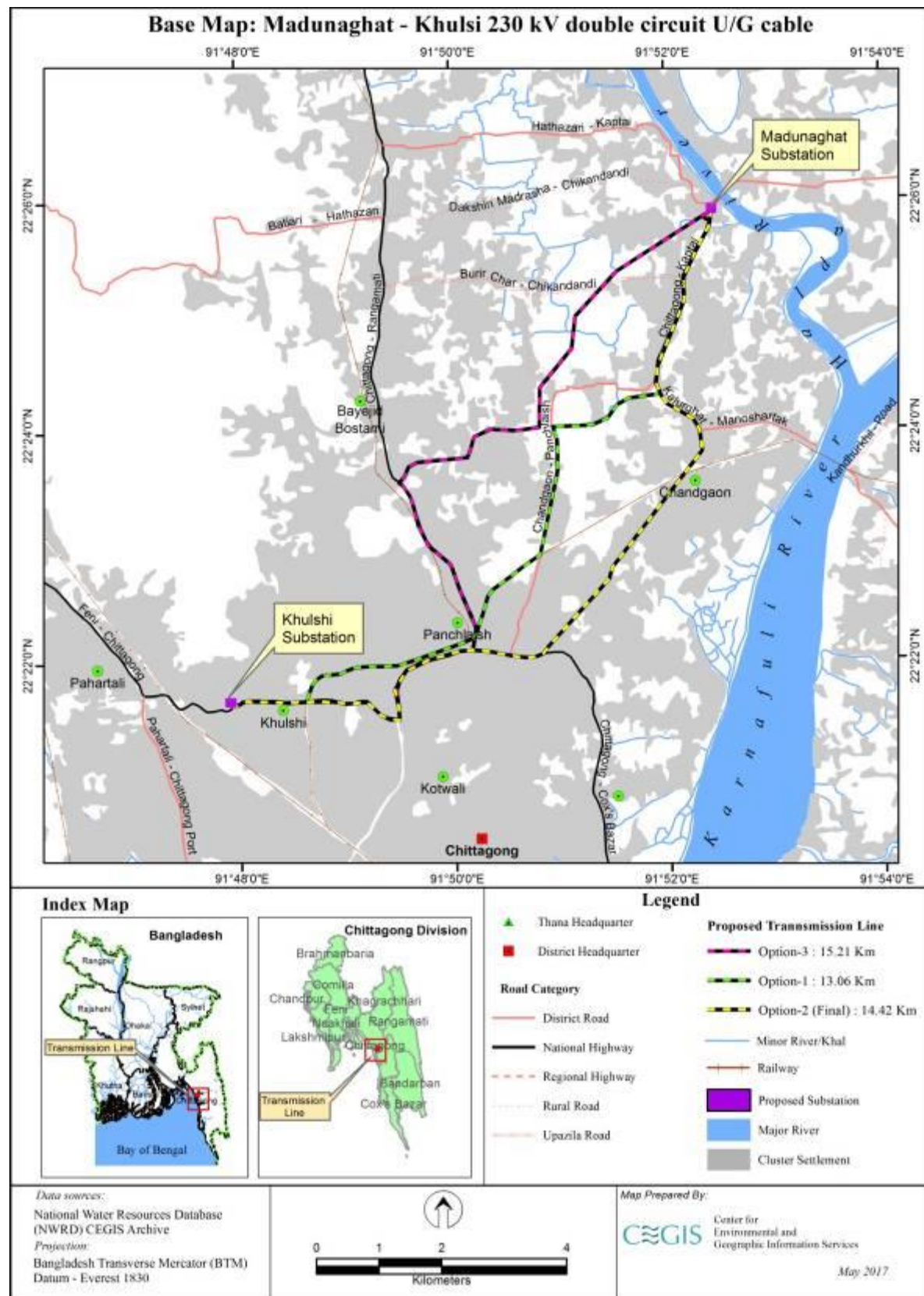


Figure 4.5: Alternate Routes for Madunaghat to Khulshi Transmission Line

4.5.2 Routing Options for Anowara to New Mooring Transmission Line

The routing options for the Madunaghat to Khulshi underground transmission line are analyzed in **Table 4.5** below.

Table 4.5: Routing Options for Anowara to New Mooring Transmission Line

Attributes	Option-1	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	Total 25.600 km (Overhead 19.347km and Underground 5.253 km)	Total 24.351 km (Overhead 19.098km and Underground 5.253 km)	Total 30.096 km (Overhead 19.390km and Underground 10.706 km)
Difficulty of Implementation with respect to trenching/ excavations	Medium	Medium	High
Crossing of any other existing or proposed Transmission line	Yes a. Shahmirpur -Julda 132kV T/L b. Sikalbaha-Shahmirpur 132kV	Yes a. Shahmirpur-Julda 132kV T/L b. Sikalbaha-Shahmirpur 132kV	Yes a. Shahmirpur-Julda 132kV T/L b. Sikalbaha-Shahmirpur 132kV c. Anowara Sikalbha 230kV T/L
Angle Towers	15	10	10
Total Number of the Towers (for OHTL)	60	59	60
Meets Present Demand	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Power Growth	High	High	Very High
Implementation Expense	High	High	Very High
Environmental and Social Aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	Moderate	Moderate
Karnaphuli River crossing	643.39m	643.39m	833.22m

Attributes	Option-1	Option-2	Option-3
Reserve forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Bird habitat and declared IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Low	Moderate	High
Resettlement Impacts	Moderate	Moderate	Moderate

Source: ESIA Study, CEGIS

Conclusion: Based on the route survey, it is identified that Option-1 will have the least difficulty with respect to excavation and trenching related activities in terms of total underground length in comparison to Option-3. At the same time, although Option-2 offers the shortest route length for the transmission line however Option-1 also will have lower impact on settlement compared to Option-2. Therefore, Option-1 has been selected for Anowara to Anandabazar (New Mooring) transmission line.

The routing options for the Anowara to New Mooring transmission lines are shown in **Figure 4.6**.

4.5.3 Alternative Routes from Hathazari to Rampur

No alternative routes were considered for the 2.66 km long 230kV line-in-line-out (LILO) underground double circuit transmission line between Hathazari and Rampur, in view of its short length.

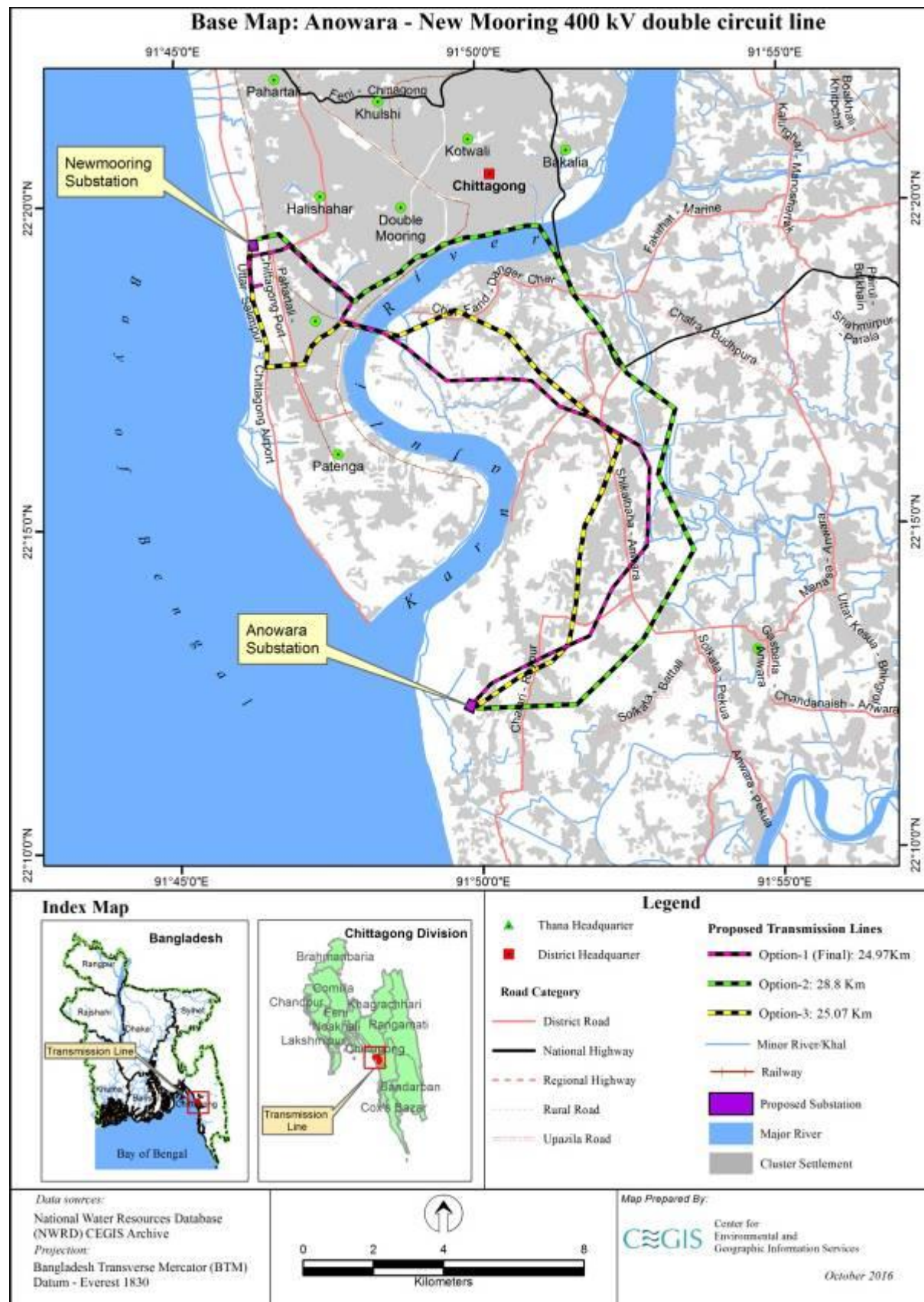


Figure 4.6: Alternate Routes for Anowara to New Mooring Transmission Line

5. Environmental Baseline

This Chapter presents the baseline or pre-project conditions of the environmental resources of the study area. This baseline has been prepared by collecting data from both secondary and primary sources. The secondary sources include Bangladesh Water Development Board (BWDB), National Water Resources Database (NWRD), Department of Public Health Engineering (DPHE), Bangladesh Meteorological Department (BMD) and Bangladesh Bureau of Statistics (BBS). Primary data has been collected during field visits in the study area.

5.1 Physical Environment

Various aspects of the physical environment of the area are discussed below.

5.1.1 Meteorology

The meteorological data like rainfall, temperature, relative humidity, wind speed, evaporation and sunshine hours of Patenga BMD station near the sea (about 12 km from the New Mooring substation) and of Ambagan BMD station inside the Chattogram city have been collected. The data were analyzed and their status is discussed briefly in the following sections.

Rainfall

Rainfall intensity is a crucial parameter for the study area. May to October are the wettest months having the highest rainfall intensity while November to February is the driest part of the year with almost negligible rainfall. The record of the last 30 years (1988-2017) of Ambagan station shows that the maximum of 1466 mm rainfall occurred in July 2015. No or very little rainfall is recorded in the month of November to January. On the other hand, data of the last 30 years (1988-2017) shows that the Patenga station experienced the maximum of 1555 mm rainfall in July 2015. No rainfall or very little rainfall is recorded in the month of December to February. The monthly maximum and average rainfall of Ambagan and Patenga stations are shown in **Figures 5.1 and 5.2**, respectively.

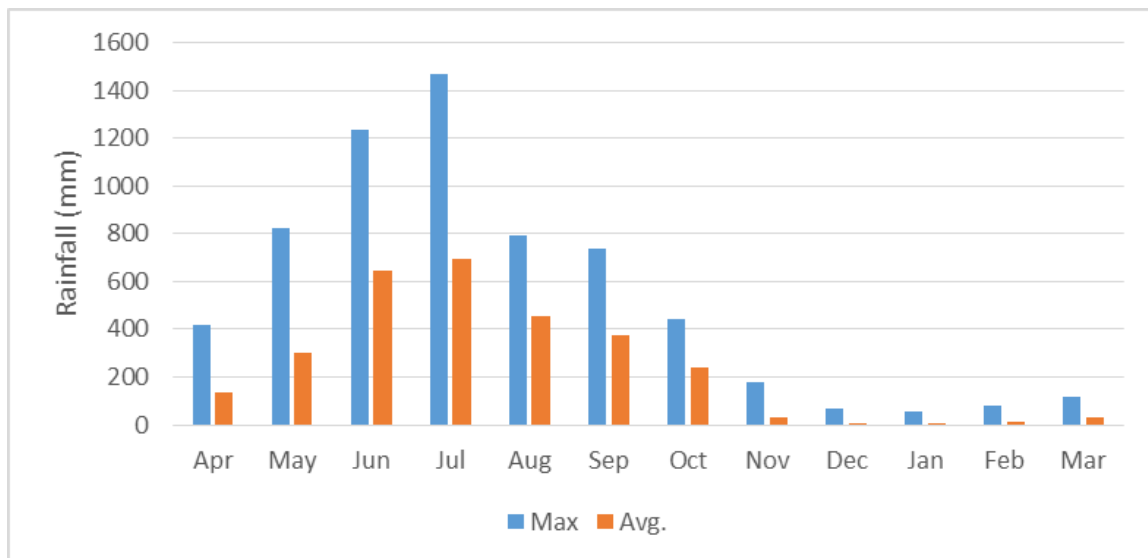


Figure 5.1: Monthly Variations of Rainfall at Ambagan BMD Station (1984-2013)

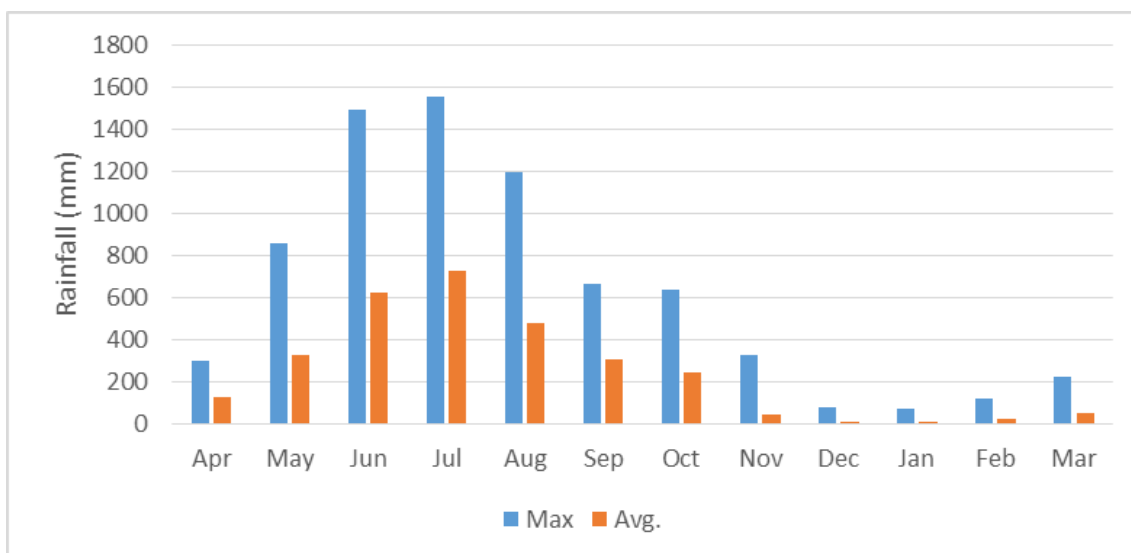


Figure 5.2: Monthly Variations of Rainfall at Patenga BMD Station (1984-2013)

Temperature

Temperature is recorded at both Ambagan and Patenga stations within/near the study area. The monthly average of last 30 years data (1988-2017) of Ambagan station shows that the maximum temperature varies from 29°C to 35°C and April is the warmest month while the minimum temperature varies from 13°C to 25°C and January is the coldest month. While monthly average of last 30 years data (1988-2017) of Patenga shows that the maximum temperature varies from 28°C to 34°C and April is the warmest month while the minimum temperature varies from 12°C to 25°C and January is the coldest month. The monthly variations of average maximum and minimum temperature of Ambagan and Patenga stations are shown in **Figures 5.3** and **5.4**, respectively.

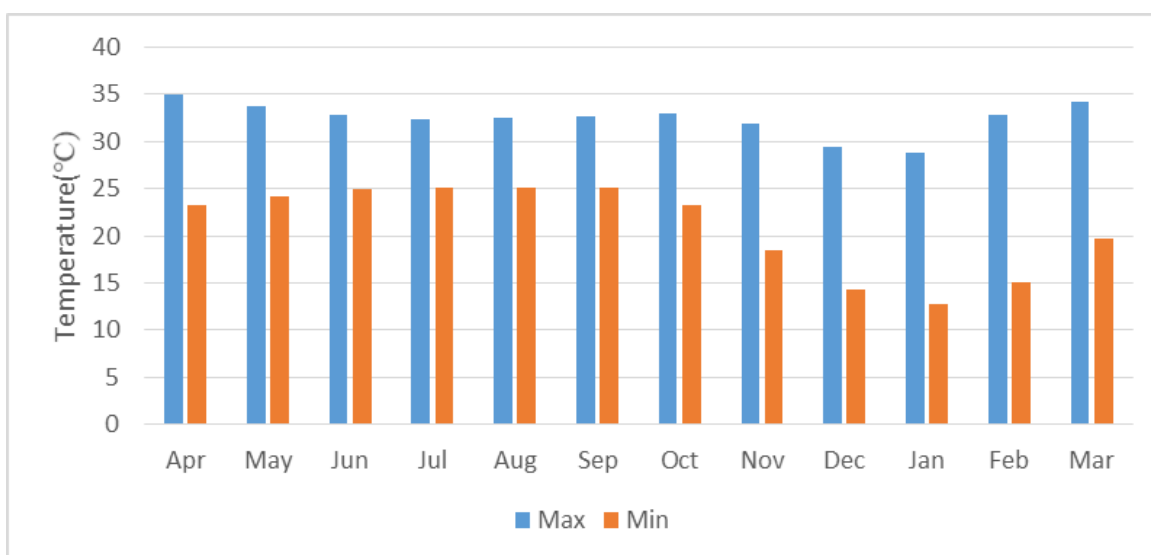


Figure 5.3: Monthly Variation of Temperature at Ambagan BMD Station (1988-2017)

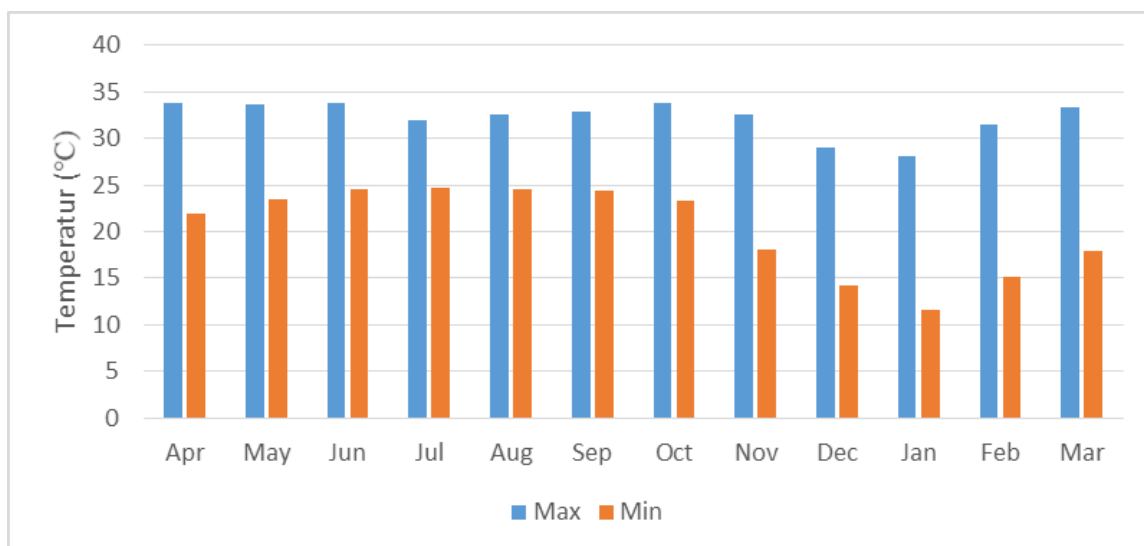


Figure 5.4: Monthly Variation of Temperature at Patenga BMD Station (1988-2017)

Relative Humidity (RH)

Relative humidity is a proportional measure of moisture in the atmosphere and expressed as percentages of the maximum amount of moisture the air could hold at the given temperature. The monthly average of relative humidity data collected from Ambagan and Patenga BMD stations for the last 30 years (1988-2017) is shown in **Figure 5.5**. It reveals that the RH varies seasonally from a minimum of 67 percent in February to a maximum of 87 percent in July-August. The most humid months are May to October when relative humidity remains greater than 80 percent.

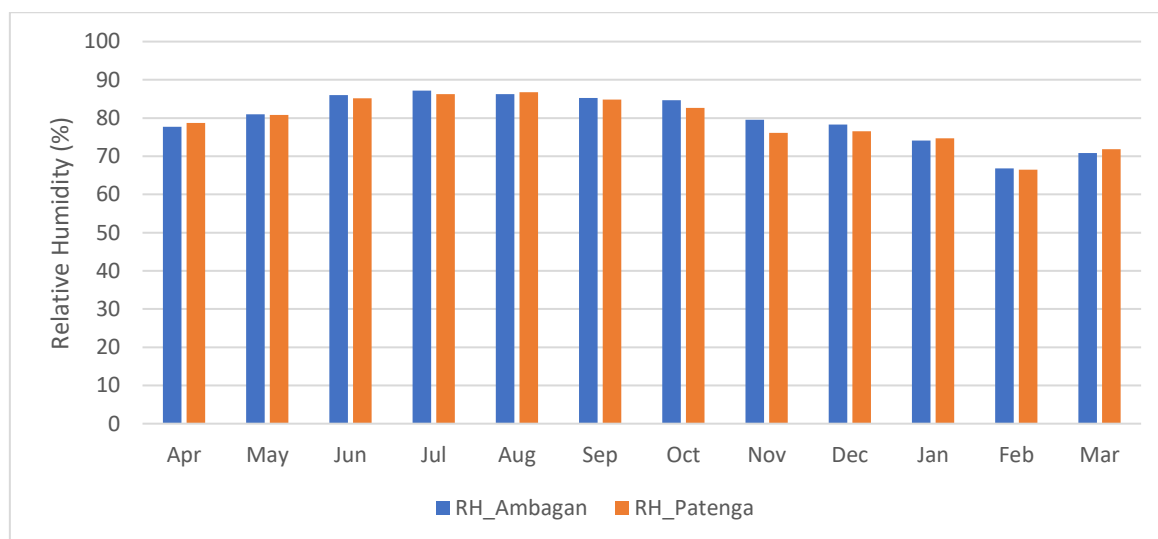


Figure 5.5: Monthly Variation of Relative Humidity at Ambagan and Patenga BMD Stations (1988-2017)

Wind Speed

Wind speed data has been collected and analyzed for both Ambagan and Patenga BMD stations in Chattogram District. Winds in the area are mostly characterized by southerly wind from the Bay of Bengal during monsoon. The wind data of last 30 years (1988 to 2017) of Ambagan station shows that the monthly maximum wind speed varies from 18.52 to 66.67 km per hour

(km/h) and the maximum wind speed was recorded as 66.67 km/h in the month of November 2005. On the other hand, data of Patenga station shown that the monthly maximum wind speed varies from 44.45 to 166.68 km/h and the maximum wind speed was recorded as 166.68 km/h during the month of May 1997. It may be noted that the maximum wind speed in Patenga station is much higher than that of Ambagan station due to its closeness to the sea. The monthly variation of maximum wind speed at Ambagan and Patenga BMD stations are shown in **Figures 5.6 and 5.7**, respectively.

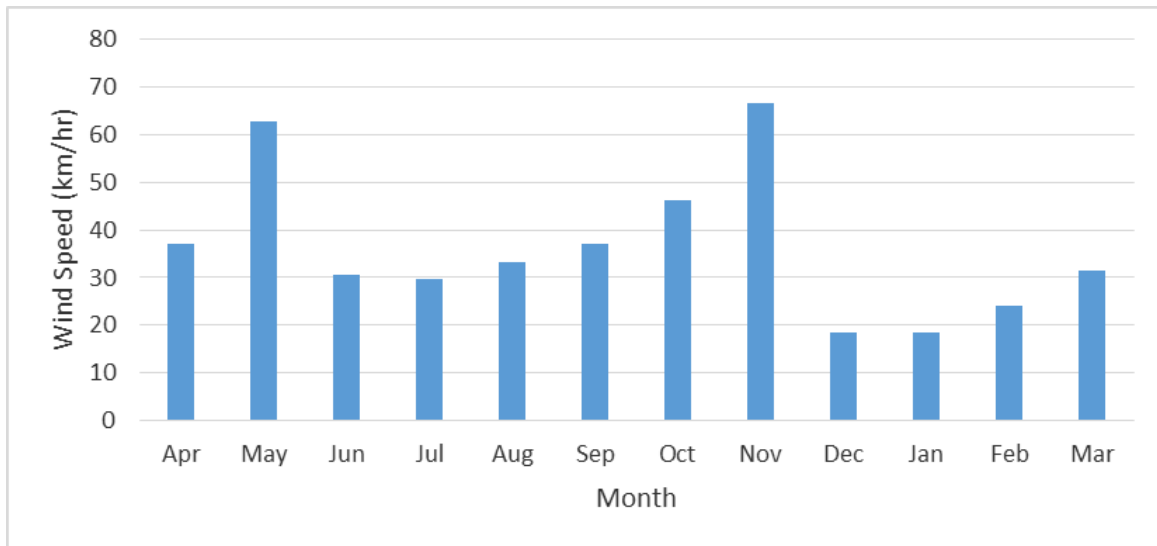


Figure 5.6: Maximum Wind Speeds at Ambagan BMD Station (1988-2017)

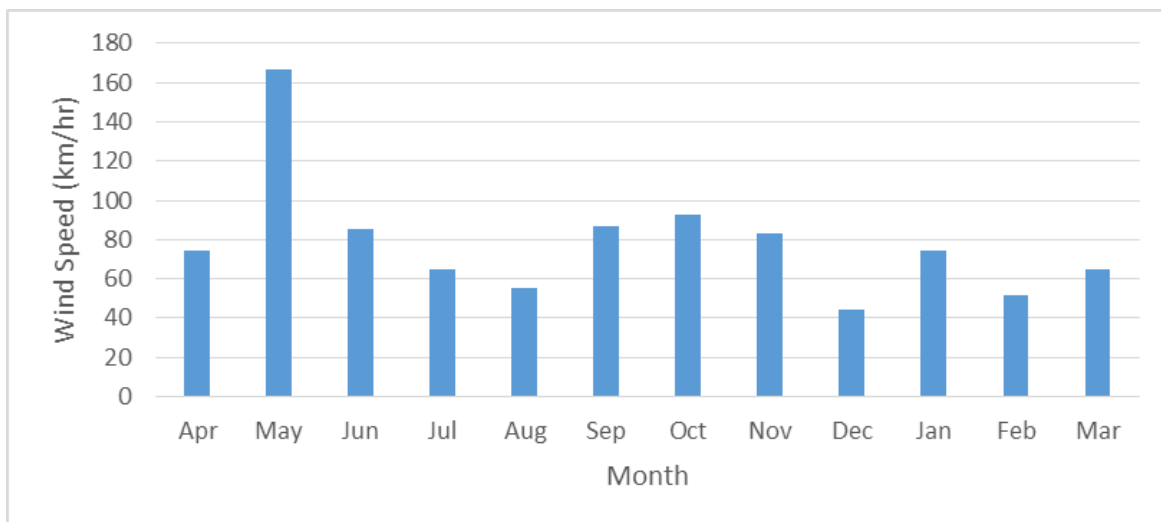


Figure 5.7: Maximum Wind Speed at Patenga BMD Station (1988-2017)

Sunshine

The sunshine hours are measured at Ambagan and Patenga stations only within the study area. The data of sunshine hours for the last 30 years (1988-2017) has been collected from this BMD station and analyzed. It shows that the monthly averages of sunshine hours vary from 4 to 8 hour per day at both the stations. The sunshine hours remain very high from November to April

and very low from June to August. The average and maximum monthly sunshine hours of Ambagan and Patenga BMD stations are shown in **Figures 5.8** and **5.9** respectively.

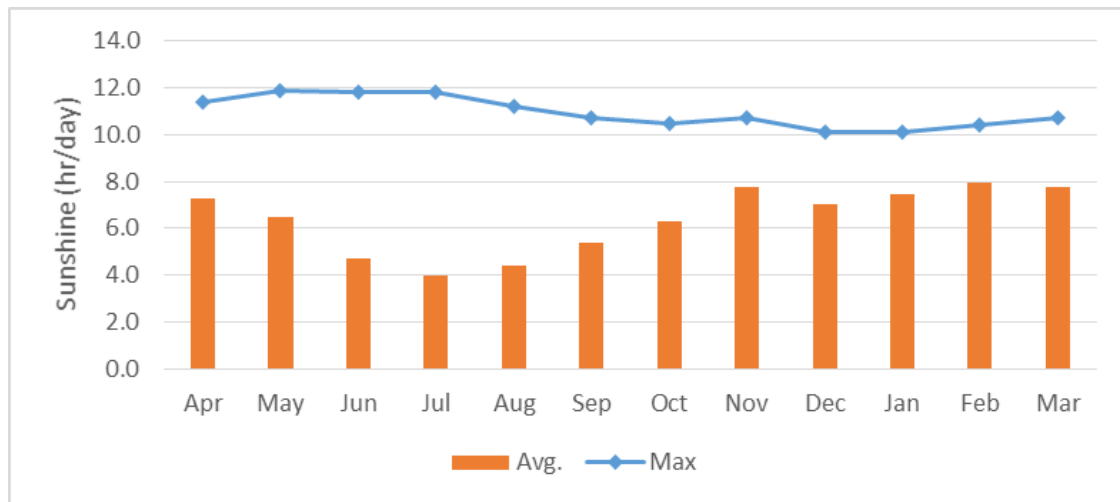


Figure 5.8: Sunshine Hours at Ambagan BMD Station (1988-2017)

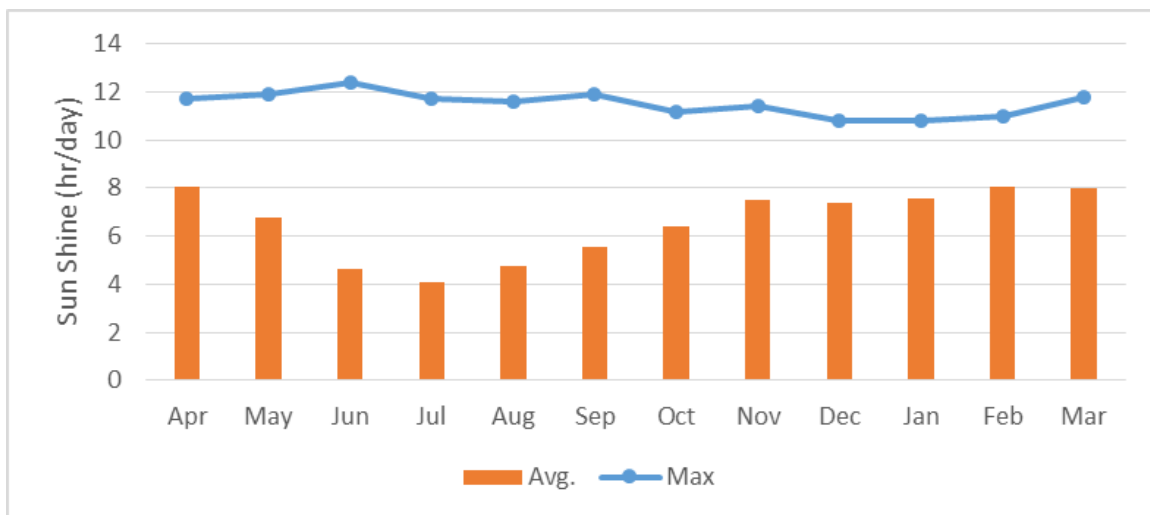


Figure 5.9: Sunshine Hours at Patenga BMD Station (1988-2017)

5.1.2 Geology

The Chattogram Hill Tracts originated as a result of the collision between India and Asian plates. Central Burma or Irrawaddy Basin represents the back-arc basin and Arakan-Yoma folded belt and its western extension up to Chattogram-Tripura hills, a part of which is the Chattogram Hill Tracts, represents the fore-arc basin. The thick sediments deposited in the Irrawaddy Basin during Miocene and Lower Pleistocene times are exposed in the Chattogram and Tripura hills. Hence, with the inception of convergence of the Indian Plate and the Tertiary sediments deposited in the fore-arc basin, the region was uplifted during Miocene orogeny and followed by Pleistocene orogeny to form the present Arakan Yoma Mega-anticlinorium and its western extension covering Chattogram-Tripura mountain belt.

5.1.3 Soils

The surficial soil materials are mostly composed of silty, clayey and sandy alluvial materials except Dupi tila formation material is only exposed from Khulshi to GEC moor area.

Along the Anowara to New Mooring transmission line, surficial soil is mostly composed of loose and unconsolidated alluvial materials such as mixed silt, fine sand and clay which are representative of fluvio-tidal complex. Along the Khulshi to Madunaghat transmission line, soil is mostly composed of valley alluvium and colluvium and partly exposed Dupi tila formation. Dupi tila formation is composed of mostly sandy clay and siltstone.

In all of the cases, surficial geology is mostly composed of loose unconsolidated soil materials and so there should not be any difficulty for the land excavation during the transmission line construction. However, preliminary examination such as soil strength test and seismic investigation are recommended to be carried out to confirm the site suitability for such constructions.

5.1.4 Topography

Chattogram straddles the coastal foothills of the Chattogram Hill Tracts in southeastern Bangladesh. The Karnaphuli River runs along the southern banks of the city, including its central business district. The river enters the Bay of Bengal in an estuary located 12 km (7.5 mi) west of downtown Chattogram. Mount Sitakunda is the highest peak in Chattogram District, with an elevation of 351 meter (1,152 ft). Within the city itself, the highest peak is Batali Hill at 85.3 meters (280 ft).

5.1.5 Seismicity

Bangladesh lies between 20°30' and 26°40' north latitude and 88°03' and 92°40' east longitude which is within an active seismic zone and the probability of earthquake is high. Tectonic framework of Bangladesh and adjoining areas indicate that Bangladesh is situated adjacent to the plate margins of India and Eurasia where devastating earthquakes have occurred in the past.

A seismic zoning map of Bangladesh was produced in 1979 by Geological Survey of Bangladesh (GSB) dividing the country into three seismic zones: Zone-I, Zone-II, Zone-III.

The Chattogram District area falls under the Zone II shown in **Figure 5.10**. The Zone-II comprising the central part of Bangladesh consists of the regions of recent uplifted Pleistocene blocks of the Barind and Madhupur and the western extension of the folded belt with the Bask seismic co-efficient of 0.05g. The first recorded earthquake in 1548 was a terrible one as Chattogram was violently shaken. The earth opened in many places and threw up water and mud of a sulfurous smell. Besides, there are also different geological faults in and around the country, as shown in **Figure 5.11**. Accordingly, the maximum magnitude of earthquake is in the range of $4 \leq M < 5$ on the Richter's scale in and around of Narsingdi District.

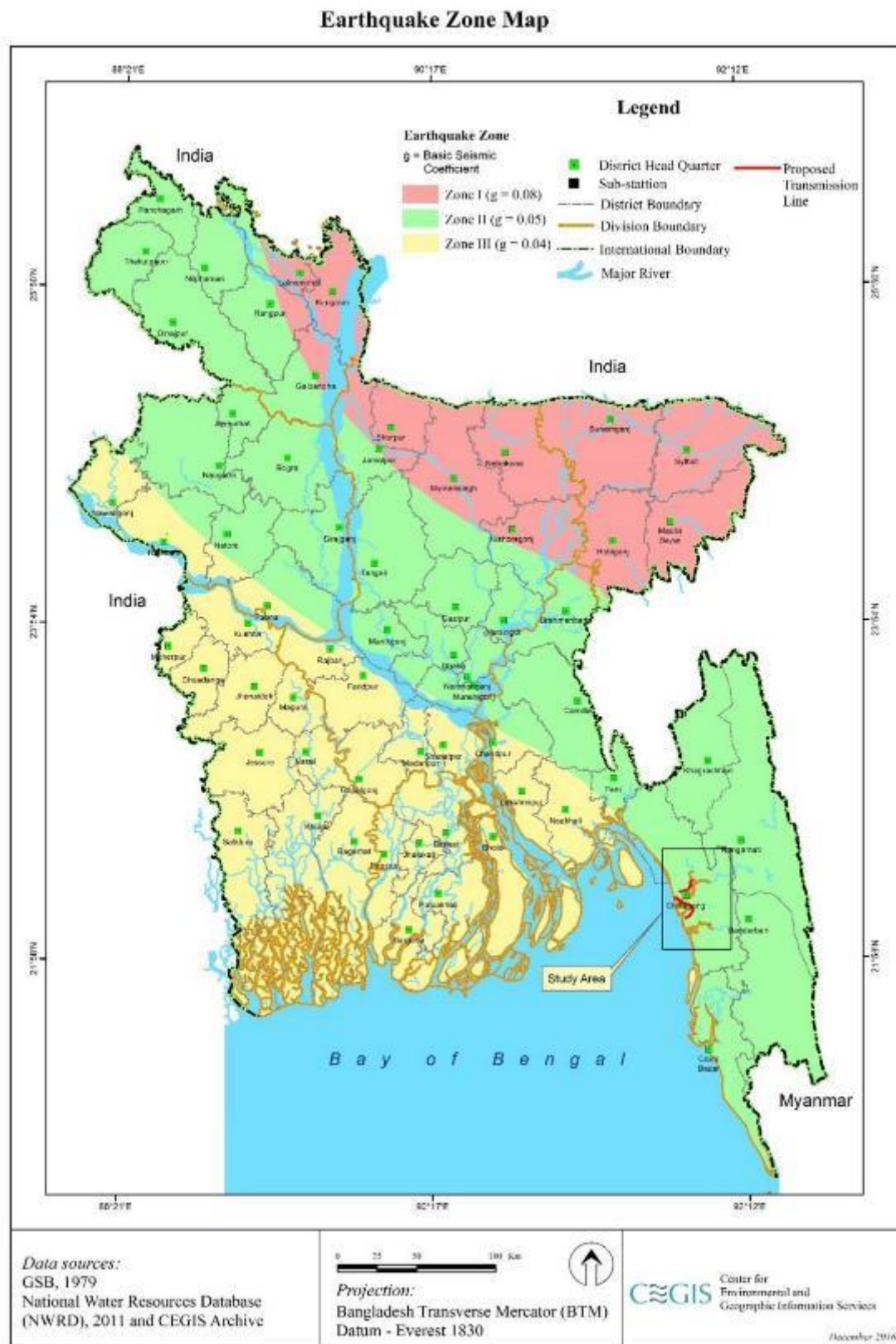


Figure 5.10: Earthquake Zoning Map with Seismic Coefficients

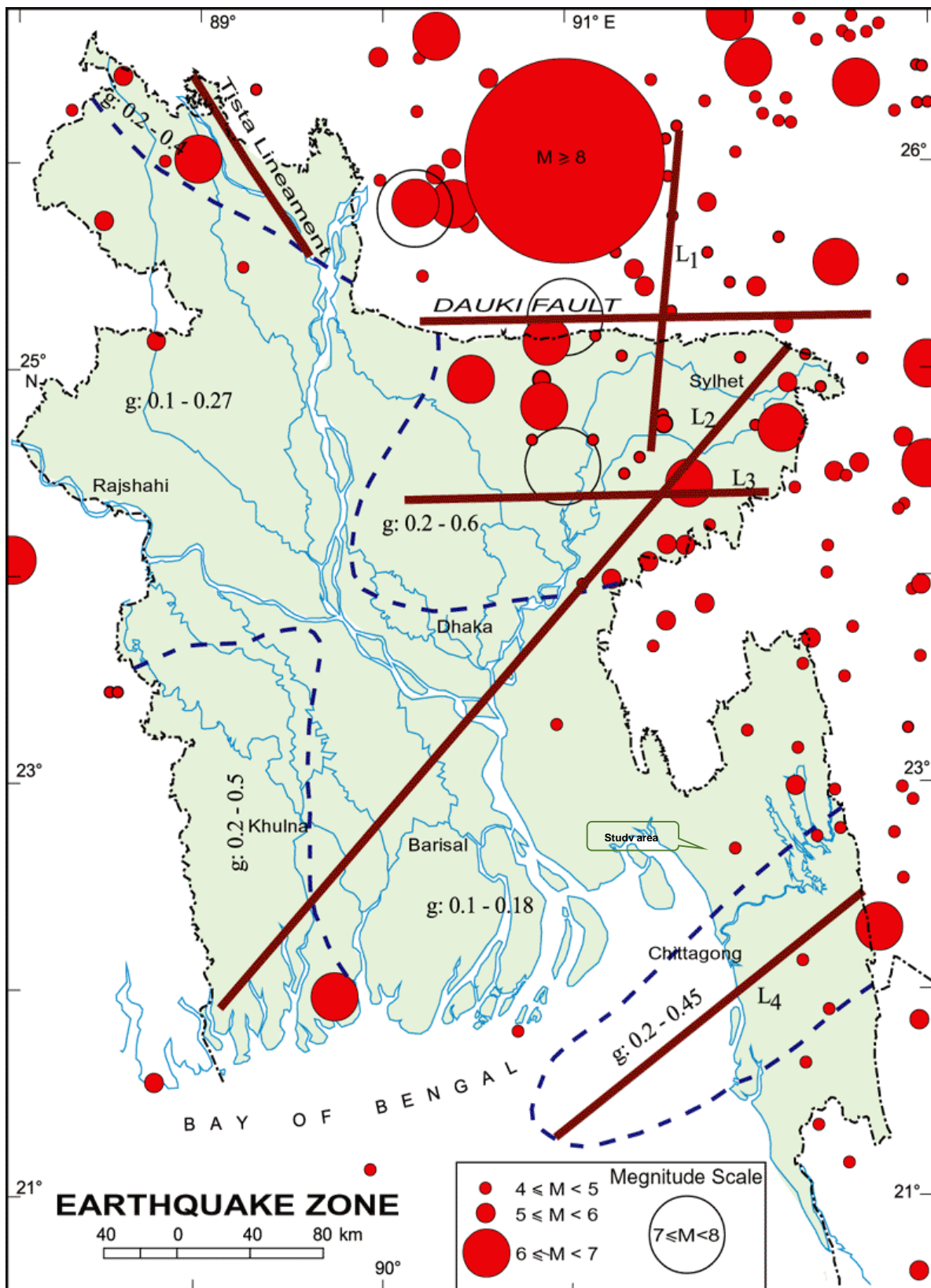


Figure 5.11: Different Geological Faults in Bangladesh

(Source: <http://en.banglapedia.org/index.php?title=Earthquake>)

5.1.6 Water Resources

The existing water resource system of the study area meets the demand of the surrounding cultivation and ecosystem. It is the source of water supply that plays an indispensable role in assimilating and diluting wastes, attenuating and regulating drainage, recharge into the aquifer, and maintaining the environment for aquatic habitats.

River System

The water resources of the study area are mainly controlled by the Karnaphuli River. This River is one of the major watercourses of the Chattogram region originating from the Lusai hill in the Assam state of India. It travels through Dighinala, Khagrachari, Kaptai, Boalkhali, Rangunia, Raozan, Patya, and Chattogram before falling into the Bay of Bengal in Chattogram district.

The Karnaphuli River becomes wide and turbulent during the rainy season and resorts to erosion. The river is perennial in nature and having both tidal effect and upstream flash water. During the dry season, the amount of water recorded to flow through the river is approximately 1155 cubic meters per second (cumec) while high flow during monsoon is approximately 10761 cumec. The flow direction of the river is from east to west.

The Halda River, another water body of the Chattogram region originating from the Badnatoli hill in Khagrachori district travels through Fatikchari, Hathazari, Chandgaon, and Rauzan before falling into the Karnaphuli River in Chattogram district. The Halda River becomes wide and turbulent during the rainy season and resorts to erosion. The river is also perennial in nature with tidal effect. During the dry season, the amount of water flows through the river is approximately 1 cumec and high flow during monsoon is approximately 290 cumec. The flow direction of the river is from north to south.

The project area consists of substations and transmission lines stretching in different locations in south-east coast under Chattogram District. The substation sites located adjacent to the Bay of Bengal and the transmission lines will cross over numbers of *khals* (water courses) and river in the study area. The overhead portion of the Anowara to New Mooring (Anandabazar) transmission line will cross over a number of major and branch *khals* as well as Karnaphuli river, where the river width is about 700 m. The *khals* include Char Lakkhakhali, Shikalbaha/Murari Khal, Karnaphuli canal, and Mahesh khal. Another transmission line from Khulshi to Madunaghat substation will be underground along with the Dhaka-Chattogram Highway, CDA Avenue, Chattogram-Cox's Bazar Highway, and Chattogram-Rangunia-Kaptai Road and cross beneath the Chandgaon khal and Burirchar khal. The Madunaghat substation is located beside the Halda river.

Water Availability: Surface Water

Chattogram is both a hilly and a coastal district. Surface water is available from springs, rivers, lakes, ponds and especially from the sea. Major surface water bodies are the Bay of Bengal, Sangu, Karnaphuli, Bakkhali, Koholia, and Meghna. The proposed New Mooring (Anandabazar) substation is located adjacent to the sea near Patenga beach.

To assess the surface water characteristics or availability of water of the area, data on surface water levels have been collected from two stations of Bangladesh Water Development Board (BWDB) in Chattogram district namely Chattogram and Madunaghat for Karnaphuli and Halda rivers, respectively. **Table 5.1** shows that the average water level of Karnaphuli and Halda rivers in different seasons.

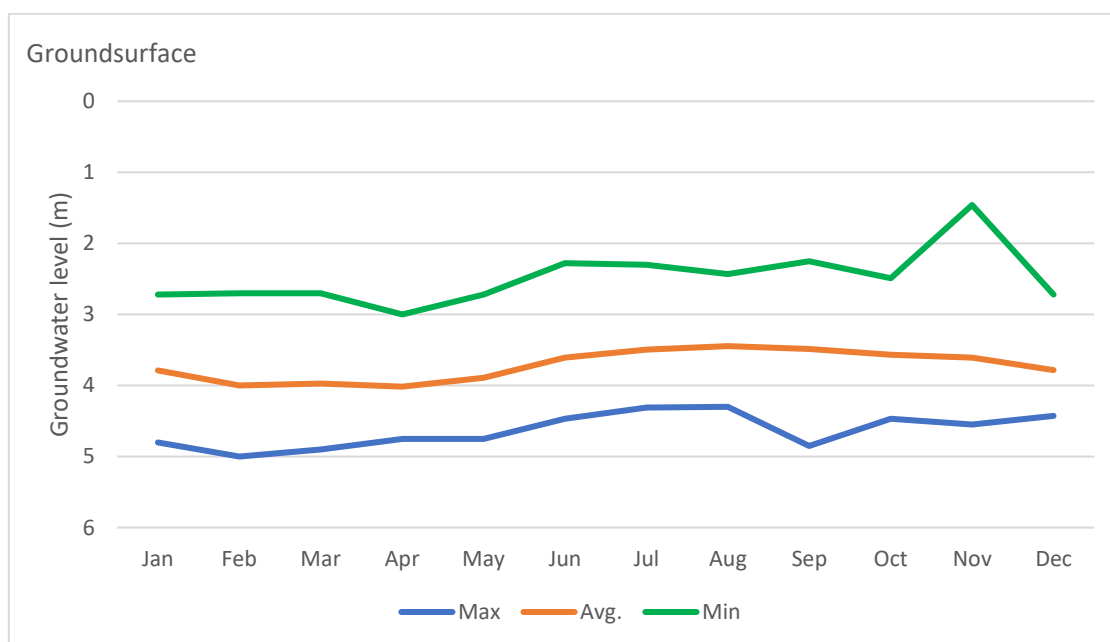
Table 5.1: Average Surface Water Levels of Halda River during High Tide

Season	Average Water Level (m+PWD)	
	Chattogram Station (1982-2009)	Madunaghat Station (1977-2009)
Dry (December-February)	3.3	2.9
Pre-Monsoon (March-May)	3.6	3.23
Monsoon (June-September)	4.2	4.15
Post-Monsoon (October-November)	3.8	3.65

Source: Chattogram and Madunaghat Water level stations, BWDB; CEGIS-NWRD Archive.

Water Availability: Ground Water

The groundwater data of BWDB observation well around the study area (station CHI008), was collected from NWRD-CEGIS database archives for the period from 1984 to 2013. The station CHI008 is located in Patenga Upazila of Chattogram District which is 12 km to the south from the proposed New Mooring sub-station. It is observed that the depth of groundwater from the ground surface in dry season goes downward and depth is highest during April. On the other hand, water table rises in monsoon and the lowest depth is observed in August due to recharge by rainwater. **Figure 5.12** shows the monthly variations of groundwater depth.



Source: Groundwater level station, CHI008, BWDB; CEGIS-NWRD Archive.

Figure 5.12: Depth of Groundwater Near Study Area

Drainage Congestion

Drainage congestion or drainage problems was found in proposed substation site of New Mooring (Anandabazar) and Khulshi and Madunaghat Sub-station area during the field visit.

5.1.7 Storms

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.

5.1.8 Cyclones

The coastal regions of Bangladesh are subject to damaging cyclones almost every year. They generally occur in early summer (April-May) or late rainy season (October-November). Cyclones originate from low atmospheric pressures over the Bay of Bengal.

A tropical cyclone forming in the Bay of Bengal has a lifetime of one week or longer. The height of the surges is limited to a maximum of 10 meters in the bay. When propagating into the shallower inland coastal areas, the heights of these waves are further reduced. The frequency of a wave (surge plus tide) with a height of about 10 m is approximately once per 20 years. A storm surge of approximately once in 5 years has a height of about 7 m (surge plus tide).

The study area faced devastating natural disasters in April, 1991 and May, 1997 where many people were victims of the cyclones. Besides, these natural disasters also caused heavy damages to settlements, livestock and other properties of the area. In 1991, the tropical cyclone reached on the land on 29 April with wind speed of around 240 km/h and the storm formed a 6 m high surge that inundated the entire area. In 1997, another strong tropical cyclone arrived on land on 17 May with winds of 215 km/h and occurred huge damage in the area.

The New mooring sub-station site is situated beside the sea, however, it will not be affected by cyclones or tidal waves because of the presence of the elevated Chittagong Coastal Road that runs parallel to the coast line west of the substation. The elevated road will act as a flood protection embankment for the coastal area including the substation (see **Figures 3.2 and 3.4**).

5.1.9 Landslide

Landslide has become a major disaster in the hilly regions of Bangladesh, occurring almost every year. From physical survey, it is observed that soil characteristic of Chattogram Hill Tracts (CHT) is alluvial, silty clay which is vulnerable to landslides. Human activities such as deforestation, jhoom cultivation and hill cutting have made the slopes unstable. In addition, excessive rainfall during monsoon causes rain cut erosion which results to landslides. During the last five decades, CHT suffered about 12 major landslides. Most devastating landslides occurred in 2007 and 2017. The landslide on 11th June, 2007 which occurred in several areas near Chattogram city was one of the severest of such occurrences in the country's history causing death of 127 people. Very recently, on 13th June, 2017 CHT experienced massive landslides. A large number of foothill settlements and slums were demolished; more than 152 people died and huge resource destruction took place.

The project sites including Khulshi Sub-station, Madunaghat Sub-station, proposed New Mooring Sub-station and the transmission lines are not situated in or beside any hilly area, and therefore the project will not be affected by the landslide effect.

5.1.10 Environmental Quality

Data on air quality, water quality and noise level were collected to assess the baseline conditions, as discussed below.

Noise Quality

Table 5.2 shows the noise levels of some locations in the study area. These levels are well within the standards given in **Table 2.5**.

Table 5.2: Noise Levels in Study Area

	Date and Time	Location	GPS Coordinates	Day-time Noise Level (dBA)	Night-time Noise Level (dBA)	Area Category by DoE
01	17.04.17 02:54pm and 9:45pm	New Mooring (Anandabazar) Proposed substation	N 22° 19' 29" E 91° 46' 1.5"	53	41	Mixed area
03	19.04.17 10:12 am and 10:15pm	Khulshi substation	N 22° 21' 42" E 91° 47' 46"	56	43	Mixed area
04	27.11.2018 11:00am and 9:30pm	Madunaghat Sub-station	N 22°25'55.77" E 91°52'15.05"	57	47	Commercial area

Source: CEGIS Study'2017

Air Quality

Table 5.3 presents the data for ambient air quality of a location in the study area. These levels are well within the standards given in **Table 2.2**.

Table 5.3: Value of Air Quality Parameters in Chattogram

Date of Measurement	Location	PM _{2.5}	PM ₁₀	NO _x	O ₃	CO
		(µg/m ³)				(mg/m ³)
April 2015	Agrabad, Chattogram (22.32N, 91.81E)	58.48	92.82	DNA	10.81	1.83
	Bangladesh standard	65	150	100	235	40
	WBG Standard	75	150	200	160	100

Source: Monthly Air Quality Monitoring Report, April 2015, DoE

Note: PM_{2.5}: Fine Particulate Matter; PM₁₀: Respirable Dust Content; NO_x: Oxides of Nitrogen;
CO: Carbone Mono-Oxide; O₃: Ozone; DNA: Data Not Available.

Surface Water Quality

Surface water quality information has been collected through secondary sources from a study report namely 'Water Quality Parameters: A Case Study of Karnaphuli River Chattogram, Bangladesh' where the water samples were collected from different points of Karnaphuli River and analyzed for various physiochemical parameters during winter. Effects of industrial wastes, municipality sewage and agricultural runoff on the river water were investigated. The study was conducted between the Kaloorghat Bridge and Patenga estuary including Chattogram port.

This is the most polluted area due to the presence of many chemical fertilizers, iron, leather and pharmaceutical industries. All these industries discharge their untreated toxic wastewater directly into the river Karnaphuli.

Water samples were collected from the Karnaphuli River during winter seasons and tested for physical and chemical parameters during an early study carried out in 2010. Fifteen sampling points were selected. The important water quality parameters, such as color, odor, temperature, pH, TSS, TDS, TS, BOD, COD, DO, turbidity, EC and salinity were analyzed; the results are presented in **Table 5.4**.

Table 5.4: Physical and Chemical Parameters of Karnaphuli River Water

ID	Color	Odor	Tem. °C	TSS mg/L	TDS mg/L	TS mg/L	Turb FTU	DO mg/L	pH	EC µs/cm	BOD mg/L	COD mg/L	Salinity mg/L
S-1	Nearly colorless	Odorless	21	590	13200	13990	42.00	3.0	7.0	19920	163	390	6.20
S-2	Nearly colorless	Odorless	21	560	17500	18300	50.10	2.6	6.9	31340	178	380	6.50
S-3	Nearly colorless	Odorless	22	610	16100	16850	49.45	2.7	6.9	29900	195	420	9.20
S-4	Nearly colorless	Odorless	23	513	18530	19210	48.23	2.9	7.0	31300	160	350	7.00
S-5	Nearly colorless	Odorless	23.5	360	15000	15490	38.54	2.5	6.9	29200	195	423	9.90
S-6	Nearly colorless	Odorless	23.5	490	12590	13193	45.00	2.3	6.8	20700	200	425	6.70
S-7	Muddy	Pungent	22	480	510	1120	40.50	0.70	6.7	1080	290	635	0.40
S-8	Turbid	High pungent	22.5	190	421	695	16.20	0.20	6.6	820	397	865	0.40
S-9	Turbid	High pungent	23	120	292	472	14.00	2.10	6.6	552	198	510	1.50
S-10	Light green	High pungent	24	230	999	1320	19.71	0.35	6.4	1806	370	755	5.20
S-11	Oily&Black	High pungent	24.5	380	6920	7441	23.33	0.65	6.2	11570	285	623	5.10
S-12	Turbid	Odorless	24	175	910	1167	18.45	0.40	6.4	1712	273	600	1.40
S-13	Nearly colorless	Odorless	24	305	7510	7932	22.00	1.50	6.5	12880	243	590	5.10
S-14	Light green	Slight pungent	23.5	210	3500	3910	19.50	0.10	6.4	6190	310	743	2.70
S-15	Turbid	Slight pungent	23.5	275	6300	6685	26.10	1.20	6.5	10450	255	695	4.70
BD Stand.	Colorless	Odorless	20-30	150	2100	-	-	4.5-8	6-9	1200	50	200	-

Sources: *Water Quality Parameters: A Case Study of Karnaphuli River Chattogram, Bangladesh*, M. Iqbal Sarwar, Ahmad Kamruzzaman Majumder and M. Nurul Islam; *Bangladesh J. Sci. Ind. Res.* 45(2), 177-181, 2010.

The mean values of water temperature, TSS, TDS, TS, turbidity, DO, BOD, COD, pH, EC and total alkalinity were 23°C, 365.87 mg/L, 8018.8, 8518.33 mg/L, 31.54 FTU, 1.55 mg/L, 6.65 mg/L, 13961 µs/cm, 247.47 mg/L, 560.27 mg/L and 4.8 mg/L, respectively.

Groundwater Quality

Groundwater quality has also been collected from another study namely ‘Supply Water Quality in Urban Bangladesh: A Case Study of Chattogram Metropolitan City to Improve Service Delivery’ carried out during 2011. In the study, the environmental (laboratory) analysis reveals that out of 13 physiochemical parameters, eight parameters including TDS, turbidity, pH, iron (Fe), nitrates (NO₃), arsenic (As), hardness and chloride (Cl⁻) are found within the permissible range. However, the values of five parameters, i.e. EC, nitrites (NO₂), DO, BOD and free chlorine are noticed quite high. Quite a few parameters are observed in critical condition in the southern part of Chattogram than in the northern part of Chattogram shown in **Table 5.5**.

Besides, the Chattogram District, especially its city area, is away from arsenic contamination and also be considered as arsenic contamination safe zone. Map of arsenic contamination of Bangladesh is shown in **Figure 5.13**.

Table 5.5: Summary of Measured Water Quality Parameters in Chattogram Area

Parameter	Northern Part of Chattogram				Southern Part of Chattogram			
	Max	Min	Mean	Std. dev	Max	Min	Mean	Std. dev
EC $\mu\text{Scm-1}$	2637.0	53.67	583.511	558.274	2637.0	53.67	733.455	641.11414
TDS mg/l	1450.30	74.44	394.814	327.569	1450.3	128.00	500.982	356.56425
Turbidity (NTU)	256.86	0.12	8.6083	39.3495	256.86	0.12	10.9307	49.15813
pH	11.80	5.50	6.8969	1.03752	8.47	5.50	6.8989	0.73235
Arsenic (mg/l)	0.00	0.00	0.0000	0.00000	0.00	0.00	0.0000	0.00000
Iron (mg/l)	1.50	0.00	0.4671	0.32726	0.80	0.30	0.4933	0.16352
Nitrate (mg/l)	60.00	0.00	17.8643	16.8045	60.00	0.00	25.2037	16.30199
Nitrite (mg/l)	14.00	0.00	1.1845	3.52080	0.60	0.00	0.0659	0.15633
DO (ppm)	33.50	6.00	11.5262	4.62169	33.50	7.20	11.2704	5.29483
BOD (ppm)	67.00	6.00	25.0845	16.1433	67.00	6.00	28.2815	18.87526
Chlorine (mg/l)	40.56	0.00	1.7800	6.16414	40.56	0.00	2.4393	7.65369
Hardness (mg/l)	430.00	32.00	140.500	84.9175	430.00	40.00	161.333	83.10142
Chloride (mg/l)	909.90	20.28	195.977	224.672	909.90	20.28	270.410	247.17871

Source: 'Supply Water Quality in Urban Bangladesh: A Case Study of Chattogram Metropolitan City to Improve Service Delivery'; water quality tested in BCSIR Laboratories, Chattogram, 2011

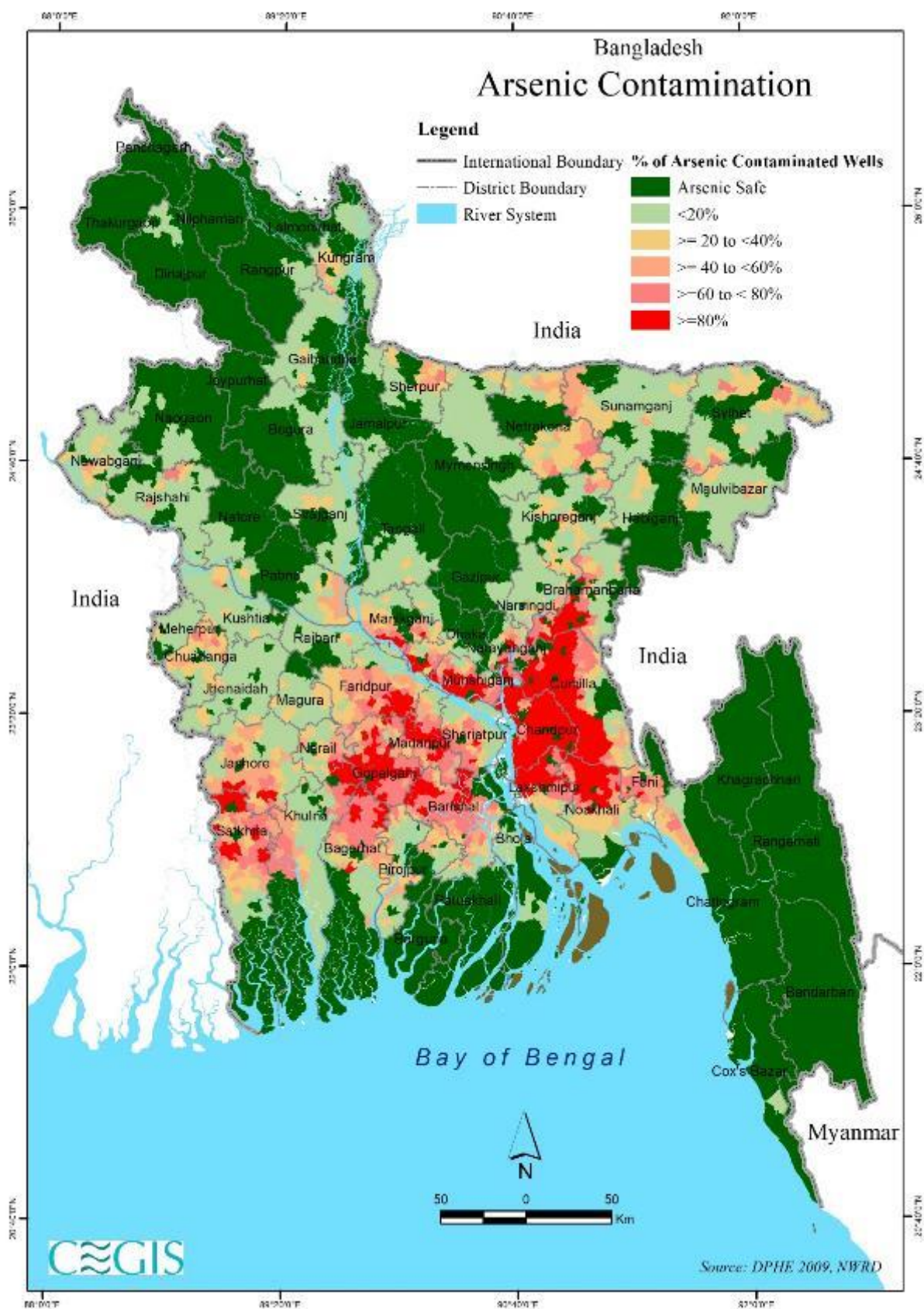


Figure 5.13: Arsenic Contamination Areas in Bangladesh

5.1.11 Land Resources

The proposed transmission line will pass through the Chattogram Coastal Plain in Hathazari, Chandgaon, Panchlaish, Khulshi and Chattogram sadar Upazilas and pass over the same zone in Patiya and Anowara Upazilas; and will pass over the Northern and Eastern Hills in Anowara Upazila. The proposed substations will be constructed in the Chattogram Coastal Plain.

The Right-of-Way (RoW) of proposed overhead transmission line from Anowara to Patiya Upazila will pass over the agriculture land. Then the line will cross the Karnaphuli River. After that the overhead line will go underground up to New Mooring substation. An underground power transmission line will be laid from Khulshi to Hathazari along the roadside. The RoW of proposed underground transmission line is mainly non-agriculture land. The local roads and levees between agricultural lands will be used as temporary access tracks for transporting construction material.

The proposed New Mooring substation will be constructed on agricultural land while the Khulshi substation will be constructed on non-agricultural fallow land (within the existing substation area).

Summaries of land use of RoW of transmission line and substations are presented in **Tables 5.6 to 5.8**. The detailed land use and land form of the transmission line corridor is presented in **Table 5.9**.

Table 5.6: Land Use of Direct Impacted Area (DIA) Considering 20m RoW

Land Use	Area (Hectares)					% of Total Area
	Anowara to New Mooring Transmission Line	Anowara to New Mooring Transmission Line	Khulshi to Madunaghat Transmission Line	LILO New Mooring Transmission Line	Total Area	
Built-Up Non-Linear	0.81	7.65	22.85	0.00	31.31	36.66
Fresh Water Aquaculture	0.03	0.00	0.00	0.00	0.03	0.03
Agricultural land (NCA)	28.46	1.17	0.33	0.56	30.52	35.72
Orchards and Other Plantations	0.62	0.91	0.88	3.21	5.62	6.58
Rivers and Khals	2.02	0.04	0.07	0.00	2.13	2.50
Rural Settlement	7.94	1.17	4.97	1.21	15.29	17.90
Forest Plantation	0.00	0.00	0.01	0.00	0.01	0.01
Shrub Dominated Area	0.00	0.00	0.00	0.00	0.00	0.00
Mud Flats or intertidal zone	0.00	0.17	0.00	0.34	0.51	0.60
Total	39.88	11.11	29.12	5.32	85.42	100.0

Source: ESIA study and NWRD-2012.

Table 5.7: Land Use of Indirect Impacted Area (IIA) Considering 80m RoW

Land Use	Area (Hectares)					% of Total Area
	Anowara to New Mooring OHTL	Anowara to New Mooring UGTL	Khulshi to Madunaghat UGTL	LILO New Mooring UGTL	Total Area	
Built-Up Non-Linear	4.74	38.07	112.25	0.00	155.06	36.39
Fresh Water Aquaculture	0.81	0.47	0.00	2.37	3.65	0.86
Agricultural land (NCA)	137.03	7.20	5.86	8.02	158.10	37.10
Orchards and Other Plantations (Trees)	0.19	2.82	1.48	8.64	13.13	3.08
Rivers and Khals	9.95	0.58	0.51	0.28	11.32	2.66
Rural Settlement	44.05	4.11	25.12	4.24	77.52	18.19
Forest Plantation	0.00	0.00	0.78	0.00	0.78	0.18
Shrub Dominated Area	0.00	0.00	0.17	0.00	0.17	0.04
Mud Flats or intertidal zone	0.00	2.76	0.00	3.66	6.42	1.51
Grand Total	196.75	56.02	146.17	27.22	426.16	100.00

Source: ESIA study and NWRD-2012.

Table 5.8: Land Use of Substation Area

Substation	Landuse	Area (hectare)
New Mooring	Agriculture	7.29
Khulshi	Settlement (inside existing substation)	0.12

Source: ESIA study and NWRD-2012.

Note: The New Mooring substation will be constructed under another project and will be upgraded to 230/132 kV under the proposed project.

Table 5.9: Land Use, Land Form, and Other Salient Information of Transmission Line Right of Way

Location of Angle Tower	Number of Towers	Terrain Type	Natural Environment	Geology and Soil	Current Land Use	Accessibility to Towers	Infra-structure Crossing	Residential Crossing
Anowara to New Mooring Overhead Transmission Line								
Anowara to Angle Point (AP)-1 Mouza- Dudhkumar, Bondor Upazila/ Thana- Anowara, Gobadia	3	Nearly flat	Mostly paddy fields	Alluvium	Agricultural land with part of the settlements	The tower locations are easily accessible from Dudhkumar soling road and West Char Peer Aulia high school road	Gobadia village and two road crossings	Part of Gobadia village
AP-1 to AP-2 Mouza- Gobadia, Boirag Upazila/ Thana- Bondor, Anowara	7	High and slightly undulated (+/-10 feet)	Scattered village and paddy fields	Alluvium	Agricultural land with part of settlements and a ditch	The tower locations are easily accessible from Goalpara Road, Fertilizer Road etc.	Goalpara village and five road crossings	Part of Gobadia village
AP-2 to AP-3 Mouza- Chatori, Boirag Upazila/ Thana- Anowara	7	High and slightly undulated (+/-9 feet)	Mostly paddy fields with some narrow canals and scattered village	Alluvium	Agricultural land with part of settlements and a canal	The tower locations are easily accessible from Chattogram to Anowara fertilizer road and Purba Bairag road	Bairag village and four road crossings	Part of Bairag village
AP-3 to AP-4 Mouza- Chatori, Koinpur	4	Low and slightly undulated (+/-12 feet)	Paddy fields	Valley Alluvium and Colluvium	Agricultural land with two narrow canals	The tower locations are easily accessible	One road crossing	Residential area is away from the TL corridor

Location of Angle Tower	Number of Towers	Terrain Type	Natural Environment	Geology and Soil	Current Land Use	Accessibility to Towers	Infra-structure Crossing	Residential Crossing
Upazila/ Thana- Anowara						from Shahbari Road		
AP-4 to AP-5 Mouza- Koinpur Upazila/ Thana- Anowara,	1	Nearly flat (+/-3 feet)	Paddy fields	Valley Alluvium and Colluvium	Agricultural land	The tower locations are easily accessible from Daulatpur to Fakirkhan road	Existing 230 kV line	Residential area is away from the TL corridor
AP-5 to AP-6 Mouza- Daulatpur, Koinpur Upazila/ Thana- Anowara, Patia	3	Nearly flat (+/-2 feet)	Paddy fields	Valley Alluvium and Colluvium	Agricultural Land	The tower locations are easily accessible from Daulatpur to Fakirkhan road	Nil	Residential area is away from the TL corridor
AP-6 to AP-7 Mouza- Daulatpur, Upazila/ Thana- Patia	2	Slightly undulated (+/-6 feet)	Paddy fields	Valley Alluvium and Colluvium	Agricultural land with part of settlement	The tower locations are easily accessible from Daulatpur to Guptal road	One road crossing	Residential area is away from the TL corridor
AP-7 to AP-8 Mouza- Koigram, Sha Mirpur Upazila/ Thana- Bondor, Patia	6	Nearly flat (+/-1 feet)	Paddy fields with scattered villages	Valley Alluvium and Colluvium	Agricultural land with part of settlements	The tower locations are easily accessible from Koigram village road and Chattogram to Anowara road	Koigram and Sha Mirpur village with three road crossings	Part of Koigram and Shamirpur Village
AP-8 to AP-9 Mouza- Juldha Sha mirpur	3	Slightly high and undulated (+/-6 feet)	Scattered villages and paddy fields	Valley Alluvium and Colluvium	Settlements with some agricultural land	The tower locations are easily accessible	Sha Mirpur village with three	Part of Shamirpur Village

Location of Angle Tower	Number of Towers	Terrain Type	Natural Environment	Geology and Soil	Current Land Use	Accessibility to Towers	Infra-structure Crossing	Residential Crossing
Upazila/ Thana-Bondor						from Sha Mirpur road	road crossings	
AP-9 to AP-10 Mouza- Juldha, Sikalbaha Upazila/ Thana-Bondor, Patia	3	high and slightly undulated (+/-7 feet)	Paddy fields	Valley Alluvium and Colluvium	Agricultural Land	The tower locations are easily accessible from Dhulda to Char Arani road	Two road crossings and one canal	Residential area is away from the TL corridor
AP-10 to AP-11 Mouza- Char Lakkha, Sikalbaha Upazila/ Thana-Patia	2	High and slightly undulated (+/-8 feet)	Paddy fields with scattered villages	Valley Alluvium and Colluvium	Agricultural lands with part of settlements	The tower locations are easily accessible from Sikalbaha village road	Two roads	Part of Dhulda village
AP-11 to AP-12 Mouza- Char Lakkha Upazila/ Thana-Patia	5	Nearly flat (+/-1 feet)	Paddy fields with one or two houses	Valley Alluvium and Colluvium	Agricultural lands with part of settlements	The tower locations are easily accessible from Char Lakkha village road	Three roads	Part of Char Lakkha village
AP-12 to AP-13 Mouza- Dangar Char Upazila/ Thana-Bondor	5	High and slightly undulated (+/-7 feet)	Paddy fields with two narrow canals.	Valley Alluvium and Colluvium	Agricultural Land	The tower locations are easily accessible from Paschim Char Lakkha village road	Existing 132 kV line	Residential area is away from the TL corridor
AP-13 to AP-14 Mouza- Dangar Char Upazila/ Thana-Bondor	1	High and slightly undulated (+/-7 feet)	Paddy fields	Valley Alluvium and Colluvium	Agricultural Land	The tower locations are easily accessible from Paschim	Existing 132 kV line	Residential area is away from the TL corridor

Location of Angle Tower	Number of Towers	Terrain Type	Natural Environment	Geology and Soil	Current Land Use	Accessibility to Towers	Infra-structure Crossing	Residential Crossing
						Char Lakkha village road		
AP-14 to AP-15 Mouza- Dangar Char Upazila/ Thana-Bondor	2	High and slightly undulated (+/-4 feet)	Paddy fields	Valley Alluvium and Colluvium	Agricultural Lands	The tower locations are easily accessible from Zulza substation road	Two roads	Residential area is away from the TL corridor
AP-15 to AP-16 Mouza- Dakkhin Halishahar Upazila/ Thana-Bondor	1	Low, undulated	Karnaphuli River	Valley Alluvium and Colluvium	River	The tower locations are easily accessible from port road	-	Residential area is away from the TL corridor
AP-16 to AP-17 Mouza- Dakkhin Halishahar Upazila/ Thana-Bondor	1	High, slightly undulated (+/-4 feet)	Urban Area	Valley Alluvium and Colluvium	Industrial area	The tower locations are easily accessible from port road	Industrial area and Chattogram port	Residential area is away from the TL corridor
AP-17 to Underground	-	Moderately undulated	Urban Area	Valley Alluvium and Colluvium	Industrial area	The tower locations are easily accessible from port road	Industrial area and Chattogram port	Residential area is away from the TL corridor
Anowara to New Mooring Underground Transmission Line								
Port Link Road to Halishahar Railway Station	-	High, slightly undulated (+/-12 feet)	Urban Area	Alluvium Beach and Alluvium	City Corporation Road	Port Link Road to Halishahar Railway Station	Along the existing road network	Underground cable route goes with the alignment of existing road

Location of Angle Tower	Number of Towers	Terrain Type	Natural Environment	Geology and Soil	Current Land Use	Accessibility to Towers	Infra-structure Crossing	Residential Crossing
Halishahar Railway Station to Chawchala	-	High, slightly undulated (+/-12 feet)	Urban Area	Alluvium	City Corporation Road	Halishahar Railway Station to Chawchala	Along the existing road network	Underground cable route goes with the alignment of existing road
Chawchala to Ananda Bazar Bridge	-	High, slightly undulated (+/-12 feet)	Urban Area	Alluvium	City Corporation Road	Chawchala to Ananda Bazar Bridge	Along the existing road network	Underground cable route goes with the alignment of existing road
Ananda Bazar Bridge to New Mooring	-	High, slightly undulated (+/-12 feet)	Urban Area	Alluvium	City Corporation Road	Ananda Bazar Bridge to New Mooring	Along the existing road network	Underground cable route goes with the alignment of existing road
LILO at New Mooring Underground Transmission Line								
Chattogram Port Link Road to Chattogram coastal road	-	Nearly flat (+/- 4)	Urban Area	Alluvium	City Corporation Road	Port Link Road to Coastal road	Along the existing road network	Underground cable route goes with the alignment of existing road
Chattogram Coastal Road to Ananda Bazar (substation)	-	Nearly flat (+/- 4)	Urban Area	Alluvium	City Corporation Road	Chattogram Coastal Road to Ananda Bazar Road	Along the existing road network	Underground cable route goes with the alignment of existing road

Location of Angle Tower	Number of Towers	Terrain Type	Natural Environment	Geology and Soil	Current Land Use	Accessibility to Towers	Infra-structure Crossing	Residential Crossing
Ananda Bazar Bridge to New mooring	-	Nearly flat (+/- 4	Urban Area	Alluvium	City Corporation Road	Ananda Bazar Bridge to New Mooring	Along the existing road network	Underground cable route goes with the alignment of existing road
Khulshi to Madunaghat Underground Transmission line								
Khulshi to GEC moor	-	Very High, significantly undulated (+/- 60 feet)	Urban Area	Dupi tila formation	City Corporation Road	Khulshi to GEC City Corporation Road	Along the existing road network	Underground cable route goes with the alignment of existing road
GEC to Bahaddarhat	-	High, significantly undulated (+/- 25 feet)	Urban Area	Valley Alluvium and Colluvium	City Corporation Road	GEC to Bahaddarhat City Corporation Road	Along the existing road network	Underground cable route goes with the alignment of existing road
Bahaddarhat to Chandgao	-	High, undulated (+/- 11 feet)	Urban Area	Valley Alluvium and Colluvium	City Corporation Road	Bahaddarhat to Chandgao City Corporation Road	Along the existing road network	Underground cable route goes with the alignment of existing road
Chandgao to MadunaGhat	-	Slightly High, undulated (+/- 16 feet)	Urban Area	Valley Alluvium and Colluvium	City Corporation Road	Chandgao to Madunaghat City Corporation Road	Along the existing road network	Underground cable route goes with the alignment of existing road

Some photographs of the transmission line corridors are presented in **Figures 5.14 to 5.19**, whereas the land use maps of these corridors are presented in **Figures 5.20 to 5.29**.



Figure 5.14: Anowara to New Mooring OHTL Route



Figure 5.15: Anowara to New Mooring OHTL Route



Figure 5.16: Anowara to New Mooring OHTL Route



Figure 5.17: Anowara to New Mooring UGTL Route



Figure 5.18: Road Crossing Point of Anowara to New Mooring Overhead Transmission Line



Figure 5.19: Khulshi to Madunaghat Underground Transmission Line Route

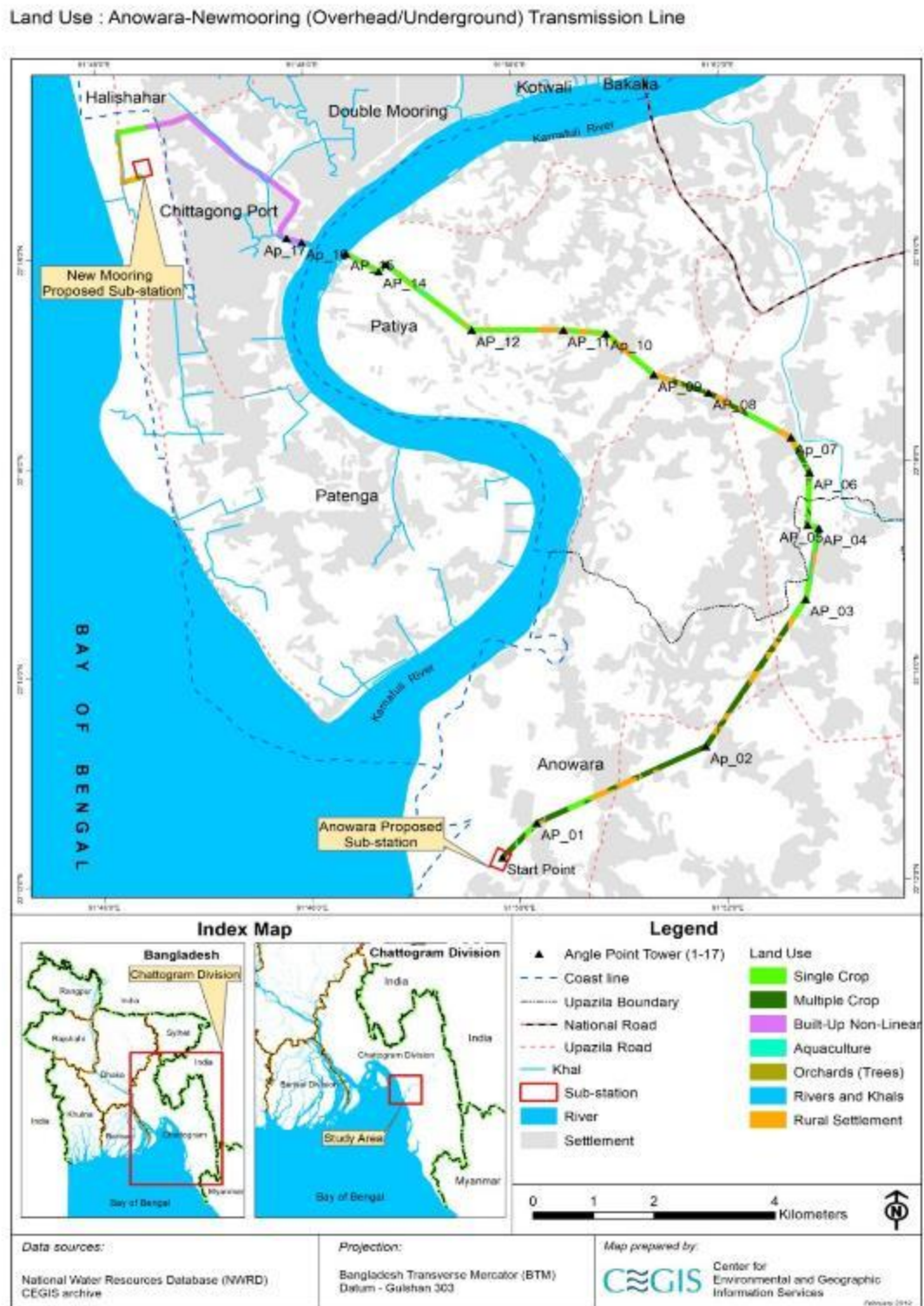


Figure 5.20: Land Use of Anowara to New Mooring Transmission Line

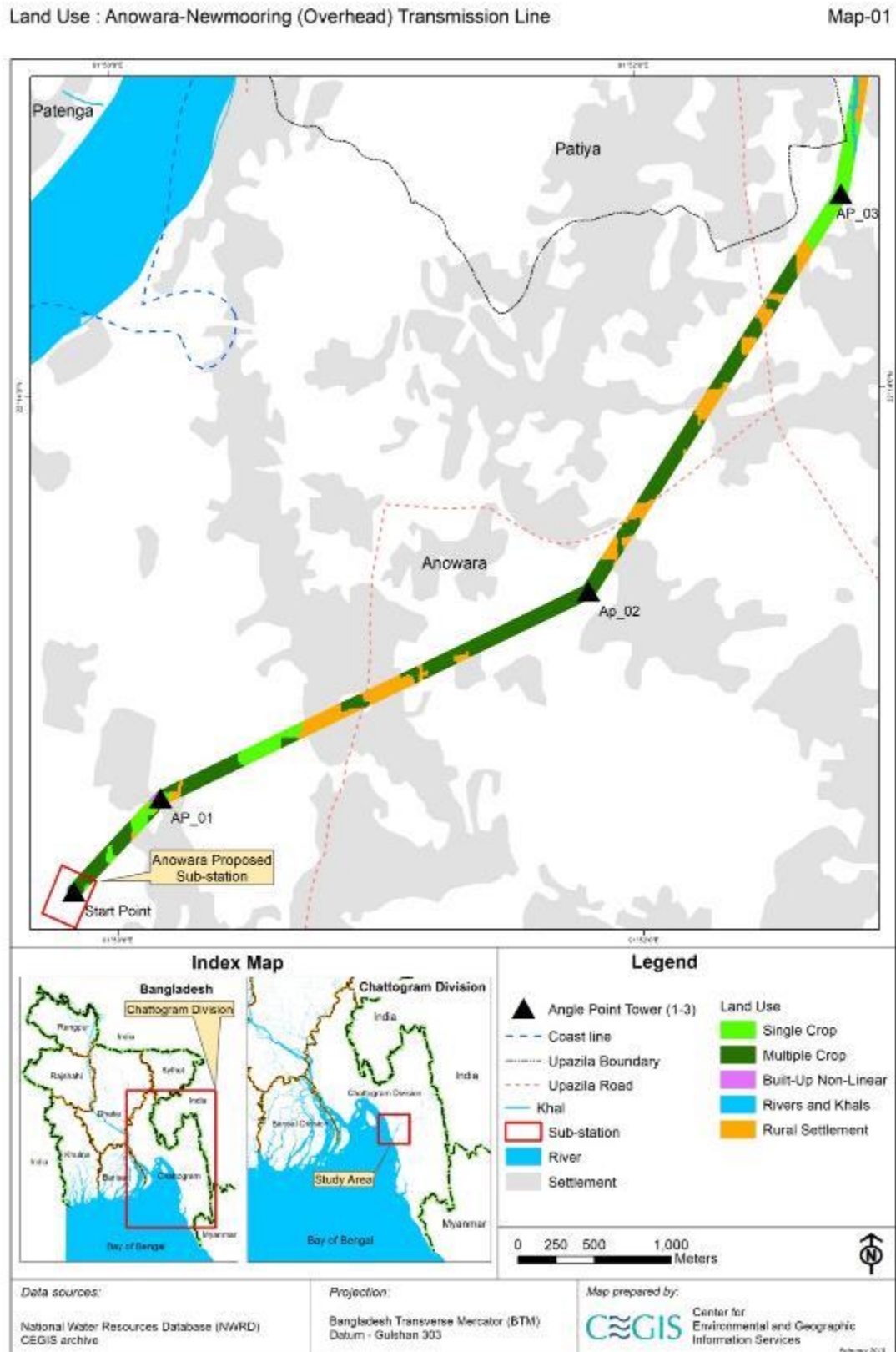


Figure 5.21: Land Use of Anowara to New Mooring Transmission Line

Land Use : Anowara-Newmooring (Overhead) Transmission Line

Map-02

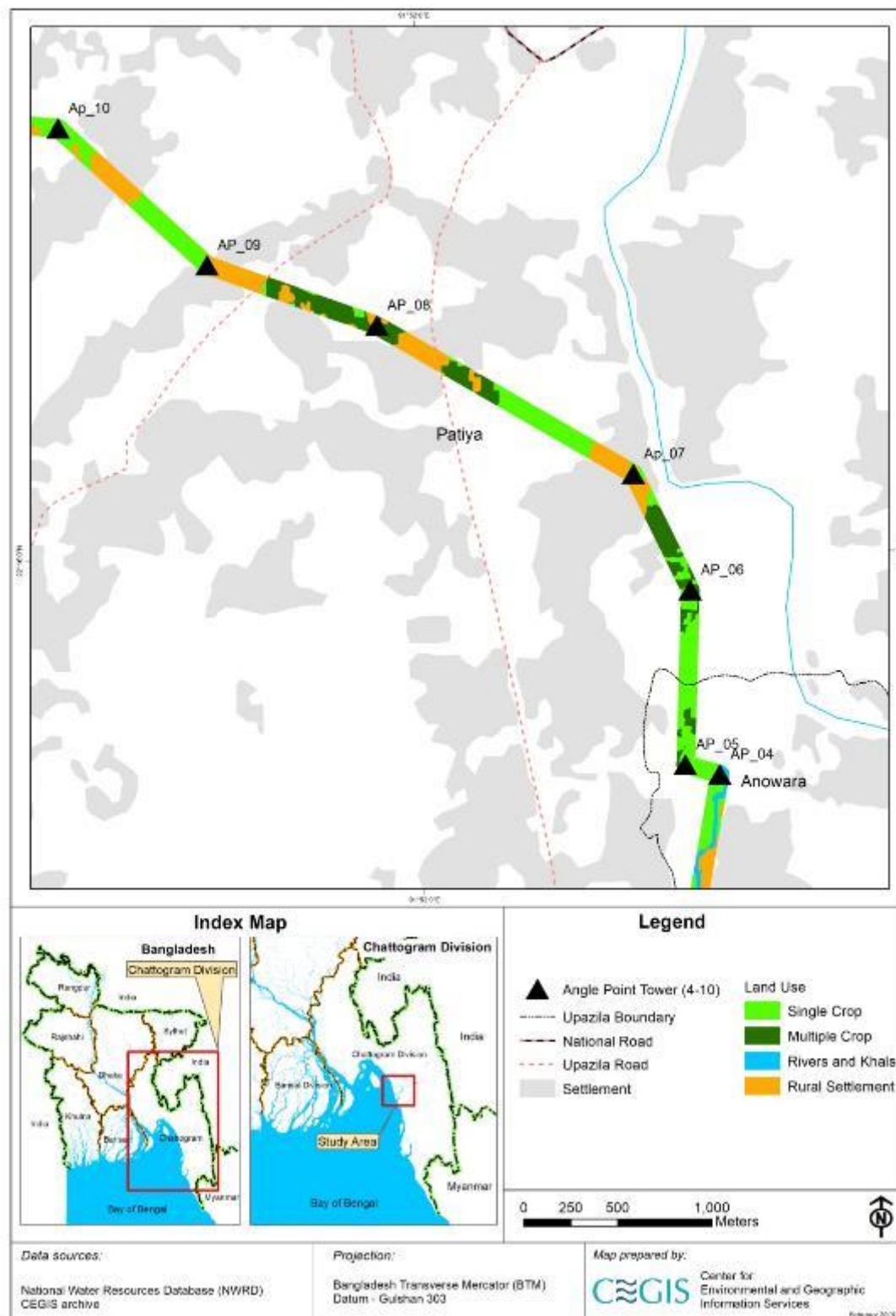


Figure 5.22: Land Use of Anowara to New Mooring Transmission Line

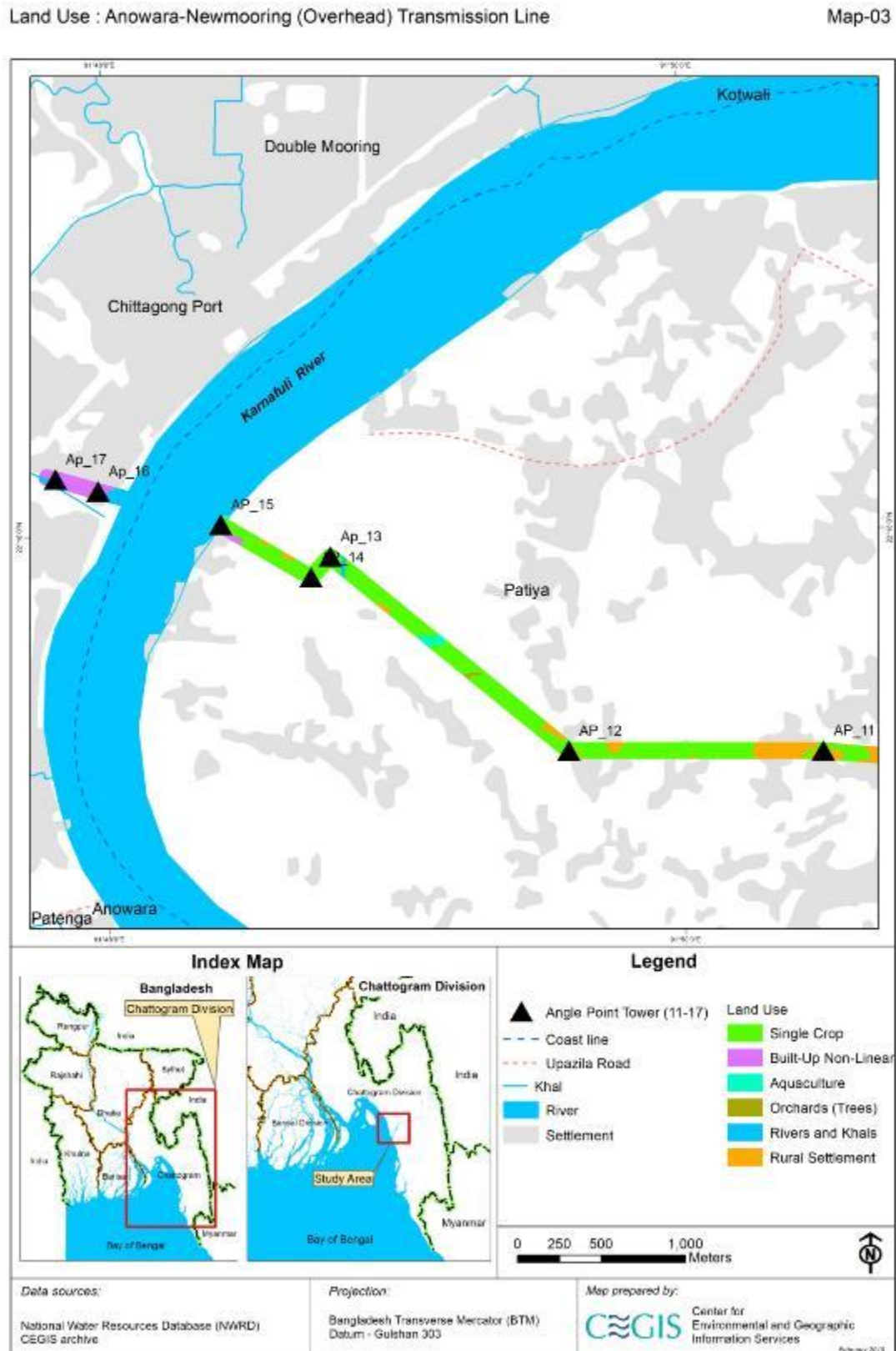


Figure 5.23: Land Use of Anowara to New Mooring Transmission Line

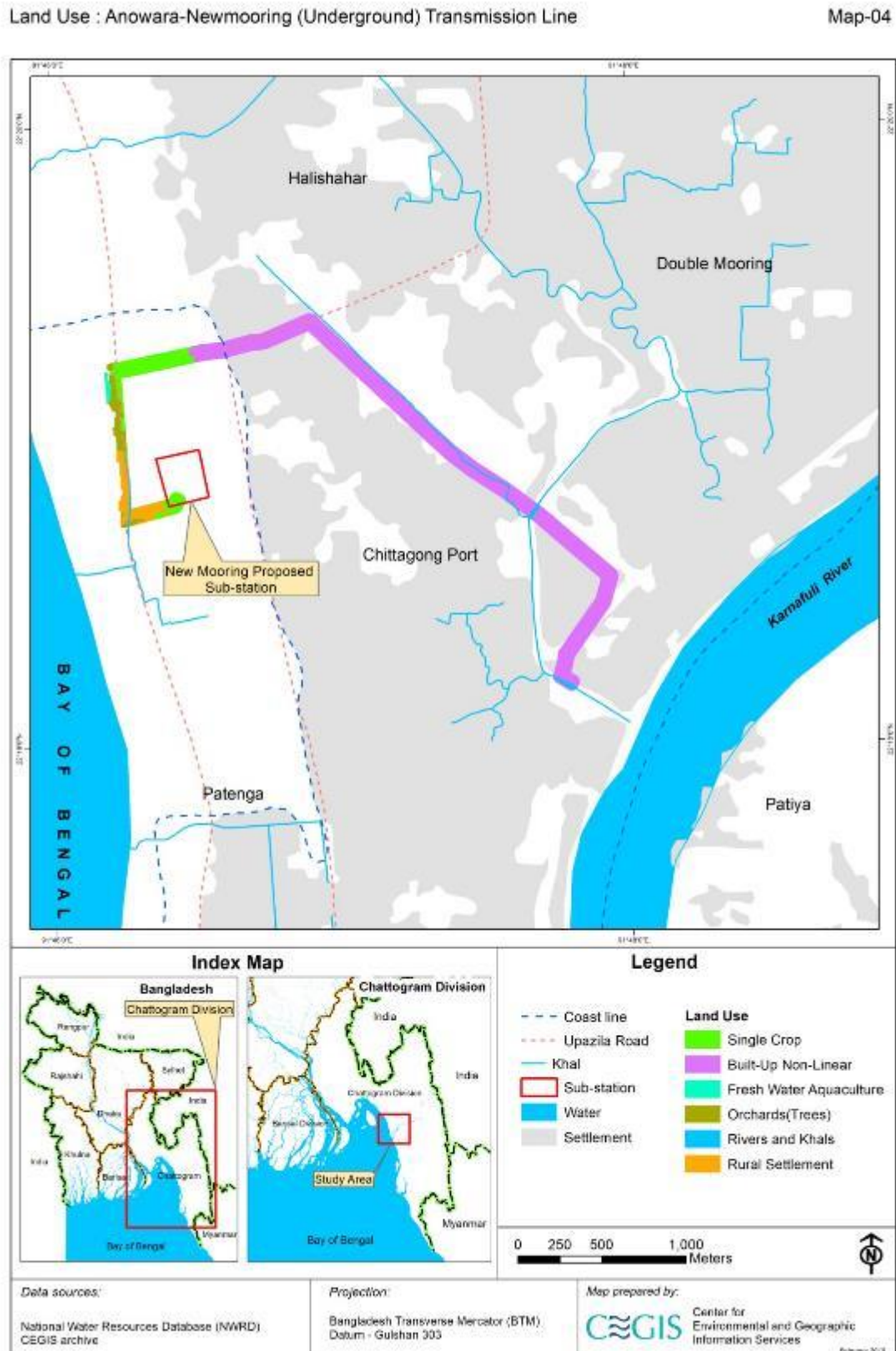


Figure 5.24: Land Use of Anowara to New Mooring Transmission Line

Land Use : Khulshi-Madunaghat Transmission Line

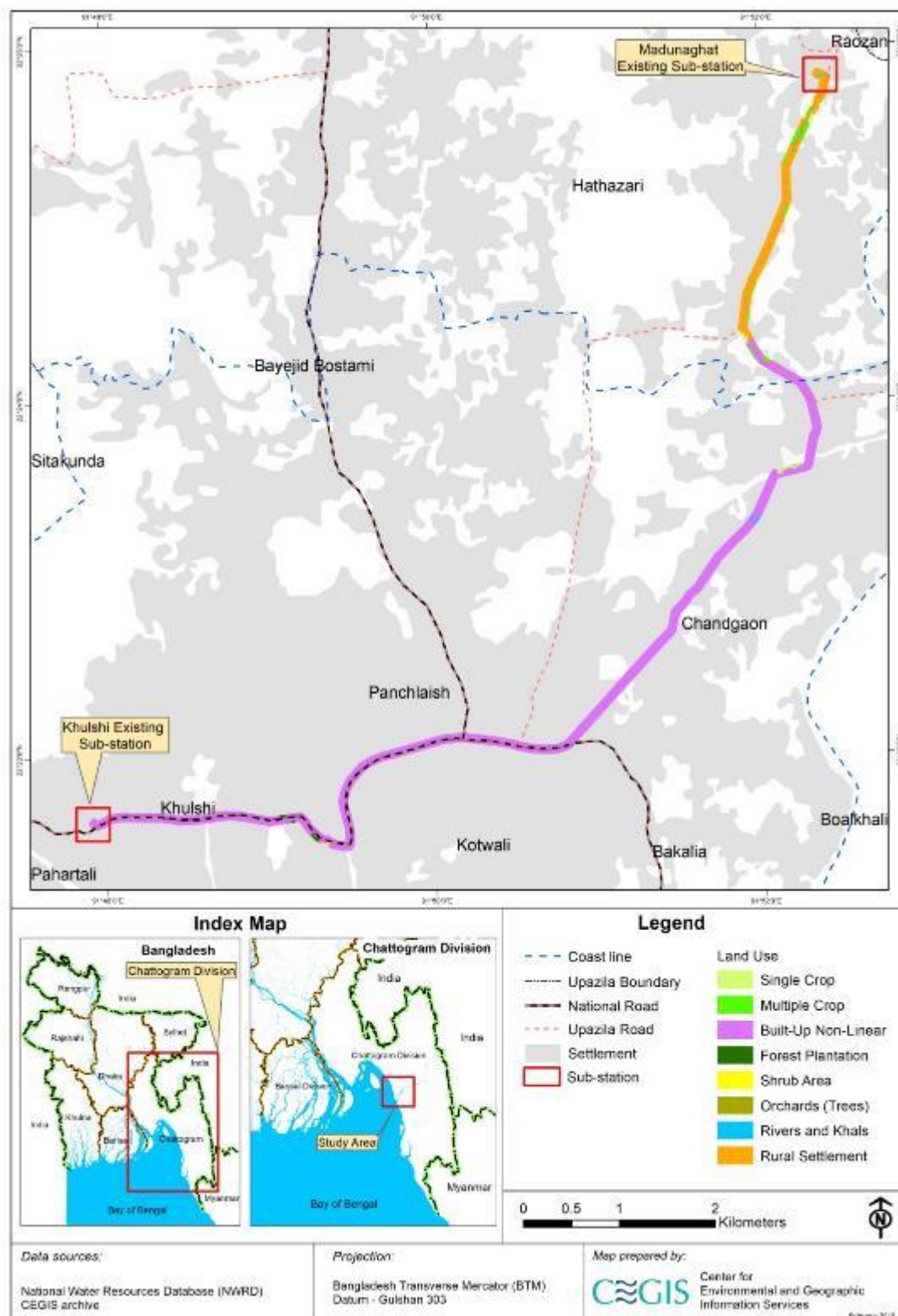


Figure 5.25: Land Use of Khulshi to Madunaghat Transmission Line

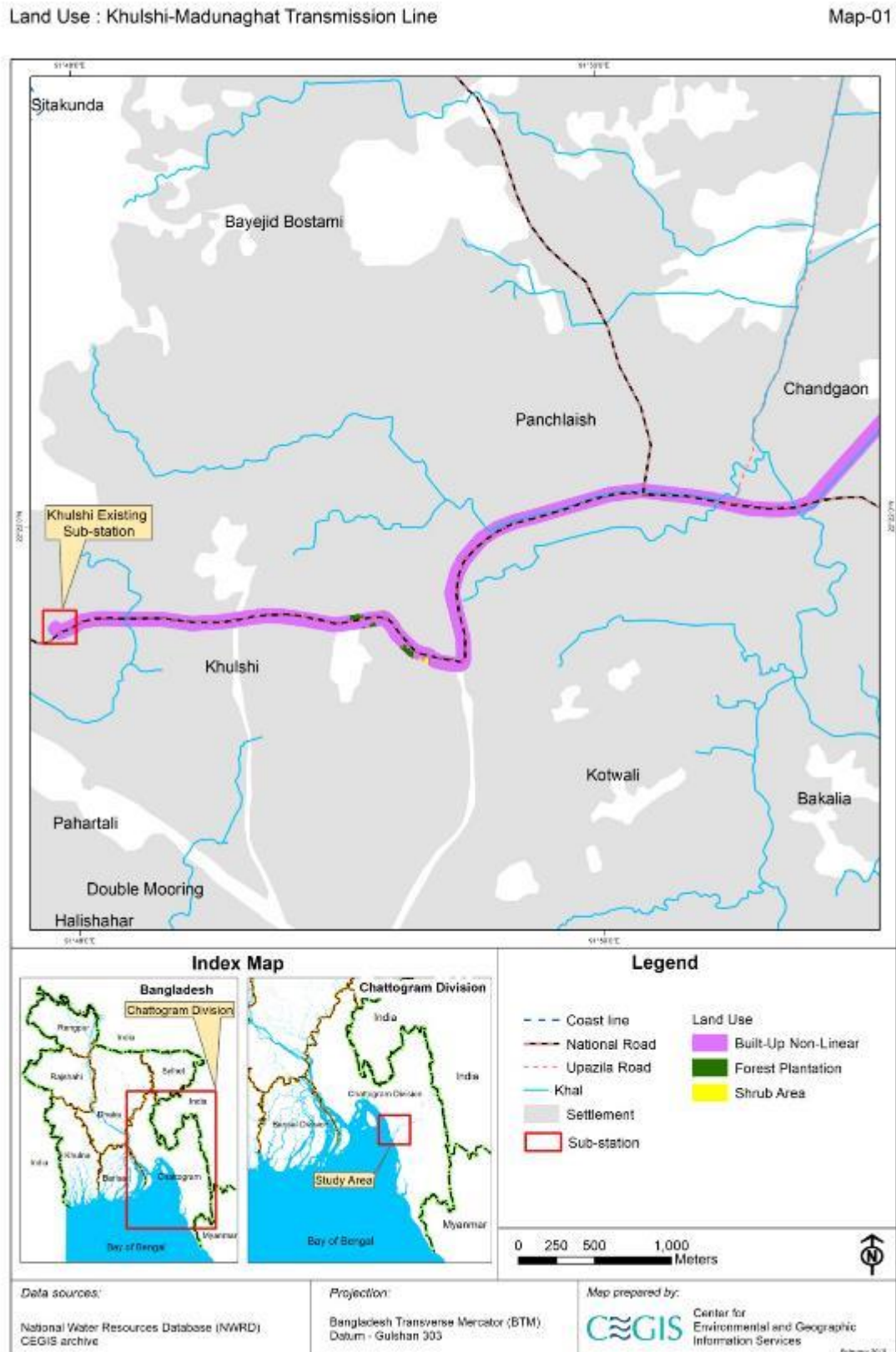


Figure 5.26: Land Use of Khulshi to Madunaghat Transmission Line

Land Use : Khulshi-Madunaghat Transmission Line

Map-02

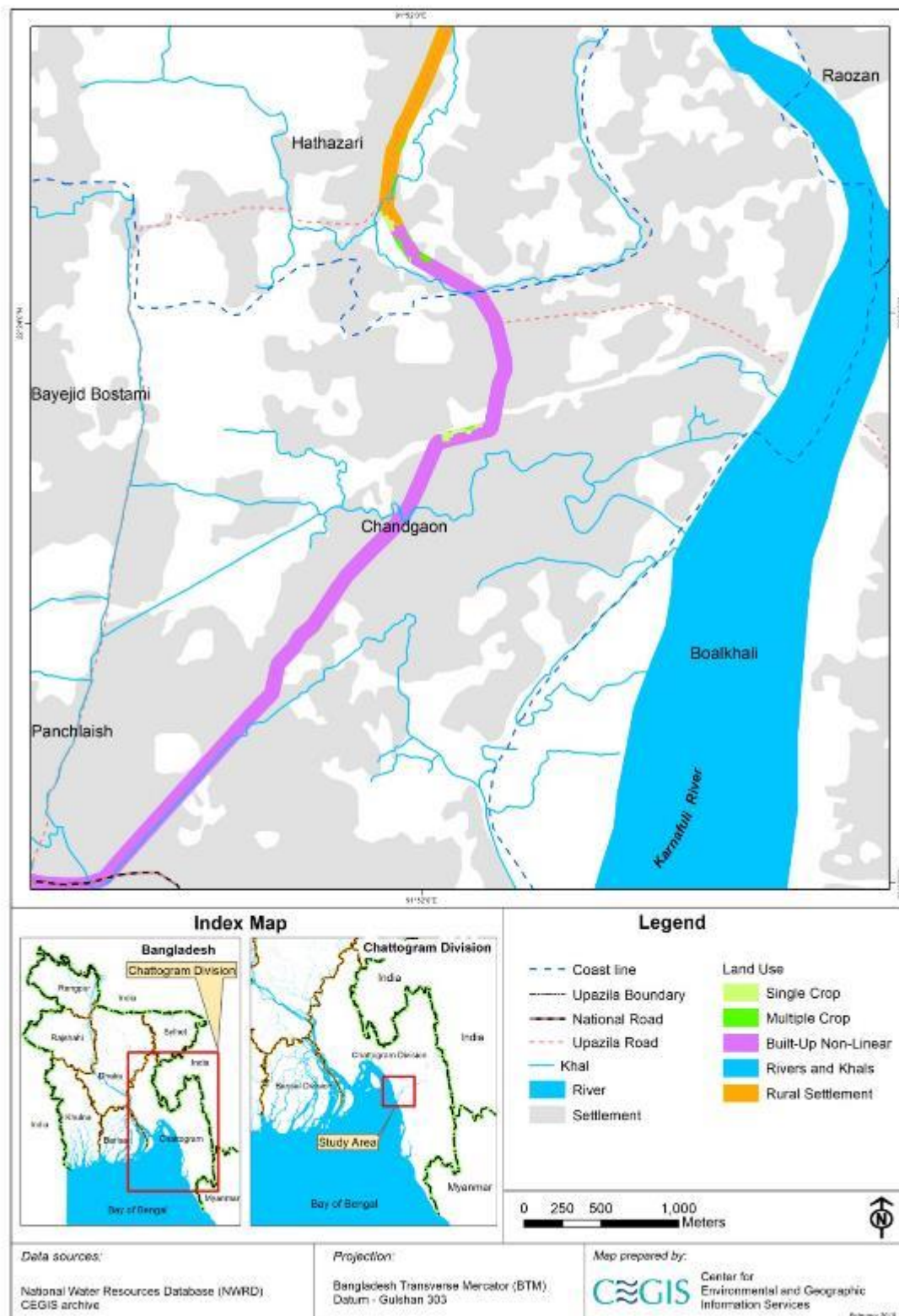


Figure 5.27: Land Use of Khulshi to Madunaghat Transmission Line

Land Use : Khulshi-Madunaghat Transmission Line

Map-03

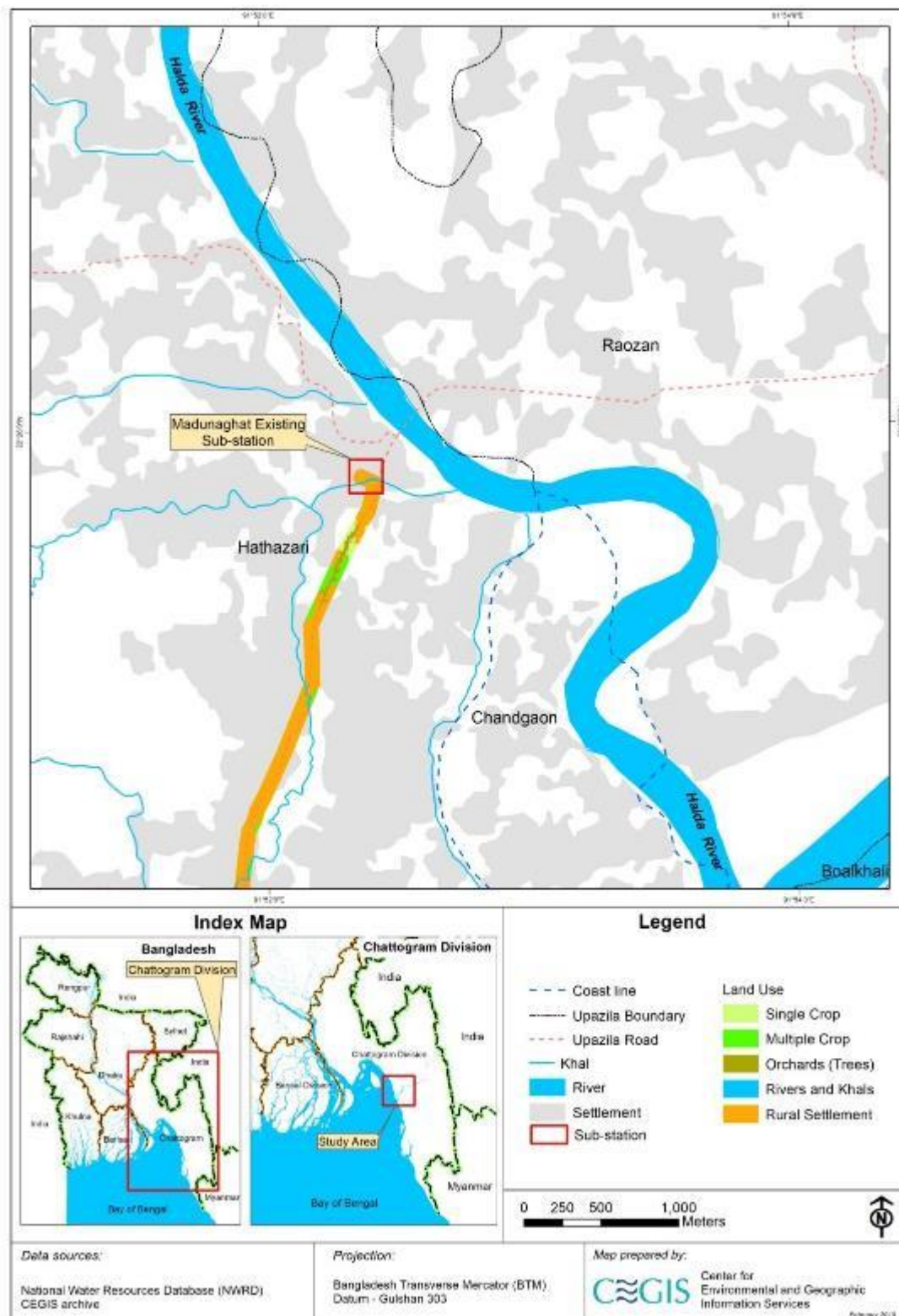


Figure 5.28: Land Use of Khulshi to Madunaghat Transmission Line

Land Use : LILO at New Mooring from Rampur- Hathazari Transmission Line

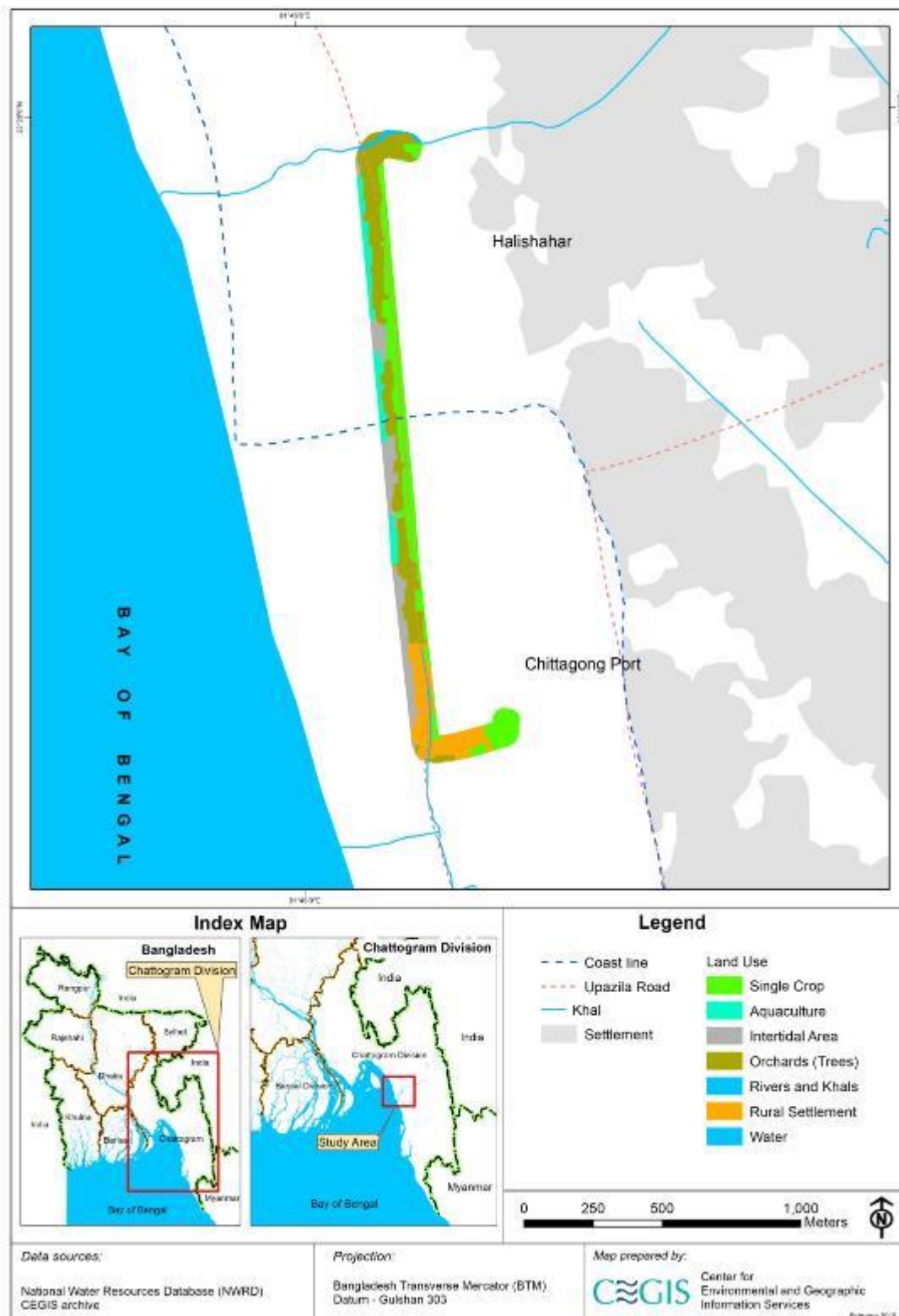


Figure 5.29: Land Use of Rampur to Hathazari Transmission Line

5.2 Agriculture Resources

5.2.1 Cropping Pattern and Intensity

Most parts of the overhead transmission lines of the proposed project are located in agricultural land, whereas the 20-meter RoW of the underground lines mostly passes through the urban areas of Chattogram City Corporation. However, most of the agricultural lands of urban area remain fallow throughout the years. Double cropping is practiced in most of the study area with triple cropping also being practiced in some areas. Hybrid *Aus* rice and summer vegetables are grown in Kharif-I and high yield varieties (HYV) of rice in Kharif-II, while HYV *Boro* rice and winter vegetables are grown in Robi (also known as Rabi) season.^{16 17} The cropping intensity of the overall study area is about 159 percent, while the cropping intensity of DIA is about 162 percent.

The New Mooring substation will also be constructed on agricultural land, while the Khulshi substation will be constructed on non-agricultural land. The substation site of New Mooring is double cropped and the cropping intensity of this area is about 200 percent.

5.2.2 Crop Area and Production

Total cropped area is 46 ha in direct impacted area (20-m RoW) of which rice is cultivated on about 37.7 ha and vegetables on about 8.3 ha. Total production of the area has been estimated to be about 239 tons per year, where rice production is 119 tons and vegetables production is 120 tons. Detailed cropped area and production in the RoW is presented in **Table 5.10**.

Table 5.10: Cropped Area and Production in Proposed RoW

Crop Name	Crop Area (ha)		Crop Yield (ton/ha)	Crop Production (tons)	
	20-m RoW	100-m RoW		20-m RoW	100-m RoW
Aus Rice	3.6	16.5	3.8	14	63
Aman Rice	28.5	136.0	2.9	83	394
Boro Rice	5.7	25.5	3.9	22	99
Total Rice	37.7	178.1		119	557
Summer Vegetables	2.1	9.0	13.0	28	117
Winter Vegetables	6.2	29.0	15.0	92	435
Total Non-Rice	8.3	38.0		120	552
Grand Total	46.0	216.1		239	1109

Source: ESIA Study, 2017.

¹⁶*Aus*, *Aman*, and *Boro* are rice varieties cultivated in Bangladesh. *Aus* is generally cultivated in July-August; *Aman* in December-January; and *Boro* in March-May cropping seasons.

¹⁷The *kharif* cropping season is from July to October and the *rabi* cropping season is from October to March.

In the substation area, the total cropped area is 14.58 hectare and annual production is about 65.89 ton. Detailed cropped area and production by substations is presented in **Table 5.11**.

Table 5.11: Cropped Area and Production in Proposed Substation

Crop Name	Crop Yield (ton/ha)	New Mooring Substation	
		Crop Area (ha)	Annual Crop Production (Ton)
Aman Rice	2.9	7.29	21.14
Boro Rice	3.9	5.82	22.7
Vegetables	15.0	1.47	22.05
Grand total		14.58	65.89

Source: ESIA Study, 2017.

Irrigation coverage of the study area is 100 percent of NCA during the rabi/dry season. Irrigation is provided by using shallow tube wells (STW) and deep tube wells (DTWs) for HYV Boro rice, potato, vegetables and wheat crops.

5.3 Ecological Resources

The substations and transmission lines of the proposed project are located in different ecosystems in Chittagong Town and Anowara Upazila of Chittagong district. The primary data for ecological resources was collected through a line transect walk to document the baseline situation and to assess the potential impacts of the proposed interventions on ecological resources of the area. A corridor of 100-m width was studied during the transect walk.

5.3.1 Bio-ecological Zone

The International Union for Conservation of Nature (IUCN), Bangladesh has divided the whole country into 25 Bio-ecological Zones in the context of biological diversity (Nishat *et al.* 2002). The study area covers i) Chittagong Hills and the CHTs; and ii) Coastal Plains, as shown in **Figure 5.30**.

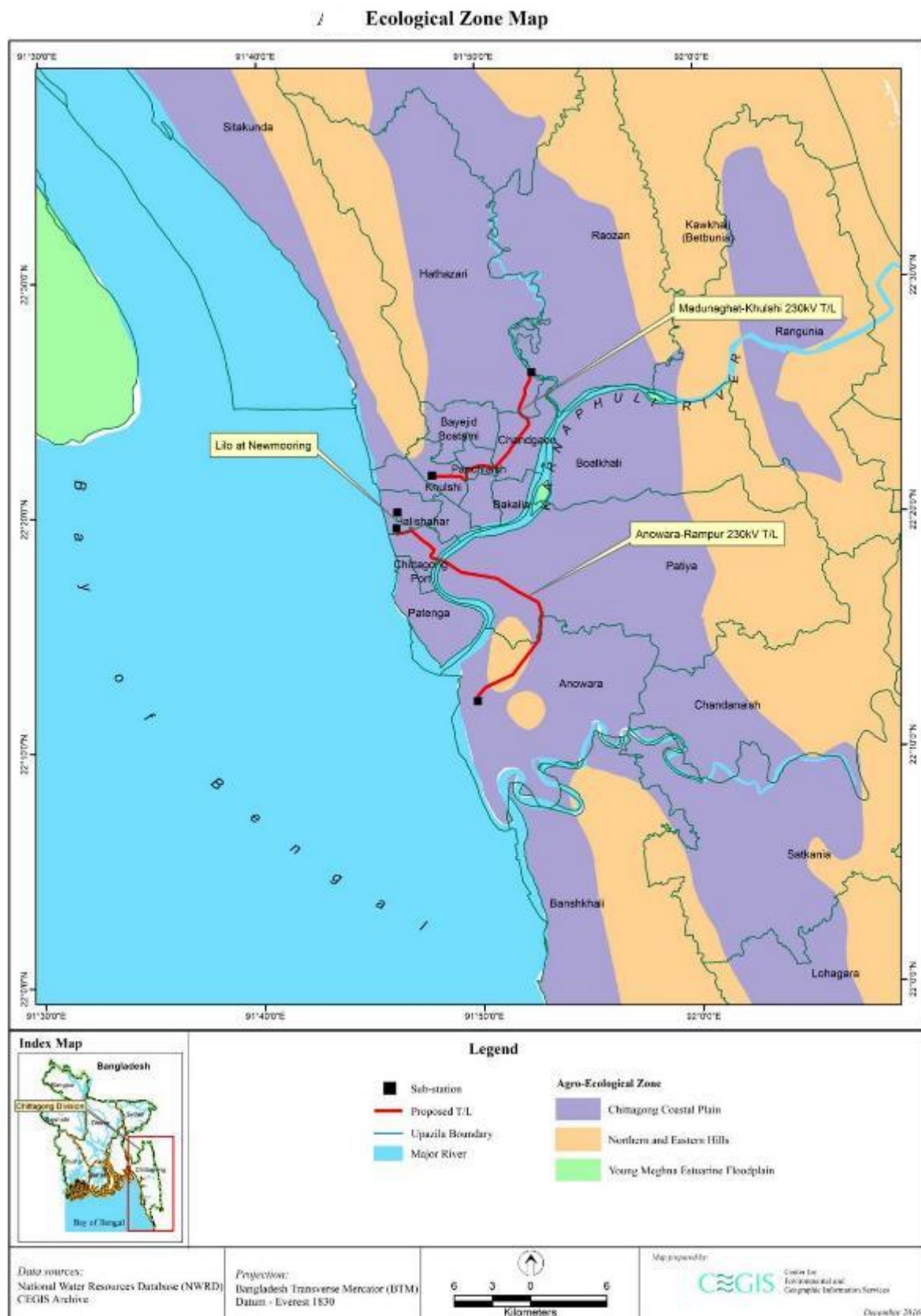


Figure 5.30: Bio-Ecological Zones of Study Area

5.3.2 Ecosystems

The ecosystem of the study area belongs to mainly two types: terrestrial and aquatic ecosystems. Brief descriptions of these ecosystems are given below.

Terrestrial Ecosystems

The terrestrial ecosystem is classified into two major groups namely terrestrial flora and terrestrial fauna.

Terrestrial Flora. According to the field investigation, the terrestrial flora of the study area has been divided into three subcategories based on landscape and vegetation patterns: i) homestead/settlement vegetation; ii) crop-field vegetation; and iii) roadside vegetation. A description of these subcategories is presented below:

Homestead/settlement vegetation is the type of vegetation that occurs within a house. Most of the study area is urban except for Anowara. The study area in Anowara is purely rural with different fruiting trees. Homestead vegetation found in this area is low in terms of abundance and diversity. Dominant species of this area recorded were Banana (*Kola*), Indian Shirish (*Gagan Shirish*), Drumstick (*Sajna*), beetle-nut (*Supari*), Albizia (*Koroi*), *Eucalyptus*, and *Acacia* (*Akashmoni*).

Crop-field vegetation is found mostly around the cultivated areas. Dominant species of the cropland include Kaisa and Bermuda grass (*Durba Ghash*). Although the crop-field vegetation shows less diversity but it provides feeding habitats to tiny wildlife.

Roadside vegetation occupies road slopes of any given area. The sides of the existing roads both in the Chittagong Town as well as Anowara are covered by a few dominant species of plants, including Pink Morning Glory (*Dhol Kolmi*), Indian Rosewood (*Sisu*), Indian Coral Tree (*Mandar*), Hill Glory bower (*Bhat*), and *Shialmutra*. Typical views of these subcategories are presented in **Figures 5.31 to 5.34**.



Figure 5.31: Homestead Vegetation, Khulshi



Figure 5.32: Homestead Vegetation, Anowara



Figure 5.33: Roadside Vegetation, Anowara



Figure 5.34: Crop-field Vegetation, New Mooring

Terrestrial Fauna. The study area belongs to mainly urban and agricultural ecosystem, which has been highly disturbed and modified by human activities. Therefore, diversity of wildlife species in this study area is very low. A brief account of terrestrial fauna is provided below in accordance with their hierarchy:

Amphibians are not truly terrestrial in account of their life cycle. They possess a diversified life cycle from larva to adult stages. Common Toad (*Kuno Beng*), Ornate Microhylid Frog (*China Beng*), Ballon Frog (*Potka Beng*), and Indian Cricket Frog (*Jhi-Jhi Beng*) are among the dominant species throughout the study area. Most of the amphibians inhabit the edges of ponds, paddy-fields, ground holes, grasslands, bushes and tree holes. According to IUCN-Bangladesh (2015a), the Microhylid Frog has been categorized as Least Concern (LC) species to the country.

Reptiles belong to a diversified group in comparison with the amphibians. They are found abundantly especially in a rural area like Anowara but occasional in the urban ecosystem. The Common Garden Lizard (*Girigiti*), Northern House Gecko (*Tiktiki*), Bengal Lizard (*Gui Shap*), Common Kukri Snake (*Boloy Uday Kal*), Bengal Monitor (*Gui Shap*), and Banded Krait (*Shankhini Shap*) are the dominant species of the area. According to locals, Monocled (*Gokhra Shap*) and Binocled Cobras (*Khoi Gokhra*) are also found in this rural area. Bengal Monitor (NT¹⁸), Monocled Cobra (NT) and Binocled Cobra (NT) have been categorized as near threatened species to the country by IUCN-Bangladesh (2015a).

Avifauna. The Chittagong region is the home to many birds both resident and migratory due to its diversified habitats located throughout the area. The key habitats of Chittagong region include Protected Areas (PAs) like Kaptai National Park, Baroiyadhala National Park, Chunati Wildlife Sanctuary, Dudpukuria-Dhopachari Wildlife Sanctuary, Hajarikhil Wildlife Sanctuary, Sitakunda Botanical Garden and Eco-park, Karnaphuli River system, and Patenga Sea Beach (none of these areas are close to the proposed project sites). According to Kamruzzaman et al. 2007, 113 species of bird species were identified in a year thorough

¹⁸ NT- Near Threatened, LC- Least concern, VU-Vulnerable.

rigorous study. Later, Kabir et al. 2017 has shown that the number of bird species has increased up to 215.

A study of the birds of the Karnaphuli River Delta and adjacent areas in Chittagong, Bangladesh, was carried out by direct field observations between July 1999 and June 2000.¹⁹ Status and distribution of the birds were assessed, habitats and some other aspects were also studied. A total of 141 species of birds belonging to 12 orders, 41 families and 98 genera were recorded. Out of 141 species of birds 61 species (43 percent) were passerines of which 45 (74 percent) were resident and 16 (26 percent) were migratory. Among the 80 non-passerine species, 59 (74 percent) were resident and 21 (26 percent) were migratory. During the study period one species, Brown Rock Chat (*Cercomela fusca*), was recorded for the first time in Bangladesh.

Birds observed frequently in this area include Black Drongo (*Fingey*), Red-vented Bulbul (*Bangla Bulbuli*), Common Myna (*Bhat Shalik*), Asian Pied Starling (*PakhraShalik*), Oriental Magpie Robin (*Doel*), Brahminy Kite (*Shankho Cheel*), Spotted Dove (*Tila Ghughu*), Coppersmith Barbet (*Bosonto Bauri*), Baya Weaver (*Babui*), Blue-eared Kingfisher (*Neelkan Machhranga*) and Common Tailorbird (*Suta Tuntuni*). No threatened species were observed within the study areas.

An Important Bird Area (IBA) is situated at Patenga Sea Beach (22°14'N 91°48'E) far from project area (4.54 km from Anowara, and 7.48 km from New Mooring) (MoEF, 2001).

A list of key avifauna of the region is presented in **Table 5.12** with their IUCN-global and Bangladesh Red list status.

Table 5.12: Key Avifauna of Chittagong Region

	Common Name	Scientific Name	Local Status	Country Status	IUCN Red list Global Status	IUCN Red list-Bangladesh Status (2015)
1	Straited Marsh Warbler	<i>Megalurus palustris</i>	R	Resident	NO	NO
2	Streaked Weaver Bird	<i>Ploceus manyar</i>	R	Resident	NO	NO
3	Greater Flameback	<i>Chrysocolaptes guttocristatus</i>	F	Resident	LC	LC
4	Black-naped Flameback	<i>Dinopium benghalense</i>	VC	Resident	NO	NO
5	Chestnut-winged Cuckoo	<i>Clamator coromandus</i>	R	Migratory	LC	LC
6	Plaintive Cuckoo	<i>Cacomantis merulinus</i>	VC	Resident	LC	LC
7	Vernal Hanging Parrot	<i>Loriculus vernalis</i>	F	Resident	LC	LC
8	Rose-ringed Parakeet	<i>Psittacula krameri</i>	VC	Resident	LC	LC

¹⁹ Birds of The Karnaphuli River Delta and Adjacent Areas in Chittagong, Bangladesh. M.F. Ahsan and M.A. Hannan, August 2002.

	Common Name	Scientific Name	Local Status	Country Status	IUCN Red list Global Status	IUCN Red list- Bangladesh Status (2015)
9	Spotted Owlet	<i>Athena brama</i>	C	Resident	LC	LC
10	Red Turtle Dove	<i>Streptopelia trpnquebaria</i>	UC	Resident	LC	LC
11	Pintail Snipe	<i>Gallinago stenura</i>	C	Migratory	LC	NO
12	Green Sandpiper	<i>Tringa ochropus</i>	UC	Migratory	LC	LC
13	Common Sandpiper	<i>Actitis hypoleucos</i>	VC	Migratory	LC	LC
14	Little Ringed Plover	<i>Charadrius dubius</i>	UC	Migratory	LC	LC
15	Red-wattled Lapwing	<i>Vanellus indicus</i>	VC	Resident	LC	LC
16	Brahminy Kite	<i>Haliastur indus</i>	VC	Resident	NO	NO
17	Black-naped Oriole	<i>Oriolus chinensis</i>	UC	Migratory	NO	LC
18	Black-hooded Oriole	<i>Oriolus xanthornus</i>	VC	Resident	LC	LC
19	Lesser Racquet-tailed Drongo	<i>Dicrurus remifer</i>	F	Migratory	NO	NO
20	Great White Egret	<i>Ardeo alba</i>	UC	Resident	LC	LC
21	Chinese Pond Heron	<i>Ardeola bachus</i>	R	Vagrant	NO	LC
22	Asian Fairy Blue-bird	<i>Irena puella</i>	R	Resident	NO	LC
23	Brown-Shrike	<i>Lanius cristatus</i>	VC	Migratory	LC	NO
24	Rufous Treepie	<i>Dendrocitta vagabunda</i>	VC	Resident	LC	LC
25	Asian Pied Starling	<i>Gracupica contra</i>	VC	Resident	NO	LC
26	Common Myna	<i>Acridotheres tristis</i>	VC	Resident	NO	LC
27	Common Hill Myna	<i>Gracula religiosa</i>	R	Resident	LC	LC
28	Red-vented Bulbul	<i>Pycnonotus cafer</i>	VC	Resident	NO	LC
29	Oriental White-eye	<i>Zosterops palpebrosus</i>	VC	Resident	LC	LC

	Common Name	Scientific Name	Local Status	Country Status	IUCN Red list Global Status	IUCN Red list-Bangladesh Status (2015)
30	Crow-billed Drongo	<i>Dicrurus annectans</i>	R	Resident	LC	DD
31	Sand Martin	<i>Riparia riparia</i>	F	Migratory	LC	LC
32	Pallas's Fish Eagle	<i>Haliaeetus leucoryphus</i>	R	Migratory	EN	EN
33	Black-bellied Tern	<i>Sterna acuticauda</i>	R	Resident	EN	CR
34	Brown-winged Kingfisher	<i>Halcyon amauroptera</i>	R	Resident	NT	VU
35	White-eyed Buzzard Eagle	<i>Butastur teesa</i>	R	Resident	NO	LC
36	Black Ibis	<i>Pseudibis papillosa</i>	R	Migratory	NO	NO
37	Golden Oriole	<i>Oriolus oriolus</i>	UC	Resident	LC	LC
38	Ashy Wren-warbler	<i>Prinia socialis</i>	R	Resident	NO	NO
39	Jungle Wren-warbler	<i>Prinia sylvatica</i>	R	Resident	NO	NO

Note: VC-Very Common, C-Common, UC-Uncommon, F-Fair, R-Rare; NO-Not Threatened, LC-Least Concern, NT-Near Threatened, EN-Endangered, CR-Critically Endangered, VU-Vulnerable.

Migratory birds.²⁰ With the advent of the winter season in every year, millions of winter migratory birds of various species settle down in the warm watery marshlands, forest, and in the rivers of Bangladesh. Bangladesh with its short spanned very comfortable winter season offers an ideal hospitable environment to millions of migratory birds.

The Bangladesh winter migratory birds are mostly duck and crane types. These birds come to this country from the coldest regions of the central Asia. The nature of Bangladesh gets rejuvenated with a new look having millions of colorful and vibrating exotic birds to its lakes, rivers, marshy lands, paddy fields, and even in the local ponds.

The Pabla Khali Wildlife Sanctuary in Bangladesh is located in the Rangamati District (about 80 km from the study area) in the Chittagong division. This 420.7 sq km expanded well developed and ideal sanctuary was developed in 1983 to protect a number of extinct species of wild animals and birds.

The winter migratory birds can be easily watched in the Pabla Khali Wildlife Sanctuary in Bangladesh are egrets, herons, little grebe, common coot, common moorhen, waterfowl, white-winged wood duck, Asian openbill stork, pelican and many more. Besides these migratory birds the local birds of Bangladesh also can be found in this sanctuary. The Bangladeshi birds found abundantly include kingfishers, herons, egrets, bitterns, storks and other water-birds.

²⁰ Source: <http://bangladeshonnet.blogspot.com/2010/11/migratory-birds-in-bangladesh.html>.

Mammals are very magnificent species, especially larger individuals. But large and medium-sized mammals have disappeared from this study area due to habitat conversion into human settlement and cultivation. The mammals found in the study area include: Common House Rat (*Ghor Indur*), Jungle Cat (*Bonbiral*), Common Mongoose (*Boro Beji*), Indian Flying Fox (*Kolabadur*), Irrawaddy Squirrel (*Kathbiral*), and Indian Pipistrelle (*Khudey Chamchika*). Of them Common Mongoose (LC), Irrawaddy Squirrel (LC), and Jungle Cat (NT) have been included in the IUCN-Bangladesh Red list (IUCN-Bangladesh, 2015b²¹).

Aquatic Ecosystem

The entire study area belongs to a few aquatic ecosystems including major river system (Karnaphuli). In accordance with the duration of inundation, the existing ecosystem has been divided into two categories namely seasonal and perennial wetlands.

The seasonal wetlands inundate for four to five months, especially during the monsoon. Canals and ditches have been considered under this category on the basis of duration of inundation.

The perennial wetlands inundate throughout the year. The Karnaphuli River system is the only such perennial aquatic ecosystem in the study area. Typical views of the wetlands are given in the **Figures 5.35** and **5.36**.



**Figure 5.35: A Seasonal Wetland,
Anowara**



**Figure 5.36: A Perennial Wetland,
Karnaphuli River**

Major components of these wetlands can be classified into major two groups: aquatic flora and aquatic fauna. A brief discussion on these is given below.

Aquatic Flora

The dominant aquatic flora both in the seasonal and perennial wetlands observed in the study area are Chinese Spinach (*Kolmi*), Water Hyacinth (*Kochuripana*), and Common Duckweed (*Khudipana*).

²¹ Here: LC= Least Concern; VU=Vulnerable; NT=Near Threatened.

Aquatic Fauna

Fauna of this ecosystem is not prominent in terms of diversity and population size, but they are present both in the urban and rural areas. Available species recorded during the field investigation include Skipper Frog (*Kotkoti Beng*), Indian Bullfrog (*Sona Beng*), Pond Heron (*Kani Bok*), Little Cormorant (*Pankouri*), River Lapwing (*Nadi Titli*), Common Snipe (*Pati Chega*) and Little Egret (*Chhoto Bok*). Only aquatic mammal the Ganges River Dolphin (*Susuk*) is present in the perennial wetland, the Karnaphuli River.

5.3.3 Fish

The Karnaphuli River supports large number of fish species whereas the ponds in the area contains a few culture species mainly carp. The major fish species of the Karnaphuli River based on the capture including secondary information and also pond culture species are listed in **Table 5.13**.

Table 5.13: Fish Species in Karnaphuli River and Ponds

	Scientific Name	Local Name	English name
1	<i>Setipinnaphasa</i>	Phesa	Gangetic Hairfin Anchovy
2	<i>Rhinomugilcorsula</i>	Khorsula, Khalla	Corsula, Kakunda, Corsula Mullet
3	<i>Gobiopsismacrostoma</i>	Baila	Longjawgobi
4	<i>Boleophthalmus Boddarti</i>	Dahuk, Menua	Boddart's Goggle - eyed Goby, Blue Spotted Mud kipper, Mud skipper
5	<i>Otolithoidespama</i>	Poa	Pama Croaker, Pama
6	<i>Parapocryptesbatoides</i>	Dali Chewa, Chiring	Gobi, Mudskipper
7	<i>Mystusgilio</i>	Nunatengra	Long-whiskered Catfish, Gulio Catfish
8	<i>Glossogobiusgiuris</i>	Baila, Bala	Fresh Water Goby, Gangetic Tank Goby, Flat headed Goby, Fork tongue Goby
9	<i>Cynoglossus lingua</i>	KukurJeeb, Banspata	Long tongue sole
10	<i>Puntiuspuntio</i>	Punti	Puntio barb
11	<i>Tenualosailisha</i>	Ilish	Toli Shad, Shad
12	<i>Channapunctatus</i>	Taki	Spotted Snake head, Green, Snake head
13	<i>Channa striatus</i>	Shol	Snakehead Murrel, Stripped or Banded Snake head, Common Snake head, Asian Snake head.
14	<i>Xenentodoncancila</i>	Kakila	Freshwater Garfish
15	<i>Mystusbleekeri</i>	Golsha	Bleeker's Mystus, Day's Mystus
16	<i>Tetraodoncutcutia</i>	Tepa	Oscillated puffer fish, oscillated, blow fish
17	<i>Sillaginopsis panijus</i>	Tulardandi	Flathead sillago and Gangeticsillago
18	<i>Macrornathusaculeatus</i>	Tara baim	One-stripe Spiny eel
19	<i>Mastacembelusarmatus</i>	Baim, Sal baim	Tire-track Spiny eel

	Scientific Name	Local Name	English name
20	<i>Mystus vittatus</i>	Tengra	Striped Dwarf Catfish, Asian Striped Catfish
21	<i>Macrobrachium rosenbergii</i>	Golda	prawn
22	<i>Macroglyphus pancalus</i>	Guchi, Guchibaim	Stripped Spiny eel (Fish base name: Barred spiny eel)
23	<i>Liza subviridis</i>	Bata	Greenback Mullet
24	<i>Labeobata</i>	Bata	Bata Labeo
25	<i>Scylla spp.</i>	Kakra	Crab
26	<i>Sperataaor</i>	Ayer	Long-whiskered Catfish
27	<i>Taenioides cirratus</i>	Chewa	Bearded Worm Goby
28	<i>Brachygobius natus</i>	Nuna Bailla	Short goby, Buzz goby, Golden - banded goby, Bumblebee goby,
29	<i>Apocryptes bato</i>	Chiring	Goby
30	<i>Odontamblyopus rubicundus</i>	Lalchewa	Rubicundus Eel goby
31	<i>Trypauchen vagina</i>	Shadachewa	Burrowing Goby
32	<i>Esomus danricus</i>	Darkina	Flying barb
Culture Fish Species			
1	<i>Labeo rohita</i>	Rui	Rohu
2	<i>Catla catla</i>	Catla	Catla
3	<i>Cirrhinus mrigala</i>	Mrigal	Mrigal Carp, Mrigal
4	<i>Cyprinus carpio</i>	Carpio	Chinese carp
5	<i>Tilapia mossambica</i>	Tilapia	Perch
6	<i>Hypophthalmichthys molitrix</i>	Silver carp	Chinese carp
7	<i>Ctenopharyngodon idella</i>	Grass carp	Chinese Carp

5.3.4 Protected Areas

The protected areas in the Chittagong region are listed in **Table 5.14** and shown in **Figure 5.37**.

Table 5.14. Protected Areas in Chittagong Area

	Protected Areas	Distance from Project Site (km)
1	Kaptai National Park	31
2	Baroiyadhala National Park	32
3	Chunati Wildlife Sanctuary	27
4	Dudpukuria-Dhopachari Wildlife Sanctuary	22
5	Hajarikhil Wildlife Sanctuary	33
6	Sitakunda Botanical Garden and Eco-park	26

Source: Department of Environment (2012)

Protected Areas in Chittagong Area

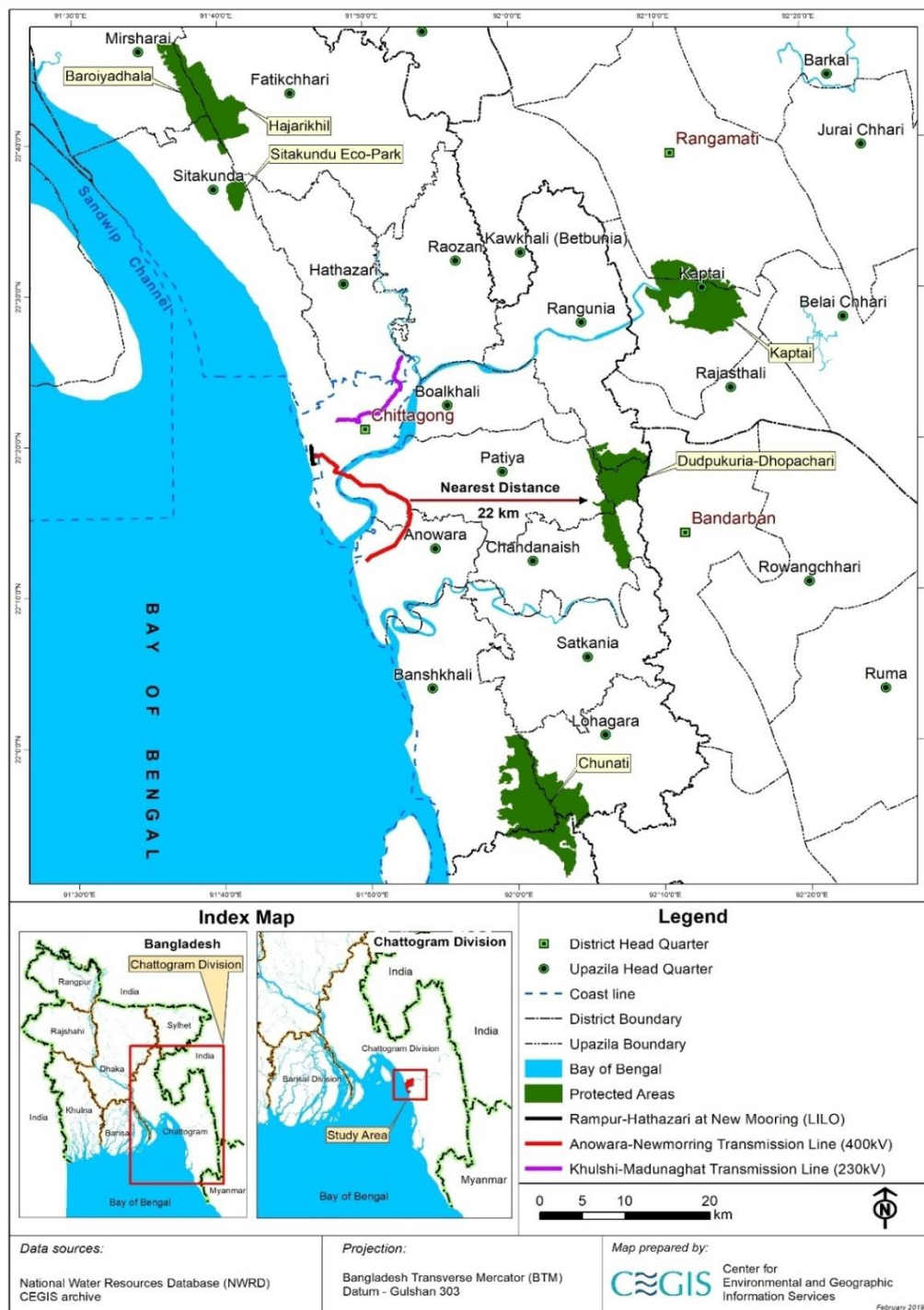


Figure 5.37: Protected Areas in Chattogram Region

6. Stakeholder Consultations

This Chapter presents the objectives, process, and outcome of the consultations carried out with the key stakeholders of the project during the present ESIA study. Also provided in this Chapter is a consultation framework, describing the consultations to be carried out during the subsequent phases of the project implementation ensuring an ongoing and inclusive dialogue with affected communities.

6.1 Objectives of Stakeholder Consultations

Stakeholder consultations (or public consultation) during the environmental and social assessment process of development projects is increasingly considered an important notion and requirements which increases the authenticity and acceptability of assessment itself but more importantly can possibly enhance the quality of decisions making as well. The dialogues will be inclusive, meaningful and transparent. Special initiatives will be taken to ensure that vulnerable people, women and people with disabilities are consulted. Stakeholder consultation/participation during various stages of developmental projects helps improve the decision making and ultimately leads towards sustainable development.

Stakeholder consultation is a two-way process. For stakeholders, the consultation process is an opportunity to obtain project information, to raise issues and concerns, and ask questions. For the project proponents, the consultation process offers opportunity to understand the stakeholders and their concerns about the project, their needs and aspirations, and also their suggestions that can potentially help shape the project. Listening to stakeholder concerns and feedback can be a valuable source of information that can improve project design and outcomes and help the project proponent to identify and control external risks. It can also form the basis for future collaboration and partnerships.

The national legislation and AIIB policies require consultations to be carried out particularly with the affected communities as part of the environmental and social assessment process. The consultation carried out during the present ESIA and reported in this Chapter meet these requirements.

Specific objectives of the consultation process carried out as part of the current ESIA are listed below.

- developing and maintaining communication links between the project proponents (PGCB) and stakeholders,
- sharing of information with stakeholders on the proposed project activities and provide key project information to the stakeholders, and to solicit their views on the project and its potential or perceived impacts,
- understanding the stakeholders' concerns regarding various aspects of the project, including the existing situation, route alignment, construction works and the potential impacts of the construction-related activities and operation of the project;
- receiving feedback on environmental and social impacts and verifying their significance;
- ensuring that views and concerns of the stakeholders are incorporated into the project design and implementation as much as possible with the objectives of reducing or offsetting negative impacts and enhancing benefits of the proposed project.

- managing expectations and misconceptions related to the project;
- obtaining local and indigenous knowledge about the environment and people living in the nearby areas of project alignment;
- engaging and assessing the specific needs of vulnerable groups, especially those below the poverty line, the landless, people with disabilities, the elderly, women and children, and those without legal title to land and ensure their participation to in consultations
- interaction with the project affected population and other stakeholders for the collection of primary and secondary data on environment and people; and
- engaging stakeholders for maximization of the project benefits.

6.2 Identification of Stakeholders

Stakeholders include all those who affect and are being affected by policies, decisions or actions within a particular system. Stakeholders can be groups of people, organizations, institutions and sometimes even individuals. Stakeholders can be divided into primary and secondary stakeholder categories. These categories are described in the sections below.

6.2.1 Primary Stakeholders

The primary stakeholders (also called direct stakeholders) are the grass-root stakeholders, such as project affected persons and general public including women and people with physical disabilities residing in the project area (for the proposed project: people living in the project area particularly the RoW). These are the people who are directly exposed to the project's impacts though in most cases they may not be receiving any direct benefit from the project.

6.2.2 Secondary Stakeholders

The secondary stakeholders are the people, department, institutions, and/or organizations that may not be directly affected by the project however they may influence the project and its design. They include project proponent (PGCB in case of the present project), other concerned departments such as BPDB that may have a role during various phases of the project, regulatory agencies such as DoE, Chattogram City Corporation, Union Parishad, Bangladesh Telecommunication Company Limited (BTCL), Karnaphuli Gas Distribution Company Limited (KGDCL), other relevant departments such as Forest and Wildlife, non-governmental organizations (NGOs), the broader interested communities including academia and journalists, and general public. The key secondary stakeholders were consulted during the present ESIA; further consultations will be carried out during later stages of the project.

6.3 Consultation Process

A participatory and inclusive approach was adopted to conduct consultations particularly with the communities. A checklist was used to maintain uniformity and relevancy in discussion and in properly recording the opinions and views of the participants. During the consultations, the socioeconomic, 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.

During the ESIA study, nine consultation sessions were held with the stakeholders and received their feedbacks about the proposed project impacts and benefits. **Table 6.1** lists these consultation sessions whereas **Figures 6.1 to 6.5** present some photographs of these sessions.

The list of participants who were present in different stakeholder meetings is presented in **Annex B**.

At the very beginning of each consultation meeting, a representative from the study team presented the whole activities related to the project construction. At the same time, the purpose of this study was described briefly so that the stakeholders could understand the purpose and importance of this consultation meeting. After getting an overview and project activities, Project Affected People (PAPs) shared their concern in terms of working time, compensation, probable risks, working environment and period of implementation.

Table 6.1: Consultation Meetings

	Place	Date	Focal Person	Number of Participants
1	Khulshi Substation	15-11-2016	Sub, Assistant Engineer	04
2	Madunaghat Substation	15-11-2016	Sub, Assistant Engineer	05
3	Council Office, Chattogram	16-11-2016	Councilor	18
4	Khulshi Substation	16-04-2017	Executive Engineer	02
5	Madunaghat Substation	17-04-2017	Executive Engineer	03
6	Barashat Union Parishad (Beside the parishad)	18-04-2017	UP Chairman	15
7	Pahartali Council Office	19-04-2017	Councilor	09
8	Madarsha Union Parishad	19-04-2017	Councilor	09
9	Lake View Hotel	31-10-2018	Shopkeepers	28

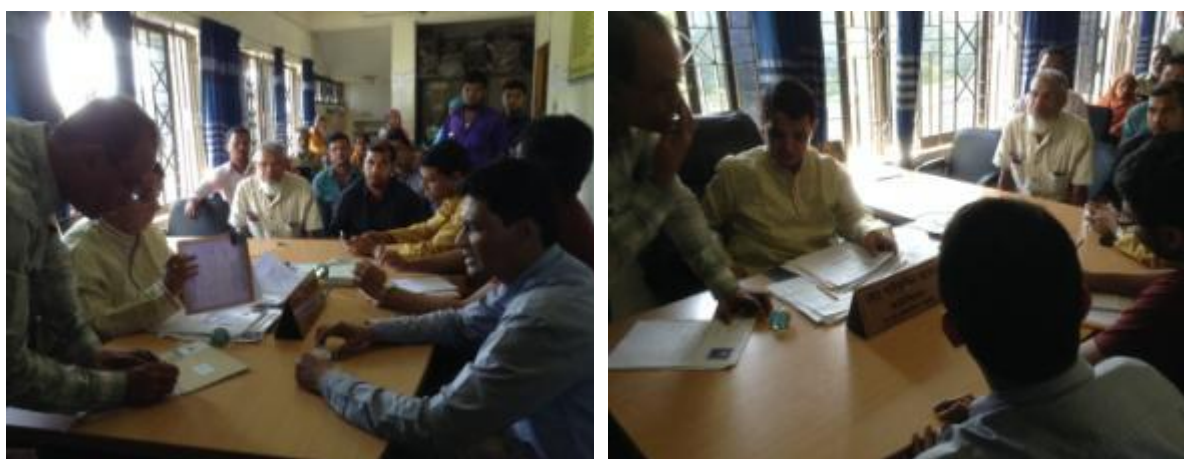


Figure 6.1: Consultation Meeting in Councilor's Office, Chattogram



Figure 6.2: Consultation Meeting in Madunaghat Substation



Figure 6.3: Consultation Meeting in Khulshi Substation



Figure 6.4: Consultation Meeting at Substation Location





Figure 6.5: Consultations Meetings with Communities

6.4 Issues Identified through Consultations

During the consultations, the communities opined that the proposed project would result in a number of benefits along with some problems. Participants expressed generally positive attitude towards the project and demanded its rapid implementation for the purpose of strengthening power system. The communities expect the project to provide to them employment opportunities.

The local people also expressed concerns that it might become difficult and risky to cultivate under the high-power transmission lines, particularly during the rainy season. They also thought that the transmission lines might cause electrocution risks to their livestock. Some participants pointed out that some *khas*(government) land was available adjacent to the proposed substation area. They stressed that the *khas* land should be preferred over private land for the proposed project, primarily because in their view the compensation procedures were quite complicated and therefore, they wanted to avoid acquisition of their lands for the proposed project.

The key issues raised by the stakeholders are presented below.

- The project proponents should ensure coordination with the Chattogram City Corporation (CCC), Chattogram Development Authority (CDA), Chattogram Water and Sewerage Authority (CWASA), BPDB, and Chattogram Gas Authority (CGA) during the project implementation.
- A project has been approved to enlarge existing road and its beautification from Bahaddarhat to Kalurghat, in Chattogram area. No activities such as laying of underground cables along this road will be allowed after the completion of this project. Therefore, laying of the underground cable under the proposed project should be completed before the implementation of this road project.
- All Project Affected People (PAPs) should be informed about the proposed project through formal notification or letter with the detailed work plan before the project implementation.
- Considering the PAPs condition and traffic movement on the right of way, the project activities and construction along the roads (such as laying the underground cables) should be conducted at night.

- The trenches for the underground cables should be appropriately backfilled and pavement should be restored over these trenches.
- It should be ensured that essential facilities such as hospitals and pharmacies are not closed because of the construction activities.
- Fencing should be fixed around construction sites to restrict unauthorized entry in the construction areas.
- Compensation should be paid for all losses -- such as land take, loss of business and livelihood, and damage to structures -- caused by the project.
- The compensation to PAPs should be provided in accordance with the national regulations.
- The excavated material should be cleared particularly from the cultivation fields, roads and other urban areas.
- The construction activities should be avoided during the monsoon season, in view of water logging situation in Chattogram area.
- The construction activities under the proposed project particularly in the urban areas should be carried out in coordination with other activities being carried out in the City by other organizations such as CWASA and CGA.

Suggested Measures to Address Issues Raised during Consultations

The suggested solutions to address the issues raised during the consultations are presented in **Table 6.2**.

Table 6.2: Identified Problems and Suggested Solutions

Issues	Problems	Suggested Solutions
Socio-economic	Permanent loss of arable land due to the construction of substations	Proper compensation should be paid for acquired land and crops.
	Traffic congestion in city area due to laying of underground transmission lines	Contractor should prepare traffic management plan. Construction timings should be selected to minimize traffic disruption. Alternate route to be provided where necessary/feasible.
	Drainage congestion in city area due to construction works on underground transmission lines and substations	It should be ensured that the drainage channels are not blocked by the project components and construction activities.
	Safety risks for communities particularly children and women caused by the construction activities and also from the transmission lines	During construction phase, the contractor will prepare and implement a safety management plan to ensure safety of local population (and also its own staff). During O&M phase, a similar plan will be prepared and implemented by PGCB.
	Lack of coordination among various development	PGCB and its contractor to maintain liaison and coordination with other development entities to

Issues	Problems	Suggested Solutions
	authorities (eg. CWASA, CGA, and PGCB) causing avoidable disturbance and hardships to the population.	avoid conflicts and to minimize disruption of traffic and hardships to local population.
Ecology	Terrestrial vegetation would be damaged due to installation of substations especially at Khulshi and New Mooring substation sites, towers and transmission lines area. Maintenance activities may affect trees and crops.	The vegetation and crop loss to be minimized through proper site/route selection. Compensation to be paid to the growers/land owners. Compensatory tree plantation to be carried out.
	Habitat loss of tiny wildlife spectacularly tiny birds, amphibians and reptiles due to implementation of substations, towers and stringing transmission cables.	Create microhabitats adjacent to the project locations before initiate project's civil works.
Agriculture	The proposed site for Anowara substation if valuable cultivation field.	Uncultivated and government land should be selected for new substation. Compensation should be paid for any loss of land and/or crops.
Infra-structure	Road Condition will be deteriorated due to the movement of heavy construction equipment	Effective traffic management plan should be implemented to minimize the damage. Contractor to repair any damage caused by the construction activities.

6.5 Future Consultation Plan for PGCB and Contractor

The stakeholder consultation and engagement is an ongoing process and will continue throughout the project's construction as well as operation and maintenance phases. The ongoing consultation process could be scheduled on monthly or quarterly basis with the stakeholders including but not limited to the concerned government departments, local administration and the community representatives from the proposed project area.

The overarching goal of consultations and community engagement is to support and facilitate the project's design and implementation, to reduce conflicts and project opposition, and to increase project's acceptability. Stakeholder consultations and participation will take place during implementation through the following means:

- Grievance Redress Mechanism (GRM) at the community level
- Awareness campaign for all stakeholders,
- Formal interactions through periodic workshops, consultation sessions with wider stakeholders especially institutional ones such as other Government Department relevant NGOs,

- Informal interactions during the construction phase and also during the maintenance activities.

Periodically, the Project may also hold formal workshops to consult a wide range of stakeholders on project activities. These workshops will involve PAPs from communities, DoE, PGCB, and representatives of other relevant departments/entities to share the progress and elicit the views of all the stakeholders for the improvement.

6.6 Disclosure

The draft ESIA document has been disclosed at the website of PGCB since December 10, 2018.²² The final ESIA will also be disclosed in a similar fashion. The executive summary of the ESIA will be translated in Bangla language and placed on the same website, in addition to being available locally at the project site (project office and contractor's office).

²² For more details, please refer to the website: <https://pgcb.org.bd/PGCB/?a=pages/esia.php>

7. Environmental Impact Assessment

This Chapter discusses potential impacts of the proposed project on various aspects of environment including air, water soil, flora, and fauna. Also discussed in this Chapter are the mitigation and control measures to avoid, minimize, or mitigate these impacts. The potential impacts of the project on people and socioeconomic resources are discussed in the next Chapter.

7.1 Summary of Potential Impacts

The project's potential impacts and their significance have been assessed using the methodology described in **Section 1.4.3**. A summary of these impacts and their significance along with the mitigation measures are presented in **Table 7.1**; the environmental impacts are discussed in the subsequent sections while the social impacts are discussed in the next Chapter as stated earlier.

Table 7.1: Summary of Potential Impacts, their Significance and Mitigation Measures

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Impacts from Siting					
Enhanced grid connectivity ensuring that additional power generation reaches the end users.	Severe	Major	Critical (positive)	Adequate maintenance of the facilities in accordance with the standard operating practices of PGCB.	-
Resettlement impacts	Very severe	Major	High	Cash compensation at replacement cost for land, structures, and trees.	Medium
Impact on income and livelihood sources of affected households including vulnerable households	Severe	Major	High	Additional cash compensation and livelihood assistance.	Low
Impact on natural vegetation and wildlife due to permanent clearing of land for siting of substations and towers and temporary	Mild	Moderate	Medium	Minimizing clearance of natural vegetation particularly near river banks and <i>khals</i> ; selecting barren lands	Negligible

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
clearing along ROW					
Greenhouse gas emissions from site clearing, materials life cycle and power leakages	Mild	Moderate	Medium	-	Medium
Impacts from Construction					
Employment opportunities for local communities	Mild	Moderate	Medium (positive)	Preference to the local communities in the construction works; Employment Policy to be announced by contractors.	-
Land use (substations)	Severe	Moderate	High	Barren and uncultivated land will be preferred to establish substations	Low to Medium
Land use (transmission lines)	Mild	Moderate	Medium	Transmission lines will be aligned to minimize impacts on cultivated land	Low
Risk of soil contamination and soil erosion	Mild	Moderate	Medium	Pollution prevention plan and implementation of environmental code of practice (ECPs) (ECPs are discussed later in the document). Excavated top soil in the cultivated areas will be stored separately, to be used as the top most layer during backfilling. Backfilled soil will be compacted to avoid soil erosion.	Negligible
Risk of water contamination	Mild	Moderate	Medium	Implementation of pollution prevention plan and of ECPs	Negligible
Damage to <i>khals</i> (water courses) and tube-wells	Severe	Moderate	High	Works close to <i>khals</i> and tube-wells will be avoided to the extent possible;	Low

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				No excavated material or debris will be released in <i>khals</i> or wells; Any damage caused by the construction activities will be immediately repaired	
Dust and air pollution from construction activities	Mild	Moderate	Medium	Maintenance of construction equipment and vehicles; dust control measures as specified in ECPs.	Negligible
Noise and vibration from construction activities	Mild	Moderate	Medium	Maintenance of construction equipment and vehicles; noise control measures as specified in ECP.	Negligible
Generation of spoils	Severe	Moderate	High	To be used as filling material where needed; disposal at approved locations; implementation of ECP.	Negligible
Generation of solid waste and hazardous waste	Mild	Moderate	Medium	Minimize generation of waste. Proper collection and disposal of wastes in approved sites or to vendors; implementation of Waste Management Plan and ECPs.	Negligible
Impact on wildlife	Severe	Minor	Medium	Minimize vegetation clearance; control of noise and artificial lighting, ban on hunting, and checks for breeding birds during vegetation clearance implementation of ECPs	Negligible
Site clearance and Restoration	Severe	Minor	Medium	Cleaning of the construction sites; implementation of ECPs	Negligible

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Crop damage	Severe	Major	High	Crop damage will be minimized through astute construction and site management and scheduling of construction works; Compensation will be paid to the growers/landowners	Low
Impacts from access roads and damages to local infrastructure and public utilities	Severe	Major	High	Minimize damages to infrastructure and public utilities; compensation as per RAP, and relocation of utilities; Coordination with relevant entities	Medium
Community health and safety from construction traffic and activities	Severe	Major	High	Traffic, noise and dust control measures in accordance with ECPs; Public safety and occupational health and safety (OHS) management plan to be implemented.	Medium
Workers health and safety	Severe	Major	High	OHS plan to be implemented; Implementation of ECPs.	Medium
Traffic congestion	Severe	Moderate	High	Contractor to prepare and implement traffic management plan; Construction activities to be scheduled to minimize traffic disruption; coordination to be maintained with relevant authorities (eg, Traffic Police).	Minor
Blocked access due to construction activities	Mild	Moderate	Medium	Traffic management plan to be implemented; alternate routes to be identified in consultation with	Negligible

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				communities and relevant authorities; GRM to be established.	
Additional load on local resources	Mild	Moderate	Medium	Contractor to obtain water in a manner not to affect the local communities; liaison with local communities to be maintained; GRM to be established.	Negligible
Social conflict and privacy of women, influx of workers	Mild	Moderate	Medium	Camps to be established at least 500 m away from communities (preferably inside the substations); contractor to enforce code of conduct to respect local norms and culture; movement of outside workers will be restricted to work sites and workers' camps; liaison with local communities to be maintained; GRM to be established.	Negligible
Damage to sites/places of religious/cultural significance	Major	Moderate	High	Such sites to be demarcated and avoided during construction activities; liaison with local communities to be maintained; GRM to be established.	Negligible
Gender issues	Major	Major	High	The contractor will prepare and implement Gender Based Violence (GBV) and Sexual Exploitation (SE) Management Plans (as part of the construction environmental and social management	Low

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				plans – discussed later in the document); code of conduct for workers will include gender aspects (such as GBV and SE); trainings, awareness raising and orientation to be provided to workers will include gender aspects; GRM will also address gender aspects (eg, GBV and SE).	
Impacts from O&M Activities					
Waste management at Substations	Severe	Moderate	High	Waste management plan as part of Standard Operating Procedures (SOPs)	Negligible
Risk of bird collision and electrocution	Severe	Moderate	High	Placing of bird markers on the transmission line cables/conductors where necessary (eg, at river crossing). Design parameters (distance between live parts) to minimize bird electrocution	Negligible
Impacts from tree cutting during maintenance activities	Mild	Moderate	Medium	Compensatory tree plantation to be carried out where appropriate.	Medium
Diminution of land value in the width of Right of Way Corridor	Severe	Major	High	There is no mitigation for this impact.	High
Impacts from electromagnetic fields from transmission lines on community health and safety	Severe	Minimal	Negligible	Complied with WHO recognized standards on EMF through design considerations	Negligible
Audible noise and radio	Severe	Minimal	Negligible	Design considerations to	Negligible

Potential Impact	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
interference from the transmission lines				comply with the standards	
Workers health and safety during maintenance	Severe	Major	High	Implementation of Standard Operating Procedures (SOPs) of PGCB.	Medium

7.2 Environmental Impacts from Project Siting

The environmental impacts associated with the project siting are discussed below.

7.2.1 Improvement of Electricity Grid in Chattogram Area

As stated in **Section 1.1**, much of the growing electricity demand in the Chattogram region remains unserved due to power supply shortages and network failures while the aging and inadequate transmission and distribution systems impose severe constraints on power delivery to consumers, primarily because of lack of investment in the system improvement, expansion, and upgrade. Furthermore, as stated in **Section 3.1**, a considerable number of existing grid substations and transmission lines in the Chattogram area will fall short of capacity when the new electricity generation are added to the national grid. The proposed project, once complete, will address these problems by adding new substations and transmission lines. This will not only overcome the limitations of supplying quality and uninterrupted electricity to the end users, but will also cater to increasing demand in the regions while also increasing the operating contingency of the system.

7.2.2 Impact on Natural Vegetation and Wildlife

The construction of new substations will permanently alter the land use and land form of the selected sites. Similarly, laying of overhead as well as underground transmission lines will also similar impacts; in particular the natural vegetation and trees under the overhead transmission line will be permanently affected. However as discussed in **Section 5.1.11** and shown in **Tables 5.6 to 5.9**, most of the affected area is either under cultivation (substations and overhead transmission lines) or located in urban area (underground transmission lines). The natural vegetation and habitats in the area are mostly limited to small patches of land along the river and *khals*, small ponds, and on the periphery of cultivation fields. In view of the altered nature of the habitat, the vegetation found in the project area mostly belongs to homestead/settlement vegetation, crop-field vegetation, and roadside vegetation, as discussed in **Section 5.3.2**. Therefore, the project will have a very limited impact on the natural vegetation of the area; the significance of this impact has been assessed as Medium, as shown in **Table 7.1**.

With respect to the faunal resources, the project area belongs to urban and agricultural ecosystems (see **Section 5.3.2**). As a result, only those species are found in the area that have long adapted to modified habitat and human presence. Therefore, much like the impacts on natural vegetation discussed above, the project will have a very limited impact on the faunal species of the area; the significance of this impact has been assessed as Medium, as shown in **Table 7.1**.

Mitigation

The following measures will further reduce the negative impacts of the proposed project on natural vegetation and habitat of the area:

- Clearing and removing of natural vegetation will be minimized
- Tree cutting will be minimized
- Selecting barren/fallow land for establishing substations and aligning transmission lines.
- Compensatory tree plantation will be carried out (eg, along the periphery of substations).
- Environmental Code of Practice (ECP) (discussed later in the document) will be implemented.

Residual Impacts

After implementing the above listed mitigation measures, whatever small impacts the proposed project might have on the natural vegetation and wildlife of the area, will be further reduced. The residual impacts have therefore been assessed as Negligible, as shown in **Table 7.1**.

7.2.3 Greenhouse Gas (GHG) Emissions

The greenhouse gas (GHG) emissions from implementation of the proposed project are estimated using the World Bank's Guidance Manual: Greenhouse Gas Accounting for Energy Investment Operations, Version 2.0 January 2013 (hereinafter "Guidance Note") and IPCC 2006 guidelines.

Three sources of emissions are considered for accounting GHG from the Project. The sources and the estimates are given below.

Direct Generation Emissions Associated with Losses

Impacts relevant to this source result from technical loss reductions in the transmission line facilities being supported by the project. Losses can be reduced by upgrading overloaded or not properly sized transformers, increasing conductor capacity, installing reactive power equipment, and undertaking other types of maintenance interventions. The losses in the transmission lines in Bangladesh are generally estimated as 3.13 percent.²³ The direct generation emissions associated with these losses (emission factor: 0.6545 tCO₂/MWh) is estimated to be 0.2 million tCO₂e per year and **6.03 million tCO₂e** for the entire life of the project, assuming that the life of the project is 30 years. (1400 MVA = 1120 MW. 1120 x 365 x 24 = 9,811,200 MWh. 0.6545 x 9,811,200 x 0.0313 = 200,991 tons of CO₂ equivalent; 200,991 x 30 = 6.03 million tons of CO₂ equivalent.)

Emissions from Land Clearing for Civil Works

Construction of towers, transmission line ROW, and some other project facilities such as grid stations require land clearing. The total land to be cleared for RoW is 426 ha (4.26 km²) and for the substations is 7.41 ha (0.071 km²). The clearing may affect the carbon stored in biomass and soil. Emissions from land clearing can be calculated as a one-time emission of CO₂ based on the available dry biomass carbon for the total cleared areas for construction. According to IPCC guidelines, temperate climate has 100 tons/ha of dry biomass, of which average carbon content is 47 percent. The conversion factor for carbon weight to CO₂ weight is 44/12. Total

²³ Source: <https://www.pgcb.org.bd/PGCB/upload/Reports/MIS-March'2014.pdf>.

land clearing emissions for 4.33 km² are **0.075 million tCO₂e**. ($4.33 \times 100 \times 100 \times 0.47 \times 44/12 = 74,678 \text{ t tCO}_2\text{e} = 0.075 \text{ million tCO}_2\text{e}$.)

Sulfur-hexafluoride Fugitive Emissions

Sulfur-hexafluoride (SF₆) is used in insulation and current interruption applications in transmission and distribution systems. SF₆ is used in gas-insulated switch-gear and substations, gas circuit breakers, and (less frequently) in high-voltage, gas-insulated lines. SF₆ may escape as fugitive emissions during the manufacturing, installation, use, maintenance, and disposal of this equipment. Sealed distribution equipment may not emit any SF₆ during use, but transmission equipment often requires periodic refilling and hence has higher rates of fugitive emissions during use. The amount of SF₆ emitted during operation and decommissioning is related to the number and type of equipment used, as well as the maintenance and recycling procedures. SF₆ emissions could occur in all transmission and distribution projects, depending on the type of equipment installed, refurbished, or maintained. Countries report SF₆ emissions from the power sector in their national emissions inventories, and emissions factors from these inventories provide one way to estimate their magnitude (emission factor is 0.119 gSF₆/MWh). Circuit breakers containing SF₆ will be used in the grid station and the SF₆ emissions are estimated as 0.026 million tCO₂e per year and **0.78 million tCO₂e** for the entire life of the project (30 years). (1.8 kg of SF₆ = 40 tCO₂e); $0.119 \text{ g} \times 9,811,200 \text{ MWh} = 1,167,532.8 \text{ g}$ or 1,168 kg SF₆; $1168 \text{ kg of SF}_6 \times 40/1.8 = 25,956 \text{ tCO}_2\text{e}$ or 0.026 million tCO₂e per year; $0.026 \times 30 = 0.78 \text{ million tCO}_2\text{e}$ for 30 years.)

Total Emissions from Proposed Project

The total Project emissions from above three sources are estimated to be **6.885 million tCO₂e** for the entire life of the project (30 years).

Significance of these emissions has been assessed as Medium, as shown in **Table 7.1**. No mitigation measures are proposed to address these emissions.

7.3 Impacts during Construction Phase

7.3.1 Employment Opportunities

As described in **Section 3.10**, the construction contractor(s) will have a sizeable work force. A large proportion of this workforce will be skilled and semi-skilled laborers including drivers, machinery operators, steel fixers, technicians, electricians, fitters, welders, watchmen, camp staff, warehouse staff, and manual laborers. The local communities during the stakeholder consultations have shown great desire to be included in the project's workforce (see **Section 6.4**). In line with the aspirations of local communities, the contractors will be contractually bound to maximize employing the locals as appropriate. In addition to maintaining good relations with the local communities, maximizing local employment may also be cost effective since engaging workforce from other parts of the Country could be costlier.

Mitigation

This is a beneficial impact of the project and hence does not need any mitigation as such. The contractors will be required to formulate an employment policy to ensure equitable availability of employment opportunities to all communities within the project area particularly the project affected persons (PAPs). It will also be ensured that no child labor is engaged by the project or its contractors/suppliers.

7.3.2 Impacts on Land Use

The existing land use of the project area is described in Section 5.1.11 and in Tables 5.6 to 5.9. As shown in these tables, the transmission line RoW will cover an area of about 85 ha and substations will require a total area of about 7.41 ha.

As can be seen in Table 5.6, about 37 percent of the transmission line RoW is covered by the built-up area, about 36 percent by cultivation fields, about 7 percent by orchards and other plantations, 2.5 percent by river and *khals*, and about 18 percent by settlements. Similarly, Table 5.8 provides the land use of the substation sites, which are covered by cultivation fields and settlements (inside existing substation).

Of the total land requirements for the project, the area for substations (7.41 ha) will be completely modified, and hence this impact has been assessed as High, as shown in Table 7.1. The RoW for the transmission line (85 ha) will be partly modified and will remain available for most of the pre-project land use such as cultivation and therefore this impact has been assessed as Medium, as shown in Table 7.1.

Mitigation Measures

The following mitigation measures will address the potential impacts discussed above to some extent:

- Location of substations have been selected in uncultivated areas, to the extent possible.
- Transmission lines will be aligned to minimize impacts on cultivation fields and other important areas.
- Compensation will be paid to the land owners for the land permanently acquired for the project. Similarly, assistance will be paid to the persons/households losing their livelihoods (resettlement impacts are discussed in the next Chapter).

Residual Impacts

Even after implementing the above listed measures, the impacts of the project on the land use of the area cannot be completely mitigated. Therefore, the significance of the residual impacts is likely to remain Low to Medium, as shown in Table 7.1.

7.3.3 Soil Contamination and Erosion

During construction phase, there is a high risk of accidental spills and leakages that may occur from fuel and oil tanks, vehicles and machinery and storage of chemicals used in construction areas, yards, batching plants, worker camps, and residential areas and from storage sites. These spills can pollute soils and contaminate surface water and groundwater in the area. Waste effluents from temporary facilities such as camps and offices can also contaminate soil and surface run off.

Disturbance of soils during construction including (and particularly) from movement of vehicles, may lead to destruction of the integrity of upper soil layers. Damaged soil is more readily eroded and washed into water courses during rainfall events and can also form dust during dry periods. This effect will be significant due to the need of access roads construction which will further damage the integrity of soil apart from vehicle movement.

Excavation for construction of transmission line towers particularly near the rivers and *khals* can cause soil erosion which can adversely affect the water quality of the rivers/water bodies. High rainfall events can also potentially cause accelerated erosion particularly in excavated areas.

The significance of impact on soil pollution and soil erosion is characterized as Medium, as given in **Table 7.1**.

Mitigation

The following mitigation measures will be implemented:

- Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected.
- Contractor will be required to implement the measures prescribed in the Environmental Code of Practices (ECP), which will be included in the contracts. Detailed ECPs are included in the **Annex C**.
- Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil
- Contractor will confine the contaminants immediately after such accidental spillage
- Contractor will collect contaminated soils, treat and dispose them in environment friendly manner
- All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation
- Top soil to be stripped and stockpiled where practical.
- Temporary stockpiles to be protected from erosion.
- For sewage waste, appropriate treatment arrangement such as septic tanks and soakage pits will be installed on site. Water will percolate into the ground so there will be no discharge. Alternatively, sewage from construction camps and other facilities will be collected and transported to nearby municipal sewage treatments plans.
- The monsoon season will be avoided to carry out construction activities particularly excavation to the extent possible to minimize soil erosion.

Residual Impacts

After implementation of the above mitigation measures, the impacts of the project on the soil contamination and soil erosion will be adequately mitigated. Hence the significance of residual impacts is expected to be Negligible, as shown in **Table 7.1**.

7.3.4 Water Contamination

The proposed transmission route crosses a major river (Karnaphuli, overhead) and several *khals*(underneath). During construction, there is a high risk of contamination of these water bodies from the following activities:

- Run-off from excavation, crushed and ground rock material from drilling
- Run off from earthmoving and spoil handling, open excavations, concrete batching for new tower construction
- Run-off from dampening systems to control dust emissions; dumping of spoil material
- Sanitary effluents from construction workers camp
- Oil and chemical spills; washing of vehicles and other machinery

- All other activities causing soil contamination discussed earlier can also cause water contamination.

The significance of impact on soil pollution and soil erosion is characterized as Medium, as given in **Table 7.1**.

Mitigation

The following mitigation measures will be implemented to address the water contamination caused by the project:

- Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected.
- Contractor will be required to implement the measures prescribed in ECP, which will be included in the contracts.
- Contractor will be required to comply with the national and WBG EHS Guidelines for waste water discharges in to the rivers.
- Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the water
- All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation
- For the treatment of effluent to be discharged, sedimentation ponds will be provided to allow sediment to settle for periodic removal for disposal in designated site spoil areas. Water being discharged from these ponds will be regulated to ensure they are within turbidity limits.
- Oil and water separators and settling ponds will be installed where appropriate to minimize the risk of contaminated construction water entering the river or groundwater and degrading water quality.
- Construction works near river and *khals* will be carried out ensuring that no debris or excavated soil falls in water.

Residual Impacts

After implementation of the above mitigation measures, the impacts of the project on the water pollution will be adequately mitigated. Hence the significance of residual impacts will be Negligible, as shown in **Table 7.1**.

7.3.5 Damage to *Khals* and Tube-wells

The proposed transmission lines will cross several *khals* (water courses), as described in **Section 5.1.6**. In addition, as stated in **Section 5.2.2**, shallow and deep tube-wells exist in the project area providing irrigation water to the crops of the area. The construction activities can potentially cause damage to these *khals* and tube-wells, which can in turn affect the irrigation system of the area and ultimately affecting the crops of the area. Significance of these impacts is High, as shown in **Table 7.1**, in view of the importance of these structures for the agriculture production of the area.

Mitigation

The following measures will be implemented to avoid/minimize impacts on *khals* and tube-wells of the area:

- Any excavation and other construction works near *khals* and tube-wells will be planned and implemented in a manner to avoid any damage to these structures.
- The vehicle movement near *khals* and tube-wells will be minimized. If unavoidable, it will be closely monitored to avoid any damage to these structures.
- No excavated material or debris will be released into the *khals*.
- The contractor will repair and restore any damage the construction activities may cause to *khals* and tube-wells. It will be ensured that the construction activities do not affect the water flow/availability in the *khals* or from the tube-wells.

Residual Impacts

After implementation of the above mitigation measures, the impacts of the project on *khals* and tube-wells will be mostly mitigated. Hence the significance of residual impacts will be Low, as shown in **Table 7.1**.

7.3.6 Dust and Air Pollution

Air quality will be affected and dust will be generated during construction activities. Major sources of air quality pollution are drilling activities, excavations, emissions from construction related traffic and equipment. The construction activities will also generate airborne dust and particulate matter. Dust raised from the above activities will have impacts on crops, animals and public health. These impacts will be most severe for the sensitive receptors in the area; see **Table 7.2**.

Table 7.2: Sensitive Receptors in the Project Area

	Name of Receptor	Type of Receptor	GPS Location	Affected by
1.	Chattogram Veterinary and Animal Science University	Academic Institution	N-22° 21' 42.36" E- 91° 48' 16.60"	Noise and Dust
2.	Bangladesh Agriculture Research Institute	Research Institution	N-22° 21' 42.54" E-91° 48' 22.57"	Noise and Dust
3.	Learning Tree School	Academic Institution	N- 22° 21' 37.37" E- 91° 49' 04.88"	Noise, Dust and Safety
4.	Nasirabad Govt. School	Academic Institution	N- 22° 21' 43.67" E- 91° 49' 15.60"	Noise, Dust and Safety
5.	Bahaddarhat Jam-e-Masjid	Religious Institution	N- 22° 22' 05.32" E-91° 50' 32.40"	Noise and Dust
6.	Chandgaon Mosque	Religious Institution	N- 22° 22' 37.37" E-91° 50' 07.29"	Noise and Dust
7.	A Mosque and Family Graveyard	Religious site	N- 22° 22' 57.99" E-91° 51' 22.63"	Noise and Dust

	Name of Receptor	Type of Receptor	GPS Location	Affected by
8.	Lusai Public School & College	Religious Institution	N-22° 31' 13.65" E-91° 51' 22.63"	Noise, Dust and Safety
9.	A Mosque	Religious Institution	N-22° 24' 06.29" E-91° 52' 00.80"	Noise and Dust
10.	Al Falah Jam-E-Masjid	Religious Institution	N-22° 25' 26.98" E-91° 52' 02.77"	Noise and Dust
11.	West Mohora Jam-e-Masjid	Religious Institution	N-22° 24' 06.95" E-91° 52' 03.88"	Noise and Dust
12.	Uttar Burischar Government Primary School	Academic Institution	N-22° 25' 51.03" E-91° 52' 13.78"	Noise, Dust and Safety

The significance of the impact has been assessed as Medium, as shown in **Table 7.1**.

Mitigation

To mitigate deterioration of air quality and generation of dust, the following measures will be taken:

- The equipment and vehicles used during the construction process will comply with the national as well as WBG EHS Guidelines on exhaust emissions.
- Concrete batching and asphalt plants will be located minimum 500 m away from residential areas and will have appropriate dust/emission suppression mechanisms such as wet scrubbers.
- Contractor will implement dust prevention measures such as watering of roads near the residential areas and spraying of water on loose material where required and appropriate.
- Loose material such as sand will be covered with tarpaulin when being transported on trucks.
- Regular air monitoring will be carried out near the sensitive receptors (**Table 7.2**) to ensure ambient air quality remains within the limits defined by national standards and WBG EHS Guidelines.
- Measures will be taken to protect the workers from excessive dust (i.e., usage of personal protective equipment).
- A GRM (discussed later in the document) will be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase.
- In addition, the measures in ECP on air quality management will be implemented.

Residual impacts

With the help of the above mitigation measures, the potential impacts associated with air quality deterioration are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in **Table 7.1**.

7.3.7 Noise and Vibration

The construction of the Project has the potential to generate significant noise and vibrations from blasting and piling activities. Off-site movement of construction related traffic also has the potential for significant noise generation. Potential noise levels have been estimated from various stages of construction activities and are presented in **Table 7.3**. In general, the noise levels are within the standards at a distance of 400m from the construction activities.

Table 7.3: Estimated Noise Levels during Construction

Stage of work	Description of works	Key activities	Activity LAeq,10m dB	Predicted noise at 400 m, dB	Predicted noise at 800 m, dB
Site preparation	Excavation and moving soil and fill	Earthmoving	90	59	47
	Site compounds and set-up	Excavation works	90	49	37
		Transport and handling of soil/ materials	70	29	30
		Storage of soil/ materials	88	47	48
		Preparation of materials (cutting, grinding)	86	45	46
Tower foundation construction	Ground preparation	Earthworks	90	51	51
	tower foundation construction	Transport and handling of soil / materials	70	30	30
	New access road	Concrete batching	95	56	42

Vibration from drilling and excavation activities is a major source of concern if any structures and trees are located within close proximity to the blasting locations. The vibrations may cause damages to the structures and trees. The impacts of noise and vibration from construction activities has been estimated as Medium, as shown in **Table 7.1**.

Mitigation

To mitigate impacts associated with noise generation, the following measures will be taken:

- The equipment and vehicles used during the construction process will comply with the national standards as well as WBG EHS Guidelines on noise.
- Contractors will adopt appropriate noise attenuation measures to reduce the noise generation from construction activities. The noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around drilling equipment.
- The construction activities near the settlements will not be carried out during night time.
- Regular noise monitoring will be carried out near the sensitive receptors listed in **Table 7.2**.

- A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase.
- In addition, the measures in ECP on noise quality management will be implemented

Residual impacts

With the help of the above mitigation measures, the potential impacts associated with noise generation are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as given in **Table 7.1**.

7.3.8 Spoil Generation

Excavations of the OHTL tower foundations and UGTL trenches will generate excess spoils. Disposal of this spoil in cultivation fields will affect the crops and irrigation. Similarly, spoil disposal in built-up area will cause hinderance and traffic congestion. The spoils will also act source of dust. The significance of the impact has been assessed as High, as shown in **Table 7.1**.

Mitigation

The first step towards addressing the impacts of spoil is to minimize the generation of spoils by recycling the excavated soil to the maximum extent possible by using it as filling material in the substations. The excess spoils should be stored in the lands provided by local communities or in the areas approved by the project management/local authorities.

Residual Impacts

With the help of the above mitigation measures, the potential impacts associated with spoil generation are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in **Table 7.1**.

7.3.9 Solid Waste Management

The construction works generate large quantities of excess materials from construction sites (concrete, steel cuttings, discarded material, vegetation), demolition wastes (dismantled transformers and other facilities), and wastes from field camps and construction yards, including garbage, recyclable waste, food waste, and other debris. A large part of this waste is biodegradable or recyclable. In addition, small quantities of hazardous waste will also be generated mainly from the vehicle maintenance activities (liquid fuels; lubricants, hydraulic oils; chemicals, such as anti-freeze; contaminated soil; spillage control materials used to absorb oil and chemical spillages; machine/engine filter cartridges; oily rags, spent filters, contaminated soil, and others). If this waste is not responsibly disposed, it can cause adverse environmental, human health and aesthetic impacts. Significance of this impacts has been assessed as Medium, as shown in **Table 7.1**.

Mitigation

The following mitigation measures will be implemented:

- Contractor will prepare and implement pollution prevention plan and waste management plan.

- The contractor will identify suitable sites for temporary storage of wastes from construction sites and demolished wastes in consultation with communities and government authorities. The wastes shall be transported for disposal in a timely manner.
- The contractor will identify suitable sites for disposal of hazardous and non-hazardous waste or will be sold to the DoE registered vendors. The selection will be done in consultation with the local government authorities.
- Protocols and measures will be prescribed in the ECPs to be included in the contracts with the contractors.

Residual Impacts

With the help of the above mitigation measures, the potential impacts associated with waste generation are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in **Table 7.1**.

7.3.10 Impacts on Wildlife

As stated in **Section 5.3.2**, the project area mainly consists of urban and agriculture ecosystems and has been greatly modified by human activities. Therefore, the wildlife species found in the area are the ones that have adapted to human presence. These wildlife species, including mammals, reptiles and birds, are likely to be affected by construction through habitat loss/degradation, disturbance (presence of people, artificial lighting and noise), injury or death owing to construction works (including trapping in deep excavations) and increased traffic, and temporary habitat fragmentation. The significance of the impact has been assessed as Medium, as shown in **Table 7.1**, primarily because of low conservation value of these species and partly because these species already survive in the modified habitat, as specified above.

Mitigation

Reduction and control of artificial lighting. Artificial lighting used on construction sites and camps at night will be shaded and directed downwards to avoid light spillage and disturbance to nocturnal birds, bats and other wildlife.

Ban on hunting and poaching. A ban on hunting and poaching by construction and operation staff will be implemented to reduce pressure on threatened and protected species in the Project areas and surroundings. All construction and operation staff will be required to follow company rules and code of conduct. Signage will be installed illustrating the hunting ban on any species throughout the Project areas.

Checks for breeding birds. To minimize the potential impact to all breeding bird species, vegetation clearance will be undertaken outside of the main bird breeding period if possible. Where this is not possible, the areas to be cleared will be checked for breeding birds prior to the clearance and if nesting birds are found, appropriate mitigation measures will be implemented. This may involve avoiding construction within 50m of the active nest until the chicks have fledged.

Vegetation clearance will be carried out in a methodical manner so that any fauna present in these areas can disperse. Where clearance of dense scrub is required, it will be preceded by a hand search for mammal and/or reptile species which may be present in the sward. The dense vegetation will only be cleared once it has been established that any individuals present have fled. The incidental creation of pockets of habitat or islands will be avoided. Before and during vegetation clearance or tree felling, any animals found will be removed and released to safe refugium. There should be no burning of natural vegetation.

Residual Impacts

With the help of the above mitigation measures, the potential impacts on wild life are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in **Table 7.1**.

7.3.11 Impacts from Access Roads and Damages to Local Infrastructure

The construction activities will require using/establishing tracks to access the RoW from the existing road network. It has been estimated that on average about 200 m long access track will be used for each tower location. Though exact locations and hence ownership of the land under these access tracks is not known at this stage, it can however be estimated that crops will be damaged over about 16.8 ha of cultivated land (200m long x 15 m wide x 56 towers).

In addition to the crop damage, the construction activities including establishing and using access tracks may also damage the local infrastructure such as existing roads/tracks, tube-wells, water courses, and drainage channels.

Significance of these impacts has been assessed as High, as shown in **Table 7.1**, primarily because of the importance of agriculture produce as the main livelihood of the communities in the area.

Mitigation

The crop damages caused by the establishing and or using access tracks will be compensated by paying cash compensation equivalent to value of crops for two seasons.

For any inadvertent damage to the existing infrastructure, the contractor will be contractually liable to repair and or replace the damaged infrastructure to original or better condition. The GRM established at the site will also address any community grievances related to the damaged infrastructure.

Residual Impacts

After payment of the compensation for crop damage, the impacts of the project on livelihood of the affected households will be mostly mitigated. Hence the significance of residual impacts will be Medium, as shown in **Table 7.1**. The impacts associated with the damaged infrastructure will be completely mitigated and hence the significance of residual impacts will be quite negligible.

7.3.12 Community Health and Safety

Community health and safety impacts during the construction and decommissioning of transmission and distribution power lines are common to those of most large industrial facilities. These impacts include, among others, dust, noise, and vibration from construction vehicle transit, and communicable diseases associated with the influx of temporary construction labor. Significance of these impacts has been assessed as High as shown in **Table 7.1**.

Mitigation

The mitigation measures to address the project impacts on communities' health and safety are listed below.

- Construction camps will be located at least 500 m away from the communities. Entry of the site personnel in the local communities will be minimized to the extent possible/appropriate.

- The contractor will prepare and implement an Occupational Health and Safety (OHS) Plan that will also cover communities' health and safety aspects.
- The contractor will prepare and implement a Traffic Management Plan that will also address traffic safety for communities.
- The community will be informed about the nature of construction activities and the associated health and safety risks; awareness raising of the communities will be carried out for this purpose with the help of training sessions, posters, signage, and other similar means.
- Awareness raising of communities will be carried out, in a culturally-sensitive manner, about the communicable diseases including sexually transmitted infections.
- Regular safety monitoring will be carried out at the sensitive receptors (**Table 7.2**)
- The construction sites will be fenced as appropriate to minimize entry of the local communities particularly children in the work areas.
- Construction camps and other site facilities will be fenced.
- Liaison with the community will be maintained.
- GRM will be established to address community grievances related to health and safety aspects.

Residual Impacts

Even after implementing the above-listed mitigation measures, the health and safety impacts on local communities cannot be fully mitigated. Hence the significance of residual impacts will be Medium, as shown in **Table 7.1**. Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.3.13 Occupational Health and Safety

If not managed appropriately, activities such as site preparation, construction activities, operation of construction machinery and equipment, vehicular traffic, and the use of temporary workers' accommodation pose potential risks to the health, safety, security and therefore wellbeing of construction workers. Health and safety issues associated with the use of temporary accommodation sites include those relating to sanitation, disease, fire, cultural alienation, sleeping space, quality and quantity of food, personal safety and security, temperature control and recreation, amongst others.

Some of the Occupational Health and Safety risks which are likely to arise during the construction phase of the Project, and are typical to many construction sites, include: exposure to physical hazards from working on heights, use of heavy equipment including cranes; trip and fall hazards; exposure to dust, noise and vibrations; falling objects; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery.

Workers on the Project, particularly sub-contracted construction workers, are vulnerable to risks to their wellbeing, health and safety on a daily basis. Appropriate health and safety management planning and execution in line with good international industry practice will be undertaken by the Project team to reduce the risks as far as possible.

Significance of the above impacts has been assessed as High, as shown in **Table 7.1**.

Mitigation

The mitigation measures to address the project impacts on workers' health and safety are listed below.

- The contractor will prepare and implement an Occupational Health and Safety (OHS) Plan
- Contractors will have dedicated and qualified staff for ensuring compliance with the OHS Plan
- Regular trainings will be provided to the workers on OHS aspects.
- Awareness raising material will be used including posters, signage, booklets, and others
- All site personnel will be screened for communicable diseases including sexually transmitted infections.
- Use of appropriate personal protective equipment (PPE) will be mandatory. No worker (or even visitor) will be allowed on the site without the required PPE (such as hard hat, safety shoes).
- Firefighting equipment will be made available as required at construction sites, camp sites, and particularly near the fuel storage.
- The project drivers will be trained in defensive driving. They will maintain low speed while driving through / near the communities.
- Complete record of accidents and near-misses will be maintained.
- First aid facilities will be made available at the work sites and in the camps. The contractors will engage qualified first aider(s).
- Location and telephone numbers of the nearest hospital will be displayed at appropriate places at work sites and in construction camps. If necessary, the contractor will have an ambulance available at the site.

Residual Impacts

Even after implementing the above-listed mitigation measures, the health and safety impacts on site personnel cannot be fully mitigated. Hence the significance of residual impacts will be Medium, as shown in **Table 7.1**. Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.3.14 Traffic Congestion

The construction activities particularly laying of underground cable in urban areas along the existing roads may cause traffic disruption and congestion. Excavation of trenches for the underground cables may involve use of machinery, further exacerbating the traffic congestion. Chittagong city already faces traffic congestion on its main roads and the potential impact of the proposed project is likely to worsen the situation. Significance of these impacts has been assessed as High, as shown in **Table 7.1**.

Mitigation

The following mitigation measures will be implemented to address the traffic congestion caused by the project:

- The contractor will prepare and implement a traffic management plan that will include plans for traffic control, signage, diverting or bypass.

- Construction activities will be scheduled in a manner to avoid peak traffic hours.
- Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police.
- Traffic signage will be placed where necessary and appropriate to warn the drivers and pedestrians about the construction activities.
- ECP to be implemented.
- GRM will address the traffic congestion related issues.

Residual Impacts

With the help of the above mitigation measures, the potential impacts associated with traffic congestion are likely to be mostly addressed and hence the residual impact is likely to be Minor in significance, as shown in **Table 7.1**.

7.3.15 Blockage of Access Routes

The construction activities can potentially block local roads and routes particularly because transmission line laying is a linear activity. This can adversely affect the local communities particularly in urban areas and also in areas where accessibility is already an issue. Any such disturbance to the local community can also result in disruption of the construction works. Significance of this impact has been assessed as Medium, as shown in **Table 7.1**.

Mitigation

The mitigation measures to address impacts associated with the blockage of local routes are listed below.

- The contractor will prepare and implement a traffic management plan, in consultation and coordination with the local community
- The community will be informed about the nature of construction activities and possibility of any blocked route; alternate routes will be identified with the help of local/affected community. Duration of such blockage will be minimized to the extent possible.
- Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police.
- Liaison with the community will be maintained.
- The GRM described earlier will also address community grievances related to any blockage of local routes.

Residual Impacts

After implementing the above-listed mitigation measures, the impacts of the project associated with blockage of routes will be adequately mitigated. Hence the significance of residual impacts will be Negligible, as shown in **Table 7.1**.

7.3.16 Additional Load on Local Resources

The construction work and camp operation will require supplies such as water, fuel, and camp supplies. Obtaining these supplies from the local sources can exert additional pressure on these sources which may already be over-exploited and therefore adversely affect the local communities. Any such impact on the local community can increase their hardship and even

result in disruption of the construction works. Significance of this impact has been assessed as Medium, as shown in **Table 7.1**.

Mitigation

The mitigation measures to address impacts associated with the availability of local resources and supplies are listed below.

- The contractor will prepare and implement a plan to obtain key supplies such as water and fuel, in consultation and coordination with the local community,
- The plan will ensure that there is no significant impact on the local community and local resources.
- Liaison with the community will be maintained.
- The GRM described earlier will also address community grievances related to usage of local resources.

Residual Impacts

After implementing the above-listed mitigation measures, the impacts of the project associated with usage of local resources will be adequately mitigated. Hence the significance of residual impacts will be Negligible, as shown in **Table 7.1**.

7.3.17 Site Clearance and Restoration

After the completion of the construction activities, the left-over construction material, debris, spoils, scraps and other wastes from workshops, and camp sites can potentially create hindrance and encumbrance for the local communities in addition to blocking natural drainage and or irrigation channels. Significance of these impacts has been determined as Medium, as shown in **Table 7.1**.

Mitigation

The contractors will be required to remove all left-over construction material, debris, spoils, and other wastes from the construction sites in a timely manner. The camps sites will be completely cleaned and restored in original condition to the extent possible. No waste disposal will be carried out in the streams and rivers.

Residual impacts

With the help of the above mitigation measures, the potential impacts associated with site clearance are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in **Table 7.1**.

7.4 Impacts during O&M Phase

7.4.1 Waste Management at Substations

The operation and maintenance activities at the substations will generate wastes such as municipal solid waste, sewage from toilets, waste transformer oil and other lubricants, disused parts, and other similar wastes. Some of these are hazardous wastes. Particularly the used transformer oil can cause soil and water contamination if not properly disposed and can also be hazardous for people and livestock. Significance of these impacts has been assessed as High, as shown in **Table 7.1**.

Mitigation

PGCB will prepare a Waste Management Plan as part of their standard operating procedures. The municipal waste will be disposed through the city municipal services whereas hazardous wastes such as transformer oil will be disposed in accordance with its Material Safety Data Sheet (MSDS).

Residual Impacts

With the help of the above measures, the negative impacts associated with waste generation from substation operation and maintenance will be adequately addressed and hence the significance of residual impact would be Negligible, as shown in **Table 7.1**.

7.4.2 Risk of Bird Collision and Electrocution

The overhead transmission lines can potentially cause bird collision and electrocution particularly for the migratory birds that visit the Chittagong area during each winter (see **Section 5.3.2**). Fatal collisions occur mostly with cables hanging perpendicular to the flight direction particularly with the top neutral conductor because of its poor visibility. One of the proposed transmission lines would cross the Karnaphuli river and hence this location could be potential for bird collision.

Power line structures (towers) provide perching, roosting, and nesting substrates for some avian species especially for birds of prey (raptors). Due to their large wingspans, the raptors may simultaneously come in contact with two energized parts or one energized and one neutral/grounded part of the transmission lines/their towers, potentially resulting in electrocution. Although raptors are most often considered when addressing electrocution risk, other birds such as crows, ravens, magpies, small flocking birds and wading birds can also be electrocuted. Closely-spaced exposed equipment, such as jumper wires on transformers, poses an electrocution risk to small birds.

The electrical design factor most crucial to avian electrocutions is the physical separation between energized and/or grounded structures, conductors, hardware, or equipment that can be bridged by birds to complete a circuit. As a general rule, electrocution can occur on structures with the following characteristics:

- Phase conductors separated by less than the wrist-to-wrist or head-to-toe (flesh-to-flesh) dimensions of a bird. The wrist is the joint toward the middle of the leading edge of a bird's wing. The skin covering the wrist is the outermost fleshy part on the wing.
- Distance between grounded hardware (e.g., grounded wires, metal braces) and any energized phase conductor that is less than the wrist-to-wrist or head-to-toe (flesh-to-flesh) distance of a bird.

Mitigation

The maximum length and wingspan of the birds are generally within 1.5 m and 3 m, respectively. Hence, mitigation to prevent or reduce the bird electrocution is possible by maintaining a minimum vertical distance of 1.5 m and horizontal distance of 3 m between the energized parts of the transmission line. As shown in **Figure 3.8**, the phase to phase and phase to ground separations are much larger (about 5m and 8m, respectively).

Contingent to its technical viability, PGCB will consider installing bird diverters such as colored balls on the top conductor of the transmission line segment crossing the river. Towers on both sides of the river should have light beams focused on the balls on the power lines, at

night, during ‘mid-February to end March’ and again from ‘mid-September to mid-November’. Bird collision and electrocution data will also be collected during early March and October.

Residual Impacts

After installation of bird diverters and colored bills, risks of bird collision and electrocution will be adequately mitigated. Hence the significance of residual impacts will be Negligible, as shown in **Table 7.1**.

7.4.3 Tree Cutting during Maintenance Activities

The trees under the overhead transmission line need to be trimmed to a certain height so as to maintain a safe distance from the top of the trees to the transmission line conductor. Depending upon the type of these trees, this trimming can cause loss of production (in case of fruit trees) or reduction in its value (in case of timber tree). Significance of these impacts has been assessed as Medium, as shown in **Table 7.1**.

Mitigation

Compensatory tree plantation should be carried out where necessary. In case of private trees, compensation will be paid to the owners for the loss of production or loss of its value.

Residual Impacts

Even after implementing the above mitigation measures, the impact of the project on the trees under the proposed transmission lines will not be fully mitigated. Hence the significance of residual impacts will remain Medium, as shown in **Table 7.1**.

7.4.4 Diminution of Land Value in Right of Way Corridor

The presence of transmission lines and towers will significantly reduce the market value and real estate potential of the land under the 80 m corridor of transmission line right of way. This impact would be major particularly in the urban areas though loss of valuable agricultural land under the transmission line towers would also be significant. Significance of this impact has been assessed as High, as shown in **Table 7.1**.

Mitigation

There is no mitigation available for this impact.

Residual Impact

Since the reduced value of the land within the transmission line RoW cannot be fully mitigated, the residual impact will remain High, as shown in **Table 7.1**.

7.4.5 Public Health Impacts from Electro Magnetic Fields from Transmission Line

Transmission lines generate electrical and magnetic fields which are considered to be health hazards although it was not scientifically proven. Though public health is not a major concern, these are estimated for the proposed transmission lines at various distances from the center of the transmission line and presented in **Table 7.5**. These values are estimated using the “Corona and Field Effects Program - Version 3”, a computer program developed by the Bonneville Power Administration (BPA). The model requires detailed inputs regarding line configuration, conductors, sub-conductors, voltage and current.

The electric field denotes the difference in electric potential measured as a voltage between two points one meter apart. The electric field is generated by the line voltage on the conductors. The electric field of power lines depends on the voltage, on the circuit numbers, on the design

of the circuits and on the design of the cable itself. Its strength lessens rapidly with increasing distance. Normally, the field is strongest in the middle of the transmission line span where the phase conductors have the greatest slag. The strength of the electric field is expressed in volts per meter, and in the power-line context usually in kV/m. Strong 50 Hz electric fields occur mainly in high voltage installations, i.e. inside switchyards and below transmission lines. Electric fields are shielded by objects which are earthed, such as trees and buildings.

The magnetic field around a power line is generated by the current in the conductors. Since the current is proportional to the line's load, the magnetic field often varies both over 24 hours and from one season to another. The magnetic field under a power line is strongest in roughly the same areas as the electric field. The magnetic field is expressed in terms of teslas [T] (1 T = 1 Vs/m²), which is a measure of the field's flux density. In the context of power lines, microteslas [μ T] are used. Magnetic fields are not shielded by walls and roofs. Around power lines they are often weaker than those one may come into contact within many other contexts in everyday life at work such as cellular phones that use frequencies in the range of GHz.

The electric and magnetic field are believed to cause cancer and affect nervous system. Today, among scientists there is still a considerable difference of opinion as to the degree of possible detrimental health influence caused by these fields. There are several investigations and publications reporting a severe influence of electromagnetic fields, but the discussion about biological and health effects is still going on. The International Council on Large High Voltage Electric Systems (CIGRE), a permanent non-governmental and non-profit-making international association based in France, publishes from time to time summaries of latest researches on bio and health effects of electric and magnetic fields.

The exposure limits for EMF fields developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - a non-governmental organization formally recognized by WHO²⁴, are given in **Table 7.5**. WHO also concluded that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on human health. The EMF field of the proposed transmission line is within the ICNIRP Standards.

Table 7.4: Electrical and Magnetic Fields from Transmission Line

Distance from Centre of TL Alignment (m)	Electric Field (kV/m)	Magnetic Field (μ T)
40 (edge of ROW)	1.34	104.81
50	0.59	68.33
60	0.17	46.17
70	0.03	32.30
80	0.03	23.31
90	0.03	17.3
100	0.03	13.14

²⁴ EMF Fields, WHO Webpage <http://www.who.int/peh-emf/standards/en/>

Distance from Centre of TL Alignment (m)	Electric Field (kV/m)	Magnetic Field (μT)
ICNIRP Standards	Public Exposure: 5; Occupational Exposure: 10	Public Exposure: 200; Occupational Exposure: 1000

Mitigation

Exposure to EMF has already been considered during the design of the transmission line conductors and right of way to ensure compliance with the internationally recognized standards. Hence no additional mitigation measures are proposed. The electromagnetic fields will be regularly monitored during O&M phase to ensure compliance with the ICNIRP standards and if required additional mitigation measures will be proposed during O&M phase.

7.4.6 Audible Noise and Radio Interference from Transmission Lines

Audible noise from transmission lines occurs primarily in wet weather. In dry weather conditions, the conductor usually operates below corona inception level and generates few corona sources for audible noise. However, in wet conditions, water drops impinging or collecting on conductor produce a large number of corona discharges and thereby creating bursts of noise. Therefore, the audible noise increases to such an extent that sometimes it represents one of the limitations for the design of transmission line conductor. The audible noise for the proposed transmission lines has been estimated and presented in **Table 7.6**. The noise levels during fair weather are generally within the national standards. However, during rainy periods, the noise levels will exceed the night time standards up to 100m from the center of transmission line alignment.

Radio interference also called radio influence is a noise type that occurs in the Amplitude Modulation Radio reception including the standard broadcast band from 0.5 to 1.6 MHz. It does not take place in Frequency Modulation bands. Power line interference tends to be roughly in inverse proportion to the frequency. Radio interference can be predicted by applying Empirical or Comparative formula as a result of regression analysis performed on experimental data of Radio Interference of various variables such as conductor diameter, surface gradient, and lateral distance from the line.

Instead of using absolute noise level, as a criterion for rating interference level, it is more logical to use a relative measure as signal to noise ratio. This parameter is generally employed to affect the effect of transmission noise on AM Radio broadcast. The radio interference is calculated and presented in **Table 7.6**.

No standard limit exists for Radio Interference but Canadian Standard Association (CSA) has developed the recommended limits for Electromagnetic Noise based on the line voltage. For high voltage level of 400kV, the acceptable limit is 60dBA in fair weather measured at the distance 40 meter from center of tower. The estimated radio interference levels from the proposed transmission lines will be within these standards.

Table 7.5: Audible Noise and Radio Interference from Transmission Line

Distance from Centre of TL Alignment (m)	Audible Noise (dBA)		Radio Interference (dBuV/m)	
	Rain Weather	Fair Weather	Rain Weather	Fair Weather
40 (edge of ROW)	51.5	26.5	59.6	42.6
50	50.8	25.8	57.4	40.4
60	50.1	25.3	55.2	38.2
70	49.4	24.4	53.5	36.5
80	48.9	23.9	52.1	35.1
90	48.4	23.4	50.9	33.9
100	47.9	22.9	49.7	32.7

Mitigation

Exposure to noise and radio interference from transmission lines has already been considered during the design of the transmission line conductors and right of way to ensure compliance with the national and international standards. Hence no additional mitigation measures are proposed.

7.4.7 Occupational Health and Safety during Operation and Maintenance

Workers may be exposed to occupational hazards from contact with live power lines during, maintenance, and operation activities. They are also exposed to occupational hazards when working at elevation and live wires, and exposure to electric and magnetic fields, and to fuels during maintenance, and operation activities. Significance of these impacts is High, as shown in **Table 7.1**.

Mitigation

PGCB has Standard Operating Procedures (SOPs) on Workers' Health and Safety and these will be implemented during the operation. Regular training will be provided to the staff on the SOPs and risk registers (reporting and recording of accidents and near misses) will be maintained. The SPOs are explained below.

General Principles: Accident prevention can be accomplished only through possessing and applying safety know-how and wholehearted cooperation of all members of the organization. Learn and understand the following five basic principles in job safety to deal with the hazards:

- IDENTIFY the Hazards.
- ELIMINATE the hazards wherever practical.
- CONTROL the hazards when they cannot be eliminated.
- PROTECT against injuries in case a hazard gets out of control.
- MINIMIZE the severity of an injury, if an accident occurs.

Neither management and supervision, nor the Safety Code can prevent accident without the help of each employee.

Unsafe workers are a danger to themselves, their fellow workers, the public property and the equipment with which they work. Due care and attention to all safety rules and devices is essential not only to prevent injury to the workers but also to protect equipment.

Capable and mentally alert employees will avoid accidents by learning all they can about their work, using proper safeguards and protective equipment and avoiding shortcuts and make shift work methods.

Good operation is safe operation. This is true for both employees and equipment. A job done safely is job done efficiently.

Accidents do not “just happen”. Accidents are the natural result of unsafe condition or unsafe acts, usually a combination of both. Machinery and equipment generally are manufactured to perform safely within limits of design. In fact, statistics show that more than 90 percent of accidents are due to the human element, such as failure to use safety devices and observe safety rules and procedures.

Residual Impacts

Even after the implementation of above measures, the safety risks will not be fully mitigated and therefore the significance of the residual impact will remain High, as shown in **Table 7.1**.

8. Social Impact Assessment

This Chapter presents socioeconomic baseline of the project area and also project's impacts on the key social aspects including involuntary resettlement.

8.1 Socio-Economic Resources

Socio-economic condition refers to social and economic factors accruing to an individual or group and is mainly measured by income, education, occupation and many other variables. In this chapter socio-economic condition of the study area is discussed. Demography, economic condition, working condition and many other indicators are the main components of this chapter. Some data collection tools like Focus Group Discussion (FGD), semi structured questionnaire, Key Informant Interview (KII) and were used to collect data from primary source. Relevant secondary information was collected from the Community Report of the Population and Housing Census 2011 published by Bangladesh Bureau of Statistics (BBS) in 2015.

8.1.1 Administrative Bounding of Study Area

The study area includes 25 Union *Parishads*²⁵ of eight Upazilas/Thanas in Chattogram District. Administrative boundary was analyzed by spatial Geographic Information System (GIS). The study area along with their administrative locations is given below (Table 8.1).

Table 8.1: Administrative Boundary of Study Area

District	Upazila/ Thana	Union	Area Percentage
Chattogram	Hathazari	Burish Char	100%
		Dakshin Madarsha	
		Shikarpur	
	Patiya	Bara Uthan	
		Char Lakshya	
		Jiri	
		Juldha	
		Sikalbaha	
	Chandgaon	Ward No-04	
		Ward No-05	
		Ward No-06	
	Panchlaish	Ward No-07	
		Ward No-08(part)	
	Khulshi	Ward No-08(part)	
		Ward No-09(part)	
		Ward No-13	

²⁵ Union *Parishad* is the lowest administrative tier in Bangladesh.

District	Upazila/ Thana	Union	Area Percentage
		Ward No-14	
	Kotwali	Ward No-15 (Part)	
	Halishahar	Ward No-26	
	Chattogram Port	Ward No-37	
		Ward No-38	
		Ward No-39 (Part)	

Source: CEGIS spatial analysis, 2017

8.1.2 Demography

There are 1,471,531 people (Population and Housing Census 2011) comprising of 286,816 households in the study area. The male and female population is respectively 761,599 (51.8 percent) males and 709,932 (48.2 percent) females. The sex ratio of male and female of these unions is 107, meaning there are 107 males for 100 females. From the demographic table (**Table 8.2**), Kotwali Upazila has the highest sex ratio, which is 115:100 (male 115, female 100). The average population density of the study area is 4,285. Panchlaish is the most densely populated area where 8,801 people live per square kilometer. As Chattogram is a division and a port city, therefore, people from different regions move to the area in search of jobs that also culminate into a massive population.

Table 8.2: Demographic Data of the Study Area

Upazila	Household	Population	Male	Female	Sex Ratio	Population Density
Anowara	14830	78432	39378	39054	101	1848
Patiya	30293	163822	83306	80516	103	2744
Hathazari	13762	69607	34012	35595	96	4002
Chandgaon	54949	256411	132054	124357	106	3375
Panchlaish	43918	214988	112927	102061	111	8801
Khulshi	60800	278623	148536	130087	114	5309
Kotwali	10672	51603	27634	23969	115	3787
Halishahar	10376	52999	27741	25258	110	5239
Chattogram Port	47216	208260	105919	102341	103	3464
Total/Average	286816	1374745	711507	663238	107	4285
Projected Population²⁶		1471531	761599	709932		

Source: Population and Housing Census 2011, BBS, 2012 *Estimated to 2017

²⁶ $Pop_{Future} = Pop_{Present} (1+r)^n$, where: Pop_{Future} = Future Population, $Pop_{Present}$ = Present Population, r = Growth Rate and n = Number of Year.

8.1.3 Household Size

Data from the Population and Housing Census 2011 shows that most households in the study area (about 72.9 percent) have four or more members. The average household size of 5 (4.9) members is similar to the national average of 4.44.

8.1.4 Age Structure

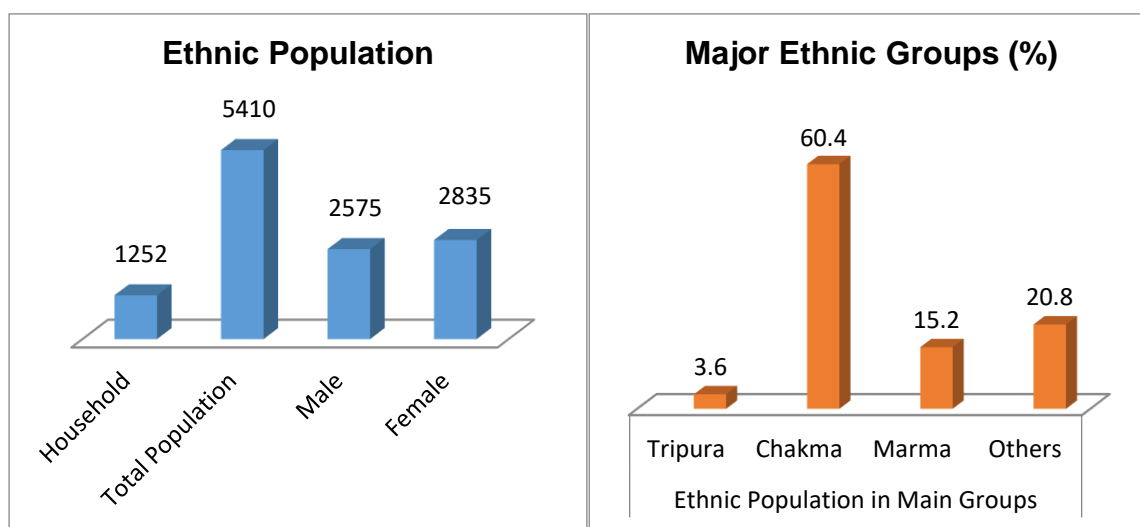
Age structure breakdown shows that the group of 30-49, regarded as the economically active population, forms the largest segment at 23.7 percent. The group of 60 and above is relatively smaller compared to others.

8.1.5 Dependency Ratio

This indicator is measured by the number of people aged below 15 or above 64 divided by the number of populations aged 15 to 64 and expressed as percentage. The average dependency ratio in the study area is 36 percent (Source: calculations from Population and Housing Census 2011), or almost 36 persons are dependent on 100 working people. The national dependency ratio (percent of working-age population) is 52 percent, according to the World Bank²⁷.

8.1.6 Ethnic Community

It is an established fact that many ethnic communities and groups live the Chattogram region. Primary data accounted for 1,252 ethnic households with 5,410 members, out of whom 2,575 males and 2,835 females. The three biggest ethnic communities in the study area are the Chakma, Marma and Tripura.



Source: Population and Housing Census 2011, BBS, 2012

Figure 8.1: Ethnic Population and Major Ethnic Groups

Out of the total population of 5410, Chakma consists of 3267 people and Marma consists of 823 people. Members of other groups, such as the Mro, Murong, Pankho, Tanchangya, Khumi, Bom were also identified and classified as Other category. However, it has been verified that there are no ethnic communities found in the AOI (Area of Influence) of the project.

²⁷<http://data.worldbank.org/indicator/SP.POP.DPND?view=map>.

8.1.7 Literacy Rate

The average literacy rate in the study area is 64.6 percent, higher than national average of 61.5 percent. Gender-segregated literacy rates are also higher than national average.

8.1.8 Access to Health Facilities

Primary surveys reveal that 34 percent of the people have access to a paramedic physician and 41 percent to a trained physician. People reported a tendency to go to a local healer (22 percent) for treatment. 3 percent people (mostly the poor) do not have access to any medical facilities.

8.1.9 Employment Opportunities

Data shows that about 45.8 percent of the population (age 7+ not attending school) is employed in different sectors of which 32.6 percent are male and 13.2 percent are females. About 30.7 percent of the women are engaged in household work. The study area has an unemployment rate of 21.8 percent. It is found that almost 0.70 percent of total population (age 7+ not attending school) including 0.5 percent male and 0.20 percent female is actively seeking employment.

8.1.10 Main Occupations

Study area consists of urban regions where most of the employed adults are engaged in service-oriented jobs. About 63.6 percent people, including 48.06 percent male and 15.54 percent female, are engaged in the service sector. Another 28.31 percent people, including 15.39 percent male and 12.92 percent female, are engaged in the industrial sector. A very small portion of people (8.1 percent) are engaged in the agricultural sector. It is particularly noteworthy that women's participation in income generation activities in the study area is 28.84 percent of total population (Population aged 7+, not attending school and employed) and they are mainly employed in service sector.

Primary survey reveals a significant number of emigrants who send remittances back to their families. Chattogram area attracts people from different parts of the country in search for work or business.

8.1.11 Availability of Labor and Wage Rate

A compatible wage rate is prevalent in the study area and is presented in **Table 8.3**. In summarizing this **Table 8.3**, it is found that wage rate is almost same in every union in our study area, but the wage rate is quite higher than other regions since the port city offers enhanced economic opportunities. Primary survey data reveal that women wage rate is comparatively lower than male.

Table 8.3: Availability of Labor and Wage Rate of the Study Area

Type of Activities	Type of labor	Availability	Wage (Taka)	
			Max.	Mini.
Farming	Male	High	400	300
	Female	Medium	350	300
Non-farming	Male	High	500-600	400
	Female	Low	350	300

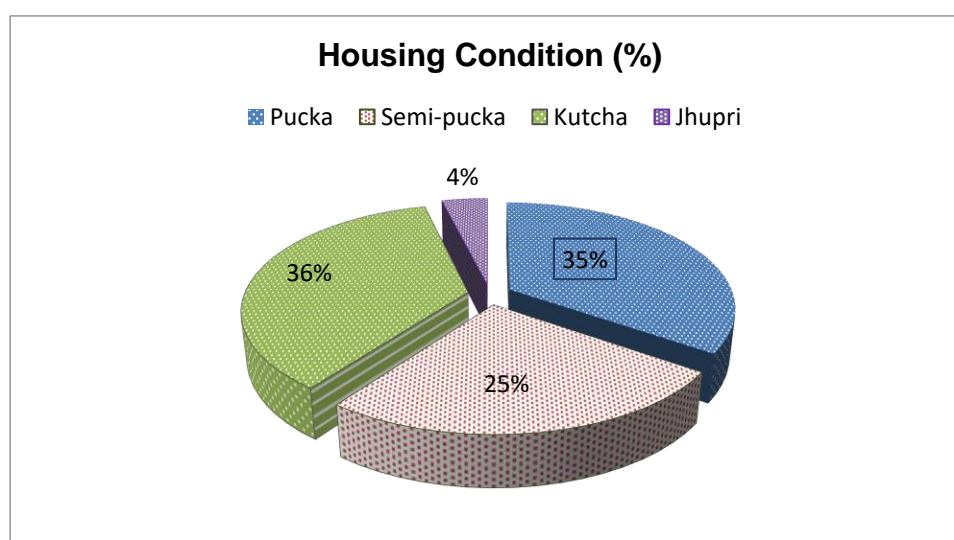
Source: CEGIS' Field visit, 2017

8.1.12 Migration

Seasonal human migration is very common in agricultural cycles. The trends of seasonal migration depend on availability of work, natural disasters, industrialization and development initiatives affecting land and natural resources. Seasonal labor migration is common phenomenon where cultivable land remains under water during rainy season so rural poor people struggle for their livelihood. But in our study area seasonal migration occurs for categories, as it is a port area. It is found that labor is from different regions of the country. Even different national and multinational organizations have their corporate branches in Chattogram city. Primary survey data revealed that there are small numbers of international out migrants (about 5 percent) that tends to go to Middle East.

8.1.13 Housing Conditions

Housing condition in the study area is characterized by 35 percent pucca²⁸ and 25 percent semi pucca households²⁹. The highest number of (36 percent) houses are kutcha³⁰ and Jhupri³¹ is negligible in number. The scenario of housing condition is now changing with increasing income of the study area in **Figure 8.2**.



Source: Population and Housing Census 2011, BBS, 2012

Figure 8.2: Housing Condition in Study Area

8.1.14 Drinking Water Facilities

In the study area, 56 percent of people are dependent on tube-well as their main source of drinking water. Here large number of people (38 percent) depends on tap water although they are used to boiling water before drinking. Tap water is mainly found in urban and sub-urban

²⁸ Pucca: House which is made by fully concrete, cement, and iron.

²⁹ Semi-pucca: 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.

³⁰ 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;

³¹ 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.

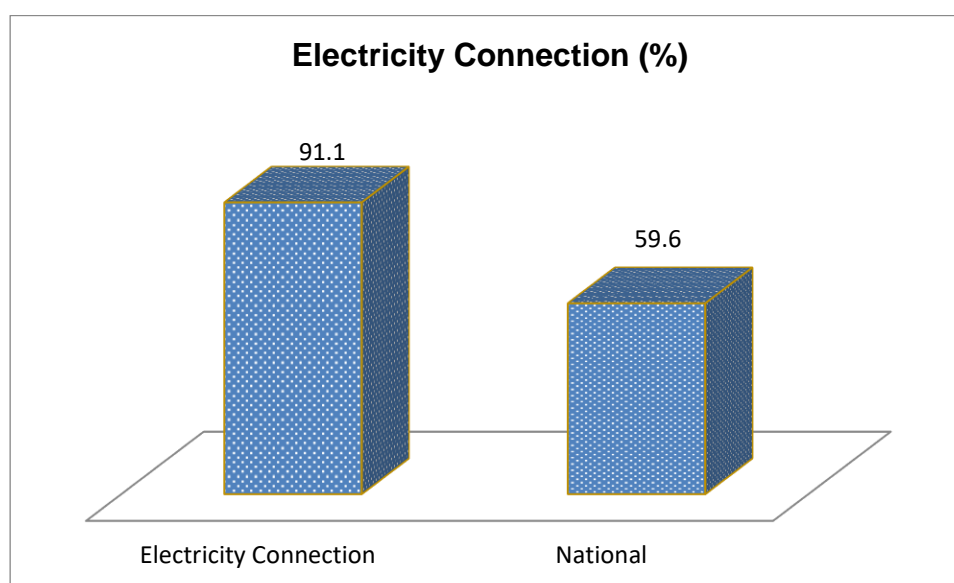
area. Negligible people use other sources like ponds, and river for drinking water. Field findings reveal that salinity is found in ground water especially at the coastal region (Anowara substation area).

8.1.15 Sanitation Facilities

In the study area, 79 percent households reported that they have sanitary toilet facilities of which 37 percent are water-sealed and another 42 percent are not water-sealed. A big portion (19 percent) of household this study area has non-sanitary toilet facility. Still 2 percent households have no sanitation facility.

8.1.16 Access to Electricity

Electrification rates for the study area is 91.1 percent, much higher than the national average of 59.6 percent.



Source: Population and Housing Census 2011, BBS, 2012

Figure 8.3: Electricity Facility in Study Area

8.1.17 Land Price

The land prices of different type of lands have been taken from the ESIA field visit. People of different areas, occupations, ages have provided indications about the land price. The areas are mostly in urban areas and as a result land price is higher. The average land prices in the different areas is presented below. It is seen that commercial and homestead land price is higher as well.

Table 8.4: Land Price of the Study Area

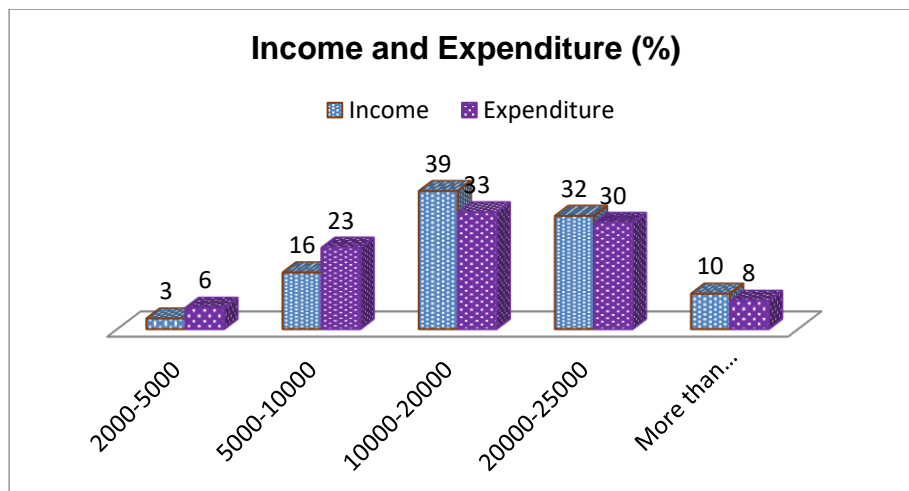
Land classes	Minimum - Maximum Land Price (Taka/Decimal)
	At Present (2017)
Agricultural land	100,000 – 150,000
Homestead land	500,000 – 750,000
Commercial land	1,200,000 – 1,500,000

Source: CEGIS field work, 2017

8.1.18 Income and Expenditure

Household Primary data on income and expenditure suggests that households in the lower income groups are spending much more than their income, thus saving practically nothing and

are potentially in a debt trap. Households with income of Tk. 10,000 and above have indicated some savings. This trend increases with households in higher income brackets. The scenario of income and expenditure is shown in the following **Figure 8.4**.



Source: CEGIS field work, 2017

Figure 8.4: Distribution of Household by income and Expenditure

8.1.19 Self-Assessed Poverty

The poverty profile has been prepared by the participants of the RRA themselves through a self-assessment exercise. The assessment is based on the year-round income along with the food consumption by the inhabitants within three different categories namely deficit, balanced and surplus. It is observed that about 19 percent of the households on average are under the poverty line, 23 percent are above the poverty line and the remaining 59 percent in the “balanced” situation.

8.2 Project Related Information

8.2.1 Public Utilities

Public services taken into consideration for this report are water supply, sanitation, solid waste management, electricity supply, telecommunication etc. It is expected that utilities will not be interrupted during the construction of the substations and overhead transmission lines. Certain services maybe interrupted due to the excavation for the underground cables from Madunaghat to Khulshi 230 kV. Field visits confirmed the existence of water supply lines and secondary drainage adjacent to the alignment of RoW.

8.2.2 Cultural Resources

The CEGIS field team has visited both substation and RoW of transmission line. No cultural resources and sensitive spaces are found in the alignment and the proposed location of substation. Proposed substation at Khulshi will be constructed at open space of Khulshi substation; New-mooring substation location is under BWDB ownership; the Anowara substation is located in an agricultural land though this SS is not under the project.

The proposed Madunaghat to Khulshi underground transmission line will cross through roadsides and there are no houses or temples found on the alignment though this is the busiest road of Chattogram. At least one mosque and a family graveyard exist in the RoW of Madunaghat to Khulshi underground transmission line. A special access to these places needs

to be ensured through wide wooden planks with hand railings. Contractor must ensure this during construction phase.

8.2.3 Land required for project Intervention

The following table indicates the total land requirement to implement the project interventions.

Table 8.5: Land Requirement for Project

	Subproject	Land required (acres)
1	400 kV transmission lines: 25.182 km Anowara – Anandabazar (New Mooring) 400 kV double circuit	1.53
2	230 kV transmission lines: 17.22 km (2.66 km LILO, 14.56 km. UGT)	
3	230/132 kV GIS substation at Anandabazar (New Mooring) with transformer of 2×350/450 MVA	18
4	230/132/33 kV GIS substation at Khulshi with transformer of 2×350/450 MVA (230/132kV) and 3×80/120MVA (132/33 kV).	-
5	Bay extensions: 2 Two 230 kV GIS substation at Madunaghat substation	-
	Total land required:	1.53

For the tower footing of overhead Transmission Line, 1.53 acres of land is required and will be procured. Under the Country system, the land is used for public purpose and the landowner is compensated for crop loss and restoration of topsoil. No land is acquired for underground Transmission Line, as these TLs will be constructed under the ground of the road side. Commercial establishments temporarily disrupted due to excavation will be compensated.

18 acres of land will be required for construction of the 230/132 kV GIS substation. Although the construction of this substation will be carried out under this project, the required land will be assembled through another project named “*Enhancement and Strengthening of Power Network in Eastern (ESPNER of Bangladesh)*” funded by the World Bank.

However, no land is required for the new substation proposed to be constructed at Khulshi, as this substation will be constructed at the existing location. No land is required for Bay extension at Madunaghat Substation, as this will also be constructed at the existing substation.

Currently, the required land proposed above has no human settlement and no displacement will take place for the land acquisition/requisition. Therefore, no resettlement/Resettlement Action Plan (RAP) is needed for this project.

8.3 Baseline Conditions of Project Affected People

For analyzing baseline condition of the project affected people a sample survey was carried out in account with some major socio-economic indicators. Temporal disruption for overhead and underground transmission line was the main concern for this section.

8.3.1 Underground Transmission Line

A sample survey was conducted to reflect the background of the PAPs affected by the underground transmission line. The sample comprised of a total of 230 numbers of project

affected people of which 201 were permanent shopkeepers and 29 were temporary or mobile shopkeepers.

Age Structure

Analyzing Primary data shows that the age categories for most of the temporarily affected people are between 30-49 years. For Permanent establishments the percentage is 62.7 and 62.1 for the temporary establishments. This age group is the most economically active segment of the population. **Table 8.6** shows the breakdown per age and type of impact for PAP.

Table 8.6: Age structure of PAP's for underground Transmission Line

Age Category	Percentage	
	Permanent	Temporary
20-24	4.5	6.9
25-29	10.9	13.8
30-49	62.7	62.1
50-59	15.4	13.8
60-64	3.0	0.0
65+	3.5	3.4

Source: CEGIS field survey, 2018

Household Size

Most PAP households consist of 5 members. This is almost same for both permanent and temporal shopkeepers. Average family size is 4-6 members, compared to national average of 4.4.

Table 8.7: Household size of PAP's for underground Transmission Line

No of Family Members	Percentage	
	Permanent	Temporal
3 Members	5.5	13.8
4 Members	23.4	17.2
5 members	32.3	34.5
6 Members	18.9	20.7
7 Members	11.9	6.9
8 Members	4.0	6.9
9 Members	2.5	0.0
10 Members	1.5	0.0

Source: CEGIS field survey, 2018

With Most PAP households consist of five members. This is almost same for both permanent and temporal shopkeepers. Average family size is 4-6 members, compared to national average of 4.4.

Land Ownership of the Affected Shops

Generally temporary shops are mobile in nature: some shops move frequently i.e. daily, while certain shops are situated in fixed locations, but are temporary and informal in nature. Permanent shops here refer to fixed structures. The following data show that most of the shops (178 nos.) are privately owned, 19 (9.5 percent) shops are operated by property owners, while the remaining 159 shops (79.1 percent) are rented out. 23 shops (all of them temporary and

informal) are situated on the state-owned khas land without having legal permission from the government, therefore, can be termed informal commercial establishments with no legal sanctity. Data shows that 6 temporary shops are operated on rental basis and owned by private owners (Table 8.8).

Table 8.8: Land ownership of PAP's for underground Transmission Line

Type of Ownership/ Occupancy	Total No	Percentage
Encroacher/ Occupier	23	11.5
Rented Shopkeepers	159	79.1
Legal Proprietor	19	9.5

Source: CEGIS field survey, 2018

Daily Income

The shops are categorized into three: small, medium and large in terms of income range. Thus, shops with daily income ranges from BDT 1,000 to 8,000 are lumped into 'small' category, and daily income ranges from BDT 8,000 to 20,000 is lumped into 'medium' category. Conversely, shops with daily income more than BDT 20,000 is considered 'large' category. Following these categories, data reveals that most of the affected shops (64.2 percent) belong to the small category, to which all temporary shops are included. Conversely, the permanent shops belong to medium and large categories. The profit margin of these shops varies regarding type of shops. The daily average margin for small shops is around BDT 1500, for medium around BDT 2500, and for large BDT 4500. The budget for compensation has been prepared based on the profit margin rather than total daily income

Table 8.9: Daily income Range of the PAP's for Underground Transmission Line

Categories (Income Range)	Total No	Percentage	Daily average profit margin (BDT)
Small (1000-8000)	129	64.2	1500
Medium (8000-20000)	55	27.4	2500
Large (20000+)	17	8.5	4500
Total	201	100	

Source: CEGIS field survey, 2018

8.3.2 Overhead Transmission Line

For the Overhead Transmission Line, 78 structures were found throughout the RoW of 20m. In this section, baseline information of these surveyed households is presented.

Age Structure

Most of the respondents (65.4 percent) of these surveyed households belong to age ranges between 30 to 49 years old. This implies the higher presence of economically active population in the study area.

Table 8.10: Age structure of respondents of households throughout the Overhead Transmission Line

Age Category	Total No	Percentage
20-24	2	2.6
25-29	3	3.8

Age Category	Total No	Percentage
30-49	51	65.4
50-59	13	16.7
60-64	5	6.4
65+	4	5.1
Total	78	100

Source: CEGIS field survey, 2018

Household Size

Of the surveyed households, 35.9 percent includes 4 members, and 21.8 percent includes 5 members. The following table indicates the details of household's family members. However, no disable member was found in the households located in the RoW of overhead transmission line.

Table 8.11: Household size of PAP's for Overhead Transmission Line

No. of Family Members	Total No	Percentage
3 Members	6	7.7
4 Members	28	35.9
5 Members	17	21.8
6 Members	9	11.5
7 Members	10	12.8
9 Members	4	5.1
10 Members	4	5.1
Total	78	100

Source: CEGIS field survey, 2018

Occupation

The following table represents the occupational variation of the study. Most of the households are dependent on farming activities. Some are doing business. Some households are found as well where household head resides outside the country. The following table represents the occupational variation of affected households.

Table 8.12: Occupational Variation of Overhead Transmission Line

Occupation	Total No	Percentage
Business	25	32.1
Day Labor	7	9.0
Farmer	28	35.9
Housewife	4	5.1
Job	11	14.1
Immigrant	3	3.8
Total	78	100

Source: CEGIS field survey, 2018

8.4 Project Impacts

8.4.1 Alternative Traffic Plan

During construction period for the underground transmission line an alternative Traffic Management Plan will be worked out to avoid traffic disruption. Construction work will be executed in consideration of the busy traffic of both vehicles and pedestrians in appropriate times of the day to limit disruption. Road excavation should be carried out in a segmented way with clear traffic signs, reflectors, etc. to ensure advanced warning. But during excavation period it may create problems at night and day though traffic is quite poor at night Contractor should carry out some specific measures to avoid any accidental incidents. Before any excavation or saw cutting work near traffic lights the utility operator and/or Contractor must liaise with the Corridor Manager to verify the location of cables and detector loops. Contractors must take appropriate steps to keep excavations free of water, to minimize risks associated with rainfall and subsoil drainage along with this the size of the Work and the Road portion of the site is kept as small as is reasonably possible and working location must be well fenced and kept covered with some planks for avoiding accidental incidents. In this regard a guideline is prepared for EPC contractor (discussed later in the document).

8.4.2 Access Restrictions

During the construction phase of the underground transmission line from Khulshi to Madunaghat, certain areas' access may be disturbed and/or restricted. Alternative access to shops, mosque and common places will be provided by the contractor with the provision and installation of appropriate wooden planks with hand-railings. Sufficient advance warnings for affected businesses and facilities will be provided. Provision of alternative access is the responsibility of the contractor and is budgeted as an ESMP item.

8.4.3 Impact on Livelihood

Impacts due to Project interventions were assessed through engineering design, ocular inspection and field surveys conducted from 20th to 27th October 2018. Upon the finalization of the detailed engineering design, the RPF and the full RP (Resettlement Plan) will be updated to include newly available impacts and mitigation. All entitlements will be paid prior to the commencement of civil works.

Based on the preliminary assessment, the Anowara-New Mooring 400 kV double circuit overhead transmission line (OHT) will include agricultural land, settlement area, river, and partial portion of pond (which impact is not considered due to no disturbance of production in water body). There are residential (76) and commercial (1) structures and family graveyard (1) of 78 households respectively, 3 large scale commercial enterprise including a government organization under the 20m strip of this OHT RoW (19.932km). There is no physical displacement due to the Project, and economic losses will be compensated.

The OHT will have both permanent assembly of land and crop loss in the 20m RoW (direct impact area). Here, crops grown in about 1.53 acres (153 decimals) of land, particularly tower footing areas, will be permanently damaged due to the construction of towers. Furthermore, crops of about 70.3 acres (7030 decimals) lands, in the RoW except tower footings, will be temporarily damaged because of storage of construction materials, vehicle movements, and construction activities.

In addition, 80m buffer just outside of the RoW is considered as an indirect impact area, in which 40m in the left side and 40m in the right side of the direct impact area. Thus, crops of 394.02 acres of land in this indirect impact area are anticipated to be affected, although

minimal, because of vehicle movement, material storage etc. for construction activities. The loss for these issues is given in Table 8.20 (Unforeseen cost for any other damages during construction). The OHT will have a permanent impact on trees by necessary felling or trimming in the RoW. Presently the laws of Bangladesh do not permit acquisition of land under towers or in the RoW; as such temporary crop impacts and tree impacts are captured herein.

The Project is expected to impact businesses, commercial entities and public spaces by the installation of the RoW of Anowara-New Mooring 400 kV double circuit underground transmission line (UGTL - 5.25km) and LILO 230 kV double circuit UGTL (2.659 km). The summary impacts are shown in **Tables 8.13** and **8.14** below; details are provided in **Annex D**.

Table 8.13: Summary of OHTL interventions and their impacts

OHTL Interventions	Details
Length of OHTL RoW (km)	19.932
Number of River Crossing Towers (RT)	2
Number of Angle Towers (AT)	16
Number of Suspension Towers (ST)	37
Number of Terminal Tower (TT)	1
Total towers (RT, AT, ST & TT)	56
Total area in the OHTL RoW (acre)	98.5
OHTL Impacts	
Total households in the RoW	78
Total households with residential structures in the RoW	76
Total households with commercial structures (poultry farm) in the RoW	1
Total households with family graveyard in the RoW	1
Number of persons expected to be affected due to RT, AT & TT (land & crop impacts)	265
Commercial Enterprises	2
Agricultural land (in acre) under the RT, AT, ST & TT (permanent crop impacts) for tower footing (20m)	1.53
Agricultural land (in acre) in the OHTL RoW (temporary crop impacts) (20m)	70.3
Agricultural land (in acre) outside the OHTL RoW (temporary crop impacts tentative) (80m)	394.02
Trees in RoW (20m)	2396

Source: Initial field survey for the study, 2018

Table 8.14: Summary of UGTL interventions and their impacts

UGTL Interventions	
Total length of UGTL RoW (km)	22.47
Anowara-New Mooring	5.25
LILO of Hathazari-Rampur	2.66
Madunaghat -Khulshi	14.56
UGTL Impacts	
Business entities (mega permanent shops) expected to be affected (number)	96

Business entities (medium permanent shops) expected to be affected (number)	162
Business entities (small temporary shops) expected to be affected (number)	307
Total business entities expected to be affected (number)	565
Taking into account of 10% increase of the numbers	57
Grand Total	622

8.4.4 Impact on Land in the OHTL RoW

The construction of 56 towers and installation of OHTL will be carried out on private agricultural and homestead land, rivers, khals and so on (see **Table 8.15**). This land will not be subject to permanent acquisition, as per the laws of Bangladesh. However, impacts on crops, structures, trees are considered in this RPF entitlement matrix.

Table 8.15: Use of land in the OHTL RoW

Land use	Area in acre
Single crop	41.0
Multiple crop	29.3
Settlement	19.6
Rivers and khals	5.0
Built-up non-linear	2.0
Orchards and other plantations (trees)	1.53
Fresh water aquaculture	0.07
Total	98.5

Source: Remote sensing image used for the study, 2018

Installation of the OHTL (19.932 km x 20m) temporarily requires 98.5 acres of land within RoW and 394.02 acres of land outside the RoW for stringing, establishment of workshop and work sites temporarily during construction. Construction of 56 towers (16 angle towers, 37 suspension towers, 2 river crossing towers and 1 terminal tower) requires 1.53 acres of land in the RoW.

The angle and terminal towers (19 = 16+2+1) will be installed on agricultural land. The exact location for suspension towers is yet to be finalized. Estimated potential losses will be compensated and are included in the entitlement matrix. Impacts, however, on structures, crops, trees in detail are presented in the subsections below.

8.4.5 Affected Residential Structures in the OHTL RoW

There are 78 numbers of entities/properties, including 76 households, one commercial structure (poultry farm) and one graveyard, and their associated structures are located in the RoW. Each entity/property includes multiple rooms/structures (associated structures), and thus, there are total 130 structures.

The following table presents the use of these structures.

Table 8.16: Use of Structures

Use of Structures	Numbers
Houses	73

Use of Structures	Numbers
Sanitary Latrine (Pucca)	1
Tube-well	1
Boundary Wall (Tin)	2
Boundary Wall (Pucca)	5
Kitchen	27
Cowshed	12
Poultry firm	1
Rice Mill	1
Shop	3
Store House	1
Garage	1
Clay Housed (used for fuel storage)	1
Sanitary Latrine (Ring slab)	1
Total	130

These 130 structures, mentioned above, are made of different construction materials. The following table (Table 8.17) shows the number of structures by type of construction materials.

Table 8.17 Affected residential structures by type in the RoW

	Type	Number
1	Pucca	28
2	Semi pucca	37
3	Tin made (roof & wall)	52
4	Tin made (roof only)	12
5	Hut (Temporary & Thatched)	1
6	Total	130

8.4.6 Affected Commercial Structures in the OHT RoW

Within the OHTL RoW commercial structures belong to (i) a poultry farm of a household and to (ii) Karnaphuli Fertilizer Company (KAFCO), a large commercial enterprise. Other than these there is a Marine Workshop of Bangladesh Shipping Corporation (government organization) also under the OHTL. Production of these commercial entities and activities of the Marine Workshop will not be affected as protection measures will be undertaken for stringing of overhead cable.

8.4.7 Temporary Loss of Crops in the OHTL RoW

The affected land is mostly agricultural (>70 percent), with the diversified crops. Hybrid Aus and summer vegetable is grown in Kharif-I season while HYV Boro and winter vegetable is grown in Rabi season. Only HYV Aman is grown in Kharif-II season. Therefore, the single cropped land grows only HYV Aman in Kharif-II season (41 acre). Among the multiple cropped area 14.1 acres of land is triple cropped while 15.2 acre of land is double cropped. Due to water logging, crop cultivation is not possible in double cropped area in Kharif-II season.

Total 239 metric tons crop is cultivated in the RoW. Among these crops 119 metric tons is paddy and 120 metric tons is crops other than paddy. Paddy contains Hybrid Aus (14 metric tons), HYV Aman (83 metric tons) and HYV Boro (22 metric tons) while crops other than paddy contains summer vegetables (28 metric tons) and winter vegetables (92 metric tons).

Compensation for loss of crops will be paid to the affected persons and is considered in the resettlement and rehabilitation (R&R) budget. The total land area being considered for crop loss is 70.3 acres in the RoW for stringing (see **Table 8.17**). Farmers will not be able to cultivate for one season in the RoW area during construction. The land under the towers (1.53 acre for four feet) after construction of the transmission line will no longer be useful for crop cultivation; the surrounding area of the tower footing will lose its fertility. Crop compensation of tower footing area (1.53 acres) is considered for four crop seasons, one season is for crop loss during construction and additional three (3) seasons for resettlement benefit of the permanent loss of crop in the tower footing land. For budget estimate purposes 265 households are anticipated to be affected in the angle and terminal tower area calculated based on the *khatian* data information. Besides, some places in 394.02 acres of land outside the RoW (80m) will be affected during stringing, construction of workshop and work sites; one season crop loss in that area, therefore, is considered. But the area to be required/affected specifically in 80m RoW for stringing and construction of workshops is unknown (at this stage), the cost for crop loss of this area is included in unforeseen cost estimate in the resettlement budget of this RPF.

Table 8.16: Cropping pattern in the OHTL RoW

Cropping Patterns			Area (acre)	% of NCA
Kharif-I	Kharif-II	Rabi		
Hybrid Aus	HYV Aman	HYV Boro	8.8	13
Fallow	HYV Aman	Winter Vegetables	15.2	22
Fallow	HYV Aman	Fallow	41.0	58
Summer Vegetable	HYV Aman	HYV Boro	5.3	8
Total			70.3	100
Cropping Intensity			162%	

Table 8.17: Crop production in the RoW of OHTL

Crop Name	Crop Area (ha)	Crop Yield (ton/ha)	Crop Production (tons)
Hybrid Aus	3.6	3.8	14
HYV Aman	28.5	2.9	83
HYV Boro	5.7	3.9	22
Total Rice	37.7		119
Summer Vegetables	2.1	13	28
Winter Vegetables	6.2	15	92
Total Non-Rice	8.3		120

Grand total	46.0		239
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8.4.8 Loss of Trees in the OHTL RoW

The initial survey indicates that there are 2396 trees (fruit and timber) on private land in the alignment (20m RoW). It is mandatory to remove and trim the trees in and adjacent to the RoW, respectively for ensuring safety. Different sizes and species of trees are anticipated to be affected within the RoW. Compensation for trees is considered in the budget of this RPF. The names of affected trees by number are presented in **Table 8.19** below.

Table 8.18: Affected trees on private land by species and number

Type	Species	Number
Fruit	Mango, Coconut, Plum, Guava, Palmia Palm, Date Palm, Black Berry, Jackfruit, Litchi, Wood Apple, Lemon	448
Timber	Mahogany, Rain Tree, Acacia, Blinding Tree, Chambol, Betel Nut, Lebbek Tree, Gum Arabic, Indian ash tree, Eucalyptus	1368
Medicinal	Indian lilac (<i>Neem</i>), <i>Arjun</i>	30
Groves/clumps	Banana	305
	Bamboo	245
Total	-	2396

8.4.9 Other Impacts in OHT RoW

There is a family graveyard (1) in the RoW of the proposed power transmission line. A household affected with residential structures has an aquaculture pond (0.07 acre) also in the RoW.

8.4.10 Affected Commercial Structures in the UGTL RoW

The underground transmission line (UGTL) installation may hamper movement of customers of business centers adjacent to the RoW of the proposed UGTL. The UGTL installation activities will be done segment wise and it is anticipated that approximately 14 days will be required at a time in a segment. There are 565 shops found along the UGT alignment during the initial survey; 258 of them are permanent and the remaining 307 are small temporary (some of them are portable/mobile/floating). The permanent structures are classified as mega and medium shops. The mega, medium and temporary small shops are defined in terms of their estimated daily profit margin and type of structures. Mega shops refer to those shops that earn 4000 BDT or more than that per day as their profit, medium shops that earn 1500-4000 BDT/day as their profit, and lastly the small shops that earn less than BDT 1500/day. The income, however, of the mega, medium and small shops expected to be affected due to the Project are considered and hence their entitlement for income loss is also included in the entitlement matrix.

8.4.11 Vulnerable Households

The vulnerability assessment of the potentially affected households is not possible at this stage of assessment. Even though, entitlement is considered for the vulnerable households. As such

the budget includes allowances for the vulnerable households in this assessment. Vulnerability impacts of the affected households will be confirmed once detailed design is confirmed and census & inventory of losses survey is done based on that for full resettlement plan preparation.

8.4.12 Social Conflict and Influx of Workers

The influx of a large number of workers from other parts of the Country can potentially cause conflict between the project personnel and the local community. This could be because of differences in culture, religion, social norms, acceptable social behavior, and even dress code. In addition, the construction activities can potentially affect the women activities and movement. Any such impact can be detrimental to the project since it can potentially cause tension between the project and local communities and even disruption of construction works.

The mitigation measures to address impacts associated with the social conflict are listed below.

- The World Bank Guidance Note³² will be used to address potential impacts caused by temporary project induced labor influx.
- The contractor will prepare and implement a Code of Conduct for all site personnel, in consultation and coordination with the local community.
- All site personnel will be provided orientation and training on Code of Conduct. Awareness raising materials such as posters and signage will be used as appropriate.
- All site personnel will be provided awareness and training to prevent communicable diseases, sexually transmitted infections, Human immunodeficiency virus (HIV) infections / Acquired Immune Deficiency Syndrome (AIDS).
- Privacy of women will be respected; routes and places used by them will be avoided as far as possible.
- As described earlier, construction camps will be located at least 500 m away from the communities. Entry of the site personnel in the local communities will be minimized to the extent possible/appropriate.
- No child labor will be engaged by the project or its contractors.
- Liaison with the community will be maintained.
- The GRM described earlier will also address community grievances related to social conflict.

8.4.13 Damage to Cultural Resources

A few cultural resources (religious or cultural significance), i.e. mosques and graveyards have been identified within the project area (see **Table 7.2**). During the construction phase, there is a possibility of any inadvertent damage to these sites. Any such impact can be detrimental to the project since it can potentially cause tension between the project and local communities and even disruption of construction works.

The mitigation measures to address impacts associated with the sites of religious and or cultural importance are listed below.

- The contractor will identify and demarcate any sites and places of religious and or cultural significance, in consultation with the local community. Such sites will be ‘no-go-areas’ and will be avoided as far as possible. If unavoidable, then the contractor will

³² The Note is available at: <http://pubdocs.worldbank.org/en/497851495202591233/Managing-Risk-of-Adverse-impact-from-project-labor-influx.pdf>.

prepare a plan to move/restore such places in consultation with local community and (related authorities if relevant and required). Such a plan will be implemented after obtaining complete consensus of the related community.

- Liaison with the community will be maintained.
- Chance Find Procedures will be put in place.
 - Chance Find Procedure: In the event of discovery of any site or artefact of archeological, historical, cultural, or religious significance, the contractor shall immediately cease all works in that area and report the find to PGCB. Works may not re-commence until approval is given by the PGCB and the Archeological Department. Upon receiving a report of a chance find, the Archeological Department will be notified and their site visit will be facilitated. Further works will be carried out on such sites only after obtaining clearance from the Archeological Department / DoE.
- The GRM described earlier will also address community grievances related to any damage to sites of religious and or cultural importance.

8.4.14 Gender Issues

Primarily because of the influx of construction worker, the proposed project can potentially create a number of gender issues particularly gender-based violence (GBV) and child sex exploitation (SE). These issues can cause serious harm to women and children living in the project area. These issues can be detrimental to the project since they can potentially cause tension between the project and local communities and even disruption of construction works.

The following specific measures need to be taken to address the gender issues:

GBV and SE Risk Assessment

- Assess the risk of GBV and SE for the proposed project. This assessment should incorporate a variety of contextual and project-specific risk factors for GBV and SE, and analyze risks to women and children separately.
- Assess risks related to labor influx for the proposed project. The risk assessment should take into account “the size and scale of a project; the scale of labor influx; the extent to which a community has capacity to absorb labor influx or requires separate camp facilities; the inflow of income to workers, which can exacerbate already existing inequities between workers and community members; and the geographic location of project activities.”

GBV and SE Risk Mitigation

- Develop a plan to prevent and mitigate identified risks. A GBV Action Plan should be put into place for all projects with a substantial or higher level of risk of GBV, and a Labor Influx Management Plan/Workers’ Camp Management Plan should be put into place for projects with high risks related to labor influx. The GBV action plan should include an awareness-raising strategy, an identification of GBV services providers, and procedures for handling GBV allegations. Labor influx mitigation measures should include prioritizing the hiring of local workers (as opposed to migrant workers from other parts of the client country or from another country).
- Raise awareness among affected stakeholders on GBV risks, with a focus on women, adolescents, and children. Project staff and workers should also be trained.

- Assess the capacity of project implementing agencies and units on GBV-related issues and identify capacity-building measures needed.
- Ensure that grievance redress systems have the capacity to address GBV complaints.
 - “Project-level grievance mechanism should have “multiple channels through which complaints can be registered in a safe and confidential manner,” including at least one channel that is accessible to children. “The GRM should not ask for, or record, information on more than three aspects related to the GBV incident: The nature of the complaint (what the complainant says in her/his own words without direct questioning); if, to the best of their knowledge, the perpetrator was associated with the project; and, if possible, the age and sex of the survivor. For GBV, the GRM should primarily serve to: (i) refer complainants to the GBV Services Provider; and (ii) record resolution of the complaint.”
 - For higher-risk projects, a local organization with the capacity to serve as a GBV services provider can also operate a GBV-specific grievance redress system.
- Ensure that contractors put into place GBV-prevention measures:
 - Civil works contracts should incorporate GBV-prevention measures.
 - Contractors should put into place zero tolerance policies for cases of GBV and SE perpetrated by project workers, and codes of conduct that prohibit these activities, including sexual harassment. Workers should be trained on these requirements.
 - If needed, the contractor should be required to institute additional prevention measures, including “separate, safe and easily accessible facilities for women and men working on the site, locker rooms and/or latrines that are “located in separate areas, well-lit and include the ability to be locked from the inside,” visible signs “around the project site (if applicable) that signal to workers and the community that the project site is an area where GBV is prohibited,” and well-lit “public spaces around the project grounds.”
- The World Bank’s good practice note on addressing GBV should be followed.³³
- The contractor will prepare the above-mentioned plans as part of its site-specific environmental and social management plans (further discussed later in the document).

8.5 Compensation and Assistance

8.5.1 Income and Livelihood Restoration

In accordance with the entitlement adopted in this Project, all affected households, businesses and farmers will be entitled to a combination of compensation packages in cash and resettlement assistance depending on the nature of ownership rights on affected/lost assets, scope of the impacts including socioeconomic vulnerability of the affected persons and measures to support livelihood restoration if livelihood impacts are envisaged. The affected persons will be entitled to:

- Compensation for crop loss due to use of land within and along the OHTL RoW;
- Compensation for land loss in the tower footing area of the OHTL;
- Compensation for loss and damage of structures (if any) for construction and repairing;

³³Note is available at: <http://pubdocs.worldbank.org/en/399881538336159607/Good-Practice-Note-Addressing-Gender-Based-Violence.pdf>.

- Compensation for trees to the owners at current market price;
- Assistance for loss of business income; and
- Special assistance to vulnerable households.

In sum, PGCB will provide compensation and assistance to the affected households to the extent possible to ensure that all affected households are compensated well before commencement of the civil works. There will be no physical and economic displacement in the OHTL and UGTL alignment. The affected households will be informed well ahead of construction work schedule (as per Act 2017 and Electricity Act 2018). PGCB will be involved through its PIU in meaningful consultation and participation with the affected people in Project implementation.

8.5.2 Resettlement Costs and Rehabilitation Cost and Budget

The estimated costs and budget for resettlement and rehabilitation (R&R) cover compensation on affected agricultural land, crops, structures, and trees. The costs of land (permanent damage) for the tower footing area as well as construction and repairing costs for structures, compensation for trees, crops and other resettlement benefits are estimated. This budget is an indicative outlay where the ownership information of the affected land is collected from local land office as per Dag/JL/Sheet number during field survey.

These costs estimate will be updated and adjusted once the OHTL and UGTL RoW is finalized based on recommendations of PVAC prior to the Project implementation. Replacement and compensation costs of all affected assets will be updated annually if the PVAC at the district level justifies the same before commencement of civil works for any considerable price escalation. There is also a budget allocation for R&R and a 10 percent contingency over the total budget to meet unforeseen expenditures. Therefore, this budget will remain as a dynamic process for cost estimate during implementation.

8.5.3 Calculation of Estimated Costs

The estimated costs for assets, especially for land which to be requisitioned for use based on replacement costs and compensation, are calculated on the basis of field findings. The current government/mouza rate of land is considered for calculating the compensation for permanent damage of land in tower footing area of OHT. The current market price (CMP) of other assets to be affected complies with replacement value as per resettlement policy of the co-financier (AIIB). The CMP thus prepared will be reviewed, verified and determined by the PVAC. The PVAC rate will be paid by the Project as replacement value/compensation for affected assets.

8.5.4 Summary of Resettlement and Rehabilitation Budget

The total estimated cost and budget for R&R is BDT 179.87 million (USD 2.15million), which is shown in **Table 8.20**. This budget includes compensation for land, structures, standing crops and trees, and R&R benefits. Additional 200 percent premium on the mouza rate is considered for permanent land damage and 100 percent premium with crop production cost of BDT 750/decimal/season is considered for crop compensation. For calculating tree compensation cost of timber value of affected trees are considered from previous study namely – (Resettlement Plan (RP) of proposed Chittagong-Bakhrabad Gas Transmission pipeline Project). This budget also includes R&R operational costs and monitoring costs. Contingency costs are also calculated and incorporated in this budget.

Table 8.19: Breakdown cost of R & R Budget

	Head of Budget	Amount (dec/sft/Nos)	Rate (BDT)	Estimated cost (million BDT)
A	Compensation for permanent damage of land for tower footing	153	427,882	65.5
B	Compensation for crops production @ BDT 750/decimal/season including 100 percent premium for tower footing area and RoW area	7,183	1500	10.8
Sub-total of (A to B)				76.3
C	Compensation for Structure			
C.1	Pucca (pucca floor) sft	4631	1301	6.03
C.2	Pucca (kutcha floor) sft	600	761	0.46
C.3	Semi-pucca (pucca floor) sft	3698	761	2.81
C.4	Semi-pucca (kutcha floor) sft	2548	729	1.86
C.5	Double-barreled tin house (pucca floor) sft	1502	729	1.1
C.6	Double-barreled tin house (kutcha floor) sft	2518	725	1.83
C.7	Tin house with only one slanting roof (pucca floor) sft	80	729	0.06
C.8	Tin house with only one slanting roof (kutcha floor) sft	2001	725	1.45
C.9	Kutcha (sft)	1526	651	0.99
C.10	Thatched (sft)	56	520	0.03
Sub-total of C		19160		16.62
D	Compensation for loss of trees			
D.1	Fruit trees	448	6000	2.7
D.2	Timber trees	1368	11300	15.5
D.3	Medicinal trees	30	9600	0.3
D.4	Bamboo	245	350	0.1
D.5	Banana	305	400	0.1
Sub-total of D				18.7
E	Resettlement and Rehabilitation Benefits			
E.1	Reconstruction grant @10% of non-shift-able structures			1.1
E.2	Shift-able grant @5% of shiftable structures			0.3
E.3	Income restoration grant for 14 days income loss (@BDT4000x14) of each permanent shops (mega) for underground transmission	96	56000	5.4
E.4	Income restoration grant for 14 days income loss (@BDT2500x14) of each permanent shops (medium) for underground transmission	162	35000	5.7
E.5	Income restoration grant for 14 days income loss (@BDT1500x14) of each temporary shop for underground transmission	307	21000	6.4

E.6	Cash grant for loss of agricultural income in the tower footing area equivalent to crop loss for three crop seasons	153	4500	0.7
E.7	Special assistance for Vulnerable people	100	10,000	1
Sub-total of E				20.6
10 % of Sub total E				2.06
F	Operation cost for R&R @5% of total from A to B			6.6
G	Monitoring cost @5% of total from A to B			6.6
H	Unforeseen cost for any other damages during construction			20
Sub total (F to H)				33.2
I	Contingency @10% of the sub-total (A-E)			13.2
Total Estimated Budget (In Million BDT)				180.68
Total Estimated Budget (in Million USD)				2.15

Source: Field survey, CEGIS, 2018

Note: 1 US Dollar (USD) = 83.85 BDT as the exchange rate of Bangladesh Bank on 12th November, 2018
100 Decimal = 1 Acre, Due to calculating the budget according to local unit Decimal is used.

8.5.5 Assessment of Unit Value for Compensation

Details of the compensation cost estimation for land, structures, crops and trees are presented sequentially below.

8.5.6 Replacement Value of Land

Replacement value of land is calculated using the current mouza rate recorded in the Sub Registry Office (land) plus 200 percent premium with mouza rate. The average rate of land in the Project area by mouza name is presented in **Table 8.21** below. The PVAC will finally decide the rates by types of land and location before commencement of the civil works under the Project.

Table 8.20: Average rate of land in Project area by mouza name

Mouza Name	Mouza rates (in BDT per decimal)
Dudkumar	29,296
Boirag	147,313
Chaturi	211,329
Koinpur	25,993
Dowlotpur	152,124
KaiGram	70,470
Sikolbaha	234,574
Chor lokkha	269,920

Mouza Name	Mouza rates (in BDT per decimal)
Average Mouza rate	142,627
Actual CCL including 200% premium	427,882

Source: Field survey, CEGIS, 2018

The replacement value of land for tower footing area is presented in **Table 8.22**. The OHTL tower footing area in 19.932km RoW cover 1.53 acre (153 decimal) of land which incur permanent damage of land. The total estimated cost of land for permanent damage is about BDT 65.5million.

Table 8.21: Estimated amount of land compensation for the Project

Quantity in decimal	Actual rate in BDT per decimal	Total estimated cost (Million BDT)
153	427,882	65.5

Source: Field survey, CEGIS, 2018

8.5.7 Cost of Structures

The replacement and repairing (if needed) costs of the structures affected due to the Project is presented in **Table 8.23**. Total estimated replacement and repairing costs of the affected structures by type are BDT 16.61million.

Table 8.22: Estimated compensation amount for primary structures

	Structure Type	Quantity in sft. /No.	Rate in BDT	Estimated amount of Compensation (in million BDT)
1	Pucca (pucca floor) sft	4631	1301	6.03
2	Pucca (kutcha floor) sft	600	761	0.46
3	Semi-pucca (pucca floor) sft	3698	761	2.81
4	Semi-pucca (kutcha floor) sft	2548	729	1.86
5	Double-barreled tin house (pucca floor) sft	1502	729	1.10
6	Double-barreled tin house (kutcha floor) sft	2518	725	1.83
7	Tin house with only one slanting roof (pucca floor) sft	80	729	0.06
8	Tin house with only one slanting roof (kutcha floor) sft	2001	725	1.45
9	Kutcha (sft)	1526	651	0.99
10	Thatched (sft)	56	520	0.03
Total (In Million BDT)		19160		16.61

Source: Field survey, CEGIS, 2018

8.5.8 Compensation for Crops

Compensation for standing crops in the tower area (including footing area) as well as in RoW is considering the market value as BDT 750 per decimal. One hundred percent (100 percent) premium is added with the CMP of crop following the government law. Therefore, total cost for compensation of standing crops is estimated as BDT 10.8 million (**Table 8.24**).

Table 8.23: Estimated amount of compensation for standing crops

Types	Quantity in decimal.	Rate in BDT	Total estimated cost (in million BDT)
Compensation for crops production @ BDT 750/decimal/season including 100% premium for tower footing area and RoW area	7,183	1500	10.8

Source: Field survey, CEGIS, 2018

8.5.9 Compensation for Trees

The cost of affected trees due to the Project is estimated in **Table 8.25**. The total estimated amount for compensation on trees is BDT 18.6 million

Table 8.24: Estimated cost of affected trees in the project area

Tree type	Number	Rate (in BDT/No.)	Estimated cost (in million BDT)
Fruit trees	448	6000	2.7
Timber trees	1368	11300	15.5
Medicinal trees	30	9600	0.3
Bamboo	245	350	0.1
Banana	305	400	0.1
Total			18.6

Source: Field survey, CEGIS, 2018

8.5.10 Resettlement and Rehabilitation Assistance

Resettlement and rehabilitation (R&R) assistance is considered in addition to compensation to be given against losses of assets the affected persons as per the guideline of co-financier (AIIB). In this regard, total BDT 18.9million is estimated for different types of allowances (**Table 8.26**). The affected persons will be received the following assistances:

- Reconstruction grant for non shiftable structures;
- Transfer grant for shifting of structures;
- Assistance for loss of business/ wage income; and
- Special assistance to vulnerable households with support to livelihood and income restoration.

Reconstruction Grant

In the budget, the House Reconstruction Grant (HRG) for non-movable residential and commercial structures will be considered. The HRG will be 10 percent of non shiftable affected structures of both titled and non-tilted owner(s).

Shifting Grant

Shifting Grant is an additional assistance which is incorporated within budget. Shifting Grant for movable residential and commercial structures will be 5 percent of the replacement value of structure.

Income and Livelihood Restoration Grant

For business units, compensation or grant is considered in the budget for income loss. An amount of BDT 21.56 million is estimated as business income restoration grant for 14 days for each of two categories of shops (permanent and temporary) in the UGTL RoW. Permanent shops are classified as (i) mega shops, and (ii) medium shops. Thus BDT4000, BDT2500, and BDT 1500 calculated as per day income on average of mega, medium and temporary shops, respectively will be given as compensation to the affected persons in the UGTL RoW.

Special assistance to vulnerable households

One-time allowance equivalent to BDT10,000/ for vulnerability in addition to other entitlements for supporting livelihood and income restoration. This amount is not included in the budget but the provision of this special assistance is kept in the entitlement matrix of this RPF.

Table 8.25: Estimated cost for resettlement benefits of the affected entities

Types of Benefits	Amount (dec/sft/No.)	Rate in BDT	Estimated cost (million BDT)
Reconstruction grant @10% of non shiftable structures			1.1
Shifting grant for shiftable structure @5% of the replacement value of structure			0.3
Income restoration grant for 14 days income loss (@BDT4000x14) of each permanent shops (mega) for underground transmission	96	56000	5.4
Income restoration grant for 14 days income loss (@BDT2500x14) of each permanent shops (medium) for underground transmission	162	35000	5.7
Income restoration grant for 14 days income loss (@BDT1500x14) of each temporary shop for underground transmission	307	21000	6.4
Cash grant for loss of agricultural income in the tower footing area equivalent to crop loss for three crop seasons	153	4500	0.7
One- time allowances for Vulnerable Families	100 ³⁴	10,000	1.0

34 Estimated 100 Vulnerable households

Types of Benefits	Amount (dec/sft/No.)	Rate in BDT	Estimated cost (million BDT)
Total	-	-	20.6

Source: Field survey, CEGIS, 2018

9. Analysis of Associated Facilities

This Chapter provides an overview of the environmental and social conditions and potential impacts of the associated facilities of the proposed project.

9.1 Objective of Analysis

According to AIIB Environmental and Social Framework (ESF)³⁵ “Associated Facilities are activities that are not included in the description of the Project set out in the agreement governing the Project, but that the Bank determines, following consultation with the Client, are: (a) directly and materially related to the Project; (b) carried out or planned to be carried out, contemporaneously with the Project; and (c) necessary for the Project to be viable and would not be constructed or expanded if the Project did not exist.”

The associated facilities for the proposed project include substations which will be directly connected to the proposed transmission lines, for instance, the Anowara GIS substation, which is connected to the transmission lines proposed in this project.

The project will form part of the overall transmission network and under this project there is no dedicated power evacuation lines for any generation facilities. Therefore it is concluded that none of the generation facilities can be considered as associated facilities.

9.2 Anowara GIS Substation

The proposed Anowara 230/132/33 kV GIS Substation (with future provision for 400 kV substation) is going to be constructed at Barasat union under Anowara Upazila in Chattogram district. Anowara GIS Substation together with the components of this proposed project were included in the Initial Environmental Examination (IEE) for DoE approval. The site clearance certificate (including that for Anowara GIS Substation) from the DoE has been received on 04/03/2018 vide the office Memo No: 22.02. 0000. 018. 72. 29. 18. 110 (see Annex A).

About 20 Acres of land will be acquired to install the proposed substation. The land is mainly private where agricultural activities are carried out. Most of the land is cultivated with three crops and the rest of the land is two cropped. As a result, land and crop compensation is mandatory. This area was affected by flood back in 1991. There is no water logging problem in this land. In rainy season if heavy rainfall occurs, water logging duration is maximum three days. Communication facility is sound as the site is situated beside main road. Moreover, local labor is available in that area.

The key physical features of the substations are given in **Table 9.1**.

Table 9.1: Salient Features of Anowara GIS Substation

Features	Specification
Type	Proposed
Land ownership	20 acres land acquired by PGCB
Type	GIS (Indoor)
MVA	2X350/450 MVA (230/132 kV level) 2X80/120 MVA (132/33 kV level)

³⁵ Published in February 2016, Page no. 15

Features	Specification
Voltage level	230/132/33 kV
Insulation Medium Power Circuit Breaker	SF6 GAS
Transformer	Gas insulated
Control System	Both manual and automation
Communication System	Optical fiber communication
Fault detector	Relays
Fire Protection System	Auto fighting water spray System
Duration of Project Implementation	Approximately 30 months form the contact signing.

9.2.1 Baseline Conditions

Surface Water. Chattogram is both a hilly and a coastal district. Surface water is available from spring, river lakes, ponds and especially from sea. Major surface water bodies are the Bay of Bengal, Sangu, Karnaphuli, Bakkhali, Koholia, and Meghna. The proposed Anowara substation is located beside the Parki beach.

Ground Water. Ground water is easily available in most of the project areas. Salinity is a main issue in Anowara Upazila according to local people.

Drainage Congestion. Low agricultural land has been selected for proposed substation site at Anowara. In monsoon, the land proposed for substations are inundated with approximate 2 to 3 feet depth. It takes not more than 3 days to drain out the excess rain water from land through the khal in front of the proposed substation.

Noise. Table 9.2 shows the noise level at the study area and found within the standard. However, details of noise quality would be carried out in the major field investigation to be conducted during ESIA of Anowara substation.

Table 9.2: Noise Level of Anowara Substation

Date and Time	Location	GPS Coordinate	Noise Level (dBA)
18.04.17 04:32pm	Anowara Proposed substation site	N 22° 12' 22" E 91° 49' 35"	47

Source: CEGIS Study '2017

Agricultural Resources. The Anowara substation will require 8.09 ha of land. The proposed land is an agricultural land where almost half of the land is three cropped. The only cropping pattern of this site is high yield variety (HYV) *Aus* rice - HYV *Aman* rice - HYV *Boro* rice. During Kharif-I HYV *Aus* is grown in almost half of the land.

HYV Aman covers the entire land in Kharif-II while some portion remains uncultivated during Rabi season when HYV *Boro* rice is the only crop. Therefore, cropping intensity of this area is 250 percent.

A total of 70 tons rice is produced in this area annually, of which Aus, Aman and Boro production is 18 metric tons, 24 metric tons and 28 metric tons, respectively.

Ecological Resources. The proposed substation site is purely an agricultural land used for cultivation of different rice varieties. Periphery of the area is covered with Indian Coral Tree, Shialmutra (a shrub of poppy family) as well as Common Duckweed. In addition, a bunch of Arum (a flowering plant) is also present in the project area. Of the fauna, Black Drongo, Indian Pond Heron and Blue-eared Kingfisher have recorded as common species. The proposed site for the substation is shown in **Figure 9.1** below.



Figure 9.1: Proposed Site for Anowara Substation

Socio-economic Resources. Anowara GIS Substation of PGCB will be constructed on private land in Barasat union. The Substation requires 20 acres of land for its implementation in Dudkumar mauza in the Project area. These 20 acres of land consist of 181 parcels of land including three types of land ownerships: land for mosque (no structure); Government Khas Land; and Bangladesh Water Development Board land.

Of the total 181 land owners, 130 are male (71.82 percent) and 51 are female (28.18 percent). All those affected are titled land owners while there may have some sharecropper, lessee and agricultural laborer (non-titled) who will also be affected due to the Project intervention.

9.2.2 Potential Impact

Air Quality. Air quality will be deteriorated slightly by transportation of construction materials to the Anowara substation site and operation of construction machinery for civil works (land filling, foundation, RCC work). Exhaust emission from the construction machineries and material carrying vehicles during construction activities will affect the ambient air quality.

Mitigation

- Water should be sprayed on road and material stockyards

- Construction machinery and vehicles should be maintained in good working condition to minimize exhaust emissions.
- Construction material should be covered with thick polythene while transporting

Water Resources. Construction wastes at substation site like sand, cement, stone, brick chips would create obstacle and contamination in water bodies during construction period. Waste effluents from construction site and also from the substation during the O&M phase would also adversely affect the local water resources.

Mitigation

- The surrounding areas of the project should be kept clean.
- Signboards and public awareness are also required.
- Waste effluents from construction site and substation will be treated before being released to the environment.

Agricultural Resources. The project will convert the agricultural land into permanent structure. Approximately 70 metric tons rice per year will be lost permanently.

Mitigation

- Fallow lands should be selected for the construction of towers and Substations.
- If avoiding is not possible, proper compensation should be provided to the land owners and growers (for both standing crops and land).

Ecological Resources. Some part of the project location is a borrow-pit providing habitat to some birds and invertebrates. This area will need to be cleared to construct the substation building and all trees and vegetation will need to be removed. This will cause permanent destruction of this habitat.

Mitigation

- Avoid vegetation loss as much as possible during earthwork
- Carry out tree plantation in the open areas around the new substation building
- Keep vegetative area untouched during stockpiling of construction
- Avoid construction work during breeding season and destruction of nests and wildlife habitats;
- Use low sound emitting machineries during construction and avoid works in night.

Socio-Economic Resources: This project needs to acquire 20 acres of land. Due to land acquisition, arable land would be impacted in terms of construction of substation and stringing transmission line using those lands. According to the farmers, use of land for proposed substation and tower construction would affect land type of existing land that would have impact on the value of land in project.

Mitigation

- Fallow or barren land needs to be identified for land acquisition.
- Proper compensation should be paid to the affected land owners before the construction of substation.

10. Environmental and Social Management Plan

This chapter describes the environmental and social management plan (ESMP) of the Project. It describes institutional arrangements for the environmental and social management of the project, provides mitigation and monitoring plans, presents monitoring and reporting requirements, and recommends environmental and social trainings to be conducted by various project entities.

10.1 Objectives of ESMP

The basic objective of the ESMP is to manage adverse impacts of proposed project interventions in a way that minimizes the adverse impact on the environment and people in the project area. The specific objectives of the ESMP are to:

- Facilitate the implementation of the mitigation measures discussed earlier in the document.
- Maximize potential project benefits and control negative impacts;
- Draw responsibilities for PGCB, contractors, consultants, and other members of the project team for the environmental and social management of the Project;
- Define a monitoring mechanism and identify monitoring parameters in order to:
 - Ensure the complete implementation of all mitigation measures,
 - Ensure the effectiveness of the mitigation measures;
- Assess environmental training requirements for different stakeholders at various levels.

10.2 Inclusion of Relevant Components of ESMP in Contract Documents

The ESMP of the Project along with the ECPs (discussed later in the Chapter) will be included in the construction bid documents and also reflected in the construction contracts. The technical specifications of the bid documents will clearly state that contractor will need to comply with the mitigation measures provided in ESMP and ECPs; AIIB ESP and Environmental and Social Standards, and national regulatory requirements.

10.2.1 BOQs in Bid Documents

The following items will be included in the bill of quantities (BOQs) of construction bid documents:

- Preparation and implementation of Contractor's Environmental Action Plan in compliance with ESMP, AIIB ESP and Environmental and Social Standards, and national standards on air, noise, water quality, and others.
- Provision of an Environmental Officer and an Occupational Health and Safety Officer (for the duration of construction phase)
- Providing and maintenance of Vibration Meters and Dust Measurement Meters for spot measurements
- Air quality monitoring (PM₁₀, NO₂, SO₂, CO₂, CO) and noise monitoring at locations specified by the PGCB.

After award of the contract and before mobilization, the Contractor will need to prepare Construction ESMP (CESMP) with site specific mitigation measures for approval by PGCB.

PGCB will ensure that contractors and their subcontractors carry out their responsibility of implementing the mitigation measures, monitoring plan as well as other environmental and safety measures provided in the ESMP.

10.2.2 Payment Milestones

Payments to contractors would be linked to environmental and social performance, measured by completion of the prescribed environmental and social mitigation measures. Contractors would be required to join forces with the executing agency, project management unit, supervising consultants and local population for the mitigation of adverse impacts of the project. For effective implementation of the proposed mitigation and monitoring measures they will be required to employ trained and experienced environmental management staff. In addition, for any non-compliance causing damages or material harm to the natural environment, public or private property or resources, the contractor will be required to either remediate / rectify any such damages in a timeframe specified by and agreed with the engineer, or pay PGCB for the cost (as assessed by PGCB) of contracting a third party to carry out the remediation work.

10.3 Institutional Arrangements

The overall responsibility of environmental and social performance of the project and effective ESMP implementation will rest with PGCB. PGCB will establish the Project Implementation Unit (PIU) to lead the Project implementation. The PIU will be headed by the Project Director (PD). An Environment and Social Unit (ESU), comprising qualified environmental and social development staff, will be established under the PIU. The ESU will assist the PIU on issues related to environmental and social management and oversee the Construction Supervision Consultant (CSC) and contractors. The ESU will compile quarterly regular progress reports on ESMP compliance, to be sent to the Project Director and also shared with the AIIB, throughout the construction period. The ESU will also provide trainings to the PGCB field personnel responsible for monitoring of environmental compliance during both construction and O&M phases of the project.

The PIU will engage construction supervision consultants (CSC) to supervise the construction contractors in order to ensure design compliance and quality assurance of the construction activities. The CSC will also supervise the contractors for ESMP implementation. For this purpose, CSC will engage environmental and social development specialists.

The contractors in turn will also have environmental, (occupational) health and safety (EHS) supervisors who will be tasked to first develop CESMP in accordance with the present ESMP and then responsible for its implementation during construction activities.

The organogram of PIU is shown in **Figure 10.1**; **Table 10.1** presents the responsibilities of PIU, its consultants, and construction contractor(s).

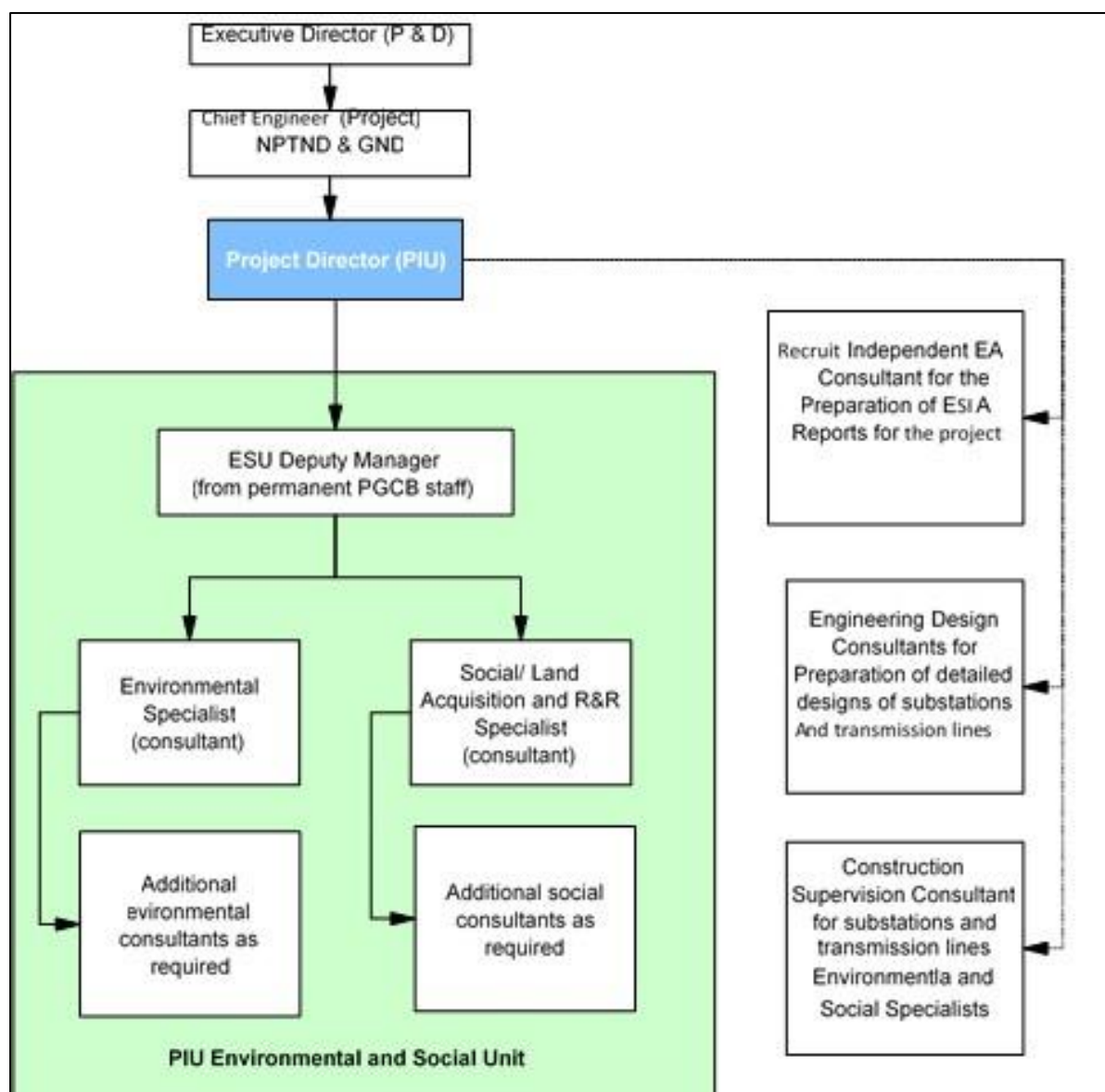


Figure 10.1: Organogram for Environmental and Social Management of Project

Table 10.1: Roles and Responsibilities for ESMP Implementation

Organizations	Responsibilities
PIU	<ul style="list-style-type: none"> • Ensure effective implementation of the project in accordance with the plans • Ensure that all project activities are well-managed and coordinated. • Establishing ESU and engaging environmental and social development specialist in it. • Recruitment of consultants for ESIA and engineering designs; and obtain approval of ESIA from the DoE • Procurement of works and goods.

Organizations	Responsibilities
	<ul style="list-style-type: none"> • Payment of compensation to the project affecters • Recruitment and supervision of Construction Supervision Consultants (CSC). • Report to AIIB.
ESU within PIU	<ul style="list-style-type: none"> • 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 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 plans and measures for O&M phase. • Commissioning and oversight/review of consultant reports for ESIA/ESMPs to be developed for the subcomponents of the Project.
CSC	<ul style="list-style-type: none"> • Supervise civil works, ensuring compliance with all design parameters including quality requirements • Supervising contractors for ESMP implementation • Prepare monthly reports and submit to PIU • CSC will have dedicated environmental, occupational health and safety and social staff.
Contractor	<ul style="list-style-type: none"> • Responsible for implementation of mitigation measures and monitoring proposed in the ESMP • Preparation and implementation of CESMP • 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.

10.4 Environmental and Social Management

The environmental and social management of the project will be achieved through implementation of a number of plans, which are discussed below.

10.4.1 Environmental Code of Practices for Construction

The environmental codes of practice (ECPs) are generic, non-site-specific guidelines for the construction phase. The ECPs consist of environmental and social management guidelines and practices to be followed by the contractors for sustainable management of all environmental issues. The contractor will be required to follow them and also use them to prepare site-specific management plans (discussed later in the Section). The ECPs are listed below and attached in **Annex C**.

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Substances Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Top Soil Management
- ECP 8: Topography and Landscaping
- ECP 9: Borrow Areas Management
- ECP 10: Air Quality Management
- ECP 11: Noise and Vibration Management
- ECP 12: Protection of Flora
- ECP 13: Protection of Fauna
- ECP 14: Protection of Fisheries
- ECP 15: Road Transport and Road Traffic Management
- ECP 16: Construction Camp Management
- ECP 17: Cultural and Religious Issues
- ECP 18: Workers Health and Safety.

10.4.2 Construction Stage Site Specific Management Plans

As stated earlier, construction contractor(s) will be required to prepare and implement CESMP. The contractors will need to obtain CSC's approval of the CESMP. The key elements of CESMP will include the following:

- **Pollution Prevention Plan** will be prepared and implemented by the contractor on the basis of the mitigation measures given in this ESIA and ECPs.
- **Waste Disposal and Effluent Management Plan** will be prepared and implemented by the Contractor on the basis of the EMP and ECP.
- **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.

- **Occupational Health and Safety (OHS) Plan** will be prepared and implemented by the contractor on the basis of the present ESMP, ECPs, and other relevant standards.
- **Traffic Management Plan** will be prepared by the contractor after discussion with PGCB and 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.
- **Construction Camp Management Plan** will be prepared by the contractor. The Plan will include the camp layout, details of various facilities including supplies, storage, and disposal.
- **Fuel and Hazardous Substances Management Plan** will be prepared by the contractor in accordance with the present ESMP, standard operating procedures and other relevant guidelines, and where applicable, material safety data sheets (MSDS). The Plan will include the procedures for handling the oils and chemical spills.
- **Spoil Management Plan** will be prepared by the contractor on the management of excess spoils from various excavation activities.
- **Emergency Preparedness Plan** will be prepared by the contractor after assessing potential risks and hazards that could be encountered during construction.
- **Communication Plan** to deal with the interaction of the community, complaints management, workers recruitment, notice of works and workers conduct with locals.

10.4.3 Mitigations and Compliance Monitoring Plan

The mitigation and compliance monitoring plans (compliance monitoring is discussed later in the Chapter) are the key element of ESMP to be prepared on the basis of impact assessment described in **Chapters 7** and **8**. The Plan describes the potentially negative impacts of each subproject activity, lists mitigation and control measures to address the negative impacts, and assigns responsibilities for implementation and monitoring of these measures. The Plan is given in **Table 10.2**.

Table 10.2: Mitigation and Compliance Monitoring Plan

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
Design/Pre-Construction					
1.1. Change of Land Use, land acquisition	Location of substations will be selected in uncultivated areas, to the extent possible. Transmission lines will be aligned to minimize impacts on cultivation fields and other important areas. Compensation will be paid to the land owners for the land permanently acquired for the project. Similarly, assistance will be paid to the persons/households losing their livelihoods.	PGCB	-	Documentary evidence of payment of compensation and assistance; Number of complaints related to land use change and compensation received through GRM; Number of complaints resolved.	Before construction
1.2. Loss of crops, trees, buildings	Compensation and assistance will be paid to the PAPs	PIU/CSC	CSC	Documentary evidence of payment of compensation and assistance Income levels of affected households; Number of public grievances re resettlement and compensation received; Number of complaints resolved.	Before construction
	Contractors will lease the land for construction facilities on temporary basis. Proper documentation will be carried out for this leasing. Site selection will be carried out in consultation with the community and local officials; approval from CSC will also be required for the selected sites.	Contractor	CSC	Documentary evidence of land leasing for temporary facilities CSC approval for the selected site(s) Absence of grievances regarding temporary facilities	Before contractor mobilization
1.3 Soil, water and noise pollution	A pollution prevention plan will be prepared in accordance with ECPs, national and IFC standards	Contractor	CSC	Approved plan; Plan itself will outline appropriate KPIs for its implementation.	Before construction

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
1.4 Disposal of excavated material	Identification of re-use of excavated material on site, to reduce off site effects Maximization of use excavated material in construction.	Contractor	CSC	Availability of plan to dispose excavated material.	Before construction
1.5 Water quality	Drainage system will be designed so that all spills will be drained and collected in a sump for further appropriate disposal; and Oil and chemical storage and vehicle wash and oil change facilities will be established on impermeable surfaces to avoid percolation	Contractor	CSC	Monitoring in accordance with Drinking Water and Sanitation Plan. No breaches of Material Safety Data Sheet (MSDS) for hazardous substances.	Before construction
1.6 Traffic Management	A Traffic Management Plan (TMP) will be prepared in accordance with ECP	Contractors	CSC	Approved TMP; Plan itself will outline appropriate KPIs for its implementation.	Before mobilization of contractor
1.7. Construction camp (and other temporary facilities) site selection	Site for construction camp will be selected with approval from the Construction Supervision Consultants (CSC). Areas having thick/dense vegetation will be avoided as far as possible. No <i>beels</i> (water ponds) or <i>khals</i> (water channels) will be affected.	Contractor	CSC	Approval from CSC Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.8. Construction camp management	Construction Camp Management Plan will be prepared per ECP and approval obtained from CSC.	Contractor	CSC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.9. Waste management	A Waste Management Plan will be prepared per ECP and approval obtained from CSC.	Contractor	CSC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.10. Fuels and hazardous substances management	A fuels and hazardous substances management plan will be prepared per ECP and approval obtained from CSC.	Contractor	CSC	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
1.11. Water resource management	A Drinking Water Supply and Sanitation Plan will be prepared per ECP and approval obtained from CSC.	Contractor	CSC	Approved Plan Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.12. Occupational Health and Safety (OHS) management	An OHS management plan will be prepared per ECP, and approval obtained from CSC.	Contractor	CSC	Approved Plan Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.13. Drinking water and sanitation	A drinking water and sanitation plan will be prepared per ECP and approval obtained from CSC	Contractor	CSC	Approved Plan Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.14. Emergency Preparedness	An emergency preparedness plan will be prepared and approval obtained from CSC	Contractor	CSC	Approved Plan Plan itself will outline appropriate KPIs for its implementation	Before mobilization of contractor
1.15. Communication and community liaison	A communication plan will be prepared	PIU	-	Approved Plan; Plan itself will outline appropriate KPIs for its implementation	Before site activities.
2. Contractor Mobilization and Demobilization; Transportation of Materials and Supplies					
2.1. Traffic management	<ul style="list-style-type: none"> The contractor will implement the traffic management plan. Construction activities will be scheduled in a manner to avoid peak traffic hours. Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police. Traffic signage will be placed where necessary and appropriate to warn the drivers and pedestrians about the construction activities. ECP to be implemented 	Contractor (with PIU's assistance)	CSC	Number of any non-compliance reports Number of complaints / grievances. Number of traffic accidents/incidents involving project vehicles and lorries bringing materials and supply to project	During mobilization and de-mobilization

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> GRM will address the traffic congestion elated issues. 				
2.2. Soil Erosion and Contamination	<ul style="list-style-type: none"> Contractor will implement the Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected. Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil Contractor will confine the contaminants immediately after such accidental spillage Contractor will collect contaminated soils, treat and dispose them in environment friendly manner All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation Top soil to be stripped and stockpiled where practical. Temporary stockpiles to be protected from erosion. For sewage waste, appropriate treatment arrangement such as septic tanks and soakage pits will be installed on site. Water will percolate into the ground so there will be no discharge. Alternatively, sewage from construction camps and other facilities will be collected and transported to nearby municipal sewage treatments plans. ECPs will be implemented. 	Contractor	CSC	Number of any non-compliance reports Number of complaints	Throughout contractor mobilization and de-mobilization
2.3. Air Quality	<ul style="list-style-type: none"> The equipment and vehicles used during the construction process will comply with the national as well as IFC Guidelines on exhaust emissions. Concrete batching and asphalt plants will be located minimum 500 m away from residential areas and will have appropriate dust/emission suppression mechanisms such as wet scrubbers. 	Contractor	CSC	Number of non-compliance reports. Number of community complaints. Ambient air quality found beyond the national and WBG EHS Guidelines	Throughout contractor mobilization and de-mobilization

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> Contractor will implement dust prevention measures such as watering of roads near the residential areas and spraying of water on loose material where required and appropriate. Regula air monitoring will be carried out near the sensitive receptors (Table 7.2) to ensure ambient air quality remains within the limits defined by national standards and IFC Guidelines. Measures will be taken to protect the workers from excessive dust (i.e., usage of personal protective equipment). A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase. ECP on air quality management will be implemented. 				
2.4. Noise	<ul style="list-style-type: none"> The equipment and vehicles used during the construction process will comply with the national standards as well as IFC Guidelines on noise. Contractors will adopt appropriate noise attenuation measures to reduce the noise generation from construction activities. The noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around drilling equipment. The construction activities near the settlements will not be carried out during night time. Regular noise monitoring will be carried out near the sensitive receptors listed in Table 7.2. 	Contractor	CSC	Number of non-compliance reports; Noise measurement data Number of community complaints.	Throughout contractor mobilization and de-mobilization

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> • A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase. • ECP on noise quality management will be implemented. 				
2.5. Safety hazards	<ul style="list-style-type: none"> • Occupational health and safety procedures and OHS Plan will be enforced. Public safety will be included in the Plan. • Implement fuels and hazardous substances management plan • Fencing would be provided around construction sites as appropriate to minimize public safety risks. • A Traffic Management Plan will be implemented that will aim at ensuring access to residential areas, and preventing of unsafe situations, especially near schools, housing areas, construction areas, camps and offices. • Special attention should be focused on safety training for workers to prevent and restrict accidents and on the knowledge how to deal with emergencies. • Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic. • Liaison with traffic police and communities will be maintained • Project drivers will be trained on defensive driving. • Vehicle speeds near / within the communities will be kept low, to avoid safety hazards. 	Contractor	CSC	Number of any non-compliance reports; Number of any related public complaints Number of accidents, incidents and near-misses.	Throughout contractor mobilization and de-mobilization

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> Awareness raising of communities will be carried out about the construction activities and associated safety hazards. ECPs will be implemented. 				
2.6. Damage to Infrastructure	All damaged infrastructure will be restored to original or better condition.	Contractor	CSC	Number of any non-compliance reports; Number of any public complaints.	Throughout contractor mobilization and demobilization
2.7. Blocked routes	<ul style="list-style-type: none"> Contractor will prepare and implement a traffic management plan, in consultation and coordination with the local community The community will be informed about the nature of construction activities and possibility of any blocked route; alternate routes will be identified with the help of local/affected community. Duration of such blockage will be minimized to the extent possible. Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police. Liaison with the community will be maintained. The GRM described earlier will also address community grievances related to any blockage of local routes. 	Contractor	CSC	Number of any non-compliance reports Number of complaints	Before and during construction
3. Construction workers camp establishment and operation					
3.1. Soil erosion; soil and water contamination	<ul style="list-style-type: none"> Camp management plan will be implemented location of camp will be selected after obtaining CSC's approval and in consultation with local community Photographs will be taken to record the site conditions prior to the establishment of the camp. Land clearing, leveling and grading will be minimized, and carried out in a manner to minimize soil erosion. 	Contractor	CSC	Compliance to the Camp Management Plan, Waste Management Plan Number of any non-compliance reports Results of soil and water quality analysis	Before and throughout the construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> • Camp will have rainwater drainage arrangements • Camps will have protection arrangements against soil erosion • Contractors will implement the Waste Management Plan and Pollution Prevention Plan. • For the domestic sewage, appropriate treatment and disposal system (e.g., septic tank and soaking pits) will be constructed having adequate capacity • Waste oils will be collected in drums and sold to the recycling contractors. • The inert recyclable waste from the site (such as cardboard, drums, and broken/used parts) will be sold to recycling contractors. The hazardous waste will be kept separate and handled according to the nature of the waste. • Domestic solid waste from the camp site will be disposed off in a manner that does not cause soil contamination. • The contractor will identify suitable sites for disposal of hazardous and non- hazardous waste. The selection will be done in consultation with the PIU and the local municipal authorities. No waste disposal will be carried out in khals, beels and rivers. • Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil • Contractor will confine the contaminants immediately after such accidental spillage • Contractor will collect contaminated soils, treat and dispose them in environment friendly manner • All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation 			Number of related complaints	

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> The camp site area will be completely restored after completion of construction works. All temporary structures will be demolished, ECPs will be implemented. 				
3.2. Air Quality	<ul style="list-style-type: none"> Pollution prevention plan will be implemented The equipment and vehicles used during the construction process will comply with the national as well as IFC Guidelines on exhaust emissions. Measures will be taken to protect the workers from excessive dust (i.e., usage of personal protective equipment). A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase. ECP on air quality management will be implemented. 	Contractor	CSC	Number of any non-compliance reports Air quality monitoring data Number of related grievances	Throughout the construction phase
3.3. Vegetation loss; threat to wildlife	<ul style="list-style-type: none"> Clearing natural vegetation will be avoided as far as possible. The camp will be established in a natural clearing, to the extent possible. Complete record will be maintained for any tree cutting. The camp staff will not indulge in any animal shooting, trapping, catching, or killing activities. Include information on wildlife protection in all tool-box orientation briefings for camp staff Contractors shall use lower wattage flat lens fixtures that direct light down and reduce glare, and shall avoid use of flood lights. 	Contractor	CSC	Number of any non-compliance reports Number of trees felled Number of sighting of key wildlife species	Before and throughout the construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> Contractors will also raise awareness about the protection of birds and other wildlife species among the work force to reduce impacts such as disturbance and poaching ECPs will be implemented. 				
3.4. Noise and vibration	<ul style="list-style-type: none"> Pollution prevention plan will be implemented. Generators and vehicles will have exhaust mufflers (silencers) to minimize noise generation. Liaison with the communities will be maintained. Noise monitoring will be carried out. Compliance will be ensured with national and WBG EHS Guidelines. GRM will be put in place ECP will be implemented. 	Contractor	CSC	Number of any non-compliance reports Noise monitoring data Number of grievances regarding noise	Throughout the construction phase
3.5. Health and Safety	<ul style="list-style-type: none"> Construction camps will be located at least 500 m away from the communities. Entry of the site personnel in the local communities will be minimized to the extent possible / appropriate. OHS plan will be prepared and implemented Implement fuels and hazardous substances management plan Drinking water management plan will be implemented Protective fencing to be installed around the Camp to avoid any accidents. Contain all fuel tanks in a fully bunded area with a storage capacity of at least 110 percent of the potential storage volume. Spill control arrangements to be made for hazardous substances (e.g., fuels) 	Contractor	CSC	Number of any non-compliance reports Number of trainings conducted Number of accidents, incidents, and near misses. Number of complaints.	Before and throughout the construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> • Firefighting equipment will be made available at the camps. • The camp staff will be provided OHS training. • All safety precautions will be taken to transport, handle and store hazardous substances, such as fuel. • Construction camps will have first aid kits • Camp crew will be provided with awareness for transmissible diseases (eg, HIV, hepatitis B and C). • ECPs will be implemented. 				
3.6. Social and Gender Issues	<ul style="list-style-type: none"> • Code of conduct will be implemented • WB Guidance Note on labor influx will be implemented • Local norms and customs will be respected • Camp crew will avoid entering the villages • No child labor will be employed in the camps. • Camp staff will be provided training on code of conduct, gender issues, GBV and SE • WB's guidance note on GBV will be followed • Liaison with the community will be maintained. • GRM will be put in place • ECP will be implemented 	Contractor	CSC	Number of non-compliance reports; Number of related complaints	Throughout the construction phase
3.7 Chance finds	In case any artifacts or sites of archeological, cultural, historical, or religious significance are discovered during camp clearance, the works will be stopped, and the Archeological Department will be informed.	Contractor	CSC	Number of non-compliance reports Number of reports of any PCR discovery	Throughout the construction phase
3.8 Increased Load on Local Services and Supplies	<ul style="list-style-type: none"> • The contractors to procure their supplies in a manner not significantly affecting the availability of essential commodities in the area for the residents. • Community liaison will be maintained 	Contractor	CSC	Number of related public grievances	Construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> GRM will be established to address community complaints and grievances. 				
4. Construction Activities (Substations; Towers Foundations; Tower Erection; and Conductor Stringing)					
4.1. Soil erosion	<ul style="list-style-type: none"> Works will be carried out in a manner not to cause soil erosion Vehicular traffic near the bank line will be minimized Protective measures such as mulching will be undertaken to stop erosion Vehicular traffic on unpaved roads will be minimized ECP will be implemented. 	Contractor	CSC	Number of non-compliances observed. Number of complaints.	Throughout the construction phase
4.2. Soil and water contamination	<ul style="list-style-type: none"> Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected. Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil Contractor will confine the contaminants immediately after such accidental spillage Contractor will collect contaminated soils, treat and dispose them in environment friendly manner All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation Top soil to be stripped and stockpiled where practical. Temporary stockpiles to be protected from erosion. For sewage waste, appropriate treatment arrangement such as septic tanks and soakage pits will be installed on site. Water will percolate into the ground so there will be no discharge. Alternatively, sewage from construction 	Contractor	CSC	Number of non-compliances observed or reported Monthly auditing of management of hazardous materials against Material Safety Data Sheet Soil and water quality monitoring data Number of any non-compliance Number of related complaints	Throughout the construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<p>camps and other facilities will be collected and transported to nearby municipal sewage treatments plans.</p> <ul style="list-style-type: none"> ECPs will be implemented. 				
4.3 Air Quality	<ul style="list-style-type: none"> The equipment and vehicles used during the construction process will comply with the national as well as WBG EHS Guidelines on exhaust emissions. Concrete batching and asphalt plants will be located minimum 500 m away from residential areas and will have appropriate dust/emission suppression mechanisms such as wet scrubbers. Contractor will implement dust prevention measures such as watering of roads near the residential areas and spraying of water on loose material where required and appropriate. While transporting loose material such as sand, it will be covered with tarpaulin. Regular air monitoring will be carried out near the sensitive receptors (Table 7.2) to ensure ambient air quality remains within the limits defined by national standards and IFC Guidelines. Measures will be taken to protect the workers from excessive dust (i.e., usage of personal protective equipment). A GRM (discussed later in the document) will be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances will be addressed by the contractor by adopting necessary pollution control measures. Continued consultations with the affected communities will be carried out during construction phase. ECP on air quality management will be implemented. 	Contractor	CSC	<p>Number of non-compliances observed or reported</p> <p>Number of dust-related complaints.</p> <p>Number of air quality-related complaints,</p> <p>Air quality monitoring data</p>	Throughout construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
4.4. Health and Safety	<ul style="list-style-type: none"> • The contractor will implement the OHS Plan that will also cover communities' health and safety aspects • The community will be informed about the nature of construction activities and the associated health and safety risks; awareness raising of the communities will be carried out for this purpose with the help of training sessions, posters, signage, and other similar means. • Awareness raising of communities will be carried out, in a culturally-sensitive manner, about the communicable diseases including sexually transmitted infections. • Regular safety monitoring will be carried out at the sensitive receptors (Table 7.2) • The construction sites will be fenced as appropriate to minimize entry of the local communities particularly children in the work areas. • Liaison with the community will be maintained. • GRM will be established to address community grievances related to health and safety aspects. • Contractors will have dedicated and qualified staff for ensuring compliance with the OHS Plan • Regular trainings will be provided to the workers on OHS aspects. • Awareness raising material will be used including posters, signage, booklets, and others • All site personnel will be screened for communicable diseases including sexually transmitted infections. • Use of appropriate personal protective equipment (PPE) will be mandatory. No worker (or even visitor) will be allowed on the site without the required PPE (such as hard hat, safety shoes). 	Contractor	CSC	<p>Number of non-compliances observed or reported</p> <p>Number of respiratory protective devices and other PPEs issues to workers.</p> <p>Monitoring of compliance with Health and Safety standards (including monthly reporting of accidents).</p> <p>Number of accidents, incidents and near misses.</p> <p>Number of trainings provided.</p> <p>Number of complaints received.</p>	Throughout construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> • Firefighting equipment will be made available as required at construction sites, camp sites, and particularly near the fuel storage. • The project drivers will be trained in defensive driving. They will maintain low speed while driving through / near the communities. • Complete record of accidents and near-misses will be maintained. • First aid facilities will be made available at the work sites and in the camps. The contractors will engage qualified first aider(s). • Location and telephone numbers of the nearest hospital will be displayed at appropriate places at work sites and in construction camps. If necessary, the contractor will have an ambulance available at the site. • ECP will be implemented. 				
4.5. Noise and Vibration	<ul style="list-style-type: none"> • The equipment and vehicles used during the construction process will comply with the national standards as well as WBG EHS Guidelines on noise. • Contractors will adopt appropriate noise attenuation measures to reduce the noise generation from construction activities. The noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around drilling equipment. • The construction activities near the settlements will not be carried out during night time. • Regular noise monitoring will be carried out near the sensitive receptors listed in Table 7.2. • A GRM will be put in place to receive complaints from public on various aspects of environmental issues, including noise pollution. These grievances will be 	Contractor	CSC	<p>Number of non-compliances observed or reported</p> <p>Record of equipment used on site capable of producing over 85dB and whether equipment has been fitted with mufflers</p> <p>Number of related community complaints</p> <p>Noise monitoring data</p>	Throughout construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<p>addressed by the contractor by adopting necessary pollution control measures.</p> <ul style="list-style-type: none"> Continued consultations with the affected communities will be carried out during construction phase. ECP on noise quality management will be implemented 				
4.6. Vegetation loss; damage to crops	<ul style="list-style-type: none"> Clearing and removing of natural vegetation and crops will be minimized Tree cutting will be minimized Selecting barren/fallow land for establishing substations and aligning transmission lines. Compensatory tree plantation will be carried out (eg, along the periphery of substations). Compensation will be paid for any crop damage. ECP will be implemented. 	Contractor	CSC	<p>Area of vegetation lost/disturbed</p> <p>Number of trees felled</p> <p>Number of complaints received.</p>	Throughout construction phase
4.7. Threat to wildlife	<ul style="list-style-type: none"> Complete record will be maintained for any tree cutting. The site staff will not indulge in any animal shooting, trapping, catching, or killing activities. Include information on wildlife protection in all tool-box orientation briefings for camp staff Contractors shall use lower wattage flat lens fixtures that direct light down and reduce glare, and shall avoid use of flood lights. Contractors will also raise awareness about the protection of birds and other wildlife species among the work force to reduce impacts such as disturbance and poaching ECPs will be implemented. 	Contractor	CSC	<p>Number of any non-compliance reports</p> <p>Number of sighting of key wildlife species</p>	Before and throughout the construction phase
4.8. Damage to infrastructure	Any damaged infrastructure such as roads, or culverts will be repaired	Contractor	CSC	<p>Number of any non-compliance reports</p> <p>Number of related complaints</p>	construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
4.9. Damage to Sites/Places of Religious / Cultural Significance	<ul style="list-style-type: none"> The contractor will identify and demarcate any sites and places of religious and or cultural significance, in consultation with the local community. Such sites will be 'no-go-areas' and will be avoided as far as possible. If unavoidable, then the contractor will prepare a plan to move/restore such places in consultation with local community and (related authorities if relevant and required). Such a plan will be implemented after obtaining complete consensus of the related community. Liaison with the community will be maintained. Chance Find Procedures will be put in place. Chance Find Procedure: In the event of discovery of any site or artefact of archeological, historical, cultural, or religious significance, the contractor shall immediately cease all works in that area and report the find to PGCB. Works may not recommence until approval is given by the PGCB. Upon receiving a report of a chance find, the Archeological Department will be notified and their site visit will be facilitated. Further works will be carried out on such sites only after obtaining clearance from the Archeological Department / DoE. The GRM described earlier will also address community grievances related to any damage to sites of religious and or cultural importance. 	Contractor	CSC	Number of any non-compliance reports Number of complaints received. Number of reports of any new PCR discovered/reported	construction phase
4.10. Loss of Access to Villages	<ul style="list-style-type: none"> Contractor will prepare and implement a traffic management plan, in consultation and coordination with the local community The community will be informed about the nature of construction activities and possibility of any blocked route; alternate routes will be identified with the help of local/affected community. Duration of such blockage will be minimized to the extent possible. 	Contractor	CSC	Number of related community complaints	construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> • Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police. • Liaison with the community will be maintained. • The GRM will be established. 				
4.11. Social conflict due to the Influx of Workers; gender issues	<ul style="list-style-type: none"> • Code of conduct will be implemented • WB Guidance Note on labor influx will be implemented • Local norms and customs will be respected • Camp crew will avoid entering the villages • No child labor will be employed in the camps. • Camp staff will be provided training on code of conduct, gender issues, GBV and SE • WB's guidance note on GBV will be followed • Liaison with the community will be maintained. • GRM will be put in place • ECP will be implemented. 	Contractor	CSC	Number of public grievances relating to in-migrants Number of trainings provided	Construction phase
4.12. Increased Load on Local Services and Supplies	<ul style="list-style-type: none"> • The contractors to procure their supplies in a manner not significantly affecting the availability of essential commodities in the area for the residents. • Community liaison will be maintained • GRM will be established to address community complaints and grievances. 	Contractor	CSC	Number of related public grievances	Construction phase
4.13. Traffic congestion	<ul style="list-style-type: none"> • The contractor will implement the traffic management plan. • Construction activities will be scheduled in a manner to avoid peak traffic hours. • Liaison and coordination will be maintained with relevant authorities such as City Corporation and Traffic Police. 	Contractor (with PIU's assistance)	CSC	Number of any non-compliance reports Number of complaints / grievances. Number of traffic accidents/incidents involving project vehicles and lorries bringing materials and supply to project	During construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> Traffic signage will be placed where necessary and appropriate to warn the drivers and pedestrians about the construction activities. ECP to be implemented GRM will address the traffic congestion elated issues. 				
4.14. Damaged <i>khals</i> and tube-wells	<ul style="list-style-type: none"> Any excavation and other construction works near khals and tube-wells will be planned and implemented in a manner to avoid any damage to these structures. The vehicle movement near khals and tube-wells will be minimized. If unavoidable, it will be closely monitored to avoid any damage to these structures. No excavated material or debris will be released into the khals. The contractor will repair and restore any damage the construction activities may cause to khals and tube-wells. GRM will be established. 	Contractor	CSC	Number of non-compliances Number of complaints received	During construction phase
4.15. Spoil generation	<ul style="list-style-type: none"> Recycle excavated material and use it in construction Surplus spoil to be disposed in consultation of communities and relevant authorities 	Contractor	CSC	Number of non-compliances Number of complaints received	During construction phase
5. Waste management					
5.1. Soil and water contamination	<ul style="list-style-type: none"> Contractors will implement the Waste Management Plan. Appropriate hazardous, industrial and domestic waste disposal facilities must be established For the domestic sewage, appropriate treatment and disposal system (e.g., septic tanks and soaking pits) will be constructed having adequate capacity Waste oils will be collected in drums and sold to the recycling contractors. 	Contractor	CSC	Monthly auditing of management of hazardous materials against Material Safety Data Sheet Soil and water quality monitoring data Reports if any non-compliance Number of complaints received	construction phase

Impacts/ Issue	Actions	Responsibility		Key Performance Indicator	Timing
		Execution	Monitoring		
	<ul style="list-style-type: none"> • The inert recyclable waste from the site (such as cardboard, drums, and broken/used parts) will be sold to recycling contractors. • The hazardous waste will be kept separate and handled according to the nature of the waste. • Domestic solid waste will be disposed off in a manner that does not cause soil contamination. • Awareness raising for minimizing use of non-biodegradable substances • Regular maintenance of waste management facilities will be undertaken • No waste dumping/release will be carried out in environmental sensitive areas and rivers • Implement ECPs 				
5.2. Odor	<ul style="list-style-type: none"> • Waste disposal sites will be located away from the communities • Regular maintenance of waste management facilities will be undertaken 	Contractor	CSC	Number of related complaints	construction phase
6. Site Restoration					
6.1. Site restoration	<ul style="list-style-type: none"> • Demolition of temporary structures • Removal of all debris, excess construction material, scraps, spoils, other wastes • Landscaping will be carried out • Restoration of sites for camps and office buildings. • ECPs will be implemented. 	Contractor	CSC	Photographic record Clearance from CSC	construction phase

10.5 Monitoring Program

As one of the key elements of the ESMP, a two-tier monitoring program has been proposed comprising compliance monitoring and effects monitoring. The main purpose of this monitoring program is to ensure that the various tasks detailed in the ESMP particularly the mitigation measures are implemented in an effective manner, and also to evaluate program impacts on the key environment and social parameters. Both these types of ESMP monitoring are discussed below.

10.5.1 Compliance Monitoring

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 CSC with the help of checklists prepared on the basis of the mitigation measures given in **Table 10.2**.

10.5.2 Effects Monitoring

Effects monitoring is a very important aspect of ESMP and aims to ensure environmental protection. The effects monitoring plan proposed for the project is presented in **Table 10.3**. 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. Compliance indicators or threshold limits for the monitoring are also given in **Table 10.3**. Actual monitoring time and location will be decided by CSC and PIU.

Table 10.3: Effects Monitoring Plan

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
During Construction						
Hydrocarbon and chemical storage and handling	Construction camps and yards	Visual Inspection of storage facilities	No leakages from the containers in the storage. Handling follows procedures to avoid spillages.	Monthly	Contractor	CSC
Spoils	At substations and tower locations	Visual inspections	Disposal in approved locations	Monthly	Contractor	CSC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
Traffic Safety	Access Roads; other roads in project area (particularly along the underground transmission line route)	Visual inspection to see whether proper traffic signs are placed and flag-persons for traffic management are engaged	Smooth flowing of traffic; and placement of traffic signs and flag-person	Monthly	Contractor	CSC
Dust	Construction sites	Visual inspection to ensure good standard equipment is in use and dust suppression measures (e.g., spraying of waters) are in place.	No dust generation from the construction activities	Weekly	Contractor	CSC
	Construction Sites	Spot measurements with potable meters	Compliance with national and WBG EHS Guidelines.	Monthly	Contractor	CSC
Noise	Construction sites; camp site	Noise measurement using potable noise meter;	Compliance with national and IFC standards	Monthly	Contractor	CSC
Waste Management	Construction camps and construction sites	Visual inspection that solid waste collection facilities are in place and waste is disposed at designated site	Facilities are clean and waste collection and disposal facilities are in place	Monthly	Contractor	CSC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
Drinking water quality	Camps, offices	Testing of water quality of workers camp water supply for drinking water standards	national and WBG EHS Guidelines for drinking water	Monthly	Contractor	CSC
Air (PM, CO ₂ , SO _x , NO _x) and Noise quality	At sensitive sites identified by CSC	24-hour continuous monitoring with appropriate equipment	Compliance with national and WBG EHS Guidelines	Half yearly	Contractor	CSC, PIU
Cultural and archeological Sites	At all work sties	Visual observation for chance finds	Indication of chance finds	Daily	Contractor	CSC, PIU
Restoration of Work Sites	All Work Sites	Visual Inspection	The facilities are clean with no waste at the works sites	After completion of all works	Contractor	CSC, PIU
Safety of workers Monitoring and reporting of accidents	At work sites	Usage of PPE and implementation of contractor OHS plan	All workers should be provided with, and use necessary PPEs	Monthly	Contractor	CSC, PIU
Grievances	In the project area	Number of grievances registered and addressed	Minutes of grievance redress meetings; number of grievances received; number of grievances resolved.	Monthly	CSC	PIU

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
During Operation and Maintenance						
Inspection as per Standard Operating Procedures	Tower locations	Visual Inspection of environmental related issues	Comply with PGCB SOPs	Monthly	PIU	PGCB
Bird collision and electrocution data	At locations crossed by major rivers	Walk over surveys and interviews	Zero mortality	Six monthly – in March and October	PIU	PGCB
Electro- magnetic fields	Near the residential areas along the TL alignment	Measurement through appropriate equipment	WHO recognized standards	Yearly	PIU	PGCB

10.6 Performance Indicators

For evaluating the performance of the environmental management and monitoring plan, performance indicators are identified to 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 PGCB.

To measure the overall environmental performance of the project, a list of performance indicators is given below:

- Number of inspections carried out by CSC per month.
- Number of non-compliances observed by CSC or PIU.
- 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/ timely resettlement of project affectees
- Timely implementation of resettlement schedule.
- Number of grievances received.

- Number of grievances resolved.
- Number of construction-related accidents.

10.7 Capacity Building

Capacity building for effective implementation of the environmental and social requirements is a key element of the ESMP. Capacity building for environmental and social management will need to be carried out at all tiers of the project, including PGCB, PIU, CSC, and contractors. At the construction site, CSC will take the lead in implementing the capacity building plan, though the contractors 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 10.4** provides a summary of various aspects of the environmental and social trainings to be conducted at the construction site. ESIC may revise the plan during the project implementation as required.

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

Table 10.4: Environmental and Social Trainings

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project influence area; Mitigation measures; Community issues and workers' code of conduct; Grievance Mechanism; ESMP; Awareness of transmissible diseases; Workers' Code of Conduct; Social and cultural values; Gender issues including GBV and SE.	PIU; CSC; selected contractors' crew	CSC	Prior to the start of the field activities. (To be repeated as needed.)
ESMP; Waste disposal; OHS; Code of Conduct; Social and cultural values; Gender issues including GBV and SE.	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.)

Contents	Participants	Responsibility	Schedule
Gender issues including GBV and SE; Code of Conduct.			
Camp operation; Waste disposal; OHS Natural resource conservation; Code of Conduct; Gender issues including GBV and SE; 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.

10.8 Documentation and Reporting

The PIU with assistance from CSC and contractors will produce the following environmental reporting documentation and report to AIIB:

Monthly Report on Environment, Health, and Safety: the contractor will prepare a monthly report covering environmental monitoring, OHS compliance, OHS incidents and accidents, trainings conducted, and any other salient activities carried out during the reporting period. The report will be submitted to CSC.

Quarterly Progress Reports on Environment: The environmental monitoring reports will include environmental mitigation measures undertaken, environmental monitoring activities undertaken, details of monitoring data collected, analysis of monitoring results particularly the non-compliances, recommended mitigation and corrective measures, environmental training conducted, and environmental regulatory violations observed. The environmental monitoring reports will be submitted quarterly during the construction period and annually for three years after completion of construction.

Quarterly Progress Reports on Social and Resettlement: The quarterly social progress reports will cover the progress on implementation of social mitigation measures including payment of compensation and assistance.

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

10.9 Grievance Redress Mechanism

Grievance (in the context of a development Project) is an issue, concern, problem, or claim (perceived or actual) that an individual or community group wants to be addressed and resolved by the Project Authority. The grievance mechanism is a local based, project-specific extra-legal way to deal with and resolve complaints and grievances faster and thus enhance project performance in terms of environment, social and resettlement management.

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 ESIA 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 or deny a person's right to go to the courts of law.

10.9.1 Objectives of Grievance Redress Mechanism

The fundamental objectives of the GRM, implemented through the Grievance Redress Committees (GRCs) serving as a para-legal body, are to resolve any environment, social or resettlement-related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of the project and present ESMP. Another important objective is to democratize the development process at the local level and to establish accountability to the affected people.

10.9.2 Grievance Redress Mechanism

The Project Proponent would establish a procedure to deal with and resolve any queries as well as address complaints and grievances about any irregularities. In this regard, a policy and/or guideline will be prepared and adopted for assessing and mitigating potential social and environmental complaints/impacts through Grievance Redress Mechanism (GRM). The GRM will deal with complaints and grievances related to both social/resettlement and environmental issues of the Project. The mechanism, process or procedure will not prevent access to judicial or administrative remedies.

The Project-affected People's Mechanism (PPM) has been established by the AIIB to provide an opportunity for an independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement its ESF in situations when their concerns cannot be addressed satisfactorily through Project-level GRM or AIIB Management's processes. It has been advised that a multi-tier GRM will be constituted for the Project in line with the prescriptions of the PPM Policy of the Bank, building on the existing complaint mechanisms.

Local and Project-level Grievances Redress Committees (GRC) will be formed to receive and resolve complaints as well as grievances from aggrieved persons from the local stakeholders including the Project-affected persons. Based on consensus, the procedure will help resolving issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal actions. The procedure will, however, not prevent a person's right to go to the courts of law. The GRCs will be established through a gazette notification from the Ministry of Power, Energy and Mineral Resources (MPEMR); therefore, the GRC will be a legally constituted body.

10.9.3 Composition of GRC

The GRCs will be established locally at Project sites and centrally at the Project level to receive as well as settle grievances from the affected persons and other local stakeholders. The two-tier GRM will be composed of local GRCs at the union/municipal level (LGRC), the first tier, and Project GRC at the central level (PGRC), the second-tier. Most of the grievances will be resolved at the local-level GRC, but those cases that cannot be resolved at the local level will be forwarded to PGRC. The LGRC will be constituted with representation of the local Union Parishad Chairman and affected people ensuring women's representation. The PGRC will be constituted with representation from the PIU, Implementing NGO/Agency (INGO/IA) and one independent person from the civil society having knowledge about land acquisition/ requisition law of Bangladesh and involuntary resettlement.

Local Level GRC (LGRC)

The following composition is proposed for the local level GRC (LGRC) with representations from Project Proponent, INGO/IA, local public representatives, representatives of affected people including women in the Project area to ensure a participatory process and to allow voices of the affected communities in the grievance procedures.

1.	Executive Engineer, PGCB	Convener
2.	Representative of INGO/IA (non-voting)	Member-Secretary
3.	Chairman of Union Parishad (UP) concerned	Member
4.	Female Member of ward of the UP concerned	Member
5.	Retired teacher from the union concerned	Member
6.	Representative of PAPs	Member

A representative of PAPs (based on the recommendation of INGO/IA and approved by the Convener) will be a member of the LGRC. The Member-Secretary of LGRC will be available and accessible to PAPs to address concerns and grievances. Unresolved cases will be forwarded to the PGRC. The LGRC is empowered to take a decision, which is bound upon the Project Proponent. But it requires the approval of the Project Director for implementation of the decisions.

Terms of Reference for Local GRC (LGRC)

The scopes of work and the Terms of Reference (ToR) for LGRC are:

- The LGRC shall review, consider and resolve grievances related to social/resettlement and environmental mitigations during implementation of the Project.
- Any grievances presented to the LGRC, should ideally be resolved on the first day of hearing or within a period of four weeks except complicated issues requiring additional investigations. Grievances of indirectly affected persons and/or persons affected during project implementation due to social or environmental problems will also be reviewed by LGRC.
- The LGRC will not engage in any review of the legal standing of an “awardee” other than in the distribution of shares of acquired property among the legal owners and associated compensation or entitlement issues.
- LGRC decisions should ideally be arrived at through consensus, failing which resolution will be based on majority vote. Any decision made by the LGRC must be within the purview of RP policy framework and entitlements.
- The LGRC will not deal with any matters pending in the court of law.
- A minimum three members (in addition to the Member Secretary) shall form the quorum for the meeting of the LGRC to proceed.

The INGO/IA will assist the PAPs in lodging their resettlement complaints in a proper format acceptable to the LGRC after they get ID Cards from the Project Proponent (EA) or are informed about their entitlements and losses. LGRC meetings will be held in the convener’s office in the Project area or other location(s) as agreed by the aggrieved persons. If needed, LGRC members may undertake field visits to verify and review the issues at dispute, including titles/shares, left-out cases during Joint Verification Survey (JVS) or other relevant matters.

Other than disputes relating to ownership right under the court of law, LGRC will review grievances involving all resettlement benefits, relocation and other assistance. However, the major grievances that might require mitigations include:

- PAPs not enlisted;
- Losses not identified correctly;
- Compensation/assistance not as per entitlement matrix;
- Dispute about ownership;
- Delay in disbursement of compensation/assistance;
- Improper distribution of compensation/assistance in case of joint ownership;
- Incorrect name in the award book of DC.

Project-level GRC (PGRC)

The Project-level GRC will review all unresolved cases involving social and environmental issues of the project. The Project Director will head the PGRC. The composition of the PGRC will be as follows:

Project Director, PIU, PGCB	Chairperson
Team Leader of INGO/IA	Member Secretary
Representative of Civil Society	Member

The Member-Secretary in the PGR will provide necessary knowledge and information regarding relevant standard policies and international protocols. He/she will also set examples of resolving such grievances from other development projects in Bangladesh. The PGRC should establish fairness and transparency in the resolution of grievances by project-affected persons. In case of technical or environmental issues as well as any legal matters, the Team Leader of the INGO/IA will advise the PGRC. In specific cases, environmental and social development specialists of ESU or external legal advisors may be consulted, if required.

ToR for Project Level GRC (PGRC)

The scope of work and the Terms of Reference (ToR) for PGRC are:

- Review, consider and settle unresolved grievances forwarded by LGRCs related to social/resettlement and environmental issues.
- Any grievances presented to the PGRC should ideally be resolved within five weeks from the date of receiving the complaints from LGRC.
- In case of complicated cases, the PGRC Members can request additional information or carry out field level verifications.
- Resolutions should be based on consensus among Members, where all the decisions may be taken on majority vote.
- Any decision made by the PGRC must be within the purview of RP policy and entitlements.
- The PGRC will not deal with any matters pending in the court of law.

- All three members are required to form the quorum for the meeting of the PGRC.

10.9.4 Processes for Filing GRC Cases and Role of GRC

The procedural steps of resolving grievances and the grievance redress processes are presented in **Figure 10.2**, which explains the GRM in detail in a flow chart. GRC procedures and operational rules will be publicized widely through community meetings and pamphlets in the local Bangla language so that PAPs are aware of their rights and obligations, and procedure of grievance redress. All local GRC documents will be maintained by INGO for review and verification by CSC, Co-financier and any external reviewers. The PGCB Field Office(s) will act as the Secretariat to the local GRCs. As a result, the records will be up-to-date and easily accessible on-site.

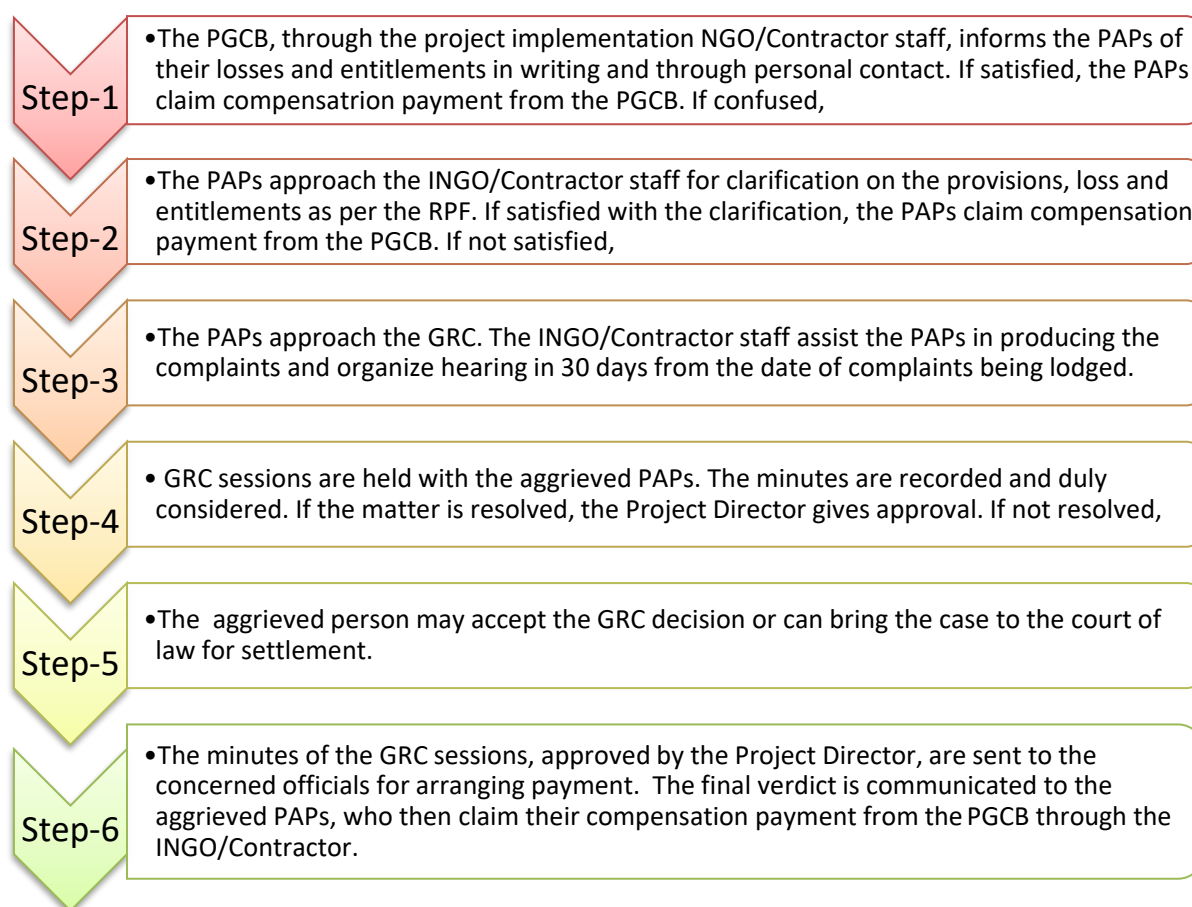


Figure 10.2: Grievance Redress Processes

10.10 Budget for ESMP Implementation

For implementing the present ESMP, about **197million BDT** (about 2.35 million US Dollars) will be required. The major components of this cost include about 180 million for R&R costs, 9.5 million BDT for mitigations and trainings, and 7.8 million BDT for monitoring and other costs. The breakdown for the ESMP implementation cost is given in **Table 10.5**.

Table 10.5: Budget for the Environmental Management Plan

Item	Quantity	Rate	Total (Million BDT)
Mitigation Plan and contingency	4 years	Lump sum	3.50
Enhancement plan	4 years	Lump sum	2.00
Training of Professionals and Worker about accidental cases and safety measures	4 years	Lump sum	4.00
Sub total			9.50
Monitoring Plan for 4 years	From revenue budget		
Consultant (for monitoring)	48 person – month	Tk.100,000 per month	4.80
Transport (for monitoring team)	200 days	Tk.10,000 per day	2.00
Reporting and others (Yearly DoE renewal cost)		Lump sum	1.00
Sub Total			7.80
R&R Cost from Chapter 8 (Table 8.20)			180.67
Total Cost (million BDT)			197.97
Total Cost (million USD) (1 USD = BDT 83.85)			2.36

Annex A. Site Clearance Certificate

See the following page for the Site Clearance Certificate issued by DoE. Citation in the main report: **Section 1.3.**

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhavan
E-16, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207
www.doc.gov.bd

Memo No: 22.02.0000.018.72.29.18. 110

Date: 04/03/2018

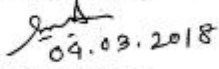
Subject: Site Clearance for the Expansion and Strengthening of power network project under Chittagong area.

Ref: Your Application dated 01/06/2017 & 24.01.2018.

With reference to the above mentioned subject, the Department of Environment (DOE) hereby accords the Site Clearance to the Expansion and Strengthening of power network project under Chittagong area subject to fulfilling the following terms and conditions.

1. This clearance shall only be applicable for the construction of transmission line under the Expansion and Strengthening of power network project under Chittagong area.
2. Proper and adequate facilities for construction and re-construction of transmission line must be ensured.
3. Drainage should be made in such a way that any solid waste cannot be discharged in the drain and drainage level should be such that it will properly drain water during extreme climatic condition.
4. In order to control noise pollution, vehicles & equipment shall be maintained regularly; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.
5. Rehabilitation of human settlement or compensation for any sort of activity which will incur damage or loss of public or private property shall be addressed as per Government of Bangladesh rules and regulations (if necessary).
6. All the required mitigation measures suggested in the Environmental Management Plan in the IEE report are to be strictly implemented and kept operative/functioning on a continuous basis.
7. Construction material should be properly disposed off after the construction work is over.
8. Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be demolished or destructed.
9. Environmental Monitoring Reports shall be made available simultaneously to Head quarters and respective Divisional office of the Department of Environment on a quarterly basis during the whole period of the project.
10. After completion of the infrastructure development, project proponent shall apply for Environmental Clearance to the Chittagong Regional Office, Chittagong.
11. This clearance is valid for one year from the date of issuance and project proponent shall apply for renewal to the Chittagong Regional Office, Chittagong at least 30 days ahead of expiry.

This Clearance Certificate has been issued with the approval of the appropriate authority.


(Syed Nazmul Ahsan)
Director (Environmental Clearance)
Phone # 8181673

Chief Engineer (Project Monitoring)
Expansion and Strengthening of power network project under Chittagong area
Power Grid Company of Bangladesh Ltd.
7th Floor, NLDC Complex, Aftabnagar, Rampura, Dhaka-1212.

Copy Forwarded to :

- 1) Private Secretary to the Hon'ble Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
- 2) Director, Department of Environment, Chittagong Regional Office, Chittagong.
- 3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

Annex B. List of Consultation Participants

The list of consultation participants is presented below. Citation in the main report: **Section 6.3.**

List of participants of Consultations

Sl. No.	Name	Age	Occupation	Phone Number
1.	Md. Abdur Rashid	38	Business	01715816326
2.	Md. Haji Nurul Amin	70	Agriculture	01815021192
3.	Md. Jalal Miah	54	Day Labor	
4.	Md Yousuf	62	Retired	01931208629
5.	Md SadhonBabu	35	Business	01823943551
6.	Md. Jony	32	Day Labor	01843773622
7.	Md Abdul Malek	28	Driver	01813268092
8.	Md. Jahangir Alam	45	Business	01831530691
9.	Md. Shamsul Alam	48	Day Labor	01706475872
10.	Md. Abul Kalam	55	Day Labor	01795805420
11.	Md. Azad	38	Day Labor	01815476883
12.	Md. Alamgir Hossain	38	SAE	01716496307
13.	S. M. Asaduzzaman	35	SAE	01837021614
14.	Md. Monjurul Haque	30	SAE	01837235211
15.	Md. Mujibur Rahman	48	UP Chairman	01817745954
16.	Md. Robiul Hossain Foysal	22	Student	01854377773
17.	Md. HumayunKarbir	38	Service	01817929795
18.	Md. Abdul Jabbar	45	Service	01812813422
19.	Md. Shakil	19	Student	01828041109
20.	Md. Zahidul Islam	48	Day Labor	
21.	Md. Nur Hossain	62	Unemployed	
22.	Md. Shah Alam	45	Farmer	01881640475
23.	Md. Bashir Ahmed	38	Farmer	
24.	Md. Sarwar Hossain	32	Business	01711050973

Sl. No.	Name	Age	Occupation	Phone Number
25.	Md. Saifuddin Khaled	42	Word Counselor	01817718321
26.	Md. Morshed Alam	45	Word Counselor	01819520007
27.	Md. Hossain Hiron	48	Ward Counselor	01670313131 01740-939428
28.	Ujjal Shaha	40	Executive Engineer	01674073791
29.	Nuruddin Mohammad Forhad Chowdhury	38	Executive Engineer	01777743223
30.	Md. Hasnat Kamrul Quysar	32	Assistant Engineer	01817773620
31.	Md. Mozammel Haque	29	Sub-Assistant Engineer	01817247339
32.	ASM Quyes Uddin	30	Sub-Assistant Engineer	01711798322
33.	Md. Abdul Halim	26	Sub-Assistant Engineer	01732956239
34.	Md. Alamgir Hossain	25	Sub-Assistant Engineer	01716496307
35.	Ariful Haque Sajib	28	Assistant Engineer	01711432920
36.	Md. Abdul Majid	52	Chairman	01817745954
37.	Abul Hashem	48	Chairman	01860389274
38.	Md. Arab Hossain	16	Student	
39.	Md. Shahjahan	54	Farmer	
40.	Md. Jakir Hossain	45	Businessman	01811204939
41.	Md. Joynal Abedin	48	Businessman	01845090932
42.	Md. Nasir Uddin	54	Service	
43.	Md. Shwapon	32	Business/Worker	01734636071
44.	Md. Saddam Hossain	20	Worker	01822009524
45.	Md. Abul Hossain	24	Worker	01966100234
46.	Md. Noor Mohammad	56	UP member	01818514634
47.	M A Quyum	35	Service	01816447530
48.	Mujibur Rahman	45	Chairman	01817745954
49.	Abu Bakar Siddique	42	Ex Up Member	01819386492
50.	Md. Arju Mia	24	Businessman	01856705751

Sl. No.	Name	Age	Occupation	Phone Number
51.	Md. Anwar Hossain	21	Worker	01815572140
52.	Md. Mosleh Uddin	24	Worker	
53.	Md. Mainuddin	25	Worker	
54.	Md. Kamal Hossain	34	Businessman	01846465947
55.	Md. Mahabubul Alam	32	Worker	
56.				

Participants List

②

Village/Mouza:

Union:

Upazilla:

District::

Date:

SL No	Name	Age	Occupation	Mobile No/Address	Signature
0	আবদুল হান্নান খান	39	কৃষক	01819360682	
0	মির্জা হোসেন	৫৫	কৃষক	01711396956 01882212108	
0	মোঃ মুনীর হোসেন		কৃষক	01815690755	
0	মোঃ আবদুল হান্নান			01815822944	
0	মোঃ হোসেন			01678295269	
0	মাকী মাকী		U.P	0181274917	
0	বাবুজান মাকী		২-পা	02688009069	
0	মাহ আলী	31	X.U.P	01820133655	
0	মোঃ মুনীর হোসেন			01879173012	
0	মুহাম্মদ হোসেন			01819672792	
1	আবদুল হান্নান		কৃষক	01813400100	
2	মুহাম্মদ হোসেন	৪৫	কৃষক	01817727895	
3	মোঃ মুনীর হোসেন	34	কৃষক	0187478881	
4	মোঃ মুনীর হোসেন	28	কৃষক	01815771662	
5					
6					
7					
8					
9					
0					

Participants List

Village/Mouza:

Union:

Upazilla:

District::

Date:

SL No	Name	Age	Occupation	Mobile No/Address	Signature
01.	মুহাম্মদ আব্দুল মালেক (মুহাম্মদ) ১৬৫/১৭৫	৪৭	কৃষক	০১৮৭৭৭৭৭৭৭	M. M. M.
02.	আব্দুল হক	৬৫	কৃষক	০১৮১২৫২১১০	H. H.
03.	আব্দুল হক	৬২	কৃষক	০১৮১৮৯৯৩০২৭	H. H.
04.	আব্দুল হক	৪২	কৃষক	০১৭৪০৫১৯২৭	H. H.
05.	নবীল হোসেন	৪২	কৃষক	০১৮৮২৭৮৬৬৬২	N. H.
06.	আব্দুল হক	৬৫	কৃষক	০১৮১৫৮৫০৬২৫	A. H.
07.	আব্দুল হক	৪৫	কৃষক	০১৮২৯০৪৯৯১২	N. H.
08.	আব্দুল হক	৪৫	কৃষক	০১৬১১৭৪৬০২২	H. H.
09.	Md. Fidaul Kabir	৫৫	কৃষক	০১৮১৭৮৩৭১৬২	F. K.
10.					
11.					
12.					
13.					
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15.					
16.					
17.					
18.					
19.					
20.					

Participants List

Village/Mouza:

Union:

Upazilla:

District:

Date:

Sl. No	Name	Age	Occupation	Mobile No/Address	Signature
01.	মোহাম্মদ হাওদ হির	৬৬	কৃষক	০১৭০৬২৬২৬৩	
02.	মোঃ আব্দুল মজিদ	৬২	কৃষক	০১৭১১৭৬২৫০০	
03.	মোঃ আব্দুল হামিদ	৬০	১১	০১৭২৬৭০৬০০	
04.	মোহাম্মদ কাহিনুর রহমান	৪৯	কৃষক	০১৬০৬০৭৭৪০	
05.	মোঃ মাহমুদুর রহমান	৩৬	১১	০১৭১১-৯৪৯৩২৭	
06.	মোঃ মুহাম্মদ হামিদ	৪৫	১১	০১৮১৪-৫০৭০৭	
07.	মোঃ আব্দুল হামিদ	৬৬	১১	০১৮১৭-৪৬৪০৪২	
08.	মুহঃ হাদিদ হুসাইন	৩৪	১১	০১৮৪৩৪০৭৪০	
09.	মোঃ হাদিদ		কৃষক	০১৬০৪-৪৬০২৪	
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"বাংলাদেশ পাওয়ার গ্রীড কোম্পানি লিমিটেড (পিজিএসবি)" কর্তৃক সাব-ট্রান্সমিশন স্থাপন ও সম্মানন লাইনের কারণে পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিরূপণ বিষয়ক

মতবিনিময় সভায় অংশগ্রহণকারীদের তালিকা

স্থান :

Bohoddharhat

সময় : 11:40

তারিখ: 16-11-2016

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
১	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
২	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
৩	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
৪	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
৫	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
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৭	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
৮	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
৯	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
১০	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
১১	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
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১৪	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
১৫	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
১৬	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
১৭	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
১৮	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
১৯	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম
২০	শ্রী: মাহমুদুল আলম	কোম্পানি প্রধান ৪৩৮ চাকরি	০১৮৭৭৮৬৩০	মাহমুদুল আলম

CEGIS

Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128



Participants List of Public Consultation

CZGIS

On
Expansion and Strengthening of Power Network Project under
Chittagong Area.

Venue: মসজিদ (মসজিদ) জামায়াত মসজিদ

Date: ৬.১০.১৬.....

SL No	Name	Age	Occupation	Address	Mobile No	Signature
01.	মোহাম্মদ হামিদুল্লাহ	২০			০৩৭০৬৮৭২	
02.	মু. রশিদুল হক	৩১			০১৪১৫৫০৬২৬ ০১৪১৫৫০৬২	
03.	মোহাম্মদ হামিদ	৩২		২৫২৫২	০১৬০৫৫৫২৮ ৫৭	
04.	মুহাম্মদ হামিদ	৩৪			০১৪১৭৪৬২২৪৩	
05.	মোহাম্মদ হামিদ	৩৫			০১৭১১৩৬৭৫৩৭	
06.	মোহাম্মদ হামিদ	২৫			০১৪১৪৭১২১০৭	
07.	মোহাম্মদ হামিদ				০১৪১৭৭৬২৭৫৫	
08.	মোহাম্মদ হামিদ	৩৫			০১৪১৭৬৬২৮৭৩	
09.	মোহাম্মদ হামিদ	৪০			০১৭২১৫০০০০৭	
10.	মোহাম্মদ হামিদ	৩৬		মোহাম্মদ হামিদ	০১৬২৭৭৭৬০১০	
11.	মোহাম্মদ হামিদ	২৪			০১৪-৭৩০০০২৭৬	
12.	মোহাম্মদ হামিদ			মোহাম্মদ হামিদ	০১৭১২০৭৮৭৫৬	
13.	মোহাম্মদ হামিদ			মোহাম্মদ হামিদ	০১৪১৫-৬১২৫৪৪	
14.	মোহাম্মদ হামিদ	৩০			০১৬৪৭২২২৫৪৬	
15.	মোহাম্মদ হামিদ				০১৪২৭৭৭৭৭৭	



Participants List of Public Consultation

C&GIS

On Expansion and Strengthening of Power Network Project under Chittagong Area.

Venue:২০ গ্রাউন্ড (মসজিদ) চারিগাছা থানা রোড

Date:০২.১০.১৫

SL No	Name	Age	Occupation	Address	Mobile No	Signature
01.	মোঃ মাহমুদ আলী	৬৫	৬৫		০১৪০৩৩৬০৫	৬৫
02.	মোঃ মাহমুদ আলী	৬৫	৬৫		০১৪৬৪৬৫৫৪৭৮৮৮৮	৬৫
03.	মোঃ মাহমুদ আলী	২২	২২		০১৪৫১৩৭৭	৩৪২
04.	মোঃ মাহমুদ আলী	৪২			০১৭৪০৭৩৪০৮	৩৪২
05.	মোঃ মাহমুদ আলী	৪২			০১৪৩১৪০৭৭১	৩৪২
06.	মোঃ মাহমুদ আলী	৫০			০১ -	৩৪২
07.	মোঃ মাহমুদ আলী	৬৫			০১৪৪৩২৪৭৩৬	৩৪২
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Annex C. Environmental Codes of Practice

The environmental codes of practice (ECPs) are presented below. Citation in the main report: **Section 7.3.3.**

Introduction

The objective of the Environmental Code of Practices (ECPs) is to address all potential and general construction related impacts during implementation of the Project. The ECPs will provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. These ECPs shall be annexed to the general conditions of all the contracts, including subcontracts, carried out under the Project.

The list of ECPs prepared for the Project is given below.

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Goods Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Top Soil Management
- ECP 8: Topography and Landscaping
- ECP 9: Air Quality Management
- ECP 10: Noise and Vibration Management
- ECP 11: Protection of Flora
- ECP 12: Protection of Fauna
- ECP 13: Protection of Fisheries
- ECP 14: Road Transport and Road Traffic Management
- ECP 15: Construction Camp Management
- ECP 16: Cultural and Religious Issues
- ECP 17: Workers Health and Safety

Contractors will prepare Construction Environmental and Social Management Plan CESMP, in compliance with AIIB and Government of Bangladesh requirements and based on the guidance given in the ECPs. The CESMP will form the part of the contract documents and will be used as monitoring tool for compliance. It is mandatory for the main contractors procured directly by the project to include these ECPs in their subcontracts. Violation of the compliance requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractors.

ECP 1: Waste Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Develop site specific waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to supervision consultant for approval. • Organize disposal of all wastes generated during construction in the designated disposal sites approved by the Project. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate and reuse or recycle all the wastes, wherever practical. • Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route. • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices. • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal. • Potable water should be supplied in bulk containers to reduce the quantity of plastic waste (plastic bottles). Plastic bag use should be avoided.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Collect chemical wastes in 200-liter drums (or similar sealed container), appropriately labeled for safe transport to an approved chemical waste depot. • Store, transport and handle all chemicals avoiding potential environmental pollution. • Store all hazardous wastes appropriately in bunded areas away from water courses.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> • Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. • Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. • Construct concrete or other impermeable flooring to prevent seepage in case of spills.

ECP 2: Fuels and Hazardous Goods Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare spill control procedures and submit them for supervision consultant approval. • Train the relevant construction personnel in handling of fuels and spill control procedures. • Store dangerous goods in bunded areas on top of a sealed plastic sheet away from watercourses. • Refueling shall occur only within bunded areas. • Store and use fuels in accordance with material safety data sheets (MSDS). Make available MSDS for chemicals and dangerous goods on-site. • Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site. • Provide absorbent and containment material (e.g., absorbent matting) where hazardous materials are used and stored; and ensure personnel trained in the correct use. • Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. • Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Store and use fuels in accordance with material safety data sheets (MSDSs).

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> • Store all liquid fuels in fully bunded storage containers, with appropriate volumes, a roof, a collection point and appropriate filling/decanting point. • Store hazardous materials above flood level considered for construction purposes • Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials.

ECP 3: Water Resources Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Follow the management guidelines proposed in ECPs 1 and 2. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems.
Discharge from construction sites	Construction activities, sewerages from construction sites and work camps may affect the surface water quality. The construction works will modify groundcover and topography changing the surface water drainage patterns of the area. These changes in hydrological regime lead to increased rate of runoff, increase in sediment and contaminant loading, increased flooding, and	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials. • Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from site. • Divert runoff from undisturbed areas around the construction site. • Stockpile materials away from drainage lines • Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	effect habitat of fish and other aquatic biology.	<p>transport to an approved waste disposal site or recycling depot.</p> <ul style="list-style-type: none"> Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This should be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Soil erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. Ensure that roads used by construction vehicles are swept regularly to remove dust and sediment. Water the loose material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds).
Construction activities in water bodies	Construction works in the water bodies will increase sediment and contaminant loading, and effect habitat of fish and other aquatic biology.	<p>The Contractor Shall</p> <ul style="list-style-type: none"> Dewater sites by pumping water to a sediment basin prior to release off site – do not pump directly off site. Monitor the water quality in the runoff from the site or areas affected by dredge/excavation plumes, and improve work practices as necessary. Protect water bodies from sediment loads by silt screen or other barriers. Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems. Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets.
Drinking water	Untreated surface water is not suitable for drinking purposes due to	<p>The Contractor Shall</p> <ul style="list-style-type: none"> Provide the drinking water that meets national and WBG EHS Guidelines. Drinking water to be chlorinated at source, and ensure presence of residual chlorine

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	presence of suspended solids and E. coli.	0.1 ~ 0.25 ppm as minimum after 30 minutes of chlorine contact time.

ECP 4: Drainage Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earth work, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms environment in terms of water and soil contamination, and mosquito growth.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare drainage management procedures and submit them for supervision consultant approval. • Prepare a program to prevent/avoid standing waters, which supervision consultant will verify in advance and confirm during implementation. • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line. • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there. • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to national and WBG EHS Guidelines, before it is being discharged into the recipient water bodies. • Ensure that there will be no water stagnation at the construction sites and camps. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion. • Protect natural slopes of drainage channels to ensure adequate storm water drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem.
Ponding of water	Health hazards due to mosquito breeding	<ul style="list-style-type: none"> • Do not allow ponding of water especially near the waste storage areas and construction camps.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> Discard all the storage containers that are capable of storing of water, after use or store them in inverted position.

ECP 5: Soil Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	<p>The Contractor shall</p> <ul style="list-style-type: none"> Strictly manage the wastes management plans proposed in ECP1 and storage of materials in ECP2. Construct appropriate spill contaminant facilities for all fuel storage areas. Establish and maintain a hazardous material register detailing the location and quantities of hazardous substances including the storage, and their disposals. Train personnel and implement safe work practices for minimizing the risk of spillage. Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site. Remediate the contaminated land using the most appropriate available method.
Construction material stock piles	Erosion from construction material stockpiles may contaminate the soils	<p>The Contractor shall</p> <ul style="list-style-type: none"> Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds.

ECP 6: Erosion and Sediment Control

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Clearing of construction sites	Cleared areas and slopes are susceptible for erosion of top soils, which affects the growth of vegetation and causes ecological imbalance.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Prepare site specific erosion and sediment control measures and submit them for supervision consultant approval. Reinstate and protect cleared areas as soon as possible.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turf/tree plantations.
Construction activities and material stockpiles	The impacts of soil erosion are (i) Increased run off and sedimentation causing a greater flood hazard to the downstream, and (ii) destruction of aquatic environment by erosion and/or deposition of sediment damaging the spawning grounds of fish	<p>The Contractor shall</p> <ul style="list-style-type: none"> Locate stockpiles away from drainage lines. Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds. Remove debris from drainage paths and sediment control structures. Cover the loose sediments of construction material and water them if required. Divert natural runoff around construction areas prior to any site disturbance. Install protective measures on site prior to construction, for example, sediment traps. Install 'cut off drains' on large cut/fill batter slopes to control water runoff speed and hence erosion. Observe the performance of drainage structures and erosion controls during rain and modify as required.
Soil erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. Ensure that roads used by construction vehicles are swept regularly to remove sediment. Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds).

ECP 7: Top Soil Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Earthworks will impact the fertile top soils that are enriched with nutrients	<p>The Contractor shall</p> <ul style="list-style-type: none"> Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	required for plant growth or agricultural development.	<ul style="list-style-type: none"> Remove unwanted materials from top soil like grass, roots of trees and similar others. The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. Locate topsoil stockpiles in areas outside drainage lines and protect from erosion. Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites. Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the soil layers, water penetration and revegetation
Transport	Vehicular movement outside ROW or temporary access roads will affect the soil fertility of the agricultural lands	<ul style="list-style-type: none"> Limit equipment and vehicular movements to within the approved construction zone. Plan construction access to make use, if possible, of the final road alignment.

ECP 8: Topography and Landscaping

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Construction activities especially earthworks will change topography and disturb the natural rainwater/flood water drainage as well as will change the local landscape.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Prepare landscaping and plantation plan and submit the plan for supervision consultant approval. Ensure the topography of the final surface of all raised lands (construction yards, approach roads and rails, access roads, etc.) are conducive to enhance natural draining of rainwater/flood water. Keep the final or finished surface of all the raised lands free from

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>any kind of depression that causes water logging.</p> <ul style="list-style-type: none"> • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use of construction activities with grass-cover and tree plantation to prevent soil erosion and bring improved landscaping. • Reinstate the natural landscape of the ancillary construction sites after completion of works.

ECP 9: Air Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare air quality management plan (under the Pollution Prevention Plan) and submit the plan for supervision consultant approval. • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel-efficient manner. • Cover hauls vehicles carrying dusty materials moving outside the construction site. • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions. • Control the movement of construction traffic. • Water construction materials prior to loading and transport. • Service all vehicles regularly to minimize emissions. • Limit the idling time of vehicles not more than 2 minutes.
Construction machinery	Air quality can be adversely affected by	The Contractor shall

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	emissions from machinery and combustion of fuels.	<ul style="list-style-type: none"> • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof or maintenance register shall be required by the equipment suppliers and contractors/subcontractors. • Focus special attention on containing the emissions from generators. • Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites. • Service all equipment regularly to minimize emissions. • Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations.
Construction activities	Dust generation from construction sites, material stockpiles and access roads is a nuisance in the environment and can be a health hazard, and also can affect the local crops;	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted. • Minimize the extent and period of exposure of the bare surfaces. • Restore disturbed areas as soon as practicable by vegetation/grass-turfing. • Store the cement in silos and minimize the emissions from silos by equipping them with filters. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations. • Not water as dust suppression on potentially contaminated areas so that a liquid waste stream will be generated. • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> Not permit the burning of solid waste.

ECP 10: Noise and Vibration Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	<p>The Contractor shall</p> <ul style="list-style-type: none"> Prepare a noise and vibration management plan (under the Pollution Prevention Plan) and submit the plan for supervision consultant approval. Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures. Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc. Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site.
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Appropriately site all noise generating activities to avoid noise pollution to local residents. Use the quietest available plant and equipment. Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. Install acoustic enclosures around generators to reduce noise levels. Fit high efficiency mufflers to appropriate construction equipment. Avoid the unnecessary use of alarms, horns and sirens.
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	<p>The Contractor shall</p> <ul style="list-style-type: none"> Notify adjacent landholders prior any typical noise events outside of daylight hours. Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> • Employ best available work practices on-site to minimize occupational noise levels. • Install temporary noise control barriers where appropriate. • Notify affected people if major noisy activities will be undertaken, e.g. blasting. • Plan activities on site and deliveries to and from site to minimize impact. • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas.

ECP 11: Protection of Flora

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora is important to provide shelters for the birds, offer fruits and/or timber/fire wood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has wide range of adverse environmental impacts.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare a plan for protection of flora and submit the plan for supervision consultant approval. • Minimize disturbance to surrounding vegetation. • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Get approval from supervision consultant for clearance of vegetation. • Make selective and careful pruning of trees where possible to reduce need of tree removal. • Control noxious weeds by disposing of at designated dump site or burn on site. • Clear only the vegetation that needs to be cleared in accordance with the engineering plans and designs. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill a, etc. • Not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds.</p> <ul style="list-style-type: none"> • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. • Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil. • Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. • Ensure excavation works occur progressively and re-vegetation done at the earliest • Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction • Supply appropriate fuel in the work camps to prevent fuel wood collection.

ECP 12: Protection of Fauna

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities	The location of construction activities can result in the loss of wild life habitat and habitat quality,	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare a plan for protection of fauna and submit the plan for supervision consultant approval. • Limit the construction works within the designated sites allocated to the contractors. • check the site for animals trapped in, or in danger from site works and use a qualified person to relocate the animal.
	Impact on migratory birds, its habitat and its active nests	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Not be permitted to destruct active nests or eggs of migratory birds. • Minimize the tree removal during the bird breeding season. If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and locate active nests.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> • If bird nests are located/ detected within the ledges and roadside embankments then those areas should be avoided. • Petroleum products should not come in contact with the natural and sensitive ecosystems. Contractor must minimize the release of oil, oil wastes or any other substances harmful to migratory birds' habitats, to any waters, wetlands or any areas frequented by migratory birds.
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding and/or physical destruction and severing of habitat areas	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Restrict the tree removal to the minimum numbers required. • Relocate hollows, where appropriate. • Fell the hollow bearing trees in a manner which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition.
Night time lighting	Lighting from construction sites and construction camps may affect the visibility of night time migratory birds that use the moon and stars for navigation during their migrations.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Use lower wattage flat lens fixtures that direct light down and reduce glare, thus reducing light pollution, • Avoid flood lights unless they are absolutely required. • Use motion sensitive lighting to minimize unneeded lighting. • Use, if possible, green lights that are considered as bird's friendly lighting instead of white or red colored lights. • Install light shades or plan the direction of lights to reduce light spilling outside the construction area.
Construction camps	Illegal poaching	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching. • Ensure that staff and Subcontractors are trained and empowered to identify, address and report potential environmental problems.

ECP 13: Protection of Fish

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities in River	The main potential impacts to fisheries are hydrocarbon spills and leaks from riverine transport and disposal of wastes into the river	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare procedures for protection of fish and submit them for supervision consultant approval. • Ensure the construction equipment used in the river are well maintained and do not have oil leakage to contaminate river water. • Contain oil immediately on river in case of accidental spillage from equipment; make an emergency oil spill containment plan (under the Fuels and Hazardous Substances Management Plan) to be supported with enough equipment, materials and human resources. • Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river.
Construction activities on the land	The main potential impacts to aquatic flora and fauna River are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	<p>The Contractor shall</p> <ul style="list-style-type: none"> • follow mitigation measures proposed in ECP 3: Water Resources Management and EC4: Drainage Management.

ECP 14: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare a traffic management plan and submit the plan for supervision consultant approval. • Strictly follow the Project's 'Traffic Management Plan' and work with close coordination with the Traffic Management Unit. • Prepare and submit additional traffic plan, if any of his traffic routes are not covered in the Project's Traffic Management Plan, and requires traffic diversion and management. • Include in the traffic plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours,

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs, etc.</p> <ul style="list-style-type: none"> • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the national Traffic Regulations.
	Accidents and spillage of fuels and chemicals	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Restrict truck deliveries, where practicable, to day time working hours. • Restrict the transport of oversize loads. • Operate vehicles, if possible, to non-peak periods to minimize traffic disruptions. • Enforce on-site speed limit.

ECP 15: Construction Camp Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare a construction camp management plan and submit the plan for supervision consultant's approval. • Locate the construction camps within the designed sites or at areas which are acceptable from environmental, cultural or social point of view; and approved by the supervision consultant. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • Submit to the supervision consultant for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.
Construction Camp Facilities	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	<p>Contractor shall provide the following facilities in the campsites</p> <ul style="list-style-type: none"> Adequate housing for all workers. Safe and reliable water supply, which should meet the national and WBG EHS Guidelines. Drinking water to be chlorinated at source, and ensure presence of residual chlorine 0.1 ~ 0.25 ppm as minimum after 30 minutes of chlorine contact time (WHO guideline). Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by location. The minimum number of toilet facilities required is one toilet for every ten persons. Treatment facilities for sewerage of toilet and domestic wastes. Storm water drainage facilities. Paved internal roads. Provide child crèches for women working construction site. The crèche should have facilities for dormitory, kitchen, indoor and outdoor play area. Schools should be attached to these crèches so that children are not deprived of education whose mothers are construction workers. Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Ensure proper collection and disposal of solid wastes within the construction camps. • Insist waste separation by source; organic wastes in one container and inorganic wastes in another container at household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approval waste disposal sites.
Fuel supplies for cooking purposes	Illegal sourcing of fuel wood by construction workers will impact the natural flora and fauna	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them using biomass for cooking. • Conduct awareness campaigns to educate workers on preserving the protecting the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse. • Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas. • Train all construction workers in basic sanitation and health care issues and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>safety matters, and on the specific hazards of their work.</p> <ul style="list-style-type: none"> • Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on regular basis. • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during rainy season in offices and construction camps and yards. • Not dispose food waste openly as that will attract rats and stray dogs. • Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices.
Safety	In adequate safety facilities to the construction camps may create security problems and fire hazards	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Provide appropriate security personnel (police or private security guards) and enclosures to prevent unauthorized entry in to the camp area. • Maintain register to keep a track on a head count of persons present in the camp at any given time. • Encourage use of flameproof material for the construction of labor housing / site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding wind storms/cyclones. • Provide appropriate type of firefighting equipment suitable for the construction camps • Display emergency contact numbers clearly and prominently at strategic places in camps. • Communicate the roles and responsibilities of laborers in case of emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to original condition requires demolition of construction camps.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Dismantle and remove from the site all facilities established within the construction camp including the

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>perimeter fence and lockable gates at the completion of the construction work.</p> <ul style="list-style-type: none"> • Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed. • Give prior notice to the laborers before demolishing their camps/units. • Maintain the noise levels within the national standards during demolition activities. • Different contractors should be hired to demolish different structures to promote recycling or reuse of demolished material. • Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site. • Handover the construction camps with all built facilities as it is if agreement between both parties (contractor and land-owner) has been made so. • Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner.

ECP 16: Cultural and Religious Issues

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near religious and cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Communicate to the public through community consultation regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Not block access to cultural and religious sites, wherever possible. • Restrict all construction activities within the foot prints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) should there be any mosque/religious/educational institutions close to the construction sites and users make objections. • Take special care and use appropriate equipment when working next to a cultural/religious institution.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> • Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given. • Provide separate prayer facilities to the construction workers. • Show appropriate behavior with all construction workers especially women and elderly people. • Allow the workers to participate in praying during construction time. • Resolve cultural issues in consultation with local leaders and supervision consultants. • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters.

ECP 17: Worker's Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (e.g. noise, dust, chemicals, construction material, solid waste, waste water, vector transmitted diseases etc.), (ii) risk factors resulting from human behavior (e.g. STD, HIV etc.) and (iii) road accidents from construction traffic.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Prepare an Occupational Health and Safety plan and submit the plan for supervision consultant's approval. • Implement suitable safety standards for all workers and site visitors which should not be less than those laid down on the international standards (e.g. International Labor Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own national standards or statutory regulations, in addition to complying with national and WBG EHS Guidelines. • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas. • Provide personal protection equipment (PPE) for workers, such as safety boots, helmets,

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones.</p> <ul style="list-style-type: none"> • Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job. • Appoint an environment, health and safety manager to look after the health and safety of the workers. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters.
	Child and pregnant labor	<p>The Contractor shall</p> <ul style="list-style-type: none"> • not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks.
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Ensure health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations should be easily accessible throughout the place of work. • Document and report occupational accidents, diseases, and incidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards, in a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules. • Provide adequate lighting in the construction area, inside the tunnels, inside the powerhouse cavern and along the roads.
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate	<p>The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECP 15 Construction Camp Management</p> <ul style="list-style-type: none"> • Adequate ventilation facilities • Safe and reliable water supply.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	substandard living standards and health hazards.	<ul style="list-style-type: none"> • Hygienic sanitary facilities and sewerage system. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECP 2 • Solid waste collection and disposal system in accordance with ECP1. • Arrangement for trainings • Paved internal roads. • Security fence at least 2 m height. • Sick bay and first aid facilities
Water and sanitation facilities at the construction sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	<p>The contractor shall</p> <ul style="list-style-type: none"> • Provide portable toilets at the construction sites, if about 25 people are working the whole day for a month. Location of portable facilities should be at least 6 m away from storm drain system and surface waters. These portable toilets should be cleaned once a day and all the sewerage should be pumped from the collection tank once a day and should be brought to the common septic tank for further treatment. • Provide safe drinking water facilities to the construction workers at all the construction sites.
Other ECPs	Potential risks on health and hygiene of construction workers and general public	<p>The Contractor shall follow the following ECPs to reduce health risks to the construction workers and nearby community</p> <ul style="list-style-type: none"> • ECP 2: Fuels and Hazardous Goods Management • ECP 4: Drainage Management • ECP 10: Air Quality Management • ECP 11: Noise and Vibration Management • ECP 14: Road Transport and Road Traffic Management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. • Train all construction workers in general health and safety matters, and on the specific hazards of their work. Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<p>procedures for fire, evacuation, and natural disaster, as appropriate.</p> <ul style="list-style-type: none"> • Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on ongoing and regular basis. This should be complemented by easy access to condoms at the workplace as well as to voluntary counseling and testing.

Annex D. Inventory of Losses

The inventory of losses is provided below. Citation in the main report: **Section 8.17.**

List of Affected Permanent Shops in the Underground Transmission Line

Sl.	Name of the Shop	Daily Income	Phone No	NID
1	Md. Kamal Hossain	250.00	01689738839	912928448481
2	Solamon Tea Stall	300.00	01823288514	1516124067794
3	Janata Pharmacy	2300.00	01923387126	3715431536
4	Momota Tyre House	2500.00	01831822788	
5	Imtiaj Telecom	20000.00	01816234949	6415362786
6	Anowar Tea Stall	400.00	01816006795	7514723115559
7	Nejam Store	7000.00	01824533854	1900319433
8	Modina Hardware	5000.00	01818050219	
9	Tutul Automobile	1400.00	01791150543	
10	Imran Hotel	6000.00	01822693961	
11	Takua Enter Prize	3500.00	01819103815	1459507669
12	Khayer Hotel	6000.00	01866905573	19757512135049300
13	Salah Vangari Store	3000.00	01817271687	
14	Jabal Hotel	5000.00	01866693308	4600753570
15	Amanot Shah Telecom	8000.00	01882587532	19921516188000025
16	Ishan Foods	20000.00	01815018509	1593526425939
17	Robi & Mintu Salon	400.00	01823456191	
18	Tahamid Fashion	6650.00	01822501000	199215920370000243
19	Alam Medico	1600.00	01816363238	1592037444436
20	Bismillah Hotel	10000.00	01830055516	8665420462
21	Farukh Mistri Auto Mobile	1000.00	01819949443	4614961573
22	Azad Hotel	850.00	01989789282	4164947089
23	Boton Kormokar	1500.00	01866356309	15182692422768
24	Shah Enterprise	12000.00	01819354073	1592037856302
25	SAWON & REZVI STORE	8000.00	01823946982	
26	Nurul Wood House	1400.00	01817255582	

Sl.	Name of the Shop	Daily Income	Phone No	NID
27	Md. Farid	15000.00	01817703546	7300326472
28	Ma Store	8000.00	01711079006	4165388093
29	Arfan Workshop	1200.00	01829922137	1450277734
30	JAFOR MOTORS	10000.00	01834852430	7770147580
31	Mizan Stor	5000.00	01711108411	5050218659
32	Babul Kanti	500.00	01818085404	28014768776
33	Salim Hotel	20000.00	01811102050	1007486135
34	Md. Naser	700.00	01866702145	8200224644
35	Arif Store	6000.00	01617208967	2800230944
36	Mayer Doa Auto Honda Garage	1000.00	01819930815	7764934324
37	Gausia Motors	5000.00	01838765814	
38	Monirul Sports and Library	5000.00	01857857336	3700232022
39	Makka Madina Diesel Service	2000.00	01855041392	
40	Momotaz Enterprise	20000.00	01819832602	1518638212802
41	Jashim Store	3000.00	01862023587	6865391020
42	Mariya Glass And Thai Fashion	10000.00	01830143253	1593526073258
43	SSN Automobiles	4000.00	01827044056	19673011495000055
44	Abdul Wahab Garage	1650.00	01818738527	5950480615
45	Rasel Store	6000.00	01839659997	5065413089
46	Shahnewaj Bappi	800.00	01616037305	7777574422
47	Akter Garej	350.00	01858548112	2564936530
48	Abu Taher Tailers	2500.00	01811212350	2800323285
49	Munireya Traders	15000.00	01817271687	8214955836
50	Jaman Shop & Stationary	8000.00	01819444202	4605896184
51	Shamsul Hotel	3500.00	01712908817	7764949678
52	Jahir Poltry Store	2500.00	01623527127	1900402817
53	Mirza Auto Center	1800.00	01823142905	19937518013000221
54	Sohag Alam Store	15000.00	01845242909	46115540475
55	Sama Store	3000.00	01828811631	1915438491
56	Jakir Pan Store	2500.00	01822536909	4600233946
57	Sawon Store	4500.00	01818166815	5965100471

Sl.	Name of the Shop	Daily Income	Phone No	NID
58	Mahabub Store	3500.00	01829502197	
59	Komor Store	5000.00	01618140798	7764824384
60	Mesars Nahar Motors	6000.00	01818021338	2350227605
61	Ma Quality Tailors	4200.00	01822119711	7764798869
62	Chowdhury Fresh Food	15000.00	01816283694	19921917470000145
63	Alamgir Store	7000.00	01855862363	1592037857753
64	Ma Babar Doya vulcanizing shop	16000.00	01909030322	1917277709436
65	Kalam Auto Mobile	6000.00	01865957694	3012930382627
66	Robin Store	4500.00	01874196348	75107527815897
67	Confidence Store	60000.00	01814142829	1917413726120
68	Harun Store	5000.00	01814996138	5950227404
69	Jabed Store	2000.00	01791511612	8202235612
70	Khokon Store	3000.00	01824993223	1593526426498
71	New Jannat Bekari	15000.00	01815510211	
72	Madie Store	18000.00	01815350626	5076262525
73	Azizur Store	2500.00	01871074965	8693472808
74	Mesars Nahar Enterprise	15000.00	01855000096	4156249502
75	Abu Taher	4000.00	01858748672	
76	Rupon shil store	2200.00	01831790870	
77	Ismail Store	9000.00	01845862508	5961654141
78	N S Cycle	8000.00	01863350761	1592829494383
79	Hanif Store	3000.00	01811534821	5500321145
80	Askandar Fruits	8000.00	01811753932	1517488717095
81	Messrs. Ahsan Radiator Soldering Serveries	2500.00	01816416856	
82	Messrs Caslima Enterprise	3500.00	01815062712	
83	Mayer Dowa Hotel	12000.00	01729137902	
84	Ma Engineering Workshop	5000.00	01831033270	
85	Shamsu Furniture	1500.00	0182941570	
86	Khalilur Rhaman	3000.00	01738774993	7767452587
87	Azad store	12000.00	01623441904	7518013884898
88	Lake View	10000.00	01823559977	19921517892000034

Sl.	Name of the Shop	Daily Income	Phone No	NID
89	Sheikh Abdul Gaffar	5000.00	01819373805	1513789161338
90	Mega Furniture	7000.00	01673690093	19911592039000596
91	Nahima store	10000.00	01813579070	09807518315000056
92	Habib Store	4000.00	01863344969	
93	Shajalal Motors	3500.00	01812294844	19951517875000049
94	Muktijodha Tea Stall	1200.00	01647530312	
95	Ma Engineering	3000.00	01811817647	1593525326973
96	Nayeem Engineering Workshop	4000.00	01814310136	1511266171883
97	Mohammadia Hotel	15000.00	01917371655	
98	Tasfi Fruit Store	7000.00	01823164833	
99	Kohinor Tyre House	10000.00	01760906175	1594132010303
100	Jamal Store	4000.00	01832608920	1591905803961
101	Shakhawat Store	25000.00	01817796822	15153224529373
102	Poly Store	3000.00	01823231870	8663230178
103	Mazumder Store	3000.00	01843032640	4616951325
104	Harun Store	10000.00	01965653836	1594309792736
105	Digital Electric Services	3200.00	01822228112	9557756211
106	Abeda Trading	5000.00	01515596324	1591904532159
107	K B K Tailors And Fabrics	7000.00	01816823612	1910912289163
108	M X Trading	20000.00	01711025260	
109	Vai auto Services	4000.00	01866778737	19929518737033683
110	Ad Computer & Photostat	2000.00	01815927296	1594121397011
111	Nur Departmental Store	10000.00	01813186150	4652611148
112	Mamoni Motors Workshop	3000.00	01829491344	1502232089
113	Lake View	8000.00	01815510805	1594309014804
114	Jubaer Honda Service	3000.00	01721500007	7329865252
115	Amir Store	1200.00	01823162158	1594308933603
116	Food Plaza Bakery&Restaurant	30000.00	01711750672	6426108111
117	New Express	2500.00	01849731638	1516158897298
118	M/A Ma Babar Ashirbad	4000.00	01823943551	1592036091294
119	Khawaja Store	8000.00	01814379560	1511828495458

Sl.	Name of the Shop	Daily Income	Phone No	NID
120	Kashem Fruit Vander	6000.00	01782505863	
121	Shohel Enterprise	9998.00	01919350880	7518394562448
122	Shahin Parlour	4000.00	01628263862	1593526426980
123	Kalam Store	20000.00	01815122453	1594309014468
124	Tusher Motors And Eng. Workshop	5000.00	01815641409	4175882234
125	M/S Roma Store	4000.00	01915839600	2363318003
126	M/S Azam Store	10000.00	01868655478	1594309792800
127	Hafej Monir Engineering	70000.00	01819610605	4600229043
128	Mostafiz Medical Hall	30000.00	01819662893	7326547531
129	Tasmin Store	1500.00	01878163980	1592037444260
130	M/S Rahman International	5000.00	01726150713	1218547979218
131	Khaja Thai Aluminum& Glass House	5000.00	01822319340	19831518666232244
132	Mum Vat Ghar	4000.00	01812062090	
133	Al Madina Traders	20000.00	01818460325	1513729129009
134	Modina Enterprise	5000.00	01818547337	1594308997484
135	Khaja Eng. Workshop	15000.00	01824572205	1915109423
136	Mintu Store	2500.00	01884802670	5064938557
137	M S Telicom	30000.00	01848480918	1594313854793
138	The Chittagong Hotel	10000.00	01819628770	9564965029
139	Ma Moni Gas Welding	3000.00	01812351681	1594116724203
140	Jakir Garage	1200.00	01832221713	4150324848
141	Ananda Polling Corner	5000.00	01815611439	1595708405299
142	Ma Auto Electric	15000.00	01822803041	
143	Foyej Enterprise	25000.00	01745624603	1595708406176
144	M/S Vai Tailors	5000.00	01715674409	7520708502277
145	Kanchon CoolingCorner	8500.00	01827835561	19921518283000113
146	Nahar Motor Tailoring Workshop	7000.00	01920552323	1990159708000068
147	Tayabia Thai Aluminum	50000.00	01824645362	1592037447642
148	Allah'r Dan Hotel	10000.00	01857001661	8230832522
149	Rafique Store	14000.00	01819621609	1513789162457

Sl.	Name of the Shop	Daily Income	Phone No	NID
150	Isma Hotel	8000.00	01782505863	8676313623
151	Car Fair	15000.00	01851642374	2842719599
152	Mukta Electric	3000.00	01759097314	
153	Dilep Medical Hall	4000.00	01814727828	2211639111221
154	Al Haque Store	2500.00	01628485563	
155	Nurzahan Ring And Tyre House	25000.00	01664746610	09924628002000014
156	Ibrahim Store	5000.00	01819357069	1517450482936
157	M/S Shumi Medico	30000.00	01819860083	1517411440268
158	Nor Jahan Enterprise	15000.00	01819644947	1518628124245
159	Shumi optics	5000.00	01674222576	
160	Al Mojib Timber & Furniture	15000.00	01821711733	
161	GausiaEnterprise	20000.00	01851377382	19931517412000100
162	Madina Gold Fashion Jewelers	5000.00	01860864995	19821517425000013
163	Allah'r Dan Biryani House	3000.00	01902842399	
164	Mirshorai Hotel	12000.00	01840336056	
165	Ohi Fast Food & Biryani House	7000.00	01817762355	1521804546569
166	M/S Sajib Enterprise	10000.00	01811205018	1528609027128
167	M/A KabirEng. Workshop	7500.00	01856847809	4150220525
168	Didar Tea Stall	3000.00		1518666250627
169	BM Electronics And Stationery	7000.00	01831407711	
170	M/S Nitu Enterprise	5000.00	01824453676	5061669338
171	ZihanEnterprise	25000.00	01817713950	7513821548770
172	Kabir Store	6000.00	01830089311	1513789164000
173	Al Madina Super Shop	7000.00	01817700541	1513710079198
174	RRahman Enterprise	20000.00	01932550460	7312396083
175	Bismillah Enterprise	25000.00	01919350880	75183954562448
176	Anisa Workshop	13000.00	01821288718	1953526343383
177	M/S Taqwa Enterprise	4000.00	01819103815	
178	A K Traders	10000.00	01811674141	5500229413
179	Angelie Rose	7000.00	01979000253	19821595707358761

Sl.	Name of the Shop	Daily Income	Phone No	NID
180	M/SThahar Shah Enterprise	40000.00	01779989039	1969595707044327
181	Jahangir Store	3000.00	01813689335	5500322036
182	Azim Store	10000.00	01633973725	
183	Mamumn Vangari Dokan	20000.00	01811860172	1592827520992
184	Bismillah Sanitary	10000.00	01746187993	1593526926716
185	Gauchia Hoque Engineering	50000.00	01932979594	
186	New General Refrigeration&Air Condition	5000.00	01811859180	3015140773909
187	Rasel Store	4000.00	01830040892	
188	Azmir Binding House	1500.00	01912060143	1594314764309
189	Rabiul Store	15000.00	01715115789	9564965193
190	Amanat ShahAuto Electronics	5000.00	01815300974	9118872648
191	Joni Store	2000.00	01843773622	1594131399050
192	Jhal Bitan	10000.00	01712078756	1013058217
193	Al Amin Trading	25000.00	01817207122	1594313855373
194	Shimul Store	11000.00	01839086851	1594309789498
195	Lucky Pharmacy	3000.00	01960552857	1528208059856
196	Biswanath Store	40000.00	01827414044	
197	Sumon Store	12000.00	01790382711	
198	Nazrul Store	13000.00	01821393047	7779661284
199	Lake View	14000.00	01843008736	
200	Fair Price	25000.00	01671204718	
201	Mohammadi Auto Car Serving	12000.00	01831014440	2826103273

List of Affected Small Temporary Shops in the Underground Transmission Line

Sl.	Name of the Shop / Owner	Daily Income	Phone No	NID
	Khayer Hotel	6000	01866905573	19757512135049342
	Banana's Store	5000	01880923385	1595707044932
	T Shirt Store	2498	01643425593	
	Rahim Halim	2998	01770406135	
	Rajib Store	2199	01829874875	5117387327486
	Solaiman Center	2000	01828065207	
	Banana Shop	1200	01840906156	15161523804566
	Kashem Store	3000	01871145852	
	Reyad Tea Stall	1500	01834686701	
	Vai Store	2500	01818441881	
	Shahid Halim Shop	3998	01874014496	
	Hanif Pant Dokan	2000	01938278418	19977510763000237
	Nurul Banana Van	2500	01866590950	
	Faruk sandal Shop	2000	01756382653	9196216282794
	Saiful Clothing's	2000	01882774573	
	Belayet Fruit Vendor	6000	01837320520	19850518785023
	Mojib Tee Stall	7000	01818588925	1594308369871
	Fruit Shop	5000	01828450572	
	Sugarcane Juice Shop	1100	01871560095	
	Md. Mahbub Alam	1500	01841161361	
	Raju Halim	6000	01876289913	
	MamaHalim	7000	01879723037	
	Shahbuddin Jhal Dokan (Spicy Food)	7000	01863380092	
	Razvi FruitVendor	8000	01814786888	6880448565
	Cosmetics Shop	4000	01643424523	
	Jashim Store	7000	01610168046	
	Fruits Corner	3000	01864833663	
	Sujon Barua	2500	01925798622	
	RahimStore	1400	01827528436	

List of Probable Affected Persons of the Tower Footing Locations (in terms of Right of Records)

PÆMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© mæcÖmviY I kw³kvjxKiY cÖK†íi AvlZvq f,Mf©` Ges
Ifvi†nW UÖvÝwgkb jvB†bi ¶¶¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgí mæcve`` gvwj†Ki ZvwjKv

wb†æœ †`lqv nj

†gŠRvt kvnvwgicyi, †RGjt 28

Dc†Rjvt e`i, †Rjvt PÆMÖvg|

µwgK bs	cwievi cÖavb Gi bvg wcZv/ `^vgxi bvg wVKvbvmn	†gŠRv	†RGj bs	cøU/ `vM bs	LwZqv†bi aiY (GmG/wmGm/AviGm/weGm)	LwZqv bs	†gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gŠíe``
1.	Av: Lv†jK, wcZv: Qid Dĭxb, mvs- kvnvwgicyi	kvnvwgicyi	28	5346	weGm	191	04 kZvsk	bvj	
2.	bwRi AvnæŠ`, wcZv: Avãyj jwZd, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
3.	Ave`yj Qvgv`, wcZv: Bgvg Dĭxb, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
4.	Ave`yj †Qvevb, wcZv: Bgvg Dĭxb, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
5.	Kzj †g†ni, Rs: Ave`yj MwY, mvs- kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
6.	Avwgbv LvZzb, Rs: Avwgbj nK, mvs- kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvxq (kZvsk)	Rwgi aiY	gšŕe
7.	†gvnv‡Š` BQvnnK, wcZv: Ave`yj AvwRR, mvs- kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
8.	Bgv Avwgb, wcZv: Ave`yj AvwRR, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
9.	Av: Lv‡JK, wcZv: Qid Dİxb, mvs- kvnvwgicyi	kvnvwgicyi	28	5348	weGm	191	07 kZvsk	bvj	
10.	bwRi Avn‡Š`, wcZv: Av‡yj jwZd, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
11.	Ave`yj Qvgv`, wcZv: Bvgv Dİxb, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
12.	Ave`yj †Qvevb, wcZv: Bvgv Dİxb, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
13.	Kzj †g‡ni, Rs: Ave`yj MwY, mvs- kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
14.	Avwgbv LvZzb, Rs: Avwgbvj nK, mvs- kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
15.	†gvnv‡Š` BQvnnK, wcZv: Ave`yj	kvnvwgicyi	28		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqv bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe
	AvwRR, mvs- kvnvwgicyi								
16.	Bgv Avwgb, wcZv: Ave`yj AvwRR, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm			bvj	
17.	Bb ‡gvnv‡Š`, Rs: byi Avnv‡Š`, mvs- kvnvwgicyi	kvnvwgicyi	28	5356	weGm	1028	06 kZvsk	bvj	
18.	Bb ‡gvnv‡Š`, Rs: byi Avnv‡Š`, mvs- kvnvwgicyi	kvnvwgicyi	28	5349	weGm	1028	06 kZvsk	bvj	
19.	Rwigb LvZzb, Rs- gKeyj Avnv‡Š`, mvs-kvnvwgicyi	kvnvwgicyi	28	5350	weGm	1599	15 kZvsk	bvj	
20.	wmwĭK Avnv‡Š`, wcZv: AvKv` Avnv‡Š`, mvs- kvnvwgicyi	kvnvwgicyi	28		weGm				
21.	AvwRRyj nK, Pvb ‡gvnv‡Š`, wcZv: byi Avnv‡Š`, mvs- kvnvwgicyi	kvnvwgicyi	28	5355	weGm	1496	04	bvj	
22.	BDQzc Avnv‡Š`, wcZv: Rvgvj Dwĭb, mvs-kvnvwgicyi	kvnvwgicyi	28		weGm				

PÆMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© mæcÖmviY I kw³kvjxKiY cÖK†îi AvIZvq f,Mf©` Ges
Ifvi†nW UÖvÝwgkb jvB†bi ¶¶¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgî mæcve` gvwj†Ki ZvwjKv
wb†æœ †`lqv nj
†gŠRvt wkKjevnv, †RGjt 8
Dc†Rjvt cwUqv, †Rjvt PÆMÖvg|

µwgK bs	cwievi cÖavb Gi bvg wcZv/ `^vgxi bvg wVKvbvmn	†gŠRv	†RGj bs	cøU/ `vM bs	LwZqv†bi aiY (GmG/wmGm/AviGm/weGm)	LwZqv bs	†gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgî aiY	gŠîe`
1.	AvjZve wgqv, wcZv: Avkivd Avjx, mvs- wkKjevnv	wkKjevnv	8	6844	weGm	269	28 kZvsk	bvj	
2.	AvjZve wgqv, wcZv: Avkivd Avjx, mvs- wkKjevnv	wkKjevnv	8	6846	weGm	269	32	bvj	
3.	iv†eqv LvZzb, Rs: Bgvg kwic, mvs- wkKjevnv	wkKjevnv	8	6845	weGm	2929	13 kZvsk	bvj	
4.	mvnv Avjg, wcZv- Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8	6856	weGm	3067	17	bvj	
5.	b~iæj Bmjvg, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
6.	Av†bvqvi Bmjvg, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe
7.	b~iæj Avjg, wcZv- Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
8.	RvwMi Avnv‡Š`, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
9.	‡gvnv‡Š` nvQb Avjx, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
10.	‡gvnv‡Š` Rbvc Avjx, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
11.	g‡bvqviv ‡eMg, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
12.	ggZvR ‡eMg, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
13.	LwZRv ‡eMg, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
14.	Rvnvbvivi ‡eMg, wcZv-Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe
15.	Rwibv LvZzb, Rs- Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
16.	wjwjqviv ‡eMg, Rs- Ave`yj gybvc, mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
17.	b~i Rvnvb ‡eMg, Rs- gby wgqv mvs- wkKjevnv	wkKjevnv	8		weGm			bvj	
18.	%oQq` gybvd, wcZv: ZwgR Dwib, mvs- wkKjevnv	wkKjevnv	8	6857	weGm	1594	18 kZvsk	bvj	

PÆMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© mæcÖmviY I kw³kvjxKiY cÖK†îi AvIZvq f,Mf©`` Ges
Ifvi†nW UÖvÝwgkb jvB†bi ¶q¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgî mæcve`` gvwj†Ki ZvwjKv
wb†æœ †`lqv nj

†gŠRvt Pijÿ``v, †RGjt 13

Dc†Rjvt cwUqv/e>`i, †Rjvt PÆMÖvg|

µwgK bs	cwievi cÖavb Gi bvg wcZv/ ``^vgxi bvg wVKvbvmn	†gŠRv	†RGj bs	cøU/ `vM bs	LwZqv†bi aiY (GmG/wmGm/AviGm/weGm)	LwZqv bs	†gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgî aiY	gšŕe``
1.	Ave`yj AvwRg, wcZv: Avjx Avnvæš`	Pijÿ``v (cwUqv)	13	2346	weGm	357	08 kZvsk	bvj	
2.	Ave`yj QËi, wcZv: Avwgb kwid	Pijÿ``v (cwUqv)	13		weGm			bvj	
3.	Aväyj Reÿi, wcZv: Avwgb kwid	Pijÿ``v (cwUqv)	13		weGm			bvj	
4.	Ave`yi ingvb, wcZv: bwRi Avnvæš`	Pijÿ``v (cwUqv)	13		weGm			bvj	
5.	Awj Avnvæš`, wcZv: AvQgZ Avjx	Pijÿ``v (cwUqv)	13		weGm			bvj	
6.	dRj Avnvæš`, wcZv: AvQgZ Avjx	Pijÿ``v (cwUqv)	13		weGm			bvj	
7.	nvRx †ejv†qZ Avjx, wcZv: d†Z Avjx	Pijÿ``v (cwUqv)	13		weGm			bvj	
8.	gwdR Dj``v, wcZv: d†Z Avjx	Pijÿ``v (cwUqv)	13		weGm			bvj	
9.	Avwgb Dj``v, wcZv- d†Z Avjx	Pijÿ``v (cwUqv)	13		weGm			bvj	
10.	Ave`yj evwiK, wcZv- Avjx Avnvæš`	Pijÿ``v (cwUqv)	13		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vvgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvx (kZvsk)	Rwgi aiY	gšŕe`
11.	Ave`yj gv‡jK, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
12.	†gvnv‡Š` †nv‡mb, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
13.	^Qq` Avnv‡Š`, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
14.	MYy wgqv, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
15.	Ave`yj AvwRg, wcZv: Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13	2347	weGm	357	20	bvj	
16.	Ave`yj QĖi, wcZv: Avwgb kwid	PijŸ`v (cwUqv)	13		weGm			bvj	
17.	Avăyj ReŸi, wcZv: Avwgb kwid	PijŸ`v (cwUqv)	13		weGm			bvj	
18.	Ave`yi ingvb, wcZv: bwRi Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
19.	Awj Avnv‡Š`, wcZv: AvQgZ Avjx	PijŸ`v (cwUqv)	13		weGm			bvj	
20.	dRj Avnv‡Š`, wcZv: AvQgZ Avjx	PijŸ`v (cwUqv)	13		weGm			bvj	
21.	nvRx †ejv‡qZ Avjx, wcZv: d‡Z Avjx	PijŸ`v (cwUqv)	13		weGm			bvj	
22.	gwdR Dj`v, wcZv: d‡Z Avjx	PijŸ`v (cwUqv)	13		weGm			bvj	
23.	Avwgb Dj`v, wcZv- d‡Z Avjx	PijŸ`v (cwUqv)	13		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vvgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe`
24.	Ave`yj evwiK, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
25.	Ave`yj gv‡jK, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
26.	†gvnv‡Š` †nv‡mb, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
27.	^Qq` Avnv‡Š`, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
28.	MYy wgqv, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)			weGm			bvj	
29.	Ave`yj AvwRg, wcZv- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13	2348	weGm	358	06	bvj	
30.	Av‡e`v LvZzb, Rs- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
31.	Ave`yj ReŸvi, wcZv: Avwgb kwic	PijŸ`v (cwUqv)	13		weGm			bvj	
32.	Ave`yj QĖvi, wcZv: Avwgb kwic	PijŸ`v (cwUqv)	13		weGm			bvj	
33.	Ave`yj AvwRg, wcZv: Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13	2349	weGm	358	31	bvj	
34.	Av‡e`v LvZzb, Rs- Avjx Avnv‡Š`	PijŸ`v (cwUqv)	13		weGm			bvj	
35.	Ave`yj ReŸvi, wcZv: Avwgb kwic	PijŸ`v (cwUqv)	13		weGm			bvj	
36.	Ave`yj QĖvi, wcZv: Avwgb kwic	PijŸ`v (cwUqv)	13		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vvgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvx (kZvsk)	Rwgi aiY	gšŕe`
37.	b~iæj Bmjvg, wcZv: QvLvqZ wgqv	Pijÿ`v (cwUqv)	13	2844	weGm	957	30 kZvsk	bvj	
38.	Lwjg wgqv, wcZv: AvgvbZ Avjx	Pijÿ`v (cwUqv)	13		weGm			bvj	
39.	‡gvnv‡Š` Bwjqvm wgTv, wcZv: ‡gvnv‡Š` b~l wgTv	Pijÿ`v (cwUqv)	13		weGm			bvj	
40.	b~iæj Avjg, wcZv: Avjx eKm	Pijÿ`v (cwUqv)	13		weGm			bvj	
41.	Rv‡b Avjg, wcZv: Avjx eKm	Pijÿ`v (cwUqv)	13		weGm			bvj	
42.	b~iRvnb †eMg, Rs- Avjx eKm	Pijÿ`v (cwUqv)	13		weGm			bvj	
43.	Ry‡jLv LvZzb, Rs- Zv‡je Avjx, mvs- †MvmvBjWv½v	Pijÿ`v (e`i)	13	12165	weGm	674	17 kZvsk	bvj	
44.	Ave`yj Kv‡`i, wcZv: evnv wgTv, mvs- ga` nvwjkn	Pijÿ`v (e`i)	13		weGm			bvj	
45.	wQwĳK Avnv‡Š`, wcZv: AwQ wgTv	Pijÿ`v (e`i)	13		weGm			bvj	
46.	Ave`yj Lv‡jK, wcZv: midZ Avjx, mvs- K`yiwlj	Pijÿ`v (e`i)	13		weGm			bvj	
47.	d‡qRv LvZzb, Rs- Qv‡j Avnv‡Š`, mvs- nvwjkn	Pijÿ`v (e`i)	13		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vvgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvx (kZvsk)	Rwgi aiY	gšŕe`
48.	‡gv: kwic, wcZv: evKi Avjx	Pijŕ`v (e`i)	13	12166	weGm	1018	16 kZvsk	bvj	
49.	gqgybv LvZzb, Rs- gwbi Dwİb, mvs- Ryjav	Pijŕ`v (e`i)	13	12167	weGm	1018	30 kZvsk	evox	
50.	‡gvnvŕŠ` ‡jvKg vb, wcZv: Bgvg kwid, mvs- ga` nvwjkn	Pijŕ`v (e`i)	13	13164	weGm	981	20 kZvsk	bvj	
51.	‡nv‡Qb AvnvŕŠ`, wcZv: nvwg` Dwİb, mvs- Ryjav	Pijŕ`v (e`i)	13	13165	weGm	1095	10 kZvsk	bvj	

PÆMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© mæcÖmviY I kw³kvjxKiY cÖK†íi AvIZvq f,Mf©` Ges
Ifvi†nW UÖvÝwgkb jvB†bi ¶¶q¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgi mæcve` gvwj†Ki ZvwjKv
wb†æœ †`lqv nj
†gŠRvt †Mvevw`qv, †RGjt 32

Dc†Rjvt e`i, †Rjvt PÆMÖvg|

µwgK bs	cwievi cÖavb Gi bvg wcZv/ `^vgxi bvg wVKvbvmn	†gŠRv	†RGj bs	cøU/ `vM bs	LwZqv†bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	†gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gŠíe`
1.	Ave`yj MwY †PŠayix. wcZv: AwQ wgqv †PŠayix	†Mvevw`qv	32	151	we Gm	06	98 kZvsk	bvj	
2.	Ave`yj MwY †PŠayix. wcZv: AwQ wgqv †PŠayix	†Mvevw`qv	32	152	we Gm	06	80 kZvsk	bvj	
3.	evsjv†`k miKv†ii c†ÿ †WcywU Kwgkbvi, PÆMÖvg	†Mvevw`qv	32	153	we Gm	01	19 kZvsk	c_	
4.	evsjv†`k miKv†ii c†ÿ †WcywU Kwgkbvi, PÆMÖvg	†Mvevw`qv	32	154	we Gm	01	08kZvsk	c_	

PAEMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© m‡cÖmviY I kw³kvjxKiY cÖK†íi AvIZvq f,Mf©` Ges
Ifvi†nW UÖvÝwgkb jvB†bi ¶¶¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgí m‡cve` gvwj†Ki ZvwjKv

wb†æ †`lqv nj

†gvU Rwgí cwígvb

†gŠRvt %eivM, †RGjt 3

Dc†Rjvt Av†bvqviv, †Rjvt PAEMÖvg|

µwgK bs	cwievi cÖavb Gi bvg wcZv/ `^vgxi bvg wVKvbvmn	†gŠRv	†RGj bs	cøU/ `vM bs	LwZqv†bi aiY (GmG/wmGm/AviGm/weGm)	LwZqv bs	†gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgí aiY	gšé`
1.	gwdRRi ingvb, wcZv: †n`v†qZ Avjx	%eivM	3	2036	weGm	1620	62 kZvsk	bvj	
2.	†kL †nv†mb, wcZv: gL†jQzi ingvb	%eivM	3	3863	weGm	1190	30	bvj	
3.	†gvnv‡Š` Avjx, wcZv: †ki Avjx	%eivM	3	3865	weGm	1190	12	bvj	
4.	ggZvR †eMg, wcZv: AvwRRyi ingvb								
5.	kKzbZvR †eMg, wcZv: AvwRRyi ingvb	%eivM	3		weGm				
6.	wmwİK Avnv‡Š`, wcZv: myjZvb Avnv‡Š`	%eivM	3	3864	weGm	1066	17	bvj	
7.	AwQqi ingvb, wcZv: iwGR Dwİb	%eivM	3	3862	weGm	09	7	bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvxq (kZvsk)	Rwgi aiY	gšŒe
8.	Ave`yj iKzi, wcZv: Ggivb Avjx, mvs- e`i	%eivM	3		weGm				
9.	Avievb Avjx, wcZv: gb‡nvi Avjx	%eivM	3	3867	weGm	574	12	bvj	
10.	gRwjk Lvb, wcZv: AvwRRyi ingvb	%eivM	3	3861	weGm	1596	09	bvj	
11.	e`iaevvgvb, wcZv: jvj wgqv	%eivM	3		weGm				
12.	wbRvgZ Avjx, wcZv: GqvKze Avjx	%eivM	3	3860	weGm	1360	7	bvj	
13.	wbqvgZ Avjx, wcZv: GqvKze Avjx	%eivM	3		weGm			bvj	
14.	Ave`ym mvjvg, wcZv †KivgZ Avjx	%eivM	3		weGm			bvj	
15.	‡iv‡Kqv LvZzb, wcZv †KivgZ Avjx	%eivM	3		weGm			bvj	
16.	ilkbqviv, wcZv †KivgZ Avjx	%eivM	3		weGm			bvj	
17.	‡MvjZvR LvZzb, Rs- †KivgZ Avjx	%eivM	3		weGm			bvj	
18.	gRwjk Luv, wcZv: AvwRRyi ingvb	%eivM	3		weGm			bvj	

PAEMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© mæcÖmviY I kw³kvjxKiY cÖK†íi AvIZvq f,Mf©` Ges
Ifvi†nW UÖvÝwgkb jvB†bi ¶¶¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgi mæcve` gvwj†Ki ZvwjKv
wb†æœ †`lqv nj

†gŠRvt `y`Kzgov, †RGjt 13

Dc†Rjvt Av†bvqviv, †Rjvt PAEMÖvg|

µwgK bs	cwievi cÖavb Gi bvg wcZv/ `^vgxi bvg wVKvbvmn	†gŠRv	†RGj bs	cøU/ `vM bs	LwZqv†bi aiY (GmG/wmGm/AviGm/weGm)	LwZqv bs	†gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšé`
1.	Ave`ym †Qvevnb, wcZv: AvjZvc wgTv, mvs- †evqvwwjqv	`y`Kzgov	13	57	weGm	145	09	bvj	
2.	Ave`yj Mdzi, wcZv: AvjZvc wgTv, mvs- †evqvwwjqv	`y`Kzgov	13		weGm			bvj	
3.	Ave`yj gv†jK, wcZv: AvjZvc wgqv, mvs- †evqvwwjqv	`y`Kzgov	13		weGm			bvj	
4.	gvweqv LvZzb, Rs- gby wgTv, mvs- †evqvwwjqv	`y`Kzgov	13		weGm			bvj	
5.	KvRjx LvZzb, Rs- AvjZvc wgTv, mvs- †evqvwwjqv	`y`Kzgov	13		weGm			bvj	
6.	Ave`ym †Qvevnb, wcZv: AvjZvc wgTv, mvs- †evqvwwjqv	`y`Kzgov	13	48	weGm	147	11	bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe
7.	Ave`yj Mdzi, wcZv: AvjZvc wgTv, mvs- †evqvwjqv	`y`Kzgov	13	55	weGm	147	5	bvj	
8.	Ave`yj gv‡jK, wcZv: AvjZvc wgTv, mvs- †evqvwjqv	`y`Kzgov	13		weGm			bvj	
9.	Ave`ym †Qvevnb, wcZv: AvjZvc wgTv, mvs- †evqvwjqv	`y`Kzgov	13		weGm			bvj	
10.	Ave`yj Mdzi, wcZv: AvjZvc wgTv, mvs- †evqvwjqv	`y`Kzgov	13	55	weGm	147	5	bvj	
11.	Ave`yj gv‡jK, wcZv: AvjZvc wgTv, mvs- †evqvwjqv	`y`Kzgov	13		weGm			bvj	
12.	myjZvb Luv, wcZv: dwKi gvgy`, mvs- †Mvevw`qv	`y`Kzgov	13	56	weGm	1085	09	bvj	
13.	Aveyj Kv‡kg, wcZv: GgvR gvmy`	`y`Kzgov	13	150	weGm	256	42	bvj	
14.	b~i Bmjvg, wcZv: GgvR gvmy`	`y`Kzgov	13		weGm			bvj	
15.	%oQq` Avnv‡š`, wcZv: GgvR gvmy`	`y`Kzgov	13		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe`
16.	Aveyj Kvjvg, wcZv: GgvR gvmy`	`y`Kzgov	13		weGm			bvj	

পাওয়ার গ্রিড কোম্পানী অফ বাংলাদেশ লিমিটেড
বিদ্যুৎ সরবরাহ উন্নয়ন ও বিস্তারন প্রকল্প, চট্টগ্রাম
স্বয়ংক্রিয় সিস্টেম ইন্সটলেশন ও অপারেশন
গাইডলাইন

৪২ নং সারণী, ৪২

পাওয়ার গ্রিড কোম্পানী অফ বাংলাদেশ লিমিটেড

ক্র.সং.	সিস্টেমের বিবরণ	৪২ নং সারণী	৪২	৪২	৪২	৪২	৪২	৪২	৪২
১.	৪২ নং সারণী, ৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২
২.	৪২ নং সারণী, ৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২
৩.	৪২ নং সারণী, ৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২
৪.	৪২ নং সারণী, ৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২
৫.	৪২ নং সারণী, ৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২	৪২

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe
	gnvRb, mvs- †`ŠjZcyi								
6.	iæwŸYx Ki, wcZv: mvi`v Pib Ki, mvs- †`ŠjZcyi	%Kbcyiv	42	107	weGm	1393	6	bvj	
7.	P>`Kzgvi Ki, wcZv: mvi`v Pib Ki, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
8.	wPšÍv niY Ki, wcZv: cÖ‡gv` iÄb Ki, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
9.	bvivqb Ki, wcZv: cÖ‡gv` iÄb Ki, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
10.	nwiab Ki, wcZv: cÖ‡gv` iÄb Ki, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
11.	ejivg Ki, wcZv: ei`v Pib Ki, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
12.	abÄq Ki, wcZv: ei`v Pib Ki, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvxq (kZvsk)	Rwgi aiY	gšŕe
13.	Kvjx Kzgvi Ki, wcZv: ei`v Pib Ki, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
14.	‡`‡e`ª jvj kxj, wcZv: g‡nk P>ª kxj, mvs- †`ŠjZcyi, cwUqv	%Kbcyiv	42	190	weGm	723	26	bvj	
15.	Kwei Avnv‡Š`, wcZv: AvwKgwİb, mvs- †`ŠjZcyi	%Kbcyiv	42	105	weGm	426	46	bvj	
16.	‡e`ywb LvZzb, Rs- evQv wgqv, mvs †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
17.	‡gvnv‡Š` Kv‡kg, wcZv: ‡gvnv‡Š` mvni gyjøYK	%Kbcyiv	42	133	weGm	464	19	bvj	
18.	cwigj P>ª kxj, Rs- mvi`v PiY kxj, mvs- †`ŠjZcyi	%Kbcyiv	42	123	weGm	856	40	bvj	
19.	gvqvK^ix kxj, Rs- mvi`v P>ª kxj, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvxq (kZvsk)	Rwgi aiY	gšŕe
20.	wegj P>`a kxj, wcZv: ni‡gvnb kxj, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
21.	Myaxi P>`a kxj, wcZv: ni‡gvnb kxj, mvs- ‡`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
22.	cwigj P>`a kxj, Rs- mvi`v PiY kxj, mvs- †`ŠjZcyi	%Kbcyiv	42	120	weGm	856	9	bvj	
23.	gvqvk^ix kxj, Rs- mvi`v P>`a kxj, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
24.	wegj P>`a kxj, wcZv: ni‡gvnb kxj, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
25.	Myaxi P>`a kxj, wcZv: ni‡gvnb kxj, mvs- ‡`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
26.	‡gvnvæš` byiæj Bmjvg, wcZv: Rv‡b Avjg, mvs- AvjKiY	%Kbcyiv	42	132	weGm	843	39	bvj	
27.	gvwZqvi ingvb, wcZv: ‡gveviK Avjx, mvs-‡`ŠjZcyi	%Kbcyiv	42	135	weGm	1271	29	bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvxq (kZvsk)	Rwgi aiY	gšŒe
28.	Lwj‡ji ingvb, wcZv: ‡gveviK Avjx, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
29.	Ave`yi ingvb, wcZv: ‡gveviK Avjx, mvs- †`ŠjZcyi	%Kbcyiv	42		weGm			bvj	
30.	নিরোধ চন্দ্র ধর, পিং- মহেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42	১০৮	weGm	৭৯২	২৪	bvj	
31.	হিমাংশু বিমল ধর, পিং- মহেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
32.	সারদা চরন , পিং- কেবল কৃষ্ণ, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
33.	বিনোদ বিহারী ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
34.	জুধাংশু শিকল ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
35.	সুখন্তি ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
36.	গিরজাঙ্গন ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
37.	মনটু ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvxq (kZvsk)	Rwgi aiY	gšŒe
38.	বক্শিম কুমার ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
39.	পেটিন ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
40.	নিরোধ চন্দ্র ধর, পিং- মহেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
41.	হিমাংশু বিমল ধর, পিং- মহেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
42.	সারদা চরন , পিং- কেবল কৃষ্ণ, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
43.	বিনোদ বিহারী ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
44.	জুধাংশু শিকল ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42	১০৯	weGm	৭৯২	২২	bvj	
45.	সুখন্তি ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
46.	গিরজাঙ্গন ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
47.	মন্টু ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	
48.	বক্শিম কুমার ধর, দেবেন্দ্র ধর, সাং- বড় উঠান				weGm	৭৯২		bvj	
49.	পেটিন ধর, দেবেন্দ্র ধর, সাং- বড় উঠান	%Kbcyiv	42		weGm	৭৯২		bvj	

PÆMÖvg AÂ†ji Aax‡b we``zr wm‡÷g †bUlqvK© m‡cÖmviY I kw³kvjxKiY cÖK‡íi AvlZvq f,Mf©` Ges
lfvi‡nW UÖvÝwgkb jvB‡bi ¶q¶wZ wbifc‡Yi Rixc Gi cøU I `vM Abyhvxq Rwgi m‡cve` gvwj‡Ki ZvwjKv
wb‡æ †`lqv nj

‡gŠRvt PvZzixqv, †RGjt 41
Dc‡Rjvt Av‡bvqviv, †Rjvt PÆMÖvg|

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ˘^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ ˘vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg ˘vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe˘
1.	Qv‡j Avnvŕš˘, wcZv: Avnvŕš˘ AvbRy wgqv,	PvZzixqv	41	66	weGm	875	10	bvj	
2.	Ave˘yj QvĖvi, wcZv: Avnvŕš˘ AvbRy wgqv	PvZzwiqv	41		weGm				
3.	Kvgvj Dĭxb Luv, wcZv: dR‡ji ingvb, mvs- eo DVvb	PvZzwiqv	41	67	weGm	383	11	bvj	
4.	QvBdzwĭb Luv, wcZv: dR‡ji ingvb, mvs- eo DVvb	PvZzixqv	41		weGm			bvj	
5.	byiæj Avjg, wcZv: AwQqi ingvb, mvs- eo DVvb	PvZzwiqv	41		weGm			bvj	
6.	Rûiæj Avjg, wcZv: AwQqi ingvb, mvs- eo DVvb	PvZzwiqv	41		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe
7.	Ave`yj nvwg` gvmy`, wcZv: AwQqi ingvb, mvs- eo DVvb	PvZzixqv	41		weGm			bvj	
8.	dwQDj Avjg, wcZv: AwQqi ingvb, mvs- eo DVvb	PvZzwiqv	41		weGm			bvj	
9.	AvwRRyj nK, wcZv: AvwRRyi ingvb, mvs- eo DVvb	PvZzwiqv	41		weGm			bvj	
10.	gvndzRyj nK Luv, wcZv: AvwRRyi ingvb, mvs- eo DVvb	PvZzixqv	41		weGm			bvj	
11.	Gg`v`yj nK Luv, wcZv: AvwRRyi ingvb, mvs- eo DVvb	PvZzwiqv	41		weGm			bvj	
12.	GRvnviæj nK Luv, wcZv: AvwRRyi ingvb, mvs- eo DVvb	PvZzwiqv	41		weGm			bvj	

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^vgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe
13.	Avgvb Dj`v Lvu, wcZv: ‡ki Avjx Luv, mvs- eo DVvb	PvZzixqv	41	68	weGm	383	19	bvj	

μwg K bs	cwievi cÖavb Gi bvg wcZv/ ^vxi bvg wVKvbvmn	‡gŠR v	‡R Gj bs	cø U/ `v M bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/ weGm)	LwZq vb bs	‡gvU Rwg `vM/c øU Abyhv qx (kZvsk)	Rw gi aiY	gšle"
৬	নাজিরআহম্মদ, পিংআছিইয়ররহমান, সাংকৈগ্রাম	দৌলত পুর	১৭		বিএস			নাল	
৭	আবুলখায়ের, পিংআনজুমিয়া,সাংকৈগ্রা ম	দৌলত পুর	১৭		বিএস			নাল	
৮	আলীআহম্মদ, পিংআনজুমিয়া,সাংকৈগ্রা ম	দৌলত পুর	১৭		বিএস			নাল	
৯	মাহাবুবআলী,পিংআবদুর রশিদ , কৈগ্রাম	দৌলত পুর	১৭		বিএস			নাল	
১০	আবদুলসালাম, পিংনুরউদ্দিন, কৈগ্রাম	দৌলত পুর	১৭		বিএস			নাল	
১১	এয়ারমোহাম্মদ, পিংআবদুররহমান, কৈগ্রাম	দৌলত পুর	১৭		বিএস			নাল	আপোষবঠনসুত্রোত্রখতিয়ানেআলতাকগংওনাজির গংআরদখলেনাই

PÆMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© m‡cÖmviY I kw³kvjxKiY cÖK†íi AvlZvq f,Mf©` Ges
Ifvi†nW UÖvÝwgkb jvB†bi ¶q¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgi m‡cve`` gvwj†Ki ZvwjKv
wb†‡œ †`lqv nj
†gŠRvt দৌলতপুর, †RGjt ১৭
Dc†Rjvtপটিয়া, †Rjvt PÆMÖvg|

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ~^vvgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwgi aiY	gšŕe”
1	এজাহারমিয়া, পিংমতিউররহমান, সাংনিজ	দৌলতপুর	১৭	৩৮৭১	বিএস	৮১৬	৩	নাল	
২	আবদুলহাকিম, পিংনুরআহাম্মদ,সাংনিজ	দৌলতপুর	১৭		বিএস				
৩	আবদুলজব্বারপিংনুরআহাম্মদ,সাংনিজ	দৌলতপুর	১৭		বিএস				
৪	এজাহারমিয়া, পিংমতিউররহমান, সাংনিজ	দৌলতপুর	১৭	৩৮৭২	বিএস	৮১৪	১২	নাল	
৫	আবদুলহাকিম, পিংনুরআহাম্মদ,সাংনিজ	দৌলতপুর	১৭	৪৩৫৩	বিএস	৪২২	১৪	নাল	
৬	আবদুলজব্বারপিংনুরআহাম্মদ,সাংনিজ	দৌলতপুর	১৭	৪৩৪২	বিএস	৪২৩	১৪	নাল	
৭	আবদুলহাকিম, পিংনুরআহাম্মদ,সাংনিজ	দৌলতপুর	১৭		বিএস				
৮	আবদুলজব্বারপিংনুরআহাম্মদ,সাংনিজ	দৌলতপুর	১৭		বিএস				
৯	জরিজান ,জংআবদুলজলিল,সাংশিবলবাহা	দৌলতপুর	১৭		বিএস				
১০	জিবজানবিবি, জংআলামিএণ ,সাংশিবলবাহা	দৌলতপুর	১৭		বিএস				
১১	সুলতানআহাম্মদ,পিংইজ্জতআলী, সাংনিজ	দৌলতপুর	১৭	৪৩৫৬	বিএস	১৭৭৪	৯	নাল	
১২	আলাউদ্দিন,রশিদআহাম্মদ, পিংআছদআলী ,সাংনিজ	দৌলতপুর	১৭	৪৩৫৭	বিএস	৫৯২	২২	নাল	
১৩	আবদুলনবী, পিংআবদুলজলিলসাংনিজ	দৌলতপুর	১৭	৩৮৭৩	বিএস	৩৫৯	১২	নাল	
১৪	বদরজামান, পিংহামিদআলীসাংনিজ	দৌলতপুর	১৭	৪৩৫৪	বিএস	১৪৩১	১৬	নাল	

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১৫	জামালউদ্দিন, পিংরমজানআলীসাংনিজ	দৌলতপুর	১৭	৪৩৫৫	বিএস	১০৯৭	১৩	নাল	
১৭	মোছলেমাখাতুন, জংনাজিরআহম্মদ সাংনিজ	দৌলতপুর			বিএস				
১৮	মোকরমখাতুনজং, মোহাম্মদসরিফ সাংনিজ	দৌলতপুর			বিএস				
১৯	নাজমাখাতুন, জংফজলকরিমসাংনিজ	দৌলতপুর			বিএস				
২০	মোহাম্মদসরিফ, পিংবাছামিঞসাংনিজ	দৌলতপুর			বিএস				
২১	সুলতানাবেগম জংমোহাম্মদমছলেমসাংনিজ	দৌলতপুর			বিএস				
২২	মোহাম্মদএছাহাক পিংগুড়ানআলীসাংনিজ	দৌলতপুর			বিএস				
২৩	মুলাবিবি, জংগুড়ানআলী, সাংনিজ	দৌলতপুর			বিএস				
২৪	রহমানখাতুন, জংহামদুমিয়া, সাংনিজ	দৌলতপুর			বিএস				

PÆMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© m‡cÖmviY I kw³kvjxKiY cÖK†îi AvlZvq f,Mf©` Ges
lfvi†nW UÖvÝwgkb jvB†bi ¶q¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgi m‡cve` gvwj†Ki ZvwjKv
wb†‡œ †`lqv nj
‡gŠRvt ডাক্তারচর †RGjt ১৭
Dc†Rjvt বন্দর, †Rjvt PÆMÖvg|

μwg K bs	cwievi cÖavb Gi bvg wcZv/ `^vgxi bvg wVKvbvmn	‡gŠR v	‡RG j bs	cøU / `vM bs	LwZqv†bi aiY (GmG/wmGm/AviGm/weG m)	LwZqv b bs	‡gvU Rwg `vM/cøU Abyhvqx (kZvsk)	Rwg i aiY	gšíe`
1	আবুলইসলাম, পিংমনিরুল্লাহ, সাংনিজ	দাংগার	২২	৬১	বিএস	৩২০	২	কাটি	
২	আবদুলহকদোভাঈ	দাংগার			বিএস	৫৮৭	৭	নাল	
৩	আবুলইসলাম, পিংমনিরুল্লাহ, সাংনিজ	দাংগার	২২	৬৩	বিএস	৩২০	১একর৩৭শতাং স	নাল	
৪	সিদ্দিকআহাম্মদ, পিংহানিফমিয়া	দাংগার	২২	১১৪	বিএস	২৬৭	৫০	নাল	
৫	আবদুলসালাম, পিংসিদ্দিকআহাম্মদ,সাংনি জ	দাংগার	২২	১১৫	বিএস	১১০	৫১	নাল	
৬	সিদ্দিক, পিংহানিফমিয়া, সাংনিজ	দাংগার	২২	১১৬	বিএস	২৬৭	৩০	নাল	
৭	বাদশামিয়া, পিংআবদুররহিম, সাংনিজ	দাংগার	২২	৫৪২	বিএস	৩৯৭	২একর৫৬শতাং স	নাল	খাসখতিয়ান৯শতাং স
৮	বদিউররহমান, পিংইয়াকুবআলীসাংনিজ	দাংগার	২২	৫৫৩	বিএস	৩৮৯	৬একর৮৭শতাং স	নাল	

PÆMÖvg AÂ†ji Aax†b we``zr wm†÷g †bUlqvK© mæcÖmviY I kw³kvjxKiY cÖK†íi AvIZvq f,Mf©` Ges
Ifvi†nW UÖvÝwgkb jvB†bi ¶q¶wZ wbifc†Yi Rixc Gi cøU I `vM Abyhvqx Rwgi mæcve`` gvwj†Ki ZvwjKv
wb†æœ †`lqv nj
†gŠRvt বন্দর, †RGjt স্র
Dc†Rjvtজুলা, †Rjvt PÆMÖvg|

μwgK bs	cwievi cÖavb Gi bvg wcZv/ ^Λvgxi bvg wVKvbvmn	‡gŠRv	‡RGj bs	cøU/ `vM bs	LwZqv‡bi aiY (GmG/wmGm/AviGm/weGm)	LwZqvb bs	‡gvU Rwg `vM/cøU Abyhvxq (kZvsk)	Rwgi aiY	gšíe”
১	আপারুজ্জামান, পিংমকবুলআলী, সাংনিজ	জুলধা	২৭	৮৬০২	weGm	৫৮৩	৩	নাল	
২	মোহাম্মদসরিফ,পিং, বাকেরআলীসাংনিজ	জুলধা	২৭		weGm				
৩	মোহাম্মদহাশেম,পিংআহাম্মদমিয়া, সাংনিজ	জুলধা	২৭		weGm				
৪	হলেমান,পিংআহাম্মদমিয়া, সাংনিজ	জুলধা	২৭		weGm				
৫	মস্তফাখাতুন, জংআহাম্মদমিয়া, সাংনিজ	জুলধা	২৭		weGm				
৬	জব্বারহোসেন,পিংমজরউল্লা,সাংনিজ	জুলধা	২৭		weGm				
৭	নুরুলআলম,পিংআবদুলজলিল,সাংনিজ	জুলধা	২৭		weGm				
৮	নুরুলইসলাম, পিংআবদুলজলিল,সাংনিজ	জুলধা	২৭	৮৬২৩	weGm	১৪৪৭	১০	নাল	
৯	ফজলআহাম্মস, পিংআবদুলরশিদ,সাংনিজ	জুলধা	২৭		weGm				
১০	মোহাম্মদআলী, পিংআবদুলরশিদ,সাংনিজ	জুলধা	২৭		weGm				
১১	আফিয়াখাতুন, পিংআবদুলরশিদ,সাংনিজ	জুলধা	২৭		weGm				
১২	করিমজান, জংআবদুলরশিদ,সাংনিজ	জুলধা	২৭		weGm				

১৩	গুনুমিয়া, পিংমির্জাআলী,সাংনিজ	জুলধা	২৭		weGm				
১৪	মোহাম্মদশরিফ,পিংবারেকআলী,সাংনিজ	জুলধা	২৭		weGm				
১৫	আজিজেররহমান,পিংমোহাববতআলী ,সাংনিজ	জুলধা	২৭		weGm				
১৬	আবদুলছবুর,পিংমফিজেররহমানসাংনিজ	জুলধা	২৭		weGm				
১৭	আবদুলগফুর, পিংমফিজেররহমানসাংনিজ	জুলধা	২৭		weGm				
১৮	আলতাপমিয়া, পিংফজরেররহমান ,সাংনিজ	জুলধা	২৭		weGm				
১৯	আলমাছাতুন, জংখায়েরআহাম্মদ, সাংনিজ	জুলধা	২৭		weGm				
২০	আবদুলছাতার,পিংআবদুলকাদের, সাংনিজ	জুলধা	২৭	৮৬০২	weGm	২৯০	১২	নাল	
২১	মোহাম্মদসরিফ,পিংবাকেরআলী, সাংনিজ	জুলধা	২৭		weGm				
২২	ফজলআহাম্মদ,পিংআবদুলজলিল,সাংনিজ	জুলধা	২৭		weGm				
২৩	মহাম্মদআলী, পিংআবদুলজলিল,সাংনিজ	জুলধা	২৭		weGm				
২৪	আলতাপমিয়া, পিংফজরেররহমান ,সাংনিজ	জুলধা	২৭		weGm				

২৫	আজিজেররহমান,পিংমোহাবতআলী ,সাংনিজ	জুলধা	২৭		weGm				
২৬	আবদুলছবুর,পিং মফিজেররহমানসাংনিজ	জুলধা	২৭		weGm				
২৭	আবদুলগফুর, পিং মফিজেররহমানসাংনিজ	জুলধা	২৭		weGm				
২৮	ছলেমান ,পিংআহাম্মদমিয়া, সাংনিজ	জুলধা	২৭		weGm				
২৯	মোহাম্মদহাশেম,পিংআহাম্মদমিয়া, সাংনিজ	জুলধা	২৭		weGm				
৩০	ছাবিয়াখাতুন,জংইছাহাক,সাংনিজ	জুলধা	২৭		weGm				
৩১	জেবলহোসেন, পিংনুরআহাম্মদ ,সাংনিজ	জুলধা	২৭	৮৬২২	weGm	১১৬৮	২১	নাল	