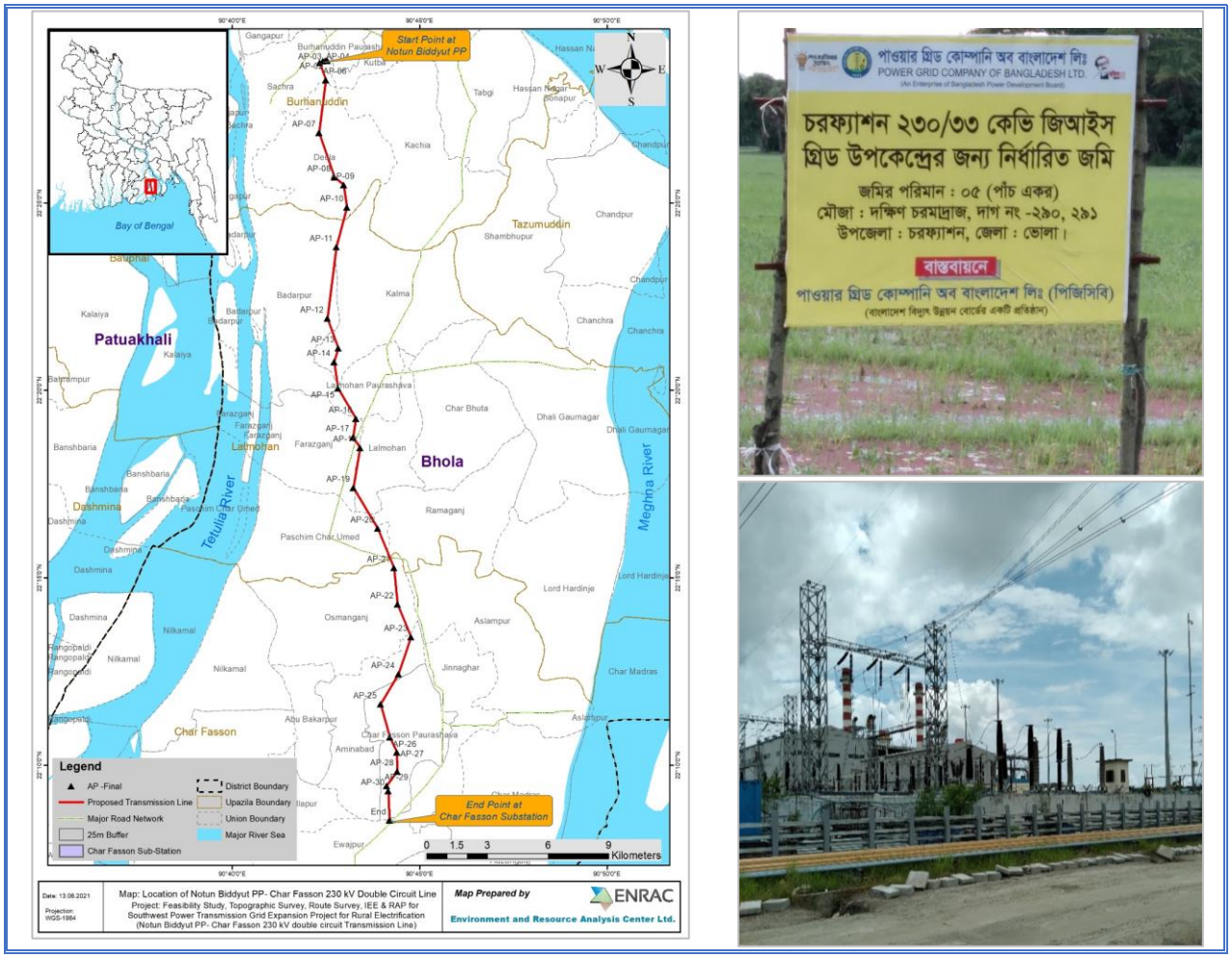
Charfasson Grid Substation & Associated Transmission Line as Additional Component under Southwest Transmission Grid Expansion Project

Initial Environmental Examination Report



Prepared By

POWER GRID COMPANY OF BANGLADESH LTD (PGCB)

October 2021

Prefaces

This report has been prepared and reviewed by ENRAC ltd, with all responsible skill, care and diligence within the Terms of the Contract with PGCB, incorporating our general Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

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Executive Summary

1. National economy and growth are greatly dependent on the availability of reliable electric power supply. The Government of Bangladesh has taken initiatives to increase the power generation capacity to meet up the rising power demand of the country. Generation of power is not only the solution, transmission of power to the consumers is also equally important for the development. To meet the rapidly increasing demand for power and to ensure its stable supply, large-scale power supply development and construction system facilities such as transmission lines and substations are necessary especially between power plants and PGCB substations. In this regard, Power Grid Company of Bangladesh Limited (PGCB) has taken numerous development projects to expand the power transmission network to supply adequate and uninterrupted electricity throughout the country. As part of the power sector master plan towards supplying electricity, PGCB has planned to construct a 230/33 kV GIS Substation at Char Fasson upazila of Bhola district under Barisal division and a 39.81 km long double circuit transmission line of 230 kV from the Notun Biddyut Power Plant (at Borhanuddin upazila, Bhola district) to the newly constructed Substation (at Char Fasson upazila, Bhola district). Additionally, two 230 kV GIS Bay Extension will also be constructed at Notun Biddyut Power Plant as part of the proposed project.

2. In this context, PGCB has initiated to conduct an Initial Environmental Examination (IEE) for the purpose of obtaining site clearance of the mentioned project. According to the Environment Conservation Act 1995 and Environment Conservation Rules (ECR) 1997, amended in December 2017, all transmission lines and substations fall under the 'Orange B Category' for which Initial Environmental Examination (IEE) including an Environmental Management Plan (EMP) is required to get clearance from the Department of Environment (DoE).

3. PGCB has entrusted Environment and Resource Analysis Center Ltd (ENRAC) as consultants to conduct Feasibility Study, Route Survey (RS), Topographical Survey (TS), Initial Environmental Examination (IEE) and Resettlement Plan (RP) studies to select the suitable route and to get necessary environmental clearance certificate from the Department of Environment (DoE).

Introduction

4. Given a steep increase in the power demand in Bhola district, Power Grid Company of Bangladesh Limited (PGCB) is facing urgent needs to increase transmission capacity in the region. The Notun Biddyut Power Plant (by NBBL) located in Borhanuddin upazila has it's own arrangement of power evacuation. Given the circumstances, construction of a 230/33 kV GIS Substation in Char Fasson and a 230 kV double circuit transmission line from Notun Biddyut Power Plant in Borhanuddin to the Substation in Char Fasson is a must, as the proposed transmission line will increase transmission capacity and reduce loss through an efficient system.

5. The environmental and social baseline conditions of the proposed study area have been developed by collecting relevant data from primary and secondary sources. Available data on climate, geology, seismicity, water resources, land resources, soil quality, agriculture, fisheries, ecology and socio-economic components have been collected from both primary and secondary sources. The study team also made field visits in potential concern locations of the study area, as per the requirement for collecting primary data on environmental and social components using Rapid Appraisal and Informal and formal Group Discussion techniques. All qualitative and quantitative information have been gathered from different primary or secondary sources and used to the relevant field accordingly for developing potential environmental and socio-economic baseline of the study area.

6. The specific environmental guideline for the power sector is not available in Bangladesh. However, the DoE environmental guidelines for the industries provide a general framework for conducting environmental study for the entire sector. Therefore, the proposed IEE will be conducted by following the DoE environmental guidelines.

Review of Policy and regulatory Frameworks

7. This report has prepared by the reviewing of several pieces of legislation and policies which have relevance to the transmission line (TL) construction activity in Bangladesh. All of these regulations are aimed at the conservation and protection of the environment and an overview of these legislations and policies is presented in this chapter. The major GoB environmental policies, rules, regulations and standards are as follows:

8. Relevant GoB Policies, Acts, Rules, Strategies and Guidelines: (1) Environmental Conservation Act (ECA), 1995 and Amendments; (2) Environment Conservation Rules (ECR), 1997 and Amendments; (3) Environment Court Act, 2010; (4) Bangladesh Water Act, 2013; (5) Wildlife (Conservation and Security) Act, 2012; (6) The Protection and Conservation of Fish Act, 1950 and Rules, 1985; (7) Disaster Management Act (2012); (8) East Bengal State Acquisition and Tenancy Act, 1950; (9) Bangladesh Labor Act, 2006 and Rules, 2015; (10) The Electricity Act, 2018; (11) Environmental Policy, 1992; (12) National Energy Policy, 2005; (13) National Conservation Strategy, 1992; (14) The National Environmental Management Action Plan, 1995; (15) The Power Policy, 1996; and (16) The Energy Policy, 1996; updated 2004; (17) ARIPA 2017; (18) Electricity Rules, 2020, etc. Relevant international policies include, (1) The Rio Declaration, 1992, (2) The Convention on Biological Diversity, 1992, (3) Convention relative to the Preservation of Fauna and Flora in their Natural State 1933; (4) International Convention for the Protection of Birds, Paris, 1950; (5) Convention on Wetlands of International Importance, Ramsar (1971), (6) Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 (Amended 1988), (7) Convention concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972, etc.

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

10. The project in concern will take place in three upazilas of Bhola district. DoE has an office under Barisal division in the Bhola district, thus this IEE report including an NOC from the local authorities concerned and other required documents should be submitted in the DoE Bhola office. In this Project, PGCB will submit the NOC letter to the respective agencies as per the sample NOC letter provided in Annex 19.

Project Description

11. Three (03) upazillas has been considered as the study area for the proposed project and the area is calculated as the Right of Way (RoW) 25 m both side of the RoW along the transmission line. This area has been considered for the impact analysis of the project. Borhanuddin, Lalmohon and Char Fasson upazilla in Bhola District under Barisal division lies as its administrative area for presenting environmental and socio-economic baseline condition of the study area. Main components of the project include:

- Construction of new 230 kV double circuit transmission line from Notun Biddyut Power Plant to Char Fasson;
- Construction of new 230/33 KV GIS substation at Char fasson.
- 2 no of Bay Extension at the Notun Biddyut Power Plant

12. The 230 kV double circuit transmission line will be 39.81 km long with 30 angle points. A total of 7.12 acres (2.4 acres for angle towers and 4.72 acres for suspension towers; 18m x18m x30 AT and 15m x15m x85 ST) of land will be required for the Transmission line tower footing. The height of the towers will be 46.2m. The transmission line will pass mostly through agricultural and barren lands. The transmission lines will pass over 92 ponds and 15 canals, but it will not cross over any rivers. However, all of the tower footings will be constructed on agricultural lands, thus no waterbody/ wetland will be harmed or filled for project purpose. Additionally, there is no freshwater collection point and irrigation point within the study area.

13. The 230/33 kV GIS Substation will require about 5 acres of land The substation area is currently an agricultural land acquired by PGCB. The land filling (approx. 3.5 m) is required before the construction of substation. The Lalmohon-Char Fasson upazila road is located just beside the substation land.

14. Two numbers of 230 kV GIS Bay Extension will be constructed at the premises of Notun Biddyut Power Plant.

15. The key construction activities will include transmission line tower and substation, installation of equipment, towers, stringing of conductors on these towers, etc.

The contractor will establish temporary facilities including construction camp, machinery yard, site office, and material storage area. These facilities are likely to be established inside the substation premises.

Baseline Condition of the Project Area

16. In order to establish a comprehensive database on the biophysical baseline conditions existing within the study area, the study team has compiled and assessed local and regional primary and secondary data from respective organizations, reports and field visits. This includes information on parameters such as surface and groundwater, air quality, meteorology, geology, soils, noise and terrestrial and aquatic ecosystems, and socio-economic conditions.

17. Key features of the existing biophysical environment are described below:

- The proposed project areas of the substation and transmission lines are located in a typical monsoon climate with three main seasons, pre-monsoon (March to May), monsoon (June to September) and post-monsoon (October to February). The weather condition, temperature, rainfall, wind of the proposed project area is varied from season to season but quite normal in range.
- The region is characterized by very high rainfall of around 2360 mm annually, particularly between the months of June and September (rainy season); Average annual temperature ranges from 11.6- 32.7°C and average annual relative humidity is around 76%.
- Topography of the project area is represented by river to delta plain topography at the surface, with elevation changes from 0 metre to 3 metres above mean sea level.
- The study area has few water bodies like khals, ponds and ditches. Tentulia River at the east and Lower Meghna river at the west are the two major water body around the study area.
- The major habitats present within the project area are cultivated land, homestead vegetation, roadside vegetation, exotic plantations, dominated by chapalish, coconut, jarul and other indigenous species, all of the remaining habitat types are widespread throughout Bangladesh.
- Terrestrial flora species are identified and recorded through visual observation, sharing photographs with community peoples, focus group discussion and public consultation and tabulated in Annex 10. The terrestrial flora of the project area mainly consisted of plantation trees, natural growing trees, herbs, shrubs, climbers, epiphytes and parasites. Plantation has been done mainly in the open field area and homestead areas using both exotic and native tree species.
- During the field visit the 150 faunal species are identified and recorded through visual observation, sharing photographs with community peoples, focus group discussion and public consultation. Among which 28 mammals, 4 amphibians, 28 reptiles, 90 bird’s and 35 fish species were recorded.

- There is no ECA nor EPA area in the closest proximity of the project area (Figure 4-25, Figure 4-26). However, 3 nearest EPA areas are Nijhum Dwip, Char Kukri Mukri and Sonarchar Wildlife Sanctuary which are located at 21.5 km, 22 km and 38km distance respectively from the Char Fasson Substation.

18. Key features of the environmental quality are described below:

- The major sources of air emissions in the study area are road dust, motor vehicle exhaust, construction dust, windblown dust from agricultural lands, smoke form biomass burning etc. Based on the ambient air quality standard of DoE, air quality in the Project area can be stated as in good condition (Annex 3).
- The existing general noise level within the study area varies from 48.8 dB to 63.5 dB during the monitoring (Annex 4) which is slightly above the standard of mixed zone land use (DoE, 1997), but not the commercial zone
- The concentration levels of all the parameters for surface water were within the acceptable limit set by the DoE, GoB (Annex 5). The water quality results indicate that water quality condition is suitable for Fisheries, irrigation and agricultural use.
- The ground water analysis (Annex 6) reveal that all the parameters are within the standard value of ECR, 1997 and it can be assuming that the ground water quality is satisfactory for drinking in the study area.

19. Key features of the existing socio-economic environment are described below:

- The majority of the people from the three upazillas are Muslims and rest of them are Hindus. However, ethnic people are present in the adjacent area of Barisal and Patuakhali districts and no ethnic community has been reported in the Bhola district during the field visit.
- The literacy rate of Borhanuddin, Lalmohon and Char Fasson Upazila in 2011 is respectively 47.9%, 40% and 43.5% for both genders. Under rural electrification program, 17-25% households reported to have access to electricity.
- Of the employed population 84.85% are engaged in agricultural work, 4.45% are working at industries and 10.7% are working as service holders.
- The land use pattern shows that a large part of the area is agricultural land covers 84.5% and vegetation covers 11.4 % of the Project corridor. The water bodies cover 3.2%, roads cover 0.6% and only 0.3% is covered by settlements.
- The major agricultural crops of Bhola District are Paddy, potato, onion, chilli, garlic, mustard seed, nut, betel leaf, betel nut. Main fruits are Coconut, jackfruit, papaya, amra, banana.
- The study area falls under the Young Meghna Estuarine Floodplain (AEZ-18) which occupies young alluvial land in and adjoining the Meghna estuary. The major soils are grey to olive, deep calcareous silt loam and silty clay loams. Calcareous alluvium and non-calcareous grey floodplain soils are the dominant general soil types.

Analyses of Alternative for TL Route and Substation Site Selection

20. 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.

21. The 'no-project' alternative was rejected because without the project, the electricity network in the Barisal 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.

22. 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.

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

24. Three different routes alignments were studied for the selection of TL with the help of published data/Google maps and walkover survey to arrive at most optimum route for detailed survey, and Option-1 (Figure 6-2) has found easy accessibility having minimum khal and permanent structure and for passing through mostly floodplain area with less amount of loss.

Impact Assessment

25. The possible impacts of the project's pre-construction and construction phase on physical and biological environment could include soil quality due to excavation of land for tower and substation construction; dust emissions caused by operation of machinery and running vehicles 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. There would be no referable impacts on wildlife habitats as well as vegetation. For civil activities for construction of Sub-station may cause habitat loss of existing rodents like mouse, mongoose etc.

26. 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, corona effect, radio interference, and solid waste generation. The EAAF did not cross the project area. The transmission line is located 27 km east from the EAAF (Figure 4-27). So migratory birds are less likely to be affected by the proposed 230kV transmission lines. However local birds may be affected by colliding with the 230kV transmission lines.

27. The most significant social impacts of the project related to the resettlement issues including land acquisition, devaluation land, impact 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, 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.

28. The construction of the transmission lines will affect 44 households with an estimated population of 375. Of the households, 44 structures may be affected by the loss of their trees and crops cleared for construction work. The land under the RoW is largely used for cultivation purposes. For the construction of the TL, there is no structures found within the 10m impact buffer from either side of the centre line. So, no physical displacement and relocation is required for this project except land acquisition and crop compensation. Number of affected trees under transmission line is 1797 which include 1055 non-fruits, 616 fruits, bamboo 84 and 42 medicinal plants.

Mitigation

29. The potentially negative environmental impacts of the substation and transmission line were found mostly during pre-construction and construction phases. Appropriate mitigation measures have been included in this IEE report. These include water sprinkling to suppress dust emissions particularly near the settlements, using properly tuned vehicles and machinery, strictly following the air pollution guideline and keep the soil moisture during any transportation for local as well as construction equipment to minimize exhaust emissions; to ensure noise pollution noise plug should be used in heavy construction equipment and construction activity time should be maintained

strictly; it is needed to ensure that the land is physically restored and construction of foundation activity to be undertaken in the dry season. It is also essential to install separator before effluent; ensuring that no untreated waste effluents are released to the environment and using appropriate treatment mechanism for this purpose; 'no hunting, no trapping, no catching' policy for the wildlife also try to avoid site clearance activity as much as possible; a compensatory replantation ratio of 1:3 will be carried out to mitigate the ecological loss of felling trees (Tree Conservation Bill, 2012), and according to tree plantation plan 5391 trees will be planted. Furthermore, the spacing between transmission line conductors will be kept in a manner to avoid electrocution of birds found in the area owing to the size of their wing span. PGCB will consider increasing the vertical clearance to 8 m or extending the height of transmission towers or use of additional angle towers to avoid any direct impacts on built structures, and physical displacements of the populations living within the corridor.

30. 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. 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, 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. Finally, to protect privacy of women, the code of conduct described above will be enforced at the site.

Stakeholder Consultation

31. The aim of public consultation is to ensure that the people and the stakeholders living in the proposed project area and make them aware of the project activities and its aim to ensure the acceptance of the transmission line and substation activities.

32. The public consultation with different stakeholders was carried out in compliance with DoE guidelines. On July 2021.ENRAC arranged three public meetings at three locations in the relevant Upazila along the project alignment as presented in Table 9-1. A total of 58 persons participated in these sessions.

33. An extensive consultation process was undertaken during the IEE field visit, in accordance with the national regulatory and ADB 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.

34. 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, geological, 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.

35. 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.

Grievance Redress Mechanism

36. 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.

37. 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 established with representation of the local Union Parishad Chairman and affected people ensuring women's representation. The PGRC will be made 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.

Environmental and Social Management Plan

38. An Environmental and Social Management Plan (ESMP) has been prepared as part of the present IEE 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).

39. An existing Environment and Social Unit (ESU) from PGCB, comprising qualified environmental and social development staff, will be engaged under the PIU. The project authority 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.

40. 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; c) Construction Environmental and Social Management Plan (CESMP), (d) labor management plan, and (e) biodiversity management plan. 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 IEE, 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 IEE 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.

41. As one of the key elements of the ESMP, a 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.

42. 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, project authority, 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.

43. For implementing the present ESMP about 9.86 million BDT will be required. The main components of this cost include 1.96 million BDT for the environmental quality monitoring of two years.

Conclusion and Recommendation

44. Barisal division is one of the important industrial zones of Bangladesh and the GoB is taking initiatives to set up multiple economic zones to upgrade different facilities and transportation network. Hence, the project was conceptualized with a rationale to expand the 230 kV transmission systems in the project area to eliminate the operational blocks caused by the existing system. The project will also provide a suitable infrastructure for the future power sector development of the area.

45. People all along the route of the transmission line and substation sites expressed their keen interest and positiveness towards the Project even after knowing the fact that they will not get electricity directly from the transmission line. Their main consideration is that the overall development in the power sector would contribute to the national development and local development as well. Local people along the transmission line

alignment will be benefited as the project will generate some employments for them during the pre-construction and construction phases.

46. Open-sourced Google image has been used in identifying the best route out of three transmission lines avoiding settlements, educational institutes, religious places, ecologically sensitive areas, etc. This has been reconfirmed by walking along the entire length of the alignment for removing confusions at some places/points. Observations of the team members suggest that the route finally selected passes mostly through agricultural crop field and does not pass-through settlements and ecologically sensitive areas. The substations sites are also fallen in the crop fields with minor aquaculture area.

47. In the construction phase, temporary disturbance to the surrounding water and settlements due to waste disposal, deterioration of soil quality during digging and earth-filling; interference with road transportation; and, reduction in crop production would be occurred in the area proposed for the substation construction.

48. Another minor impact of noise and increase in traffic are within the existing level that is experienced by the people. The erection and installation will be done under expert supervision. The contractor will ensure usage of PPE by the workers engaged in construction activities

49. Risks may arise also from traffic or heavy vehicle accidents during or in the post-construction period, electrocution, electrification from falling materials and wires, etc., which may result in physical injury, loss of life, vehicle and/ or property damage. Appropriate mitigation measures have been suggested in the report, to address all types of hazards and risks identified in the report.

50. If the COVID-19 safety protocols are not maintained adequately, it may spread among the labors and adjacent communities during project implementation. Contractor should maintain and follow the health and safety guidelines of WHO and Bangladesh government for the project during construction phase as discussed in Annex 1 (ECP 14).

51. Moreover, construction phase is a short-term phase that can be reduced by adopting the mitigation measures properly. Therefore, the anticipated negative construction related impacts could be mostly minimized by taking suggested mitigation measures and manage the implementation of the mitigation measures through the EMP including effective monitoring plan during pre-construction/construction and operation phases of the project.

52. The potential impacts during operation are long term and PGCB should ensure to mitigate these impacts through implementation of the EMP including monitoring plan properly.

53. The study recommends that the contractor should employ at least 50% of workforce from the project sites. Construction work is recommended to start just after the harvest of the standing crops and provide adequate time to harvest fish of the aquaculture pond if required to be filled up any low lands during construction. Vegetation clearance and tree felling should be bare minimum for sustaining the local ecosystem at the pre-construction and construction phases. Proper compensation for all types of damages

must be paid and the land should be brought back to its original form before handing them over to the owners. The construction labor camps should be provided with water supply and sanitation facilities. The stores and equipment yards should be properly guarded so that all equipment remain safe. The sub-stations should be fully equipped with firefighting equipment. Finally, on proper examination it is observed that the project has been proposed to be implemented safely and, in an environment friendly manner.

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Acronyms and Definitions

ADB	Asian Development Bank
AEZ	Agro Ecological Zone
AIS	Air Insulated Switchgear
AP	Angle Point
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorological Department
BPDB	Bangladesh Power Development Board
DC	Deputy Commissioner/ Double Circuit
DEPC	Department of Environmental Pollution Control
DG	Director General
DGM	Deputy General Manager
DIA	Direct Impact Area
DoE	Department of Environment
EC	Electrical conductivity
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EQS	Environment Quality Standards
FD	Forest Department
FGDs	Focused Group Discussions
GIS	Geographic Information Services
GIS	Gas Insulated Switchgear
GOB	Government of Bangladesh
GRC	Grievances Redress Committee
HES	Health Environment and Safety
HHs	Households
IEE	Initial Environmental Examination
IUCN	International Union for Conservation for Nature
Km	Kilometer
kV	kilo Volt
LGED	Local Government Engineering Department

MoEF	Ministry of Environment and Forest
MVA	Mega Voltage
MW	Mega Watt
NCS	National Conservation Strategy
NEMAP	National Environment Management Action Plan
NGOs	Non Governmental Organizations
NOC	No Objection Certificate
OMS	Operation Management System
PAPs	Project Affected Peoples
PD	Project Director
PDB	Power Development Board
PGCB	Power Grid Company Bangladesh Ltd.
PRA	Participatory Rural Appraisal
PWD	Public Works Department
PVC	Poly Venial Chloride
P&D	Project and Development
RAP	Resettlement Assessment Plan
RCC	Reinforced Cement Concrete
REB	Rural Electricity Board
RoW	Right of Way
RRA	Rapid Rural Appraisal
RS	Remote Sensing/Route Survey
SES	Socio Economic Survey
SIA	Social Impact Assessment
SMEs	Small and Medium Scale Enterprises
SPM	Suspended Particulate Matter
SPS	Safeguard Policy Statement
ToR	Terms of Reference
UNO	Upazila Nirbahi Officer
WB	World Bank

1. Introduction

1.1 Project Background

1. Electricity is the key to all development. Bangladesh is one of the fastest growing economies amongst the South Asian nations. Over the past few years, the country's economy has grown at an impressive rate of close to 8%, better than that of other nations in the same region. Sustainable power supply is a major precondition for the socio-economic development of Bangladesh.

2. The Government assigns top priority to the development of power sector realizing its importance in economy, industrial and social development of the country. Electricity Demand growing day by day. In order to mitigate the demand-supply gap, an aggressive plan is prepared by the Government for new generation addition. As part of the plan, 43 power generation projects of capacity 15,294 MW are now under construction. The plan envisages around 21,977 MW new generation addition by 2025. (BPDB Annual Report 2019-2020). In order to evacuate power from the power plants, Notun Biddyut PP- Char Fasson 230 kV double circuit transmission line is proposed.

3. Power Grid Company of Bangladesh Ltd. (PGCB) was formed under the restructuring process of Power Sector in Bangladesh with the principal objective of bringing about commercial environment including increase in efficiency, establishment of accountability and dynamism in accomplishing its objectives. It was entrusted with the responsibility to own the national power grid to operate and expand the same with efficiency. PGCB expanded its network and capacity manifold and operating those efficiently and effectively. The objective of PGCB is to increase the stability, transmission capability and reliability of Grid network and technical loss throughout the country.

4. During fiscal year 2019-20, very significant transmission components have been added to the power system because of the completion of different project works. Transmission line length (ckt. km) has enlarged by 5.15% than that of previous year. Total length of 400 KV transmission line increased to 861 circuit km from the previous year 697.76 circuit km. The total length of 230 kV transmission line increased to 3658 circuit km from the previous year of 3406.69 circuit km. The total length of 132 kV transmission line increased to 7,764 circuit km from the previous year of 7545.5 circuit km. (BPDB Annual Report 2019-2020)

5. The Government of Bangladesh has undertaken massive development activities to strengthen the power generation, transmission and distribution sectors of the country with the aim of reaching electricity to all. As Bangladesh is undergoing a transformation to be in the rank of middle-income countries; her economy is experiencing significant progress in various sectors A reliable and adequate source of quality electric power is a prerequisite to keep the economy running. Besides the government is working to realize the vision of reaching electricity to all throughout the country. To meet the proliferating electricity demand, Power Grid Company of Bangladesh Limited (PGCB) has taken numerous development projects to expand the power transmission network to supply adequate and uninterrupted electricity throughout the country.

6. To meet the rapidly increasing demand for power and to realize its stable supply, large-scale power supply development and construction of system facilities such as transmission lines and substations are necessary, and relevant authorities should

undertake new projects. Thus “Charfasson Grid Substation & Associated Transmission Line as Additional Component under Southwest Transmission Grid Expansion Project” should be implemented.”.

7. According to the Environment Conservation Act (ECA, 1995) and Environment Conservation Rules (ECR, 1997) (Amendment in December, 2017), Power Transmission Lines (more than 50 km) fall under ‘Orange B Category’ which requires an Initial Environmental Examination (IEE) to get a ‘Site Clearance Certificate’ from the Department of Environment (DoE). Therefore, PGCB assigned the ENRAC to conduct the IEE Study for the above-mentioned Project.

1.2 Project Overview

8. Given a steep increase in the power demand in Burhanuddin, Lalmohan, Char Fasson and surrounding area, the Power Grid Company of Bangladesh Limited (PGCB) is facing urgent needs to increase transmission capacity from power generation facilities located in Notun Biddyut power plant. 220 MW Notun Biddyut power plant is located at Borhanuddin, Bhola. For power transfer from Notun biddyut to Char Fasson, Construction of 230 kV transmission line from Notun Biddyut PP to Char Fasson is mandatory. Based on PGCB plan, demand forecast, analysis through system study, the proposed transmission line and substation facilities under this project area to meet the reliable power supply and future needs with optimum flexibility are detailed below Table 1-1. The substation construction will require an area of 5 acres and the transmission lines’ tower footing will require an area of 7.12 acres.

Table 1-1: Details of the Project

Description of major components	Quantity	Implementing agency
Transmission Lines		
Notun Biddyut PP- Char Fasson 230 kV double circuit line	39.81	PGCB
Substations		
230/33 KV GIS substation: Char Fasson	1 Lot	PGCB
Bay Extension		
230 KV bay Extension at Notun Biddyut PP	2 nos.	PGCB

Source: PGCB

9. The location of Char Fasson is provided in Figure 1-1. The Notun Biddyut PP-Char Fasson 230 kV double circuit line project falls under the "Orange B Category" as per the Environmental Conservation Rules of 1997, which requires Site Clearance and Environmental Clearance Certificates (ECC) from Department of Environment prior to commencement of the Project. As such, for obtaining these aforementioned clearance certificates from DOE, PGCB has to submit an Initial Environmental Examination (IEE) report to DoE.

10. In this regard, PGCB has entrusted Environment and Resource Analysis Center Ltd (ENRAC) as consultants to conduct Feasibility Study, Route Survey (RS), Topographical Survey (TS), Initial Environmental Examination (IEE) and Resettlement Plan (RP) studies to select the suitable route and to get necessary environmental clearance certificate from the Department of Environment (DoE).

1.3 IEE Study

1.3.1 Objective and Scope of IEE Study

11. The implementation of the project could have both negative and positive impacts on the surrounding environment, depending on environmental sensitivities and the design of responsive mitigation measures. Environmental impacts include physical, ecological and socio-economic impacts. An Initial Environmental Examination (IEE) is required to address the anticipated impacts and to suggest appropriate mitigation measures in the Environmental Management Plan (EMP). The overall objective of the study is to conduct an Initial Environmental Examination (IEE) Study of the Project for obtaining 'Site Clearance Certificate' from the DoE.

12. The specific objectives of the IEE Study are:

- To delineate baseline condition based on primary and secondary data;
- To assess preliminary impact of the interventions on the surrounding environment;
- To identify suitable and effective mitigation measures for alleviating negative impacts;
- To prepare a preliminary environmental management and monitoring plan (EMP and EMoP); and
- To prescribe proper recommendation.

13. The scope of work for the IEE Study includes the following:

- To conduct field visits to collect data relevant to the study area and also collect secondary data for establishment of the baseline environmental status of the study area;
- To assess the impacts on environmental attributes due to the location, design, construction and operation of the proposed project;
- To identify critical environmental parameters required to be monitored subsequent to the implementation of the proposed project;
- Conducting public consultation to obtain peoples' perception about the Project and potential impacts;
- Preparing an Environmental Management Plan (EMP); and an Environmental Monitoring Plan (EMoP), including cost estimates for PGCB to comply with during the project implementation; and
- To prepare an IEE report in accordance with the ADB's SPS 2009 and the national regulations of the government
- Assisting in obtaining a 'Site Clearance Certificate' from the DoE

1.3.2 Study Area

14. The proposed project study area lies within the administrative area of Burhanuddin, Lalmohon and Char Fasson Upazila under Bhola District Barishal, Bangladesh (Figure 1-1). Table 1-2 presents the administrative crossings of the study area. About 7.12 acres land for tower footings and 5 acres land for the substation construction is considered as the direct affected area. The environmental and social influence on the surroundings of the direct affected area from three upazilas are considered as the study area for this project.

15. The substation will be constructed in Char Fasson upazila under the following coordinates- 22° 8'34.54"N, 90°44'12.59"E; 22° 8'30.77"N, 90°44'15.97"E; 22° 8'27.05"N, 90°44'12.04"E and 22° 8'30.75"N, 90°44'8.54"E. This area is currently an agricultural land which has been acquired by PGCB.

16. The Transmission Line will be in between Notun Biddyut Power plant and 230/33 KV GIS Char Fasson substation. The height of the towers will be 46.2m. There will be 30 angle points (AP) thus 30 tower footings will be constructed for the transmission line. The transmission line passes mostly through agricultural and barren lands. Section 3.2.3, Table 3-1outlines detailed description of the AP locations of the transmission line.

Table 1-2: Administrative crossing list of the Study Area

Division	District	Upazila	Union
Barisal	Bhola	Burhanuddin	Deula
Barisal	Bhola	Burhanuddin	Sachra
Barisal	Bhola	Char Fasson	Aminabad
Barisal	Bhola	Char Fasson	Jinnaghar
Barisal	Bhola	Char Fasson	Osmanganj
Barisal	Bhola	Char Fasson	Char Fasson Paurashava
Barisal	Bhola	Lalmohan	Badarpur
Barisal	Bhola	Lalmohan	Farazganj
Barisal	Bhola	Lalmohan	Kalma
Barisal	Bhola	Lalmohan	Lalmohan
Barisal	Bhola	Lalmohan	Lalmohan Paurashava
Barisal	Bhola	Lalmohan	Paschim Char Umed

1.3.3 Study Methodology

17. The report is prepared on the basis of the information of the project activities supplied by the project proponent (PGCB). The Consultant's multi-disciplinary team of experts made further reconnaissance and exploratory site visits. The interaction between the project activity and the significant environmental components was made based on a checklist. This checklist was prepared following the DoE Guidelines for selected industries (DoE, 1997), Environmental Guidelines for selected industrial and water development projects (ADB 1990) and the consultants' experience on similar projects.

18. At the IEE stage socio-economic data and environmental data were collected from the project area (along the transmission line and the substation) by administering a Socio-economic questionnaire and environmental questionnaire in area having a width of 125 m on both sides of the line and 250 m buffer area from the boundary of the Substation area.

19. Environmental and socio-economic data from different sources (BPDB, PGCB, BBS, DoE, BMD, BWDB, Agro-climatic survey of Bangladesh and other lEE reports) of the proposed project area were collected to prepare baseline environmental and socio-economic profile of the area. The Consultant's multi-disciplinary team of experts, made a reconnaissance visit to visualize the condition of project sites and it's surroundings and to identify alternate sites for investigation.

20. The environmental baseline, project components, possible environmental impacts, mitigation measures and environmental monitoring plan are presented in a report following the DoE guidelines.

21. The Methodology of the IEE is guided by the guidelines of the Department of Environment (DoE) and Terms of Reference (ToR) provided by PGCB.

22. The required data for conducting IEE study has been collected from the primary and secondary sources. Data collection through field investigation falls under primary data and secondary data sources include scientific publications, data provided by government agencies and academic institutions and information from ENRAC's own database. The dataset was then used to predict the likely impacts and when the construction and operations take place, it will be applied to monitor change (usually negative) using the dataset as a baseline.

23. Key elements which were assessed are as follow:

- aspects of the physical environment such as climate, global warming, temperature, rainfall and underlying geology;
- aspects of the biological environment such as species presence and distribution (plants, mammals, fish, invertebrates etc.), potential presence of protected species and presence of protected areas;

24. The data was collected with the intent of developing the baseline for existing conditions, as well as determining the potential impacts and options for mitigation. The data collection was conducted primarily within 125 m of either side of the centre line of the proposed transmission line of PGCB.

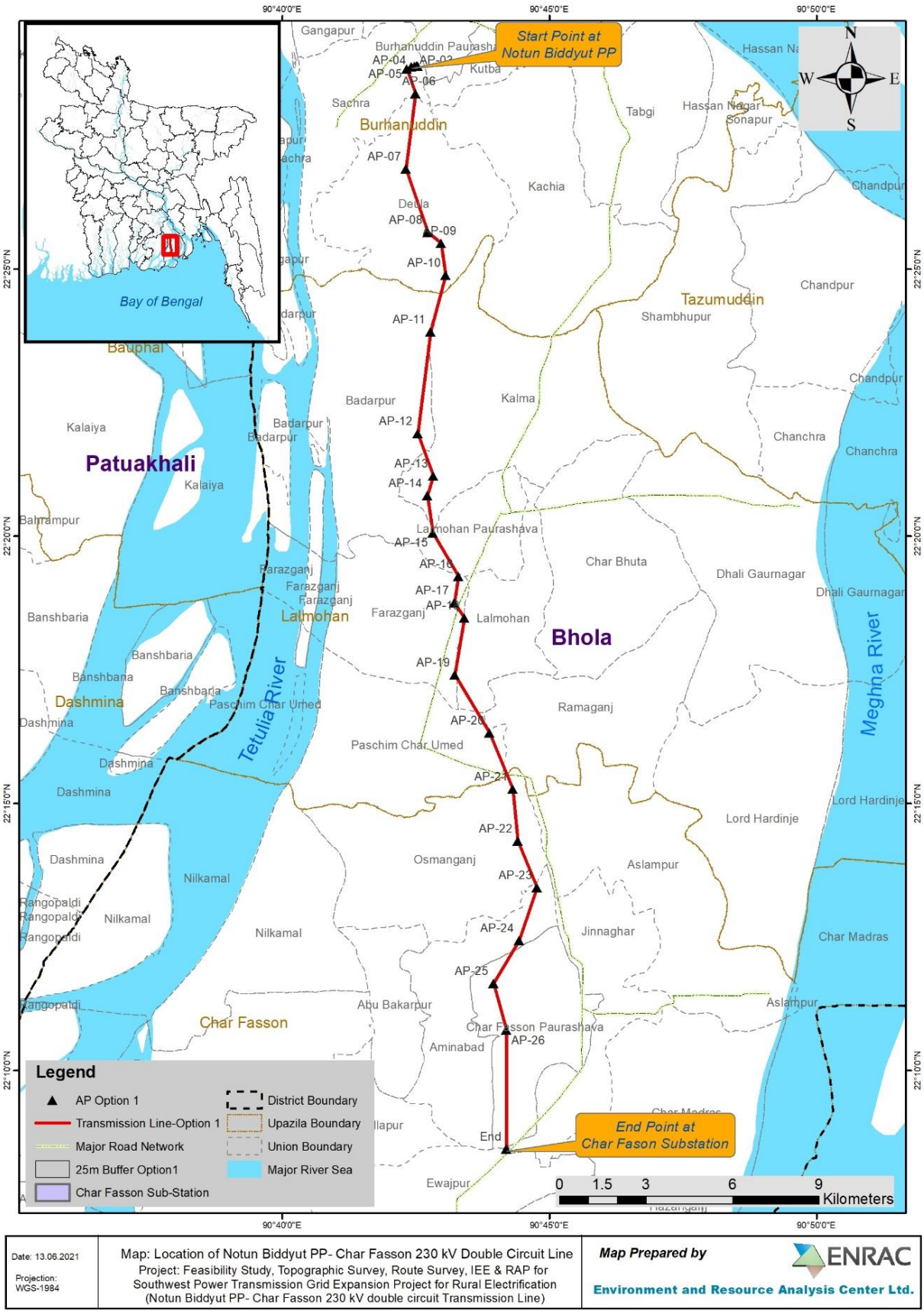

Figure 1-1: Location Map of the Study Area

1.3.3.1 Preliminary Discussion with Project Proponent

25. Discussion held with PGCB to understand the proposed project, current status of agreement (i.e., implementation, land, water, power etc.), project milestones, legal requirements and scopes; and collection of relevant project documents.

1.3.3.2 Screening and Scoping Exercise

26. Desk based review of the relevant documents and available imagery of the project site and its surroundings. Reconnaissance survey of the project sites, surrounding areas and preliminary discussion with local stakeholders, Meeting and discussion with Department of Environment (DoE) of Bangladesh to understand regulatory requirements associated with the project.

27. The outcome of the screening was then used to identify the study area, key data to be collected and categorize of the project. A preliminary stakeholder mapping exercise was also undertaken to identify key stakeholders from the Government, relevant Government agencies. NGOs as well as the community at the local, regional and national level. This information was then used for consultation during different stages of the project.

1.3.3.3 Baseline Data Collection

Environmental Data Collection and Analysis

28. In order to establish the baseline physical conditions within the study area, relevant secondary and primary data was collected and reviewed, a comprehensive field visit was undertaken, and a number of specialist studies were carried out. This process also included consultation with various relevant agencies including Government department, PGCB, locally-active NGOs, and members of the local community.

29. The data generated allowed the Project team to better understand the complex interplay between the various biotic and abiotic factors within the study area and to establish the baseline conditions. Once this baseline was established it was used as a reference point to identify potential changes to the environment that may occur as a result of the proposed Project activities, as well as to allow development of measures to prevent, mitigate or manage these potential impacts.

30. To comprehensively evaluate the existing Project area baseline conditions, a detailed field visit and data collection program was developed and implemented.

31. This survey aimed to identify important environmental components and environmental issues within the study area. It included investigation and observation of the local landforms, habitat types, drainage patterns, species abundance and distribution, soil types, water quality (surface water and groundwater), air quality, noise and hydro morphology.

32. The study area and surrounds were surveyed by foot and by vehicle. Important environmental features were identified and logged. Hand-held geographic positioning systems (GPS) were used to identify specific features for mapping and further analysis in office.

33. Direct field observations were also made for significant portions of the study area including rivers, roads, embankments, village groves and zones of intact vegetation, and these were transcribed onto pre-prepared environmental observation checklists. The

observations were cross-referenced with primary, secondary and anecdotal information provided by government representative and the local community about key issues such as agricultural practices, flood levels, groundwater quality and presence of significant fauna.

Terrestrial and Aquatic Ecological Data Collection and Analysis

34. A terrestrial and aquatic ecological survey was conducted in the Project area to determine the extent, species composition and the condition of existing vegetation, wildlife, threatened and protected flora and fauna, and important habitat for local migratory species. Pre-prepared detailed questionnaires and checklists were used during the survey to collect both observed and anecdotal data on terrestrial and aquatic biodiversity. Local elderly stakeholders and forest officials were interviewed for collecting primary data and secondary data as well. The following activities were undertaken during the terrestrial and aquatic field surveys:

- **Direct Observation**

35. Direct observation on the occurrence and abundance of flora and fauna was made while travelling within water bodies, along road edges, across the agricultural fields and within village groves. As well as direct sightings, identification of animal presence was also based on identification of tracks, foot prints, feeding signs and animal/bird calls. Appropriate field guides and data proformas were used for this activity so that information was accurately recorded. Some plant species which could not be identified in the field were pressed.

- **Interviews with Local Residents**

36. Interviews with local people are a very useful method for collecting information on local biodiversity. This data is anecdotal and as such should not form the core of any assessment; however, it does nonetheless provide useful supplementary information. During the field survey period, extensive interviews with local people were conducted to collect information on animal and plant presence, including occurrences, behaviour, breeding, distribution and seasonal appearance.

Environmental Quality Data

37. Environmental Quality Data such as air quality, noise level, surface water & ground water quality was collected on July 2021. The sampling stations were defined and data were collected, allowing a set of baseline or/ existing conditions to be recorded. This dataset was then used to predict the likely impacts and when the construction and operations take place, it will be applied to monitor change (usually negative) using the dataset as a baseline. The sampling was conducted primarily within the project corridor at locations reflecting representative land use conditions and population densities.

1.3.3.4 Stakeholder Consultation

38. Stakeholder consultation is the process relevant stakeholders about the project and its impacts as well as addressing their concerns. In order to obtain opinion from direct and indirect stakeholders, the stakeholder consultation broadly divided into regional and community level.

39. During the study period, public consultations were set up in five separate locations spread out throughout the Project corridor. These locations were selected due

to their importance as major urban areas with highly dense communities located on areas notably close to the Project's corridor. In fact, there were heavy levels of encroachment and squatting taking place in and around various points of the corridor. The primary function of the public consultation was twofold – to inform the stakeholders that are most likely to be directly impacted by the Project, and to gather opinions on the Project's perceptions, the wants and needs of the communities in order to develop a fine-tuned Environment Management Plan that will eventually ensure their wants and needs.

1.3.3.5 GIS Mapping

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

41. Detailed on-ground validation of spatial information – particularly land use – was undertaken using a hand-held, non-differential GPS. The spatial data acquisition team undertook detailed transect walks through the Project area in order to identify various land use types and confirm the findings of the satellite imagery analysis. The extensive ground-truthing exercise both validated the land use mapping and identified additional sensitive areas to include within the environmental fieldwork for sampling. The collected information is demonstrated by means of the numerous GIS mapping figures found throughout this report.

1.3.4 IEE Study Team and Timeline

42. ENRAC has formed a multidisciplinary team of professionals having experience in conducting Initial Environmental Examination and Environmental and Social Impact Assessment in power sector especially in power transmission and distribution line projects. A list of members of the study team is given in Table 1-3. Additionally, a group of multidisciplinary field workers has assisted the study team in collecting data from the field.

Table 1-3: IEE Study Team

Sl. No	Name of the Expert	Qualification	Position
1	Mehedi Hasan	Master of Engineering (Environmental), Canada, 2006; Bachelor of Environmental Science, IUB, 2001	Team Leader cum Environmental Engineer
2	Md. Kaykobad	Master of Science in Electrical & Electronic Engineering-AIU, California, USA, 2008 Bachelor of Science in Electrical & Electronic Engineering, RUET, Bangladesh, 2004	Transmission Line Specialist

Sl. No	Name of the Expert	Qualification	Position
3	Mohammad Mokammel Hossain	M.Sc. Zoology (Fisheries), UBC, 1985 M.Sc. Zoology (Fisheries), DU, 1975 B.Sc. Biology, DU, 1972	Senior Fisheries Specialist
4	Mahidul Islam	Masters Social Science (MSS) in Anthropology 2007, Rajshahi University; B.Sc. Social Science (BSS) in Anthropology, Rajshahi University	Social and Resettlement Specialist
5	Rahedun Nabi	M.Sc. in Earth & Environmental Science, June 2007 B.Sc. in Earth & Environmental Science 2005	Environmental Specialist
6	Saiful Islam	M.Sc. in Environmental Science, Jahangir Nagar University, 2015; B.sc in Environmental Science, Jahangir Nagar University, 2012	Environmental Specialist cum Ecologist
7	Tanveeer Hossain	M.Sc. in Water and Flood Management, BUET, 2017; B.Sc. in Urban and Regional Planning, Chittagong University of Engineering and Technology, 2010	GIS and Auto-CAD Specialist
8	Tanzeem Mashroor	MSc in Environmental Science, NSU, 2015; B.Sc. in Environmental Science, NSU, 2013	Junior Environmental Specialist
9	Md. Muhibullah	MSc in Disaster Management, DU, 2017; B.Sc. in Environmental Science, Jessore University, 2015	Junior Environmental Professional
10	Tahsin Uz Zaman	B.Sc. in Textile Engineering, Ahsanullah University of Science and Technology, 2016	Junior Environmental Professional

1.3.5 Structure of IEE Report

43. The IEE report structure is as follows. Chapter 1: Providing introduction presenting a brief overview of the assignment along with its background, objectives, scope of work, etc., Chapter 2: discussing about the Policy, Legal and Administrative Framework, Chapter 3: Description of the project describes the proposed interventions including background, project category, and the need for the project, location, size and magnitude of operations, Chapter 4: Analysis of Alternatives describing different options for the project, Chapter 5: Description of Environment (Baseline Data), Chapter 6: Description of the Social Baseline, Chapter 7: Environmental Impact Assessment and Mitigation Measures, Chapter 8: Social Impact Assessment and Mitigation Measures, Chapter 9: Information Disclosure, Consultation and Participation, Chapter 10: Grievance Redress Mechanism, Chapter 11: Environmental Management Plan and finally the Report is rounded up with Conclusion and Recommendations in Chapter 12.

2. Review of Policy and Regulatory Frameworks

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

44. The project has relevance to several environmental policies and legislations promulgated by the GoB, particularly, the Environment Conservation Act, 1995 and the Environment Conservation Rules, 1997 (Amendment December, 2017). The Department of Environment (DoE) under the Ministry of Environment, Forest and Climete Change is responsible for ensuring application of environmental laws and issuance of the necessary clearances.

45. This report has been prepared by the review of several pieces of legislation and policies which have relevance to the TL and substation construction activity in Bangladesh. All of these regulations are aimed at the conservation and protection of the environment and an overview of these legislations and policies is presented in this chapter.

46. According to the Environment Conservation Rules 1997 (Amendment December, 2017) substation construction activities for all transmission line project are placed into the 'Orange B' category. This requires submission of an IEE and EMP to the DoE. The administrative procedures and checklist of necessary documents are also described in this chapter.

2.2 Administrative Procedures for Obtaining Location/ Environmental Clearance

2.2.1 Requirement for Initial Environment Examination (IEE) Report

47. All proposed projects in Orange-B category have to conduct IEE which helps in understanding the potential extant of environment changes, and in finding ways to mitigate by considering the available information, of past experience or standard operating practices. The steps for conducting IEE are:

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

48. After completion of IEE Report the project proponent should apply to the DOE in the prescribed format for site/ environmental clearance. The application for environmental clearance for the project classified in the Orange-B Category should be accompanied by the following documents:

- Feasibility Study Report of the project
- IEE report
- An NOC (No Objection Certificate) from the local authorities concerned

- Pollution minimization plan including emergency plan for mitigation of adverse environmental impacts
- Outline of relocation plans (where applicable)
- Other information as deemed necessary

49. The project in concern will take place in three upazilas of Bhola district. DoE has an office under Barisal division in the Bhola district, thus this IEE report along with other required documents should be submitted in the DoE Bhola office.

50. Public participation or consultation is not a condition in the ECR 1997 and/or EIA Guidelines; however, DoE prefers the proponent to do public consultation during the assessment and puts condition for it while providing site clearance or during the approval of the EIA TORs. Steps to be followed for obtaining Environmental Clearance Certificate (ECC) in connection with the power industry (under Orange B Category) from DoE are outlined in Figure 2-1. Figure 2-2 shows the process of obtaining the environmental clearance for 'Orange B' category projects (such as this Project) as per the changes made by the DoE in December 2017.

51. It is also mentioned in the Environment Conservation Rules that the Director General of the Department of Environment can issue environmental clearance directly without issuing any site clearance to any industry or project if he (the Director General) finds appropriate reason for doing so. As the proposed transmission line and substation system project falls under Orange-B category, all necessary requirement mentioned above will be adopted for the project.

52. For Green Category Projects the gestation period for granting Environmental Clearance has been fixed at within 15 days; For Orange A, Orange B and Red Category Projects at first Location Clearance and thereafter Environmental Clearance will be granted. The gestation period for Location Clearance is within 30 days for Orange A. and within 60 days for Orange B and Red Category Projects.

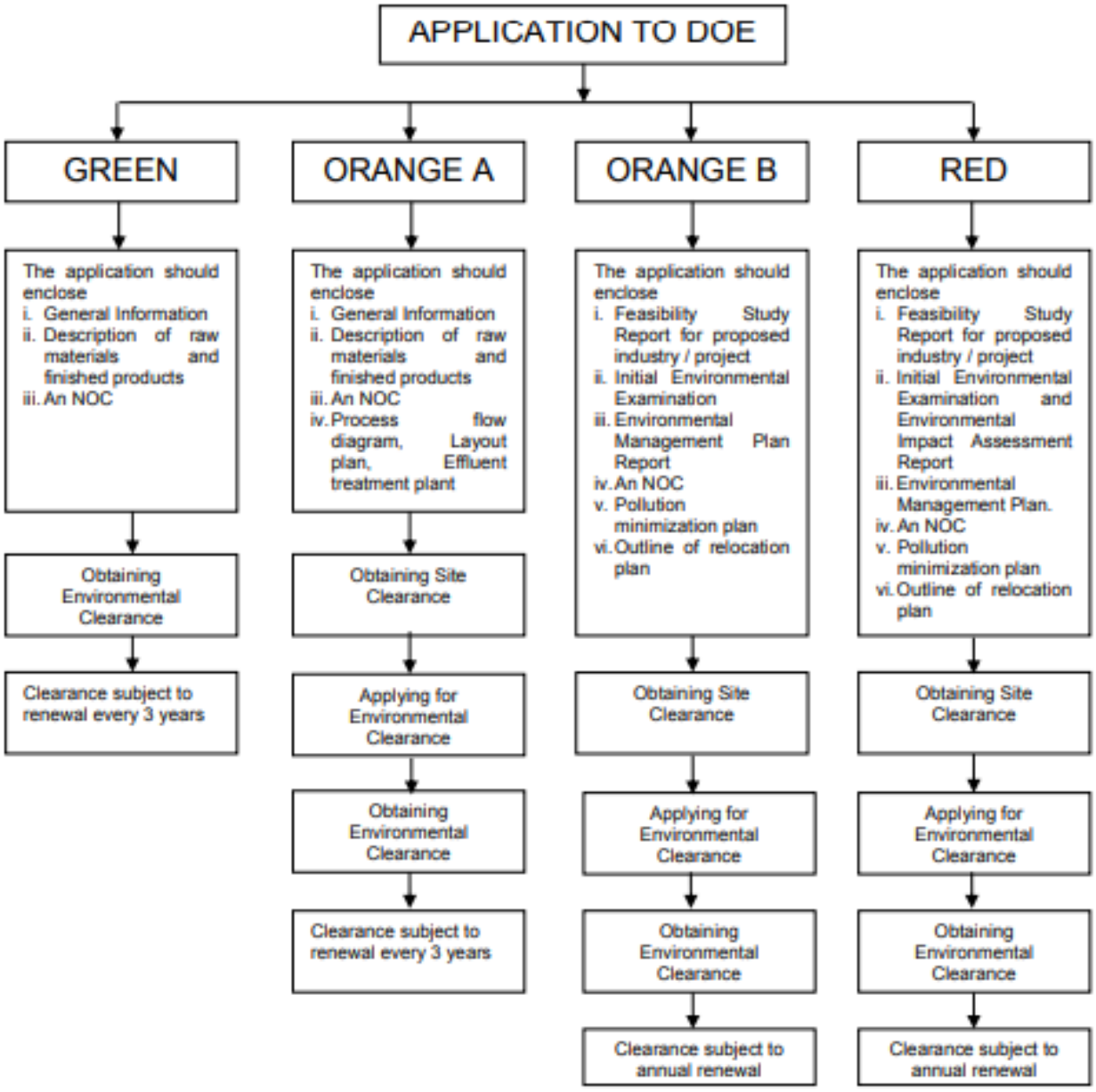

Figure 2-1: Steps Involved in Environmental Clearance following DoE Guideline

NOC = No Objection Certificate, usually obtained from local government.
Note: These requirements vary from those of the DoE (1997) in requiring EMPs for proposed, as well as current projects.

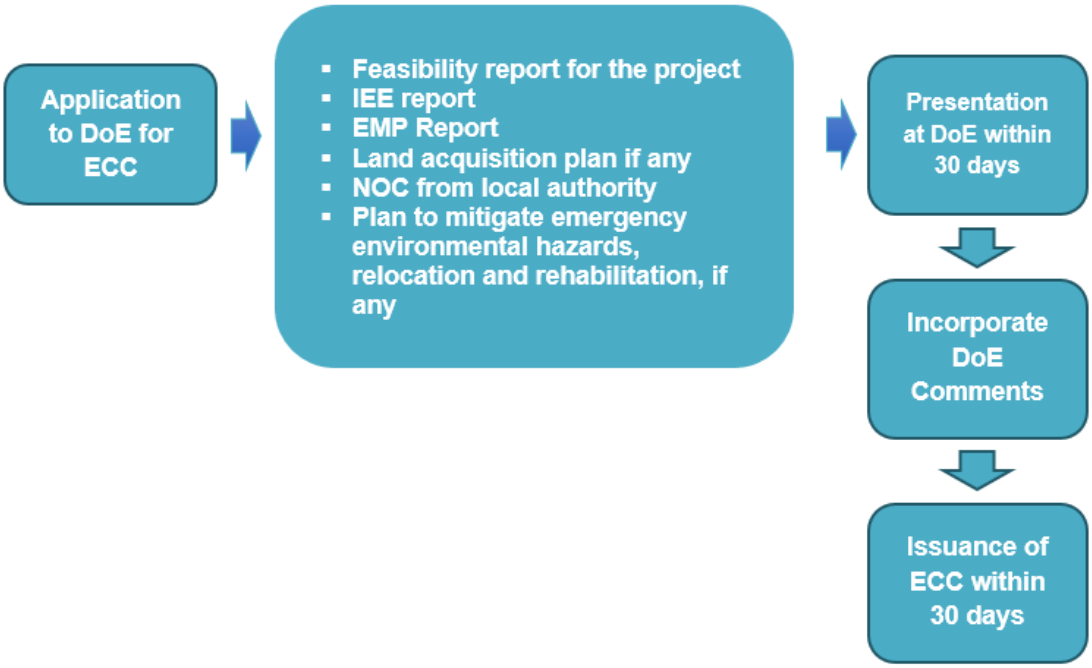

Figure 2-2: Process of Obtaining Environmental Clearance for Orange B Category

2.2.1.1 Process of Receiving the NOC

53. The No Objection Certificate (NOC) is a mandatory requirement to obtain environmental clearance from the Department of Environment. Usually, DoE indicates the name of the agency/ies from where NOC would be required. DoE requires that proponent obtain NOCs from affected agencies or local/ regional administrations, which essentially sign off on the project. It is only after these NOCs are provided that DoE gives the Environmental Clearance certificate, or green light to proceed to construction.

54. Since obtaining these certificates can take more than a month from few agencies, speeding up the DoE notification by securing NOCs in advance of DoE's request can speed up the process especially since, based on past experience. The process to obtain these can begin as soon as the draft environmental assessment has been completed.

55. A NOC letter basically contains description of the project including location, justification to obtain NOC from that agency, and proposed measures under the project. In this Project, PGCB will submit the NOC letter to the respective agencies (A sample NOC letter is provided in Annex 19). This is a labour and time intensive process and can take more than a month, and is largely contingent on regular and persistent follow up. Therefore, the NOC steps are:

56. PGCB to submit the NOC letter or the standard NOC form of DoE, if applicable. The steps are:

- PGCB will sends letters to head of the agency;
- The requesting agency then evaluate the NOC request that sometime require field investigation for verification;
- PGCB will pursue this and generally requires constant follow up to get a result; and
- Once the NOCs are received-signed, they are forwarded by PGCB to DOE.

2.2.2 Organization related to Enforcement of Environmental Standards

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

58. 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 follows:

- The Director General may take such measures as he considers necessary and expedient for the conservation of the environment, and improvement of environmental standards, and for the control and mitigation of environmental pollution, and he may issue necessary directions in writing to any person for the discharge of his duties under this Act;
- Co-ordination with the activities of any authority or agency having relevance to the objectives of this Act;
- Prevention of probable accidents which may cause environmental degradation and pollution, undertaking safety measures and determination of remedial measures for such accidents and issuance of directions relating thereto;
- Searching any place, examining any equipment, manufacturing or other processes, ingredients, or substance for the purpose of improvement of the environment, and control and mitigation of pollution; and issuance of direction or order to the appropriate authority or person for the prevention, control and mitigation of environmental pollution;
- Advising the Government to avoid such manufacturing processes, commodities and substances as are likely to cause environmental pollution;
- The Director General shall, before issuing a direction of closure or prohibition of an industry, undertaking or process, send to the owner or occupier thereof a written notice so that he gets reasonable opportunity to make that industry, undertaking or process environmentally sound; and
- The DG has the power to close down the activities considered harmful to human life or the environment. The operator has the right to appeal and procedures are in place for this. However, if the incident is considered an emergency, there is no opportunity for appeal.
- The DG has the power to declare an area affected by pollution as an ecologically critical area. The DoE governs the type of work or process, which can take place in such an area.
- Before undertaking any new development project, the project proponent must take an Environmental Clearance from the DoE. The procedures to take such clearance are in place.
- Failure to comply with any part of ECA 1995 may result in punishment by a maximum of 10 years imprisonment or a maximum fine of Tk. 1,000,000 or both.

2.3 National Legislations Frameworks

2.3.1 Environment Related

2.3.1.1 Environment Conservation Act 1995

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

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

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

- Declaration of ecologically critical areas, and restriction on the operation and processes which can be carried out or cannot be initiated in the ecologically critical areas.
- Regulation in respect of vehicles emitting smoke harmful to the environment.
- Environmental clearance.
- Regulation of the industries and other development activities – discharge permits.
- Promulgation of standards for the quality of air, water, noise and soil for different areas for different purposes.
- Promulgation of standard limits for discharging and emitting waste.
- Formulation and declaration of environmental guidelines.

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

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

63. The Bangladesh Environmental Conservation Act (Amendment 2010) elaborates on: (1) demarcation of wetlands and water bodies; (2) hazardous waste import, transportation, storage, etc.; (3) cutting of hills, mountains; and (4) Ecologically Critical Areas.

64. Failure to comply with any part of the Environment Conservation Act 1995 may result in punishment to a maximum of 10 years imprisonment or a maximum fine of Tk. 1,000,000 or both. This act is supported by the Environment Conservation Rules (ECR). 1997.

2.3.1.2 Environment Conservation Rules, 1997 (amendments in 2002, 2003 and 2017)

65. This is a set of the relevant rules promulgated to implement the ECA 1995. There have been four amendments to the Rules, in February 2002, in August 2002, in April 2003 and December2017, respectively. The Rules mainly consist of:

- According to ECR'97 Amendment in December, 2017, an IEE is sufficient for Orange B category projects.
- After getting a site clearance certificate upon approval of IEE, only the EMP report is submitted to DoE for Environmental Clearance Certificate (ECC).
- 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 an EMP according to categories of industries/development projects/activities.
- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

Categorization of Projects or Industrial Units –

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

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

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

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

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

71. **Environmental Quality Standards** in operation in Bangladesh have also been promulgated under the Environment Conservation Rules 1997. There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges, and vehicular emissions, etc.

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

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

2.3.1.3 Environment Court Act 2010

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

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

2.3.1.4 Bangladesh Water Act, 2013

76. 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.

77. As per this Act, all forms of water (e.g.,, surface water, groundwater, 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 impedes the natural flow of rivers and creeks.

2.3.1.5 Wildlife (Conservation and Security) Act, 2012

78. Bangladesh after her liberation took initiatives to combat wildlife crime and secure and preserve wildlife population along with many other development challenges. In 1973 President promulgated an Order, namely, Bangladesh Wild Life (Preservation) Order, 1973 (President's Order No. 23 of 1973). To accommodate new provisions in law for coping with changed situations, in 2012 parliament passed another Act, namely, The Wildlife (Preservation and Security) Act, 2012. The later repealed the earlier. The Act of 2012 has enabled the government to form a "Wild life Advisory Board" comprised of experts. The Board will assess present condition and give direction from time to time in relation to development and management of biodiversity, wildlife and forest. On the contrary Chief Warden, Additional Chief Warden and Warden have been assigned to look after overall development and management of them. Chief Conservator of Forest, Conservator of Forest and Divisional Forest Officers will carry out the duties of Chief Warden, Additional Chief Warden and Warden respectively by dint of their official capacity.

79. Section 11 of the Act has made it mandatory for every private person to register collected or preserved wildlife or any product from wildlife, protected plants and any product from them. Section 12 prohibits any trade or transfer of the said wildlife or wildlife products without registration. Any breach of it has been made punishable. Punishment is up to 1 year imprisonment under section 39 of the Act, which can be extended up to 2 years imprisonment in case of recurrence of the offence. The Act has empowered the government to declare any area as sanctuary, community conservation area, safari park, eco-park, botanical garden, wildlife reproduction center, landscape zone, buffer zone, core zone in relation to wildlife and plant preservation, protection and their smooth growth. If anybody enters into a sanctuary and does any prohibited act there, he has been made liable to punishment up to 2 years imprisonment and in case of recurrence the punishment can be extended up to 5 years imprisonment. The Act also has a provision to set up Wildlife rescue center to give treatment, food, shelter and security to the wounded, seized, confiscated or abandoned wildlife. To combat with the crime related to wildlife and to enforce provisions of international conventions, protocol, treaty etc the Act has made a provision for forming a unit comprised of member of law enforcement agencies.

80. Tigers and elephants are two most endangered animals in Bangladesh. The Act has made illegal killing of these two animals punishable up to 7 years imprisonment and in case of recurrence of the offence the punishment can be extended up to 12 years imprisonment. Along with imprisonment, a quite considerable amount of fine can be imposed upon the offender. If anybody trades in tiger or elephant or any product of them, he is to suffer 3 years imprisonment, which can be extended up to 5 years imprisonment in case of recurrence.

81. The Act also prohibits illegal killing of or trading in leopard, crocodile etc. and birds or migratory birds. Punishment for these offences' rages from 1 to 5 years

imprisonment. Abetment of offences described above has also been made punishable under the Act.

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

82. The Act aims for the protection and conservation of fish in Bangladesh andwas amended in 1995. This Act provides power to the government to:

- Make and apply rules in any water or waters for the purposes of protection of fisheries.
- Prohibit or regulate the erection and use of fixed gear; and the construction, temporary or permanent, of weirs, dams, bunds, embankments and other structures.
- Prohibit the destruction of fish by explosives, guns, and bows in inland or coastal areas.
- Prohibit the destruction of fish by means of poisoning, pollution and effluents.
- Prescribe the seasons during which fishing is allowed.
- Prohibit fishing in all waters during spawning periods.
- Specify the officials with authority to detect breaches.

83. The Government made Rules in 1985 which contain 11 sections about various measures of protection and conservation and 2 Schedules specifying waters in which the catching of certain fish species is prohibited without a valid license, specifying fish species of which the catching or sale in certain periods is prohibited, and containing a form of a license for the catching of carps in Prohibited Waters. Regulation 3 prohibits the erection of fixed gear in rivers and canals. No fish shall be destroyed by making use of poison or explosives (regulations 4 and 5). Licenses issued under regulation 8 shall be issued only for the purposes of pisciculture. Regulations prohibit the catching, carrying, transporting, offering for sale, or possessing of frogs.

2.3.1.7 Noise Pollution (Control) Rules, 2006

84. According to the Environment Protection Act 1995, the government formulated the noise pollution Rules & Regulation in 2006. This regulation recommends to keep the sound level: at50 dB in quieter areas from 6am until 9pm and at night 40 dB; similarly, in residential areas in the day at 55 dB and at night 45 dB;in mixed areas, 60 dB in the day time and at night 50 dB;in commercial areasin the day,70 dB and at night 60 dB; and, in industrial areas in the day, 75 dB and at night 70 dB.

2.3.1.8 Disaster Management Act (2012)

85. 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 for effective disaster management to fight all types of disasters. Disaster means any such incidents created by nature or humans.

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

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

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

2.3.1.9 More Rules and policies in Related Fields

88. In addition to the policies, rules and regulations related environment and energy the following rules and regulations, listed in Table 2-1 are to be checked for compliance for maintaining sustainable environment.

Table 2-1: More rules and policies in related fields

Year	Title	Objectives and Relevance to Project
1885	The Telegraph Act (Act XIII of 1885)	Under the law sections 10-19, specifies parameters and obligations for government-built transmission lines throughout the country.
2013	Bangladesh Labor (Amendment Act # 30, 2013)	Amends and clarifies appropriate working conditions in all sectors and the rights of workers regarding safe working conditions.
1910	The Electricity Act (Act IX of 1910)	Under the law section 51, government-built transmission lines throughout the country.
2012	Electricity (Amendment) Act 2012	Among other things, specifies conditions of distribution, sale, and use of electricity, including related generation and transmission infrastructure, and obligations regarding the need for preservation of the environment, and associated protection and safety clauses
2018	Electricity (Amended) Act 2018	This act repeals the provisions of Electricity Act 1910. A chain of penal measures, intended to serve temporary demand, have been taken. Anyone involved with electricity misappropriation, pilferage, or wastage, or with interference or destruction of supply lines, may now be subjected to both fines and imprisonment
1950	East Bengal Protection and Conservation of Fish Act	Requirements and actions for protection and conservation of fish in Bangladesh.

Year	Title	Objectives and Relevance to Project
1985	The Protection and Conservation of Fish Rules	Prevention of harm to fisheries resource and fisheries habitat in coastal and inland waters.
1953	Town Improvement Act	Improvement and development of Dhaka City.
1958	Antiquities Act	Protection and preservation of archaeological and historical artefacts, if found during project construction.
1960, 1966	Port rules, shipping operation	Control of discharges in ports; waterway rules.
1965	Factories Act	Industrial workers' health and working conditions (now better addressed by the new Labor Act).
1971	Pesticide Ordinance	Pesticide use, production, selection and importation.
1976	Antiquities (Amendment) Ordinance	Protection and prohibition of export of archaeological artefacts.
1977	Municipal Ordinance	Municipal activities in health, sanitation, water supply, drainage, etc. in the city.
1979	Factory Rules	Disposal of wastes and effluents.
1980	Agricultural Pesticides (Amendment) Act	Selection, use and handling of pesticides in the agricultural sector.
1982	Municipal Act	Drainage, sewerage, water supply and sanitation.
1982	Acquisition and Requisition of Immovable Property ordinance	The Acquisition of Immovable Property Rules, 1982 (No. S.R.O. 172-U82) The government adopted these rules in exercise of the powers conferred upon by section 46 of The Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance No. II of 1982). Not directly relevant to this project, as no structures are to be removed except a very small bridge on the site cross-over road).
1983	Agricultural Pesticides (Amendment) Ordinance	Revised Agricultural Pesticides Ordinance.
1985	The Pesticide Rules	Pesticide selling, use and safety measures.
1990	Bangladesh standard specification for drinking water	Formulation and revision of national standards (inasmuch as the sub-station will continue to require access to safe drinking water).

Year	Title	Objectives and Relevance to Project
1860	The Penal Code	This contains several articles related with environmental protection and pollution management (it is considered over-ridden by the latest laws and regulations in the last 20 years governing environmental management).
1996	Building Construction (Amendment) Act and Building Construction Rules	The Rules are more comprehensive for taking care of the present circumstances and issues of building, such as the new sub-station.

2.3.2 Social Related

2.3.2.1 Acquisition and Requisition of Immovable Property Act, 2017 (ARIPA, 2017)

89. The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Act, 2017 and subsequent amendments during 1993 - 1994. The 2017 Act requires that compensation be paid for: (i) land and assets permanently acquired (including standing crops, trees, and houses); and, (ii) any other damages caused by such acquisition. The Act provides certain safeguards for the owners and has provision for payment of "fair value" for the property acquired.

90. Deputy Commissioners (DC) will pay compensation for the land to be acquired based on Land Acquisition Proposals to be submitted by the requiring body. DCs, in all cases, determine market value of acquired assets on the date of notice of acquisition (notice under section 3 of the Ordinance). The DC then adds a 50% premium on the assessed value for cash compensation under the law (CCL) of all acquired assets except standing crops due to compulsory acquisition. The CCL paid for land is generally less than the "current market price" as owners customarily report undervalued land transaction prices in order to pay lower stamp duty and registration fees. If the land acquired has standing crops cultivated by a tenant under a legally constituted agreement, the law requires that part of the compensation money be paid in cash to the tenants as per the agreement. Places of worship, graveyards, and cremation grounds are not to be acquired for any purpose. The law requires that the salvaged materials upon payment of compensation will be auctioned out by the government. Under the 1982 Ordinance, the Government is obliged to pay compensation only for the assets acquired.

91. However, the provisions under this law are not adequate to cope with the adverse effects related to land acquisition and involuntary resettlement, nor do they fully match the requirements of ADB's safeguards requirements or international standards. Such gaps in the existing land acquisition law of the country are:

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

92. In light of addressing these shortcomings, the Government of Bangladesh is working on preparation of a national policy on involuntary resettlement, which is consistent with the general policy of the Government that the rights of those displaced by

development projects shall be fully respected, and persons being displaced shall be treated with dignity and assisted in such a way that safeguards their welfare and livelihoods, irrespective of title, gender, and ethnicity. The Government will undertake further work towards legislative changes to safeguard resettlement rights by law once the draft policy is approved in the Cabinet.

2.3.2.2 East Bengal State Acquisition and Tenancy Act, 1950

93. A law relating to tenancies to be held under the state and other matters connected therewith. Prior to its enactment, agrarian law of Bengal mainly consisted of the Bengal permanent settlement regulations of 1793 and the bengal tenancy act 1885. The Permanent Settlement regulations made zamindars owners of their land subject to payment of a fixed amount of their land revenue to the government and they were entitled to collect rent from their subordinate tenants, who were again entitled to create subordinate interests. Permanent Settlement regulations 1793 created a landed aristocracy, which was supposed to be loyal to the British regime. Bengal Tenancy Act of 1885 defined the rights and liabilities of the tenants in relation to their superior landlords.

94. Under the scheme of the Act, the government became the only landlord to acquire all rent receiving interest by phases. By operation of section 3 of the Act, all holders of land became directly tenants under the government and they are described as malik (owner), but all interest in subsoil right to minerals, hats, bazaars, forests, fisheries and ferries are vested in the government. The said law authorises the government to own and manage hats, bazaars, ferries, fisheries, etc.

95. In consequence of introduction of the State Acquisition Act, there exits no intermediary interest between the government and tenant, the government has become the only landlord and the cultivators were relieved of the baneful effect of subinfeudation and intermediate class. The service tenures in vogue in Bengal, more particularly in the district of sylhet, were done away with. Acquisition of rent receiving interest has been done under a scheme of payment of compensation to zamindars and intermediary interest holders.

96. Under State Acquisition of Tenancy Act, khatiyan is prepared in the names of respective tenants directly under the government and the Act provides for a process of updating khatiyan in the names of the persons by transfer, inheritance, and settlement from government. That Act provides a process of pre-emption of land by a co-sharer of contiguous tenant if the transfer is made to any stranger. The Act also provides a scheme of precedence of any co-sharer by inheritance against any co-sharer by purchase. This provision of pre-emption was first introduced as a part of general law incorporated in Bengal Tenancy Act of 1885 relating to agricultural tenancy. However, pre-emption for non-agricultural tenancy is governed by the provision of non-agricultural tenancy act.

97. The statute also provides for periodical field survey of land and updating the record of right through such periodical settlement operations. It may be mentioned that this law has no application for chittagong hill tracts, which constitute almost one tenth of Bangladesh and is governed by Chittagong Hill Tracts Regulation 1900 and subsequent amending laws. Areas of Chittagong Hill Tracts are excluded from the operation of State Acquisition and Tenancy Act by gazette notification dated 30 November 1955. The gazette notification also stipulated restriction on transfer by the tribal people of different areas of the country. A member of a tribe can transfer his property to another one of the

same or a different tribe at his will but he cannot do so to a non-tribal person without the permission of the revenue authority

2.3.2.3 Bangladesh Labor Act, 2006 and Rules, 2015

98. The 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 introduced a good number of important items like workers' welfare, rights and safety and industrial safety and expansion of the industry (particularly relevant for this project).

99. This Act applies to the proposed project as it will involve construction and erection of structures. 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 workers with personal protection equipment.

100. In 2015, the Bangladesh government introduced the Bangladesh Labor Rules. Some of the relevant points of these Rules are health and fire safety. 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.

2.3.3 Energy Related

2.3.3.1 Categorization of Projects or Industrial Units

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

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

2.3.3.2 The Electricity Act, 2018

103. The Electricity Act, 2018 is an Act to repeal and re-enact the Electricity Act, 1910 with modification for developing and reforming the sectors of power generation, transmission, supply and distribution and for better service delivery to consumers and meeting the increasing demand for electricity.

104. The Electricity Act 2018, repeals the provisions of Electricity Act 1910. A chain of penal measures, intended to serve temporary demand, have been taken. Anyone involved with electricity misappropriation, pilferage, wastage, or with interference or destruction of supply lines, be they civilians or government officials or corporations, may now be subjected to both fines and imprisonment. The current Act does not require officials to obtain a magisterial order before entering the premises of consumers to test or terminate supply.

105. Under this act, any person can get a license to supply energy & to lay down or place electric supply lines for the conveyance & distribution of energy. The licensee can open & break up the soil & pavement of any street, railway or tramway and can lay any

line or do other works near other utility services (like gas, T&T, water Sewer etc.) provided that prior permission is taken from respective authority, as staled in section 6 - 11 of this act.

106. According to section 12(1) of this act, the licensee shall make full compensation for any damage detriment or inconvenience caused by him or by any one employed by him.

107. According to Section 13 of this Act, right of way-For the purpose of laying power supply lines or doing civil works under this Act, the licensee shall reserve the right of way over the land and the space above or underground thereof provided that the licensee shall inform the land owner in writing before laying of power supply lines and doing civil works within a reasonable time.

108. According to section 14 of this Act, if acquisition of land is required for establishment of power generation plant or sub-station, it shall be deemed to have been necessary for public interest and the existing laws and regulations on acquisition of land shall have to be followed.

2.3.3.3 Electricity Rules 2020 (Clause 59 of Electricity Act 2018 (SRO 297 of Act/ 2020))

109. Electricity Rules has been published by Ministry of Power, Energy and Mineral Resources on November 2020 based on Clause 59 of Electricity Act 2018 (SRO 297 of Act/ 2020). The main observation is to provide compensation for the installation of transmission line towers to the land owners as per the applicable laws and policy.

2.4 Relevant National Policies and Plans

2.4.1 Environmental Policy 1992

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

111. The 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 causes environmental pollution, closure of such existing industries in phases and discouragement of the use of

such goods through the development and/or introduction of environmentally sound substitutes.

- To ensure sustainable use of raw materials in the industries to prevent their wastage.

2.4.2 National Energy Policy 2005

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

113. 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 the 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 the rural economy.
- To bring the entire country under electrification by the year 2020.
- To ensure a reliable supply of energy to the people at reasonable and affordable prices.
- To develop a regional energy market for rational exchange of commercial energy to ensure energy security.

2.4.3 National Conservation Strategy, 1992

114. National Conservation Strategy, 1992 was prepared under a project of Government of Bangladesh in the Ministry of Environment and Forest, and coordinated by Bangladesh Agricultural Research Council with financial assistance of International Union for Conservation of Nature and Natural Resources (IUCN). With understanding the increasing environmental pollution and natural resources degradation, the National Conservation strategy was adopted. Following this strategy the Government of

Bangladesh prepared the National Environment Policy in 1992, and revised the old law by enacting the Bangladesh Environment Conservation Act. 1995.

115. Bangladesh has completed the first phase of a national conservation strategy aimed at integrating conservation goals with national development objectives and overcoming identified obstacles to sustainable development. Some twenty sectors in the Third Five-Year Plan were identified for critical analysis during a second phase, including the conservation of genetic resources, and wildlife management and protected areas. The Bangladesh Agricultural Research Council, Ministry of Agriculture is the lead agency for the implementation of Phase n which began in October 1989.

2.4.4 The National Forest Policy, 1994

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

2.4.5 National Environmental Management Action Plan 1995

117. The National Environment Management Action Plan (NEMAP) is a national plan with a multi-sectoral approach. The Plan covers the period from 1995 to 2005. The document aims at: a) reducing the rate of environmental degradation, b) improving natural and manmade environment, c) preserving habitats and biodiversity, d) promoting sustainable development, and e) improving quality indicators of human life. Self-sufficiency in food will be attained in an environmentally sound manner.

118. Safe drinking water and basic sanitary materials will be supplied. Environmentally sound utilization of water resources will be ensured. Water resources and irrigation networks which do not create any adverse impact on the environment will be developed. Environmentally sustainable and scientific ground and surface water resource management will be ensured. The key issues of loss of biodiversity and degradation of natural habitats will be addressed.

119. Importance will be given to sustain the ecological balance while conserving forests. Tree plantation and afforestation programmes will be launched. Regarding the conservation of wildlife, sanctuaries and protected areas in relevant coastal areas will be established. Wetlands will be conserved and migratory birds will be protected. Further measures concern soil fertility, sustainable use of fisheries and livestock resources, rehabilitative measures will be taken to protect natural habitats of fish. In particular, measures will be taken to ensure that activities aimed at developing fisheries and livestock do not create any adverse impact of the mangrove forests and other ecosystems.

2.4.6 The Power Policy, 1996

120. As with the Petroleum Policy, this is presently an integral part of the National Energy Policy (1996). It has different policy statements on a whole range of issues including demand forecasts, long-term planning and project implementation, investment and lending terms, fuel and technology, power supply to the different zones, isolated and remote load centres, tariffs, captive and standby generation, system loss reduction, load

management and conservation, reliability of supply, system stability, load dispatching, institutional issues, private sector participation, human resource development, regional/international cooperation, technology transfer and research program, and environment policy and legal issues.

121. As the proposed project is a power transmission project, all necessary requirements mentioned above will be adopted for the Project.

2.4.7 The Energy Policy, 1996; updated 2004

122. The first National Energy Policy (NEP) of Bangladesh was formulated in 1996 by the Ministry of Power, Energy and Mineral resources to ensure proper exploration, production, distribution and rational use of energy resources to meet the growing energy demands of different zones, consuming sectors and consumers groups on a sustainable basis. With rapid change of global as well as domestic situation, the policy was updated in 2004. The updated policy included additional objectives namely to ensure environmentally sound sustainable energy development programmes causing minimum damage to environment, to encourage public and private sector participation in the development and management of energy sector and to bring the entire country under electrification by the year. The policy highlights the importance of protecting the environment by requiring an EIA for any new energy development project, or introduction of economically viable and environment friendly technology.

2.5 Comparison with National Standards and Justifications of their Requirements

2.5.1 Air Quality

123. Table 2-2 shows the air quality standard in Bangladesh.

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

Parameter	Concentration (mg/m3)	Exposure Time
Carbon Mono-oxide (CO)	10	8hours
	40	1hour
Lead (Pb)	0.5	Year
Nitrogen Oxide (NO2)	0.1	Year
	-	1hour
Suspended Particulate Matter (SPM)	0.2	8hours
Particulate Matter 10µm(PM10)	0.05	Year
	0.15	24hours
Particulate Matter 2.5µm(PM2.5)	0.015	Year
	0.065	24hours

Parameter	Concentration (mg/m3)	Exposure Time
Ozone(O3)	0.235	1hour
	0.157	8hours
Sulfur Dioxide (SO2)	0.08	Year
	0.365	24hours

Source: DOE. Schedule-2, Rule 12, ECR of 1997 (Page 3123, Bangladesh Gazette, 28 August 1997).
Notes:(1) Sensitive area includes national monuments, health resorts, hospitals, archaeological sites, educational institutions and other government designated areas (if any).
(2) Any industrial unit located not in a designated industrial area will not discharge such pollutants, which may contribute to exceed the ambient air quality above in the surrounding areas of category 'Ga' and 'Gha'.
(3) Suspended particulate matters mean airborne particles of diameter of 10 micron or less

2.5.2 Water Quality

124. Table 2-3 shows ambient water quality standard (inland surface water), and Table 2-4 shows environmental water quality standard (drinking water).

Table 2-3: National Standard for Inland Surface Water

Best Practice Based Classification	pH	BOD mg/1	Dissolved Oxygen (DO),mg/l	Total Coliform Bacteria quantity/ml
Potable water source supply after bacteria freeing only	6.5- 8.5	2 or less	6 or above	**50 or less**
Water used for recreation purpose	6.5- 8.5	3 or less	5 or above	**200 or less**
Potable water source supply after Conventional processing	6.5- 8.5	3 or less	6 or above	**5000 or less**
Water used for pisci-culture	6.5- 8.5	6 or less	5 or above	**5000 or less**
Water used for irrigation	6.5- 8.5	10 or less	5 or above	**1000 or less**

Source: DOE.
BOD = biological oxygen demand, mg/l = milligram per liter, pH = negative decimal logarithm of the hydrogen ion activity in a solution
Notes: In water used for pisiculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l. Electrical conductivity for irrigation water – 2250 µmhoms/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

Table 2-4: National Standard for Drinking Water

No.	Parameter	Unit	Standard Limit	WHO Guidelines
1	Aluminum	mg/l	0.2	**0.2**
2	Ammonia (NH3)	mg/l	0.5	**-**
3	Arsenic	mg/l	0.05	**0.01**
4	Barium	mg/l	0.01	**0.7**
5	Benzene	mg/l	0.01	**0.01**
6	BOD5 20 C	mg/l	0.2	**-**
7	Boron	mg/l	1.0	**0.5**
8	Cadmium	mg/l	0.005	**0.003**
9	Calcium	mg/l	75	**-**
10	Chloride	mg/l	150-600	**-**
11	Chlorinated Alkanes			**-**
	Carbon Tetrachloride	mg/l	0.01	**-**
	Dichloroethylene	mg/l	0.001	**-**
	Dichloroethylene	mg/l	0.03	**-**
	Tetrachloroethylene	mg/l	0.03	**-**
	Trichloroethylene	mg/l	0.09	**-**
12	Chlorinated Phenols			**-**
	Pentachlorophenol	mg/l	0.03	**-**
	Trichlorophenol	mg/l	0.03	**-**
13	Chlorine (residual)	mg/l	0.2	**-**
14	Chloroform	mg/l	0.09	**0.3**
15	Chromium(hexavalent)	mg/l	0.05	**-**
16	Chromium(total)	mg/l	0.05	**0.05**
17	COD	mg/l	4	**-**
18	Coliform(fecal)	n/100ml	0	**-**
19	Coliform(total)	n/100ml	0	**-**
20	Color	Huygens unit	15	**-**

No.	Parameter	Unit	Standard Limit	WHO Guidelines
21	Copper	mg/l	1	**-**
22	Cyanide	mg/l	0.1	**-**
23	Detergents	mg/l	0.2	**-**
24	DO	mg/l	6	**-**
25	Fluoride	mg/l	1	**1.5**
26	Hardness (as CaCO3)	mg/l	200-500	**-**
27	Iron	mg/l	0.3-1.0	**-**
28	Nitrogen (Total)	mg/l	1	**-**
29	Lead	mg/l	0.05	**0.01**
30	Magnesium	mg/l	30-35	**-**
31	Manganese	mg/l	0.1	**0.4**
32	Mercury	mg/l	0.001	**0.006**
33	Nickel	mg/l	0.1	**0.07**
34	Nitrate	mg/l	10	**3**
35	Nitrite	mg/l	Lessthan1	**-**
36	Odor		Odorless	**-**
37	Oil & Grease	mg/l	0.01	**-**
38	pH		6.5-8.5	**-**
39	Phenolic compounds	mg/l	0.002	**-**
40	Phosphate	mg/l	6	**-**
41	Phosphorus	mg/l	0	**-**
42	Potassium	mg/l	12	**-**
43	Radioactive Materials (gross alpha activity)	Bq/l	0.01	**-**
44	Radioactive Materials (gross beta activity)	mg/l	0.1	**-**
45	Selenium	mg/l	0.01	**-**
46	Silver	mg/l	0.02	**-**
47	Sodium	mg/l	200	**-**

No.	Parameter	Unit	Standard Limit	WHO Guidelines
48	Suspended particulate matters	mg/l	10	**-**
49	Sulfide	mg/l	0	**-**
50	Sulfate	mg/l	400	**-**
51	Total dissolved solids	mg/l	1000	**1000**
52	Temperature	℃	20-30	**-**
53	Tin	mg/l	2	**-**
54	Turbidity	JTU	10	**-**
55	Zinc	mg/l	5	**-**

Source: DOE.
BOD = biological oxygen demand, mg/l = milligram per liter, ml = milliliter
Notes: In coastal area 1000. Reference: Bangladesh Gazette, Addendum, August 28, 1997.

2.5.3 Noise Quality

125. As for noise, the standard limit is set for every category of zone class. Table 2-5 shows the Noise standard in Bangladesh.

Table 2-5: Bangladesh Standards for Noise

Zone Class	Limits in dBA	
	ECR	
	Day	Night
Silent Zone	45	35
Residential Zone	50	40
Mixed Zone (this area is used combining residential, commercial and industrial purposes)	60	50
Commercial Zone	70	60
Industrial Zone	70	70

Source: The Environmental Conservation Rules, 1997; IFC Environmental Health and Safety Guidelines, 2008
Note: The day time is considered from 6 a.m. to 9 p.m. and the night time is from 9 p.m. to 6 p.m. From 9 at night to 6 morning is considered night time.
Area within 100 meters of hospital or education institution or educational institution or government designated / to be designated / specific institution / establishment are considered Silent Zones. Use of motor vehicle horn or other signals and loudspeaker are forbidden in Silent Zone

2.6 International Requirements

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

2.6.1 Rio Declaration

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

2.6.2 Convention on Biological Diversity, (1992)

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

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

2.6.3 Others (Conventions and Agreements)

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

- Convention relative to the Preservation of Fauna and Flora in their Natural State 1933; International Convention for the Protection of Birds, Paris, 1950;
- Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (1971), This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetlands habitat. Obligation for Contracting Parties include the designation of wetlands to the “List of Wetlands of International Importance”, the provision of wetland considerations within their national land use planning, and the creation of Natural Reserves. Parts of Sundarbans Reserved Forest (Southwest of Bangladesh) are one of the Ramsar Sites.
- International Plant Protection Convention, Rome, 1951;
- Convention concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972 has been ratified by 175 states. This defines and conserves the world's heritage by drawing up a list of natural and cultural sites whose outstanding values should be preserved for all humanity. Of the 730 total sites, there are currently 144 natural, 23 mixed and 563 cultural sites that have been inscribed on the World Heritage List (distributed in 125 State parties). These are the 'Jewels in the Crown' of conservation;

- Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 (Popularly known as CITES): This provides a framework for addressing over harvesting and exploitation patterns, which threaten plant and animal species. Under CITES governments agree to prohibit or regulate trade in species which are threatened by unsustainable use patterns; and
- Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 (Amended 1988): This provides a framework for agreements between countries important to the migration of species that are threatened.
- UN Convention on the Law of the Sea, Montego Bay, and (1982) This Convention was adopted on 10 December 1982 at Montego Bay, Jamaica. Bangladesh has ratified this Convention. The main objectives of the convention are:
    - To set up a comprehensive new legal regime for the sea and oceans, as far as environmental provisions are concerned, to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment; and
    - To establish basic environmental protection principals and rules on global and regional cooperation, technical assistance, monitoring, and environmental assessment, and adoption and enforcement of international rules and standards and national legislation with respect to all sources of marine pollution.
- The East Asian-Australasian Flyway Partnership (EAAFP) was launched on 6 November 2006. It aims to protect migratory waterbirds, their habitats and the livelihoods of people dependent upon them. EAAFP Partners work together to develop Flyway Site Network to ensure the internationally important wetlands are sustainably managed.
    - It works to enhance research, monitoring, information exchange as well as CEPA (communication, education, participation, awareness) of conservation of migratory waterbirds and their habitats. It enhances capacity building on management and develop flyway-wide conservation approaches.
    - The Partnership provides a flyway wide framework to promote dialogue, cooperation and collaboration between a range of stakeholders to conserve migratory waterbirds and their habitats. Stakeholders include all levels of governments, site managers, technical institutions, UN agencies, development agencies, industrial and private sector, academe, non-government organizations, community groups and local people.

2.6.4 Policy regarding PCB free electrical equipment

131. Polychlorinated biphenyls (PCBs) are synthetic compounds with stable chemical properties that were used mainly in electrical components

132. In 1980, the United State Environmental Protection Agency (EPA) issued interim guidance determination of penalties for violation of the Polychlorinated Byphenyles (PCB) rules. That interim policy was published in the Federal Register on September 10, 1980.

133. In the Canada PCB Regulations (SOR/2008-273) came into force on September 5, 2008. The most recent amendments to the regulations came into force on January 1, 2015. The purpose of the regulations is to protect the health of Canadians and the environment by preventing the release of polychlorinated biphenyls (PCBs) to the environment. Some regulations of Canada are given below

134. No person shall release more than one gram of PCBs into the environment from equipment referred to in section 16 that is in use or from equipment in use for which an extension has been granted under section 17.

135. A person may manufacture, export, import, offer for sale, sell, process and use PCBs or products containing PCBs for the purpose of laboratory analysis if the analysis is conducted

136. A person may offer for sale or sell PCBs or products containing PCBs to be processed or used for the purpose of research to determine the effects of those PCBs or products on human health or on the environment, if the facility in which they are processed

137. A person may offer for sale, sell and use an electrical capacitor containing PCBs if the electrical capacitor

(a) is an integral part of a consumer product;

(b) is fusion sealed; and

(c) Would be rendered inoperable and irreparable if the PCBs were removed from it.

138. In Bangladesh on 15 March 2005, the Director General of DoE issued a letter to the Chairman of BPDB and other relevant organization's requesting them to buy PCB free transformers, transformer oil, capacitors and to store all unserviceable oil in a safe place so that it is not sold in the market for other uses and it is kept away from humans. This letter could serve as the initial step prior to official notification.

139. **Stockholm Convention on Persistent Organic Pollutants (POPS)** – a global treaty in May 2001which was made effective in May 2004 to protect human health and the environment from chemicals that remain intact for a long time and become widely distributed geographically and accumulate in human and wildlife tissue. GOB signed the Stockholm Convention on POPS on 23 May 2001 and was ratified on 27 March 2007. The treaty requires the Parties to take measures to eliminate or reduce the release of POPS in the environment. The POPS of major concern to power sector projects is the polychlorinated biphenyl (PCB) used before as a transformer oil. PCB is not manufactured in Bangladesh and its international production generally was ended in 1980. Tranche 2 will ensure that management of POPS, if any, from the subprojects will be managed consistent with the Stockholm Convention.

2.6.5 Policy regarding nuclear power plant

USA Energy Policy Act 2005

140. After much preliminary debate, the Energy Policy Act (EPA) 2005 comfortably passed both houses (74-26 in the Senate and 275-156 in the House). It included incentives for the domestic nuclear power industry, including:

- Production tax credit (PTC) of 1.8 ¢/kWh for the first 6000 MWe of new nuclear capacity in the first eight years of operation. Under the initial terms of the EPA, to qualify for the nuclear PTC, a plant must be in service on or before 31 December 2020, and the maximum value of the nuclear PTC is $6 billion over eight years (or £750 million per year). However, in February 2018, an extension to the PTC was passed by the US Senate and Congress. The extension allows reactors entering service after 31 December 2020 to qualify for the tax credits, and allows the US Energy Secretary to allocate credit for up to 6000 MWe of new nuclear capacity which enters service after 1 January 2021. The PTC cannot be claimed until assets begin generating electricity, and is not inflation adjusted.
- Federal risk insurance of $2 billion to cover regulatory delays in full-power operation of the first six advanced new plants.
- Rationalized tax on decommissioning funds (some reduced).
- Federal loan guarantees for advanced nuclear reactors or other emission-free technologies up to 80% of the project cost.
- Extension for 20 years of the Price Anderson Act for nuclear liability protection.
- Support for advanced nuclear technology.

2.7 ADB Safeguard Policy Statement, SPS 2009

141. ADB's environmental and social safeguards form the cornerstone of its support to inclusive economic growth and environmental sustainability in Asia and the Pacific. In July 2009, ADB's Board of Directors approved the new Safeguard Policy Statement (SPS) governing the environmental and social safeguards of ADB's operations. The objectives of the SPS are to avoid, or when avoidance is not possible, to minimize and mitigate adverse project impacts on the environment and affected people. Objectives also include helping borrowers strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

142. ADB’s environmental safeguards emphasize development and implementation of a comprehensive EMP. Key elements of EMP are mitigation measures, monitoring programs, budgets, and institutional arrangements for implementation. In addition, the environmental assessment process emphasizes public consultation, information disclosure, and consideration of alternatives.

143. The key safeguard areas which must be addressed are

(i) environmental;

(ii) involuntary resettlement; and

(iii) indigenous peoples.

144. ADB’s environmental safeguards emphasize development and implementation of a comprehensive EMP. Key elements of EMP are mitigation measures, monitoring programs, budgets, and institutional arrangements for implementation. In addition, the environmental assessment process emphasizes public consultation, information disclosure, and consideration of alternatives.

145. Further, ADB adopts a set of specific safeguard requirements that borrowers or clients are required to meet in addressing environmental and social impacts and risks associated with a specific project. ADB will not finance projects that do not comply with its safeguard policy statement, nor will it finance projects that do not comply with the host country's social and environmental laws and regulations. The safeguard policy statement applies to all ADB-financed and/or ADB-administered sovereign and non-sovereign projects, and their components, regardless of the source of financing.

2.7.1 ADB's Environmental Safeguard Requirements - Policy Principles

146. Environmental assessment incorporates the following policy principles:

- Projects are screened and assigned to one of the following categories described in Table 2-6 as soon as possible.
- Conduct an environmental assessment for each proposed project. Assess potential trans-boundary and global impacts, including climate change.
- Examine alternatives to the project's location, design, technology, and components. Avoid, minimize, mitigate, and/or offset adverse impacts.
- Prepare an EMP.
- Carry out meaningful consultation with affected people and facilitate their informed participation.
- Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.
- Implement the EMP and monitor its effectiveness. Document and disclose monitoring results.
- Do not implement project activities in areas of critical habitat, unless

  (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function,

  (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and

  (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area.
- Apply pollution prevention and control technologies and practices consistent with international good practices such as the World Bank Group's Environmental, Health and Safety Guidelines.
- Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease.

- Conserve physical cultural resources (PCRs) and avoid destroying or damaging them by using field-based surveys.

147. The project categorization system and the assessment required are described in Table 2-6. Most of the environmental impacts of the project are temporary and reversible. This project is categorized as an Environmental Category B project. The project will also address the World Bank/IFC EHS guidelines as they apply to Substation and transmission lines and any associated work (such as bay extension).

Table 2-6: ADB's Environmental Safeguards Categorization and Requirements

Category	Definition	Assessment Requirement
A	Likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and may affect an area larger than the sites or facilities subject to physical works.	Environmental Impact Assessment (EIA)
B	Likely to have adverse environmental impacts that are less adverse than those of Category A. Impacts are site-specific, few if any of them irreversible, and in most cases mitigation measures can be designed more readily than Category A.	Initial Environmental Examination (IEE)
C	Likely to have minimal or no adverse environmental impacts.	No environmental assessment is required but the environmental implications of the project will be reviewed
FI	Project involves investment of ADB funds to or through a financial intermediary (FI).	FIs will be required to establish an environmental and social management system (ESMS) commensurate with the nature and risks of the FI's likely future portfolio to be maintained as part of the FI's overall management system.

Source: (ADB, 2009)

2.7.2 Comparison of Environmental Safeguard Principles between ADB and Bangladesh

148. Table 2-7 presents a summary comparing the environmental safeguard principles of ADB and the government.

Table 2-7: Comparison of Environmental Safeguard Principles Between ADB and Bangladesh

	SPS 2009			
No.	**Principles**	**Delivery Process**	**Government**	**Gaps (if any)**
1	Use of screening process to determine the appropriate environmental assessment	Uses sector-specific rapid environmental assessment checklist for screening and assigns categories based on potential impacts: A - EIA required (irreversible, diverse or unprecedented adverse environmental impacts) B - IEE required C - no environmental assessment required but a review of environmental implications FI - ESMS required	ECA 1995 and ECR 1997(amended in 2017) set screening criteria to classify industries/projects based on potential environmental impacts as follows: Green (pollution-free), Orange-A, Orange-B and Red (causes significant environmental impacts). The screening criteria are based on project or industry type and do not consider the scale and location. The category determines the level of environmental assessment.	No major gaps
2	Conduct an environmental assessment	EIA and IEE - Identify potential impacts on physical, biological, PCRs, and socioeconomic aspects in the context of project's area of influence (i.e., primary project site and facilities, and associated facilities) ESMS for FIs	Industry/project category Green- no environmental assessment required Orange-A - no IEE or EIA required but must provide process flow, lay-out showing effluent treatment plant, etc. Orange-B - IEE required Red - both IEE and EIA are required	No major gaps
3	Examine alternatives	Analyze alternatives to the project's location, design, and technology Document rationale for selecting the project location, design, and technology Consider "no project" alternative	Regulations (i.e., ECA 1995 and ECR 1997 amended in 2017) do not require specifically the identification and analysis of alternatives	Not required by law but the TOR for EIA to be approved by the DOE now includes a discussion on analysis of alternatives.
4	Prepare an EMP	EMP to include monitoring, budget and implementation arrangements	EMP and procedures for monitoring included in the IEE and EIA (i.e., Orange-A, Orange-B, and Red category projects)	No major gaps

SPS 2009				
No.	**Principles**	**Delivery Process**	**Government**	**Gaps (if any)**
5	Carry out meaningful consultation	Starts early and continues during implementation Undertaken in an atmosphere free of intimidation Gender inclusive and responsive Tailored to the needs of vulnerable groups Allows for the incorporation of all relevant views of stakeholders Establish a grievance redress mechanism	Public consultation and participation are not mandatory based on ECA 1995 and ECR 1997 (amended in 2017) Grievance redress mechanism is not mentioned in ECA 1995 and ECR 1997 (amended in 2017) EIA format required by DOE includes stakeholders' consultation	Approval of the TOR of EIA by DOE now includes consultation with stakeholders.
6	Timely disclosure of draft environmental assessment (including the EMP)	Draft EIA report posted on ADB website at least 120 days prior to Board consideration (for Category A) Draft IEE/EARF prior to appraisal Final or updated EIA/IEE upon receipt Environmental monitoring report submitted by borrowers upon receipt	No requirement for public disclosure of environmental reports but DOE posts the Minutes of the Meeting on the application for environmental clearance certificate to its website, http://www.doe-bd.org/minutes.php	Still no requirement for public disclosure of environmental assessment, but the project will be posted to the DoE website and will be available in summary form at the project site.
7	Implement EMP and monitor effectiveness	Prepare monitoring reports on the progress of EMP Retain qualified and experienced external experts or NGOs to verify monitoring information for Category A projects Prepare and implement corrective action plan if non-compliance is identified Requires submission of quarterly, semi-annual, and annual reports to ADB for review	Environmental clearance is subject to annual renewal based on compliance of the conditions set by DOE	No major gaps

SPS 2009				
No.	Principles	Delivery Process	Government	Gaps (if any)
8	Avoid areas of critical habitats (use of precautionary approach to the use, development and management of renewable natural resources)	Provides guidance on critical habitats	ECA 1995 and ECR 1997 (amended in 2017) identifies ecologically critical areas and the rules to protect them	No major gaps
9	Use pollution prevention and control technologies and practices consistent with international good practices	Refers to World Bank's Environmental Health and Safety (EHS) General Guidelines 2007 (or any update) If national regulations differ, more stringent will be followed If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification	Effluent standards, ambient and emission standards included in ECA 1995 and ECR 1997 (amended in 2017) Ambient noise levels included in Noise Pollution Control Rules 2006	No major gaps
10	Provide workers with safe and healthy working conditions and avoid risks to community health and safety	Refers to WB EHS General Guidelines 2007 (or any update)	Occupational health and safety standards included in the Factories Act 1965, the Bangladesh Labor Law 2006, and the Bangladesh Labor Act 2013.	No major gaps; WB/IFC EHS guidelines will still apply, as per the ADB SPS, and enforcement requirements will be noted.
11	Conserve physical cultural resources (PCRs) and avoid destroying or damaging them	Use of field-based surveys and experts in the assessment Consult affected communities on PCRs findings Use chance find procedures for guidance	Preservation and protection of cultural resources are within the Antiquities Act 1968.	No major gaps

No.	SPS 2009 Principles	SPS 2009 Delivery Process	Government	Gaps (if any)
12	Grievance Redress Mechanism	Establish a grievance redress mechanism	Grievance redress mechanism is not mentioned in ECA 1995	Not required by regulation in Bangladesh

ADB = Asian Development Bank, DoE = Department of Environment, EARF = Environmental Assessment and Review Framework, ECA = Environment Conservation Act, ECR = Environment Conservation Rules, EHS = Environmental Health and Safety, EIA = Environmental Impact Assessment, EMP = Environmental Management Plan, ESMS = Environmental and Social Management System, FI = Financial Intermediary, IEE = Initial Environmental Examination, NGO = Non-governmental Organization, PCRs = Physical Cultural Resources, ToR = Terms of Reference, WB = World Bank.

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3. Project Description

3.1 Background

149. Power Grid Company of Bangladesh Ltd. (PGCB) was formed under the restructuring process of Power Sector in Bangladesh with the principal objective of bringing about commercial environment including increase in efficiency, establishment of accountability and dynamism in accomplishing its objectives. It was entrusted with the responsibility to own the national power grid to operate and expand the same with efficiency. PGCB expanded its network and capacity manifold and operating those efficiently and effectively.

150. The Government of Bangladesh has undertaken massive development activities to strengthen the power generation, transmission and distribution sectors of the country with the aim of reaching electricity to all. As Bangladesh is undergoing a transformation to be in the rank of middle-income countries; her economy is experiencing significant progress in various sectors A reliable and adequate source of quality electric power is a prerequisite to keep the economy running. Besides the government is working to realize the vision of reaching electricity to all throughout the country.

151. To meet the rapidly increasing demand for power and to realize its stable supply, large-scale power supply development and construction of system facilities such as transmission lines and substations are necessary, such a transmission line is between “Notun Biddyut PP- Char Fasson 230 kV double circuit transmission line”.

3.2 Project Location

152. The Transmission Line is between Notun Biddyut Power plant and 230/33 KV GIS: Char Fasson substation. A total of about 500 acres direct affected area, its surroundings and its environmental & social influence, three upazillas are considered as the study area for this project. The proposed project study area lies within the administrative area of Burhanuddin, Charfasson and Lalmohon Upazila under Bhola District Barishal, Bangladesh.

153. The project includes construction of a new substation, two Bay Extension at Notun Biddyut Power Plant and construction of 230 kV double circuit transmission lines. The locations of project components are described below:

3.2.1 Substation

154. One new 230/33 KV GIS substation at Char Fasson will be constructed under this project. PGCB has selected the location of the proposed Char Fasson substation is in southern part of Bangladesh, Char Fasson upazila under Bhola District Barishal division. The substation will be constructed under the following coordinates- 22° 8'34.54"N, 90°44'12.59"E; 22° 8'30.77"N, 90°44'15.97"E; 22° 8'27.05"N, 90°44'12.04"E and 22° 8'30.75"N, 90°44'8.54"E.

155. This area is currently an agricultural land which has been acquired by PGCB. There are no built structures on land at present, and the land filling (approx. 3.5 m) is required before the construction of substation. The Lalmohon-Char Fasson upazila road is located just beside the proposed substation land, thus, no access road construction will be required. The satellite image of the proposed location of Char Fasson substation is shown in Figure 3-1, layout plan provided in Annex 20.

3.2.2 Bay Extension:

156. Two numbers of 230 kV GIS Bay Extension will be constructed at Notun Biddyut Power Plant.

3.2.3 Transmission Line:

157. The proposed 230 kV double circuit transmission line will start from Notun Biddyut Power plant to 230/33 KV GIS Char Fasson substation passing through Burhanuddin, Charfasson and Lalmohon Upazila under Bhola District Barishal, Bangladesh. A geographic Map showing the location of the proposed 230kV transmission line is given in Figure 3-1. The height of the towers will be 46.2m. There will be 30 angle points (AP) thus 30 tower footings will be constructed for the transmission line. The transmission line passes mostly through agricultural and barren lands. The transmission lines will pass over 92 ponds and 15 canals, but it will not cross over any rivers. However, all of the tower footings will be constructed on agricultural lands, thus no waterbody/ wetland will be harmed or filled for project purpose. Table 3-1 presents a detailed location of the APs'.

Table 3-1: Land Type under Angle Tower Footing

AP	Easting	Northing	Land Type
Strat Point	264278.22	2487738.53	**230kV GIS Buiding (Gantry) of Nuton Biddyut 225MW PP**
AP-01 (TT)	264275.52	2487752.23	**Existing Power Plant**
AP-02	264247.05	2487767.28	**Existing Power Plant**
AP-03	264179.6	2487749.79	**Agricultural Land**
AP-04	264068.8	2487739.22	**Agricultural Land**
AP-05	263932.19	2487662.5	**Agricultural Land**
AP-06	264190.38	2486814.88	**Agricultural Land**
AP-07	263850.91	2484215.85	**Agricultural Land**
AP-08	264509.02	2482011.98	**Agricultural Land**
AP-09	264931.51	2481625.32	**Agricultural Land**
AP-10	265068.39	2480521.38	**Agricultural Land**
AP-11	264546.48	2478569.15	**Agricultural Land**
AP-12	264082.64	2475064.83	**Agricultural Land**
AP-13	264556.75	2473592.21	**Agricultural Land**
AP-14	264363.11	2472908.68	**Agricultural Land**
AP-15	264521.3	2471612.38	**Agricultural Land**

AP	Easting	Northing	Land Type
AP-16	265311.18	2470116.51	**Agricultural Land**
AP-17	265166.44	2469197.77	**Agricultural Land**
AP-18	265490.34	2468675.7	**Agricultural Land**
AP-19	265154.07	2466712.43	**Agricultural Land**
AP-20	266225.73	2464687.32	**Agricultural Land**
AP-21	266956.62	2462739.03	**Agricultural Land**
AP-22	267083.64	2460938.53	**Agricultural Land**
AP-23	267683.77	2459315.68	**Agricultural Land**
AP-24	267078.1	2457502.95	**Agricultural Land**
AP-25	266234.86	2456033.46	**Agricultural Land**
AP-26	266631.8	2454400.81	**Agricultural Land**
AP-27	266950.87	2453655.94	**Agricultural Land**
AP-28	266953.62	2452714.08	**Agricultural Land**
AP-29	266454.35	2452004.84	**Agricultural Land**
AP-30	266516.92	2451750.83	**Agricultural Land**
End Point	266564.29	2450300.93	**Agricultural Land**

Source: ENRAC Topographic Survey

158. The width of the right of way has been selected as per the provisions of the applicable part /section of the Power Grid Company of Bangladesh ltd (PGCB) Practice for Design, Installation and Maintenance of Overhead Power Lines. For lines up to 230 kV, PGCB recommends the right of way widths taking into consideration the theoretical requirement of right of way and transport requirements of maintenance as per Table 3-2. However, survey width has been selected as 50m, considering 25m from the centre line to either side) as per PGCB ToR (Attachment -4, Route Survey for Transmission line, section 1.10.4).

Table 3-2: Transmission Line Right of Way Selection

Transmission Voltage Recommended	Width of Right of Way
132 kV	28 meters
230 kV	40 meters

Source: PGCB ToR (Attachment -4, Route Survey for Transmission line, section 1.6.1, 1.6.2)

3.3 Project Components

159. PGCB has taken an initiative to construct a new substation, two bay extensions and a Double circuit line project named “Notun Biddyut PP- Char Fasson 230 kV double circuit line Project”. The Capacity of this line is 2X120/140 MVA. The detail project information is furnished in Table 3-3.

Table 3-3: Details of the project

Name of Substation	Capacity (MVA)	Interconnection Details	Bay Extension
230/33 KV GIS: Char Fasson (5 Acre)	2X120/140 MVA	Notun Biddyut PP- Char Fasson 230 kV double circuit line: 39.81 km	230 KV bay Extension at Notun Biddyut PP. 2 nos.

Source: PGCB

160. The location of Char Fasson is provided in Figure 1-1. The Notun Biddyut PP-Char Fasson 230 kV double circuit line project falls under the "**Orange B Category**" as per the Environmental Conservation Rules of 1997, which requires Site Clearance and Environmental Clearance Certificates (ECC) from Department of Environment prior to commencement of the Project. As such, for obtaining these aforementioned clearance certificates from DOE, PGCB has to submit an Initial Environmental Examination (IEE) report to DoE.

161. In this regard, PGCB has entrusted Environment and Resource Analysis Center Ltd (ENRAC) as consultants to conduct Feasibility Study, Route Survey (RS), Topographical Survey (TS), Initial Environmental Examination (IEE) and Resettlement Plan (RP) studies to select the suitable route and to get necessary environmental clearance certificate from the Department of Environment (DoE).

3.4 Project Rationale

162. The Government of Bangladesh (GoB) has targeted GDP growth of 7.4 percent per year between 2016 and 2020 in its Seventh Five Year Plan. Solid performance by the power sector is considered necessary to achieve this target. The current Power System Master Plan (PSMP) notes that if Bangladesh were to follow Thailand’s growth trajectory as desired by the Government, it would have to sustain a per capita GDP growth rate of 5.2 percent per year between 2016 and 2014. This would require the development of new export-oriented industries and a significant increase in power generation capacity along with a quadrupling of the total energy used. The Government has also set the goal of achieving universal access to electricity by 2021, when Bangladesh completes 50 years of independence.

163. The Power System Master Plan 2016 establishes the need for major transmission capacity to be developed to transfer power from the new power plants to be developed in southern Bangladesh. Demand for electricity is growing rapidly in the Bhola district. It has been identified that construction of a new substation will be required to serve the growing demand. Accordingly, new 230/33 kV GIS substations with interconnecting transmission

lines are required to enhance the reliability of electricity supply in the Bhola district. It is anticipated that the new substations and transmission interconnections will not only increase operating contingency, but also will help overcome the limitations of supplying uninterrupted electricity to end-users.

3.5 Land ownership and Compensation

164. 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 transmission line and substation. The affected households will be informed well ahead of construction work schedule (as per Act 2017 and Electricity Rule 2020). PGCB will be involved through its PIU in meaningful consultation and participation with the affected people in Project implementation.

165. There were 3 land owners of the substation area. PGCB has compensated the respective Deputy Commissioner of Bhola, Land Acquisition Department, the full amount for acquisition. However, among the 3 owners, 2 were compensated through DC, and 1 of them had dispute regarding inheritance, which is currently being resolved by DC of Bhola. Details of the land ownership and compensation are presented in Annex 18.

3.6 Salient Features of Substations

166. 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 sulphur hexafluoride (SF6) gas as the primary insulator. SF_6 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. Each sub-station has electrical specifications for voltage, switchgear, circuit breaker, transformer, protection systems. The key physical specifications of the sub-stations are given in Table 3-4.

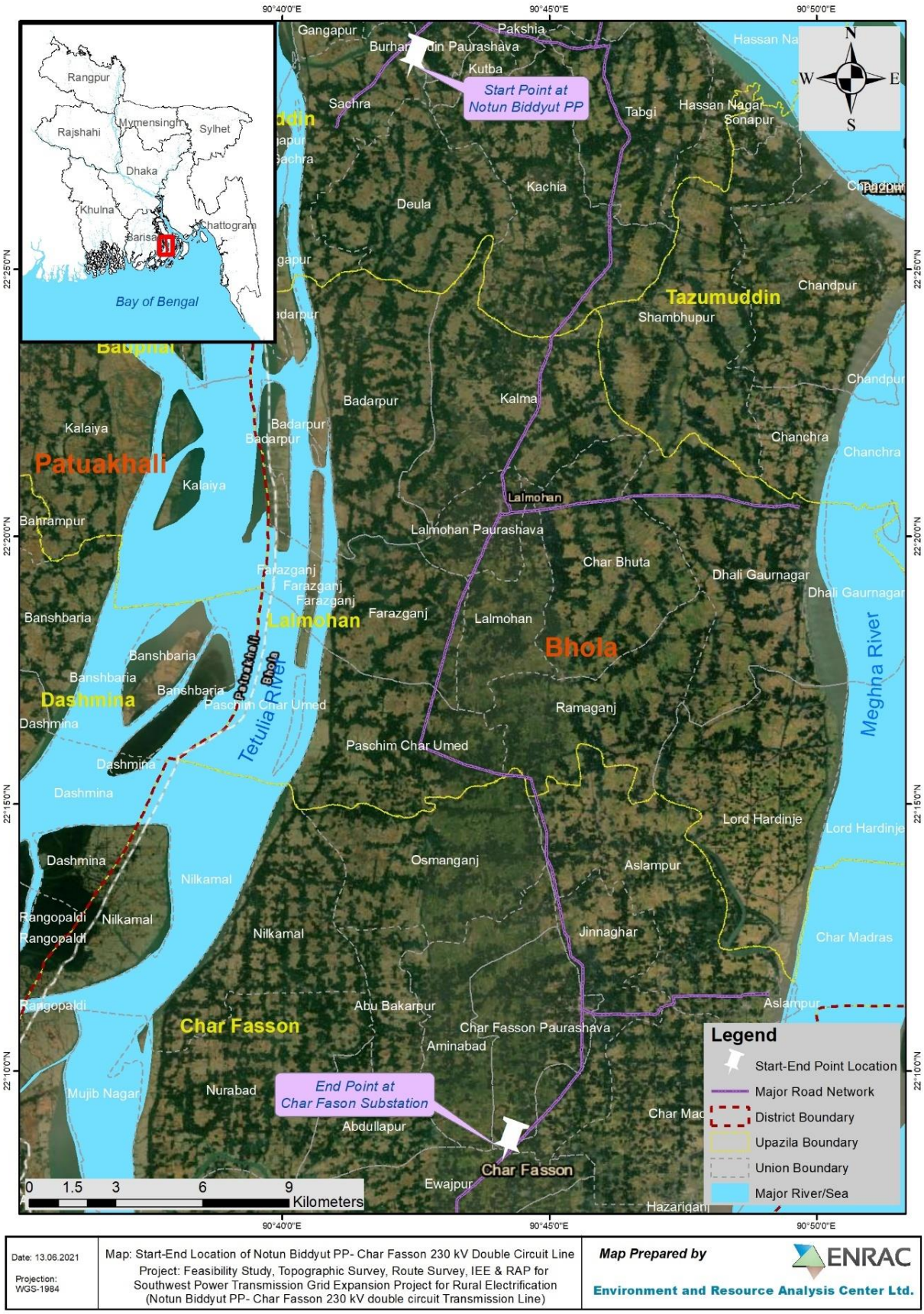

Figure 3-1: Satellite image showing Substation and Transmission Line of the project

Table 3-4: Salient features of the 230/33 kV Substation

Features	Specification
Type	Sub-station: 230/33 KV GIS:
Land ownership	PGCB acquired land
No. & Capacity	2X120/140 MVA
Voltage level	230 kV
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

Source: PGCB

3.7 Proposed Substations and Bay Extension Works

167. The 230/33 KV GIS substation at Char Fasson will be constructed at the Char fasson upazila. The proposed 230 kV double circuit transmission line will start from Notun Biddyut Power plant at Burhanuddin, to 230/33 KV GIS Char Fasson substation passing through Burhanuddin, Lalmohon and Char Fasson Upazila, and end at the newly constructed GIS substation. There will be two 230 kV GIS Bay Extension at Notun Biddyut Power Plant.

3.8 Salient Features of Transmission Lines

168. The major physical features of the 230 kV Transmission Line are presented in Table 3. The transmission line will be double circuit, made of ACSR Grosbeak conductor materials. The line supporting towers will be steel towers which are of two types– Tension and Suspension (Figure 3-2). Tension towers will be installed in the angles and suspension towers will be installed along the line, as load bearing support. Disc type insulator will be used in the towers to bear the wire (Figure 3-3). Table 3-5 shows the Specifications of 230 kV proposed Transmission line.

Table 3-5: Specifications of 230 kV proposed Transmission line

Physical Features	Attribute
Voltage Rating	230kV
Type of Transmission Line	Double Circuit
Width of T/L Right of Way	25 m

Physical Features	Attribute
Type of Line Support	Steel Towers-Tension for angles & Suspension for load bearing
Conductor Material	ACSR Grosbeak
Line Insulator	Disc type
Type of Connection	Power plant to Sub-station

Source: PGCB

Figure 3-2: Tension and Suspension Tower

Figure 3-3: Disc Insulator

3.8.1 List of TLs

169. There will be one transmission line under the project component. The proposed 230 kV double circuit transmission line will start from Notun Biddyut Power plant to 230/33 KV GIS Char Fasson substation passing through Burhanuddin, Lalmohon and Char Fasson Upazila under Bhola District.

3.9 Construction

3.9.1 Construction Activities Related Works for Transmission Lines

170. The activities in all alignment of the Transmission Line are almost similar. The activities to be undertaken include:

171. To install transmission towers, workers typically build or improve a road to create access to the sites. Then workers prepare and pour concrete foundations, connect partially assembled towers and use cranes to complete the towers, Access roads for the Transmission Line Project typically will be 2 m to 3 m wide to allow for ongoing line operations and maintenance. Figure 3-4 presents a typical tower line construction activity.

172. Construction of OHLs involves the following activities, site preparation; foundation construction; structure construction and wire-stringing operations.

Site Preparation: Tower locations are cleared of vegetation prior to construction of the towers. Access roads may need to be upgraded or new roads may require to be constructed to accommodate construction vehicles and equipment access to each tower site. Alternative routes may be required in case the routes pass through residential area, market place, etc.

Foundation Construction: Most structures have a concrete foundation. The size of the foundation depends on the type of structure and the terrain. Foundation construction begins with the auguring of holes for footings (four for lattice steel towers [LSTs]). For LSTs, each hole is usually 3 to 4 feet wide and 15 to 30 feet deep. Regardless of the structure type, foundations typically have a slight projection above the ground. After the footing holes are excavated, they are reinforced with steel and then concrete is poured into the holes. Once the concrete has cured, crews can begin the construction of the structure itself.

Structure Construction: Generally, structures are built from the ground up. Structures are assembled in sections near the new tower location and a crane is used to lift the sections into place. Crews then bolt the sections together. The method used is determined by terrain and available space next to the structure site. Tower erection is usually performed by crane, but helicopters are used in areas that are inaccessible to large ground-based construction equipment.

Wire-Stringing Operations: Wire stringing includes all activities associated with the installation of the primary conductors onto the transmission line structures. These activities include the installation of conductor, ground wire, insulators, stringing sheaves (rollers or travellers), vibration dampeners, weights, suspension and dead-end hardware assemblies for the entire length of the route. Figure 3-5 presents a typical wire stringing operation.

173. To string the wire involves the following five steps:

(i) Stringing the pilot line to install the conductor A light-weight sock line (pilot line) is flown from tower to tower by helicopter, threading the sock line through wire rollers attached to the insulators on each structure. A clam lock device secures the sock line in the rollers.

(ii) Pulling The sock line is attached to a conductor pulling rope/cable, which is connected to a tensioning machine on a truck. The conductors are then pulled through by a puller machine. The puller and tensioner work together during the pulling operation to ensure that the conductor maintains the proper ground clearance at all times. Wire set-up sites or pulling stations, where the associated pulling machinery and equipment are staged, are located at intervals along the span.

(iii) Sagging and dead ending Once the conductor is pulled through the length of the line, the tensioner is then used to sag the conductors to the proper tension. Conductors expand with changes in temperature (they are longer at higher temperatures), so they need to be installed at the proper tension such that they do not sag too low when temperatures increase. All phases (or bundled phases) between two towers must be sagged to the same tension.

(iv) Splicing Once the conductor is pulled in and the proper tension of the conductor is reached, mid-span splicing is performed at dead-end tower locations to connect or splice segments together. Any temporary pulling splices are removed and replaced with permanent splices. Implosive sleeves may be used for splicing, which involves placing a layer of explosives around an aluminum sleeve. The layer of explosive is designed to create the required compression of the sleeve around the conductor. After splicing and sagging, conductors are affixed to deadend towers.

(v) Clipping-in, spacers After the conductors are spliced and affixed to dead-end towers, they are “clipped in”, or attached to tangent towers. This process involves removing the rollers and replacing them with clamps and other final insulator hardware to secure the conductors to the insulators. Vibration dampeners, weights, and spacers between the conductors of a bundled phase are then installed.

Guard poles or guard structures may be installed at transportation, flood control, utility crossings, parks, and other sensitive locations to protect these underlying areas during wire stringing operations. The guard structures intercept wire should it drop below a conventional stringing height, preventing damage to underlying structures. These guard structures are temporary and are removed after conductor installation is complete.

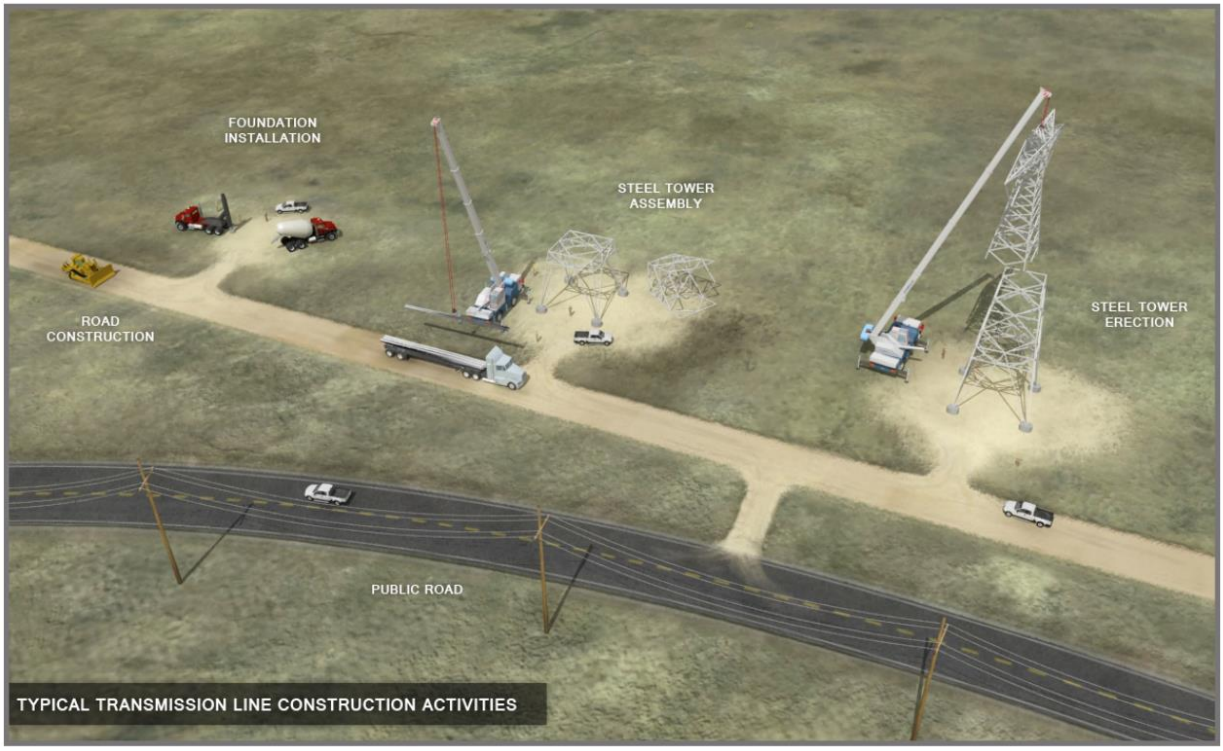

Figure 3-4: Tower of transmission line construction activities

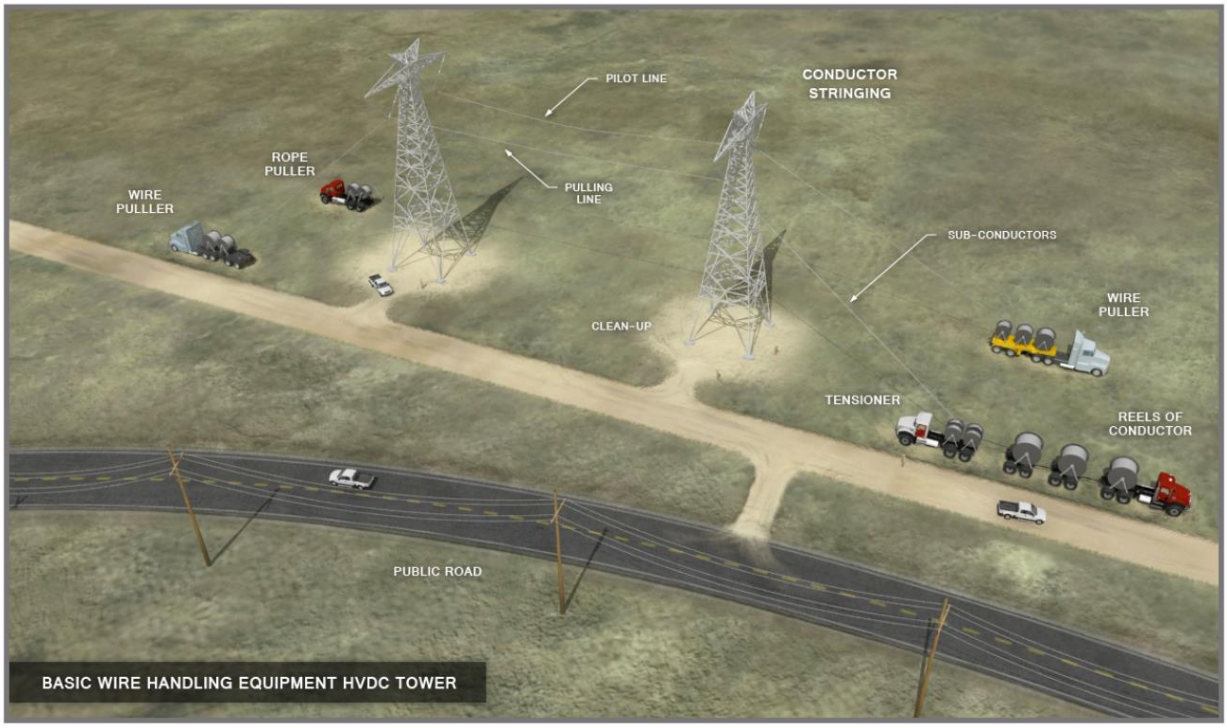

Figure 3-5: Wire handling and stringing of transmission line

3.9.2 Construction Activities Related Works for Substations

- Earth Work in Foundation

174. Construction of the substation requires earthwork excavating or filling for the foundation up to the required level. The excavated earth should be kept in a nearby vacant place and after completion of foundation work; back-filling of the excavated area will be done with local soil and sand. The substation civil designs will include drainage and flood control measures to avoid adverse impacts by land filling in new substation land and also specify that the soil/sand shall be sourced only from licensed suppliers who are authorized by the government to supply soil/sand for land filling.

- Foundation Treatment

175. The foundation area will be investigated geo-technically. The test result will help in designing of foundation of structures. It will help to identify if foundation treatment is required. The type of treatment like bullah piling, precast RCC piling or in-situ concrete piling, sand piling, removal of peat or loose soil will be suggested after geo-technic investigation.

- RCC Work

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

- Brick Work up to Plinth Level and Superstructure

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

- Back Filling by Local Sand

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

- Plastering and Finishing (Electric wiring, Distemper or Plastic Paints)

179. Concealed electric wiring with good quality and proper size of wire are to be done and provision of bulb, switchboard are to be provided. Plastering of walls inside and outside, roof of the building will be done accordingly and curing works to be done for at least three weeks. After that distemper of plastic painting will be done of the walls and roof of the building.

- Wood Works/Thai Aluminum for Door and Windows and Glass Fitting

180. Wood/Thai Aluminum works are to be done for door shutter and windows of the building with glass fitting.

- Sanitary Works

181. Sanitary works such as laying of sewerage line either PVC or RCC, installation, fitting fixing of toilet accessories (BISF) will be done for all the buildings.

- Water Supply System

182. Existing water supply system where available will be used for water use in the substations. In places where there is no supply system, tube wells will be set for supply of water for the workers and staff at the sub-station.

- Boundary Fencing with Concrete Pillar and Barbed Wire

183. The project area will be Protected from encroachment and unauthorized entrance of the public by fencing the boundary either with 1.8 m (six feet) high wall with barbed wire fitted with concrete pillar 3 meter apart.

Electrical Works and Towers

184. For GSSs, installation of equipment will include transformers, circuit breakers, isolators, lightning arresters, panel boards, batteries, and battery chargers, etc. All equipment will be installed at the GSSs (outdoors and indoors) as per design specifications and standards. For this project, all material will be procured from foreign countries. Domestic materials like bricks, sand, cement, and reinforcing rods, will be sourced locally from existing licensed sources for the installation works.

3.9.3 Construction Equipment and Materials

185. Equipment and materials required for the construction of the substation such as poles, conductors, conductor joining material, cable, indoor termination kit, insulator, distribution transformer accessories, transformer protection equipment, hardware materials for transmission system etc. will be procured from abroad. Construction materials such as bricks, sand, cement, rods, etc. will be acquired locally from domestic suppliers.

3.9.4 Construction Waste and Hazardous Materials Disposal

186. Generation of construction wastes (such as solid wastes: electric wire, pipes, stones, woods, rods etc., and liquid waste: paint, oil, bitumen, etc.) from the construction camp and general wastes (solid wastes: papers, containers, residues of food, fruits etc., and liquid waste: waste water from bathroom and kitchen, etc.) from workers' camps could impact on the health and safety of the local community and workers, as well as on the aesthetic beauty of the area. Proper arrangement, e.g., disposal to existing licensed sanitary landfill etc. will be made for waste management, fuel oil and chemical storage at all work sites.

187. During the operation phase substances and oily waste might get leached through soil by precipitation of water and percolate to the groundwater table, due to handling, disposal and oil spills in substation sites. This results in groundwater pollution in nearby area.

188. Solid wastes collection system will be essential, which should include separation and collection of solid wastes in the dustbins/waste containers throughout the work sites, construction yard/ labor camps. Wastes such as pieces of rods and wood, newspapers, containers etc. can be sold to the vendors and the rest of the waste must be taken to the licensed, engineered sanitary landfill by the contractor or licensed third party. A log of the disposal of toxic and other waste materials is to be kept by the Contractors. Prior to the start of construction, contractor should prepare waste management plan (WMP) based on the EMP, for approval by PGCB before access to site reflecting national and EHS guideline requirements.

3.9.5 Construction Manpower and Work Schedule

189. 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.

3.10 Temporary Facilities and Associated Facilities

190. Temporary facilities for workers including field office and warehouse requirements stair, ladder, ramp, scaffold, hoist, run way, warehouse/storage barricade, chute etc. shall be substantially constructed and erected so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them"

3.11 O&M Activities for Substation and Transmission Lines

3.11.1 O&M Activities for Substation

191. 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 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.

3.11.2 O&M Activities for Substation and Transmission Lines

192. Operation and Maintenance (O&M) activities of transmission lines are largely dependent on built-in monitoring system 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.

193. 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.

194. For TL, fault maintenance works include replacing or repairing the damaged conductor, insulator, or any other component.

195. 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.

3.12 Electromagnetic Field Effects of Power Transmission Lines

196. An EMF is a combination of an electric field (electric field) and a magnetic field (magnetic field). It can either be directly measured with appropriate measurement instruments or calculated with appropriate information. Power frequency EMFs are natural consequences of electrical circuitry.

197. This is becoming significantly important while developing understanding for impacts and effects it has on biodiversity (both flora & fauna) of the project area. Any biological effects that could occur from exposure to microwave frequencies will result in heating of biological tissues. Safety measures, for such frequency ranges are thus based on limiting field levels that may cause a rise in tissue temperature. Effects associated with exposure to power frequency, occur as a result of electric current induced in the subject by electric & magnetic fields. Electric fields are produced by the presence of electric charges and therefore induced voltage gets applied to a conductor. Generally, voltage on a system is stable and does not variety much. Electric fields decrease with an increase in distance from the source (conductor). Magnetic fields are produced by the current flowing (movement of electric charge) on a conductor. The current on a system may vary depending on the number of devices (load) connected in the system. Magnetic field varies depending upon variation in load connected.

3.12.1 Electric and Magnetic Field Profile of TL

198. Figure 3-6 (Magmatic Profile with respect to distance) and Figure 3-7 (Magmatic field with respect to distance in graphical from) illustrates the magnetic field profiles with distance from the lines that would occur with typical (or greater) current loads for the voltage classifications shown. As a general rule the fields decrease with the inverse square of distance as you move away, meaning if you double your distance from a line, the field decreases to one fourth (1/22) of the field's value at the closer distance; tripling the distance would decrease the field to (1/32), or one-ninth of the field at the closer

distance. Despite this general rule, the specific magnetic field values associated with overhead power lines are highly variable.

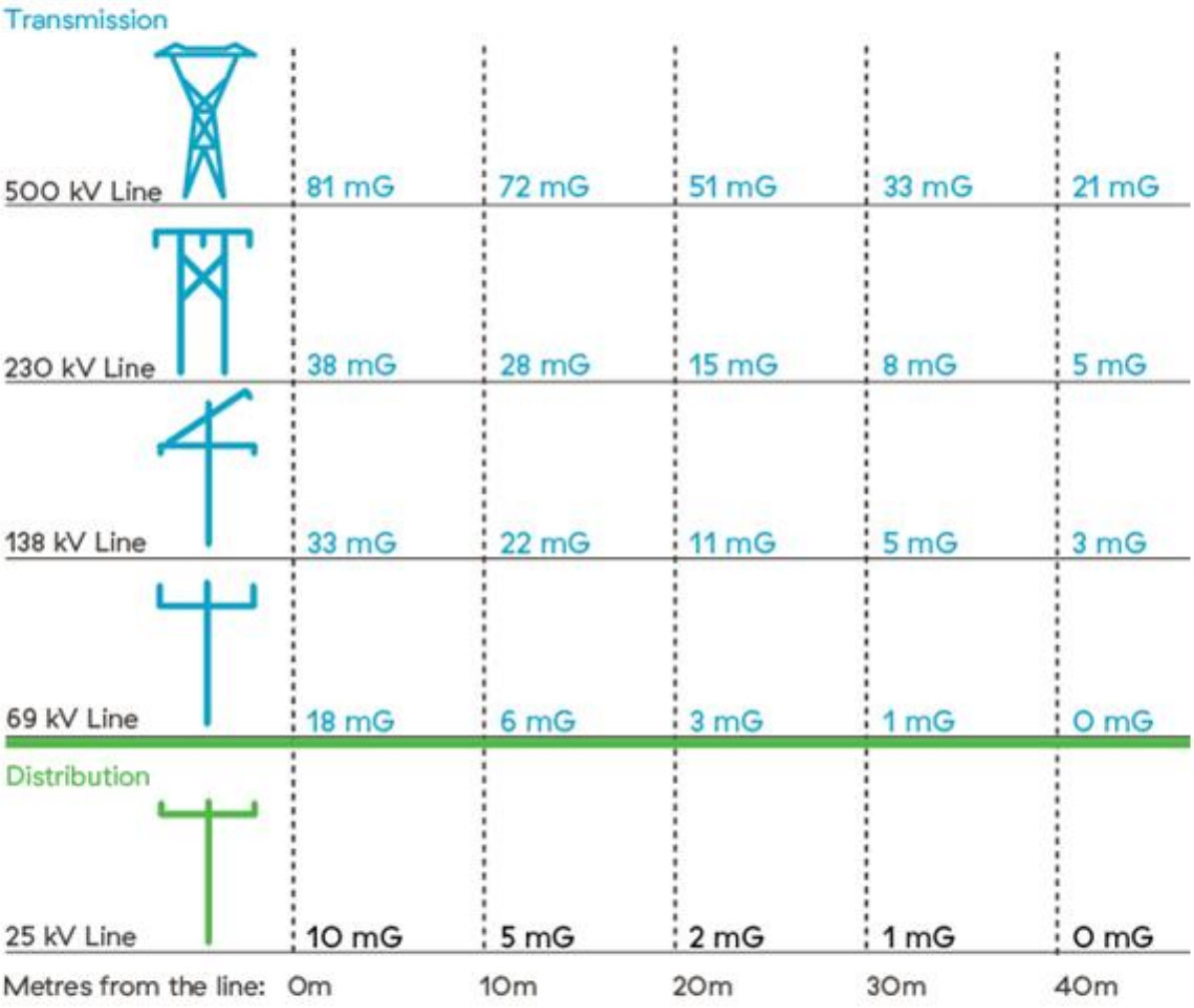

Figure 3-6: Typical Magmatic Profile Near Transmission Lines

Source: (BC Hydro, 2021)

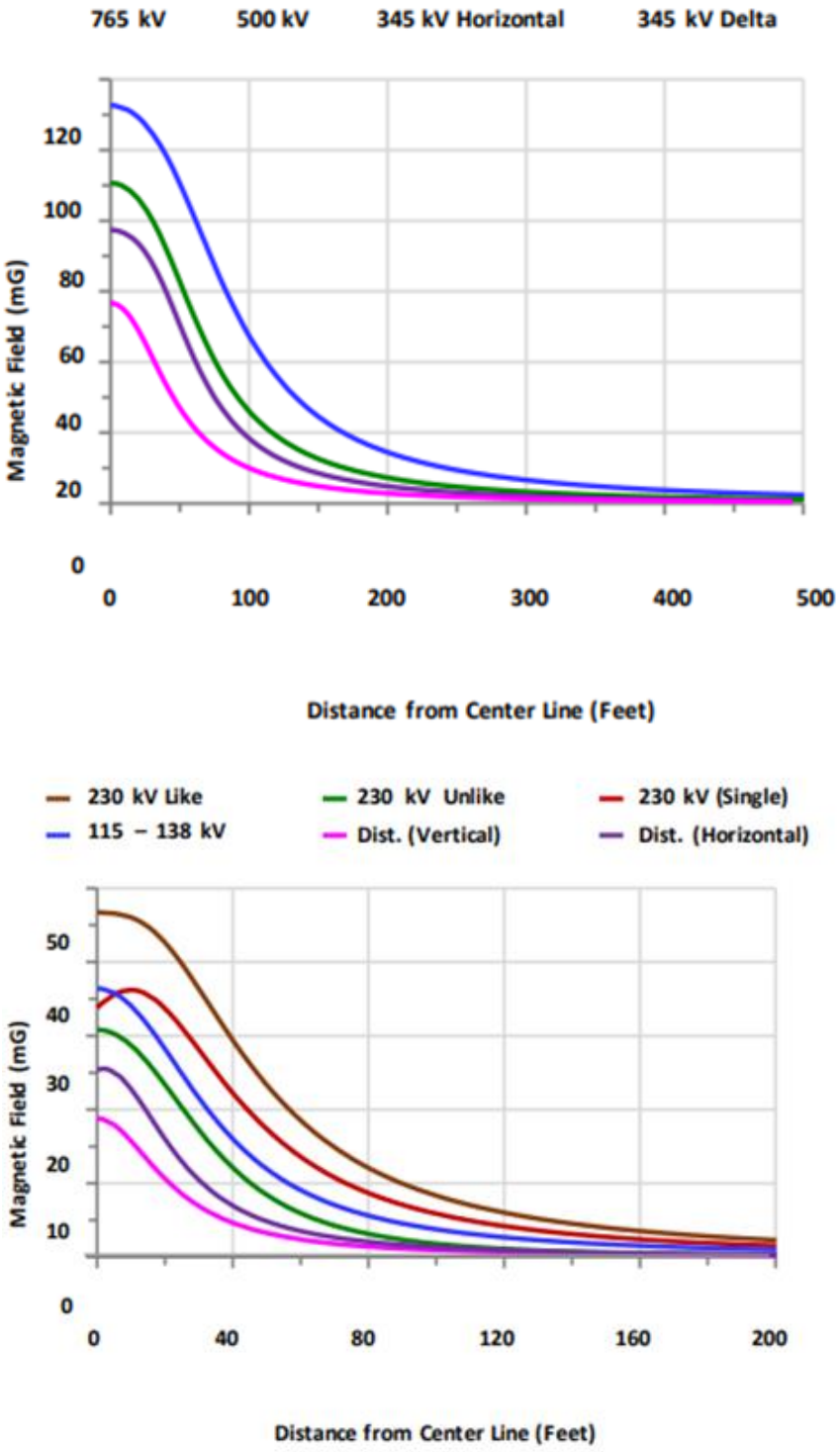

Figure 3-7: Magnetic field profile from transmission lines representing the range of voltages and from distribution lines.

Source (EPRI , 2015)

199. Electric fields are produced by the voltage in a wire. The strength of electric fields remains fairly constant, even when electricity isn't being used. The electric fields from transmission and distribution lines change very little because of the line's stable voltage, and can easily be shielded. Trees, fences and buildings naturally reduce electric field

strength and the walls and the roof of your home further reduces the electric field strength from equipment outside of your home. From Figure 3-8 it is clear that for moderate changes in the height above ground, there is only a small change in the electric field, as long as the height above ground does not approach the line clearance

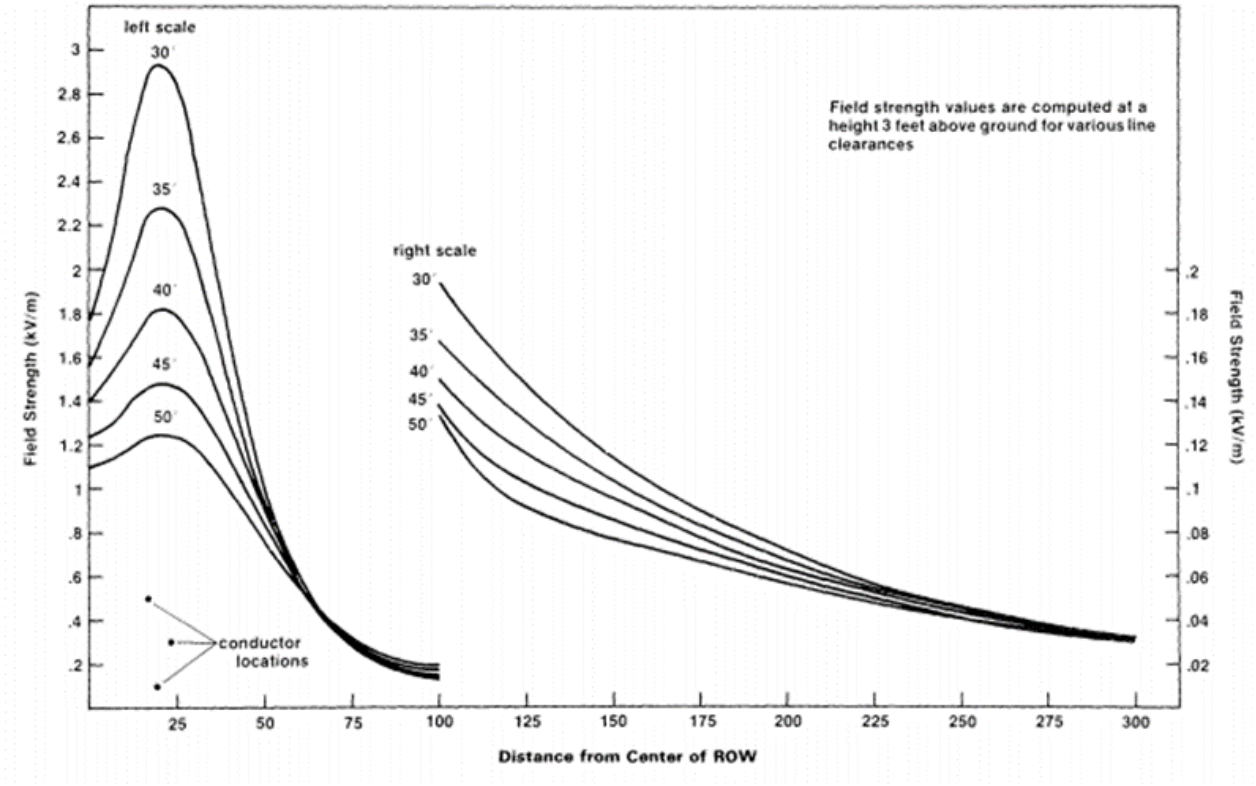

Figure 3-8: Electric Field Profile for 230 Double Circuit Transmission Line

Source: (Wiqdor, 1980)

3.12.2 Simulation result of TL

3.12.2.1 Steady State Assessment

200. Steady state power flow assessment has been performed based-on Bangladesh network data. Pre-project power flow study was conducted to analyze the magnitude and phase angles of bus voltages, line loadings, and power flows under normal conditions. Post project power flow analysis has also been performed after the interconnection of the proposed project with the transmission system.

3.12.2.2 Dynamic Assessment

201. The transmission line power-transfer capability curves, also known as "St. Clair curves". St. Clair curve provides a simple means for estimating power transfer capabilities of transmission lines. It concerns three limiting factors: thermal limit, voltage quality (or drop) limit, and angular stability limit.

202. A proper conductor selection and loading in case of lower voltage lines of 50 miles or less considering the thermal limitation. The conductor selection and loading of the transmissions line long enough (over 200 miles) considered in contrast with the line-voltage-drop limitation, the steady-state-stability limitation. However, the voltage

dynamics assessment required for the transmission line length over the line 80 km and angular dynamics for the transmission line length over 320 km.

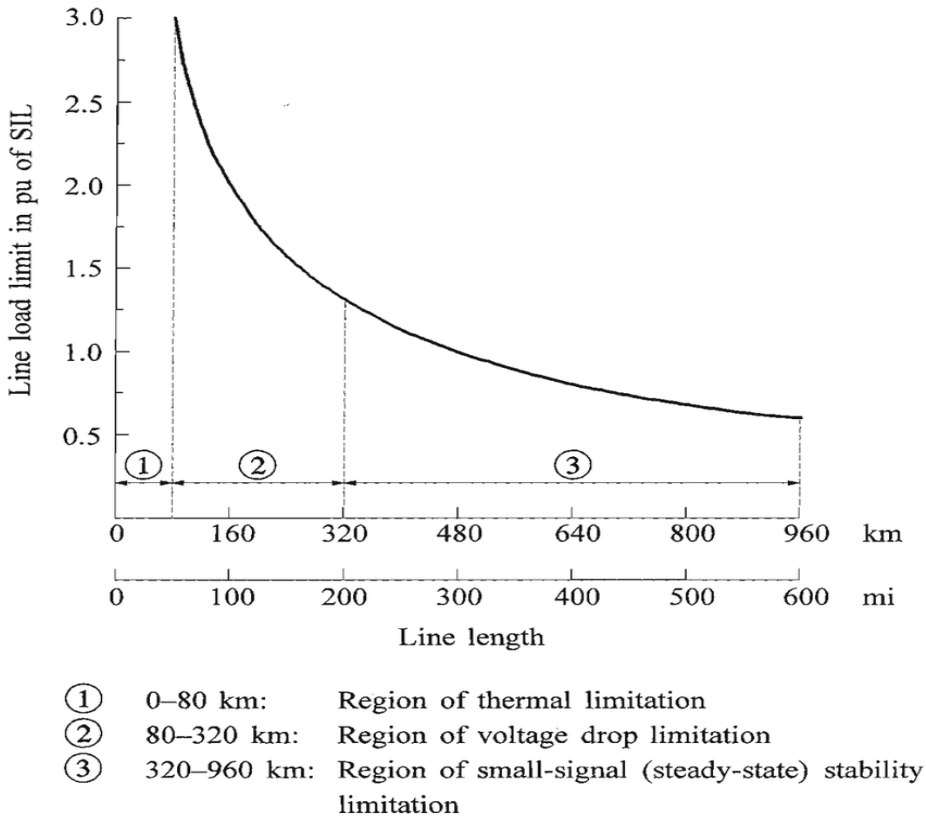

Figure 3-9: Simulation Result for TL

3.12.2.3 Short Circuit Assessment

203. Short circuit analysis has been performed to evaluate the contribution of the proposed project in fault current levels of substations in its electrical locality. Fault currents have been computed based on simulation of three-phase faults by applying the criteria as mentioned in the IEC-909 standard. Result of the analysis shows that the calculated fault currents are below the circuit-breaker interrupting ratings of existing grid stations located in locality of the project; also, it will help the EPC to select the switch-gear ratings in this project. It is therefore; recommended the short circuit rating of circuit breaker at 230 kV 40 kA.

3.12.2.4 Loading condition of Transmission Line and Power Transformer

204. The project component commissioning date is considered in the year 2024. All new transmission lines load flow is found in the normally loaded and maintained N-1 contingency margin & new substations transformer capacity found within 60% loading of capacity.

205. Contingency: Each circuit of the transmission line should be capable of evacuating total power individually, so that sudden tripping of one of the circuits shall not result in overloading and tripping of the other circuit.

Table 3-6 Loading Condition of TL and Power Transformer

Sl. No.	Conductor Code name	Stranding No/dia. mm	Alu Area mm2	Overall dia. mm	Ultimate Strength kg	Weight Kg/m	*Ampacity 25°C	*Ampacity 35°C
1	Mallard ACSR	30/4.135	024.8	28.95	16,800	1.728	915	723
2	Finch ACSR	54/3.647	564.0	32.83	17,000	2.045	1100	869
3	Grosbeak ACSR	26/3.973	322.3	25.15	11,200	1.240	790	629
4	Egret ACSR	30/3.698	322.3	25.89	13,500	1.382	795	628
5	Hawk ACSR	26/3.439	241.7	21.78	8,590	0.9295	660	529
6	AAAC Verbena	37/3.59	374.53	25.53	11,191	1.0365	790	622
7	AAAC Hawkweed/ Greely	37/4.176	507.0	29.23	14,923	1.397	990	750

*Current carrying capacity of single conductor.

206. Proposed transformer capacity of Char Fasson substation 2x120/140 MVA. Considering substation capacity and forecasted demand the loading of power transformer is given in below Table 3-7:

Table 3-7: Forecasted Loading of the Loading of Power Transformer

Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Load (MW)	41	45	50	54	60	66	72	80	88	95	102	110	119
Loading	16%	18%	20%	21%	24%	26%	29%	32%	35%	38%	40%	44%	47%

3.12.3 Interference Caused by Power Line Corona Effects

207. Potential gradients (or electric fields) are created when a potential difference is applied between two conductors. At the surface of the conductors, this gradient is maximum. Under the influence of this potential gradient, existing free electrons in the air acquire greater velocities. Some free electrons are always present in the air due to cosmic rays, UV radiations etc. Greater the applied voltage, greater the potential gradient and, hence, greater the velocity of free electrons.

208. When the potential gradient at conductor surfaces is large enough (about 30 kV/cm), existing free electrons strike neutral air molecules with enough velocity to dislodge one or more electrons from it. Hence, cumulative ionization of the air near the conductor surfaces occurs. Ionized air is partially conductive. Electric discharge occurs due to the ionized air which results in corona (the phenomenon of violet glow, hissing noise and production of ozone gas in an overhead transmission line). And if the

conductors are close enough to each other, the air insulation breaks down and electric discharge occurs through a spark.

209. The minimum phase-neutral voltage at which corona starts to occur is called as critical disruptive voltage. And, the minimum phase-neutral voltage at which visual corona glow appears all along the conductors is called as visual critical voltage. Coronas can generate audible and radio-frequency noise, particularly near electric power transmission lines. Therefore, power transmission equipment is designed to minimize the formation of corona discharge. Regarding the Electric power transmission, Corona causes:

- Power loss
- Audible noise
- Electromagnetic interference
- Purple glow
- Ozone production
- Insulation damage
- Possible distress in animals that are sensitive to ultraviolet light

3.12.3.1 Factors Affecting Corona loss:

- Electrical Factors: Higher the frequency of supply, higher is corona losses. This shows that dc corona losses are less as compared to ac corona.
- Field around the conductor: The field around the conductor in addition to being a function of the voltage depends upon the configuration of conductors. If the formation is horizontal the field near the middle conductor is large as compared to the outer conductors, hence corona on the middle conductor is more than outer conductors. The height of conductors from the ground has its effect on corona loss. The smaller the height, the greater the corona loss.
- Atmospheric Factors: Corona loss is more on hilly areas where temperature is low and pressure is high. The particles of dust clog to the conductor, which increases corona. Similarly, bad atmospheric conditions such as rain, snow, and hailstorm increase corona.
- Heating of the conductors by load current: The heating of conductor by load current has an indirect reducing effect on the corona loss. Without such heating, the conductor would tend to have a slightly lower temperature than the surrounding air. In the absence of heating, dew in the form of tiny water drops would form on the conductor in foggy weather or at times of humidity, which induces additional corona

3.12.4 International Exposure Guideline (ICNIRP'1998, WHO guidelines)

210. As has been indicated, a mechanism through which low level EMF could cause biological effects has not been identified. The absence of a validated biological effect in whole animals or humans at low levels is consistent with the absence of a mechanism. However, at much higher exposure levels magnetic and electric fields can produce immediate (or 'acute') effects through established mechanisms. Magnetic fields 'couple' to people causing currents to flow within the body. Above a threshold level these currents stimulate nerve tissue, a phenomenon referred to as 'electro stimulation'. Electric fields

also cause currents to flow in the body, but before an exposure threshold is reached that causes electro stimulation inside the body, electric fields can stimulate sensory receptors present on the surface of the body; this interaction is also grouped under the broader term of electro stimulation. At the levels at which magnetic and electric fields reach their respective perception thresholds, that is, levels at which they are just perceived or sensed, the effect does not produce any apparent harm or injury and ends when exposure at those levels ceases. However, as the exposure level is raised past the perception threshold, the effect can become annoying and ultimately painful, though reversible when exposure ceases.

3.12.5 Possible health effect and safety procedure

211. Power lines carry electricity and, hence, current, they understandably generate electric and magnetic fields known as low-frequency electromagnetic fields (EMF). Whilst relatively high AC electric fields from power lines and home electrical wiring can certainly have an adverse effect on the body, it is AC magnetic fields that have been studied the most for their impacts on health

212. There has been concern overpower line radiation and its effect on human health. Living close to power lines has been shown to increase the risk of leukemia and other cancers which was first discovered by Wertheimer & Leeper (1979). Recent study has found links between living near power lines (and other electrical wiring configurations) and a range of health woes, including

- brain cancer
- childhood and adult leukemia
- Lou Gehrig's disease (ALS)
- Alzheimer's disease
- breast cancer in women and men,
- miscarriage, birth defects and reproductive problems,
- decreased libido
- fatigue
- depression and suicide
- blood diseases
- hormonal imbalances
- heart disease
- neuro-degenerative diseases
- sleeping disorders

213. The association between health effects, such as cancer, and high EMF occurs over many years. Electromagnetic radiation starts doing damage from the first exposure. For a long while there may be no noticeable symptoms, but that does not mean that nothing is happening. As the exposure continues, damage could be accumulating.

214. Generation of EMF is unavoidable for transmission line. As there is no BD guidelines/ Standard, so International exposure guideline (ICNIRP'1998 and WHO guidelines should be followed for the safety of the power lines construction in the first place. As EMF strength reduces with distance so, for housing structures clearance between TL and roof top is 6.5m-8m to minimize the level of exposure.

3.12.6 Field Strength at Stakeholders' Premises

215. The following figure shows the variation of field strength of EMF with variation of distances from the center of RoW. For the proposed transmission line construction project, the height from the premises have been considered to be 7 m (22 ft). Depending on the height of the existing premises will vary as per Figure 3-10.

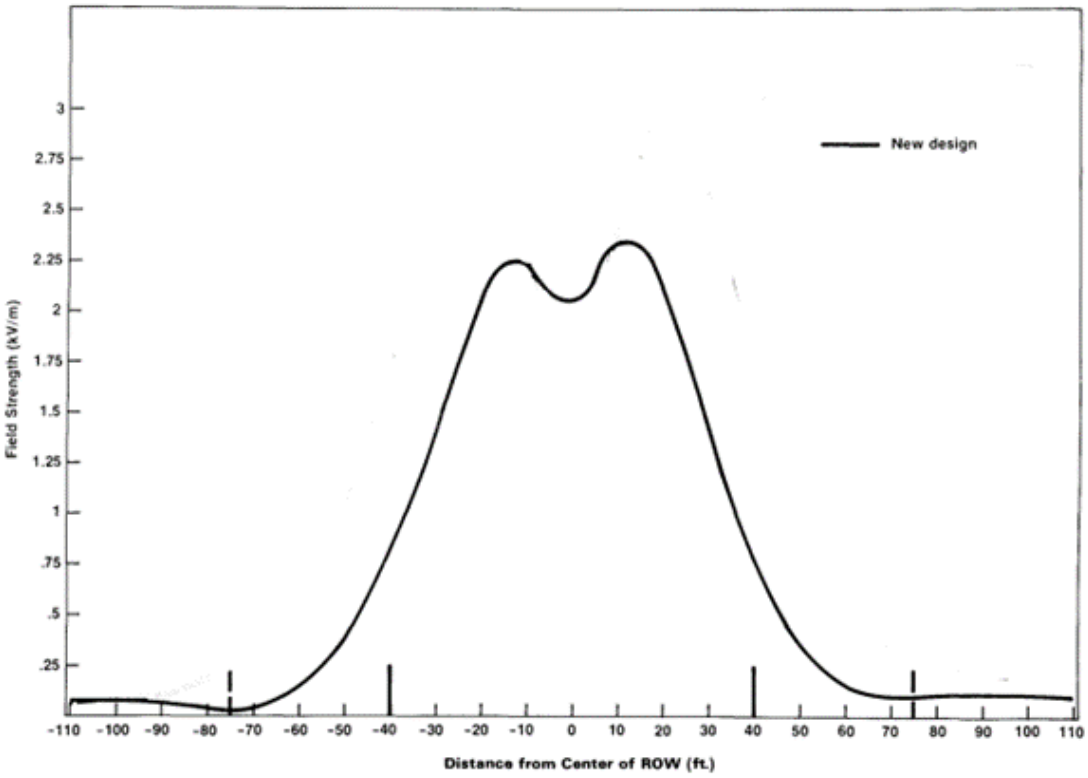

Figure 3-10: Variation of Field Strength Profile for 230 kv Double Circuit Line

Source: (Wiqdor, 1980)

3.12.7 Audible Noise and Radio Interference from Transmission Line

216. During corona activity (Deno & Silva, 1985), transmission lines (primarily those rated at 345 kV and above) can generate a small amount of sound energy. This audible noise can increase during bad weather conditions. Water drops may collect on the surface of the conductors and increase corona activity so that a crackling or humming sound may be heard near a transmission line. Transmission line audible noise is measured in decibels using a special weighting scale, the "A" scale, that responds to different sound characteristics similar to the response of the human ear. Audible noise levels on typical 230 kV lines are very low and are usually not noticeable. For example, the calculated rainy weather audible noise for a 230 kV transmission line at the right-of way edge is about 25 dBA, which is less than ambient levels in a library and much less than background noise for wind and rain.

217. Overhead transmission lines do not, as a general rule, interfere with radio or TV reception. There are two potential sources for interference: corona and gap discharges. The corona discharges can sometimes generate unwanted electrical signals. Corona-

generated electrical noise decreases with distance from a transmission line and also decreases with higher frequencies (when it is a problem, it is usually for AM radio and not the higher frequencies associated with TV signals). Corona interference to radio and television reception is usually not a design problem for transmission lines rated at 230 kV and lower. Calculated radio and TV interference levels in fair weather and in rain are extremely low at the edge of RoW for a 230 kV transmission line.

3.13 Power Supply Route of the Project

218. There are three stages of electric power supply; generation, transmission and distribution. After electrical power is generated, it is transmitted over distances using transmission lines. Transmission lines are constructed between transmission substations located at electric generating stations. Transmission lines may be supported overhead on towers or they may be underground. They are operated at high voltages. They send out large amounts of electrical power and extend over considerable distances. When electricity comes out of a generating station, the transmission substation located there steps up the voltages to the range of 138,000–765,000 volts. Within the operating area, transmission substations reduce the transmitted voltage to 34,500–138,000 volts. This power is then carried through lines to the distribution systems located in the local service territory.

219. Electricity generated at the Notun Biddyut Power Plant will be evacuated through the Notun Biddyut PP- Char Fasson 230 kV Double Circuit Transmission Line, and finally be distributed through the 230/33 kV GIS Substation.

3.14 Work Schedule

220. The completion of works is proposed to take place in 34 months (after loan effectiveness) as indicated below in Figure 3-11 and Figure 3-12

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Implementation Schedule of Substation and Bay Extensions

Work Schedule	Duration																																
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Pre-Construction Phase																																		
DPP and Tender Documents Preparation																																		
Bidding Process																																		
Procurement of Land																																		
Award of Contract																																		
Establishment of Site Office																																		
Construction Phase																																		
Approval of Design																																		
Contour Survey, Soil Investigation & Level Finalization																																		
Engineering Activity including detail design and specification																																		
Procurement Activity																																		
Construction of Foundation for Control Room Building, Equipment, Road, Sewerage, Fencing & Cable Trenches etc. (Civil Works)																																		
Erection of gantry Tower, Beam, Indoor & Outdoor Equipment etc. (Erection Works)																																		
Earthing																																		
Cable Laying & Termination																																		
Testing & Pre-commissioning																																		
Commissioning of Substation																																		

Figure 3-11: Project Implementation Schedule for Substation and Bay Extension

Implementation Plan for Transmission Line

Work Schedule	Duration																																
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Pre-Construction																																		
DPP Preparation																																		
Bidding Process																																		
Award of Contract																																		
Establishment of Site Office																																		
Construction Phase																																		
Approval of Design																																		
Proto Assembly																																		
Submission of Proto corrected Drawings, BOM, Shop drawing etc.																																		
Approval of Proto corrected Drawings., BOM, Shop drawing etc.																																		
Submission of Stringing Chart																																		
Approval of Stringing Chart																																		
Detailed Survey including route alignment, profiling & tower spotting																																		
Check Survey																																		
Detailed Soil Investigation																																		
Casting of Foundation including Completion of associated works																																		
Supply of Material, tower, conductors																																		
Earthing of Tower																																		
Tower erection including Tack welding																																		
Stringing including Completion of all associated work																																		
Fixing of Accessories																																		
Checking, Testing & Commissioning																																		

Figure 3-12: Project Implementation Schedule for Transmission Line

4. Environmental Baseline

4.1 Physical Environmental Baseline Data

4.1.1 Meteorology

221. Although less than half of Bangladesh lies within the tropics, the presence of the Himalaya Mountain range has created a tropical macroclimate across most of the east Bengal land mass (Rashid, 1991). Brammer (Brammer, 1996) has identified four distinct seasons resulting from this weather pattern, namely:

- Pre-Monsoon Hot Season (March to May): Characterized by the highest temperatures of the year – up to 360C. Some rainfall may occur, with tropical cyclones occasionally affecting coastal areas;
- Rainy Monsoon Season (June to September): Period of highest rainfall, humidity and cloud cover, with up to 80% of the annual rainfall occurring during this time. Increased rain and cloud cover generally causes a small reduction in mean daily temperatures;
- Post-Monsoon Season (October to November): Temperatures remain hot and humid, though cloud cover reduces. Limited tropical thunderstorms may still occur during this period, particularly in coastal areas; and
- Cool Dry Winter Season (from December to February): Coolest time of the year with mean minimum temperatures

222. Despite the general predictability of the seasons in Bangladesh, local conditions vary widely across the country. As such, Bangladesh can be divided into seven climactic sub-zones based on differences in a range of factors including rainfall, temperature, evapotranspiration and local seasonality (Rashid, 1991). According to the climatic sub-regions of Bangladesh project area is located in South Eastern region of Bangladesh (Figure 4-1).

223. Five-year average climatic data (2016-2020) collected from BMD (Bangladesh Meteorological Department, Dhaka) Bhola weather station reflect the expected South-Eastern weather pattern as outlined in Table 4-1.

Table 4-1: Five Year Average Weather Pattern of the Project Corridor

Climate Parameter	Bhola Station
Average Annual Maximum Temperature	32.7 (°C)
Average Annual Minimum Temperature	11.6 (°C)
Average Annual Total Rainfall	2360 mm
Average Annual Relative Humidity	79.2%

Source: BMD

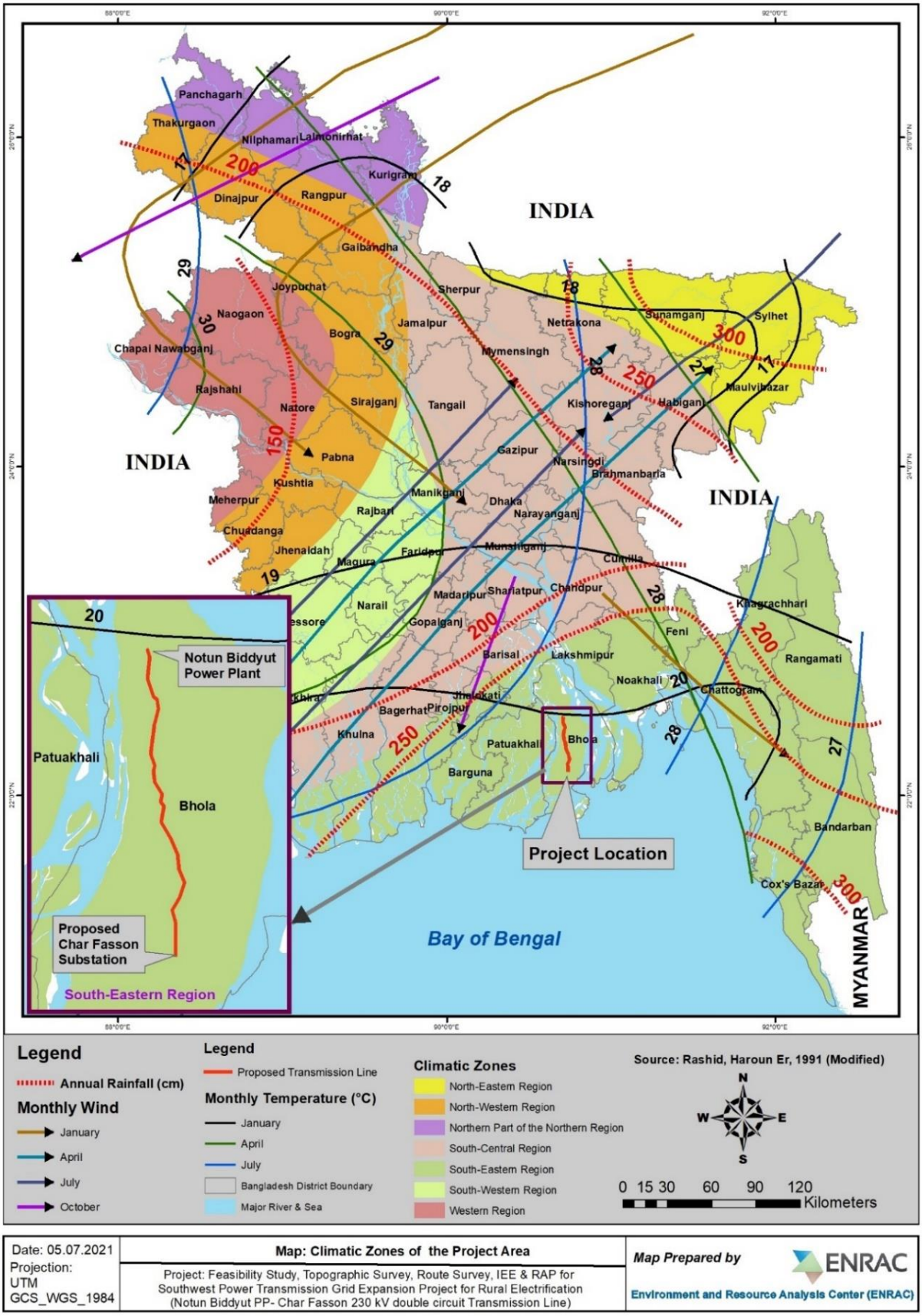


Figure 4-1: Climate Zones of the Project Alignment

4.1.1.1 Rainfall

224. The average annual rainfall data from 2001 to 2020 of the study area was approximately 2539 mm, with about 95% of the mean annual rainfall occurring during the period from April to October, and 60% during June-September (Figure 4-2) and minimum precipitations are reported during the months of November to February. Total annual rainfall (Figure 4-3) varies from 1944 mm (2015) to 3579 mm (2008), (Source: climatetoolbox.org).

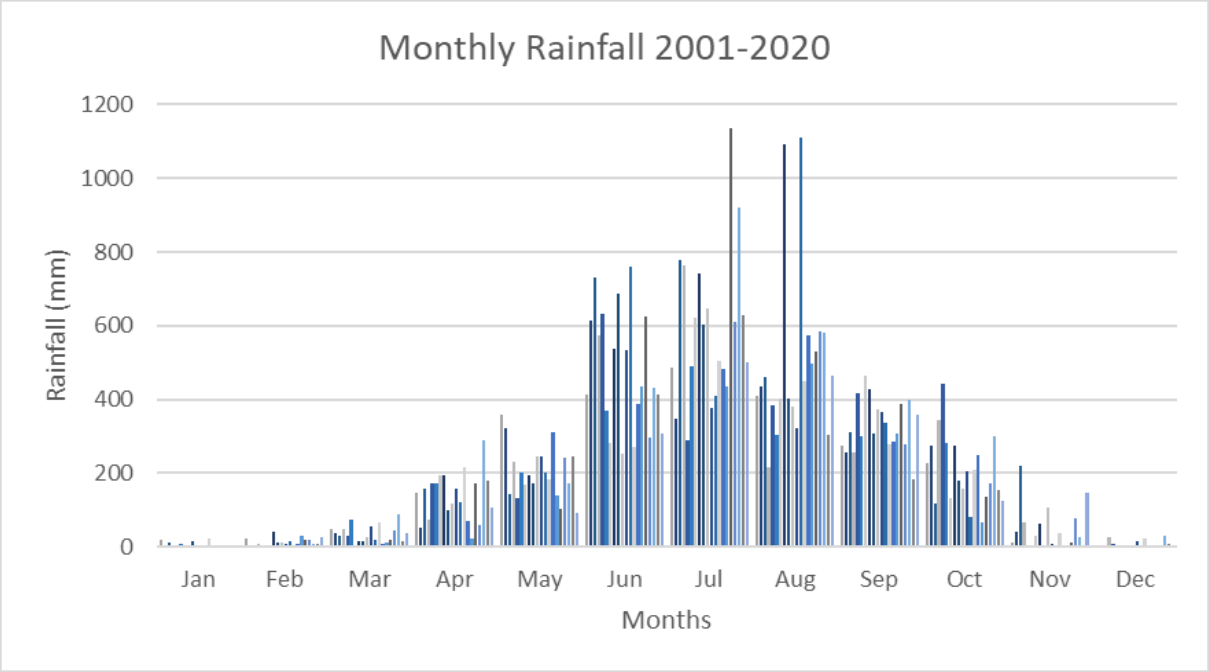


Figure 4-2: Monthly average Rainfall at Study area (2001-2020)

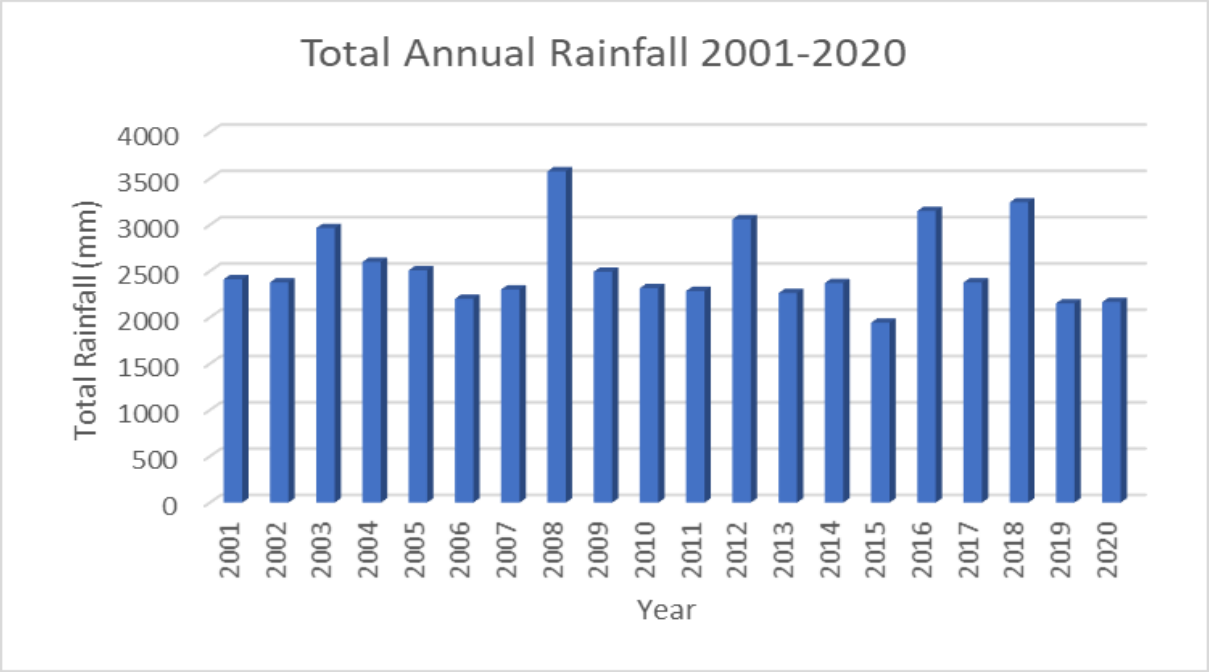


Figure 4-3: Total Annual Rainfall at Study area (2001-2020)

4.1.1.2 Temperature

225. The following figure (Figure 4-4) shows the maximum, minimum and average air temperature of the study area during 2001-2020. April and May are the warmest month with highest recorded temperature 34.6°C, and December and January are the coolest month in the study area with minimum recorded temperature 17 °C (Source: climatetoolbox.org).

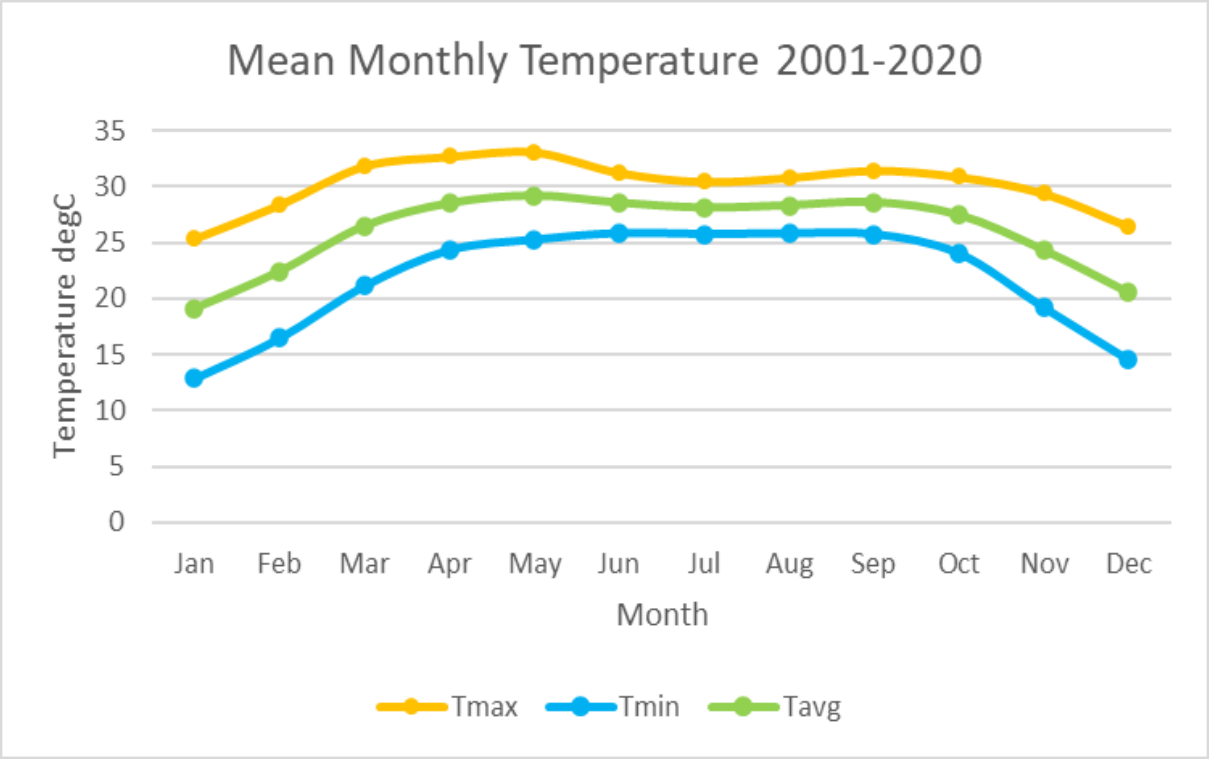


Figure 4-4: Monthly Maximum, Minimum and Average Temperature at Bhola (2001-2020)

4.1.1.3 Wind

226. Wind could be the biggest and most influential weather fact. So it is extremely important to know the direction and velocity. The Wind Rose model is used to understand wind factors. Wind direction and speed keeps changing due to seasonal variations. Prevalent wind direction is south/north and vice versa. Wind is generally moderate during non-monsoon season, whereas during the monsoon season, it is moderate to strong. The wind speed varies from 2.0 knots to 15.0 knots, with average wind speed of about 7.0 knots. Meteorological data for the project site was also collected from the MM5 pre-processed data. Monthly wind roses based on the meteorological data for year 2020 is presented in Figure 4-5 and annual wind rose diagram is presented in Figure 4-6 (Source: Pre-processed meteorological data from MM5).

227. Risk co-efficient factor are considered when there are high-raised structures associated, but the study area does not comprise of any such structures.

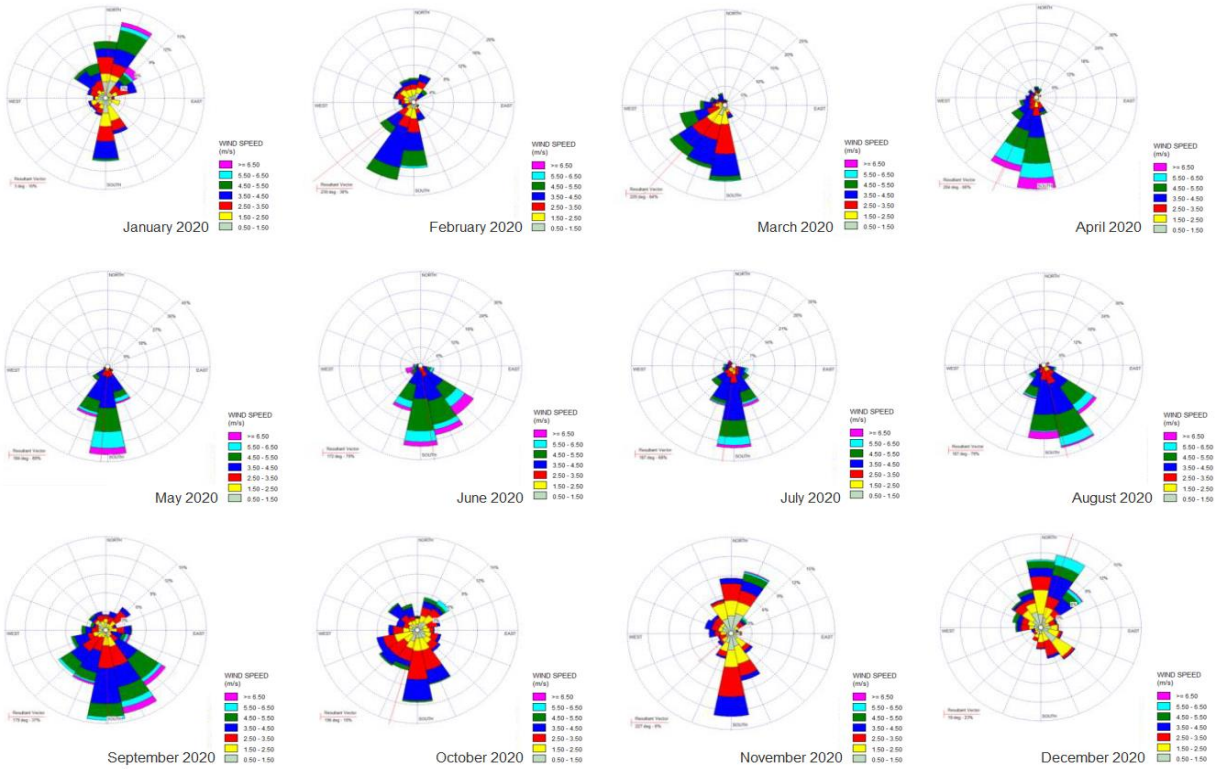


Figure 4-5: Monthly Wind Rose Diagram for Bhola

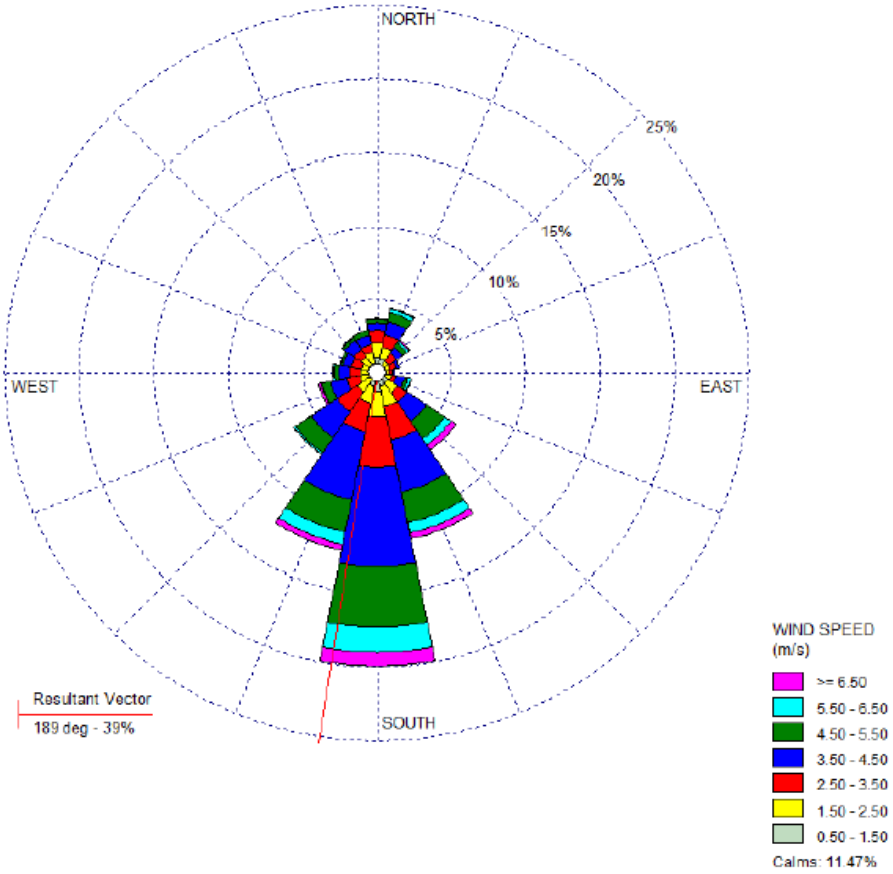


Figure 4-6: Annual Wind Rose Diagram for Bhola

4.1.2 Geology and Soil

The study area is part of the young Meghna estuarine floodplain and is situated in an active delta Bhola Island (Figure 4-7). In the young Meghna estuarine floodplain area, new deposition and erosion are constantly taking place on the margins, continuously altering the shape of the land areas. The sediments are deep silts, which are finally stratified and are slightly calcareous (Figure 4-8). In many, but not all parts, the soil surface becomes saline to varying degrees in the dry season ((FAO/UNDP, 1986)).

228. About 95% of the study area comprises of Calcareous Alluvium Soils and other 5% are Calcareous Grey Floodplain soils (Figure 4-9). Calcareous Alluvium Soils are stratified or raw alluvium throughout or below the cultivated layer. They are calcareous throughout or part of it and lack in having diagnostic subsoil horizon. This alluvium on the Lower Meghna estuarine floodplain is slightly calcareous grey to olive, finely stratified silts. Calcareous Grey Floodplain soils have grey matrix cambic B-horizon and lime in the profiles. They range from silt loam and silty clay loam on riverbanks and floodplain ridges to silty clays in basins.

4.1.3 Topography

229. The study area is located in the Bengal Foredeep at the Hatia trough (Figure 4-10). The Foredeep is located in the west and it is characterized by only mild or no folding compared to the eastern fold belt as intensity of fold decreases gradually towards west. Thus, the sedimentary layers are generally horizontal to sub horizontal and are free from major tectonic deformation. This unit covers the central part of the basin and is represented by river to delta plain topography at the surface.

230. A digital elevation model (DEM) representation of the terrain surface of 25 m study radius is shown in Figure 4-11. The DEM shows that the topography of the 25 m study area is predominantly a flat terrain with elevation ranging from 0-3 m above MSL.

4.1.4 Drainage

231. Bhola Island falls under the Ganges tidal flood plain and young Meghna estuarine floodplain and has a network of large number of tidal rivers and their distributaries. The lower Meghna River is highly influenced by the tidal interactions and consequential backwater effects. North and West of Bhola falls under the micro tidal region (0-2m) under the global tidal classification (DHV et al, June 2001). Riverine processes dominate the lower Meghna River, Tentulia River and Shabazpur channel surrounding the Bhola Island. All the rivers are connected with streams and tidal channels and flow down to the Bay of Bengal. Figure 4-12 presents the drainage pattern in the study area.

232. Meghna (Lower Meghna), one of the largest rivers of Bangladesh along with its distributary, Shahbazpur channel separates the Bhola district from the Lakshmipur district in the east. The Shahbazpur channel, 5-8 km wide, flows between Bhola and Ramgati-Hatiya islands. The Tentulia river, a channel of Meghna further separates the Bhola island from the rest of the Barisal Division in the west.

233. From the topographic survey it was identified that the transmission line will pass over 92 ponds and 15 canals, but it will not cross over any rivers. However, none of the AP thus tower footings will be constructed on any waterbody/ wetland. Within the 25m buffer of the transmission line water body is only 3.1% (ENRAC GIS Analysis,Table 5-4: Land use Classification of Char Fasson 230 kV TL and Substation (within 25m Buffer)).

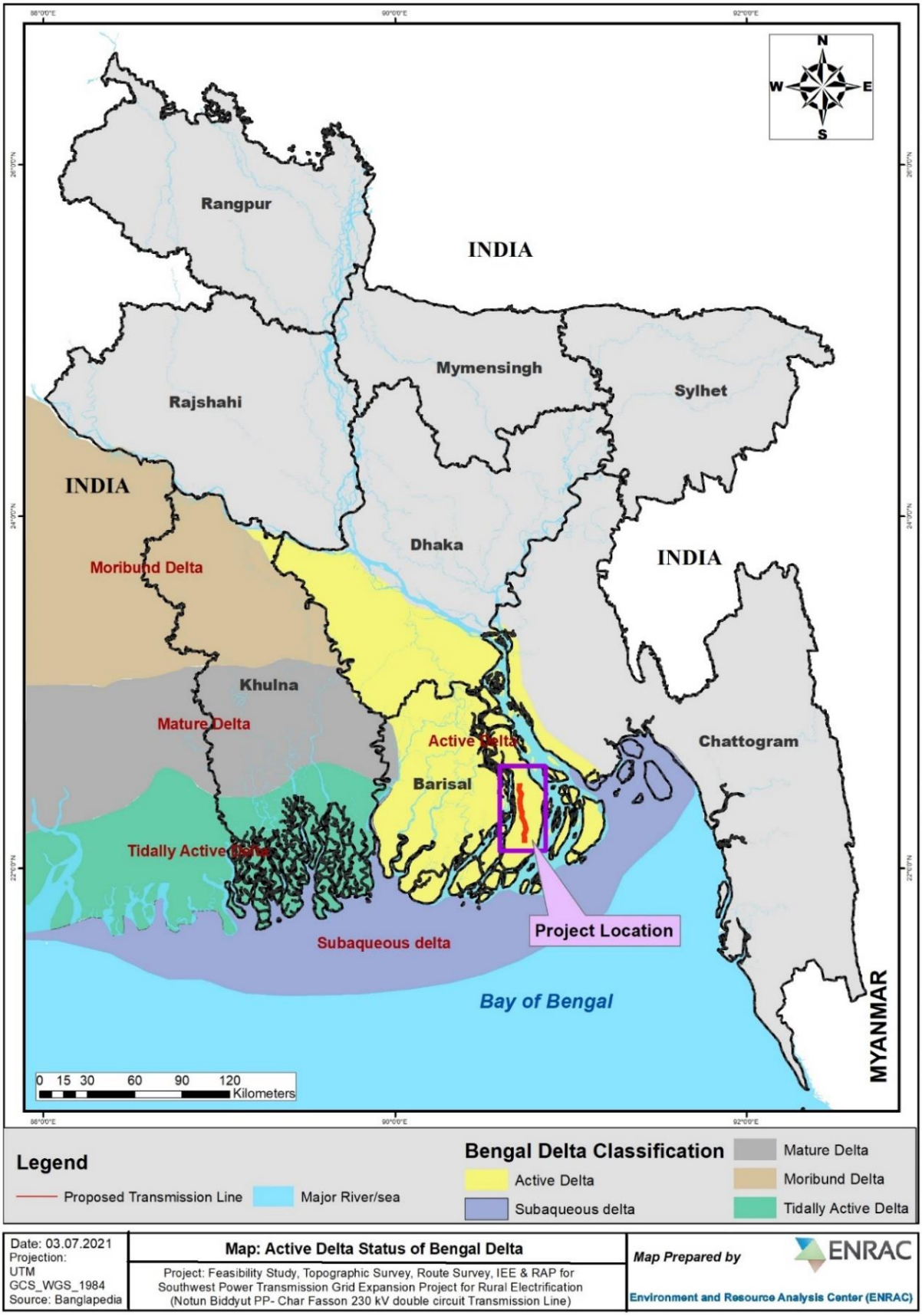


Figure 4-7: Bhola Island as a part of Active Delta

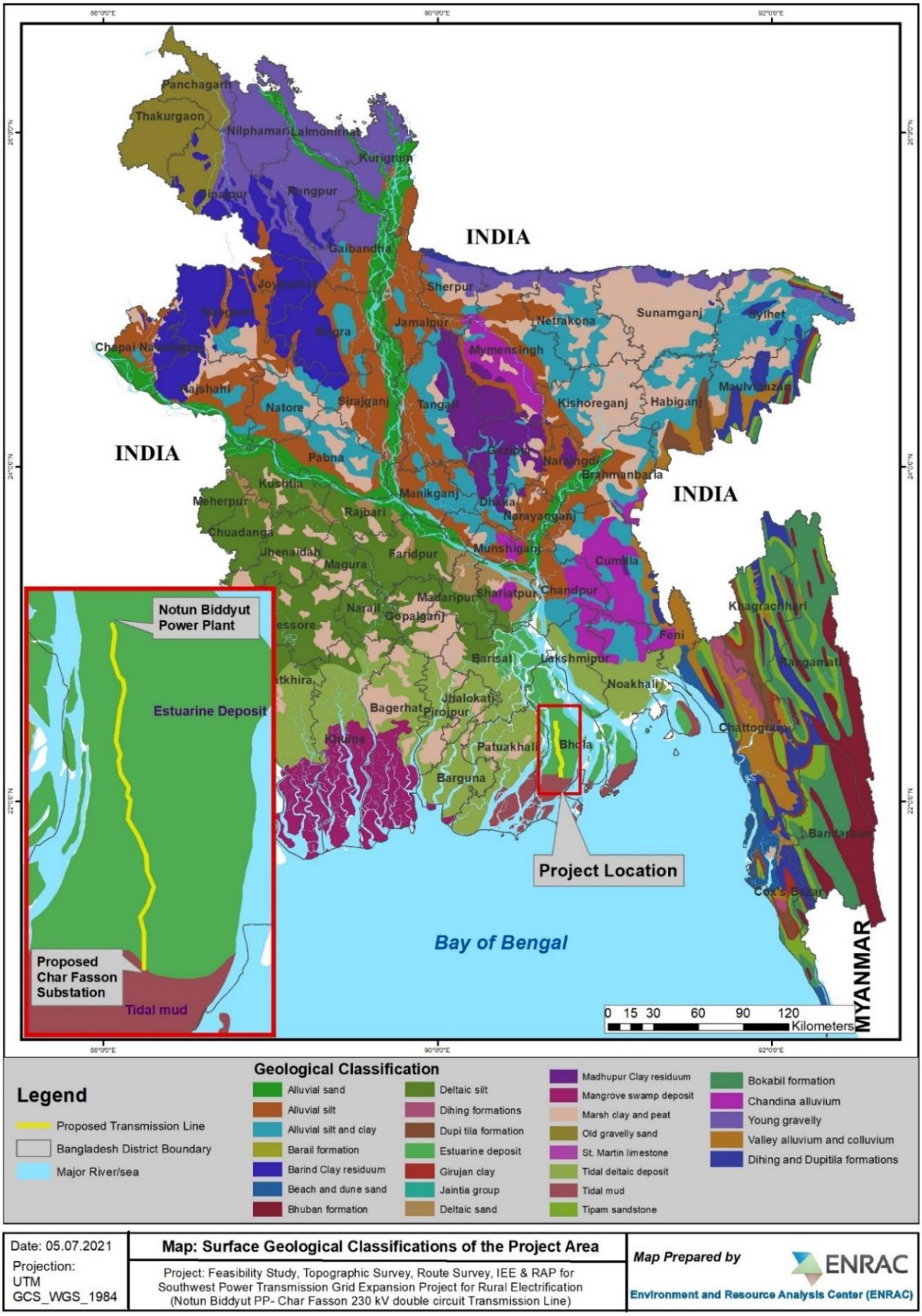


Figure 4-8: Surface Geological Classification of the Project Alignment

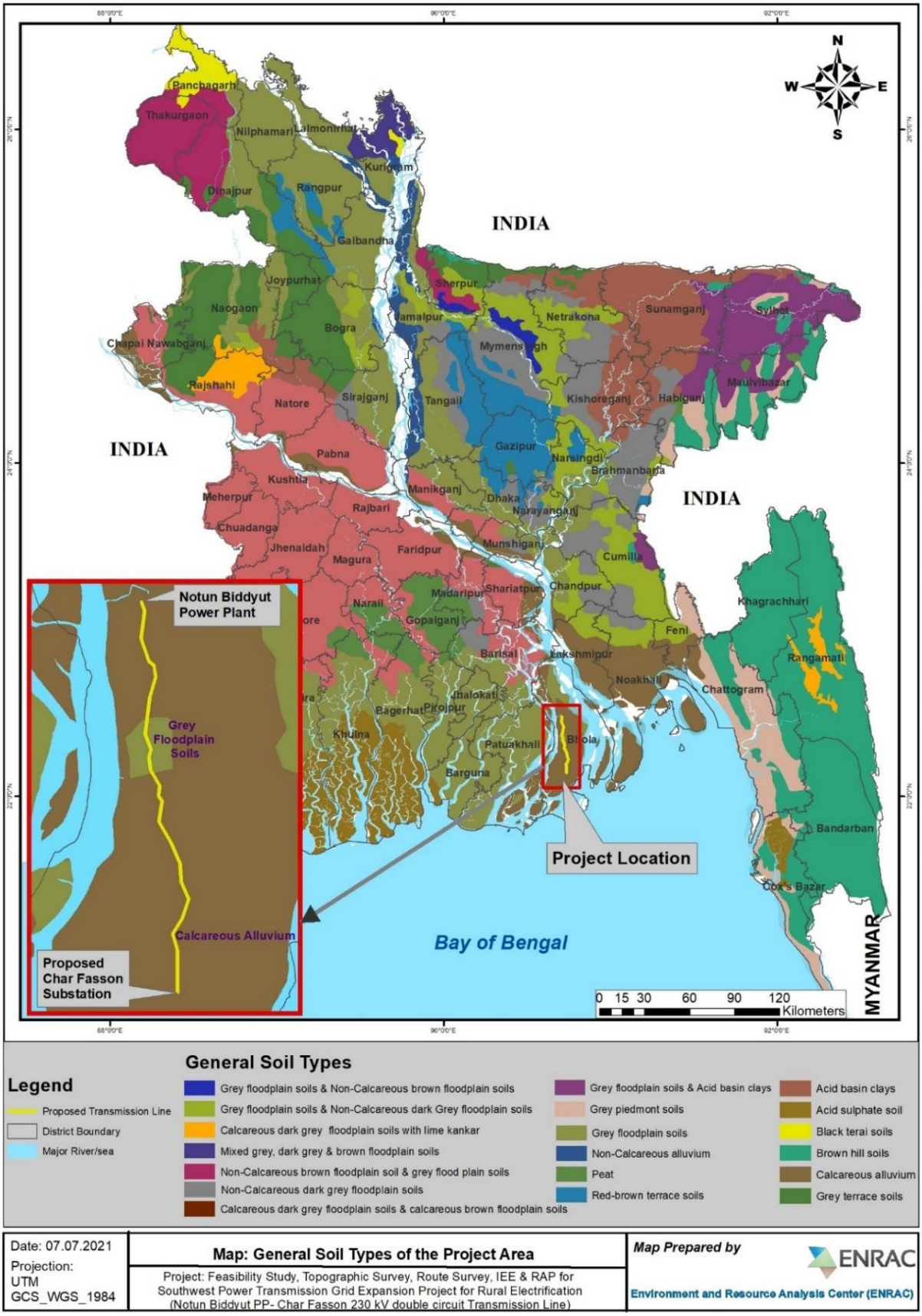


Figure 4-9: General Soil Type in the Project Alignment

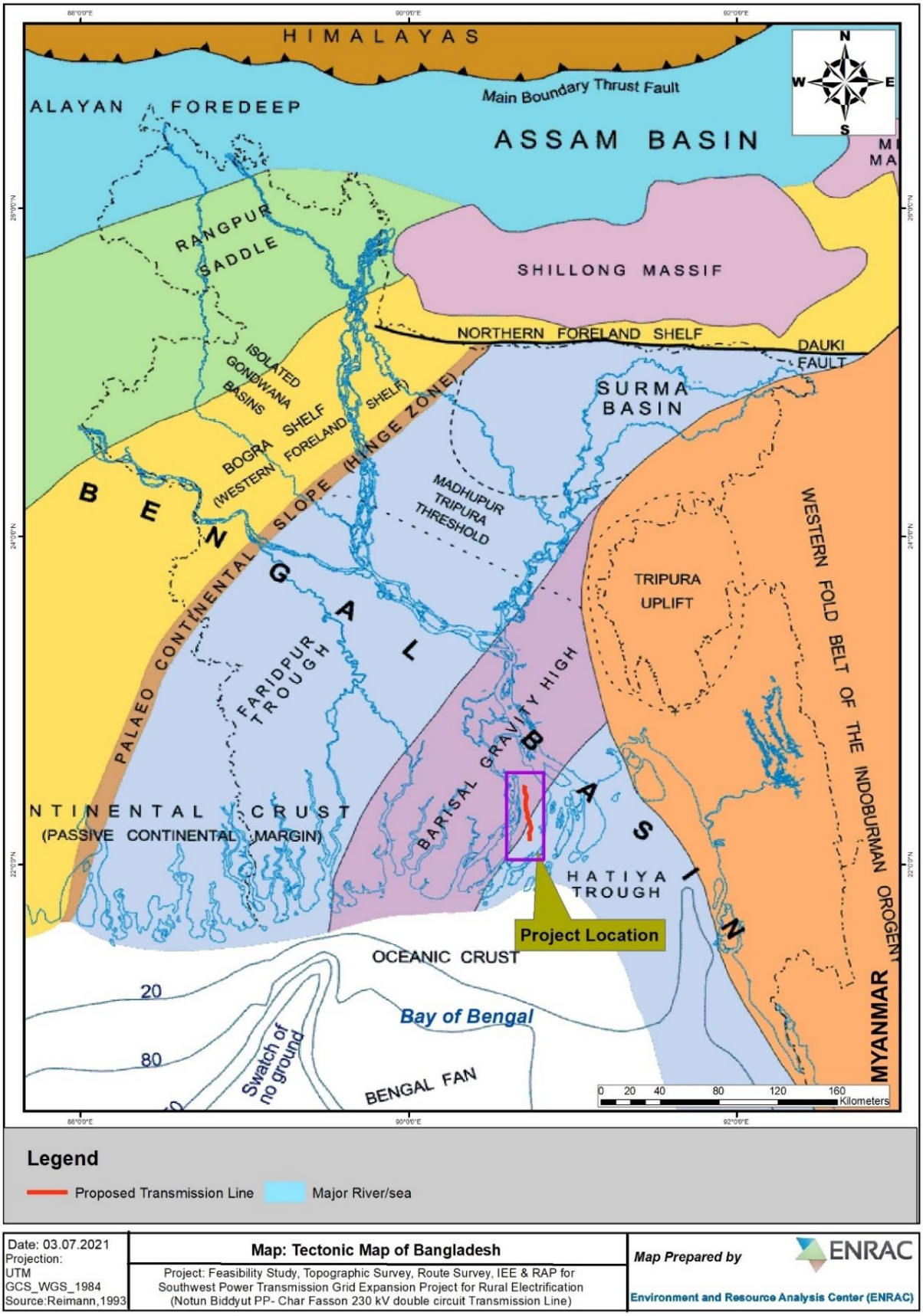


Figure 4-10: tectonic Map of Bangladesh

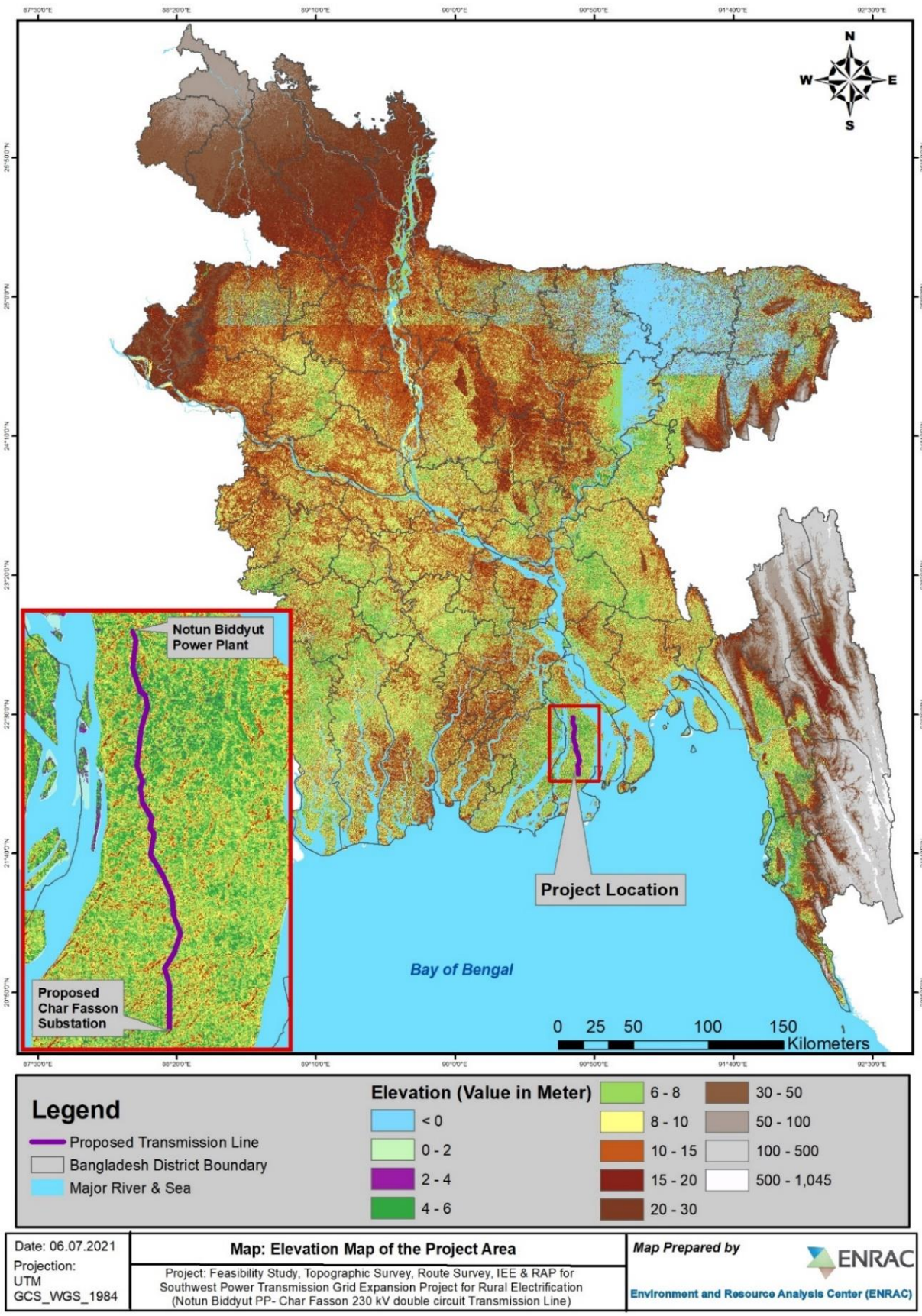


Figure 4-11: Elevation Map of the Project Alignment

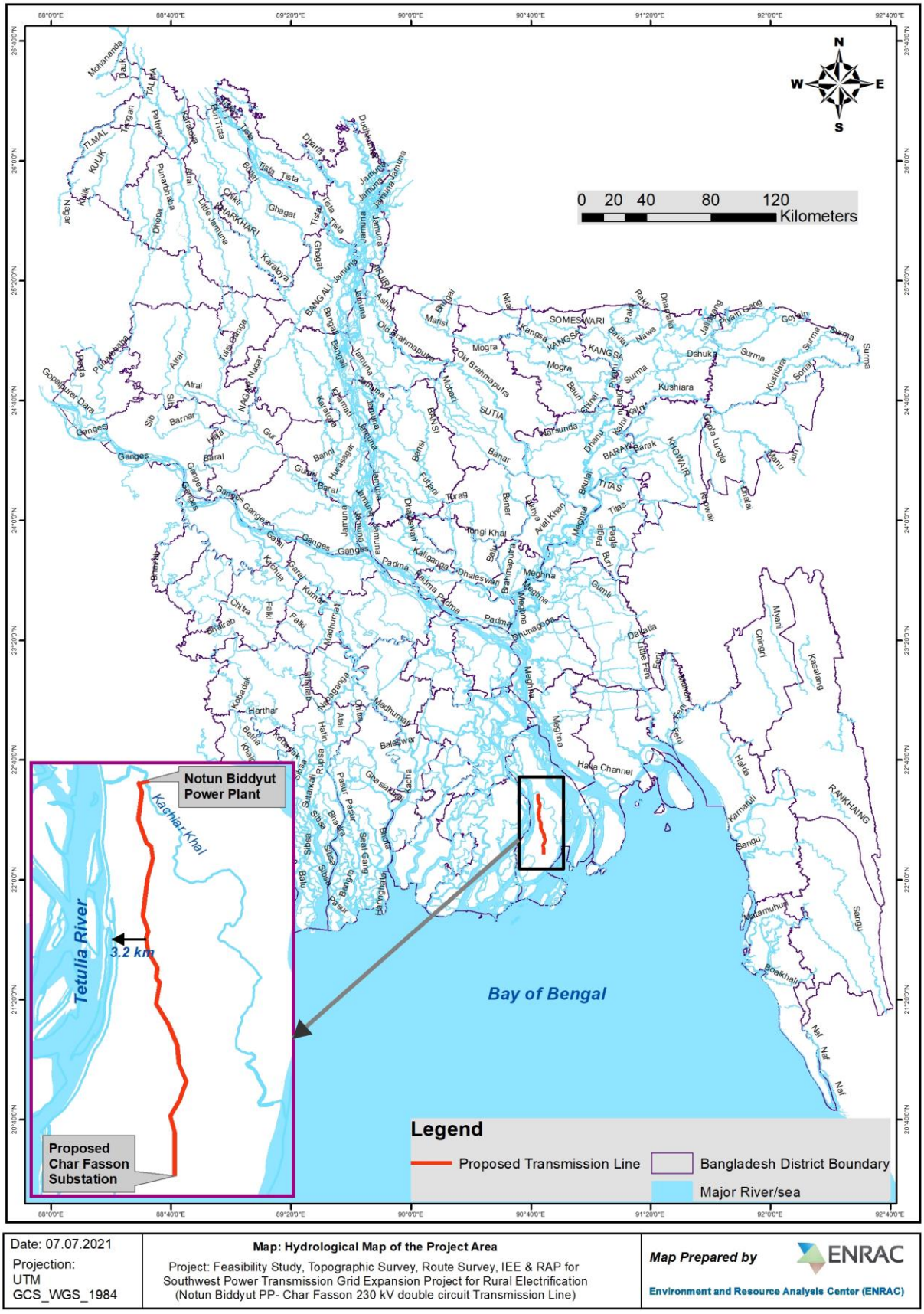


Figure 4-12:Drainage Pattern in the Study Area

4.1.5 Natural Disaster

234. Bangladesh is one of the most disaster-prone countries in the world with great negative consequences being associated with various natural and human induced hazards. The geophysical location, land characteristics, multiplicity of rivers and the monsoon climate render Bangladesh highly vulnerable to natural hazards. The coastal morphology of Bangladesh influences the impact of natural hazards on the area (ADRC, 2020). Especially in the south eastern area, natural hazards increase the vulnerability of the coastal dwellers.

4.1.5.1 Seismicity

235. According to ADPC (2010), Bangladesh is classified into four seismic zones with Zone IV being the most and Zone I being the least vulnerable to seismic risks (Figure 4-13). The northern part of the country that includes the greater districts of Rangpur, Mymensingh, and Sylhet are in the Zone-IV, where earthquake shock of maximum intensity of IX of the Modified Mercalli Scale is possible. The Zone-II includes the greater districts of Dinajpur, Bogra, Dhaka and Chittagong and the shocks of intensity of VIII are possible. The southern part of the country, the least active region, where the maximum intensity is not likely to exceed VII, is in the Zone-III. The Project site along with the entire Bhola Island falls in the Zone-I area. Seismicity map of Bangladesh and neighbouring countries is presented in (Figure 4-14) which also indicate that there is no seismic activity in the delta region of Bangladesh.

4.1.5.2 Flood

236. Flood is one of the major natural disasters in Bangladesh. In general, the normal inundation of flood-free areas by water caused by excessive rain and spillage from the over flown riverbanks is called flood. Floods bring about immense havoc to the lives of the people. Flooding is a natural phenomenon in Bangladesh and occurs on an annual basis. The rivers are huge by global standards, and can inundate over 30% of the land mass at a time. Bangladesh is prone to serious and chronic flooding. Even in an average year, 18% of the landmass is inundated and previous floods have affected 75% of the country (as in 1988). 75% of the country is below 10m above sea level and 80% is classified as floodplain as Bangladesh is principally the delta region of South Asia's great rivers. Bangladesh floods on a regular basis, recent notable and catastrophic floods have occurred in 1988, 2004, 2007 and 2010.

237. Floods cause erosion of chars (islands) by flooding rivers, cause landlessness amongst Bangladesh's poor; environmental refugees, loss of property, lives, epidemic, other water borne diseases, lack of drinking water, loss of agricultural land and crops, communication disruption are some of the major effects of flooding.

238. Every year near about one-fifth of Bangladesh undergoes flood during the monsoon season. A flood season in Bangladesh may start as early as May and can continue until November. Floods of Bangladesh can be divided into three categories:

- monsoon flood - seasonal, increases slowly and decreases slowly, inundate vast areas and causes huge loss to the life and property;
- flash flood- from sudden torrential flows, following a brief intense rainstorm or the bursting of a natural or man-made dam or levee; and

- tidal flood - short duration, height is generally 3-6m, prevents inland flood drainage.

239. Figure 4-15 shows the flood map of the project area, indicating that the project area falls under 'Moderate Tidal Surge" zone. Highest flood level was reported to be 5.527m during 1998 flood, according to the local information (Final Route Survey Report).

4.1.5.3 Cyclones and Storm Surges

240. Cyclone is so far proven to be the deadliest hazards in Bangladesh. Around 10% of the world's cyclones originate in the Indian Ocean and the adjacent Bay of Bengal each year, which account for at least 85% of the cyclone damage worldwide (Choudhury, 2002). Originated from (approximately) the hot spot Nicobar and Andaman Island in the Indian Ocean, where tropical disturbances develop, and often turn to cyclones of various severities and hit Bangladesh during April-May and October-November (NPDM, 2020).

241. Cyclone Risk Zones of Bangladesh is presented in

242. Figure 4-16 and it shows that the offshore islands of Bhola are among the islands most prone to cyclones. Cyclones in Bangladesh are presently classified according to their intensity and the following nomenclature is in use:

- depression (winds up to 62 km/hr)
- cyclonic storm (winds from 63 to 87 km/hr);
- severe cyclonic storm (winds from 88 to 118 km/hr); and
- very severe cyclonic storm of hurricane intensity (winds above 118 km/hr).

243. Some of the most devastating natural disasters in recorded history with high casualties were tropical cyclones that hit the region. Among them, the 1970 Bhola cyclone alone claimed more than 500,000 lives.

244. Key cyclonic storm tracks in Bangladesh have been shown in Figure 4-16. It is very clear that many areas of Bhola Island are in the high-risk zone of cyclone facing storm surges of above 1 m height. However, the OHTL will not be affected by storm surge and the substation area is situated 3 m above MSL which indicates the Project area is not affected by storm surges.

4.1.5.4 Tornado

245. The two transitional periods between southwest and northeast monsoons over the Indian sub-continent are characterized by local severe storms. The transitional periods are usually referred to as pre-monsoon (March-May), and post-monsoon (October-November). It is the pre-monsoon period when most of the abnormal rainfall or drought conditions frequently occur in different parts of Bangladesh. Also there are severe local seasonal storms, popularly known as nor 'westers (Kalboishakhi). Severe nor 'westers are generally associated with tornadoes. Tornadoes are embedded within a mother thundercloud, and moves along the direction of the squall of the mother storm. The frequency of devastating nor' westers usually reaches the maximum in April, while a few occur in May, and the minimum in March. Nor' westers and tornadoes are more frequent in the afternoon. Figure 4-18 shows the tornado affected settlements of Bhola district.

Figure 4-13: Earthquake Zoning Map of the Project Alignment

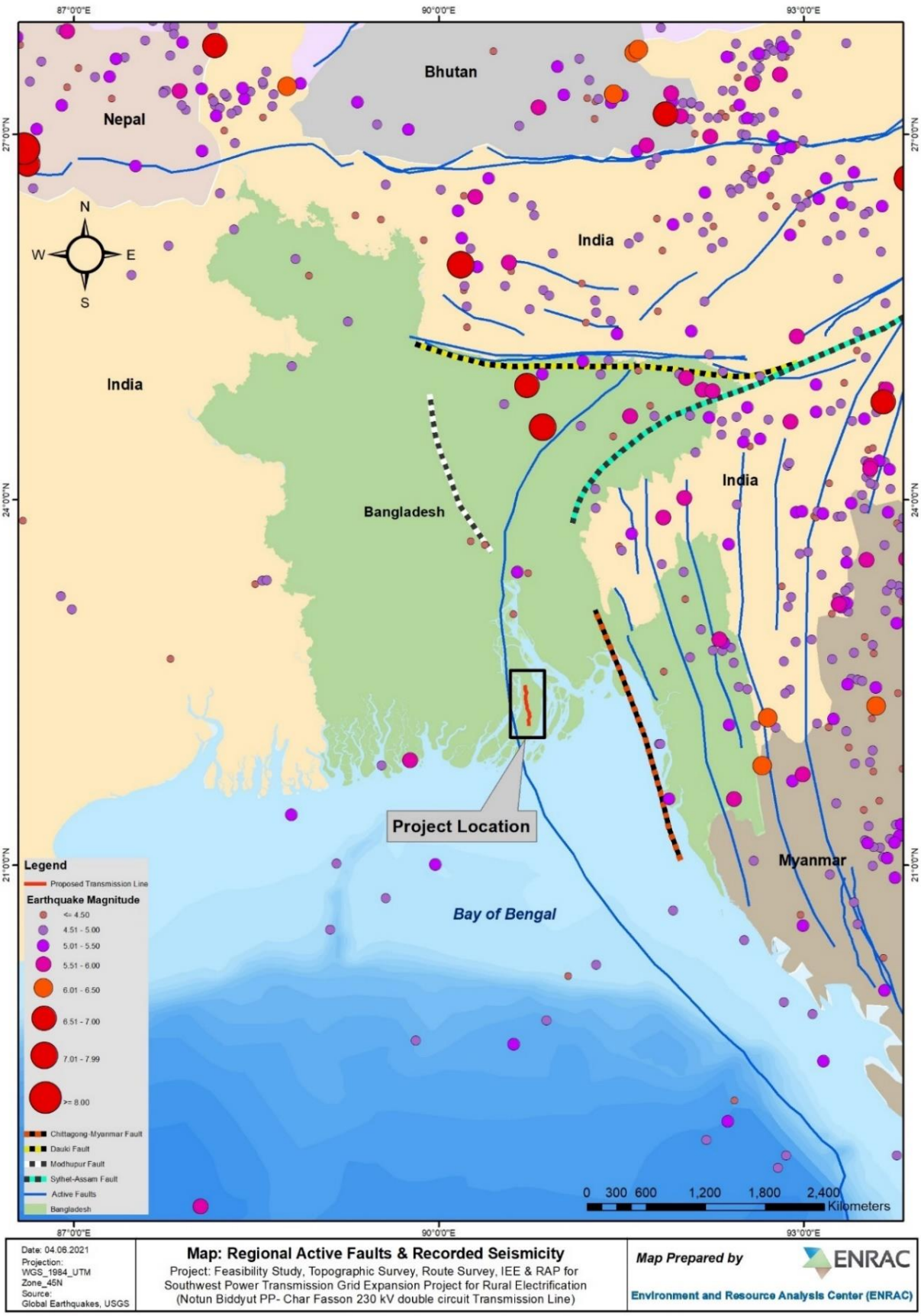


Figure 4-14: Regional Seismic Activity Map of the Project Alignment

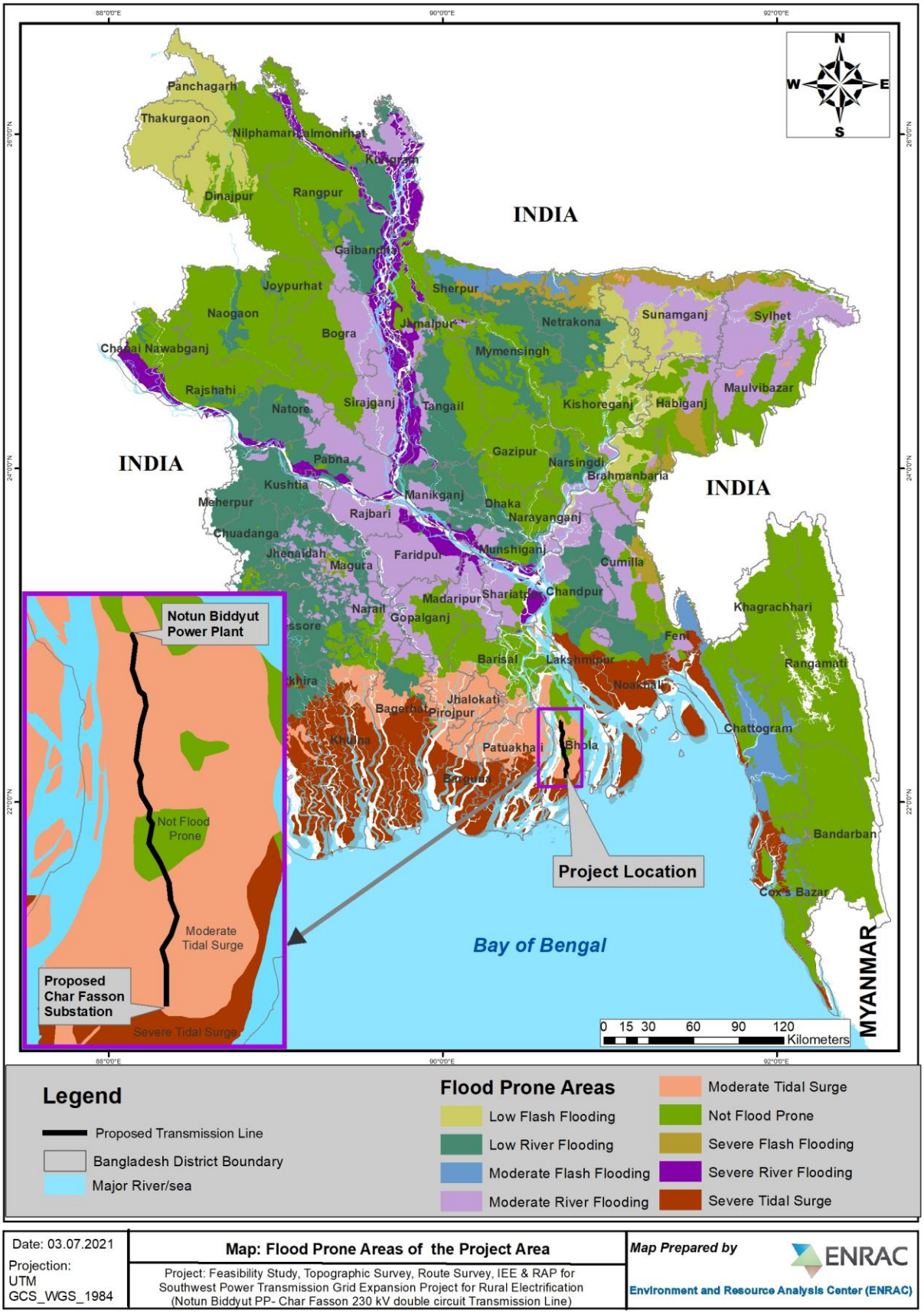


Figure 4-15: Flood Map of the Project Area

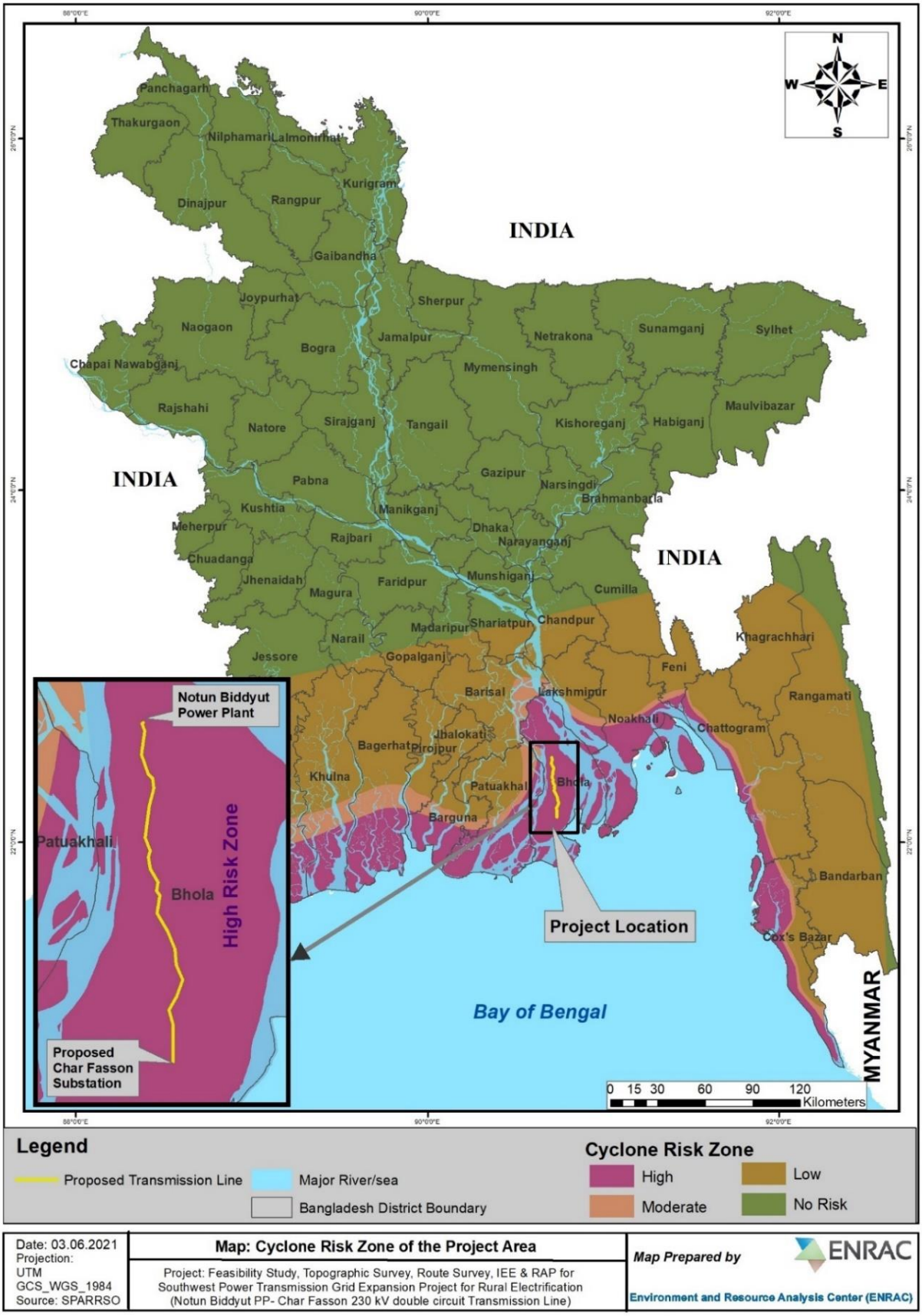


Figure 4-16: Cyclone Risk Zoning Map of the Project Alignment

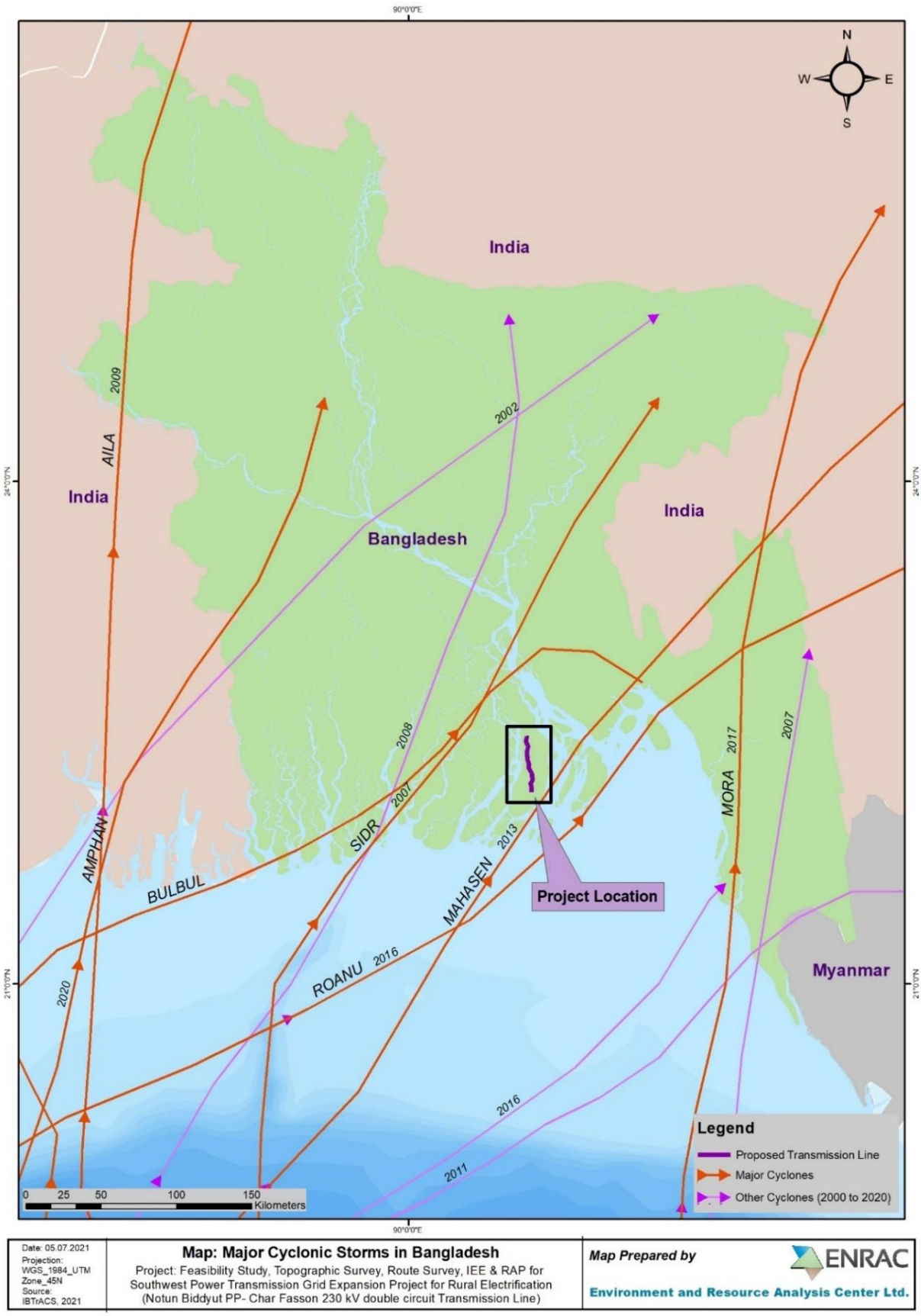


Figure 4-17: Major Cyclone Track along the Project Alignment

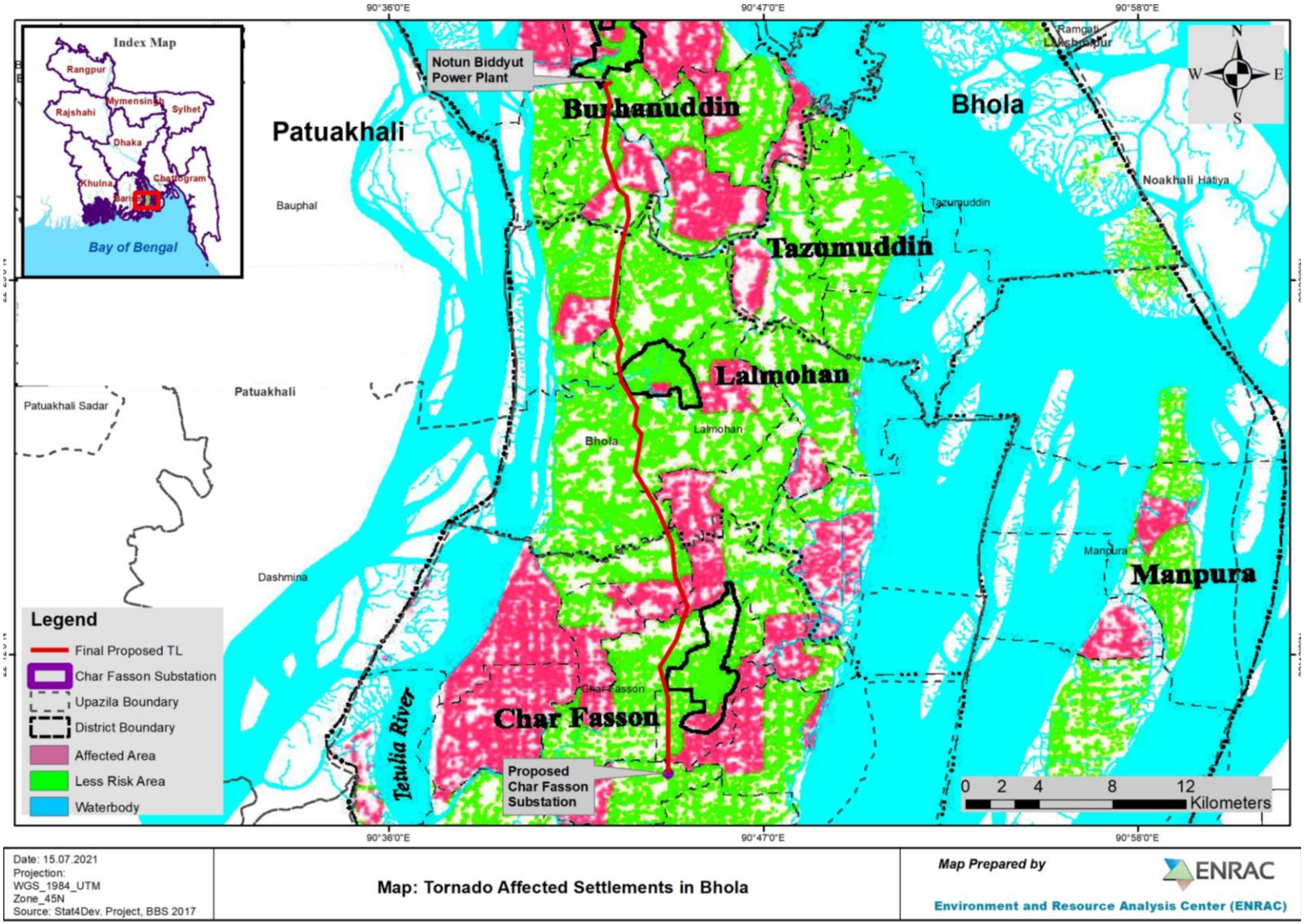


Figure 4-18: Tornado Affected Settlements in the Study Area

4.1.5.5 Landslide

246. Landslide in the recent years became major concern in the south-eastern and north eastern part of the country. Since 1997, the regions have experienced numbers of moderate to severe landslides which killed more than 1000 people and damaged property worth billion taka. The hilly parts are mainly susceptible to earthquake and rainfall induced landslide. Among the hilly districts Bandarban, Khagrachari, Rangamati and Cox's Bazar are most vulnerable to rainfall induced landslide. However, due to haphazard development and hill cutting, city of Chattogram experiences frequent landslide (NPDM, 2020). However, no landslide event was reported in and around the project alignment in recent past.

4.1.5.6 Thunderstorms

247. A thunderstorm is basically a storm, characterised by lightning and thunder. When the temperature rises, hot moist air rises upwards- known as updrafts. At the same time, the cool air sinks downwards, and this is called downdrafts. Collision between the updrafts and downdrafts creates cumulonimbus clouds and it produces lightning and thunder. Thunderstorms occur almost everywhere on the earth's surface, one of the most dangerous convective weather events. An estimated more than 1600–2400 thunderstorms occur at any moment and 50,000 each day, around the globe (Rahman, Hossain, & Jahan, 2019).

248. The majors controlling factors of lightning in Bangladesh includes seasonal variation of temperature, the intensity of monsoon rainfall, topographic landforms, and demographic and cultural aspects (e.g., low literacy rate, high population density, poor infrastructures, scarcity of medical hospital and health care systems, agriculture- based economy and so on). In Bangladesh, the isokeraunic level is 80 days per year. The mean thunderstorm days over Bangladesh increase significantly as the season progresses from March to May and are maximum in May. The area of highest frequency of monthly and seasonal thunderstorm days extremes south-westwards from Sylhet region to Dhaka region within elongated part extended southwards up to Barisal-Khepupara region. Annual thunderstorms frequency of Indian region including Bangladesh is shown in Figure 4-19. The statistics of death due to lightning hazard demonstrated that 1164 peoples lost their lives during the time interval 2015–2018. The rate of death due to lightning hazard in Bangladesh was 291 people by per year during the same time interval (Biswas, Islam, Mia, & Islam, 2019). Figure 4-20 shows the spatial lightning susceptibility of Bangladesh from 2015-2018.

249. Bangladesh is witnessing unusual casualties from lightning strikes well ahead of monsoon, that is in the pre-monsoon season comprises the months of March through May. It is due to the increased warmer weather and climate change are causing more water evaporation from the land and ocean, increasing cumulonimbus clouds, which is generating fatal lightning strikes. Experts opine that the frequency of lightning has intensified in recent times in Bangladesh due to growing and global warming and environmental imbalance (Rahman, Hossain, & Jahan, 2019).

250. Table 4-2 shows spatial lightning death statistics of Bhola district with respect to Bangladesh and Figure 4-21 presents thunderstorm affected settlements of Bhola district.

Table 4-2: Lightning death statistics of Bhola District

Year	2015	2016	2017	2018
Bhola	6	2	3	0
Bangladesh	219	379	265	301

Source: (Biswas, Islam, Mia, & Islam, 2019)

251. Considering the massive death toll due to lightning, in 2016, the Government of Bangladesh has declared it as a natural disaster (Rahman, Hossain, & Jahan, 2019). Aimed to reduce the deaths and damage, the Govt. Bangladesh has taken a number of initiatives including plantation of one million palm trees across the countries, development of public awareness on the thunderstorms and lightning through printed and electronic media as well as using other platforms, encourage people to plant palm and other tall tree, installing lightning rods in their houses etc. Furthermore, the warning systems have also been strengthened to make people aware of lighting preparedness. In addition to public awareness and emergency health services for the victims, the Directorate General of Health Services of Ministry of Health and Family Welfare collects information on deaths and injuries due to thunderstorms and lightning across the country regularly.

4.1.5.7 Combined natural Hazard Status

252. A multi-hazard map was prepared for the project alignment which identified the project RoW and the proposed substation site as a safe zone from all potential hazards except cyclonic storm surge (Figure 4-22). The project alignment is situated at a cyclone risk zone with surge height above 1 m above MSL.

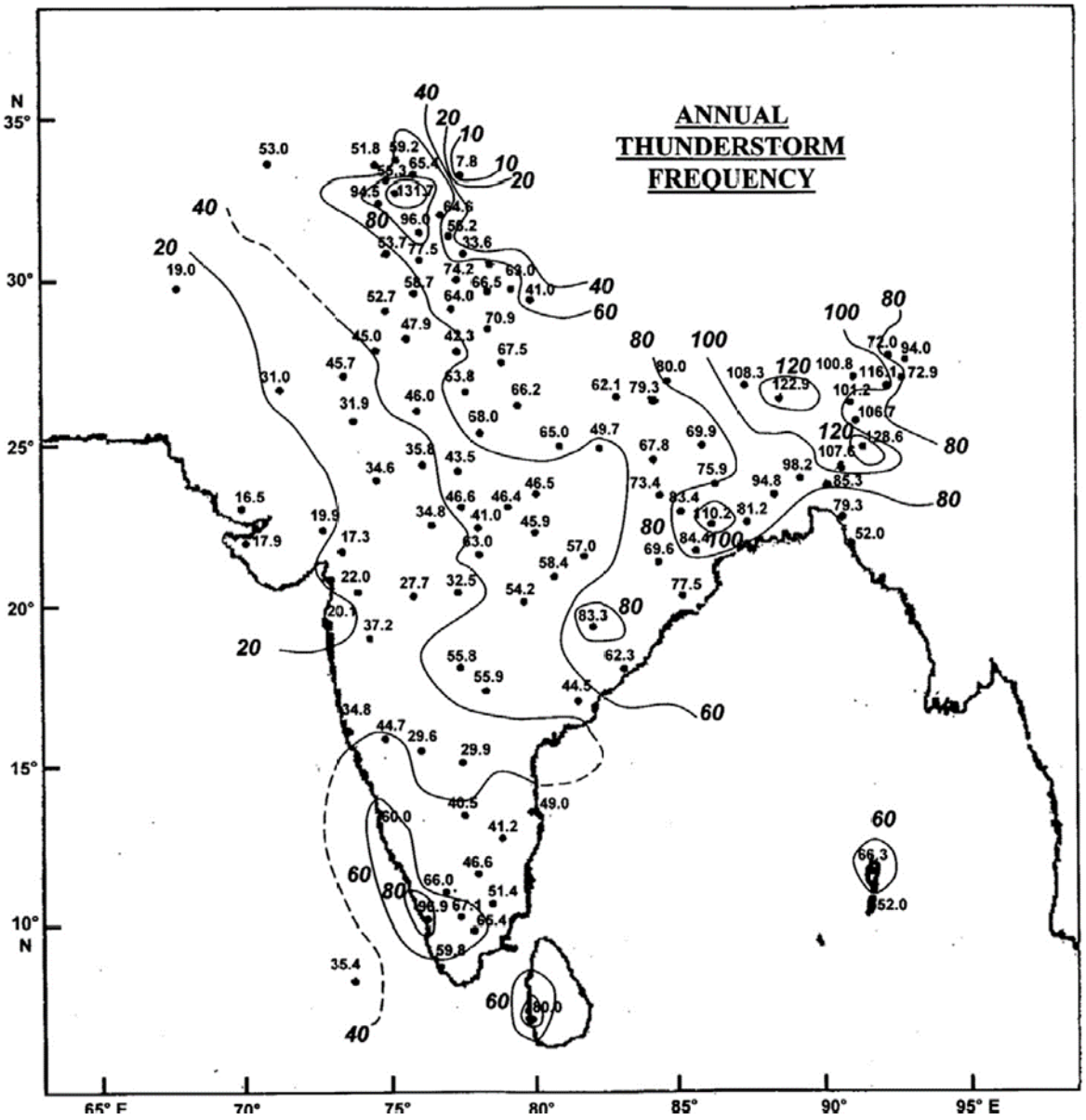


Figure 4-19: Annual thunderstorms frequency of Indian region including Bangladesh

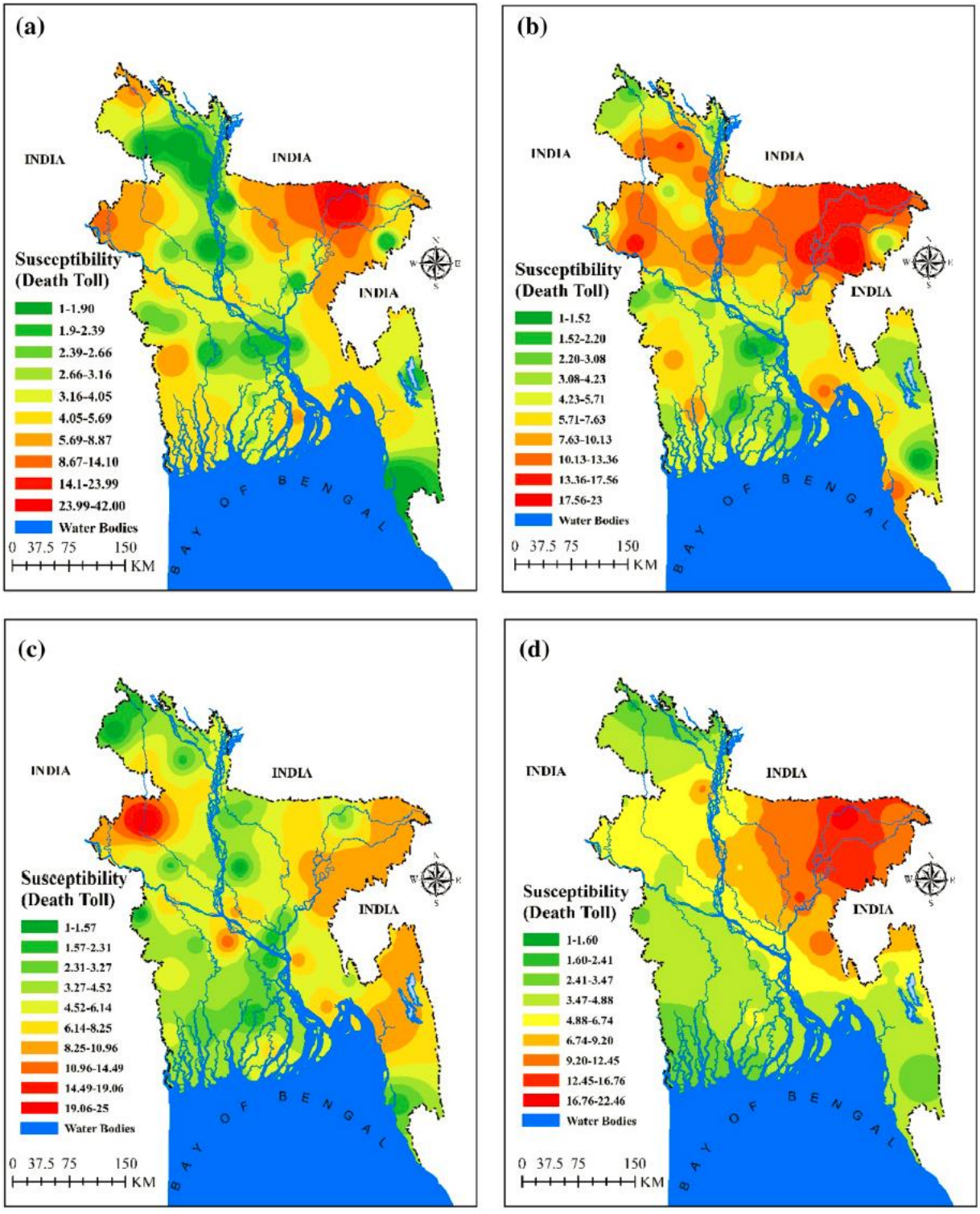


Figure 4-20: Spatial lightning susceptibility (death toll) of Bangladesh; a 2015, b 2016, c 2017, d 2018

Source: (Biswas, Islam, Mia, & Islam, 2019)

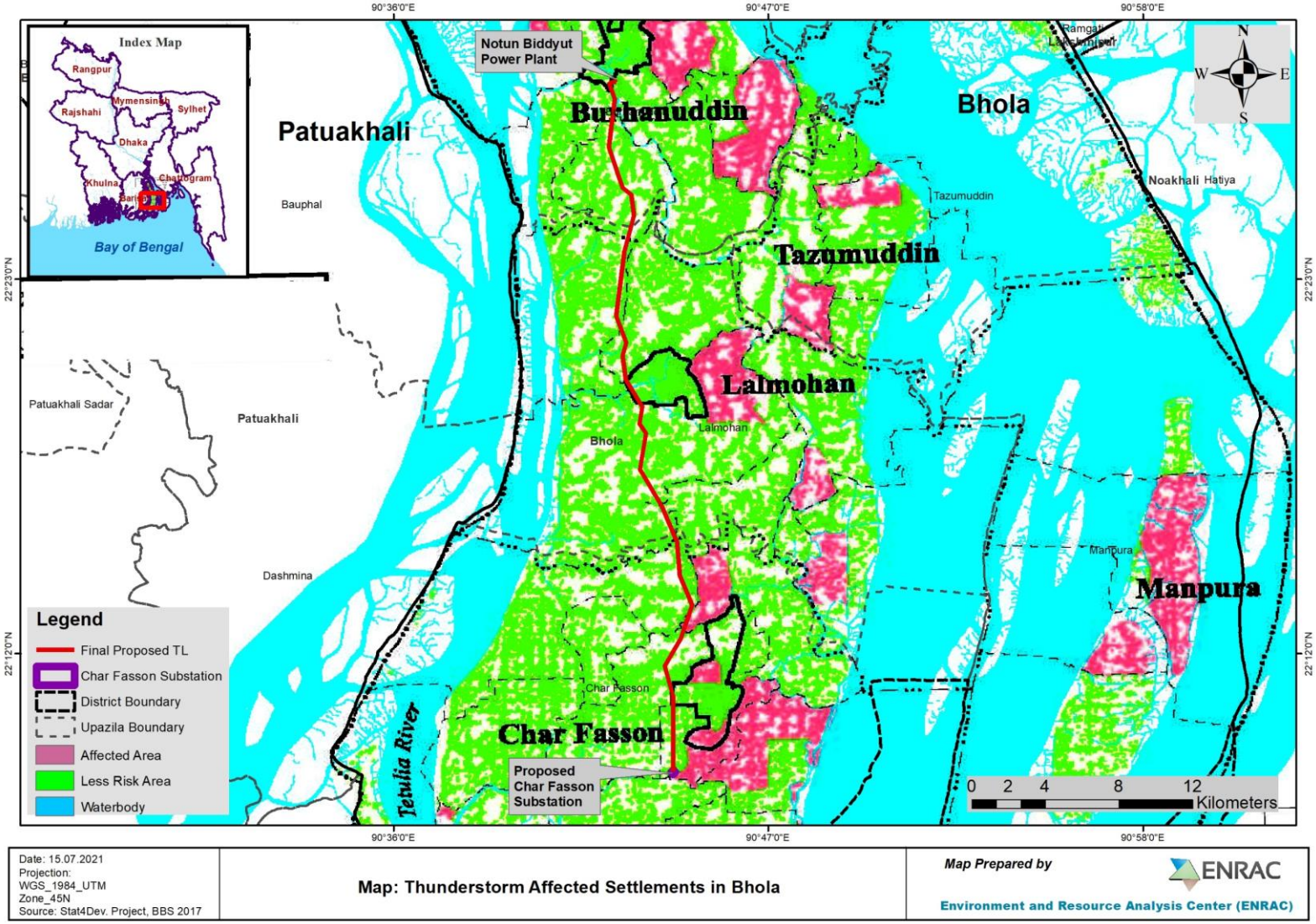


Figure 4-21: Thunder Storm Affected Settlements in the Study Area

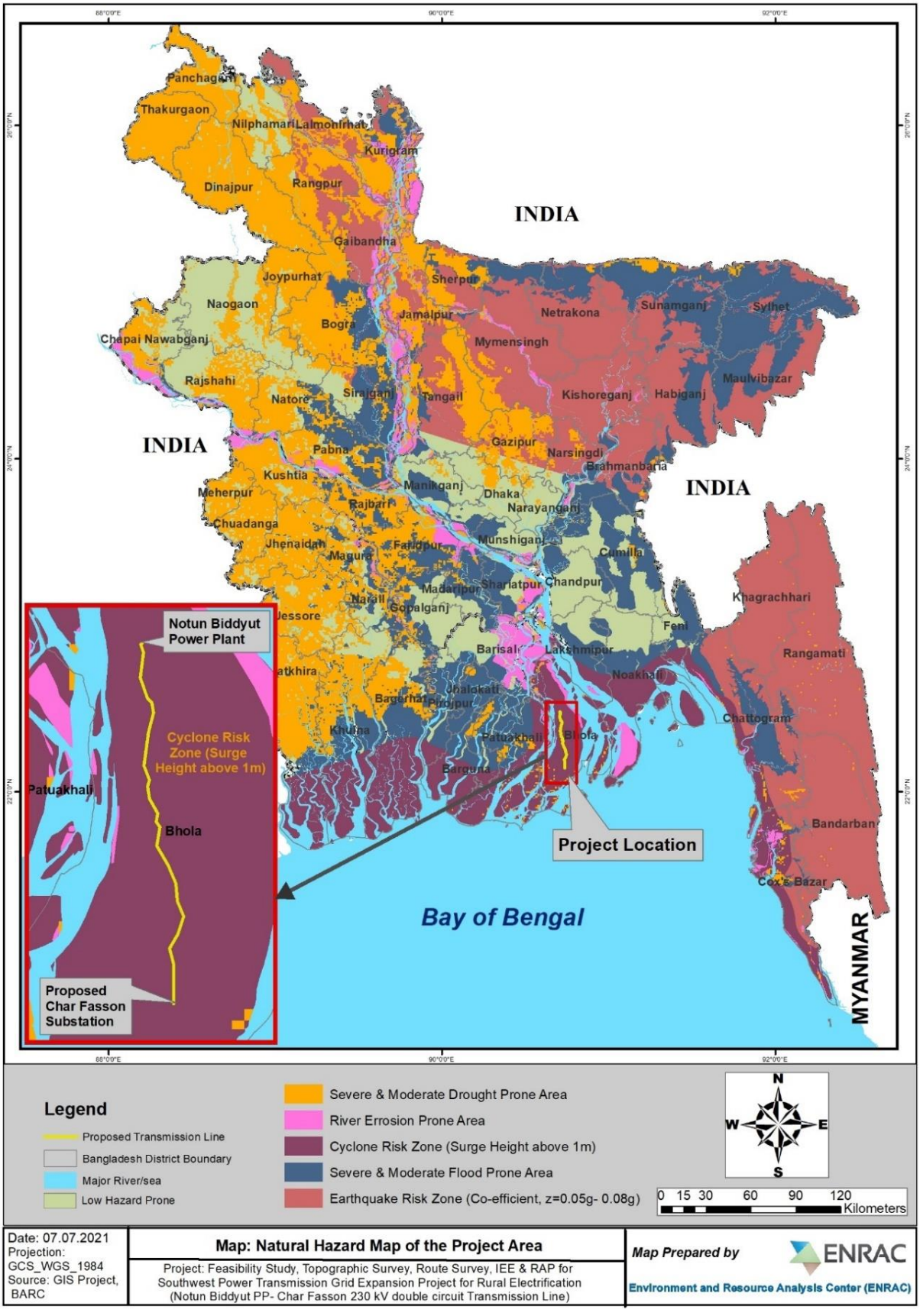


Figure 4-22: Multi Hazard map of the project alignment

4.1.6 Environmental Quality

4.1.6.1 Air quality

253. Ambient air quality measurements were carried out during July 2021 at 4 specific locations within the Project corridor for 1 hour. The key air quality parameters (PM10, PM2.5, CO, SO2, NO, NO2, temperature and humidity) were monitored. Following the methodology described, the one-hour air quality data were converted to 24 hours average. These data were used to develop Table 4-3 and compared with Bangladesh national standards for ambient air quality. The test results show that the local ambient air quality condition meets the national standard, according to the Bangladesh National Ambient Air Quality Standards defined in the Environmental Conservation Rules amendment 19th July 2005 vide S.R.O. No. 220-Law/2005. All air quality test reports have been provided in Annex 3

Table 4-3 Existing Air Quality along project corridor (24 hours average), July 2021

Sample ID	Sample Location	Coordinate	Parameters								
			CO µg/m³	NO µg/m³	NO_2 µg/m³	SO2 µg/m³	O3 µg/m³	PM10 µg/m³	PM2.5 µg/m³	VOC µg/m³	Air Temp/°C
AAQ_01	South side of the Proposed Substation	22°8'25.74"N 90°44'8.21"E	0.31	3.98	3.80	96.42	7.83	68.09	26.21	3.14	25.64
AAQ_02	East side of the proposed Substation	22°08'29.2"N 90°44'14.7"E	0.27	5.07	4.71	95.43	9.70	66.54	35.93	7.76	25.74
AAQ_03	Langalkhali, Lalmohan	22°19'48.67"N 90°43'47.05"E	0.29	5.22	4.96	54.24	10.02	93.47	22.75	8.47	26.71
AAQ_04	Beside Bhola Combined cyclic PP	22°28'41.62"N 90°42'26.40"E	0.33	7.52	5.18	129.22	9.98	74.65	30.07	10.51	25.79
GoB Air Quality Standards*			**10 (8 hour)**	**100 (Annual)**	**100 (Annual)**	**365 (24 hour)**	**157 (8 hour)**	**150 (24 hour)**	**65 (24 hour)**	**NSE ****	**NSE ****

Note: * The amended Schedule-2, 2005, of (Air Quality Standard) Environmental Conservation Rules, 1997

254. **Carbon monoxide** ranged from 0.27 to 0.33 µg/m^3. Measured concentrations for **NO and NO_2** were from 3.98 to 7.52 µg/m^3 and 3.80 to 5.18 µg/m^3, respectively. **Sulphur dioxide (SO_2)** ranged from 054.24 to 129.22 µg/m^3. **O_3** ranged from 7.83 to 10.02 µg/m^3.

Measured concentrations for Particulate matters **PM10 and PM2.5** varied from 66.45 to 93.47 µg/m^3 and 22.75 to 35.93 µg/m^3, respectively. **VOC** ranged from 3.14 to 10.51 µg/m3. None of the test results at all sampling station exceeded the DoE acceptable limits.

255. The measurement results showed achievement of all air quality standards. Based on the ambient air quality standard of DoE, air quality in the Project area can be stated as in good condition.

4.1.6.2 Noise Level

256. According to World Health Organization's Guidelines for Community Noise (1999), daily sound pressure levels of 50 decibels (dB) or above can create discomfort amongst humans, while ongoing exposure to sound pressure levels over 85 dB is usually considered the critical level for at least temporary hearing damage. Noise level measurements were carried out during July 2021 at 4 specific locations of the Project corridor (day and night) for 1 hour. These data were used to develop Table 4-4 and compared with the amended Schedule-4, 2006, of (Noise Level Measurement Standard) Environmental Conservation Rules, 1997, DoE. The laboratory test results have been provided in Annex 4**.**

Table 4-4 Noise Level Measurement within 100m of existing RoW of project (Nov 2018)

ID	Location	GPS Location	Noise Level (Leq)dB Day	Evaluation Criteria	GoB Noise Standard* dB)	
					Day	Night
NM_01	South side of the Proposed Substation	22°08'27.6"N 90°44'13.2"E	48.8	Mixed area	60	50
NM_02	East side of the propose Substation	22°08'29.2"N 90°44'14.7"E	55.5	Mixed area	60	50
NM_03	Langalkhali, Lalmohan	22°19'47.3"N 90°43'46.8"E	53.6	Commercial area	70	60
NM_04	Beside Bhola Combined cyclic power plant.	22°28'40.1"N 90°42'27.2"E	63.5	Commercial area/ Industrial Area	70	60

The amended schedule-4, 2006, of (Noise Measurement Standard) Environmental Conservation Rules, 1997

257. The existing general noise level within the study area varies from 48.8 dB to 63.5 dB during the monitoring which is slightly above the standard of mixed zone land use (DoE, 1997), but not the commercial zone.

4.1.6.3 Surface Water Quality

258. Surface water samples were collected for laboratory analysis from three locations, of the khal crossing area, a total of 3 sampling points along the corridor during July, 2021(Table 4-5). The samples were submitted to DPHE Laboratory to analyze for

the presence of BOD, COD, DO, pH, TDS, TSS & Turbidity. These analyzed results were used to develop Table 4-6 and compared with the Schedule-3(A) of (Standards for Inland Surface Water) Environmental Conservation Rules, 1997. All surface water quality lab test reports are provided in Annex 5.

Table 4-5 Surface Water quality sampling locations in project

Sample #	Sampling Area	Coordinates
SW_01	Surendra khal, beside proposed Substation	22°08'25.90"N 90°43'59.40"E
SW_02	Gorder khal, Langalkhali, Lalmohan	22°19'47.22"N 90°43'46.43"E
SW_03	Kachiar khal, Borhanuddin	22°28'41.36"N 90°42'27.55"E

Source: ENRAC Field Visit

Table 4-6: Surface Water Sample Analysis Result for Project Area

Sample ID	Temp.	BOD	COD	DO	TDS	TSS	Turbidity	pH
	°C	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	NTU	-
SW_01	24	1	4	6.05	230	7	146	7.6
SW_02	25.7	1	4	5.94	96	15	156	8
SW_03	25.3	1	4	6.25	110	12	215	7.9
Bangladeshi Standards	20-30	50	200	≥ 5	2100	150	10	6-9

Note: The standard value of COD is 4 mg/l for drinking water (ECR 1997, The Schedule-3B) and standard value of COD is 200 mg/l for Waste from Industrial Units or Projects (ECR 1997, The Schedule-10, Page 213). There is no standard value of COD for normal surface water in DoE (ECR, 1997).

Source: DPHE Analysis, Annex 5

4.1.6.3.1 Observation on Surface Water Quality

259. Biological Oxygen Demand (BOD): Natural waters will have a BOD of 5mg/L or less. ADB (1994) and GoB (1997) proposed BOD of 50 mg/L in waste water quality standards for Bangladesh. BOD directly affects the amount of dissolved oxygen in rivers or streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. Accordingly, the study shows the BOD values that all are same which is 1 mg/L in three collected water samples which belongs under standard limit. Considering this level of as found in the samples indicating the water is acceptable for common use purpose and the concentration levels of this parameters for surface water were within the acceptable limit set by the DoE.

260. Chemical Oxygen Demand (COD): COD values are same at three different location which is 4 mg/L. One shallow pump was observed near the sampling location.

Our tested sample value is 4 mg/L and standard value is 200mg/L (ECR 1997). Considering this level of as found in the samples indicating the water is acceptable for common use purpose and the concentration levels of this parameters for surface water were within the acceptable limit set by the DoE.

261. Dissolved Oxygen (DO): Dissolved Oxygen or free oxygen is needed for respiration of aquatic organisms. Levels suggest that nutrient pollution is a serious issue at the stations sampled. Above this values It is evident that the DO levels below 1 mg/L will not support fish population, thus, 5 to 6 mg/L are required for fish survival. Decrease in DO values below the critical level of 3 mg/L causes death for most fishes and other aerobic aquatic organisms. DO values in our collected samples are varied between 5.94 to 6.25 mg/L indicates the average quality of river/canals water. Considering this level of as found in the samples indicating the water is acceptable for common use purpose and the concentration levels of all the parameters for surface water were within the acceptable limit set by the DoE.

262. Total Dissolve Solids (TDS): It refers to the sum of all the components dissolved in water. Noticeably, the water that contains too much dissolve matter is not for common uses, therefore, the standard limit set for Bangladesh is 2100 mg/l (ECR 1997). TDS in the collected samples were varied from 96 to 230 mg/L. Comparison between tested values and standard value shows higher difference of concentrations in water sample. Overall, the collected water samples showed TDS concentrations of less than 230 mg/L thus indicating the water suitable for common use. The concentration levels of all the parameters for surface water were within the acceptable limit set by the DoE.

263. Total Suspended Solids (TSS): The level of TSS found in the samples range between 7 to 12 mg/L, however, the set standard is 150 mg/L. The result of collected water samples showed that the water is suitable for common use and within the DoE acceptable limit.

264. Turbidity: Turbidity values of the surface water samples range between 146 to 215 NTU whereas the set standard value is 10 NTU. All samples showed upper the standard concentration. Due to rainy season the water turbidity level crosses the acceptable limit set by the Govt. standard. Some earth work activities were observed near the sampling location this will be the reason for higher concentration of turbidity.

265. pH: There is less significant version of pH in various sampling stations and the tested samples ranged from 7.6 to 8.0 while the set standard is 6 to 9 (ECR ‘97) indicating suitability of water for common purposes. The concentration levels of all the parameters for surface water were within the acceptable limit set by the DoE.

266. Surface water quality of the all location in the project corridor was found to meet the best designated use (i.e. propagation of wildlife and fisheries). Surface water is not fit for drinking purpose.

4.1.6.4 Ground Water Quality

267. Three groundwater sample were collected from deep well within the proposed project corridor (Table 4-7). Water samples were collected in pre washed one litter plastic bottles and 250 ml sterilized clean PET bottle. The laboratory tests were performed for Temperature, pH, Arsenic (As), Manganese (Mn), Iron (Fe), Phosphorus (as Phosphate). The collected samples were sent to the Department of Public Health Engineering (DPHE),

Mohakhali, Dhaka, Bangladesh Council of Scientific and Industrial Research (BCSIR) for testing the required parameters. Results of the groundwater testing are shown in Table 4-8. All ground water quality lab test reports are provided in Annex 6.

Table 4-7: Ground Water Quality sampling location in the Project area

Sample #	Sampling Area	Coordinates
GW_01	Beside Proposed substation Area, Charfasson	22°80'21.32"N 90°44'12.20"E
GW_02	Langalkhali, Lalmohan	22°19'54.19"N 90°43'48.20"E
GW_03	Yousuf nagar, Borhanuddin	22°28'47.04"N 90°42'23.01"E

Source: ENRAC Field Visit

Table 4-8: Ground Water Sample Analysis Result for Project Area

Sample ID	Temp	As	Fe	Mn	Phosphate	pH
	°C	mg/L	mg/L	mg/L	mg/L	-
GW-01	24.6	0.002	0.11	0.03	0.25	**7.7**
GW-02	24.8	0.001	0.14	0.04	0.30	**7.8**
GW-03	24.5	0.001	0.12	0.03	0.32	**7.6**
Bangladesh Standard for Ground Water (ECR' 97 mg/L)	20-30	0.05	0.3-1	0.1	6	**6.5-8.5**
WHO Guideline for Ground Water, 2004	**30**	**0.01**	**0.3**	**0.5**	_	**6.5-8.5**

Source: DPHE Analysis, Annex 6

4.1.6.4.1 Observation on Ground Water Quality

268. Arsenic (As): The level of Arsenic (As) was found in 0.001 to 0.002 mg/l in the tested water samples which complies the Bangladesh Standards for Ground water (ECR, 1997) as 0.05 ppm and WHO guideline 0.01 ppm in all samples. Considering this level of as found in the samples indicating the water is acceptable for drinking water purpose. The concentration levels of this parameters for surface water were within the acceptable limit set by the DoE.

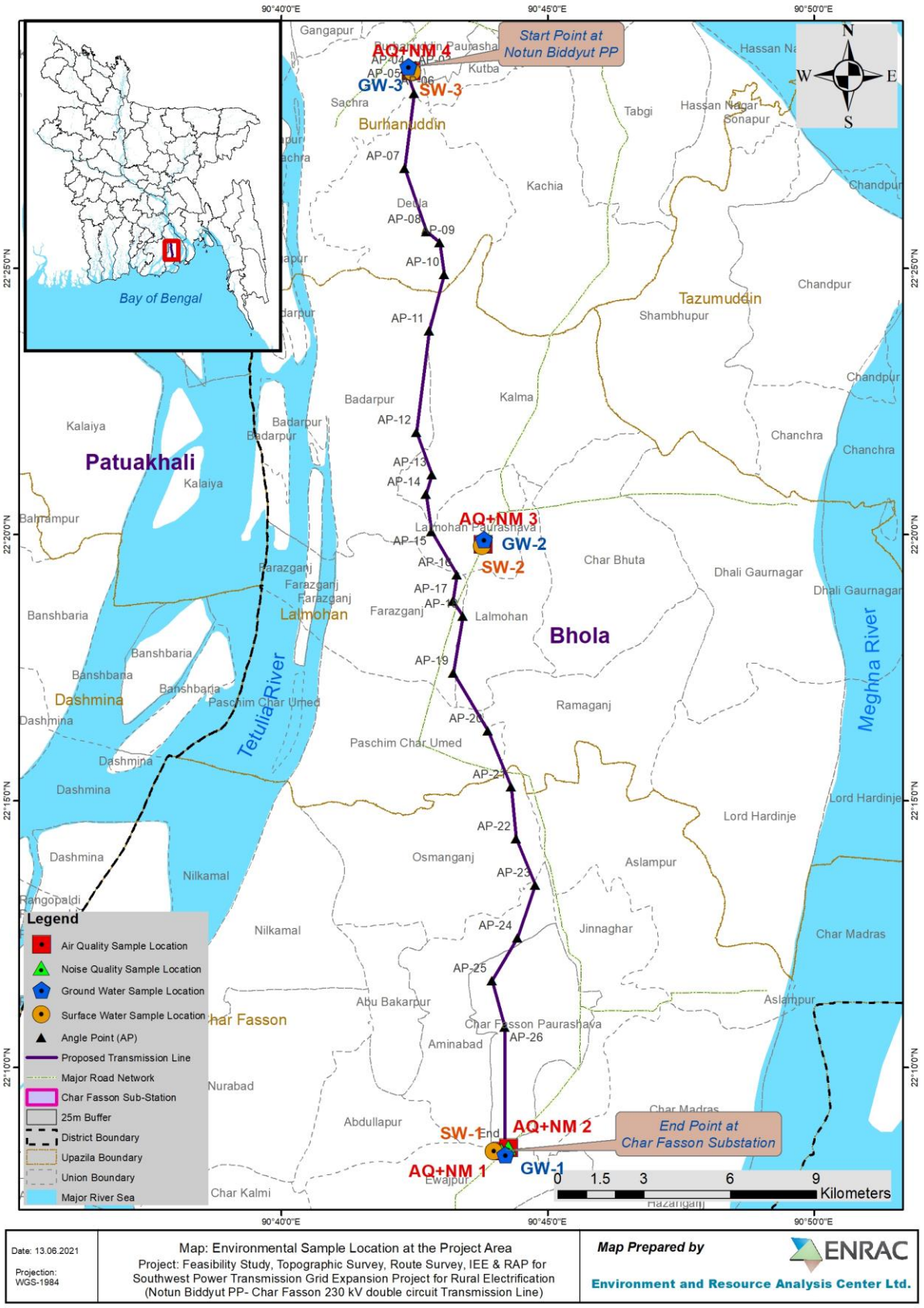
269. Iron (Fe): All the tested groundwater samples contain lower concentrations from the standard level. The Iron (Fe) range from 0.11 to 0.14 mg/L while the standard value ranges from 0.3 to 1.0 mg/L for Bangladeshi perspective. Although high iron in drinking water is not a major health problem, it may unacceptable to users at such high concentrations. Besides, it is a problem varied region to region instead of construction effect. Considering this level of as found in the samples indicating the water is acceptable for drinking water purpose. The concentration levels of all the parameters for ground water were within the acceptable limit set by the DoE.

270. Manganese (Mn): The tested report shows the Mn value found ranges from 0.03 to 0.04 mg/L Considering this level of Mn is regarded as a potential health problem in waters and WHO have set a guideline value of 0.5 mg/L for this element while BD sets 0.1 mg/L. The tested report shows the Mn value found ranges from 0.03 to 0.04 mg/l. Considering this level of Mn found in the samples indicating the water is acceptable for drinking water purpose. The level of Mn found in the samples indicate that the water is within acceptable limit set by the Government Standard for drinking purpose.

271. Phosphate and pH: The concentrations of Phosphate found in the tested samples range from 0.25 to 0.32 mg/L, however, the standard value sets as 6.0mg/L for ground water. Accordingly, the concentration of Phosphate was not found higher than the standard value in the project corridor. Similarly, groundwater samples meet the pH standards, however, the found values vary from 7.6 to 7.8. The concentration levels of this parameters for ground water were within the acceptable limit set by the DoE.

272. In the study area, no excessive level of tested parameter value was found in the groundwater. The concentration levels of all the parameters for ground water were within the acceptable limit set by the DoE.

273. Figure 4-23 presents the sample locations for Air, Noise quality, Surface and Ground water collection points.



Date: 13.06.2021 Projection: WGS-1984	Map: Environmental Sample Location at the Project Area Project: Feasibility Study, Topographic Survey, Route Survey, IEE & RAP for Southwest Power Transmission Grid Expansion Project for Rural Electrification (Notun Biddyut PP- Char Fasson 230 kV double circuit Transmission Line)	*Map Prepared by* ENRAC Environment and Resource Analysis Center Ltd.

Figure 4-23: Sample Locations of Project Area

4.2 Ecological Resources

274. The entire floodplain of Bangladesh was once well forested, but most of the native forests have disappeared in recent decades due to mounting pressure from human populations. The floodplain land has long been subject to cultivation. Thus, only scattered patches of native trees, wetlands and associated fauna habitat remain in isolated locations within the terrestrial environment (IUCN, 2002). In many parts of the country, the abundance of plantations and groves of trees around villages creates an aspect of discontinuous forest (Wahab, 2008).

275. The river systems within the study area are used as local transport routes and are also important for fishing and fish farming. The freshwater watercourses also provide an important nursery ground for native fish. In addition, a number of fish ponds and freshwater wetlands occur within the study area. These areas provide diverse habitats for many freshwater aquatic flora and fauna.

276. The natural forests of Bangladesh have been subject to rapid depletion in recent years. Forests have been declining at a rate of 2.1% annually from the early 1980s. It was estimated in 1999 that only about 6% of the total area of the country merits the term „forested" (Salam, et. al. 1999). Traditionally "sal" and mixed evergreen forests used to cover vast areas in the center and east of Bangladesh. Most of the forests, which are considered of low productivity, have been replaced for tree monoculture plantations using eucalyptus and rubber among other species. Most of this forest land has been denuded, degraded, and occupied by forestry companies or displaced people (IUCN, 2002).

277. The project site terrestrial and aquatic flora and fauna were assessed from visual observations, focus group discussion, public consultation, review of literature, and information documented by other agencies. The project area is situated in the largest riverine delta island in the world named Bhola Island, which is bounded by Lower Meghna river in the east and Tetulia river in the west and Bay of Bengal in the south; and is characterized by flat land and low relief.

4.2.1 Bio-ecological Zones

278. Using six parameters such as, physiography, soil, rainfall and temperature, floral distribution, faunal distribution and flood depth, 25 bio-ecological zones have been delineated within Bangladesh by the IUCN (IUCN 2002). The project site occurs in the Offshore Islands (8b) bio-ecological zone as shown in Figure 4-24.

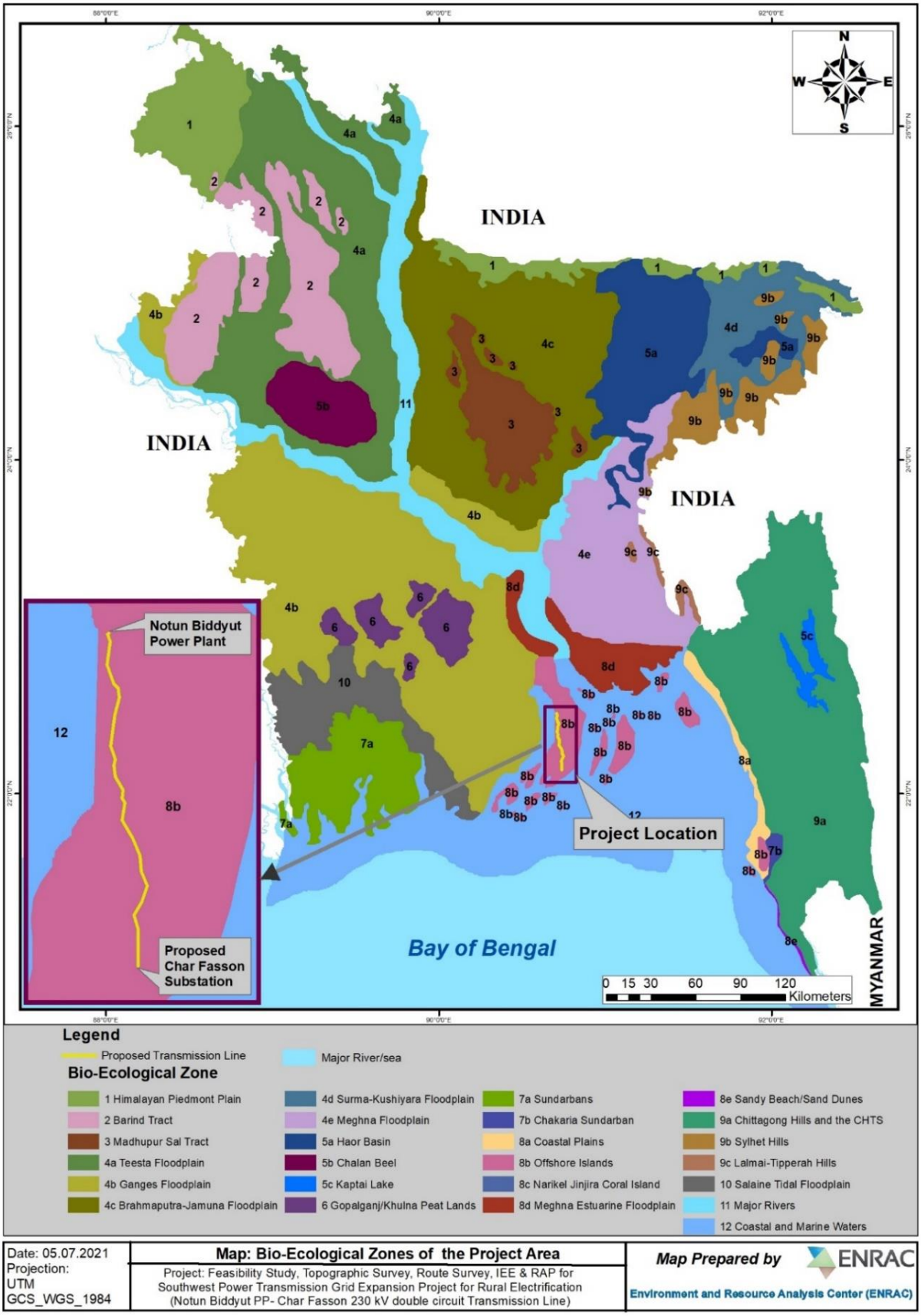


Figure 4-24: Bio Ecological Zones of the Project Alignment

4.2.2 Offshore Islands Bio-ecological zone (8b)

279. This zone covers Bhola, Hatiya, Ghasiar char, Moulvir char, Shahebanir char, Char bata, Char kukri mukri, Nijhum dweep, etc. Shapes of most of the islands are continuously changing as a result of erosion and tidal insurgence. More-over, there are exclusive inter-tidal mudflats composing parts of the islands. Most of these mudflats occur along the inland creeks. There are also large shoals in this area; these may consolidate into large islands by the end of this century. The vast amount of sediment brought down by the Meghna made the estuary shallow for a considerable distance (Rashid, 1991).

280. Among the rich vegetation observed in this zone, there are man-made plantations of mangroves, such as the Keora and Tiyan in the Nijhum dweep, Ghasiar char and Char bata. The vegetation in the interiors of Hatiya is similar to that of the mainland and includes: the Sada koroi, Shaora, gab, Baba, kadam, Banyan, Jam, Mandar, Sonalu, Date palm, Toddy palm, Coconut and various bamboo species (GoB-IUCN, 1992).

281. The inlands of this zone are very important staging and venturing areas for a wide variety of waterfowl, particularly the migratory shorebirds. Rashid (1989) recorded over 108,000 waterfowl of 49 species, together with 5,500 unidentified ducks and 56,500 unidentified shorebirds.

282. The bio-ecological zone thus flora and fauna of this zone has been separated into two broad ecosystem types, these are:

- Terrestrial; which represents the flora and fauna that occurs in land-based areas that remain relatively unaffected by inundation associated with the monsoon; and
- Aquatic; which includes the flora and fauna associated with water bodies.

4.2.3 Detail Biodiversity Assessment Analysis

283. The study area's terrestrial and aquatic flora and fauna were assessed from field investigations, visual observations, focus group discussions, public consultations, review of literatures and information documented by other agencies. Detailed bio-diversity assessment of the project area is discussed in the below sections.

4.2.3.1 Flora

284. Much of the Bhola district is an intermediate level island, but falls within the active delta as there has been diluvion in the east and accretions in the north-west. The whole island is affected by the movements of the lower Meghna channel.

285. Table 4-9 outlines the type of flora found in the project corridor during field survey. A detailed plant list is provided in Annex 10.

Table 4-9: Plant types along the project alignment

Plant Type	Trees	Shrubs	Herbs and Climbers	Total
Number	**47**	**16**	**34**	**97**

Source: ENRAC Field Survey

286. Various types of agricultural crops are cultivated in the island. Among cereal crops, aman covers the largest area followed by aus, boro and wheat. The acreage under jute is the minimal. Other crops include khesari, mug, musur, gram, potaot, sugarcane, onion and garlic, betel leaf, and tobacco and different kinds of vegetable, betelnut, betel leaf and chillies are the main cash crops. Common fruit crops that are grown in the area are mango, jackfruit, guava, banana, papaya, amra, chalta, coconut etc.

287. The groves that surround the village homesteads, represent various types of commonly planted trees. These are mango (Mangifera indica), kalojam/black berry (Syzygium cumini), amra (Spondia pinnata), guava (Psidium guajava), coconut (Cocos nucifera), betelnut (Arcca catechu), kantal/jackfruit (Artocurpus heterophyllus), kadam (Anthocephalus cadamba), jambura (Citrus decumana), and mandar (Erythrina variegata).

288. Common way side trees are karoy (Albizzia procera), tentul (Tamariandus indica), neem (Azadirachta indica), hijol (Barringtonia acutangula), banyan (Ficus benghalensis), oshot (Ficus religlosa), raintree (Samanca saman), and pitraj (Aphanamixls polystachia).

289. Besides the above, the entire coastal belt of the island has recently been covered with trees like Australian acacia, babla (Acacia nilotica), jarul (Lgerstroemia speciosa), coconut (Cocos nucifera), betel nut (Areca catechu) etc. Moreover, in different ponds ditches and beels of this area, various hydrophytes likevallisneira, hydrilla, potamogetan, lemna and floating ferns like salvinia and azola gown in abundance. Other aqua plants like lotus (Nelumbo nucifera), various species of water-lily (Nymphaea nouchaliq) and the introduced weed known as water hyacinth (Eichhornia crassipes) are spectacularly seen in different shallow water bodies.

4.2.3.2 Fauna

290. The fauna from the study area is categorized as mammals, birds, reptiles, amphibians and fishes. Table 4-10 summarizes both terrestrial and aquatic faunas from the study area.

Table 4-10: Fauna of the project alignment

Group	Total No.	EX	RE	CR	EN	VU	NT	LC	DD	NE
Amphibians	4					0		4		
Reptiles	28			1	1	0	3	18	2	3
Birds	90		2	1	1	3	4	76	3	
Mammals	28	1		1	0	0	1	21	3	1
Fish	35				1	2	2	28	3	
Total	**150**	**1**	**2**	**3**	**2**	**3**	**8**	**119**	**8**	**4**

Code: EX-Extinct, RE-Regionally Extinct, CR-Critically Endangered, EN-Endangered, VU-vulnerable, NT-Near Threatened, LC-Least Concern, DD-Data Deficient, NE-Not Evaluated
Source: IUCN Red Book of Bangladesh 2015

- **Mammals**

291. Long-tailed Macaque (Macaca fascicularis), Phayre's langur (Trachypithecus phayrei) are listed as Critically Endangered as per IUCN 2015, v3 Red List of Threatened Species. Red Dog (Cuon alpinus) are listed as Endangered as per IUCN 2015, v3 Red List of Threatened Species. Ganges River Dolphin (Platanista gangetica), Black Giant Squirrel (Ratufa bicolor) are listed as Vulnerable as per IUCN 2015, v3 Red List of Threatened Species.

292. Of the mammals the following species are most familiar in the study area, Indian pipistelle (Pipistrellus corromandra), tickel's bat (Hesperoptenus tickelli), benji (Herpestes edwardsi), dhari Indur/rat (Bandicota bengalensis), indur (Rattus rattus) metho indur (Mus Booduga), shial/ jackal (Canis aureus), ud biral (Aonyx cinerea) and dura kathbirali (Funambulus pennanti). Some species of mammals are now rarely seen in the island. These are banar (Macaca mullata), khek shial (Vulpes bengalensis), kahrgosh (Lepus nigricollis), sajaru (Atherurus macrourus), khatash (Viverra zibetha), shusuk (Neophocaena phocaenoides) etc.

- **Birds**

293. A total of 90 species of birds belonging to 48 families from the Study area were recorded. Black-headed Ibis (Threskiornis melanocephalus) are listed as Vulnerable as per IUCN 2015, v3 Red List of Threatened Species. Some common species are, House Crow, Indian Cuckoo, White throated Muniya, Black headed Bulbul, Indian Pond heron, barn Owl, Vernal Hanging Parrot etc.

294. Different species of birds are commonly found in the island. These are doel (Copsychus saularis), babui (Ploceus phillippinus), tuntuni (Orthotomus sutorius), lejnachani (Rhipidura albicollis), tila munia (Lonchura punctulata), crow (Cornus spendens), dar kak (Corvus macrorhynchos), bhat shalik (Acridotheres tristis), sharui (Passer domesticus), kaliphecha (Glaucidium radiatum), choto fingey (Diciris macrocercus), holdey pakhi (Oriolus Xanthornus), kaththokra (Picus myrmecophoneus), machranga (Alcedo atthis), laxmi pencha (Tyto alba), tia (Psillacula Krameri), tila ghugu (Strepto pelia chinensis, dahuk (Amaurornis phoenicurus), kana korchy bok (Ardeola grayii), panikaor (Orilus xanthornus) etc.The migrant birds that come to visit different swamps of the island are tibetan shrike (Lenius tephronotus), khuntey hans (Anas clypeata), giria hans (Anas querquedula), goganbar (Podiceps cristatus) chokachaki (Tedorna ferruginea), badami koshai pakhi (Lanuis cristatus), lenja hans (Anas acuta), khonjan (Motacilla cinerea) and booted warbler (Happlais caligata).

- **Reptiles**

295. Common batagur (Batagur baska), Green Sea Turtle (Chelonia mydas), hawksbill Turtle (Eretmochelys imbricata) and Gharial (Gavialis gangeticus) are listed as Critically Endangered as per IUCN 2015, v4 Red List of Threatened Species. Crowned River Turtle (Hardella thurjii) are listed as Endangered as per IUCN 2015, v4 Red List of Threatened Species. Olive Ridley Sea Turtle (Lepidochelys olivacea) and Ring Lizard (Varanus salvator) are listed as Vulnerable as per IUCN 2015, v4 Red List of Threatened Species.

296. Due to indiscriminate destruction of their natural habitat, many of the wild fauna of the study area have been declining since long. As a result, some of the reptiles have

now become rare. Few of the species that are still observed are gui shap (Varanas bengalensis), ghargini shap (Lycodon jara), dhora shap (Xenodrophis piscator), paina shap (Enhydris enhydris), gokhra (Naja naja), tiktiki (Hemidactylus brooki), shanda (Gekko geeko), dhum kasim (Trionyx hurum) and kori kaitta (Kachuga tecta).

- **Amphibians**

297. A total of 4 species of amphibians belonging to 2 families from the study area were enumerated. None of those possess any threatened status as per IUCN 2015.v4 Red List of Threatened Species. Most common amphibians are kuno bang (Bufo melanostictus), venpu bang (Kaloula pulchra), bhawa bang (Rana tigerina), kotkoti kang (Rana Cyanophlyctis) etc.

- **Fish**

298. Clown Knife Fish (Chitala chitala) are listed as Endangered as per IUCN 2015, v3 Red List of Threatened Species. Long-whiskered Catfish (Sperata aor) are listed as Vulnerable as per IUCN 2015, v3 Red List of Threatened Species

299. Fish resources of this district are represented by indigenous, exotic, brakish and marine varieties. In the fresh water the popular species are ruhi (Labco rohita), katla (Catla catlaa), mrigel (Cirrhinus mrigala), calbaus (Labeo calbasu), magur (Clarius batrachas), shing (Heteropneustes fossilis), koi (Anumbas testudineus), airh (Mystus aor), boal (Wallago attu), shaul (Channa striatus), phali (Notopterus notopterus) etc. Exotic fishes like silver carp (Hypopthlmihthy molitrix) mirror carp (Cyprinus carpio), telapia (Oreochromis mossumbicus), nilotica (Oreochromis niloticus) etc. have also been introduced in the island. Among brackish water fishes, koral (Lates calearifer), Bata (Labco bata), khorsola (Rhinomugil corsula), bacha (Eatropicthys vacha), pabda (Ompok pabda), tatkini, gangchela (Salmostoma acinaces) etc. are the most common. Besides, marine fishes like bhetki (Lates calearifer), illis (Hilsa Ilisha), topshi (Polynemus paradiseus), datina (Acanthopagrus latus), terabhangan (Polynemus indicus), bhola (Scheama semiluctuosa) etc. are commonly found.

4.2.4 Ecologically Sensitive Areas

300. An Ecologically Critical Area (ECA) is an environmental protection zone in Bangladesh. In 1995, specific areas in Bangladesh could be deemed Ecologically Critical Areas as a result of the Environmental Conservation Act. The Government after considering the human habitat, ancient monument, archaeological site, forest sanctuary, national park, game reserve, wild animal habitat, wetland, mangrove, forest area, biodiversity and other relevant factors of the area can be declared as ECA.

4.2.4.1 Sensitive locations and project boundaries

As per the legal mandate the MOEF till now 13 areas are declared as ECA and 57 areas as EPA. DoE as a statutory body is entrusted to manage the ECAs and EPAs. There is no ECA nor EPA area in the closest proximity of the project area (Figure 4-25, Figure 4-26). However, 3 nearest EPA areas are Nijhum Dwip, Char Kukri Mukri and Sonarchar Wildlife Sanctuary which are located at 21.5 km, 22 km and 38km distance respectively from the Char Fasson Substation.

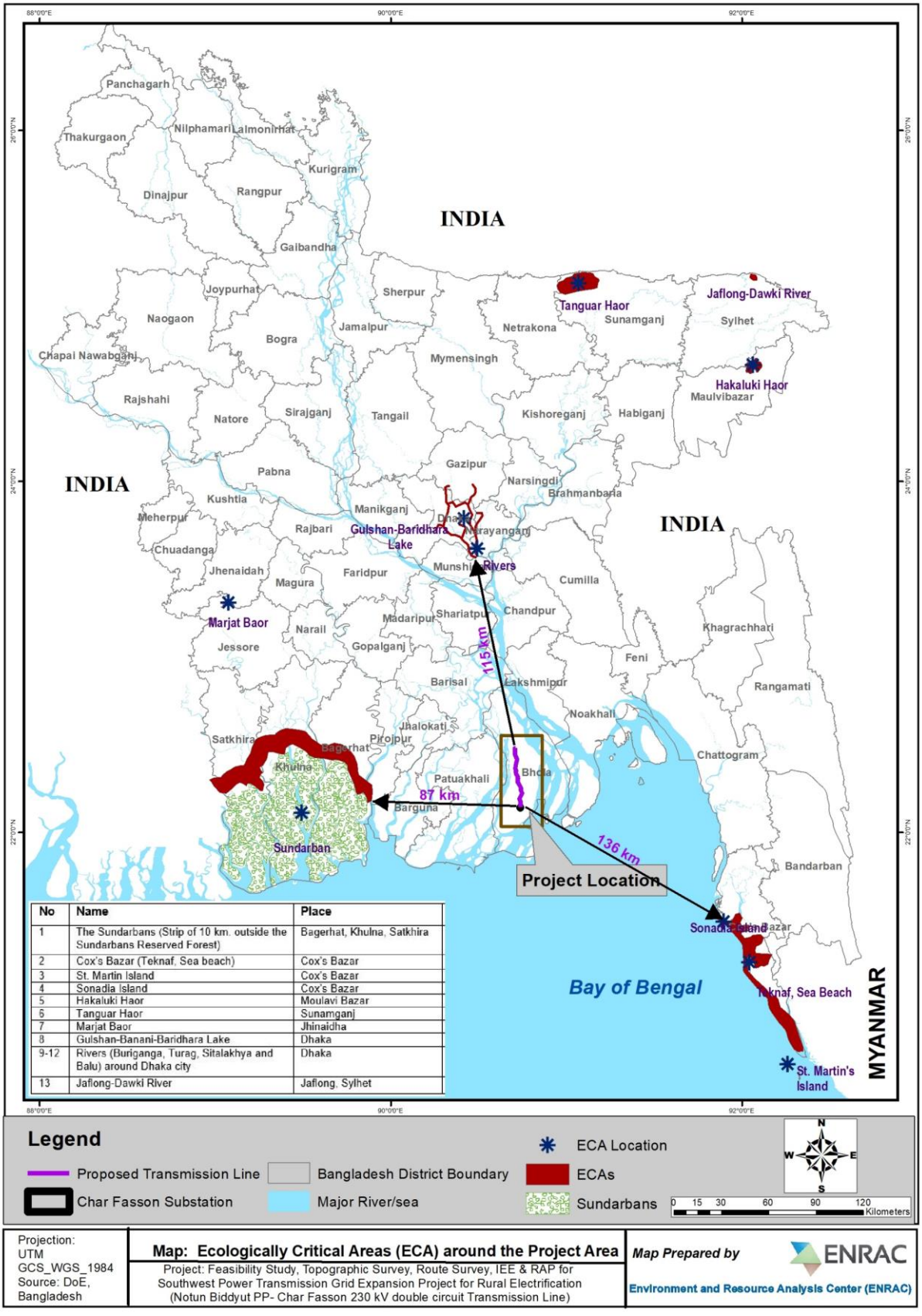
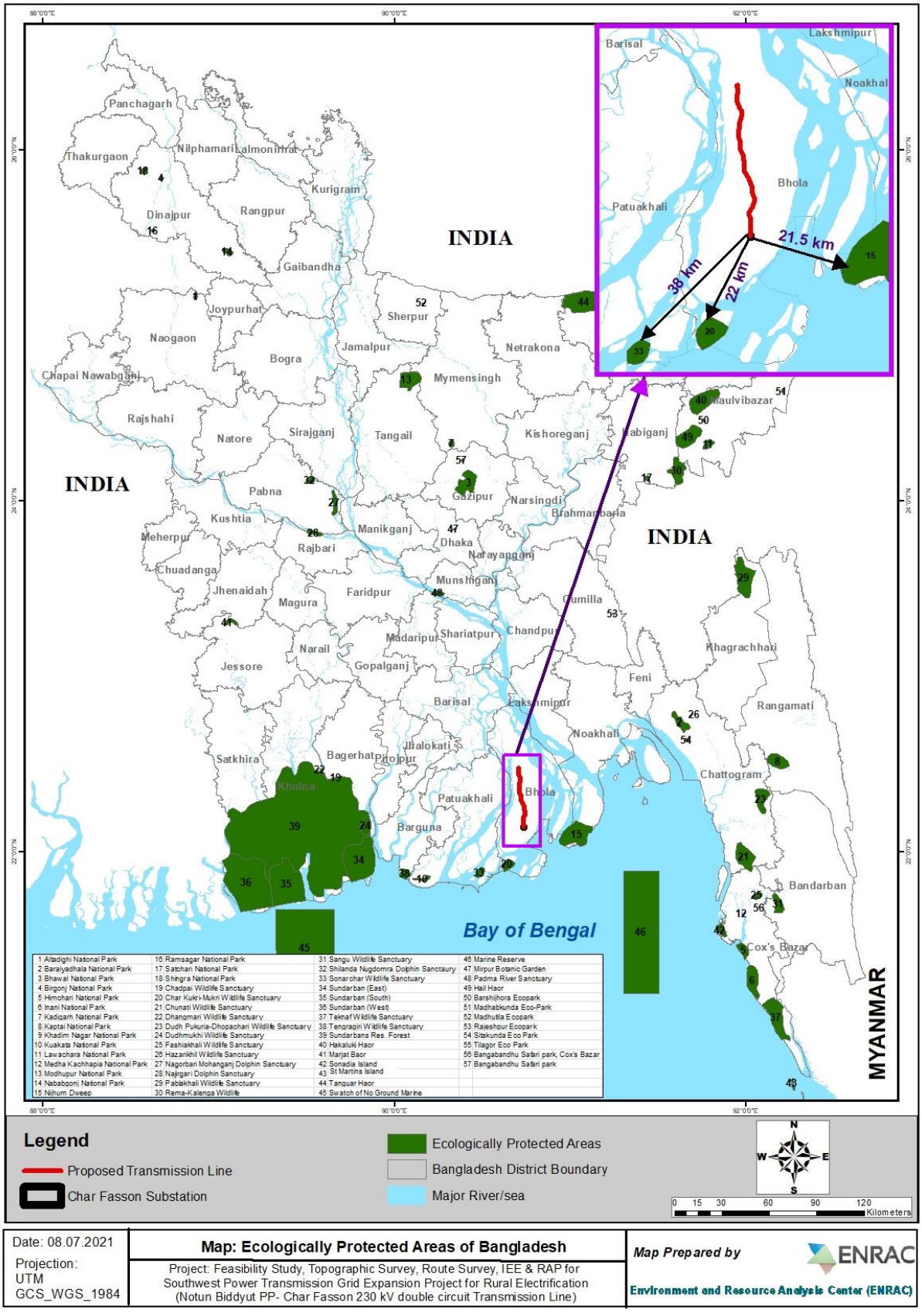


Figure 4-25: Ecologically Critical Areas of Bangladesh



Date: 08.07.2021
Projection: UTM
GCS_WGS_1984

Map: Ecologically Protected Areas of Bangladesh

Project: Feasibility Study, Topographic Survey, Route Survey, IEE & RAP for Southwest Power Transmission Grid Expansion Project for Rural Electrification (Notun Biddyut PP- Char Fasson 230 kV double circuit Transmission Line)

Map Prepared by
ENRAC
Environment and Resource Analysis Center (ENRAC)

Figure 4-26: Ecologically Protected Areas of Bangladesh

4.2.4.2 International Migratory Bird flyways and breeding places

301. Flyways are the routes that migratory birds use to cross from breeding grounds to wintering grounds. A number of migratory flyways crisscross Asia: The West Pacific Flyway, East Asia-Australasia Flyway, and the Central Asia-Australasia Flyway, which covers most of Asia. EAAF extends from the Arctic Circle to Australia, New Zealand, and east and south-east Asia, covering 22 countries. During the annual migration, hundreds of thousands of waterbird species use this route. This flyway is home to more waterbird species, including 34 species that are globally threatened or Near Threatened. (That is 20% of the total of all threatened species of all the world's flyways.) Moreover, EAAF contains 95% of all the birds that migratory birds have ever existed, including Spoon-billed Sandpipers and Chinese Crested Terns (both critically endangered species).

302. The EAAF did not cross the project area. The transmission line is located 27 km east from the EAAF (Figure 4-27). So migratory birds are less likely to be affected by the proposed 230kV transmission lines. However local birds may be affected by colliding with the 230kV transmission lines.

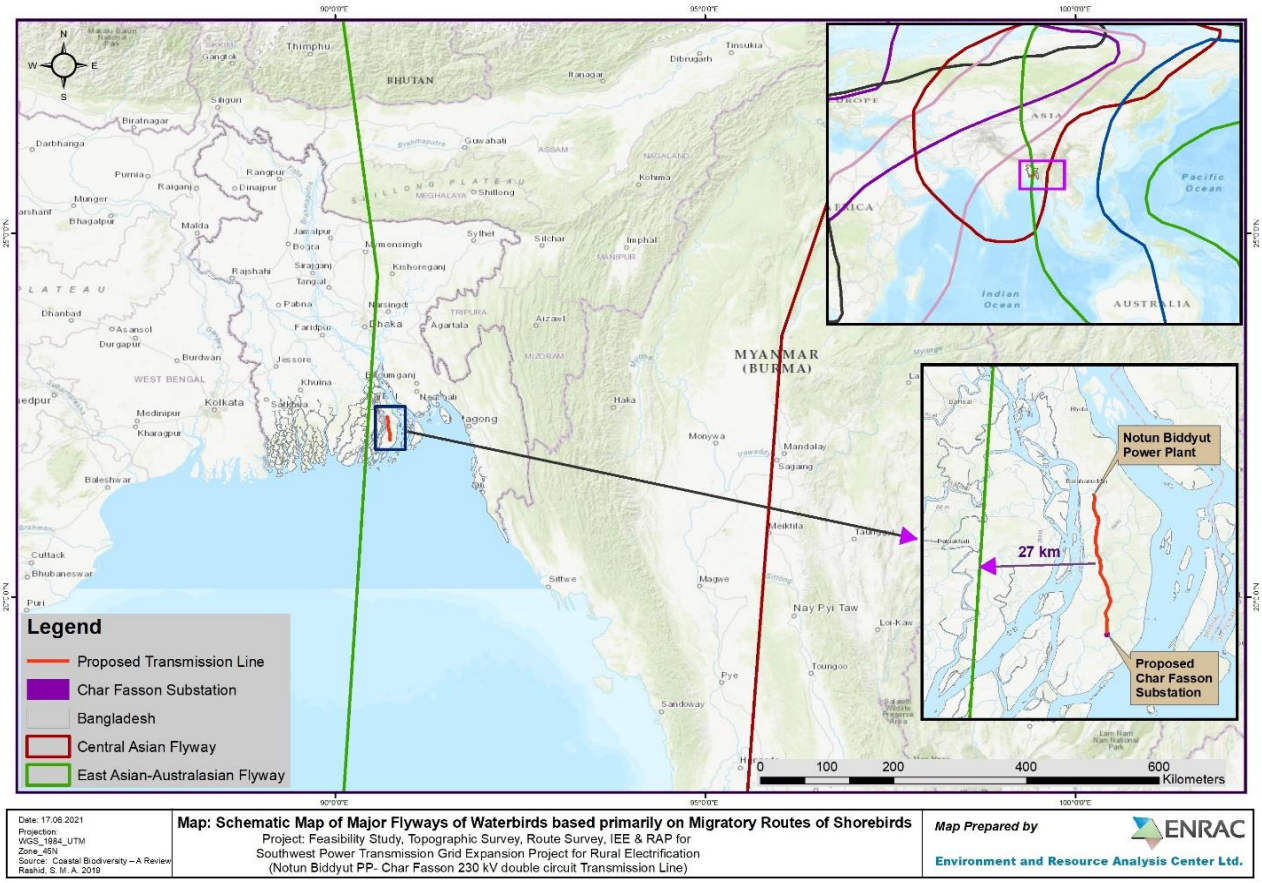


Figure 4-27: Major Flyway Near Project Site

4.2.4.3 Compliance with the Asia-Pacific Migratory Water Bird Conservation Strategy 2001-2005

303. The Asia-Pacific migratory waterbirds conservation strategy outlines 16 countries in the Central Asian-Indian Flyway viz., Afghanistan, Azerbaijan, Bangladesh, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Maldives, Mongolia, Nepal, Pakistan, Russian

Federation, Sri Lank, Tajikistan and Uzbekistan (Ghalib, 2009). More than 130 shorebird species have been recorded in Asia-Pacific, and a minimum population of 9 million birds is estimated.

304. There is a threat to these species because they are vulnerable. It was felt that international cooperation is necessary for their conservation. The result was the Asia-Pacific Shorebirds Conservation Strategy 1996-2000 (Ghalib, 2009) and the Asia-Pacific Shorebirds Action Plan 1998-2000 (SWGWIAS, 1998-2000). The 2001-2005 version has now been updated. The mission statement of the plan is "To achieve the long-term conservation of migratory shorebirds and their habitats in Asia-Pacific through the establishment of networks of appropriately.

305. Power lines kill millions of birds every year around the world. Several of these species are critically endangered. Utility networks can also be damaged, and this can result in power shortages. In order to comply with the Asia-Pacific Migratory Water Bird Conservation Strategy 2001-2005 along with avoid the utility network damage the following steps will be followed as per the requirement.

4.2.5 Vulnerability to Birds, Flying Mammals and Species

306. The vulnerability to Birds, flying mammals and species due to collision with transmission line and electrocuted by electric power lines. Vulnerability due to collusion raise due to the not having the visual of transmission line in most of the cases and the possibility of electrocution occurs when the wires are close together. In that scenario the avifauna get in contact with energized wire and neutral which results in electrocution. The vulnerability of Birds, flying mammals and species have been assessed and provided in Table 4-11. There is mitigation measure to reduce the vulnerability by increase the height of the transmission line and the placement of individual wire at a minimum width of (>60cm). This will minimize the vulnerability for both scenarios.

Table 4-11: Vulnerability Assessment of Birds, Flying Mammals and Species to Colloid with Transmission Lines During Operation

Potential Impacts	Type	Duration of Impact	Spatial Extent	Reversible or not	Likelihood	Intensity	Sensitivity	Significance Prior to Mitigation	Significance after Mitigation
Birds, Flying mammal's collision	Direct	Long term	Local	No	Likely	Low	Low	Low	Low
Electrocution of Birds, Flying mammal's	Direct	Long term	Local	No	Likely	Medium	Medium	Medium	Low

4.2.6 Introduction of Invasive Species

307. An invasive species is a led animal that negatively alters its new environment. Although their spread can have beneficial aspects, but can also cause of ecological, environmental, and/or economic damages.

308. A complete and reliable inventory of invasive alien species is still lacking in Bangladesh. The majority of the exotic species were introduced into the country without any proper documentation (Barua et al. 2001). There are also contradictions in the definition and the use of the term IAS in Bangladesh, and not all the exotics are harmful (Mukul et al. 2006). Table 4-12 provides a list of common invasive species in Bangladesh based on secondary literature.

Table 4-12: List of Invasive Species

Life form	Scientific name	Common name	Origin/ Native range	Habitat type(s)
Bird	Columba livia	Rock pigeon	Europe	TER
Fish	Aristichthys nobilis	Cyprinus carpio	China	AQU
	Carassius auratus	Goldfish	Europe, Asia	AQU
	Clarias gariepinus	African sharptooth catfish	Africa	AQU
	Ctenopharyngodon idella	Grass carp	China, Russia	AQU
	Cyprinus carpio	Common carp	China, Russia	AQU
	Oreochromis mossambicus	Common tilapia	Africa	AQU
	Oreochromis niloticus	Nilotica	Africa	AQU
	Pangasius sutchi	Pangas	Thailand	AQU
Insect	Diaphorina citri	Asian citrus psyllid	Asia	AGR
	Paratrechina longicornis	Crazy ant	Africa	FOR
	Tapinoma melanocephalum	Ghost ant	N/A	FOR
	Trogoderma granarium	Khapra beetle	India	AGR
Plant	Acacia auriculiformis	Acacia	Australia and Pacific	FOR
	Acacia mangium	Black wattle	Australia and Pacific	FOR
	Acanthospermum hispidum	Hispid starburr	Central and South America	AGR, WF

Life form	Scientific name	Common name	Origin/ Native range	Habitat type(s)
	Ageratum conyzoides	Billy goat weed	South America	FOR, AGR, WF
	Alternanthera flocoidea	Joseph's coat	South America	WF
	Atylosia scarabaeoides	Wild pigeonpea	Australia	AGR, WF
	Cardamine flexuosa	Wavy bittercress	Europe	AGR, WF
	Cassia occidentalis	Mogdad coffee	South America	WF
	Cestrum diurnum	Day blooming cestrum	South America	AGR, WF
	Chromolaena odorata	Siam weed	South America	FOR, AGR

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5. Social Baseline

5.1 Socio-Economic Resources

5.1.1 Administrative Bounding of the Study Area

309. The alignment has an approximately southward direction. It starts at the Bhola Notun Bidyut Power Plant in Burhanuddin upazila and moves towards south for 39.81 km and ends at Char Fasson substation passing through the Lalmohan upazila. In Burhanuddin upazila the alignment starts at Sachra union, then towards Deula union. From Deula union the alignment enters Lalmohan upazila through Badarpur union and crosses Kalma union, then further south passes through Lalmohan Paurashava, Farazganj, Lalmohan and Paschim Char Umed unions. From Paschim Char Umed union the alignment enters Char Fasson upazila and passes the unions Osmanganj, Aminabad and Char Fasson Paurashava.

5.1.2 Demography

Burhanuddin Upazila

310. According to Population and Housing Census 2011, the total population of the upazila is 233860 of which 115033 are males and 118827 are females. The sex ratio of the upazila is 97 which has remarkably decreased in 2011 as against 106 in 2001.

Lalmohan Upazila

311. According to Population and Housing Census 2011, the total population of the upazila is 283889 of which 138877 are males and 145012 are females. The sex ratio of the upazila is 96 which has remarkably decreased in 2011 as against 107 in 2001.

Char Fasson Upazila

312. According to Population and Housing Census 2011, the total population of the upazila is 456437 of which 228693 are males and 227744 are females. The sex ratio of the upazila is 100 which has remarkably decreased in 2011 as against 107 in 2001.

313. Table 5-1shows population for all 3 upazilas in years 2001 and 2011 as per Population and Housing Census 2011 (BBS-1, July 2013).

5.1.3 Household Size

Burhanuddin Upazila

314. In the Burhanuddin upazila, there are 48534 households. Distribution of household by type shows that there are 99.68% general unit, 0.04% institutional and 0.28% other unit. The average household size (General) for the upazila is 4.8 persons, for rural area the size is also 4.8 and for urban area the size is slightly higher i.e., 4.9. (BBS-2, December 2013).

Lalmohan Upazila

315. In Lalmohon upazila, there are 60988 households. Distribution of household by type shows that there are 99.88% general unit, 0.02% institutional and 0.10% other unit. The average household size (General) for the upazila is 4.6 persons, for rural area the size is also 4.6 and for urban area the size is slightly higher i.e., 4.8 (BBS-2, December 2013).

Char Fasson Upazila

316. In the Char Fasson upazila, there are 94649 households. Distribution of household by type shows that there are 99.83% general unit, 0.02% institutional and 0.15% other unit. The average household size (General) for the upazila as well as for its rural and urban area is 4.8 persons (BBS-2, December 2013).

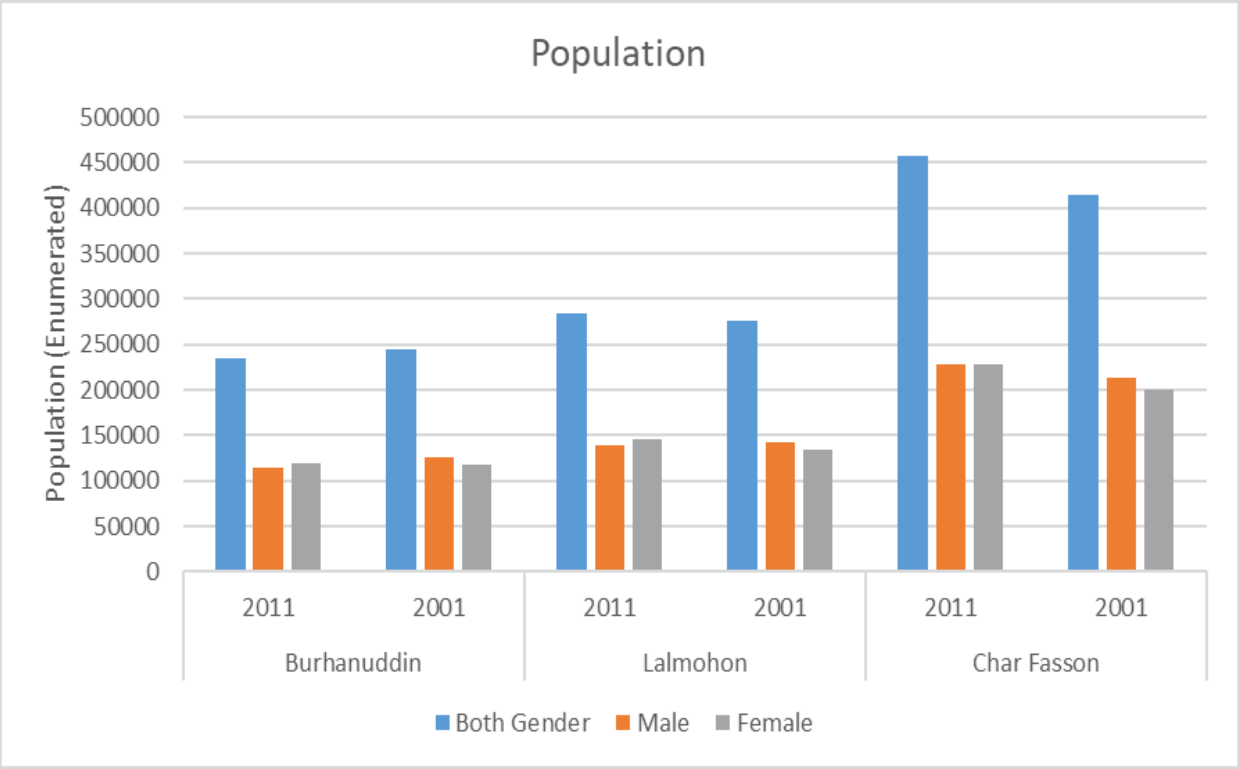


Figure 5-1: Population of the project area

5.1.4 Age Structure

317. Though the population growth of the country is now gradually declining, yet around 2.0 million population are being added to our population every year which is larger than the total population of many countries of the world. Age-sex composition of population is important as it has direct bearing on many socioeconomic factors of the country. The large population in the younger age group particularly 0-14 leads to higher demographic dependency or burden to the working age population which is also true for the population of higher ages 65 years and over. Figure 5-2 shows a graphical presentation of the age structure for Bhola district. Figure 5-3 shows Percentage of Population by Age Group for three upazilas. And Table 5-1 presents Population Distribution by Age Group and Gender for three Upazilas

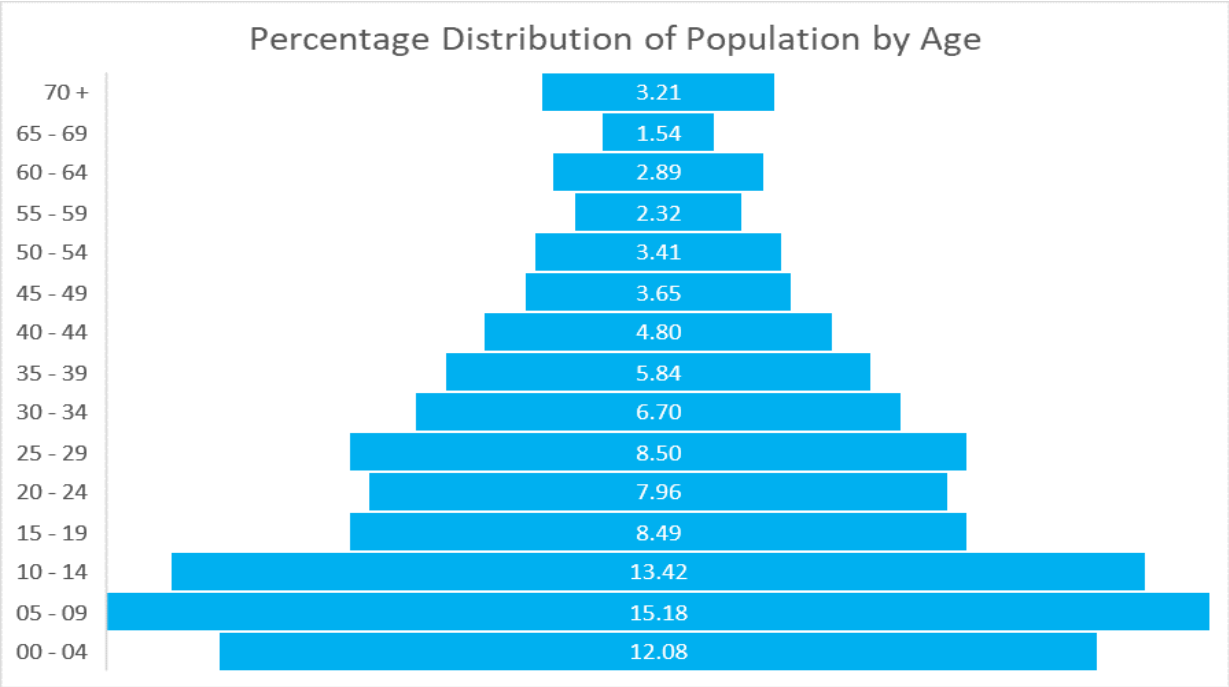


Figure 5-2: Percentage Distribution of Population by Age Group-2011,

Source: (BBS-3, November 2015)

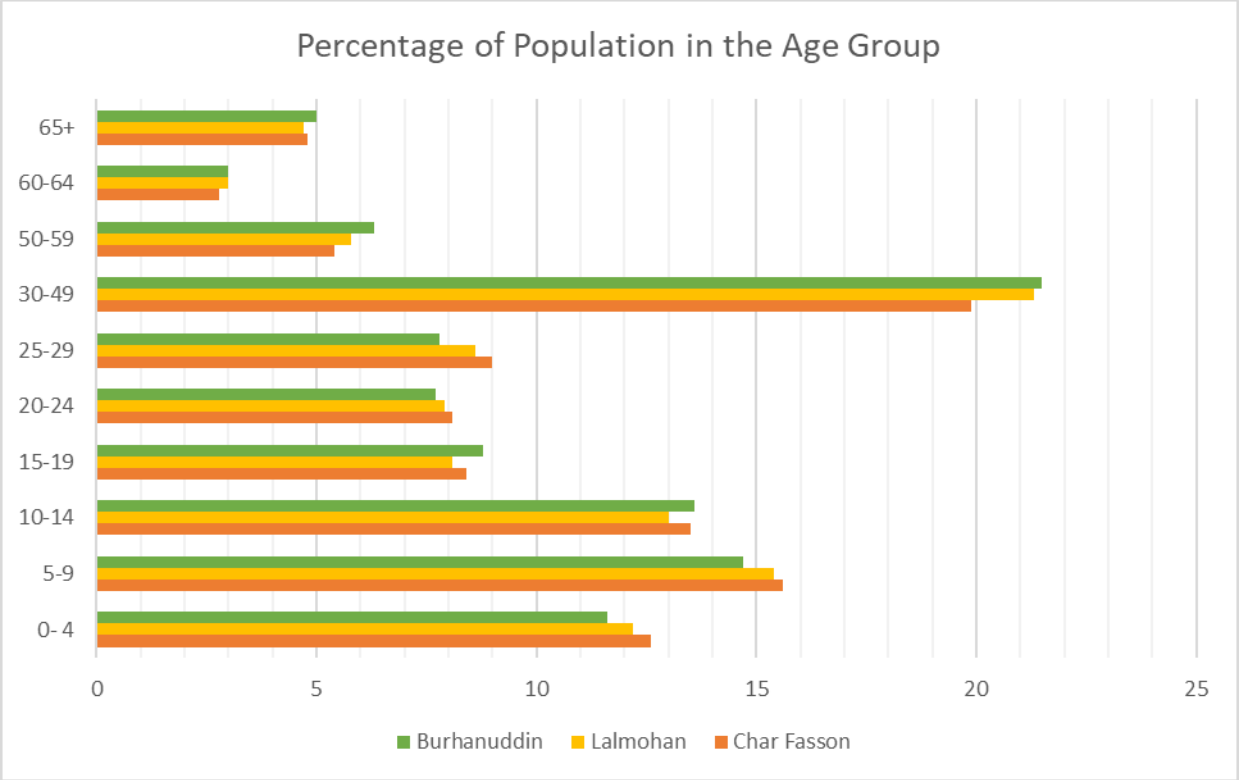


Figure 5-3: Percentage of Population by Age Group

Source: (BBS-2, December 2013)

Table 5-1: Population Distribution by Age Group and Gender for three Upazilas

	Burhanuddin			Lalmohan			Char Fasson		
Age Group	5-9	10-14	18+	5-9	10-14	18+	5-9	10-14	18+
Male	17612	16383	60537	22340	19266	72694	36350	31976	118449
Female	16676	15389	68102	21412	17694	82711	34982	29716	125270
Both	**34288**	**31772**	**128639**	**43752**	**36960**	**155405**	**71332**	**61692**	**243719**

Source: (BBS-4, March 2014)

5.1.5 Dependency Ratio

318. It is the ratio of population in the age groups 0-14 and 65 and above to the total working population in age group 15-64. The child dependency ratio measures the ratio of population of age group 0-14 to the total working population in age group 15-64 and the elderly dependency ratio is the ratio of population in age group 65 years and above to the same total working population. According to above description, the dependency ratio, child dependency ratio and elderly dependency ratio for the three upazilas is resented in Table 5-2.

Table 5-2: Dependency Ratio of Three Upazilas

	Burhanuddin	Lalmohan	Char Fasson
Dependency Ratio	81.49	82.82	86.75
Child Dependency Ratio	72.41	74.22	77.80
Elderly Dependency Ratio	9.07	8.59	8.96

Source: Data from (BBS-2, December 2013)

5.1.6 Ethnic Community

319. The majority of the people from the three upazilas are Muslims (>95%), the rest are Hindus. However ethnic people are present in adjacent districts Barisal and Patuakhali, but no ethnic people has been reported in the Bhola district (FTPP, 2017)

5.1.7 Literacy Rate

Burhanuddin Upazila

320. In Burhanuddin Upazila, it is found that 47.9% population aged 7 years and over are literate. the literacy rate of the upazila in 2011 is 47.9% for both sex, 49.2% for male and 46.7% for female. It shows an increase of 10.7, 9.2 and 12.5 percent point in 2011 over 2001 for both sex, male and female respectively. In the upazila, the literacy is the highest i.e., 77.6% in Ward No. 06 of Burhanuddin Paurashava and the lowest i.e., 34.3% in Deula Union.

Lalmohon Upazila

321. In Lalmohan upazila, it is found that 40.0% population aged 7 years and over are literate. the literacy rate of the upazila in 2011 is 40.0% for both sex, 41.3% for male and 38.8% for female. It shows an increase of 7.8, 5.6 and 10.3 percent point in 2011 over 2001 for both sex, male and female respectively. In the upazila, the literacy is the highest i.e., 71.7% in Ward No. 06 of Lalmohan Paurashava and the lowest i.e., 33.7% in Farazganj Union.

Char Fasson Upazila

322. In Char Fasson Upazila, it is found that 43.5% population aged 7 years and over are literate. the literacy rate of the upazila in 2011 is 43.5% for both sex, 43.1% for male and 43.8% for female. It shows an increase of 5.8, 3.0 and 8.5 percent point in 2011 over 2001 for both sex, male and female respectively. In the upazila, the literacy is the highest i.e., 86.3% in Ward No. 07 of Char Fasson Paurashava and the lowest i.e., 22.1% in Mujib Nagar Union.

323. Figure 5-4 shows literacy rate comparison for all 3 upazilas among years 1991, 2001 and 2011 as per Population and Housing Census 2011 (BBS-1, July 2013).

5.1.8 Access to Health Facilities

324. According to District Statistics 2011- Bhola, there are 1 Zila Hospital, 7 Upazila Health Complexes, 9 Non-Government Health Complexes, 9 Private Diagnostic Clinics, 68 Union Health and Family Planning Centers and 11 Satellite Clinics. Healthcare facilities with number of private hospitals/ clinics, diagnostic centers, health centers and family planning services are presented in Figure 5-5. Health facilities in overall Bhola district is presented in Table 5-3.

Table 5-3: Health facilities in overall Bhola district

Facility Type	Number
Community Clinic	25
Union Sub-Center	6
Family Welfare Center	14
Upazila Family Welfare Center	4
Upazila Health Complex	6
Maternal and Child Welfare Center	2
District Hospital	1
Clinics	2
Hospitals	0
PHs	1
Total	**61**

Source Bangladesh Health Facility Survey, 2016, USAID

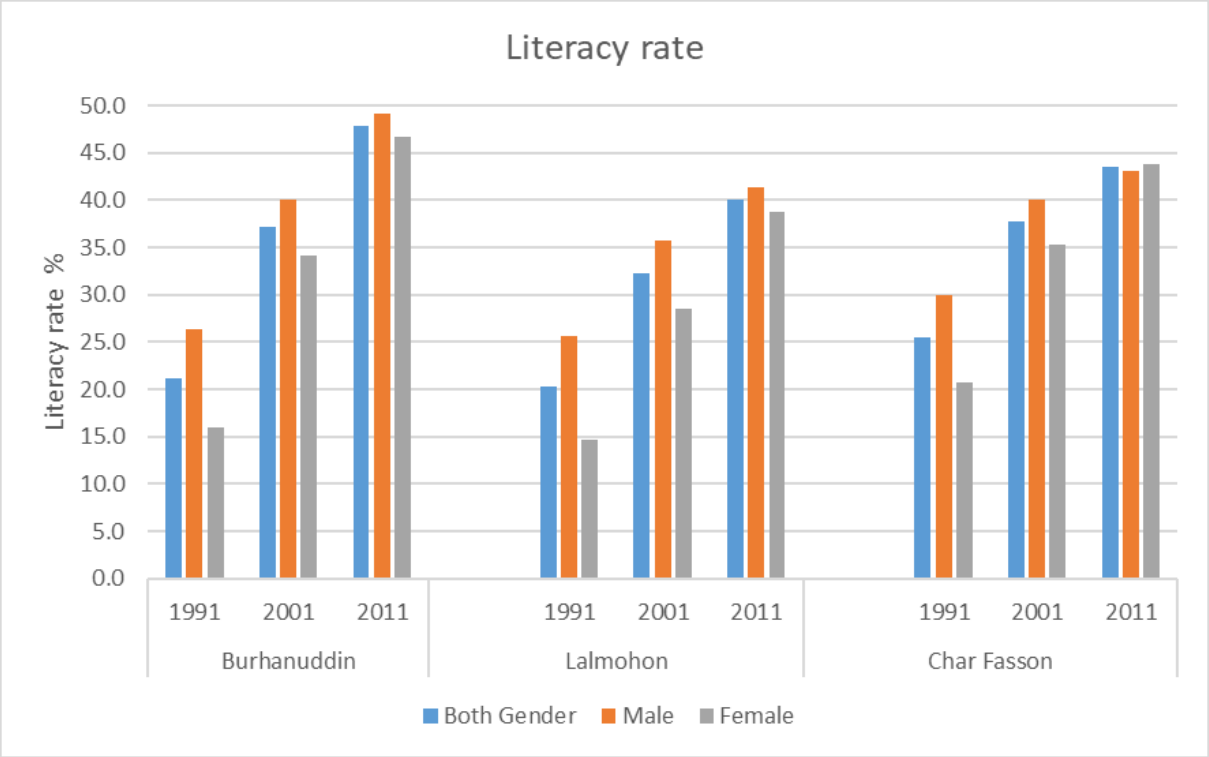
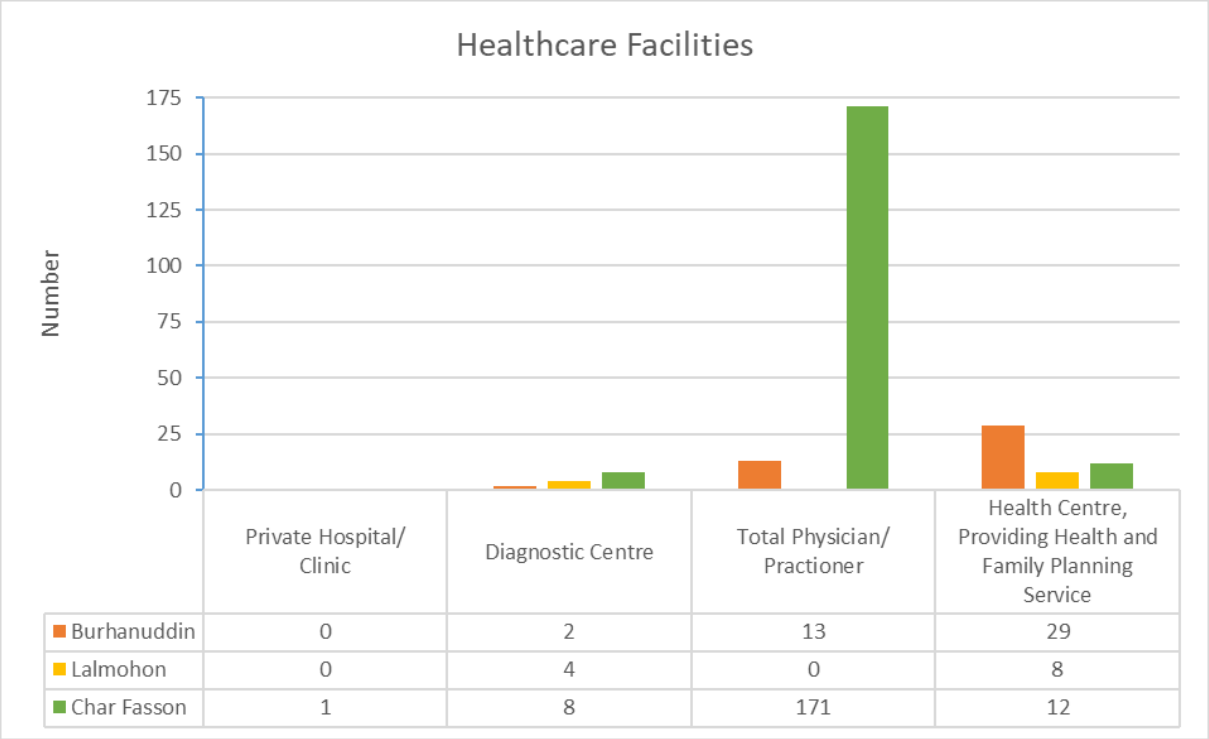


Figure 5-4: Literacy rate Comparison of three upazilas,

Source (BBS-1, July 2013)



	Private Hospital/ Clinic	Diagnostic Centre	Total Physician/ Practioner	Health Centre, Providing Health and Family Planning Service
Burhanuddin	0	2	13	29
Lalmohon	0	4	0	8
Char Fasson	1	8	171	12

Figure 5-5: Healthcare Facilities of three Upazilas

Source: (BBS-2, December 2013)

5.1.9 Employment Opportunity and Unemployment

325. The number of unemployed persons in the sample is relatively small and represented only 3.6% of the household population (BBS-2, December 2013). This may be due to the engagement of many household members in a variety of seasonal and casual employment such as in daily paid labor work.

326. Employment opportunities in the project impact areas are rather negligible as there are no industrial or commercial ventures that can absorb the unemployed. Due to a lack of employment opportunities in the surrounding areas, most of the unemployed people find work in seasonal agricultural activities, fishing or in daily paid casual labor work as a source of livelihood to support their families. Some unemployed persons will operate as tenant farmers, cultivating the land belonging to another party and sharing part of the produce with the landowner. A fair number of children also work in various factories or fishing activities to find extra incomes for their families despite child labor being illegal. Agricultural laborers and sharecroppers in the study area suffer from lack of work and inability to engage in cultivations due to regular flooding in the area. Most of the women are engaged in household labor and in agriculture, livestock farming, tailoring and manufacture of handicrafts to earn a supplementary income for their families. In some communities, women would also engage in casual daily paid labor work whereas in other communities they would not go for such labor work. Many rural women are deprived of working outside due to customary and social beliefs and taboos. Many youth aspire to find employment in a foreign country.

327. According to Bangladesh Population and Housing Census 2011, employment status for the population aged 7 years and above-but not attending school for the three upazilas is presented in Figure 5-6. Data shows that about 12.16% of the population from the three upazilas are employed whose age is 7 years plus and not attending school. Of the employed population 84.85% are engaged in agricultural work, 4.45% are working at industries and 10.7% are working as service holders.

5.1.10 Availability of Labor and Wage Rate

328. According to Bangladesh Population and Housing Census 2011, Daily average wage rate of agricultural labor for the upazilas range from taka 250-300 for males, 200-250 for females and 170-200 for children (considered under 15 years old).

329. Daily average wage rate for the upazilas for construction labor for Mason, Helper (Jogaly), Carpenter, Painter, Electrician, Plumber etc. range from taka 300-500.

330. Daily average wage rate of non-agricultural labor for the upazilas range from taka 200-300 depending on work types (BBS-2, December 2013).

5.1.11 Migration

331. 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.

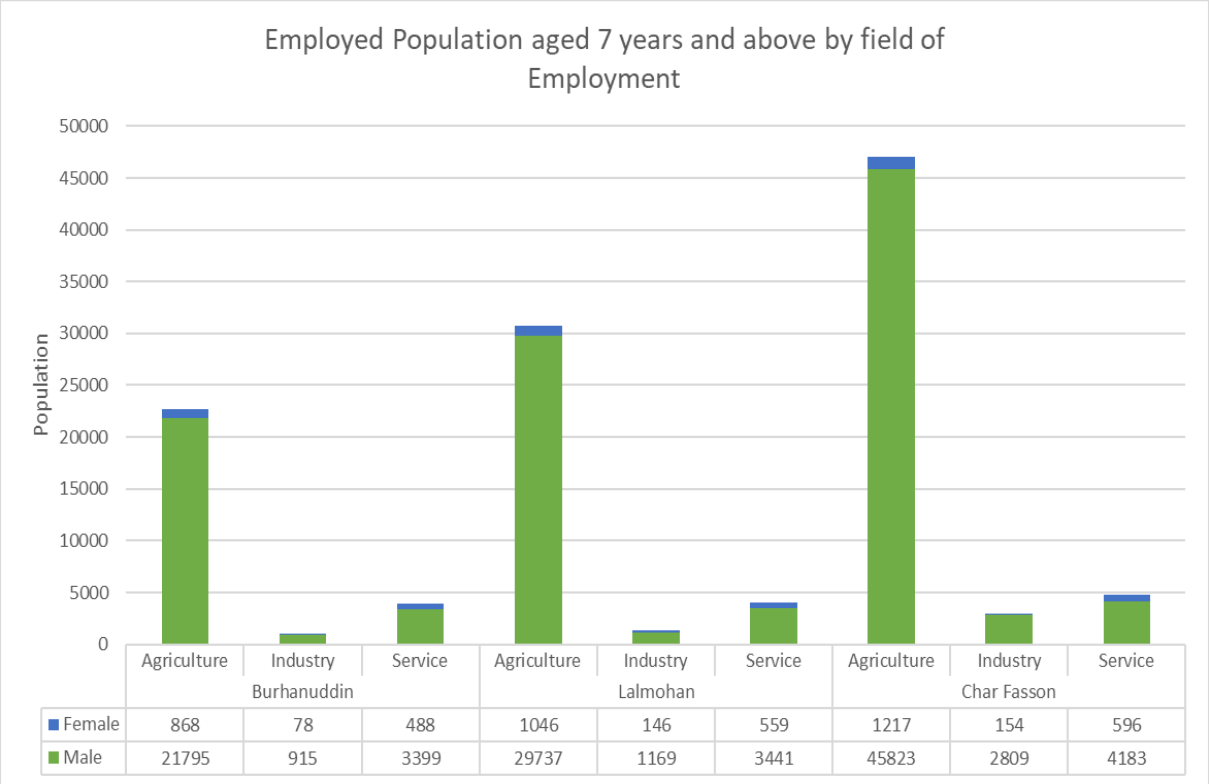


Figure 5-6: Employed Population Aged 7 years and above in three Upazilas

Source: (BBS-1, July 2013)

5.1.12 Housing Condition

Burhanuddin Upazila

332. In the upazila, 1.7% general household live in pucca house, 7.6% in semi-pucca house, 87.8% in kutcha house and the remaining 2.9% live in jhupri.

Lalmohan Upazila

333. In the upazila, 1.3% general household live in pucca house, 6.4% in semi-pucca house, 89.5% in kutcha house and the remaining 2.8% live in jhupri.

Char Fasson Upazila

334. In the upazila, 1.3% general household live in pucca house, 7.0% in semi-pucca house, 85.5% in kutcha house and the remaining 6.2% live in jhupri.

335. Figure 5-7 presents each type of housing structure percentage per upazila (BBS-1, July 2013).

5.1.13 Drinking Water Facilities

Burhanuddin Upazila

336. In Burhanuddin Upazila, 97.5% general household get the facility of drinking water from tube-well, 0.2% from tap and the remaining 2.3% household get water from other sources.

Lalmohan Upazila

337. In Lalmohon Upazila, 97.8% general household get the facility of drinking water from tube-well, 0.4% from tap and the remaining 1.8% household get water from other sources.

Char Fasson Upazila

338. In Char Fasson Upazila, 93.3% general household get the facility of drinking water from tube-well, 0.3% from tap and the remaining 6.4% household get water from other sources.

339. Figure 5-8 shows graphical representation of sources of drinking water for all three upazilas (BBS-1, July 2013).

5.1.14 Sanitation Facilities

Burhanuddin Upazila

340. In Burhanuddin Upazila, 63.6% general household use sanitary latrine, 31.0% non-sanitary latrine and the remaining 5.4% have no toilet facility.

Lalmohan Upazila

341. In Lalmohon upazila, 71.0% general household use sanitary latrine, 25.2% non-sanitary latrine and the remaining 3.8% have no toilet facility.

Char Fasson Upazila

342. In the upazila, 49.5% general household use sanitary latrine, 41.9% non-sanitary latrine and the remaining 8.6% have no toilet facility.

343. Figure 5-9 shows the sanitation types for each upazila (BBS-1, July 2013).

5.1.15 Access to Electricity

Burhanuddin Upazila

344. All the 9 unions of the Burhanuddin upazila have brought under the Rural Electrification Program. However, a total of 25.1% general household reported to have electricity connection in the entire upazila in 2011 as against 8.7% in 2001.

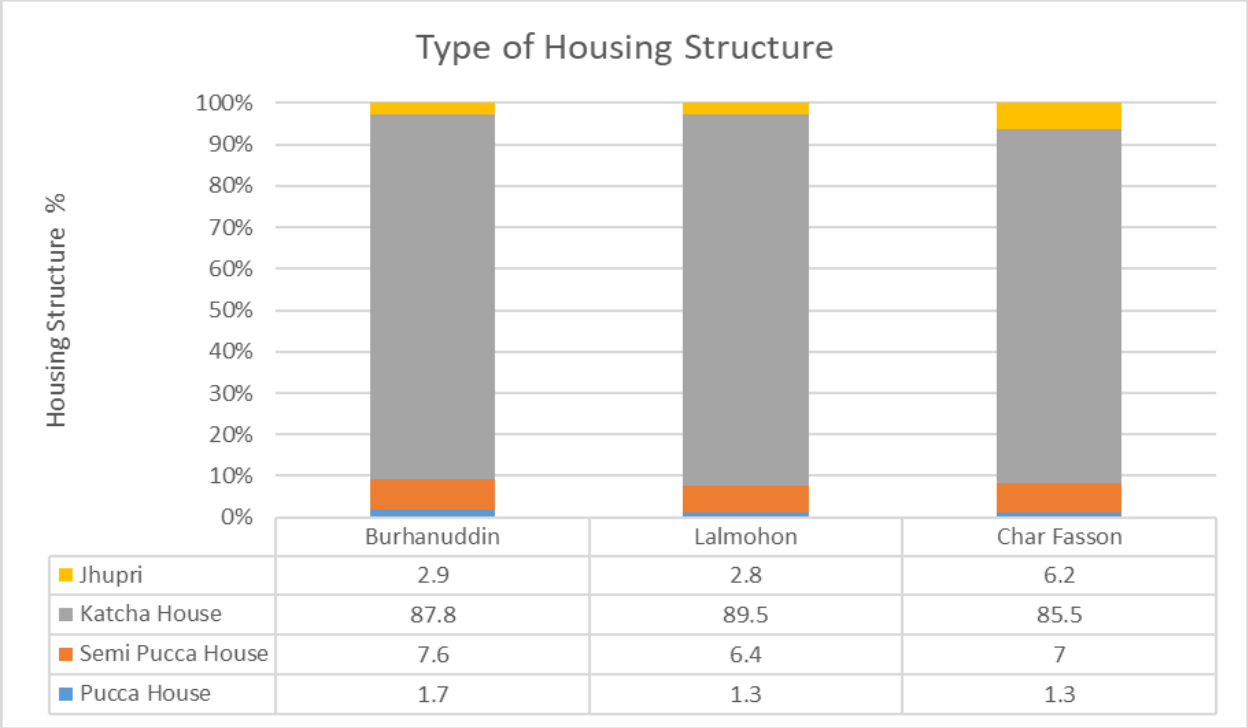
Lalmohan Upazila

345. All the 9 unions of the Lalmohon upazila have brought under the Rural Electrification Program. However, a total of 16.9% general household reported to have electricity connection in the entire upazila in 2011 as against 4.4% in 2001.

Char Fasson Upazila

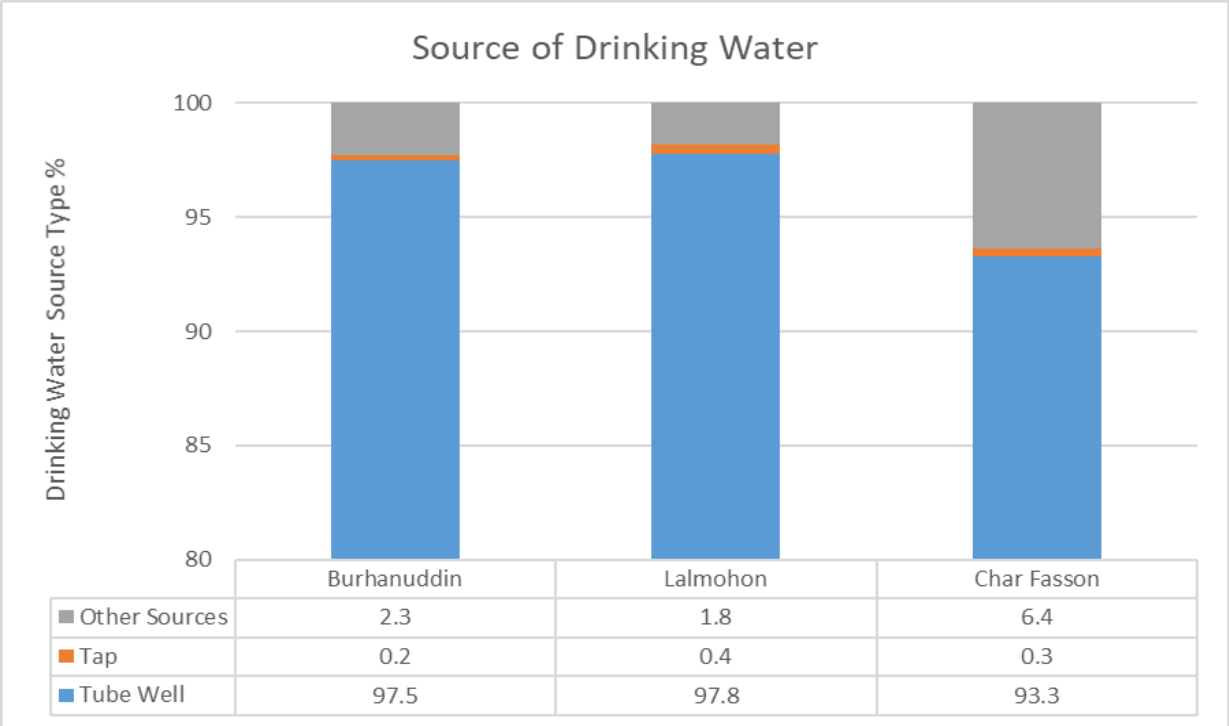
346. All the 19 unions of the upazila have brought under the Rural Electrification Program. However, a total of 18.7% general household reported to have electricity connection in the entire upazila in 2011 as against 3.8% in 2001.

347. Figure 5-10 shows improved electricity connection in the three upazilas after brought back under Rural Electrification Program (BBS-1, July 2013).



	Burhanuddin	Lalmohon	Char Fasson
Jhupri	2.9	2.8	6.2
Katcha House	87.8	89.5	85.5
Semi Pucca House	7.6	6.4	7
Pucca House	1.7	1.3	1.3

Figure 5-7: Type of Housing Structure in three Upazilas



	Burhanuddin	Lalmohon	Char Fasson
Other Sources	2.3	1.8	6.4
Tap	0.2	0.4	0.3
Tube Well	97.5	97.8	93.3

Figure 5-8: Drinking water source in three upazilas

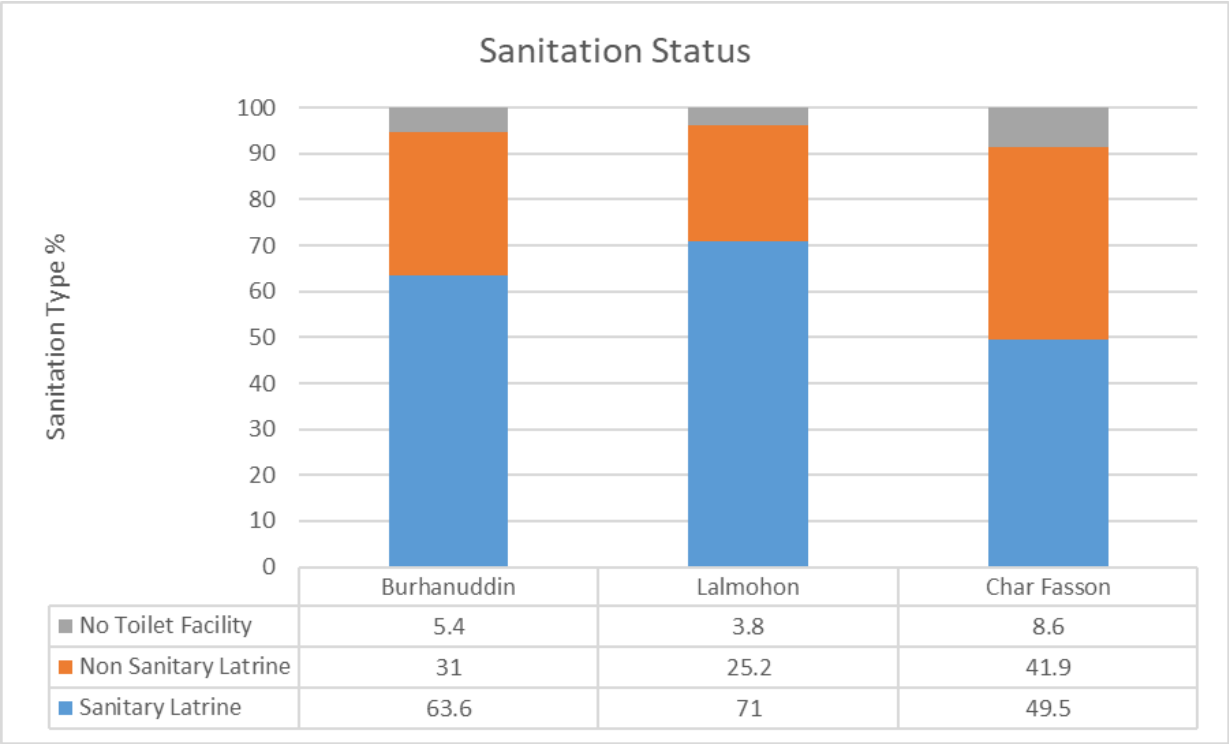


Figure 5-9: Sanitation Status for the three upazilas

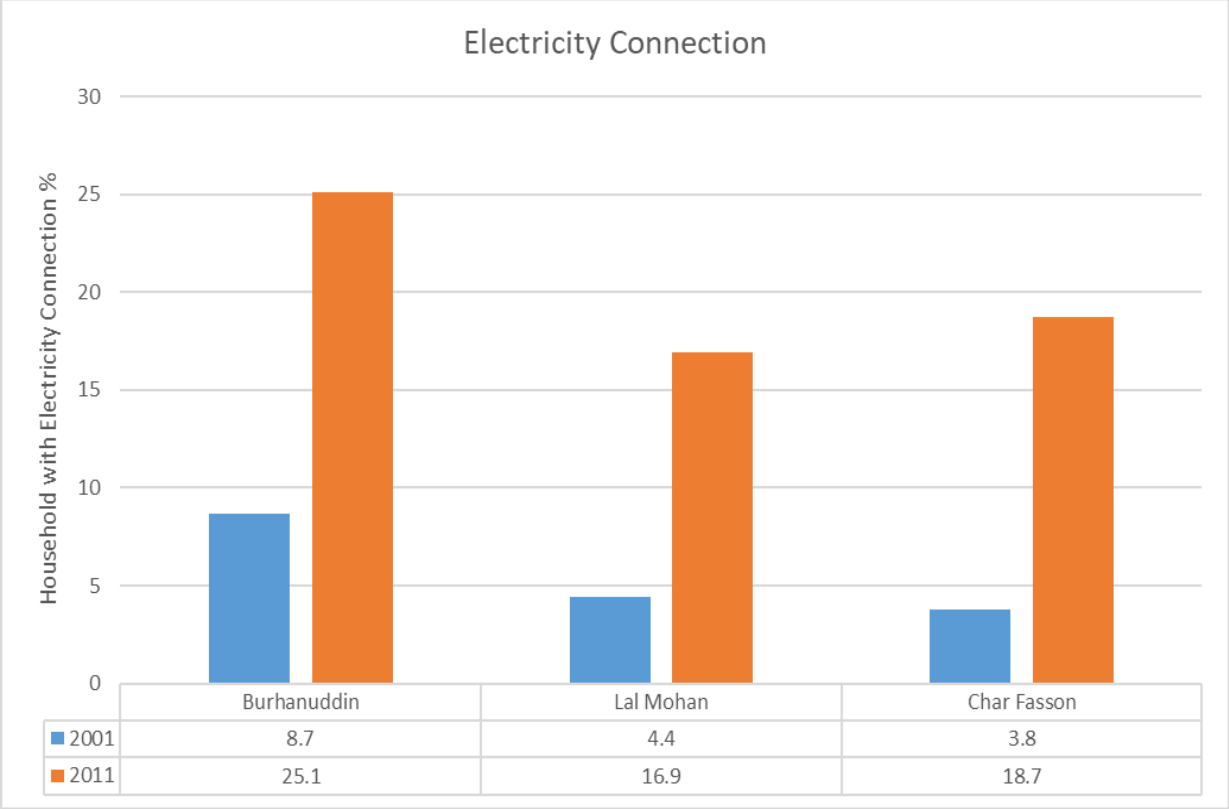


Figure 5-10: Household with improved Electricity Connection from 2001 to 2011

5.1.16 Land Use

348. Land use pattern of a country reflects its socio-economic stipulation. With the growth of a country's economy, agricultural land is usually transferred to non-agriculture as the demand for non-farm products and services increases. The land use map has been prepared to identify the land classification within the study area. Unlike the general floodplain area of Bangladesh, the land is typically covered by vegetation with settlements and agricultural areas. The land use pattern shows that a large part of the area is agricultural land covers 84.5% and vegetation covers 11.4 % of the Project corridor. The water bodies cover 3.2%, roads cover 0.6% and only 0.3% is covered by settlements. Land use map within 25m buffer of the Transmission lIne and the Substation has been presented in Figure 5-11 to Figure 5-17 in seven sections starting from Notun Biddyut Power Plant to the Substation.

Table 5-4: Land use Classification of Char Fasson 230 kV TL and Substation (within 25m Buffer)

Land use Classification	Area (Acre)	Area (%)
Settlement/ Structures	1.48	0.30
Waterbody	15.58	3.1
Vegetation	55.92	11.5
Road	2.97	0.6
Agricultural	413.84	84.5
Total	489.79	100.00

Source: ENRAC GIS Analysis

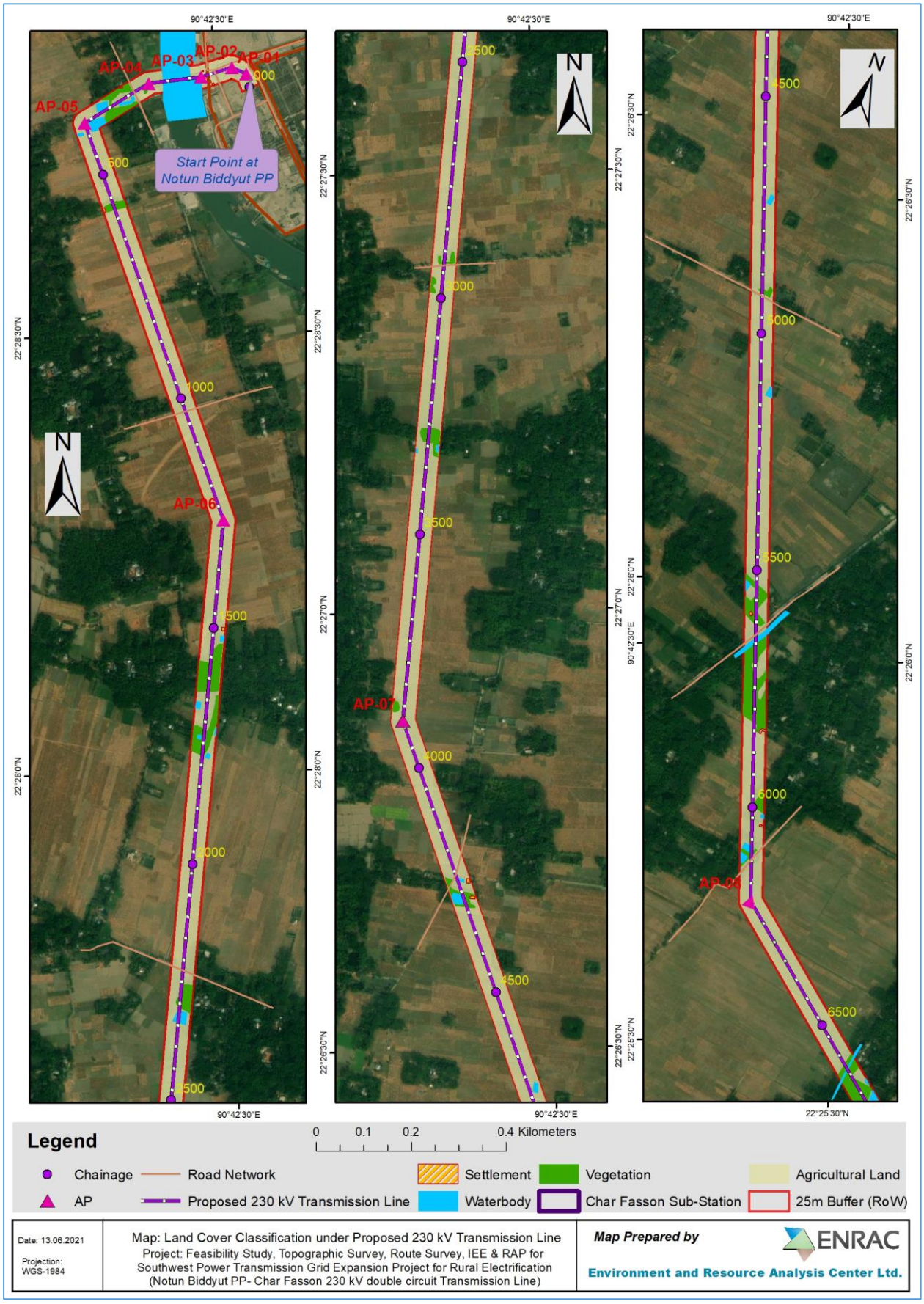


Figure 5-11: Land Use Classification of Project Area with 25m Buffer (Section 1 of 7)

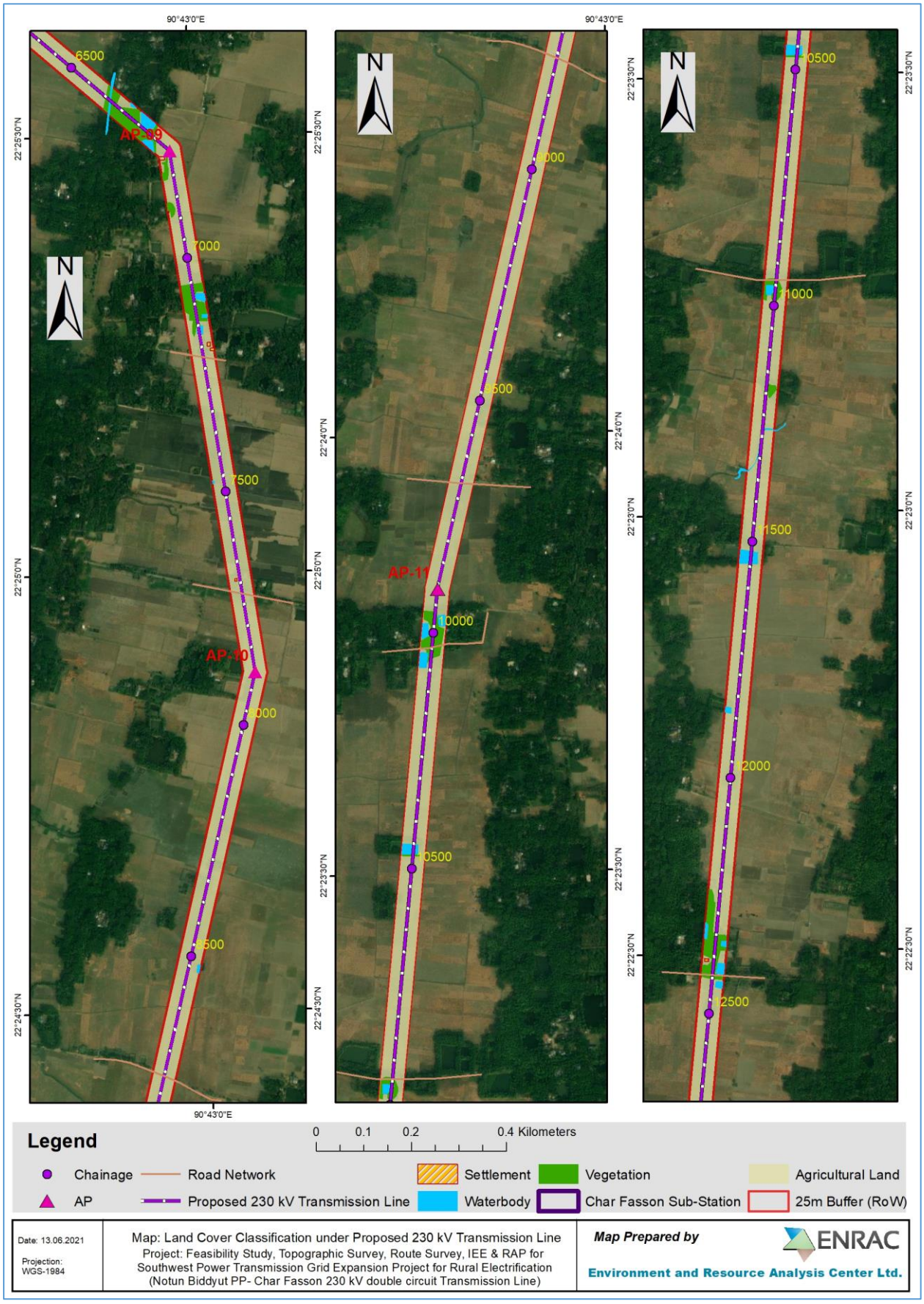


Figure 5-12: Land Use Classification of Project Area with 25m Buffer (Section 2 of 7)

Figure 5-13: Land Use Classification of Project Area with 25m Buffer (Section 3 of 7)

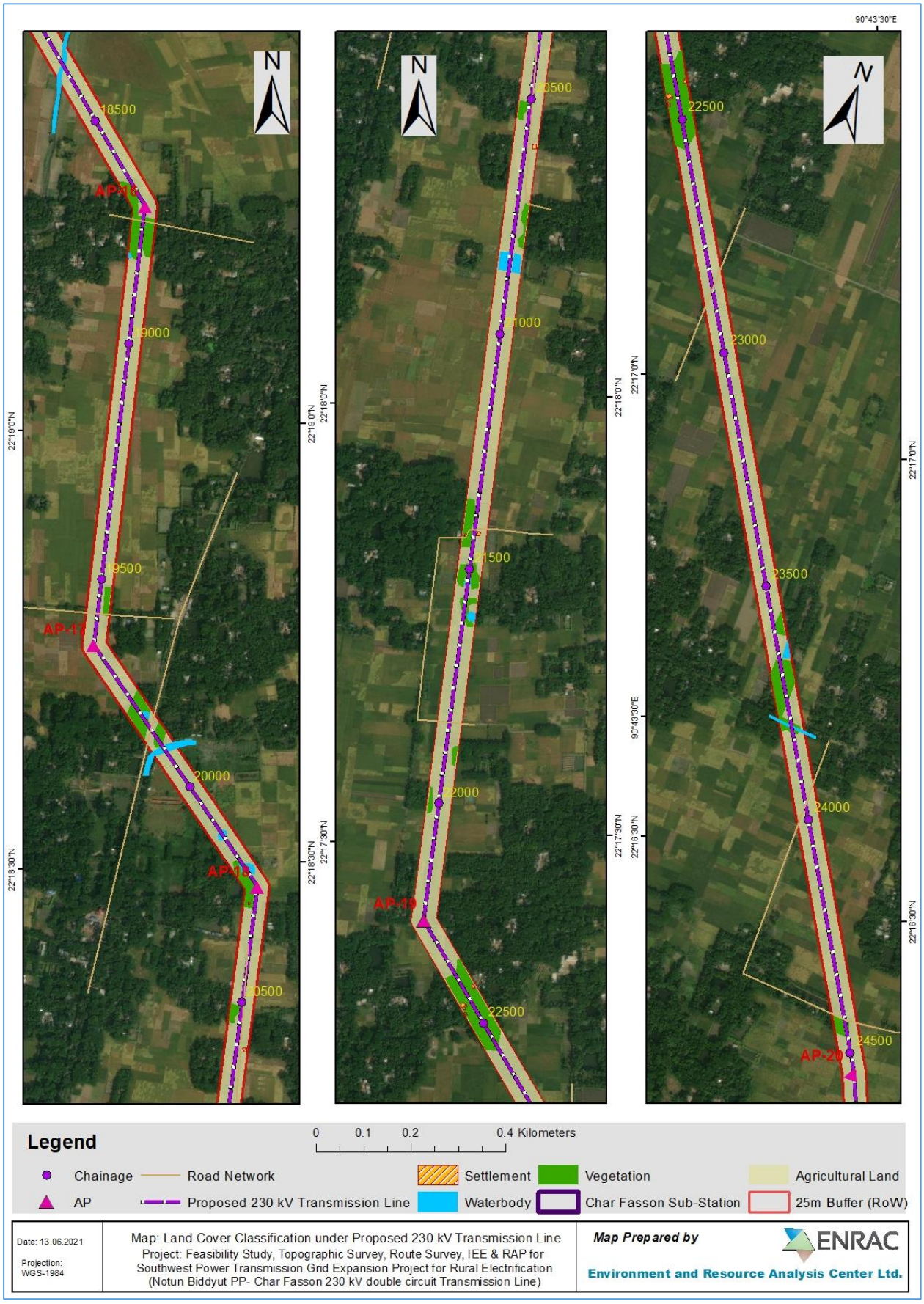


Figure 5-14: Land Use Classification of Project Area with 25m Buffer (Section 4 of 7)

Figure 5-15: Land Use Classification of Project Area with 25m Buffer (Section 5 of 7)

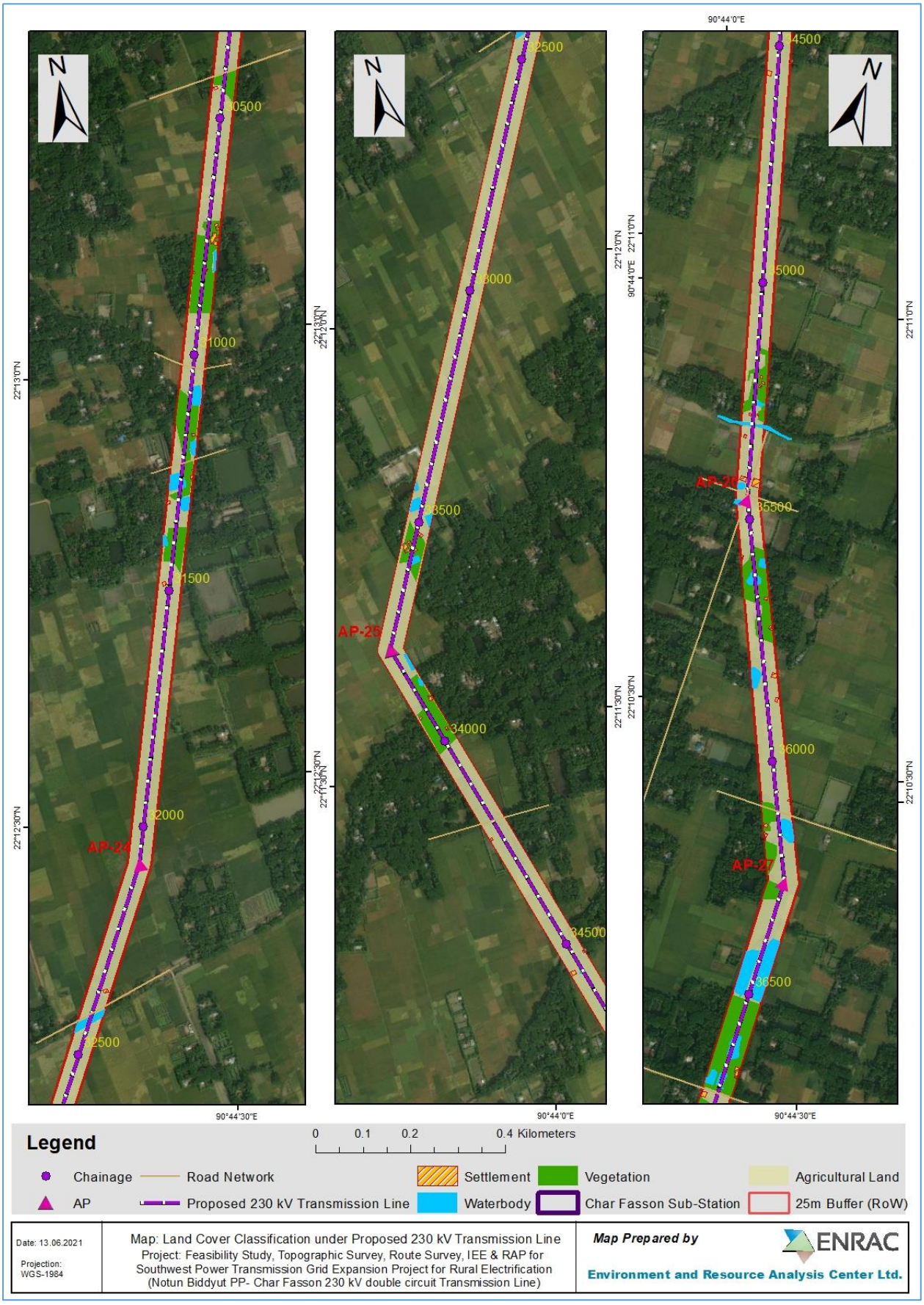


Figure 5-16: Land Use Classification of Project Area with 25m Buffer (Section 6 of 7)

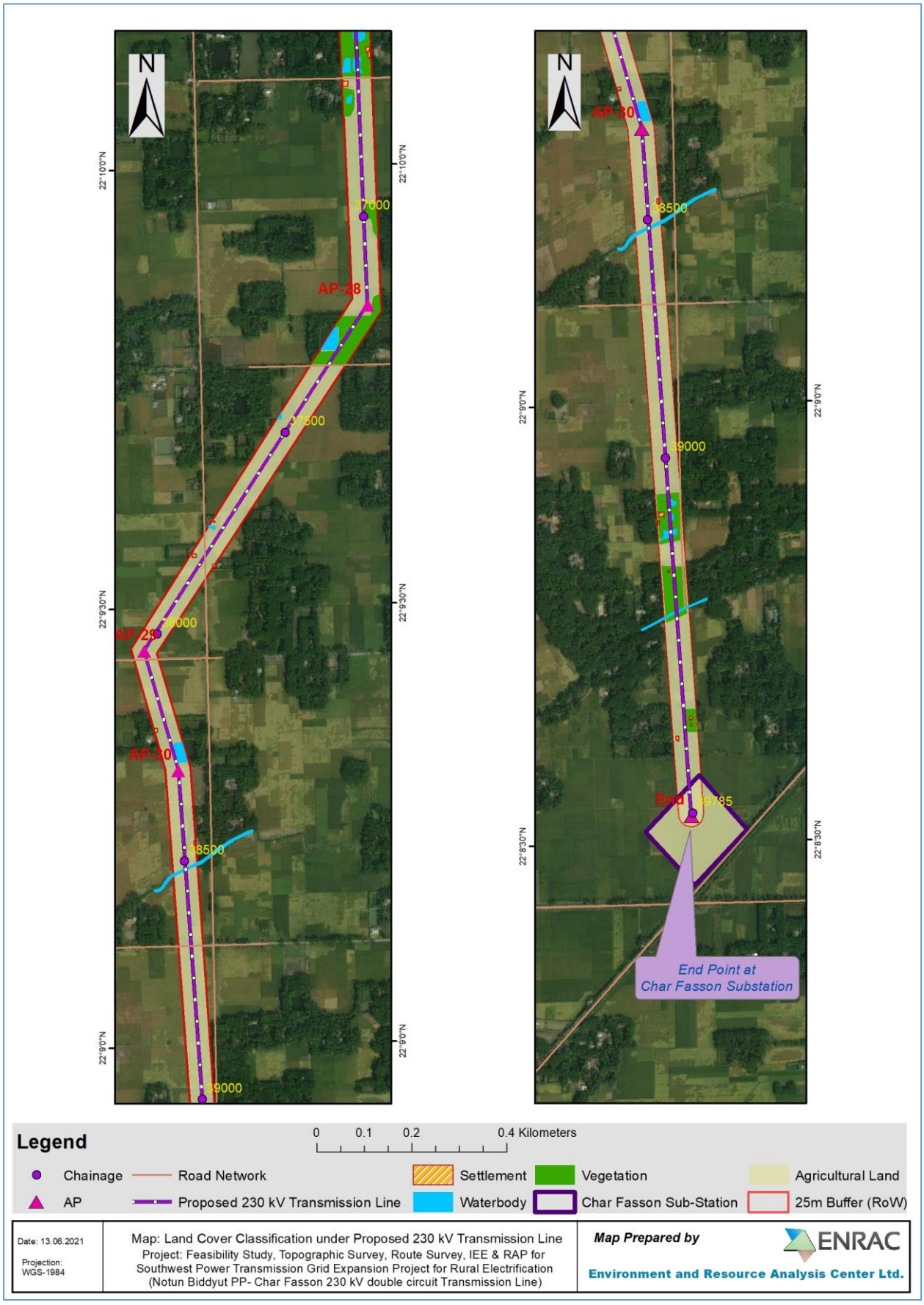


Figure 5-17: Land Use Classification of Project Area with 25m Buffer (Section 7 of 7)

5.1.17 Crop Production

349. The country grows a wide variety of crops which are broadly classified, according to seasons in which they are grown, into two groups:

- Kharif crops- grown in the spring or summer season and harvested in late summer or in early winter.
- Rabi crops- sown in winter and harvested in the spring or early summer.

350. Cropping intensity for Bhola district has decreased from 2018-19 to 2019-20 agricultural year by 2% as presented in Figure 5-18 (Yearbook of Agricultural Statistics-2020, BBS). The major agricultural crops of Bhola District are Paddy, potato, onion, chilli, garlic, mustard seed, nut, betel leaf, betel nut. Extinct and nearly extinct crops are Tobacco, linseed.

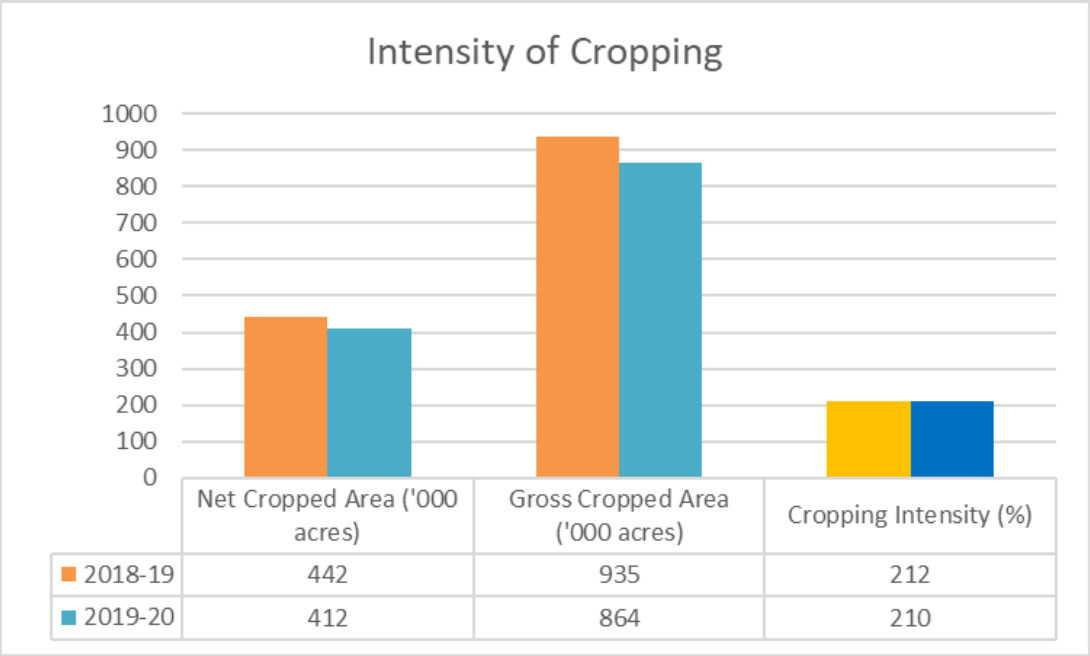


Figure 5-18: Cropping intensity for Bhola district for 2019-2020

Source: Yearbook of Agricultural Statistics-2020, BBS

351. Agro-ecological Zones of Bangladesh define the fertility of land units in terms of Physiography, hydrology, seasonal flooding, soil type and tidal activity. According to the variations of all these factors and agricultural potential, the total land area has been classified into thirty agro ecological zones (Yearbook of Agricultural Statistics-2020, BBS).

352. The study area falls under the Young Meghna Estuarine Floodplain (AEZ-18) (Figure 5-19). This region occupies young alluvial land in and adjoining the Meghna estuary. The major soils are grey to olive, deep calcareous silt loam and silty clay loams, and are stratified either throughout or at shallow depth. Calcareous alluvium and non-calcareous grey floodplain soils are the dominant general soil types. Topsoils and subsoils of the area are mildly alkaline. General fertility is medium but low in N and organic matter.

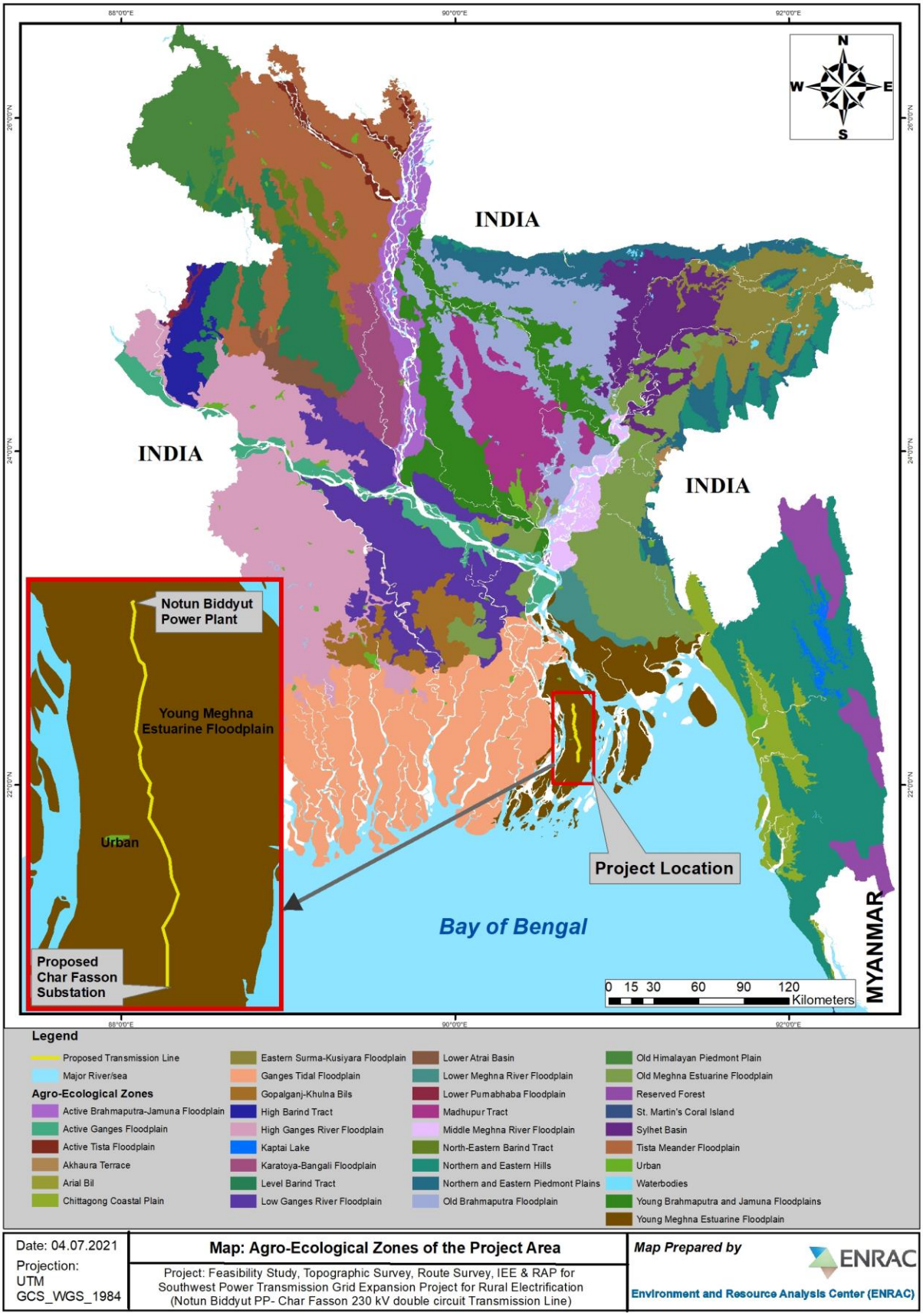


Figure 5-19: Agro-Ecological Zones of the Project Area

5.1.18 Land Ownership and Price

353. Consultations with land owners and other farmers in the study area revealed that most of the big landlords in and around the project location belonged to Hindu community. Post 1971-72, an outmigration trend was reported among Hindus towards India. Hence, most of the Hindu landlords sold their lands to local community or such land was redistributed to landless or marginal farmers by the government. Land ownership pattern among the respondents of the socio-economic survey indicate that approximately 40% of the respondents fall in the landless category owning less than 5 decimal of land. The pie chart in Figure 5-20 below depicts the land ownership pattern across the surveyed villages.

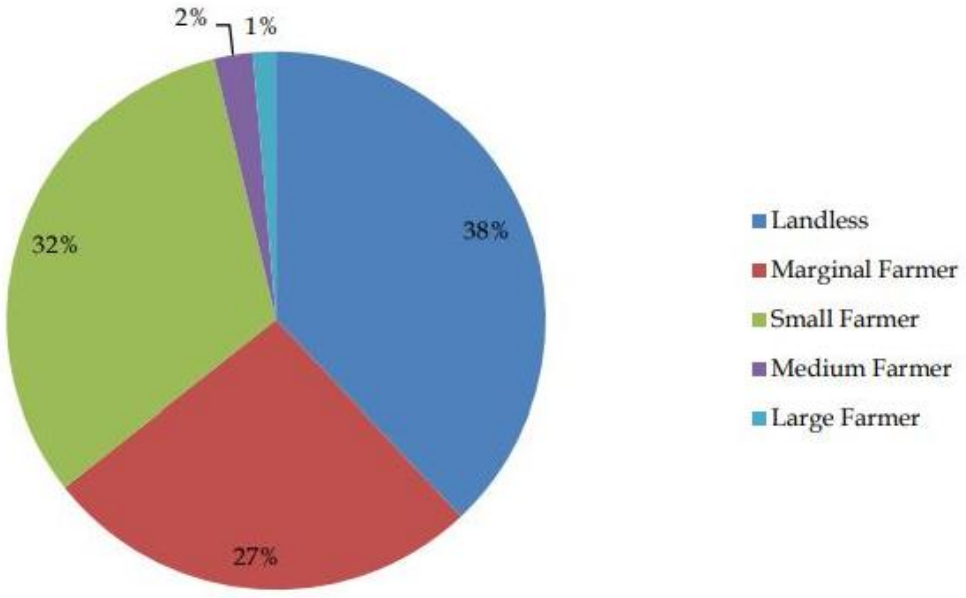


Figure 5-20: Land ownership pattern across the surveyed areas

354. The land prices of different type of lands have been taken from the field visit. People of different areas, occupations, ages have provided indications about the land price. The average land prices in the different areas are presented below Table 5-5, it is seen that commercial and homestead land price is higher than agricultural lands. The land selected for substation is an agricultural land. Compensation was provided calculating 200% of the land price and the price is about BDT 207.9 lacs for 5 acres or 500 decimals (Annex 18).

Table 5-5: Land Price (in Lac) Along the Project Alignment

Land category	Borhanuddin		Lalmohan		Charfasson	
	Sachra	Deula	Badarpur	Kalma	Aminabad	Ewazpur
Commercial	1.5-2	02-03.	1-1.5	3.5-4	3.5-4	1-1.5
Homestead	1-1.2	1.5-2	0.80-1	2.5-3	2.5-3	0.80-1
Agricultural	0.50-1	0.40-1	0.40-0.80	2-2.5	0.50-1	0.50-0.80

Source: ENRAC Field Survey

5.1.19 Income and Expenditure

5.1.19.1 Income Pattern

355. Assessment of household income and expenditure patterns and an analysis of the trends across different villages showed consistency in terms of income levels, sustenance needs, and expenditure levels. The patterns and heads of expenditure and sources of income were found to be similar due to the similarity in the livelihood and occupation patterns, means and opportunities available in the study area. The average monthly income of the study area as per the household survey is BDT 21,972. Figure 5-21 below provides the average income figures for various sources of income in the study area: 30% of the households earn between BDT 15,000 and 20,000 per month while 16% earn less than BDT 10,000 per month. The figure below presents distribution of surveyed households across income ranges. The average per-capita income as per the household survey was recorded at BDT 4860 per month or BDT 162 per person per day. As per the World Bank (1) poverty line ($1.25 or BDT 100 per person per day), more than one-fourth (26%) of the households surveyed earn less than BDT 100 per person per day and hence fall below poverty line.

5.1.19.2 Expenditure Patterns

356. The key heads of expenditure ranges from expenditure incurred on housing, food, clothing, entertainment, travel, education and health care. Broad estimates of monthly expenditure were reported to be in the range from BDT 5000 per month to BDT 25,000 per month depending upon the size of the household, number of earning members, land and asset ownership etc. Figure 5-22 provides average percentage share of various items in monthly household expenditure. Maximum expenditure in households of the project area is incurred on food (58 %) followed by clothing (14 %); education and health (11 %).

5.1.20 Self-Assessed Poverty and Indebtedness

5.1.20.1 Self-Assessed Poverty

357. Poverty mapping is a statistical exercise to estimate the incidence of poverty at sub-national levels to enable the government, civil society organizations, and development partners to accurately identify locations with a relatively higher concentration of poor people. Figure 5-23 shows percentage of extreme poor people (living below poverty line) and poor people (living upper poverty line).

358. 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 15% of the households on average are under the poverty line, 28% are above the poverty line.

5.1.20.2 Indebtedness

359. As per the Household survey, 30% of the households are in some form debt. Of the households which are in debt, the average debt in BDT among them is reported to be approximately BDT 43500. However, none of the project affected people were reported to be in indebtness.

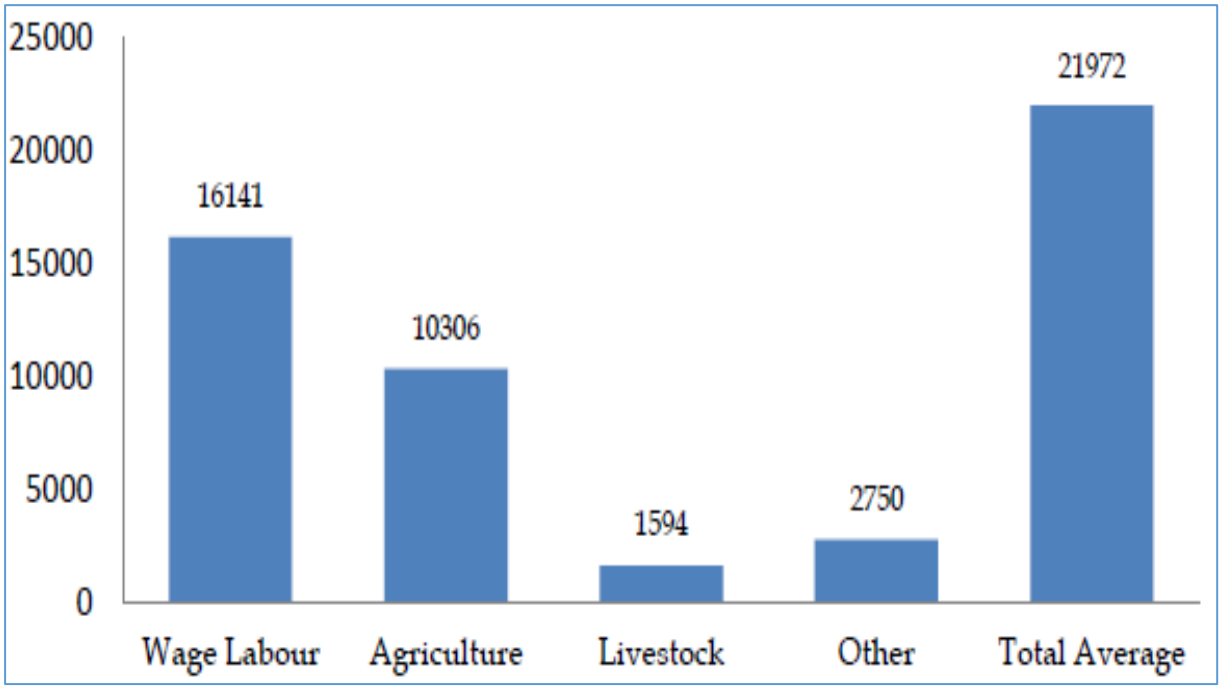


Figure 5-21: Average Monthly Income from various sources in Study Area

Source: Socio-Economic Household Survey ERM 2017

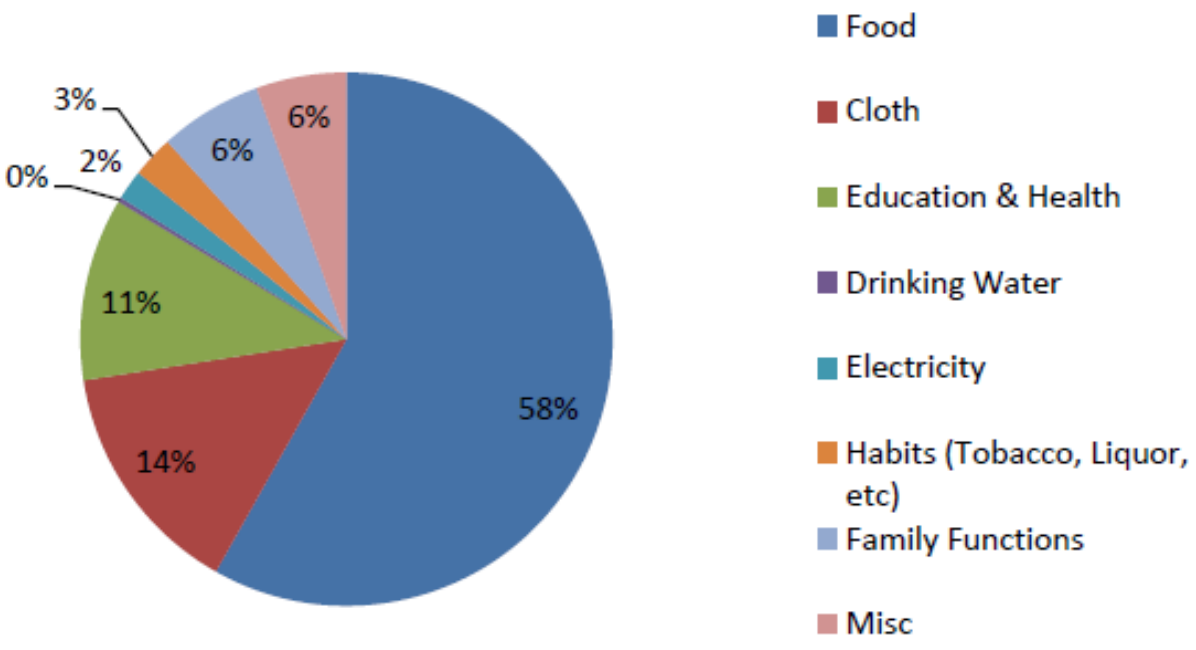


Figure 5-22: Expenditure Pattern in the Study Area

Source: Socio-Economic Household Survey ERM 2017

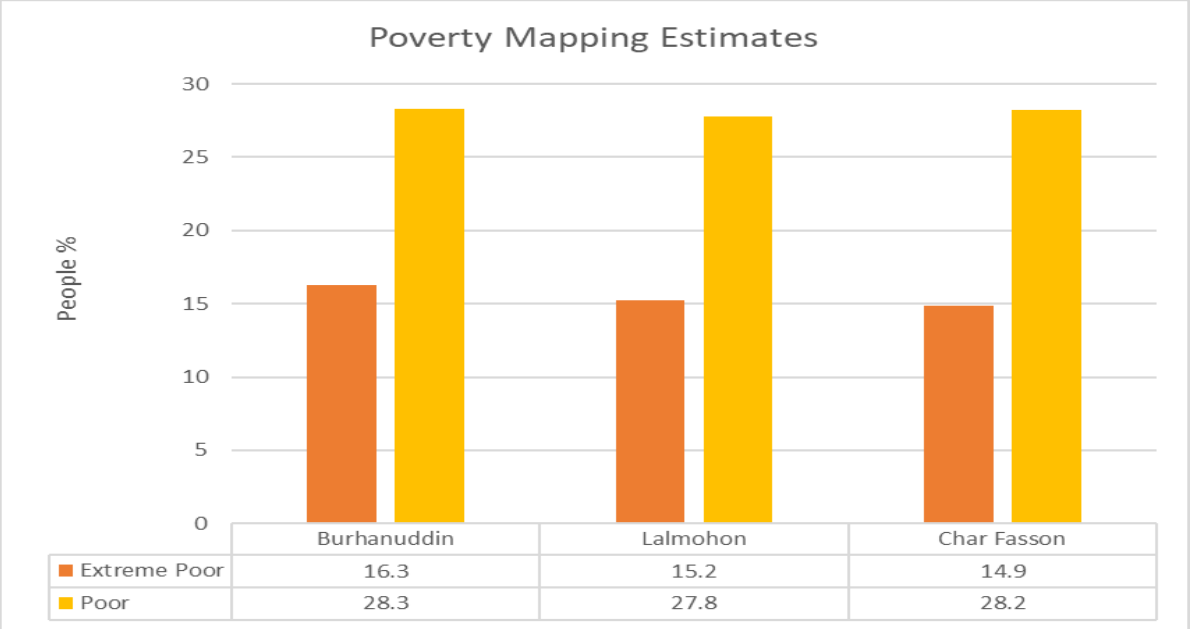


Figure 5-23: Poverty map for the three upazilas

5.1.21 Indigenous People

360. There are no indigenous people's settlements in the impact area of the the proposed 230 kV double circuit transmission line project. Therefore, no permanent or temporary and direct or indirect impacts on indigenous people's communities are anticipated. However, the project has taken necessary steps to avoid the indigenous people's communities and their properties and other social and cultural activities from the areas identified for project implementation.

5.1.22 Role of Women and Gender issues

361. Women in the project impact areas are engaged in multiple activities. Apart from their household roles such as household cooking, cleaning, fetching water, feeding children, helping in children's studies and looking after the in-laws (particularly those living in extended families), women across the project areas also make a significant contribution to the household economy. Despite strong pressures from the families to dissuade women finding employment, they take a lead role in livestock farming and take care of the feeding of their cattle, goats and poultry.

362. Home gardening is another important economic activity of women, produce of which is used for both household consumption and marketing. Other forms of economic activities conducted by women include agricultural labor work, dress-making, handicraft-making, employment in apparel industries etc. Educated women are employed in both government and private sector jobs. Women's earnings are mainly used for children's education and clothes, to supplement the households' consumption needs, and to repay the past debts. Some women would also save some money to be used in emergencies or for their children's future. In some communities, however, it has been reported that women have to hand over their earnings to husbands or else get prior consent of the husband to spend their earnings. Women also participate in the activities of NGOs like

BRAC and Grameen Bank to access micro-credit which they would use to buy cattle, goats and poultry.

363. Women who engage in daily paid labor work are paid less compared to their counterpart men. For example, when a man is paid BDT 300 a day, a woman would get only BDT 150 or BDT 200 though there is not much difference in the work load that both groups carry out and the duration of work. Excess of labor available and social attitudes towards women are also reported as factors that influence to pay lower salaries for women.

364. Household level decision-making is largely vested with the husband. A few instances of joint decision making by both men and women were reported. Women also perform a significant role in managing household assets despite the key immovable assets like land and house are owned by men. Physical assets such as land and jewelry received by women as part of their dowry remain in her possession but in some occasions they are transferred to the ownership of men as part of matrimonial agreements. Women are discouraged from participating in social and political activities mostly by their male counterparts. However, many women struggle to change this situation.

365. During consultations, women expressed concerns over the loss of their fruit-bearing trees, livestock farming activities, household incomes and their social networks as a result of their potential displacements. As women play a major role in these household level activities. However, as the majority of the displaced households are able to remain within the remaining portion of their land and continue to engage in their routine activities, thus the impacts in terms of gender are likely to be minimal. The project will pay compensation for all their economic losses and will encourage their participation in livelihood restoration activities such as tree planting programs. Female headed households, will receive additional cash allowances as vulnerable households. Consultation will continue to pay attention to women's concerns throughout the project lifecycle.

5.2 Project related information

5.2.1 Public utilities

366. 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.

5.2.2 Cultural resources

367. The ENRAC 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 Char Fasson will be constructed at an open space.

5.2.3 Land required for project intervention

368. As per the electricity act 2018, if any damage, harm or inconvenience is caused while doing civil works, the licensee shall, in such manner as may be prescribed by rules, pay compensation to the person affected or the owner of the land affected for acquiring land for construction of electricity towers.

5.2.3.1 Required Land for Transmission Line

369. The RoW for the 230 kV transmission lines is established at 20 m either way from the center of the line/tower, as per PGCB Practice for Design, Installation and Maintenance of Overhead Power Lines. However, the clearing width which is affected by installation and construction will be one-fourth of the total width of RoW is 10m for 230kV line. In addition, no land will be acquired for the RoW as per the laws of Bangladesh. Table 5-6 shows the land requirement under the right of way of the transmission line.

Table 5-6: Land under the Right of Way of the Transmission Lines

Transmission Line	Line Length (km)	RoW (m)	Clearing width in RoW (m)	Land to be cleared in the RoW (acre)
Notun Biddyut PP-Char Fasson 230 KV double circuit	39.81	40	10	98.31

Source: PGCB Standard of Similar Projects

370. The number of towers required for the transmission line and the land area required for their installation are shown in Table 5-7. The total extent of land required for the tower footings at ground level of 30 angle towers is approximately 2.4 acre and for 85 suspension towers is 4.72 acres. The land area used for the tower footings will be a permanent loss to their respective landowners. As per the practice, people will be allowed to cultivate underneath the tower area.

Table 5-7: Land Requirements for Installation of Transmission Towers

Transmission Line Tower	Estimated Number of Tower	Tower Footing Measurements	Land Required for each Angle Tower (acre)	Total Land Area Required for Tower Footings (acre)	Land Ownership
Angle Tower	30	18m x 18m	0.08	2.4	Private
Suspension Tower	85	15m x 15m	0.055	4.72	Private
Total	**115**			**7.12**	

Source: PGCB Standard of Similar Projects

5.2.3.2 Required Land for Sub-station

371. Direct inspection has shown that the selected tentative location for the construction of the new 230/33 KV GIS substation at Char Fasson is an open agricultural land. A total of 5 acres land will be permanently acquired for this substation. There will be some temporary impacts surrounding the substation area during project construction to facilitate the transportation of construction material and the movement of machinery.

372. The CCL value of land is considered including 200% premium with the mauza rate of land collected from the Tehsil office; and 100% premium is added with the CMP of

crops (for crops) compensation. CMP of crop was collected through property valuation survey. If the CCL is less than the CMP, additional top- up value is considered by deducting CCL value from the CMP which is paid by the EA. In this Project the CCL value of land per decimal is higher than CMP of land per decimal, and thus CCL value is considered as replacement value of land.

5.3 Baseline condition for PAP

373. The construction of the transmission lines will affect 44 households. and an estimated population of 375 living within the clearing width of the transmission lines (230 kV 40 m). Of the households, 44 structures may be affected by the loss of their trees and crops cleared for construction work. The land under the RoW is largely used for cultivation purposes. A total of 7.12 acres of land is required for transmission tower footings at ground level. A variety of crops such as paddy, potato, mustard and vegetables are cultivated in both homesteads and open agricultural fields. Number of affected trees under transmission line is 1797 which include 1055 non-fruits, 616 fruits, bamboo 84 and 42 medicinal plants.

374. None of the households from the project area were reported to have received Govt. Assistance & foreign remittance for households.

6. Analysis of Alternatives

6.1.1 Without Project Alternative

375. From a purely physical environmental point of view, the “do-nothing” is preferable to any project implementation, since it would avoid creation of any of the adverse impacts associated with the project. However, the potential socio-economic benefits to the nation would be foregone and industrial growth would be hampered by going for this option. It is concluded that the “No build” alternative is unacceptable, and the potential socio-economic benefits of implementation of such project far outweighs the adverse impacts which are minor and temporary can be controlled and minimized to an acceptable level.

6.1.2 Substation Technology and Siting Alternatives

376. 230/33 KV GIS: Char Fasson substation will be constructed at the Char Fasson upazila. For selection of appropriate sites and optimization of safeguards for substations, the following points are taken into consideration:

i) Construction activities do not adversely affect the population living near the proposed substations and do not create any threat to the survival of any community with special reference to indigenous, tribal community etc.;

ii) The location of the substation does not affect any PCRs;

iii) No resettlement of households by the substation site, no loss of livelihoods, siting of transformers away from schools, hospitals and other sensitive receptors, with due consultation with the community and local government units concerned;

iv) Transformers and other equipment specifications compliant with government rules/regulations and International Electro-Technical Commission standards shall be followed;

v) Construction techniques and machinery selection shall be made with a view to minimize ground disturbance;

vi) While planning for substations, drainage lines shall also be marked and studied to avoid seepage/leakages and pollution of water sources;

vii) Substation location/design to ensure that noise will not be a nuisance to neighboring properties. Provision of noise barriers near substation sites will be made;

viii)Substation design will comply with the limits of electromagnetic interference within the floor area. Security fences will be erected around substations. Warning signs shall be displayed;

ix) PGCB shall adopt good practices and shall always strive for a high standard of housekeeping for its substations and ancillary facilities;

x) PGCB shall incorporate the best technical practices to deal with environmental issues in its workings;

xi) Site selection should consider seismicity and geography of the local area; the area should not be prone to flooding, landslides or be unstable; and

xii) Design of substations shall be made to include modern fire control systems/ firewalls. Provision of fire-fighting equipment would be made to be located close to transformers, switchgears etc.

6.1.2.1 Siting Alternative option for the Proposed Substation:

377. Initially 2 alternatives sites were selected based on environment and social aspects and technical requirements for substation site selection. Such analysis considers various site-specific parameters that include availability of infrastructure facilities such as access roads, water, distance from railheads, type of land (Government/private land); social impacts such as number of families getting affected; Common Property Resources (CPR) including feasibility of acquisition.

378. For proper environmental assessment, it is important that each substation sub-project is clearly described by the project proponent (PGCB). The key information required for describing a particular subproject would vary depending on the type of sub-project. Once a sub-project description is prepared by the project authority, it will be easier to carry out environmental/social screening of the sub- project.

379. By considering certain issues during project formulation, it is often possible to reduce some of the possible negative environmental impacts during both construction and operational phases of a project. For example, efforts to avoid, where possible, critical homestead areas or crossing of rivers/hills/bamboo groves on the substation subprojects could greatly reduce negative impacts during construction and operational phases. A number of such environmental and social issues to be considered for substation subprojects are identified and given below.

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

380. **Option-1:** The design of the substation took into consideration the areas of natural forests and wildlife habitats. The design acknowledged that the clearance of vegetation around the area can lead to fragmentation of already diminishing natural forests and wildlife habitats and that the ecological value of the system will be diminished.

381. The construction of access roads to the substation was not required as the proposed site is located near the Lalmohon-Char Fasson upazila road.

382. In areas where patches of secondary forests such as the village grove and village cemeteries cannot be avoided, the vegetation were removed only at the ROW after approval from the proper authority (e.g., Forest Department), in collaboration with local village authorities and affected villagers. Detailed survey and inventory of trees were undertaken.

383. **Option-2:** There is another land located around 1km far from south side of the option-1. The land is completely fallow. As a result, excavation cost will be very high. The locations of the above-described siting options are shown in Figure 6-1, while the technical, financial, economic, environmental aspects of these alternatives are presented in Table 6-1.

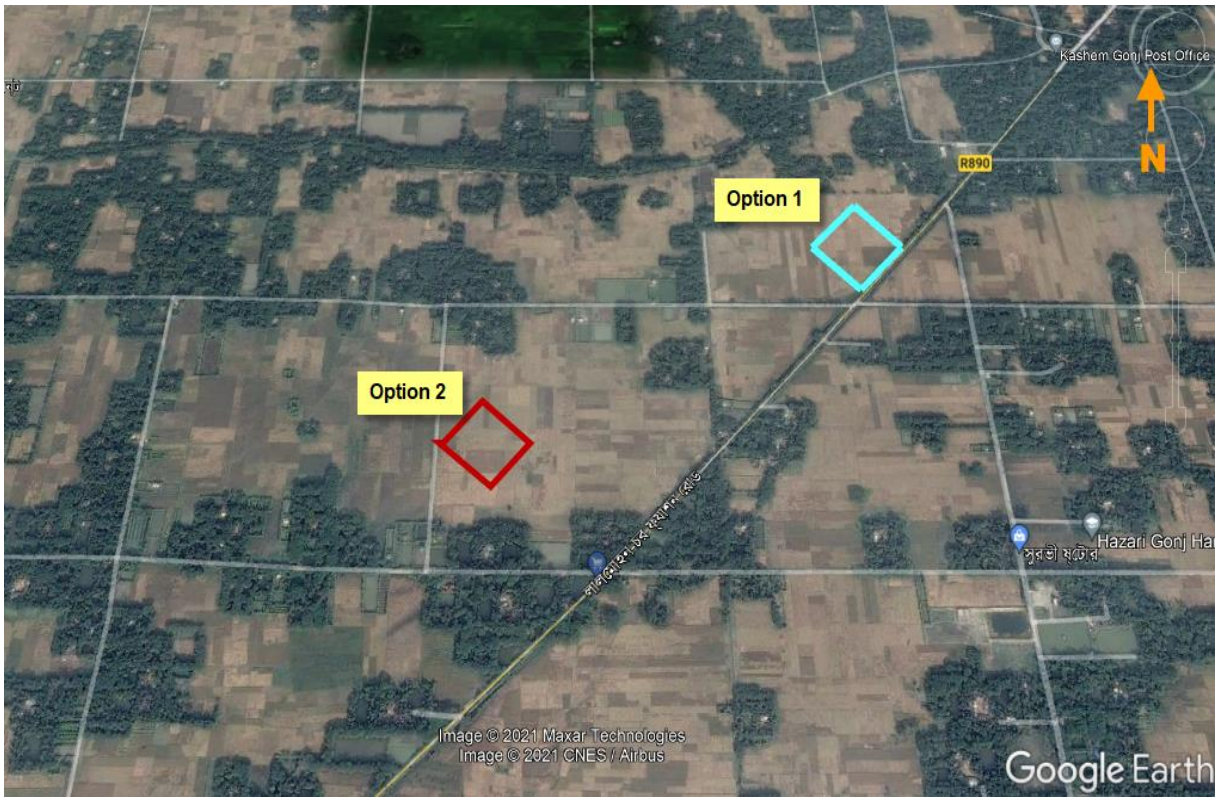


Figure 6-1: Location Proposed Options for Substation in satellite image

Table 6-1: Comparison between Option-1 and Option-2 for Substation

Attribute	Option-1	Option-2
Technical Aspects		
Land Use	Fallow land	Fallow land
Land acquisition	Owned by PGCB	Not owned by PGCB
Road condition	Very good	Very good
Transmission shifting required	Yes	Yes
Land levelling work	Medium	High
Scope of future expansion	No	Yes
Implementation Expense	High since land will need to be procured and land will need to be cleared and levelled.	High since land will need to be procured and land will need to be cleared and levelled.
Environmental Aspects		
Construction related impacts	High since land levelling and clearing will need to be carried out	High since land levelling and clearing will need to be carried out
Nearby Water Body	No	No
Loss of vegetation	Medium	High
Noise	High since land levelling and clearing will need to be carried out	High since land levelling and clearing will need to be carried out

Source: ENRAC Topographic Survey 2021

6.1.2.2 Reasons for the Final Selection

384. The Option-1 will significantly minimize impacts related to engineering, environmental, land acquisition, resettlement and sensitive areas, and social disturbance. Considering the various reasons above, the alternatives selected were found to be the most suitable as they involved lesser populated area, few homesteads in the Row and in the immediate surroundings. Option-1 have significantly lower potential environmental and social impacts than Option-2. Therefore, the alternatives will not have any violation of environmentally sensitive area, protected area, critical area, forest reserves, wildlife reserves, rivers or wetlands or Important Bird Areas.

6.1.3 Alternative Transmission Line Routes Analysis

385. There were 3 (Three) candidate routes of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line. Notun Biddyut PP-Char Fasson have been proposed taking into the following considerations:

- To avoid crossing with settlements
- To keep the right of way as low as possible
- To keep minimum angle points
- To keep the length of the transmission line as low as possible.

386. A map showing the 3 alternative routes of the proposed Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line is given in Figure 6-2. Alternative analyses of the three transmission line options are presented in Table 6-2, Table 6-3 and Table 6-4. The detailed preliminarysurvey report for all three options is presented in Annex 2.

Table 6-2: Alternative Analysis of Three Options for the Transmission line

Option	Distance (km)	No. of AP	Building	Industry	Pond	Roads/ Highway	Khal/ Canal
Option-1	39.81	30	44; (Pucca 2, Semi Pucca 16, Katcha 26)	-	92	43	15
Option-2	41.95	30	108	2	97	29	24
Option-3	42.53	31	85	3	99	32	17

Source: ENRAC Topographic Survey 2021

387. From the preliminary survey report and the table above, it is found that the length, angle point, building, industry, pond, road and canal crossing in option 1 is less than the other two options.

Table 6-3: Comparison of Land use Pattern within Three Options

Option	Distance (km)	Building (%)	Industry (%)	Pond (%)	Roads/ Highway (%)	Khal/Canal (%)	Trees (%)	Agricultural Land Crossing (%)	Open space (non-agri) (%)	Others (%)
Option-1	39.81	1.5	-	0.91	0.4	0.5	11.7	58.09	18.5	8.4
Option-2	41.95	2.2	0.6	1.9	0.7	1.58	10.8	54.81	16.8	10.7
Option-3	42.53	2.1	0.8	0.9	0.27	0.91	8.4	51.4	23	12.2

Source: ENRAC Topographic Survey 2021

388. From the land use mentioned in above table, it is evident that out of three options, Option 1 is the shortest route (39.81 km) and has the maximum open area of 76.59% including agricultural land (58.09%) and non-agricultural land (18.5%). The option 1 also has less canal crossings (0.5%).

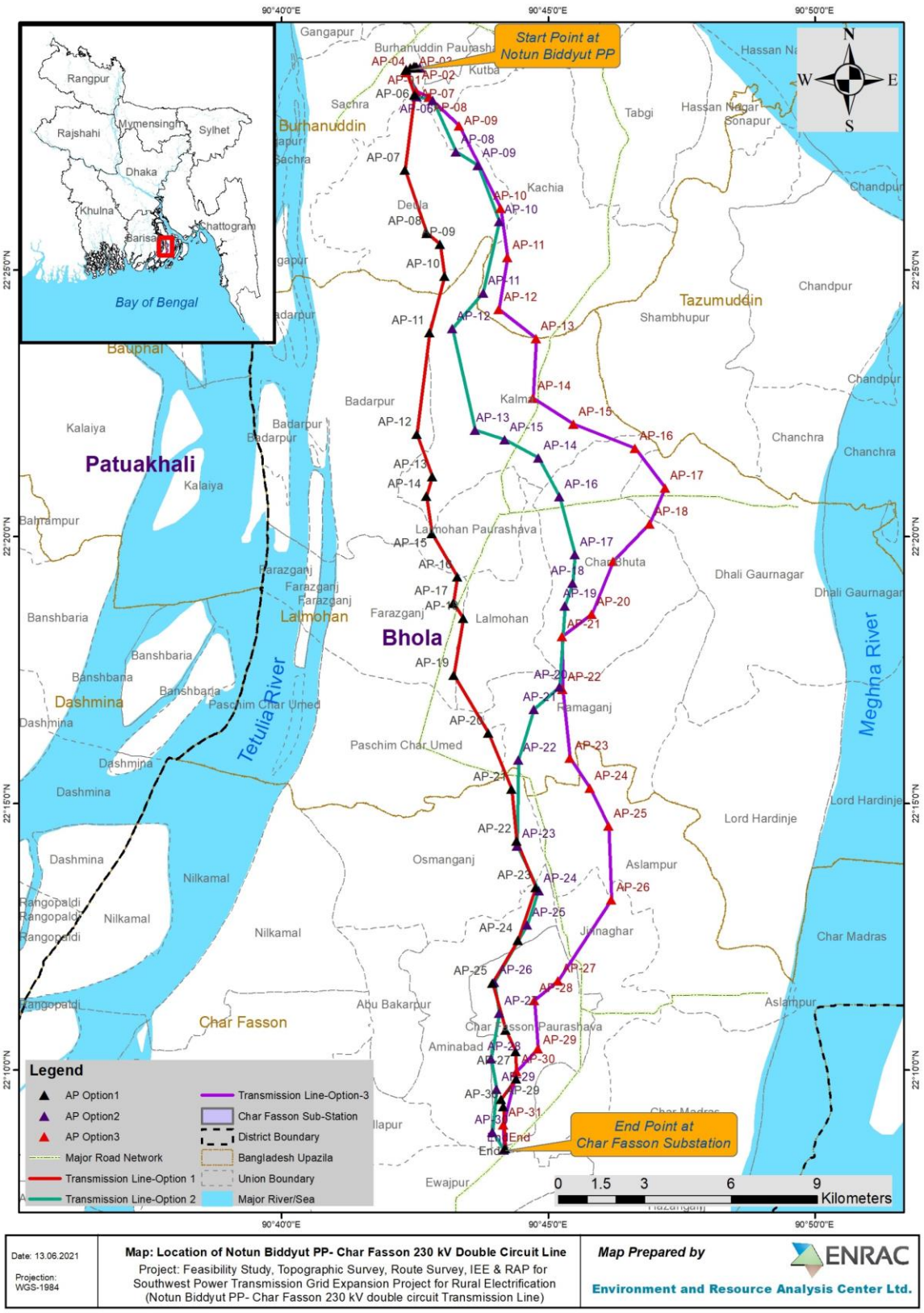


Figure 6-2: Location of Proposed Three Alternative Transmission lines

Table 6-4: Ecological critical area, Sensitive Areas, Forests, Rivers and Other Crossings

Type	Option 1	Option 2	Option 3
Environmentally Critical Areas	N/A	N/A	N/A
	Nearest ECA: Char Kukri Mukri is 21 km away	Nearest ECA: Char Kukri Mukri is 21 km away	Nearest ECA Char Kukri Mukri is 21 km away
Forest Areas	N/A	N/A	N/A
Railway Crossing	N/A	N/A	N/A
River Crossing	N/A	N/A	N/A
	Nearest River: Minimum distance to Tetulia River is 3.5 km and Meghna River is 8.5 km away	Nearest River: Minimum distance to Tetulia River is 4.2 km and Meghna River is 7.9 km away	Nearest River: Minimum distance to Tetulia River is 5.8 km and Meghna River is 4.9 km away
Biodiversity Rich Area	N/A	N/A	N/A
House Holds	44	108	85
Ethnic Minority	N/A	N/A	N/A
Tree Trimming	1797 (Considering the clearance for RoW)	2032	1861
Habitat Damage for Site Access	Low	Moderate	Moderate

Source: ENRAC Topographic Survey 2021

389. It is clear from above table that none of the three options passes through the environmentally critical areas, forest areas, railway, biodiversity rich area, river and ethnic minority.

6.1.3.1 Reasons for the Final Selection

390. From the above comparison it is evident that the proposed option-1 having less length compared to other alternatives is passing through mostly plain area with easy accessibility having minimum Khal & Permanent Structure crossing. Additionally, option 1 does not pass through any environmentally critical areas, forest areas, railway, biodiversity rich area, river and ethnic minority So, proposed option-1 has been found to be the most optimum alignment and recommended for Construction works.

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7. Environmental Impact Assessment and Mitigation Measures

7.1 Summary of Potential Impacts

391. Based on the environmental baseline data and environmental screening, potential environmental impacts assessment for the finally selected subprojects (Substations, Transmission Lines) have been done. The impacts are given in below Table 7-1:

Table 7-1: Summary of Potential Impacts

Stage	Environmental Impacts
Pre-construction/Construction Phase of Transmission line and substation construction	Land Acquisition Clearing of Vegetation Disturbance of Fauna (wildlife) Loss of Top Soil Hydrology/Drainage Congestion Ground Water Pollution Noise Pollution Air and Dust Pollution Soil Pollution Pollution due to Wastes Traffic Congestion/Road Accident Siting of Construction Camps Occupational Health and Safety Community Health and Safety Employment Generation/Income
Operation Stage of Transmission line and substation construction	Hydrology/Drainage Congestion Landscape Community Health and Safety Occupational Health and Safety Short Circuit/Accident Electro-Magnetic Field (EMF) Trimming of Trees

7.2 Environmental Impacts from Project Siting

392. All environmental and social components are not impacted by the project interventions. In reality, some of the components may be impacted while others are unaffected. Environmental and social components likely to be impacted by the project interventions are termed as Important Environmental and Social Components (IESCs).

Important Environmental and Social Components (IESCs), likely to be impacted by the construction of the electricity transmission lines are selected as follows

7.2.1 Important Environmental Components

393. Important Environmental Components (IECs) for different resources are outlined below.

7.2.1.1 Water and Physical Environment

394. Important Environmental Components (IECs) for physical resources along with their rationales are described in Table 7-2.

Table 7-2: Important IECs on water and physical environment and its rationale

IECs	Rationale for Selection
Noise Level	During each phase of construction of the transmission line and substation, noise will be generated by the construction equipment and activities. Such noise may impact the local people and as such it has been considered as an IEC
Water Quality	Water quality can be impacted not only by work within a waterway but also by nearby vegetation clearing and other construction activities. Therefore, water quality has been considered as an IEC
Water body	Most of the cases mineral oil transported by waterway that may harmful for water body by accidental cases.
Irrigation Channel	Towers that will carry the proposed transmission lines may cause disturbance to irrigation channels
Construction waste	Construction wastes in the back-to-back station and tower site may create hazard to the surroundings. Therefore, this is considered as IEC.
Interference with road crossing	There may be interference in crossing points of rural roads and regional highways during stringing the transmission lines.

7.2.1.2 Soil and Agriculture

395. Important Environmental components (IECs) which are likely to be impacted by the proposed have been selected. The selected IECs and its rationale are presented in Table 7-3.

Table 7-3: Important IECs on Soil, agriculture and its rationale

IECs	Rationale for selection
Land form and land type	For the proposed project, the land be developed by filling for raising the platform with external materials, then the leveling the ground and clearing the terrestrial vegetation. For this, the land form and land type might change. Hence, it has been selected as an IEC.
Change of land use	The 23 towers would be constructed. Existing agricultural land might be changed to non-agricultural land use. So, change of land use has been considered as one of the IEC

IECs	Rationale for selection
Soil quality	The soil might be excavated and might be refilled for construction of the tower's areas and substation. These might affect the soil quality. For this reason, soil quality has been considered as one of the IECs
Crop production loss	During construction period, the tower legs would occupy some land. So, crop production might be affected. Hence, crop production has been considered as an IEC.

7.2.1.3 Biological Environment

396. Important Environmental Components (IECs) for the biological environment and its rationales have described in the Table 7-4.

Table 7-4: Important IESC on Biological environment and its rationale

IECs	Rationale for selection
Terrestrial Vegetation	Inside the study area terrestrial vegetation occupied an amount of total vegetation coverage with different canopy layers. Terrestrial vegetation provides foods and habitats for various wild animals and contributes enormous support to functioning local ecosystems. Construction activities of towers, Moreover, there may be restriction to plant tall tree under the transmission wires. All of these phenomena may induce to change terrestrial vegetation condition of the RoW. Therefore, terrestrial vegetation is selected an IEC.
Wildlife and their habitat	Wildlife is usually depending on vegetation as their feeding roosting habitats. Cutting or damaging of vegetation is directly impact on wildlife habitat condition. Beside this, changing of physical environment due to noise, human movement, structural interventions are also deteriorating habitat quality of an area. Construction activities and establishment of towers may change wildlife habitat condition due to vegetation loss as well as changing of physical environment. So, wildlife and their habitat is selected as IEC for this study

7.2.1.4 Socio-Economic Environment

397. Important Environmental and Social Components (IESCs) for the socio-economic environment and its rationales have described in the Table 7-5.

Table 7-5: Important ISC on socio-economic environment and its rationale

IECs	Rationale for selection
Industrial Development	Bangladesh is a developing country. Industrial development is a must to make it developed. And no industrial development is possible without creating a sound power sector. This project would be able to provide electricity as per demand. So that a large scales industrial opportunity may be created after the implementation of this project. Moreover, construction of Padma Bridge would create an opportunity to make this area industrially developed. Thus, it has been taken as an ISC.

IECs	Rationale for selection
Employment opportunities during construction (technical and non-technical)	Unemployment of unskilled labor is a problem in the area. Temporary employment of unskilled and skilled labor may be a component for impact analysis due to transmission line construction activities. So, employment opportunity has been selected as an ISC
Income Generation	Per capita income shows the income of the people of the study area. It is also a vital social determinant. The proposed intervention will increase the per capita income of the people of the study area through industrialization and creating employment opportunities later. Construction activities may create an income generation opportunity temporarily. So, Per capita income is chosen as an ISC.
Land Price	The price of land has lessened where the land for Angle Point has been selected. Most of the venues are selected in the crop field. Then it would be unusable to grow crops. And the building cannot be raised those are situated between two AP (Angel Points). Thus, it has taken as an ISC.
Economic Development	Rural area is turning into urban as well as industrial area is interrelated with the proposed power line. The electricity is a major potency for economic development. It would be supportive for this area as well as the entire country. So, economic development has been selected as an ISC.
Human Safety	In the field of constructing high voltage power transmission line, human safety is an important issue. Power transmission tower and line, other electrical instruments may cause some accidents. The future impact of high voltage power transmission line may be correlated with physical and biological implications. That why human safety is considered as an ISC.

7.2.2 Improvement of Electricity Grid in surrounding Area

398. Much of the growing electricity demand in the southern 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. A considerable number of existing grid substations and transmission lines in the southern area will fall short of capacity when the new electricity generation are added to the national grid.

399. Transmission of generated power from power plants to the load centers and then distribution to the end users must be ensured to achieve the real benefits out of above generation expansion program. At present, a total 12,283 km (Circuit Km) transmission lines and 5, 77,479 Km distribution lines have been connected to power system network.

400. As of July 2021, PGCB is having 3 nos. 400/230kV grid substations having capacity of 3,120 MVA, 1no. HVDC having capacity of 650 MVA, 2no's 400/132kV grid substations having capacity of 1,300 MVA, 26nos. 230/132kV grid substations having capacity of 14,625 MVA including 5 nos 1,460 MVA.120 nos 132/33kV grid substations having capacity of 23,492120MVA and 5,711.6 MVA for 36 nos 132/33kV grid substations.

401. As of June 2021, The PGCB took over about 1144 circuit km of 230 kV lines, 5255 circuit km of 132 kV lines, 6 nos of 230/132 kV substation and 63 nos of 132/33 kV

substations from BPDB and DESA in different phases. Transmission lines of the company up to June, 2021 are stood at 950 ckt km of 400 kV lines, 3658 circuit km of 230 kV lines, 8086.3 circuit km of 132 kV lines and 1 nos of 400 kV Station, 3 nos of 400/230kV substation, 2 nos of 400/132kV substation, 26 nos of 230/132 kV substation and 120 nos of 132/33 kV substations. The total circuit length of Transmission lines is 12835.9 km.

402. The proposed project, once completed, 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.

7.2.3 Impact Matrix

7.2.3.1 Impact Magnitude

403. The potential impacts have been categorized as major, moderate, minor or minimal, based on consideration of parameters such as: (i) duration of the impact; (ii) spatial extent of the impact; (iii) reversibility; (iv) likelihood; and (v) legal standards and established professional criteria. The magnitude of potential impacts has been identified according to the categories outlined in Table 7-6.

Table 7-6: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Minimal
Duration	Long-term (more than 15 years)	Medium-term Lifespan of the project (5 to 15 years)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries, with no detectable potential impact
Reversibility	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Potential impact requires a year or so for recovering with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains almost constant
Legal standards and established professional criteria	Breaches national standards and/or international guidelines/ obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable

Parameter	Major	Moderate	Minor	Minimal
Likelihood of occurrence	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (Occasional)	Unlikely occur

7.2.3.2 Sensitivity of Receptor

404. The sensitivity of an environmental receptor (a parameter that may be affected by the project) has been determined based on review of the local population (including proximity/ numbers/ vulnerability) and presence of features at the project sites or the surrounding area. Criteria for determining receptor sensitivity are given in Table 7-7.

Table 7-7: Criteria for Determining Sensitivity

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

7.2.3.3 Assigning Significance

Following the assessment of magnitude provided by DoE guidance, and the quality and sensitivity of the receiving environment or potential receptor has been determined, the significance of each potential impact is established using the impact significance matrix shown in below Figure 6-1.

Magnitude of Impact	**Sensitivity of Receptors**			
	Very High	**High**	**Medium**	**Low**
Major	Critical	Major	Moderate	Minor
Moderate	Major	Major	Moderate	Minor
Minor	Moderate	Moderate	Minor	Minimal
Minimal	Minimal	Minimal	Minimal	Minimal

Figure 7-1: Significance of Impact Criteria

7.3 Impacts during Construction Phase

7.3.1 Soil Contamination and Erosion

405. The land would be dug into deep for making the basement of the towers and substation construction. For this, the top and sub-soils might be affected. These might disturb the valuable top soils and sub-soils. Soil nutrients might be imbalanced in the project areas. Soil quality as well as soil characteristics might be deteriorated due to mishandling and disposing of wastes during construction.

406. Chemicals that are commonly handled in the transmission lines and substation is mineral oil in transformers and other electrical components and liquid petroleum fuel. There are also potential hazardous materials and oil spills associated with the operation of equipment and retrofitting/maintenance works. Storage facilities of liquid petroleum fuels for the generator sets and for vehicles and other equipment are potential sources of accidental spills. Oil leak or accidental spills of hazardous materials could give rise to contamination of soil and water. Proper handling of wastes will reduce the risk of soil contamination during construction

7.3.2 Water Contamination

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

408. Storage of liquid fuels, raw and in-process materials, solvents, wastes may cause of the contamination of water from the construction stage of the project, proper handling of wastes, fuel will reduce the risk of water contamination during construction.

7.3.3 Impact on Khals and Tube-wells

409. The proposed transmission line will cross 92 ponds and 15 khals (canals), as described in the route survey (Annex 2). In addition, some shallow and deep tube-wells exist in the project area providing irrigation water to the crops of the area. However, the construction activities will not have any impact on the khals and tube wells, as most of the towers will be built on open agricultural lands.

410. Following measures will be implemented to avoid/minimize impacts on khals and tube-wells of the area:

- Any excavation and other construction work 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.

7.3.4 Dust and Air Pollution

411. Generally rural roads in most cases are Kutcha or herring bone made. Movement of heavy vehicles carrying the construction materials by such unpaved tracks/roads and also in construction site could cause the emission of considerable dust particles, pollute air, thereby affecting the passers-by, adjacent settlers and involved laborers. The impact magnitude is more during dry season.

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

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

7.3.5 Noise and Vibration

414. The proposed project areas are in relatively rural locations. Generation of noise pollution will occur, due to construction of the tower and substation foundations, but these will be sporadic and temporary activities over the landscape. Noise and vibration will be generated during the preconstruction phase of the project with removal and/or cutting of vegetation in the RoW and during the movement of trucks or other required vehicles. Transmission tower foundations and pads are constructed using a standard drill rig to bore to required depth, depending on geology. If water is encountered, pumps will be used to remove the water to either adjacent defined areas without disposal to surface water or to waiting tanker trucks for proper disposal.

415. Noise and vibration also generated by heavy machineries, placing electrical heaving components such as power transformers and civil construction works such as drilling, piling, excavation works etc. Noise from vibration effect during winter, transformer humming, loud tripping sound, etc.

416. After the construction is completed, clearing and grading will happen. The agricultural soils are compacted, and the RoW is cleaned up. All these activities might create noise impacts for short periods at each location.

7.3.6 Spoil Generation

417. Spoil is defined as any earthen material that is surplus to requirements or unsuitable for reuse in fill and embankments (such as unsuitable rock and soil material) or material that is contaminated. From the construction of this project, it has possibility to generate spoil from the earth work activities by ensuring that the design minimizes the volume of spoil generated from excavation, maximize the beneficial reuse of spoil on site, dispose of spoil off site based on its contamination classification and finally manage the

excavation, storage, transport reuse and disposal of spoil to minimize impacts and meet other environmental requirements

7.3.7 Solid Waste Management

418. Generation of construction solid wastes: electric wire, pipes, stones, woods, rods etc, and liquid waste: paint, oil, bitumen, etc. from the construction camp and general wastes (solid wastes: papers, containers, residues of food, fruits etc., and liquid waste: waste water from bathroom and kitchen, etc.) from workers' camps (if needed) could impact on the environment, health and safety of the local community and workers, as well as on the aesthetic beauty of the area. Proper arrangement, e.g., disposal to existing licensed sanitary landfill etc. will be made for waste management, fuel oil and chemical storage at all work sites.

7.3.8 Impacts on Wildlife

419. As wildlife are dwell inside the vegetation, so, vegetation clearing or damage of proposed alignment will be affected them (e.g., reptiles, birds, mammals). Although the land area is small, insignificant local habitats of those wild species will be disturbed. Hopefully they can survive in surrounding areas as the ecological composition is very similar. Some birds, reptiles (e.g., lizard and snakes) may leave the place due to tree cutting and earth excavation at the tower sites. Additionally, generation of noise due to labor and construction movement will cause minor disturbance to the surround wildlife.

420. Although the tower height will be beyond the flying range of most of the local birds, but flying mammals (i.e., Bats and vampire) and some birds (Kites, hawks and eagles) may be disturbed while flying through transmission lines. Indian Flying-fox, Little Indian Bat and Greater Short-nosed Fruit Bat would be risk of death due to electrification after completion of the transmission line.

421. Transmission towers may be supportive to local birds as their resting place although there have no treatments along the proposed alignment. Many bird species like kites, buzzards, hawks are depending on floodplains for their feeding and will be positively impacted.

422. There would be no referable impacts on wildlife habitats as well as vegetation. Civil activities for construction of Sub-station may cause habitat loss of existing rodents like mouse, mongoose etc.

7.3.8.1 Habitat Damage for Site Access

423. The existing vegetation inside the tower base area of the proposed transmission line and substation will need to be cut before starting the construction works. To access the project site some roadside vegetation will require trimming and cutting. The natural habitat damage and fragmentation may cause by vegetation clearance and felling of trees.

7.3.9 Community Health and Safety

424. Improper health policies at work sites may lead to an outbreak of different diseases in the surrounding communities/public, if construction workers are sick. Further, construction vehicles will pose a risk to local communities. Collapse of towers (possibly during a cyclone or earthquake) and broken lines could pose a risk to local communities. The transmission lines should not pose a hazard to local communities, as long as they do not climb them, or fly kites or drive tall items into the lines. The awareness raising of the

risk will be provided from pre-construction to operation. Substation will be fenced with authorized access. Information and public awareness programs, as well as placement of safety signages within the vicinity can reduce this risk. Traffic management will be required with special care in project sites adjacent to public or project components requiring large number of trucks to transport the construction materials.

425. The work force for construction will be sourced locally, as much as possible. Camps will not be necessary for the transmission line construction, but there may be small camps at the locations of proposed grid substations. These sites are away from any settlements; any small camps for laborers will be provided with water supply and sanitation facilities. The whole project work site will be fenced off and signs regarding potential hazards posted in conspicuous locations. Access to the construction site will be under traffic controls when trucks enter and exit (traffic managers with appropriate signs). Local communities will continue to be informed about project construction activities, schedules, and possible health and safety risks. The project will ensure that Bangladesh Labor Code regulations and the World Bank/IFC OHS standards are followed, including provision of safe working conditions and all appropriate personal protection equipment (PPEs). The Contractor will establish a mechanism for receiving and handling complaints about unfair treatment or unsafe living or working conditions (without reprisal). Health/accident insurance for employees/contractor staff will be provided for the duration of their contracts. A Health and Safety Officer (HSE tasks) will be designated and will provide regular briefing on worksite risks and the need to protect local communities. An accident reporting system will also be put in place, including notifications to ADB and Government of Bangladesh, and annotation of situation remedies. Special consideration will be given to risks associated with working at height and with electrical components (workers will be suitably trained for these tasks and fitted with safety equipment).

7.3.10 Occupational Health and Safety

426. Construction workers are more likely to face occupational health hazards such as minor or major injuries due to lack of general safety requirements and precautions applicable while working at construction sites, and handling machines and equipment, use of equipment and driving vehicles and so on. Poorly designed temporary labor camp and sanitation facilities may pose a health threat and nuisance to the workers. Uncontrolled vending of food and drinking water at work sites may also pose a risk with respect to the transmission of contagious diseases like typhoid, diarrhea, malaria, and dengue in particular.

427. Although presently the total ratio of affected people in Bangladesh with HIV/AIDS is far less than 0.1%, this percentage is slowly being increased due to injection drug users and overseas migrant workers returning to Bangladesh. Only trained workers are permitted to work at height. Construction workers will be required to handle materials such as cement, bitumen, chemicals, fuels, and so on which will increase health risks if personal protective equipment is not used (as noted above).

7.3.11 Traffic Congestion

428. Heavy construction vehicles will be required for carrying of construction materials and equipment. Local vehicles (such as trucks, buses, jeeps, microbuses, cars, rickshaw vans, motorbikes, bicycles), as well as students and local people walking on the roads could result in traffic jams, especially during morning and evening times, as observed

during field survey. The construction vehicles will add more traffic and as a result, traffic congestion and road accidents could increase. Traffic congestion may also occur if the stock piling of construction materials will be at the road sides.

429. Traffic management plans will be put in place with public awareness programs and warning signs at designated sites. Scaffolding will be placed over road crossing points while stringing of conductors takes place. A detailed traffic plan will be prepared by EPC contractor after consultation with relevant authorities.

7.3.12 Additional Load on Local Resources

430. Most of the construction material for the substations and transmission line will have to be procured abroad. Thus, there will be limited domestic resource utilization for the project. Construction materials such as bricks, sand cement, rods, etc. will be locally purchased. So, there will be no such notable load on local resources

7.3.13 Site Clearance and Restoration

431. The existing vegetation inside the tower base area of the proposed transmission line and substation will need to be cut before starting the construction works. Though most of the portions of the alignment fall inside paddy fields/ floodplains, so, occurrence of tree felling is limited within the settlements. Additional vegetation damage (mainly shrubs and herbs) will be occurred at the construction sites for storing construction materials, labor and construction vehicle movement.

432. Second time vegetation damage will be occurred during stringing of wires. All trees will need to be shaved out inside RoW. In this case, trees on the settlement which are falls inside the alignment would be cut. In the same way existing crop field vegetation will be damaged.

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

7.3.14 Impact due to Land Filling of Substation

434. The substation will require about 3.5m of land filling. The excavated earth should be kept in a nearby vacant place and after completion of foundation work; back-filling of the excavated area will be done with local soil and sand. Major impacts from the landfill materials are air pollution- from the landfill material carrying vehicles, Soil pollution -from the excavated earth or sourced fill material. In addition to this, drainage congestion, waste generation may occur if not managed properly.

435. The substation civil designs will include drainage and flood control measures to avoid adverse impacts by land filling in new substation land and also specify that the soil/sand shall be sourced only from licensed suppliers who are authorized by the government to supply soil/sand for land filling. The vehicles carrying land fill materials should be covered to mitigate air pollution.

7.4 Impacts during O&M Phase

7.4.1 Waste Management at Substations

436. Waste may generate at O&M phase of substation by workers, staff, employers and generated by machines, utilities, equipment.

437. Waste management and handling was seen to be a problem in substation. Pieces of solid wastes (removed parts of transformers, scraps) had no specific and designated area for collection and eventual disposal. Substation facilities should designate special areas/ points for solid waste collection and collect all unwanted scraps for a safe disposal. Wastes such as pieces of cables, switch gears and other waste could have special bins. Handling of hazardous and non-hazardous material needs to be improved especially in storage arrangement and prevention of spillage. To ensure used and scrap equipment/material are properly disposed after removal/replacement, it is recommended for hand-over procedures of equipment/projects to include an environmental checklist which prompts the disposal method. This is required to avoid new debris and waste/scrap being accumulated at the substations in the future, leading up to project implementation

438. During the operation phase substances and oily waste might get leached through soil by precipitation of water and percolate to the groundwater table, due to handling, disposal and oil spills in substation sites. This results in groundwater pollution in nearby area. This situation will increase during the rainy season and have a critical impact on soil, surface and groundwater

7.4.2 Public Health Impacts from Electro-Magnetic Fields

439. Overhead lines produce both electric and magnetic fields. Electric fields are created by differences in voltage. The strength of the electric field is measured in kilovolts per meter (kV/m). Any electrical wire that is charged will produce an associated electric field. This field exists even when there is no current flowing. The higher the voltage, the stronger the electric field at a given distance from the wire. Magnetic fields are created when electric current flows; the greater the current, the stronger the magnetic field. Electric fields are strongest close to a charge or charged conductor, and their strength rapidly diminishes with distance from it. Magnetic fields arise from the motion of electric charges. The strength of the magnetic field is measured in micro tesla, µT.

440. For the double circuit line configuration system, the results for line currents of 215A shows a maximum magnetic flux density value within the transmission corridor of 8.3074µT and 10.7735µT at 1 and 4m above ground respectively. The maximum values at 1000A line currents are 38.6392µT and 50.1093µT at 1 and 4m above ground level respectively. The maximum magnetic flux density outside the transmission corridor (at the ROW edges) is less than 1.31µT at 215A line currents, and less than 6.1µT at 1000A line currents; which are about 98.69% and 93.9% below the general public exposure level limit set by the ICNIRP. Within the transmission corridor, and for line currents of 1000A, the magnetic flux density, B, is 92.27% and 89.98% less than the ICNIRP exposure level limit for the 1 and 4m heights above ground respectively. For line currents of 215A, these percentages go higher than those for 1000A line currents. Outside the transmission corridor, the maximum average magnetic flux density is 1.28µT and 5.96µT for 215A and 1000A line currents respectively. The table below shows the maximum magnetic flux density within and outside the transmission corridor.

441. A comparison of the computed field values to the ICNIRP international standards was the second step to see whether the magnetic field constitutes health risks or not according to some specific magnetic field reference level. Because magnetic fields produced around overhead power transmission lines are decaying as the distance increases after the outer line conductors, the maximum magnetic field values in the general public area (outside the transmission corridor specified by the ±30m off the center line) are those at exactly the ROW edges. These field values as compared to the ICNIRP standards for exposure limits to Mf are too weak to cause any health effects. Consequently, more safe areas are guaranteed as we go far away from the ROW edges. For workers in the occupational area, the magnetic field strength increases as they go closer to the line conductors where risk increases and the magnetic field reaches its maximum. The results also show a noticeable decrease of the field values by an increase in the minimum clearance of the line conductors.

7.4.3 Audible Noise and Radio Interference

Audible Noise

442. When corona is present on the conductors, EHV lines generate audible noise which is especially high during foul weather. The noise is broadband which extends from very low frequency to about 20 KHz. Corona discharges generate positive and negative ions which are alternately attracted and repelled by periodic reversal of polarity of the ac excitation. Their movement gives rise to sound pressure waves at frequencies of twice the power frequency and its multiples, in addition to broadband spectrum which is the result of random motion of ions. Since audible noise is manmade, it is measured in the same manner as other types of manmade noise such as aircraft noise, automobile ignition noise, transformer hum, etc. therefore, it is measured in decibels

Radio Interference

443. Pulse type of corona gives interference to radio broadcast in the range of 0.5 MHz to 1.6 MHz, in addition to corona generated on line conductors, there are spark discharges from broken insulators and loose wires which interfere with TV reception in the 80 – 20 MHz range. Corona on conductors also causes interference to Carrier Communication and Signalling in the frequency range 30-500 KHz.

7.4.4 Tree Cutting / Trimming during Maintenance Activities

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

7.4.5 Risk of Bird Collision and Electrocution

445. Electric lines are obstructions typically placed within the range of average bird flight level and are difficult for birds to see. Birds can be injured or killed when they collide with electric lines in mid-flight. Electric lines are a particular risk in locations frequently travelled by birds and in areas where poor weather or darkness could further decrease visibility. Although birds of all sizes and types collide with wires, their behaviour and body type put them more at risk for line collisions. For instance, herons, egrets, raptors, and storks breed and roost in elevated areas such as trees and poles, which makes their daily

exposure to these areas much higher than other ground roosting and nesting birds. In addition, herons, egrets, and storks, as well as many species of waterfowl and cranes, travel between breeding, feeding, and roosting sites in flocks. All these behaviours increase the possibility of a bird's exposure to electric lines. In fact, it was an incident involving collisions of Whooping Cranes with transmission lines in the 1980s that spurred important advances in the work being done to reduce bird collisions with electric utility lines.

446. Bird collisions can be mitigated by increasing the visibility of TL to the Birds with a variety of lighting conditions. Using of BIRD-FLIGHT diverters can be an effective solution to mitigate this problem. BIRD-FLIGHT diverters conceal overhead lines and guyed structures so that birds can see them and are less likely to be harmed as well as the lines themselves. However, if the design team and the EPC contractor considers this option feasible then bird flight diverters can be introduced in Bangladesh as a mitigation measure. Also keeping a standard space in between parallel wires would avoid any connection through birds/ bats etc.

7.4.6 Risks of Bat

447. Overhead power transmission cables, towers at substations, distribution poles or pylons rise high enough in space to pose risks of collision of flying animals. There is therefore concern that cumulatively there could be risk of bats crushing into the pylons especially when they are erected in migratory paths, congregator habitats such as roosts. There could be positive impacts of towers acting as roosts to some bats. However, constructions of pylons should be aligned to habitats that are not critical to bats' breeding and mass migration.

448. Bats may be electrocuted by electric power lines when a part of their body, normally wing membranes simultaneously get in contact with energized wire and neutral, energized wire and earthed object or touching two energized wires same time. The probability of this happening is more likely when wires are close together, the size of wing span of a bat (10cm-60cm apart). Bats will not be electrocuted when they get in contact with a single wire, energized or otherwise. To minimize this risk on the transmission line, overhead power cables should be spaced sufficiently wide (>60cm) enough beyond the size of wingspan of the largest bat known or suspected to use the area. Where this is not possible to observe insulation may be considered.

449. The following are mechanisms through which Transmission line between Notun Biddyut and Char Fasson potentially may impact on bats during the construction and operational phases of the development.

- Habitat alteration and disturbance
- Construction site waste generation
- Fugitive dust and waste generated by heavy machines, trucks and vehicles
- Noise from heavy construction and transport machines and vehicles
- Potential oil spill and other hazardous material

450. The following table contains the risk assessment for Bat during operation phase without mitigation measures and with mitigation measure.

Unmitigated Impact: Bat collision with transmission line, pylons and towers during Operation Phase					
Criteria	**Geographic Extent**	**Magnitude of Impact**	**Duration of Impact**	**Probability**	**Risk**
Value	2	2	2	3	Low (-18)
Mitigation: Echolocating bats are less likely to fall victim of crushing into overhead cables. According to study results, Fruit bats which could be vulnerable are rare and often fly lower than proposed height					
Mitigated Impact: Bat collision with transmission line, pylons and towers during Operation Phase					
Criteria	**Extent**	**Magnitude**	**Duration**	**Probability**	**Risk**
Value	1	2	2	3	Low (-15)
Unmitigated Impact: Electrocution of bats by overhead electric cables					
Criteria	Extent	Magnitude	Duration	Probability	Risk
Value	2	4	5	3	Medium (-33)
Mitigation: This risk is real and can be huge if the cables are close to each other. Many bat species recorded in this area include curious species capable of inspecting, and feeding close to cables and could be at risk when their wings touch two cables as explained above. Young bats may be more at risk as they often fly close to potential perches. Keeping cables far apart >60cm, will certainly minimize or eliminate this risk of electrocution along the lines. Where wide spacing of electric cables is not practical then insulation is recommended					
Mitigated Impact: Electrocution of bats by overhead electric cables					
Criteria	**Extent**	**Magnitude**	**Duration**	**Probability**	**Risk**
Value	2	2	4	2	Low (-16)
Confidence of assessment: high					

7.4.7 Occupational Health and Safety during Operation and Maintenance

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

7.4.7.1 Corona Effect

452. One of the phenomena associated with all energized electrical devices, including high-voltage transmission lines, is corona. The localized electric field near a conductor can be sufficiently concentrated to ionize air close to the conductors. This can result in a partial discharge of electrical energy called a corona discharge, or corona. Several factors, including conductor voltage, shape, and diameter, and surface irregularities such as scratches, nicks, dust, or water drops, can affect a conductor's electrical surface

gradient and its corona performance. Corona is the physical manifestation of energy loss and can transform discharged energy into very small amounts of sound, radio noise, heat, and chemical reactions with the air components.

453. During corona activity (Deno & Silva, 1985), transmission lines (primarily those rated at 345 kV and above) can generate a small amount of sound energy. This audible noise can increase during bad weather conditions. Water drops may collect on the surface of the conductors and increase corona activity so that a crackling or humming sound may be heard near a transmission line. Transmission line audible noise is measured in decibels using a special weighting scale, the "A" scale, that responds to different sound characteristics similar to the response of the human ear. Audible noise levels on typical 230 kV lines are very low and are usually not noticeable. For example, the calculated rainy weather audible noise for a 230 kV transmission line at the right-of way edge is about 25 dBA, which is less than ambient levels in a library and much less than background noise for wind and rain.

454. Overhead transmission lines do not, as a general rule, interfere with radio or TV reception. There are two potential sources for interference: corona and gap discharges. The corona discharges can sometimes generate unwanted electrical signals. Corona-generated electrical noise decreases with distance from a transmission line and also decreases with higher frequencies (when it is a problem, it is usually for AM radio and not the higher frequencies associated with TV signals). Corona interference to radio and television reception is usually not a design problem for transmission lines rated at 230 kV and lower. Calculated radio and TV interference levels in fair weather and in rain are extremely low at the edge of RoW for a 230 kV transmission line.

7.4.8 Impact on Health and Safety

7.4.8.1 EMF (electromagnetic field)

455. Overhead lines produce both electric and magnetic fields. Electric fields are created by differences in voltage. The strength of the electric field is measured in kilovolts per meter (kV/m). Any electrical wire that is charged will produce an associated electric field. This field exists even when there is no current flowing. The higher the voltage, the stronger the electric field at a given distance from the wire. Magnetic fields are created when electric current flows; the greater the current, the stronger the magnetic field. Electric fields are strongest close to a charge or charged conductor, and their strength rapidly diminishes with distance from it. Magnetic fields arise from the motion of electric charges. The strength of the magnetic field is measured in micro tesla, µT.

456. Health concerns over exposure to EMF are often raised when a new transmission line or substation is proposed. However, in spite of all the studies that have been carried out over the past 30 years, there is still no persuasive evidence that the fields pose any health risks. Rehabilitation of existing power lines is unlikely to increase EMF, but new lines may induce EMF. The transmission lines will traverse minor populated areas. Therefore, inspection of existing EMF along the selected routes of existing and new transmission lines in such areas would be important.

457. WHO (June 2007) recommends using exposure guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP (2010) has set the limits at 50 HZ for the public exposure as: (1) electric field strength (kV per meter) is 5 kV/m, and (2) magnetic field strength (micro tesla) is 200 µT (equivalent

to 160 A/m); while for the occupational exposure as: (1) electric field strength is 10 kV/m and (2) magnetic field strength is 1000 μT.

458. Based on the literature review (WHO, 1984) and (Salma, Kamal, & Hiba, 2006) the maximum electrical field generated by the 400kV double circuit line is estimated at 5 kV/m, around the distance of 11 m from axis of line, equivalent to the 5 kV/m safe limit for public specified by ICNIRP. The maximum magnetic field generated by the proposed new lines is estimated to be 81.942 μT at the nearest distance from the line, below the 200 μT limit specified by ICNIRP. Thus, in the future any residents living underneath or very close to the proposed transmission lines are not expected to be exposed to an environment above EMF limits. Community health and safety, placement of safety signages within the vicinity, awareness training will be provided to the people in the vicinity.

7.5 Mitigation

459. The impact significance assessment and mitigation measures for potential environmental impacts applicable to pre-construction and construction stages is presented in Table 7-8 and Table 7-10 for TL and SS respectively.

460. The impact significance assessment and mitigation measures for potential environmental impacts applicable to operation and maintenance stages is presented in Table 7-9 and Table 7-11 for TL and SS respectively.

7.5.1 Mitigation Measures for potential Environmental Impacts during pre-construction / construction stages for Transmission Line

Table 7-8: The Impact Significance Assessment and Mitigation Measures for potential Environmental Impacts during pre-construction / construction stages for Transmission Line

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	▪ Localized impairment of air quality by exhaust emissions from vehicles and equipment engines ▪ Elevated dust levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	Affected communities in area of influence	Major	▪ All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) should be well maintained and not emit dark or smoky emissions in excess of the limits described in the EQS. ▪ Focus on reducing dust and exhaust gas emissions from heavy construction vehicles ▪ Appropriate training should be provided to workers on reducing dust and air pollution ▪ Drivers of vehicles used during construction should be under strict instructions to minimize unnecessary trips and minimize idling of engines. ▪ Dust suppression facilities (back pack water sprayer) should be available where earth and cement works are required. ▪ Spray water on dry & loose surface of the construction sites regularly; ▪ Maintain adequate moisture content of soil during transportation, compaction and handling;	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	▪			▪ Construction materials (sand, gravel, and rocks) and spoil materials should be transported by trucks covered with tarpaulins. ▪ Sprinkle and cover stockpiles of loose construction materials (e.g.,, fine aggregates, sand); and ▪ Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter. ▪ Dust masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.	
Noise	▪ Nuisance noise from construction activities, heavy machines, generators and construction vehicle movement.	Affected communities in area of influence Construction workers	Moderate	▪ Use of noise plug in heavy construction equipment; ▪ It is recommended that no construction should be allowed during night time (9 PM to 6 AM) ▪ Avoid using of construction equipment producing excessive noise at night; ▪ Construction activities should not be during night time ▪ Avoid prolonged exposure to noise (produced by equipment) by workers; and ▪ Regulate use of horns and avoid use of hydraulic horns in project vehicles. ▪ Generator should be placed within room (concrete walls with roof).	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				▪ Monitoring of noise level at construction site, construction camp as and when required.	
Soil	▪ Change to soil structure (erosion and compaction) as a result of excavation and backfilling and removal of vegetation (at the tower foundation pits and possibly parts of the access roads)	Soil on construction site	Major	▪ Construction of foundations to be undertaken in the dry season. ▪ Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. ▪ Protect excavated soil materials from erosion. ▪ Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season. ▪ Use of existing track for transport of man and material to the extent possible.	Minor
	▪ Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminum oxide paint, etc)	Soil on construction site, especially by construction camp and each tower	Moderate	▪ Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. ▪ Install oil/water separators and silt traps before effluent, leaves the site. ▪ Minimize bare ground and stockpiles to avoid silt runoff. ▪ Appropriate sites need to be identified for disposal of hazardous and nonhazardous waste	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				▪ Appropriate measures should be taken to insulate the oil spillage. Immediate action should be taken if any oil spills.	
Water resources	▪ Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	Local groundwater- well and bore hole	Moderate	▪ Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. ▪ Minimize bare ground and stockpiles to avoid silt runoff. ▪ Appropriate sites need to be identified for disposal of hazardous and nonhazardous waste ▪ Appropriate measures should be taken to insulate the oil spillage. Immediate action should be taken if any oil/ chemical spills.	Minor
	▪ Exploitation of water resources (e.g., casting of foundations) sourced from nearby water bodies through tanks	Nearby canals or ponds	Major	▪ Regular inspection/checks to minimize the impacts on the waterbodies	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Drainage Congestion and Flooding	▪ Localized flooding due to congestion from construction wastes.	Affected communities in area of influence	Major	▪ Provision for adequate drainage of storm water ▪ Provision of adequate diversion channel, if required ▪ Provision for pumping of congested water, if needed ▪ Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season	Minor
Waste generation	▪ Generation of construction wastes from the construction materials.	Affected communities in area of influence	Major	▪ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time ▪ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements ▪ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials ▪ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste ▪ Use of construction materials containing recycled content when possible and in accordance with accepted standards. ▪ Adequate collection and storage of waste on site and safe transportation to the disposal sites	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				and disposal methods at designated area should be provided.	
Terrestrial ecology	Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	Flora and fauna and habitat in the area of influence	Major	See above measures on air quality, noise and vibration, soils and water resources. Limit lightening on site. Sensitivity training to staff and anti-poaching policy. Prepare construction management plan by the contractor and follow it. Follow GoB rules and regulations on noise.	Minor
	▪ Loss of vegetation due to clearance activities	Flora and fauna within the RoW	Moderate	▪ Site clearance activities to be restricted to the minimum required area.	Minor
Aquatic ecology	▪ Construction may cause wetland habitat loss	Flora and fauna within the RoW	Moderate	▪ The TL will pass through ponds and canals, but the TL towers will be constructed on land. Thus, no impact on any waterbody thus aquatic ecology.	Minor
Clearing of vegetation	▪ 1797 trees will be partially affected by trimming as well as standing crops (if any) and bushes along the RoW also will be affected.	bushes along the RoW also will be affected.	Major	▪ Cleaning natural vegetation should be avoided as much as possible ▪ Records must be maintained for any tree cutting ▪ Prior to start clearing of vegetation; provide adequate compensation to the owners.	Moderate

7.5.2 Mitigation Measures for potential Environmental Impacts during operation and maintenance stages for Transmission Line

Table 7-9: The Impact Significance Assessment and Mitigation Measures for potential Environmental Impacts during operation and maintenance stages for Transmission Line

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	No impact on the Air quality of the area is anticipated at this stage				
Noise & vibration	No impact on the Noise & vibration of the area is anticipated at this stage				
Geology and Soils	No impact on the Geology and Soils of the area is anticipated at this stage				
Water resources	No impact on the surface water and hydrogeology of the area is anticipated at this stage				
Drainage Congestion and Flooding	No impact on the Drainage Congestion and Flooding of the area is anticipated at this stage				
Waste generation	No impact on the Waste generation in the area is anticipated at this stage				
Terrestrial ecology	▪ Avian collision ▪ Transmission line may affect the free movement of the birds, flying mammals (bat) etc.	▪ Terrestrial Fauna (Avifauna, Flying Mammals etc) along TL construction site	Major	▪ Increase the visibility of TL to the Birds with a variety of lighting conditions, ▪ Use of BIRD-FLIGHT diverters. BIRD-FLIGHT can be an effective solution to mitigate this phenomenon. However, if the design team and the EPC contractor considers this option feasible then bird flight	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				diverters can be introduced in Bangladesh as a mitigation measure. ▪ Keep standard space in between parallel wires to avoid connection through birds/ bats etc. Visibility of Double circuit will not allow the birds to collide with power line	
	▪ Increasing of the traffic volume and human activities directly or indirectly affect the shorebirds habitat and movements ▪ Noise pollution may affect the shorebirds communities	Terrestrial Fauna (Avifauna, Flying Mammals etc) along TL construction site	Major	▪ Maintenance of the existing green belt and creation of more greenery areas inside the project as well as outside the project boundary (as possible); ▪ Wild life and shorebird should be protected through enforcing law/act;	Minor
	▪ Loss of vegetation due to routine clearance of vegetation	Maximum of 7.5m wide within center line of RoW shall be maintained for TL maintenance	Moderate	▪ Maximum of 7.5m wide within center line of RoW shall be maintained for TL maintenance	Minor
Aquatic ecology	No impact on the Aquatic ecology of the area is anticipated at this stage				

7.5.3 Mitigation Measures for potential Environmental Impacts during pre-construction / construction stages for Sub-station

Table 7-10: The Impact Significance Assessment and Mitigation Measures for potential Environmental Impacts during pre-construction / construction stages for Sub-station

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	▪ Localized impairment of air quality by exhaust emissions from vehicles and equipment engines ▪ Elevated dust levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	Affected communities in area of influence	Major	▪ All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) should be well maintained and not emit dark or smoky emissions in excess of the limits described in the EQS. ▪ Focus on reducing dust and exhaust gas emissions from heavy construction vehicles ▪ Appropriate training should be provided to workers on reducing dust and air pollution ▪ Drivers of vehicles used during construction should be under strict instructions to minimize unnecessary trips and minimize idling of engines. ▪ Dust suppression facilities (back pack water sprayer) should be available where earth and cement works are required. ▪ Spray water on dry & loose surface of the construction sites regularly; ▪ Maintain adequate moisture content of soil during transportation, compaction and handling; ▪ Construction materials (sand, gravel, and rocks) and spoil materials should be transported by trucks covered with tarpaulins.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				▪ Sprinkle and cover stockpiles of loose construction materials (e.g., fine aggregates, sand); and ▪ Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter. ▪ Dust masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.	
Noise	▪ Nuisance noise from construction activities, heavy machines, generators and construction vehicle movement.	Affected communities in area of influence Construction workers	Moderate	▪ Use of noise plug in heavy construction equipment; ▪ It is recommended that no construction should be allowed during night time (9 PM to 6 AM) ▪ Avoid using of construction equipment producing excessive noise at night; ▪ Construction activities should not be during night time ▪ Avoid prolonged exposure to noise (produced by equipment) by workers; and ▪ Regulate use of horns and avoid use of hydraulic horns in project vehicles. ▪ Generator should be placed within room (concrete walls with roof). ▪ Monitoring of noise level at construction site, construction camp as and when required.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Soil	▪ Top soil loss (about 0.5m thick) due to construction of substation sites		Moderate	▪ Prior to start filling the site, collect and storage top soils (minimum 0.5m thick) for using on the surface of the site boundary and access road side slopes for protection from side slope erosion. ▪ Construction of foundations to be undertaken in the dry season. ▪ Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. ▪ Protect excavated soil materials from erosion. ▪ The topsoil, excavated from the proposed construction sites should be re-spread in areas to be landscaped.	Minor
	▪ Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminum oxide paint, etc.)	Soil on construction site,	Moderate	▪ Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. ▪ Install oil/water separators and silt traps before effluent, leaves the site. ▪ Minimize bare ground and stockpiles to avoid silt runoff. ▪ Appropriate sites need to be identified for disposal of hazardous and non-hazardous waste ▪ Appropriate measures should be taken to insulate the oil spillage. Immediate action should be taken if any oil spills.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Water resources	▪ Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	Local groundwater- well and bore hole	Moderate	▪ Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. ▪ Minimize bare ground and stockpiles to avoid silt runoff. ▪ Appropriate sites need to be identified for disposal of hazardous and nonhazardous waste ▪ Appropriate measures should be taken to insulate the oil spillage. Immediate action should be taken if any oil/ chemical spills.	Minor
	▪ Exploitation of water resources (e.g., casting of foundations) sourced from nearby water bodies through tanks	Nearby canals or ponds	Moderate	▪ Regular inspection/checks to minimize the impacts on the waterbodies	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Drainage Congestion and Flooding	▪ Localized flooding due to congestion from construction wastes.	Affected communities in area of influence	Major	▪ Provision for adequate drainage of storm water ▪ Provision of adequate diversion channel, if required ▪ Provision for pumping of congested water, if needed ▪ Ensure adequate monitoring of drainage effects, ▪ especially if construction works are carried out during the wet season	Minor
	▪ Reducing floodplain storage area and increase local flooding ▪ Due to earth filling of substation sites above highest flood level (HFL). ▪ Drainage congestion if the surrounding the sites are blocked by the earth embankment.	Affected communities in area of influence	Major	▪ Ensure adequate monitoring, especially if construction works are carried out during the monsoon period. ▪ Provision for pumping of congested water, if needed; ▪ Consider of HFL during design of substations to avoid inundation.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Waste generation	▪ Generation of construction wastes from the construction materials.	Affected communities in area of influence	Major	▪ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time ▪ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements ▪ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials ▪ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste ▪ Use of construction materials containing recycled content when possible and in accordance with accepted standards. ▪ Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area should be provided.	Minor
Terrestrial ecology	▪ Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	Flora and fauna and habitat in the area of influence	Moderate	▪ See above measures on air quality, noise and vibration, soils and water resources. ▪ Limit lightening on site. ▪ Sensitivity training to staff and anti-poaching policy. ▪ Prepare construction management plan by the contractor and follow it. ▪ Follow GoB rules and regulations on noise.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	▪ Loss of vegetation due to clearance activities	Flora and fauna within the Substation	Moderate	▪ Site clearance activities to be restricted to the minimum required area.	Minor
Aquatic ecology	▪ Construction may cause wetland habitat loss	Flora and fauna within the Substation	Moderate	▪ There is no significant water body in close proximity of the substation area.	Minor
Landfilling	▪ Vehicle carrying landfill materials may elevate air pollution ▪ Excavated earth/or sourced soil may pollute top soil condition ▪ Unmanaged landfill material may arise drainage congestion.	Affected communities and habitat in area of influence	Moderate	▪ All vehicles carrying landfill materials should be covered ▪ Landfill materials should be dumped in a designated area with proper covers around. ▪ Prior to start filling the site, collect and storage top soils for using on the surface of the site boundary and access road side slopes for protection from side slope erosion. ▪ Construction of foundations to be undertaken in the dry season. ▪ Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. ▪ Protect excavated soil materials from erosion. ▪ The topsoil, excavated from the proposed construction sites should be re-spread in areas to be landscaped. ▪ Should follow drainage and waste management measures as identified in the ECPs (Annex 1).	Minor

7.5.4 Mitigation Measures for potential Environmental Impacts during operation and maintenance stages for Sub-station

Table 7-11: The Impact Significance Assessment and Mitigation Measures for potential Environmental Impacts during operation and maintenance stages for Sub-station

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	No impact on the Air quality of the area is anticipated at this stage				
Noise & vibration	No impact on the Noise & vibration of the area is anticipated at this stage				
Geology and Soils	No impact on the Geology and Soils of the area is anticipated at this stage				
Water resources	No impact on the surface water and hydrogeology of the area is anticipated at this stage				
Drainage Congestion and Flooding	▪ Drainage congestion will occur in the surface drains within the substation area if O&M is not done regularly.	Affected communities in area of influence	Moderate	▪ Provision for adequate drainage of storm water ▪ Provision of adequate diversion channel, if required ▪ Provision for pumping of congested water, if needed ▪ Clean the drains, especially during monsoon regularly; ▪ Ensure adequate monitoring.	Minor
Waste generation	No impact on the Waste generation in the area is anticipated at this stage				

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Terrestrial ecology	▪ Loss of vegetation due to routine clearance of vegetation	Flora and fauna in and around the substation site	Minor	▪ Cleaning natural vegetation should be avoided as much as possible	Minor
	▪ Tree replantation	Community and habitat along the TL	Positive	▪ Plantation of 5391 saplings to replace 1797 felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow Tree plantation plan as per Annex 28.	Positive
Aquatic ecology	No impact on the Aquatic ecology of the area is anticipated at this stage				

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8. Social Impact Assessment and Mitigation Measures

8.1 Project Impacts

8.1.1 Employment Opportunities

461. During construction, considerable quantities of workers (both male & female) may be required at various work sites. Some local people may also involve themselves in small businesses (e.g., tea stall, grocery shop, etc.). Local people can be involved in the project construction work as per their skills

462. During the 36-month construction phase, there will be a need for both skilled and non-skilled labor to build the tower pads, erect towers, and string conductors. Employment opportunities will be created for people in the immediate area, as well as in the country. Contractors will be encouraged to provide opportunities to local people. Jobs in construction and supporting industries will result in increased productivity and capital income of the people.

8.1.2 Access Restrictions

8.1.2.1 Impacts from Access Roads and Damages to Local Infrastructure

463. During the construction phase of the overhead transmission line from Bhola Notun Biddyut PP- Char Fasson, certain areas' access may be disturbed and/or restricted.

464. 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.

8.1.2.2 Blockage of Access Routes

465. The transmission line route selected has 30 angle points and crosses through 43 roads/ highways. All the angle point from the transmission line falls has been selected in such a way that the construction of towers falls under vacant agricultural lands. Thus, blockage of access routes is not expected from the Transmission line.

8.1.3 Impact on Livelihood

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

8.1.4 Impacts on Land Use

467. Currently, rice crops are being cultivated on these lands. The standing crops will be affected during the construction of tower bases and stringing. Further, there will be a small change in land use with up to 7.12 acre lost for tower foundations and 5 acres has been acquired by PGCB for the substation. During construction, activities will be phased to allow farmers to harvest standing crops and for construction storage and vehicle activity, barren areas will be identified.

8.1.5 Impact due to Land Acquisition

468. Land owners have been compensated for the land acquired for the requirement of the substation construction as per the electricity rule 2020. Due to land acquisition the farmers who were renting the land for cultivation will temporarily be in loss of jobs.

8.1.6 Affected Residential Structures in the TL RoW

469. There is no structure found in the proposed land to be acquired for substations. For the construction of the TL, there is also no structures found within the 10m impact buffer from either side of the centre line. So, no physical displacement and relocation is required for this project except land acquisition and crop compensation. The tower footings for laying transmission lines require land compensation as per Electricity Rules 2020 even if land for tower footings will not be acquired. Compensation will be provided for standing trees under RoW which require felling before laying the transmission lines.

470. However, there are 44 structures present within the 25m buffer of either side of the centre line of the TL. Table 8-1 outlines detailed structure types as identified during the topographic survey, and states there will be 42 residential structures along the TL, of which 2 are pucca, 16 semi pucca and 24 are kacha structures.

Table 8-1: Residential and Commercial Structures of the TL (outside of 10m impact buffer)

Structure Type	Pucca	Semi Pucca	Kacha	Total
Residential	2	16	24	42
Commercial	-	0	2	2
Total	2	16	26	44

Source: ENRAC Topographic Survey

8.1.7 Affected Commercial Structures in the TL RoW

471. For the construction of the TL, there is no structures found within the 10m impact buffer from either side of the centre line, however, within 25m buffer from either side of the TL there are a total of 44 structures present (Table 8-1). Of the structures identified frm the topographic survey, 2 are commercial structures of kacha type.

8.1.8 Temporary Loss of Crops in the TL RoW

472. About 7.12 acres and 5 acres of land will be required for the footings of towers (angle tower and suspension tower) and substation respectively. So, a total of 7.12 acres of agricultural land will face loss of crops due to transmission tower. The land area used for the tower footings will be a permanent loss to their respective landowners. The landowners will be compensated as per the electricity rule 2020. As per the practice, people will be allowed to cultivate underneath the tower area. Once the towers are constructed paddy and other seasonal crops would be planted between the footings of the tower, therefore no land loss is anticipated. In addition, a small quantity of land will be required temporarily for the construction camps nearby the tower sites. A large number of households were originally identified within the chosen alignments and deviations to the routes were selected to reduce the number of affected houses.

8.1.9 Loss of Trees in the TL RoW

473. The tree assessment survey identified 450 trees those will be within the footprint of the towers. The installation of the transmission lines will affect a number of standing trees of different varieties along the RoW which have to be removed to pave the way for the construction work of the transmission lines. The standing trees which are grown directly under the proposed conductors and falling within an estimated area of a clearing width of the respective RoWs will be removed. The total number of trees to be removed is estimated at 1797 which include 1055 non-fruits, 616 fruits, Bamboo 84 and 42 medicinal plants. The proposed transmission lines stretch approximately 39.81 km and require clearance of the RoW, resulting in temporary loss of vegetation. In general, vegetation destruction shall result in some loss of biodiversity, as valuable trees, such as those of medicinal importance or producing fruit may be adversely impacted. Trees also provide habitat for most birds, and some animals, so these may also be affected, as vegetation cover of the understory is reduced. A compensatory replantation ratio of 1:3 will be carried out to mitigate the ecological loss of felling trees (Tree Conservation Bill, 2012). Some additional vegetation damage will occur at sites required for storing construction materials, for construction activities, for labor camps, and for construction vehicle storage, etc.

8.1.10 Other Impacts in TL RoW

474. There is a mosque near AP 26 in the RoW of the proposed power transmission line. The mosque is located 13m east from the centre of the transmission line. It will be affected by the project in terms of losing only trees that fall under the RoW. The mosque may be impacted from the EMF, however, EMF strength at 13m distance is very insignificant. Additionally, clearance to obstacles guidelines to be followed as per PGCB practise, as outlined in Annex 21.

Table 8-2: Affected Community Property Resource

CPR Name	Impacts	Location
Iman Ali Jame Mosjid	Only trees None of the structure will be damaged due to the project intervention	Mouza: Kulsumbagh, Union: Aminbagh Upazila: Char Fasson

8.1.11 Damage to Cultural Resources

475. Bangladesh is a country where civilization has existed for thousands of years and encountering physical and cultural monuments in construction related excavations is a distinct possibility. During construction, with many small construction sites along the line alignment, there is potential to unearth or discover objects of a cultural nature that will need to be protected. While there is no evidence of such sites within the study area, there are various tombs, temples and other sites in the country. It is, therefore, important to have a procedure in place to ensure that there is a mechanism in place to handle any material culture finds.

476. To protect cultural resources from accidental damage from construction, existing cultural property will be treated as sensitive receptors. They will be avoided where

possible and subject to the control on air pollution and noise. Implement Chance Find Protocols as soon as historical/cultural monuments are encountered during construction activities (Annex 16). Stop work and inform the relevant authorities including the Ministry of Cultural Affairs, Bangladesh. The Ministry would implement measures to avoid damage to monuments and valuable features which the contractor is bound to follow

8.1.12 Vulnerable Households

477. Vulnerable households under this project include those that are: (i) households headed by women; (ii) household headed by persons with disabilities; (iii) households whose annual incomes are lower than Tk90,000; (iv) elderly headed households, (v) households who are landless, and (vi) who are without legal title to land. The vulnerable status for persons without legal title is determined based on the social impact assessment/survey.

478. The vulnerability assessment was based on 30 households affected by the crop loss during TL tower construction. The socio-economic survey did not identify any vulnerable household or group within the 50 m corridor (25m either side of the TL).

8.1.13 Gender Issues

479. Pandemics and outbreaks have differential impacts on women and men. From risk of exposure and biological susceptibility to infection to the social and economic implications, individuals' experiences are likely to vary according to their biological and gender characteristics and their interaction with other social determinants. Because of this, global and national strategic plans for COVID-19 preparedness and response must be grounded in strong gender analysis and must ensure meaningful participation of affected groups, including women and girls, in decision-making and implementation.

8.1.13.1 Gender based Violence Prevention Management Plan:

480. If any harm or suffering that is committed against a woman or girl, man or boy and that has negative impact on the physical, sexual or psychological health, development or identity of the person is called gender-based violence (GVB). Gender equality is achieved when women and men, girls and boys, have equal rights, life prospects and opportunities, and the power to shape their own lives and contribute to society. Ending of GBV and ensuring women's security is a priority for any project authority. The cause of this violence is founded in gender-based inequalities and discrimination. This is a violation of human rights.

481. A well-developed gender-based prevention plan is required for the smooth continuation of different phases of the project. The project authority will monitor and maintain any violence throughout project related activities.

482. The project authority will engage a person who will monitor GBV. To maintain this strategy, the responsible person should follow few steps i.e. throwing awareness program weekly/quarter of the year, providing equal opportunity for any specific work for men/women, stop abusing in workplace, Social roles and expectations may affect the decisions about relationships. Men are taught that expressing feelings is not "masculine." The roles and learning ways should be guided directly and non-violently to create more

meaningful interpersonal relationships. In addition, following steps can also be followed by the project authority to prevent GBV.

- A system and outreach service in place for psycho-social support, including safe workplace and economic empowerment.
- A strengthened health sector for effective and efficient response is needed for management, documentation and reporting on clinical evidence.
- A well developed and integrated national protection system with the capacity to prevent and respond effectively.
- A strengthened institutional framework for the coordination and monitoring of the implementation of the National GBV Plan of Action for the prevention and case management of GBV.

8.1.14 Social Conflict and Influx of Workers

483. 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.

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

- 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.
- 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.

8.1.15 Impact of COVID-19

485. In response to COVID-19, countries across the globe have implemented a range of public health and social measures, including movement restrictions, partial closure or closure of schools and businesses, quarantine in specific geographic areas and international travel restrictions. As the local epidemiology of the disease changes,

Bangladesh adjusted (i.e. loosen or reinstate) these measures accordingly. Government issued COVID-19 Guidelines for taking measures for preventing transmission. Additionally, "No mask, no service" policy has been implemented nationwide to combat the coronavirus infection. The guidelines are as below:

- Hand hygiene
- Respiratory hygiene
- Physical distancing
- Reduce and manage work-related travels
- Regular environmental cleaning and disinfection
- Awareness building regarding Corona Virus.

486. COVID-19 situation in Bangladesh is getting worse and if the COVID safety protocols are not maintained adequately, it may spread among the labors and adjacent communities during project implementation. Contractor should maintain and follow the health and safety guidelines of WHO and Bangladesh government for the project during construction phase. In addition, Contractor shall contact nearest hospitals, and community clinic for any emergency. Environmental code of practise for potential COVID-19 transmission has been discussed in Annex 1 (ECP 14).

8.1.16 Diminution of Land Value

487. There is no doubt that the value of land in the width of RoW of transmission lines will be decreased as people cannot expand their structures vertically. The presence of transmission lines and towers will significantly reduce the market value and real estate potential of the land under corridor of transmission line right of way. This impact would be major though loss of valuable agricultural land under the transmission line towers would also be significant. According to Electricity Rules 2020, there is no scope to provide compensation towards diminution of land value in the width of RoW corridor due to laying of transmission line. Government can explore possibility of enlarging scope of survey to include land scheduling for complete RoW width including name of land owners to facilitate payment of diminution of land value compensation to all eligible persons.

488. On the other hand, land values in the general area are likely to increase because of the availability of additional power supply resulting in changes in land use from agriculture to commercial and industrial use.

8.2 Alternative Traffic Plan

489. During construction period, increased traffic use of road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users, thus 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. Contractor should carry out some specific measures to avoid any accidental incidents, include in the traffic plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs, restrict truck deliveries, where practicable, to day time working hours, restrict the transport of oversize loads, check on speed limits, etc. In this regard a guideline is prepared for EPC contractor

as discussed in ECP 13, Annex 1 as well as a traffic management plan has been outlined in Annex 24 .

8.3 Mitigations

490. The impact significance assessment and mitigation measures for potential social impacts applicable to pre-construction and construction stages is presented in Table 8-3 and Table 8-5 for TL and SS respectively.

491. The impact significance assessment and mitigation measures for potential social impacts applicable to operation and maintenance stages is presented in Table 8-4 and Table 8-6 for TL and SS respectively.

8.3.1 Mitigation Measures for potential Social Impacts during pre-construction / construction stages for Transmission Line

Table 8-3: The Impact Significance Assessment and Mitigation Measures for potential Social Impacts during pre-construction / construction stages for Transmission Line

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Visual amenities	▪ Temporary presence of an active construction site with storage of materials and equipment within the RoW	People living close to the construction sites.	Minor	▪ Maintain construction site in orderly condition and do not distribute material over many sites before usage.	Minor
	▪ Domestic waste might be disposed to construction area, creating visual impact.	Construction workers and neighbors	Moderate	▪ Follow proper waste management plan to dispose domestic waste and construction waste	Minor
Land acquisition/ requisition	▪ Loss of 7.12 acres of land (mainly agricultural) permanently for the tower bases of the TL. ▪ Temporarily loss of land (requisition) for construction camps etc.	Project affected people along the RoW	Major	▪ Prior to commence construction activities, the owner of the affected land must be noticed and provided proper compensation in time as per GOB and PGCB guidelines; ▪ GOB & PGCB guidelines should be followed for land acquisition/requisition/compensation ▪ RAP should be followed for land acquisition/ requisition/ compensation.	Moderate
Land Planning and Use	▪ Change in land use caused by land take for towers, vegetation clearance, and access restriction	Project affected people along the RoW	Major	▪ Site clearance activities to be restricted to the minimum required area. ▪ Provision of predefined route, barriers or boundary markings to prevent incursion of machinery and workers into neighboring areas	Moderate

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				▪ RAP process will mitigate the impact to the minimum level	
Resettlement	▪ Households living in the RoW need to be relocated and assets in the RoW will be lost	Affected properties and livelihood	Major	▪ Follow principles and procedures of ▪ Resettlement Action Plan (RAP) Report prepared for the proposed project.	Minor
Stakeholder and Community expectation/ relations Management	▪ Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/security, noise/vibration, etc.) ▪ and adverse impact/ inconveniencies resulting from it.	Affected communities in area of influence	Major	▪ Follow mitigation for construction phase air quality, noise and traffic. ▪ Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting ▪ Set-up and effectively monitor construction grievance mechanism ▪ Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP.	Minor
Community Health, Safety and Security	▪ Increased risks of traffic safety incidents on public roads.	People living close to access roads and road users	Major	▪ Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site. ▪ Follow BRTA traffic rules and regulations;	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				▪ Schedule deliveries of material/ equipment during off-peak hours ▪ Engage flagman construction site and construction camps for traffic control ▪ Arrange for signal light at night ▪ Engage experienced drivers to drive project vehicles ▪ Proper traffic management; ▪ Avoiding stockpiling of materials specially at the road sides that could hamper traffic movement.	
	▪ Temporary influx of outside workers in the communities, risking tensions between outside labor and local population.	Affected communities in area of influence	Minor	▪ A Local Content Plan should be prepared to facilitate involvement of local labor. See HR policies and procedures below. ▪ No hiring of short-term labor to be made at the site gate. ▪ Develop a code of behaviors for workers. All workers to receive training on community relations and code of behavior. ▪ Periodic refreshing as needed based on community liaison/grievance mechanism feedback.	Minor
Traffic Congestion	▪ Increased traffic use of road by construction vehicles ▪ Movement of normal road traffics and the safety of the road-users	Affected communities in area of influence	Moderate	▪ Follow Traffic Management Plan as provided in Annex 1, ECP 13. ▪ Ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				signs / lights, road signs, restrict truck deliveries, where practicable, to day time working hours, restrict the transport of oversize loads, check on speed limits, etc.	
Labor and working conditions	▪ Exploitation of workers	Labor force	Moderate	▪ Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non-discrimination, monitoring, roles and responsibilities following Labor Law. ▪ Provide reasonable, and if applicable negotiated, working terms and conditions. ▪ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ▪ No use of child labor (workers under age 18) or forced labor.	Minor
	▪ Activities and staff at site may create security risks	All staff working at the construction site	Minor	▪ Make security plan and emergency ▪ response and contacts with security forces.	Minor
	▪ Risk of health & safety incidents amongst labor force, including minor incident's such as cuts and ▪ major incidents such as loss of life	Construction labor force	Moderate	▪ Develop project specific health and safety procedures based on PGCB standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors. ▪ Especially slip-trip and fall hazards with tower erection and electrocution need attention.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Employment and economy	▪ Creation of temporary jobs for local residents and nationals with skilled trades	Local residents of affected communities	Positive	▪ Employ local people specially PAPs for the project activities as much as possible.	Positive
	▪ Supply chain opportunities for companies that can provide goods and services needed by the company	Local companies and local SMEs	Positive	▪ Prepare a local content plan to facilitate identification and selection of qualified local companies to provide needed supplies and services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.	Positive
Infrastructure	▪ Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	Affected communities in area of influence	Moderate	▪ Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. ▪ Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. ▪ Upgrading of existing access roads.	Minor
Cultural heritage	▪ If any cultural heritage is located within the RoW along the transmission line that may require relocation	Affected communities-	Major	▪ There is a mosque near AP 26 of the RoW of the TL ▪ The mosque is located 13m east from the centre of the transmission line and may be impacted from the EMF, however, EMF strength at 13m distance is very insignificant. ▪ Make aware of the construction activities. ▪ Follow Clearance to Obstacles as per PGCB guideline, outlined in, Annex 21	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	▪ Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities along the substation site	Minor	▪ Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Minor

8.3.2 Mitigation Measures for potential Social Impacts during operation and maintenance stages for Transmission Line

Table 8-4: The Impact Significance Assessment and Mitigation Measures for potential Social Impacts during operation and maintenance stages for Transmission Line

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post- mitigation)
Corona Effect	▪ The glow appears across the conductor which shows the power loss ▪ The audio noise occurs because of the corona effect which causes the power loss on the conductor ▪ The vibration of conductor occurs ▪ Generates the ozone because of which the conductor becomes corrosive ▪ It produces the no sinusoidal signal thus the no sinusoidal voltage drops occur in the line ▪ The corona power loss reduces ▪ the efficiency of the line ▪ The radio and TV interference occurs on the line because of corona effect.	Affected communities along the RoW	Major	▪ Corona decreases the efficiency of transmission lines. Therefore, it is necessary to minimize corona. The following factors may be considered to control corona effect: ▪ Conductor diameter – For reducing corona loss, this method of increasing conductor diameters is very effective. ▪ The diameters of conductors can be increased by using hollow conductors and by using steel-cored aluminum conductors (ACSR) ▪ The voltage of the line – Voltage of transmission lines is fixed by economic considerations. To increase the disruptive voltage the spacing of the conductors is to be increased, but this method has some limitations; ▪ Spacing between conductors – If the space between conductor's increases, then the voltage drops between them also increases due to increase in inductive reactance.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post- mitigation)
EMF	▪ EMF from overhead line due to Corona effect and EMF effect ▪ Due to EMF, human health may be affected	Affected communities along the RoW	Major	▪ Noise generation is unavoidable. ▪ Use of conductors to minimize corona effect during rainy weather conditions ▪ Avoiding over loading Transmission Lines ▪ As there is no BD guidelines/ Standard, so international standard should be followed for the safety of the power lines. ▪ For housing structures clearance between TL and roof top is 6.5m-8m and for river crossing it will 14.6m-15.9m. ▪ Noted that no houses will be directly affected by the TL lines.	Minor
Visual amenities	▪ Transmission lines and towers will be visible from far and become an extrinsic element in the landscape. ▪ Cumulative with the other Transmission lines this may result in a loss of the visual amenity.	communities near RoW	Minor	▪ The RoW does not affect forests or valuable landscapes. ▪ Vegetation will be felled, but if possible smaller trees can be kept. ▪ Towers have an open structure, not hampering the view very much.	Minor
Land planning and use	▪ No impact on Land planning and use in the area is anticipated at this stage				

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post- mitigation)
Community Health, Safety and Security	▪ External safety risks of electrocutions, bush fires, line snapping, tower collapses	Affected communities along the RoW	Major	▪ Develop an emergency response plan following PGCB and international best practice including provisions for prevention and response to electrocution, bush fires, repair of snapped lines, roles and responsibilities. ▪ Coordinate with emergency services ▪ Annual safety audit of the transmission lines and poles and maintenance of the RoW to keep free of higher vegetation and structures. ▪ Communicate to communities in communities along RoW about the safety risks of the transmission lines and provide response measures. ▪ Put sign boards on towers about electrocution risk.	Minor
Short Circuit/ Accident	▪ Due to short circuit at the TL disruption of power and accident might occur.	Affected communities along the RoW	Major	▪ O&M of TL should be done in time by experienced personnel.	Minor
Labor and working conditions	▪ Exploitation of workers	Labor force for maintenance work	Moderate	▪ Follow human resources policies and procedures of PGCB, following Labor Law. ▪ Provide reasonable, and if applicable negotiated, working terms and conditions. ▪ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ▪ No use of child labor (workers under age 18) or forced labor.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post- mitigation)
	▪ Occupational H&S risks in operation and maintenance ▪ Risk to continuous power supply	Labor force for maintenance work	Major	▪ PGCB should follow their Occupational HSE plan following Bangladeshi and international requirements: train staff, monitor and keep record. ▪ Special focus on slip- trip, fall from height and electrocution in maintenance and repair works, emergency prevention and management. ▪ Use personal protection equipment. ▪ Have medical emergency equipment for primary treatment at hand.	Minor
Employment and Economy	▪ Improved electricity supply for the national grid, creating opportunities for businesses and economic development in the country.	National level Bangladesh	Positive	▪ Regular maintenance of the project to ensure reliable production of power	Positive
Cultural heritage	▪ interactions between maintenance works and cultural festivals due to traffic, noise and/or vibration impacts	communities in the area of influence	Minor	▪ festivals and potentials for interaction with maintenance works. If required cease works on the specific dates.	Minor

8.3.3 Mitigation Measures for potential Social Impacts during pre-construction / construction stages for Sub-station

Table 8-5: The Impact Significance Assessment and Mitigation Measures for potential Social Impacts during pre-construction / construction stages for Sub-station

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Visual amenities	▪ Temporary presence of an active construction site with storage of materials and equipment within the site for the substation.	People living close to the construction sites.	Minor	▪ Maintain construction site in orderly condition and do not distribute material over many sites before usage.	Minor
	▪ Domestic waste might be disposed to construction area, creating visual impact.	Construction workers and neighbours	Moderate	▪ Follow proper waste management plan to dispose domestic waste and construction waste	Minor
Land acquisition/ requisition	▪ Loss of 5 acres land (mainly agricultural) permanently for the substation site. ▪ Temporarily loss of land (requisition) for construction camps etc.	Project affected people along the substation	Major	▪ Prior to commence construction activities, the owner of the affected land must be noticed and provided proper compensation in time as per GOB and PGCB guidelines; ▪ GOB & PGCB guidelines should be followed for land acquisition/ requisition/ compensation ▪ RAP should be followed for land acquisition/ requisition/compensation.	Moderate
Stakeholder and Community expectation/ relations Management	▪ Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community	Affected communities in area of influence	Major	▪ Follow mitigation for construction phase air quality, noise and traffic. ▪ Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	safety/security, noise/vibration, etc) ▪ and adverse impact/ inconveniencies resulting from it.			▪ Set-up and effectively monitor construction grievance mechanism ▪ Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP.	
Community Health, Safety and Security	▪ Increased risks of traffic safety incidents on public roads.	People living close to access roads and road users	Major	▪ Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site. ▪ Follow BRTA traffic rules and regulations; ▪ Schedule deliveries of material/ equipment during off-peak hours ▪ Engage flagman construction site and construction camps for traffic control ▪ Arrange for signal light at night ▪ Engage experienced drivers to drive project vehicles ▪ Proper traffic management; ▪ Avoiding stockpiling of materials specially at the road sides that could hamper traffic movement.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	▪ Temporary influx of outside workers in the communities, risking tensions between outside labor and local population.	Affected communities in area of influence	Moderate	▪ A Local Content Plan should be prepared to facilitate involvement of local labor. See HR policies and procedures below. ▪ No hiring of short-term labor to be made at the site gate. ▪ Develop a code of behaviors for workers. All workers to receive training on community relations and code of behavior. ▪ Periodic refreshing as needed based on community liaison/grievance mechanism feedback.	Minor
Traffic Congestion	▪ Increased traffic use of road by construction vehicles ▪ Movement of normal road traffics and the safety of the road-users	Affected communities in area of influence	Moderate	▪ Follow Traffic Management Plan as provided in Annex 1, ECP 13. ▪ Ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs, restrict truck deliveries, where practicable, to day time working hours, restrict the transport of oversize loads, check on speed limits, etc.	Minor
Labor and working conditions	▪ Exploitation of workers	Labor force	Moderate	▪ Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non-discrimination, monitoring, roles and responsibilities following Labor Law.	Minor

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				▪ Provide reasonable, and if applicable negotiated, working terms and conditions. ▪ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ▪ No use of child labor (workers under age 18) or forced labor.	
	▪ Activities and staff at site may create security risks	All staff working at the construction site	Minor	▪ Make security plan and emergency response and contacts with security forces.	Minor
	▪ Risk of health & safety incidents amongst labor force, including minor incident's such as cuts and ▪ major incidents such as loss of life	Construction labor force	Major	▪ Develop project specific health and safety procedures based on PGCB standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors. ▪ Especially slip-trip and fall hazards with tower erection and electrocution need attention.	Minor
Employment and economy	▪ Creation of temporary jobs for local residents and nationals with skilled trades	Local residents of affected communities	Positive	▪ Employ local people specially PAPs for the project activities as much as possible.	Positive
	▪ Supply chain opportunities for companies that can provide goods and services needed by the company	Local companies and local SMEs	Positive	▪ Prepare a local content plan to facilitate identification and selection of qualified local companies to provide needed supplies and services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.	Positive

Indicator	Potential impact	Receptor	Significance (pre- mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Infrastructure	▪ Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	Affected communities in area of influence	Moderate	▪ Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. ▪ Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. ▪ Upgrading of existing access roads.	Minor
Cultural heritage	▪ If any cultural heritage is located within the proposed substation site that may require relocation	Affected communities-	Major	▪ There is no cultural heritage within the close proximity of the substation site.	Minor
	▪ Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities along the substation site	Minor	▪ Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Minor

8.3.4 Mitigation Measures for potential Social Impacts during operation and maintenance stages for Sub-station

Table 8-6: The Impact Significance Assessment and Mitigation Measures for potential Social Impacts during operation and maintenance stages for Sub-station

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Visual amenities	No impact of Visual amenities in the area is anticipated at this stage				
Land planning and use	▪ Stabilization of electricity will lead to increase in land use and pressure on natural environmental area for the upazila.	Communities in Char Fasson and nearby upazila	Major	▪ Government shall regulate the acquisition of land in the study area	Minor
Community Health, Safety and Security	▪ External safety risks of electrocutions, bush fires etc.	Affected communities along the substation area	Major	▪ Develop an emergency response plan following PGCB and international best practice including provisions for prevention and response to electrocution, bush fires, repair of snapped lines, roles and responsibilities. ▪ Coordinate with emergency services ▪ Annual safety audit of the transmission lines and poles and maintenance of the RoW to keep free of higher vegetation and structures. ▪ Communicate to communities in communities along the substation area the safety risks of the transmission lines and provide response measures. ▪	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				▪ Put sign boards on towers about electrocution risk.	
	▪ Risk to continuous power supply and even damage of substation	Affected communities along the substation area	Major	▪ Ensure security of substation in collaboration with law enforcing agencies. ▪ Keep complain book in the substation for recording peoples' complains. ▪ Ensure availability of adequate safety gears for substation operations	Minor
Short Circuit/ Accident	▪ Due to short circuit of the substation, disruption of power and accident might occur.	Affected communities along the substation area	Major	▪ O&M of substations should be done in time by experienced personnel.	Minor
Fire Explosion	▪ Fires in substations can severely impact the supply of power to customers and assets. ▪ These fires can also create a fire hazard to utility personnel, emergency personnel, and the general public	Affected communities around the substation area, as well as crew in substation charge	Major	▪ Isolation (from persons). (i) calculation and documenting fire clearance zones on the project drawings (ii) the use of oil and fire containment bund, kerbs or retaining walls for outdoor substations ▪ Engineering controls. (i) correct electrical protection settings, correct fuse sizes, correct loading and derating factors applied to the transformers based on the type of and method of installation (prevention).	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				(ii) Oil bunds, kerb stones, retaining walls and flame traps (crushed rock) to minimize the size of the oil pool and fire exposed to air (minimize the consequences). (iii) Fire suppression systems like CO_2 or self-activated aerosol generator fire suppression systems for use in a substation room located within a host building (active fire suppression and fighting the fire remotely). ▪ Administrative controls. Such as: (i) access routes should be documented and shown along with fire risk zones on the project design drawings. (ii) Easements or restricted covenants should be placed on the property title to ensure clearances are to be maintained by the landowner or a notification that 2hr fire rated structures are to be provided and maintained. ▪ Personal protective equipment (PPE) for use during inspections and equipment operation. ▪ Good asset management practices and regular monitoring, follow Fire and Explosion Management Plan as per Annex 22	

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Accidental Spillage	▪ Accidental spillage that could contaminate land and water ▪ Occupational health risks to workers due to exposure	Labor force for maintenance work/ Substation Crew	Major	▪ Acceptance of mineral oil should be accompanied with Material Data Safety Sheets and/or be certified that it is PCB-free ▪ Provision of oil-water separator ▪ Fire extinguishers readily available in storage areas for mineral oil ▪ Provide for oil containment structure	Minor
Labor and working conditions	▪ Exploitation of workers	Labor force for maintenance work	Moderate	▪ Follow human resources policies and procedures of PGCB, following Labor Law. ▪ Provide reasonable, and if applicable negotiated, working terms and conditions. ▪ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ▪ No use of child labor (workers under age 18) or forced labor.	Minor
	▪ Occupational H&S risks in operation and maintenance ▪ Risk to continuous power supply	Labor force for maintenance work	Major	▪ PGCB should follow their Occupational HSE plan following Bangladeshi and international requirements: train staff, monitor and keep record. ▪ Special focus on slip- trip, fall from height and electrocution in maintenance and repair works, emergency prevention and management. ▪ Use personal protection equipment. ▪ Have medical emergency equipment for primary treatment at hand. ▪ Ensure security of substation in collaboration with law enforcing agencies.	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				▪ Keep complain book in the substation for recording of people's complains. ▪ Ensure availability of adequate safety gears for substation operations	
Employment and Economy	▪ Improved electricity supply for the national grid, creating opportunities for businesses and economic development in the country.	National level Bangladesh	Positive	▪ Regular maintenance of the project to ensure reliable production of power	Positive
Cultural heritage	▪ interactions between maintenance works and cultural festivals due to traffic, noise and/or vibration impacts	communities in the area of influence	Minor	▪ festivals and potentials for interaction with maintenance works. If required cease works on the specific dates.	Minor

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9. Information Disclosure, Stakeholder Consultations and Participations

492. This Chapter presents the objectives, process, and outcome of the consultations carried out with the key stakeholders of the project during the present IEE study. The public consultation with different stakeholders was carried out in compliance with DoE guidelines. On July 15-17, 2021.ENRAC arranged three public meetings at three locations in the relevant Upazila along the project alignment. The locations of the consultation are shown in Table 9-1.

Table 9-1: Public Consultations Information

Public Consultation	Name of Upazila	PC Locations	Date
PC No. 1	Borhanuddin	Deula Union	15, July-2021
PC No. 2	Lalmohan	Kalma union	16, July-2021
PC No. 3	Char-fasson	Aminabad union	17, July-2021

9.1 Objectives of Stakeholder Consultations

493. The objective of the stakeholder consultation is to take public opinion about the project especially the view of environmental and social issues raised during construction and operating periods of the project so that Proponent can take adequate mitigation measures to reduce its impact to environment and society.

494. The objective of the consultation was to inform people along the proposed alignment about the work to be completed, scale of operations, timing, and sub-components, activities, potential positive and negative impacts and measures taken to mitigate those impacts. The views of each of the participants was documented.

9.2 Identification of Stakeholders

495. 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.

9.2.1 Primary Stakeholders

496. Primary stakeholders are people who would be directly benefited or impacted by a certain project intervention. In case of the proposed Project, the primary stakeholders include the people fall under the direct impact area and those who reside within and in the immediate vicinity of the project area. The primary stakeholders of the Project include PGCB, farmers, the owners of households to be impacted, small business community as well as Shopkeepers, pedestrians and students. Primary stakeholders identified and consulted during the present IEE study include communities to be benefitted and/or affected by the Project.

9.2.2 Secondary Stakeholders

497. This category of stakeholders pertains to those who may not be directly affected but have interests that could contribute to the study, play a role in implementation at some stage, or affect decision making on Project aspects. In this Project, concerned government departments and line agencies fall under this category. Secondary stakeholders for the Project include local government institutions (LGI) like City Corporation, Union Parishad; other government agencies; civil society representatives, NGOs and general public at large.

498. After the reconnaissance field visit three locations were selected based on the significance of those areas in relation to resettlement issues, loss of property including land and structures, loss of trees and disturbance to livelihoods. The final selection also the same based on the discussion with local villagers within the corridor.

499. ENRAC invited various local groups and individuals to attend the meeting. A list of participants including staff of DoE, Local Government, PGCB staff, local women's groups, farmers, businessman, project affected people were considered. A list of participants and number of representatives from each category is detailed in Table 9-2.

Table 9-2: Type of Participants during Public Consultation

Sl. No.	Participant's category	No. of Participants
1	UP Chairman	**6**
2	Ward commissioner/Union Member	**5**
3	Project Affected People (both rural and urban)	**9 (45% women)**
4	Farmer	**12**
5	Businessman	**9**
6	Teacher	**6**
7	Health Practitioner	**3**
8	NGO representative	**2**
9	Student	**4**
10	Local government official	**2**
	Total	**58**

9.3 Consultation Process

500. Stakeholder consultation is the process where people in the alignment corridor are informed about the project and its impacts as well as urged to voice concerns and them addressed by the ESIA team and PGCB. In order to obtain opinion from direct and indirect stakeholders, the stakeholder consultation organized in community level.

9.3.1 Approach and Methodology

501. During the study period, stakeholder consultations were set up in three separate locations within or near the proposed alignment corridor. The locations of the consultations were selected due to their importance as major urban areas and or who are close or under the alignment route. The primary function of the Stakeholder Consultation was twofold; to inform the stakeholders that are most likely to be directly impacted by the alignment work, and to gather opinions on the perceptions of the alignment's potential impacts on the communities in order to develop a fine-tuned Environment Management Plan that better reflects community wants and needs. The locations of the consultations were Burhanuddin, Lalmohon and Char Fasson upazila.

502. The consultation process entailed a highly participatory approach involving as many stakeholders as possible. It involved a short presentation describing the work, project components, such as, construction of a new substation at Char Fasson and a 39.81 km transmission line from Notun biddyut power plant to the to be constructed substation, scale of operations, timing and project area maps showing the corridor of impact, etc., using graphics, photos and maps and posters, accompanied with a hand-out folder, and flyer. This was followed by discussions and Q/A sessions. The use of these materials enabled the participants be better informed about issues, which allowed them to participate in the discussions more effectively and provide informed comments and opinions.

9.3.2 Public Consultation Approach

503. Alignment maps, drawing and photos of crossing as well as an implementation timetable was tabled and those attending had been invited to make comments/suggest changes or just raise issues, which were recorded. The continuation of the consultations, during which the focus will be on the presentation of the environmental management plan and its mitigation measures. The consultation methods applied were as follows:

504. **Project's perceptions**, the wants and needs of the communities in order to develop a fine-tuned Environment Management Plan

505. **Presentations, panel debates, keynotes, workshops, and lectures** are all examples of information sharing meetings. The primary goal of these meetings is for the speaker to share information with the attendees.

506. **The presenter** is in a position of authority, like a manager passing on information or instructions to subordinates, or a subject matter expert sharing his/her knowledge with those present.

507. **Audience members** make up the bulk of participants in information sharing meetings. Their level of interest, and motivation to absorb the information shared, is highly dependent on their motivation for attending.

508. The photos showing participation of local people and representatives of government and non-government organizations for the public consultation are presented in Annex 8 and Annex 9.

9.3.3 Information Disclosure

509. During the field visits, the government officials, elected public representatives and members of the local community in the designated areas were consulted using the

project questionnaire/checklist about the project. For uniformity and clarity in conducting the public consultation meetings, the questionnaire, as devised by the consultants, was used to enable the participants to comprehend the issues easily, so that they could participate in the discussions more effectively and express their opinions and views objectively. This participatory approach was well accepted by all participants. During the public consultation stage, social, environmental as well as cross-cutting issues were discussed in detail, including potential impacts of the project activities on environmental and social parameters, identification of sensitive issues, risks, potential threats, public concerns, expectations from the project and the mitigation measure proposed.

9.3.4 Tools Used in Consultation

510. Tools used in the public consultation process are presented in Table 9-3 below.

Table 9-3: Tools Used in Consultation Meetings

Tools	Process
Arrange meetings	Arrangement of the meeting at Union office with PAP and Union Parishad Chairman. Group discussions with local people at different places along the transmission line route.
Discussions	Presentation about the project, its benefits, potential impacts and mitigations on local community.
Identify Issues	Discussion on any environmental and social issues raised by the community.

9.4 Issues Identified through Consultations

511. The summary of the comments/suggestions shared by the audience are presented below. The comments rose during public consultation at various locations along the Project corridor and ENRAC's replies are summarized in below sections.

9.4.1 Environmental Issues

512. The concerns regarding environmental issues are listed in below Table 9-4.

Table 9-4: Environmental Issues Identified Through Consultation

#	Issue Raised	Reply from Consultants
PC-1: Project Disclosure Meeting		
01.	The project deserves to be highly praised. For the continuous development of the country such projects are very important.	Thank you for your good positive comments. Consultant noted the point of optimism.
02.	Birds often sit in the line and die in few cases. Will it be a hazard for them as well as for us?	The engineering team will design the line with bird streamers if required for bird safety.

#	Issue Raised	Reply from Consultants
03.	Regarding waste management take necessary measures to keep the environment clean especially in workers camp area	The environmental management plan will address these issues and will have provision for good hygienic housekeeping in construction camps.
04.	Proper action plans should be implemented in order to mitigate issues regarding noise and air pollution during construction period.	Consultant noted the point of optimism.
05.	Due to the implementation of the project, existing environment will be imbalanced. What will be the solution for existing educational institute, mosque, temple etc.	It is true that existing environment will be affected but it is manageable through implementation of appropriate mitigation measures i.e. no work after 6:00pm, watering twice a day to reduce dust pollution if any.
06.	Cutting trees causes the negative impact on environment. How it will be managed? What will be solution about the tree owner?	If one tree will need to cut then three seedlings will be planted. Compensation will be given to the tree owner as per the resettlement action plan.
07.	Terrestrial vegetation would be damaged due to installation of substations, towers and, transmission lines area. Grid maintenance may impede augmentation of trees to the peripheries of project/subproject.	The site selected for the substation is an agricultural land acquired by PGCB. The TL RoW was selected considering minimum damage to terrestrial vegetations.
08.	Habitat loss of tiny wildlife spectacularly tiny birds, amphibians and reptiles due to implementation of substations, towers and stringing transmission cables.	Microhabitats will be created adjacent to the project locations before initiate project's civil works.

Source: ENRAC Field Survey

9.4.2 Social Issues

513. The concerns regarding social issues are listed in below Table 9-5.

Table 9-5: Social Issues Identified Through Consultation

#	Issue Raised	Reply from Consultants
PC-1: Project Disclosure Meeting		
01.	The project deserves to be highly praised. To progress development of the country such kind of project are very important.	Thank you for your good positive comments. Consultant noted the point of optimism.
02.	How about the land acquisition due to the implementation of the project especially in congested densely populated areas? Who will bear the cost of land acquisition?	The selected option for the substation is an open agricultural land (5 acre) already acquired by PGCB. The transmission line route was selected with the minimum damage to the surroundings. Land required for the TL footing is 2 acre and the RoW is about

#	Issue Raised	Reply from Consultants
		97 acres. Land acquisition will be determined by the land price on the basis of new land acquisition act 2017. The price of the land to be paid according to the new act that has a provision to pay maximum three times of the mouza rate.
03.	Due to the implementation of the high voltage line project, there is a risk for electrification.	The transmission line safe for local people as risk hazards have will be mitigated in engineering design phase.
04.	Many shops, market, house is located under the TL corridor, if the project goes through this area what will the owner do or get compensation.	The engineering design will mainly follow open area and will by-pass any populated settlements and or community resources such as bazar, hat, and etc.
05.	Agricultural land, houses etc. should be less affected for this project.	Crop land will not be affected as the contractors will mainly work after harvesting their crop. They will work for a limited time so that farmers can plough again.
06.	As the line has high voltage, it is suggested to fence around the tower area for safety of the farmers.	Thank you for your suggestion.
07.	Where the construction camp will be built. If the camps will be built in any public place, then that will be harmful for the local people.	Consultant noted the point of optimism. Construction camp will be built in open spaces, away from settlement, market, school, mosque etc.
08.	As a result of this project agricultural land will be affected. It will be a very good decision, if Govt. can make employment opportunity for affected person.	Consultant noted the point of optimism.
09.	How to determine the value of the land?	Based on Acquisition and Requisition of Immovable Property Act 2017.

Source: ENRAC Field Survey

9.5 Future Consultation plan for PGCB and Contractor

514. The stakeholder consultation is a continuous process, and should be maintained throughout the project. The consultations carried out during the present IEE and reported in this Chapter are essentially a first step in this process. During the subsequent project phases as well, participation of the project stakeholders needs to be ensured. In this regard a future framework for consultation has been developed, and presented in Table 9-6.

515. At every stage of the consultation and communication process the identified stakeholders need to be informed, the entire consultation process (including methodology and approach) must be documented showing when and where the consultations were

held (participants list for consultations carried out for the purpose of this IEE are annexed); the issues and topics discussed as well as responses, feedback and suggestions must be documented.

Table 9-6: Future Consultation Guideline

Consultation stages	Locations for consultations	Stakeholders	Facilitating party	Objectives	Activities
Before starting the construction activity	▪ Respective Union Parishad Office ▪ Respective Councilors office ▪ Local Project Office ▪ Shops & social gathering places ▪ In every four km distance of the alignment	▪ Identified PAPs ▪ Union Council Chairman and Members ▪ Ward councilors of the project alignment ▪ Shop keepers ▪ Other local People	Contractors	▪ To build a congenial environment with local stakeholders intending to sooth completion of construction activities ▪ To inform local stakeholders about the project construction activity ▪ To resolve issues like compensation, resettlement and other associated social problems during construction stage, which cannot be solved through GRM.	Announcing the project through miking as well as through local satellite channel Arrange consultation at a well-known and easily communicable places Informed the participants about the construction schedule and activities Publish leaflets and flyers containing project related information to distribute to the local stakeholders Announcing the project through miking as well as through local satellite channel Documentation of the meetings through meeting minutes
Once every week during construction		▪ Market associations ▪ Temporary Shop-keepers ▪ Local people	PGCB and Contractor		

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10. Grievance Redress Mechanism

10.1 Objectives of Grievance Redress Mechanism

516. A GRM is a locally based, project-specific extra-legal way to deal with and resolve complaints and grievances faster and thus enhance project performance standards in terms of environmental, social and resettlement management. The fundamental objectives of the GRM, implemented through a Grievance Redress Committee (GRC) serving as a para-legal body, are to resolve any environmental and resettlement related grievances in consultation with the aggrieved party to facilitate smooth implementation of environmental and resettlement plans and establish accountability of the affected people.

10.2 Grievance Redress Mechanism

517. Affected persons may appeal any disagreeable decision, practice or activity arising from project related activities to the GRC. Affected persons will be fully informed of their rights and of the procedures for addressing complaints, either verbally or in writing during consultation, survey, and time of compensation. The construction of the transmission lines will affect 44 households and an estimated population of 375 living within the clearing width of the transmission lines (230 kV). Of the households, 44 structures may be affected by the loss of their trees and crops cleared for construction work.

10.3 Composition of GRC

518. The project will establish a three-tier GRM, which will function throughout the life cycle of the project implementation and PGCB will ensure its accessibility to affected parties, and transparency and efficiency in grievance resolution (Table 10-1). However, it will not deal or interfere with any matters which are already placed before the country's courts of law. The Project will provide wider publicity for the GRM established using a variety of media such as brochures and leaflets printed in Bengali, and through community level awareness raising programs.

Table 10-1: GRC Members at Different Levels

Level	Members at Different Levels	Time Frame
Field Level	▪ Project officers appointed by PGCB	Time frame is two weeks
Local Community Level	▪ Executive engineer of the project; ▪ Contractor or his representative; ▪ A male and a female member of the concerned Union; ▪ A representative of the aggrieved party (the representative should be a female if the aggrieved party is a female)	Time frame is two weeks
PMU Level	▪ Project Director of the relevant subproject; ▪ Resettlement Specialist of the environmental and social unit; ▪ Team Leader of the contractor; ▪ The one responsible for land acquisition; ▪ A representative of the aggrieved party; ▪ A representative of the civil society.	Time frame is one month

519. The roles and functions of the GRM and its different tiers, specific locations where the different tires are established, grievance reporting procedures, time frames for grievance resolution at each level etc. will be disseminated to the affected persons as well as the general public using the above-mentioned modes of communication. Furthermore, the Project will provide orientation and training to the members of the GRM on effective grievance handling procedures.

520. GRM – Level 1: Level 1 of the GRM will be the project officers appointed by PGCB. The persons can be sub assistant engineers, or any other engineers appointed by PGCB to the sites. Also, contractors on project sites can be windows for field level grievances. In case of grievances that are urgent and minor, aggrieved parties can easily approach PGCB's field officers and/or contractors. Contact phone numbers, mails and names of the focal persons will be posted at all construction sites at visible locations. Considering female complainants, a contact point of a female focal will be posted too. The field officers of PGCB and focal persons of the contractors will record the name of the complainants, the dates of complaints and the nature of the complaints. The field officers of PGCB and/or focal persons of contractors will communicate with the complainants to reach an amicable settlement within a period of two weeks.

521. GRM – Level 2: Level 2 of the GRM will be the Local Grievance Redress Committee (LGRC) chaired by one of the Executive Engineers. PGCB will establish five LGRCs. The rest of the members of the GRC with special care of gender balance will include (i) the project officers from concerned project areas; (ii) the focal persons from the contractors; (iii) representatives of the concerned Unions; and (iv) representatives of the relevant government offices such as DC. Grievances that cannot be resolved at GRM-Level 1 or else if the affected persons were dissatisfied with the Level 1 resolution can submit their grievances to LGRC. The meetings of the LGRC will be held at the local office of PGCB or the union office in the area where the complaint originated. The LGRC can convene the affected person to explain his/her grievance at the meeting. The complainant can also send his/her nominee to the LGRC, if he/she is unable to physically participate in the LGRC. During the committee deliberations, LGRC will clarify the issues involved, and would try its best to reach a settlement acceptable to both the affected person and the project within a period of two weeks. The executive engineer can also consult the deputy project director (DPD) for advice and guidance if necessary. If an agreement or resolution is reached, the key points of the agreement/resolution will be summarized, documented and signed by both the affected person and the members of the GRC. The project officer of PGCB at site level from where the complaint is submitted to LGRC will assist in the documentation and record keeping, summaries of which will also be reported to ADB through monitoring reports.

522. GRM – Level 3: Level 3 of the GRM will be the Project Management Unit (PMU) of PGCB. The GRC at the PMU with special care of gender balance will be chaired by Project Director (PD) and comprise (i) External monitor for resettlement; (ii) dedicated safeguards specialist(s) under PMU/ESU; (iii) relevant technicians and engineers from PGCB and contractor; and (iv) representatives of the relevant government offices. The complainant and/or representative will be called to appear before the Level 3 GRC and explain his/her grievance. An officer from ESU/PMU will coordinate with the complainant. The complainant can send his/her nominee to the GRC, and in the event of both being unable to physically participate in the GRC, the ESU/PMU officer will explain the

grievances on behalf of the complainant. If necessary, GRC members will undertake field inspections to verify the issues reported. Level 3 GRC will reach a settlement through consensus among its membership, failing which the decision may be taken on a majority vote. The GRC located at PMU will conclude its proceedings within a period of one month since the submission of the grievance and inform the complaint the conclusion. Any significant grievances which may pose a life-and-death scenario should be resolved immediately. Also, in the case of critical issues to be resolved, PD can also consult the managing director of PGCB for advice and guidance. The ESU/PMU officer will assist in the documentation and record keeping, and summary outcomes will be reported to ADB through monitoring reports. Also, the external monitor will take a role as a liaison between the GRC and ADB.

523. Apart from the above described three levels of GRM, contractors will also establish GRM at site level which will exclusively address the issues and grievances of the labor teams. However, whenever necessary, the aggrieved laborers also have the choice of approaching the project based GRM.

524. The member secretary of GRCs will be regularly available and accessible for affected persons to address concerns and grievances. The legal advisor of the PGCB will support the GRCs in the regular process.

10.4 Processes for Filing GRC Cases and Role of GRC

525. Grievances will be filed without any fear and stress. The contractors will support the affected persons in drafting the grievances. All grievances must be submitted in writing to the Chair, GRC. The affected person himself/herself or appointed agent such as local elected officials/legal advisors are to represent the complainants. The judgment made by GRC will be communicated to the concerned affected person mainly in writing, also will be made allowances for those that are illiterate to be able to access. If dissatisfied, and with the agreement of the GRC, the affected person may request a further review of the judgment of GRC by the Project-level GRC. In such cases, the case will be forwarded to the Convener of the project-level GRC with all documentations. If he/she remains unsatisfied, he/she can go to the formal court of law or accountability mechanism for SPS related grievances.

526. Through community meetings, notices and pamphlets in the local language (Bangla) and the GRC procedures and operational rules will be publicized widely, so that APs are aware of their rights and obligations, and procedure of grievance redresses. Figure 10-1 shows a Grievance Redress flowchart.

527. GRC meetings will be held as agreed by the Committee, in the respective field offices of the contractors/PGCB or other location(s). If required, GRC members may carry out field visits to verify and review the issues at dispute, including titles/shares, the reason for any delay in payments or other relevant matters. Through the process described in below Table 10-2 the affected persons will address the complaints and grievances.

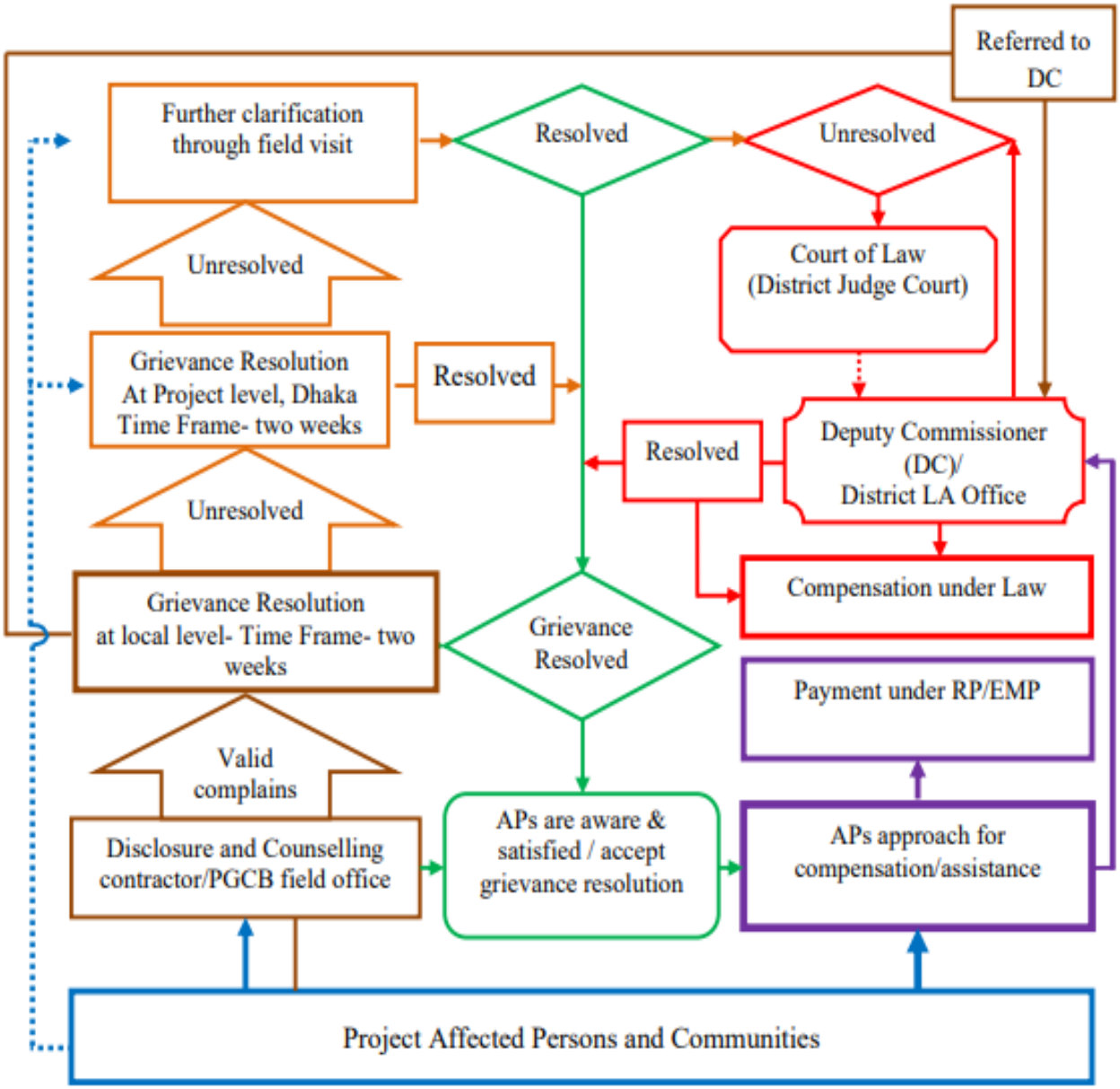

Figure 10-1: Grievance Redress Flow Chart

Note: The ongoing issues which pose a life- and – death scenario shall be resolved immediately

Table 10-2: Addressing Complaints and Grievance Resolution Process

Step 1	Complaint relating to the environmental impacts such as construction site waste disposal, soil erosion to agricultural lands, access roads, and site preparation activities, fugitive dust and other emissions (e.g., from vehicle traffic, land clearing activities, and materials stockpiles), noise from heavy equipment and traffic, materials and oil spills associated with heavy equipment operation and fuelling activities will be entertained by the GRC
Step 2	The contractor assists the aggrieved affected persons to produce a written complaint to the convener of GRC with stories and expectations. The contractor counsels the aggrieved persons on the mandate and procedure of grievance resolution. GRC scrutinize the case records and sort out cases to be referred to the Deputy Commissioner or the court of law and those to be resolved in GRC. Hearing is organized on cases with merit at the GRC secretariat or at Union Parishad/Municipality Offices at local level and resolution is given by the GRC in one month of receiving the complaints. Aggrieved APs satisfied with the resolution approach the executing agency for assistance under the provision of the EMP/ RP. The agreed resolution is forward to PGCB for approval by the Project Director. In case the resolution is not acceptable to the aggrieved person, he/she approaches the Project Director through the GRC convener with assistance from the contractor for further review. Aggrieved APs may opt to approach to the Court of Law, if the resolution at PGCB is not acceptable to him/her
Step 3	The resolution accepted by the aggrieved persons at any level (local, PMU) is approved by the Project Director and forwarded back to the Conveners' office keeping records at his/her office.

EA = executing agency, DP = Displaced Person, GRC = grievance redress committee, NGO = non-governmental organization, PGCB = Power Grid Company of Bangladesh, PMU = Project Management Unit

528. The project level GRC at headquarters will keep records of complaints received for its use, as well as for use by ADB during regular supervisions. The GRM does not impede access to the legal system. Affected persons can resort to legal action through the country's judiciary system at any time. They can also submit their grievances to ADB's Accountability Mechanism. A sample grievance form has been presented in Annex 17.

10.5 Approval of GRCs and Entitlements of GRC Members

529. All the decisions and proceedings of GRC meetings at any level will be finally approved by the contractor and PGCB.

530. All GRC members will attend a training and orientation meeting earlier, before commencement of their work. Project staff and consultants/environment specialists will conduct the training.

531. Grievances will be heard once a month by GRC. Before starting project work, the resettlement process must be completed, the GRC may meet more than once in every 30 days depending upon the number of such cases. Within two weeks of the hearing of the grievances the LGRC will inform the concerned aggrieved persons of their decision. If necessary, GRC will conclude its proceedings based on field inspection within a period of one month since the submission of grievances.

10.6 Grievance Redress Monitoring

532. The Project Directors of PMU will keep records of all the grievances and their redress in monthly cumulative formats, which will be provided by the contractor and to be signed by the convener of the GRC. The format will contain information on the number of grievances received with nature, those resolved, and the number of unresolved grievances.

11. Disaster Impact Assessment and Management Plan

11.1 Disaster in Bangladesh

534. The natural or manmade events that adversely affect the entire environment in an area, including human beings, shelters and the resources essential for livelihoods are termed as disasters. Bangladesh is considered as one of the most vulnerable countries in the world in terms of natural and anthropogenic hazards. The geographical setting and meteorological characteristics have made the country vulnerable to different geo-hazards and hydro-metrological hazards. The population density is also very high compared to other countries. The major disasters (natural and manmade) concerned in the country are floods, cyclones and storm surges, droughts, tidal surges, tornadoes, flash flood, earthquakes, river bank erosion, landslide etc.

11.2 Disaster Impact Assessment of the Project Area

535. The disaster impact assessment for the proposed project has been carried out using the qualitative and quantitative methods based on the available secondary data and primary data from the field visit and consultation with the local people. Natural disasters of the project area have been described broadly in section 4.1.5. A brief summary of disaster relevant to proposed project is shown below Table 11-1.

Table 11-1: Summary of Potential Disaster for the Proposed Project

Type of Disaster	Potential Hazard in Bangladesh	Potential Hazard for Project	Significance without Mitigation measures	Significance with Mitigation measures	Consider in DIA
Earthquake/ Tsunami	Yes	No	N/A	N/A	**N/A**
Floods	Yes	Yes	Moderate	Low	**Yes**
Flash Flood	Yes	No	N/A	N/A	**N/A**
Cyclone & Storm Surges	Yes	Yes	High	Low	**Yes**
Tornado	Yes	Yes	Low	Low	**N/A**
Landslide	Yes	No	N/A	N/A	**N/A**
Drought	Yes	No	N/A	N/A	**N/A**
Thunder Storm	Yes	Yes	Low	Low	**N/A**
Fire	Yes	Yes	High	Low	**Yes**
Fatal Accidents	Yes	Yes	High	Low	**Yes**
Utilities failure	Yes	Yes	High	Low	**Yes**

11.3 Prevention

536. Prevention and mitigation activate work toward eliminating or reducing the impact of an event and increasing the resilience of an affected community to recover from the consequences of an emergency event.

537. Typical prevention and mitigation actions will include:

- Setting, coordinating and reviewing the emergency management policy and programmers for the project assets;
- Management and monitoring of project asset conditions;
- Liaise between different response agencies and emergency managers (through the Disaster management team (DMT));
- Review and update the risk register, taking into account any new or emerging risks to project assets;
- Seeking government funding support to mitigate identified risks.

11.4 Prevention Through Mitigation Measures

538. The following mitigation measures should be taken by the project proponent to reduce damage, loss, and causalities of any disaster event in the proposed project. Disaster/risk insurance could be introducing in the proposed project

- **Flood, Cyclone and Tidal surges**
    - Consideration of cyclonic wind/wind velocity in the design of the project and associated infrastructures;
    - Construction of dike around the proposed project site. The dikes should be designed to prevent flooding during high astronomical tides and during cyclone-generated storm surge too;
    - Suitable dike height can be selected based on the analysis of last 100 years historical data; Plantation of selected species at different layer around the proposed project site as well as parallel to the coastline in response to cyclone wind;
    - Regular monitoring of the weather news/bulletin especially for the cyclone disasters during April to May and October to November;
    - Close communication with the volunteers of the Cyclone Preparedness Program (CPP) for the preparedness of cyclone disaster;
    - Establishment of site emergency evacuation and management plan for the cyclone disasters; Foundation structure of machines and buildings should be elevated to avoid cyclones associated storm surges water;
    - Breakwaters along the coast can be provided the necessary cushion against cyclone hazards; The proposed project operating personnel and other key personnel will be trained to manage cyclone disasters;
    - Switch off the Power Supply of Sub-station;

- Close all the in and out doors where possible wind enters;
- Instruct all the associates including workmen not to allow them to go outside till the wind & cyclone effect reduces to the normal level: and
- After the cyclone, inform to Emergency Response Team to investigate the property loss in the TL and SS for further action.

- **Fire**
  - Evacuate the people from Fire surrounding area and send through safe exit direction;
  - Remove unwanted combustible material; Keep cool and do not panic;
  - Inform to substation and electrician to get the affected area isolated from power supply:
  - Keep Fire Hydrant accessible;
  - Keep newest and good conditioned fire hoses and Fire Extinguishers readily available;
  - Ensure one operator is always present at Hydrant system area when using the fire Hydrant system;
  - If the fire is very small, use the correct Fire Extinguisher for extinguishing the fire;
  - Try to isolate the fire by removing the surrounding inflammable material from within reach of fire;
  - In case of big fire use local Hydrant system for extinguishing the fire;
  - If the fire is beyond the control inform the security or higher authority to call local fire Brigade and Inform Substation In charge or Emergency Response Team;
  - On arrival of the fire brigade pave way for them reach the exact site of fire; and In case of any accident in human life please call first aid team and get medical attention as quickly as possible.
- **Fatal Accidents**
  - During emergency operation if there is any injured person, carry out victim /causality to the designated assembly area;
  - Call First Aid Team and carry out the first aid with the help of first aid item;
  - Inform to Emergency Response Team;
  - If the accident is severe then call emergency vehicle and immediately rush the injured person to the local hospital or company recommended nursing home; and
  - Fill in the accident report form with the help of witness and deposit the same to the Emergency Response Team

- **Utilities Failure**

    - Examples of utility failure that may occur are electrical outage, plumbing failure/flooding, electrocution, ventilation problems and/or elevator failure. In the event of a failure, immediately notify Emergency Response Team.
    - For emergencies and potential danger or after hours call to Control room;
    - In a situation where a building needs to be evacuated, please proceed to the building specific evacuation area;
    - Turn off equipment, machines and computers;
    - Stay at the designated evacuation area until the fire department or designated representative has given the "all clear" to re-enter the area.

11.5 Preparedness

Preparedness Activities

539. Preparedness ensures that arrangements and resources are maintained in a state of readiness to be mobilized and deployed for response and recovery to an emergency event. The DMT will oversee the adequacy of preparedness in case of an emergency event and will undertake the following preparedness activities:

- Review and update the ERP, any sub-plans and Response Procedures;
- Ensure all officers are aware of, and hold sufficient competency to perform their emergency management roles and responsibilities;
- Arrange training and education programs for staff, contractors and community leaders, including environmental management committee members of the site;
- Conduct exercises to test specific aspects of the ERP, and its sub-plans or procedures;
- Establishing processes for lessons learned including conducting debriefs and reviews of other emergency events or exercises that are relevant to the project;
- Maintain working relationships for emergency management and refreshing any specific response and recovery support arrangements with Councils and other agencies;
- Have supporting systems in place for response and recovery e.g., cost capture and documents and records management;
- Ensure the Emergency Response Centre is adequate, accessible and properly resourced to meet needs during an emergency; and,
- Continual review, evaluation and auditing of emergency management arrangements, identifying and promoting opportunities for improvement.

Exercises

540. The DMT will prepare sub-plans and procedures on conducting test (mock) runs/exercises. The DMT will also determine the effectiveness and efficiency of

emergency management arrangements and identify opportunities for improvement, for example through field and classroom exercise.

541. The DMT will develop and execute an exercise schedule. In determining what aspect of the emergency management process will be exercised, consideration will be given to:

- Any new or emerging risks;
- Those sections of the DMP that have not recently been tested (whether in operations or in an exercise); and
- Where there have been specific changes in the emergency management roles or the personnel.

542. If a field exercise is being planned independently of other emergency response agencies, it is especially important to advise the local emergency services of the exercise details, so the exercise does not disrupt their response to genuine emergency calls. The ERT shall conduct debriefs following the exercise to identify what worked well, and what are the opportunities for improvement. A nominated administrative staff member at the ERC will be responsible for updating the ERP (including contact telephone numbers) and informing all plan holders of any changes. A record of plan amendments will be maintained; the plan will be updated at least annually.

543. Records will be maintained of all exercises and drills and will include but not limited to the following information;

(i) Response times,

(ii) Adequacy of responding personnel,

(iii) Adequacy of equipment; and

(iv) Improvements needed.

Updating the Emergency Contact List

544. The emergency contact information will be reviewed and updated on a regular basis. Both an electronic and hard copy of the Emergency Contact List will be maintained and readily available within the DMT. Records will be kept indicating the date each time the Emergency Contact list is updated and the electronic file location should also be kept available.

11.6 Response

545. Response means effectively coordinating a response to an emergency event, limiting threat to life, property, and the environment. Response Covers:

- On-Site Management of the situation;
- Initial assessment and reporting of the event and location;
- Identification of communication methods;
- Coordination of resources (off-site coordination) to support the on-site management;

- Providing advice and reports of the situation to officers higher in the chain of command; and
- Ending response actions when the situation is resolved.

Emergencies and Response Agencies

546. Table 11-2 shows the identified emergency events that may potentially affect the project and the responding agencies are described below.

Table 11-2: Emergencies and Response Agencies

Emergency Event	Lead Agencies	Other Agencies
Flooding, Cyclone, Tidal surges,	National Defense	BWDB DC Office PGCB
Spill/ Leak of Hazardous Materials	Fire Service and Civil Defense	DC Office PGCB
Fire	Fire Service and Civil Defense	Police DC Office Health PGCB
Civil Disturbance/ Riot	National Defense	Police PGCB

Communication Plan

547. Security guards and patrol personnel will carry two-way radios and/or other communication devices with them at all times. In the event, an emergency incident is reported to, or observed by a PGCB operating personnel; they shall immediately report it to the DMT. The DMT will then contact the appropriate agencies to deal with the emergency event. Operating personnel will be trained how to react in emergency response and reporting protocol.

Logistics

548. When multiple agencies are responding to an emergency event, the movement of personnel and equipment must be properly coordinated and organized for an effective response.

549. For accidents during transportation and emergencies, Police and Paramedics will be the first responders. The police will seal off the corridor to prevent unauthorized personnel from entering, then the Fire Service and Civil Defense, and all other appropriate agencies will follow.

550. For all fire related and hazardous material emergencies, the Fire Service and Civil Defense will be the lead agency. Once it has been deemed safe by the Fire Service and Civil Defense, all other appropriate agencies will follow.

551. For cyclone, storm surge and flooding events, the National Defense will be the first agency to respond. All other agencies will follow when given authorization by the National Defense.

Public Relations and Media

552. In the event of an emergency, the DMT will release all media information, warning information and updates. Information to be provided may include, but not necessarily be limited to:

- Nature of the emergency event,
- Likely duration,
- Alternative routes,
- Alternative transport options, and
- Advice to delay or cancellation of planned journeys.

11.7 Recovery

Recovery Management

553. Recovery is defined as measures, which supports emergency affected individuals and communities in the reconstruction of physical infrastructure and restoration of emotional, economic and physical well-being.

554. The DMT will typically manage the following operations:

- Damage assessment and categorization;
- Provision of temporary services;
- Reinstatement of traffic signals and road signs;
- Reinstatement of environmental and workplace standards.

Clean-up

555. In the event of hazardous material spill appropriate clean-up of the affected area will be conducted once the emergency has been mitigated. Appropriate measures will be taken to ensure the safety of the clean-up workers in the case of hazardous material spills.

Investigative Follow-Up

556. In the case of emergency events such as fire or hazardous material spills events, a through investigative follow-up will be conducted by the DMT and a report of the findings will be sent to the PGCB authority

557. The report may include, but is not limited to the following sections:

- Cause of emergency;
- Evaluation of response time;
- Evaluation of emergency response procedures;
- Recommendations to mitigate future such emergencies.

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12. Environmental and Social Management Plan

558. 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.

12.1 Objectives of ESMP

559. The primary objective of the EMP is to ensure implementation of the identified "mitigation measures" in order to reduce adverse impacts and enhance positive impacts. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operational phases of the projects. The EMP should clearly lay out:

(a) the measures to be taken during both construction and operation phases of a project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels;

(b) The actions needed to implement these measures; and

(c) A monitoring plan to assess the effectiveness of the mitigation measures employed.

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

561. The major components of the EMP include

- Mitigation and enhancement measures
- Monitoring plan
- Estimation of cost of ESMP
- Institutional arrangement for implementation of ESMP

12.2 Inclusion of Relevant Components of ESMP in Contract Documents

562. The ESMP of the Project along with the ECPs (discussed later in section 12.3.6) 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; PGCB and Environmental and Social Standards, and national regulatory requirements.

12.2.1 BOQs in Bid Documents

563. 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, PGCB 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 (PM_{10}, NO_2, SO_2, CO_2, CO) and noise monitoring at locations specified by the PGCB.

564. 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. The SEMP must be approved by the project director before commencement of construction.

12.2.2 Payment Milestones

565. 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.

12.3 Environmental and Social Management Plan

566. Environmental and Social Management Plan (ESMP) usually includes mitigation, enhancement, compensation, and contingency plans for managing the impact and consequences of the Project interventions at the pre-, during, and post-construction phases of the project implementation. In order to prepare the ESMP for the 230/33 kV transmission lines with Sub-stations at Bhola Char Fasson, the study team has gone through relevant literatures along with extensive field visits consisting of a multidisciplinary expert team. Expert opinions were also taken in finalizing ESMP. A number of mitigations, enhancement, compensation and contingency measures have been suggested in view of the diverse impacts of the project interventions. A monitoring plan is also included within the ESMP.

567. The ESMP for the TL and substation during pre-construction/ construction and operation/ maintenance phases are presented in section 12.3.6 of this chapter.

12.3.1 Biodiversity Management Plan

568. The Biodiversity Management Plan is presented in below Table 12-1.

Table 12-1: Environmental Management Plan for Bio-diversity Management

Environmental Issues/ Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
▪ **Pre-Construction/Construction Stage**				
Terrestrial vegetation	▪ Terrestrial vegetation coverage might be changed due to induce development in the study area; ▪ Branches of the trees or big trees may be cut off due to construct of transmission line	▪ Cutting of big trees are to be limited as they are practically possible; ▪ Plant indigenous trees/busses for green belt development; ▪ The authority may take policy level initiatives for road side plantation.	Contractors	DSC/PGCB
Terrestrial Fauna and Shorebirds	▪ Construction activities would impacts negatively to the wildlife species due to noise from construction machineries, blocking the passage and lighting at night.	▪ Initially the boundary wall/fence will have the facilities of fauna passing. ▪ Water bodies should be avoided as much as possible due to construction activities; ▪ Light and noise must be limited after 9:00 PM in the project area as well as of the transportation route; ▪ Take policy level initiatives and intrude awareness not to kill or capture any wild animals and shore birds in the study area.	Contractors	DSC/PGCB
Benthic community	▪ The waste materials will destroy river bed vegetation and other components of aquatic ecosystem. ▪ Transportation of heavy equipment and construction material may affect on the aquatic ecosystem ▪ Invasion of any invasive species may	▪ Do not run dredging activities in the entire proposed area simultaneously; ▪ Do not dump dredged spoil onto mangrove vegetation existing in the bank-line. ▪ Take necessary action for checking and quarantine of the invasive species may invade through cargo/ships ▪ A well-developed monitoring plan needs to be prepared for the species diversity and abundance of the benthic community. ▪ Follow ECP 1,3,9,10	Contractors	DSC/PGCB

Environmental Issues/ Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
	impact on benthic communities			
▪ **Operation Stage**				
Terrestrial vegetation and Aquatic Habitat	▪ Micro-elements like may interrupt into the ecosystem; ▪ Aquatic habitat quality may be deteriorated due to discharge hot water;	▪ EPC standards should be followed strictly; ▪ Monitoring result (aquatic and terrestrial community) must be checked regularly and disclose in public domain; ▪ Ecosystem conservation program might be taken.	Contractors	DSC/PGCB
Terrestrial Fauna (Avifauna, Flying Mammals etc)	▪ Increasing of the traffic volume and human activities directly or indirectly affect the shorebirds habitat and movements ▪ Noise pollution may affect the shorebirds communities ▪ Transmission line may affect the free movement of the birds, flying mammals (bat) etc.	▪ Maintenance of the existing green belt and creation of more greenery areas inside the project as well as outside the project boundary (as possible); ▪ Wild life and shorebird should be protected through enforcing law/act; ▪ Increase the visibility of TL to the Birds with a variety of lighting conditions, ▪ Use of BIRD-FLIGHT diverters (Figure 12-1). BIRD-FLIGHT can be an effective solution to mitigate this phenomenon. However, if the design team and the EPC contractor considers this option feasible then bird flight diverters can be introduced in Bangladesh as a mitigation measure. ▪ Keep standard space in between parallel wires to avoid connection through birds/ bats etc.	Design Team/ Contractors	DSC/PGCB

Figure 12-1: A typical bird flight diverter:

Note: Bird Flight diverters are commonly used depending upon local condition and the Avifauna route, usually at 10m spacing (Miguel Ferrer, September 2020).

12.3.2 Labor Management Plan

569. The Labor Management Plan is presented in below Table 12-2.

Table 12-2: Labor Management Plan

Issues / Parameters	Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
Pre-Construction/ Construction Stage				
Labor Recruitment	Recruitment policy may be biased due to involvement of any influential person.	The labor recruitment policy should be formulated in such a way that the local laborers can get preference. As these laborers have no previous experience on such type of technical jobs, the authority can recruit them in non-technical posts of the project or the authority can facilitate technical trainings for them.	Contractors	DSC/ PGCB
Engagement of child and forced labor	Underage children maybe recruited for lower wage.	Contractor will be prohibited to employ anyone under the age of 14. NID cards and/or birth certificates should be verified. Labor expert/ focal point should be engaged.		
Operation Stage				
Worker and community health risk	The authority should arrange health services and facilities, supply of safe and clean drinking water facilities and neat and clean sanitation system.	The third- party independent consultant should check that they have available sanitation facilities and they use safe water for drinking also supply water is available for use.	Contractors	DSC/ PGCB
Worker's relation maintained	Management and worker's relation is friendly with each other. Management should always try to keep this relation.	Relationship among workers and authority should be supportive. The workers should work together with harmony and cooperate with each other for better work.		

Issues / Parameters	Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
Risk of potential transmission of COVID-19	Neglecting safety guidelines for COVID-19	Pre-employment health check-up should be mandatory. Entry and exit from site/ workplace should be controlled. Accommodation arrangements should be adequate and designed to reduce contact with the community. Rearrangement of work tasks or number of people on the worksite should be reduced to allow social/ physical distancing, or rotating workers through a 24-hour schedule; Adequate number of personal protective equipment (PPE) should be provided; Any suspected COVID 19 employees should be sent for quarantine.		

12.3.3 Gender based Violence Prevention Management Plan

570. Discrimination against women and girls is a historical and social phenomenon that manifests itself in many ways. Achieving gender equality and women's empowerment is therefore a challenge for all of us. Legislation and policies are important but not sufficient to eliminate gender biases and discrimination. Reducing gender disparities requires the promotion of and support for gender equality in the various interventions and programs that the government undertakes, which also promote changes in attitudes and practices in the government and broader society. This requires long-term commitment and efforts of all development partners, including ADB.

571. The Bangladesh Gender Equality Diagnostic of Selected Sectors (GEDSS) 2016 is produced to support the development objectives of the Government of Bangladesh set out in its Seventh Five-Year Plan (2016–2020), as well as the thrust of the Asian Development Bank (ADB) in promoting inclusive and environmentally sustainable growth as indicated in its Country Partnership Strategy (2016– 2020).

572. In the issues, identifying opportunities for and constraints on promoting women's empowerment in four sectors are (i) urban development (including governance, water supply and sanitation, primary health care, and environmental health including waste management); (ii) transport (especially mobility and gender-related aspects of infrastructure development—national rural and urban roads, railways, and ports—and transport services); (iii) energy (including rural electrification and renewable energy); and (iv) education (with emphasis on vocational education, skills development, and tertiary education). This technical report presents the results of this gender equality diagnostic (GED). This GED is aligned with the Seventh Five Year Plan of the Government of Bangladesh, and with the gender equality targets of the United Nations Sustainable Development Goals (SDGs). It provides the government with a tool and platform to advance progress in mainstreaming gender in sector policies, strategies, and programs, in line with the commitments set out in the National Women Development Policy 2011. It also serves as a resource to support government agencies and development partners to mainstream gender equality into its operational sectors. It presents an in-depth analysis of the different areas and forms of discrimination in each sector, and recommends sector specific solutions and strategies.

573. The report also provides planners, practitioners, and evaluators with a practical reference for sector analyses, designing projects, monitoring implementation, and engaging in policy dialogue. It provides an analysis of institutions, policies, and strategies to mainstream gender; insights into experiences of development initiatives in these sectors; and suggestions for further strengthening of gender equality.

574. The Contractor must address the risk of gender-based violence, through: - Mandatory training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women. Training may be repeated; - Informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; - Adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence; Developing a system to capture gender-based violence, sexual exploitation and workplace sexual harassment related complaints/issues. This process

will be under the portfolio of the Social Standards Officer who shall identify and engage the relevant stakeholders on GBV and HIV and Aids issues.

12.3.4 Mitigation plan for intercultural operation

575. At present the intercultural operation or cropping pattern is traditional. During implementation period and under post-project condition, it will be partially impacted (Table 12-3).

Table 12-3: Mitigation plan for intercultural operation

Environmental Issues/Parameters	Environmental Impacts	Mitigation Measures	Implementation Agency	Supervision Agency
Pre- construction: Partially impacted				
Construction: Partially impacted along RoW, fully impacted in tower location				
Post- Construction: Moderately impacted only in tower location				
Intercultural operation in RoW	Difficult intercultural operation in tower location	Imparted training to the farmers to aware on avoiding any possible accident for proper intercultural operation in the tower locations.	-	PGCB

12.3.5 List of sensitive receptors in the project area.

576. The participants opined that the sensitive establishments such as farming lands, households, mosques, temples, graveyards, churches, colleges, schools, madrasa etc. may be affected from the establishment of the 230/33 kV transmission line. Apart from the above, some flora and fauna may also be affected. A list of sensitive receptors in the project area is given in the following Table 12-4.

Table 12-4: List of Sensitive Receptors in the project area

Sl No	Sensitive Receptors in the project area	Sl No	Sensitive Receptors in the project area
1	Cultivable Land	5	Health Centre
2	Homesteads	6	School/ College/ Madrasha
3	Mosque/ Temple/ Church	7	Archaeological Sites
4	Graveyard	8	Flora & Fauna

12.3.6 Environmental Code of Practices for Construction

577. 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 1.

578. 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: Top Soil Management
- ECP 7: Air Quality Management
- ECP 8: Noise and Vibration Management
- ECP 9: Protection of Flora
- ECP 10: Protection of Fauna
- ECP 11: Workers Health and Safety
- ECP 12- Water and Sanitation Facility for labors
- ECP 13: Road Transport and Road Traffic Management
- ECP 14: Potential Risk of transmitting COVID-19

12.3.7 Construction Stage Site Specific Management Plans

579. Construction contractor(s) will be required to prepare and implement CESMP. The contractors will need to obtain CSC's approval of the CESMP. The CESMP must be approved by the project director before commencement of construction. 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.
- Air Quality Management Plan will be prepared and maintained by the contractor on the basis of the mitigation measures provided in this ESIA and ECPs.
- Noise Management Plan will be prepared and maintained by the contractor on the basis of the mitigation measures provided in this ESIA and ECPs.
- Soil Management Plan will be prepared and maintained by the contractor on the basis of the mitigation measures provided in this ESIA and ECPs.
- Waste Disposal and Effluent Management Plan will be prepared and implemented by the Contractor on the basis of the ESMP and ECP.
- 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.

- Biodiversity management Plan will include protection measures for flora fauna, clearing vegetations etc., on the basis of this ESMP and ECPs.
- 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 ESCMC 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.
- 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. COVID-19 context must be included in in the plan.
- 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.
- Labor Management Plan will be prepared by the contractor. This plan will include Labor Recruitment, Engagement of child and forced labor issues, COVID-19 context etc.
- 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.
- 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.

12.3.8 Environmental and Social Management Plan

580. The ESMP for the TL during pre-construction/ construction and operation/ maintenance phases are presented below in Table 12-5 and Table 12-6 respectively.

581. The ESMP for the substation during pre-construction/ construction and operation/ maintenance phases are presented below in Table 12-7 and Table 12-8 respectively.

12.3.8.1 ESMP for the Transmission Line during Pre-construction and Construction Stage

Table 12-5: ESMP for the Transmission Line during Pre-construction and Construction Stage

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Air quality	▪ Localized impairment of air quality by exhaust emissions from vehicles and equipment engines ▪ Elevated dust levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	▪ All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) should be well maintained and not emit dark or smoky emissions in excess of the limits described in the EQS. ▪ Focus on reducing dust and exhaust gas emissions from heavy construction vehicles ▪ Appropriate training should be provided to workers on reducing dust and air pollution ▪ Drivers of vehicles used during construction should be under strict instructions to minimize unnecessary trips and minimize idling of engines. ▪ Dust suppression facilities (back pack water sprayer) should be available where earth and cement works are required. ▪ Spray water on dry & loose surface of the construction sites regularly; ▪ Maintain adequate moisture content of soil during transportation, compaction and handling; ▪ Construction materials (sand, gravel, and rocks) and spoil materials should be transported by trucks covered with tarpaulins. ▪ Sprinkle and cover stockpiles of loose construction materials (e.g., fine aggregates, sand); and ▪ Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.	Contractor	DSC/ PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Noise	▪ Nuisance noise from construction activities, heavy machines, generators and construction vehicle movement.	▪ Use of noise plug in heavy construction equipment; ▪ It is recommended that no construction should be allowed during night time (9 PM to 6 AM) ▪ Avoid using of construction equipment producing excessive noise at night; ▪ Construction activities should not be during night time ▪ Avoid prolonged exposure to noise (produced by equipment) by workers; and ▪ Regulate use of horns and avoid use of hydraulic horns in project vehicles. ▪ Generator should be placed within room (concrete walls with roof). ▪ Monitoring of noise level at construction site, construction camp as and when required.	Contractor	DSC/PGCB
Soil	▪ -Change to soil structure (erosion and compaction) as a result of excavation and backfilling and removal of vegetation (at the tower foundation pits and possibly parts of the access roads)	▪ Construction of foundations to be undertaken in the dry season. ▪ Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. ▪ Protect excavated soil materials ▪ from erosion. ▪ Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season. ▪ Use of existing track for transport of man and material to the extent possible.	Contractor	DSC/PGCB
	▪ Potential contamination of soil from inadvertent release of hazardous or contaminating	▪ Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
	material (liquid fuel, solvents, lubricants, aluminum oxide paint, etc.)	shall include cut-off drains to divert surface runoff from exposed soils or construction areas. ▪ Install oil/water separators and silt traps before effluent, leaves the site. ▪ Minimize bare ground and stockpiles to avoid silt runoff. ▪ Appropriate sites need to be identified for disposal of hazardous and non-hazardous waste ▪ Appropriate measures should be taken to insulate the oil spillage. Immediate action should be taken if any oil spills.		
Water resources	▪ Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	▪ Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. ▪ Minimize bare ground and stockpiles to avoid silt runoff. ▪ Appropriate sites need to be identified for disposal of hazardous and nonhazardous waste ▪ Appropriate measures should be taken to insulate the oil spillage. Immediate action should be taken if any oil/ chemical spills.	Contractor	DSC/PGCB
	▪ Exploitation of water resources (e.g., casting of foundations) sourced from nearby water bodies through tanks	▪ Regular inspection/checks to minimize the impacts on the waterbodies	Contractor	DSC/PGCB
Drainage Congestion and Flooding	▪ Localized flooding due to congestion from construction wastes.	▪ Provision for adequate drainage of storm water ▪ Provision of adequate diversion channel, if required ▪ Provision for pumping of congested water, if needed ▪ Ensure adequate monitoring of drainage effects,	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
		▪ especially if construction works are carried out during the wet season		
Waste generation	▪ Generation of construction wastes from the construction materials.	▪ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time ▪ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements ▪ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials ▪ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste ▪ Use of construction materials containing recycled content when possible and in accordance with accepted standards. ▪ Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area should be provided.	Contractor	DSC/PGCB
Terrestrial ecology	▪ Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	▪ See above measures on air quality, noise and vibration, soils and water resources. ▪ Limit lightening on site. ▪ Sensitivity training to staff and anti-poaching policy. ▪ Prepare construction management plan by the contractor and follow it. ▪ Follow GoB rules and regulations on noise.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
	▪ Loss of vegetation due to clearance activities	▪ Site clearance activities to be restricted to the minimum required area.	Contractor	DSC/PGCB
Aquatic ecology	▪ Construction may cause wetland habitat loss	▪ The TL will pass through ponds and canals, but the TL towers will be constructed on land. Thus, no impact on any waterbody thus aquatic ecology.	Contractor	DSC/PGCB
	▪ The waste materials will destroy river bed vegetation and other components of aquatic ecosystem. ▪ Transportation of heavy equipment and construction material may affect the aquatic ecosystem. ▪ Invasion of any invasive species may impact on benthic communities	▪ Do not run dredging activities in the entire proposed area simultaneously; ▪ Do not dump dredged spoil onto mangrove vegetation existing in the bank-line. ▪ Take necessary action for checking and quarantine of the invasive species may invade through cargo/ships ▪ A well-developed monitoring plan needs to be prepared for the species diversity and abundance of the benthic community. ▪ Follow ECP 1,3,9,10	Contractors	DSC/PGCB
Biodiversity Conservation	▪ Project may have potential impact on biodiversity conservation.	▪ A biodiversity conservation plan is required for crossing the reserve forest, rivers etc. The project does not fall under any such area. However, a Biodiversity management plan (BMP) will focus trees, avifauna, and any other species with ecological conservation value. BMP was prepared based on the guidelines of ADB.I	Contractors	DSC/PGCB
Visual amenities	▪ Temporary presence of an active construction site with storage of materials and equipment within the RoW	▪ Maintain construction site in orderly condition and do not distribute material over many sites before usage.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
	▪ Domestic waste might be disposed to construction area, creating visual impact.	▪ Follow proper waste management plan to dispose domestic waste and construction waste ▪	Contractor	DSC/PGCB
Land acquisition/ requisition	▪ Loss of 7.12 acres land (mainly agricultural) permanently for the tower bases of the TL. ▪ Temporarily loss of land (requisition) for construction camps etc.	▪ Prior to commence construction activities, the owner of the affected land must be noticed and provided proper compensation in time as per GOB and PGCB guidelines; ▪ GOB & PGCB guidelines should be followed for land acquisition/requisition/compensation ▪ RAP should be followed for land acquisition/ requisition/compensation	Contractor / DC	DSC/PGCB
Land Planning and Use	▪ Change in land use caused by land take for towers, vegetation clearance, and access restriction	▪ Site clearance activities to be restricted to the minimum required area. ▪ Provision of predefined route, barriers or boundary markings to prevent incursion of machinery and workers into neighboring areas ▪ RAP process will mitigate the impact to the minimum level	Contractor / DC	DSC/PGCB
Clearing of vegetation	▪ 1797 trees will be partially affected by trimming as well as standing crops (if any) and bushes along the RoW also will be affected.	▪ Cleaning natural vegetation should be avoided as much as possible ▪ Records must be maintained for any tree cutting ▪ Prior to start clearing of vegetation; provide adequate compensation to the owners.	Contractor	DSC/PGCB
Resettlement	▪ Households living in the RoW need to be relocated and assets in the RoW will be lost	▪ Follow principles and procedures of ▪ Resettlement Action Plan (RAP) Report prepared for the proposed project.	Contractor	DSC/PGCB
Stakeholder and Community expectation/	▪ Management of Community concerns linked to impacts associated with construction phase issues (like	▪ Follow mitigation for construction phase air quality, noise and traffic. ▪ Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
relations Management	air and dust emissions, traffic, influx and community safety/security, noise/vibration, etc.) and adverse impact/ inconveniencies resulting from it.	activities, traffic including movements of oversized loads) by billboards, posters and community meeting ▪ Set-up and effectively monitor construction grievance mechanism ▪ Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP.		
Community Health, Safety and Security	▪ Increased risks of traffic safety incidents on public roads.	▪ Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site. ▪ Follow BRTA traffic rules and regulations; ▪ Schedule deliveries of material/ equipment during off-peak hours ▪ Engage flagman construction site and construction camps for traffic control ▪ Arrange for signal light at night ▪ Engage experienced drivers to drive project vehicles ▪ Proper traffic management; ▪ Avoiding stockpiling of materials specially at the road sides that could hamper traffic movement.	Contractor	DSC/PGCB
	▪ Temporary influx of outside workers in the communities, risking tensions between outside labor and local population.	▪ A Local Content Plan should be prepared to facilitate involvement of local labor. See HR policies and procedures below. ▪ No hiring of short-term labor to be made at the site gate. ▪ Develop a code of behaviors for workers. All workers to receive training on community relations and code of behavior.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
		▪ Periodic refreshing as needed based on community liaison/grievance mechanism feedback.		
Traffic Congestion	▪ Increased traffic use of road by construction vehicles ▪ Movement of normal road traffics and the safety of the road-users	▪ Follow Traffic Management Plan as provided in Annex 1, ECP 13. ▪ Ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs, restrict truck deliveries, where practicable, to day time working hours, restrict the transport of oversize loads, check on speed limits, etc.	Contractor	DSC/PGCB
Labor and working conditions	▪ Exploitation of workers	▪ Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non- discrimination, monitoring, roles and responsibilities following Labor Law. ▪ Provide reasonable, and if applicable negotiated, working terms and conditions. ▪ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ▪ No use of child labor (workers under age 18) or forced labor.	Contractor	DSC/PGCB
	▪ Activities and staff at site may create security risks	▪ Make security plan and emergency response and contacts with security forces.	Contractor	DSC/PGCB
	▪ Risk of health & safety incidents amongst labor force, including minor incident's such as cuts and major incidents such as loss of life	▪ Develop project specific health and safety procedures based on PGCB standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
		▪ Especially slip-trip and fall hazards with tower erection and electrocution need attention.		
	▪ Risk of potential transmission of COVID-19 by neglecting safety guidelines	▪ Pre-employment health check-up should be mandatory. ▪ Entry and exit from site/ workplace should be controlled. ▪ Accommodation arrangements should be adequate and designed to reduce contact with the community. ▪ Rearrangement of work tasks or number of people on the worksite should be reduced to allow social/ physical distancing, or rotating workers through a 24-hour schedule; ▪ Adequate number of personal protective equipment (PPE) should be provided; ▪ Any suspected COVID 19 employees should be sent for quarantine.	Contractor	DSC/PGCB
Employment and economy	▪ Creation of temporary jobs for local residents and nationals with skilled trades	▪ Employ local people specially PAPs for the project activities as much as possible.	Contractor	DSC/PGCB
	▪ Supply chain opportunities for companies that can provide goods and services needed by the company	▪ Prepare a local content plan to facilitate identification and selection of qualified local companies to provide needed supplies and services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.	Contractor	DSC/PGCB
Infrastructure	▪ Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	▪ Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. ▪ Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. ▪ Upgrading of existing access roads.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Cultural heritage	▪ If any cultural heritage is located within the RoW along the transmission line that may require relocation	▪ There is a mosque near AP 26 of the RoW of the TL ▪ The mosque is located 13m east from the centre of the transmission line and may be impacted from the EMF, however, EMF strength at 13m distance is very insignificant. ▪ Make aware of the construction activities. ▪ Follow Clearance to Obstacles as per PGCB guideline, outlined in, Annex 21	Contractor	DSC/PGCB
	▪ Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	▪ Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Contractor	DSC/PGCB
	▪ Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	▪ Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Contractor	DSC/PGCB

12.3.8.2 ESMP for the Transmission Line during Operation and Maintenance Stage

Table 12-6: ESMP for the Transmission Line during Operation and Maintenance Stage

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Corona Effect	▪ The glow appears across the conductor which shows the power loss ▪ The audio noise occurs because of the corona effect which causes the power loss on the conductor ▪ The vibration of conductor occurs ▪ Generates the ozone because of which the conductor becomes corrosive ▪ It produces the no sinusoidal signal thus the no sinusoidal voltage drops occur in the line ▪ The corona power loss reduces the efficiency of the line ▪ The radio and TV interference occurs on the line because of corona effect.	▪ Corona decreases the efficiency of transmission lines. Therefore, it is necessary to minimize corona. The following factors may be considered to control corona effect: ▪ Conductor diameter – For reducing corona loss, this method of increasing conductor diameters is very effective. ▪ The diameters of conductors can be increased by using hollow conductors and by using steel-cored aluminum conductors (ACSR) ▪ The voltage of the line – Voltage of transmission lines is fixed by economic considerations. To increase the disruptive voltage the spacing of the conductors is to be increased, but this method has some limitations; ▪ Spacing between conductors – If the space between conductor's increases, then the voltage drops between them also increases due to increase in inductive reactance.	PGCB	PGCB
EMF	▪ EMF from overhead line due to Corona effect and EMF effect ▪ Due to EMF, human health may be affected	▪ Noise generation is unavoidable. ▪ Use of conductors to minimize corona effect during rainy weather conditions ▪ Avoiding over loading Transmission Lines	Contractors	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
		▪ As there is no BD guidelines/ Standard, so international standard should be followed for the safety of the power lines. ▪ For housing structures clearance between TL and roof top is 6.5m-8m and for river crossing it will 14.6m-15.9m. ▪ Noted that no houses will be directly affected by the TL/Lilo lines.		
Terrestrial ecology	▪ Avian collision ▪ Transmission line may affect the free movement of the birds, flying mammals (bat) etc.	▪ Increase the visibility of TL to the Birds with a variety of lighting conditions, ▪ Use of BIRD-FLIGHT diverters. BIRD-FLIGHT can be an effective solution to mitigate this phenomenon. However, if the design team and the EPC contractor considers this option feasible then bird flight diverters can be introduced in Bangladesh as a mitigation measure. ▪ Keep standard space in between parallel wires to avoid connection through birds/ bats etc. Visibility of Double circuit will not allow the birds to collide with power line	Design Team/ Contractors	DSC/PGCB
	▪ Increasing of the traffic volume and human activities directly or indirectly affect the shorebirds habitat and movements ▪ Noise pollution may affect the shorebirds communities	▪ Maintenance of the existing green belt and creation of more greenery areas inside the project as well as outside the project boundary (as possible); ▪ Wild life and shorebird should be protected through enforcing law/act;	Contractors	DSC/PGCB
	▪ Loss of vegetation due to routine clearance of vegetation	▪ Maximum of 7.5m wide within center line of RoW shall be maintained for TL maintenance. ▪ Plantation of trees wherever applicable along the TL route.	Contractors	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Visual amenities	▪ Transmission lines and towers will be visible from far and become an extrinsic element in the landscape. ▪ Cumulative with the other Transmission lines this may result in a loss of the visual amenity.	▪ The RoW does not affect forests or valuable landscapes. ▪ Vegetation will be felled, but if possible smaller trees can be kept. ▪ Towers have an open structure, not hampering the view very much.	PGCB	DSC/PGCB
Community Health, Safety and Security	▪ External safety risks of electrocutions, bush fires, line snapping, tower collapses	▪ Develop an emergency response plan following PGCB and international best practice including provisions for prevention and response to electrocution, bush fires, repair of snapped lines, roles and responsibilities. ▪ Coordinate with emergency services ▪ Annual safety audit of the transmission lines and poles and maintenance of the RoW to keep free of higher vegetation and structures. ▪ Communicate to communities in communities along RoW about the safety risks of the transmission lines and provide response measures. ▪ Put sign boards on towers about electrocution risk.	PGCB	PGCB
Short Circuit/ Accident	▪ Due to short circuit at the TL disruption of power and accident might occur.	▪ O&M of TL should be done in time by experienced personnel.	PGCB	PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Labor and working conditions	▪ Exploitation of workers	▪ Follow human resources policies and procedures of PGCB, following Labor Law. ▪ Provide reasonable, and if applicable negotiated, working terms and conditions. ▪ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ▪ No use of child labor (workers under age 18) or forced labor.	PGCB	PGCB
	▪ Occupational H&S risks in operation and maintenance ▪ Risk to continuous power supply	▪ PGCB should follow their Occupational HSE plan following Bangladeshi and international requirements: train staff, monitor and keep record. ▪ Special focus on slip- trip, fall from height and electrocution in maintenance and repair works, emergency prevention and management. ▪ Use personal protection equipment. ▪ Have medical emergency equipment for primary treatment at hand.	PGCB	PGCB
Employment and Economy	▪ Improved electricity supply for the national grid, creating opportunities for businesses and economic development in the country.	▪ Regular maintenance of the project to ensure reliable production of power	PGCB	PGCB
Cultural heritage	▪ interactions between maintenance works and cultural festivals due to traffic, noise and/or vibration impacts	▪ festivals and potentials for interaction with maintenance works. If required cease works on the specific dates.	PGCB	PGCB

12.3.8.3 ESMP for the Sub-station during Pre-construction and Construction Stage

Table 12-7: ESMP for the Sub-station during Pre-construction and Construction Stage

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Air quality	▪ Localized impairment of air quality by exhaust emissions from vehicles and equipment engines ▪ Elevated dust levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	▪ All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) should be well maintained and not emit dark or smoky emissions in excess of the limits described in the EQS. ▪ Focus on reducing dust and exhaust gas emissions from heavy construction vehicles ▪ Appropriate training should be provided to workers on reducing dust and air pollution ▪ Drivers of vehicles used during construction should be under strict instructions to minimize unnecessary trips and minimize idling of engines. ▪ Dust suppression facilities (back pack water sprayer) should be available where earth and cement works are required. ▪ Spray water on dry & loose surface of the construction sites regularly; ▪ Maintain adequate moisture content of soil during transportation, compaction and handling; ▪ Construction materials (sand, gravel, and rocks) and spoil materials should be transported by trucks covered with tarpaulins. ▪ Sprinkle and cover stockpiles of loose construction materials (e.g., fine aggregates, sand); and ▪ Avoid use of equipment such as stone crushers at site, which produce significant amount of particulate matter.	Contractor	DSC/ PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Noise	▪ Nuisance noise from construction activities, heavy machines, generators and construction vehicle movement.	▪ Use of noise plug in heavy construction equipment; ▪ It is recommended that no construction should be allowed during night time (9 PM to 6 AM) ▪ Avoid using of construction equipment producing excessive noise at night; ▪ Construction activities should not be during night time ▪ Avoid prolonged exposure to noise (produced by equipment) by workers; and ▪ Regulate use of horns and avoid use of hydraulic horns in project vehicles. ▪ Generator should be placed within room (concrete walls with roof). ▪ Monitoring of noise level at construction site, construction camp as and when required.	Contractor	DSC/PGCB
Soil	▪ Top soil loss (about 0.5m thick) due to construction of substation sites	▪ Prior to start filling the site, collect and storage top soils (minimum 0.5m thick) for using on the surface of the site boundary and access road side slopes for protection from side slope erosion. ▪ Construction of foundations to be undertaken in the dry season. ▪ Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. ▪ Protect excavated soil materials from erosion. ▪ The topsoil, excavated from the proposed construction sites should be re-spread in areas to be landscaped.	Contractor	DSC/PGCB
	▪ Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents,	▪ Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
	lubricants, aluminum oxide paint, etc.)	▪ Install oil/water separators and silt traps before effluent, leaves the site. ▪ Minimize bare ground and stockpiles to avoid silt runoff. ▪ Appropriate sites need to be identified for disposal of hazardous and nonhazardous waste ▪ Appropriate measures should be taken to insulate the oil spillage. Immediate action should be taken if any oil spills.		
Water resources	▪ Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	▪ Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. ▪ Minimize bare ground and stockpiles to avoid silt runoff. ▪ Appropriate sites need to be identified for disposal of hazardous and nonhazardous waste ▪ Appropriate measures should be taken to insulate the oil spillage. Immediate action should be taken if any oil/ chemical spills.	Contractor	DSC/PGCB
	▪ Exploitation of water resources (e.g., casting of foundations) sourced from nearby water bodies through tanks	▪ Regular inspection/checks to minimize the impacts on the waterbodies	Contractor	DSC/PGCB
Drainage Congestion and Flooding	▪ Localized flooding due to congestion from construction wastes.	▪ Provision for adequate drainage of storm water ▪ Provision of adequate diversion channel, if required ▪ Provision for pumping of congested water, if needed ▪ Ensure adequate monitoring of drainage effects, ▪ especially if construction works are carried out during the wet season	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
	▪ Reducing floodplain storage area and increase local flooding ▪ Due to earth filling of substation sites and access roads above highest flood level (HFL). ▪ Drainage congestion if the surrounding the sites are blocked by the earth embankment.	▪ Provide culvert in the access road of the substation; ▪ Ensure adequate monitoring, especially if construction works are carried out during the monsoon period. ▪ Provision for pumping of congested water, if needed; ▪ Consider of HFL during design of substations to avoid inundation.	Contractor	DSC/PGCB
Waste generation	▪ Generation of construction wastes from the construction materials.	▪ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time ▪ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements ▪ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials ▪ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste ▪ Use of construction materials containing recycled content when possible and in accordance with accepted standards. ▪ Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area should be provided.	Contractor	DSC/PGCB
Terrestrial ecology	▪ Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic,	▪ See above measures on air quality, noise and vibration, soils and water resources. ▪ Limit lightening on site. ▪ Sensitivity training to staff and anti-poaching policy.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
	▪ accidental spillages and sediment run-off	▪ Prepare construction management plan by the contractor and follow it. ▪ Follow GoB rules and regulations on noise.		
	▪ Loss of vegetation due to clearance activities	▪ Site clearance activities to be restricted to the minimum required area.	Contractor	DSC/PGCB
Aquatic ecology	▪ Construction may cause wetland habitat loss	▪ There is no significant water body in close proximity of the substation area.	Contractor	DSC/PGCB
Biodiversity Conservation	▪ Project may have potential impact on biodiversity conservation.	▪ A biodiversity conservation plan is required for crossing the reserve forest, rivers etc. The project does not fall under any such area. However, a Biodiversity management plan (BMP) will focus trees, avifauna, and any other species with ecological conservation value. BMP was prepared based on the guidelines of ADB.I	Contractors	DSC/PGCB
Landfilling	▪ Vehicle carrying landfill materials may elevate air pollution ▪ Excavated earth/or sourced soil may pollute top soil condition ▪ Unmanaged landfill material may arise drainage congestion.	▪ All vehicles carrying landfill materials should be covered ▪ Landfill materials should be dumped in a designated area with proper covers around. ▪ Prior to start filling the site, collect and storage top soils for using on the surface of the site boundary and access road side slopes for protection from side slope erosion. ▪ Construction of foundations to be undertaken in the dry season. ▪ Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. ▪ Protect excavated soil materials from erosion. ▪ The topsoil, excavated from the proposed construction sites should be re-spread in areas to be landscaped.	Contractors	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
		▪ Should follow drainage and waste management measures as identified in the ECPs (Annex 1).		
Visual amenities	▪ Temporary presence of an active construction site with storage of materials and equipment within the site for the substation.	▪ Maintain construction site in orderly condition and do not distribute material over many sites before usage.	Contractor	DSC/PGCB
	▪ Domestic waste might be disposed to construction area, creating visual impact.	▪ Follow proper waste management plan to ▪ dispose domestic waste and construction waste	Contractor	DSC/PGCB
Land acquisition/ requisition	▪ Loss of 5 acres land (mainly agricultural) permanently for the substation site. ▪ Temporarily loss of land (requisition) for construction camps etc.	▪ Prior to commence construction activities, the owner of the affected land must be noticed and provided proper compensation in time as per GOB and PGCB guidelines; ▪ GOB & PGCB guidelines should be followed for land acquisition/requisition/compensation ▪ RAP should be followed for land acquisition/ requisition/compensation.	Contractor / DC	DSC/PGCB
Stakeholder and Community expectation/ relations Management	▪ Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/security, noise/vibration, etc.) and adverse impact/ inconveniencies resulting from it.	▪ Follow mitigation for construction phase air quality, noise and traffic. ▪ Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting ▪ Set-up and effectively monitor construction grievance mechanism ▪ Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Community Health, Safety and Security	▪ Increased risks of traffic safety incidents on public roads.	▪ Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site. ▪ Follow BRTA traffic rules and regulations; ▪ Schedule deliveries of material/ equipment during off-peak hours ▪ Engage flagman construction site and construction camps for traffic control ▪ Arrange for signal light at night ▪ Engage experienced drivers to drive project vehicles ▪ Proper traffic management; ▪ Avoiding stockpiling of materials specially at the road sides that could hamper traffic movement.	Contractor	DSC/PGCB
	▪ Temporary influx of outside workers in the communities, risking tensions between outside labor and local population.	▪ A Local Content Plan should be prepared to facilitate involvement of local labor. See HR policies and procedures below. ▪ No hiring of short-term labor to be made at the site gate. ▪ Develop a code of behaviors for workers. All workers to receive training on community relations and code of behavior. ▪ Periodic refreshing as needed based on community liaison/grievance mechanism feedback.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Traffic Congestion	▪ Increased traffic use of road by construction vehicles ▪ Movement of normal road traffics and the safety of the road-users	▪ Follow Traffic Management Plan as provided in Annex 1, ECP 13. ▪ Ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs, restrict truck deliveries, where practicable, to day time working hours, restrict the transport of oversize loads, check on speed limits, etc.	Contractor	DSC/PGCB
Labor and working conditions	▪ Exploitation of workers	▪ Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non- discrimination, monitoring, roles and responsibilities following Labor Law. ▪ Provide reasonable, and if applicable negotiated, working terms and conditions. ▪ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ▪ No use of child labor (workers under age 18) or forced labor.	Contractor	DSC/PGCB
	▪ Activities and staff at site may create security risks	▪ Make security plan and emergency response and contacts with security forces.	Contractor	DSC/PGCB
	▪ Risk of health & safety incidents amongst labor force, including minor incident's such as cuts and ▪ major incidents such as loss of life	▪ Develop project specific health and safety procedures based on PGCB standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors. ▪ Especially slip-trip and fall hazards with tower erection and electrocution need attention.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
	▪ Risk of potential transmission of COVID-19 by neglecting safety guidelines	▪ Pre-employment health check-up should be mandatory. ▪ Entry and exit from site/ workplace should be controlled. ▪ Accommodation arrangements should be adequate and designed to reduce contact with the community. ▪ Rearrangement of work tasks or number of people on the worksite should be reduced to allow social/ physical distancing, or rotating workers through a 24-hour schedule; ▪ Adequate number of personal protective equipment (PPE) should be provided; ▪ Any suspected COVID 19 employees should be sent for quarantine.	Contractor	DSC/PGCB
Employment and economy	▪ Creation of temporary jobs for local residents and nationals with skilled trades	▪ Employ local people specially PAPs for the project activities as much as possible.	Contractor	DSC/PGCB
	▪ Supply chain opportunities for companies that can provide goods and services needed by the company	▪ Prepare a local content plan to facilitate identification and selection of qualified local companies to provide needed supplies and services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.	Contractor	DSC/PGCB
Infrastructure	▪ Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	▪ Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. ▪ Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. ▪ Upgrading of existing access roads.	Contractor	DSC/PGCB
Cultural heritage	▪ If any cultural heritage is located within the proposed substation site that may require relocation	▪ There is no cultural heritage within the close proximity of the substation site.	Contractor	DSC/PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
	▪ Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	▪ Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Contractor	DSC/PGCB

12.3.8.4 ESMP for the Sub-station during Operation and Maintenance Stage

Table 12-8: ESMP for the Sub-station during Operation and Maintenance Stage

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Drainage Congestion and Flooding	▪ Drainage congestion will occur in the surface drains within the substation area if O&M is not done regularly.	▪ Provision for adequate drainage of storm water ▪ Provision of adequate diversion channel, if required ▪ Provision for pumping of congested water, if needed ▪ Clean the drains, especially during monsoon regularly; ▪ Ensure adequate monitoring.	Contractor	DSC/PGCB
Terrestrial ecology	▪ Loss of vegetation due to routine clearance of vegetation	▪ Cleaning natural vegetation should be avoided as much as possible	Contractors	DSC/PGCB
	▪ Tree replantation	▪ Plantation of 5391 saplings to replace 1797 felled trees on the side slopes of the access roads during monsoon period. ▪ The dead saplings should be replaced by new saplings ▪ Nursing period of planted sapling should not less than 2 years. ▪ Follow Tree plantation plan as per Annex 28.	Contractors	DSC/PGCB
Land planning and use	▪ Stabilization of electricity will lead to increase in land use and pressure on natural environmental area for the upazila.	▪ Government shall regulate the acquisition of land in the study area	PGCB	PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Community Health, Safety and Security	▪ External safety risks of electrocutions, bush fires etc.	▪ Develop an emergency response plan following PGCB and international best practice including provisions for prevention and response to electrocution, bush fires, repair of snapped lines, roles and responsibilities. ▪ Coordinate with emergency services ▪ Annual safety audit of the transmission lines and poles and maintenance of the RoW to keep free of higher vegetation and structures. ▪ Communicate to communities in communities along the substation area the safety risks of the transmission lines and provide response measures. ▪ Put sign boards on towers about electrocution risk.	PGCB	PGCB
	▪ Risk to continuous power supply and even damage of substation	▪ Ensure security of substation in collaboration with law enforcing agencies. ▪ Keep complain book in the substation for recording peoples complains. ▪ Ensure availability of adequate safety gears for substation operations	PGCB	PGCB
Short Circuit/ Accident	▪ Due to short circuit of the sub-station, disruption of power and accident might occur.	▪ O&M of substations should be done in time by experienced personnel.	PGCB	PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Fire Explosion	▪ Fires in substations can severely impact the supply of power to customers and assets. ▪ These fires can also create a fire hazard to utility personnel, emergency personnel, and the general public ▪ Affected communities around the substation area, as well as crew in substation charge	▪ Isolation (from persons). (i) calculation and documenting fire clearance zones on the project drawings (ii) the use of oil and fire containment bund, kerbs or retaining walls for outdoor substations ▪ Engineering controls. (i) correct electrical protection settings, correct fuse sizes, correct loading and derating factors applied to the transformers based on the type of and method of installation (prevention). (ii) Oil bunds, kerb stones, retaining walls and flame traps (crushed rock) to minimize the size of the oil pool and fire exposed to air (minimize the consequences). (iii) Fire suppression systems like CO_2 or self-activated aerosol generator fire suppression systems for use in a substation room located within a host building (active fire suppression and fighting the fire remotely). ▪ Administrative controls. Such as: (i) access routes should be documented and shown along with fire risk zones on the project design drawings. (ii) Easements or restricted covenants should be placed on the property title to ensure clearances are to be maintained by the landowner or a notification that 2hr fire rated structures are to be provided and maintained. ▪ Personal protective equipment (PPE) for use during inspections and equipment operation. Good asset management practices and regular monitoring, follow Fire and Explosion Management Plan as per Annex 22	PGCB	PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Accidental Spillage	▪ Accidental spillage that could contaminate land and water ▪ Occupational health risks to workers due to exposure	▪ Acceptance of mineral oil should be accompanied with Material Data Safety Sheets and/or be certified that it is PCB-free ▪ Provision of oil-water separator ▪ Fire extinguishers readily available in storage areas for mineral oil ▪ Provide for oil containment structure	PGCB	PGCB
Labor and working conditions	▪ Exploitation of workers	▪ Follow human resources policies and procedures of PGCB, following Labor Law. ▪ Provide reasonable, and if applicable negotiated, working terms and conditions. ▪ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ▪ No use of child labor (workers under age 18) or forced labor.	PGCB	PGCB
	▪ Occupational H&S risks in operation and maintenance ▪ ▪ Risk to continuous power supply	▪ PGCB should follow their Occupational HSE plan following Bangladeshi and international requirements: train staff, monitor and keep record. ▪ Special focus on slip- trip, fall from height and electrocution in maintenance and repair works, emergency prevention and management. ▪ Use personal protection equipment. ▪ Have medical emergency equipment for primary treatment at hand. ▪ Ensure security of substation in collaboration with law enforcing agencies. ▪ Keep complain book in the substation for recording of people's complains. ▪ Ensure availability of adequate safety gears for substation operations	PGCB	PGCB

Indicator	Potential impact	Mitigation or enhancement measures	Implementation Agency	Supervision Agency
Employment and Economy	▪ Improved electricity supply for the national grid, creating opportunities for businesses and economic development in the country.	▪ Regular maintenance of the project to ensure reliable production of power	PGCB	PGCB
Cultural heritage	▪ interactions between maintenance works and cultural festivals due to traffic, noise and/or vibration impacts	▪ Festivals and potentials for interaction with maintenance works. If required cease works on the specific dates.	PGCB	PGCB

12.4 Environmental Benefits and Enhancements

12.4.1 Green Development Plan

582. Under this Project, a tree plantation programme has been proposed. The objective of the tree plantation and replacement programme is to compensate for the loss of trees due to the proposed implementation of the Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission Line Project and Char Fasson substation. Other major objectives of the programme are to protect the affected cultural and sensitive areas (within 20 m from the RoW boundary), and to enhance the health of the ecosystem.

583. During pre-construction and construction, 1,797 trees (of varying sizes) will be cut along the Project alignment, among them 1,055 timber trees, 616 fruit trees, 42 medicinal trees; and 84 bamboo trees. The proposed tree plantation and replacement programme (TPRP) will plant at least three times the number of removed trees. In consultation with senior ecologist and local communities, the species for the proposed tree replacement have been selected, based on lost vegetation statistics and suitability for the intended purpose. The main considerations for species selection for the Project is to protect the substation embankment from erosion, preserve habitats for biotic species, minimise visual impacts, improve aesthetics, conserve ecological environments, and create commercial benefits. Agreement from PGCB and local communities will determine the species to be planted

584. Therefore, a total of (1,797×3) 5,391 new trees will be planted during the construction and post-construction stages of the Project. A detail tree plantation programme is provided in Annex 28.

12.5 Institutional Arrangements

585. 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 existing Environment and Social Unit (ESU) from PGCB, comprising qualified environmental and social development staff, will be engaged 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 ADB 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.

586. 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.

587. 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.

588. The organogram of PIU is shown in Figure 12-2; Table 12-9 presents the responsibilities of PIU, its consultants, and construction contractor(s).

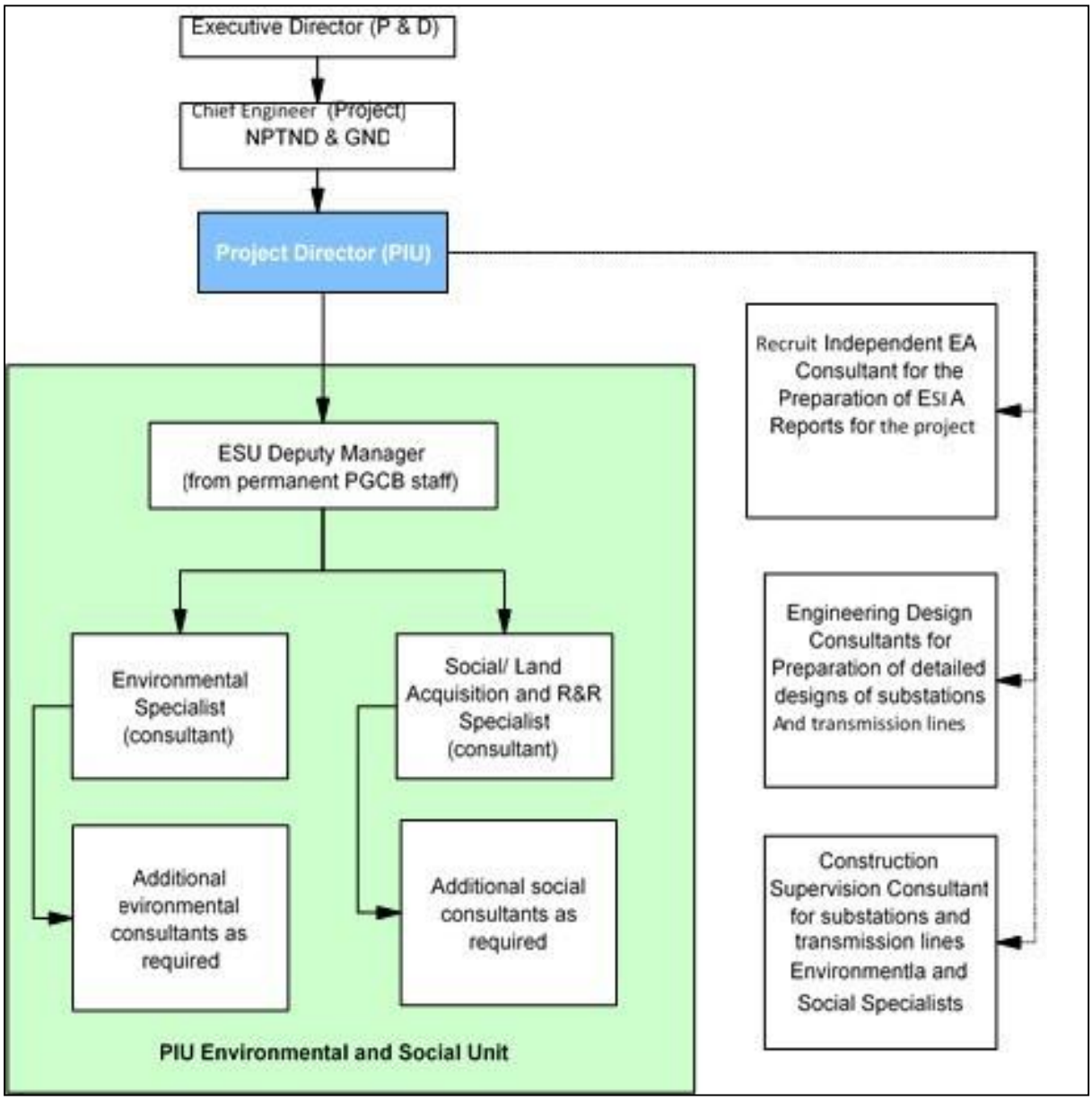

Figure 12-2: Organogram for Environmental and Social Management of Project

Table 12-9: Roles and Responsibilities for ESMP Implementation

Organizations	Responsibility
PIU	• Ensure effective implementation of the project in accordance with the plans • Ensure that all project activities are well-managed and coordinated. • Engaging existing ESU from PGCB and occupying 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. • Payment of compensation to the project affecters • Recruitment and supervision of Construction Supervision Consultants (CSC). • Report to ADB.
ESU within PIU	• Responsible for screening and determining scope of EA work required for subprojects and studies, assisting PD with developing ToRs and hiring of consultants to carry out any required environmental assessment work, reviewing consultant's deliverables related to environmental assessment, reviewing bid documents for inclusion of ESMP measures, supervising construction activities, producing periodic monitoring reports, • Ensuring inclusion of ESMP in bidding documents • Providing training on ESMP principles and requirements to PGCB 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 ESIAs/ESMPs to be developed for the subcomponents of the Project.
CSC	• 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	• 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.

12.5.1 Monitoring Program

589. 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.

12.5.2 Compliance Monitoring

590. 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 12-10 and Table 12-11 for TL and SS respectively.

12.5.2.1 Compliance Monitoring Plan for Transmission Line during Design/ Pre-construction/ Construction Stages

Table 12-10: Compliance Monitoring Plan for Transmission Line during Design/ Pre-construction/ Construction Stages

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Air quality	▪ Localized impairment of air quality by exhaust emissions from vehicles and equipment engines ▪ Elevated dust levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	▪ Pollution prevention plan will be implemented ▪ The equipment and vehicles used during the construction process will comply with the national 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. ▪ Regular air monitoring will be carried out near the sensitive receptors (Table 12-4) to ensure ambient air quality remains within the limits defined by national standards ▪ 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	Contractor	CSC	▪ Air quality monitoring data ▪ Ambient air quality found beyond the national Guidelines ▪ Number of non-compliance reports. ▪ Number of community complaints. ▪ Number of related grievances	▪ Throughout contractor mobilization and de-mobilization and the construction phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
		control measures. Continued consultations with the affected communities will be carried out during construction phase. ▪ ECP7 on air quality management will be implemented.				
Noise	▪ Nuisance noise from construction activities, heavy machines, generators and construction vehicle movement.	▪ A pollution prevention plan will be prepared in accordance with ECPs, national standards ▪ The equipment and vehicles used during the construction process will comply with the national 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 12-4).	Contractor	CSC	▪ Approved plan; ▪ Plan itself will outline appropriate KPIs for its implementation. ▪ Number of non-compliance reports ▪ Noise measurement data ▪ Number of community complaints.	▪ Before construction ▪ Throughout contractor mobilization and de-mobilization

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Soil	▪ Soil Erosion and Contamination	▪ 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	▪ Approved plan; ▪ Plan itself will outline appropriate KPIs for its implementation ▪ Number of any non-compliance reports ▪ Number of complaints	▪ Before construction ▪ Throughout contractor ▪ Mobilization and de-mobilization

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
	▪ Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminum oxide paint, etc.)	▪ A pollution prevention plan will be prepared in accordance with ECPs, national standards (ECP5)	Contractor	CSC	▪ Approved plan; ▪ Plan itself will outline appropriate KPIs for its implementation.	▪ Before construction
Water resources	▪ Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	▪ A pollution prevention plan will be prepared in accordance with ECPs, national standards (ECP3)	Contractor	CSC	▪ Approved plan, ▪ Plan itself will outline appropriate KPIs for its implementation. ▪ Number of any non-compliance reports	▪ Before and throughout the construction phase
	▪ Drinking Water quality	▪ 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 ▪ mobilizatio n of contractor

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Drainage Congestion and Flooding	▪ Localized flooding due to congestion from construction wastes.	▪ Drainage system will be designed so that all spills will be drained and collected in a sump for further appropriate disposal; ▪ 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 and throughout the construction phase
Waste generation	▪ Generation of construction wastes from the construction materials.	▪ 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 ▪ ▪ Throughout the construction phase
Ecology	▪ Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	▪ 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.	Contractor	CSC	▪ Number of any non-compliance reports ▪ Number of sightings of key wildlife species	▪ Before and throughout the construction phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
		▪ 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.				
	▪ Loss of vegetation and crops due to clearance activities	▪ Clearing and removing of natural vegetation and crops will be minimized ▪ Tree cutting will be minimized ▪ Selecting barren/fallow land for aligning transmission lines.	Contractor	CSC	▪ Area of vegetation lost/disturbed Number of trees felled ▪ Number of complaints received.	▪ Throughout construction phase
Land acquisition/ requisition	▪ Loss of 5 acres land (mainly agricultural) permanently for the tower bases of the TL. ▪ Temporarily loss of land (requisition) for construction camps etc.	▪ Alignment of TL will be selected in uncultivated areas, to the extent possible ▪ 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	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

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Land Planning and Use	▪ Change in land use caused by land take for towers, vegetation clearance, and access restriction	▪ 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
Clearing of vegetation	▪ 20252 trees will be partially affected by trimming as well as standing crops (if any) and bushes along the RoW also will be affected.	▪ 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

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Stakeholder and Community expectation / relations Management	▪ Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/ security, noise /vibration, etc) and adverse impact/ inconveniencies resulting from it.	▪ A communication plan will be prepared	PIU	PGCB	▪ Approved Plan; ▪ Plan itself will outline appropriate KPIs for its implementation	▪ Before site activities.
Community Health, Safety and Security	▪ Increased risks of traffic safety incidents on public roads.	▪ A Traffic Management Plan (TMP) will be prepared in accordance with ECP	Contractor	CSC	▪ Approved TMP; ▪ Plan itself will outline appropriate KPIs for its implementation.	▪ Before mobilization of contractor

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
	▪ Traffic management	▪ 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 ▪ GRM will address the traffic congestion elated issues.	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
	▪ Temporary influx of outside workers in the communities, risking tensions between outside labor and local population.	▪ Code of conduct will be implemented ▪ Local norms and customs will be respected	Contractor	CSC	▪ Number of public grievances relating to in-migrants ▪ Number of trainings provided	▪ Construction phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Labor and working conditions	▪ Risk of health & safety incidents amongst labor force, including minor incident's such as cuts and ▪ major incidents such as loss of life	▪ 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 ▪ Number of any non-compliance reports ▪ Number of trainings conducted ▪ Number of accidents, incidents, and near misses. ▪ Number of complaints.	▪ Throughout contractor mobilization and de-mobilization ▪ Before and throughout the construction phase
	▪ Emergency Preparedness	▪ An emergency preparedness plan will be prepared and approval obtained from CSC				
	▪ Occupational health and safety	▪ 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.				

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
		▪ 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.				
Camp	▪ 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 beels (water ponds) or khals (water channels) will be affected.	Contractor	CSC	▪ Approval from CSC ▪ Plan itself will outline appropriate KPIs for its implementation	▪ Before mobilization of contractor
Infra-structure	▪ Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	▪ 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	▪ Constructi on phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Cultural heritage	▪ Damage to Sites/Places of Religious / Cultural Significance	▪ 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.	Contractor	CSC	▪ Number of any non-compliance reports ▪ Number of complaints received. ▪ Number of reports of any new PCR discovered/reported	▪ Constructi on phase

12.5.2.2 Compliance Monitoring Plan for Sub-station during Design/ Pre-construction/ Construction Stages

Table 12-11: Compliance Monitoring Plan for Sub-station during Design/ Pre-construction/ Construction Stages

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Air quality	▪ Localized impairment of air quality by exhaust emissions from vehicles and equipment engines ▪ Elevated dust levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	▪ Pollution prevention plan will be implemented ▪ The equipment and vehicles used during the construction process will comply with the national 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. ▪ Regular air monitoring will be carried out near the sensitive receptors (Table 10-4) to ensure ambient air quality remains within the limits defined by national standards ▪ 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	Contractor	CSC	▪ Air quality monitoring data ▪ Ambient air quality found beyond the national Guidelines ▪ Number of non-compliance reports. ▪ Number of community complaints. ▪ Number of related grievances	▪ Throughout contractor mobilization and de-mobilization and the construction phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
		with the affected communities will be carried out during construction phase ▪ ECP on air quality management will be implemented.				
Noise	▪ Nuisance noise from construction activities, heavy machines, generators and construction vehicle movement.	▪ A pollution prevention plan will be prepared in accordance with ECPs, national standards ▪ The equipment and vehicles used during the construction process will comply with the national 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 10-4.	Contractor	CSC	▪ Approved plan; ▪ Plan itself will outline appropriate KPIs for its implementation. ▪ Number of non-compliance reports ▪ Noise measurement data ▪ Number of community complaints.	▪ Before construction ▪ Throughout contractor mobilization and de-mobilization

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Soil	▪ Soil Erosion and Contamination	▪ 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	▪ Approved plan; ▪ Plan itself will outline appropriate KPIs for its implementation ▪ Number of any non-compliance reports ▪ Number of complaints	▪ Before construction ▪ Throughout contractor ▪ Mobilization and de-mobilization

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
	▪ Top soil loss (about 0.5m thick) due to construction of substation sites	▪ Identification of re-use of excavated material on site, to reduce off site effects	Contractor	CSC	▪ Availability of plan to dispose excavated material.	▪ Before construction
	▪ Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminum oxide paint, etc.)	▪ A pollution prevention plan will be prepared in accordance with ECPs, national standards	Contractor	CSC	▪ Approved plan; ▪ Plan itself will outline appropriate KPIs for its implementation.	▪ Before construction
Water resources	▪ Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	▪ A pollution prevention plan will be prepared in accordance with ECPs, national standards	Contractor	CSC	▪ Approved plan; ▪ Plan itself will outline appropriate KPIs for its implementation. ▪ ▪ Number of any non-compliance ▪ reports	▪ Before and throughout the construction phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
	▪ Drinking Water quality	▪ 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
Drainage Congestion and Flooding	▪ Localized flooding due to congestion from construction wastes.	▪ Drainage system will be designed so that all spills will be drained and collected in a sump for further appropriate disposal; ▪ 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 and throughout the construction phase
Waste generation	▪ Generation of construction wastes from the construction materials.	▪ 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 ▪ ▪ Throughout the construction phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Ecology	▪ Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	▪ 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	▪ Number of any non-compliance reports ▪ Number of sighting of key wildlife species	▪ Before and throughout the construction phase
	▪ Loss of vegetation and crops due to clearance activities	▪ Clearing and removing of natural vegetation and crops will be minimized ▪ Tree cutting will be minimized ▪ Selecting barren/fallow land for establishing substations ▪ Compensatory tree plantation will be carried out (eg, along the periphery of substations).	Contractor	CSC	▪ Area of vegetation lost/disturbed ▪ Number of trees felled ▪ Number of complaints received.	▪ Throughout construction phase
Land acquisition/ requisition	▪ Loss of 5 acres land (mainly agricultural) permanently for	▪ Location of substations will be selected in uncultivated areas, to the extent possible. ▪ Compensation will be paid to the land owners for the land permanently acquired for the project. Similarly, assistance will be paid	PGCB	PGCB	▪ Documentary evidence of payment of compensation and assistance;	▪ Before construction

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
	the substation site. ▪ Temporarily loss of land (requisition) for construction camps etc.	to the persons/ households losing their livelihoods.			▪ Number of complaints related to land use change and compensation received through GRM; ▪ Number of complaints resolved.	
Stakeholder and Community expectation/ relations Management	▪ Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/ security, noise /vibration, etc) and adverse impact/ inconveniencies resulting from it.	▪ A communication plan will be prepared	PIU	PGCB -	▪ Approved Plan; ▪ Plan itself will outline appropriate KPIs for its implementation	▪ Before site activities.
Community Health, Safety and Security	▪ Increased risks of traffic safety incidents on public roads.	▪ A Traffic Management Plan (TMP) will be prepared in accordance with ECP	Contractor	CSC	▪ Approved TMP; ▪ Plan itself will outline appropriate KPIs for its implementation.	▪ Before mobilization of ▪ contractor

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
	▪ Traffic management	▪ 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 ▪ GRM will address the traffic congestion elated issues.	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
	▪ Temporary influx of outside workers in the communities, risking tensions between outside labor and local population.	▪ Code of conduct will be implemented ▪ Local norms and customs will be respected	Contractor	CSC	▪ Number of public grievances relating to in-migrants ▪ Number of trainings provided	▪ Construction phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
Labor and working conditions	▪ Risk of health & safety incidents amongst labor force, including minor incident's such as cuts and ▪ major incidents such as loss of life	▪ 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 ▪ Number of any non-compliance reports ▪ Number of trainings conducted ▪ Number of accidents, incidents, and near misses. ▪ Number of complaints.	▪ Throughout contractor mobilization and de-mobilization ▪ Before and throughout the construction phase
	▪ Emergency Preparedness	▪ An emergency preparedness plan will be prepared and approval obtained from CSC				
	▪ Occupational health and safety	▪ 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				

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
		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.				
Infrastructure	▪ Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	▪ 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
Cultural heritage	▪ Damage to Sites/Places of Religious / Cultural Significance	▪ 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	Contractor	CSC	▪ Number of any non-compliance reports ▪ Number of complaints received. ▪ Number of reports of any new PCR discovered/reported	▪ Construction phase

Indicator	Potential impact	Actions	Responsibility		Key Performance Indicator	Timing
			Execution	Monitoring		
		implemented after obtaining complete consensus of the related community. ▪ Liaison with the community will be maintained.				
	▪ Chance Find issue	▪ 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 (Annex 16). 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.				

12.5.3 Effects Monitoring

591. Effects' monitoring is a very important aspect of ESMP and aims to ensure environmental protection. The effects monitoring plan proposed for the TL and SS is presented in Table 12-12 and Table 12-13 respectively. 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.

12.5.3.1 Environmental Monitoring Plan for Transmission Line

Table 12-12: Environmental Monitoring Plan for Transmission Line

Environmental Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Preconstruction/Construction Stage							
Requirement of land (Temporary requisition for 3 years)	Ensure that PAPs get compensation as per RAP which needs to be prepared.	As per RAP	Inspection	As per RAP	ROW of the TL	DC	DSC/PGCB
Trimming of trees within ROW and clearing vegetation from the tower bases of the TL	Checking whether proper compensation as mentioned in RAP is received by PAPs.	DOE/FD	Inspection	Regular during tree felling and site clearing operations	Trimming of trees within ROW and clearing vegetation from the tower bases of the TL	FD	DSC/PGCB
Noise Pollution	Ambient noise level	DOE standards	Measurement	As & when required	At adjacent subproject cultural sites & construction camps	Contractor	DSC/PGCB
Air pollution	PM10, PM2.5, SPM, SO2, NOX, CO,O3	DOE guidelines	Sampling and Laboratory Analysis	Quarterly	Construction sites and camps	Contractor	DSC/PGCB

Environmental Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Pollution due to Wastes	Checking storage, transportation, handling, and disposal of wastes; Wastes from construction sites and camps to be disposed properly at the designated waste dumping sites.	DOE guidelines	Inspection	Regular	Construction sites and camps	Contractor	DSC/PGCB
Surface Water Quality	pH, NH3-N, BOD, COD, PO4, Total Organic Content, Total Suspended Solids, Dissolved Oxygen, Total Coliform Turbidity	DOE Standards	Sampling and Laboratory Analysis	Quarterly	Pond, canal Crossing by TL	Contractor/ Consultant	DSC/PGCB
Ground Water/ Drinking Water Quality	pH, Chloride, As, TC, FC, Fe, Mn, EC, Turbidity	DOE Standards	Sampling and Laboratory Analysis	Quarterly	Construction camps	Contractor/ Consultant	DSC/PGCB
Traffic congestion/Road Accident	Checking road crossing points, road adjacent to towers etc.	BRTA	Inspection	Regular	At road/Rly. crossing points & road adjacent to towers	Contractor/ Consultant	DSC/PGCB

Environmental Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Cultural sites (if any)	Checking whether any cultural sites are affected by the project activities such as by noise, wastes etc.	DOE guidelines	Inspection	As & when required	A mosque near AP 26 of the transmission line	Contractor/ Consultant	DSC/PGCB
Occupational health and safety	Use of PPE, general health, water supply and sanitation	DOE guidelines	Inspection	Regular	At construction sites and camps	Contractor	DSC/PGCB
Community health and safety	Awareness of local people	DOE guidelines	Inspection	Regular	At construction site and crossing of roads	Contractor	DSC/PGCB
Operation Stage							
Tall trees	Trimming of tall trees under the TL	ESMF	Inspection	Once every year and as directed by the relevant engineer of PGCB	Along the TL	PGCB	PGCB

Environmental Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
EMF	Checking of clearance of TL & top of houses (for housing structures) and for river crossing clearance from HFL to TL	International Standard for the safety of power lines (No BD standard & no device available in BD)	Inspection	As & when required	At populated/ Housing area where TL passes over	PGCB	PGCB
Short circuit/ accident	Safety	DOE guidelines	Inspection	Regular	Along the TL	PGCB	PGCB
Occupational Health and Safety (OHS)	Use of PPE	As required	Inspection	Regular	Along the TL	PGCB	PGCB
Power Supply	Access to electricity in the rural area on priority basis.	DOE/PDB guidelines	Inspection	Whole project period	Along the TL	PGCB	PGCB

12.5.3.2 Environmental Monitoring Plan for Sub-station

Table 12-13: Environmental Monitoring Plan for Sub-station

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Preconstruction/Construction Stage							
Felling of trees and clearing of vegetation	Checking whether proper compensation as mentioned in RP is received by PAPs.	DOE/FD	Inspection	Regular during tree felling and site clearing operations	Within ROW of substation & access road sites	Contractor/FD	DSC/PGCB
Fauna (Wildlife)	Checking whether wildlife is disturbed /killed by the workers	DOE/FD	Inspection	Weekly	ROW of Route	Contractor/FD	DSC/PGCB
Drainage Congestion/ Flooding	Checking drainage congestion & top of substation site above HFL	Hydrological / Drainage study	Inspection	Regular during earthworks	Substation site	Contractor	DSC/PGCB
Noise Pollution	Ambient noise level	DOE Noise Pollution Control Rules, 2006	Measurement	As & when Required Quarterly must	At construction sites & camps	Contractor	DSC/PGCB
Air Pollution	PM10, PM2.5, SPM, SO2, NOX, CO, O_3	DOE Standards	Sampling and Laboratory Analysis	Quarterly	SS sites	Contractor	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Dust Pollution	Dust should be controlled by water spraying regularly specially during dry period.	DOE guidelines	Inspection	Regular	SS sites	Contractor	DSC/PGCB
Surface Water Quality	pH, NH3-N, BOD5, COD, PO4, Total Organic Content, Total Suspended Solids, Dissolved Oxygen, Total Coliform Turbidity	DOE Standards	Sampling and Laboratory Analysis	Quarterly	Nearby 3 Water bodies	Contractor	DSC/PGCB
Ground Water/Drinking Water Quality	pH, Chloride, As, TC, FC, Fe, Mn, EC, Turbidity	DOE Standards	Sampling and Laboratory Analysis	Quarterly	At 3 construction camps (	Contractor	DSC/PGCB
Dredge Materials	Pb, Cd, Cr, Cu, Zn, Mn, As, Se, Hg	US EPA, 2000	Sampling and laboratory Analysis	Once before dredging and once after dredging	Dredging sites	Contractor	DSC/PGCB
Pollution due to Wastes	Checking collection, storage, transportation, and	DOE guidelines	Inspection	Regular	Construction camps	Contractor	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
	disposal of hazardous waste; Waste from construction site to be collected and disposed safely to the designated sites; and Wastes from labor camp to be disposed properly at the designated sites.						
Traffic Congestion/ Road Accident	Checking meeting point of existing road & access road	BRTA	Inspection	Regular	Meeting point of existing road & Access road	Contractor	DSC/PGCB
Occupational health and safety	Checking health, use of PPE & 1st aid facilities, DWQ, sanitation and accommodation	DOE guidelines	Inspection & testing of DWQ	Regular & twice	At construction sites and camps	Contractor	DSC/PGCB
Community health and safety	Awareness of local people and staying safely from the project activities	DOE guidelines	Inspection	Regular	At construction site and camps	Contractor	DSC/PGCB

Environmental Issues/Parameters	Monitoring Parameters	Standards/ Guidelines	Means of Monitoring	Frequency	Location	Implementation Agency	Supervision Agency
Operation Stage							
Tree replantation	Replanting of saplings and checking replacement of dead saplings & nursing (watering & fertilizer) of saplings for 2 years	FD	Inspection	As & when required	Access road side slopes	FD	PGCB
Drainage congestion	Checking drainage congestion in the substation sites during monsoon	Hydrological /Drainage e study	Inspection	As & when required during monsoon	Substation sites	PGCB	PGCB
Community health and safety	Community H&S nearby the substation site	DOE guidelines	Inspection	Regular	Substation sites	PGCB	PGCB
Safety & Security of Substation & workers	Checking use of PPE & duty of security force	DOE guidelines	Inspection	Regular	Substation sites	PGCB	PGCB

12.5.4 Performance Indicators

592. 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.

593. 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 affected people
- Timely implementation of resettlement schedule.
- Number of grievances received.
- Number of grievances resolved.
- Number of construction-related accidents.

12.5.5 Capacity Building

594. 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 12-14 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 12-14: 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; Occupational Health and Safety; COVID-19 awareness and safety, 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; Gender issues including GBV and SE; Code of Conduct.	Drivers	Contractors	Before and during the field operations. (To be repeated as needed.)
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.

12.5.6 Documentation and Reporting

595. The PIU with assistance from CSC and contractors will produce the following environmental reporting documentation and report to ADB:

596. 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.

597. 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 two years.

598. 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.

599. 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.

12.5.7 Budget for ESMP Implementation

600. For implementing the present ESMP about 9.86 million BDT will be required. The main components of this cost include 1.96 million BDT for the environmental quality monitoring of two years, 4.8 million BDT for the consultants, 1.1 million BDT for the tree plantation etc. The breakdown for the ESMP implementation cost is given in Table 12-15.

Table 12-15: Budget for the ESMP for Substation and Transmission line

Sl no	Environmental Component	Item	Unit	Frequency (No./ Year)	Time (Project Year)	Qty.	Rate	Amount
A. Sub-station								
1	Air Quality	PM_{10}, $PM_{2.5}$, SPM, SO_2, NO_X, CO, O_3	4	4	2	32	15,000	**480,000**
2	Noise Pollution	Ambient noise level (Day & Night) level (LAeq)	4	4	2	32	5,000	**160,000**
3	Surface Water Quality	pH, NH_3-N, BOD, COD, PO_4, Total Organic Content, Total Suspended Solids, Dissolved Oxygen, Total Coliform, Turbidity	1	4	2	8	15,000	**120,000**
4	Ground Water/ Drinking Water Quality	pH, Chloride, As, TC, FC, Fe, Mn, EC, Turbidity	1	4	2	8	15,000	**120,000**
5	Soil Quality	Inside Substation for parameters as Organic Matter, Phosphorus, Potassium, Zinc, pH, Sodium, Calcium, Magnesium, Copper, Iron, Manganese, Lead	1	1	2	2	15,000	**30,000**
6	Waste Management	Handling, storage and disposal in the designated area of the construction camp					50,000	**50,000**
7	Occupational and Health and Safety (H&S)	H&S measures for workers (such as PPEs for workers, safety equipment such as barriers, posters, banners etc.)					50,000	**50,000**
8	H & S Training	Contractor's workforce with special attention to mitigating COVID-19 related threat					200,000	**200,000**
9	Consultant (for monitoring)		Person-Month			24	100,000	**2,400,000**
10	Transport (for monitoring team)		Days			50	10,000	**500,000**
11	Reporting and others (Yearly DoE renewal cost)		Lump Sum				100,000	**100,000**
12	Contingency						100,000	**100,000**
	Total A							**4,310,000**

Sl no	Environmental Component	Item	Unit	Frequency (No./ Year)	Time (Project Year)	Qty.	Rate	Amount
B. Transmission Line								
1	Air Quality	PM_{10}, $PM_{2.5}$, SPM, SO_2, NO_X, CO, O_3	3	4	2	24	15,000	**360,000**
2	Noise Pollution	Ambient noise level (Day & Night) level (LAeq)	3	4	2	24	5,000	**120,000**
3	Surface Water Quality	pH, NH_3-N, BOD, COD, PO_4, Total Organic Content, Total Suspended Solids, Dissolved Oxygen, Total Coliform, Turbidity	3	4	2	24	10,000	**240,000**
4	Ground Water/Drinking Water Quality	pH, Chloride, As, TC, FC, Fe, Mn, EC, Turbidity	3	4	2	24	10,000	**240,000**
5	Soil Quality	Inside Substation for parameters as Organic Matter, Phosphorus, Potassium, Zinc, pH, Sodium, Calcium, Magnesium, Copper, Iron, Manganese, Lead	3	1	2	6	15,000	**90,000**
6	Waste Management	Handling, storage and disposal in the designated area of the construction camp					50,000	**50,000**
7	Replantation of saplings	Replantation of trees with nursing and fence at the end of construction or starting of operation (preferably during monsoon period)					1,100,000	**1,100,000**
8	Occupational and Health and Safety (H&S)	H&S measures for workers (such as PPEs for workers, safety equipment such as barriers, posters, banners etc.)					50,000	**50,000**
9	H & S Training	Contractor's workforce with special attention to mitigating COVID-19 related threat					200,000	**200,000**
10	Consultant (for monitoring)		Person-Month		24		100,000	**2,400,000**
11	Transport (for monitoring team)		Days		50		10,000	**500,000**
12	Reporting and others (Yearly DoE renewal cost)		Lump Sum				100,000	**100,000**
13	Contingency						100,000	**100,000**
	Total B							**5,550,000**
	Grand Total (A+B)							**9,860,000**

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13. Conclusions and Recommendations

13.1 Conclusion

601. People all along the route of the transmission line and substation sites expressed their keen interest and positiveness towards the Project even after knowing the fact that they will not get electricity directly from the transmission line. Their main consideration is that the overall development in the power sector would contribute to the national development and local development as well. Local people along the transmission line alignment will be benefited as the project will generate some employments for them during the pre-construction and construction phases.

602. Open-sourced Google image has been used in identifying the best route out of three transmission lines avoiding settlements, educational institutes, religious places, ecologically sensitive areas, etc. This has been reconfirmed by walking along the entire length of the alignment for removing confusions at some places/points. Observations of the team members suggest that the route finally selected passes mostly through agricultural crop field and does not pass-through settlement and ecologically sensitive areas. The substations sites are also fallen in the crop fields with minor aquaculture area.

603. Minor temporary negative impact of the project will be felt during the pre-construction and site preparation phases which may involve removal of vegetation and felling of trees. The impact assessment reveals that construction of the Transmission Line and Substations will lead to some generation of noise due to transportation, unloading of materials and construction activities. for carrying construction materials to the site, erection of towers and construction of the transmission lines. These problems would be overcome by paying compensation for standing crops and bringing back these lands to their original form before handing them over to the owners after the construction is over. Crop production lost due to these activities during the pre-construction and construction phases will have to be compensated as well.

604. In the construction phase, temporary disturbance to the surrounding water and settlements due to waste disposal, deterioration of soil quality during digging and earth-filling; interference with road transportation; and, reduction in crop production would be occurred in the area proposed for the substation construction. Risks may arise also from traffic or heavy vehicle accidents during or in the post-construction period, electrocution, electrification from falling materials and wires, etc., which may result in physical injury, loss of life, vehicle and/ or property damage. Appropriate mitigation measures have been suggested in the report, to address all types of hazards and risks identified.

605. The project is not likely to have any major negative impact. So major mitigation is not required. The minor impact of noise and increase in traffic are within the existing level that is experienced by the people. The erection and installation will be done under expert supervision. The contractor will ensure usage of PPE by the workers engaged in construction activities.

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

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

608. PGCB needs to take site and environmental clearance from the Department of Environment (DoE) for implementation for the construction of transmission line and substation. This IEE report will facilitate PGCB in obtaining such clearance from DoE.

13.2 Recommendations

609. The IEE study reveals that the Bhola- Char Fasson 230/33 kV Sub-station and Notun Biddyut Power Plant to Char Fasson transmission line has no major negative impact, but will contribute to national development by improving the supply of electricity. Local people will be able to avail employments during the pre-construction and construction phases. The study recommends that the contractor should employ at least 50% of workforce from the project site(s).

610. Construction work is recommended to start just after the harvest of the standing crops and provide adequate time to harvest fish of the aquaculture pond if required to be filled up any low lands during construction. Vegetation clearance and tree felling should be bare minimum for sustaining the local ecosystem at the pre-construction and construction phases. Selection of the season for carrying out the work should be made by adjusting with the cropping season so as to inflict minimum damage to field crops. In both cases proper compensation for all types damages must be paid and the land should be brought back to its original form before handing them over to the owners.

611. The construction labor camps should be provided with water supply and sanitation facilities. The workers should be appraised of hygienic practices. The transportation of heavy equipment should be done by river craft where wheeling is not feasible. The stores and equipment yards should be properly guarded so that all equipment remain safe. The sub-stations should be fully equipped with firefighting equipment. Finally, on proper examination it is observed that the project has been proposed to be implemented safely and, in an environment friendly manner.

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Annexure

Annex 1. The Environmental Codes of Practice (ECPs)

The environmental codes of practice (ECPs) are presented below. Citation in the main report: in Section 11.3.6.

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: Top Soil Management
- ECP 7: Air Quality Management
- ECP 8: Noise and Vibration Management
- ECP 9: Protection of Flora
- ECP 10: Protection of Fauna
- ECP 11: Workers Health and Safety
- ECP 12- Water and Sanitation Facility for labors
- ECP 13: Road Transport and Road Traffic Management
- ECP 14: Potential Risk of transmitting COVID-19

Contractors will prepare Construction Environmental and Social Management Plan CESMP, in compliance with international agency 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 Construction Waste	▪ . Soil and water pollution from the improper management of wastes and excess materials from the construction sites, also impact on worker's health and safety.	▪ The Contractor shall 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	▪ The Contractor shall 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. ▪ 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.	The Contractor shall ▪ 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). ▪ 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	The Contractor shall ▪ 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 led to increased rate of runoff, increase in sediment and contaminant loading, increased flooding, and effect habitat of fish and other aquatic biology.	The Contractor shall ▪ 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 transport to an approved waste disposal site or recycling depot. ▪ 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.	The Contractor shall ▪ 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).

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activitiesin water bodies	▪ Construction works in the water bodies will increase sediment and contaminant loading, and effect habitat of fish and other aquatic biology.	The Contractor Shall ▪ 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 presence of suspended solids and E. coli.	The Contractor Shall ▪ Provide the drinking water that meets 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.

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.	▪ The Contractor shall ▪ 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

Project Activity/ Impact Source	▪ Environmental Impacts	▪ Mitigation Measures/ Management Guidelines
		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	▪ Do not allow ponding of water especially near the waste storage areas and construction camps. ▪ 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	The Contractor shall ▪ 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	The Contractor shall ▪ Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds.

ECP 6: 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 required for plant growth or agricultural development.	The Contractor shall ▪ Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m. ▪ 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	▪ 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 7: 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.	The Contractor shall ▪ 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.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		▪ 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 emissions from ▪ machinery and combustion of fuels.	The Contractor shall ▪ 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;	The Contractor shall ▪ 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.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		▪ Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems. ▪ Not permit the burning of solid waste.

ECP 8: 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	The Contractor shall ▪ 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.	The Contractor shall ▪ 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.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activity	▪ Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall ▪ 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. ▪ 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 9: 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.	The Contractor shall ▪ 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.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		▪ 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 embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. ▪ 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 10: 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, ▪ Impact on migratory birds, its habitat and its active nests	The Contractor shall ▪ 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. The Contractor shall ▪ 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. ▪ 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.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		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	The Contractor shall ▪ 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.	The Contractor shall ▪ 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	The Contractor shall ▪ 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 11: Worker's Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Health and Safety	▪ 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.), COVID-19 and (iii) road accidents from construction traffic. ▪ Child and pregnant labor	The Contractor shall- ▪ 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 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, 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. ▪ 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. ▪ The Contractor shall not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Occupational health and Safety / Accidents	▪ Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	The Contractor shall- ▪ 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 substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECP 11- ▪ Adequate ventilation facilities Safe and reliable water supply. ▪ 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

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
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.	The contractor shall- ▪ 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	▪ The Contractor shall follow the following ECPs to reduce health risks to the construction workers and nearby community- ▪ ECP 2: Fuels and Hazardous Goods Management ▪ ECP 4: Drainage Management ECP 10: Air Quality Management ▪ ECP 8: Noise and Vibration Management ▪ ECP 13: 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.	The Contractor shall- ▪ 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 procedures for fire, evacuation, and natural disaster, as appropriate. ▪ 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.

ECP 12- Water and Sanitation Facility for labors

Project activity/ impact source	Environmental and Social Impacts	Mitigation Measures/ Management Guidelines
Lack of WASH facility for laborers can cause inconvenience to the user and affect their personal hygiene	▪ Spreading sewage water cause negative impacts on ground and surface water. Besides, sewage water may create vector borne diseases.	The contractor shall: ▪ Arrange a proper hygienic toilet facility. ▪ Manage toilet wastes properly. ▪ Ensure clean water and soap for toilets. ▪ Adequate lighting and ventilation for toilets. ▪ Separate toilet for male and female.
Drinking water	▪ Groundwater at shallow depths is contaminated with arsenic and hence not suitable for drinking purposes.	The contractor shall: ▪ Ensure pumping of groundwater from deep aquifers (more than 300 m) to supply arsenic-free water. Safe and sustainable discharges are to be ascertained prior to the selection of pumps. ▪ Install tube wells with due regard for the surface environment, protection of groundwater from surface contaminants, and protection of aquifer cross-contamination. ▪ All tube wells, test holes, monitoring wells that are no longer in use or needed shall be properly decommissioned.

ECP 13: 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. ▪ Accidents and spillage of fuels and chemicals	The Contractor shall ▪ 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, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs, etc. ▪ Provide signs at strategic locations of the roads complying with the schedules of signs contained in the national Traffic Regulations. The Contractor shall

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		▪ 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 14: Potential Risk of transmitting COVID-19

Project activity/ impact source	Environmental and Social Impacts	Mitigation Measures/ Management Guidelines
Setting up labor shed for the accommodation of labor, conducting disinfecting activities, possible interaction of labor force with the local community.	▪ Lack of awareness and knowledge in health care among laborers pose a risk of transmitting COVID-19 ▪ Child and pregnant labor	The contractor shall: ▪ Conduct all types of construction activities as per plan to minimize risks. ▪ Provide personal protection equipment (PPE), such as safety boots, masks, gloves, protective clothing, goggles etc. ▪ Enforce health and hygiene protocols: hand washing, wearing a mask for all workers and laborers. ▪ Provide adequate ventilation facilities at all working areas and construction camps. ▪ Ensure safe and reliable water supply. Water supply from deep tube wells that meets the national standards. ▪ Hygienic sanitary facilities and sewerage system; ▪ Follow the wastes management guidelines proposed in ECP1 ▪ Implement suitable safety standards for all sub-project laborers, which shall not be less than those laid down on the international standards (WHO and CDC guidelines). ▪ Not to hire children of less than 14 years of age and pregnant women or women who delivered a child within eight preceding weeks, in accordance with the Bangladesh Labor Code, 2006

Annex 2. Detailed Preliminary Survey Report

Preliminary Survey Report of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line (Option 1)

Preliminary Survey Report of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line (Option 1)	
Angle Point	**Description**
Start point-AP1 (TT)	Existing Power Plant
AP1 (TT)- AP2	Existing Power Plant
AP2 - AP3	Existing Power Plant
AP3 - AP4	One (1) canal (75m) and agricultural land crossing.
AP4-AP5	Three (3) Pond, One (1) Road Crossing, Some Trees and Agricultural Land Crossing
AP5-AP6	One (1) Pucca Building, One (1) road crossing, Some Trees, and Agricultural Land Crossing
AP6-AP7	One (1) semi Pucca Building, ten (10) Pond, two (2) road Crossing, Some Trees, and Agricultural Land Crossing
AP7-AP8	three (3) semi Pucca Building, Two (2) katcha Building, ten (10) pond and one (1) canal (18m) crossing. Some Trees and Agricultural Land Crossing
AP8-AP9	One (1) semi Pucca Building, two (2) pond crossing. Some Trees and Agricultural Land Crossing
AP9-AP10	Four (4) katcha Building, Three (3) Road Crossing. Some Trees and Agricultural Land Crossing
AP10-AP11	Two (2) Road Crossing, One (1) pond. Some Trees and Agricultural Land Crossing
AP11-AP12	One (1) semi Pucca Building, six (6) pond and six (6) road crossing, two (2) canal (8m,11m) crossing Some Trees and Agricultural Land Crossing
AP12-AP13	Two (2) katcha Building, One (1) road, Five (5) pond and one (1) Canal (11m) Crossing. Some Trees and Agricultural Land Crossing
AP13-AP14	One (1) road, Five (5) pond and one (1) Canal (7m) Crossing. Some Trees and Agricultural Land Crossing
AP14-AP15	One (1) katcha Building, Two (2) road, Two (2) pond and one (1) Canal (12m) Crossing. Some Trees and Agricultural Land Crossing
AP15-AP16	One (1) katcha Building, Two (2) road, four (4) pond, two (2) Canal (62m, 6m) Crossing. Some Trees and Agricultural Land Crossing
AP16-AP17	All distance crossing trees and agricultural land.

Preliminary Survey Report of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line (Option 1)	
Angle Point	**Description**
AP17-AP18	Three (3) ponds, One (1) road and one (1) canal (40m) crossing. Some Trees and Agricultural Land Crossing
AP18-AP19	One (1) Pucca Building, Two (2) katcha Building, four (4) road, Five (5) ponds and all distance trees and Agricultural Land Crossing
AP19-AP20	three (3) semi Pucca Building, one (1) katcha Building, three (3) road, One (1) pond and some trees and Agricultural Land Crossing
AP20-AP21	Four (4) semi pucca building and three (3) Road Crossing. seven (7) pond, some trees and Agricultural Land Crossing
AP21-AP22	two (2) road, one (1) pond crossing and all distance trees and Agricultural Land Crossing
AP22-AP23	One (1) semi pucca building, Seven (7) pond, three (2) canal (12m,13m) and all distance trees and agricultural land crossing.
AP23-AP24	Two (2) semi pucca building, Two (2) Katcha building, five (5) pond and two (2) road crossing. Some trees and agricultural land crossing.
AP24-AP25	Three (3) katcha building, one (1) pond, one (1) road and one (1) canal (25m) crossing. Trees and agricultural land crossing.
AP25-AP26	Two (2) semi pucca building, One (1) katcha building, four (4) pond, three (3) road, one (1) canal (18m) crossing and one (1) mosque, Some trees and agricultural land crossing.
AP26- AP27	One (1) semi pucca building, two (2) katcha building, two (2) pond, one (1) road, Some trees and agricultural land crossing.
AP27-AP28	One (1) pucca building, One (1) semi pucca building, four (4) ponds, Some trees and agricultural land crossing.
AP28-AP29	two (2) katcha building, one (1) pond, one (1) road, Some trees and agricultural land crossing.
AP29-AP30	One (1) katcha building, Two (2) pond, one (1) road, agricultural land crossing.
AP30-End	One (1) katcha building, four (4) ponds, one (1) road, one (1) canal (18m), Some trees and agricultural land crossing.
Total= 30 nos	39.81 km

Option 2: Preliminary Survey Report of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line (Option 2)

Preliminary Survey Report of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line (Option 2)	
Angle Point	**Description**
Start point-AP1 (UG)	Existing Power Plant
AP1 (UG)- AP2 (UG)	Existing Power Plant
AP2 (UG)- AP3 (UG)	Existing Power Plant
AP3 (UG)-AP4	One (1) canal (58m) and agricultural land crossing.
AP4-AP5	Two (2) building, Two (2) Pond, One (1) road crossing, Some trees and Agricultural Land Crossing
AP5-AP6	Two (2) building Crossing, Two (2) pond, One (1) road and Some Agricultural Land Crossing
AP6-AP7	One (1) Road, One (1) Canal (80m), Trees and Agricultural Land Crossing
AP7-AP8	Two (2) building, Two (2) pond, Two (2) Canal (50,8) m Crossing, Some Trees and Agricultural Land Crossing
AP8-AP9	One (1) Canal (92m), Trees and Agricultural Land Crossing
AP9-AP10	Four (4) building, three (3) pond, One (1) road Crossing and Agricultural Land Crossing
AP10-AP11	Two (2) Building, six (6) pond, One (1) Ditch, Some Trees and Agricultural Land Crossing
AP11-AP12	One (1) road, Some Trees and Agricultural Land Crossing
AP12-AP13	Six (6) Building, two (2) road crossing, two (2) Canal (12,38) m Crossing, Some Trees and Agricultural Land Crossing
AP13-AP14	Eight (8) Building, Six (6) pond, Two (2) road and one (1) canal (11m) crossing, Some Trees and Agricultural Land Crossing
AP14-AP15	Five (5) building, three (3) pond, four (4) road and one (1) canal (6m) crossing, Some Trees and Agricultural Land Crossing
AP15-AP16	Four (4) Building, Five (5) pond, two (2) road and some Trees and Agricultural Land Crossing
AP16-AP17	Three (3) building, Seven (7) pond, Some Trees and Agricultural Land Crossing
AP17-AP18	Six (6) building, One (1) industry, seven (7) pond, one (1) canal(10m) and one (1) road crossing. Some trees and Agricultural Land Crossing

Preliminary Survey Report of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line (Option 2)	
Angle Point	**Description**
AP18-AP19	Six (6) building, two (2) pond, One (1) canal (8m), one (1) Road Crossing, Some Trees and Agricultural Land Crossing
AP19-AP20	Two (2) Building, Two (2) canal (7,8) m, Four (4) pond, Some Trees and Agricultural Land Crossing
AP20-AP21	Five (5) Building, nine (9) pond, one (1) Road Crossing Some Trees and Agricultural Land Crossing
AP21-AP22	Three (3) Building, five (5) pond, Three (3) Canal (7,9,6) m Crossing, Some Trees and Agricultural Land Crossing
AP22-AP23	Twelve (12) Building, one (1) industry, two (2) road, ten (10) pond, Two (2) Canal (7,6) m Crossing, Some Trees and Agricultural Land Crossing
AP23-AP24	Two (2) building, one (1) Road Crossing, Five (5) pond, Some Trees and Agricultural Land Crossing
AP24-AP25	Ten (10) building, Seven (7) pond, one (1) road and one (1) canal (14m) crossing. Some trees and agricultural land crossing.
AP25-AP26	Nine (9) building, three (3) pond, three (3) road and one (1) canal (12m) crossing. Some trees and agricultural land crossing.
AP26-AP27	Thirteen (13) building, five (5) pond, two (2) road and three (3) canal (16,15,12) m crossing. Some trees and agricultural land crossing.
AP27-End	Three (3) pond, one (1) road and one (1) canal (13m) crossing. Some trees and agricultural land crossing.
Total= 27 nos	41.93 km

Option 3: Preliminary Survey Report of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line (Option 3)

Preliminary Survey Report of Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission line (Option 3)	
Angle Point	**Description**
Start point-AP1 (UG)	Existing Power Plant
AP1 (UG)- AP2 (UG)	Existing Power Plant
AP2 (UG)- AP3 (UG)	Existing Power Plant
AP3 (UG)-AP4	Two (2) Building, One (1) Pond, One (1) Road Crossing, Some Trees and Agricultural Land Crossing

Angle Point	Description
AP4-AP5	Two (2) Pond, and Agricultural Land Crossing
AP5-AP6	One (1) building, One (1) pond, One (1) road crossing, Agricultural Land Crossing
AP6-AP7	One (1) Road crossing, One (1) pond, One (1) canal, Some Trees, and Agricultural Land Crossing
AP7-AP8	Two (2) building, five (5) pond, one (1) canal, One (1) Road, and Agricultural Land Crossing
AP8-AP9	Two (2) building, one (1) industry, Two (2) pond, Two (2) canal Some Trees and Agricultural Land Crossing
AP9-AP10	One (1) industry, One (1) big Canal and one small canal Crossing, one (1) road crossing and Agricultural Land Crossing
AP10-AP11	One (1) Canal Crossing, Some Trees and Agricultural Land Crossing
AP11-AP12	One (1) Building, One (1) Road Crossing, Five (5) pond, Some Trees and Agricultural Land Crossing
AP12-AP13	One (1) building, Two (2) Canal Crossing, Two (2) road crossing, four (4) pond and Agricultural Land Crossing
AP13-AP14	Eight (8) building, None (9) pond, Two (2) road crossing Some Trees and Agricultural Land Crossing
AP14-AP15	Two (2) Building, Two (2) Canal, One (1) Road, Four (4) pond, Some Trees and Agricultural Land Crossing
AP15-AP16	Two (2) Building, One (1) road, Five (5) pond, one (1) canal, Some Trees and Agricultural Land Crossing
AP16-AP17	Six (6) Building, Two (2) road, Four (4) pond, Some Trees and Agricultural Land Crossing
AP17-AP18	Eight (8) Building, Two (2) road, Ten (10) pond, Some Trees and Agricultural Land Crossing
AP18-AP19	Two (2) Building, Two (2) pond, One (1) Road Crossing, Some Trees and Agricultural Land Crossing
AP19-AP20	Three (3) building, one (1) industry, One (1) Road Crossing, Two (2) pond, and Agricultural Land Crossing
AP20-AP21	One (1) Building, Three (3) pond, Two (2) Road Crossing, Some Trees and Agricultural Land Crossing
AP21-AP22	Six (6) Building, Six (6) pond, one (1) canal crossing, One (1) Road Crossing, Some Trees and Agricultural Land Crossing

Angle Point	Description
AP22-AP23	Seven (7) Building, Six (6) pond, three (3) Canal, Three (3) Road Crossing Some Trees and Agricultural Land Crossing
AP23-AP24	Ten (10) Building, Twelve (12) pond, Two (2) road, One (1) Canal Crossing, Some Trees and Agricultural Land Crossing
AP24-AP25	Four (4) Building, One (1) road, Three (3) pond, One (1) Canal Crossing, Some Trees and Agricultural Land Crossing
AP25-AP26	Three (3) Building, Three (3) Road Crossing, Four (4) pond, Some Trees and Agricultural Land Crossing
AP26-AP27	Three (3) Building, Three (3) Road Crossing, Four (4) pond, Some Trees and Agricultural Land Crossing
AP27-AP28	Twelve (12) Building, Four (4) Road Crossing, Four (4) pond, One (1) Ditch, One (1) Canal Crossing, Some Trees and Agricultural Land Crossing
AP28-End	Two (2) Building, Four (4) Pond Some Trees and Agricultural Land Crossing
Total= 28 nos	42.52 Km

Annex 3. Air Quality Measurement Reports

ENRAC

Environment and Resource Analysis Center Ltd. (ENRAC)

Block-G, Road-13, House-19, Flat-B1, Niketon, Gulshan-1, Dhaka-1213
Cell: +880248810445, E-mail: info@enrac.com.bd

ENRAC REF : ENRAC 0101/21

AMBIENT AIR QUALITY TESTING REPORT

COMPANY NAME :Power Grid Company of Bangladesh (PGCB)
PROJECT NAME :Southwest Power Transmission Grid Expansion Project for Rural Electrification
CLIENT REF. : N/A
CLIENT ADDRESS :Aveneu-3, Zaharul Islam city, Aftab Nagar, Badda, Dhaka-1212, Bangladesh
SAMPLE COUNT :Time- 01 Hour (08:30 AM-09:30 AM)
SAMPLING DATE :16/07/2021
ANALYSIS DATE :31/07/2021
SAMPLING ID : AAQ_01_South side of the Proposed Substation (Charfasson)
GPS COORDINATES : 22°08'27.62"N 90°44'13.02"E

Ambient Air Quality (AAQ) Test Results

Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters	GoB Air Quality Standards*
			Average Value	
• Environmental Perimeter Air Station (EPAS) was set on the side of Proposed Substation beside a local road at Ewazpur union in Charfasson upazila under Bhola District. • All types of local vehicles, such as., Bus, truck, private car, auto and other local transport were continuously passing during sampling nearby road. • Dust particles were flying when vehicles were running. • There were low agricultural land around the sampling site • Some sensitive reseptors were beside the sampling point • A power troly was cultivating near the point during sampling.	Carbon Monoxide (CO)	µg/m3	0.31	10 (8 hour) 40 (1 hour)
	Nitric Oxide (NO)	µg/m3	3.98	100 (Annual)
	Nitrogen Dioxide (NO2)	µg/m3	3.80	100 (Annual)
	Sulpher Dioxide (SO2)	µg/m3	96.42	365 (24 hour)
	Particulate Matter (PM_{10})	$\mu g/m^3$	68.09	150 (24 hour) 50 (Annual)
	Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	26.21	65 (24 hour) 15 (Annual)
	Temperature	(°C)	25.64	NSE**
	Relative Humidity	(%)	51.62	NSE**
	Wind Speed	km/h	1.04	NSE**
	Wind Direction	(°)	151.0	NSE**

* The amended Schedule-2, 2005, of (Air Quality Standard) Environmental Conservation Rules, 1997
** NSE- No standards established yet

Prepared by
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Approved by
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ENRAC REF : ENRAC 0102/21

AMBIENT AIR QUALITY TESTING REPORT

COMPANY NAME	:Power Grid Company of Bangladesh (PGCB)
PROJECT NAME	:Southwest Power Transmission Grid Expansion Project for Rural Electrification
CLIENT REF.	:N/A
CLIENT ADDRESS	:Aveneu-3, Zaharul Islam city, Aftab Nagar, Badda, Dhaka-1212, Bangladesh
SAMPLE COUNT	:Time- 01 Hour (09:40 AM-10:40 AM)
SAMPLING DATE	:16/07/2021
ANALYSIS DATE	: 31/07/2021
SAMPLING ID	: AAQ_02_East side of the Proposed Substation
GPS COORDINATES	: 22°08'29.2"N 90°44'14.7"E

Ambient Air Quality (AAQ) Test Results

Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters	GoB Air Quality Standards*
			Average Value	
• Environmental Perimeter Air Station (EPAS) was set on the east side of the proposed Substation beside the Lalmohan-Charfasso road at Ewazpur union in Charfasson upazila under Bhola District. • On the road (Lalmohan-Charfasson) all types of vehicles, such as., Bus, truck, private car, easy bike, auto van and other local transport were continuously passing during sampling. • Emmission of various gases from local vehicles. • Dust particles were flying when vehicles were running.	Carbon Monoxide (CO)	µg/m3	0.27	10 (8 hour) 40 (1 hour)
	Nitric Oxide (NO)	µg/m3	5.07	100 (Annual)
	Nitrogen Dioxide (NO2)	µg/m3	4.71	100 (Annual)
	Sulpher Dioxide (SO2)	µg/m3	95.43	365 (24 hour)
	Particulate Matter (PM_{10})	$\mu g/m^3$	66.54	150 (24 hour) 50 (Annual)
	Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	35.93	65 (24 hour) 15 (Annual)
	Temperature	(°C)	25.74	NSE**
	Relative Humidity	(%)	43.2	NSE**
	Wind Speed	km/h	4.24	NSE**
	Wind Direction	(°)	224.6	NSE**

* The amended Schedule-2, 2005, of (Air Quality Standard) Environmental Conservation Rules, 1997
** NSE- No standards established yet

Prepared by
Md.Giash Uddin
Environmental Officer

Approved by
Mehedi Hasan
Environmental Specialist

ENRAC

Environment and Resource Analysis Center Ltd. (ENRAC)

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ENRAC REF : ENRAC 0103/21

AMBIENT AIR QUALITY TESTING REPORT

COMPANY NAME	:Power Grid Company of Bangladesh (PGCB)
PROJECT NAME	:Southwest Power Transmission Grid Expansion Project for Rural Electrification
CLIENT REF.	: N/A
CLIENT ADDRESS	:Aveneu-3, Zaharul Islam city, Aftab Nagar, Badda, Dhaka-1212, Bangladesh
SAMPLE COUNT	:Time- 01 Hour (02:30 PM-03:30 PM)
SAMPLING DATE	:16/07/2021
ANALYSIS DATE	: 31/07/2021
SAMPLING ID	: AAQ_03_Langalkhali, Lalmohan
GPS COORDINATES	: 22°19'47.3"N 90°43'46.8"E

Ambient Air Quality (AAQ) Test Results

Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters	GoB Air Quality Standards*
			Average Value	
• Environmental Perimeter Air Station (EPAS) was set beside the Borhanuddin-Charfasso road at Lalmohan upazila in Bhola District. • There was a local market near the point some shops were there. • Various types of local vehicles were continuously passing during sampling on the Borhanuddin-Charfasson road. • Dust particles were flying when vehicles were running. • Some worker were working near the sampling point during sampling.	Carbon Monoxide (CO)	µg/m3	0.29	10 (8 hour) 40 (1 hour)
	Nitric Oxide (NO)	µg/m3	5.22	100 (Annual)
	Nitrogen Dioxide (NO2)	µg/m3	4.96	100 (Annual)
	Sulpher Dioxide (SO2)	µg/m^3	54.24	365 (24 hour)
	Particulate Matter (PM_{10})	µg/m^3	93.47	150 (24 hour) 50 (Annual)
	Particulate Matter ($PM_{2.5}$)	µg/m^3	22.75	65 (24 hour) 15 (Annual)
	Temperature	(°C)	26.71	NSE**
	Relative Humidity	(%)	50.6	NSE**
	Wind Speed	km/h	2.8	NSE**
	Wind Direction	(°)	203.8	NSE**

* The amended Schedule-2, 2005, of (Air Quality Standard) Environmental Conservation Rules, 1997
** NSE- No standards established yet

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ENRAC REF : ENRAC 0104/21

AMBIENT AIR QUALITY TESTING REPORT

COMPANY NAME :Power Grid Company of Bangladesh (PGCB)
PROJECT NAME :Southwest Power Transmission Grid Expansion Project for Rural Electrification
CLIENT REF. : N/A
CLIENT ADDRESS :Aveneu-3, Zaharul Islam city, Aftab Nagar, Badda, Dhaka-1212, Bangladesh
SAMPLE COUNT : Time- 01 Hour (06:30 PM-07:30 PM)
SAMPLING DATE :16/07/2021
ANALYSIS DATE :31/07/2021
SAMPLING ID : AAQ_04_Beside Bhola Combined Cycle Power Plant (Borhanuddin)
GPS COORDINATES : 22°28'40.1"N 90°42'27.2"E

Ambient Air Quality (AAQ) Test Results

Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters	GoB Air Quality Standards*
			Average Value	
• Environmental Perimeter Air Station (EPAS) was set on the back side of the Bhola combined cycle power plant, bank of a canal named after Kachiar khal in Sanchra union in Borhanuddin upazila under Bhola District. • There was a local road beside the sampling point. • Some local vehicle such as private car, easy bike, motor cycle etc were passing on the road during sampling. • Some local people were working near the sampling location during sampling. • Emission from combined cycle power plant will be occured. • There were some clustered settlement About 85 m far from the sampling location.	Carbon Monoxide (CO)	$\mu g/m^3$	0.33	10 (8 hour) 40 (1 hour)
	Nitric Oxide (NO)	$\mu g/m^3$	7.52	100 (Annual)
	Nitrogen Dioxide (NO2)	$\mu g/m^3$	5.18	100 (Annual)
	Sulpher Dioxide (SO2)	$\mu g/m^3$	129.22	365 (24 hours)
	Particulate Matter (PM_{10})	$\mu g/m^3$	74.65	150 (24 hour) 50 (Annual)
	Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	30.07	65 (24 hour) 15 (Annual)
	Temperature	(°C)	27.5	NSE**
	Humidity	(%)	59.4	NSE**
	Wind Speed	km/h	3.80	NSE**
	Wind Direction	(°)	210.3	NSE**

* The amended Schedule-2, 2005, of (Air Quality Standard) Environmental Conservation Rules, 1997
** NSE- No standards established yet

Prepared by
Md.Giash Uddin
Environmental Officer

Approved by
Mehedi Hasan
Environmental Specialist

Annex 4. Noise Level Measurement Reports

ENRAC

ENRAC REF: ENRAC 0105/21

NOISE LEVEL MEASUREMENT REPORT

COMPANY NAME	: Power Grid Company of Bangladesh (PGCB)
PROJECT NAME	: Southwest Power Transmission Grid Expansion Project for Rural Electrification
CLIENT ADDRESS	: Aveneu-3, Zaharul Islam city, Aftab Nagar, Badda, Dhaka-1212, Bangladesh
SAMPLE COUNT	: Time: 01 hour (08:30 AM - 09:30 AM)
SAMPLING DATE	: 16/07/2021
DATE OF ANALYSIS	: 31/07/2021
SAMPLING ID	: NM_01_South side of the Proposed Substation (Charfasson)
GPS COORDINATES	: 22°08'27.62"N 90°44'13.02"E

Sampling Site Description
The Noise Level Measurement NM_01 had been set on the side of Proposed Substation beside a local road at Ewazpur union in Charfasson upazila under Bhola District. All types of local vehicles, such as., Bus, truck, private car, auto and other local transport were continuously passing during sampling nearby road. A power trolley was cultivating near the point during sampling. Sampling location. Birds were chirping nearby trees. Some local people were talking near the sampling point during sampling.

Noise Measurement (NM) Results

Sampling ID	Time	Unit	Noise Measurement Data		
			Minimum	Maximum	LAeq
NM_01_ Day	01 hour	dBA	31.5	64.7	48.8
GoB Noise Standard*	Zone		Day	Night	
	Silent Zone		50	40	
	Residential Zone		55	45	
	Mixed Area (Residential together with areas used for commercial and industrial purposes)		60	50	
	Commercial Area		70	60	
	Industrial Area		75	70	

* The amended Schedule-4, 2006, of (Noise Level Measurement Standard) Environmental Conservation Rules, 1997

Analysed and Prepared by

Md.Giash Uddin
Environmental Officer

Approved by

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ENRAC

ENRAC REF: ENRAC 0106/21

NOISE LEVEL MEASUREMENT REPORT

COMPANY NAME	: Power Grid Company of Bangladesh (PGCB)
PROJECT NAME	: Southwest Power Transmission Grid Expansion Project for Rural Electrification
CLIENT ADDRESS	: Aveneu-3, Zaharul Islam city, Aftab Nagar, Badda, Dhaka-1212, Bangladesh
SAMPLE COUNT	: Time: 01 hour (03:30 PM - 04:30 PM)
SAMPLING DATE	: 16/07/2021
DATE OF ANALYSIS	: 31/07/2021
SAMPLING ID	: NM_02_East side of the proposed Substation (Charfsson)
GPS COORDINATES	: 22°08'29.2"N 90°44'14.7"E

Sampling Site Description
The Noise Level Measurement NM_01 had been set on the east side of the proposed Substation beside the Lalmohan-Charfasso road at Ewazpur union in Charfasson upazila under Bhola District. On the road (Lalmohan-Charfasson) all types of vehicles, such as., Bus, truck, private car, easy bike, auto van and other local transport were continuously passing during sampling. There were many trees around the sampling location. Birds were chirping nearby tree during sampling. Some local people were working near and talking with each other the during sampling.

Noise Measurement (NM) Results

Sampling ID	Time	Unit	Noise Measurement Data		
			Minimum	Maximum	LAeq
NM_02_ Day	01 hour	dBA	36.9	69.7	55.5
GoB Noise Standard*	Zone	Day		Night	
	Silent Zone	50		40	
	Residential Zone	55		45	
	Mixed Area (Residential together with areas used for commercial and industrial purposes)	60		50	
	Commercial Area	70		60	
	Industrial Area	75		70	

* The amended Schedule-4, 2006, of (Noise Level Measurement Standard) Environmental Conservation Rules, 1997

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ENRAC

ENRAC REF: ENRAC 0107/21

NOISE LEVEL MEASUREMENT REPORT

COMPANY NAME	**: Power Grid Company of Bangladesh (PGCB)**
PROJECT NAME	: Southwest Power Transmission Grid Expansion Project for Rural Electrification
CLIENT ADDRESS	: Aveneu-3, Zaharul Islam city, Aftab Nagar, Badda, Dhaka-1212, Bangladesh
SAMPLE COUNT	: Time: 01 hour (03:30 PM - 04:30 PM)
SAMPLING DATE	: 16/07/2021
DATE OF ANALYSIS	: 31/07/2021
SAMPLING ID	: NM_03_ Langalkhali, Lalmohan
GPS COORDINATES	: 22°19'47.3"N 90°43'46.8"E

Sampling Site Description
The Noise Level Measurement NM_01 had been set on beside the Borhanuddin-Charfasso road at Lalmohan upazila in Bhola District. There was a local market near the point some shops were there. Various types of local vehicles were continuously passing during sampling on the Borhanuddin-Charfasson road. Some worker was working and talking near the sampling point during sampling. Birds were chirping nearby trees.

Noise Measurement (NM) Results

Sampling ID	Time	Unit	Noise Measurement Data		
			Minimum	Maximum	LAeq
NM_03_ Day	Every 20 min in 12 hours	dBA	34.7	66.9	53.6
GoB Noise Standard*	Zone		Day		Night
	Silent Zone		50		40
	Residential Zone		55		45
	Mixed Area (Residential together with areas used for commercial and industrial purposes)		60		50
	Commercial Area		70		60
	Industrial Area		75		70

* The amended Schedule-4, 2006, of (Noise Level Measurement Standard) Environmental Conservation Rules, 1997

Analysed and Prepared by

Md.Giash Uddin
Environmental Officer

Environment and Resource Analysis Center Ltd. ENRAC

Approved by

Mehedi Hasan
Environmental Specialist

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ENRAC REF: ENRAC 0108/21

NOISE LEVEL MEASUREMENT REPORT

COMPANY NAME	**: Power Grid Company of Bangladesh (PGCB)**
PROJECT NAME	: Southwest Power Transmission Grid Expansion Project for Rural Electrification
CLIENT ADDRESS	: Aveneu-3, Zaharul Islam city, Aftab Nagar, Badda, Dhaka-1212, Bangladesh
SAMPLE COUNT	: Time: 01 hour (06:30 PM - 07:30 PM)
SAMPLING DATE	: 16/07/2021
DATE OF ANALYSIS	: 31/07/2021
SAMPLING ID	: NM_04_ Beside Combined cycle power Plant (Borhanuddin).
GPS COORDINATES	: 22°28'40.1"N 90°42'27.2"E

Sampling Site Description
The Noise Level Measurement NM_01 had been set on the back side of the Bhola combined cycle power plant, bank of a canal named after Kachiar khal in Sanchra union in Borhanuddin upazila under Bhola District. Some local vehicle such as private car, easy bike, motor cycle etc were passing on the road beside the point during sampling. Some local people were talking near the sampling location during sampling. Many birds were chirping nearby trees during sampling.

Noise Measurement (NM) Results

Sampling ID	Time	Unit	Noise Measurement Data		
			Minimum	Maximum	LAeq
NM_04_ Day	01 hour	dBA	36.1	70.8	63.5
GoB Noise Standard*	Zone		Day	Night	
	Silent Zone		50	40	
	Residential Zone		55	45	
	Mixed Area (Residential together with areas used for commercial and industrial purposes)		60	50	
	Commercial Area		70	60	
	Industrial Area		75	70	

* The amended Schedule-4, 2006, of (Noise Level Measurement Standard) Environmental Conservation Rules, 1997

Analysed and Prepared by

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Annex 5. Surface Water Quality Test Reports (SW_1 to SW_3)

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 079/ CC, DPHE, CL, Dhaka — Date: 29-08-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021080166	Sample Receiving date: 18-07-2021
Ref. Memo No: ENRAC/2021/Nill & Dated: 18-07-2021	Sample Source: Suface Water
Sent by:Md. Giash Uddin ,Environmental Officer , ENRAC, Gulshan-1, Dhaka-1213.	Dist:Bhola, Upa:
Care Taker: ENRAC (Sample ID : SW_01)	Union:, Vill.:Surendra Khal
Sample Collection date:	Date of Testing: 18/07/2021-29/08/2021

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Biochemical Oxygen Demand (BOD)	0.2	1	mg/L	5 days Incubation	0.1
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Dissolved Oxygen (DO)	6.0	6.05	mg/L	Multimeter	-
4	pH	6.5-8.5	7.6	-	pH Meter	-
5	Temperature	20-30	24	°C	Thermometer	-
6	Total Dissolved Solid (TDS)	1000	230	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-
8	Turbidity	10	146	NTU	Turbidity Meter	-

Comments: Sample was collected & supplied by client.
N.B: CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	29.08.2021	1.) Name: Mita Sarker Designation: Senior Chemist	29/08/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	29.08.21	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	29/08/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 079/ CC, DPHE, CL, Dhaka

Date: 29-08-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021080167	Sample Receiving date: 18-07-2021
Ref. Memo No: ENRAC/2021/Nill & Dated: 18-07-2021	Sample Source: Suface Water
Sent by:Md. Giash Uddin ,Environmental Officer , ENRAC, Gulshan-1, Dhaka-1213.	Dist:Bhola, Upa:
Care Taker: ENRAC (Sample ID : SW_02)	Union:, Vill.:Branch of Tetulia
Sample Collection date:	Date of Testing: 18/07/2021-29/08/2021

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Biochemical Oxygen Demand (BOD)	0.2	1	mg/L	5 days Incubation	0.1
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Dissolved Oxygen (DO)	6.0	5.94	mg/L	Multimeter	-
4	pH	6.5-8.5	8.0	-	pH Meter	-
5	Temperature	20-30	25.7	°C	Thermometer	-
6	Total Dissolved Solid (TDS)	1000	96	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	15	mg/L	Gravimetric Method	-
8	Turbidity	10	156	NTU	Turbidity Meter	-

Comments: Sample was collected & supplied by client.
N.B: CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	29.08.2021	1.) Name: Mita Sarker Designation: Senior Chemist	29/08/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	29.08.21	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	29/08/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 079/ CC, DPHE, CL, Dhaka

Date: 29-08-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021080168	Sample Receiving date: 18-07-2021
Ref. Memo No: ENRAC/2021/Nill & Dated: 18-07-2021	Sample Source: Suface Water
Sent by:Md. Giash Uddin ,Environmental Officer , ENRAC, Gulshan-1, Dhaka-1213.	Dist:Bhola, Upa:
Care Taker: ENRAC (Sample ID : SW_03)	Union:, Vill.:Kachiar Khal
Sample Collection date:	Date of Testing: 18/07/2021-29/08/2021

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Biochemical Oxygen Demand (BOD)	0.2	1	mg/L	5 days Incubation	0.1
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Dissolved Oxygen (DO)	6.0	6.25	mg/L	Multimeter	-
4	pH	6.5-8.5	7.9	-	pH Meter	-
5	Temperature	20-30	25.3	°C	Thermometer	-
6	Total Dissolved Solid (TDS)	1000	110	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	12	mg/L	Gravimetric Method	-
8	Turbidity	10	215	NTU	Turbidity Meter	-

Comments: Sample was collected & supplied by client.
N.B: CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	29.08.2021	1.) Name: Mita Sarker Designation: Senior Chemist	29/08/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	29.08.21	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	29/08/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Annex 6. Ground Water Quality Test Reports (GW_1 to GW_3)

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 079/ CC, DPHE, CL, Dhaka

Date: 29-08-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021080163	Sample Receiving date: 18-07-2021
Ref. Memo No: ENRAC/2021/Nill & Dated: 18-07-2021	Sample Source: Ground Water
Sent by:Md. Giash Uddin ,Environmental Officer , ENRAC, Gulshan-1, Dhaka-1213.	Dist:Bhola, Upa:
Care Taker: ENRAC (Sample ID : GW_01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/07/2021-29/08/2021

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Iron (Fe)	0.3-1	0.11	mg/L	AAS	0.05
3	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
4	pH	6.5-8.5	7.7	-	pH Meter	-
5	Phosphate	6.0	0.25	mg/L	UVS	0.10
6	Temperature	20-30	24.6	°C	Thermometer	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	29.08.2021	1.) Name: Mita Sarker Designation: Senior Chemist	29/08/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	29.08.21	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	29/08/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 079/ CC, DPHE, CL, Dhaka

Date: 29-08-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021080164	Sample Receiving date: 18-07-2021
Ref. Memo No: ENRAC/2021/Nill & Dated: 18-07-2021	Sample Source: Ground Water
Sent by:Md. Giash Uddin ,Environmental Officer , ENRAC, Gulshan-1, Dhaka-1213.	Dist:Bhola, Upa:
Care Taker: ENRAC (Sample ID : GW_02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/07/2021-29/08/2021

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Iron (Fe)	0.3-1	0.14	mg/L	AAS	0.05
3	Manganese (Mn)	0.1	0.04	mg/L	AAS	0.03
4	pH	6.5-8.5	7.8	-	pH Meter	-
5	Phosphate	6.0	0.30	mg/L	UVS	0.10
6	Temperature	20-30	24.8	°C	Thermometer	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	29.08.2021	1.) Name: Mita Sarker Designation: Senior Chemist	29/08/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	29.08.21	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	29/08/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 079/ CC, DPHE, CL, Dhaka

Date: 29-08-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021080165	Sample Receiving date: 18-07-2021
Ref. Memo No: ENRAC/2021/Nill & Dated: 18-07-2021	Sample Source: Ground Water
Sent by:Md. Giash Uddin ,Environmental Officer , ENRAC, Gulshan-1, Dhaka-1213.	Dist:Bhola, Upa:
Care Taker: ENRAC (Sample ID : GW_03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/07/2021-29/08/2021

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Iron (Fe)	0.3-1	0.12	mg/L	AAS	0.05
3	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
4	pH	6.5-8.5	7.6	-	pH Meter	-
5	Phosphate	6.0	0.32	mg/L	UVS	0.10
6	Temperature	20-30	24.5	°C	Thermometer	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	29.08.2021	1.) Name: Mita Sarker Designation: Senior Chemist	29/08/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	29.08.21	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	29/08/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Annex 7. Sampling Pictures at Different Locations

AAQ-1: Air quality monitoring beside proposed substation at Ewajpur Union, Char-fasson, Bhola.

AAQ-2: Air quality monitoring beside proposed substation at Ewajpur Union, Char-fasson, Bhola.

AAQ-3: Air quality monitoring at Lalmohon union, Lalmohon, Bhola.

AAQ-4: Air quality monitoring at Sachra union, Borhanuddin, Bhola.

NM-1: Noise level monitoring beside proposed substation at Ewajpur Union, Char-fasson, Bhola.

NM-2: Noise level monitoring beside proposed substation at Ewajpur Union, Char-fasson, Bhola.

NM-3: Noise level monitoring at Lalmohon union, Lalmohon, Bhola.

NM-4: Noise level monitoring at Sachra union, Borhanuddin, Bhola.

SW-1: Surface water collection from Surendra khal, Ewajpur union, Char-fasson, Bhola

SW-2: Surface water collection from branch of tetulia river, Lalmohon union, Lalmohon, Bhola

SW-3: Surface water collection from Kachiar khal, Sachra union, Borhanuddin, Bhola

GW-1: Ground water collection from Ewazpur union, Char-fasson, Bhola

GW-2: Ground water collection from Lalmohon union, Lalmohon, Bhola

GW-3: Ground water collection from Sachra union, Borhanuddin, Bhola

Annex 8. Pictures from Public Consultation at Different Locations

Consultation with UP Chairman at Sachra Union, Borhanuddin, Bhola.

Consultation with UP Chairman at Deula Union, Borhanuddin, Bhola

Consultation with UP Secretory at Badarpur union, Lalmohan, Bhola

Consultation with UP Secretory at kalma union, Lalmohan, Bhola

Consultation with UP Secretory at Ewajpur union, Char-fasson, Bhola

Consultation with UP Chairman at Aminabad union, Char-fasson, Bhola

Public consultation with local people at Badarganj union, Lalmohan

Public consultation with local people at kalma union, Lalmohan

Public consultation with local people at Lalmohan union, Lalmohan

Public consultation with local people at Ewazpur union, Char-fasson

Public consultation with local people at Ewazpur union, Char-fasson

Public consultation with local people at Aminabad union, Char-fasson

Public consultation with local people at Deula union, Burhanuddin

Public consultation with local people at Deula union, Burhanuddin

Public consultation with local people at Farajgonj union, Lalmohan

Public consultation with local people at Chr-fasson pouroshava,Char-fasson

Public consultation with local people at Kalma union, Burhanuddin

Public consultation with local people at Aminabad union, Char-fasson, Bhola

Public consultation with local people at Deula union, Burhanuddin

Public consultation with local people at Ewazpur union, Char-fasson

Annex 9. Public Consultation Attendance List

Attendance Sheet

পরিবেশগত মতবিনিময় সভা

প্রকল্পের নামঃ Southwest Power Transmission Grid Expansion Project for Rural Electrification

উপস্থিতি তালিকা

সভার স্থানঃ ______ তারিখঃ ২৫/০৭/২০২২ ইং

ইউনিয়নঃ ______ উপজেলাঃ বোরহানউদ্দিন জেলাঃ ভোলা

ক্রমিক নং	অংশগ্রহণকারীর নাম	পেশা	মোবাইল নং	স্বাক্ষর
১	Md. Mohibulla Mridha	UP Chairman	01712260292	[signature]
২	Md. Moin uddin	UP Secratory	01736275560	Moin
৩	সেলিম সিকদার	ইউপি. মেম্বার	01921621044	সেলিম
৪	জিনহতন চৌধুরী	"	01712690961	জিনহতন
৫	মোঃ কামাল মীর	"	01913715367	কামাল
৬	শেখ ওয়ালিউল্লাহ	চাকুরী	01908122581	ওয়ালিউল্লাহ
৭	ফজলুল হক	কৃষি	01918484115	ফজলু
৮	মোঃ শাহীন	ছাত্র	01945-329845	শাহীন
৯	আঃ রাজ্জাক	ব্যবসা	01748847767	রাজ্জাক
১০	সাহিদুল	কৃষি	01937542435	সাহিদুল
১১	হালেমিন	কৃষি		হালেমিন
১২	আবদুল আলী	ব্যবসা	01924298819	A. Ali
১৩	A.K.M Ashaduzzaman	UP chairman	01916722091	[signature]
১৪	নাজু হাওলাদার	ইউপি. মেম্বার	01920058657	Noshun
১৫	মোঃ রাকিব	ব্যবসা	01906318349	রাকিব
১৬	জাহাঙ্গীর	কৃষি	01922933079	জাহাঙ্গীর
১৭	সালাউদ্দিন	"	01922972812	সালাউদ্দিন
১৮	আকবার		01872800581	আকবার
১৯	মোঃ রুবেল	চাকুরী	01942638585	Rubel
২০				

পরিবেশগত মতবিনিময় সভা

প্রকল্পের নামঃ Southwest Power Transmission Grid Expansion Project for Rural Electrification

উপস্থিতি তালিকা

তারিখঃ ১৬/০৭/২০২২ ইং

সভার স্থানঃ

ইউনিয়নঃ উপজেলাঃ লালমোহন জেলাঃ ভোলা

ক্রমিক নং	অংশগ্রহণকারীর নাম	পেশা	মোবাইল নং	স্বাক্ষর
১	মোঃ ফরিদুল হক	চেয়ারম্যান	01714-211877	[illegible]
২	মোঃ [illegible]	ইউপি- সচিব	01718-376905	[illegible]
৩	মোঃ রতন	কৃষি	01759185398	রতন
৪	[illegible]	”	0754837475	[illegible]
৫	আলামিন	কৃষি	01772214398	আলামিন
৬	[illegible]	ব্যবসা	01728782538	[illegible]
৭	মোঃ [illegible]	”	0176212284[illegible]	[illegible]
৮	মোঃ তারেক	ছাত্র	01317008280	তারেক
৯	সাখাওয়াত	কৃষি	01735714536	সাখাওয়াত
১০	MD. AKHTAR HOSSEN - CHAIRMAN		01722405821	Akhtar
১১	[illegible]	ইউপি. সচিব	01731179453	[illegible]
১২	মাহমুদ	[illegible]	01718235773	মাহমুদ
১৩	সাইফুল ইসলাম	[illegible]	01716894283	সাইফুল
১৪	নুরু [illegible]	কৃষি	01846221080	নুরু
১৫	Noshu Matbar	Student	01988-210372	Noshu
১৬	মোঃ সবুজ	ব্যবসা	01[illegible]6221	সবুজ
১৭	মোস্তফা [illegible]	কৃষি	01624-613204	[illegible]
১৮	ইসমাইল	কৃষি	0[illegible]62-189329	ইসমাইল
১৯				
২০				

পরিবেশগত মতবিনিময় সভা

প্রকল্পের নামঃ Southwest Power Transmission Grid Expansion Project for Rural Electrification

উপস্থিতি তালিকা

সভার স্থানঃ ____________ তারিখঃ ২৭।০৭।২০২৩ ইং

ইউনিয়নঃ ____________ উপজেলাঃ চর ফ্যাশন জেলাঃ ভোলা

ক্রমিক নং	অংশগ্রহণকারীর নাম	পেশা	মোবাইল নং	স্বাক্ষর
১	Md. Helal Uddin	Job	01711002098	Helal
২	Md. TUTUL	ব্যবসা	01910741256	TUTUL
৩	মোঃ আলামিন	"	01743-604764	আলামিন
৪	নুর নবী	কৃষি	01746034933	নুর নবী
৫	সাহাবুদ্দিন	ব্যবসা	01768-210623	সাহাবুদ্দিন
৬	Md. Jamal Uddin	Teacher	01767404180	Jamal
৭	মোঃ নুরুল্লাহ	শ্রমিক	01712 384428	নুরুল্লাহ
৮	সালাহ উদ্দিন	চাকুরী	01715722854	সালাহ উদ্দিন
৯	নাসির আলি	কৃষি	01314560913	নাসির
১০	মোঃ মাহবুব আলম	[illegible]	01753-09633	মাহবুব
১১	মাঃ হারুন ইসলাম	সচিব	0171785144	[illegible]
১২	সিরাজ	কৃষি	01768371567	সিরাজ
১৩	রাসেল	কৃষি	01785930395	Rassel
১৪	মোঃ সবুজ	ব্যবসা	01716394224	সবুজ
১৫	সাহিন	কৃষি	01703934906	সাহিন
১৬	নুর ইসলাম	চাকুরী	01770228098	নুর ইসলাম
১৭	মোঃ হারুন	ছাত্র	01724807252	হারুন
১৮	মোঃ আলমগীর	ব্যবসা	01733532865	আলমগীর
১৯	সাহাবুদ্দিন	মজুর	01716225989	সাহাবুদ্দিন
২০				

Annex 10. Inventory of Plants within Study Area

Source: Bio ecological Zones of Bangladesh, IUCN,
Field Survey

	Scientific Name	Bengali Name	Family
Trees			
1	*Acacia auriculiformis*	Akashi	Mimosaceae
2	*Acacia mangium*	Akashi	Mimosaceae
3	*Acacia nilotica*	Babul, Baul	Mimosaceae
4	*Albizia lebbeck*	Sirish	Mimosaceae
5	*Alstonia scholaris*	Chatim	Apocynaceae
6	*Areca catechu*	Supari	Arecaceae
7	*Artocarpus heterophyllus*	Kathal	Moraceae
8	*Avicennia alba*	Dulia baen	Verbenaceae
9	*Avicennia officinalis*	Baro baen	Verbenaceae
10	*Avicennia officinalis*	Baro baen	Verbenaceae
11	*Bambusa vulgaris*	Bangla bans	Poaceae
12	*Bombax ceiba*	Simul tula	Bombacaceae
13	*Borassus flabellifer*	Tal	Arecaceae
14	*Calophyllum inophyllum*	Hundal	Clusiaceae
15	*Casuarina equisetifolia*	Jaw, Popan	Casuarinaceae
16	*Ceriops decandra*	Goran	Lythraceae
17	*Citrus aurantifolia*	Kagazi lebu	Rutaceae
18	*Citrus limon*	Lebu	Rutaceae
19	*Cocos nucifera*	Narkel	Arecaceae
20	*Dalbergia sissoo*	Sishoo	Fabaceae
21	*Delonix regia*	Krisnachura	Caesalpiniaceae
22	*Dillenia indica*	Chalta	Dilleniaceae
23	*Eucalyptus camaldulensis*	Eucalyptus	Myrtaceae
24	*Excoecaria agallocha*	Geowa	Euphorbiaceae

	Scientific Name	Bengali Name	Family
25	*Ficus benghalensis*	Bat	Moraceae
26	*Ficus religiosa*	Asath, Jil	Moraceae
27	*Gmelina arborea*	Gamar	Verbenaceae
28	*Lepisanthes rubiginosa*	Aul	Sapindaceae
29	*Leucaena leucocephala*	Ipil, Telikorai	Mimosaceae
30	*Magnolia champaca*	Chapa	Magnoliaceae
31	*Mangifera indica*	Aam	Anacardiaceae
32	*Melia azederach*	Ghora nim	Meliaceae
33	*Mimusops elengi*	Bakul	Sapotaceae
34	*Phoenix sylvestris*	Khejur	Arecaceae
35	*Pithecellobium dulce*	Natai,	Mimosaceae
36	*Pongamia pinnata*	Kerenja	Fabaceae
37	*Saraca asoca*	Asok	Caesalpiniaceae
38	*Senna siamea*	Minjiri	Caesalpiniaceae
39	*Spondias pinnata*	Amra	Anacardiaceae
40	*Sterculia foetida*	Keron	Sterculiaceae
41	*Swietenia mahagoni*	Mehagoni	Meliaceae
42	*Syzygium cuminii*	Butigajam	Myrtaceae
43	*Tamarindus indica*	Tetul	Caesalpiniaceae
44	*Terminalia arjuna*	Arjun	Combretaceae
45	*Terminalia catappa*	Katbadam	Combretaceae
46	*Thespesia populnea*	Correa Balai	Malvaceae
47	*Ziziphus mauritiana*	Barai	Rhamnaceae
Shrubs			
1	Bougainvillea spectabilis	Baganbilas	Nyctaginaceae
2	Calotropis gigantea	Akand	Asclepiadaceae
3	Calotropis procera	Akand	Asclepiadaceae
4	Carica papaya	Cokia, Papa	Caricaceae

	Scientific Name	Bengali Name	Family
5	Carissa carandas	Kormocha	Apocynaceae
6	Clerodendrum inerme	Bandulpata	Verbenaceae
7	Gardenia jesminoides	Gondoraj	Rubiaceae
8	Hibiscus rosa-sinensis	Latkonjaba	Malvaceae
9	Lantana camara	Khutus kanta	Verbenaceae
10	Lawsonia inermis	Methi	Lythraceae
11	Pandanus foetidus	Angjadakanta	Pandanaceae
12	Ricinus communis	Veron, Verenda	Euphorbiaceae
13	Rosa centifolia	Golap	Rosaceae
14	Suaeda maritima	Sagorsuda	Chenopodiaceae
15	Vitex negundo	Nishinda	Verbenaceae
16	Woodfordia fruticosa	Rangkat	Lythraceae
Herbs and Climbers			
1	Ipomoea pes-caprae	Chhagol kuri	Convolvulaceae
2	Alternanthera sessilis	Sachishak	Amaranthaceae
3	Alternanthera philoxeroides	Helencha,	Amaranthaceae
4	Amaranthus spinosus	Kantamairra	Amaranthaceae
5	Bacopa monnieri	Brammishak	Scrophulariaceae
6	Boerhavia repens	Punarnava	Nyctaginaceae
7	Celosia argentea	Thenthenna	Amaranthaceae
8	Centella asiatica	Thankuni	Apiaceae
9	Colocasia esculenta	Kachu	Araceae
10	Cucurbita maxima	Mistikumra	Cucurbitaceae
11	Cynodon dactylon	Dublakher	Poaceae
12	Cyperus compressus	Chancha	Cyperaceae
13	Cyperus rotandus	Nagarmutha	Cyperaceae
14	Eclipta prostrata	Kalakeccha,	Asteraceae
15	Enhydra fluctuans	Hinchashak	Asteraceae

	Scientific Name	Bengali Name	Family
16	Hydrilla verticillata	Kureli	Hydrocharitacea
17	Hygrophila auriculata	Alicha	Acanthaceae
18	Hygroryza aristata	Jonglidhan	Poaceae
19	Lemna perpusilla	Guri fena	Lemnaceae
20	Mimosa pudica	Lajjabati	Mimosaceae
21	Musa paradisiaca	Attakola	Musaceae
22	Ocimum basilicum	Tulsi	Lamiaceae
23	Ocimum tenuiflorum	Tulsi	Lamiaceae
24	Phragmites karka	Nolkhagra	Poaceae
25	Phyllanthus niruri	Vuiamla	Euphorbiaceae
26	Pistia stratiotes	Futihena	Araceae
27	Porteresia coarctata	Dhani ghas	Poaceae
28	Saccharum spontaneum	Kasful,	Poaceae
29	Sesuvium portulacastrum	Sagornunia	Aizoaceae
30	Eichhornia crassipes	Kachuripana	Pontederiaceae
31	Abutilon indicum	Junka	Malvaceae
32	Aeluropus lagopoides	Nona Kher	Poaceae
33	Centrostachys aquatica	Thuas	Amaranthaceae
34	Spirodela polyrhiza	Fena	Lemnaceae

Annex 11. Inventory of Amphibians within Study Area

Source: Red List of Bangladesh, Volume 4, IUCN, 2015, / Field Survey

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Anura	Dicroglossidae	*Euphlyctis cyanophlyctis*	Skipper Frog, Skittering Frog	LC	LC	AM0007	246
Anura	Dicroglossidae	*Hoplobatrachus tigerinus*	Indian Bullfrog, Bull Frog, Golden Frog, Tiger Frog, Tiger Peters Frog	LC	LC	AM0022	209, 210, 217, 254
Anura	Rhacophoridae	*Polypedates leucomystax*	Common Tree Frog, Four- lined Tree Frog, White-lipped Tree Frog	LC	LC	AM0040	264
Anura	Rhacophoridae	*Polypedates maculatus*	Maculated Tree Frog, Indian Tree Frog, Spotted Tree Frog	LC	LC	AM0041	265

Annex 12. Inventory of Reptiles within Study Area

Source: Red List of Bangladesh, Volume 4, IUCN, 2015, /Field Survey

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Squamata	Colubridae	*Ahaetulla nasuta*	Vine Snake, Common vine Snake, Common Whip Snake, Long-nosed Tree Snake, Green vine snake, Long-nosed Whip Snake	LC	NE	RE0117	128
Squamata	Natricidae	*Atretium schistosum*	Olive Keelback Water Snake, Olivaceous Keelback, Olive Keelback Wart Snake, Split Keelback Snake	LC	LC	RE0101	145

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Testudines	Geoemydidae	*Batagur baska*	Batagur, Common Batagur, Four-toed Terrapin, River Terrapin, Mangrove Terrapin, Asian River Terrapin	CR	CR	RE0002	32, 40, 47
Squamata	Colubridae	*Boiga multomaculata*	Large-spotted Cat Snake, Many-spotted Cat Snake, Marbled Cat-eyed Snake	NE	NE	RE0125	-
Squamata	Agamidae	*Calotes versicolor*	Common Garden Lizard, Garden Lizard, Bloodsucker	LC	NE	RE0035	109, 4
Squamata	Homalopsidae	*Cerberus rynchops*	Dog-faced water snake, Asian Bockadam, Bockadam Snake, New Guinea Bockadam	LC	LC	RE0131	159
Testudines	Cheloniidae	*Chelonia mydas*	Green Sea Turtle, Green Turtle, Black (sea) Turtle, Pacific Green Turtle	CR	EN	RE0009	32, 56
Squamata	Homalopsidae	*Enhydris enhydris*	Common Smooth-scaled Water Snake, Rainbow Mud Snake, Rainbow Water Snake, Striped Water Snake, Smooth Water Snake	LC	LC	RE0128	160
Testudines	Cheloniidae	*Eretmochelys imbricata*	Hawksbill Turtle, Hawksbill Sea Turtle	CR	CR	RE0023	33, 57
Crocodylia	Gavialidae	*Gavialis gangeticus*	Gharial, Indian Gharial, Fish- eating Crocodile, Gavial, Long-nosed Crocodile	CR	CR	RE0170	33, 39, 40,61
Squamata	Gekkonidae	*Gekko gecko*	Tokay Gecko	LC	NE	RE0048	31, 11
Testudines	Geoemydidae	*Hardella thurjii*	Crowned River Turtle, Brahminy River Turtle	EN	VU	RE0017	64, 33

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Squamata	Gekkonidae	*Hemidactylus bowringii*	Oriental Leaf-toed Gecko, House lizard	LC	NE	RE0041	112
Squamata	Elapidae	*Hydrophis cyanocinctus*	Annulated Sea Snake	LC	LC	RE0150	152
Squamata	Elapidae	*Hydrophis fasciatus*	Stripped Sea Snake, Banded Sea Snake	LC	LC	RE0152	153
Squamata	Elapidae	*Hydrophis obscurus*	Russell's Sea Snake, Estuarine Sea Snake	LC	LC	RE0151	156
Squamata	Elapidae	*Laticauda colubrina*	Yellow-lipped Sea Krait, Columbrine Sea Krait	NE	LC	RE0147	-
Squamata	Elapidae	*Laticaudata laticaudata*	Blackbanded Sea Krait, Brown-lipped Sea Krait	NE	LC	RE0146	-
Testudines	Cheloniidae	*Lepidochelys olivacea*	Olive Ridley Sea Turtle, Pacific Ridley Sea Turtle	VU	VU	RE0024	34, 77
Squamata	Colubridae	*Liopeltis calamaria*	Lesser Stripe-necked Snake, Calamaria Reed Snake, Reed-Like Stripe-Necked Snake	DD	NE	RE0111	180
Squamata	Colubridae	*Lycodon aulicus*	Common Wolf Snake, Indain Wolf Snake	LC	NE	RE0080	136
Squamata	Colubridae	*Lycodon jara*	Yellow-speckled Wolf Snake	LC	LC	RE0079	137
Squamata	Elapidae	*Naja kaouthia*	Monocled Cobra, Monocellate Cobra	NT	LC	RE0144	10, 100
Squamata	Colubridae	*Sibynophis sagittarius*	Cantor's Black-headed Snake	DD	NE	RE0091	184
Squamata	Varanidae	*Varanus bengalensis*	Bengal Lizard, Bengal Monitor, Bengal Monitor Lizard, Clouded	NT	LC	RE0065	91

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
			Monitor, Common Indian Monitor, Indian Monitor				
Squamata	Varanidae	*Varanus flavescens*	Yellow Monitor, Yellow Land Lizard, Yellow Monitor Lizard, Yellow Lizard, Golden Monitor, Calcutta Oval-grain Lizard, Indian Oval-grain Lizard, Ruddy Snub-nosed Monitor	NT	LC	RE0066	92
Squamata	Varanidae	*Varanus salvator*	Ring Lizard, Water Monitor, Common Water Monitor, Asian Water Monitor, Two- banded Monitor, Rice Lizard, Plain Lizard, No-Mark Lizard	VU	LC	RE0067	34, 79
Squamata	Natricidae	*Xenochrophis piscator*	Checkered Keelback, Asiatic Water Snake	LC	NE	RE0098	147

Annex 13. Inventory of Birds within Study Area

Source: Red List of Bangladesh, Volume 3, IUCN, 2015, /Field Survey

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Accipitriformes	Accipitridae	*Accipiter badius*	Shikra	LC	LC	BI0240	321
Accipitriformes	Accipitridae	*Aviceda jerdoni*	Jerdon's Baza	LC	LC	BI0220	309
Accipitriformes	Accipitridae	*Circaetus gallicus*	Short-toed Snake Eagle	LC	LC	BI0556	312
Accipitriformes	Accipitridae	*Haliastur indus*	Brahminy Kite	LC	LC	BI0225	326

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Accipitriformes	Accipitridae	*Spilornis cheela*	Crested Serpent Eagle	LC	LC	BI0235	311
Bucerotiformes	Bucerotidae	*Anthracoceros albirostris*	Oriental Pied Hornbill	LC	LC	BI0058	331
Bucerotiformes	Upupidae	*Upupa epops*	Common Hoopoe	LC	LC	BI0060	332
Caprimulgiformes	Cprimulgidae	*Caprimulgus jotaka*	Grey Nightjar	LC	LC	BI0123	191
Caprimulgiformes	Apodidea	*Cypsiurus balasiensis*	Asian Palm Swift	LC	LC	BI0103	197
Charadriformes	Glareolidae	*Glareola lactea*	Little Pratincole	LC	LC	BI0201	282
Charadriformes	Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	LC	LC	BI0188	246
Charadriformes	Jacanidae	*Metopidius indicus*	Bronze-winged Jacana	LC	LC	BI0185	258
Charadriformes	Laridae	*Sterna albifrons*	Little Tern	LC	LC	BI0211	287
Charadriformes	Chardridae	*Vanellus indicus*	Red-wattled Lapwing	LC	LC	BI0198	255
Ciconiformes	Ciconidae	*Anastomus oscitans*	Asian Openbill	LC	LC	BI0289	225
Columbiformes	Columbidae	*Columba livia*	Rock Dove	LC	LC	BI0125	177
Columbiformes	Columbidae	*Ducula aenea*	Green Imperial Pigeon	LC	LC	BI0138	189
Coraciformes	Coracidae	*Eurystomus orientalis*	Oriental Dollarbird	LC	LC	BI0063	9, 338
Coraciformes	Alcedinidae	*Halcyon coromanda*	Ruddy Kingfisher	LC	LC	BI0070	9, 343

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Coraciformes	Alcedinidae	*Halcyon smyrnensis*	White-breasted Kingfisher	LC	LC	BI0072	344
Cuculiformes	Cuculidae	*Cacomantis merulinus*	Plaintive Cuckoo	LC	LC	BI0085	209
Cuculiformes	Cuculidae	*Clamator jacobinus*	Jacobin Cuckoo	LC	LC	BI0081	203
Cuculiformes	Cuculidae	*Cuculus micropterus*	Indian Cuckoo	LC	LC	BI0084	214
Passeriformes	Dicruridiae	*Dicrurus annectans*	Crow-billed Drongo	DD	LC	BI0564	616
Cuculiformes	Cuculidae	*Eudynamys scolopaceus*	Western Koel (Asian koel)	LC	LC	BI0091	205
Cuculiformes	Cuculidae	*Surniculus lugubris*	Square-tailed Drongo- Cuckoo	LC	LC	BI0090	211
Gruiformes	Rallidae	*Gallicrex cinerea*	Watercock	LC	LC	BI0148	221
Gruiformes	Rallidae	*Porphyrio porphyrio*	Purple Swamphen	LC	LC	BI0149	222
Charadriformes	Burhinidae	*Esacus recurvirostris*	Great Thick-knee	NT	NT	BI0187	6, 10, 130
Passeriformes	Nectarinidae	*Arachnothera magna*	Streaked Spiderhunter	LC	LC	BI0499	552
Passeriformes	Artamidae	*Artamus fuscus*	Ashy Woodswallow	LC	LC	BI0313	383
Falconiformes	Falconidae	*Falco jugger*	Laggar Falcon	VU	NT	BI0259	6, 40, 46, 116

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Galliformes	Phasianidae	*Francolinus pondicerianus*	Grey Francolin	RE	LC	BI0529	58
Passeriformes	Corvidae	*Cissa chinensis*	Green Magpie	LC	LC	BI0308	415
Passeriformes	Corvidae	*Corvus levaillantii*	Jungle Crow	LC	LC	BI0311	419
Passeriformes	Corvidae	*Corvus splendens*	House Crow	LC	LC	BI0312	418
Passeriformes	Herundinidae	*Delichon nipalensis*	Nepal House Martin	LC	LC	BI0400	425
Passeriformes	Corvidae	*Dendrocitta formosae*	Grey Treepie	LC	LC	BI0309	417
Passeriformes	Dicaeidae	*Dicaeum concolor*	Plain Flowerpecker	LC	LC	BI0489	542
Passeriformes	Dicaeidae	*Dicaeum trigonostigma*	Orange-bellied Flowerpecker	LC	LC	BI0492	545
Passeriformes	Dicruridiae	*Dicrurus aeneus*	Bronzed Drongo	LC	LC	BI0329	408
Gruiformes	Heliornithidae	*Heliopais personatus*	Masked Finfoot	EN	EN	BI0141	6, 10, 33, 39, 40, 45, 90
Piciformes	Picidae	*Hemicircus canente*	Heart-spotted Woodpecker	DD	LC	BI0561	611
Passeriformes	Dicruridiae	*Dicrurus macrocercus*	Black Drongo	LC	LC	BI0332	406
Accipitriformes	Accipitridae	*Ichthyophaga ichthyaetus*	Grey-headed Fish- eagle	NT	NT	BI0228	141

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Passeriformes	Dicruridiae	*Dicrurus remifer*	Lesser Racket-tailed Drongo	LC	LC	BI0334	409
Passeriformes	Muscicapidae	*Enicurus immaculatus*	Black-backed Forktail	LC	LC	BI0376	523
Strigiformes	Srtigidae	*Ketupa Flavipes*	Tawny Fish Owl	DD	LC	BI0555	34, 599
Passeriformes	Timalidae	*Garrulax leucolophus*	White-crested Laughingthrush	LC	LC	BI0457	478
Ciconiformes	Ciconidae	*Leptoptilos dubius*	Greater Adjutant	RE	EN	BI0545	6, 32, 65
Ciconiformes	Ciconidae	*Leptoptilos javanicus*	Lesser Adjutant	VU	VU	BI0293	6, 10, 33, 39, 106
Passeriformes	Estrilidae	*Lonchura malabarica*	White-throated Munia	LC	LC	BI0517	559
Passeriformes	Alaudidae	*Mirafra assamica*	Rufous-winged Lark	LC	LC	BI0482	427
Passeriformes	Motacilidae	*Motacilla madaraspatensis*	White-browed Wagtail	LC	LC	BI0507	569
Passeriformes	Nectarinidae	*Nectarinia sperata*	Purple-throated Sunbird	LC	LC	BI0494	547
Passeriformes	Oriolidae	*Oriolus oriolus*	Eurasian Golden Oriole	LC	LC	BI0315	402
Passeriformes	Sylvidae	*Orthotomus atrogularis*	Dark-necked Tailorbird	LC	LC	BI0435	448
Passeriformes	Sylvidae	*Orthotomus cuculatus*	Mountain Tailorbird	LC	LC	BI0436	446

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Passeriformes	Sylvidae	*Orthotomus sutorius*	Common Tailorbird	LC	LC	BI0437	447
Passeriformes	Timalidae	*Pellorneum ruficeps*	Puff-throated Babbler	LC	LC	BI0463	471
Passeriformes	Ploceidae	*Ploceus manyar*	Streaked Weaver	LC	LC	BI0514	556
Passeriformes	Ploceidae	*Ploceus philippinus*	Baya Weaver	LC	LC	BI0515	557
Pelecaniformes	Threskiornithidae	*Platalea leucorodia*	Eurasian Spoonbill	CR	LC	BI0286	10, 12, 40, 41, 81
Passeriformes	Cicticolidae	*Prinia inornata*	Plain Prinia	LC	LC	BI0413	437
Passeriformes	Cicticolidae	*Prinia rufescens*	Rufescent Prinia	LC	LC	BI0414	433
Passeriformes	Ptcnonotidae	*Pycnonotus atriceps*	Black-headed Bulbul	LC	LC	BI0401	438
Passeriformes	Ptcnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	LC	LC	BI0402	441
Passeriformes	Ptcnonotidae	*Pycnonotus jocosus*	Red-whiskered Bulbul	LC	LC	BI0403	440
Passeriformes	Ptcnonotidae	*Pycnonotus melanicterus*	Black-crested Bulbul	LC	LC	BI0404	439
Passeriformes	Herundinidae	*Riparia paludicola*	Plain (Brown-throated) Martin	LC	LC	BI0395	422
Passeriformes	Sturnidae	*Sturnus contra*	Asian Pied Starling	LC	LC	BI0382	488
Passeriformes	Sturnidae	*Sturnus malabaricus*	Chestnut-tailed Starling	LC	LC	BI0383	489
Passeriformes	Campephagidae	*Tephrodornis gularis*	Large Woodshrike	LC	LC	BI0338	385

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Passeriformes	Timalidae	*Turdoides striata*	Jungle Babbler	LC	LC	BI0475	477
Anseriformes	Anatidae	*Sarkidiornis melanotos*	African Comb Duck	NT	LC	BI0015	124
Passeriformes	Zestropodidae	*Zosterops palpebrosus*	Oriental White-eye	LC	LC	BI0416	483
Pelecaniformes	Ardidae	*Ardeola grayii*	Indian Pond Heron	LC	LC	BI0277	233
Pelecaniformes	Ardidae	*Bubulcus ibis*	Cattle Egret	LC	LC	BI0275	235
Pelecaniformes	Ardidae	*Gorsachius melanolophus*	Malayan Night Heron	LC	LC	BI0280	230
Pelecaniformes	Ardidae	*Ixobrychus cinnamomeus*	Cinnamon Bittern	LC	LC	BI0281	229
Pelecaniformes	Ardidae	*Ixobrychus sinensis*	Yellow Bittern	LC	LC	BI0282	228
Pelecaniformes	Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	LC	LC	BI0284	226
Piciformes	Picidae	*Sasia ochracea*	White-browed Piculet	LC	LC	BI0037	352
Pelecaniformes	Threskiornithidae	*Threskiornis melanocephalus*	Black-headed Ibis	VU	NT	BI0285	40, 41, 108
Podicipedifprmes	Podicipedidae	*Tachybaptus ruficollis*	Little Grebe	LC	LC	BI0264	174
Psittaciformes	Psittacidae	*Loriculus vernalis*	Vernal Hanging Parrot	LC	LC	BI0095	372
Strigiformes	Srtigidae	*Ketupa zeylonensis*	Brown Fish Owl	LC	LC	BI0113	305

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Strigiformes	Tytonidae	*Tyto alba*	Common Barn Owl (Barn Owl)	LC	LC	BI0106	13, 295
Charadriformes	Chardridae	*Vanellus malarbaricus*	Yellow-wattled Lapwing	NT	LC	BI0199	132
Trogoniformes	Trogonidiae	*Harpactes erythrocephalus*	Red-headed Trogon	LC	LC	BI0061	330

Annex 14. Inventory of Mammals within Study Area

Source: Red List of Bangladesh, Volume 2, IUCN, 2015, /Field Survey

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Carnivora	Mustelidae	*Aonyx cinerea*	Oriental Small-clawed Otter, Asian Small-clawed Otter, Small-clawed Otter	EN	VU	MA0071	40, 94
Rodentia	Muridae	*Bandicota bengalensis*	Lesser Bandicoot Rat, Indian Molerat, Sind Rice Rat	LC	LC	MA0103	124
Rodentia	Muridae	*Bandicota indica*	Large Bandicoot Rat, Greater Bandicoot Rat, Bandicoot Rat.	LC	LC	MA0104	125
Rodentia	Sciuridae	*Callosciurus pygerythrus*	Hoary-bellied Squirrel, Irrawaddy Squirrel	LC	LC	MA0094	133
Lagomorpha	Leporidae	*Caprolagus hispidus*	Hispid Hare, Assam Rabbit	DD	EN	MA0116	170

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Carnivora	Canidae	*Cuon alpinus*	Dhole, Red Dog, Indian Wild Dog, Asiatic Wild Dog	EN	EN	MA0059	40, 92
Chiroptera	Pteropodidae	*Cynopterus sphinx*	Greater Short-nosed Fruit Bat	LC	LC	MA0019	139
Chiroptera	Vespertilionidae	*Eptesicus pachyotis*	Thickeared Bat	NE	LC	MA0034	32
Carnivora	Herpestidae	*Herpestes edwardsii*	Indian Grey Mongoose, Common Mongoose	LC	LC	MA0069	150
Chiroptera	Vespertilionidae	*Hesperoptenus tickelli*	Tickell's Bat	DD	LC	MA0035	185
Primates	Cercopithecidae	*Macaca fascicularis*	Long-tailed Macaque, Crab- eating Macaque, Cynomolgus Monkey	CR	LC	MA0052	39, 66
Pholidota	Manidae	*Manis crassicaudata*	Indian Pangolin, Scaly Anteater, Thick-tailed Pangolin	CR	EN	MA0090	39, 70
Chiroptera	Megadermatidae	*Megaderma lyra*	Greater False Vampire, Greater False Vampire Bat, Indian False Vampire Bat	LC	LC	MA0027	138
Carnivora	Ursidae	*Melursus ursinus*	Sloth Bear, Honey Bear	EX	VU	MA0004	32, 35, 36,60, 61
Cetartiodactyla	Cervidae	*Muntiacus muntjak*	Barking Deer, Indian Muntjac	EN	LC	MA0087	40, 96
Rodentia	Muridae	*Nesokia indica*	Short-tailed Bandicoot Rat	DD	LC	MA0108	161
Primates	Lorisidae	*Nycticebus bengalensis*	Slow Loris, Bengal Slow Loris, Bengal Loris, Northern Slow Loris	EN	VU	MA0050	40, 84, 89

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Species ID	Page No.
Carnivora	Viverridae	*Paguma larvata*	Masked Palm Civet, Gem-faced Civet	VU	LC	MA0080	41, 106
Carnivora	Felidae	*Panthera pardus*	Leopard	CR	NT	MA0014	14, 39, 72
Carnivora	Viverridae	*Paradoxurus hermaphroditus*	Common Palm Civet, Asian Palm Civet	LC	LC	MA0081	151
Chiroptera	Vespertilionidae	*Pipistrellus tenuis*	Least Pipistrelle, Indian Pygmy Bat	LC	LC	MA0041	144
Cetartiodactyla	Platanistidae	*Platanista gangetica*	Ganges River Dolphin, Ganges Dolphin, Blind River Dolphin, South Asian River Dolphin	VU	EN	MA0012	6, 10, 41,107
Chiroptera	Pteropodidae	*Pteropus giganteus*	Indian Flying Fox, Indian Flying-fox	LC	LC	MA0020	140
Rodentia	Sciuridae	*Ratufa bicolor*	Black Giant Squirrel, Malayan Giant Squirrel	VU	NT	MA0101	33, 41, 100
Eulipotyphla	Soricidae	*Suncus murinus*	House shrew, Asian house shrew.	LC	LC	MA0016	136
Primates	Cercopithecidae	*Trachypithecus phayrei*	Phayre's langur, Phayrei's leaf monkey, Spectacle langur	CR	EN	MA0056	39, 67
Carnivora	Viverridae	*Viverra zibetha*	Large Indian Civet	NT	NT	MA0005	116
Carnivora	Canidae	*Vulpes bengalensis*	Bengal Fox	VU	LC	MA0060	41, 99, 101

Annex 15. Inventory of Fishes within Study Area

Source: Red List of Bangladesh, Volume 5, IUCN, 2015, /Field Survey

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Habitat	Species ID	Page No.
Cypriniformes	Cyprinidae	*Amblypharyngodon mola*	Mola Carplet, Pale Carplet	LC	LC	FP, R	FI0015	178
Clupeiformes	Clupeidae	*Anodontostoma chacunda*	Shortnosed Gizzard Shad, Chacunda Gizzard Shad	LC	NE	ET	FI0049	157
Perciformes	Gobiidae	*Boleophthalmus boddarti*	Boddart's Goggle-eyed Goby, Blue Spotted Mud skipper, Mudskipper	LC	LC	R,ET	FI0033	221
Cypriniformes	Cyprinidae	*Catla catla*	Catla	LC	NE	R, Migratory	FI0070	185
Osteoglos-siformes	Notopteridae	*Chitala chitala*	Humped Featherback, Clown Knife Fish	EN	NT	R	FI0044	80
Pleuronecti-formes	Cynoglossidae	*Cynoglossus arel*	Largescale Tonguesole	LC	NE	ET,R	FI0037	247
Pleuronecti-formes	Cynoglossidae	*Cynoglossus cynoglossus*	Bengal Tongue Sole, Gangetic Tongue-Sole, Indian Turbot, Tonguefish, Tonguesole	LC	NE	ET,R	FI0023	245
Pleuronecti-formes	Cynoglossidae	*Cynoglossus lingua*	Long tongue sole	LC	NE	ET,R	FI0024	246
Beloniformes	Hemiramphidae	*Dermogenus brachynotopterus*	Gangetic Halfbeak	DD	-	R, ET	FI0245	278

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Habitat	Species ID	Page No.
Clupeiformes	Clupeidae	*Hilsa kelee*	Kelee Shad, Five Spot Herring	LC	NE	Migratory	FI0052	160
Clupeiformes	Pristigasteridae	*Ilisha filigera*	Coromondel Ilish, Jewelled Ilisha, Jewelled Shad, Big- eyed Herring, Big Eye Shad	LC	NE	Migratory, ET	FI0056	169
Clupeiformes	Pristigasteridae	*Ilisha megaloptera*	Bigeye Ilisha	LC	NE	Migra tory, ET	FI0057	170
Clupeiformes	Pristigasteridae	*Ilisha melastoma*	Indian Ilisha	DD	NE	Migra tory, ET	FI0058	279
Mugiliformes	Mugilidae	*Liza parsia*	Goldspot Mullet, Brackish Water Mullet, Grey Mullet	LC	NE	ET	FI0210	200
Perciformes	Sciaenidae	*Macrospinosa cuja*	Cuja Bola	NT	NE	ET, R	FI0206	138
Siluriformes	Bagridae	*Mystus gulio*	Long-whiskered Catfish, Gulio Catfish	NT	LC	ET, R	FI0144	142
Perciformes	Gobiidae	*Odontamblyopus rubicundus*	Rubicundus Eelgoby	LC	NE	ET, R	FI0223	230
Beloniformes	Adrianichthyidae	*Oryzias dancena*	Indian Ricefish/Ricefish	DD	LC	ET, FP	FI0191	277
Siluriformes	Ariidae	*Osteogeneiosus militaris*	Soldier Catfish, Walking Catfish, Clarias Catfish, Freshwater Catfish	LC	NE	ET	FI0185	251
Perciformes	Sciaenidae	*Otolithoides pama*	Pama Croaker, Pama	LC	NE	ET, R	FI0207	243

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Habitat	Species ID	Page No.
Pleuronecti-formes	Cynoglossidae	*Paraplagusia bilineata*	Fingerlip Tonguesole, Doublelined Tonguesole, Lemon Tonguesole	LC	NE	ET	FI0038	248
Clupeiformes	Pristigasteridae	*Pellona ditchela*	Indian Pellona	LC	NE	R,ET	FI0059	171
Scorpaeni-formes	Platycephalidae	*Platycephalus indicus*	Bar-tailed Flathead, Bartail Flathead, Flathead, Gobi, Indian Flathead, Indo-Pacific Flathead	LC	DD	ET,R	FI0198	249
Perciformes	Polynemidae	*Polynemous paradiseus*	Paradise Threadfin	LC	NE	ET	FI0215	241
Perciformes	Gobiidae	*Pseudapocryptes elongatus*	Lanceolate goby, Goby, Mud skipper	LC	LC	ET, R	FI0220	227
Cypriniformes	Cyprinidae	*Salmophasia bacaila*	Large Razorbelly Minnow	LC	LC	R	FI0030	181
Perciformes	Gobiidae	*Scartelaos histophorus*	Walking goby	LC	NE	ET, R	FI0221	228
Clupeiformes	Engraulidae	*Setipinna taty*	Scaly Hairfin Anchovy	LC	NE	R,ET	FI0064	167
Perciformes	Sillaginidae	*Sillaginopsis panijus*	Flathead sillago and Gangetic sillago	LC	NE	ET	FI0204	244
Siluriformes	Bagridae	*Sperata aor*	Long-whiskered Catfish	VU	LC	R	FI0149	110
Siluriformes	Bagridae	*Sperata seenghala*	Giant River-catfish	VU	LC	R	FI0150	111
Perciformes	Gobiidae	*Stigmatogobius sadanundio*	Knight Goby	LC	NE	ET, R	FI0222	229

Order	Family	Scientific Name	English Name	Status in Bangladesh	Global Status	Habitat	Species ID	Page No.
Perciformes	Gobiidae	*Taenioides buchanani*	Burmese Gobyeel	LC	NE	ET	FI0224	231
Clupeiformes	Clupeidae	*Tenualosa ilisha*	River Shad, Hilsha Shad	LC	LC	Migratory	FI0054	162
Clupeiformes	Clupeidae	*Tenualosa toli*	Toli Shad, Shad	LC	NE	ET	FI0055	163
Perciformes	Gobiidae	*Trypauchen vagina*	Burrowing Goby	LC	NE	ET	FI0226	233

Annex 16. Chance Find Procedures for Physical Cultural Resources

1.0 Introduction

These procedures describe the measures to be undertaken if an accidental discovery or chance find, or an encounter with a physical cultural resource (PCR) occurred during the construction phase. The chance find procedures will be finalized as Physical Cultural Resources Plan (PCRP) by PGCB and the Contractor(s), in consultation with the Department of Archaeology (DOA) or the Ministry of Cultural Affairs to ensure compliance to The Antiquities Act 1968 (amended 1976), National Cultural Policy 2006, and applicable regulations. The PCRP will be included in the Construction Management Plan that will be required from the Contractor(s). These procedures aim to identify and promote the preservation, protection, and recording of any PCR that may be discovered or exposed during the earthmoving works and ground alteration.

2.0 Orientation and/or Briefing of Workers

The Contractor(s), with the assistance from the DOA or Ministry of Cultural Affairs and PIU-PGCB, will conduct an orientation or training for all workers, particularly those who will be involved in earth movements and excavation on how to recognize artifacts that they may encounter or discover.

An archeological map of Bangladesh (if available) will be obtained from the DOA or other relevant sources to examine if there are potential "hot spots" within the project corridor. This map will be part of the references on-site to guide the construction supervision staff in determining the potential "hot spots."

3.0 Procedures

3.1 General

In case a PCR was encountered during excavation, construction activities in the area will be stopped. The site or area discovered will be marked or demarcated using a global positioning system (GPS) unit to determine the exact coordinates and photographs will be taken. The construction supervision staffs of the Contractor and PIU-PGCB site engineer/staff will secure the site to prevent damage, loss or pilferage of removable objects. The PIU-PGCB site engineer or designated staff will be responsible for coordinating with the DOA.

If the encounter involves removable items, a security person will be posted until the representative of DOA or Ministry of Cultural Affairs arrives to assess and determine its value. The DOA staff will be responsible in determining the appropriate course of action. Further excavation or earth moving works may be conducted at the distance and demarcation area recommended by the DOA staff.

If the chance find will have significant cultural value, this may entail consequent changes in the lay-out particularly if the discovery is considered or assessed as remains of cultural or archeological importance that is not removable.

The Contractor will not be entitled for compensation due to work stoppage as a result of the discovery and its associated subsequent actions.

3.2 Assessment and Recovery

Appropriate heavy equipment such as wheel loader will be made available to recover the excavated material from the excavation site to allow the geologist onsite or the DOA staff to inspect, recover or conduct sampling. A safe storage area will be provided to protect the discovered object. If the chance find is part of a large artifact, deposit or structure, the inspection or recording will include photography and video on an "as-is, where is" manner. The exact location will be recorded using a GPS unit.

3.3 Resumption of Work

The Contractor can continue with excavation and construction works within the affected area after the DOA staff has given clearance. All the discovered objects of value will be given to the Government.

4.0 Reporting

The Contractor will prepare a Chance Find Report within a week showing the date and time of discovery, specific location, description of the PCR, and interim protection measures implemented. This Report will be submitted to PIU-PGCB who will provide it to the DOA or Ministry of Cultural Affairs.

Annex 17. Grievance Complaint Form

Project Name:		
Date:		
Compliant Details:		
Location of the Project:		
Complaint Description:		
Evidence/ Clarification:		
Have you complained about this matter before?	Yes	No
	If Yes, when was the issue addressed?	
Contact Details:		
Name:		
Organization:		
Address:		
Phone:	Email:	

Annex 18. Land Ownership Details

ফরম- গ

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
জেলা প্রশাসকের কার্যালয়, ভোলা
(ভূমি অধিগ্রহণ শাখা)
[ধারা ৮এর (৩) নং উপ-ধারা দ্রষ্টব্য]
এল.এ কেস নং ০২ভো:/২০২০-২১

জারির নম্বর: ১১৬ তারিখ: ৫/৫ -০৫.২০২১ খ্রি.

নোটিশ

প্রাপক :
মেরিনা রহমান
পিং হালিমুর রহমান
বাসা নং-১৮, রোড নং ৩০, সেক্টর-০৭
উত্তরা, ঢাকা-১২৩০।

এতদ্বারা স্থাবর সম্পত্তি অধিগ্রহণ ও হুকুমদখল আইন, ২০১৭ (২০১৭ সনের ২১ নম্বর আইন) এর ৮ ধারার (৩)(ক) উপধারা মোতাবেক নোটিশ প্রদান করা যাইতেছে যে, আপনি/আপনারা উপরোক্ত ভূমি অধিগ্রহণ কেসে স্বার্থ সংশ্লিষ্ট ব্যক্তি/ব্যক্তিগণ বলিয়া গণ্য হইয়াছেন এবং প্রাপ্ত রেকর্ডপত্র অনুসারে আপনাকে/আপনাদিগকে নিম্নবর্ণিত হারে ক্ষতিপূরণ প্রদান করা হইবে, যথা:

প্রতি একর ভিটা জমি ...../-টাকা হিসাবে	একর জমির মূল্য বাবদ মোট..... টাকা
প্রতি একর নাল জমি .....১৪,২৯,৩১৫/০০- টাকা হিসাবে	১.৬৬৬৬৬ একর জমির মূল্য বাবদ মোট .....=২৩,৮২,১৯১/৬৭ টাকা
প্রতি এক পুকুরের জমি.....-/টাকা হিসাবে	একর জমির মূল্য বাবদ মোট..... টাকা
প্রতি একর পুকুরপাড়ের জমি.....-/টাকা হিসাবে	একর জমির মূল্য বাবদ মোট..... টাকা
প্রতি একর ডোবা/গর্ত জমি .....-/- টাকা হিসাবে	একর জমির মূল্য বাবদ মোট .... টাকা
অবকাঠামো/ ঘরবাড়ির মূল্য বাবদ	.....টাকা
পুকুর খনন মূল্য বাবদ	.....টাকা
গাছপালার মূল্য বাবদ	.....টাকা
ফসলের মূল্য বাবদ	.....টাকা
অন্যান্য (যদি থাকে) মৎস্যের ক্ষতিসহ মালিককের উপার্জনের ক্ষতিপূরণ বাবদ	.....টাকা
	মোট = ২৩,৮২,১৯১/৬৭ টাকা
অতিরিক্ত (ক) জমির মূল্যের (২০০%)	.....= ৪৭,৬৪,৩৮৩/৩৩ টাকা
(খ) অবকাঠামোর মূল্যের (১০০%)	.....টাকা
(গ) গাছপালার মূল্যের (১০০%)	.....টাকা
(ঘ) পুকুর খনন মূল্যের (১০০%)	.....টাকা
(ঙ) ফসলের মূল্যের (১০০%)	.....টাকা
(চ) অন্যান্য/ মৎস্যের ক্ষতিসহ মালিককের উপার্জনের (১০০%)	.....টাকা
	সর্বমোট=৭১,৪৬,৫৭৫/০০ টাকা
	উৎসে কর কর্তন ৩% হারে= ২,১৪,৩৯৭/২৫ টাকা
	প্রদেয় টাকা = ৬৯,৩২,১৭৭/৭৫ টাকা

কথায়: (উনসত্তর লক্ষ বত্রিশ হাজার একশত সাতাত্তর টাকা পঁচাত্তর পয়সা) টাকা

যথাযথ কর্তৃপক্ষ কর্তৃক উপরোক্ত ক্ষতিপূরণের টাকা গ্রহণের নিমিত্ত আপনি স্বয়ং বা যথাযথভাবে ক্ষমতাপ্রাপ্ত প্রতিনিধির মাধ্যমে ৩০০ টাকার স্ট্যাম্পে নির্ধারিত ফরমে অঙ্গীকারনামাসহ ১৮.০৫.২০২১ খ্রি. তারিখে জেলা প্রশাসকের কার্যালয়, ভোলা এর ভূমি অধিগ্রহণ শাখায় আমার সম্মুখে হাজির হইবেন।

তফসিল

জেলা: ভোলা উপজেলা: চরফ্যাশন মৌজা : দক্ষিণ চরমাদ্রাজ জে.এল.নং-৮১

ক্রমিক নং	খতিয়ান নং	দাগ নম্বর	শ্রেণি	অধিগ্রহণের জন্য প্রস্তাবিত জমির পরিমাণ (একরে)	মন্তব্য
০৩	৬৪৬	২৯০	নাল	১.১৮০০০ একর	
		২৯১	নাল	০.৪৮৬৬৬ একর	

অধিগ্রহণকৃত জমির মালিক/ স্বার্থ সংশ্লিষ্ট ব্যক্তিগণের জন্য জ্ঞাতব্য :

০১। নিজে বা ক্ষমতাপ্রাপ্ত প্রতিনিধির মাধ্যমে সরাসরি আবেদন করুন। ক্ষমতাপ্রদানের জন্য নির্ধারিত ফরম ব্যবহার করুন।
০২। অনলাইনে আবেদন ফরম, অঙ্গীকারনামা ও পদ্ধতি জানার জন্য এ কার্যালয়ের ওয়েব সাইট ভিজিট করুন।

০৫/০৫/২১
(সালেহ আহমেদ)
ভূমি অধিগ্রহণ কর্মকর্তা
জেলা প্রশাসক
ভোলা এর পক্ষে

ফরম- গ

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
জেলা প্রশাসকের কার্যালয়, ভোলা
(ভূমি অধিগ্রহণ শাখা)
[ধারা ৮এর (৩) নং উপ-ধারা দ্রষ্টব্য]
এল.এ কেস নং ০২ভো:/২০২০-২১

জারির নম্বর: ১৬৫ তারিখ: ০৫ .০৫.২০২১ খ্রি.

নোটিশ

প্রাপক :
রোক্সেনা আজম
স্বামী-ডা: মো: ফারুক আজম
বাসা নং-১৮, রোড নং ৩০, সেক্টর-০৭,
উত্তরা, ঢাকা-১২৩০।

এতদ্বারা স্থাবর সম্পত্তি অধিগ্রহণ ও হুকুমদখল আইন, ২০১৭ (২০১৭ সনের ২১ নম্বর আইন) এর ৮ ধারার (৩)(ক) উপধারা মোতাবেক নোটিশ প্রদান করা যাইতেছে যে, আপনি/আপনারা উপরোক্ত ভূমি অধিগ্রহণ কেসে স্বার্থ সংশ্লিষ্ট ব্যক্তি/ব্যক্তিগণ বলিয়া গণ্য হইয়াছেন এবং প্রাপ্ত রেকর্ডপত্র অনুসারে আপনাকে/আপনাদিগকে নিম্নবর্ণিত হারে ক্ষতিপূরণ প্রদান করা হইবে, যথা:

প্রতি একর ভিটা জমি ...../-টাকা হিসাবে	একর জমির মূল্য বাবদ মোট..... টাকা
প্রতি একর নাল জমি .....১৪,২৯,৩১৫/০০- টাকা হিসাবে	১.৬৬৬৬ একর জমির মূল্য বাবদ মোট .....=২৩,৮২,১৯১/৬৭ টাকা
প্রতি এক পুকুরের জমি...../-টাকা হিসাবে	একর জমির মূল্য বাবদ মোট..... টাকা
প্রতি একর পুকুরপাড়ের জমি...../-টাকা হিসাবে	একর জমির মূল্য বাবদ মোট..... টাকা
প্রতি একর ডোবা/গর্ত জমি ...../- টাকা হিসাবে	একর জমির মূল্য বাবদ মোট .... টাকা
অবকাঠামো/ ঘরবাড়ির মূল্য বাবদ	.....টাকা
পুকুর খনন মূল্য বাবদ	.....টাকা
গাছপালার মূল্য বাবদ	.....টাকা
ফসলের মূল্য বাবদ	.....টাকা
অন্যান্য (যদি থাকে) মৎস্যের ক্ষতিসহ মালিককের উপার্জনের ক্ষতিপূরণ বাবদ	.....টাকা
	মোট = ২৩,৮২,১৯১/৬৭ টাকা
অতিরিক্ত (ক) জমির মূল্যের (২০০%)	.....= ৪৭,৬৪,৩৮৩/৩৩ টাকা
(খ) অবকাঠামোর মূল্যের (১০০%)	.....টাকা
(গ) গাছপালার মূল্যের (১০০%)	.....টাকা
(ঘ) পুকুর খনন মূল্যের (১০০%)	.....টাকা
(ঙ) ফসলের মূল্যের (১০০%)	.....টাকা
(চ) অন্যান্য/ মৎস্যের ক্ষতিসহ মালিককের উপার্জনের (১০০%)	.....টাকা
	সর্বমোট=৭১,৪৬,৫৭৫/০০ টাকা
	উৎসে কর কর্তন ৩% হারে= ২,১৪,৩৯৭/২৫ টাকা
	প্রদেয় টাকা = ৬৯,৩২,১৭৭/৭৫ টাকা

কথায়: (উনসত্তর লক্ষ বত্রিশ হাজার একশত সাতাত্তর টাকা পঁচাত্তর পয়সা) টাকা

যথাযথ কর্তৃপক্ষ কর্তৃক উপরোক্ত ক্ষতিপূরণের টাকা গ্রহণের নিমিত্ত আপনি স্বয়ং বা যথাযথভাবে ক্ষমতাপ্রাপ্ত প্রতিনিধির মাধ্যমে ৩০০ টাকার স্ট্যাম্পে নির্ধারিত ফরমে অঙ্গীকারনামাসহ ১৮.০৫.২০২১ খ্রি. তারিখে জেলা প্রশাসকের কার্যালয়, ভোলা এর ভূমি অধিগ্রহণ শাখায় আমার সম্মুখে হাজির হইবেন।

তফসিল

জেলা: ভোলা উপজেলা: চরফ্যাশন মৌজা : দক্ষিণ চরমাদ্রাজ জে.এল.নং-৮১

ক্রমিক নং	খতিয়ান নং	দাগ নম্বর	শ্রেণি	অধিগ্রহণের জন্য প্রস্তাবিত জমির পরিমাণ (একরে)	মন্তব্য
০২	৬৪৬	২৯০	নাল	১.১৮০০০ একর	
		২৯১	নাল	০.৪৮৬৬৬ একর	

অধিগ্রহণকৃত জমির মালিক/ স্বার্থ সংশ্লিষ্ট ব্যক্তিগণের জন্য জ্ঞাতব্য :

০১। নিজে বা ক্ষমতাপ্রাপ্ত প্রতিনিধির মাধ্যমে সরাসরি আবেদন করুন। ক্ষমতাপ্রদানের জন্য নির্ধারিত ফরম ব্যবহার করুন।
০২। অনলাইনে আবেদন ফরম, অঙ্গীকারনামা ও পদ্ধতি জানার জন্য এ কার্যালয়ের ওয়েব সাইট ভিজিট করুন।

(সালেহ আহমেদ)
ভূমি অধিগ্রহণ কর্মকর্তা
জেলা প্রশাসক
ভোলা এর পক্ষে

Annex 19. Sample NOC Letter

Source: https://doe.portal.gov.bd/site/page/7398ec78-0ee7-43c0-871e-96d16fd50a6b/-

http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/71a829c3_6b74_4ee9_90a6_158e2898b228/noc.pdf

(সংশ্লিষ্ট স্থানীয় কর্তৃপক্ষের ঠিকানা সম্বলিত প্যাড-এ হবে)

স্মারক নং- তারিখ ঃ ----------

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কর্তৃপক্ষ কর্তৃক প্রদেয় অনাপত্তিপত্রের ছক

১। আবেদনকারীর নাম ঃ

২। পিতা/স্বামী/স্ত্রীর নাম ঃ

৩। আবেদনকারীর ঠিকানা ঃ

৪। কারখানা/প্রকল্পের অবস্থানগত ঠিকানা ঃ

৫। কারখানা/প্রকল্পের তফসিল ঃ

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	জমির ধরণ	মোট জমির পরিমাণ

৬। কারখানা/প্রকল্পের উৎপাদিত/উৎপাদিতব্য পণ্যের নাম ঃ

উপরোক্ত তথ্যাদির আলোকে----------(কারখানা/প্রকল্পের নাম)----------

কারখানা/প্রকল্পকে নিম্নবর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো।

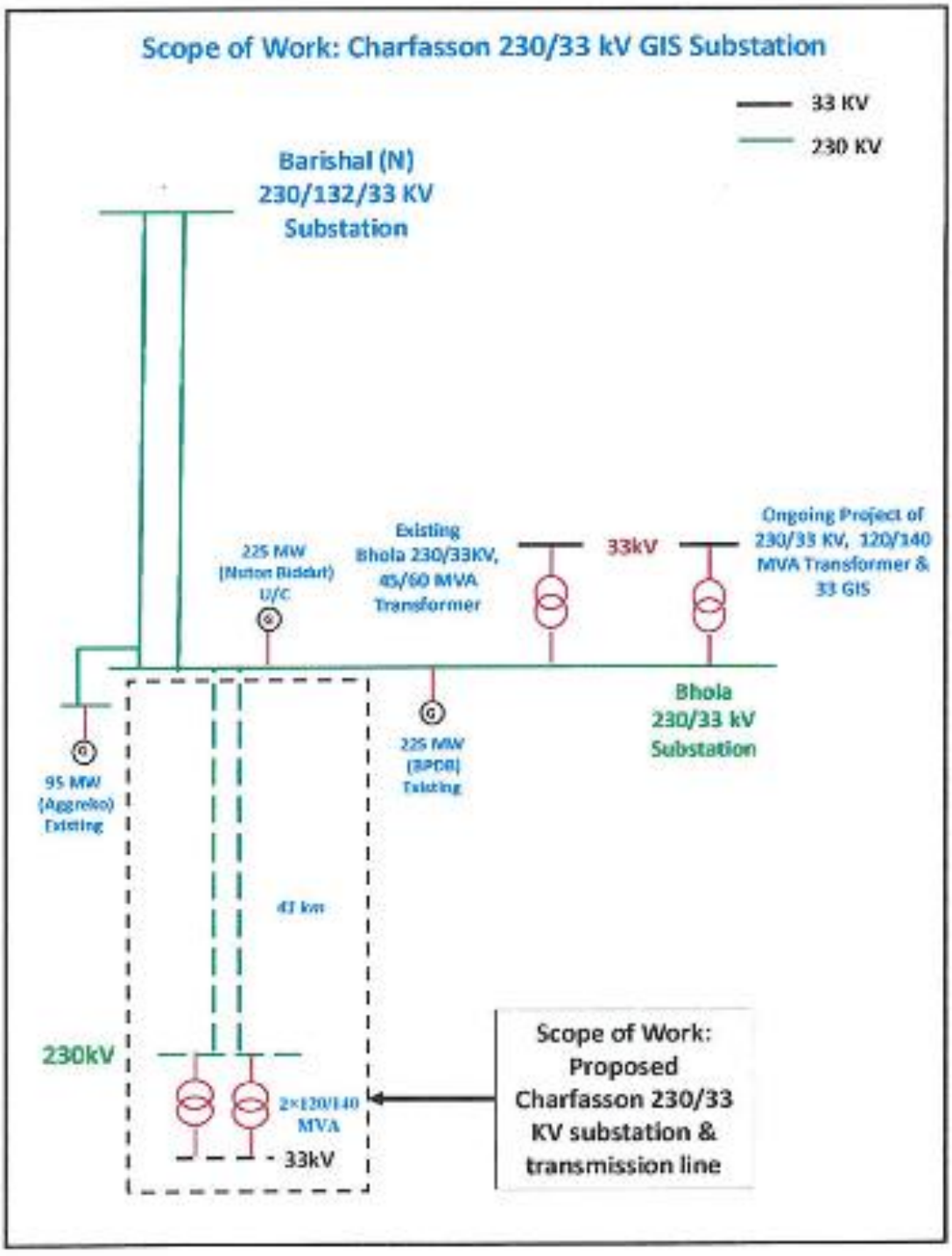
শর্তাবলী ঃ

১. প্রকল্প/কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরণ করতে হবে।
২. পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহণ করতে হবে।
৩. কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে।
৪. উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরি নির্গমন ব্যবস্থা থাকতে হবে।
৫. বায়ু ও শব্দদূষণ করা যাবে না।
৬. কারখানা/প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লিখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কর্তৃপক্ষ কর্তৃক কারখানা/প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

তারিখ ঃ স্থানীয় কর্তৃপক্ষের স্বাক্ষর ও সীল ঃ

Annex 20. Layout Plan for the Substation



Annex 21. Clearance to Obstacles

Source: (PGCB, 2016)

APPENDIX 6.A2

CLEARANCE TO OBSTACLES

The minimum clearances defined below shall not be infringed at the specified maximum conductor temperature with the phase conductors and suspension insulators hanging vertically or deflected to any angle upto 70° from the vertical.

Nominal system voltage	(kV)	230
Maximum conductor temperature	(°C)	80

Description of Clearance		Minimum Clearance
Ground (see note d)	(m)	8.0
Roads	(m)	**9.0**
Buildings, structures, walls or other objects on which a person can stand or against which he can lean a ladder (see note b)	(m)	7.0
Trees (see note c)	(m)	5.5
Shrubs	(m)	5.5
Railways (measured from railway track)	(m)	**10.0**
River Crossing	(m)	25.0

Notes:

(a) Clearances are measured to the nearest projection of an object.

(b) These clearances also apply to earthed metalclad buildings.

(c) Clearances applicable to trees under the transmission line and to trees adjacent to the line. Clearances also applicable to trees falling, towards the line with conductors hanging in a vertical plane.

(d) The clearence shall be measured from the highest flood level.

Annex 22. Fire Management and Explosion Prevention Plan

1. Purpose

The action plan is for use in the event of a fire incident, if any at the proposed project. The primary objectives of plan are to save lives, prevent injuries and eliminate or minimize damage to property during the construction new substation and the transmission line.

2. Responsibilities

Phases	Staff	Responsibility	Monitoring Frequency
Construction Phase	Project Director	Overall responsibility	Weekly and monthly
	Fire Marshal Contractor/ Employees	Responsible for implementation and monitoring Compliance with PD's/PGCB's directions as per tender documents	Daily (During work)
Operation Phase	Executive Engineer/Asst. Engineer / Sub-Asst.Engineer	Overall responsibility during operation phase for substations and transmission lines	Schedule routine as per PGCB policy

3. General Principle of Fire-Fighting

(a) The safeguarding of life and safety of personnel shall take precedence overall other considerations when determining the actions to be taken in case of fire;

(b) The key to successful firefighting is to take action quickly to suppress, extinguish, or control the fire before it can become established or spread further;

(c) A fire requires three elements in order to start and to be sustained

- Heat
- Oxygen (Air)
- Fuel

These elements form the triangle of fire. If any one of these elements is removed the fire will be extinguished.

(d) All firefighting efforts should be based on the triangle of fire and should aim at eliminating one or more of the three essential elements.

4. Fire Prevention, Preparedness and Planning

1) The project personnel must be prepared to respond to a fire at all times regardless of operating status:

(a) The Contractor shall ensure that all fire-fighting equipment is maintained in a constant state of readiness and is available to personnel

(b) It is the responsibility of the contractor and every supervisor to ensure that the employees under their supervision know how exit the project activity in a fire emergency. An ordinary evacuation depends on both adequate warning and employee awareness of the proper procedures. State of readiness by conducting weekly fire drills

(c) The Contractor shall establish an emergency organization consisting of a selected number of employees, organized and trained, to deal effectively with fires, explosions, and similar occurrences

(d) The Contractor shall ensure that procedures and check lists are maintained and kept current for after-hours notification of key personnel when the facility is operating at less than normal complement or shutdown

(e) Proposed change in facility layout, materials, operation and construction shall be reviewed by unit safety and fire prevent personnel as early in the planning stage as possible to establish necessary fire prevention and control measures

2) The fire marshal shall inspect the project activity daily to ensure that all fire- fighting equipment is in place and available for use, as well as to identify any potential fire hazards

(a) Emergency exits and roots leading to them shall be clearly identified by signs

(b) Current standard on construction, dimensions, lighting and number of exits required by safety codes shall apply in designating exits

3) A program of fire-fight training shall be established by the fire marshal under the direction of the Contractor. This program shall ensure that all personnel are familiar with:

(a) The fire-fighting equipment at the project site

(b) Fire- fighting techniques

(c) The fire emergency preparedness plan.

4) The project fire-fighting plan shall be posted at various strategic locations throughout the project areas, including in the control room. This plan shall include a floor plan drawn to indicate the emergency exits, the procedure for sounding an alarm and evacuation instructions

5) If possible, the safety committee shall arrange for key emergency instruction and telephone numbers from plan to be highlight in the project's internal directory

6) A set of master keys providing access to all doors will be maintained in a special fire locker within the control room

7) Interface with local fire department

(a) Contractor/PGCB management through the fire marshal, shall establish an interface with local fire department and shall establish an action plan for action plan for use in case the local fire department is called to respond to emergency

(b) The action plan shall:

(c) Establish a protocol for responding to an emergency call from the project site

(d) Define the types of firefighting equipment to be used at the project site

(e) Ensure that the fire department has access to the facility

(f) Determine who will be in overall command of fire-fighting efforts.

(g) Clearly establish actions to be taken by the fire department in response to different types of fire and different types of fire and different sections for example, oil storage tank fires, electricity fires and lubricant store fire etc.

8) The fire marshal shall ask the fire department to become familiar with the project and to participate in firefighting training conducted at the project sites including substation and transmission sensitive areas especially reserve forest.

9) The Contractor shall also ensure that the fire department can connect directly to the project site fire-fighting system without on the spot modifications.

10) Special fire-fighting procedures are to be posted at fixed firefighting operating stations such as the control room CO_2 flooding station, the separator room and so on.

11) Training

(a) Fire awareness training shall be given to all project personnel as a part of new employee orientation;

(b) Fire- fighting training and qualification examinations will be given to all project operating staff and to maintenance staff. Selected personnel will be required to attend advanced fire-fighting course;

(c) Specialized training shall be provided to persons with responsibilities for maintenance of fire- fighting equipment, related systems and supplies;

(d) The fire marshal must attend advance fire-fighting course and demonstrate a complete understanding of the project procedures and fire- fighting system;

(e) The fire marshal shall coordinate with the local fire department and shall arrange for joint fire- fighting training at the project site.

12) Fire Drills

(a) Each location shall establish an evacuation procedure to be followed in fire drills and emergencies

(b) Each location shall have an alarm system or other suitable means to alert the occupants to the need for evacuation

(c) The Contractor shall conduct weekly fire drills to:

- Demonstrate the operational readiness or fire-fighting equipment;

- During each drill, the fire pump and at least one fire hose should be operated for a minimum of ten minutes;
- The fire hose used in weekly drill should be rotated.

Personnel Response to a fire alarm (Drill or emergency)

- Take whatever immediate steps are necessary and feasible to minimize any hazard in leaving the working area unattended.
- Do not use elevators for evacuation purposes.
- Do not reenter facilities until the "All clear" signal sounds or clear verbal instructions to reenter are given by responsible authority.

Supervisor Response to a fire alarm (Drill or emergency)

- Direct the evacuation of your area and account for personnel.
- Advice the responding authority of the situation and warn of potentially hazardous conditions.

If a fire Occurs

- In all cases, immediately raise the alarm by operating local fire alarm buttons
- Assess the situation to determine if the fire can be extinguished easily. If so attempt to fight the fire using available equipment
- If the fire is large or has the potential to become large:
  - (i) If possible, isolate the air supply and/or the fuel supply to the fire. This may include shutting down vent fans, closing ventilators and closing fuel supply valves;
  - (ii) Stop any operating equipment. Shut down engines adjacent to the fire;
  - (iii) Bear in mind that shutting down the project activity completely will cause a black out and may make fire-fighting difficult;
  - (iv) Attack the fire using the appropriate equipment. Be aware of potential electrical shock hazards when using water to fight a fire

13) In all cases, the shift supervisor shall initiate a call to the local fire department and notify others according to the fire emergency notification and response lists in attachment.

14) If the fire is too large or cannot be readily extinguished by actions of one person, a firefighting team should be assembled under the direction of the person designated to be in charge. Based on the individual circumstances the approach will be some appropriate combination and sequence of the following:

(a) Contain the fire. Use hoses or the means to restrict the fire to as small an area as is practically possible. If necessary, use boundary cooling.

(b) Isolate the fuel supply by closing all supply valves to the equipment or area.

(c) Isolate or minimize the air supply to the fire by closing vents and dampers and shutting down vent's fans.

(d) Attack the fire using appropriate means.

15) After a fire

(a) Post a fire watch for at least 30 minutes after any fire. In the case of larger fires, a longer fire watch may be necessary.

(b) The operations supervisor or maintenance supervisor shall prepare an incident report. The Contractor shall distribute copies of the incident report for any fire at the project site to the owner and to the PD, with a copy retained on file.

(c) The Contractor shall hold a debriefing to review the action taken during the fire and to emphasize "lessons learned". Any recommendations for changes in this procedure or in the project fire- fighting plan, as deemed appropriate, should be made to the safety committee.

5. Records

(a) All records are to be maintained for three years.

(b) Superseded copies of the procedure are to be retained on file for three years.

Annex 23. Waste Management Plan

All debris, spoilt materials, and other wastes shall be cleared regularly from the site and disposed at approved dump sites operated by designated waste disposal authorities. Instructions on material safety handling sheet shall be strictly adhered to and shall form the basis for the disposal of wastes related to such products. Wastes in transits shall be accompanied and tracked by waste disposal notes. The note shall contain such information as date of dispatch, description of wastes, waste quantity, container type, designated disposal site and method, consignee name, means of transport and confirmation of actual disposal time and date. Special attention will be accorded to transformers removed from the sites and also drums of transformer oil that might contain PCBs; these are to be transported to a site designated by Contractor for safe storage and subsequent testing prior to disposal Waste management audit of facilities shall be carried out in consultation, and findings shall be properly documented and followed up. Accommodation, catering services areas and work site shall maintain acceptable standard of hygiene and good house-keeping.

Solid waste is generated during the time of making Transmission line. The steel rod and angle is cut with proper design and measured its total exert length from the catalog of exported raw materials. These exported raw materials are very costly, so care is taken during the cutting of measurement of making pole cage. So that, rod or solid wastes not form during the making of Transmission line. However, wood boxes (exported raw materials box), paper, silica dust is formed during the operation.

- Poorly disposed waste wood boxes, waste paper & especially silica dust can block drainage;
- Empty chemical drums & containers if not disposed properly can pollute soil & water of the receiving environment;
- Odor emanating from degradable waste especially kitchen (office and residential) waste can pollute local ambient air;
- Poorly managed and disposed kitchen waste can attract dieses vectors;
- Decomposing kitchen waste can pollute local ambient condition;
- Poorly managed electrical, mechanical, and chemical wastes can pollute soil, water, and air.

Solid wastes need proper handling, transportation, and disposal. Disposal of solid wastes should be of the sanitary land filling type among others, which does not pose hazards to ground water pollution in any case. Containers (box) containing rod which is the main component of possibly harmful nature may be sold to DoE approved vendors or after proper washing should be disposed of in an environment friendly manner. The following mitigation options are generally recommending for solid waste management

- Solid waste to be handled, managed and disposed according to the waste management regulations;
- Waste handling bins to be provided, each bin should have a lid which should always be covered;
- Color code to be used to distinguish waste bins of different waste;
- Waste to be sorted at source;
- All scrap metal and wood to put in a designated handling area which should be away from active areas, the area should also be marked and labeled appropriately and preferably have some form of enclosure;
- Paving of unpaved areas, regular sprinkling of water on dusty areas and regular sweeping of fine particles from paved areas can address the issue of dust and fine particles emanating from paved and unpaved areas within the facility;
- Daily disposal of food based waste before decomposition and production of odor;
- Plastic waste should be collected and handled separately in closed waste receptacles;
- Prompt maintenance of sewer line, appropriate location of soakage pits away from boreholes will avoid contamination of ground water resources.
- There should be no scattering of waste during transportation to disposal site.

Figure 14-1: Solid Waste Management Plan

Contractor should have sufficient numbers of cleaners who regularly cleans and collects solid wastes generated in the complex. Sufficient numbers of dustbins will put in place at the TL site. In case of electro mechanical waste the amount is very negligible and will collect and stored in store room.

Figure 14-2: 3R Policy of waste Management

Raw materials are coming from abroad. The steel, angle, wires from coil are cutting as a desire length. The wire will be used to make Transmission line with desire height at the selected locations.

Annex 24. Traffic Management Plan

Traffic management is the management of pedestrian, vehicles, and machinery in the areas surrounding the project's TL and SS sites. The EIA has identified the need for having traffic management plan in view of the increased traffic the project will generate and the sensitivity of the project's location in an area where there is heavy pedestrian movement. By implementing the guidelines provided in this Traffic and Transport Management Plan it is expected to mitigate the impacts to residents by the addition of vehicle movements created by the Project.

The traffic management plan for the existing project will deal primarily with the vehicles carrying TL materials, spoils, and other vehicles, transporting persons to and from the TL project site and other work places and other moving equipment and machinery such as Forklift

trucks, compact dumpers and mobile cranes, etc. with a view to avoiding any accidents, congestion and public inconvenience.

The plan will comply with the requirements of Bangladeshi traffic laws and legislation; regulations stipulated by traffic procedures that have been in force in the District. 2. Traffic related legal and regulatory background in Bangladesh Road Transport and Traffic Act 2012 and Traffic Act 2018 stipulates provisions for traffic and road safety in Bangladesh. This Act defines licensing authorities, mechanism for granting various classes of licenses compliance requirements, and the enforcement regime. It also provides for conditions of motor vehicles for use on a road, provision to deal with causing bodily injury or death through dangerous driving or carelessness, reckless and dangerous driving, offences and penalties, etc. Bangladesh Road Transport Authority is vested with powers to among other things, to manage public works including government infrastructure and to promote standards in the TL, through the Transport Regulation Department. One of the activities of the Department is to monitor movement of heavy vehicles to ensure compliance with axel load regulations. Bangladesh Road Transport Authority is the key department in charge of developing highways which is monitored by Roads and Bridges Department of the Ministry. Among other things the department provides guidelines for the maintenance of district and community access roads. The Local Government Act promulgated devolves responsibility for road maintenance of rural, community feeder and urban roads to district and urban authorities. One of the features need to be noted in this plan is the requirement to comply with axel loads. Axel loads limits are geared towards preventing rapid deterioration of the road infrastructure. Highway traffic management is the responsibility of the Bangladesh Traffic Police and is implemented through the respective Traffic divisions of the police offices in the Police Divisions. Police Posts have been deployed in most parts of the country. The police are empowered to stop and search. As per Bangladesh Road Transport and Traffic Act 2018, without driving license, no one can drive the vehicles in the road.

At all important road crossing (including highway), the tower shall be fitted with normal suspension and tension insulator strings depending on the type of tower, but the ground clearance at the roads under maximum temperature and in still air shall be such that even with conductor broken in adjacent span, ground clearance of the conductor from the road surfaces will not be less than specified minimum ground clearance. Crossing span will not be more than 250 meters.

Both social and environmental aspects will be considered during the construction of period so that people will not be affected by the project. In the project pathway- many khals and ponds will cross TL and special traffic mitigation measure will be considered during the crossing of khals.

In the stringing of wire, raw materials transportation to the construction wire house or project area, Traffic Law will be maintained by contractor. Among other things the department provides guidelines for the maintenance of district and community access roads. The Local Government Act promulgated devolves responsibility for road maintenance of rural, community feeder and urban roads to district and urban authorities. One of the features need to be noted in this plan is the requirement to comply with axel loads. Axel loads limits are geared towards preventing rapid deterioration of the road infrastructure. Highway traffic management is the responsibility of the Bangladesh Traffic Police and is implemented through the respective Traffic divisions of the police offices in the Police Divisions. Police Posts have been deployed in most parts of the country. The police are empowered to stop and search. If

needed, contractor will take permission from local traffic office (district and Upazila) for transportation of goods for project.

Figure: Traffic safety at TL project at the road side

The project sites will mainly cross cropland along with ponds, canals, road and trees. The main project activities are of TL Project and traffic congestion will be arisen from carrying materials and to site of the TL project.

Transportation

- – To transport labor's to the project sites
- – To transport equipment to stores and project sites

Stringing

- – Pilot wire paring by tractor
- – The use of tension stringing equipment (TSE) for stringing of conductors

1) Project Site Accessibility and its traffic congestion

The project area is situated at Bhola district crossing three Upazila named Borhanudin, Lalmohon and Char Fasson. Bhola district itself is an island, the biggest in Bangladesh. The project area is a low-lying land but flood doesn't occur here generally but sometimes occurs

mainly due to tidal surge in this area. The total length of the proposed transmission line is about 39.81 km starting from Notun Biddyut Power Plant at Borhanuddin Upazila to Char Fasson Substation.

There is no railways and airport in this district and no direct connection to the capital by road. Waterways are the main medium of transportation. Launch, steamer and ship are used for transportation. Bhola is 195 km away from Dhaka by waterways and 247 km away by road. The condition of internal travels is very good. Road transportation is available between the sub-districts.

Transportation of different construction materials will be done by the different types of vehicles of the above project. Most of the roads of the above areas are good conditions. The project of construction of transmission line is temporary or one time work. The transmission line materials will be conveyed to tower locations of the transmission line. The roads are used by villagers; those roads will be used for carrying the materials of transmission line. The minimum traffic congestion might be often due to remote areas (villages), the areas having lower amount of traffic congestion.

Appropriate safe and decent transportation mode should be used to transport workers to project sites, during the construction phase. Although it is not envisaged that large number of workers will be transported from distanced town and villages to the work site, it is imperative that if they are provided routine transport, they must be provided with transport in vehicles equipped with canopy (closed vehicles) with seating facility. No worker must be allowed or must be asked to travel in a back of a pickup, flatbed truck or a lorry which is not suited for passenger travel. This aspect had been very poor in the TL project site. In case of transporting heavy machinery, appropriate Lorries (Low bed) should be used and they should be loaded and parked on the vehicles using required safety methods.

The project may require large quantities of materials such as cement, sand, iron bar, fitting equipment during stringing, diesel engine, WM, wire, safety PPE, generator. It is desirable to locate storage and loading areas away from the areas of frequent pedestrian activity (community foot paths and agricultural land areas)

The area that has been identified for the storage of aggregates will have to be reviewed in the light of its close proximity to human activities such as agriculture, play areas and areas used by the pedestrians.

The following measures are to be followed:

a) All deliveries of stocks should be carefully planned and suppliers should be advised as to the time and location at which these will have to be delivered.
b) They should inform in advance the site stores officers the delivery of such stocks so that traffic and transportation can be properly managed.
c) The frequent presence of trucks can add to increased traffic, sound excessive noise), and smoke pollution through exhaust emission.
d) Avoid as far as possible the peak traffic hours such as school hours in order to reduce the risk of any children/traffic accident/incidents.
e) In the event that spills of aggregates occur, (TL materials) all the roads should be cleaned after the deliveries are made. The drivers should be made aware of this requirement.

f) Ensure that allowable axel weight is not exceeded when the deliveries are brought by the suppliers using the Fort portal main highway.
g) All the drivers employed by the contractor must be fully sensitized about the speed limits and the need for strict compliance to the safety rules.
h) Regular sensitizing sessions are to be carried out by the Site administration Manager and the Environment/Health & Safety Manager of Contractor.
i) In case of transporting of friable materials and spoils, adequate protection will be ensured when transporting them. All materials will be transported in closed trucks or by using tarpaulin sheets to cover materials.

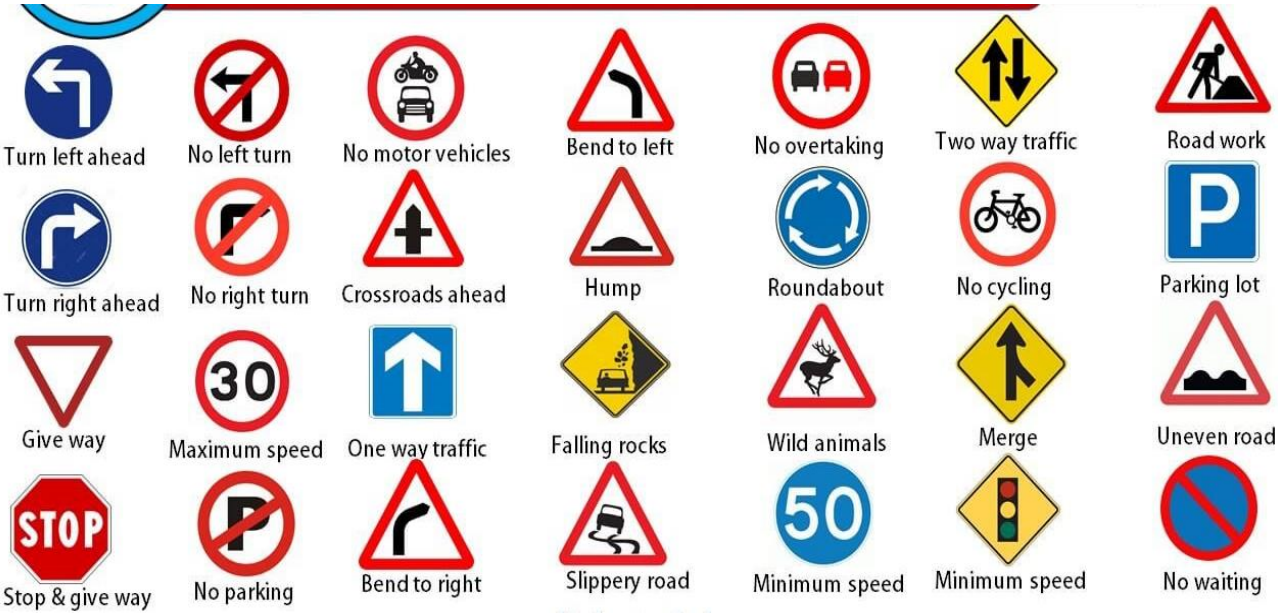
2) Operation of heavy machinery plant and vehicles

Experienced drivers should be engaged in driving all types of vehicles in the fleet. In case of machinery operators (Crane, heavy trucks, rollers, excavator operators etc.) competency for such work should be proved through accepted permits licenses. A copy of the license or driving permit or a permit to handle heavy duty equipment should be retained by the site manager of **Contractor**. All equipment operators should possess valid permits issued by the traffic authorities or traffic police. The vehicle and machinery used for the construction TL purposes of the site should be inspected regularly by the Site Transport Manager of **Contractor** employed for regular servicing, safety of Tires, repairs oil and hydraulic vacuum. Stickers of different colors may be introduced to recognize the vehicles and machinery used by contractors and sub-contractors.

The Transport Manager of **Contractor** should also:

- Ensure that all the drivers comply with traffic and transport guideline disciplines;
- Ensure that vehicle parking space is provided away from the towns carrying stocks.
- Ensure that the vehicles carrying stocks and TL materials roads
- Ensure that vehicle road worthiness certificates are received for all in the site,
- Ensure that all the vehicles have updated insurance coverage.

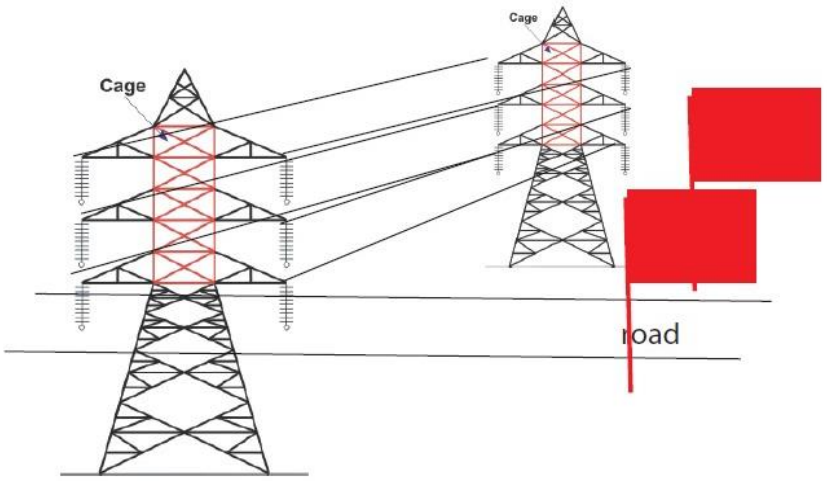
Make sure that warning devices are fitted to the vehicles and machine when maneuvering in public roads and the work sites. Flashing orange lights should be mounted on all the vehicles and equipment Heavy duty machinery should be fitted with reversing alarms or in the absence should have a banks-man to guide the driver/operator. Signaler should be engaged enabling the operators to safely operate their machinery. Ensure that drivers and signalers are in constant communication during operations of heavy machinery.



Traffic accessioning at the TL site

3) Public Awareness

The Contractor shall undertake to increase the level of public awareness prior to commencement of the works to advise all road users of the impending TL work, the time taken for such work, and the road conditions likely to be encountered. Since there are several educational institutions located along the main access roads of the work sites, the awareness should be specially targeted to school children. Public awareness meetings need to be conducted in regular intervals enabling the community members in the area to be well aware of the specific TL related activities and how they will be affected to the routine pedestrian activity and the normal traffic of the area. It is also important that regular visits are made to the schools in the area and inform the children as well as the teachers about the impending work and solicit their assistance in implementing Traffic Plan. Provide necessary assistance to the schools in developing a cadre of signalers from the school children and ensure that signage in front of schools is repaired and replaced when they become distorted or faded.



Traffic safety along the road

In addition, this campaign should be broad enough to reach the general motoring public and will consist of a combination of the following options:

a) Erecting advance advisory signage in the form of black and yellow temporary sign erected on the approaches to the work site 10 days prior to commencement of works indicating the type of work to be undertaken, and the time and date of the works.
b) Place notices in the local project office, the high officials about the TL construction schedule and the possible vehicle movements.
c) Install message signs (sign posting) to warn possible traffic congestion at work area. This can be done by referring to the TL construction schedule. For example, there will be delineation required when the areas very close to the main road will be excavated for installing of penstock pipes.
d) Liaise with emergency services (Police, Fire Brigades, and other emergency services) regarding impending road closures and TL construction.
e) Obtain the services of the Traffic Police to improve driver awareness and training before the drivers are engaged in TL construction work.
f) On completion of the awareness and training, the contractor should arrange issuance of a workplace identity card to the respective drivers. Before issuing the ID, the Transport Manager should obtain a copy of the ID Details and the details of the driving permit, record same in a register for future reference. Also, other such times will be identified through public consultation and during this periods truck traffic will be restricted.
g) Discussions to be held with community leaders to identify measures to ensure safety for pedestrians, including school children that use the road as a walkway. Public and truck drivers will be advised regarding the road safety requirements.
h) All the Drivers employed by the contractor to be fully sensitized about the speed limits and the need for strict compliance to the safety rules. The Transport Manager should have a record of how many drivers have attended the sensitization programs and when did they take part last in such sessions.
i) Regular sensitizing sessions are carried out by the Site Transport/Administration Manager and the Environment/Health & Safety Manager whenever new drivers/contractors will be engaged into the work site. There should be leaflet (prepared in English/local languages) to sensitize about the key compliances for the benefit of the drivers who will transport TL materials to the site. This can be given to the suppliers enabling the suppliers to circulate among the drivers.
j) Humps (using gravel and cement) to be introduced along the main community access road and where needed additional action should be taken to control traffic by engaging signalers (especially in front of schools).
k) A pre-warning road side sign board is erected before each of the hump in keeping with traffic management procedures.

Public notification at site of high voltage TL project

There is a necessity to maintain all the existing road signage and other traffic control methods adopted by the traffic police. Therefore, in consultation with the traffic police and with the EHS Manager of **Contractor**:

a) Improve or repair the road signs indicating the speed limits/signage/humps
b) All signs shall to be positioned and erected such that they:
    - Are within the drivers' line of sight
    - Cannot be obscured from view
    - Do not obscure other devices from the driver's line of sight
    - Do not become a possible hazard to workers or vehicles and
    - Do not deflect into an undesirable path.

Record Keeping

The site Health & Welfare Officer under the direction of the Site Administration Manager of **Contractor** needs to ensure that temporary signs, devices, and traffic control methods are maintained at all times. To achieve this, procedures in line with requirements outlined above will be instituted. All the traffic related issues should be recorded on a daily basis and that action should be taken to avoid any disturbances to the public immediately. When road accidents take place, strictly follow an accepted procedure to report, investigate and to address the complaints.

Procedures to follow when road accidents take place:

a) Road accident or vehicle breakdown within the project area will be attended to immediately and remedial measures taken.
b) Road works that may impact on any services requiring access the area need to clear from the area quickly as possible.
c) Project traffic controllers, supervision and foreman should be equipped with mobile communications to advice and /or liaise with emergency services to ensure a prompt response will the need arise.
d) The contractor shall, when necessary, advise the authorities (Police, Fire brigades and other emergency services) in the event an emergency during the proposed works and the traffic management arrangements.

Contractor will use most of the road of the TL project of Borhanudin, Lalmohon and Char Fasson Upazila. However, most of the roads are pucca.

Upazila Road along RoW of TL

During the above TL work, fancy temporary boundary wall will be made at the around the TL work site, so that local people cannot enter the work site due to safety issues. The red flag will be used on the TL site, so that local people can know from beforehand that some work is being done here. The local people will be alerted for civil TL work at the transmission line tower through the red flag.

Annex 25. Emergency Response Plan

The emergency situation might be initiated by a number of anthropogenic or natural events like accident, explosion, electrocution, earthquake, flood, oil spill, riots, terrorism, illegal trespassing etc. The following points should be taken into consideration for an emergency response plan.

- A leading person should be identified and appointed to be responsible for emergencies occurring on the site. He should guide an emergency response team who are clearly familiar to the employers.
- Members of the emergency response team will be recruited from different divisions and level, and they should be trained up continually.
- The regular emergency response mock drill should be arranged under different accidental scenarios.
- The on-site or vulnerable position should be equipped with First Aid Kits and safety outlet which every employee mandatory knows how to use it.
- Members of an emergency team of different divisions and level should intrude formally or informally the emergency response plan to his fellow colleagues.
- Make prior arrangements with the healthcare facilities like safe water, First Aid kits, Ambulances and driver onsite and nurses, doctors and available accommodation in nearest hospitals.

Safety and Emergency Plan

Safety plan has been developed based on safety measures identified through the hazard assessment process. During hazard assessment including occupational hazard, safety measures for each potential hazard were identified. Incorporating the identified hazard safety measures, this safety plan has been developed. The safety plan includes a fire safety plan, explosion safety plan, electrocution safety plan, medical emergency plan and hazardous material management plan. Proposed The detailed plan including safety and emergency preparedness are presented in below table.

Hazard	Safety Plan	Responsible Person	Emergency Plan	Responsible person
Fire	Fire prevention, instruction and training of staff, maintenance of escape route, fire protection system and equipment maintenance of fire safety register, provision of information to workers, reporting	Emergency Manager, Fire safety Officer	Fire alarm system, exit system, fire equipment, smoke control equipment, fire and evacuation plan, drills, assistance to the fire bridge	Fire safety Officer
Explosion	Explosion prevention, instruction and training stuff, maintenance of escape route, explosion protecting system and	Employer, owner, occupier	Explosion and emergency evacuation plans, exiting the building as quickly as possible and move to	Emergency Personnel

Hazard	Safety Plan	Responsible Person	Emergency Plan	Responsible person
	equipment, provision of information to building users, regular inspection and monitoring of pressure parts and units, reporting		designated evacuation areas, roadways and walkways should be clear for emergency vehicles and crews	
Electrocution	Prevention measures, instruction and training of staff, maintenance of escape route, proper training, awareness, control room, reporting	Supervisor, Coordinator	Prevention and precaution from and electricity and avoid contact with overhead lines	Safety Officer
Medical	Provision of health and service Centre, provision of on-duty trained medical officers, specializing in burn injury, orthopedics, chemical toxicity or poisoning and shock treatment	Medical Officer	Rescue action, first aid, ambulance services, transportation facilities	Rescue officer
Hazardous materials Management	Safe design, regular inspection, continuous monitoring, regular maintenance, reporting	Emergency manager	Internal alarm, notification, use of personal protective equipment	Hazard responding agencies

Annex 26. SOP for Oil and Chemical Handling for Substation

1. Aim and Scope

The objective of this SOP is to specify detailed rules, times and responsibilities related to the use, storage and handling of oils and chemicals within Substation installations and working areas by any third party such that the Contractor adopts the same behavior of Substation personnel when using chemical products within Substation.

The Responsible Engineer shall ensure that the Contractor has clearly understood these good practices for chemical handling and shall abide by them. PGCB shall demand that any identified breach or failure to abide to safe operating practices shall be remedied immediately.

2. Terms and Definition

SOP	Standard Operating Procedure
SDS	Safety Data Sheet
H&S	Health and Safety
HSE	Health Safety and Environment
PPE	Personal Protective Equipment
COMAH	Control of Major Accident Hazard
HFO	Heavy Fuel Oil
EWC	European Waste Catalogue
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals

3. Responsibilities

Responsible Person

- PGCB personnel responsible for the task assigned to the Contractor
- Coordinates with Contractor and ensures that the Contractor is working in accordance with this SOP
- Provides the SDS to the Chemist

Contractor

- Ensures that personnel assigned to handle and transport chemicals are properly trained and equipped to handle chemicals safely, and prepared to contain and clean accidental spills
- Ensures that chemicals are labelled and placed in designated location according to this SOP
- Provides Safety Data Sheet of the chemicals to be used to the responsible person

Contactor Personnel (CP)

- Carry out handling of chemicals from one location to another
- Responsible to place chemicals on site, under the supervision of the Contractor

Chemist

- Reviews the SDSs provided by the Responsible Person and informs the HSE Responsible Officer about the chemicals which the Contractor will use.

HSE Responsible Officer

- Responsible for regular checks required in the implementation of this SOP
- Responsible for the site inspection of chemicals being used by the Contractor and his personnel and ensuring that their corresponding SDSs are in place

4. Operative Rules

The Responsible Person from PGCB is to ensure that the pertaining sections of these procedures are followed when handling chemicals. This procedure also defines the training requirements, handling methods and precautions to be taken during transportation of chemicals from one site to another, in order to minimize any hazards these chemicals might pose to human beings as well as to the environment.

4.1 Chemicals handling planning

- The person planning the transfer of chemicals must be informed of quantities to be transferred, the type of packaging and the scheduled locations when assessing the methods and means necessary for the handling.
- The person in charge of the transfer and/or handling of chemicals must:
  - CLEARLY identify the chemical and be aware of the hazards involved.
  - Consult Safety Data Sheet or seek expert advice when in doubt.
  - Ensure that the chemicals being sanctioned for transfer are stored and stacked in a correct and safe manner as detailed in the subsequent clauses of this SOP to avoid accidental spills and possible injuries.
- The Contractor must provide his personnel with the Personal Protective Equipment (PPE), adequate means of transportation and spill control materials.

4.2 General safety requirements

When a hazardous chemical is handled, the following recommendations should be observed:

- Where necessary, the contractor must supply PGCB with a risk assessment and a safe work method statement for all tasks / works prior commencement of works.
- The Contractor must ensure that his personnel are trained in chemical handling and spill management.
- The Contractor must ensure that adequate manpower is assigned to the task in order to carry out the job safely.
- The Contractor has to ensure that the competent personnel are provided with the appropriate PPE.
- The Contractor must be equipped with appropriate means to be able to move the chemicals around such as fork lifters and trailers, avoiding spills during transportation. These means of transportation could be provided by PGCB/ Contractors, depending on the contract details.
- Adequate materials should be readily available for spill management and the action to be taken in case of Oil and/or Chemical Spills should include:

- Use of appropriate PPE
- Ensure that the necessary spill kit material is handy and used
- Isolate source
- Inform responsible person so he can inform the required personnel so that the spill can be contained with minor consequences.
- Contain spill as far as possible, especially if it can go into the road or drains
- Inform the responsible person if the spill is in the road and can cause a hazard to traffic such that he can place warning signs and advice Police to assist controlling traffic, if necessary
- Recover spill using suitable means:
  (i) Bucket & shovel / dustpan work well on smooth floors
  (ii) Absorbent pads which can each absorb (approx) 1 litre
  (iii) Sand or other oil absorbing particulates
- Recovered chemical and absorbent material is to be dealt with as “hazardous waste”.

4.3 Chemicals Usage

When using chemicals on Substation premises, the Contractor has to ensure that the following rules/recommendations apply:

- Wherever possible, chemicals and their compounds used shall be free from Mercury, Chromium and Zinc (refer to IPPC permits).
- Use CFC and HCFC-free sprays and products.
- Chemicals used must be REACH registered in compliance with PGCB standards
- All chemicals used are to be accompanied by the “Safety Data Sheet (SDS)”.
- Wherever possible, the use of toxic and very toxic substances as well as carcinogenic substances shall be avoided.
- Preference should be given to products with less dangerous characteristics
- The Contractor should ensure that any chemicals used within PGCB premises are not stored in a damaged container/drum and that they are labelled properly.

4.4 Labelling and identifying chemicals

The Contractor should ensure that:

- All bunded areas and basins, vessels, drums or cans and pipelines containing hazardous chemicals shall be properly labelled. The label/s shall not be removed and should be replaced if damaged or faded.

- In case the container or packaging needs to be changed or substances are to be transferred to a smaller container for safer handling, the Contractor must fix a label to the new container. It must be ensured that the label is firmly affixed to the container or alternatively, the name of the hazardous chemical, as indicated in the original label, is to be clearly written directly onto the new container. Apart from the chemical name, the common name of the chemical is also to be written on the container to ensure that the container's content is easily understood by the personnel who will be using it. Moreover, each container should depict pictograms to indicate constituent chemical properties.
- When reusing a container, it must be ensured that the original label on the old container is removed to eliminate any possibility of incorrect use of the chemical.
- When identifying containers, cans, etc. of chemicals, it must be ensured that a permanent marker is used and text is written clearly (preferably in block letters) and in an adequate font size to allow for easy identification.

4.5 Handling chemicals

All Contractor personnel handling chemicals should adhere to the following rules and recommendations:

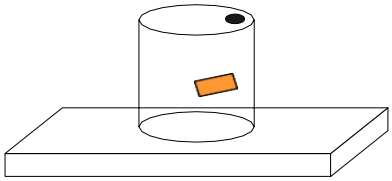
- Handler/end user should be trained in chemical handling prior any handling
- Use of PPE is mandatory
- The specific SDS of the chemicals are always to be consulted prior to the handling of a chemical
- Mixing or pouring of chemicals should be performed on waterproof surfaces to prevent soil contamination
- Handling of hazardous chemicals (transportation, change of containers, etc.) should always be kept to a minimum
- Chemical containers are not to be left open and are always to be kept closed when not in use
- Mixing of hazardous chemicals should be avoided since mixing of incompatible chemicals can induce emissions of toxic gases and other dangerous reactions
- The right amount of product is to be used (check product instructions to dilute chemicals)
- Hazardous chemicals are never to be left unattended

4.6 Storage of chemicals

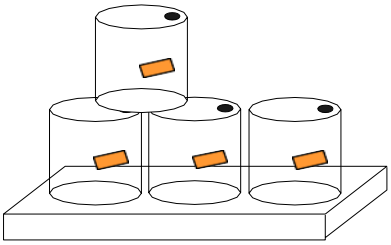
If any chemicals are to be stored on Substation premises for the duration of works, the Contractor must ensure that the following rules are put into practice:

- It should be verified that all legal limits related to chemical storage are being met (e.g.: maximum quantities declared in the safety report submitted to the COMAH Competent Authority).
- Storage areas for the chemicals are to be defined.
- All dangerous chemicals must be located in the appropriate storage area unless currently in use.
- Storage areas should always be bunded and covered to avoid leaching of pollutants through rainwater.
- The capacity of the chemical storage basin or containment should always be the greater of the following two options:
  - Either 110% of the capacity of the largest container in the bunded area (CASE 1 or CASE 2);
  - Or 25% of the total volume of chemical containers in the bunded area (CASE 3)

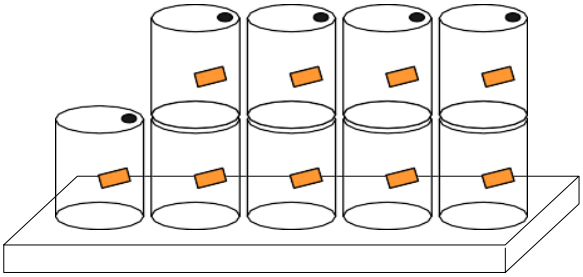
CASE 1: The capacity of the containment basin should be equal to 110% of the total capacity of the container.



CASE 2: The capacity of the containing basin should be equal to 110% of one of the four containers.



CASE 3: The capacity of the containing basin should be 25% of the total volume of the drums.



- Any spill occurring within the bunded storage area shall be isolated from the drainage and sewage systems. Resulting waste will be disposed of as hazardous waste.

Waste Management Procedure for Contractors:

- It must be ensured that the capacity and characteristics of storage areas, shelves and any other device used to store chemicals are adequate for the specific operation.
- Good housekeeping must be ensured in storage areas
- Chemicals cannot be stored and/or located in areas such as passageways, vehicles, and so on.
- It must be ensured that incompatible chemicals are segregated within the storage areas.
- Storage areas for explosives shall be designed in such a way as to prevent hits, falls or any other potential cause of explosion and to protect the surroundings against explosions.
- Chemicals should ideally not be stored under direct sunlight, in warm areas or near heat sources.
- When storing chemicals, the label and SDS are to be consulted for correct storage of each substance.
- Certain chemicals or substances have to be stored in well ventilated areas or at a specific humidity and temperature.
- It must be ensured that all containers such as drums and their lids are in good condition, are safe to use and there is no possibility for spills or leakages.

4.7 Control and monitoring activities

The Contractor has the responsibility to:

- Check periodically for correct identification, handling, use and storage of process chemicals at point-of-use;
- Check periodically that all waterproof areas where chemicals are located are in good condition and that there are no surface irregularities or cracks. This is especially important for storage of large containers;
- Check periodically for spills and leaks;
- Check periodically on the correct use of products by his personnel and give adequate training if deemed necessary.
- Visual checks shall suffice.

4.8Abnormal conditions and emergency situations

In case of an accident or emergency such as spills, dangerous chemical reactions, etc, the Contractor shall ensure that the following recommendations are followed:

- Necessary safety protection devices (gloves, glasses, etc.) are to be worn
- The hazardous chemical causing the problem is to be identified
- If the level of risk is acceptable, all valves are to be isolated and taps turned off in order to stop the spill from spreading further out in the accident area as well as to contain the spill as much as possible and stop it from reaching unprotected areas, such as areas which are not waterproof, sewage discharges, etc;
- The PGCB Responsible Person is to be informed so as to intervene;
- The accident area is to be cordoned off;
- Given that the danger level is acceptable, appropriate materials are to be used to clean up the spill. Rags, sawdust or other combustible materials are not to be used to collect combustible agents or flammable chemicals;
- Access to the area is only to be allowed when the spill has been contained, cleaned and the area is risk free.
- In case of damage to a container, this is to be replaced and it must be ensured that the container is clearly and correctly identifiable and disposed of in the appropriate manner.
- Proper absorbent materials should always be readily available for use close to all chemical storage and handling areas.

Annex 27. EMF Management Plan for Transmission Line

Electric and magnetic fields (EMF) are invisible lines of force emitted by and surrounding any electrical de- vice (e.g., power lines and electrical equipment). Electric fields are produced by voltage and increase in strength as the voltage increases. Electric field strength is measured in volts per meter (V/m). Magnetic fields result from the flow of electric current and increase in strength as the current increases. Magnetic fields are measured in units of gauss (G) or tesla (T), where 1T equals 10,000G. Electric fields are shielded by materials that conduct electricity, and other materials, such as trees and building materials. Magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields decrease rapidly with distance. Power frequency EMF typically has a frequency in the range of 50 - 60 Hertz (Hz), and is considered Extremely Low Frequency (ELF). Although there is public and scientific concern over the potential health effects associated with exposure to EMF (not only high voltage power lines and substations, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment. However, while the

evidence of adverse health risks is weak, it is still sufficient to warrant limited concern. Recommendations applicable to the management of EMF exposures include:· Evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure. Considering siting new facilities so as to avoid or minimize exposure to the public. Installation of transmission lines or other high volta e equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, should be avoided. If EMF levels are confirmed or expected to be above the recommended exposure limits, application of en-gineering techniques should be considered to reduce the EMF produced by power lines, substations, or transformers. Examples of these techniques include:

- Shielding with specific metal alloys
- Increasing height of transmission towers
- Modifications to size, spacing, and configuration of conductors

Post Construction

During the Post-construction phase PGCB should monitor the EMF around the substations and under the Distribution/Transmission lines on a regular basis. Construct ion of residential buildings and/or small households should only be allowed ensuring the safe distance as specified in the Code.

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

- Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities; A 1994 study estimated the average exposure of electrical workers (including jobs in electric utilities and other industries) in Los Angeles, California to be 9.6 milligauss (mG), compared to 1.7 mG for workers in other fields (S. J. London et al., 1994). 35 Although detailed studies of workplace exposure to EMF in the United States, Canada, France, England, and several Northern European countries have found no conclusive link or correlation between typical occupational EMF exposure and adverse health effects, some studies have identified a possible association between occupational exposure to EMF and cancer, such as brain cancer (U.S. National Institute of Environmental Health Sciences 2002) indicating there is evidence to warrant limited concern.
- Training of workers in the identification of occupational EMF levels and hazards;
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
- Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP),

Annex 28. Tree Plantation and Replacement Programme

Objectives:

The objective of the Tree Plantation and Replacement Programme is to compensate for the loss of trees due to the proposed project on the Notun Biddyut PP-Char Fasson 230 KV double circuit Transmission Line Project and Char Fasson substation. Other major objectives of the programme are to protect the affected cultural and sensitive areas (within 20 m from the RoW boundary), and to enhance the health of the ecosystem.

Scope:

During pre-construction and construction, 1,797 trees (of varying sizes) will be cut along the Project alignment, among them 1,055 timber trees, 616 fruit trees, 42 medicinal trees; and 84 bamboo trees. The proposed tree plantation and replacement programme (TPRP) will plant at least three times the number of removed trees. These trees are calculated on both sides of the proposed new alignment, around the substation areas, and substation access road areas (associated facilities). Therefore, a total of (1,797×3) 5,391 new trees will be planted during the construction and post-construction stages of the Project.

Tree Plantation Sites in the Project Areas

- Along the both sides of RoW of the constructed new transmission line where suitable places are available
- Constructed new substations premises:
- Along the affected cultural and sensitive areas (within 20 m from the RoW boundary).
- Seedlings will be distributed among the community people, where lands are insufficient.

1) Selection of Tree Species

In consultation with senior ecologist and local communities, the species for the proposed tree replacement have been selected, based on lost vegetation statistics and suitability for the intended purpose. The main considerations for species selection for the Project is to protect the substation embankment from erosion, preserve habitats for biotic species, minimise visual impacts, improve aesthetics, conserve ecological environments, and create commercial benefits. Agreement from PGCB and local communities will determine the species to be planted. Accordingly, the list of tree species proposed to be planted is as Table 14-1.

Table 14-1: List of Proposed Tree Species

Sl.	Local Name	Scientific Name	Sl.	Local Name	Scientific Name
Timber			**Ornamental**		
1	Gamar	*Gmelia arborea*	1	Jau	*Casuarina littoralis*
2	Mehegoni	*Swietenia mahagoni*	2	Sonalu	*Cassia fistula*
3	Chikrasi	*Chickrasia tabularis*	3	Jarul	*Lagerstoemia speciosa*
4	Telsur	*Hopea odorata*	4	Kisnochura	*Delonix regia*
5	Garjan	*Dipterrocarpus terbinatus*	5	Radhachura	*Peltophorum pterocarpum*
6	Kat badam	*Terminalia calappa*	6	Polash	*Butea monosperma*
7	Shegun	*Tectona grandis*	7	Kodom	*Anthocephalus kadamba*
8	Epil-epil	*Leucaena leucocephala*	8	Bokul	*Mimusops elengi*
9	Rain tree	*Samania saman*	9	kanchon	*Bauhinia purpurea*
Medicinal			10	Mahua	*Madhuca indica*
1	Horitoki	*Terminallia cebula*	11	Sarnachapa	*Michelia champaca*
2	Arjun	*Terminalia arjuna*	12	Naghesor	*Mesua nagassarium*
3	Ashok	*Saraca indica*	**Fruit**		
4	Chalmugra	*Hydnocarpus kurzii*	1	Kalojam	*Syzyzum cumini*
5	Neem	*Azadirachta indica*	2	Bilimbi	*Averrhoa bilimbi*
6	Ulatkambal	*Abroma augusta*	3	Jalpai	*Elaeocarpus robustus*
7	Shimul	*Bombax ceiba*	4	Latkon	*Baccaura ramiflora*
8	Amloki	*Phyllanthus emblica*	5	Tetul	*Tamirindus indica*
9	Bohera	*Terminalia bellirica*	6	Dewoa	*Artocarpus lacucha*
Palm					
1	Narikel	*Cocos nucifera*			
2	Supari	*Areca catechu*			
3	Tal	*Borassus flabellifer*			
4	Khajur	*Phoenix sylvestris*			

2) Guidelines of Tree Replacement

In Bangladesh, the Forest Department generally recommends the plantation of a minimum two trees for each tree felled in any development project. However, in consultation with PGCB, the Consultant recommends the plantation of three saplings for each tree felled.

Under the proposed tree replacement programme:

- Timber tree species will cover 50% of the total area.
- Fruit tree species will cover 30% of the total area.
- Medicinal tree species will cover 10% of the total area.
- Fuel tree species will cover 10% of the total area.

3) Implementation Agreement

The Forest Department (FD) is generally responsible for plantation of all government owned sites. In Bangladesh, the Forest Department typically performs the task by themselves. However, the FD will be encouraged to involve PGCB and the PAPs, especially the vulnerable, poor, and women, in the plant replacement programme. The Forest Department will provide all technical and other support in planning and developing the plantations. However, the implementation arrangement for the Project is distinct from other tree replacement programmes in country, and was agreed to in consultation with ADB, PGCB, and the Consultant. It was decided that PGCB will be responsible for the successful implementation of the tree plantation and replacement programme without involving PAPs and FD.

The tasks of the PGCB are as follows:

- Training of the local PGCB staff on tree maintenance;
- Preparation of the tree replacement programme in accordance with this plan, and approval by the Forest Department, if necessary;
- Coordination of sapling procurement process of approved species prescribed above; and
- Supervision of nurseries for raising saplings.

4) Responsibility

The contractor will be responsible for planting trees throughout the transmission line and substation area, and other areas as prescribed above. The contractor will procure and raise saplings until they survive for at least one years from the date of planting, and can establish nurseries in consultation with PGCB and the Engineer early in the Project. This period may be reviewed and modified by the Engineer at the Contractor's request. Alternatively, the contractor can purchase saplings from the local nursery. The Environmental Officer of PGCB will be responsible for overall coordination with the FD, PAPs, and impoverished or disadvantaged women (if necessary), as well as supervision of the tree replacement programme. It is recommended that PGCB start a dialogue with the FD during pre-construction, if required, so that nurseries can be established early on.

Programme

The Contractor shall prepare and submit to the Engineer of PGCB, a final Tree Plantation and Replacement Programme in close compliance with the plan presented in the RAP and IEE, for approval, provided that all trees planting is completed at least one year prior to the time for completion of the works. The species to be planted will be based on consultation with local residents, the Forest Department and PGCB's maintenance units.

Sources

The Contractor may establish plant nurseries or purchase saplings from an established commercial organization.

Provision of Training

The Contractor shall prepare a programme to provide training for PGCB maintenance staff, to be submitted to the Engineer of PGCB for approval.

The content of the training programme shall include but not be limited to the following;

- Selection of suitable species;
- Plant procurement;
- Quality of plants selected;
- Preparation of planting area;
- Planting and establishment including selection of fertilizers;
- Irrigation requirements and methods;
- Tree maintenance;
- Preparation of the tree replacement programme in accordance with requirements of the Forest Department;
- Procedure for seeking approval from Forest Department for tree replacement programme;
- Coordination of sapling procurement process of approved species prescribed above; and
- Establishment and supervision of nurseries for raising saplings if necessary.

Cooperation with Local Communities

The Contractor is strongly encouraged to engage workers from the local communities to assist with implementation of this specification and to participate in the selection of species to be planted.

The Engineer and the Employer can assist the Contractor with this cooperative effort.

Cooperation with Forest Department

Notwithstanding anything else contained in this Specification, the Contractor shall ensure that advice is sought from the Forest Department at all stages of this tree replacement programme, to ensure continuity of maintenance and compliance with Forest Department requirements.

5) Budget and Payment Method

The budget for the proposed tree replacement programme is provided in Table 2. The budget also includes maintenance for one year from the date of plantation, to ensure that all planted saplings will survive, and provision for an additional plantation is available. The budget also includes procurement and development of all facilities required to establish a nursery, such as collection of suitable soils, decomposing cow dung, and procurement of fertilizers. The budget also includes measures required for maintenance of the plantation, such as watering, weeding, fertilizer application, and replacement of dead saplings (if any), for the first year after planting. The proposed values of trees of the Project are presented in Table 2. The estimated amount for afforestation is Tk 10,78,200 (approx. USD 12,685).

Table 2: Estimated Cost and Trees for Afforestation

Tree Types		Space (Seedling to Seedling)	Total Number of Plants	Rate	Total Cost BDT
Timber	50%	2m×2m=	2,696	200	539,200
Fruits	30%	2m×2m=	1,617	200	323,400
Medicinal	10%	2m×2m=	539	200	107,800
Firewood	10%	3m×3m=	539	180	107,800
Total	100%		5,391		10,78,200

Measurement and Payment

Measurement will be based on certification by the Engineer of PGCB, of the numbers of plants which are proven to be viable one years after planting.

The rate shall include procurement of saplings, transportation to planting area, all necessary excavation and backfilling, provision of all necessary fertilisers, irrigation, pruning, maintenance and all other things necessary including replacement and removal of non-viable saplings to ensure that the saplings become fully established and self-sustaining within two years from the date of plantation

The Contractor will be paid 50% of the rate on planting and 50% after survival and having a healthy plant for 12 months. The Contractor shall replace at his cost any plant that is not healthy or has died.

Annex 29. Health and Safety Plan in response to COVID-19

Project activities under TL may give rise to a number of risks for community health and safety. The project would support the provision of health services to deter the COVID-19 outbreak through various health facilities. The project will generate both non-hazardous and hazardous waste throughout the renovation. The Infection Control and Waste Management Plan (ICWMP) will address minimizing exposure to medical waste to the community. Community awareness raising activities and preparedness will be addressed through the Stakeholder Engagement Plan (SEP).

Minimize Chance of Exposure

- Any worker showing symptoms of respiratory illness (fever + cold or cough) and has potentially been exposed to COVID-19 should be immediately removed from the site and tested for the virus at the nearest local hospital
- Close co-workers and those sharing accommodations with such a worker should also be removed from the site and tested
- Project management must identify the closest hospital that has testing facilities in place, refer workers, and pay for the test if it is not free

- Persons under investigation for COVID-19 should not return to work at the project site until cleared by test results. During this time, they should continue to be paid daily wages
- If a worker is found to have COVID-19, wages should continue to be paid during the worker's convalescence (whether at home or in a hospital)
- If project workers live at home, any worker with a family member who has a confirmed or suspected case of COVID-19 should be quarantined from the project site for 14 days, and continued to be paid daily wages, even if they have no symptoms.

Training of Staff and Precautions

Train all staff in the signs and symptoms of COVID-19, how it is spread, how to protect themselves and the need to be tested if they have symptoms. Allow Q&A and dispel any myths.

- Use existing grievance procedures to encourage reporting of co-workers if they show outward symptoms, such as ongoing and severe coughing with fever, and do not voluntarily submit to testing
- Supply face masks and other relevant PPE to all project workers at the entrance to the project site. Any persons with signs of respiratory illness that is not accompanied by fever should be mandated to wear a face mask
- Provide hand wash facilities, hand soap, alcohol-based hand sanitizer and mandate their use on entry and exit of the project site and during breaks, via the use of simple signs with images in local languages
- Train all workers in respiratory hygiene, cough etiquette and hand hygiene using demonstrations and participatory methods
- Train cleaning staff in effective cleaning procedures and disposal of rubbish

Managing Access and Spread

Should a case of COVID-19 be confirmed in a worker on the project site, visitors should be restricted from the site and worker groups should be isolated from each other as much as possible; Extensive cleaning procedures with high-alcohol content cleaners should be undertaken in the area of the site where the worker was present, prior to any further work being undertaken in that area.