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FINAL ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT (VOL-I)

Western Economic Corridor and Regional Enhancement Program (WeCARE) Phase-I: Local Government Engineering Department

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ABBREVIATIONS

APs	:	Affected Persons
BBS	:	Bangladesh Bureau of Statistics
BMD	:	Bangladesh Meteorological Department
BWDB	:	Bangladesh Water Development Board
CO	:	Carbon Monoxide
COD	:	Cut-Off Date
CPR	:	Community Property Resources
dB	:	Decibel
DoE	:	Department of Environment
DPHE	:	Department of Public Health and Engineering
E&S	:	Environmental and Social
EADS	:	Environment Agriculture and Development Services
EC	:	Environment Clearance
ECA	:	Environment Conservation Act
ECC	:	Environmental Clearance Certificate
ECL	:	Enviro Consultants Ltd.
ESCoPs	:	Environmental Codes of Practice
ECR	:	Environmental Conservation Rules
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
EQS	:	Environmental Quality Standards
ER	:	Engineering Representative
ERP	:	Emergency Response Plan
ESF	:	Environmental and Social Framework
ESIA	:	Environment and Social Impact Assessment
ESMF	:	Environmental and Social Management Framework
ESMP	:	Environmental and Social Management Plan
ESRC	:	Environmental and Social Risk Classification
ESS	:	Environmental and Social Standard
FGD	:	Focus Group Discussion
GAP	:	Gender Action Plan
GBV	:	Gender-Based Violence
GCMs	:	Growth Center Markets
GIS	:	Geographical Information Systems
GoB	:	Governments of Bangladesh
GPS	:	Geographic Positioning Systems
GRC	:	Grievance Redress Committee
GRM	:	Grievance Redress Mechanism
HH	:	Household
HS	:	Health and Safety

IEE	:	Initial Environmental Examination
IFC	:	International Finance Corporation
IGA	:	Income-Generating Activities
JV	:	Joint Venture
KII	:	Key Informant Interview
LGED	:	Local Government Engineering Department
LMP	:	Labour Management Plan
MIS	:	Management Information System
MOEFCC	:	Ministry of Environment, Forest and Climate Change
MSDS	:	Material Safety Data Sheets
NGO	:	Non-Government Organizations
NMT	:	Non-Motorized Traffic
NO2	:	Nitrogen Dioxides
NOC	:	No Objection Certificate
NOX	:	Oxides of Nitrogen
OFC	:	Optical Fiber Cable
OHS	:	Occupational Health and Safety
PAP	:	Project Affected People
PIU	:	Project Implementation Unit
PMCSC	:	Project Management and Construction Supervision Consultant
RAP	:	Resettlement Action Plan
RCMLIIP	:	Rural Connectivity, Market and Logistic Infrastructure Improvement Project
RHD	:	Roads and Highways Department
RoW	:	Alignment and Right of Way
RP	:	Resettlement Plan
RPF	:	Resettlement Policy Framework
SEA-SH	:	Sexual Exploitation and Abuse and Sexual Harassment (SEA-SH)
SEP	:	Stakeholder Engagement Plan
SIA	:	Social Impact Assessment
SMVT	:	Slow Moving Vehicular Traffic
SO2	:	Sulphur Dioxide
SoW	:	Scope of Work
SRDI	:	Soil Resource Development Institute
STIs	:	Sexually Transmitted Infections
SW	:	Solid Waste
ToR	:	Terms of Reference
USEPA	:	United States Environmental Protection Agency
VCPL	:	Venus Consulting Pvt. Ltd.
WB	:	World Bank
WeCARE	:	Western Economic Corridor and Regional Enhancement Program
WMP	:	Waste Management Plan

EXECUTIVE SUMMARY

E1 Introduction

E1.1 Background

i. Road transport is Bangladesh's predominant mode of transport, accounting for about 80% of total traffic. The Western Economic Corridor and Regional Enhancement (WeCARE) program aims toprovide efficient, safe, resilient connectivity and reduce travel time, transport, and logistics costs alonga section of a regional transport corridor in Western Bangladesh. The World Bank is financing the Government of Bangladesh (GoB) to improve the present condition of Growth Center Markets (GCM)and the adjacent roads in the four districts of Jashore, Magura, Chaudanga, and Jhenaidah as part of thePhase-I project. LGED will upgrade priority Upazila, Union, and village roads and complementary logistics infrastructure at rural markets (commonly referred to as "growth centers"). These roads are a vital link in the national highway network. The existing roads are primarily two-lane roads with shoulders. There is no separate provision for slow-moving vehicular traffic (SMVT) or non-motorizedtraffic (NMT).

E1.2 Purpose of the Study

ii. As per the latest Environmental Conservation Regulation (ECR) 2023, any road construction or expansion of more than 10 km will be treated as a "Red Category" project. Hence, the detailed Environmental Impacts Assessment (EIA) report along with the Environmental Management Plan (EMP) is required for the proposed project to get prior site clearance and Environmental Clearance (EC) from the DoE.

iii. As per WB guidelines, the project falls into the "High Risk" category, which requires an Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP).

E2 Project Description

iv. Under the WeCARE Program Phase-I, LGED will upgrade priority Upazila, Union, and Village roads and complementary logistics infrastructure at rural markets (commonly referred to as "growth centers"). These roads are a vital link in the national highway network. The upgrading of this road is consistent with Bangladesh's Road Master Plan 2008. Keeping in view the importance of the roadfor economic development, the proposed construction of about 611 km of road, including 32 GCMs, is envisaged to fulfill the project objectives of efficient, safe, and climatically resilient connectivity alonga section of a regional transport corridor in Western Bangladesh and reduce post-harvest losses in the land of the area. The project features include widening an approximately 431.263 km road stretch, the construction of 37 bridges, 465 culverts and 26 cross drainage structures, pedestrian crossings, bus bays, rumble strips, existing market improvement, slaughterhouse construction, commercial waste, solid waste management, sanitation facilities, drainage system improvement, barrel composting, a shed for the cattle market, a river ghat, the installation of the solar system, land acquisition, resettlement and rehabilitation, and tree plantation. These are envisaged to fulfill the project objectives of efficient, safe,and resilient connectivity along a section of a regional transport corridor in Western Bangladesh and reduce post-harvest losses in the hinterland of the section.

E3 Resource Requirement

v. Land Requirement: No land acquisition will be required for roads and markets for any package. The improvement of roads and markets will not require any land acquisition.

vi. Manpower Requirement: During the construction phase, the labor requirement will range from

1000-1500 during normal operations and 2500-3000 workers for peak construction activities.

E4 Description of Environment

vii. The existing environmental baseline status of the study area covers both the natural and social environments. The analysis was completed using a combination of primary and secondary data sourcesto understand the project area's environmental and socio-economic baseline. The likely possible impactson the environment and society have been studied based on actual and foreseeable events and project activities.

E4.1 Physical Environment

Hydrogeological

viii. The sub-project trunk road alignment is Upazila, Union, and village roads and is mainly in the western parts of the country. The sub-projects connecting road alignment pass across the physiographic unit of the Ganges Floodplain. The project (including all sub-projects) is located south of the confluence of the Jamuna and the Padma rivers.

Meteorology

ix. The temperature data of Jashore Station from BMD for ten years (from January 2013 to December 2022) has been analyzed to see the monthly variation of the average maximum temperature between 39.4°C and 29.5°C. The monthly variation of the average minimum temperature is 25°C to 7°C. The maximum recorded temperature was 42.4°C at Jashore in April 2014 and 41.5°C at Chaudanga in April 2013. On January 1995, the minimum temperature was recorded as 4.2°C at Jashorein January 2013 and 3.9°C at Chaudanga in January 2013. The warmest month of the year is April, andthe coldest month is January. The monsoon is a prominent season in this area. The project area receives between 1200 and 2500 mm of rainfall. The variance in the average relative humidity throughout the year is77.3% to 79.6%, whereas, during the monsoon, the variance is 82.4% to 85.4% at Jashore and Chaudanga, respectively.

Air Quality

x. The primary field investigation covered ambient air quality at forty-six (46) locations covering all packages. According to the monitoring results, dust particles (particulate matter), e.g., PM 2.5, PM 10, and gaseous pollutants such as NO_2, SO_2, CO, CO_2, O_3, etc. have been monitored. The air quality results are well within national standards.

Noise Level

xi. The primary field investigation covered noise and vibration levels at forty-six (46). The noise levels are also within the standards during the day and night in all areas. The average vibration level is 0.364 to 1.175 mm/s on the existing Upazila Road.

Water Quality

xii. The primary field investigation covered surface and groundwater at forty-six (46) locations. The overall study suggests that the water quality of the studied area is well and within a suitable range. Additionally, the site is untouched by any organic or inorganic pollution from human activities.

E4.2 Biological Environment

xiii. The sub-project road site has some vegetation but no ecologically sensitive area. So, the activities will not have any significant impact on the ecology. Runoff from the construction site is expected

to be a source of water pollution. Such pollution may persist during the initial phase of the construction period when site development and excavation for road construction and backfilling will bein progress. The study area site falls in the Brahmaputra-Jamuna Floodplain bio-ecological zone. The Brahmaputra-Jamuna floodplain possesses a unique variety of plants, medicinal herbs, fruit-bearing trees, hundreds of jungle shrubs, creepers, climbers, flowering trees, etc., many of which yield valuable products. The ecology team has considered the depressed area for an aquatic vegetation survey. A visual observation study has been carried out for the aquatic vegetation survey in this area. A total of 16 aquatic species belonging to 12 families were found, with the Lemnaceae and Polygonaceae families being recorded a maximum of three times each. A list of aquatic vegetation is shown in the following **Table 5.14**.

E4.3 Socio-economic Environment

xiv. Data on population, age/gender composition, household patterns, drinking water sources, sanitation facility, and ownership of agricultural land were enumerated from the latest community series census published by the Bangladesh BBS. **Table 5.18** represents the demographic status of the project area. **Table 5.19** estimates the population likely to be impacted negatively by the project.

E5 Environmental Impacts and Mitigation Measures

xv. All possible impact sources were identified during the study period for the proposed project pre-construction, construction, and operation phases. Following sections describe the proposed construction and operation's potential environmental and social impact.

E5.1 Impact and Mitigation Measures during Pre-Construction, Construction and Operational Phase

Drainage Congestion

Impact

xvi. An adequate waterway opening of the new bridges will cause drainage congestion, and this may cause riverbank erosion simultaneously. Runoff from construction material storage near water bodies or uncontrolled disposal may cause temporary drainage congestion, especially near service areas and construction sites. Stockpiling of fill materials dredged from the river beds for the upgradation of the connecting Road may result from erosion and subsequent deposition in the adjacent crop fields.

Mitigation

xvii. Careful attention has to be given so that no negative impacts are caused by the Road at the bridge construction site. Adequate numbers and sizes of box culverts should be provided at the culvert sites to avoid drainage congestion. The opening of cross structures, including bridges and culverts, shall be kept as wide as possible to ensure the backwater upstream is negligible. Care should also be taken so that there is no loss of navigability or reduction of water flow in the rivers or canals. Proper slope protection measures are required to avoid any drainage congestion caused by siltation/ sedimentation from the roads.

Soil Erosion and Siltation

Impact

xviii. During the construction phase, some trees, shrubs, and grasses will need to be cleared. This may create localized soil erosion problems during the rains. The potential risk of river erosion will increase after the implementation of the Project if the bridge crossings are provided with a waterway width less than the regime width of the river. The Project is not expected to worsen the erosion risk, particularly in areas where soil and topography are less vulnerable to erosion.

Mitigation

- Adopt good engineering and construction.
- Provide adequate bank protection and structures;Retaining wall or pala siding should be providedfor the protection of pond and lake.
- The erosion tendency increases in water-logged areas as well. Adequate drain and slope protection measures shall be applied;
- Particular attention needs to be taken while designing the bridge, which will be provided forthe regime waterway width without narrowing the natural channel width. The portion of the Road that is in contact with the river, channel, and canal will be provided with slope protection measures.

Disruption of Water Transport and Navigation

Impact

xix. A small number of construction materials and equipment are to be transported using water transports that might disrupt movements of mechanized and non-mechanized water transport unless dealt with carefully and properly. The piling and other construction-related operations might also disrupt the movement of navigational transports in the main river channels. This disruption will be localized and last during the construction period only.

Mitigation

- Not to obstruct other normal riverine transport while doing riverine transport and works.
- Identify the channel to be followed using navigation aids such as buoys, beacons, and lighting.
- Provide proper buoy age, navigation lights, and markings for bridge and works to guide the other normal riverine transport.
- Keep regular and close contact with the Bangladesh Inland Water Transport Authority (BIWTA) regarding their needs during construction.

Water and Soil Quality

Impact

xx. Spillage of hazardous materials such as fuel, solvents, lubricants, and paint by leakage of tanks, careless handling of disposal of hazardous wastes, and washing of construction vehicles/equipment in the rivers can cause severe pollution of water (groundwater and surface water) and soil. Soil and water pollution by liquid waste can have a serious impact on the community health and safety and aquatic animals (fish, snakes, frogs, etc.) of the rivers.

Mitigation

xxi. The contractor should prepare a waste management plan (WMP) and follow it. Handling and storage of all the hazardous materials and wastes, as well as washing of vehicles/equipment, will be organized under strict conditions through a construction management plan to avoid water and soil pollution during the construction of the bridge.

Noise and Vibration

Impact

xxii. The noise level is expected to increase due to other construction activities, such as loading and unloading construction materials, transportation, placing box girders, and electricity generation. It is expected that the noise caused by these activities will still be within acceptable levels.

Mitigation

xxiii. The contractor should prepare a proper construction management plan and follow it during the

construction of the piling activities. The workers will be provided with suitable ear muffs, and the community in the vicinity will be informed of the period the excessive noise will be generated.

River Ecology

Impact

xxiv. The construction of bridges may lead to the loss of aquatic animal habitat due to increased turbidity, decreased dissolved oxygen in the water, and reduction of food sources, including a temporary decline of plankton and benthos organisms. An increase in suspended solids in the rivers would drive fish away from the bridge construction sites during the construction phase. The water courses may be contaminated by the pollutants generated from the bridge construction sites and workers" camps, such as sediments in wastewater discharged from excavated areas, nutrients, and biological contents in domestic sewage charged from worker" scamps, and oil and grease leaked from construction types of machinery.

Mitigation

xxv. In order to avoid impacts on these species, the construction works will be limited to the designated sites allocated to the contractors. Regular monitoring of the worksite for animals trapped in or in danger will be done, and the contractor will use a qualified person to relocate the animal. Monitor work areas for endangered reptiles and bird species to ensure they are well away from the piling site if they are too close to the site. An acoustic enclosure will be placed to cover the hammer and the exposed pile to reduce the air and noise. To avoid turbidity in the river during the pier construction of the bridge, use a confined/barricaded pier area so that water will not turbid for fish survival.

E6 Assessment of Impacts

xxvi. The methodology of assessing environmental impacts from the project activities entailed clearly identifying the environmental components that will be impacted, type of impacts, assessment area where the impacts will be felt and defining the criteria for assessing the significance of each type of impact. The environmental impact was assessed by Environmental Impact Valuation (EIV), detail methodology of which is explained in **Chapter 7**.

E7 Mitigation of Impacts

xxvii. Mitigating negative impacts and enhancement of positive effects are shown in **Chapter 7**. Potential implications ofthe proposed project have been identified at every step of development, and the mode of impact has been detailed to understand its significance towards socio-economic, ambient environment, landscape,and water resources. Aftermath, this study suggests mitigation measures to the project to limit negative impacts as minimally as possible in compliance with GoB's rules and regulations and enhance environmental, ecological, and societal benefits.

E8 Analysis of Alternatives

xxviii. Consideration of alternates is a crucial aspect of the ESIA. The considerations for the project areas on issues like alternative design, alignment, locations, techlology including 'do nothing' sceanaros were analyzed and found that selected locations, methods and alignment are more suitable from environmental perspective.

E9 Environmental and Social Management Plan

xxix. An ESMP has been developed which include activities under all 16 packages covering recommended measures during pre-construction, construction and operation phase. ESMP covers the potential impacts identified during impact assessment, propose appropriate mitigation measures to

reduce/mitigate intensity of impacts, assign responsibility to ensure execution of these measures. ESMP is presented in **Chapter 8**. Besides ESCoPs are developed and attached as **Annex F**. To evaluate the performance of the environmental management and monitoring plan, performance indicators are identified for efficient and timely implementation of measures/actions proposed in ESMP. To measure the overall environmental performance of the project, a list of performance indicators is given in **Chapter 8**; however, a detailed list of hands will be prepared by PMCSC.

E10 ES Monitoring Plan

xxx. The ES monitoring plan proposed for the packages is presented in **Table 8.3**. The monitoring will comprise surveillance to check whetherthe contractor meets the contract's provisions during the construction and operation, includingthe responsible agencies for implementation and supervision.

E11 Public Consultation

xxxi. 30 consultations meeting are conducted with different stakeholders during the study. The project Stakeholder Engagement Plan (SEP) for LGED seeks to define a technical and cultural approach to consultation and disclosure. The SEP is useful for managing communications between LGED and its stakeholders.

xxxii. In preparing ESIA and ESMP under the present study, all the stakeholders have been primarily synthesized into two categories: Primary stakeholders, Project-affected parties, and Secondarystakeholders or other interested parties.

E12 Costing of ESMP Implementation

xxxiii. Cost of ESMP implementation for CW-01 which includes two GCMs and adjacent 7 roads is BDT 3,509,800.00 and the total cost of ESMP implementation for 27 GCMs and 431.263 km of road under 16 CWs will be BDT 54,844,800.00 (**Table 8.6**). While PD has the overall responsibility for ES management, he will be assisted by ES consultants and PMCSC. Detailed institutionl arrangement to impement ESMP included in **Chapter 9**.

E13 Institutional Arrangement

xxxiv. This institutional arrangement ensures the efficient implementation of the LGED WeCARE project, with clear roles and responsibilities assigned to each stakeholder. Regular monitoring, evaluation, and communication mechanisms are established to promote transparency, accountability, and responsiveness to the needs of vulnerable rural communities in Bangladesh impacted by climate change. Project director will responsible for the ESMP and the individual consultants, supervisor, and contractors will assist the peoject director for the implementation of the project.

CHAPTER 1: INTRODUCTION

1.1 Background

1. Road transport is Bangladesh's predominant mode of transport, accounting for about 80% of total traffic moved. The existing highway links are primarily two-lane roads, and the rail links are single-track. The Government of Bangladesh (GoB), through the Ministry of Finance (MoF), has received funds from the World Bank (WB) to support the preparation and implementation of the Western Economic Corridor and Regional Enhancement Programme (WeCARE Programme), with the Roads and Highways Department (RHD) and the Local Government Engineering Department (LGED) as the central implementing agencies. In phase-i of the WeCARE Program, there are plans to implement 16 Civil Works (CW) packages comprising sub-project roads, Growth Centre Markets (GCMs), and logistic support across 18 upazilas in four districts of Bangladesh, namely Jashore, Magura, Jhenaidah, and Chuadanga. LGED will implement the construction, rehabilitation, and improvements of priority rural roads and market infrastructure in four districts in the Western Region.

2. The project is designed as an economic corridor; consequently, it is expected to focus on the resultant economic benefits for the communities surrounding the central infrastructure. To achieve this,the districts that comprise the overall corridor will design a suitable mix of investments in important auxiliary and trunk infrastructure. Connectivity will speed up the flow of goods and commodities, providing faster communication for individuals and interests.

1.2 Project Scope

3. The WeCARE Program is categorized into the following five (5) components:

4. Component 1: Upgrading National Highway Corridor and enhancing digital connectivity: This component will be implemented by RHD and will finance associated works, services, and goods for the following sub-components:

i. Sub-component 1(a): Upgrading the Jashore-Jhenaidah national highway (48 km).
ii. Sub-component 1(b): Installation of OFC and deployment of the Intelligent Transportation System (ITS) along the Jashore-Jhenaidah national highway.
iii. Sub-Component 1(c): Implement a Safe Corridor Demonstration Program (SCDP) along the Jashore-Jhenaidah national highway.

5. Component 2: Upgrading secondary and tertiary roads and complementary logistics infrastructure and services: This component will be implemented by LGED and will financeassociated works, services, and goods in the four (4) program districts of Jashore, Jhenaidah, Magura, and Chaudanga for the following sub-components:

i. Sub-Component 2(a): Development and upgrading complementary logistics infrastructure andservices.
ii. Sub-Component 2(b): Upgrading the secondary and tertiary road networks serving selected markets.

6. Component 3: Project Implementation Support and Sustainability: This component will be implemented by both RHD and LGED and will finance associated services and goods for the following Sub-components:

i. Sub-Component 3(a): Training and Capacity Building.

ii. Component 3(b): Strategic Environmental and Social Assessment (SESA).
iii. Sub-component 3(c): Establishing a Fiduciary Advisory Panel.
iv. Sub-component 3(d): Establishing the Transport Sector Integration and Coordination Platform(TSICP) and operationalizing the Road Maintenance Fund Board Act.
v. Sub-component 3(e): Preparatory Activities for Subsequent Program Phases.

7. Component 4: COVID-19 Relief and Recovery: This component will be implemented by both RHDand LGED to help GoB provide just-in-time livelihood support to poor people in rural areas and stimulate the local economy to help fight against the COVID-19 emergency. This component will finance associated services and goods for the following sub-components:

i. Component 4 (a): Provision of jobs through labor-intensive civil work.
ii. Component 4 (b): Developing an Emergency Response Plan for COVID-19.
iii. Component 4 (c). Provision of necessary physical upgrades to transport agencies.

8. Component 5- Contingent Emergency Response: This component will improve the GoB's ability torespond effectively in an emergency, in line with WB disaster prevention and preparedness procedures. Following an eligible crisis or emergency, the recipient may request the bank to reallocate project fundsto support emergency response and reconstruction. This component would draw on other project components to cover emergency response.

9. These program activities are likely to cause adverse E&S risks and impacts in terms of loss of mature trees along the road alignments and their rows, HS, acquisition of private lands for the up-gradation and expansion of road networks and related utilities, and partial or complete impacts on structures such as houses, mosques, temples, graves, and madrasas. Therefore, it is required to evaluate,based on ESIA and ESMP, RAP studies for their infrastructure components.

1.3 Objectives of the Study

10. The objective of this ESIA is to assess the environmental and social risks and impacts of upgrading secondary and tertiary roads and complementary logistics infrastructure and services in the four (4) districts of Jashore, Jhenaidah, Magura, and Chaudanga. This report focuses on the assessment of the relatedrisks and impacts and the required mitigation measures:

11. Environmental impacts are assessed by identifying potential adverse effects on the local ecosystem by road and GCM construction and operation. This encompasses evaluating impacts on soil quality,water bodies, air quality, and local flora and fauna. Comprehensive plans for mitigating identified environmental risks, including sediment control, water resource conservation, waste management,and drainage management, are developed. A monitoring framework is established to track the implementation and effectiveness of mitigation measures, ensuring compliance with environmentalregulations, standards, and community involvement in monitoring throughout the project's lifecycle.

12. Social impacts are assessed by considering how the road project affects the livelihoods of local agricultural populations, including changes in market access, agricultural productivity, and income opportunities, with particular attention to vulnerable and low-income households. Resettlement and compensation mechanisms are identified for potential displacement due to construction, developed in consultation with affected communities. The project explores ways to enhance social well-being, such as improving access to healthcare and education, stimulating localeconomic development, and creating jobs. Furthermore, ongoing community engagement encourages active participation in decision-making and incorporating community concerns and aspirations throughout the project's lifecycle.

13. The ESIA report aims to assess environmental and social impacts, focusing on agricultural preservation, water protection, low-income support, loss of assets, and community well-being for sustainable development.

1.4 Scope of ESIA

14. To fulfill the requirements above, officials of LGED have designed the Scope of Work (SoW) in connection with the Environmental and Social Study under the project titled "Implementation Supportto Environmental and Social Safeguard Consultancy Services under WeCARE Phase-I: RCMLIIP, LGED (SP-04)". The comprehensive scope of the Environmental and Social Impact Assessment (ESIA)for the rural road project encompasses the following key aspects:

- **Data Collection:**
  - Meteorological data collected from the Bangladesh Meteorological Department (BMD)
  - Hydrological and morphological data were gathered from the Bangladesh WaterDevelopment Board (BWDB).
  - Agricultural data was collected from various sources, including the Bangladesh Bureau of Statistics (BBS), the Department of Agricultural Extension (DAE), and primary surveys.
  - Primary and secondary socio-economic data were collected through field visits andreferencing the 2011 population and housing census (BBS).
    Environmental quality data was collected, including soil investigation, air quality, waterquality, and noise level, specifically from the selected site.
- **Environmental and Social Baseline Assessment:**
  - Establishing baseline conditions for water resources, noise levels, and land resources, encompassing land use/land cover, agriculture, fisheries, ecosystems, and socio-economic conditions.
- **Community Engagement and Consultation:**
  - Conducting public consultation meetings to involve local communities in decision-makingand consider their concerns and aspirations.
- **Impact Assessment and Mitigation:**
  - Identifying potential environmental and social impacts of construction and operation activities, such as soil erosion, water pollution, habitat disruption, and changes in microclimates.
  - Evaluating the likelihood and severity of these impacts, prioritizing them based on Significance.
  - Developing specific mitigation measures and strategies to minimize adverse environmental impacts, including erosion control, water management, waste management, and habitat restoration.
- **Environmental and Social Management Plan:**
  - Formulating a comprehensive Environmental and Social Management Plan (ESMP) that outlines the implementation and monitoring of proposed mitigation measures throughout the project's lifecycle.
- **Presentation and Reporting:**
  - Producing an ESIA report to obtain Environmental Clearance (EC) from the Department of Environment (DoE).
  - Presentation of the ESIA report to the DoE as required.

15. This comprehensive ESIA approach is essential to thoroughly assess and address the rural road project's potential environmental and social impacts while considering the unique characteristicsand needs of the local context in rural Bangladesh.

1.5 Approach and Methodology

16. The initial environmental screening revealed that the six individual sub-projects/packages road would be considered a "Red" category according to the ECR, 2023. Considering the 16-CW package, the environmental category becomes red per the DoE. Besides, according to the risk rating of the World Bank, the project falls into the high risk category. Hence, an ESIA study would be required. The study is initiated with project components, detailed engineering drawings, and a layout plan for constructing the proposed widening of roads, GCMs, and modification of auxiliary infrastructure.

17. GIS-based maps were prepared and studied to visualize the land use of the study area. The multi-disciplinary team members conducted a study to determine the area's baseline environmental and social conditions. The multi-disciplinary team drew maps of the project area, selected VECs likely to be impacted, and assessed the project's potential environmental consequences. These areas are explained in detail in the influence area.

18. The study has been conducted following the Environment Conservation Rules, 2023; the Government of Bangladesh (GoB) EIA Guidelines, 1997; the Environmental and Social Framework of the World Bank; and the Environmental and Social Mangeemnt Framework of WeCARE, LGED (ESMF, April 2020). The study is based on both primary and secondary data and information.The preliminary data includes data collected from field observations, and the secondary data consists of a review of Bangladesh's statistical data and relevant information from government departments. For the social baseline, discussions were held with stakeholders, including government officials, community representatives, and a wide range of road users and roadside dwellers. The primary purpose of this approach was to obtain a fair impression of the people's perceptions of the project and its environmental and social impacts.

19. The data collection program was planned per the segmented contract packages for better assessment. The data generated allowed to understand better the complex interplay between the various biotic and abiotic factors within the study area and establish baseline conditions. Once this baseline was established, it was used as a reference point to identify potential environmental changes that may occur due to the proposed project activities and to allow the development of measures to prevent, mitigate, or manage these potential impacts.

1.6 ESIA Study Team

20. Environment, Agriculture and Development Services (EADS), Enviro Consultants Ltd. (ECL),and Venus Consulting Pvt. Ltd. have assembled a multi-disciplinary team to conduct the ESIAs and prepare ESMPs. The team's key members are shown in **Table 1.1**.

Table 1.1: Name of Professional with Position

Sl.No.	Name of Professional	Position
1.	Dr. Jagadish Chandra Saha	Team Leader (Environment Specialist)
2.	Dr. Abu Rashed Mohammad Momtajuddin	Social Devolvement Specialist
3.	Md. Humayun Kabir	Land Acquisition & Resettlement Specialist
4.	Dr. Md. Kamrul Hasan	Ecology and Biodiversity Expert
5.	Md. Nurul Hoque Upal	Health and Safety Specialist
6.	Salma Akter	Gender Expert
7.	Md. Hedayet Hossain	Stakeholder Engagement Specialist
8.	Prof. Dr. Md. Akteruzzaman	Livelihood Improvement Specialist

Sl.No.	Name of Professional	Position
9.	Shubhakar Chakma	Social Researcher/Jr. Database Manager
10.	Md. Al Amin	Resettlement Officer/Organizer-1
11.	Md. Alamgir Shah	Resettlement Officer/Organizer-2
12.	Mirza Zadid Hasan	GIS Specialist
13.	Mohammad Kawsar Uddin	Land Use Specialist

1.7 Structure of the Report

21. The ESIA Report as part of the Environmental Study fulfills the requirements of ESIA under ECA, 1995, and the latest ECR, 2023, and has been prepared following the ESF of WB, ESMF OF LGED and ToR given by DoE for WeCARE Phase-I: LGED. The report contains ten (10) chapters, and these are narrated in **Table 1.2**.

Table 1.2: Structure of the Report

Chapter	Content
Chapter 1: Introduction	This chapter includes the project's background, objectives, scope, and methodology for preparing the ESIA report.
Chapter 2: Regulatory Framework, Standards, and Guidelines	This chapter describes the national and international laws and policies relevant to the project's environmental aspects.
Chapter 3: Project Description	This chapter includes the background and objectives of the proposed project, the location of the proposed project interventions, and the project described here.
Chapter 4: Analysis of Alternatives	In this chapter, the alternative options for the proposed project are analyzed. It starts with no alternative project and ends with exploring all the possible alternatives.
Chapter 5: Environment and Social Baseline	This section provides the study area's definition, baseline conditions, or attributes, and its existing physical, biological, and socio-economic environment.
Chapter 6: Stakeholder Engagement and Information Disclosure	This section presents the outcomes of stakeholder engagement and consultation under the ESIA. Different types of engagement and consultation were undertaken with different stakeholder groups.
Chapter 7: Potential Environmental and Social Impacts and Risks and Mitigation Measure	This section identifies the project's potential positive and negative environmental, physical, and socio-economic impacts. From this risk assessment, the identified potentially significant impacts are drawn out and presented as those that require the most attention in developing specific management and mitigation measures.
Chapter 8: Environmental and Social Management Plan (ESMP)	This chapter includes the ESMP, comprising the proposed project's environmental and social impacts. A comprehensive plan has been developed to address project impacts, and a monitoring program has been implemented to ensure its effectiveness.
Chapter 9: Institutional Arrangement for Implementation of ESMP	This chapter describes the institutional arrangement for monitoring ESMP during project implementation.
Chapter 10: Conclusions and Recommendations	This chapter includes the conclusion, and some recommendations about the proposed project are suggested here.

CHAPTER 2: REGULATORY FRAMEWORK, STANDARDS AND GUIDELINES

2.1 Introduction

22. Development projects are governed by legal and institutional requirements set by the national environmental legislation of Bangladesh. Therefore, the assessment of relevant legal provisions, policies, strategies, and institutional issues is important for any project proponent before the execution of a program or plan. Before initiating any development project, e.g., "Implementation Support to Environmental and Social Safeguard Consultancy Services under WeCARE Phase-I: RCMLIIP, LGED (Package SP-04)," it is required to obtain environmental clearance from the Department of Environment (DoE).

23. In Bangladesh, the environmental approval process is overseen by the Department of Environment (DoE) under the Ministry of Environment, Forest and Climate Change (MOEFCC), and the key regulations that govern this process are the Environment Conservation Act (ECA), 1995, and the amendments in 2010, Environment Conservation Rules (ECR), 2023 (including all amendments), and National Environment Policy (NEP), 2018. In addition, DoE ensures the consistent application of environmental rules and regulations and guides the implementation of all projects. A systematic procedure was followed to obtain the approval of the ToR and EIA report. Under the ECR 2023, once the ESIA has been filed, DoE has 60 days to respond with its review comment and approval. Submission of any further materials would be carried out, as per the requirement of the DoE to obtain the ECC. The steps to be followed for obtaining the ECC for this proposed project and an additional, flow diagram detailing the steps for obtaining an ECC are shown in **Figure 2.1**.

24. The activity of the proposed project falls under the "Red" category according to the Bangladesh Environment Conservation Rules (ECR) 2023. Therefore, it is necessary to carry out an Initial Environmental Examination (IEE) followed by an EIA with EMP.

25. Activities under the planned 16 packages falls into the "High Risk" category as per WB guidelines, which requires an Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP).

2.2 Brief Descriptions of Relevant National Policies, Laws and Rules

26. National policy, laws, and rules relevant to road construction/reconstruction/extension (Feeder and local roads), commercial waste, operation, and maintenance, including associated activities, have been preliminary identified under this study. Under the national legal framework, the proposed intervention needs to comply with the country's environmental legislation and fulfill the requirements to obtain the required permissions to implement these activities. The key national policies and legislation that are relevant to this proposed project are briefly described below in **Table 2.1**.

Table 2.1: Relevant Bangladesh Regulations

Regulations	Relevance to the Sub-project
National Environment Policy 1992 (Amendment), 2018	The project required proper action to prevent any hindrance to biodiversity in natural water bodies and the aquatic environment.
Environmental Conservation of Rules (Amended) 2023	According to the latest amended ECR Rules 2023, it should address all the impacts.

Regulations	Relevance to the Sub-project
Protection and Conservation of Fish Act 1950 (Amended 1982)	Through this framework legislation, the government makes rules to prohibit the striction of, or any attempt to destroy, fish by the poisoning of water or the depletion of fisheries by pollution, industrial effluent, or otherwise. Protection and Conservation of Fish Rules (1985).
National Agriculture Policy, 1999	According to the policy alignment of the proposed project, it must be selected carefully so that the acquisition of fertile agricultural land is minimal. Moreover, adequate measures should be taken to reduce waterlogging and hamper irrigation systems due to the construction of the project's connecting roads.
National Land Use Policy, 2001	The proposed project must adhere to this policy so that the environmental sustainability of land-use practices is assured.
The Embankment and Drainage Act, 1952	Disposal of excess river bed material/dredged spoil may create drainage obstructions. So, the environmental assessment must address adherence to the relevant section of the Act.
Bangladesh Environment Court Act, 2010	According to this act, the government can take legal action if any environmental problem occurs due to project interventions.
Compliance with DoE's Guidelines	The guidelines provide a step-by-step methodology for the completion of EIAs. EQS for air quality, noise, odor, soil, sewage discharge, industrial effluents, and industrial project emissions for Bangladesh are furnished in ECR 2023.
The Forest Act of 1927 and the Amendment Act of 2000	The ACT is relevant to the project as the construction of the project connecting the road will require cutting trees.
National Forest Policy (amendment), 1994	The ACT is relevant to the project as the construction of the project's connecting roads will require cutting trees.
Wildlife (Conservation and Security) Act 2012	This ACT is relevant to the project as an intervention may affect wildlife habitation and obstruct movement.
National Water Policy, 1999	Clause 4.6 b of this policy states that natural depressions and water bodies in major urban areas must be preserved to recharge underground aquifers and drain water. Moreover, measures must be taken to minimize corruption in the natural aquatic environment in streams and water channels (Clause 4.9b).
National Fisheries Policy, 1998	The project required taking proper action to prevent any hindrance to biodiversity in natural water bodies and aquatic environment.
Protection and Conservation of Fish Act 1950 (Amended 1982)	It is considered that the proposed project construction works are in line with the objectives of the above-mentioned Act and Rules. The project required taking proper action to prevent any hindrance to biodiversity in natural water bodies and the marine environment.
Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009	Relevant as the country is vulnerable to climate change effects.
The Land Acquisition and Requisition of Immovable Property Act 2017 and Vested Property Amendment Act (2) Khas Land Distribution Policy	The proposed project must adhere to this policy so that environmental and social sustainability are assured in the area.

Regulations	Relevance to the Sub-project
National Land Transport Policy, 2004	According to the policy, all new roads and major improvements tolled or otherwise, are subjected to an EIA.
Environmental Guideline of LGED, 2004	According to the guidelines, any impacts due to road construction activities need to be minimized, and proper compensation should be paid to the affected people.
The Penal Code, 1860	According to the guidelines, safety measures should be taken for labor in a work zone.
The Fatal Accidents Act, 1855	According to the guidelines, insurance should cover labor and employees.
Bangladesh Labor Rules-2015	According to the guidelines, GRM should be taken into consideration.
Solid Waste Management Rules 2021	Solid Waste Management (SWM) guidelines should be taken into consideration by a contractor.

27. Since the proposed project is being financed by the World Bank, the ESIA and ESMP required to follow environmental and social standards (ESSs) of ESF. These ESSs and the gap between WB's ESS and relevant national laws and policies are listed in **Table 2.2**.

Table 2.2: The World Bank's Environmental and Social Standard, Related National Laws and their Gaps on WeCARE Phase-I

World Bank ESS Standards	Objectives	Gaps between National Laws and WB's ESS Standards	Applicability
ESS-1: Assessment and Management of Environmental and Social Risks and Impacts	Identify, assess, evaluate, and manage the environmental and social risks and impacts in a manner consistent with the ESF. Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities.	The gaps between National Laws and WB's ESS standards • The ESIA screening and scoping study may not comprehensively cover all of the WB's ESS in their analysis. • Stakeholder engagement is carried out during the ESIA. However, the nature of the stakeholder engagement is limited in scope. • The ESIA report is also not publicly disclosed as required by ESS. • The ESIA framework doesn't require the analysis of alternatives.	• Yes, the existing ESIA and ESMP prepared in 2023 have been updated. • The ESS1 applies to all associated facilities.1
ESS-2: Labor and Working- Conditions	Promote safety and health at work. Promote fair treatment, non-discrimination, and equal opportunity for project workers. Protect project workers, with particular emphasis on vulnerable workers. Prevent the use of all forms of forced labor and child labor. Support the principles of freedom of association and collective bargaining for project workers in a manner consistent with national law. Provide project workers with accessible means to raise workplace concerns.	Gaps: i. The Labor Act does not make it mandatory for development interventions to be assessed and reviewed in terms of labor and working conditions, including OHS, before approval. ii. The Labor Act does not require development projects to prepare labor management plans, procedures, or OHS plans.	The project will hire the following types of workers: 1. Direct workers will include the project managers and supervisors, who are employees of LGED; ii) All the workforce deployed by the Contractors and the Project Management Consultant (for all contracts) under LGED will be deemed to be contracted workers. The Contractor(s) might further engage multiple subcontractors; iii) The inflow of migrant labor from other districts for construction works is the norm in this district and is likely to continue in this project; 2. A labor management procedure will be followed by the LMP. Prepared by the LGED to regulate working

World Bank ESS Standards	Objectives	Gaps between National Laws and WB's ESS Standards	Applicability
			conditions and management of worker relations, including worker-specific GRM, terms and conditions of employment, non-discrimination, equal opportunity, GBV, protection of the workforce, the prohibition of child /forced labor, and the provision of OHS.
ESS-3: Resource Efficiency and Pollution Prevention and Management	Promote the sustainable use of resources, including energy, water, and raw materials. Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities. Avoid or minimize project-related emissions of short and long-lived climate pollutants. Avoid or minimize the generation of hazardous and non-hazardous waste. Minimize and manage the risks and impacts associated with pesticide use. Requires technically and financially feasible measures to improve efficient consumption of energy, water, and raw materials, and introduces specific requirements for water efficiency where a project has high water deman.	ESS-3 refers to national law and good international industry practice, in the first instance, the World Bank Groups' EHSGs. Gaps: The majority of ESS-3 requirements are addressed by existing regulations and indirectly by resource efficiency and climate change aspects. Existing energy and water conservation policies, laws, and regulations do not require development projects to assess resource efficiency issues and incorporate resource efficiency measures in their ES risk management plans.	Concerning resource efficiency, the project preparation and the ESIA process will identify feasible measures for efficient (a) energy use; water usage and management to minimize water usage during construction, conservation measures to offset total construction water demand and maintain balance for the demand for water resources; and (c) raw materials used by exploring the use of local materials, recycled aggregates, and innovative technology to minimize the project's footprints on finite natural resources. Concerning Pollution Management, based on past road project experiences, the project will develop, as part of the ESIA process, prevention and management measures to offset the risks and impacts of pollution from potential sources such as dust and emissions from the operation of hot mix and batching plants, crushers,

World Bank ESS Standards	Objectives	Gaps between National Laws and WB's ESS Standards	Applicability
			construction and haulage vehicles, material and spoil stockpiles; effluents and wastewater from labor camps, construction camps; spillage or leakage during handling of chemical admixtures, hazardous materials like bitumen, high strength diesel used oil, battery wastes, etc., and disposal of non-hazardous wastes (municipal wastes) generated during the project implementation period.
ESS-4: Community Health and- Safety	Anticipate or avoid adverse impacts on the health and safety of project-affected communities during the project lifecycle from routine and non-routine circumstances. Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams. Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. Have in place effective measures to address emergency events. Ensure that personnel and property are safeguarded in a manner that avoids or minimizes risks to the project-affected communities.	GoB Laws and Regulations a) National Road Transport Act b) ECR 2023 c) BLA 2006 d) Public Procurement Rule, 2008 e) Water Act 2013 Gaps: • While other acts cover all of the ESS-4 requirements, gaps exist for community exposure to health issues. • The gaps are addressed through suitable provisions in the ESMP and contractual obligations as part of the Construction Environmental and Social Management Plan (C- ESMP) for community health and safety including the need for an OHS plan, an influx management plan, a workers camp management plan, traffic, and a road safety management plan. • Covered under ESIA, but the systems do not provide clear requirements for the development project and implementation.	In the project corridor, there is likely to be road excavation, use of vibratory equipment, construction debris handling and disposal, etc. during construction; ii) a high likelihood of direct exposure to increased construction-related traffic and equipment, especially at road sections traversing settlement areas with limited carriageway/roadway width, and sensitive receptors such as schools, religious places, health center /hospitals; iii) high dust levels from earthworks, high noise levels, and emission levels from traffic congestion and idling of vehicles; and iv) an influx of migrant workers could potentially cause local discomfort or potential conflicts with local people. The gaps between GoB regulations and ESS-4 will be addressed through suitable provisions in the ESMP and the contractor's

World Bank ESS Standards	Objectives	Gaps between National Laws and WB's ESS Standards	Applicability
			obligation as part of the contractor's ESMP for CHS. This should also include the OHS plan, influx management plan, workers' camp management plan, and traffic and road safety management plan.
ESS-5: Land-Acquisition-Restrictions on Land Use and Involuntary	Avoid or minimize involuntary resettlement by exploring project design alternatives. Avoid forced evictions. Mitigate unavoidable adverse impacts from the land acquisition or restrictions on land use by providing compensation at replacement cost and assisting displaced persons in their efforts to improve, or at least restore, livelihoods and living standards to pre-displacement levels or levels prevailing before the beginning of project implementation, whichever is higher. Improve the living conditions of poor or vulnerable persons who are physically displaced, through the provision of adequate housing, access to services and facilities, and security of tenure. Conceive and execute resettlement activities as sustainable development programs.	Gaps: i. Preparation of SIA and RAP is not required. ii. Does not provide compensation or assistance to those who are non-title holders. iii. Does not have provisions to include transitional allowances for the restoration of livelihoods for informal settlers focused on cash compensation, which may be viewed as a short-term strategy; however, involuntary resettlement can cause long-term impacts. ARIPA-2017 does not include sustainable or inclusive developmental objectives. iv. No special provisions for specific groups, such as the vulnerable groups of the population. v. The valuation of lost assets is not based on the replacement cost principle.	The project is expected to require acquiring a small amount of land. The land will be required for widening, and gradation works have been identified. Hence, impacts on land, private and community-owned assets, including structures, trees, and crops within existing and proposed ROWs are likely. Economic displacement is also very likely. i) Important gaps (between ESS and GoB policy) exist in terms of determination of compensation, identification of non-titleholders, cut-off dates for non-title holders, and valuation of structures with depreciation. These gaps, along with other short- and long-term measures will be included in the RAP
ESS-6: Conservation and Sustainable Management of Living Natural Resources	Protect and conserve biodiversity and habitats. Apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. To promote the sustainable management of living natural	Gaps: No equivalent requirements on: i. the application of the hierarchy of measures; ii. the preparation of the Biodiversity Management Plan; differentiated measures on types of habitats; the conduct of due diligence on primary suppliers.	Though the construction of GCMs and connecting roads will have little or no noticeable effect on the local biodiversity, it will have some direct effect on it. Roadside trees will be cut down, and bushes will be cleaned.

World Bank ESS Standards	Objectives	Gaps between National Laws and WB's ESS Standards	Applicability
	resources.		Nocturnal animals will lose their daytime hiding places. Movement routes will be interrupted for slow-moving animals such as amphibians and reptiles, especially turtles, nocturnal animals like Fishing Cats (Prionailurus viverrinus), Jungle Cat (Felis chaus), Large Indian Civets (Viverra zibetha), Small Indian Civet (Viverricula indica), Asian Golden Jackal (Canis aureus) and also for Mongoose (Herpestes auropunctatus). Road deaths due to vehicle collisions will increase. To mitigate the adverse effects on local biodiversity, a sufficient number of bridges and culverts should be constructed on the road passing through any important wildlife habitats. Roadside plantations should be initiated after the construction phase.
ESS-7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	To ensure that the development process considers full respect for affected parties' human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods. Promote sustainable development benefits and opportunities in a manner that is accessible, culturally appropriate, and inclusive. Improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with affected parties. Obtain the Free, Prior, and Informed Consent	Gaps: No equivalent requirements on: i. coverage of IP impacts in the ESIA; ii. special treatment or differentiated approach to IPs and vulnerable groups; iii. conduct of FPIC; Development of an IP plan.	This ESS identifies the measures to minimize disruption of livelihoods due to the project's development. There is an Indigenous person.

World Bank ESS Standards	Objectives	Gaps between National Laws and WB's ESS Standards	Applicability
ESS-8: Cultural Heritage	Protect cultural heritage from the adverse impacts of project activities and support its preservation. Address cultural heritage as an integral aspect of sustainable development. Promote meaningful consultation with stakeholders regarding cultural heritage. Promote the equitable sharing of benefits from the use of cultural heritage.	Gaps: i. No equivalent requirements on: ii. The application of the hierarchy of measures; iii. The development of a Cultural Heritage Management Plan; iv. The development and adoption of project-specific change-finding procedures; and v. the engagement of cultural heritage experts.	The alignment of the project road does not have any ancient monuments and/or archaeological site(s), protected. A "Chance Find Procedure" is stipulated in this ESIA and necessary measures will be taken consistent with the relevant national laws and ESS8.
ESS-9: Financial-Intermediaries	Sets out how Financial Intermediaries (FI) will assess and manage environmental and social risks and impacts associated with the sub-projects they finance.	Gaps: Not applicable to the country system. Project proponents, regardless of funders, are subject to the same country's laws.	Not applicable
ESS-10: Stakeholder-Engagement- and Information- Disclosure	Establish a systematic approach to stakeholder engagement that helps the project proponent (LGED) identify stakeholders and maintain a constructive relationship with them. Assess stakeholder interest and support for the project and enable stakeholders' views to be considered in project design. Promote and provide means for effective and inclusive engagement with the project-affected parties throughout the project life cycle. Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible, and appropriate manner.	GoB Laws/Regulation No Specific Policy or Legislation identified Gaps: i. The ECA/ECR does not specifically require consultation, but the ESIA guidelines issued by DoE and other agencies recommend public consultations during scoping and the preparation of the ESIA. ii. There is also no provision for any stakeholder engagements during project implementation.	This is relevant to the project, and LGED has prepared a stakeholder engagement plan. The project will ensure: i) Stakeholders have been/are to be consulted on the stakeholder engagement plan. (ii) The project SEP will be applicable during the implementation of the project. Ensure stakeholders are well informed, and have access to the project documentation, which is expected to be publicly disclosed as and when available and in publicly assessable places in local languages.
Gender and Gender-Based Violence	Gender and Gender-Based violence are considered a cross-cutting theme across all of the World Bank's ESS and are especially relevant for major infrastructure projects.	(I) Adequate measures to address gender issues and SEA/SH, including a Sea/SH compliant GRM, have been addressed in this ESIA.	

[1] **Note:** Associated Facilities will meet the requirements of the ESSs, to the extent that the Borrower has control or influence over such Associated Facilities.

Source: Adopted from Environmental and Social Management Framework (ESMF) Report for WeCARE Phase-I Project 19th April 2020.LGED

28. ES Risk Category of the Project: The World Bank classifies all projects into four categories (High, Substantial, Moderate, and low), depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. According to the World Bank's ESF, most of the activities under the planned 16 packages fall within the substantial category. However as the RHD portion is red the overall WB risk rating is High. However, the latest Environmental Conservation Rules (ECR), 2023 from the Department of Environment (DoE), rates some of the sub-projects as 'Red Category". Consequently, the entire project is classified as 'Red Category' by the DoE."

2.3 Overview of Bangladesh Environmental Approval Process

29. Industrialization is an essential prerequisite for rapid and sustained economic development and social progress. But it causes environmental degradation like air, water, and soil pollution. So, environmental management is necessary to decrease such environmental pollution and degradation. The Government of Bangladesh stresses the importance of protecting the environment and natural resources. The Government has included an article on environmental protection and the pursuit of sustainable development.

30. The DoE has issued guidelines on undertaking the EIA for several industrial sectors and activities. Each Project Proponent shall conduct an EIA and is expected to consult and follow the DoE guidelines. The DoE has issued an application procedure for obtaining site and environmental clearances. **Figure 2.1** shows this procedure for obtaining the environmental clearance from the DoE for the "RED" category of projects under the Environment Conservation Rules 2023. It should be noted that the environmental clearance for this project was first secured under the previous Environment Conservation Rules, 1997 which has been repealed with the issue of the ECR 2023. The application process was similar, and any renewal will be issued under the Environment Conservation Rules, 2023.

31. Clearance certificates will expire after 30 days if not renewed. The steps to be followed for obtaining an ECC are shown in **Figure 2.1**.

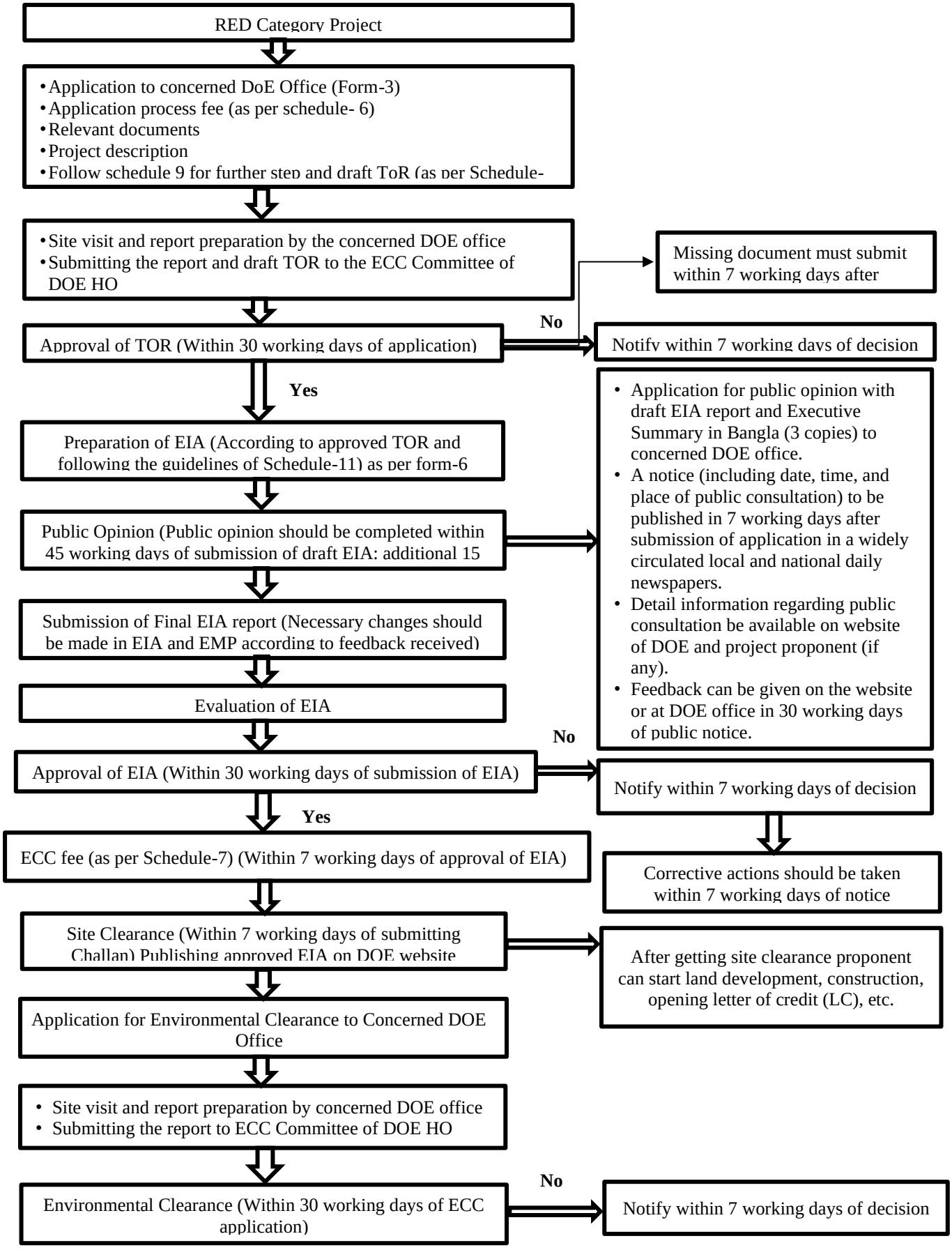


Figure 2.1: Detailing the Steps for Obtaining an ECC

CHAPTER 3: PROJECT DESCRIPTION

3.1 Description of the Project

32. The proposed project, "The Western Economic Corridor & Regional Enhancement (WeCARE) Program," by LGED has been initiated to develop 16 packages/sub-projects including road, bridge , culvert and Growth Center Market (GCM), under 18 Upazila of four (4) districts namely Jashore, Magura, Jhenaidah, and Chaudanga, Bangladesh for Phase-I. LGED will implement the construction, rehabilitation, and improvements of priority rural roads and market infrastructure in four districts in the Western Region.

33. The proposed project activities will be implemented for the construction and widening of the existing road to reduce the time and cost of travel for passengers and freight and also develop supportive trunk infrastructure, including markets and logistics, to provide an impetus to the regional economy. In addition, this proposed project will help to facilitate new investments in LGED-managed rural roads, local markets, and agro-logistics in the ten districts through which the corridor passes.

3.2 Study Area

34. LGED will upgrade priority Upazila, Union, and village roads and complementary logistics infrastructure at rural markets (commonly referred to as growth centers) in the four (4) Program Districtsof Jashore, Jhenaidah, Magura, and Chuadanga.

35. 16 packages/sub-projects are divided into four groups. Group I (CW-05, CW-06, CW-13, CW-16), Group II (CW-01, CW-04, CW-07, CW-10), Group III (CW-08, CW-11, CW-14, CW-15), Group IV (CW-02, CW-03, CW-09 and CW-12) were screened, and few sample ES screening reports are included in **Annex A**. A brief description of these 16 packages is given below, GIS mapping of different packages is also shown in **Figure 3.1 to 3.16**.

36. CW-01: This package spans 30.073 km and connects Sadar Baghdanga Mandatola More to Sofia Kanon near Khalilor Rahman's House. The Bhairab Bridge is a significant part of the package , symbolizing historical importance and facilitating movement It passes through important sites like the Imambara, Chandutia Government Primary School and Chandutia Dakshinpara Jame Moshjid. After the Chandutia sluice Gate, an Oxbow Lake named Bukbhara Baor is situated on the left side of the sub-project road. 264 trees need to be cut, and 95 electric poles need to be shifted.

37. CW-02: The CW-02 package is a 33.4-km-long road connecting Arkandi to Charabari. It aims to enhance accessibility and preserve natural beauty. The area has a diverse population, institutions, and religious landmarks. It includes the Marjat or Mrjan baor, a refuge for avian species. 49 trees need to be cut, and 29 electric poles need to be shifted to preserve the environment. The project considers the Birsrestho Noor Mohammad Shrine and balances progress and preservation. The project map includes road patterns, environments, and water bodies.

38. CW-03: The CW-03 Package spans approximately 38.57 kilometers, connecting Yakub Ali House to Chutipur Bazar and encompassing the area from Bishori to Chutipur within the jurisdiction of Ganganandapur, situated in Jhikargacha Upazilla of Jashore district. This comprehensive initiative is centered on improving accessibility and fostering the development of the local community. Within this package area, notable educational institutions include Abdul Awal Smrity Autistic School, Jadhupur Government Primary School, and Kulia Government Primary School. Significant religious landmarks encompass Kulia Central Moshjid and Ganganandapur Kali Mandir. Cutting of 161 trees and shifting 45 electric poles will be required.

39. CW-04: The CW-04 project in Jashore district enhances education and accessibility over 17.823 km. The project connects Bethna to Sonadia Baor, fostering community development. Key establishments include government primary and high schools, Birsherestho Noor Mohammad Degree College, Pakshia Girls' High School, and cultural landmarks such as Sharupdaha Moshjid. 176 trees need to be cut, and 46 electric poles must be shifted carefully.

40. CW-05: The CW-05 project spans 34.212 kilometers in the Jashore district, amplifying connectivity and education. Institutions like Polashi College and landmarks like Taposshidanga Koborsthan Jame Moshjid make education and culture the focus. 273 trees need to be cut and 39 electric poles need to be shifted. Heritage preservation is embodied in landmarks like Michael Mudhusudon Datta Memorial House.

41. CW-06: CW-06 spans 23.74 km in Magura District. It covers Nobogram High School, Goalpara Primary School, Horindi Primary School, Khamarpara High School, Gopalpur Primary School, Langalbad Alia Dakhil Madrasa, and Dariapur Bazar Jame Moshjid. CW-06 also includes the Sreepur Mother and Child Hospital. No survey of tree cutting and pole shifting was done for the CW-06.

42. CW-07: The CW-07 package spans 18.07 kilometers in the Magura district and aims to improve connectivity and education. It includes bridges like Alaipur, Ichakhada, Alokdia, and Binodpur Bridges, which make travel across waterways easier. The package also connects the Nabadanga River, promoting unity among residents. Several schools and mosques are part of the project. 64 trees needs to be cut, and 9 electric poles will be shifted.

43. CW-08: The CW-08 package stretches for 30.651 kilometers through Singra in Magura, showcasing a dedication to improved connectivity and education. The project is anchored by esteemed institutions such as Bhaokhali Government Primary School, Bihari Lal College, Amiyan Secondary School, Bhulbaria Primary School, Bhulbaria High School, Khaila High School, and Binodpur BK School. The road winds through Singra's villages, promoting education and connecting communities. Along with education, the project also nurtures spiritual bonds through mosques such as Shingra Jame Moshjid, Khaila Math Para Jame Moshjid, Tallabaria Moshjid, Binodpur College Moshjid, and Piyadapara Jame Moshjid. Cutting of 76 trees and shifting of 20 electric poles will be needed.. Additionally, the project incorporates local heritage sites such as the Chandura Jomidar Bari and Cricketer Sourav Ganguly's House, which further enrich the story of Singra's evolution. This comprehensive project connects geography, aspirations, education, spirituality, and ecological sensitivity, all while capturing the essence of Singra's development.

44. CW-09: Project CW-09 unfurls a 24.55-kilometer route, bridging communities and knowledgein the Alamdanga region of the Chuadanga district. This corridor between Sonatonpurmor and Kumarigazirdongaparamor is synonymous with progress, touching the villages of Sonatonpurmor and Kumari. Along this transformative path, educational institutions like Kumari Union High School, Madarhuda Primary School, Munshiganj Girls' School, Daffodil Kindergarten and Precadet School, Putimari Government Primary School, JCB High School, Tekpara Panchila Government Primary School, Nowda Panchila Government Primary School, Panchila Secondary School, and Panchila JamalUddin School are pivotal in shaping the area's future. Spiritual and healthcare facilities such as the Himadri Eidgha, Mondir, Boro Putimari Jame Moshjid, Tekpara Panchila Jame Moshjid, Puraton Panchila Jame Moshjid, Red Crescent Hospital, and Mirzapur Community Clinic provide a holistic tapestry for the community's well-being. No survey of tree cutting and pole shifting was done for the CW-09.

45. CW-10: Package CW-10 pioneers development along a transformative 16.74-kilometer stretch in the heart of Chuadanga district. This dynamic corridor, bordering the Kopotakkho River, represents

progress and accessibility in the region. The package traverses several key localities, including Andulbaria, Puitala, Minajpur, and Banka. These vibrant villages showcase an array of educational institutions, such as Andulbaria Government Primary School, Puitala Government Primary School, Minajpur Government Primary School, Minajpur High School, and Banka Government Primary School, fostering a nurturing environment for learning. The package's construction included protective measures, striking a balance between infrastructure and nature. As 132 trees need to be cut and 30 electric poles need to be shifted before construction, the package encapsulates the harmonious coexistence of infrastructure and environment.

46. CW-11: The CW-11 road package in Chuadanga spans about 22.893 kilometers and passes by the picturesque Nobodanga River, featuring a lively bazaar. The area is home to educational institutions like Mohammad Juma D A.S.S Junior School, Asannagar Government Primary School, and Badarganj Degree College, as well as several religious sites such as Paschimpara Jame Moshjid, Boalia Puja Mondir, Boalia Majher Para Jame Moshjid, and Baki Billah Kamil Madrasa. BRM Hospital and Diagnostics Center also provide crucial healthcare services. No survey of tree cutting and pole shifting was done for the CW-11.

47. CW-12: CW-12, starting from Karpashdanga and extending to the Mujibnagar to Meherpur Road, traverses the charming villages of Karpashdanga to Boalmari and Karpashdanga to Natodah. This road project, spanning a length of 29.32 kilometers, crosses the Kajila River. It provides access to two bustling bazaars and hosts a range of educational institutions, including Hudapara Primary School, Kadipur Government Primary School, Loknathpur SS High School, Natipota Primary School, and Natipota High School. The religious diversity of the area is reflected in the presence of various institutes, such as Hudapara Jame Moshjid, Jahajhuta Uttorpara Jame Moshjid, Kutubpur Jame Moshjid,and many more. With a single bridge and thirty culverts, no survey of tree cutting and pole shifting was done for the CW-12.1.

48. CW-13: CW-13, located in the Jhenaidah district, covers a road length of approximately 20.50 kilometers, catering to a sizable population of over 1.77 million. This package is a vital regional connector, facilitating transportation and accessibility. Institutions like Mandarbaria Primary School, Amena Khatun College, and Kushbaria Primary School enrich the educational landscape. Diverse religious centers mark the area, including Sri Kali Mondir, Mandarbaria Hafezia Madrasa, Abdul Latif Dakhil Madrasa, Kushbaria Moshjid, and Hatgopalpur Central Moshjid. Jhenaidaha Sadar Hospital, Prince Hospital, Habiba Clinic, Diagnostic Center, and Balidanga Community Clinic addresshealthcare needs. This project activities contributes significantly to the region's development and connectivity with one bridge and thirteen culverts. No survey of tree cutting and pole shifting was done for the CW-13.

49. CW-14: CW-14, spanning approximately 33.60 kilometers, connects Bhatoibazar to Atfazilpurbazar in the Shailkupa Upazilla of Jhenaidah district. While specific population data and some project details are unavailable, this road project is vital in enhancing regional connectivity. Falia High School is among the educational institutions along this route, contributing to the local education landscape. Bhatai Kali Mondir and Nakoilbazar Community Clinic are religious and healthcare centers catering to the spiritual and medical needs of the community. With two bridges andnine culverts, CW-14 brings about improved accessibility and transportation options for the residents in this area. 27 trees need to be cut and 16 electric poles need to be shifted.

50. CW-15: CW-15 stretches approximately 28.808 kilometers, connecting Singaroad to Chulkanibazar in Harinakundu Upazilla of Jhenaidah district. The road is a crucial regional link, enhancing mobility and accessibility. Along this route, educational institutions like Payradanga Primary Schools contribute to the local educational landscape. The area is enriched with religious centers,

including Payradanga Old Moshjid, Kestopur Pata Koborsthan, Dokhalpur Bazar Jame Moshjid, Amerchara Eidgha, Parbotipur Eidgah, Biswaspara Jame Moshjid, Khalishakunda Madrasa, and Kalitala Kali Mandir. Ema Diagnostic Center, Harinakunda Health Complex, and Bhabanipur Hospitaladdress healthcare needs. With six bridges and fifty-eight culverts, CW-15 significantly fosters connectivity and development in Harinakundu. No survey of tree cutting and pole shifting was done for the CW-15.

51. CW-16: CW-16, extending approximately 28.27 kilometers, traverses the Jhenaidah district. CW 16 includes the Rangomohol Bridge over the Bhairab River, enhancing connectivity and transportation options. Educational institutions such as GK United Secondary School, GGMN College,Kolabazar High School, Kolabazar Primary School, and Mokhles Anowar College contribute to the local education landscape. The area features religious centers like Kolabazar Jame Moshjid and Salabhora Jame Moshjid. CW-16's impact extends to improved connectivity and accessibility for the residents. It plays a vital role in regional development with two bridges and twenty-one culverts. 31 trees need to be cut, and 14 electric poles need to be shifted before construction starts.

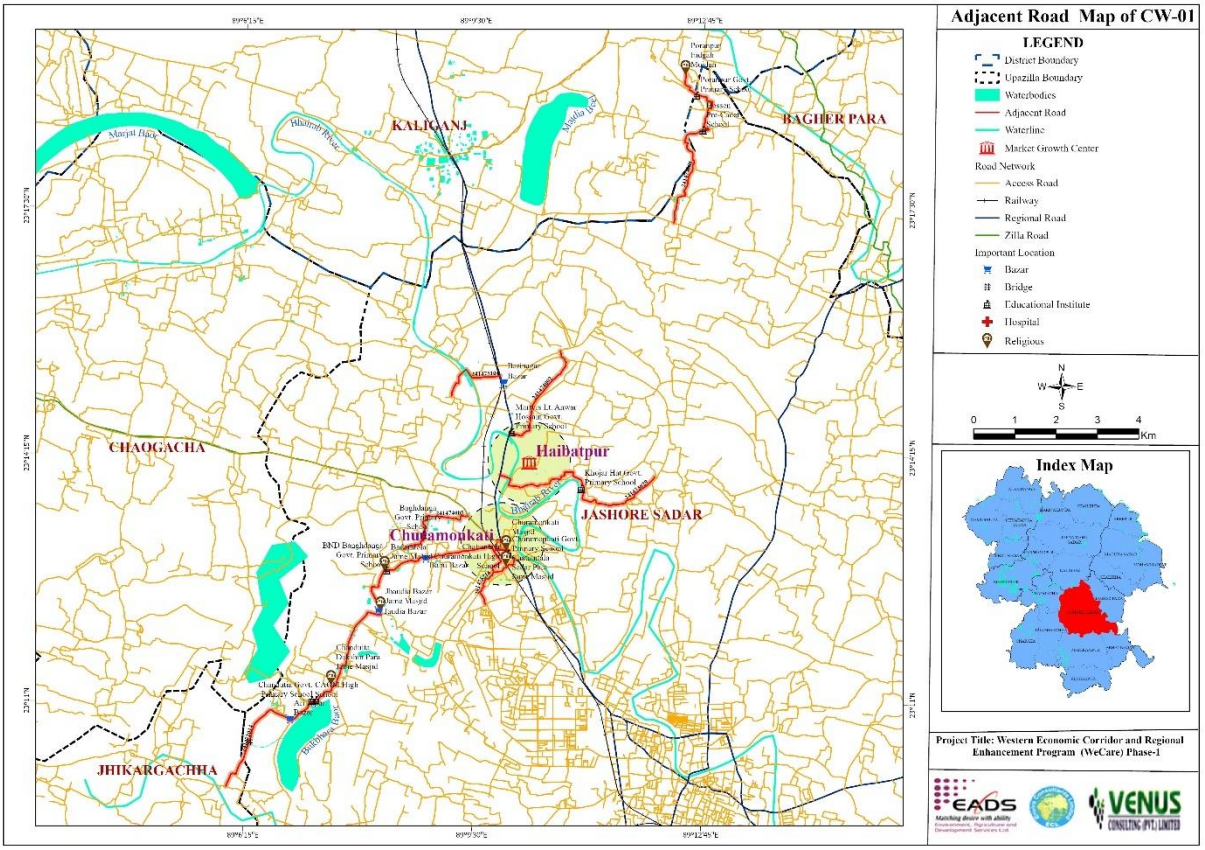


Figure 3.1: GIS Mapping for CW-01

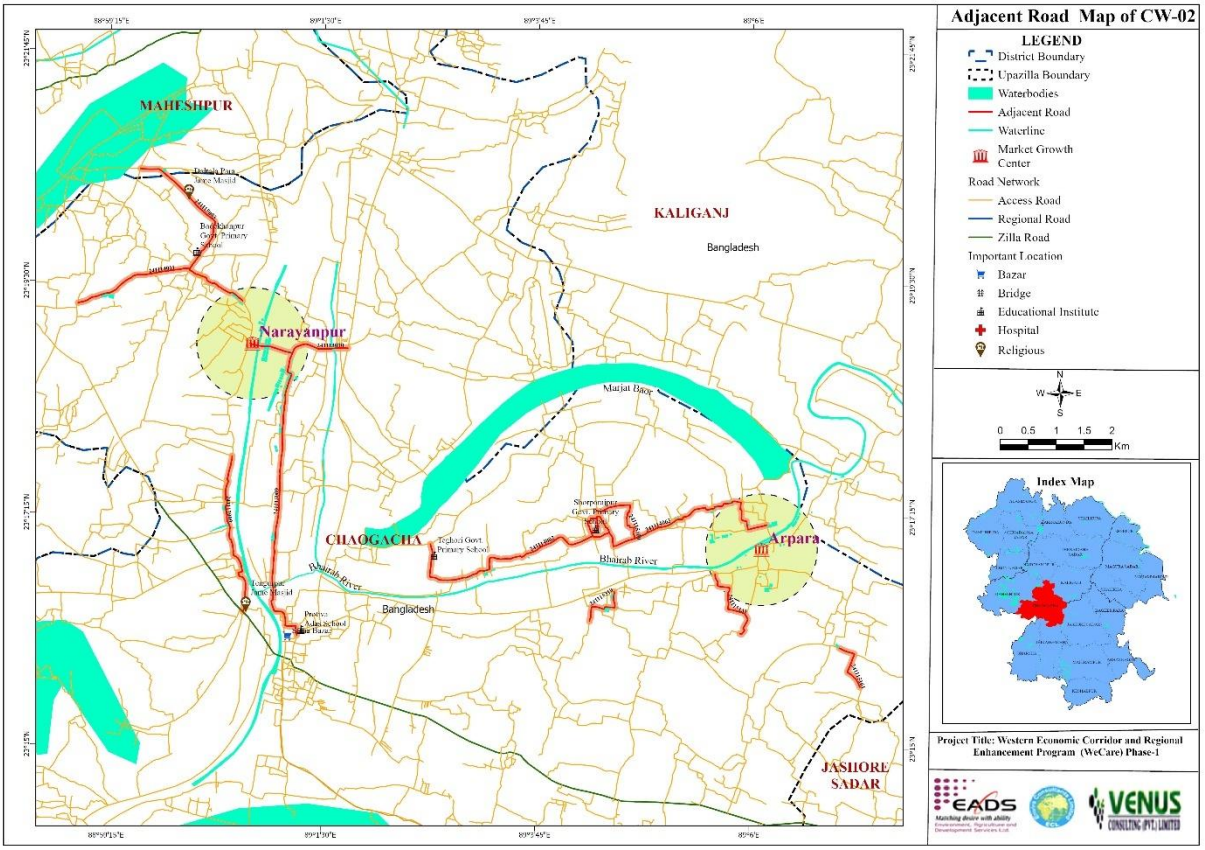


Figure 3.2: GIS Mapping for CW-02

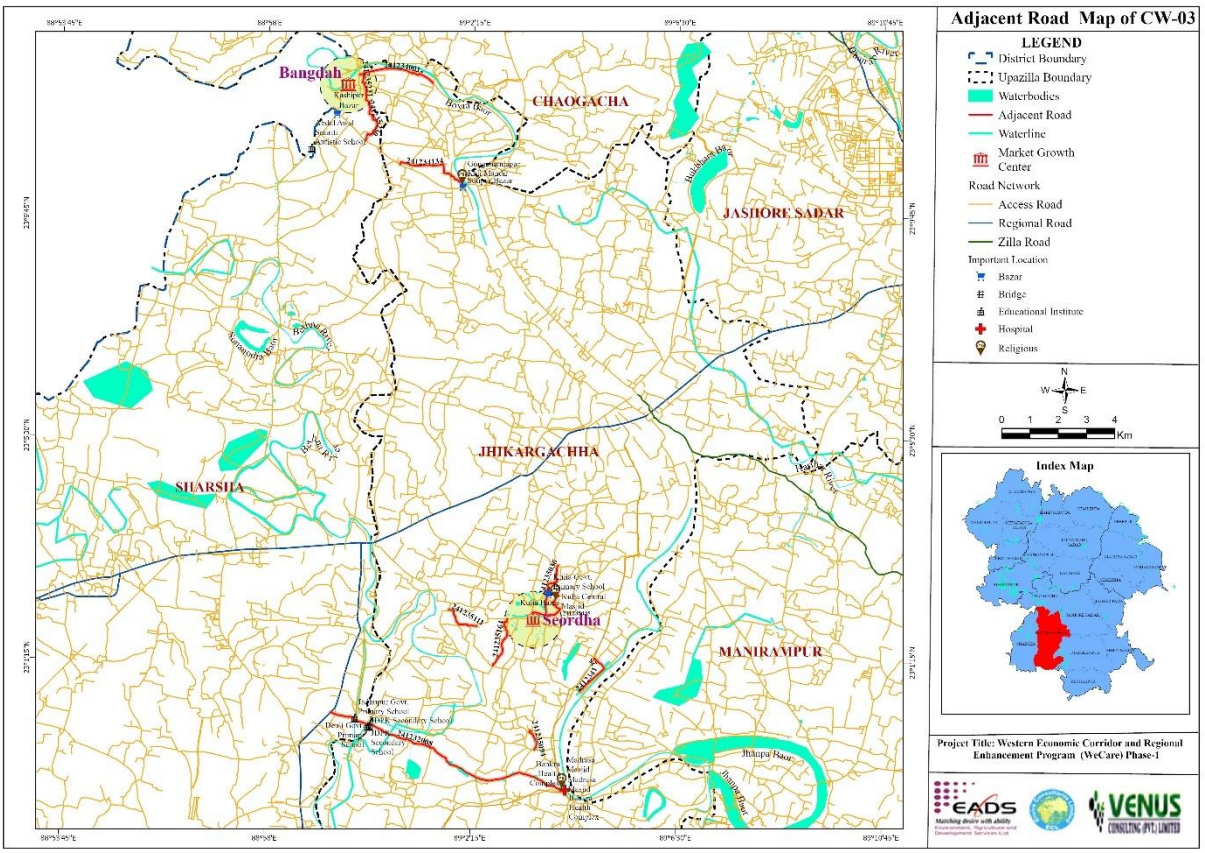


Figure 3.3: GIS Mapping for CW-03

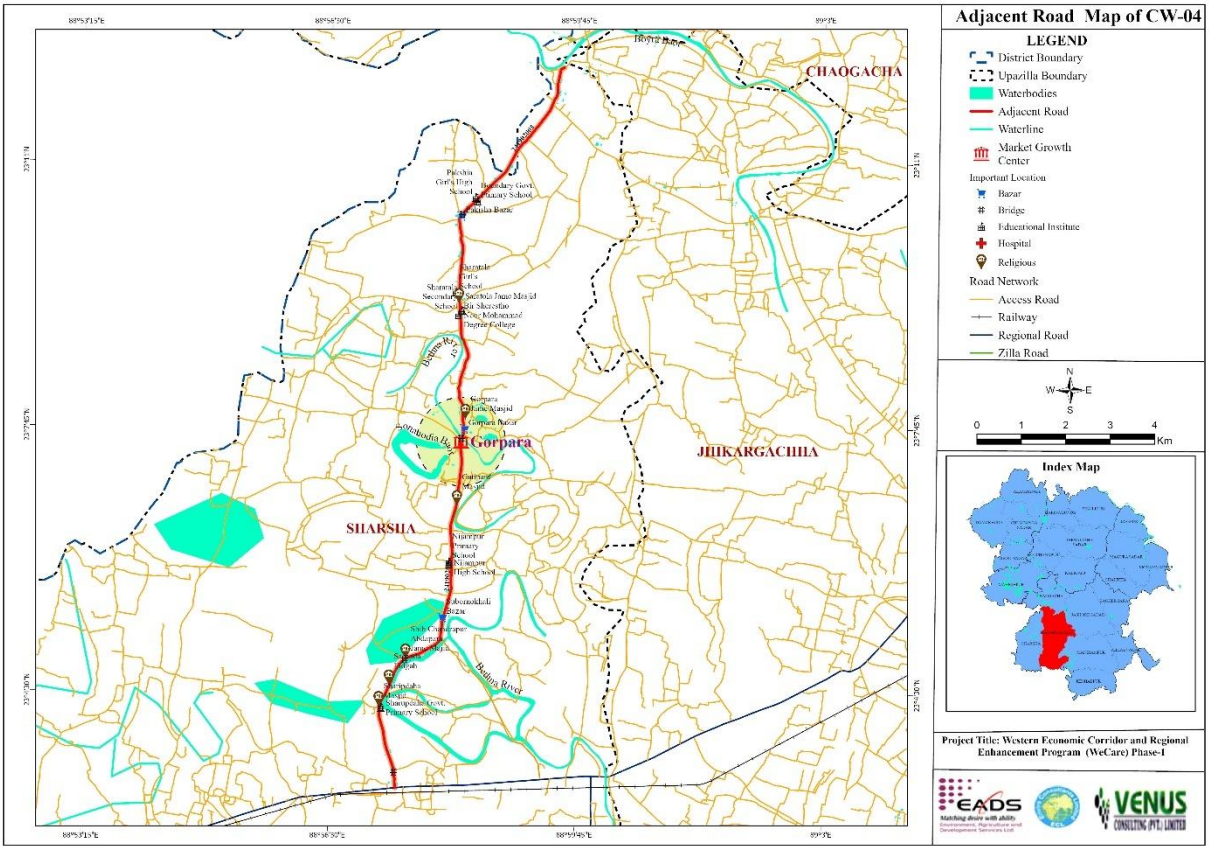


Figure 3.4: GIS Mapping for CW-04

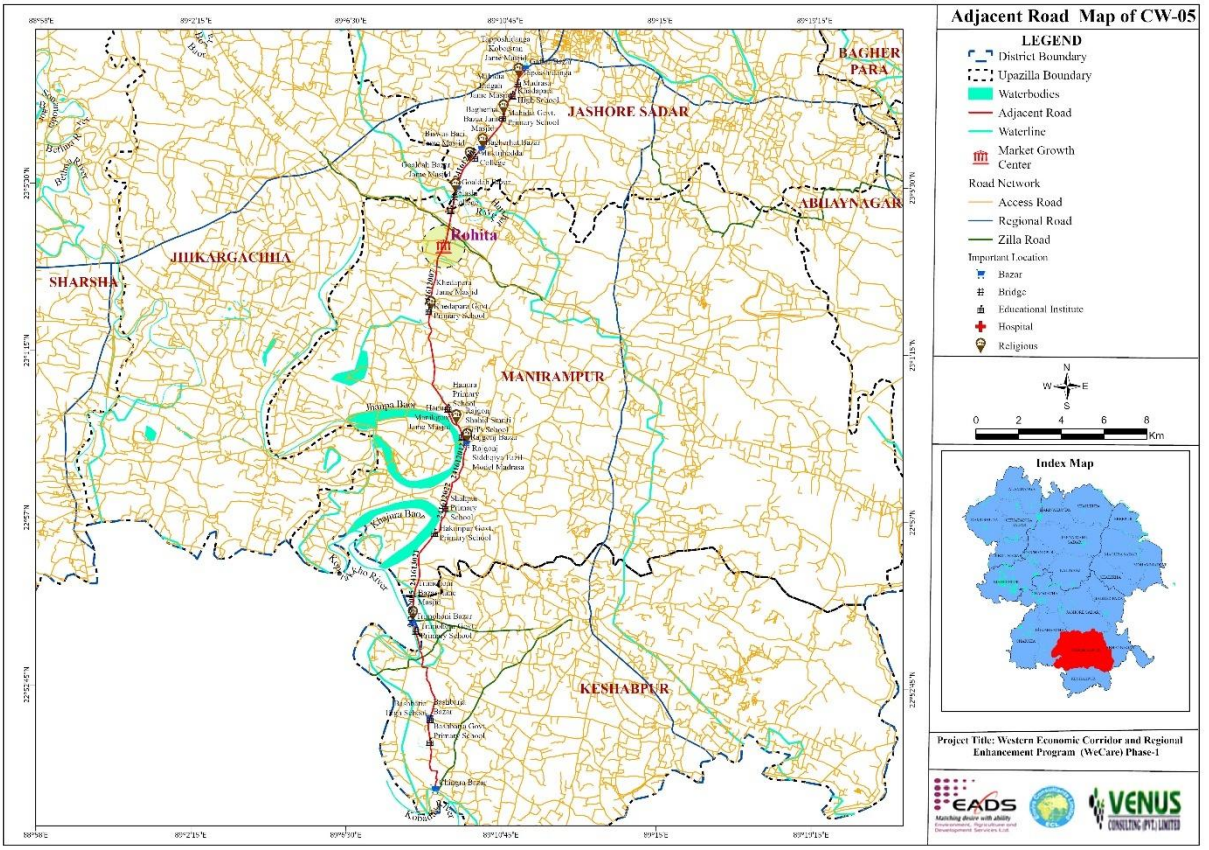


Figure 3.5: GIS Mapping for CW-05

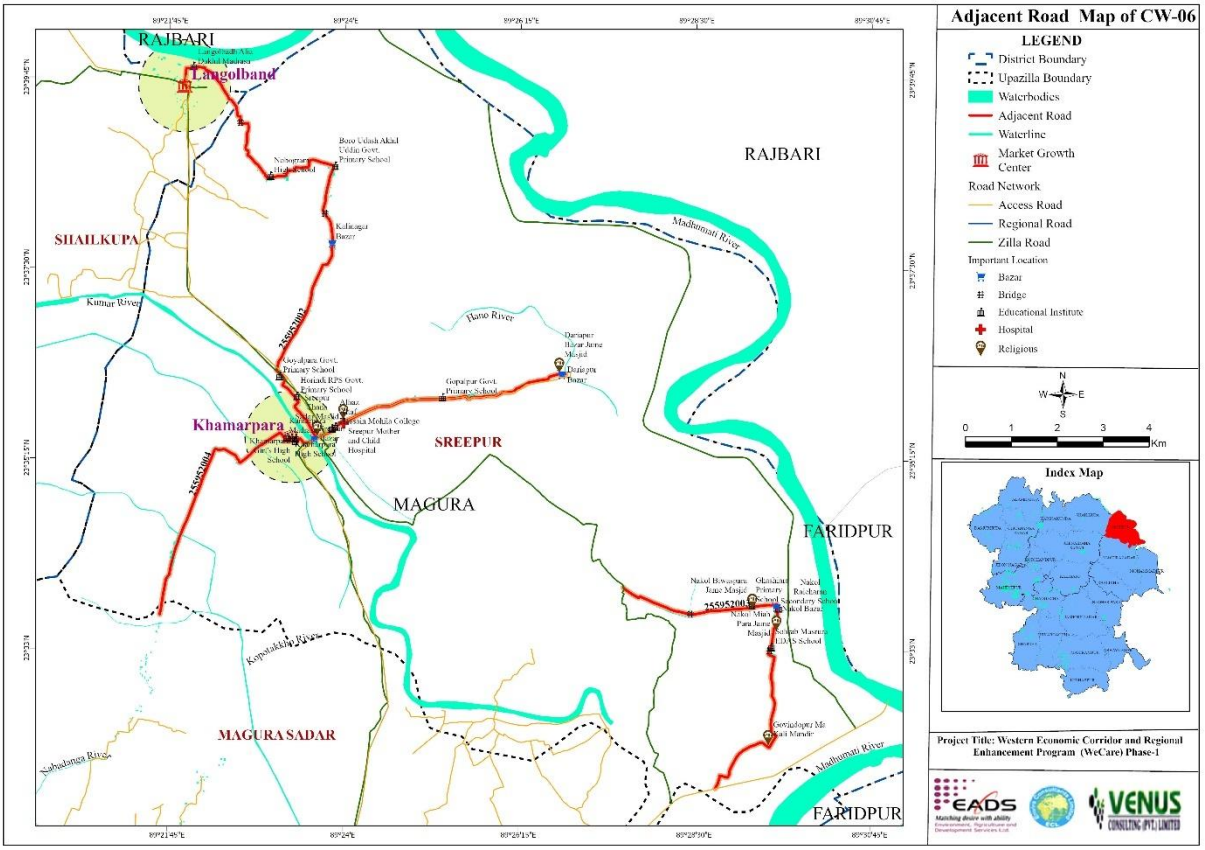


Figure 3.6: GIS Mapping for CW-06

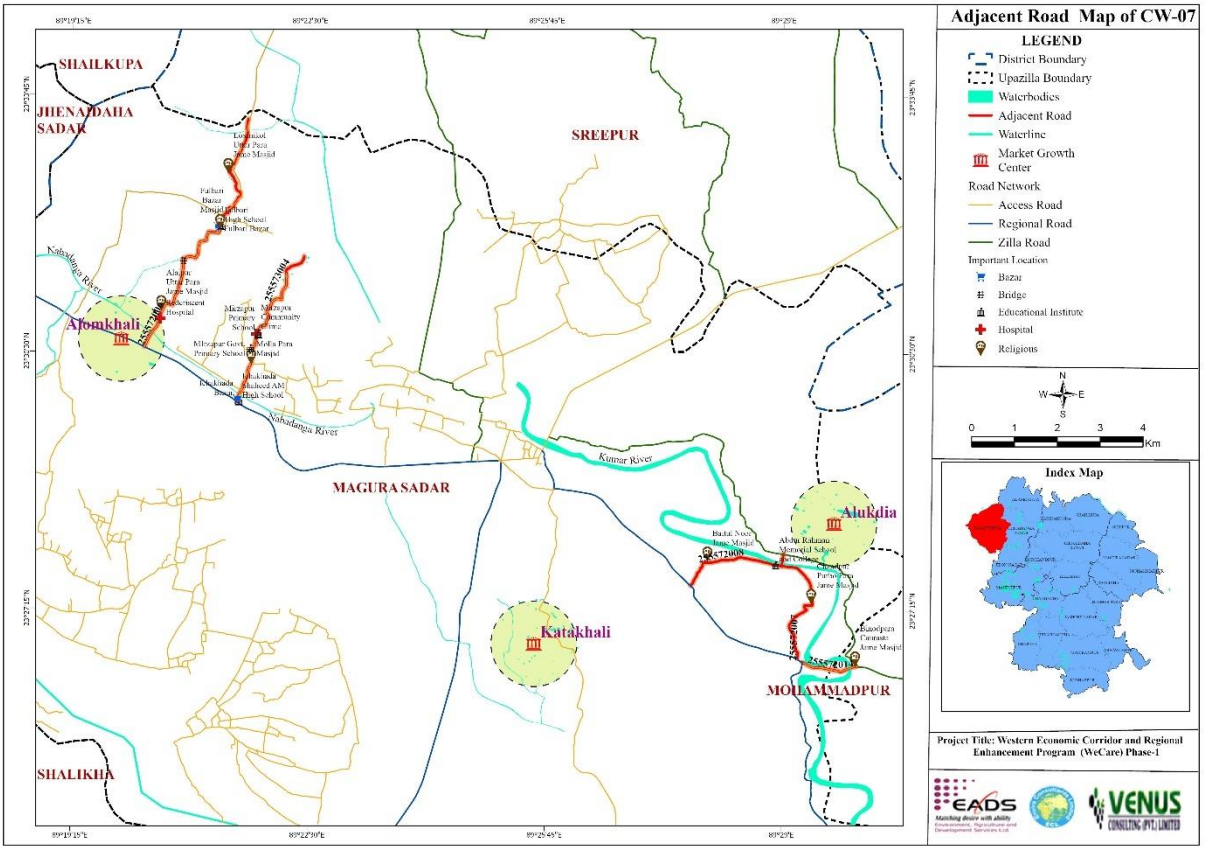


Figure 3.7: GIS Mapping for CW-07

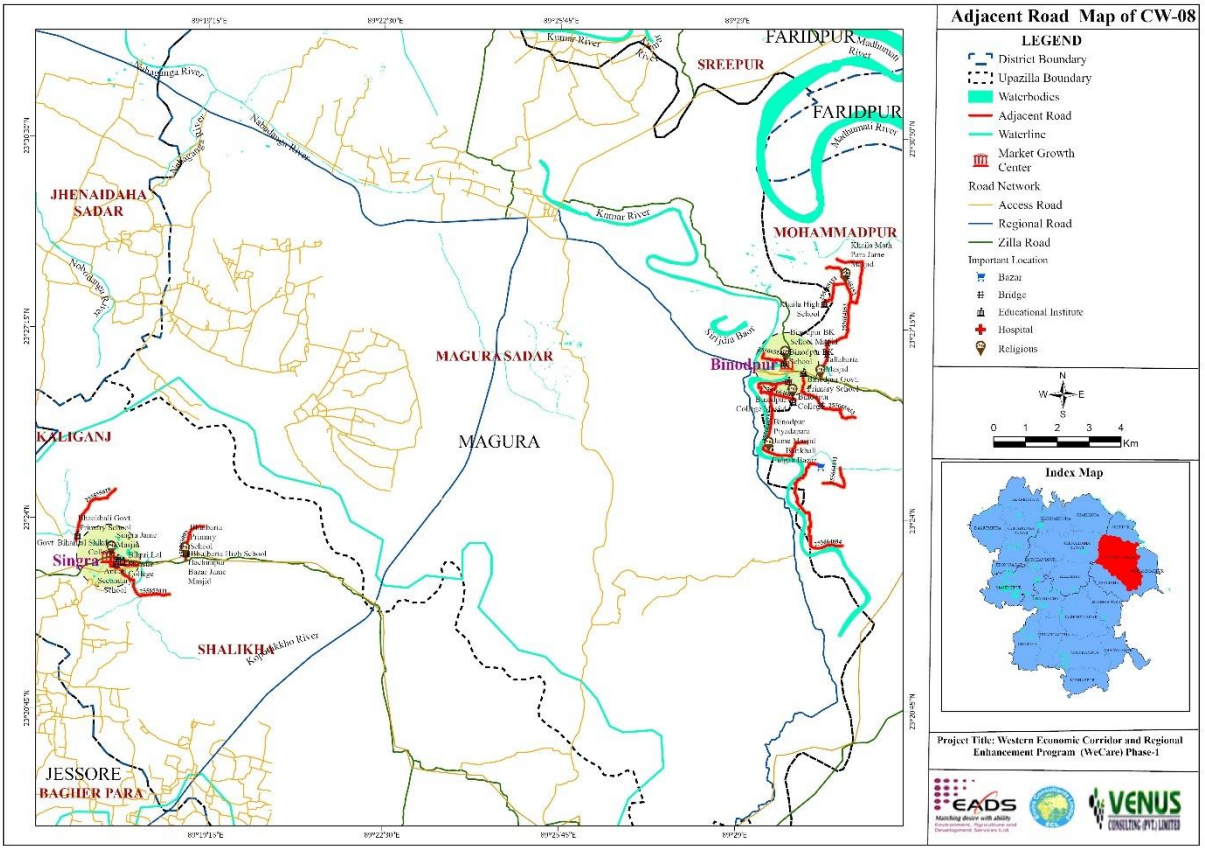


Figure 3.8: GIS Mapping for CW-08

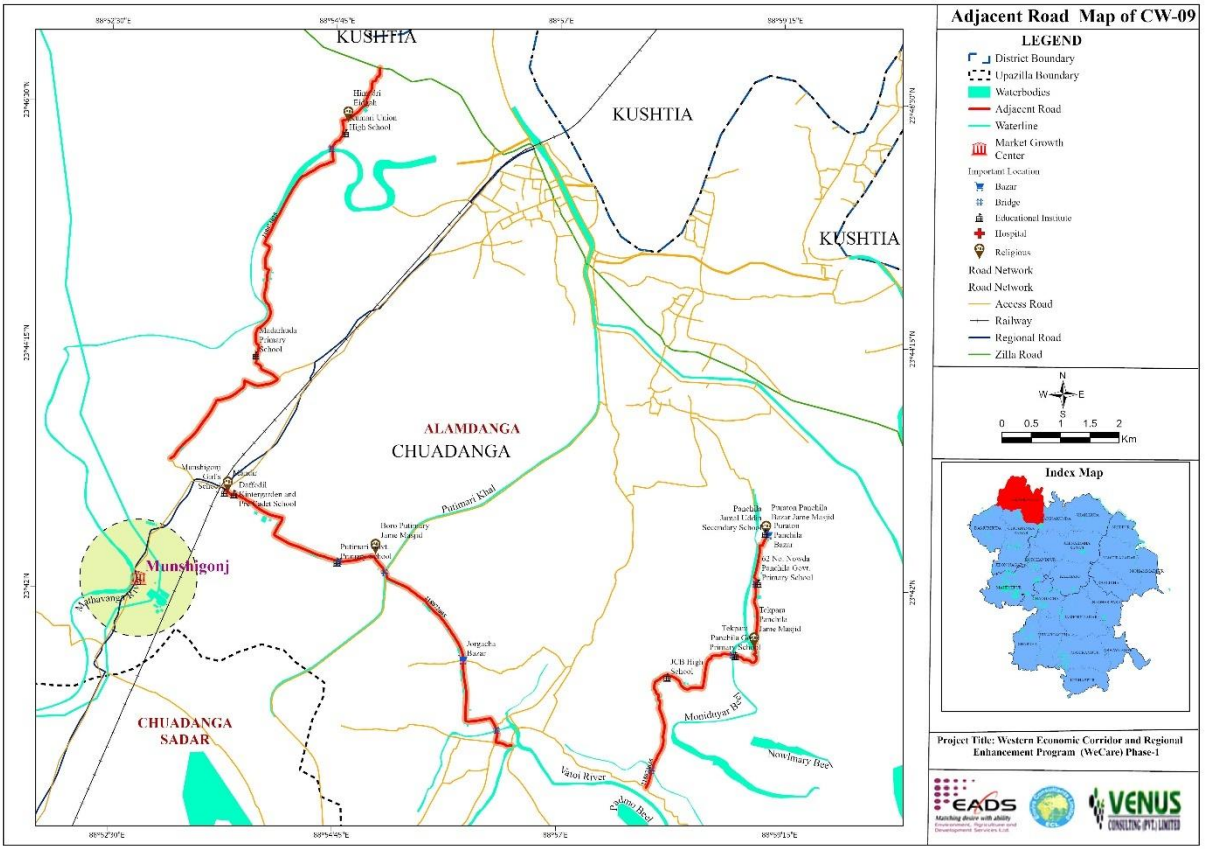


Figure 3.9: GIS Mapping for CW-09

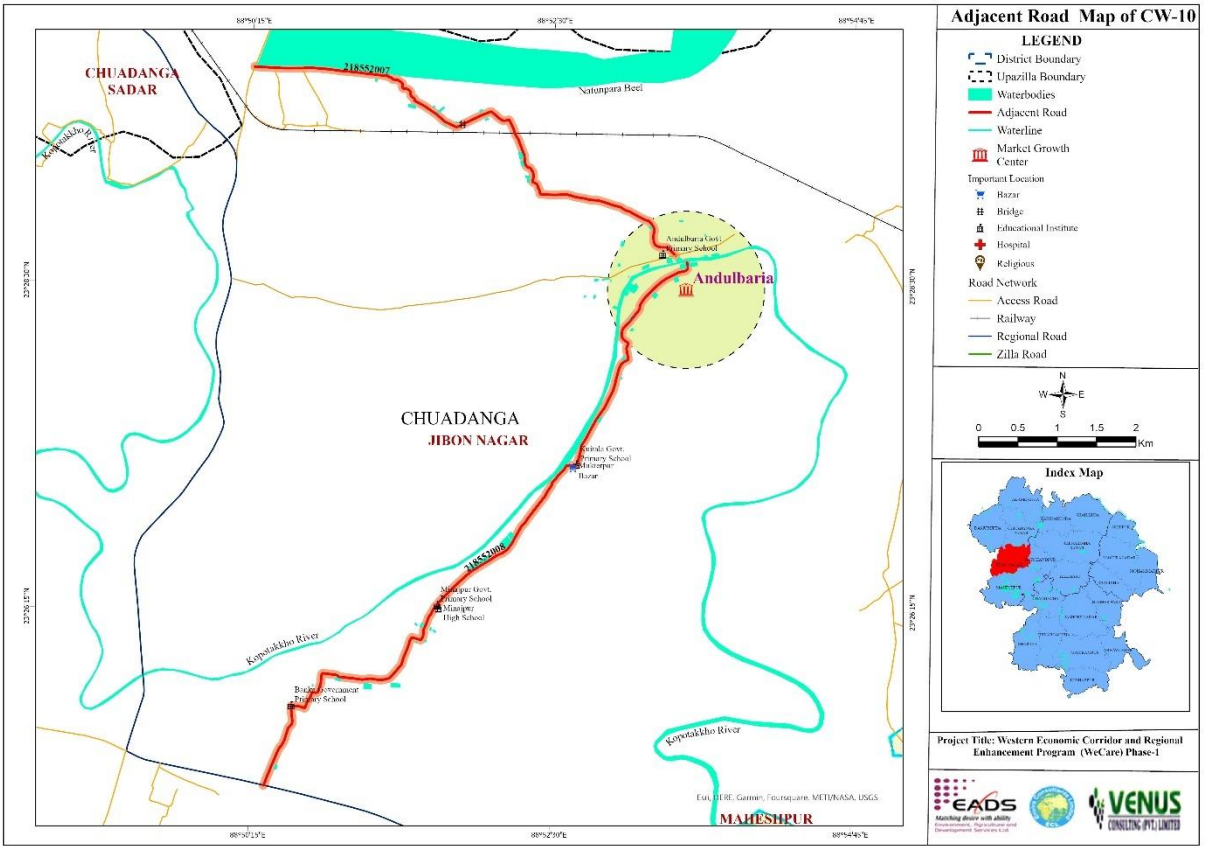


Figure 3.10: GIS Mapping for CW-10

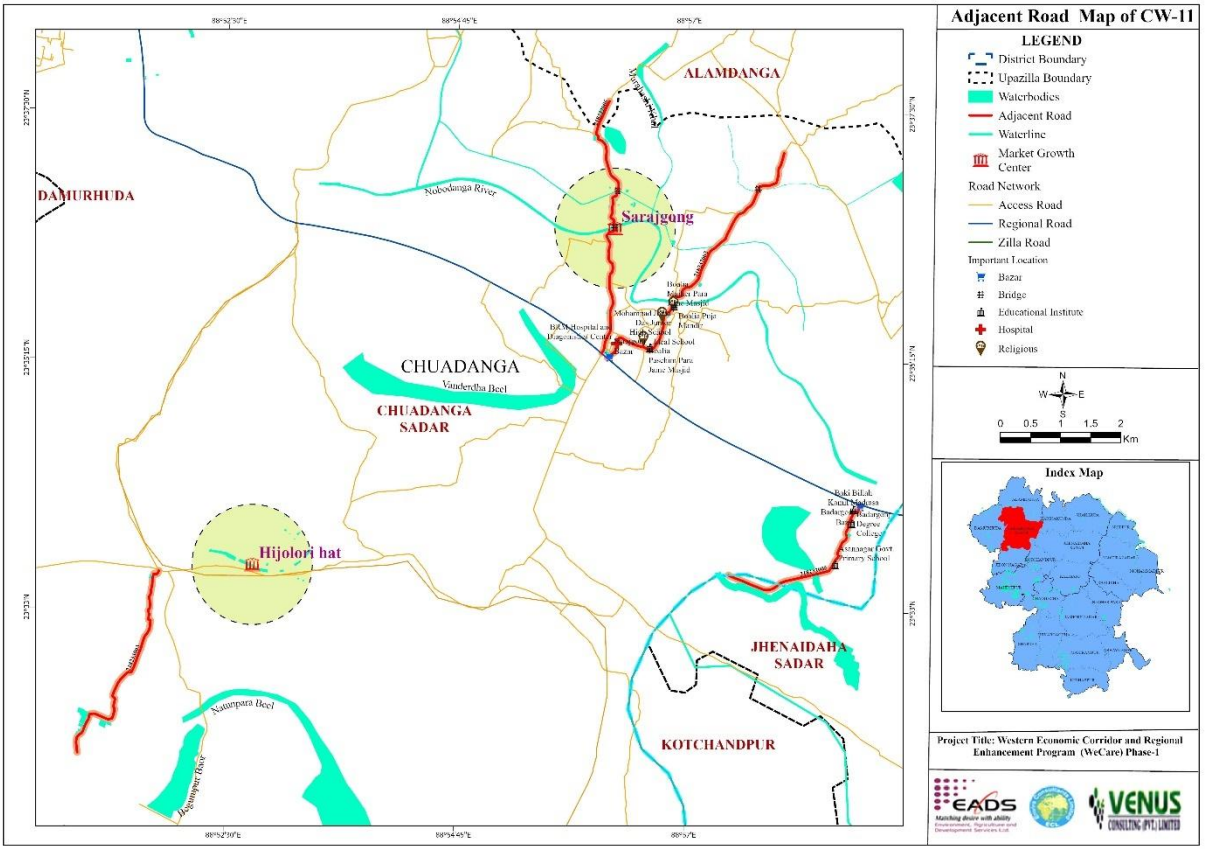


Figure 3.11: GIS Mapping for CW-11

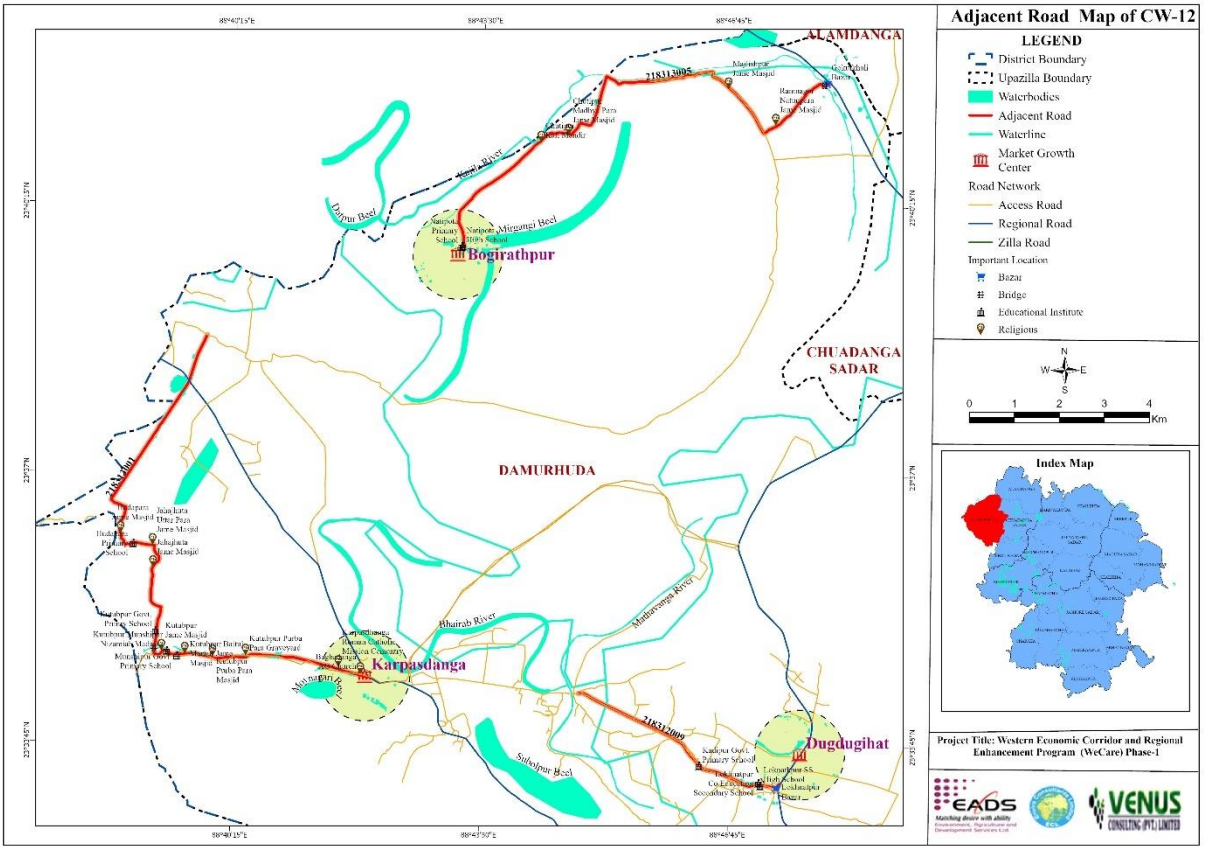


Figure 3.12: GIS Mapping for CW-12

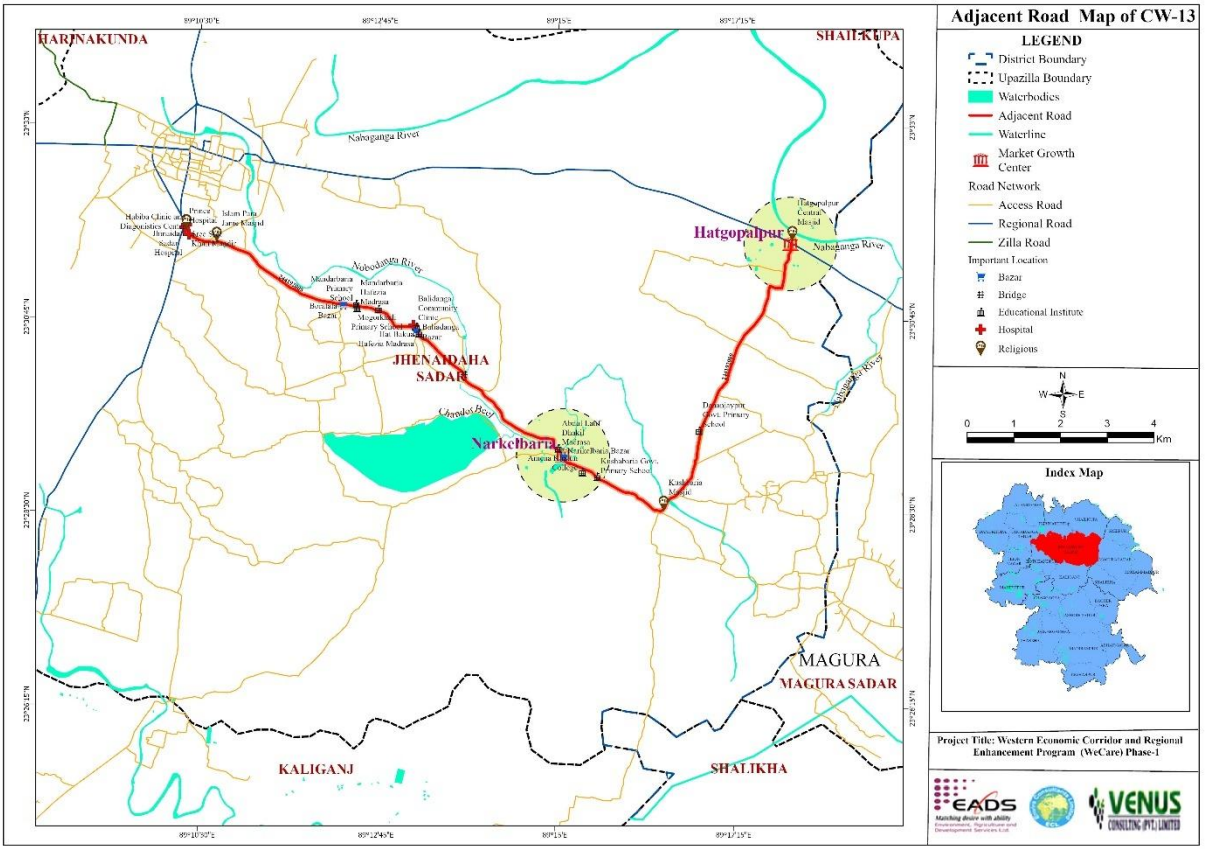


Figure 3.13: GIS Mapping for CW-13

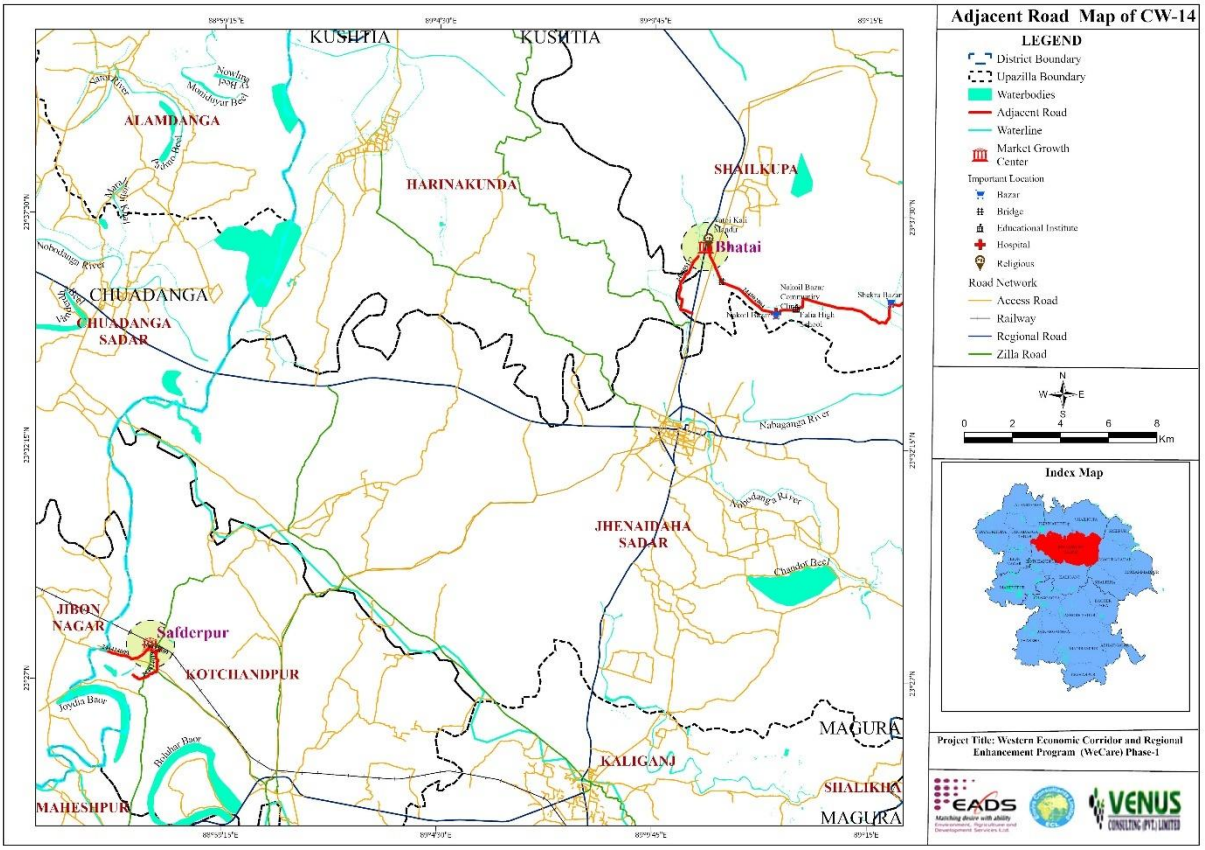


Figure 3.14: GIS Mapping for CW-14

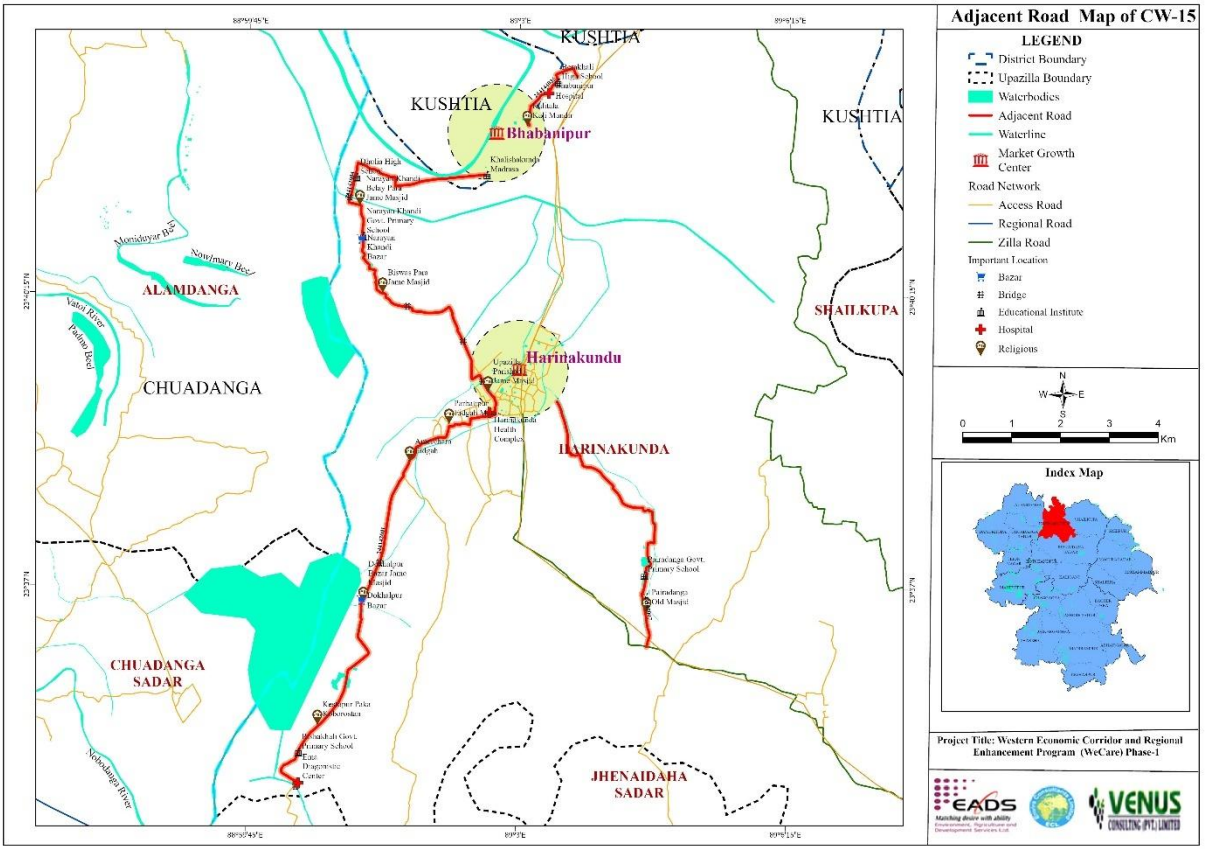


Figure 3.15: GIS Mapping for CW-15

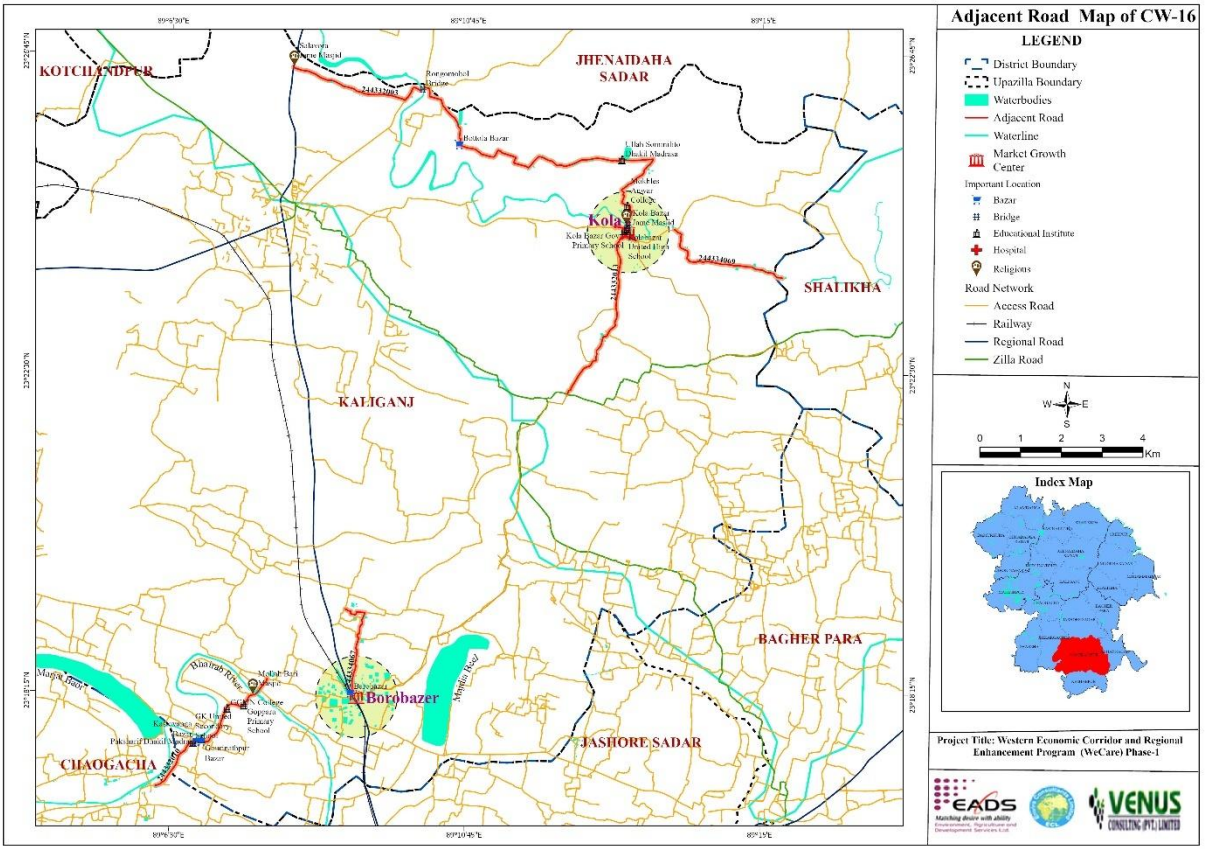


Figure 3.16: GIS Mapping for CW-16

3.3 Location and Length of the Road

52. A map showing 32 GCMs and adjacent roads is shown in **Figure 3.17**. For all 16 packages, detailed Information on available Khas Land, Total Number of Shops, SWM, Water Supply, Sanitation, Trees, and Electric Poles are shown in **Table 3.1**.

Table 3.1: List of Status of GCMs and Length of Adjacent Sub-projects Roads for 16 Packages

Sl. No.	CW	Name of GCM	Market (Dec.), Khas Land	Total no. of Shop	SWM Condition	Water Supply	Sanitation	Bridges/Culvert	Trees Cut	Electric Poles Shift	Length Road adjacent GCM, km	Archaeological sites in the project
1	CW 01	Haibatpur,Jashore	134	11	Poor	Tubewell	Poor	1/33	264	95	30.073	Imambara
		Churamankati, Jashore	64	28	Poor	Tube well	Poor					
2	CW 02	Arpara Bazar, Chaugacha,Jashore	35	135	Poor	Tube well	Poor	0/84	49	29	33.443	Shrine of Birsrestho Noor Mohammad
		Narayanpur Bazar, Chaugacha, Jashore	39	55	Poor	Tube well	Poor					
3	CW 03	Seordha, Jhikargacha,Jashore	135	138	Poor	Tube well	Poor	0/60	161	45	38.57	
		Bangdah, Jhikargacha,Jashore	63	23	Poor	Tube well	Poor					
4	CW 04	Gorpara, Sharsha, Jashore	150	41	Poor	Tube well	Poor	4/15	176	46	17.823	
5	CW 05	Ruhita, Monirampur Jashore	42	41	Poor	Tube well	Poor	1/22	273	39	34.212	Micale Mudhusudon Datta Memorial

Sl. No.	CW	Name of GCM	Market (Dec.), Khas Land	Total no. of Shop	SWM Condition	Water Supply	Sanitation	Bridges/Culvert	Trees Cut	Electric Poles Shift	Length Road adjacent GCM, km	Archaeological sites in the project
												House, Haummam Khana, Chachra Shib Mondir
6	CW 06	Longalbandh, Sreepur, Magura	1203	29	Poor	Tube well	Poor	4/19	57	25	23.74	
		Khamarpara, Sreepur, Magura	119	59	Poor	Tube well	Poor					
7	CW 07	Katakhali Magura Sadar	280	136	Poor	Tube well	Poor	1/19	64	9	18.07	
		Alamkhali Bazar, Magura Sadar	475	45	Poor	Tube well	Poor					
		Alokdia Bazar, Magura Sadar	160	45	Poor	Tube well	Poor					
8	CW 08	Singra, Shalika, Magura	181	205	Poor	Tube well	Poor	3/19	76	20	30.651	
		Binodpur, Mohammadpur, Magura	318		Poor	Tube well	Poor					
9	CW 09	Jamjamir Hat, Alomdanga, Chudanga	48	1	Poor	Tube well	Poor	7/16	82	55	24.55	
		Gokulkhali Alomdanga, Chudanga	168	51	Poor	Tube well	Poor					
		Munshigonj Alomdanga, Chudanga	979	185	Poor	Tube well	Poor					
10	CW 10	Andulbaria, Chaudanga	111	199	Poor	Tube well	Poor	1/31	132	52	16.74	
11	CW 11	Hijolgari, Chudanga Sadar	33	66	Poor	Tube well	Poor	3/16	65	92	22.893	
		Siraojgonj, Chudanga Sadar	Pending		Poor	Tube well	Poor					
12	CW 12	Dugdugi, Damurhuda, Chaudanga	195	75	Poor	Tube well	Poor	1/30	-	-	29.32	
		Bogiratpur, Damurhuda, Chaudanga	40	1	Poor	Tube well	Poor					
		Karpashdanga, Damurhuda, Chaudanga	183	383	Poor	Tube well	Poor					
13	CW-13	Narkelbria, Jhenaidah Sadar	93	183	Poor	Tube well	Poor	1/13	-	-	20.50	
		Hatgopalpur, Jhenaidah Sadar	243	255	Poor	Tube well	Poor					
14	CW 14	Bhatai, Shalokopa, Kotchandpur	256	312	Poor	Tube well	Poor	2/9			33.6	
		Sabderpur, Shailokopa, Kotchandpur	90	413	Poor	Tube well	Poor		27	16		
15	CW 15	Bhabanipur,henaidah	Pending	Pending	Poor	Tube well	Poor	6/58	59	59	28.808	
		Harinakundu, Jhenaidah	Pending	Pending	Poor	Tube well	Poor					

Sl. No.	CW	Name of GCM	Market (Dec.), Khas Land	Total no. of Shop	SWM Condition	Water Supply	Sanitation	Bridges/Culvert	Trees Cut	Electric Poles Shift	Length Road adjacent GCM, km	Archaeological sites in the project
16	CW 16	Kola bazar,Kaliganj, Jhenaidah	267	Pending	Poor	Tube well	Poor	2/21	31	14	28.27	
		Borobazar, Kaliganj, Jhenaidah	115.53	4	Poor	Tube well	Poor					Pir Pukur Mosque, Gorar Mosque, Hasilbag Mosque, Zor banglow Mosque
			5720.53	3135				37/465	1516	596	431.263	

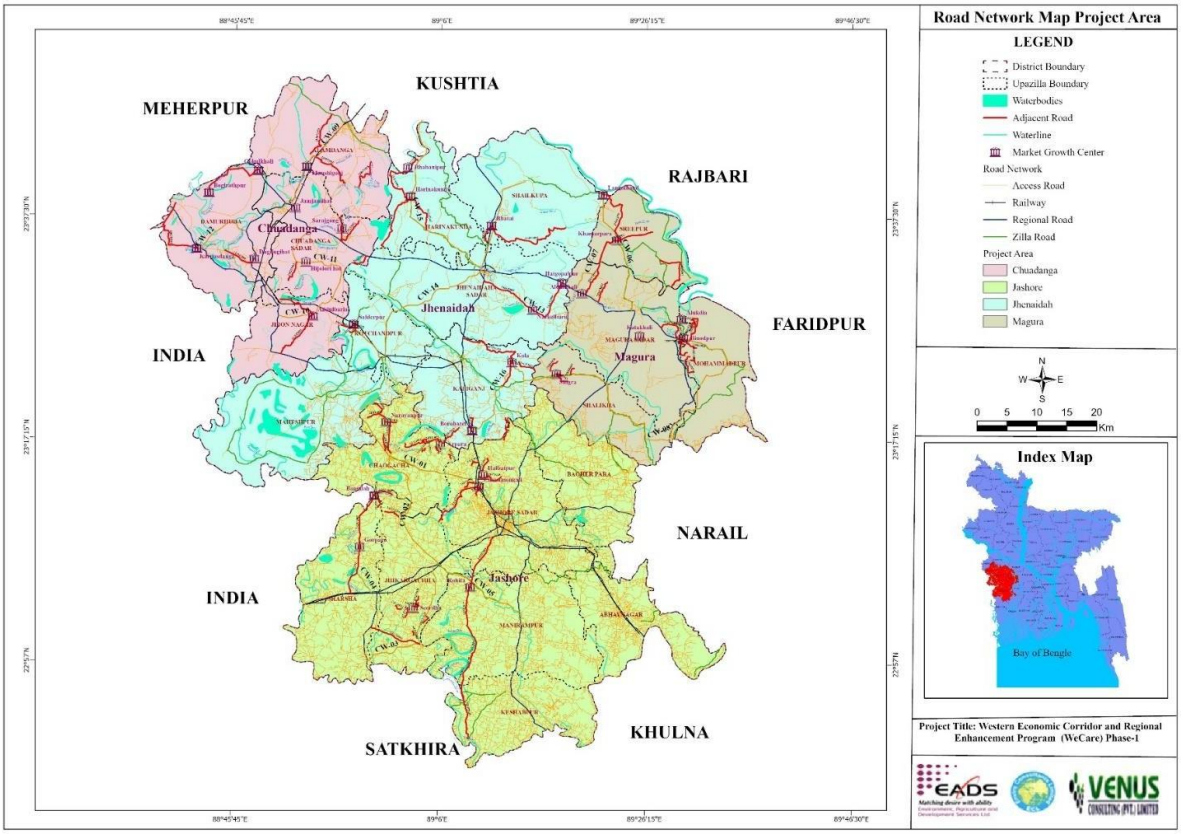


Figure 3.17: Location Map Showing 32 GCMs and Adjacent Road under 16 Sub-Projects within 4 Districts in Phase-I Project Area

3.4 Project Activities

53. Several activities, planned under the 16 packages are shown in **Table 3.2**.

Table 3.2: Project Activities of Roads, Markets, Bridges, and Culvert

Activities of Road	Activities of Markets	Activities of Bridge and Culvert
1. Widening of road 2. Removal of base and sub-base material 3. Road safety 4. Road Divider 5. Lightening and landscaping 6. Bus bay	1. New Construction of Markets 2. Construction of drainage system 3. Solid Waste Management (Waste from vegetable kitchen markets, slaughter houses, fish markets, cattle markets, and various shops) 4. Cattle market improvement 5. Vegetable wholesale market development	1. Road sharp curve 2. Regional Hydrology/ Flooding 3. Erosion and Siltation 4. Ghat

Activities of Road	Activities of Markets	Activities of Bridge and Culvert
7. River Bank Protection 8. Road Sharp curve 9. Sign and signal 10. Occupational HS 11. Climate resilience 12. Dust Pollution/Noise Pollution 13. Disposal of solid waste 14. Occupational HS 15. Labor camp management	6. Waste Management (Compost) 7. Waste generation per day, Hat Day, disposal site 8. Toilet Facilities available 9. Water supply and Sanitation 10. Separate toilet facilities for women 11. Labor camp management 12. Parking space 13. Renewable (Solar) energy 14. Rainwater harvesting 15. Dust Pollution/Noise Pollution 16. Disposal of Wastewater 17. Occupational HS	construction for ferry/boat landing near a river 5. Drainage Congestion /Waterlogging 6. Road safety

3.5 Project Influence Area

54. The project's area of influence incorporates two concepts: direct and indirect impacts. Areas of direct impact are considered the physical footprint of the project, such as right-of-way, construction sites, work staging areas, and areas affected during the construction and operational phase.

55. Identifying the scope of indirect effects can be difficult as it involves changes arising fromroad construction, operation, and activities beyond the project's direct control. These changes may have cumulative or induced effects on nearby areas. GCM will consider a one-kilometer radius and for road a 50-meter width on either side of the road alignment will be considered as the project's area of influence. This area covers indirect impacts such as land-use changes, water quality, biodiversity, transportation patterns, employment rates, economicgrowth, and social issues related to land acquisition. The project influence area varies depending on theactivities of each package/sub-project.

3.6 Sub-Project Footprint and Activities Considered for ESIA

3.6.1 Present Status of the Project

56. The project is now in its initial phases. Physical development and construction work have yet to start, as observed during the July 15, 2022 site visit.

3.6.2 Pre-construction Phase Project Activities

57. The topography in the project area will be changed to some extent because of the construction of the proposed project-related structures, such as bridges, culverts, markets, etc. Visual changes to the topography would be permanent.

58. The project (LGED component) requires no land acquisition for any package. None of the other packages involve land acquisition, although all have presence of informal occupants. The project RAPs – in total 4 covering all 16 packages – set down the related compensation measures and other compliance issues consistent with the Bank ESS5 and relevant national laws.

3.6.3 Detail Drawing and Design

59. Environmental and social factors will be considered necessary forprotected areas,designated archaeological sites, water bodies, graveyards, and other religious sites. They will be avoidedbefore the

market, road, and bridge designs are finalized. A typical layout plan of the market, typical cross section of UZ and Union/village road and a typical design of a bridge is presented in the **Annex C**. Upazila Road cross-section: total crest width 7.32 m, carriage width 5.5 m, softshoulder 0.91 m on the left side and 0.91 on the right sides, and slope 1:1.5. Union/Village Road is of total crest width 5.52 m, carriage width 3.7 m, soft shoulder 0.91 m on the left side and 0.91 right sides, and has a slope 1:1.5.

3.6.4 Construction Phase

60. Once preliminary preparations are completed, the construction phase will proceed. Major construction activities include work side area preparation, civil work, roads, the removal of existing pavement material, the improvement of markets, and other logistical infrastructure. These activities willbe scheduled consecutively for the highest possible efficiency to complete the GCMs and roadconstruction within the dry season. Several development activities and their completion methodologieswould require special attention. A diverse workforce comprising skilled and unskilled labor will be engaged during construction activities. Essential tasks such as Right of Way (RoW) clearance, trenching, and testing will be executed through manual labor and mechanical methods. The primary working camp will be in a rented facility with essential amenities, including office space, water facilities, and sanitary provisions with safety tanks. During the construction phase, the labor requirement will range from 1000-1500 during normal operations and 2500-3000 workers for peak construction activities. Additionally, field camps strategically positioned near project activity areas along the RoW will be established to meet specific project needs for temporary durations. These field camps will be equipped with essential services such as drinkable and washable water, power supply, and sanitary facilities featuring septic tanks. To ensure the stability of the backfill material, compaction will be carried out using approved methods to prevent any subsequent subsidence in the construction zone.

61. The project SEA/SH risk rating for LGED is ‘moderate’. A standalone SEA/SH Risk Mitigation Plan has been prepared that includes provisions, among others, enforcement of a Code of Conduct (CoC) for all workers (**Annex G**), a SEA/SH compliant GM along with awareness generation and mapping of SEA/SH service providers. The project LMP also includes provisions of CoC and as well as workers GM, among other measures.

3.6.5 Operational Phase Activities

62. Once the roads are upgraded and GCM is improved and commissioned, it will be ready to transport and start the markets. Road maintenance requires constant vigilance. Emergency maintenance engineers will be trained and available immediately to repair breaks and other necessary repairs along a road route. Efficient waste disposal is integral to the environmental management system of the project. The LGED authority is committed to minimizing waste generation through practical measures. Solid wastes, like vegetation and domestic refuse, will be screened and disposed of in designated areas. Chemicals will be listed and disposed of following government guidelines. Septic tanks and designated sites will manage sewage water and diesel/oil. Socially, the displacement of shopkeepers and the associated costs must be managed throughout the project phases.

CHAPTER 4: ANALYSIS OF ALTERNATIVES

4.1 Introduction

63. Based on the results of the environmental and social screening, alternative site and technological designs were analyzed for the proposed project interventions, considering environmental, social, and technological criteria (**Annex-B**). In the case of major impacts or risks in any area of the proposed roads and growthcenter, the consultant will suggest a recommendation as per local feedback and other social and environmental considerations to LGED. The village road will be connected to the Upazila road and the Upazila road, and the trunk road will be connected to the RHD road from Jashore,Jhenaidah, Magura, and Chuadanga.

4.2 Site Selection

64. During the environmental screening, it was found that the proposed sub-project roads and GCMs are existing infrastructure with inadequate road width and poor conditions.

4.3 Alternate Method of Analysis

65. Technological Design: Alternate designs are considered based on climate resilience measures, mainly temperature, and flood, for the sustainability of the road project, along with adaptation measures. Use high-quality bitumen and admixture and maintain the road as climate-resilient as possible.

66. Alternative Construction Materials: Alternative construction materials should be used where applicable. Stone chips, sand-cement uni-block, and environmentally friendly materials are proposed tobe used instead of brick chips. Nanotechnology-based additives, such as nanoparticles, nanofibre membranes, etc., can be used as an admixture for road construction, which improves the strength, durability, and performance of roads and infrastructure, waterproofing, reducing air pollution, and making the road climate resilient.

4.3.1 Uni-Paver Block Pavement

67. The roads with interlocking uni-paver blocks have been proposed on road segments on a pilot basis. Uni-block provides better benefits and solutions for Environment and Climate Change Considerations.

68. Alternative Method of Construction: The most sustainable method of construction is to use sustainable materials, such as recycled materials, low-carbon-emitting products, and renewable energy. The use of recycled asphalt pavement (RAP) in road construction has become more common over the last few years. RAP is produced by grinding up old asphalt pavement and using it as a base material for new pavement.

69. In some cases, may also add crushed glass or plastic bottles. Warm-mix-asphalt is an alternative to traditional hot-mix-asphalt. It reduces temperature during mixing and laying resulting in reduced energy consumption and greenhouse gas emission. It also allows easier compaction. The projectauthority also planned for tree plantations for the stability of the roads and to increase scenic beauty atthe same time. The trees will balance the warm temperature, be a source of carbon sinks, and reduce soil erosion and ecological balance.

70. Alternate Site Consideration: Two alternatives have been considered for the alternate site: oneat CW-08 and the other at CW-14. The first one is the Khalia Mondolpara Jafor Master House to KhaliNurul Mollah House Road ID no. 255665152 from Ch. 0+000-1+601 m (total length=1.601 km). Thereis an

existing damaged sluice gate at the Kalia-Masterpara (255665152) road, which is very narrow andsituated in a very sharp curve location. No vehicles can go through the sluice gate except motorcycles,bicycles, and auto rickshaws. The community requested a bridge or culvert in a suitable location. A 3-vent box culvert (size: 4.5 X 3.0 X 5.5 m) was proposed by the design consultant. However, the safeguard consultant suggested that three vent box culverts or bridges shift up steam and join both endroads and make it straight to maintain the speed of the road and avoid accidents, which will be helpfulfor the community. There are many advantages to straightening the road.

71. Advantages of the proposed Sub Project alignment over the existing alignment are presented in **Table 4.1**. The existing Topographical view with the proposed Sub Project alignment (red color dotted line) of Khalia Mondolpara Jafor Master House to Khalia Nurul Mollah House Road (Road ID-255665152) under CW-08 is presented in **Figure 4.1**.

Table 4.1: Criteria for Selection of Proposed Alignment for Sub-Projects Over the Existing Alignment

SL	Name of Road/ Issues	Present Location and after implementation of Road	Proposed alternate alignment	Advantages
1	Khalia Mondolpara Jafor Master houseto Khali Nurul Mollah house. (Ch. 830m to Ch. 905m)	All types of vehicles cannot move, only three-wheelers, motorcycles,and rickshaws can move, and is unsafe. After implementation, the following 14 factors affect road communications.	All types of vehicles can move if alternate alignment is considered and straight the roadalignment	Reduce the time of travel and cost of fuel, less risk travel.
2	Safe journey	Unsafe safe journey	Safer journey and traffic	Safer journey and for traffic
3	Length of the road including culvert	75 m	25 m (3-vent box culvert 15 m plus both sides 10 m approach road)	50 m length of the roadwill be reduced.
4	The cost of the road will be reduced	No cost will be reduced. Maintenance costs will increase	67% cost will reduce. Less maintenancecost.	67% of the cost of road construction will be reduced. Because no need construction of 50 m road. Hence, the construction cost of a 50 m road will save
5	Risk of accident	High	Less	Reduce risk significantly
6	Curve	4 curves in the existing design	No curve. The road will be straight	No need for additional carefulness.

SL	Name of Road/ Issues	Present Location and after implementation of Road	Proposed alternate alignment	Advantages
7	Carefulness	Need additional carefulness the driver	No need for additional carefulness from the driver	Relax the driver whiledriving
8	Needs to stay alert and aware	Driver needs to stay alert and aware	Driver need not stay alert and aware	Comfortable for all
9	Pedestrian awareness	Pedestrians need to have more awareness while crossing the culvert	Pedestrians need to have less awareness while crossing the culvert	Pedestrians need to have less awareness while crossing the ditch and safer
10	Additional care	Need additional care from the opposite side vehicle drivers and pedestrian	Need less additional care from the opposite side vehicle drivers and pedestrian	Only normal care will be required for the drivers andpedestrians
11	Speed of the vehicle	Need to reduce the speed of the vehicle	No need to reduce the speed of vehicles	Time saves, fuel saves, and less vehicle maintenance will be required
12	Land	60 m required Length be will	20 m length will be required	40 m length of road length will be surplus which can be used for other purposes.
13	Road safety	Need more caution	Need less caution	Driver needs less perception time and less caution
14	Road board safety sign	More road safety sign boards are required only before the culvert	A road safety sign board is required only before the culvert	Reduce the number of theroad safety sign board
15	Land acquisition	Land acquisition will not be required but the construction of a new culvert will require permission from BWDB.	Land acquisition will not be required. Land requisition or permission will be required from BWDB.	Since the Khal is Govt. (BWDB) owned khas land,only land requisition or permission from BWDB will be required.
16	Opinion of the localpeople	If the culvert isconstructed at the existing location there will be unsafe transportation dueto sharp curves and risk of accident.	Safe travel and no risk of accident. Local people demanded that the road should be straight.	Local people suggested that the culvert should be shifted upstream as locatedin the dotted line and make the road straight.

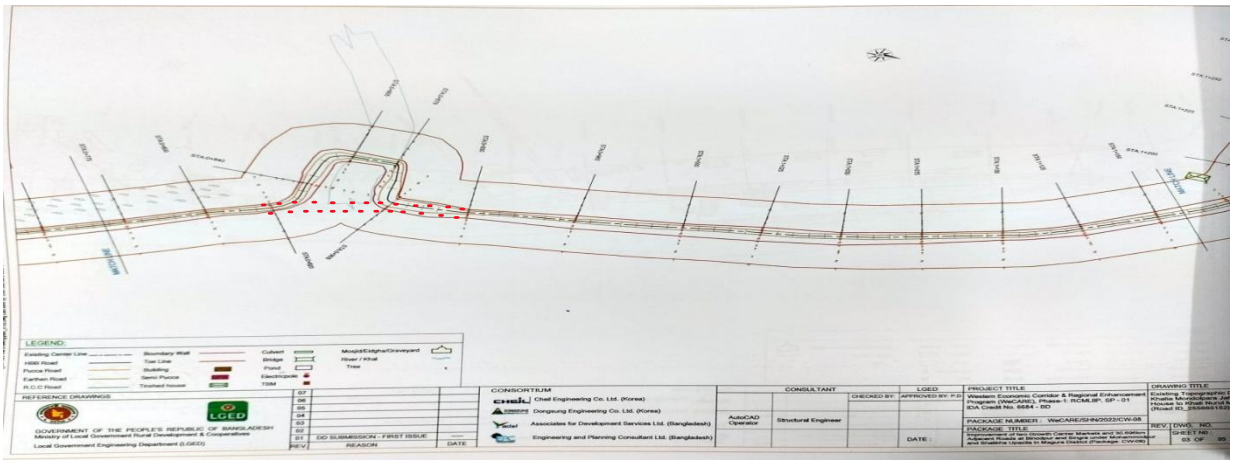


Figure 4.1: Existing Topographical View with Proposed Sub Project Alignment (red color dotted line) of Khalia Mondolpara Jafor Master House to Khalia Nurul Mollah House Road (Road ID-255665152) under CW-08

72. The second one is at Vatoi GC Road to Hatfazilpur GC Road, under CW-14. The bridge at Chainage is 15+567 m to 15+591.4 m under CW-14, with sharp curves at both ends. An alternate parallel bridge through alternate alignment will be required. The existing bridge is narrow, and the widthof the bridge is inadequate for vehicle movement. The existing bridge width expansion is not possible.Hence, an alternative alignment with straightening the road is suggested for new bridge construction.

4.4 Without Project Scenarios

73. From a physical and environmental point of view, “do nothing” is preferable to “any project implementation” to avoid the adverse impacts associated with the project. However, the potential socioeconomic benefits to the nation would be foregone, and human resources would not be developed.It is concluded that the ‘no build’ alternative is unacceptable, and the potential socio-economic benefitsof the implementation of such a project far outweigh the adverse impacts, all of which can be controlledand minimized to an allowable level.

4.5 Selection of Different Project Considerations Over the Alternates

74. The reasons for selecting different project considerations over the alternates are presented in **Table 4.2**.

Table 4.2: Reasons for Selecting Different Project Considerations Over the Alternates

	Selected Option	Possible Alternates	Reason for Selecting the Option	Benefits achieved by the proposed selection
Design Method	Bangladesh National Building Code (BNBC) 2020, UBC 1997, ASCE 7-02, and ACI 2008. AASHTO Code, 2007/2020.	Non-conventional method	The standard method is generally used in Bangladesh. Non-conventional methods are not justified since they are not proven and established.	It is a proven and established method.
Site Selection for GCM	Multi-criteria Analysis Consider crop production and the	Value Chain Analysis (VCA)	No expertise on VCA of Feasibility study consultant	More economic, and social benefit

	Selected Option	Possible Alternates	Reason for Selecting the Option	Benefits achieved by the proposed selection
	price of crops at the field and market. Road condition			
Selection of road alignment	Multi-criteria Analysis	Value Chain Analysis (VCA)	No expertise on VCA of Feasibility study consultant	More economic, and social benefit
Construction Method	Recycled Asphalt Pavement (RAP) on road	Rigid Pavement	It reduces lower temperature during mixing and laying resulting in reduced energy consumption and greenhouse gas emissions. It also allows easier compaction. Rigid pavement is costly.	Lost cost with durability
Site Consideration for Material Mobilization	Through truck, lorry, etc.	Non-motorized traditional cart.	Mobilization of Non-motorized traditionalcarts is time-consuming and increases transport costs.	Low cost with less time for mobilization.
Paving Material	Stone chips, Brick Chips,bitumen, Asphalt	Admixture can be usedfor road construction to increase strength, Nanoarticle can be used. Waste plastic material can be used as road paved material with the latest technology.	Standard materialused. Technology is not available for the waste plastic material for road paved construction.	Locally available. No import will be required.
Cutting and Filling Method	Excavator and Backhoe	Manual method. Not possible within thestipulated time.	Standard andconventional, Timely completion ofwork is possible	Less cost, lesstime with require.
Locating the cut earth mass	They were not identified by the Feasibility study. A part of the cut earth will be used in the shoulder. The rest of the cut material will be used to fill up the lowland.	Store in the project site.	Waste use as a resource. Save money.	Application of 3R

CHAPTER 5: ENVIRONMENT AND SOCIAL BASELINE

5.1 Introduction

75. This section includes the existing environmental baseline status of the study area, covering both the natural and social environments. The analysis was completed through the use of a combination of secondary data sources to establish an understanding of the environmental and socio-economic baselineof the project area. The likely possible impacts on the environment and society based on the actual and foreseeable events/project activities have been studied. The data for this chapter were collected from:

- Primary Sources: This included gathering information from field surveys and public consultations in the project area.
- Secondary Sources: This included data from literature reviews, maps, and monitoring reports.

76. First-hand information has been collected to record the micro-environmental features within and adjacent to the project area. The consultation was another source of information to explain local environmental conditions, impacts, suggestions, etc. The following section describes the baseline environment in four broad categories:

- Physical Environment: Meteorology, Geology and Soil, Topography, Hydrology, and Land Use;
- Biological Environment: Factors related to life such as habitats, aquatic life, fisheries, terrestrial habitats, and flora and fauna;
- Environmental Baseline Quality: Air, Water and Noise Quality; and
- Socio-economic Environment: anthropological factors like demography, income, and infrastructure.

5.1.1 Method for Selection of Sampling Location

77. Selection of representative sampling location criteria play an important role in the initiation of any developmental activity as it provides an outlook on the type of environmental compliance and management to be adopted by the project proponent. The methodology for environmental sampling location involves a systematic approach to ensure representative and reliable data collection. The project proponent had primarily given the sites for monitoring of ambient air, noise, water (surface, and ground), vibration, and soil.

78. The consultant selected the suitable sampling locations based on Area of Influence (AOI) of GCMs andadjacent Roads where maximum emission or health hazard will happen for ambient air quality and noiselevel. The selections of sampling sites were chosen based on the free-flowing air, wind direction, and well-mixed air. Surface water sampling location were selected from nearby pond or river. Ground watersample's locations were selected hand tubewell within the GCM. Soil sample locations were selected near the Auto/Tempu or Bus stand. The selected parameters and their selection basis is presented in **Table 5.1** below:

Table 5.1: Rationale of the Parameters

Parameters	Number of Locations Selected	Reasons
Air Quality	46	All the GCMs and road junctions where most of the gathering happens and air pollution will be significant.
Ambient Noise Level	46	All the GCMs and road junction where most of gathering happened and noise pollution will significant.

Parameters	Number of Locations Selected	Reasons
Surface Water	46	Pond, River and Canal available nearby GCMs and road where generally wastewater discharge into the nearby water course.
Ground Water	46	Tubewell available nearby GCMs and road where generally people take water from this tubewell for various purposes.
Drinking Water	46	Deep tubewell available nearby GCMs and road where generally people take water from this tubewell for drinking purposes;
Soil	46	At the GCM and road where possibility of soil contamination happen.

79. The detail of GPS coordinates of 16 CWs along with the name of the sampling locations are presented in **Table 5.2**.

Table 5.2: Specific Location, GPS Coordinates and Rationale of 16 Packages (GCM Wise)

Sl. No.	Ambient Air Quality (AAQ)	Ambient Noise Level, Vibration & Met. Data	Water Quality (Collected from near GCMs)			Soil
			Ground Water	Surface Water	Drinking Water	
CW 01	Haibatpur					
	150 m Southwest corner of the Satmail Bazar, Haibatpur	150 m Southwest corner of the Satmail Bazar, Haibatpur	150m Southwest corner of the Satmail Bazar, Haibatpur	Nearby Pond GPS coordinates shown below	150 m Southwest corner of the Satmail Bazar, Haibatpur	150 m Southwest corner of the Satmail Bazar, Haibatpur
	23°15'4.09"N 89° 9'51.30"E	23°15'4.09"N 89° 9'51.30"E	23°15'3.78"N 89° 9'51.53"E	23°14'54.16"N 89° 9'34.96"E	23°15'3.78"N 89° 9'51.53"E	23°15'4.52"N 89° 9'51.94"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 02	NARAYANPUR					
	5 m North of Narayanpur Bazar, 50 m North of Narayanpur Land Office	5 m North of Narayanpur Bazar, 50 m North of Narayanpur Land Office	5 m East of Narayanpur Bazar, 100 m East of Narayanpur Land Office	Tube well, 5 m North of Narayanpur Bazar, 50 m North of Narayanpur Land Office	Tube well, 5 m North of Narayanpur Bazar, 50 m North of Narayanpur Land Office	5 m North of Narayanpur Bazar, 50 m North of Narayanpur Land Office
	23°18'54.13"N 89° 0'45.29"E	23°18'54.37"N 89° 0'45.28"E	Kopotakhho River 23°18'53.76"N 89° 0'48.98"E	23°18'54.34"N 89° 0'49.10"E	23°18'54.10"N 89° 0'45.78"E	23°18'54.24"N 89° 0'45.86"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and	Most used nearest GW source from where market people take	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate

Sl. No.	Ambient Air Quality (AAQ)	Ambient Noise Level, Vibration & Met. Data	Water Quality (Collected from near GCMs)			Soil
			Ground Water	Surface Water	Drinking Water	
			wastewater discharge into this	water		
CW 03	BANGDHA					
	20 m East side of Bangdha Market, 50 m Northeast corner of Bangdah Bazar Jame Mosque	20 m East side of Bangdha Market, 50 m Northeast corner of Bangdah Bazar Jame Mosque	50 m South side of Bangdha Market, 50 m East side of Bangdah Bazar Jame Mosque	Tube well, 20 m East side of Bangdha Market, 50 m Northeast corner of Bangdah Bazar Jame Mosque	Tube well, 20 m East side of Bangdha Market, 50 m Northeast corner of Bangdah Bazar Jame Mosque	20 m East side of Bangdha Market, 50 m Northeast corner of Bangdah Bazar Jame Mosque
	23°12'15.28"N 88°59'38.18"E	23°12'14.76"N 88°59'38.08"E	23°12'13.75"N 88°59'38.08"E	23°12'15.40"N 88°59'37.74"E	23°12'15.41"N 88°59'37.38"E	23°12'13.00"N 88°59'37.72"E
	Bus stop, Traffic density mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 04	GORPARA					
	5 m Southwest corner of Gorpara Bridge	5 m Southwest corner of Gorpara Bridge	5 m Southwest corner of Gorpara Bridge	120 m Northwest Corner of Gorparabazar Mor	5 m Southwest corner of Gorpara Bridge	130 m Northwest corner of Gorpara Kachabazar
	23° 7'36.60"N 88°58'13.46"E	23° 7'36.60"N 88°58'13.46"E	23° 7'36.39"N 88°58'13.60"E	Betna River water 23° 7'39.97"N 88°58'10.03"E	23° 7'36.39"N 88°58'13.60"E	23° 7'41.27"N 88°58'12.45"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 05	ROHITA					
	Rohita market and adjacent road	Middle of bazar	250 m North of the Bazar	Tube well at North-East Corner Bazar	Tube well at North-East Corner Bazar	240 m North of the Bazar and west side of the road
	GPS coordinate 23° 3'57.49"N 89° 9'5.28"E	GPS coordinate 23° 3'57.49"N 89° 9'5.28"E	GPS coordinate 23° 4'0.38"N 89° 9'7.85"E	GPS coordinate 23° 3'56.71"N 89° 9'5.80"E	GPS coordinate 23° 3'56.68"N 89° 9'5.42"E	GPS coordinate 23° 3'56.54"N 89° 9'3.48"E
	Near road side	Bazar with	Only the	Nearest Ground	Nearest	Nearest Soil

Sl. No.	Ambient Air Quality (AAQ)	Ambient Noise Level, Vibration & Met. Data	Water Quality (Collected from near GCMs)			Soil
			Ground Water	Surface Water	Drinking Water	
	for Traffic density, mass people movement.	road side to most density and noisy place.	nearest surface water source	water source for GCM	Drinking water source for GCM	source for GCM
CW 06	LANGOLBADH BAZAR					
	Langalbandh market	Middle of bazar	470 m south of the GCM	Deep tube well 500 m south of the GCM	Tube well 480 m south of the GCM	South side of GCM
	23°39'39.14"N 89°21'56.17"E	23°39'39.14"N 89°21'56.17"E	Canal water 23°39'36.42"N 89°22'0.31"E	23°39'39.48"N 89°21'55.09"E	23°39'38.90"N 89°21'55.22"E	23°39'39.11"N 89°21'55.39"E
	Near road and most density place	Bazar with road side to most density and noisy place.	Nearest surface water source	Nearest Ground water source for GCM	Nearest Drinking water source for GCM	Nearest Soil source for GCM
CW 07	ALOMKHALI					
	50 m north corner of Alamkhali Bazar	50 m north corner of Alamkhali Bazar	50 m north corner of Alamkhali Bazar	170 m west side of Alamkhali Bazar	50 m north corner of Alamkhali Bazar	50 m north corner of Alamkhali Bazar
	23°30'56.06"N 89°19'12.32"E	23°30'56.06"N 89°19'12.32"E	23°30'57.46"N 89°19'9.19"E	Naboganga River water 23°30'57.40"N 89°19'6.71"E	23°30'57.46"N 89°19'9.19"E	23°30'54.84"N 89°19'13.81"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 08	SINGHRA					
	Middle Singhra Market, 200 m East side of Dhaneshargati UP, 250 West side of Govt. Biharilal Govt. College	Middle Singhra Market, 200 m East sideof Dhaneshargati UP, 250 West side of Govt. Biharilal Govt. College	Middle Singhra Market, 200 m East sideof Dhaneshargati UP, 250 West side of Govt. Biharilal Govt. College	Tube well, Middle Singhra Market, 200 m East sideof Dhaneshargati UP, 250 West side of Govt. Biharilal Govt. College	Tube well, Middle Singhra Market, 200 m East sideof Dhaneshargati UP, 250 West side of Govt. Biharilal Govt. College	Middle Singhra Market, 200 m East sideof Dhaneshargati UP, 250 West side of Govt. Biharilal Govt. College
	23°23'21.29"N 89°17'27.68"E	23°23'21.29"N 89°17'27.68"E	Pond water 23°23'18.80"N 89°17'26.19"E	23°23'19.26"N 89°17'26.73"E	23°23'19.11"N` 89°17'26.28"E	23°23'18.65"N 89°17'25.74"E
	Bus stop, Traffic density, mass people	More noise generates at this point, near road side	Nearest surface water source where surface runoff	Most used nearest GW source from where market	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may

Sl. No.	Ambient Air Quality (AAQ)	Ambient Noise Level, Vibration & Met. Data	Water Quality (Collected from near GCMs)			Soil
			Ground Water	Surface Water	Drinking Water	
	movement.		and wastewater discharge into this	people take water		contaminate
CW 09	GOKULKHALI					
	120 m northeast of Chuyadanga-Meherpur Highway, 50 m East Side of Gokulkhali Madrasah	120 m northeast of Chuyadanga-Meherpur Highway, 50 m East Side of Gokulkhali Madrasah	120 m northeast of Chuyadanga-Meherpur Highway, 50 m East Side of Gokulkhali Madrasah	Tube well, 120 m northeast of Chuyadanga-Meherpur Highway, 50 m East Side of Gokulkhali Madrasah	Tube well, 120 m northeast of Chuyadanga-Meherpur Highway, 50 m East Side of Gokulkhali Madrasah	120 m northeast of Chuyadanga-Meherpur Highway, 50 m East Side of Gokulkhali Madrasah
	23°41'48.88"N 88°48'2.35"E	23°41'48.64"N 88°48'2.05"E	Pond water 23°41'49.03"N 88°47'57.06"E	23°41'48.93"N 88°48'1.88"E	23°41'49.44"N 88°48'3.87"E	23°41'49.68"N 88°48'3.71"E
	Bus stop, Traffic density mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 10	ANDULBARIA					
	400 m West of Andulbaria Bazar, 50 m South Andulbaria Bridge over Kopotakkho River	400 m West of Andulbaria Bazar, 50 m South Andulbaria Bridge over Kopotakkho River	400 m West of Andulbaria Bazar, 50 m South Andulbaria Bridge over Kopotakkho River	Tube well, 400 m West of Andulbaria Bazar, 50 m South Andulbaria Bridge over Kopotakkho River	Tube well, 400 m West of Andulbaria Bazar, 50 m South Andulbaria Bridge over Kopotakkho River	400 m West of Andulbaria Bazar, 50 m South Andulbaria Bridge over Kopotakkho River
	23°28'42.15"N 88°53'29.56"E	23°28'42.15"N 88°53'29.56"E	23°28'40.95"N 88°53'32.43"E	23°28'42.54"N 88°53'32.07"E	23°28'42.54"N 88°53'32.07"E	23°28'41.99"N 88°53'32.30"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 11	HIZOLGARI					
	2 m north side of Hijolgari Kachabazar, 80 m southwest corner of	2 m north side of Hijolgari Kachabazar, 80 m southwest corner of	30 m north side of Hijolgari Kachabazar, 20 m southwest	Tube well, 2 m north side of Hijolgari Kachabazar, 80 m southwest corner of	Tube well, 2 m north side of Hijolgari Kachabazar, 80 m southwest corner of	2 m north side of Hijolgari Kachabazar, 80 m southwest corner of

Sl. No.	Ambient Air Quality (AAQ)	Ambient Noise Level, Vibration & Met. Data	Water Quality (Collected from near GCMs)			Soil
			Ground Water	Surface Water	Drinking Water	
	Hijolgari Govt. primary school	Hijolgari Govt. primary school	corner of Hijolgari Govt. primary school	Hijolgari Govt. primary school	Hijolgari Govt. primary school	Hijolgari Govt. primary school
	23°33'20.18"N 88°51'55.63"E	23°33'20.23"N 88°51'55.03"E	Pond water 23°33'21.99"N 88°51'56.79"E	23°33'20.19"N 88°51'55.39"E	23°33'22.58"N 88°51'56.71"E	23°33'21.87"N 88°51'56.08"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 12	DUGDUGIRHAT					
	5m west side of High way, 5 m East of Dugdugirhat Kacha Bazar, 1 km northeast corner of Laknathpur Govt. Primary, High School.	5m west side of High way, 5 m East of Dugdugirhat Kacha Bazar, 1 km northeast corner of Laknathpur Govt. Primary, High School.	30 m west side of High way, 10 m East of Dugdugirhat Kacha Bazar, 1 km northeast corner of Laknathpur Govt. Primary, High School.	Tube well, 5m west side of High way, 5 m East of Dugdugirhat Kacha Bazar, 1 km northeast corner of Laknathpur Govt. Primary, High School.	Tube well, 5m west side of High way, 5 m East of Dugdugirhat Kacha Bazar, 1 km northeast corner of Laknathpur Govt. Primary, High School.	5m west side of High way, 5 m East of Dugdugirhat Kacha Bazar, 1 km northeast corner of Laknathpur Govt. Primary, High School.
	23°33'39.90"N 88°47'41.30"E	23°33'39.94"N 88°47'41.12"E	Pond water 23°33'43.67"N 88°47'40.62"E	23°33'40.47"N 88°47'41.69"E	23°33'39.57"N 88°47'41.12"E	23°33'42.18"N 88°47'42.02"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 13	HAMDAH					
	5 m from the adjacent road	5 m east side from the road	40 m Southwest corner from the adjacent road	20 m west side from the road	20 m west side from the road	50 m west side of the road .
	23°31'45.98"N 89°10'20.07"E	23°31'45.98"N 89°10'20.07"E	Pond water 23°31'43.11"N 89°10'20.05"E	23°31'44.88"N 89°10'19.76"E	23°31'48.18"N 89°10'20.08"E	23°31'45.64"N 89°10'19.81"E
	Midpoint between adjacent roads and Traffic	Bazar with road side to most density and noisy	Nearest surface water source	Nearest Ground water source	Nearest Drinking water source	Nearest Soil source

Sl. No.	Ambient Air Quality (AAQ)	Ambient Noise Level, Vibration & Met. Data	Water Quality (Collected from near GCMs)			Soil
			Ground Water	Surface Water	Drinking Water	
	density, mass people movement.	place				
CW 14	VHATOI					
	70 m north of Dudshar UP, 10 m west Kustia-Jhinaidah Highway	There's a Bazar here. So, its important to keep the desired decibel	170 m north of Dudshar UP, 50 m west Kustia-Jhinaidah Highway	Tube well, 70 m north of Dudshar UP, 10 m west Kustia-Jhinaidah Highway	Tube well, 70 m north of Dudshar UP, 10 m west Kustia-Jhinaidah Highway	70 m north of Dudshar UP, 10 m west Kustia-Jhinaidah Highway
	23°36'50.5"N 89°10'58.89"E	23°36'50.35"N 89°10'58.83"E	Pond water 23°36'51.80"N 89°10'53.56"E	23°36'51.46"N 89°10'58.68"E	23°36'52.39"N 89°10'58.41"E	23°36'49.89"N 89°10'58.07"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 15	BHABANIPUR					
	5 m west Bhabanipur Market, 5m East side of Bhavbnipur-Khalishakunda road, 250 m South of Taherhuda Land Office, 50 m West of Govt. Primary School	5 m west Bhabanipur Market, 5m East side of Bhavbnipur-Khalishakunda road, 250 m South of Taherhuda Land Office, 50 m West of Govt. Primary School	50 m west Bhabanipur Market, 5m west side of Bhavbnipur-Khalishakunda road, 250 m South of Taherhuda Land Office, 100 m West of Govt. Primary School	Tube well, 5 m west Bhabanipur Market, 5m East side of Bhavbnipur-Khalishakunda road, 250 m South of Taherhuda Land Office, 50 m West of Govt. Primary School	Tube well, 5 m west Bhabanipur Market, 5m East side of Bhavbnipur-Khalishakunda road, 250 m South of Taherhuda Land Office, 50 m West of Govt. Primary School	5 m west Bhabanipur Market, 5m East side of Bhavbnipur-Khalishakunda road, 250 m South of Taherhuda Land Office, 50 m West of Govt. Primary School
	23°42'2.76"N 89° 2'43.32"E	23°42'2.96"N 89° 2'43.50"E	Pond water 23°42'2.22"N 89° 2'39.97"E	23°42'3.25"N 89° 2'43.77"E	23°42'2.90"N 89° 2'43.97"E	23°42'2.61"N 89° 2'43.31"E
	Bus stop, Traffic density, mass people movement.	More noise generates at this point, near road side	Nearest surface water source where surface runoff and wastewater discharge into this	Most used nearest GW source from where market people take water	Nearest Most used drink water source	Nearest source and Vehicles are stop here so soil may contaminate
CW 16	BAROBAZAR					
	5 m South from Barobazar	5 m South from Barobazar	10 m South from Barobazar	50 m South from Barobazar	100 m South from Barobazar	10 m South from Barobazar

Sl. No.	Ambient Air Quality (AAQ)	Ambient Noise Level, Vibration & Met. Data	Water Quality (Collected from near GCMs)			Soil
			Ground Water	Surface Water	Drinking Water	
	23°18'11.33"N 89° 9'11.49"E	23°18'11.33"N 89° 9'11.49"E	Pond water 23°18'10.61"N 89° 9'13.75"E	23°18'11.45"N 89° 9'11.34"E	23°18'11.73"N 89° 9'11.28"E	23°18'11.09"N 89° 9'13.65"E
	Three-wheeler stop, Traffic density, people movement, mass people	More noise generates at this point, near three-wheeler stop	Only the nearest surface water source where surface runoff and wastewater discharge into this	Most used GW source from where market people take water	Most used drink water source	Nearest source, Vehicles are stop here so soil may contaminate

5.2 Physical Environment

5.2.1 Meteorology

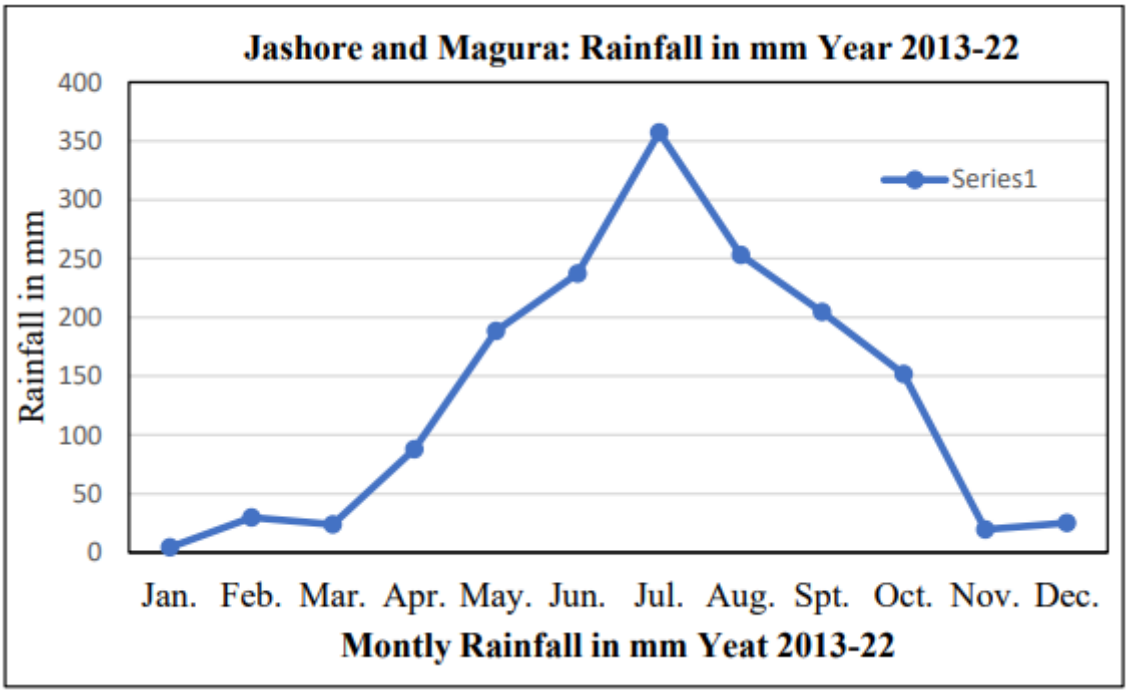
80. The southwest monsoon, or monsoon, is the most important feature controlling the climate of Bangladesh. More than 71% of the annual rainfall is received during this season. Variability in the onset, withdrawal, and quantum of rainfall during the monsoon season has profound impacts on water resources, power generation, agriculture, economics, ecosystems, and fisheries. On the other hand, in the winter season, the temperature falls sharply in the north and north-western parts of Bangladesh. Theproject area has a tropical monsoon climate with four seasons: dry or winter season (December- February); pre-monsoon or hot season (March-May); monsoon or rainy season (June-September); and post–monsoon or autumn season (October-November). **Source:** BMD.

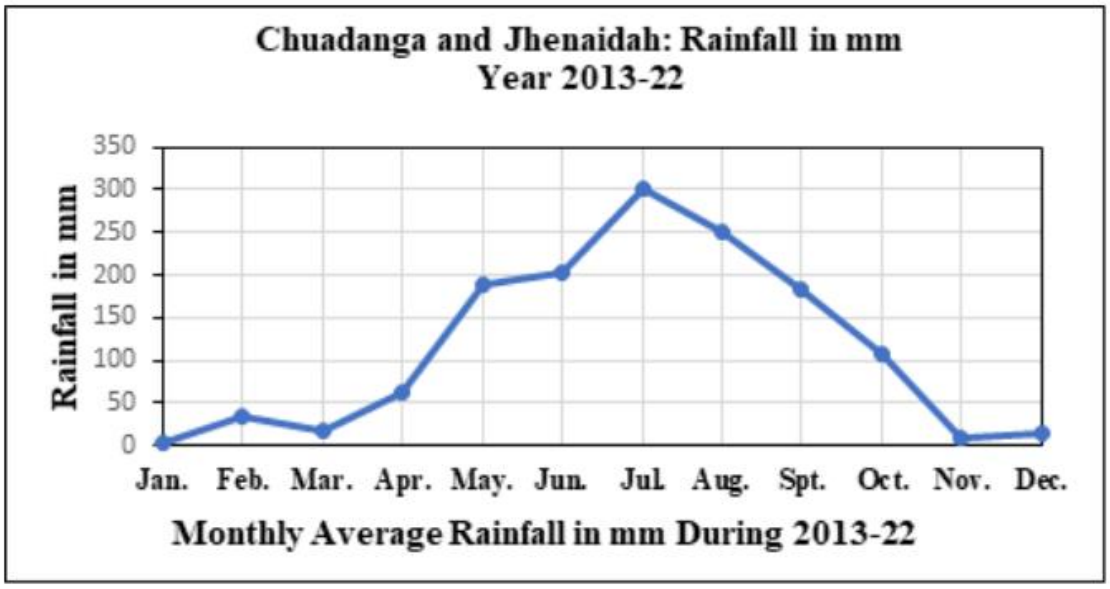
5.2.2 Rainfall

81. The monsoon is a prominent season in this area. The annual rainfall in Bangladesh varies regionally between 1,700 mm and 5,500 mm. Rainfall varies considerably from year to year and monthto month. The project area receives between 1200 and 2500 mm of rainfall as per the annual rainfall pattern in Bangladesh assessed by BMD. The highest rainfall recorded was 2178 mm in 2017 in Jashore,when it peaked in July with 663 mm, and 1749 mm in Chaudanga, when it peaked in July with 490 mm.Over those 10 years, the average rainfall in the study area is 132 mm per month in Jashore and 115 mmper month in Chaudanga. However, minimal and negligible rainfall was recorded during November, December, January, and February. The pattern of the average monthly rainfall in Jashore is similar to Magura, and Chaudanga is similar to Jhenaidah, where July has a clear peak of monthly precipitation. The average monthly rainfall of Jashore and Magura is shown in **Figure 5.1**. The rainfall data of BMDcovering 4 districts that contain our 16 packages are shown in **Table 5.3** in details.

Table 5.3: Average Monthly Rainfall of Jashore, Magura Chuadanga, and Jhenaidah

Monthly Average of Rainfall of Jashore and Magura District for 2013-2022													
Month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Spt.	Oct.	Nov.	Dec.	Annual
Ave.	4.3	29.7	23.8	87.8	189	237	357	253	205	152	19.4	25.1	1583
Monthly Average of Rainfall of Chaudanga and Jhenaidah District for 2013-2022													
Ave.	4	33.4	18.7	63.5	190	202	301	252	183	108	9.9	15.8	1381





Source: Bangladesh Meteorological Department (BMD), 2013-2022

Figure 5.1: Average Monthly Rainfall of Jashore, Magura, Chuadanga and Jhenaidah

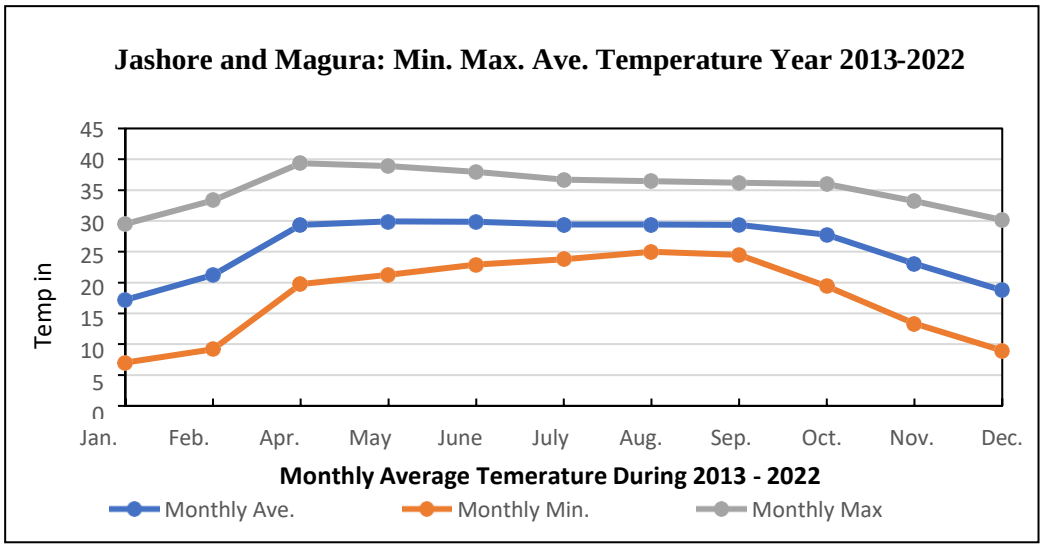
5.2.3 Temperature

82. The temperature data of Jashore Station from BMD for 10 years (from January 2013 to December 2022) has been analyzed to see the monthly variation of the average maximum temperaturebetween 39.4°C and 29.5°C. The monthly variation of the average minimum temperature is 25°C to 7°C. The maximum recorded temperature was 42.4°C, at Jashore which occurred in April 2014, and 41.5°C at Chaudanga in April 2013. On January 1995, the minimum temperature was recorded as 4.2°C at Jashore in January 2013 and 3.9°C at Chaudanga in January 2013. The warmest month of the year is April, and the coldest month of the yea. The study shows the maximum, minimum, average maximum, and average minimum temperatures of Jashore, Magura, Chaudanga, and Jhenaidah from 2013 to 2022. The average monthly maximum and minimum temperatures of 16 packages of Jashore, Magura are shown in **Table 5.4** and **Figure 5.2** below:

Table 5.4: Monthly Average Dry Bulb Temperature in Degree Celcius of Jashore, Magura, Chuadanga and Jenaidah Districts

Monthly average dry bulb Temperature in degree celcius of Jashore and Magura Districts for 2013-22												
Month	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Spt.	Oct.	Nov.	Dec.
ve. of all Temp.	17.2	21.2	26.2	29.4	29.9	29.9	29.4	29.4	29.3	27.7	23.1	
Ave. Min.	7	9.19	14.4	19.7	21.2	22.9	23.7	25	24.5	19.4	13.3	8.96
Ave. Max.	29.5	33.3	37	39.4	38.9	37.9	36.7	36.5	36.2	36	33.2	30.1
Monthly average dry bulb Temperature in degree celcius of Chaudanga and JhenaidahDistricts for 2013-22												
Ave. of all Temp.	15.8	19.8	25	28.6	29.1	29.4	28.8	28.8	28.6	26.7	22	17.7
Ave. Min.	6.16	8.43	13.4	18.9	20.5	23.2	24.2	24.8	24.3	19	12.9	8.08
Ave. Max.	28.2	32.6	37	39.7	38.7	37.9	36.3	36	36.2	35.6	32.9	29.2

Source: Bangladesh Meteorological Department (BMD), 2013-2022



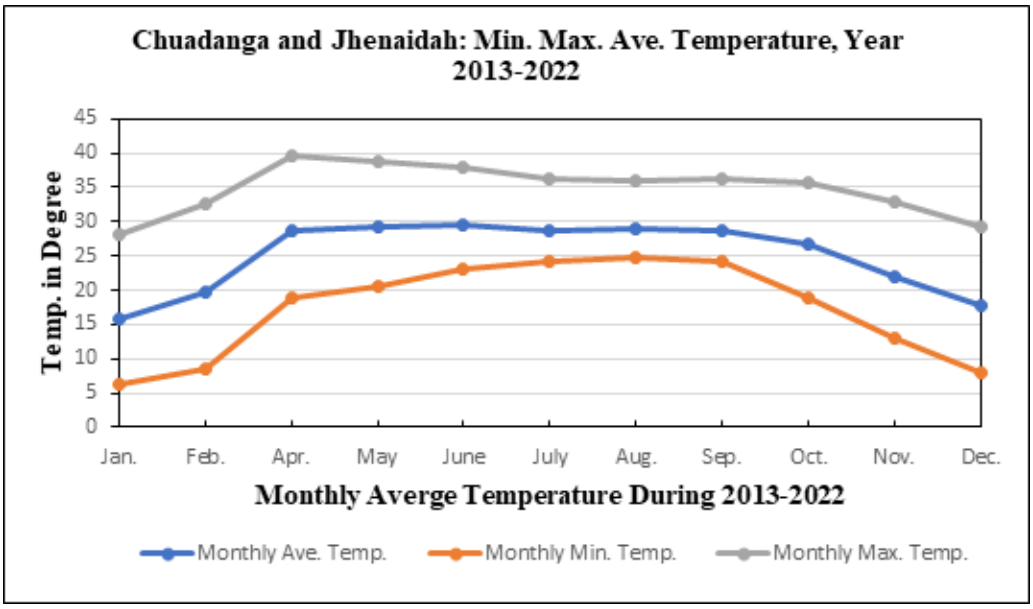


Figure 5.2: Average Monthly Temperature Year 2013-2022 in Jashore, Magura, Chuadanga and Jhenaidah

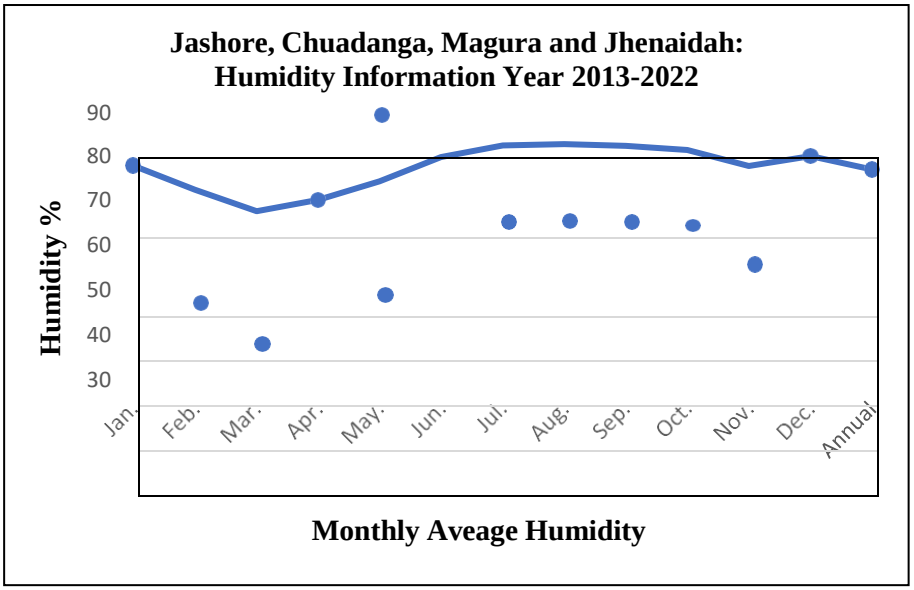
5.2.4 Relative Humidity

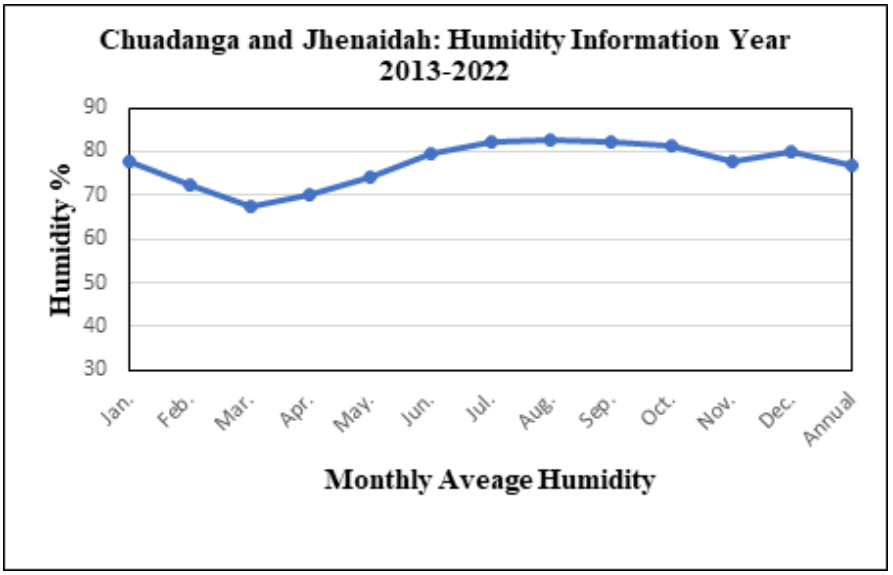
83. The average relative humidity (RH) remains higher during the monsoon season. The variance in the average relative humidity throughout the year is 77.3% to 79.6%, whereas during the monsoon the variance is 82.4% to 85.4% at Jashore and Chaudanga, respectively. The monthly average humidity of16 packages of Jashore, Magura Chuadanga, and Jhenaidah is shown in **Figure 5.3** and **Table 5.5**.

Table 5.5: Average Monthly Humidity of Jashore, Magura Chuadanga, and Jhenaidah

Monthly average Humidity of Jashore and Magura Districts for 2013-22												
Month	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Spt.	Oct.	Nov.	Dec.
Ave.	80.5	75	68.3	70.1	76.6	82.2	85.9	85.6	85.1	83.5	79.9	82.6
Monthly average humidity of Chaudanga and Jhenaidah Districts for 2013-22												
Ave.	77.8	72.4	67.6	70.1	74.3	79.7	82.3	82.6	82.2	81.3	77.7	79.9

Source: BMD 2013-2022





Source: Bangladesh Meteorological Department (BMD), 2013-2022

Figure 5.3: Monthly Average Humidity in Jashore, Chuadanga Magura, and Jhenaidah

5.2.5 Wind Speed and Direction

84. The direction of the wind varies depending on the season. Therefore, a whole year wind rose has been developed: Wind speed data and direction have been collected from the Bangladesh BMD stationat a height of 10 m above ground level. For more understanding, we have collected the BMD data at allfour districts with ten years of historical data and formed a wind rose diagram for individual sites, viz.,Magura, Chaudanga, Jashore, and Jhenaidah, and depicted in **Figure 5.4**. In the last 10 years, wind predominantly blew from the following directions:

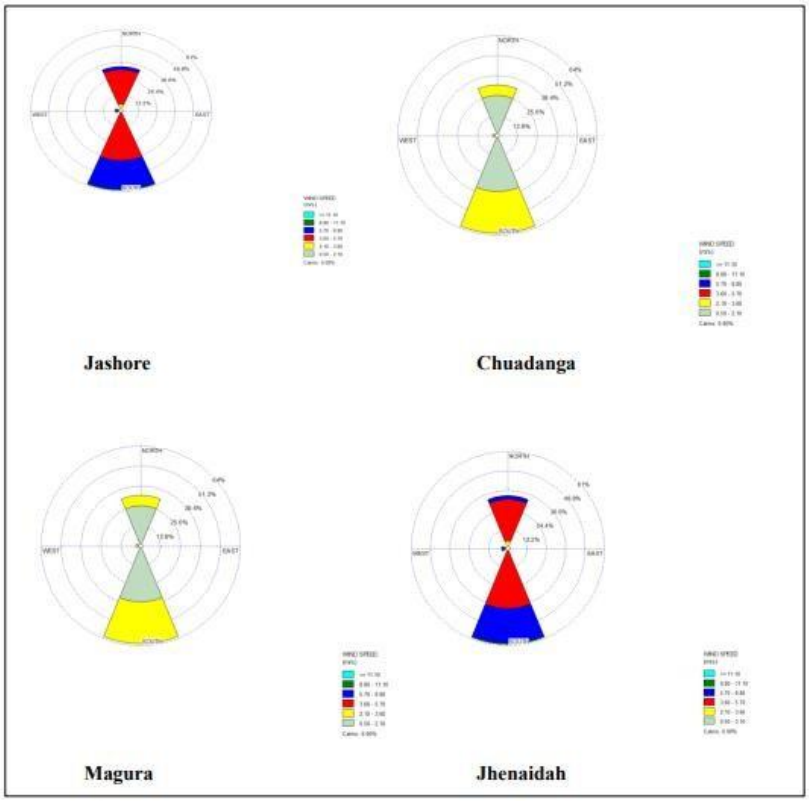
85. Magura District: We have found that the Magura District wind blows from SE and E with 1.0 to 2.5m/s speed. The annual calmness of the wind was around 42% in the last 10-year data.

86. Chaudanga: In this district, the wind blows from the S direction at 1.0 to 2.5 m/s speed. The annualcalmness of the wind was around 57% in the last 10-year data.

87. Jashore: In this district, the wind blows from the S direction at 1.0 to 2.5 m/s speed. The annualcalmness of the wind was around 46 % in the last 10-year data.

88. Jhenaidah: In this district, the wind blows from the S and SE directions at 2 to 25 m/s speed. Theannual calmness of the wind was around 66% in the last 10-year data.

89. Overall, most of the time the wind predominantly blows from the south and north directions, with the highest speed at 7 to 10 m/s and the lowest at 1 to 2.5 m/s.



Source: Bangladesh Meteorological Department (BMD), 2013-2022

Figure 5.4: Wind Class using 10-Year Historical Data of Project Sites (2013-2022)

5.2.6 Thunderstorm

90. Thunderstorms are a common weather phenomenon in Bangladesh, particularly during the pre-monsoon and monsoon seasons. Here's a brief overview of the history of thunderstorms in Bangladesh:

91. Bangladesh experiences thunderstorms primarily between the months of March and October. During this period, the country's climate is characterized by high humidity, warm temperatures, and the convergence of different air masses.

92. Thunderstorms in Bangladesh often occur as a result of the clash between moist air from the Bay of Bengal and drier continental air masses from the northwest. When these air masses meet, the warm, moist air rises rapidly, leading to the formation of cumulonimbus clouds, which are associated with thunderstorms.

93. Thunderstorms in Bangladesh can be accompanied by heavy rainfall, lightning, strong winds, and occasionally hail. They can develop rapidly and bring intense downpours, leading to localized flooding and waterlogging in low-lying areas. Lightning strikes associated with thunderstorms can also pose a significant risk to life and property. The monthly average of thunderstorms in Jashore, Magura, Chaudanga, and Jhenaidah districts for 2013-2023 is presented in **Table 5.6**.

Table 5.6: Monthly Average of Thunderstorm of Jashore, Magura, Chaudanga and Jhenaidah Districts for 2013-2022

Monthly Average of Rainfall of Jashore and Magura District for 2013-2022													
Month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Spt.	Oct.	Nov.	Dec.	Total
Ave.	1	6.5	10.5	16.9	39.2	38.9	32.4	32.7	34.5	22.6	0.6	0.4	236
Monthly Average of Rainfall of Chaudanga and Jhenaidah District for 2013-2022													
Ave.	0.6	6.5	9.2	21.8	44	35.8	30.7	29.2	33.3	16.3	0	0.2	228

5.2.7 General Geology

Magura

94. The subsurface geology is not fully understood in the study area. It is reported by Umitsu (1987) that the alluvial sediments shallower than 30 m in depth in the northwestern part of the Ganges Delta are divided into an upper silty layer and a lower sandy layer (**Figure 5.5**). The faces of the upper layertend to change from sandy faces to silty/clayey facies from north to south. However, the face's near theBhairab River shows to be sandy. In addition, the facies of the upper layer become peaty or rich in organic materials near the city.

Chaudanga

95. The surface geology of the study area is comprised of deltaic sediments from the Holocene Age. The deltaic sediments are the sediments that are deposited on the active delta, which is south of the Ganges River and mostly west of the Meghna estuary. Most of the area is less than 15 meters above mean sea level. The delta is crossed by parallel, south-southeast trending distributary channels. Most ofthe study area is underlain by deltaic silt. Deltaic sand occurs in the northern part of the study area. Marsh clay and peat are distributed from the central to the eastern part of the study area (**Figure 5.6**).

Jhenaidah

96. The JICA Expert Team (2000)2 collected drilling records of the existing deep tube wells sunk by DPHE in the study area. Although the number of available data points, drilling depths, and accuracyof the geologic descriptions are limited, the JICA Expert Team drew several geological profiles in the study area. According to the geological profiles made for Jhenaidah District, a clay/silt layer occurs at a depth of 100 ft. from the ground surface throughout the district (**Figure 5.7**).

Jashore

97. According to the geological profiles in Jashore District, a shallow clayey layer occurs in the district with a thickness of 10 to 50 ft. The subsurface geology in Jashore District is characterized by a thick clayey layer that occurs in the southern part. The clayey layer occurs below depths of 200 to 400ft. In Keshabpur Thana, the thickness is about 600 ft. In the western part of the Jashore District, the existing wells often encounter a deep clayey layer at depths of 500 to 900 ft (**Figure 5.8**)

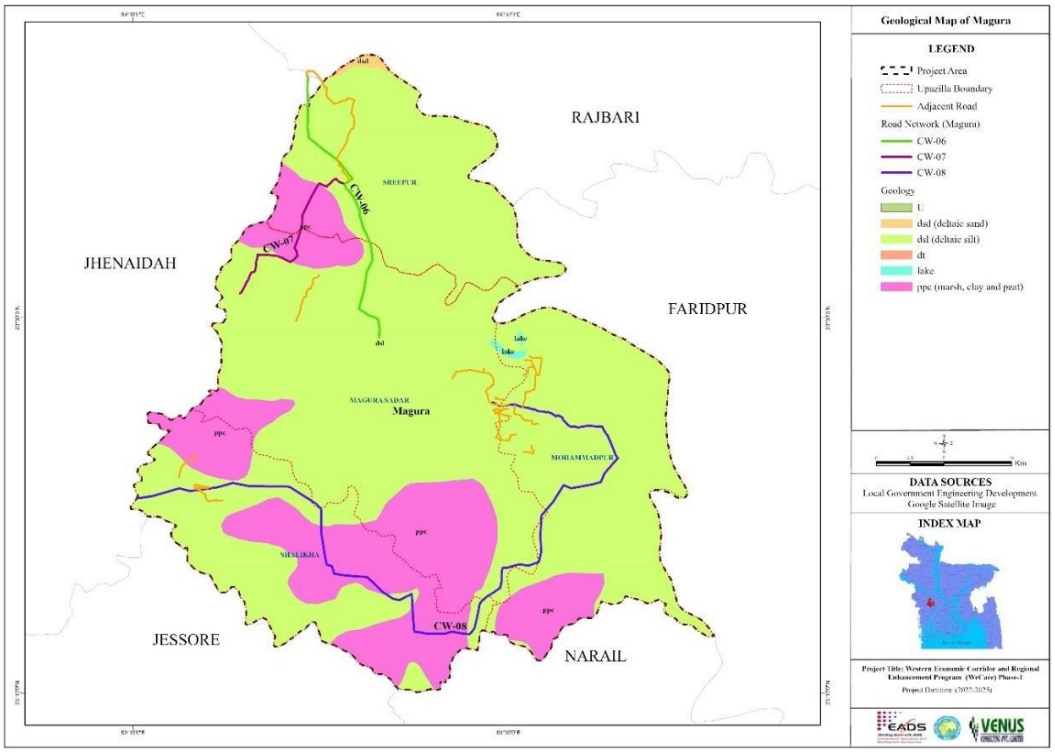


Figure 5.5: General Geology of Magura District

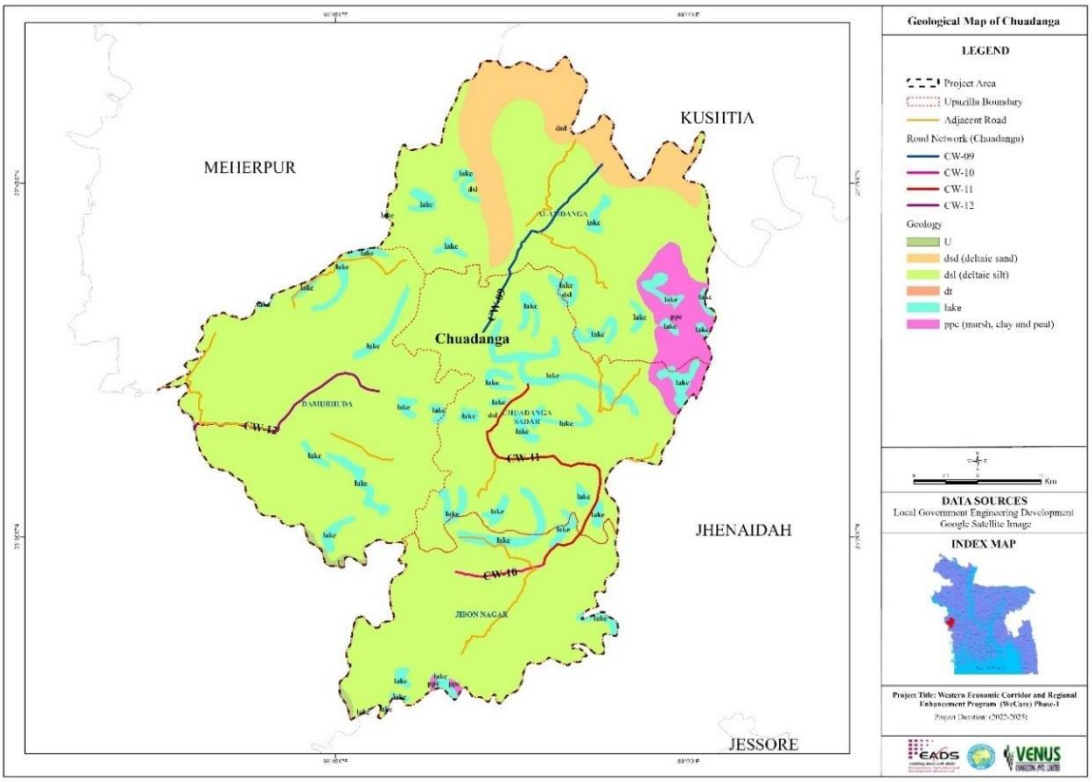


Figure 5.6: General Geology of Chaudanga District

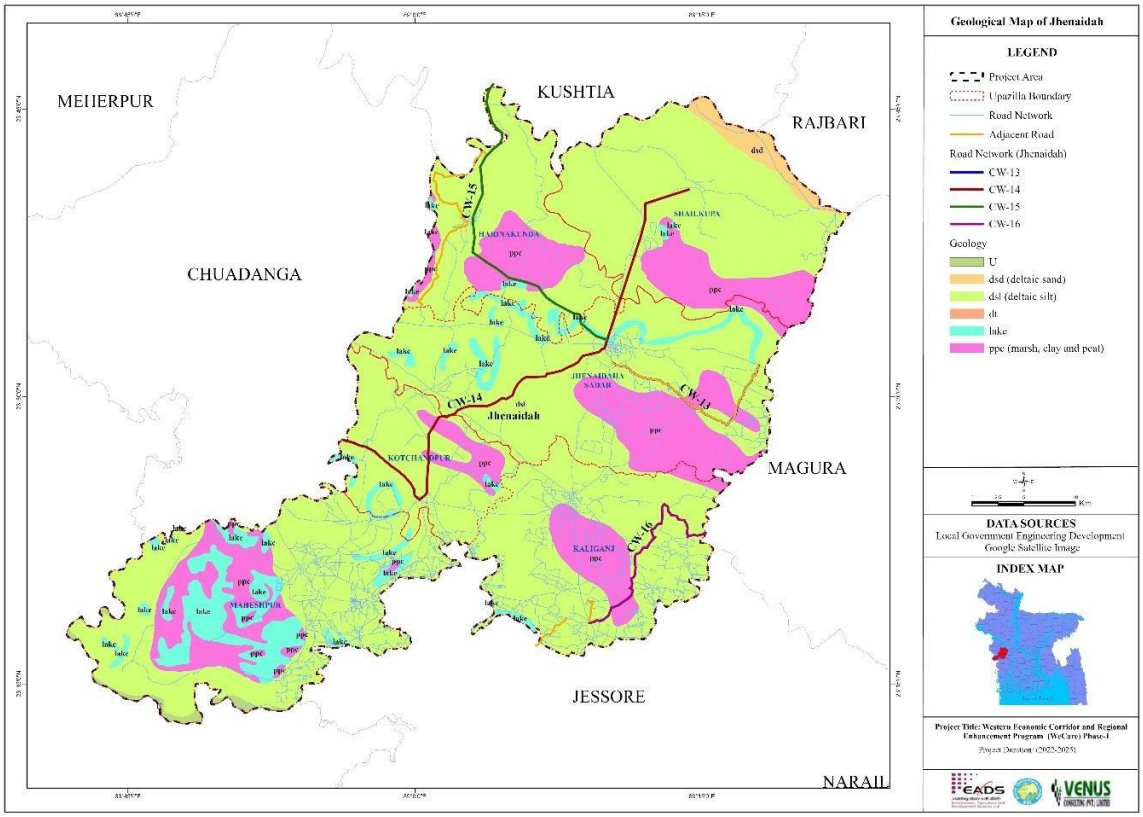


Figure 5.7: General Geology of Jhenaidah District

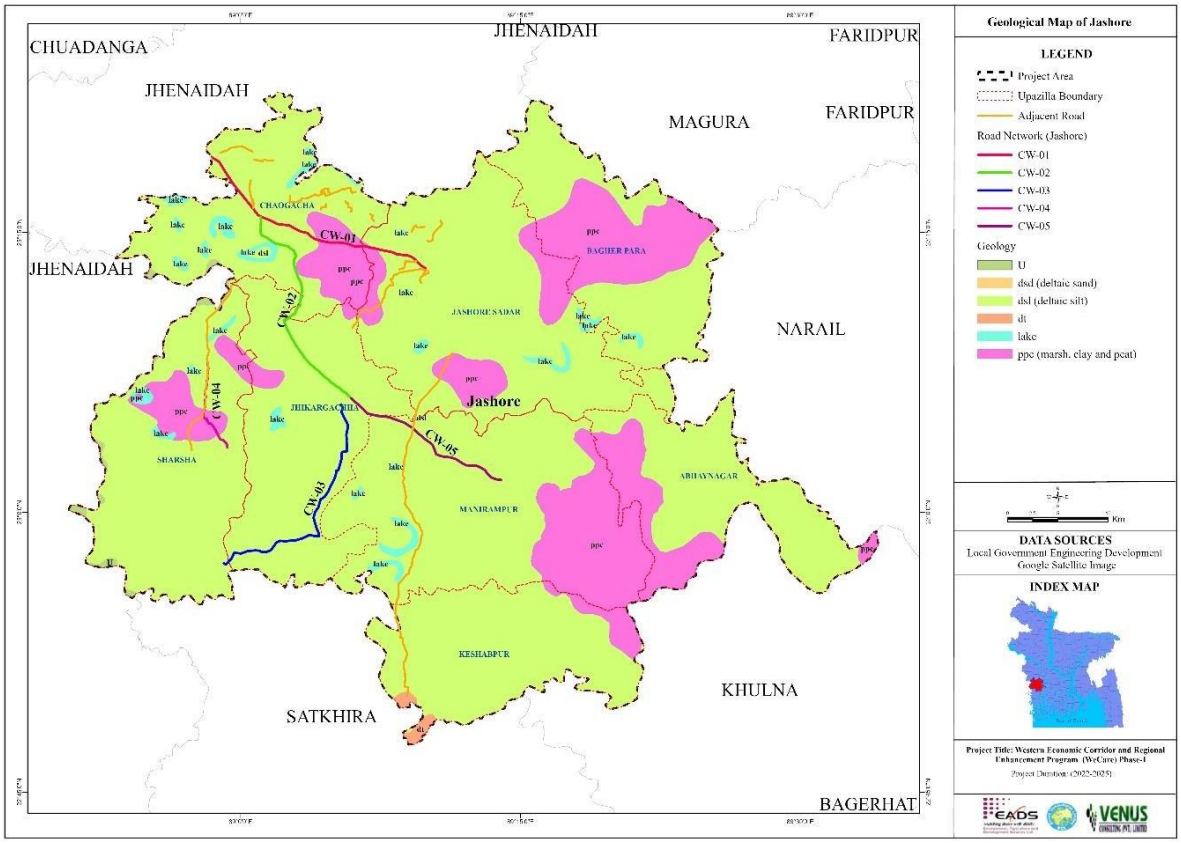


Figure 5.8: General Geology of Jashore District

5.2.8 Topography

98. The Ganges Delta comes under the jurisdiction of the greater districts of Kushtia, Jashore, Faridpur, Khulna, Barisal, and Patuakhali. It comprises an area of approximately 40,450 km2, or 27 percent of Bangladesh's total area. It is bordered by India to the west, by the Ganges (Padma) and Lower Meghna Rivers to the north and east, and by the Bay of Bengal to the south. The ground elevations in the study area range from 0.5 to 15 meters above mean sea level. **Figure 5.9** shows the distribution of ground elevation in the study area. The northwestern part of the study area is comparatively high to medium-high land with rolling topography. The ground elevation in Chaudanga District ranges from 8to 15 masl. From Jhenaidah District to Jashore District, the topography starts as gently sloping but soonbecomes very flat. The eastern half of Jashore District and the southern to southwestern parts of the district are laid by lowlands with an elevation of less than 5 masl.

5.2.9 Seismicity

99. The country has been divided into four seismic zones with different levels of ground motion. **Table 5.7** includes a description of the four seismic zones. According to the National Seismic Zoning Map produced by the Geological Survey of Bangladesh (GSB), the study area lies in the southwest. According to the Global Seismic Hazard Assessment Program (GSHAP), the most hazardous division in Bangladesh is the port city, of Chittagong. The project area is situated in seismic zone 1.

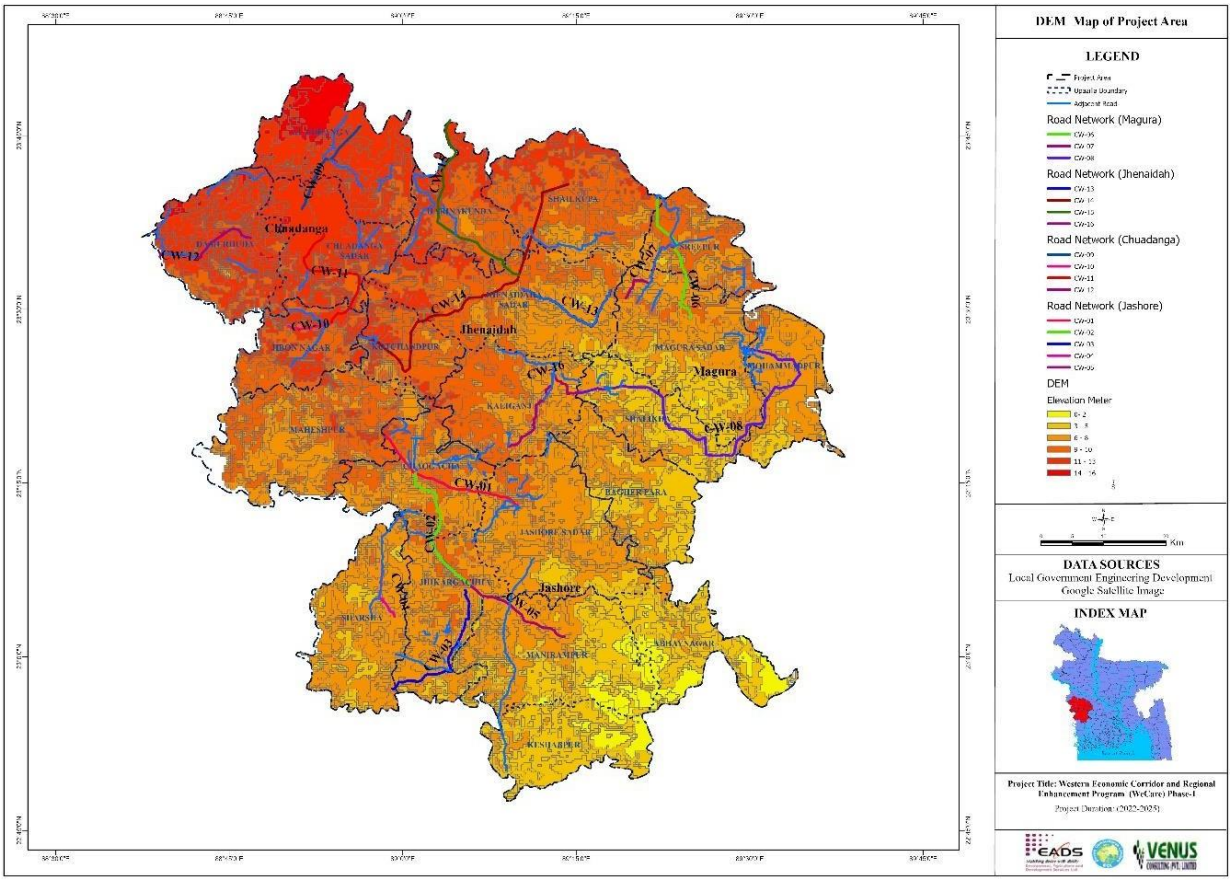


Figure 5.9: Elevation Level of the Study Area

Table 5.7: Seismic Zones of Bangladesh

Seismic Zone	Location	Seismic Intensity	Seismic Zone Coefficient, Z
1	South-western part including Barisal, Khulna, Jashore, Rajshahi	Low	0.12
2	Lower central and North-western parts including Noakhali, Dhaka, Pabna, and Dinajpur as well as the south-western corners including Sundarbans.	Moderate	0.20
3	Upper central and north-western parts including Brahmanbaria, Sirajganj, Rangpur	Severe	0.28
4	North-western part including Sylhet, Mymensingh, Kurigram	Very Severe	0.36

5.2.10 Hydrology

100. There are a large number of rivers in Bangladesh, and most of the sources flow from India. Among the major rivers are found three streams, which are the Ganges (Padma), Brahmaputra (Jamuna), and Meghna Rivers. Most rivers flow into the Brahmaputra River in the north-western part of Bangladesh, and all rivers flow into the Meghna River in the north-eastern part of Bangladesh (**Figure 5.10**).

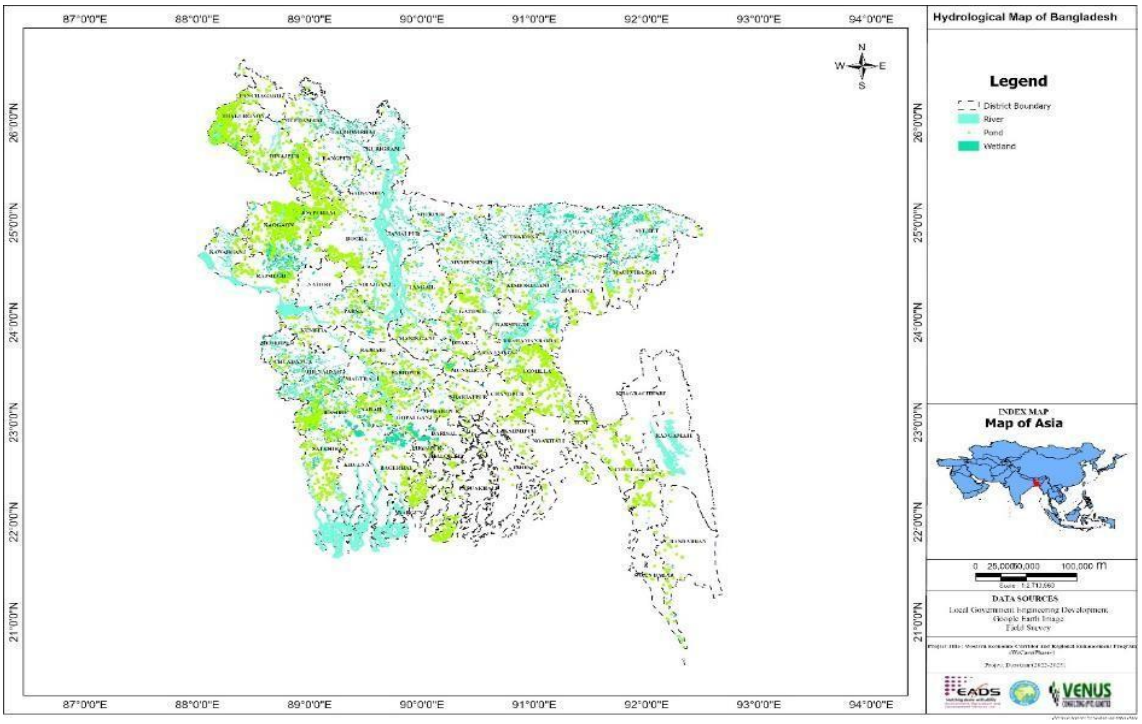


Figure 5.10: Hydrological Network of Bangladesh

101. These two big rivers also join the Ganges River downstream. However, all rivers directly run off into the Bay of Bengal in the southern part of Bangladesh. The areas for the study are the three western districts of Chaudanga, Jhenaidah, and Jashore. It is a part of the Ganges Delta and is located on the right side of the Ganges River (the Padma River in Bangladesh). The Ganges River originates inthe Central Himalayas and flows about 2,500 km to the Bay of Bengal. There are many tributaries of the Ganges River in the study area.

5.2.11 Hydrological Network

102. There are three (3) major rivers in Bangladesh: the Padma River, the Jamuna River, and the Meghna River. The Padma (Ganges) River flows along the Bangladesh-India border in Nawabganj and Rajshahi districts. Then it flows southeast and meets the Jamuna River at the junction of the Pabna, Rajganj, and Manikganj districts. The Meghna River joins the Padma River in the southern part of Munshiganj and then flows to the Bay of Bengal. The rivers generally flow from northwest to southeast.In the northern part, rivers flow from west to east, whereas the rivers in the southern part of the study area flow from north to south. Major rivers in the study area originate in Indian Territory. There are numerous water bodies, such as lakes, beels, haors, and baors, present in the study area. The major rivers in the study area are Naba Gangga River, Kumar River, Bhairab River, and Madhumati River.

103. There are about 12 Baor, including Marjat Baor. Rainwater and groundwater from the confined deep aquifer are also sources of water in the study area. The only protected area closest to the project area is Marjat Baor, which is about 5 km away from the project area. Marjat Baor is an Ecologically Critical Area (ECA), situated in the Jhenaidah district (23° 18’ 39.22″ N, 89° 5’ 2.54″ E). It is an OxbowLake and a good source of fishing resources. Every year, a good number of migratory birds visit this lake. The proposed road will not have any effect on this lake as it is not running through or very close to it. The forest-protected areas, such as the Sundarbans are more than 100 km away from the project area and thus will not affect Sundarbans. Crescent lakes are distributed particularly in the western partand southern parts of the Study Area. Shallow lakes, which are located at natural land depressions, areknown as beels. The beels are also found in the western to southern parts of the Study Area. Small lakesand tanks/ponds are mainly distributed in the central to eastern parts. Canals are developed mainly in the northern part of the Study Area **Figure 5.11**.

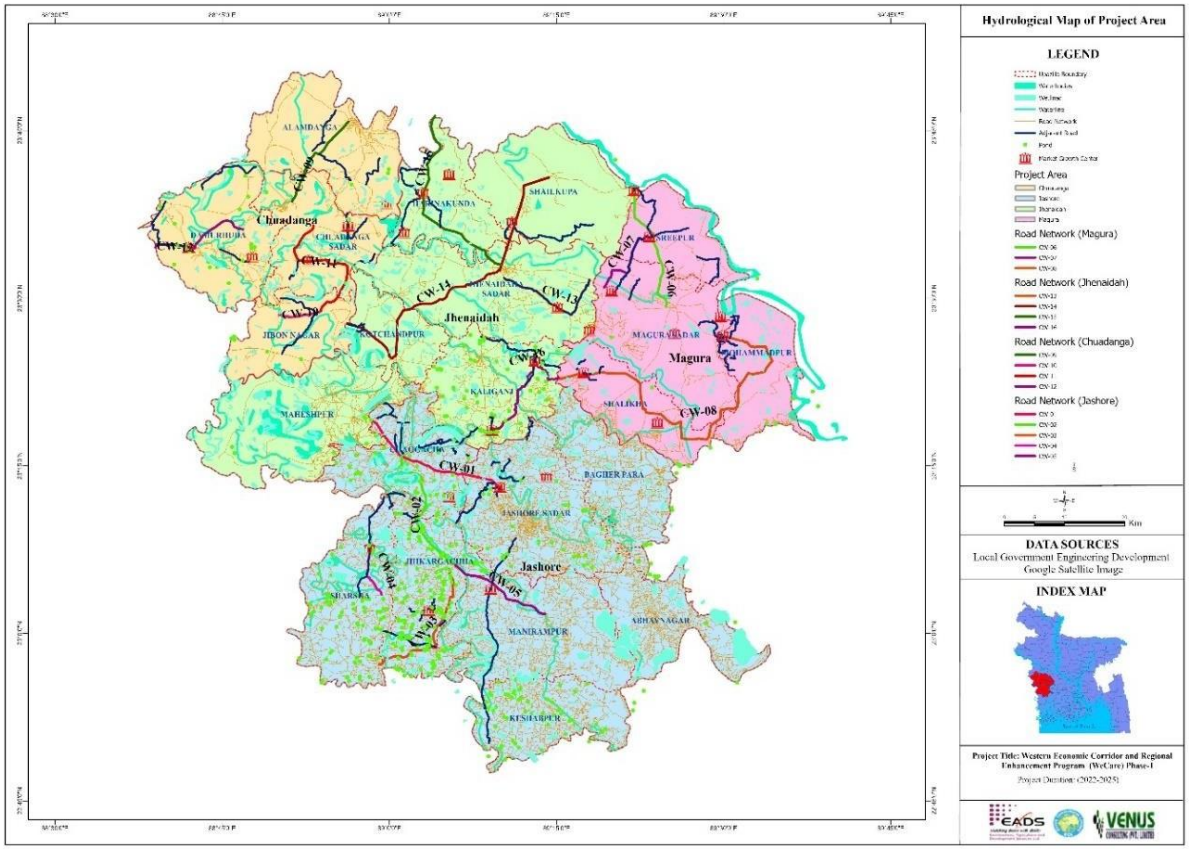
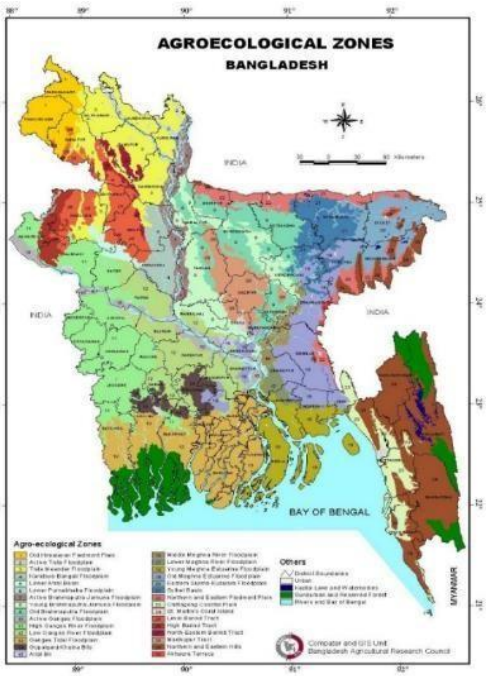


Figure 5.11: Hydrological Condition of the Study Area

5.2.12 Agro-ecological Zones



104. The physiographic unit of the project is the Young Padma/Ganga Floodplain (AEZ# 29) (shown in the figure below). The region comprises the area of Padma/Ganga sediments. It has a complex relief of broad and narrow ridges, and inter-ridge depressions, partially in filled cut-off channels and basins. This area is occupied by permeable silt loam to silty clay loam soils on the ridges and impermeable clays in the basins, neutral to slightly acid in reaction. General soil types include predominantly grey floodplain soils. Organic matter content is low in ridges and moderate in basins. Soils are deficient in N, P, and S but the status of K and Zn are reasonable. The general fertility level is medium.

105. WeCARE's sub-project will be implemented in four districts/ pourashavas which fall in AEZ-11 (High Ganges River Floodplain) agroecological zones under project districts. The map shows the Agro-Ecological Zones under the proposed project corridor.This region includes the western part of the Padma/Ganges River Floodplain which is predominantly highland and medium highland. Most areas have a complex relief of broad and narrow ridges and inter- ridge depressions, separated by areas with smooth broad ridges and basins.

5.3 Land Use

5.3.1 Land Type

106. The landforms of Bangladesh can be divided into three major classes:

A. The northern and eastern hills
B. The Holocene floodplains
C. The Pleistocene terraces

107. The sediment deposits of Bangladesh mainly consist of those laid down by the Ganges, Brahmaputra, and Meghna (GBM) river systems. Holocene floodplain deposits cover most of the surface area of present-day Bangladesh. According to geographic and geomorphic distribution, the Holocene floodplains are divided into four classes:

A. Piedmont plains
B. Meander floodplains
C. Tidal floodplains
D. Estuarine floodplains

5.3.2 Soil Texture

108. The soils of the area consist of late Holocene to Recent Alluvium of the Ganges deltaic plain in the north and tidal plain in the south. The area is composed of sand, silt, and clay in various proportions with a small amount of coarse sand, which is classified into seven litho-stratigraphic units from base to top Alluvial deposits carried by the Brahmaputra- Jamuna, Ganges-Padma, and Meghna rivers and their numerous tributaries and distributaries formed a large part of Bangladesh. Alluvial deposits of Bangladesh have been defined into several units in the Geological Map of Bangladesh (1990). Alluvial deposits range from flood sand to overbank silt and pounded clay. The project area has overlapping alluvial sand deposit (asd), alluvial silt deposit (asl) and alluvial silt-clay deposit (asc). Alluvial sand unit (asd) is composed of light to brownish grey, coarse sand to fine silty sand, and sand is generally sub-

rounded. Alluvial silt unit (asl) is composed of light to medium-grey, fine sandy to clayey silt, commonly poorly stratified; average grain size decreases away from main channels; chiefly deposited in flood basins and inter-stream areas. Alluvial silt unit includes small back swamp deposits and varyingamounts of thin, inter-stratified sand, deposited during episodic or unusually large floods. Included in this unit are thin veneers of sand spread by episodic floods over floodplain silts.

5.4 Environmental Baseline Quality

5.4.1 Selection of Sampling Locations

109. The selection of representative sampling location criteria plays an important role in the initiation of any developmental activity as it provides an outlook on the type of environmental compliance and management to be adopted by the project proponent. However, for locating sampling points, apreliminary reconnaissance survey covering the entire study area was carried out before the sampling. During the reconnaissance survey, all necessary investigations have been carried out including existing drainage patterns, and land elevation; the land use pattern of the location, and physiographical conditionhave been taken into consideration. In the first step, a preliminary investigation was carried out to assemble as much of the general, or background information and identified gaps, and map out the strategies for collecting the missing data. The project proponent had primarily given the sites for monitoring the ambient air, noise, vibration, water (surface, drinking, and ground), soil samples. The consultant finally identified the suitable sampling locations based on Area of Influence (AOI) of GCMs and adjacent Roads where maximum emission or health hazard will happen.

110. All the environmntal quality were monitored and measured for selected 46 monitoring locations. **Chapter 5.1.1** contains the rationale behind selecting those places for determining different environmental parameters.

5.4.2 Regulatory Compliance Standards

111. For carrying out the Compliance Monitoring and assessing its conformance to the regulation the standard for the air and noise quality specified in Schedule 2 and Schedule 4 of the Environment Conservation Rules 2023 of GoB will be followed. For carrying out ES assessment and Compliance Monitoring following national and international standards will be used in this study.

- **A.** Ambient Air: Amended Schedule 2, 2005 of Environment Conservation Rules 2023, GoB and World Bank Community Health and Safety Guidence note for borrower per ESS4.
- **B.** Ambient Noise: Schedule 4: Environment Conservation Rules 2023, GoB and World Bank Community Health and Safety ESS4.
- **C.** Surface water quality: Environment Conservation Rules 2023, GoB, Standards for inland surface water, schedule 3.
- **D.** Groundwater: Environment Conservation Rules 2023, GoB, Standards for (B) Standards for drinking water, schedule 3.

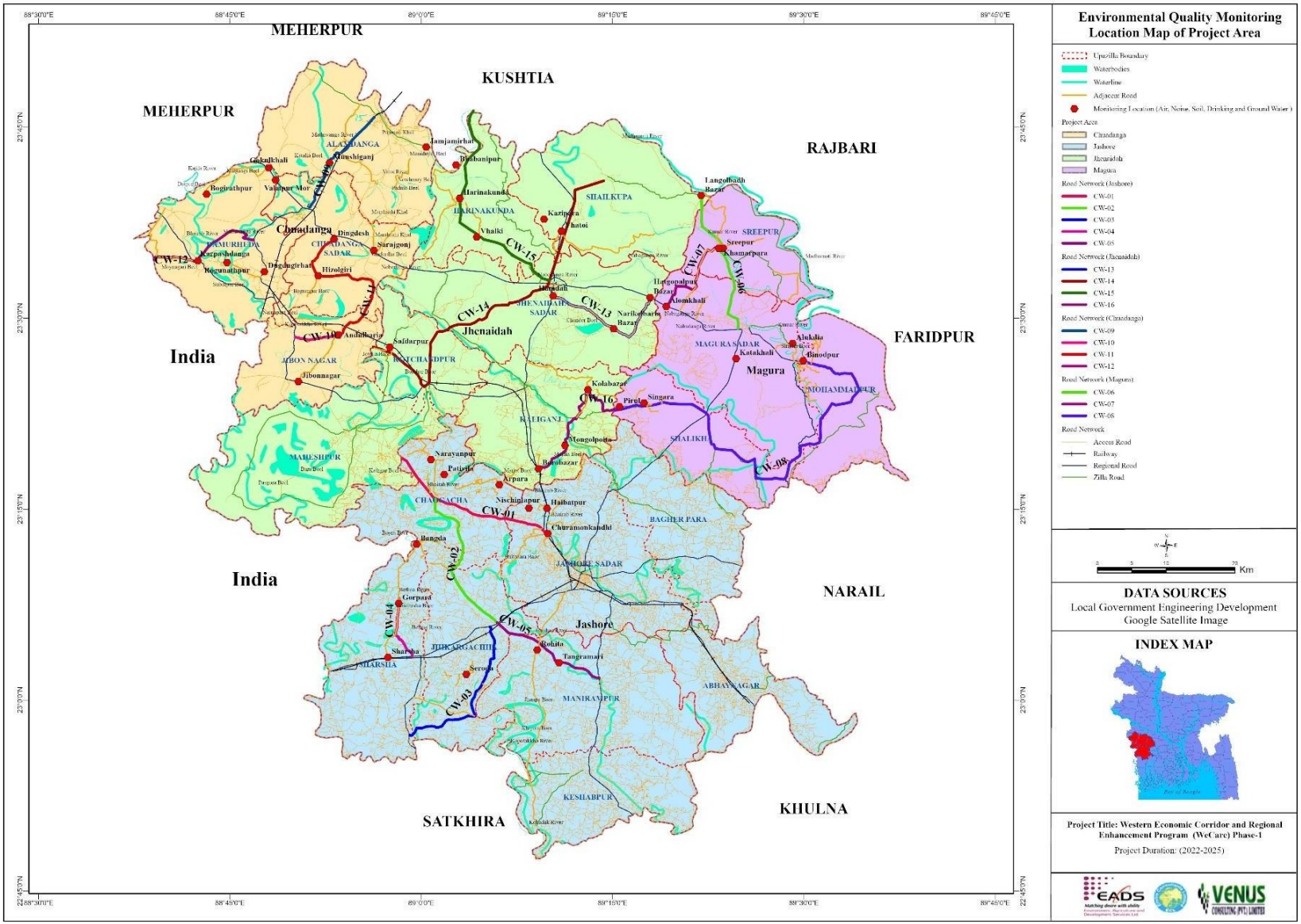


Figure 5.12: Environmental Monitoring Location for All CWs Packages using GIS Map

5.4.3 Air Quality

112. The ambient sampling locations were carried out based on the background of the area keeping in mind of point source and other interference. Additionally, the height of the sampling point was considered based on the presence of walls and other obstructions. The height of the ambient air qualitysampler was about one meter which was on a vehicle (pickup). All the samples and data were collectedfrom about 1-1.5 meters in height. The selections of sampling sites were chosen based on the free- flowing air, wind direction, and well-mixed air. The elevation angle of nearby buildings and other obstructions has been considered during site selection. All steps were carried out under consideration of the World Bank and Bangladesh Standard Guideline for Ambient Air Quality Monitoring Program. Air quality monitoring were done for the 16 packages.

113. In all the GCMs and road junctions where most of the gathering happens air pollution expected to be significant. Based on this, 46 air quality parameters were selected and their unique names were given as AAQ (Ambient Air Quality). A well-designed monitoring program developed to assess the status of ambient air qualityin the project area. The parameters studied will be Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur Dioxide(SO_2), Nitrogen dioxide (NO_2), and CO. 24 hours monitoring will be carried out to cover above mentioned parameters. The objective is to assess the existing level of air pollutants. Regarding the techniques for the collection of samples of particulate matter, (PM_{10} & $PM_{2.5}$) the "Respirable Dust Sampler and "Fine Dust Sampler (FDS)" combo sampler will be used for air monitoring. The gaseous pollutants were collected simultaneously by a known volume of air through several bubblers of differentflow rates through the appropriate solution for absorbing different gases shown in **Figure 5.13**.

5.4.3.1 Result and Discussion

114. In this study, the estimation of a particulate load of PM_{10}, $PM_{2.5}$, and gaseous compounds like SO_2, NOx, CO, and O_3 was studied because of understand the baseline concentration of air quality to establish the management plan against this project. For this, eleven sites were chosen based on the land use characteristic of the area under consideration of industrial, commercial residential, and mixed zone areas to gather the voluminous air quality into information for the proposed project.

5.4.3.2 Particulate Load (PM10 and PM2.5)

115. In the study area, the particulate load was found in moderated concentration but well within the limit as per ECR 2023guideline for 24 Hrs. monitoring. The descriptive statistic shows that the particulate load viz. PM10 was varied from 92.86 to 139.81 µg/m3 with a means value of 113.67 µg/m3.Similarly, the standard deviation of the studied sample shows that the air quality of the study area hasa wide variation from one to another. Such observation was noted mainly due to the different land use patterns of the location. In the spatial view, an elevated concentration of particulate was noted at AAQ-5-Kola (139 µg/m3) and AAQ-10-Sreepur (137.14 µg/m3) in the study area. AAQ-5-Kola location is densely populated with the wide market area having Khan Market, a supermarket, and a tri-junction ofKola Road and Kharikadanga Road. In addition, the area has high traffic congestion with narrow roads.Similarly, AAQ-10-Sreepur is also situated at the marketplace where the supermarket, wooden work, high traffic load, and bust stand have been noted in the survey. All these observations indicated that theelevated level of the particulate load which mainly due to traffic congestion and anthropogenic activitiesfrom the market area which contribute an additional amount of particulate in the regional atmosphere **Figure 5.13**.

5.4.3.3 Gaseous Parameters

116. Parameters like SO2, NOx, CO, and O3 were found well and within the limit at the location. Descriptive statistics show that Sox varied from 0.0 to 9.0 µg/m3 and NOx varied from 51.14 to 75.22 µg/m3, CO varied from 0.03 to 1.33 µg/m3 and O3 varied from 11.6 to 29.77 µg/m3 with a mean value of 2.38 µg/m3, 64.19 µg/m3, 0.56 µg/m3and 19.94 µg/m3 respectively. However, maximum levels of gaseous parameters were observed at the AAQ-3-Hamdh area **Figure 5.14**.

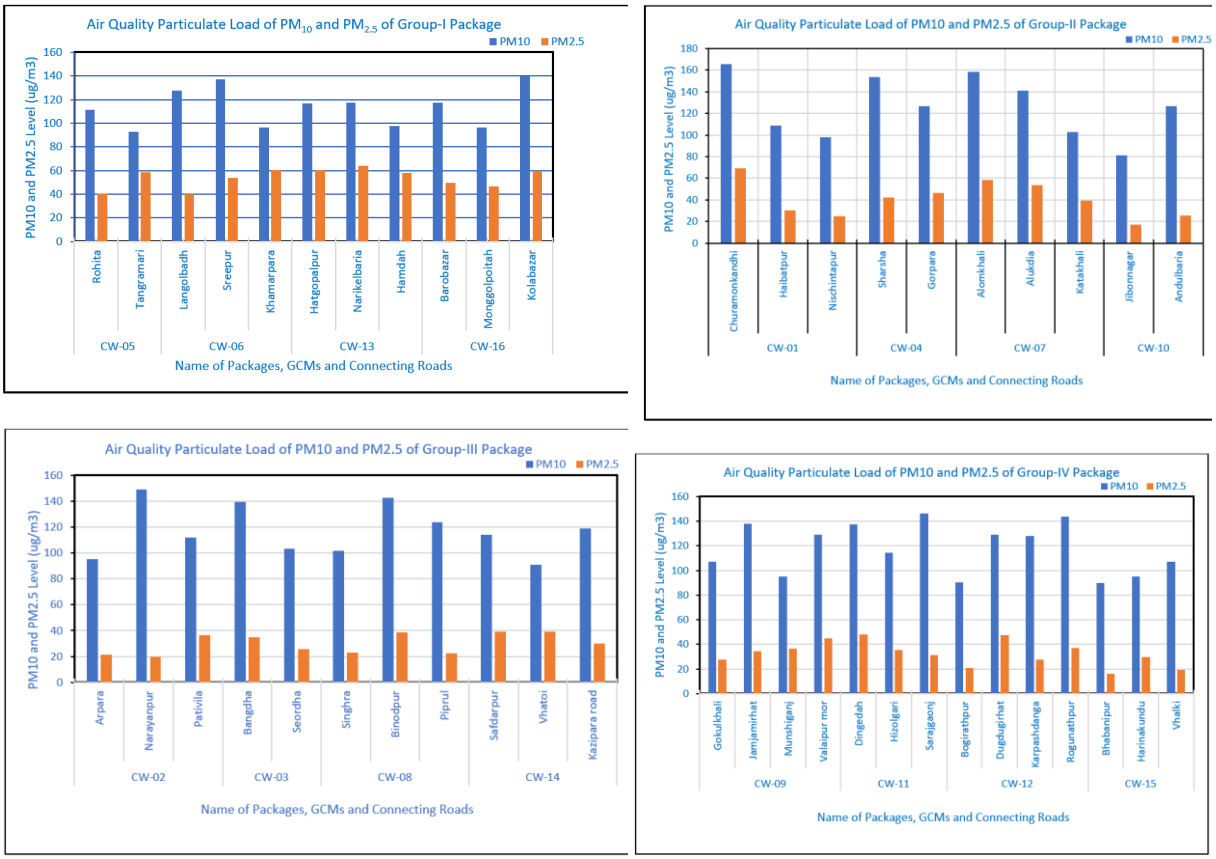
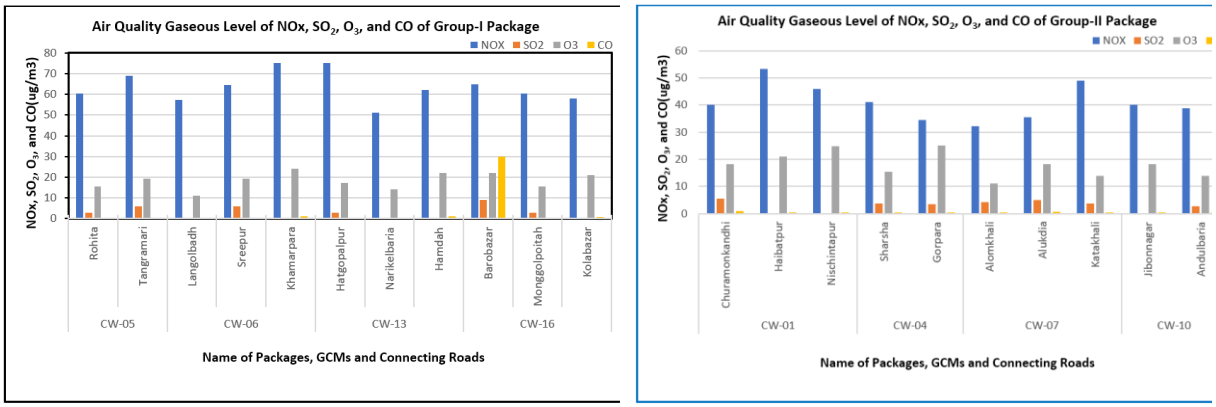


Figure 5.13: Air Quality Particulate Level in the Study Area.



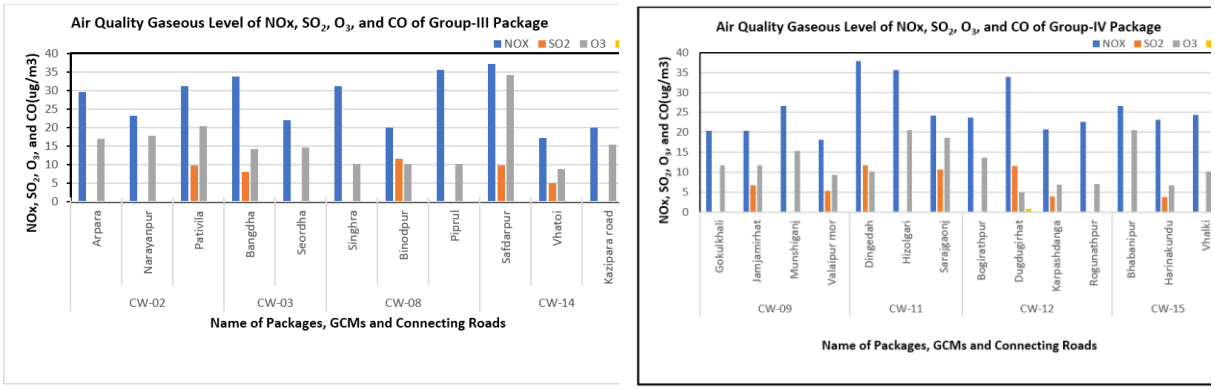


Figure 5.14: Ambient Air Gaseous Levels in the Study Area

5.4.4 Noise Quality

117. Before construction activities, sub-project contractors shall conduct noise level measurements in the pre-construction phase. During construction, contractors will be required to conduct noise level measurements and ensure that the sub-project does not cause deterioration of noise levels beyond the standards. Both, GoB and World Bank Community Health and Safetyguidelines were consulted.. While nighttime in Bangladesh is defined as the time interval between 9 PM and 6 AM, WB considers nighttime from 10 PM to 7 AM. Considering theguidelines of the country 9 PM and 6 AM night time is applied for all evaluations as shown in **Table 5.8**.

Table 5.8: Noise Standards

IFC EHS Guidelines (Leq) over 1 hour	Silent area	50	40
	Residential Area	55	45
	Mixed Area	60	50
	Commercial	70	60
	Industrial	75	70
	Residential, institutional, educational	55	45
	Industrial, Commercial	70	70

118. In the absence of national standards describing the noise measurement methodology, the World Bank Community Health and Safety guidelines shall be used as a minimum: “Noise monitoringprograms should be designed and conducted by trained specialists.Fourty Six (n=46) monitoring locations were selected for the study geographically.

5.4.4.1 Result and Discussion

119. Ambient daytime highest noise level (Leq day) was recorded at 67.26 dB (A) at NQ-7 (Ruhita) while the lowest value was 53.01 dB (A) at NQ-8 (Tangramari). Similarly, the Ambient nighttime highest noise level (Leq night) was recorded at 64.89 at NQ-5 (Kola) while the lowest value was 56.91at NQ-11 (Khamarpara)., Total 46 locations were selected considering the maximum potential for noise pollution throughout the 16 packages. Noise Level Analysis at 16 packages of 46 Different Locations are shown in **Figure 5.15**.

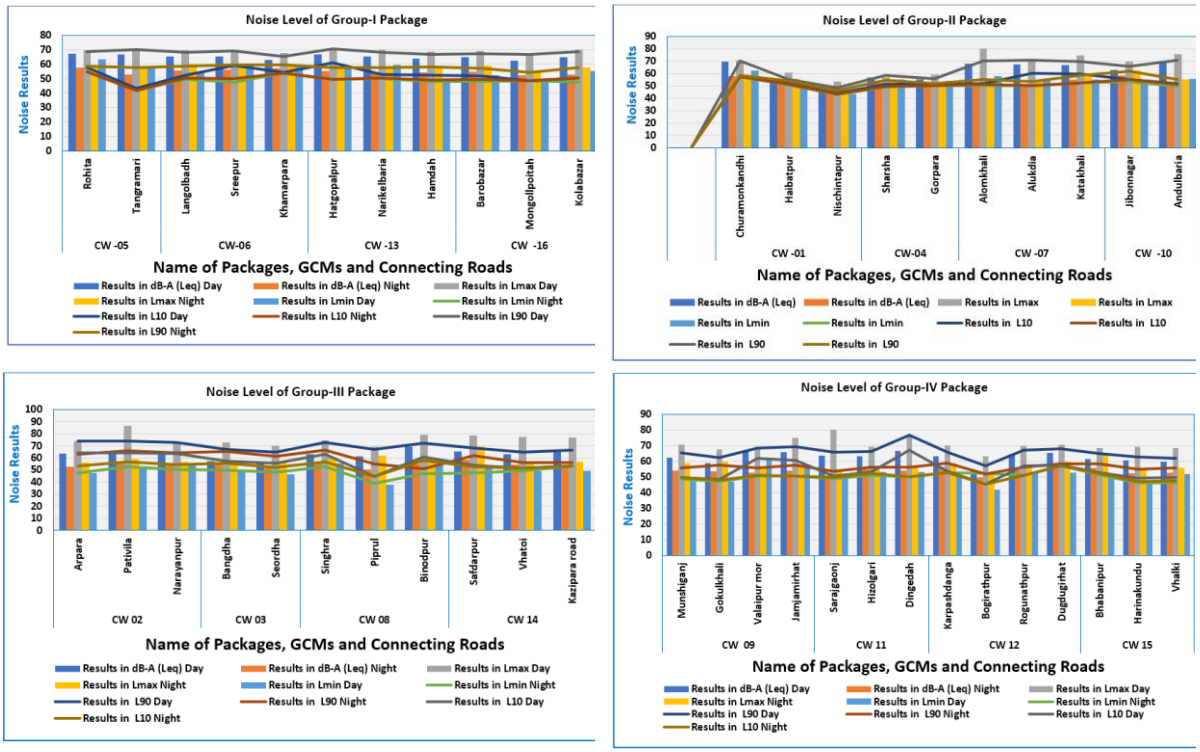


Figure 5.15: Noise Level Analysis at 46 different Locations

5.4.5 Vibration Level Measurement

120. Vibrations represent Acceleration: m/s2, Velocity: mm/s, and Displacement: mm. Displacement describes the distance that the measuring point has moved; velocity describes how fast the movement is; and acceleration is self-explanatory. The three types are all widely used, specifically acceleration, which offers the widest frequency range and is extensively applied for dynamic fault analysis. The vibration was measured through a VT-8204 vibration meter/photo tachometer/contact tachometer, with separate professional vibration sensor. Measured parameters are displacement, velocity, and acceleration,. The Vibration level data was monitored in 16 packages along the project site.

S

Result and Discussion

121. Vibration analysis is a process that monitors the levels of vibration signals within a component, vehicle, or structure, to detect abnormal vibration events and evaluate the overall condition of the test object. Proper and careful analysis of vibration data is laborious and time-consuming, but essential. Result of data analysis is presented in **Table 5.9**.

Table 5.9: Vibration Level Measurement Result at 46 Locations

Package Name	Location Code	Location	Acceleration range (m/s2)	Velocity range (mm/s)	Displacement (p-p) range (mm)
CW-01	VL-01/1	Churamonkandhi	0.577	0.724	0.0197
	VL-01/2	Haibatpur	0.152	0.51	0.008
	VL-01/3	Nischintapur	0.0356	0.396	0.005
CW-02	VL-02/1	Arpara	0.1071	0.6214	0.0107
	VL-02/2	Pativila	0.0947	1.1172	0.0479
	VL-02/3	Narayanpur	0.0778	0.4737	0.0044

Package Name	Location Code	Location	Acceleration range (m/s2)	Velocity range (mm/s)	Displacement (p-p) range (mm)
CW-03	VL-03/1	Bangdha	0.1375	1.3208	0.0825
	VL-03/2	Seordha	0.0643	0.4875	0.0079
CW-04	VL-04/1	Sharsha	0.402	0.669	0.011
	VL-04/2	Gorpara	0.181	0.469	0.007
CW-05	VL-05/1	Rohita	0.179	0.724	0.019
	VL-05/2	Tangramari	0.123	0.487	0.014
CW-06	VL-06/1	Khamarpara	0.047	0.364	0.004
	VL-06/2	Sreepur	0.186	0.691	0.011
	VL-06/3	Langolbadh	0.061	0.716	0.025
CW-07	VL-07/1	Alomkhali	0.159	0.617	0.011
	VL-07/2	Alukdia	0.182	0.693	0.012
	VL-07/3	Katakhali	0.078	0.627	0.009
CW-08	VL-08/1	Singhra	0.0667	0.3714	0.0033
	VL-08/2	Piprul	0.0889	0.3889	0.0033
	VL-08/3	Binodpur	0.0789	0.6053	0.0124
CW-09	VL-09/1	Munshiganj	0.0857	0.6643	0.013
	VL-09/2	Gokulkhali	0.0429	0.5071	0.0031
	VL-09/3	Valaipur mor	0.0778	0.4684	0.0052
	VL-09/4	Jamjamirhat	0.0857	0.6143	0.0069
CW-10	VL-10/1	Jibonnagar	0.087	0.622	0.02
	VL-10/2	Andulbaria	0.233	0.602	0.011
CW-11	VL-11/1	Sarajgaonj	0.0643	0.5375	0.0078
	VL-11/2	Hizolgari	0.0778	0.4316	0.0036
	VL-11/3	Dingedah	0.0778	0.4643	0.0051
CW-12	VL-12/1	Karpashdanga	0.0786	0.6947	0.0059
	VL-12/2	Bogirathpur	0.0556	0.3421	0.0049
	VL-12/3	Rogunathpur	0.0571	0.4421	0.0052
	VL-12/4	Dugdugirhat	0.0786	0.4786	0.0042
CW-13	VL-13/1	Hatgopalpur	0.343	0.542	0.006
	VL-13/2	Narikelbaria	0.151	0.513	0.008
	VL-13/3	Hamdah	0.190	0.529	0.011
CW-14	VL-14/1	Safdarpur	0.0778	0.0707	0.0117
	VL-14/2	Vhatoi	0.0667	0.3167	0.0039
	VL-14/3	Kazipara road	0.0857	0.5316	0.0072
CW-15	VL-15/1	Bhabanipur	0.06316	0.5222	0.0051
	VL-15/2	Harinakundu	0.05556	0.1895	0.0023
	VL-15/3	Vhalki	0.0786	0.2786	0.0029
CW-16	VL-16/1	Barobazar	0.173	1.175	0.034
	VL-16/2	Monggolpoitah	0.129	0.487	0.009
	VL-16/3	Kolabazar	0.078	0.623	0.010

122. Vibration monitoring is relatively rare on construction projects, despite the well-known potential for damage. It is most commonly done only after a damage report. When it is done, vibration monitoring reporting quality frequently is so deficient that the provided information fails to support adequately any scientifically verifiable and meaningful conclusions, despite guidance provided in various publically available standards, documents, and regulations to aid in preparing proper and defensible reports. In our experience, it is rare, indeed, to encounter a "professional" vibration monitoring report which meets even

basic scientific reporting standards. It is concluded that vibration levels for different locations is not harmful to the environment.

5.4.6 Water Quality

123. Water, samples were taken from the project locations as per the sampling method suggested by American Public Health Association (APHA) and United State Environmental Protection Agency (USEPA) respectively.

Result and Discussion

5.4.6.1 Groundwater

124. Fourty six samples (n=46) of Groundwater were studied and their results have been tabulated in **Table 5.10**. The results of groundwater quality monitoring are summarized below:

- The pH of the samples was found neutral to alkaline range (7.15 to 7.94) and suitable for aquatic habitats.
- TDS and EC of the sample were found slightly elevated at some areas like GW 9 and GW 3 and very comparable to the groundwater characteristic. TDS and EC concentration in groundwater indicates the high range of dissolved ions mineralized through a geogenic processlike rock weathering, water-rock interaction, precipitation, and ion exchange proceeds.
- Another parameter like the Salinity of the sample was comparable to the groundwater characteristic.
- Heavy metals like Lead, Cadmium, Copper, Nickel, and Chromium were noted below the detection limits which suggests that the water of the study area is not affected by any anthropogenic activities.
- The overall study suggests that the water quality of the study area is within acceptable range. Additionally, the area is untouched by any organic or inorganic pollution from any human activities.

Table 5.10: Groundwater Quality Results of Studied Samples

Sl	Parameter	pH	EC	TDS	DO	COD	Chloride (Cl^-)	Salinity	Iron (Fe)	Arsenic (As)	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Total Coliform (TC)	Fecal Coliform (FC)
Unit			**µS/cm**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**%**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**n/100 ml**	**n/100 ml**
DoE Ground Water Standard		**6.5 – 8.5**	**NYS**	**1000**	**6**	**4**	**150-600**	**NYS**	**0.3-1.0**	**0.05**	**0.05**	**0.005**	**0.05**	**0.001**	**0**	**0**
Ground Water Quality (Collected from near GCMs) Result																
CW-01	Churamonkandhi	7.27	1118	578	6.2	<LOD	70	0.6	<LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Haibatpur	7.4	774	387	5.9	<LOD	12	0.25	<LOD	0.034	<0.005	<0.001	<0.01	<0.001	<2	<2
	Nischintapur	7.49	621	310	6.4	<LOD	19	0.36	<LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-02	Arpara	7.32	887	444	7.9	<LOD	12	0.15	0.23	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Pativila	7.24	729	396	7.86	<LOD	53	0.45	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Narayanpur	7.57	618	309	7.06	<LOD	22	0.41	1.4	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-03	Bangdha	7.24	602	301	7.56	<LOD	5.9	0.35	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Seordha	7.2	643	322	7.7	<LOD	14	0.38	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-	Sharsha	7.26	827	414	6.6	<LOD	47	0.48	<LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2

Sl	Parameter	pH	EC	TDS	DO	COD	Chloride (Cl^-)	Salinity	Iron (Fe)	Arsenic (As)	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Total Coliform (TC)	Fecal Coliform (FC)
Unit			µS/cm	mg/l	mg/l	mg/l	mg/l	%	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	n/100 ml	n/100 ml
04	Gorpara	7.79	1035	517	6.8	<LOD	91	0.62	<LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-05	Rohita	7.16	642	320	7.4	LOD	25	0.41	LOD	0.04	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
	Tangramari	7.18	623	312	7.4	16	9.6	0.39	LOD	0.06	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
CW-06	Khamarpara	7.34	833	417	7.2	LOD	25	0.52	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
	Sreepur	7.4	640	320	7.1	LOD	23	0.41	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
	Langolbadh	7.46	987	492	6.8	LOD	60	0.62	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
CW-07	Alomkhali	7.29	612	306	6.7	<LOD	19	0.36	<LOD	0.026	<0.005	<0.001	<0.01	<0.001	<2	<2
	Alukdia	7.48	602	301	6.3	<LOD	18	0.34	<LOD	0.008	<0.005	<0.001	<0.01	<0.001	<2	<2
	Katakhali	7.37	753	377	6.1	<LOD	7.8	0.28	<LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-08	Singhra	6.99	781	391	7.9	<LOD	36	0.42	6.4	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Piprul	7.37	736	368	7.65	<LOD	97	0.56	17	<0.005	<0.005	<0.001	<0.01	<0.001	34	9
	Binodpur	7.14	758	379	7.15	<LOD	22	0.32	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-09	Munshiganj	7.61	629	315	7.35	<LOD	9.9	0.45	0.19	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Gokulkhali	7.63	604	302	7.33	<LOD	12	0.36	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Valaipur mor	7.12	662	330	7.16	<LOD	18	0.4	2.2	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Jamjamirhat	8.07	250	124	7.29	<LOD	9.9	0.27	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-10	Jibonnagar	7.47	731	366	6	<LOD	21	0.38	<LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Andulbaria	7.4	1038	520	7.2	<LOD	56	0.54	<LOD	0.022	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-11	Sarajgaonj	8.31	590	295	7.24	<LOD	87	0.62	3.4	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Hizolgari	7.42	867	434	7.28	<LOD	48	0.46	2.9	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Dingedah	7.69	816	408	7.3	<LOD	67	0.52	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-12	Karpashdanga	7.21	937	466	7.34	<LOD	53	0.47	1.9	<0.005	<0.005	<0.001	<0.01	<0.001	27	11
	Bogirathpur	7.37	613	307	7.31	<LOD	20	0.42	7.0	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Rogunathpur	7.26	1180	589	7.31	<LOD	89	0.62	5.8	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Dugdugirhat	7.19	983	492	7.67	<LOD	85	0.57	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
CW-13	Hatgopalpur	7.55	769	385	6.5	LOD	7.69	0.46	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
	Narikelbaria	7.24	707	354	5.9	LOD	7.7	0.44	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
	Hamdah	7.15	921	460	6.8	LOD	7.55	0.42	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
CW-14	Safdarpur	7.21	1089	544	7.41	<LOD	95	0.6	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Vhatoi	7.3	601	301	7.79	<LOD	14	0.36	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Kazipara road	7.14	780	390	7.93	<LOD	28	0.3	3.4	<0.005	<0.005	<0.001	<0.01	<0.001	13	<2
CW-15	Bhabanipur	7.27	826	413	7.32	<LOD	30	0.41	6.1	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Harinakundu	7.5	483	241	7.57	<LOD	9.9	0.29	<0.05	<0.005	<0.005	<0.001	<0.01	<0.001	<2	<2
	Vhalki	7.37	760	380	7.87	<LOD	12	0.43	3.7	<0.005	<0.005	<0.001	<0.01	<0.001	50	14
CW-16	Barobazar	7.16	606	303	6.6	LOD	7.75	0.48	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
	Mongolpoita	7.94	601	301	7.2	LOD	7.7	0.42	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8
	Kolabazar	7.4	603	301	7.2	LOD	7.85	0.39	LOD	<0.005	<0.005	<0.001	<0.01	<0.001	<1.8	<1.8

5.4.6.2 Surface Water

125. Forty-Six (46) sampling locations were targeted to test the surface water quality and their results have been tabulated in **Table 5.11**.

126. The results of surface water quality monitoring are summarized below;

- The pH of River, Canal, and Pond water was showed alkaline in nature and varied from 7.00 to 7.73.

BOD_5 is within the the DoE standards. However, surface water is highly prone to pollution due to its open environment, so, atmospheric deposition, surface runoff, and otheranthropogenic activities can influence surface water quality.

- To evaluate the health status of the surface water, BOD_5 and COD as well as Oil and greasetests were conducted. The study shows that elevated level of these parameters in the surfacewater is the evidence of organic and inorganic pollution in the surface water which mainly due to effluent-bearing water directly or indirectly discharge into the surface water.
- However, the oxygen concentration of water bodies shows well in condition for the aquatic organism which is mainly due to surface river currents that enhance the oxygen in the waterbodies.

5.4.6.3 Drinking Water

127. Drinking water quality was tested from46 sampling locations and their results have been tabulated in**Table 5.12**.

128. The results of drinking water quality monitoring are summarized below;

- The pH of drinking water shows alkaline in nature and is very suitable for human consumption.
- EC and TDS levels at DW-8, DW-9, and DW-11 were found higher but below the regulatory standard DoE portable uses.
- The heavy metals were found below the detection limit at all locations which indicate that the water is not contaminated by any anthropogenic sources.

129. Overall, the result suggests that the dirking water of the study really is well and suitable for human consumption.

Table 5.11: Surface Water Quality of the Study Area

Sl	Parameter	pH	EC	TDS	TSS	DO	BOD	COD	Chloride	Salinity	Hardness	Oil and Grease
Unit			**µS/cm**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**%**	**mg/l**	**mg/l**
DoE Surface Water Standard		**6.5 – 8.5**	**2250**	**NYS**	**NYS**	**≥5**	**≤10**	**NYS**	**150-600**	**NYS**	**NYS**	**NYS**
Surface Water Quality (Collected from near GCMs) Result												
CW-01	Churamonkandhi Pond Water	7.08	287	144	23	6	8.22	64	5.8	0.18	180	1.7
	Haibatpur Bhairab River water	7.12	348	174	40	5.8	6.48	32	16	0.21	127.5	1.85
	Nischintapur Pond Water	7.11	280	140	14	6.1	6.98	64	18	0.17	120	1.8
CW-02	Arpara - Pond	7.39	660	330	38	6.7	9.4	96	18	0.39	156	1.7
	Pativila - Pond	7.03	353	177	37	6.3	9.5	112	24	0.23	150	1.6
	Narayanpur-Kopotakhho River	6.82	316	158	15	6.5	9.6	96	10	0.2	144	1.5
CW-03	Bangdah – Kopotakhho River	7.06	348	174	18	6.8	9.1	80	14	0.22	144	1.8
	Seordha - Pond	7.1	554	277	35	6.6	8.8	73	36	0.33	141	1.75
CW-04	Sharsha Pond Water	6.77	283	142	15	5.9	6.9	96	27	0.18	157.5	1.65
	Gorpara Betna River water	7.03	715	358	53	6.2	7.44	32	76	0.43	171	1.9
CW-05	Rohita Pond water	7.41	343	172	91	5.6	9.2	48	12	0.22	159	1.95
	Tangramari Pond water	7.63	286	143	75	5.7	9.1	48	12	0.18	135	1.4
CW-	Khamarpara Kumar River water	7.73	374	187	58	5.9	8.6	48	21	0.23	150	1.25

Sl	Parameter	pH	EC	TDS	TSS	DO	BOD	COD	Chloride	Salinity	Hardness	Oil and Grease
Unit			µS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	%	mg/l	mg/l
06	Sreepur Kumar River water	7.66	424	212	68	6	7.8	48	23	0.26	168	1.15
	Langolbadh Canal water	7.52	327	163	62	5.3	9.6	48	19	0.21	126	1.2
CW-07	Alomkhali Naboganga River water	7.04	401	201	30	6.2	8.15	64	21	0.24	141	1.5
	Alukdia Naboganga River Water	7.13	361	181	29	6.1	7.26	16	19	0.22	183	1.35
	Katakhali Pond Water	7.02	305	153	26	6	7.52	32	25	0.18	165	1.45
CW-08	Singhra - Pond	7.1	498	247	39	6	8.7	96	24	0.24	120	1.8
	Piprul - Pond	7.15	904	452	48	6.8	8.7	80	14	0.35	105	1.65
	Binodpur-Novogonga River	7.29	355	178	19	6.8	8.9	80	18	0.22	135	1.55
CW - 09	Munshiganj-Mathavanga River	7.08	284	142	16	6.8	9.2	64	20	0.17	159	1.85
	Gokulkhali - Pond	7.31	412	206	40	5.8	8.7	80	30	0.25	138	1.75
	Valaipur mor - Pond	7.18	305	153	51	5.8	8.6	112	16	0.19	147	1.1
	Jamjamirhat-Kumar River	6.83	316	158	39	6.8	8.7	73	14	0.23	105	1.7
CW-10	Jibonnagar Pond Water	6.98	483	242	20	6	9.69	16	18	0.26	174	1.75
	Andulbaria Kapotakkho River water	7.14	550	274	20	6.4	7.99	32	29	0.33	150	1.9
CW-11	Sarajgaonj - Pond	8.16	409	204	91	5.7	8.4	105	44	0.24	150	1.25
	Hizolgari - Pond	6.8	285	142	77	5.4	8.5	96	22	0.17	126	1.45
	Dingedah- Pond	7.02	320	160	52	5.4	9.5	80	34	0.2	144	1.65
CW-12	Karpashdanga-Bhairab River	7.24	440	221	16	5.4	8.9	73	24	0.26	150	1.4
	Bogirathpur - Pond	7.07	360	179	41	5.2	9.2	112	14	0.21	138	1.2
	Rogunathpur-Mathavanga River	6.88	270	135	25	6	9.6	64	12	0.15	153	1.35
	Dugdugirhat - Pond	6.76	541	270	46	6.1	8.6	96	59	0.32	141	1.65
CW-13	Hatgopalpur Pond water	7	254	126	69	5.3	9	48	12	0.17	112.5	1.75
	Narikelbaria Pond water	7.07	509	253	102	5.8	9.2	48	25	0.34	165	2.1
	Hamdah Pond water	7.38	404	202	98	5.8	8.6	48	42	0.25	105	1.1
CW-14	Safdarpur - Pond	6.56	274	137	68	6.5	8.2	96	32	0.17	120	1.3
	Vhatoi - Pond	6.77	373	186	45	6	8.5	80	34	0.23	129	1.6
	Kazipara road - Pond	8.12	323	162	53	5.4	9.1	96	14	0.2	126	1.5
CW-15	Bhabanipur - Pond	7.41	322	162	63	5.1	9	73	16	0.2	144	1.65
	Harinakundu - Pond	7.57	431	215	49	6.6	8.3	128	42	0.27	153	1.55
	Vhalki - Pond	7.18	439	220	73	6.8	8.9	96	20	0.26	156	1.4
CW-16	Barobazar Pond water	7.26	398	199	120	5.7	7.9	48	25	0.25	142.5	1.7
	Mongolpoita Chitra River water	7.61	467	233	43	6	8.5	80	15	0.29	219	1.5
	Kolabazar Beghoboti River water	7.1	350	175	60	6.2	9	80	15	0.22	156	1.1

Note: NYS = Not yet set

Table 5.12: Drinking Water Quality Results of the Study Area

Sl	Parameter	pH	EC	TDS	Iron (Fe)	Arsenic (As)	Total Coliform (TC)	Fecal Coliform (FC)
Unit			µS/cm	mg/l	mg/l	mg/l	n/100 ml	n/100 ml
DoE Drinking Water Standard		**6.5–8.5**	**NYS**	**1000**	**0.3-1.0**	**0.05**	**0**	**0**
CW-01	Churamonkandhi	7.2	984	491	<LOD	0.01	<2	ND
	Haibatpur	7.1	746	373	<LOD	ND	<2	ND
	Nischintapur	7.34	469	234	<LOD	ND	<2	ND
CW-02	Arpara	7.49	876	438	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Pativila	7.58	490	244	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Narayanpur	7.84	535	267	BDL(DL:0.05)	BDL(DL:0.005)	34	<2
CW-03	Bangdha	7.43	727	364	BDL(DL:0.05)	BDL(DL:0.005)	26	11
	Seordha	7.29	588	294	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
CW-04	Sharsha	7.36	1096	548	<LOD	ND	<2	ND
	Gorpara	7.38	950	473	<LOD	ND	<2	ND
CW-05	Rohita	7.65	574	286	LOD	LOD	<1.8	Not Detected
	Tangramari	7.66	1411	706	LOD	LOD	<1.8	Not Detected
CW-06	Khamarpara	7.34	1151	574	LOD	LOD	<1.8	Not Detected
	Sreepur	7.6	573	287	LOD	LOD	<1.8	Not Detected
	Langolbadh	7.32	1018	508	LOD	LOD	<1.8	Not Detected
CW-07	Alomkhali	7.06	408	204	<LOD	0.013	<2	ND
	Alukdia	7.14	535	267	<LOD	ND	<2	ND
	Katakhali	7.17	573	277	<LOD	ND	<2	ND
CW-08	Singhra	7.18	816	408	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Piprul	7.85	602	301	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Binodpur	7.24	688	344	BDL(DL:0.05)	BDL(DL:0.005)	13	<2
CW-09	Munshiganj	7.69	618	308	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Gokulkhali	7.22	778	390	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Valaipur mor	7.01	658	329	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Jamjamirhat	4.45	492	246	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
CW-10	Jibonnagar	7.3	551	276	<LOD	0.012	<2	ND
	Andulbaria	7.1	1027	513	<LOD	ND	<2	ND
CW-11	Sarajgaonj	8.09	585	292	BDL(DL:0.05)	BDL(DL:0.005)	34	14
	Hizolgari	7.12	1029	513	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Dingedah	7.83	585	292	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
CW-12	Karpashdanga	7.23	912	456	0.86	BDL(DL:0.005)	11	<2
	Bogirathpur	6.89	1133	566	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Rogunathpur	7.27	875	438	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Dugdugirhat	7.17	795	397	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
CW-13	Hatgopalpur	7.55	769	385	LOD	0.02	<1.8	Not Detected
	Narikelbaria	7.24	707	354	LOD	LOD	<1.8	Not Detected
	Hamdah	7.24	920	460	LOD	0.022	<1.8	Not Detected
CW-14	Safdarpur	7.16	1252	626	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Vhatoi	7.23	747	373	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
	Kazipara road	7.52	601	299	BDL(DL:0.05)	BDL(DL:0.005)	<2	<2
CW-15	Bhabanipur	7.24	830	415	0.52	BDL(DL:0.005)	30	13

Sl	Parameter	pH	EC	TDS	Iron (Fe)	Arsenic (As)	Total Coliform (TC)	Fecal Coliform (FC)
Unit			µS/cm	mg/l	mg/l	mg/l	n/100 ml	n/100 ml
	Harinakundu	7.88	413	207	BDL(DL:0.05)	BDL(DL:0.005)	23	<2
	Vhalki	7.42	616	308	1.5	BDL(DL:0.005)	<2	<2
CW-16	Barobazar	7.32	762	381	LOD	LOD	<1.8	Not Detected
	Mongolpoita	7.94	601	301	LOD	0.008	<1.8	Not Detected
	Kolabazar	7.4	603	301	LOD	LOD	<1.8	Not Detected

5.4.7 Soil Quality

130. Considering the topography, slope, vegetation, land type, and drainage condition, a suitable sampling technique was applied for this study. For the sampling, 1 Kg of cleaned polyethylene bags for soil/sediment were used and transferred to the laboratory as per United States Environmental Protection Agency (US EPA, 1992) guidelines. Fourty Six soil sampling locations were chosen based on their importance and effect over the GCMs.

Result and Discussion

131. The soil samples collected from the nearby GCM and adjacent road study area revealed that the majority of the samples (n=46) belonged to Sandy Clay characteristics which are evident from the analytical results of sediment samples (as given in **Table 5.13**). The following conclusions could be made from the above-tabulated data;

- The all-sediment sample's pH shows neutral to alkaline in nature. The textural analysis of soil revealed the sandy clay nature, with dominant to sand, clay, and silt.
- Temporal studies showed that the majority of ions are derived from the geo-genic origin as no significant change in the hydro-chemical facies was noticed during the study period.
- Similarly, the majority of the metals trend showed similar distribution throughout the study period which indicates that these metals had similar sources in the natural environment like humid and monsoonal climatic conditions, so evaporation rate, precipitation, weathering of soil interaction may also contribute in the additional amount of elemental concentration in this area.
- Similarly, in the temporal behavior, metal content did not show any major deviation in results during the study period which reveals that soil is well and untouched by any serious contaminants from human activities.

Table 5.13: Soil Quality Result of the Study Area

Sl	Parameter	pH	Particle Size Distribution					Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Mercury (Hg)	Arsenic (As)	Oil and Grease
			Texture	Coarse sand	Fine sand	Silt	Clay							
Unit				%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Soil Quality (Collected from near GCMs) Result														
CW-01	Churamonkandhi	7.98	Sand	80.64	12.32	5.06	1.98	6.1	<2.0	37	19	<0.1	<0.25	302
	Haibatpur	8.03	Sand	69.13	25.10	3.28	2.49	5.8	<2.0	15	13	<0.1	<0.25	194
	Nischintapur	7.01	Loamy sand	67.61	15.95	9.35	7.09	8.4	<2.0	20	15	<0.1	<0.25	<5.0
CW-02	Arpara	8.18	Sandy Loam	58.34	17.075	7.8	16.735	4.8	<2.0	12	8.4	<0.1	<0.25	86
	Pativila	7.76	Loam	18.05	23.86	41.165	16.87	6.2	<2.0	10	9.1	<0.1	<0.25	121
	Narayanpur	7.53	Sandy Loam	47.675	22.9	11.68	17.705	6.7	<2.0	13	9.5	<0.1	<0.25	112
CW-03	Bangdha	7.62	Loamy Sand	52.915	26.905	9.295	10.85	7.3	<2.0	13	11	<0.1	<0.25	<25
	Seordha	7.06	Loamy Sand	71.41	11.615	6.24	10.705	4.5	<2.0	14	8.2	<0.1	<0.25	122
CW-04	Sharsha	6.91	Loamy sand	55.12	25.75	10.23	8.90	7.4	<2.0	14	10	<0.1	<0.25	204
	Gorpara	7.51	Sandy loam	44.63	25.17	16.09	14.11	6.7	<2.0	23	16	<0.1	<0.25	126
CW-05	Rohita	7.88	Loamy sand	49.85	34.07	7.13	8.75	9.3	<2.0	8.3	16	<0.1	4.5	<25
	Tangramari	7.56	Sandy loam	20.44	39.47	31.05	8.97	9.8	<2.0	16	13	<0.1	4.9	47
CW-06	Khamarpara	7.52	Sandy loam	45.85	35.85	9.63	8.58	13	<2.0	19	15	<0.1	4.8	93
	Sreepur	7.81	Sandy clay loam	46.76	27.51	12.33	13.26	7.6	<2.0	15	12	<0.1	3.6	61
	Langolbadh	8.25	Loamy sand	52.66	24.41	10.30	12.47	13	<2.0	17	14	<0.1	3.7	51
CW-07	Alomkhali	7.16	Loamy sand	47.63	28.75	13.68	9.94	8.7	<2.0	17	12	<0.1	<0.25	<5.0
	Alukdia	8.6	Sandy loam	25.16	43.27	18.40	13.17	9.4	<2.0	13	11	<0.1	<0.25	78
	Katakhali	8.18	Clay loam	25.42	20.43	17.32	36.83	5.9	<2.0	16	9.2	<0.1	<0.25	182
CW-08	Singhra	7.87	Sand	76.42	11.43	3.695	8.43	9	<2.0	16	10	<0.1	<0.25	98
	Piprul	8.08	Sand	73.23	19.455	3.34	3.94	8.9	<2.0	18	9	<0.1	<0.25	<25
	Binodpur	8.18	Loamy Sand	62.92	15.535	7.56	13.935	8.8	<2.0	20	11	<0.1	<0.25	<25
CW-09	Munshiganj	8.02	Sand	89.17	7.76	1.905	1.13	7.4	<2.0	17	13	<0.1	<0.25	<25
	Gokulkhali	8.16	Loamy Sand	63.515	15.785	11.355	9.245	6	<2.0	14	12	<0.1	<0.25	<25
	Valaipur mor	7.61	Sand	76.06	15.795	6.2	1.895	6.5	<2.0	19	10	<0.1	<0.25	176
	Jamjamirhat	8.21	Sandy loam	50.975	21.56	9.365	18.065	7.6	<2.0	17	18	<0.1	<0.25	68
CW-10	Jibonnagar	8.2	Clay loam	28.09	16.55	22.07	33.29	4.5	<2.0	11	8.5	<0.1	<0.25	174
	Andulbaria	8.14	Sandy clay loam	44.55	20.89	12.17	22.39	7.1	<2.0	18	14	<0.1	<0.25	168
CW-	Sarajgaonj	7.72	Sandy	58.955	17.68	7.68	15.655	7.9	<2.0	17	9.6	<0.1	<0.25	<25

Sl	Parameter	pH	Particle Size Distribution					Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Mercury (Hg)	Arsenic (As)	Oil and Grease
			Texture	Coarse sand	Fine sand	Silt	Clay							
Unit				%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
11			Loam											
	Hizolgari	8.07	Loamy Sand	55.24	24.34	8.44	11.935	7.2	<2.0	16	10	<0.1	<0.25	128
	Dingedah	7.81	Loamy Sand	74.835	8.74	10.73	5.65	8.2	<2.0	21	14	<0.1	<0.25	52
CW-12	Karpashdanga	7.62	Sand	82.12	12.22	3.17	2.43	8.1	<2.0	18	11	<0.1	<0.25	92
	Bogirathpur	8.09	Loamy Sand	53.06	31.28	10.675	4.96	8.3	<2.0	20	13	<0.1	<0.25	<25
	Rogunathpur	7.97	Loamy Sand	64.13	16.285	11.04	8.51	9.5	<2.0	22	7.6	<0.1	<0.25	102
	Dugdugirhat	8.66	Loamy Sand	54.825	22.19	14.66	8.305	9.4	<2.0	25	14	<0.1	<0.25	82
CW-13	Hatgopalpur	8.2	Loamy sand	10.70	77.86	8.44	2.88	4.2	<2.0	9.1	7.3	<0.1	2.2	<25
	Narikelbaria	7.55	Sandy loam	46.23	29.91	14.38	9.36	11	<2.0	17	12	<0.1	4.6	<25
	Hamdah	7.07	Sandy loam	21.75	48.31	20.38	9.44	9.6	<2.0	18	15	<0.1	3.1	<25
CW-14	Safdarpur	7.68	Loamy Sand	67.96	11.885	7.39	12.73	8.4	<2.0	15	9.7	<0.1	<0.25	146
	Vhatoi	7.92	Sand	68.345	18.14	4.47	8.99	6.1	<2.0	18	13	<0.1	<0.25	88
	Kazipara road	7.73	Clay loam	24.705	16.735	27.85	30.665	6.8	<2.0	19	15	<0.1	<0.25	90
CW-15	Bhabanipur	7.98	Sandy loam	18.88	45.35	29.525	6.19	7.4	<2.0	15	16	<0.1	<0.25	<25
	Harinakundu	8.06	Loamy Sand	64.885	20.085	4.935	10.065	8.4	<2.0	13	15	<0.1	<0.25	<25
	Vhalki	7.62	Loamy Sand	52.095	22.715	15.585	9.58	9.6	<2.0	14	12	<0.1	<0.25	108
CW-16	Barobazar	7.44	Sandy clay loam	43.10	28.39	15.02	13.35	23	<2.0	21	17	<0.1	4.2	152
	Mongolpoita	7.1	Sandy loam	52.51	25.75	12.09	9.43	5.8	<2.0	12	10	<0.1	3.2	54
	Kolabazar	7.68	Sandy loam	52.64	20.84	8.95	17.32	29	<2.0	8.5	15	<0.1	2.6	<25

Note: NYS-Not Yet Set

5.4.8 Biological Environment

5.4.8.1 Ecological Resources

132. The sub-project road site has some vegetation but no ecologically sensitive area. So, the clearance will not have any significant impact on the ecology. Runoff from the construction site is expected to be a source of water pollution. Such pollution may persist during the initial phase of the construction period when site development and excavation for road construction and backfilling will be in progress. During this phase, the rainwater runoff will carry more soil/silt than normal and this may cause silting problems in the receiving canal water bodies.

133. Before starting the survey, we have consulted all sorts of published literatures, unpublished

reports and other sources. We have treated species of the project area against IUCN Red List of Threatened Animals; both national and global threat categories were considered. The project areas were located in sub-urban and rural areas along existing highway and does not include any forest or protected areas. The nearest protected area is Sundarbans, which is about 65-90 km south of the project area. The habitat of Sundarbans mangrove forest is completely different from the project area and the species found in the Sundarbans are not expected to found in the project area. We did not consider IBAT data as it was out of the scope of the work. But we considered all the threatened species found in the project area.

5.4.8.2 Bio-Ecological Zones

134. The study area site falls in Brahmaputra-Jamuna Floodplain bio-ecological zone. The Brahmaputra-Jamuna floodplain possesses a unique variety of plants, medicinal herbs, fruit-bearing trees, hundreds of jungle shrubs, creepers, climbers, flowering trees, etc., many of which yield valuableproducts.

5.4.8.3 Floral Component

135. The team conducted an ecological survey of flora and fauna in the connecting road area. The team also collected secondary information from literature and FGD from the study area to understand the overall terrestrial ecosystem. No endangered or threaten tree species were found in the sub-project location during the study period. The floral habitat has been described below:

136. The common fruits are the mango, jackfruit, banana, papaya, guava, lemon, coconut, palm, tamarind, ata (Anama reticulata), karamcha (Carisscacarandas), safeda (Achras sapota), wood apple, lichi, plums, watermelon,sweet melon, etc. Non-fruit plants are arjun (Terminalia arjun), sandal tree, banayan tree, krishnachura (Delonix regia), palash, etc. Local, English,and scientific names of the species found.

137. Flowering plants are fairly common in the project area where roses, kamini, champa (Michelia champa), etc. are available. The area produces a good amountof vegetables and spices of which eggplant, okra, coriander, potato, pointed gourds, gourds, long beans, country beans, chilly, cabbages, bitter gourds, etc.are worth mentioning. List of plants confirmed around the site is presented in **Table 5.14**.

Table 5.14: List of Plants Confirmed Around the Site

No.	Local Name	Scientific Name	No.	Local Name	Scientific Name
1	Lichu	Lichi Chinensis Sonn	30	Madar	Erythriana variegata L. var. orientalis Merr.
2	Am	Mangifera indica L. (Anacard)	31	Jaba	Hibiscus rosa sinensis L. (Malvaceae)
3	Kathal	Artocarpus heterphyllus Lamk	32	Man Kochu	Alocasia indica
4	Pepe	Carica papaya L (caricaceae)	33	Kachu	Colocasia esculenta (L.)
5	Golap	Rosa centifolia L. (Rosaceae)	34	Jambura	Citrus grandis
6	Beli	Jasmin sambac Ait (Olea)	35	Dumur	Ficus hispida
7	Narikel	Cocos nucifers L. (Palmae)	36	Koroi	Derris robusta Benth.
8	Chameli	Jasminum grandiflorum L. (Oleace)	37	Lebu	Citrus aurantifolia
9	Patabahar	Codiaeum variegatum	38	Mehogini	Swietenia mahagoni
10	Peyara	Psidium Guajava (L) Bat.(Myrtaceae)	39	Kowa nim	Melia sempervirens

No.	Local Name	Scientific Name	No.	Local Name	Scientific Name
11	Kola	Musa Paradisica	40	Shimul	Bombax ceiba
12	Rangan	Ixora rosea Will (Rubiceae)	41	Pui Shak	Basella alba L.
13	Gashpul	Zephyranthes tubispatha Herb. (Amaryllidaceae)	42	Rain tree	Samea Samon
14	Sajina	Moringa Oleifera Lamk. (Moringa)	43	Dol Kolme	Ipomoea fistolosa
15	Supari		44	Bansh pata	Podocarpus nerifolia
16	Jam	Syzygium cumini skiel. (Myrtaceae)	45	Mankata	Xeromphis spinosa
17	Shimul	Bombax ceiba L. (Bombacaceae)	46	Babla	Acacia nilotica
18	Kamranga	Averrhoa carambola	47	Ulatkambal	Abroma augusta
19	Sofeda	Manilkara Zapota	48	Basak	Adhatoda zeylanica
20	Kadbel	Feronia limonia (L.)	49	Muktajhuri	Abroma augusta
21	Bel	Aegle marmelos (L).	50	Rashun	Allium sativum
22	Tal	Borassus flabellifer L. (Palmae)	51	Shatamuli	Asparagus racemosus
23	Krishnachura	Delonix regia (Boj.) Raf. (Leguminosae)	52	Neem	Azadirachta indica
24	Bot	Ficus benghalensis L. (Mora)	53	Nayantara	Catharanthus roseus
25	Pakur	Ficus Infectoria	54	Arjun	Terminalia arjuna
26	Thankuni	Centella asiatica	55	Methi	Trigonella foenum-graecum
27	Kalo Dhutra	Datura metel	56	Ashwagondha	Withania somniferum
28	Mehedi	Lawsonia inermis	57	Ada	Zingiber officinale
29	Ashoke	Saraca asoca			

5.4.8.3.1 Agricultural Land Vegetation

138. Some land in the sub-project area is used for agricultural activities. Generally, paddy is cultivated on agricultural land. Vegetables and mustard have been cultivated in the small patch of agricultural land.

5.4.8.3.2 Fallow Land Vegetation

139. Three fallow land quadrates (each of size 2 m x 2 m) have been studied and out of 3 quadrates, a total of 12 species belonging to 12 families. Among the 12 species, 75% are medicinal plants, 17% are vegetables, and 8% are cattle fodder.

140. Fallow lands were dominated by herb species of Taro (Colocasia esculenta) Shame plant (Mimusa pudica), Scutchgrass (cynodon dactylon), Black nightshade (Solanum nigrum), spiny amaranth (Amaranthus spinos), Hill glory bower (Aleroden dronviscosum), Nut Grass (Cyperus rotundus), Ironweed (Vernonia cinerea), Yellow fruit nightshade (Solanum xanthocarpum), Caesarweed (Eurena lobata), Rattlebox Plant (Crotalaria pallida), diamond burbark (Triumfettarhomboidea).

5.4.8.3.3 Grass Land Vegetation

141. Three quadrates of grassland (each of size 1 m x 1 m) were studied and 7 families have been recorded with 11 different species Cyperraceae family has been found three times among those species. The second dominating family was Poaceae and Composite which were found twice during the survey tenure. Among the common grasses species Cyperus rotundus, Cynodon doctylon, Amaranthus

philoveroides, Alternanthera sessilis, Alerodendron viscosum, and Eurena loba were notable.

5.4.8.3.4 Aquatic Vegetation

142. The ecology team has considered the depressed area for an aquatic vegetation survey. A visual observation study has been carried out for the aquatic vegetation survey in this area. A total of 16 aquatic species belonging to 12 families were found whereas Lemnaceae and Polygonaceae family hasbeen found a maximum of three times. A list of aquatic vegetation is shown in the following **Table 5.15**.

Table 5.15: List of Aquatic Vegetation Observed During Field Survey

Sl.	Common Name	Family name	Scientific name	Types	Uses	Red DataBook of IUCN
1	Alligator Weed	Amaranthaceae	Alternanthera philoxeroides	Herb	Medicine	Not Evaluated
2	Coco Yam	Araceae	Colocasia esculenta	Herb	Medicine	Not Evaluated
3	Flatsedge	Cyperaceae	Cyperus sp.	Herb	Medicine	Not Evaluated
4	Common Water Hyacinth	Pontaderiaceae	Eichhornia crassipes	Herb	Medicine	Not Evaluated
5	Helencha	Cyperaceae	FluctuansEnhydra	Herb	Medicine	Not Evaluated
6	Swamp Morning-Glory	Convolvulaceae	Ipomoea aquatica	Herb	Vegetable	Not Evaluated
7	Four Leaf Clover	Mersileaceae	Marsilea quadrifolia	Herb	Vegetable	Not Evaluated
8	Pondweed Arrow Leaf	Pontaderiaceae	Monochoria hatata	Herb	Fertilizer	Not Evaluated

5.4.9 Faunal Component

5.4.9.1 Birds (Avifauna)

143. Common bird species have been found on both sides of the road alignment during the survey period. During the survey tenure, a total of 22 species belongings to 15 families have been observed in the study area survey. The highest number of families has been found four times in Sturnidae and the second highest has been found in Alcedinidae family. The depressed grasslands are the feeding and roosting ground of wild birds. All species are least concerned (LC) according to IUCN Red List 2015. A detail of the bird's species checklist is presented in **Table 5.16**.

Table 5.16: List of Birds Identified during Field Survey

Sl.	Local Name	Common Name	Scientific name	Family	IUCN status
1	Doyel	Oriental Magpie	Copsychus saularis	Muscicapidae	LC
2	Deshi Kanibok	Indian Pond Heron	Ardeola grayii	Ardeidae	LC
3	Chhoto pankouri	Little Cormorant	Microcarbo niger	Phalacrocorac	LC
4	Kala Fingey	Black Drongo	Dicrurus macrocercus	Dicruridae	LC
5	Gash pakhi	Striated Grass bird	Megalurus palustris	Locustellidae	LC
6	Pati Chorui	House Sparrow	Passer domesticus	Passeridae	LC
7	Telia Ghughu	Spotted Dove	Spilopelia chinensis	Columbidae	LC
8	Pati Hoodhood	Common Hoopoe	Upupa epops	Upupidae	LC
9	Pakra Shalik	Asian Pied Starling	Gracupica contra	Sturnidae	LC

Sl.	Local Name	Common Name	Scientific name	Family	IUCN status
10	Dhan salik	Common Myna	Acridotheres tristis	Sturnidae	LC
11	Pati Maachranga	Common Kingfiher	Alcedo atthis	Alcedinidae	LC
12	Pati Kak	House Crow	Corvus splendens	Corvidae	LC
13	Bulbuli	Red-vented Bulbul	Pycnonotus cafer	Pycnonotidae	LC
14	Sada Bok	Little Egret	Egretta garzetta	Ardeidae	LC
15	Dar Kak	Jungle Crow	Corvus levaillantii	Corvidae	LC
16	Moutusi	Sun bird	Nectarinia asiatica	Nectariniidae	LC
17	Dholagola Maachranga	White-throated Kingfisher	Halcyon smyrnensis	Alcedinidae	LC
18	Metepith Latora	Grey-backed Shrike	Lanius tephronotus	Laniidae	LC
19	Pati Fotikjol, Towfi	Common Iora	Egithina tiphia	Aegithinidae	LC
20	Bon salik	Jungle Myna	Acridotheres fuscus	Sturnidae	LC
21	Kath Shalik	Chestnut-tailed Starling	Sturnus malabaricus	Sturnidae	LC
22	Lenja Latora	Long tailed shrike	Lanius schach	Lanidae	LC

Source: Field Survey

5.4.9.2 Amphibians and Reptiles

144. During the field investigation, a total of 5 species belonging to the same number of families were found on both sides of the road alignment. Bengal Monitor (Varanus bengalensis), Long-tailed Lizard (Takydromous khasiensis), Asian Common Toad (Duttaphrynus melanostictus), and Common House Gecko (Hemidactylus frenatus) are found in the sub-project area. Bengal Monitor (Varanus bengalensis) has been found Near Threatened (NT) according to the IUCN red list status 2015whereas the rest of the species is Least Concern. A detailed species list has been provided in **Table 5.17**.

Table 5.17: List of Amphibians and Reptiles in Sub-project Area

SL	Local Name	English Name	Scientific Name	Family	IUCN Red List Status (Regional)
1	Anjon	Common Skink	Eutropis carinata	Scincidae	LC
2	Gui shap Lamba Leiz	Bengal Monitor	Varanus bengalensis	Varanidae	NT
3	Roktochusa	Long-tailed Lizard	Takydromous khasiensis	Lacertidae	LC
4	Kono bang	Asian Common Toad	Duttaphrynus melanostictus	Bufonidae	LC
5	Tiktiki	Gecko	Hemidactylus frenatus	Gekkonidae	LC

Note: LC-Least Concern, NT-Near Threatened

5.4.9.3 Mammals

145. A total of 9 species of mammals under six families were recorded during the field trip. Among the identified mammals, Three-striped Palm Squirrel, House Rat, Indian Flying Fox, and Golden Jackal were high in number. List of mammals recorded from the Longalbondh and Khamarpara GCM.is presented in **Table 5.18**. According to the IUCN red list status 2015, all species are the least concerned.

Table 5.18: List of Mammals Recorded from the Longalbondth and Khamarpara GCM

Sl. No.	Family	Common Name	Scientific Name	Status
1.	Family- Sciuridae	Three-striped Palm Squirrel	Funambulus palmarum	VC
2.	Family- Pteropidae	Indian Flying Fox	Pteropus giganteus	C
3.		Greater Short-nosed Fruit Bat	Cynopterus sphinx	VC
4.	Family- Muridae	Lesser Bandicoot Rat	Bandicota bengalensis	VC
5.		Brown rat	Rattus norvegicus	C
6.		Common House Rat	Mus musculus	C
7.	Family- Soricidae	Asian House Shrew	Suncus murinus	VC
8.	Family- Herpestidae	Small Indian Mongoose	Herpestes auropunctatus	VC
9.	Family- Canidae	Golden Jackal	Canis aureus	VC

Status code: VC- Very Common, C-Common, R-Rare

5.4.9.4 Fisheries

146. According to the fisheries officer and local people a total of 15 fish species belongings to 10 families are found in the sub-project area. Cyprinidae family has been found eight times among this species. All species are the least concerned status according to the IUCN red list status 2015. The checklist of the fish species in the project area has been provided in **Table 5.19**.

Table 5.19: List of Fish Species Rrecorded from the Sub-project Area (GCM)

Sl.	Local Name	English Name	Scientific Name	Family	IUCN Red List Status
1	Guchi Baim	Striped spinyeel	Macrognathuspancalus	Mastacembelidae	LC
2	Khailsha	Giant gourami	Colisa fasciata	Osphronemidae	LC
3	Lal Khalisha	Red gourami	Colisa lalia	Osphronemidae	LC
4	Koi	Climbing perch	Anabas testudineus	Anabantidae	LC
5	Bele	Tank goby	Glossogobius giuris	Gobiidae	LC
6	Shol	Striped snakehead	Channa striatus	Channidae	LC
7	Taki	Spotted Snakehead	Channa punctatus	Channidae	LC
8	Shing	Stinging catfish	Heteropneustesfossilis	Heteropneustidae	LC
9	Magur	Air breathing Catfish	Clarias batrachus	Clariidae	LC
10	Gutum	Cross fish	Lepidocephalichthysguntea	Cobitidae	LC
11	Rui	Rohu	Labeo rohita	Cprinidae	LC
12	Catla	Catla	Catla	Cyprinidae	LC
13	Chola Punti	Swamp barb	Puntius chola	Cyprinidae	LC
14	Jat punti	Pool barb	Puntius stigma	Cyprinidae	LC
15	Mola	Mola carplet	Amblypharyngodonmola	Cyprinidae	LC

5.5 Socio-Economic Environment

147. It is essential for every development project, whether small or large, to understand the social, human, and economic baseline condition of the primary stakeholders, i.e., people living in and around the project site. The following tools and techniques were used to collect the relevant data/information on the social and economic aspects of affected people:

- Literature review;
- FGD; and
- Informal meetings with various professionals

148. In addition, data obtained from secondary sources were compared with the primary data /information gathered during the study. Data on population, age/sex composition, household patterns,

drinking water sources, sanitation facility, and ownership of agricultural land were enumeratedfrom the latest community series census published by the Bangladesh BBS.

5.5.1 Demography

149. The demographic condition of the proposed districts is shown in **Table 5.20**. The table shows that as per BBS data, among 4 districts, the highest number of households are found in Jashore (656,413) followed by Jhenaidah (422,322), Chaudanga (277,464), and Magura (205,902). Household size ranges from 4.05 to 4.44. The population density was found highest in Jashore i.e., 1060 per square km while this is 884 per square km in Magura.

Table 5.20: Demographic Condition of the Districts

Name of the Zilla	Population			Household
	Total	Male	Female	
Jhenaidah	1771304	886402	884902	422322
Magura	918419	454739	463680	205902
Chaudanga	1129015	5647369	463680	277464
Jashore	2764547	1386293	1378254	656413
Total	6583285	8374803	3190516	1562101

150. This section deals with the general baseline socio-economic profile of the project area and affected households. Socio-economic details of the affected households were collected during the social studies. In addition to the specific social information collected during the census survey, general socio-economic information was also collected through individual household-level surveys among theaffected entities in the project footprint to prepare an overall socio-economic profile of the affected households and people.

5.5.2 Socio-Economic Profile of the Affected Households

151. The Socioeconomic profile deals with various socio-economic details of the surveyed households (437 HHs covering 1609 people) based on the finding of the survey. Demographic and socioeconomic information along with potential impacts on the people and community were collected from the affected people during the survey.

152. The census and inventory of losses survey identified 437 households with a total population are 1609. The average HH size is 3.68 which is lower than the national average HH size of 4.06 in 2016. Among the affected households less than 2% are headed by females and more than 98% are headed by males which significantly varies with the statistical data of the World Bank 2018 (84.20% Male headed and 15.80% female-headed HHs). A detail of the demography is shown in **Table 5.21** below.

Table 5.21: Demography of the Project Affected Households and People

GCM	HH	Male HH	Female HH	Male No.		Female No.		Total Population	HH. Size
				No.	%	No.	%	No.	
Churamonkati (CW-01)	27	27	0	51	55.43	41	44.57	92	3.41
Narayanpur Bazar (CW-02)	35	34	1	66	52.384	60	47.62	126	3.60
Seordah Bazar (CW-03)	139	7	132	261	45.16	229	39.62	490	3.53

GCM	HH	Male HH	Female HH	Male No.		Female No.		Total Population	HH. Size
				No.	%	No.	%	No.	
Ghorepara (CW-04)	46	44	2	90	55.56	72	44.44	162	3.52
Rohita (CW-05)	40	39	1	80	61.54	50	38.46	130	3.25
Alokdia Bazar (CW-07)	39	39	0	78	55.71	62	44.29	140	3.59
Alomkhali Bazar (CW-07)	74	74	0	139	51.48	131	48.52	270	3.65
Kathakhali (CW-07)	11	11	0	29	58.00	21	42.00	50	4.55
Singra Bazar (CW-08)	207	205	2	366	44.10	317	38.19	683	3.30
Binodpur Bazar (CW-08)	45	44	1	87	10.48	60	7.23	147	3.27
Andulbaria (CW-10)	39	39	0	86	54.78	71	45.22	157	4.03
Hatgopalpur (CW-13)	55	53	2	111	52.61	100	47.39	211	3.84
Narikelbaria (CW-13)	58	58	0	126	54.55	105	45.45	231	3.98
Bhatoi (CW-14)	103	103	0	208		189		397	3.85
Safderpur (CW-14)	76	74	2	148		135		283	3.72
Barobazar (Cw-16)	30	30	0	60	55.05	49	44.95	109	3.63
Kola Bazar (CW-16)	18	18	0	30	52.63	27	47.37	57	3.17
Total	437	432	5	880	54.69	729	45.31	1609	3.68

Source: Census and IOL survey, June to July2022

5.5.3 Age and Gender Composition

153. The census and inventory of losses survey show that among the affected people about 54.69% are male and 45.31% are female. A detail of the location-wise age group by gender is shown in the following **Table 5.22**. The detail of the packages information will be given in the site-specific ESMP report.

Table 5.22: Affected People by Age and Gender

Age	Male		Female		Total	
	N	%	N	%	N	%
Up to 5	62	7.05	59	8.09	121	7.52
5+ to 15	144	16.36	105	14.40	249	15.48
15+ to 30	203	23.07	185	25.38	388	24.11
30+ to 60	377	42.84	343	47.05	720	44.75
More than 60	94	10.68	37	5.08	131	8.14
Total	880	54.69	729	45.31	1609	100.00

Source: Census and IOL survey, June to July, 2022

5.5.4 Marital Status

154. Considering marital status among the affected population, 512 males and 482 females are married. Of the total married, there is no one found below the age of 15 years, meaning child marriage does not exist in the project area. It is seen those 11 women in the age group above 60 years, 8 womenin the age group between 30-60 years, and 2 women age group between 15-30 are reported as widows. Among the male, 3 aged more than 60 years were found to be widowers.

155. It reveals that the death rate of males is higher than that of females in the same age group. It reveals that the death rate of males is higher than that of females in the same age group. A detail of the marital status by age group in all locations of the above packages is shown in the following **Table 5.23**.

Table 5.23: Marital Status of Male and Female by Age

Age	Married		Unmarried		Widow/ Widower		Total		
Group	Male	Female	Male	Female	Male	Female	Male	Female	Total
Up to 5			62	59			62	59	121
5+ to 15			144	105			144	105	249
15+ to 30	55	123	148	60		2	203	185	388
30+-60	366	335	9		2	8	377	343	720
>60	91	24		2	3	11	94	37	131
Total	512	482	363	226	5	21	880	729	1609

Source: Census and IOL survey, June to July, 2022

5.5.5 Household by Religion

156. Bangladesh is traditionally a Muslim-dominated country. As per the population census 2022, about 91.02% of Bangladeshis are Muslims, followed by Hindus (the largest minority) at 7.95%, Buddhists at 0.61%, Christians at 0.30%, and others at 0.12%. Among the affected people, the Muslim populations are more than 80% whereas the rest of them are the Hindu population. Other religious people are not affected by the project interventions. The following table shows the distribution of households by religion. A detail of the household by religion is shown in **Table 5.24**.

Table 5.24: Household by Religion

Religion	No.	%
ISLAM	376	86.04
HINDU	61	13.96
Total	437	100.00

Source: Census and IOL survey, June to July 2022

5.5.6 Education

157. The literacy rate in the project area is about 89.31% which is much higher than the national literacy rate (74.68 in the year 2019) of Bangladesh. Among the affected people, male is found more educated than female. Up to Class IX-X, female students were found more than male students. This is due to government financial support for female students. Since the 1980s secondary school enrolmentsof girls jumped from 39 in 1998 to 67 in 2017. After the Higher Secondary Certificate (HSC), female students become significantly low. This is due to marriage and social customs, few samples are shown in **Table 5.25**.

Table 5.25: Education Level of the PAPs

Education Level	Male (%)	Female (%)	Total (%)
CW-13 Education Level			
Illiterate	3.70%	4.40%	8.10%
Only Signature	1.16%	2.08%	3.24%
Class I - Class V	7.87%	11.34%	19.21%
Class VI - Class VIII	7.87%	7.64%	15.51%
Class IX - Class X	7.64%	6.71%	14.35%

Education Level	Male (%)	Female (%)	Total (%)
SSC/ Dakhil	10.88%	6.48%	17.36%
HSC/ Alim	6.48%	3.24%	9.72%
Honors/ Fazil	4.40%	4.17%	8.56%
Masters/ Kamil	3.47%	0.46%	3.94%
Total	**53.47%**	**46.53%**	**100.00%**
CW-05 Education Level			
Illiterate	5.23%	5.57%	10.80%
Only Signature	4.18%	2.44%	6.62%
Class I - Class V	8.36%	7.32%	15.68%
Class VI - Class VIII	9.06%	9.06%	18.12%
Class IX - Class X	6.97%	9.06%	16.03%
SSC/ Dakhil	9.76%	5.92%	15.68%
HSC/ Alim	5.92%	2.44%	8.36%
Honors/ Fazil	3.14%	1.05%	4.18%
Masters/ Kamil	3.48%	1.05%	4.53%
Total	**56.10%**	**43.90%**	**100.00%**

Source: Census and IOL survey, June to July 2022

5.5.7 Income and Poverty of HHs

158. It is known that the project-affected area (Growth Center) is full of small business units/shops run by poor people for their livelihood. Most of the business units are small or medium scale and very few are large-scale. The income level of small businessmen is quite low. According to the income levelof the affected households (437), a total of 93 vulnerable people have been identified during the survey, among them, 83 HHs have been identified as having income under the poverty line (BDT 10,500/month). Of the total HHs living under the poverty line, 78 HHs are headed by males, and 5 areheaded by a female.

159. Households living below the poverty line3, women-headed and disabled headed are called vulnerable and they will be entitled to additional grants on top of other compensation. They will also be provided skill development training (one from each vulnerable HHs) under the RAP policy on income-generating activities with a seed grant, market linkage, and linkage with financing institutions under the income and livelihood restoration program (ILRP). Apart from these, vulnerable people will get preferential employment opportunities in the civil construction of the project according to their eligibility. The table underneath presents the income level of the affected households. A detail of the income and the poverty level of the HHs are shown in **Table 5.26**.

Table 5.26: Income and the Poverty Level of the HHs

Income Range	Male	Female	Total	%
Up to 10500	82	3	85	19.45
10500-21,000	225	2	227	51.95
21,001-30,000	83	0	83	18.99
30,001-40,000	19	0	19	4.35
40,001-50,000	14	0	14	3.20
50,001-60,000	4	0	4	0.92
More than 60,000	5	0	5	1.14
Total	**432**	**5**	**437**	**100.00**

Source: Census and IOL survey, June to July 2022

5.5.8 Occupation Pattern

160. As per the socio-economic survey, 33.50% of the total affected person are engaged in income-generating activities. Of the total income-generating activities, businesses appear to be the main occupation (24.30%). Among the male population, most of the eligible and capable members (59.89%) are involved in income-generating activities which are 1.65% for women. Females are mostly housewives (66.26) and are also involved in allied activities focusing on maintaining household chores.About 26% of people are found, students. Around 1.68% are found to be unemployed although they areeducated and willing to work. Around 1.49% of people are retired and old, but they are the heads of theHHs. Income and livelihood restoration programs can enhance the capacity of the people particularly females and vulnerable people for doing more income-generating activities. A detail of the Principal occupation of the affected population in percentage is shown in **Table 5.27**.

161. According to the Household Income and Expenditure Survey (HIES) 2016 of the Bangladesh Bureau of Statistics (BBS) income poverty of the poor in Khulna Division is BDT 8550 (2106/per person) for HH size of 4.06. Acknowledging the averageHH size of the project area (3.98) BDT 8340 for 2016. BDT 10697 (say 10500) has been adopted as the 2022 poverty line forthe project acknowledging inflation rate of 5% per year details in the link below:

http://www.bbs.gov.bd/site/page/648dd9f5-067b-4bcc-ba38-45bfb9b12394/Income,-Expenditure-&-Poverty

Table 5.27: Principal Occupation of the Affected Population in Percentage

Occupation	Male	Female	Total
Agriculture	6.48		3.54
Business	43.86	0.69	24.3
Day Labor	1.02		0.56
Expatriate	0.34		0.19
Motor Driver	0.11		0.06
Rickshaw/van/pushcart puller	0.11		0.06
Private service	7.96	0.96	4.79
Child	6.7	7.27	6.96
Housewife	0	66.26	30.02
Old/Retired	1.7	1.23	1.49
Student	29.09	23.05	26.35
Unemployed	2.61	0.55	1.68
Total	54.69	45.31	100

Source: Census and IOL survey, June- July 2022

5.5.9 Dependency

162. Among the affected people, only 33.56% are earning members, and the remaining are dependent members of the HHs. Taking into consideration the total affected population, one wage earner must support almost 2 dependents. The survey identified only a few women are engaged in the income- earning groups. Resulting, they are to some extent dependent on males. A detail of income-earning anddependent members in the affected HHs is shown in **Table 5.28**.

Table 5.28: Income-earning and Dependent Members in the Affected HHs

No. of Population			Ratio Income gen. Dependents
Income Generating	Dependent	Total	
540 (33.56%)	1069 (66.43%)	1609	1:1.98

Source: Census and IOL survey, March to April 2022

5.5.10 Poverty and Gender Dynamics

5.5.10.1 Overview

163. The census and socioeconomic survey revealed that few women are engaged in income-generating activities including some allied activities in the household. Housewife is the main occupationin the case of married women. The adult female members (unmarried) also take part in the household chores. Since then, it was found during the survey that male household members remain reluctant to have adult female household members engage in outside work and services. However vulnerable poor women are already doing work outside the home either as laborers or small shopkeepers/vendors.

5.5.10.2 Sexual Exploitation and Abuse and Sexual Harassment

164. GBV, SEA-SH field survey was conducted from 14th of December 2022-5th January 2023 in Jashore, Jhenaidah, Magura, and Chaudanga districts. Sexual exploitation and abuse (SEA) and sexual harassment (SH) related risks, although anticipated to be low to moderate, were found during KII one-to-one interviews as well as focus group discussions. The informant/participants discussed potential risks and mitigation measures of SEA-SH. The consultants disclosed that GRM at each level will be available to receive, record, and investigate all SEA-SH-related complaints. The GRM will document whether the complaint is project-induced or not. If the complaint is related to the project, the GRM will track the complaint and keep updates through monthly progress reports. If not, the GRM will not track the complaint but keep in the project records.

165. During construction, the women may face sexual exploitation and abuse/sexual harassment due to migrant labour influx or due to traditional gender discriminatory attitudes of the male. The women workers may receive unequal payment compared to the men for the same volume of works. Sexual transmitted diseases may be spread due to migrant labor influx. LGED will ensure that contractors willtry to engage local workers as much as possible to avoid labor influx. During labor recruitment, poor women need to be encouraged to work and equal pay for similar work must be ensured. SEA-SH compliant GRM and other relevant preventive and curative measures for SEA-SH must be ensured andrelevant provisions of this ESIA/ESMP and GBV Action Plan are included in the bid documents.

5.5.10.3 Gender-Based Violence Analysis

166. Effects of improvement of roads and markets on women and girls' lives:

1. Education: School and college-going girls will be benefited from the development of roads asit's hard to come to school and college in the rainy season now. Also, those who live far shall get the opportunity to use a van and rickshaw for coming to their institutes and save time.
2. Women employees: A good number of women are doing jobs near the Upazila compound. They face lots of problems to join their workplace due to the lack of roads. Existing roads are too narrow and have potholes which make their journey difficult.
3. Health: Women and children have to come frequently to health complexes for their medical treatment, like general health issues, maternity issues, and children's vaccination. It's hard

to come in time due to the lack of connecting roads and existing poor-quality roads.

4. Women buyers: Women of various ages and backgrounds have to come to bazar area for various reasons. Existing roads are too narrow and have potholes which make their journey difficult.
5. Women entrepreneurs: In some of the GCMs some women entrepreneurs are selling vegetables and ready-made garments etc.
6. Easy market access: A quality structure market helps a lot for women to come and easily fulfilltheir needs in a decent environment as buyers and sellers.
7. Hygiene toilet: Toilet is a big issue for women in the marketplace. A quality market with hygienic toilets will encourage them to come to market and stay there as needed particularly for the sellers and buyers who are coming from far.
8. Small and medium enterprise business development: Nowadays lots of women started small and medium enterprise businesses. A structured market allows them to expand their business. Also, connecting road development helps them to come easily to the workplace and also savestheir time and energy.

5.5.11 Field-level Information on Gender-Based Perception and Violence

167. A gender-based Perception and Violence section of the questionnaire aims to gauge the perception of the respondents on gender-related issues. Data has been collected in December 2022, on SEA/SH/GBV/VAC issues from the project area (Jashore, Magura, and Jhenaidah from CW-05, CW-06, CW-13, and CW-16) through conducting discussion meetings under several GC) and Roads sides. A meeting was organized with institutional stakeholders, DPD and XENs in the project districts, MMCand local businessmen, etc. In total, 16 questions were directed at the respondent concerning gender issues. The following table shows the gender perception and violence covering: Child Marriage, Polygamy, Forced Dowry, Sexual Harassment, Rape, Child/Women Trafficking, Drug Addicts, and HIV/AIDS percentage in the project area. The summary of the survey is shown in **Table 5.29**.

Table 5.29: Field-Level Information on Gender Perception and Violence

District (Package No.)	Child Marriage (%)	Polygamy (%)	Forced Dowry (%)	Sexual Harassment due to Polygamy (%)	Rape Case (%)	Child/ Girl/ Women Trafficking (%)	Drug Addicts (%)	HIV/AIDS or Sexually Transmitted Disease (%)	Sexual Harassment (%)
Jashore (CW-05)	13%	14%	9%	8%	5%	9%	25%	8%	10%
Magura (CW-06)	22%	15%	12%	10%	13%	8%	49%	-	9%
Jhenaidah (CW-13)	32%	22%	15%	12%	14%	18%	58%	7%	11%
Jhenaidah (CW-16)	29%	18%	17%	15%	15%	12%	55%	5%	17%
Average	24%	16%	14%	12%	14%	12%	47%	5%	12%

Source: Field Data (Data has been collected in December 2022 from 4 CWs: like CW-05, CW-06, CW-13, and CW-16. Due to the similar type of socio-economic conditions of the project area (3 districts-Jashore, Magura, and Jhenaidah), data on SEA/SH/GBV has been collected from randomly selected 4 (four) CWs, [2 (two) from Jhenaidah District and 1 (one) each from Jashore, Magura District]).

168. The collected information shows that the Jhenaidah area is more vulnerable than Jashore and Magura in most aspects.

5.5.11.1 Existing Utilities /Civic Facilities

169. It is known that the project is located in rural areas in the western and southern regions of the country. There is only an electricity supply facility available in the affected growth centers. Residential and commercial entities, CPRs, and offices /institutions have such utilities/civic facilities in the project area. Such facilities may be disconnected temporarily due to the project and will be further connected by the PAPs. Compensation and resettlement benefits will include financial support for the reconnection of civic facilities.

5.5.11.2 Source of Drinking Water

170. There is no water supply connection to household and commercial structures so no compensation should be paid for the reconnection/ reinstallation charge. LGED will further verify the existing alternative facilities once again before the finalization of the indent. A detail of Sources of drinking water at the household level is shown in **Table 5.30**.

Table 5.30: Sources of Drinking Water at the Household Level

Source of drinking water			Total
Details	Hand Tube well	Shallow Tube Well	
Total	430	7	437
%	98.40	1.60	100.00

Source: Census and IOL survey, June to July 2022

5.5.11.3 Type of Toilet

171. Hygienic sanitation in Bangladesh particularly in urban/semi-urban settings is well-practiced. The survey revealed that more than 84% of the affected HHs use sanitary toilets while 7.55% use Semi pucca toilets. Only 8.01% HHs use Katcha (slab) toilets or use others toilets since they have no facilityin their houses. A detail of the use of toilets is shown in **Table 5.31**.

Table 5.31: Use of Toilets

Details	Type of Toilet			Total
	Sanitary	Semi Pucca	Katcha Slab	
Total	369	33	35	437
%	84.44	7.55	8.01	100.00

Source: Census and IOL survey, June to July 2022

5.5.11.4 Source of Cooking

172. It is revealed that about 14.19 % of affected HHs use Gas (cylinders) in their house for cooking and majority use firewood and very few use electric cookers for cooking. It is to be noted here that thereis no pipe supply gas connection, so no one will be entitled to a Gas reconnection charge from the project. A detail of Sources of cooking at the household level is shown in **Table 5.32**.

Table 5.32: Source of Cooking

Details	Source of Light			Total
	Electricity	Gas	Wood	
Total	12	62	363	437
%	2.75	14.19	83.07	100.00

Source: Census and IOL survey, June to July 2022

5.5.11.5 Source of Light

173. The project locations are in rural settings where 100% of the affected people enjoy electricity. It is to be noted that all of the affected CPRs/Offices/Institutions have electricity supply to their premises. Displaced entities including residential, commercial, and CPRs having electric supply in their premises within the project footprint, will be entitled to the electricity reconnection charge. LGED will verify at the field level during RAP implementation and confirm in the Indent for making the payment. A detailof Sources of light at the household level is shown in **Table 5.33**.

Table 5.33: Source of Light

Details	Source of Light	Total
	Electricity	
Total	437	437
%	100.00	100.00

Source: Census and IOL survey, June to July 2022

5.5.11.6 Communications

174. The WeCARE project areas are well connected by national and regional highways and pucca roads and in some area's railway network is also good. Local peoples ply through buses, cars, trains, jeeps, tempos/votvoti, motorcycles, bicycles, rickshaws, etc. In some areas waterways are also a meansof communication and as a means of communication, local people use mechanized and traditional country boats regularly.

5.5.11.7 Crop Production

175. In general, there are three types of cropping seasons prevailing in Bangladesh. Kharif-1 Mid-March to Mid-July, Kharif-2 mid-July to Mid-November, and Rabi mid-November to Mid-March. Major crops in Kharif-1 are Jute, Aus Rice, Summer vegetables, cotton, sesame, etc. while in Kharif-2Major crops are T. Aman, B. Aman, Soybean, Groundnut, Late summer vegetables, and in the Rabi season major crops are wheat, potato, mustard, Boro rice, winter vegetables, lentil, tobacco, soybean, cabbage, etc. At the present percentage of cropping intensity varies in the proposed project areas. As per the agriculture yearbook 2020, among the four project districts highest cropping intensity was found in Chaudanga (264%) and the lowest in Jhenaidah (226%) and while the national average cropping intensity is 198%.

5.6 Archaeological and Historic Sites

176. There are some important archaeological and historic sites nearby the proposed project location but none will require dislocation or displacement. Rather the new LGED road networks will make a positive impact on the local communities' livelihood and income as sightseers and visitors would be able to visit the sites from all over the country because of their scenic beauty and natural environment.There are several old mosques and mandirs found in the area. Packagewise Historic/Archeological attraction at Jashore, Jhenaidah, and Magura Region is presented in **Table 5.34**.

Table 5.34: Historic/Archeological Attraction at Jashore, Jhenaidah, and Magura Region

Sl. No	Name of Monument	Address			Near at CW/GCM	GPS	
		Site	Upazila	District		Latitude	Longitude
01	Imambara	Jashore Sadar	Jashore Sadar	Jashore	Churamonkathi - 01	23.836.78N	89.144.67E

Sl. No	Name of Monument	Address			Near at CW/GCM	GPS	
		Site	Upazila	District		Latitude	Longitude
02	Shrine of Birsrestho Noor Mohammad	Kashipur	Chougasha	Jashore	Arpara - 02	23.1148N	88.5922E
03	N/A	N/A	Jhikargacha	Jashore	GCM for CW-3		
04	N/A	N/A	Sharsha	Jashore	GCM for CW-4		
05	Michael Madhusudan Datta Memorial House	Sagordary	Monirampur and Keshobpur	Jashore	Rohita – 05	22.81918.	89.16348
	Haummam Khana	Mirzanogor	Keshobpur	Jashore		22.5422.76N	89.818.79E
	Chachra Shib Mondir	Chachra	Jashore Sadar	Jashore		23.839.89N	89.1215.07E
06	N/A	N/A	Sreepur	Magura	GCM for CW-6		
07	N/A	N/A	Sadar	Magura	GCM for CW-7		
08	Chandura Jomidar Bari and Cricketer Shourov Ganguly's House	Chandura	Shalikha	Magura	Singra – 08	23.2248.00N	89.2248.00E
09	N/A	N/A	Alamdanga	Chuadanga	GCM for CW-9		
10	N/A	N/A	Jibannagar	Chuadanga	GCM for CW10		
11	N/A	N/A	Sadar	Chuadanga	GCM for CW 11		
12	N/A	N/A	Damurhuda	Chuadanga	GCM for CW 12		
13	N/A	N/A	Sadar	Jhenaidah	GCM for CW 13		
14	N/A	N/A	Shailkupa	Jhenaidah	GCM for CW 14		
15	N/A	N/A	Harinakundu	Jhenaidah	GCM for CW 15		
16	Pir Pukur Mosque	Barobazar	Kaligong	Jhenaidah	Barobazar-16	23.3025219	89.1448098
	Gorar Mosque					23.11.15N	89.831.69E
	Hasilbag Mosque					23.1752.19N	89.833.85E
	Zor banglow Mosque					23.1821.30N	89.811.51E

5.7 Ethnic Minority and Vulnerable Groups

5.7.1 Vulnerable Groups

177. Vulnerable households have been defined as (i) headed by a single woman or woman with dependents and low incomes; (ii) headed by elderly/disabled people without means of support; (iii) households that are below the latest nationally defined poverty line; (iv) households of the indigenous population or ethnic minority; and (v) households of a low social group or caste. During the elaborationof the RAP no indigenous population, ethnic minority, or affected person of a low social group or castewas identified.

178. Among the total affected population, 93 are found as vulnerable. Of the total vulnerable people, 85 are living under the poverty line, 7 people with disabilities, and 5 are female-headed household.

179. Affected, interested, disadvantaged, and vulnerable groups are identified for groups I and II total of 8 packages, and other packages will be identified during the preparation of site-specific RAP and relevant mitigations measures will be included there. The project would arrange separate consultation sessions for different target groups. A total of 93 vulnerablepeople were found during the IOL survey of

CW-01, CW-04, CW-05, CW-07, CW-10, CW-13, and CW-16) including income poverty, female-headed, and disabled-headed. Among these 7 people are People with physical disabilities, 85 are from under the poverty line and 5 people are from female HH heads.

180. There are total of 225 households, 4 Upazila parishad and 5 Market Samity will be temporarily affected during the construction period. Of them 83 squatters from two GCM and 142 title holders from Jhenaidah and Magura district during upgrading of road network. The census identified that 206 commercial structures will require to be dismantled and accordingly 204 business will be affected temporarily as they have to move from their current locations to a nearby area in the same market place. They'll be all able to return to their original location once the civil works at GCMs are complete. The survey also identified that 58 Vulnerable HHs, 3 wage laborers, and 61 tenants will be affected from the affected structure by the project intervention. Of the total affected HHs, 621 PAPs have been identified and will be affected by the project intervention but none of them will be physically displacedsince their residential premises are not affected. They will be taken care of them including resettlementbenefits, Income livelihood restoration program, skill development training, and linkage with differentGO/NGO programs following the RPF of this project. A detail of the Type of Vulnerable Household isshown in **Table 5.35**.

Table 5.35: Type of Vulnerable Household

Type	No.
People with physical disabilities	5
Under Poverty Line	83
Female HH Head	5
Total	93

Source: Census and IOL survey, March to August 2022

5.7.2 Inclusion Criteria/Definition of SEC/IP

181. The project, for its interventions, will adopt the World Bank's criteria for the identification of small ethnic communities(SEC) which are as follows:

1. Self-identification as 'indigenous peoples' by the concerned community/group
2. Distinct social and cultural traditions, belief systems, and lifestyles indifferent to the majority community
3. A distinct language different from the official language of the country or the language of the majority
4. A distinct history of living in a particular area/territory of the country before the in-migration by the majority in that area although such in-migration has (or has not) rendered them into a status of a numerical minority

5.7.3 Existence of SEC in the Project Boundary

182. During the stakeholder consultation, small ethnic communities are identified in the project areas. However, the social team conducting social surveys including census and if any household belonging to small ethnic communities is found affected, ESS7 will apply.

183. During the field survey, the survey team found that there is no ethnic minority adjacent to most of the sub-project GCM and road site. It is anticipated that the project will not affect the ethnic minority community, but rather would benefit them by providing employment opportunities through various development activities to be undertaken under this project. However, some ethnic minorities are present in the zone of influence area as reported by the public during stakeholder consultations meetings. A prior informed consultation approach followed for meaningful consultation with the smallethnic communities and identification of their priorities for additional measures for maximizing projectbenefits to them.

5.7.4 The Small Ethnic Community and Vulnerable People in the Project Areas

184. The Project will generate substantial direct short and longer-term benefits for the ethnic communities, and poor, including disadvantaged men and women. The sub-project will cover all-ethnic groups in 4 districts of Bangladesh i.e., Jashore, Magura, Jhenaidah, and Chaudanga. So, it is expected that several small ethnic communities will be considered beneficiaries under the WeCARE phase-I project. Relevant mitigation measures including to enhance the project benefits to the SECs will be included in the site-specific RAPs.

185. The major small ethnic groups in the project areas are (non-exhaustive) and is provided in **Table 5.36**.

Table 5.36: List of Ethnic Minority Group

SL	Group Identity	Location	No. of Affected People	District
01	Bagdi	Vatoi Bazar, CW-14, Sailokupa	35	Jhenaidah
02	Malo	Langalband, CW-06, Sreepur	09	Magura
03	Malo	Khamarpara, CW-06, Sreepur	28	Magura
	Rajbonshi	Khamarpara, CW-06, Sreepur	02	Magura

Source: Census and IOL survey, July to August 2022

5.7.5 Grievance Redress Mechanisms (GRM)

186. A project-level GRM will be followed based on the established four-tiered existing institutional mechanism already approved by LGED and reviewed by the Bank. The project specific Grievance Redress Committee (GRC) has been formed on April 24, 2022, to compensate the affected persons/families for the land acquisition, structure, tree,business, and other impacts during the RAP implementation program. In sites/locations where there are presence of EM PAPs, a repsentative of them will be included in the site/local level GRC. Overall, the 5 members local GRC will take effective measuresto solve complaints from affected persons within a short period and maintain transparency.

187. The grievance redress process will be implemented in four phases: the primary level at the Upazila phase, the second at the district level, the third at the project management phase, and the fourth at the ministry of LGED phase.

188. In addition, LGED has already set up workers and SEA/SH GRM consistent with the provisions of the project LMP and SEA/SH Action Plan. The project GRM will include SEC members in the GRCs at site/Upazilla level where there are SEC beneficiaries or project affected persons.

5.7.6 Monitoring and Reporting

189. LGED is responsible for the monitoring and reporting and for this purpose, will maintain disaggregated data on the beneficiaries from the small ethnic communities. The process will be conducted in synchronized with the regular reports such as quarterly or six-monthly basis by LGED, and these will be shared with the Bank on time. For monitoring the SEVCDF implementation, the following factors are to be considered:

- The demographic presence of the SEVCs in the project areas;
- The number of SEVC affected by gender and age standard;
- The number of SEVC participants in project beneficiary groups;
- The degree of satisfaction addressed by the SEVC regarding the project process, input, output, and results;
- Active participation of the SEVC in project work through effective consultation.

CHAPTER 6: STAKEHOLDER ENGAGEMENT AND INFORMATION DISCLOSURE

6.1 Public Participation Process

190. The project Stakeholder Engagement Plan (SEP) for LGED seeks to define a technical and cultural approach to consultation and disclosure. The goal of this SEP is to improve and facilitate decision-making and create an atmosphere of understanding that actively involves project-affected people and other stakeholders on time and that these groups are provided sufficient opportunity to voicetheir opinions and concerns that may influence project decisions. The SEP is a useful tool for managing communications between LGED and its stakeholders. The key objectives of the SEP are summarised as follows:

- Understand the stakeholder engagement requirements of government legislation;
- Guide stakeholder engagement such that it meets the standards of International Best Practices;
- Identify key stakeholders that are affected, and/or able to influence the Project and its activities;
- Identify the most effective methods, timing, and structures through which to share project information, and to ensure regular, accessible, transparent, and appropriate consultation;
- Develop a stakeholder engagement process that provides stakeholders with an opportunity to influence project planning and design;
- Establish formal grievance/resolution mechanisms;
- Define roles and responsibilities for the implementation of the SEP;
- Define reporting and monitoring measures to ensure the effectiveness of the SEP and periodical reviews of the SEP based on findings.

191. Stakeholder Engagement will be free of interference, coercion, and intimidation,and conducted based on timely, relevant, understandable, and accessible information, in a culturally appropriate format. It involves interactions between identified groups of people and provides stakeholders with an opportunity to raise their concerns and opinions (e.g., by way of meetings, surveys,interviews, and/or focus groups), and ensures that this information is taken into consideration when making project decisions.

6.2 Stakeholder Identification and Analysis

192. Total 30 stakeholder consultations were conducted during praeparation of the study. In the preparation of ESIA and ESMP under the present study, all the stakeholders have been primarily synthesized into two categories that have been identified:

- Primary stakeholders Project-affected parties: those who are or likely to be affected directly either positively or negatively by the project, decisions, or actions and
- Secondary stakeholders or other interested parties: who may indirectly be affected by the project, decision, or actions or have an interest in the project and who could Influence the opinions of affected parties either positively or negatively, or affect the implementation processor the sustainability of the project's outcomes. For example, people who are not living in the village but use the roads will be affected indirectly due to closer and road repairs, so they will be affected by the delays, soil runoff, etc.

193. These two categories of stakeholders will be found in the groups of people or entities having a direct or indirect interest: Government organizations, and agencies, local communities, vulnerable or disadvantaged groups, non-government organizations (NGOs), private sector, academic institutions,

development partners, the general public of the local community (students, families), among others. However,this list of stakeholders will continuously be updated throughout project implementation.

6.3 Information Disclosure

194. Information disclosure and consultation processes have been adopted through a combination of mixed methods of ESIA report preparation. The methods used in the consultation process were: (i) Key Informants Interview (KII), (ii) Public Consultation, (iii) FGDs, and (iv) Interviews during the Survey. The public consultation method was applied as well. Consultation and information disclosure weremade in the area of influence of the sub-project. On all occasions, the date, time, and venue of the consultation were decided by the stakeholders keeping in view their prior engagement and availability. Group discussions with various occupational groups in the project influence area were conducted in public places mainly at Union Parishad Bhavan Hall room convenient to them.

195. All the 30 stakeholder consultation meetings were completed under Group-I (CW-13, CW-16, CW-06, and CW-05) and Group-II (CW-01, CW-04, CW-07, and CW-10), Group-III (CW-08, CW-11, CW-14, and CW-15) and Group-IV (CW-02, CW-03, CW-09, and CW-12) packages. Distribution of participants by

a. Age: 30-70 Years
b. Gender: More than 95% Male
c. Occupation: Business, Agriculture, services

196. The images of the stakeholder consultation meeting is presented in **Annex D**.

197. The detailed discussion, stakeholders' grievances, problem findings, and suggestions are recorded. The Summary of Issues and Concerns Raised by the People and the Responsibility are presented in **Table 6.1**.

Table 6.1: Summary of Issues and Concerns Raised by the People and the Responsibility

Issues	Issue Raised by	Solution
1. We requested to authority to keepaeye on the contractor that does not pending the work after statingthe construction 2. To provide compensation transportation and livelihood support for PAPs. 3. Ensure separate male-female toilets at different places. Our observation isfemale entrepreneurs and customers do not feel comfortable using the public toilets in the same area. 4. Demanding dedicated hygienic slaughterhouses in the market area.	The local community along with LGED personnel and LGED consultants, NGO workers, Local Chairman, Teachers, students, freedom fighters, public representatives, local politicians, businessmen, Local Elites, etc. 70 to 80 participants present for each consultation meeting.	1. Start development work step by step not at a time. At first, developed at Chandina, then other structures. 2. To prepare the design and drawing layout of the markets where all owners, tenants, and vendors will be accommodated. 3 To establish a dedicated slaughterhouse, well drainage system, and waste management and dumping provisions.
5. Construct an extended entrance road of GCM so that rickshaws and vans can move easily.		To give preference to local and Female laborers in the

Issues	Issue Raised by	Solution
6. Demanding for the well drainagesystem. 7. Providing sufficient lighting CCTVfacilities for the safety and securityin the GCM. 8. Suggested taking initiatives to control dust and sound during the construction period; The local laborersto be given priority in the project work; 9. Overhead Tank to be set up in themarket for the running water. 10. Demanding office space for the Bonik Samity, Workers Union, Market Management Committee, and Women entrepreneurs. 11. The trees of the GCM at Narayanpurneed to be cut down. During the monsoon storm, there is a loss of shops and other structures. 12. India is very close to the market. Both countries have a good relationship with border neighbors. Proposed a joint and friendship market at Bangdah GCM between Bangladesh and India 13. Preparing design and drawing layoutof the market where all owners, tenants, and vendors will be accommodated in the GCM. 14. Expansion of Growth Center Market (GCM) facilities, covering- construction of cold chain facilities, an all-weather shed for dumping agro products, vehicle parking area. 15. Demanding load and unloadfacilities in the GCM. 16. Demanding development of Bazar Mosque with the development of the marketat Seordha. 17. Demanding the WeCARE to develop the market in the vacant place, The business community will benefit		construction work;To build an office in the GCM for the Bonik Samity, Workers Union, Market Management Committee, and Women entrepreneurs. 6.To provide resettlement support for the annual lease persons.7. To cover load and unloadfacilities vehicle parking zone in the GCM.8.To allocate a few shops for encouraging female entrepreneurs. 7. To build the male-female toilet in different places, notadjacent to the same apartment.
if the development of the market after theresettlement of business. 18. Wage labor seeks financial helpfrom projects to run a family; 19. Need fair compensation and financial help from the project 20. The annual lease persons will be affected and should be measured forresettlement support; 21. Expansion of Growth Center Market (GCM) facilities, covering- construction of cold chain facilities, an all-weather shed for dumping agro products, vehicle parking area for wholesale buyer's trucks. 22. Start development work step by stepnot at a time. At first developed at Chandina, then other structures sutures. 23. Demanding rest house facilitates for drivers and businessmen who are coming from other districts. 24. Demanding bank facilities where a lot of money is transected particularly at animal markets. 25. All the internal roads of the GrowthCenter should be made by RCC/CCor uni-block. 26. Build a multi-stored building for the deployment of all permanent businessmen and vendor		

6.4 The Outcome of Stakeholder Engagement Consultations

198. Community engagement: LGED will engage with affected communities through the process of stakeholder engagement described in ESS 10 on Stakeholder Engagement and Information Disclosure.

199. There are some Women entrepreneurs found in the GCM for example Haibatpur in Jashore and Katakhali GCM at Magura. Due to the poor condition of GCM women entrepreneurs are not interestedin doing business. Once the GCM improves including separate toilet facilities and a breastfeeding center, the number of women entrepreneurs will increase in the GCMs.

200. During consultation meetings, the farmers, businessmen, and stakeholders raised their demands for the following:

- Cold storage requirements as early as possible.
- Dedicated hygienic environmental pollution, odor, and health risks of slaughterhouse in the market area need to ensure.
- Community Center where the local community could gather for social events like wedding
- Solar Street Lights; small cold storage using a solar panel for the preservation of seeds and agro products etc.
- CCTV coverage for the safety and security in the markets, and important establishments including transport parking areas.

201. Based on the identified needs of the meeting participants the outcome of the stakeholder consultation recommended for following items:

- A clear understanding of land acquisition and if so, where and its amount;
- Eligibility of non-titled persons for compensation and support to resettle their livelihood;
- All the internal roads of the Growth Center should be made by RCC/CC or unblocked.
- The road should be wide, with full carpeting and pedestrian facilities for local people;
- Load-bearing capacities should be calculated before construction;
- Proper measures should be taken when crops and trees are cut for road construction/ construction of allied facilities;
- The local people should be given priority in the project work;
- Whom to complain/grievance mechanism must be communicated in clear terms;
- Construct market shade with enough space for agro products;
- Construct store/cool facility for keeping un-sold agro goods;
- Develop vehicle parking spaces; and
- Construct goods load and unload platforms.
- For slauhghter house suitable location to be selected avoiding residential areas, water bodies and any environmental and social sensitive areas. Besides, hygienic environmental pollution, odor, and health risks of slaughterhouse will be considered in detailed design.

6.5 Collection of NOC from Union Parishad

202. During the stakeholder consultation meeting 30 NOCs were obtained from each of the Chairman of the Union Parishad.

CHAPTER 7: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

7.1 Introduction

203. This section identifies the impact on the project area's physical, biological, and socio-economic environment. An impact is defined as any change to an existing condition of the domain.Potential impacts have been identified based on baseline data collected from secondary and primary sources. ESIA was carried out considering the present environmental setting, the project area, and the nature and extent of the proposed activities. Potential ES impacts associated with the proposed project activities are classified as:

a. Impacts during the pre-construction/design phase;
b. Impacts during the construction phase; and
c. Impacts during the operation phase.

204. Project's area of influence in this study, considers 50 m from the RoW and 1 km radius buffer zone for GCM..

7.2 Impact Assessment Methods

205. The methodology of assessing environmental impacts from the project activities entailed clearly identifying the environmental components that will be impacted, type of impacts, assessment area where the impacts will be felt and defining the criteria for assessing the significance of each type of impact.

206. The environmental impact was assessed by Environmental Impact Valuation (EIV) which may be defined mathematically as equation:

$$EIV = \sum_{i=1}^{N} ((Vi)(Wi)$$

207. A simple methodology has been developed for Environmental Evaluation System (EES) developed by Battelle Columbus Laboratories in the United States. In Bangladesh, in absence of a database it is only possible to estimate the potential environmental changes from the existing situation. In this method, the existing environmental conditions represents the reference level and the positive and negative changes in environmental conditions resulting from the proposed project activities are evaluated. The environmental impact is assessed by EIVs, which may be defined mathematically as shown above; Where Vi is the relative change in the value of environmental quality of parameter i with respect to existing situation, Wi is the relative importance or weight of parameter i, and n is the total number of environmental parameters related to the project activities. The computation of Environmental Impact Value (EIV) of a project needs determination of Vi, the value representing the magnitude of alteration of the environmental parameters, and Wi is the value representing relative weight or importance of the respective parameters. For this study relative importance value has been assigned from 0 to 10 and degree of impact from 0 to 5. Degree of impact can be both negative (adverse impact) and positive (beneficial) depending on its effect on the impacted parameter. Thus EIV value for any activity may range from 0 to 50 (+/-) depending on the relative importance value and degree of negative/positive impact on the parameter in question. An Impact rating has been used depending on the calculated EIV value as shown in **Table 7.1**. The highest rating from differenet activities under a package will represent the resultant impact rating of the package (**Table 7.2**).

Table 7.1: Impact Rating Depending on EIV Values

Sr.	EIV Range	Impact rating	Remarks
1	0 to 14	Low	Can be both positive (+) and negative (-)
2	15 -29	Moderate	Can be both positive (+) and negative (-)
3	30-40	Substantial	Can be both positive (+) and negative (-)
4	40-50	High	Can be both positive (+) and negative (-)

208. EIV of different activities under all 16 packages has been determined based on above guidelines and details are shown in **Annex E**. Packagewise summary of Impact assessment is presented in **Table 7.2**. It shows that packagewise rating varies from low to substantial.

Table 7.2: Package Wise Summary of Impact Assessment

Package No.	Activities under the package	Relative Impact		EIV	Activity wise Impact rating	Resultant Impact Rating of the Package
		Positive (+)	Negative (-)			
CW-01	Haibatput and Churamonkathi Bazar adjacent roads	42	55	-13	Low (-)	Moderate (-)
	Churamonkadhi Bazar	42	64	-22	Moderate (-)	
	Haibatpur Bazar	39	62	-23	Moderate (-)	
CW-02	Teghori-Sorfarajpur bazar road	39	54	-15	Low (-)	Substantial (-)
	Arpara Bazer- Sarfarajpur Bazer via Kandi Road	39	55	-16	Moderate (-)	
	Badekhanpur-Borokhanpur Road	39	70	-31	Substantial (-)	
	Kandi Kamal House-Near Marua Chowgacha Arpara GC Road	39	67	-28	Moderate(-)	
	Dhakinsagor-Charabari via H/O Abdul Bari Road	39	67	-28	Moderate(-)	
	Chowgacha (Damodar Battala)-Bidhadharpur Road	39	66	-27	Moderate(-)	
	Debipur-Narayanpur GC Road	39	69	-30	Moderate(-)	
	Chowgacha-Narayanpur GC Road	29	64	-25	Moderate(-)	
	Guatoli UZR-Narayanpur UZR Road	39	60	-21	Moderate(-)	
	Chandpara GCB Adarsha College Badakhanpur Road	41	70	-29	Moderate(-)	
	Borokhanpur Bazar-Badekhanpur Road	41	73	-32	Substantial(-)	
	Narayanpur Bazar	42	60	-18	Low (-)	
CW-03	Bangdah-Goalhati via Sreechandrapur, Dhuliani ghat	41	64	-23	Moderate (-)	Substantial (-)
	Bishahari GPS-Chutipur Bazar	41	69	-28	Moderate (-)	

Package No.	Activities under the package	Relative Impact		EIV	Activity wise Impact rating	Resultant Impact Rating of the Package
		Positive (+)	Negative (-)			
	Bangdah UZR Mosque-Belta	41	70	-29	Moderate (-)	
	Bangdah UZR -Bangdah Beledari Goshpara	41	63	-22	Moderate (-)	
	Bakra GC-Harikhali Panchpota RHD Via Matikumra Road	41	70	-29	Moderate (-)	
	Balla Sher Ali's house-Sadipur River ghat	39	58	-19	Moderate (-)	
	Gabropur-Kulia via Kulia Madrasha	41	74	-33	Substantial(-)	
	Panishara-Kulia	39	58	-19	Moderate (-)	
	Sonakur Rowshon Morol House More-Sonakur Taltala	41	58	-17	Moderate (-)	
	Nandidumuria-Panchpota Bazar	39	59	-20	Moderate (-)	
	Bausa village - Arshingri BC Road	41	62	-21	Moderate (-)	
	Seordah Bazar	39	64	-25	Moderate (-)	
CW-04	Gorpara Bazar	42	56	-14	Low (-)	Moderate (-)
	Gorpara Bazar adjacent roads	42	61	-19	Moderate (-)	
CW-05	Pularhat (RHD) – Goaldah – Rajgonj GC (Monirampur) Road (Sador Portion), Pularhat (RHD) - Rajgonj GC Road, Rajgonj GC- Khordo Gc Road, Nalta Bazar More – Trimohoni Bazar Road up to Hazrakati Road, and Chingra –Rajgonj Vai Trimohoni Up (Keshabpur Portion) Road.	42	54	-12	Low (-)	Low (-)
	Rohita Bazar	42	49	-7	Low (-)	
CW-06	Radhanagar GC - Kashtaour RHD Via Nakol Bazar Road (Part 1)	50	39	11	Low (-)	Low (-)
	Radhanagar GC - Kashtaour RHD Via Nakol Bazar Road (Part 2)	46	51	-5	Low (-)	
	Khamarpara Bazar	42	51	-9	Low (-)	
	Langalband Bazar	43	54	-11	Low (-)	
CW-07		58	74	-16	Moderate (-)	Moderate (-)
	Alomkhali Bazar	39	67	-28	Moderate (-)	
	Alukdia Bazar	30	37	-7	Low (-)	
	Katakhali Bazar	39	56	-17	Moderate (-)	
CW-08	Singra-Naghosa via Gurpagla road	41	55	-14	Low (-)	Moderate (-)

Package No.	Activities under the package	Relative Impact		EIV	Activity wise Impact rating	Resultant Impact Rating of the Package
		Positive (+)	Negative (-)			
	Thaipara-Dhaukhali	39	57	-18	Moderate (-)	
	Binodpur-Narayanpur Rd.	39	58	-19	Moderate (-)	
	Tollabaria to Bohelbaria via Khalia Modhopara Rd.	39	61	-22	Moderate (-)	
	Binodpur College-Noboganga River Rd.	41	56	-15	Moderate (-)	
	Binodpur Momin Chairman House - Kawra Village rd.	39	55	-16	Moderate (-)	
	Binodpur Food Godown to Binodpur Baparipara house of Hafiz road.	41	58	-17	Moderate (-)	
	Khalia Bazar to khalia Matpara mosque road.	39	63	-24	Moderate (-)	
	Naovanga BC road -Rarikhali bazer via Goalbathan Ghat	41	59	-18	Moderate (-)	
	Rarikhali Golam Rasul Sikder House - Baperir Char Jame Mosque	39	53	-14	Low (-)	
	Khalia Mondolpara Jafor master house to khali Nurul Mollah hous	41	65	-24	Moderate (-)	
	Singra Bazar	42	56	-14	Low (-)	
	Binodpur Bazar	42	49	-7	Low (-)	
CW-09	Gholdari G.C-Munsigonj G.C	39	59	-20	Moderate (-)	Moderate (-)
	Jehala UP-Kumari UP	42	63	-21	Moderate (-)	
	Panchlia Bazar-Nagdah UP Office Road	39	60	-21	Moderate (-)	
	Munshiganj Bazar	42	51	-9	Low (-)	
	Gokulkhali Bazar	43	54	-11	Low (-)	
	Jamjamihat Bazar	39	55	-16	Moderate (-)	
CW-10	Andulbaria GC Road	38	36	2	Low (-)	Low (-)
	Andulbaria Bazar	39	51	-12	Low (-)	
CW-11	Sarajgonj G.C-Alamdanga (Sadar Portion)	39	57	-18	Moderate (-)	Moderate (-)
	Sarajgonj R&H-Gholdari G.C	39	62	-23	Moderate (-)	
	Badorganj R&H-Andulbaria G.C (Sadar Portion)	41	62	-21	Moderate (-)	
	Hizolgari G.C-Kotali-Begumpur UP	41	61	-20	Moderate (-)	
	Choto Solua-Boldia Battalla	39	62	-23	Moderate (-)	
	Boldia Madrasha-Boalia	39	61	-22	Moderate (-)	
	Hizolgari Bazar	30	37	-7	Low (-)	
CW-12	Lokhnathpur RHD-Karpasdanga GC Road via Subolpur Ferryghat	41	57	-16	Moderate (-)	Moderate (-)
	Damurhuda - Laxmipur Hat	39	57	-18	Moderate (-)	

Package No.	Activities under the package	Relative Impact		EIV	Activity wise Impact rating	Resultant Impact Rating of the Package
		Positive (+)	Negative (-)			
	Karpashdanga Up-Jagonnathpur G.C	39	58	-19	Moderate (-)	
	Dugudugi Hat	39	51	-12	Low (-)	
	Karpasdanga Bazar	42	48	-6	Low (-)	
CW-13	Hamdard to Nirikelbaria GCM to Hatgopalpur GCM	48	54	-6	Low (-)	Low (-)
	Hatgopalpur Bazar	42	48	-6	Low (-)	
	Narkelbaria Bazar	42	51	-9	Low (-)	
CW-14	Bhatoi GC – Hatfazilpur GC Road	39	58	-19	Moderate (-)	Moderate (-)
	Bhatai bazar -Sathbila kulchara-National road via bara kulchara	41	58	-17	Moderate (-)	
	Sabdarpur GC – Andulbaria GC Road	42	59	-17	Moderate (-)	
	Laxmikundu – Ramchandrapur Road	39	62	-23	Moderate (-)	
	Laxmikundu – Sabdarpur Road via Baliadanga	41	60	-19	Moderate (-)	
	Boluhar UP office – Gobindopur Bazar via Ramchandrapur, Shingia	39	62	-23	Moderate (-)	
	Bhatai Bazar	42	51	-9	Low (-)	
	Sabdarpur Bazar	42	49	-7	Low (-)	
CW-15	Harinakunda GC to Bhabanipur GC via Narayankandi Bazar-Bherkhali	39	56	-17	Moderate (-)	Moderate (-)
	Bhabanipur Kalitola H/O Nita Shar - Bharakhali botola pucca Rd. via UP helth center	41	63	-22	Moderate (-)	
	Harinakunda GC – Bhalki Bazar R&H via Singra Road	41	63	-22	Moderate (-)	
	Harinakunda GC to Shadhuhati R&H road	41	54	-13	Moderate (-)	
	Bhabanipur Bazar	36	47	-11	Moderate (-)	
CW-16	Sala Bhora Bazar (RHD) to Kola GC Road, Sadikpur Trimohoni to Arpara Bazar Road, Bethuly High School to Kola GC Road, Dhaka- Khulna (Mithapokur) to Pirojpur Pripary School Road, Kola Sarabaria Road Khulna Borobari to Dasbaisha Bridge Road	38	36	-2	Low (-)	Moderate (-)
	Barobazar Bazar	42	49	-7	Low (-)	
	Kola Bazar	36	62	-26	Moderate (-)	

7.3 Methods for Mitigation and Management

209. Mitigation measures are how potential adverse impacts associated with the Project may be avoided or reduced to appropriate levels through modifications to the project's design, construction methods, or context. In real terms, reducing negative impacts to an appropriate level means that the potential impacts are reduced to a point where they no longer pose a significant threat to the current or future status of the surrounding natural environment, biodiversity value, and social or economic environment of the region. Suggested mitigation measures have been translated into actions to maintain the environmental integrity of the Project and provide workable solutions.

210. An ESMP has been developed covering activities of all 16 packages in **Chapter VIII**. The ESMP incorporates environmental mitigation measures for impacts identified in **Chapter VII** and forms a practical guide to the ongoing management of all aspects of the Project, including monitoring of the Project. ESMP is consistent with the standards and guidelines of Bangladesh, WB and with international best practice.

7.4 Potential Key Environmental and Social Impacts of the Sub-projects (ESS1-10)

211. ESRC of the WeCARE program has been classified as High ' It is high for social, substantial for the environment – overall high. However, the packages/sub-projects to be implemented by LGED under the WeCARE program has low to substantial risk. Thus, overall E&S risk is categorized as high.

7.4.1 Potential Environmental and Social Impacts in Pre-constructioin Phase

7.4.1.1 Land Cover, Land Use Changes and Land Aquisition (ESS 1, 3, 5)

212. Sub-project construction of different infrastructures and Feeder roads widening may change existing land use and land cover at the local level. Although most proposed infrastructures, viz. market improvement, are relatively small, their quantity is significantly high and will be spread over GCs and villages across the RoW. However, most of the activities will be confined within RoW of LGED, minor realignments, acquisition of structures, which are located within the proposed RoW, will occur in markets and villages along the project road. During improvement of existing GCM and connecting roads agricultural land, water bodies, barren land and settlement (residential and commercial) within the ROW are likely to be affected. Lands such as fallow land, barren land, flood plain, will be temporarily used for the establishment of labour camp, crusher sites, worker camp site, for the disposal of spoil, and will be changed during the time of construction temporarily. Land acquisition will not be required for any packages.

7.4.1.2 Loss of Natural Vegetation and Trees (ESS 6)

213. Sub-project siting of proposed infrastructures will require cutting of trees and removing natural vegetation, which could be insignificant in number. The results of the baseline survey indicate that project corridor is relatively less diverse due to human intervention/habitation. The ecological investigations have indicated that there are neither rare, endangered and threatened species nor presence of any environmentally-sensitive areas within the area of influence. In the assessment of trees designated for removal, the survey results indicate varying quantities for different contract packages. Total 1516 tree cutting will be required packagewise distribution as follows: 264 trees for CW-01, 176 for CW-04, 273 for CW-05, 64 for CW-07, 132 for CW-10, 31 for CW-16, 57 for CW-06, 49 for CW-02, 161 for CW-03, 76 for CW-08, 27 for CW-14, 82 for CW-09, 65 for CW-11, and 59 for CW-15. Any loss of trees will impact other flora and may affect wildlife, particularly birds and animals that rely on trees as their food

and shelter source. In addition, the loss of trees may increase soil erosion from rain cuts. Apart from trees and undergrowth other vegetation affected will be crops, bamboo bushes and other native vegetation.These trees, however, are just lining the along the road sides and are not part of any ecosystems. Thus, impacts on ecosystems are not anticipated.

7.4.1.3 Shifting of Utility Poles (ESS 2,4)

214. Total 596 utility poles (Electric poles, Telephone line, and solar panel) need to be shifted detail packagewise distribution of which is shown in **Table 3.2**. This will enatail OHS and CHS issues, there may be temporary disruption of electricity which must be informed to the community with arrangemaent of alternative provisions.There will be disruption of public services and inconvenience to the residents during shifting. Besides, during transportion normal traffic may be affected.

7.4.1.4 Loss of Aquatic Habitat (ESS 1, 3, 6)

215. Aquatic habitats will be an insignificant loss due to the siting of proposed infrastructures, especially the construction of feeder roads, culverts, bridges, sheds, markets, collection and landing sites, etc.

7.4.1.5 Clearance and Approval (ESS1)

216. According to the Environmental Conservation Rules, the project falls under red category and thus under the provisions of the Bangladesh Environment Conservation Act, 1995, LGED obtained approved ToR for EIA and applied for ECC for individual sub-projects. Later on, DoE requested LGED to apply from Rigional offices and it is in the way of application to the respective region.

7.4.1.6 Drainage Congestion and Water Logging (ESS 1, 3, 4)

217. Selected GCM and road construction activity will cause drainage congestion and water logging in the local area if drainage of runoff is not properly considered/designed. Besides in the labor camp drainage congestion may occur if proper drainagae arrangement is not provided within the camp. Drainage congestion is insignificant for all the packages.

7.4.1.7 Social, SEA/SH and Resettlement

218. LGED will not require any land acquisition under any packages. However, in all packages will have impacts on informal occupants. Site-specific RAPs will include relevant mitigation measures consisten with ESS5 and Bangladeshi national laws. LGED will also ensure that a grievance mechanism for the Project is in place, following ESS 10 and ESS 5 to address specific concerns about compensation, relocation, or livelihood restoration measures raised by displaced persons (or others) in a timely fashion.

219. Risks of Sexual Exploitation and Abuse, and Sexual Harassment (SEA-SH) in the project area and probable mitigation measures discussed in the focus group meetings, and PAPs made aware of the GRM, where SEA-SH-related complaints can be. Separate GRMs for managing SEA/SH and labor-related GRM have been formed with the guidelines of ESS 2, ESS4, and ESS 10.

7.4.1.8 Crushers, Hot-mix Plants and Batching Plants Location

220. Sensitive areas like hospital, schools, commercial buildings, mosques, mondirs etc. located near the road section may be affected by the placing of Crushers, Hot-mix Plants and Batching Plants due to emission of harmful gases.

7.4.1.9 Impacts on Vulnerable and Disadvantaged Groups/Communities/Individuals (ESS1)

221. The sub-projects have been designed in such a way as to provide a holistic response to a set of dynamic issues that poor, vulnerable rural communities face. It aims to increase economic contribution, poverty reduction, quality of life, and environmental sustainability. The Project intends to improve the management of targeted rural community's access to livelihoods and economic activities using improved communication and connectivity towards RGCs, RMs, etc. The Project's inclusive approach will result in benefits to households and individuals, especially the most disadvantaged, like female-headed households, widows, the poorest, and elderly people in rural communities. The Project will support the establishment and empowerment of community co-management associations to make decisions on market management and support the dependent poor to adopt supplementary and alternative economic activities. With its inclusive approach, the Project will target to reduce the gender gaps that are the most glaring. Women and children will also benefit from the support for the consumption, production, processing, and marketing of high nutrient- and protein-rich agro-products. The Project will also promote more productive and better-performing institutions and, over time, better services and effective and sustainable environmental management in rural areas. Business loss/restoration and livelihood support /improvement, as appropriate, will follow as per the RPF/RAPs.

7.4.2 Potential Environmental and Social Impacts during Construction Phase

7.4.2.1 Air Pollution (ESS 1, 3, 4, 6)

222. Construction of roads and markets, removal of existing road material, excavation/re-excavation, culverts, and bridges may generate emissions from excavation equipment, other machinery, and construction traffic. The baseline results of all air quality parameters (PM10, PM2.5, SO2, NO2 and CO) from different packages are foundbelow the prescribed standards of the DoE. This can be attributed to overall good pavement condition, less volume of traffic, and absence of polluting sources in project study area.

223. Construction activities can give rise to dust emissions under particular circumstances if not effectively managed. Road construction activities have the potential to affect receptors near to the main construction sites due to dust generated from site preparation, site excavation,construction activities and the tracking out of dust from Heavy Goods Vehicles (HGVs) onto the local road network. Earth works of both road and GCM will result in exposed areas of soil which will potentially generate dust when it is windy, with dust potentially being generated when winds blow at all times of day or night, not just during active periods of construction. The presence of concrete batching plant, hot mix plant and wet mix macadam plants could also result in significant emissions of dust, though the impact will depend on their location in relation to sensitive receptors. The level and distribution of dust emissions will vary according to the duration and location of activity, weather conditions, and the effectiveness of suppression measures.

224. Gaseous emission during construction will be from road construction machinery, equipment and trucks used for material transportation. The operation of vehicles and equipment will result in emissions of carbon monoxide, sulphur dioxide, and oxides of nitrogen. In particular, all commercial vehicles driven with diesel fuel are often used in Bangladesh. The greatest impact on air quality due to emissions from vehicles and plant will be in the areas immediately adjacent to site access. Generally, additional vehicle movements generated during the construction phase will have the potential to influence local air quality at sensitive receptors located at close proximity to road and pollutant concentration is likely to reduce with increase distance from road. The impacts will therefore apply mostly within the nearby markets /villages, though may also affect some isolated properties where they are located close proximity of construction traffic movements.

7.4.2.2 Road Traffic Safety (ESS 1,4)

225. Traffic will increase during construction due to increased project movement and cause safety problem. The study involves road intervention of 431.26 km in length and intersected by UZ , RHD and union road. The road will act as haul road for transporting construction materials along with construction activities will result in blocking of dirt track and access restrictions across the roads, which will cause nuisance to local road users (road users and pedestrians). Adding to aforementioned impacts, the site setting i.e. narrow roadway width will provide limited option for maneuvering, but will depend on contractor working procedures that are not yet known. There will be need for creating temporary access to Contractor's camps/establishments, diversion road for 37 bridge locations as shown in **Table 3.2**. The project interventions will also expose communities to health and safety risks from increased traffic during construction along different project routes. Traffic management plan would need to be put in place to address these challenges. Specifically, the community may face high likelihood of direct exposure to increased construction related traffic and equipment especially at certain road sections including sensitive receptors such as schools, religious places, health center/hospitals.

7.4.2.3 Noise Pollution (ESS 1, 3, 4)

226. Vehicular movement, generators, excavation machinery, concrete mixing, and other construction activities will generate noise pollution. The principal source of noise during construction of project road and GCM would be from operation of equipment, machinery and vehicles. Earth moving machineries e.g. excavators, graders and vibratory rollers has potential to generate high noise levels. These machineries produce noise level of more than 70 dB (A). This can cause disturbance to the settlement, adjacent to the carriageway or within 500 m from the worksite. The noise generated during the construction would cause inconvenience to the population especially within 50m of the site after which it would be attenuated to acceptable levels. Since, the settlement along the road alignment is not very dense the severity of the impact is not expected to be significant.

7.4.2.4 Water Pollution (ESS 1, 3, 4, 6)

227. Surface water in the study area might get polluted due to the disposal of construction waste generated from the project activity. Uncontrolled dumping of wastes, sewage, and accidental spillage of fuels and chemicals into the water bodies may greatly pollute them. Disposal of sewage and wastes from the construction camps to surface water bodies without treatment will deteriorate the water quality. This contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement. The impact on these water bodies will be only for the period of construction and not likely during operation period. Besides ground water may be polluted due to improper sanitation of labor camp and if excavated soil is placed on ground for prolong period.

7.4.2.5 Soil Contamination (ESS 1, 3, 4, 6)

228. Soils in the construction area and nearby lands that are used for agriculture will be prone to pollution from the construction activities, construction yards, workers' camps, and other construction areas. Soil will be directly impacted due to removal of topsoil, compaction and spillage of chemical. During construction phase stripping of topsoil up to depth of 15cm is anticipated to be directly affected during clearing and grubbing. The compaction of soil due to plying of traffic, stockpiles, and temporary facilities is also likely to impact soil structure with potential to impact organism activity, water retention capacity and nutrient retention. There is also possibility of contamination of soil from leakage and spillage during handling and storage of fuels and chemicals. The land within the project influence area will be directly impacted due to removal of topsoil, compaction and spillage of chemical. There is also possibility

of contamination of soil from leakage and spillage during handling and storage of fuels and chemicals. The compaction of soil due to plying of traffic, stockpiles, and temporary facilities is also likely to impact soil structure with potential to impact organism activity, water retention capacity and nutrient retention. There is also possibility of contamination of soil from leakage and spillage during handling and storage of fuels and chemicals.

7.4.2.6 Generation of Solid Waste and Hazardous Waste (ESS 1, 3, 4, 6, 8)

229. The solid waste generated during the construction phase will include excess construction material such as sand and soil, faulty/damaged parts, cardboard boxes and containers, and domestic solid waste from construction offices and camps. The Project activities will generate both solid non-hazardous and hazardous wastes throughout the construction phase. The anticipated non-hazardous wastes types include excavated material, construction material, Municipal Solid Waste, waste waters. While hazardous waste may include used oil, empty drums or replaced parts of the construction machinery, used battery, chemical for concreting like admixture etc. There are potentially a number of risks to human health and the environment that may be associated with the handling, storage and disposal of waste, both on and off-site. Incorrect handling and storage could result in possible cross contamination of air, soil and water resources; as well as direct and indirect effects on human health. Environmental pollution with organic and non-organic waste generated from project activities may occur due to uncontrolled disposal and inadequate management of waste during road construction and operation of the camps for construction workers. Discharge of untreated waste waters can result in pollution to soils, water bodies and have adverse effects on human health, flora and fauna and surface and groundwater. Bad odour, blockage and obstruction of road side drain, traffic congestion, contamination of ground and river water and agricultural land close to the road, GCM and camps are likely to be affected due to direct disposal of waste from the construction camps and sites during the construction period. Besided during working of markets at GCMS will generate solid waste in operation phase.

7.4.2.7 Impacts on Aquatic Habitat (ESS 1, 3, 6)

230. Construction activities will not have any direct impact on terrestrial or aquatic wildlife or their habitat since no sensitive ecological hot spots have been identified.

7.4.2.8 Site Clearance and Restoration (ESS 1, 2, 4, 6)

231. The site clearance activities for road construction will involve removal of road side vegetation and felling of trees. The result of the baseline survey indicates that project corridor is relatively less diverse due to human intervention. The ecological investigations have indicated that there are no rare, endangered and threatened species within the corridor or environmentally-sensitive areas. After the completion of the construction activities, the leftover construction material, debris, spoils, and campsites can potentially create hindrance and encumbrance for the local communities.

7.4.2.9 Occupational Health and Safety (ESS 1, 2, 4)

232. During improvement of GCMs and connecting road construction occupational health and safety of the workforces is one of the key risks and impacts likely to occur. Generally, the construction activities will involve small to medium-scale excavation, operations of construction machinery, and vehicular traffic. These activities may pose health hazards to the workers at the site during the use of hazardous substances, excavation work, and operation of construction vehicles such as excavators and dump trucks, operation of crusher plants, operation of quarry sites, lifting and handling of heavy equipment, operating machinery, and electrical equipment, working near water or at height. The labors could encounter injuries

and accidents (sometimes casualties) in lack of adequate safety measures.This may be increased in the absence of proper training of unskilled workers to be engaged. Details on OHS and CHS issues are furnished in section 7.5.5.

7.4.2.10 Impact on Labor, Working Conditions, and Labor Risks, Including Risks of Child Labor, Forced Labor, and Human Trafficking (ESS 2)

233. The proposed sub-projects will entail the employment of a significant number of laborers, especially during construction. During the construction phase, the labor requirement will range from 1000-1500 during normal operations and 2500-3000 workers for peak construction activities depending on the progress of work. The majority of labor will be locally hired, except for skilled workers who may not be found in the sub-project areas. For the rural roads, labor requirements are expected to be more modest and satisfied by local labor. However, potential risks for the hired skilled and non- skilled workers, especially during the construction period, include health hazards, poor living conditions, accidental hazards, etc. Similarly, hiring labor from an external area may cause social risk in the local communities, including SEA/SH, price hiking of daily used products /foods, etc. Following are the potential risks associated with workers/labors engaged in construction works.

i. Safety issues while at work like injuries/accidents/ fatalities leading to even death, while at work;
ii. Short terms effects due to exposure to dust and noise levels, while at work
iii. Long term effects on life due to exposure to chemical /hazardous wastes
iv. Inadequate accommodation facilities at work force camps, including inadequate sanitation and health facilities
v. Non-payment of wages by Employer
vi. Non-payment of benefits (compensation, bonus, maternity benefits etc.) by Employer
vii. Discrimination in Employment (e.g. abrupt termination of the employment, working conditions, wages or benefits etc.)
viii. Engagement of child labor
ix. Sexual harassment at work
x. Forced labor trafficking
xi. Security of women work force
xii. Inadequate facilities for pregnant women and lactating mothers
xiii. Inadequate facilities for the children of the workforce at workforce camp sites
xiv. Possibility of Gender based violence as the road shall traverse through sensitive locations such as hospitals, schools, etc. that are near to habitations.
xv. Absence or inadequate or in accessible emergency response system for rescue of labor/workforce in situations of natural calamities like earthquake, caving in/landslides, fire outbreak, floods and cloud bursts etc.
xvi. Health risks of labor relating to HIV/AIDS and other sexually transmitted diseases
xvii. Unclear terms and conditions of employment
xviii. Discrimination and denial of equal opportunity in hiring and promotions/incentives /training opportunities
xix. Denial for workers' rights to form workers organizations, etc.
xx. Absence of a grievance mechanism for labor to seek redressal of their grievances/issues

7.4.2.11 Involuntary Resettlement Impacts (ESS 5)

234. The Project will try to avoid taking any private land through involuntary acquisition and avoid any physical displacement of residents for activities under the Project. Most of the work will be carried out within the existing available lands. However, the acquisition of private lands would not be required

in any packages. Any land acquisition will cause removal of commercial structures, resettlement of affected people, removal of vegetation, sifting of utilities and inconvenience to the local people and animals living in and around the land area to be acquired. Site-specific RAPs will provide detail plan to address these issues.

7.4.2.12 Social Impact

235. Implementation of the sub-project, the local people and pedestrians will have an easy movement problem. Those who are involved in the business of the GCM their business will be hampered.As a result, their livelihood will affect the immediate vicinity and area of influence of the Project. Themajor social impact will start when the construction work starts, and livelihood will be affected due tothe loss of business. When the existing market is dismantled for improvement, income and livelihood will be affected.

7.4.2.13 Impacts on Small Ethnic Communities (Impacts on Indigenous People) (ESS 7)

236. In CW-06 and CW-14, there is a presence of SECs. However, instead of getting affected, they will get benefits from the project works.

7.4.2.14 Disruption of Services and Borrow Area (ESS4)

237. Local services, including tube wells, drains, cables, irrigation channels, drainage ditches and trails, are commonly cut during road earthworks. These services are required by local people for crop production, drinking water and access and have the potential to damage road works. These services are often either inadequately reconnected or not reinstated at all. Borrow area should be selected not to impact agriculture land and preferably within LGED RoW. In case of using of private land contractor has to come to an agreement with the owener of the land.

7.4.2.15 Impact on Cultural Heritage (ESS8)

238. Few mosques, temples, and graveyards along the proposed LGED sub-project area will be affected by project works. According to the **Table 3.2**, CW-01 (Imambar Jame Mosque), CW-02 (Shrine of Birsrestho Noor Mohammad), CW-05 (Michael Mudhusudon Datta Memorial House, Haummam Khana, Chachra Shib Mondir), CW-16 (Pir Pukur Mosque, Gorar Mosque, Hasilbag Mosque, Zor Bunglow Mosque) located near the project sites may be affected due to dust generation and noise pollution from project activities. Though none of these sites will be directly affected by the construction activities due to confinement of embankment within the existing setup, the regular movement to these places during prayer time, visting hour and traffic congestion during construction may affect smooth movement of local people to thses places. During prayer time work to be stopped (like crushing of bricks and stone boulder) where noise and dust generates.

7.4.2.16 Potential Hazards Caused by Bitumen and Other Toxic Chemicals (ESS3)

239. The use of chemical hazardous materials for road such as epoxy, gypsum, additives, admixtures, cements, bitumen etc. is inevitable during the time of construction. The storage of such chemical should meet by special precautionary measures. Containers of such chemicals such as bitumen drums often are damaged during transit, leading to a leakage in storage places that often are not or not adequately cleaned up afterwards. The bitumen could remain at the boiling area and decanter sites for many years after the road construction if it is not properly rehabilitated along the existing natural drainages and agricultural land.

7.4.3 Environmental and Social Impacts During Operational Phase

7.4.3.1 Loss of Vegetation (ESS1, 6)

240. Infrastructures that will be constructed under the proposed Project would be the sites of human access, which may lead to the loss of more vegetation (herbs, shrubs, and trees) in the surroundings dueto the human footprint.

7.4.3.2 Generation of Solid Waste (ESS 1, 3, 4)

241. Solid waste will be generated from markets/GCMs, if not appropriately disposed of, has the potential to contaminate soil and water bodies thus negatively affecting communities as well as natural habitats.

7.4.3.3 Air Pollution (ESS 1, 3, 4)

242. Emissions from local road traffic along the markets, road and other infrastructures mayaffect the ambient air quality. Road traffic will be increased due to the construction of these infrastructures in the project area due to availability of better facilities.

7.4.3.4 Water Pollution (ESS 1, 3, 6)

243. Generally, paved Road increases the impermeable surface area, increasing the surface runoff rate. Increased stormwater flow rates can lead to stream erosion and flooding downstream, causing soil erosion, channel modification, and siltation of streams. During the operation phase, some localized turbidity increases may occur during any maintenance works of the constructed sites. Similarly, the maintenance works can generate a limited quantity of waste effluents.

7.4.3.5 Changes in Land Use Pattern (ESS 1, 3, 6)

244. Markets, landing sites, roads, and other activities may change local land use patterns upon gaining popularity during the operation period, which will replace existing users such as agriculture and vegetation in terrestrial areas and natural aquatic systems and agro-ecosystem at the project area. The post operational phase will impact the land use patterns of all the packages.

7.4.3.6 Increased Risk of Road Accidents (ESS4)

245. One of the key potential risks associated with rural road sub-projects is the increased risk of road accidents due to higher speed and additional traffic. The design speed will be 40 kph. However, substantial roadsafety measures and facilities will be installed under the WeCARE program to minimize accidents.

7.5 Specific Impacts Due to Bridge and Culvert Construction

246. There are 37 bridges and 465 culverts in Group-I, II, III, and IV packagesin the project area where the Road will cross several rivers and canals. The major bridge lengths are 40m at CW-04, 36 m at CW-06, and two nos. 50 m at CW-16. All the bridges that are less than 100m long, mostly within 10-30 m, will be required to be constructed at different locations. However, these bridges are less than 100m; thus, no separate EIA is required. Details of impact and mitigation measuresfor major bridges have been covered in this ESIA. Additionally, this section will discuss some major impacts and mitigation measures due to these bridge constructions. Since the construction of such bridges will involve earthwork, piling, concrete

structures across rivers and over both the river-banks protection, restriction to plying of country boats, blockage of aquatic biodiversity movement, etc., environmental impacts due to such activities will be different from those due to the construction of theroads and, hence, different will be the environmental components and parameters to be addressed duringthe impact assessment and management processes. Impact and Mitigation Measure of Bridge and culvertconstruction are presented in **Table 7.3**.

Table 7.3: Impact and Mitigation Measure of Bridge and Culvert Construction

S.N.	Impact	Mitigation
a) Drainage Congestion	An adequate waterway opening of the new bridges will cause drainage congestion, and this may cause river bank erosion simultaneously. Runoff from construction material storage near water bodies or uncontrolled disposal May cause temporary drainage congestion, especially near service areas and construction sites. Stockpiling of fill materials dredged from the river beds for the upgradation of the connecting Road may result from erosion and subsequent deposition in the adjacent crop fields.	Careful attention has to be given so that no negative impacts are caused by the Road at the bridge construction site. Adequate numbers and sizes of box culverts should be provided at the culvert sites to avoid drainage congestion. The opening of cross structures, including bridges and culverts, shall be kept as wide as possible to ensure the backwater upstream is negligible. Care should also be taken so that there is no loss of navigability or reduction of water flow in the rivers or canals. Proper slope protection measures are required to avoid any drainage congestion caused by siltation/ sedimentation from the roads.
b) Soil Erosion and Siltation	During the construction phase, some trees, shrubs, and grasses will need to be cleared. This may create localized soil erosion problems during the rains. The potential risk of river erosion will increase after the implementation of the Project if the bridge crossings are provided with a waterway width less than the regime width of the river. The Project is not expected to worsen the erosion risk, particularly in areas where soil and topography are less vulnerable to erosion.	• Adopt good engineering and construction. • Provide adequate bank protection and structures; Retaining wall or pala siding should be providedfor the protection of pond and lake. • The erosion tendency increases in water-logged areas as well. Adequate drain and slope protection measures shall be applied; • Particular attention needs to be taken while designing the bridge, which will be provided for the regime waterway width without narrowing the natural channel width. The portion of the Road that is in contact with the river, channel, and canal will be provided with slope protection measures.
c) Disruption of Water Transport and Navigation	A small number of construction materials and equipment are to be transported using water transports that might disrupt movements ofmechanized and non-mechanized water transport unless dealt with carefully andproperly. The piling and other construction-related operations might also disrupt the movement of navigational transports in the main riverchannels. This disruption will be localized and last during the construction period only.	• Not to obstruct other normal riverine transport while doing riverine transport and works. • Identify the channel to be followed using navigation aids such as buoys, beacons, and lighting. • Provide proper buoy age, navigation lights, and markings for bridge and works to guide the othernormal riverine transport. • Keep regular and close contact with the Bangladesh Inland Water Transport Authority (BIWTA) regarding their needs during construction.

S.N.	Impact	Mitigation
d) Water and Soil Quality	Spillage of hazardous materials such as fuel, solvents, lubricants, and paint by leakage of tanks, careless handling of disposal of hazardous wastes, and washing of construction vehicles /equipment in the rivers can cause severe pollution of water (groundwater and surface water) and soil. Soil and water pollution by liquid waste can have a serious impact on the community health and safety and aquatic animals (fish, snakes, frogs, etc.) of the rivers.	The contractor should prepare a waste management plan (WMP) and follow it. Handling and storage of all the hazardous materials and wastes, as well as washing of vehicles/equipment, will be organized under strict conditions through a construction management plan to avoid water and soil pollution during the construction of the bridge.
e) Noise and Vibration	The noise level is expected to increase due to other construction activities, such as loading and unloading construction materials, transportation, placing box girders, and electricity generation. It is expected that the noise caused by these activities will still be within acceptable levels.	The contractor should prepare a proper construction management plan and follow it during the construction of the piling activities. The workers will be provided with suitable ear muffs, and the community in the vicinity will be informed of the period the excessive noise will be generated.
f) River Ecology	The construction of bridges may lead to the loss of aquatic animal habitat due to increased turbidity, decreased dissolved oxygen in the water, and reduction of food sources, including a temporary decline of plankton and benthos organisms. An increase in suspended solids in the rivers would drive fish away from the bridge construction sites during the construction phase. The water courses may be contaminated by the pollutants generated from the bridge construction sites and workers" camps, such as sediments in wastewater discharged from excavated areas, nutrients, and biological contents in domestic sewage charged from worker" scamps, and oil and grease leaked from construction types of machinery.	In order to avoid impacts on these species, the construction works will be limited to the designated sites allocated to the contractors. Regular monitoring of the worksite for animals trapped in or in danger will be done, and the contractor will use a qualified person to relocate the animal. Monitor work areas for endangered reptiles and bird species to ensure they are well away from the piling site if they are too close to the site. An acoustic enclosure will be placed to cover the hammer and the exposed pile to reduce the air and noise. To avoid turbidity in the river during the pier construction of the bridge, use a confined/barricaded pier area so that water will not turbid for fish survival.

7.5.1 Climate Change Impact on Road Transport System (applicable to all 16 packages)

247. Road transport plays an important role in the overall socio-economic development of a country. In Bangladesh, roads are the main transport infrastructure enabling trade, public services delivery, governance, tourism, etc. However, road infrastructure, especially in geologically fragile areas, is extremely environmentally challenging and highly vulnerable to the impacts of climate change, such as flash floods and landslides caused by heavy rains. In addition, rapid growth in vehicle numbers and movement make road infrastructure vulnerable. The road networks of developing countries are generally more vulnerable to climate change impacts due to poor conditions, a high proportion of unpaved roads, and limited resources and technology to adapt.

248. For this, the Local Government Engineering Department (LGED) has established a Climate Resilient Local Infrastructure Center (CReLIC) under its Climate Resilient Infrastructure Mainstreaming Project (CRIMP) funded by the Green Climate Fund (GCF). The Government of Germany, through the German Development Bank (KfW) and the Government of Bangladesh (GoB), is responsible for designing and implementing all infrastructures at a local level to combat climate resilience issues.

7.5.2 Risk of Climate Change on the Bangladesh Road System

- Road assets are particularly vulnerable to climate stressors such as higher temperatures, increased precipitation, or flooding.
- Weather extremes damage and accelerated aging of roads caused increased maintenance and more frequent rehabilitation.
- Aside from higher maintenance and rehabilitation costs, it causes more frequent disruptions to the movement of people and goods, directly impacting economic productivity.

7.5.3 Area of Investigation for Climate Resilience Management

7.5.3.1 Rising Temperatures

249. Very high temperatures are manifested by an increased risk of asphalt rutting, flushing, and bleeding of bituminous surfaces and/or cracking; this historical data will be analyzed to gather the information based on the spatial and temporal change in temperature in the project area for the implementation of mitigation measures.

7.5.3.2 Heavier Monsoon Rainfall/Storm/Tidal Surges

250. Rain causes wet pavement, which reduces vehicle traction and maneuverability. Heavy rain also reduces visibility distance. In the rainy season, pavement destruction occurs in various forms, like widening potholes and cracks. Various other types of defects get accelerated due to rain;

i. Raveling
ii. Rutting
iii. Patch deterioration

251. Inland flooding, usually following the evolution of a tropical storm or cyclone, has typically been the greatest source of fatalities and caused the most damage to roadway infrastructure.

7.5.3.3 Road Pavement

252. The main risks to the road surface associated with climate change are, depending on the climate zone, extreme heat and insolation, higher occurrence of heavy rain, and temperature fluctuation. Very high temperatures are manifested by an increased risk of asphalt rutting, flushing, and bleeding of bituminous surfaces and/or cracking. Polymer-modified asphalt may be explored to decrease the asphalt rutting, flushing, and bleeding of bituminous surfaces and/or cracking. As the temperature of the asphalt mixture increases, the binder phase loses stiffness, and the irreversible deformations caused by static or dynamic traffic loading will accumulate faster.

7.5.3.4 Road Drainage Systems

253. Drainage system capacity should be adapted to higher intensity and frequency of extreme rainfall events and complemented with water retaining facilities (e.g., dams, reservoirs) and structural protection measures (dikes, embankments). The culvert design should be adjusted to accommodate higher water

volumes within a short time. In terms of defining the capacity design of the drainage system, the intensity-duration-frequency curves (IDF curves) should be used, taking into account the influence of climate change and updating these IDF curves with the rainfall characteristics projected in future climate scenarios.

7.5.3.5 Bridges and Similar Infrastructure and Culvert

254. The main climate change concerns relevant to the design, construction, and management of existing bridge structures are the higher occurrence of flooding, river discharge, erosion and slope instabilities, and temperature fluctuation. The standards for bridge structures that are currently used show considerable resistance to these effects; nevertheless, the research of new climate-proofed standards is ongoing.

7.5.3.6 Vegetation Along Roads

255. Vegetation along roads contributes to environmental protection, particularly by reducing noise and pollution, and can also have an adaptation function, such as protecting the Road from direct sunlight. On the other hand, improper use of vegetation along the Road can be a risk factor for traffic disruption when extreme weather events occur and may also influence road safety. Therefore, the recommendations for building up climate-resilient roads include replacing mature trees with hedges (using elastic woody plants suitable for and more adapted to a given climate zone) and planting the vegetation at a sufficient distance from the Road.

7.5.3.7 Quantifying Climate-Related Traffic Disruptions

256. When climate events shut down or reduce the capacity of a road, the consequences on supply chains, economic output, and access to services will vary widely based on local factors such as traffic volume on a particular road or alternative routes. On high-traffic roads, even relatively mild changes in climate could severely affect people and the economy-making. The case for adaptation is particularly strong.

7.5.3.8 Mitigation Measures

257. Fortunately, there are effective ways of adapting new roads and modifying existing ones to enhance climate resilience. A climate-resilient road comprises a set of technological measures rather than a single technology. The measures to make roads climate-proof are generally classified into two categories.

7.5.3.9 Engineering and Structural Measures

258. Under these measures, the technologies typically include the following:

a. Slope stabilization structures include dry-stone, gabion, and jute bag walls. The choice of the structure is dependent on the gradient of the road construction materials and road safety measures.
b. Paving of roads with durable materials
c. Proper alignment of new roads to avoid the vegetative loss
d. Improved drainage systems to avoid erosion of road materials. The drainage system includes drainage and cross-drainage structures such as cascades, small check walls, culverts, and causeways.
e. Improved planning of roads with proper cross-sections and standard dimensions.
f. Use of permeable/reservoir pavements. Water is stored in the pavement structure, infiltrated

into the soil, or discharged by a drainage system.

g. For concrete surfaces, higher cement contents and lower water-cement ratios are recommended.
h. Development of hydrophobic coatings suitable for use at the micro-mechanical and/or pavement surfacing level.
i. Adjustment of bituminous mixture design (using binders with higher softening points, includingpolymer modification of bitumen and selection of stronger aggregate skeleton);
j. Adjustment of the structural design of the pavement (flexible, semi-rigid and rigid/composite designs);
k. Greater use of concrete due to its higher temperature resistance and other advantages (longer lifetime, possibility of increased load, lower need for maintenance), albeit slightly higher purchase costs.
l. Changing the design of the concrete pavement mixture to reduce the amount of water required.
m. Increase the reflectance (albedo) of the road surface, e.g., employing bright, colored elements on the Road or reflective coatings of road surfaces.
n. Cooling pavements with water.

7.5.3.10 Composite Systems

259. Various composite systems are also used, including live check dams, vegetated stone pitching, and planted geo-textiles later supplemented by the vegetation. The composite systems reinforce the soil, thereby stabilizing the slopes. Proper maintenance of roads is very important to prevent its destruction.If there are existing cracks, then it is important to fill them. Otherwise, water penetrates during rain and produces hazards for the Road. Some possible mitigation measures are given below;

a. Repairs to potholes, cracks, and other minor defects come under routine maintenance.
b. Cleaning of drains and culverts
c. Upkeep of carriageway
d. Thin mix seal surfacing
e. Improving drains
f. Thin premix carpet

7.5.3.11 Tree Plantation Plan

260. During Road widening, the loss of vegetation and trees is one of the inevitable consequences and most common impact of road improvement. The project area is wet, so the impact will be less, where the tree can be planted three times as cut down and grown easily.

a. Grass Planting- Grass seed is spread; alternatively, the grass is hand-planted in lines across the slope. This results in slope stabilization by armoring and reinforcing slopes.
b. Shrub and Tree Planting- Shrubs or trees are planted regularly on the slope, which later create a dense network of roots in the soil supporting the slope.
c. Brush Layering, Palisades, and Fascines- In this system, woody cuttings are laid in lines across the slope, usually following the contour, which forms a strong barrier, preventing the development of rills and trapping material moving down the slope. The system catches debris and armor and reinforces the slope.

7.5.3.12 Climate Change Adaptation Benefits

261. Roads built to be climate resilient can tremendously enhance the adaptive capacity of a country like Bangladesh. It can augment other adaptation measures as well. Climate-resilient roads can help

provide people with a route to reach safety during calamities and ensure adequate service levels of the road network under extreme weather conditions.

262. It also helps planners to determine the most cost-effective and appropriate adaptation pathway. The study has developed a methodology to compare the cost of inaction vs. proactive adaptation, looking at three main dimensions:

- Assessing the cost of road assets over their entire life cycle, including construction, maintenance, repairs, and rehabilitation
- This analysis is important as climate-resilient roads tend to have higher upfront construction costs, yet, in many cases, those are more than offset by the lower annual cost for maintenance, repairs, and rehabilitation.
- Considering a variety of climate change scenarios:

7.5.4 Impacts on Gender and Sexual Exploitation and Abuse and Sexual Harassment (SEA-SH)

Impact:

263. SEA-SH risks can increase within local communities when there are large influxes of male workers from outside the area during the construction period. Such workers often come without their families and have large disposable incomes relative to the local community, and can pose a risk in termsof sexual harassment, violence and exploitative transactional relationships. These risks are higher where workers come into close contact with the local community, for example on access routes or when living together in remote areas. A large labor influx of male labor may increase exploitative sexual relationships.

264. During the construction phase, female workers are also vulnerable to various forms of harassment, exploitation and abuse, aggravated by traditionally-male working environments. This SEA-SH was committed mostly by coworkers or construction supervisors and was largely due to gendered stereotypes about the sexual availability of female construction workers.

265. No land acquisition and resettlement may also not contribute to the risks of SEA-SH. Individuals who make decisions about resettlement and compensation can abuse this power to sexually exploit vulnerable female PAPs.

Mitigation:

266. However, a SEA-SH Action Plan and the existing Gender Action Plan (GAP) will be followed to deal with the issues. Contractors must address the risk of SEA/SH, through:

a. Mandatory training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women. Training will be repeated. All such training should be conducted in Bengali;

b. Enforcement of a Code of Conduct for all the workers, including for the sub-contractors, explicitly prohibiting any SEA/SH.

c. Mandatory training and awareness raising on sexually transmitted diseases.

d. Informing workers about national laws that make sexual harassment and gender-based violence a punishable offense that is prosecuted;

e. Adopting a policy to cooperate with law enforcement agencies in investigating complaints about SEA/SH;

f. The Contractor shall provide separate waiting rooms for female workers & one waiting room for per 10 female workers with minimum provision of beds, chairs, water supply, ceiling fan,

lighting etc. nearest to each construction site.

g. The Contractor shall provide one large room for child care of lactating women's with minimum provision of beds, chairs, water supply, ceiling fan, lighting etc. nearest to the each construction site.

h. The Contractor shall provide separate toilet blocks for female worker with a minimum of one shower, hand basin, tissue stand, cloth stand, looking glass, urinal and toilet per 10 people.

i. Developing a system/GRM to responds to sexual exploitation and workplace sexual harassment related complaints/issues.

Occupational Health and Safety

267. There are several risks associated with project, especially during the construction period. Several hazards can be encountered while lifting cranes, drilling or using heavy types of machinery. Beside these, lack of clean and ventilated workspace and fire hazards are also associated risks during the project.OHS and CHS risk is likely to increase based on previous project experience. The expected risks maylead to personal injury, traffic-related accidents, fall from height, poor working and living conditions ofworkers, and lack of PPEs. LGED will make arrangements for contractor's training on OHS and CHS,and records of their compliance have to be inspected monthly and audited bi-annually. The key potential OHS and CHS risk associated with construction and operation phases are listed below.

a. Hazardous work and process: risk due to working at heights or in confined spaces, use of heavy machinery, or use of hazardous materials.

b. Accidents or emergencies: exposure to unsafe machineries, flammable chemicals/fuel, construction materials, a landslide at the workplace.

c. General understanding and implementation of occupational health and safety requirements. Work related diseases (e.g. Allergies, Respiratory problems, Muscular-skeletal disorders, Eye problems), and communicable diseases including Sexually Transmitted Infections (STIs).

CHAPTER 8: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

8.1 Introduction

268. The basic objective of the ESMP is to manage the adverse impacts of proposed project interventions in a way that minimizes the adverse impact on the environment and people at the sub-project sites. The proposed activities under 16 packages will be implemented at Jashore, Magura, Jhenaidah, and Chaudanga. The mitigation and benefit enhancement measures, identified in the screening report fully compliment the prime function of ESIA. The proposed ESMP covers the potential impacts identified during the study, mitigation measures to reduce/mitigate intensity of impacts, responsibility matrix for mitigations, and budgetary cost estimates for ESMP implementation. The objective of the ESMP would be to:

- Maximize potential project benefits and mitigate negative impacts;
- Facilitate the implementation of mitigation measures;
- Draw responsibilities for LGED, contractors, consultants, and other members of the project team for the environmental and social management of the Project;
- Define a monitoring mechanism and identify monitoring parameters to:
    - Ensure the complete implementation of all mitigation measures,
    - Ensure the effectiveness of the mitigation measures;
- Assess environmental training requirements for different stakeholders at various levels.

269. The ESMP will be managed through some tasks and activities and management plans. One purpose of the ESMP is to record the procedure and methodology for the management of mitigation identified for each negative impact of the sub-project. The management will delineate the responsibility of various participants and stakeholders involved in the planning, implementation, and operation of the sub-project.

8.2 Inclusion of Relevant Components of ESMP in Contract Documents

270. The bidding documents to be preapared should include a section on environmental and social specifications/clauses from ESMP to be incorporated in the Tender Document under General/Particular Specification. These clauses are aimed at ensuring that the Contractor carries out his responsibility of implementing the environment and social management plan (ESMP), monitoring plan as well as other environmental and safety measures. Such clauses may specify, for example, penalties for non-compliance as well as incentives to promote strong compliance. The various contractors must be made accountable for implementing the plans and mitigation measures that pertain to them through contract documents and/or other agreements regarding the obligations and importance of the environmental and social components of the project.

8.3 Environmental and Social Codes of Practice (ESCoPs)

271. The ESCoPs are generic, non-site-specific guidelines. The ESCoPs consist of environmental 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 use them to prepare site-specific management plans (discussed later in the Section). The ESCoPs 1-18 are listed below and attached in **Annex F**.

ESCoP 1: Waste Management
ESCoP 2: Fuels and Hazardous Substances Management
ESCoP 3: Water Resources Management
ESCoP 4: Drainage Management
ESCoP 5: Soil Quality Management
ESCoP 6: Erosion and Sediment Control
ESCoP 7: Top Soil Management
ESCoP 8: Topography and Landscaping
ESCoP 9: Borrow Areas Management
ESCoP 10: Air Quality Management
ESCoP 11: Noise and Vibration Management
ESCoP 12: Protection of Flora
ESCoP 13: Protection of Fauna
ESCoP 14: Protection of Fisheries
ESCoP 15: Road Transport and Road Traffic Management
ESCoP 16: Construction Camp Management
ESCoP 17: Cultural and Religious Issues
ESCoP 18: Workers HS
ESCoP 19: Occupational and Health and Safety

8.4 Environmental and Social Management Plan

272. The mitigation and compliance monitoring plans are the key elements of ESMP to be prepared based on the impact assessment described in **Chapter 7**. The Plans describe the potentially negative impacts of each sub-project activity, list mitigation and control measures to address the negative impacts and assign responsibilities for the implementation and monitoring of these measures. Environmental and Social Management Plan (ESMP) for mitigating environmental impacts during Pre-Construction, Construction and Operation Phase covering activities of 16 packaages is shown in **Table 8.1**.

Table 8.1: Environmental and Social Management Plan (ESMP): Pre-Construction, Construction and Operation Phase

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
	Pre-construction Phase		
5	No Land Acquisition (Details in **Table 3.2**)	• The payment of compensation and removal of private assets will be carried out in line with the RAP. Encroachers and squatters will be paid compensation in line with the agreed entitlement matrix along with titleholders. • Prior notice to the owners of the trees and ensure proper compensation to the affected people according to the RAP. Trees will be planted at a ratio of 1:3 once construction work completes • The ESMP and RAP will be disclosed websites of LGED and World Bank, before commencement of civil works.	PMCSC/SP-04/LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
4,1	Utilities Shifting 596 electric poles are to be shifted (CW 1-11 & 14-16) Details in **Table 3.2**	• Well-maintained and good working condition machines and equipment shall be deployed at site during erection of electrical poles. • Warning signboards shall be placed at visibility locations. • Proper safety measures should be adopted during the implementation of the utility shifting so that accidents of workers, technicians and local people can be avoided. • All workers and project personnel should use PPE at the site. • Utility shifting shall be done as per the agreed Utility shiting plan • The contractor in consultation with the responsible agencies and LGED will inform the local people about the schedule of the utility shifting prior to start of the work • Any grievance / complain shall be recorded and resolved by the competent authority as soon as possible. • To reduce the impacts, shifting shall be carried out in phases	Contractor/PBS/PMCSC/LGED
1	Clearance and approval	• Contractor shall follow the requirement of Environmental Clearance Certification (ECC) in addition to mitigation measures suggested in ESMP herein while establishing the construction camp sites, crusher units, hot mix plants, concrete batch mix plants, WMM plants, work force camp, waste management etc.	
All ESS except 9	Orientation for Contractors	Contractors are required to be oriented with the requirement of ESMP and ESS requirements of WB. This will include: • Regulatory compliance requirements • Grievance redress mechanism for both social and environmental issues • Training of contractors onESMP • Labor management procedures to be adopted • Community health & safety aspects at workplace and reporting requirements etc. under the packages. • Provision to prevent any form of sexual harassment (SH) or sexual exploitation and abuse (SEA) and sexual harassment (SH) as per ESMP and RAP	PMCSC/ LGED
4,3,2	Crushers, Hot-mix Plants and Batching Plants	• All construction plants are to be sited sufficiently away from sensitive areas like hospital, schools,	PMCSC/ LGED/

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
	Location	houses, commercial buildings, mosques (minimum 500 m). • The Contractor shall submit a detailed layout plan for all such site establishments and approval of Environmental/social Specialist shall be necessary prior to the establishment. Site specific protection measures required at such location will be considered to minimize associated environmental and social risk. • Specifications for crushers, hot mix plants and batching plants will comply with the requirements of the relevant emission control legislation. • Consent for the Establishment and Operation from LGED shall be obtained by the Contractor before establishment and operation of crushers, hot mix plants and batching plants. A copy of these permissions should be submitted to the PIU/PMCSC and LGED	Contractors: All Asphalt hot mix plant, rock crushing plants
2	Orientation of Implementing Agency and Contractors	• The PIU jointly with PMCSC shall identify the target audience for capacity building of project key stakeholders on the implementation of the project's ESMP. • The PIU and PMCSC shall organize orientation sessions and regular training sessions during all phases of the Project. This shall include on-site training (general as well as in the specific context of a sub-project). These sessions shall involve staff of PMCSC (involved in the implementation of ESMP), PIU, and Contractors.	Contractors, PMCSC/ LGED
Construction Phase			
4	Lack of sufficient planning fails to schedule construction to allow works to occur in the proper sequence and minimize disturbance /cost	• Plan the sequence of construction so that roads and basements can be disturbed the least, resurfacing occur only once, and inconvenience to the public minimized	Contractors, PMCSC/ LGED
3,4	Vegetation Clearance	• Vegetation clearance shall be confined to the minimum area required for improvement activities within the proposed formation width in order to limit the loss of productive resources, limit damage to surrounding features and limit ground disturbance and the associated erosion hazard. This shall be achieved by clearly marking out the extent of the proposed clearing and ensuring that clearing is only undertaken within	Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		these areas. • Trees within the boundaries of ancillary sites shall be retained wherever possible (**Table 3.2**). • The pits resulting from uprooting of trees and stumps shall be backfilled and compacted to prevent soil erosion and sedimentation. • clearly mark work area to prevent unnecessary or careless clearing, • Necessary OHS and CHS measures will be undertaken during tree-cutting.	
3,4,2	Hot mix plant/WMM/batching plant/crusher (air pollution, dust, noise, water pollution)	• To prevent water logging in the batching plant, drainage and sump shall be provided which shall be cleaned regularly. • Hot mix plant shall be fitted with pollution control devices Bag filters etc. • The stack height shall be at least 10m above the ground. • The premises shall be enclosed, and trespassing shall not be allowed. • The contractor shall submit the detailed layout plan for approval to the Engineer before getting into formal agreement with landowners for setting up of such site • Actions by Engineer and PIU against any non-compliance shall be borne by the Contractor at his own cost. • These plants need to be operated by the skilled and trained staff which will be ensured by the PMCSC.	Contractors, PMCSC/ LGED
8	Archaeology and cultural heritage management: CW-01 Imambara mosque CW-02: Shrine of Birsrestho Noor Mohammad CW-05: Micale Mudhusudon Datta Memorial House, Haummam Khana, Chachra Shib Mondir CW-16: Pir Pukur Mosque, Gorar Mosque, Hasilbag Mosque, Zor banglow Mosque	• Speed reduction around these sensitive receptors. • Flagman will be present to control the speed and divert the vehicles where possible • Barricade the crossing of both sides of the road with caution tape near the mosque, mondir, school, and shrines • More frequency (3-5 times) water spraying need to spray • Complaints to be referred to the Client • Contractor shall clearly spell out above mitigation measures and chance find measures in consultation with the local champions. • If an important site/potentially significant asset is uncovered during construction, contractor shall immediately stop the work temporarily and report the finding to the project authorities.	Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		• Contractor shall take necessary steps to protect chance finds from the impacts of any further project activities. • Contractors' code of conduct with rules and guidance on how to address chance finds and training of contracted workers on this	
3,5	Borrow Areas	• The Contractor shall obtain permissions in writing from all private landowners whose land will be temporarily utilized as borrow area • Only identified and approved borrow areas shall be used by the contractor. The environmental and social specialist of the PIU will inspect every borrow area locations prior to approval. • The Contractor will not start borrowing earth from selected borrow areas until formal agreement is signed between landowner and Contractor and Borrow Area management and redevelopment plan is submitted and approved by PIU. The operation of borrow area shall strictly adhere to approved borrow area management and redevelopment plan. • Borrow pits shall be rectangular in shape with one side parallel to the center line of the road and generally maintain the form of the land • No borrow pits shall be dug within 5 m of the toe of the final section of the road embankment; • Borrowing of earth from the cultivable land shall not be allowed; • Side slopes of 1:4 shall be maintained in the borrow areas • Borrow pits shall not be dug continuously but will dig according to the necessity of the construction work. • To ensure efficient drainage, the bed level of the borrow pits shall, as far as possible, slope down progressively towards the nearest cross drain, if any, and shall not be lower than the bed of the cross-drainUsed borrow areas may be converted into ponds for multipurpose uses by the local villagers / landowner. This will also act as a rainwater harvesting structure to help recharge the ground water of the area. However, the rehabilitation options shall be finalized in consultation with the landowner and Union Parishad and shall be approved by the Engineer / SDS Consultant.	Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
6	Changes in landscape Quality	• Plantation of trees should be done at all possible open space along the roads	Contractors, PMCSC/ LGED
4	Canal/waterbody/ river/ bank erosion for 37 bridges and 465 culverts covering different packages details of which is shown in **Table 3.2**	• Revetment and training work should be done by retaining wall, palisading etc. • All preventive measures such as temorary installation of silt fencing shall be undertaken to control potential siltation of these water bodies during retaining wall construction .	Contractors, PMCSC/ LGED
3,4	Approach road for 37 bridges under different packages list of which is shown in **Table 3.2**	• Slope protection should be done by concrete block and thick grass turfing • Adequate signage covering g night movement	Contractors, PMCSC/ LGED
3,4	Soil Erosion	• Local erosion protection works for pier and abutments for for 37 bridges and 465 culverts as shown in **Table 3.2** • Stockpile protection for loose materials. • Installation of erosion & sediment controls (e.g. berms/sediment fences) on the downslope of stockpiles • Topsoil stockpiles will be placed in suitable locations and not in drainage channels or on the banks of watercourses. • Excavation or similar activities shall not be undertaken during the monsoon periodImmediately after completion of work on bridges or high embankments, the slope stabilization measures such as turfing etc. shall be done • If excavation of soil is unavoidable during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces shall be protected by temporary drainage measures	Contractors, PMCSC/ LGED
3,4	Topsoil Saving and Reuse	• Topsoil is a valuable resource for the re-vegetation of cut and fill batters. Accordingly, it shall be saved from all Row sites and ancillary sites that will be disturbed during road improvement. • Topsoil shall be stripped from each site prior to any associated filling or sub-surface excavation. It shall be saved by stockpiling it at designated locations for reuse in covering embankment slopes, cut slopes, berms and other disturbed areas where the need for re-vegetation is identified. • The method for saving topsoil embankment requires stripping of the section to be excavated	Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		and re-spreading immediately onto the previously completed adjacent section of road. • If topsoil is to. be stockpiled it shall only be done above the excavation site to avoid mixing it with excavated sub-soil. • The Contractor shall save all available topsoil from construction sites within the ROW and re-use this material as approved by the Engineer / SDS Consultant. • Stockpiled topsoil shall be kept separate from other materials • The Contractor shall sow a cover crop on each topsoiled batter within 2 days of Topsoiling	
3,4	Stockpiling	• Stockpiled materials shall be stored on non-hazardous sites, away from both habitation and drainage lines to minimize off-site sedimentation and protect off-site features. • Stockpiling of backfilling materials shall not be allowed within the right of way especially on the side slops of the roads. • There is a common tendering of contractors to stockpile backfilling materials on the batter slope and utilize these materials without compacting then in layers. This practice shall be stopped completely.	Contractors, PMCSC/ LGED

2	Labor camp management	• Only one camp will generally be required along each 5 - 10 km length of the project road or at a major bridge site
		• Labor camps shall be located away from the at least 500m away from the residential areas/water bodies where damage to local resources is minimized
		  • Sufficient measures shall be taken to ensure provision of drinking water, garbage bins and sanitation facilities in the camps;
		  • A detailed layout plan for all camp shall submit and get approval from the PMCSC.
		  • Contractor shall prefer to the non-productive lands which has access to the existing roads.
		  • Contractor must make an agreement with the land parcel owner along with the photographs of original land
		  • Rooms of the labor camps must be properly ventilated.
		  • Hygienic conditions must be ensured in the labor camps
			Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		• No illegal tree cutting shall be allowed. • No waste disposal on pnd or water bodies	
2	Labor Requirements	• The Contractor preferably will use unskilled labor to give the maximum benefit to the local community. The contractor to be guided by the LMP. • Contractor shall enforce a Code of Conduct for all workers, including by sub-contractors, with provisions explicitly prohibiting any SEA/SH. • The contractor will ensure that labor related complains are addressed through the GRM of the project and extend co-operation to the PIU and GRC and implement GRC decisions. • The contractor will also conduct awareness building on social & Gender based violence /sexual exploitation and abuse and arrange training of the entire workforce at the worksite on gender- based violence Sexual Exploitation and Abuse /Sexual Harassment/Child and Women Trafficking for key local stakeholders. • Contractor will also conduct awareness training program on OHS, CHS, waste management on GCM, GBV/SEA/SH. Contractor will also conduct community and Stakeholders meeting for assessment of people living adjacent areas are aware and satisfy with their presence. • Contractor has to ensure that construction material supplies and primary supply workers do not use child and forced labor, and verify proper OHS conditions of the primary supply workers;	Contractors, PMCSC/ LGED
3,4	Reinstatement of services	• Local services, including tube wells, drains, cables, irrigation channels, drainage ditches and trails, are Commonly cut during road earthworks. These services are required by local people for crop production, drinking water and access and have the potential to damage road works. These services are often either inadequately reconnected or not reinstated at all. • All irrigation tube wells, channels, drainage ditches and walking trails shall be maintained during improvement works or, if necessary, temporary services shall be arranged or the owner/user's permission for temporary cessation shall be gained. Services shall be progressively reinstated as soon as road improvement works has been completed in the vicinity	

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
3,4	Drainage system	• Adequate drainage passages and routes during construction. • surface drainage is essential to ensure that storm runoff across the project roads causes minimal or no damage to the road and down slope features. • Excavate to improve drainage • The Contractor shall provide temporary surface drainage on sites that are prone to erosion. Where possible, the Contractor shall restrict access to these sites by placing fencing to prevent vehicle access.Wherever possible, drains shall outlet into stable drainage lines. Where this is not possible, the Contractor shall consult with adjoining down slope landowners on mutually acceptable locations for drain outlets The Contractor shall construct all designed drainage structures prior to, during or immediately following road improvement works in order to minimize potential erosion problems;	Contractors, PMCSC/ LGED
3,4	Disposal of Unsuitable Excess Materials /Spoil	The excavated top layer of pavement including HBB / scarified black tops shall be utilized as fill in widening of the project road. Unsuitable materials shall be disposed of properly. This material could also be used for improvement of access roads to ancillary sites (e.g. borrow areas, break crushing yards, workforce camps). The disposal of spoil at low impact sites shall be undertaken to minimize damage to environmental and social features in accordance with the instructions of the Engineer. Spoil shall generally not be sidecast over the edge of the excavation or placed in small drainage lines, above houses or at other sites where it is likely to cause damage to natural features or structures.	Contractors, PMCSC/ LGED
4,3	Water Pollution: Pile driving for bridge construction, turbid water, waste water, accidental spillage of oil into river, canal and/or water bodies -creating water pollution.	• Generated construction mud by pile driving, concrete plant and asphalt plant is treated by silt basin and remaining mud is disposed at designated dumping site. • Turbid water from construction work area to be treated in silt basin for satisfying water quality standard and drain away to the nearest drainage or River. • Domestic wastewater is treated by septic tank for satisfying water quality standard and drain away to the nearest drainage or river. Water quality including contents of arsenic will be checked	Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		before using groundwater as potable water for construction workers. • Waste oil shall be stored without leaking before legal disposal process. Refueling place to equipment/ vehicles shall be concreted floor. Fuel and oil shall be stored at concrete floored tank surrounded with concrete fence.	
	Air Quality		
3	Dust from excavation, and backfilling.	• Water trucks/sprays as required. • Excavation with limited soil free fall. • After compacting, water spraying shall be done at regular intervals to prevent dust nuisance	Contractors, PMCSC/ LGED
3	Dust from dirt on roads	• Water trucks/sprays for dirt roads as required. • Spraying water on ground surfaces in GCM, roads re-construction sites, stockpiled materials, etc. • Restricted/limited access – only approved access roads used.	Contractors, PMCSC/ LGED
3	Dust from ROW	• Minimize areas of vegetation clearing and disturbed soils during construction where possible. • All vehicles travel at 40 km/hr or less on the ROW, 20 km/hr max when driving past a work site (walking speed).	Contractors, PMCSC/ LGED
3	Greenhouse gas emissions from operating plant and equipment	• Plant and equipment to be shut down when not required. • Vehicles not to be left idling to keep the air conditioning running. • Vehicles to be properly serviced and maintained.	Contractors, PMCSC/ LGED
3	Dust received at sensitive receptors (nearby mosque, mandir, school and residents)	• Speed reductions around sensitive receptors if required.	Contractors, PMCSC/ LGED
3	Dust from vehicle movement with construction material, equipment, burning of fossil fuel etc.	• Speed reductions around sensitive receptors if required. • Vehicles and machinery shall be regularly maintained and fitted with pollution control devices to keep emission and noise levels at a minimum.Cover the construction material by tarpaulin to prevent the blowing the soil. • Contractor to use good quality equipment with minimum emissions	Contractors, PMCSC/ LGED
	Noise Pollution		
3	All equipment and construction activities	• Notifications of impending works provided to residents by contractor • Properly maintained equipment with effective exhaust systems	Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		• Construction would be stopped between 9.00 p.m. and 6.00 a.m. in the residential areas and the public shall be informed about the regulations of noise pollution. • Workers in the vicinity of strong noise shall wear earplugs and their working time shall be limited.	
4,3	Construction equipment – excavators; concrete trucks, generators, padding machines etc.	• Operate only within allowable working hours (6am-6pm 7 days a week). • Use well-maintained equipment with low noise modern mufflers • Use alternative construction methods, such as sonic or vibratory pile driving in noise sensitive areas. • Program loudest operations for the time of day likely to cause least impact wherever practicable.	Contractors, PMCSC/ LGED
4	Light vehicles and delivery trucks	Restrict vehicle operation and deliveries to inside working hours.	Contractors, PMCSC/ LGED
4,3	Solid waste Management	• Contain all solid wastes at designated location within construction sites. • Contractor shall undertake segregation of waste at source • The municipal waste shall be disposed to the approved landfill site only or contractor shall make necessary arrangements with the municipalities /Zila Parishad. • Construction and demolition (C&D) waste shall be disposed to approved locations. • Open burning of solid wastes, whether hazardous or nonhazardous, shall not be allowed • E-waste shall be collected properly and disposed to approved vendors only.All hazardous waste containers to be labeled clearly with a waste hazard identification label, (b) Contractor will establish a demarcated temporary waste storage area where waste will be stored pending transport to final treatment/disposal location. • Contractor should follow the 3R (Reduce, reuse, recycle) guideline of waste management. • Barrel composting for solid waste management can be the best option of the solid waste management in GCMs of the project. Barrel composting is a composting technique involving aerobic digestion of organic wastes and therefore is almost free from bad smell. It is income generative and solves the solid waste management problem at the source	Contractors, PMCSC/ LGED Poor Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		level. It recognizes the potentiality of resource recovery from bulk volume of organic wastes and provides opportunities for income for the poor who are interested in such income generative activities.	
2	OHS issues	• Contractor shall plan the activities to prevent any untoward accidents at site. • Induction training to the workers and subsequent training on safety aspects. • Trained workers at hot mix plants/batching plant/Wet Mix Macadam (WMM) shall be deployed. • Toolbox (including its maintenance) training to the workers. such as job rotation, training safe work procedures, workplace monitoring, limiting exposure or work duration, etc. • Safe work systems and administrative or institutional control measures shall be followed by the contractor. • Protective footwear such as safety boots/gumboots, helmets and protective goggles shall be used by the workers. • Welders shall use protective eye-shields or safety goggles. • All electric wire must have proper insulation • All combustible waste materials should be disposed promptly • Lifesaving jacket shall be used by the workers and flagmen • Workers working in noisy area shall be provided earmuff • Fall prevention and protection measures shall be implemented for the worker working at more than 2m height. • Use of proper PPE at sites. • First aid box shall be provided at identified locations. • Ensure all earthmoving/compacting equipment with obstructed view does not operate in reverse gear unless the equipment has a reverse signal alarm or a worker has been designated to signal when it is safe.	Contractors, PMCSC/ LGED
2	Sexual exploitation and abuse (SEA) -Sexual Harassment (SH) and Community Health and Safety (CHS)	• Contractor shall enforce a Code of Conduct explicitly prohibiting all workers on SEA/SH. • Ensure to mitigate the SEA-SH related complaints; • Provide necessary training on SEA-SH • Contractor should conduct awareness campaign and	Contractors, PMCSC/ LGED

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		educate on the SEA-SH	
4	Community health and safety	• The contractor shall plan activities in residential areas after having discussion with the community. • Local shall be kept informed about the activities which the contractor is taking up in the residential areas. • Trained drivers having valid license shall be allowed to drive construction vehicles/heavy equipment/plants • Excavated areas shall be properly barricaded. • Tresspassing of construction site shall be prohibited • Traffic Management Plan shall be prepared by the contarctor during construction • Contractor shall take all precautionary measures to prevent community exposure to water-borne, water based, water-related, and vector-borne diseases, and communicable and noncommunicable diseases that could result from project activities	Contractors, PMCSC/ LGED
4	Traffic Management	• The Contractor will bear the full technical and statutory responsibility in maintaining the public and vehicular access along the project right of way. • Movement especially at nearby the educational (Schools, colleges, Madrasha etc.), community infrastructure (mosques, graveyards, Prayer Ground etc.) and health complex should be controlled • At least 30 days before commencing work on any section of the road, ghat /market, the Contractor shall submit to the Engineer his proposals for traffic management including working drawings of traffic arrangements, showing all detours, temporary roads, temporary market sheds, temporary bridges, necessary barricades, warning lights, road signs, etc. • Contractor to preapare diversion road in bridge locations and get it approved from enginner (**Table 3.2**) • The Contractor shall control the passage of traffic in one-way operation either manually by posting flagmen or using signals.	
2	SEA-SH Complain	• PIU shall run a SEA/SH responsive GRM and shall ensure to resolve the SEA-SH related complaints; • Provide necessary training on SEA-SH • Contractor should conduct awareness campaign	Contractors, PMCSC/ LGED
	Incidence reporting	• PIU and contractor together promptly report any incidence as per the Bank's ESIRT (March 2023)	PIU, PMCSC/Cont

ESS	Environmental and Social Impact/ Issue	Mitigation Measures and Enhancement	Implementation and Monitoring Agency
		• PIU will organize regular orientation on incidence reporting with the contractors and other project relevant staffs • Contractor, in turn, will organize similar orientations for the site engineers/managers.	ractor
Operation Phase			
3	Air Pollution	• Increase Road side vegetation cover. • Good maintenance of road • Regular monitoring of for air quality • Good maintenance and operation of vehicle	LGED
3	Noise Pollution	After construction: Compliance with traffic control and regulations.	LGED
3	Solid waste generation	• Develop and ensure proper collection, storage and disposal system in a safe place. • Ensure organic waste decompose through barrel composting system.	LGED
6	Trees and Vegetation CW 1 – CW 16 Details in **Table 3.2**	• The tree plantation will be undertaken during the construction phase in lieu of the tree removal. It will be carried out in 1:3 ratio i.e., three (3) saplings for one tree cutting. • Necessary tree guards shall be provided to protect saplings. • Watering of the tree plantation will be ensured. • All realignments shall be enhanced with the tree plantation.	LGED

8.5 Resettlement Action Plan (RAP)

273. Land Acquisition will not be required any package.

8.6 Monitoring Program

274. 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 effectively, and also to evaluate program impacts on the key environmental and social parameters. Various types of ESMP monitoring are discussed below.

Compliance Monitoring

275. The purpose of 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 PMCSC with the help of prepared checklists.

Phasewise Monitoring Plan

276. Effects monitoring is a very important aspect of ES management to safeguard the ES issues. The monitoring plan proposed for the sub-projects/packages is presented in **Table 8.2**. The monitoring will comprise surveillance to check whether the contractor is meeting the provisions of the contract during the construction and operation of the project including the responsible agencies for implementation and supervision.

Table 8.2: Environmental and Social Monitoring Plan

Project Phase/ Affected Component	Environmental/ social Issues	Parameters to be Monitored	Location	Measures	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
Pre-construction and Construction Phase								
Employment	Engaging local labour	Associated project worker	Camp site	Consultation with local labour	World Bank and GoB	Weekly	Contractor	PMCSC, PIU, LGED
Women Worker/ Vulnerable/ Disadvantaged	GBV, SEA-SH	Wage, increment, working hour etc.	Camp site and work site	Consultation with female labour	World Bank and GoB	Weekly	Contractor	PMCSC, PIU, LGED
Community or labour	Social conflict and labour rest	GRM	At project office	Complaint box and discussion with labour	World Bank and GoB	Weekly	Contractor	PMCSC, PIU, LGED
Source of Materials	Borrow site and Safety	Materials	Borrow pit/ site	Visual inspection of borrow site and ensuring operational health and safety	World Bank and GoB	Monthly	Contractor	PMCSC, PIU, LGED
Operation of borrow site	Health and Safety	operational health and safety	Borrow pit/site	Visual inspection of borrow site and ensuring operational health and safety	World Bank and GoB	Monthly	Contractor	PMCSC, PIU, LGED
Ambient Air Quality For all the packages test should be conducted in the locations shown in **Table 5.1**or as instructed by the Engineer	Dust generation	Dust	Project activity areas and construction workers camp	Visual inspection of all active work areas	Government of Bangladesh (GoB) and international standard	Daily	Contractor	PMCSC, PIU, LGED
	Ambient Air Pollutant	SPM, PM 2.5, PM10, CO, SO2, NOx	4 samples at Project site (one sample at labor camp and other three at environmental sensitive areas in the construction activity areas)	24-hour	Air quality standard by DOE, Bangladesh	Quarterly	Contractor by Engaging Govt. Institute/ Environmental Firm	PMCSC, PIU, LGED
Noise For all the packages test to be conducted in the	Increase in ambient noise	Noise levels in Leq, Leq day, Leq	Four locations Project site at high noise generation	Visual & hourly	Noise Pollution Control Rules (2006)	Daily and Quarterly	Contractor by Engaging Govt.	PMCSC, PIU, LGED

Project Phase/ Affected Component	Environmental/ social Issues	Parameters to be Monitored	Location	Measures	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
locations shown in **Table 5.1** or as instructed by the Engineer	levels	night	location and adjacent sensitive receptor				Institute/ Environmental Firm	
Water Quality For all the packages test should be conducted and for the locations shown in **Table 5.1** or as instructed by the Engineer	Contamination of surface water	Turbidity, pH, DO, Total dissolved solids, Salinity, oil & grease, BOD5, COD, NH3	Water sample at each of river for each polder	Monitoring	Surface water quality standard as per Schedule 2 (A) (1) of ECR 2023	Dry and wet two seasons	Contractor by Engaging Govt. Institute/Environmental Firm	PMCSC, PIU, LGED
	Contamination of Groundwater quality	pH, Alkalinity, Cl, Fe, As, TSS, Salinity, Pb, etc.	Sources of drinkingwater at construction camp/site	Monitoring	Drinking water quality standard as per Schedule 2 (B) of ECR 2023	Dry and wet two seasons	Contractor by Engaging Govt. Institute/ Environmental Firm	PMCSC, PIU, LGED
Oil spill	Soil and water contamination	Check the spillage of oil and other lubricants	Storage of Fuel Oil container, vehicle parking of Project Site	Monitoring	Visual Monitoring	Weekly	Contractor by Engaging Govt. Institute/ Environmental Firm	PMCSC, PIU, LGED
Topsoil For all the packages test to be conducted in the locations shown in **Table 5.1** or as instructed by the Engineer	Soil Pollution	Check liquid waste is carried out by experienced personnel and in proper way Careful and proper handling of oil and other hazardous liquids	Project Site	Visual inspection of all active work areas	Monitoring	Daily	Contractor	PMCSC, PIU, LGED
Erosion	Soil erosion	Soil erosion	Side slopes of the embankments and material storage sites	Visual inspection of erosion prevention measures and occurrence of erosion	-	Daily and at the end of filling activity	Contractor	PMCSC, PIU, LGED
Sediment of Khal	Sediment Pollution	Heavy Metal	Project site	Monitoring	International Standard	Quarterly	Contractor	PMCSC, PIU, LGED
Waste	Liquid waste, Solid Waste	Check storage, transportation, disposal,	Project Site	Visual inspection of all active work areas	Monitoring	Weekly	Contractor	PMCSC, PIU, LGED

Project Phase/ Affected Component	Environmental/ social Issues	Parameters to be Monitored	Location	Measures	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
		handling of hazardous waste Waste and effluents to be collected and disposed safely of camp. Wastes and garbage from construction sites to be disposed safely						
Sanitation	Health & safety	Pollution, Cleanlines, handwash facility	Construction camp/ site	Visual Inspection	National Strategy for Water Supply and Sanitation	Daily and Weekly	Contractor	PMCSC, PIU, LGED
Ecology	Terrestrial and aquatic flora and fauna	Tree and Aquatic Species	River, Ponds, Canals and Forest	Visual inspection	Monitoring	Once for tree prior to starting construction and yearly aquatic monitoring	Contractor	PMCSC, PIU, LGED
Occupational Health and Safety	Workers Health & Safety	Check quality of food and accommodation at construction camp. Check safe water supply, hygienic toilet at camp, construction of drain at campsite. Check toilets are close to construction site. First Aid Box	Construction Camp & Construction area	Visual inspection of all active work areas	Monitoring	Daily	Contractor	PMCSC, PIU, LGED

Project Phase/ Affected Component	Environmental/ social Issues	Parameters to be Monitored	Location	Measures	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
		with required tools and medicines. The heavy construction material to handled and stored safely putting due care on public safety. Heavy construction materials at construction site to be stored and handled safely; and Check of personal protective equipment (PPE) for worker at the sites						
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic Risk of SEA/SH Transmission of STDs	Accidents, incidents, and complaints	Embankment area	Incidents, accidents, and community complaints	Monitoring	Based on occurrence	Contractor	PMCSC, PIU, LGED
Traffic safety	Safety and signs	Traffic sign, flagman, traffic risk	Construction area	Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	WB and National traffic safety guidelines	Daily and Monthly reporting	Contractor	PMCSC, PIU, LGED
Post-Construction Phase								
Noise For all the	Increase in	Noise levels in	4 locations Project site at	24-hour	Noise Pollution	Yearly	LGED through a	PIU, LGED

Project Phase/ Affected Component	Environmental/ social Issues	Parameters to be Monitored	Location	Measures	Standards/ Guidelines	Frequency	Responsible Agency	
							Implemented by	Supervised by
packages test should be conducted and for the locations shown in **Table 5.2**	ambient noise levels	Leq, Leq day, Leq night and hourly Leq	high noise generation location and adjacent sensitive receptor		Control Rules (2006)		nationally recognized laboratory	
Water Quality For all the packages test should be conducted and for the locations shown in **Table 5.1**	Contamination of surface water	Turbidity, pH, DO, Total dissolved solids, Salinity, oil & grease, BOD5, COD, NH3, Tc, Fc	River, Canals, Ponds of the project area	Monitoring	Surface water quality standard as per Schedule 2 (A) (1) of ECR 2023	Yearly	LGED through a nationally recognized laboratory	PIU, LGED
	Contamination of Groundwater quality	pH, Alkalinity, Cl-, Fe, As, TSS, Pb Total and Fecal coliform etc.	4 Locations Project site	Monitoring	Drinking water quality standard as per Schedule 2 (B) of ECR 2023	Yearly	LGED through a nationally recognized laboratory	PIU, LGED
Soil Quality For all the packages test should be conducted and for the locations shown in **Table 5.1**	Soil Pollution	Heavy Metal	Project site soil	Monitoring	-	Yearly	LGED through a nationally recognized laboratory	PIU, LGED
Sediment Quality	Soil Pollution	Heavy Metal	Project site soil	Monitoring	-	Yearly	LGED through a nationally recognized laboratory	PIU, LGED
Biological Environment	Horticulture and Greenbelt Development	Survival rate of plants and shrubs	Green belt	Monitoring	number successful growth	Quarterly	LGED	PIU, LGED

8.7 Performance Indicators

277. For evaluating the performance of the ES management and monitoring plan, performance indicators are identified for efficient and timely implementation of measures/actions proposed in ESMP. The indicators are defined both for the implementation phase and for the operation phase. PMCSC will be responsible for compiling the information on these indicators and reporting to LGED. Income generation-related training will help the PAP/VG for their livelihood improvement. The contractor shall keep accurate records of the Contractor's personnel, including the number of each class of Contractor's personnel on the site and the names, ages, genders, hours worked, and wages paid to all workers. These records shall be summarized every month in a form approved by the concerned authority and shall be available for inspection by the project authority until the Contractor has completed all work.

278. To measure the overall ES performance of the project, a list of performance indicators is given below; however, a detailed list of indicators will be prepared by PMCSC.

- Number of inspections carried out by PMCSC per month
- Number of non-compliances observed by PMCSC or E&S.
- Availability of environmental specialists in E&S.
- Availability of environmental specialists in PMCSC.
- Availability of environmental specialists with contractors.
- Timely reporting of documents (as defined in EMP and monitoring plan)
- Number of training imparted to stakeholders/other capacity-building initiatives
- Timely disbursement of compensation/ timely resettlement of project-affected people
- Timely implementation of resettlement schedule.
- Some grievances were received.
- The number of grievances resolved.
- Some construction-related accidents.

8.8 Grievance Redress Mechanism (GRM)

279. A project-level GRM needs to be established based on its existing institutional mechanism. Joint Verification Committee (JVC), Property Valuation Advisory Committee (PVAC), Resettlement Action Committee (RAC), and Grievance Redress Committee (GRC), have been formed on April 24, 2022, to compensate the affected persons/families for the land acquisition, structure, tree, business, and other impacts during the RAP implementation program with the financial assistance of the World Bank. Committees will take effective measures to solve complaints from affected persons within a short time and maintain transparency.

280. The grievance redress process will be implemented in four phases: the primary level at the Upazila phase, the second at the district level, the third at the project management phase, and the fourth at the ministry of LGED phase. PIU will also set up and run GRM responsive to labor management and SEA/SH risk management.

8.9 Capacity Building

281. Capacity building for effective implementation of the environmental and social risk management requirements is a key element of the ESMP. Capacity building for environmental and social safeguard management will need to be carried out at all tiers of the project, including LGED, E&S Cell, PMCSC, and contractors. At the construction site, PMCSC will take the lead in implementing the capacity building plan, though the contractors will also be responsible for conducting pieces of training for their 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 8.3** provides a summary of various aspects of the environmental and social training to be conducted at the construction site. E&S Cell may revise the plan during the project implementation as required.

282. During the O&M phase of the project, this training will continue to be conducted by LGED staff for all relevant O&M personnel and the community.

- Reporting
- Documentation

283. The E&S Cell will assist PMCSC and contractorsin conducting training.

Table 8.3: Environmental and Social Training

Contents	Participants	Responsibility	Schedule/Frequency
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 Social and cultural values.	PIU; PMCSC; Selected contractors' crew	PMCSC	Before the start of the field activities. To be repeated as needed
ESMP; Waste disposal; OHS	Construction crew	Contractors	Before the start of the construction activities. To be repeated as needed
Road/waterway safety; Defensive driving/ Waste disposal; Cultural values and social sensitivity.	Drivers; boat/launch	Contractors	Before and during the field operations. To be repeated as needed
Road and GCM operation; Waste disposal; OHS Natural resource conservation; Housekeeping.	Road and GCM 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.
SEA-SH	GCM and Road staff	PMCSC	Before the start of the field activities To be repeated as needed.

8.10 ES Reporting

8.10.1 ES Monitoring Reports

284. The PIU will submit quarterly monitoring reports on the environmental, social, health and safety (ESHS) performance of the Project, including but not limited to the implementation of the ESCP, status of preparation and implementation of E&S documents required under the ESCP, stakeholder engagement activities, functioning of the grievance mechanism(s).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. Additionally the environmental monitoring reports will be submitted before, during, and end of the construction period and annually for three years after the completion of construction.

8.11 ESMP Implementation Cost

285. The mitigation measures that are needed to be part of the design of Road and GCM are included in the cost estimate. Detailed cost estimates for ES mitigation and monitoring for CW-01 are given in **Table 8.4** and summary of total cost for ES management of 16 packages are given in **Table 8.5**.

286. Cost of mitigation and monitoring measures during ESMP implementation for CW-01 which includes two GCMs and adjacent 7 roads will be BDT 3,509,800.00 and the total cost of ESMP implementation for 27 GCMs and 431.263 km of road within 16 CWs will be BDT 54,844,800.00.

Table 8.4: Environmental Mitigation, Monitoring, and Management Cost for CW-01 Package

Sl. No.	Item Code	Description of Item	No. Item	Rate (Tk.)	Amount (Tk.)
Environmental Mitigation and Monitoring					
	WeC 14.01.01	First Aid Box: Supplying, equipping, and maintaining adequate first-aid box made of Aluminum, stainless steel, plastic, or fabric. Medicine during the construction period: Burn Free / Burn Gel, emergency sterile water, Rolls of Gauze, Trauma dressing, Antiseptic wipes, Band-Aid, Tweezers, First Aid Tape, and Paramedic Scissors. (COVID-19 Safety medicine, Sufficient Masks, Antiseptic, Saline, scissors, cotton, and other emergency medicine related to human injury, Trauma, etc.	10	15000.00	150,000.00
	WeC 14.02.03	Waste Disposal Facilities: Providing, installing, and maintaining waste collection bins one for organic waste and the other for inorganic waste of minimum capacity of 80 liters 3 three types of color (Green, Red, and yellow)	24	4200.00	100,800.00
	WeC 14.03.03	Rehabilitation of ancillary sites Facilities including stockpile sites, brick crushing sites, borrow areas, workforce camps	6	50000.00	300000.00
	WeC 14.05.01	Personal Protection Equipment for Workers (Gum Boot/safety boot, Gloves, Masks, Helmet, , etc.	6	20000.00	120000.00
	WeC 14.05.01	Air Quality Test PM10, PM2.5, NOX, SO2, CO. (Before, during and end of the work)	24	15000.00	360000.00
	WeC 14.05.06	Noise level measurement before, during, and end of construction	27	2000.00	54,000.00
	WeC 14.05.03	Water Quality Test: pH, EC, TDS, Turbidity, DO, BOD5, COD, NH4N, and Phosphate.	24	7500.00	180,000.00
	WeC 14.05.04	Fire Hazard Equipment at 2 GCM Site	6	15000.00	90,000.00
	WeC 14.05.05	Environmental Training for Contractors and Workers	4	50000.00	200,000.00
	Sub-Total in Word: Tk. Fifteen Lac Fifty-Four Thousand Eight Hundred Only				**1,554,800**
Social Mitigation and Monitoring					
	WeC 15.01.01	Implementation of GRM for workers: Implementation cost of GRC decisions	10.00	20000.00	200000.00
	WeC 15.01.02	Awareness building on social and Gender-based violence /sexual exploitation and abuse Training of all the workforce at the worksite on gender-based violence Sexual Exploitation and Abuse/Sexual Harassment / Child and Women Trafficking for key	6.00	25000.00	150000.00

Sl. No.	Item Code	Description of Item	No. Item	Rate (Tk.)	Amount (Tk.)
		local stakeholders (50 Participants in a day).			
	WeC 15.01.03	Awareness raising training program: Awareness training program particularly for occupational health and safety and infectious diseases such as sanitation, safe water use, waste management GCM for key local stakeholders (50 Participants in a day)	6.00	30000.00	180000.00
	WeC 15.01.05	Capacity building session of key local stakeholders: Capacity building of key local stakeholders (50 Participants in each session)	6.00	20000.00	120000.00
	WeC 15.01.06	Community Engagement: Community and Stakeholders meeting for assessment of whether people living in adjacent areas are aware and satisfied with the presence (200 participants in each meeting)	6.00	50000.00	300000.00
	WeC 15.01.07	Gender sensitization on GBV/SEA/SH: Refresher's training of all the workforce on gender-based violence/ sexual exploitation and abuse/sexual harassment at the workplace. (50 participants in each training)	6.00	25000.00	150000.00
	WeC 15.01.08	GBV awareness building communication material development (Leaflet, poster, billboard, signboard, street show)	6.00	25000.00	150000.00
	WeC 15.02.01	COVID-19 response and prevention: Awareness campaign, making and inadequate preventive measures including testing, treatment, and isolation facilities at worksite for protection of COVID-19.	6.00	25000.00	150000.00
	WeC 15.02.02	Providing fitting fixing and maintenance of COVID-19 Awareness signboard as per direction of EIC-IC to place in a suitable place on the site including submission of proposal for the materials and size of the signboards	15.00	20000.00	300000.00
	WeC 15.02.03	Supplying distribution and stock-up of COVID-19 awareness leaflets and posters (Color) in A4 size glossy paper	2000	40.00	80000.00
	WeC 15.02.04	Awareness building program for the contractors (or his appointed sub-contractors/ suppliers and the workers on minimization of the labor influx impacts and efficient workforce management (50 Participants in each program)	6	25000.00	150000.00
	WeC 15.02.05	Occupational health and safety: Testing treatment for waterborne diseases (Cholera, Typhoid, diarrhea dysentery, etc.)	25.00	1000.00	25000.00
	B. Sub-Total in Word: Tk. Nineteen Lac and Fifty-Five Thousand Only				1,955,000.00
	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)				3,509,800.00

Table 8.5: Summary of Environmental Mitigation, Monitoring, and Management Cost for 16 Package

CW	Amount (Tk.) in Word	Amount (Tk.)
01	In Word: BDT. Thirty-Three Lac Forty-Five Thousand Eight Hundred Only (A+B)	3,345,800.00
3	In Word: BDT. Thirty-Three Lac Forty-Five Thousand Eight Hundred Only (A+B)	3,345,800.00
04	In Word: BDT. Thirty-Three Lac Forty-Five Thousand Eight Hundred Only (A+B)	3,345,800.00
05	In Word: BDT. Thirty-Three Lac Forty-Five Thousand Eight Hundred Only (A+B)	3,345,800.00
06	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)	3,509,800.00
07	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)	3,509,800.00
08	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)	3,509,800.00
09	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)	3,509,800.00
10	In Word: BDT. Thirty-Three Lac Forty-Five Thousand Eight Hundred Only (A+B)	3,345,800.00
11	In Word: BDT. Thirty-Three Lac Forty-Five Thousand Eight Hundred Only (A+B)	3,345,800.00
12	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)	3,509,800.00
13	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)	3,509,800.00
14	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)	3,509,800.00
15	In Word: BDT. Thirty-Three Lac Forty-Five Thousand Eight Hundred Only (A+B)	3,345,800.00
16	In Word: BDT. Thirty-Five Lac Nine Thousand Eight Hundred Only (A+B)	3,509,800.00

8.12 Responsibility of the Contractor

287. The Contractor shall carry out the project-related activities as specified in the contract agreement. LGED shall ensure that contractors take due responsibility to mitigate those negative impacts. Environmental awareness creation, particularly about the direct construction impacts and the health, pollution, and safety issues will be the Contractor's responsibility. Consultants' supervisory roles will conform to relevant Clauses incorporated in construction contracts and national legislation. Clauses that may be incorporated with tender documents are:

- The Contractor shall take all steps to protect the environment and avoid causing damage to water bodies, and public nuisances of all types during implementation operations;
- The contractor shall comply with the existing statutes and regulations concerning the execution of works as per requirements of DoE and donor's environmental guidelines;
- The contractor shall be responsible for familiarizing himself with the legislation relating to environmental protection that is relevant to his activities. Reference to rational environmental quality guidelines should be made;
- The contractor shall be responsible for bearing the costs of cleaning up any environmental pollution resulting from his activities if methods for doing that are available and effective;
- Precautionary signboards /danger signals/ propitiatory billboards shall be placed in appropriate places to notify people about the possible dangers;

- The contractor in case of surface water pollution from his activities shall take adequate prevention measures not to pollute water and in case pollution of surface water occurs he shall be liable to revert to the original quality of water particularly where surface water has a potential use. Cost both for tests and purification shall be borne by Contractor;
- Where water abstraction from boreholes dug by the Contractor results in adverse effects on groundwater that at the time of commencement of the contract was being used by local people, the Contractor under the situation shall ensure the supply of an equivalent quantity of safe water to the users;
- The Contractor shall at all times maintain the camp and construction sites under his control in clean and tidy conditions and shall provide appropriate and adequate facilities for temporary dumping of all types of wastes before disposed of properly;
- Remove equipment, surplus material, rubbish, and temporary works and leave the site in a clean condition to the satisfaction of the company's representatives after completion of construction activities;
- Be responsible for paying compensation upon the appropriate monetary evaluation applicable to the local market if any damage is incurred to agricultural land or surrounding homesteads outside of the requisitioned land;
- The contractor shall be responsible for the safe transportation and disposal of all types of wastes generated out of his activities in a manner so that no environmental pollution or hazard to health is caused to the workers and local people. In case any third party is employed to dispose of wastes, the Contractor shall even in such case be considered as if he has discharged the responsibilities himself under this Clause until the wastes leave the site under his control. He remains legally bound to exercise due diligence to ascertain that the proposed transport and disposal mechanism do not cause pollution or public health hazards;
- The contractor shall not allow waste oil, lubricant, or other petroleum derivatives to be used as dust suppressants and shall take all reasonable precautions to prevent accidental spillage of petroleum products, contact of such materials with soil or water course through discharge, run-off, and seepage;
- The contractor shall be responsible for the provision of adequate sanitary facilities to the construction workers (including those employed under subcontract) at construction sites, offices, and campsites. He shall not knowingly allow the discharge of any untreated sanitary waste to the ground or surface water. Before mobilization of the construction workforce, the Contractor shall provide details of sanitary and drainage arrangements to the Engineering Representative (ER) for approval. The details should include maintenance and operation plans and sufficient other information to allow the ER to assess whether or not the proposed facilities are adequate;
- All vehicles and plants operated by the Contractor (including the subcontractor) shall be maintained according to manufacturers' specifications and their original manual, particularly regarding control of noise and/or smoke emission. The ER shall reserve the right to ask the Contractor for replacement or rectification of any vehicle or plant within 48 hours that he believes emits excessive noise and smoke by serving a notice in writing;
- The contractor shall make every reasonable effort to reduce noise pollution caused by construction activities including relocation of the crusher and ancillary plant at a new site where the distance between these plants and residential sites is safer for attenuation of noise in the existing residential areas;
- The contractor shall take all reasonable measures to minimize dust-blowing from sites under his control by spraying water on stockpiles, bare soil, haul roads, un-surfaced traffic routes, and any other

source of dust when conditions require dust suppression. If the ER considers dust suppression measures adopted by the Contractor ineffective, the Contractor shall in that case take further measures to minimize dust blowing at the construction site as per his direction.

- In case any traffic disruption is caused due to construction activities of the Contractor (or subcontractors), the Contractor shall in that case be responsible for providing alternative road access for operational use by vehicles. The facilities provided shall be such that neither of the parties is disturbed by the arrangement;
- In case of any road damage by the Contractor (or subcontractor), the Contractor shall notify the ER of it and shall repair the road to its original condition at his own cost;
- In case of any damage caused to agriculture or to the surrounding homesteads outside the RoW either permanently or temporarily by the Contractor or Subcontractor's activities, the Contractor shall in such case remain responsible for paying monetary compensation for the damage appropriate to the local market value;
- The Contractor on completion of the Contract shall remove the equipment, surplus materials, rubbish, and temporary structures of all types and shall leave sites in a clean condition to the satisfaction of local people and the ER.
- Contract shall be responsible for the enforcement of a Code of Conduct for all the workers including ny the sub-contractors related to SEA/SH risk management and ensure that there is "zero tolerance" any such behavior by any worker.
- Contractor will also manage labor and SEA/SH compliant GRM and in case of any incidence including SEA/SH will promptly report to PIU as per the guidelines of the Bank's ESIRT, dated March 2023.

8.13 Emergency Response and Disaster Management Plan

288. An Emergency Response and Disaster Management Plan is a written document, which is required according to occupational health safety standards for an organization and must be displayed at every work site. It is a detailed step-by-step procedure to follow in an emergency such as a fire, chemical spill, or major accident. An emergency response plan also includes information such as whom to notify, who should do what, and the location of emergency stock. The Emergency Response Plan includes any measures that should be in place at all facilities to combat an accident resulting from fire, explosion, or due to any natural calamities (e.g., Earthquakes, cyclones, and floods).

CHAPTER 9: INSTITUTIONAL ARRANGEMENT FOR IMPLEMENTATION OF ESMP

9.1 Institutional Arrangement

289. The project implementation will be carried out under the overall supervision of the Project Director. PMCSC will carryout detailed supervision of contarctor's ES performance.. The responsibilities include screening of packages to identify ES requirements, undertaking due diligence, reviewing the contractor's plans, assisting the LGED in buildingcapacity,, assist in ES management, monitoring and supervision.

290. Additional responsibilities include assessing projects and their environmental and social impacts, preparing ES plans, and engaging with affected communities through information disclosure, consultation, and informed participation. Submission of all required information, including assessment reports, ES plans/frameworks, and monitoring reports, to PIU for review.Ensure that contractors appropriately implement the agreed measures, including the ES requirements in bidding documents.

9.2 Environmental and Social Management Unit (ESMU): LGED has Established an ESMU to Provide Support on ES Issues

291. The team members of the ESMU will be:

1. Headed by Superintending Engineer
2. Executive Engineer (Environment unit of EMU)
3. Executive Engineer (Social unit of EMU)
4. Two Assistant Engineers for Assisting the Executive Engineers
5. PIU Environmental Specialist
6. PIU Social Specialist

9.3 Project Organization

292. The PIU and PMCSC will be responsible for ES management of the project. DoE will approve the ESIA report and issue environmental clearance certificate to Project authority. The roles and responsibilities of ESMU, PMCSC, and contractors are presented in **Table 9.1** below. The project organization is presented in **Figure 9.1**. PIU will be critical in coordination among the EMU, PMCSC, Contractors, and district LGED office.

Table 9.1: Roles and Responsibilities for Implementation of Environmental and Social Risk Management

Sl.	Position	Responsibilities
1	Project Director (PD)	Overview of the WeCARE, Phase-I, Project's compliance to World Bank's and national laws and regulations on ES Aspects
		Ensure compliance with the mitigation measures by the Contractors, and coordinate the PIU;
		Ensure that the ES requirements are integrated into the Project formulation, implementation and bid documents
		Ensure that sufficient funds are available for the implementation of all agreed ES risk management measures.

Sl.	Position	Responsibilities
		Review of environment and social monitoring and audit findings and grievances
		Submit quarterly risk reports to World Bank.
		Review the annual environmental audit and approve any changes in the ESIA and ESMP if any new or unanticipated impacts occur during project implementation due to design change or other reasons
		In case of significant new or unforeseen impacts, immediately inform Bank to make a decision on the same as well as update relevant project reports.
2	PIU Environmental Specialist	Ensure that SP-04 Projects meet the statutory and Bank's requirements;
		• Assist the PD in the implementation of the ESMP during the project implementation period; Ensure compliance with the mitigation measures by the Contractors;
		• Recommend for approval to PIU all documents and ensure that design and documents include all relevant EHS risk management;
		• Review the environmental performance of the project through Monthly Reports and Monthly Environmental Audits reports submitted by the Project Management Consultants and report to the PD;
		• Carry out quarterly environmental audits and report back to the management
		• Review Corrective Action Plan for closure of monitoring non-compliances and Environmental Audit Findings
		• Overall coordination and management of environmental risk management through PIU supported by Design and Supervision Consultants (PMCSC)
		• Review and action on all grievances related to the environment through the GRM.
		• Prepare the Annual risk management Monitoring Reports to the Management for review and onward submission to LGED and the Bank;
		• Review all the findings in the monitoring and auditing report and ensure corrective action are implemented so that it does not reoccur;
		• Updating of the ESMP if any new or unanticipated environmental impacts occur during project implementation due to design change or other reasons
		• Organize training for Capacity building of the PIU for effective implementation of safeguard requirements
3	PIU Social and resettlement Specialist	• Ensure that SP-04 Projects meet the statutory and Bank's requirements; • Recommend for approval to PIU all documents and ensure that design and documents include all relevant Social Safeguards; • Review the social performance of the project through Monthly Reports and report to the PD; • Review Corrective Action Plan for closure of monitoring non-compliances; • Overall coordination and management of social risk management through PIU supported by Design and Supervision Consultants PMCSC; • Review and action on all grievances related to social issues through the GRM; • Prepare the Annual Safeguards Monitoring Reports to the Management for review and onward submission to LGED and the Bank; • Review all the findings in the monitoring and auditing report and ensure corrective action are implemented so that it does not reoccur; • Updating of the ESMP if any new or unanticipated social impacts occur during project implementation due to design change or other reasons; • Organize training for Capacity building of the PIU and the PIA for effective

Sl.	Position	Responsibilities
		implementation of risk management requirements.
4	PIU Labour and Occupational Health and Safety Officer)	• Responsible for monitoring and assessing labor management issues, unsafe situations and developing measures to assure site safety. • Correct unsafe acts or conditions or stop unsafe acts when immediate action is required
		• Inspect construction camps and worksites to identify potential hazards and unsafe works and report the findings with recommendations for Corrective Action. Report back to the PIU on follow-up actions
		Advise • To reduce or eliminate work-related accidents which may occur through • Usage of faulty equipment and electrical cord extensions • Trenching and excavating • Working at height, on elevated surfaces, and at night time. • In case of an accident, the safety officer will conduct a safety investigation to determine root causes, what procedures may have gone wrong, and gather the evidence necessary to identify the cause of the accident. Based on the investigation results, the safety officer will document findings and recommendations that would be followed to prevent the accident from happening again.
		• The safety officer is also responsible for reviewing and meeting all state and national safety standard requirements for record-keeping. The safety officer also submits a record of all injuries that resulted in lost work time, restricted duties or job transfers.
		• Guide the Contractor to develop safety management systems like work permits, close-out and tag-out procedures etc.
		• Carry out periodic HS training/refresher training on Health and Safety;
		• Assist the PIU in making reporting the performance of the project. w.r.t safety to the Management.
		• Carry out induction and refresher training of PIU and contractor on Occupational Health and safety aspects;
5	LGED Environment Officer	• Preparation of all applications including documentation required for statutory clearance. Assisting LGED in obtaining requisite clearances.
		• Review all documents and ensure that design and documents include all relevant EHS Safeguards; • Supervise the environmental monitoring for air quality, noise and water quality on daily basis using portable, hand-held monitoring meters and visual water quality during the construction period.
		• Compile and analyze all reports submitted by the Contractor;
		• Review the Contractor's ESMP and make necessary recommendations to PIU;
		• Carry out monthly environmental audits of the project components;
		• Preparation of the Corrective Action Plan for closure of the Environmental Audit Findings along with the PIU the Authority Engineer and the Contractor;
		• Assisting the Environment Specialist of the PIU in the discharge of their duties;
		• Carry out any specialized studies which would be required for the environmental safeguards e.g. rainwater harvesting, solar energy and environmental enhancements, etc.
		• Assist the PIU to implement the process and procedures described in the Project

Sl.	Position	Responsibilities
		Management Manual;
		• Capacity building of PIU for effective implementation of ESMP;
		• Updating of checklists and reporting formats prepared by Authority Engineer for ESMP implementation.
6	PIU Gender Specialist	• Ensure all applicable laws and regulations relating to gender issues are followed • Assist with resolution of grievances related to gender issues are properly resolved on time • Ensure project GAP is properly implemented • Provide input to quarterly, and annual reports as directed by PD and/or PIU.
7	PMCSC	• Responsible for ensuring the project activities and assisting PIU in the execution of the project that the environmental and social management measures are being implemented with the implementation of the project. • Supervise civil works, ensuring compliance with all design parameters including quality requirements and supervise all other project activities that have a significant environmental impact • Supervising contractors for ESMP implementation • Prepare monthly reports and submit them to PIU • PMCSC will have dedicated environmental and social staff • Responsible for preparing all project documents • Provide support in project management and operation on a day-to-day basis • Prepare contract documents and other necessary reports • Supervise contractors engaged in the project implementation to perform their works • Responsible for ensuring the health and safety issues on construction sites. • Responsible for ensuring that the environmental management measures are well incorporated in the design and planning of projects as well as in the project budget. • Review the environmental studies of projects, prepared by a consultant, to ensure compliance with the requirements of LGED and DoE. • Assist to improve necessary guidelines, and detail the Environmental Code of Practice for the project. • Assist to prepare and review the tender documents, Contract documents for contractors and ToR for recruitment/engagement of contractors (e.g. detail work order) to ensure that the environmental management measures are included in the legal obligations in the contract. • To monitor and supervise the implementation of ESMP and SMP done by contractors in the pre- • for implementing ESMP, as and when required. • To provide relevant information construction, construction and post-construction phases of each project. • Coordinate with different stakeholders to the Independent Consultant for M&E for implementation of ESMP.
8	Contractor (Environment, Health and Safety Officer)	• Ensure all applicable laws and regulations relating to environment, health, and safety are followed. All environmental monitoring including air, noise, and water quality as per monitoring plan and schedule and submit the report to PIU. Strictly follow the ES requirement of bidding document.
		• Ensure the reinstatement pathways, and other local infrastructure to at least their pre-project condition upon the completion of construction; and

Sl.	Position	Responsibilities
		• Ensure application of all Labor laws and standards related to: - prohibition of child labor as defined in national legislation for construction and maintenance activities; - equal pay for equal work of equal value regardless of gender, ethnicity, or caste; - no discrimination in respect of employment and occupation; - Allow freedom of association and effectively recognize the right to collective bargaining and elimination of forced Labor; and with the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the project sites.

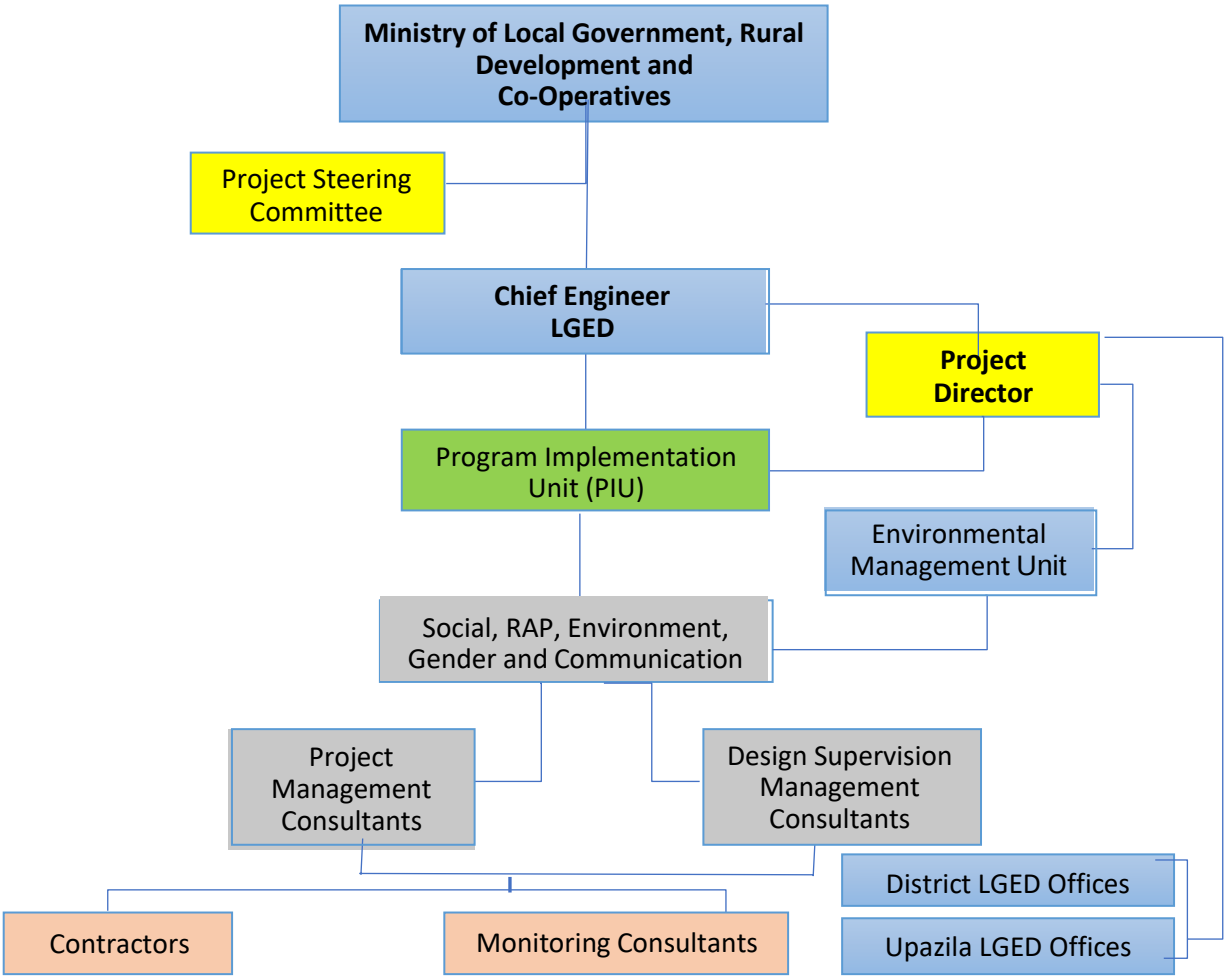


Figure 9.1: Organizational Structure for ESMP Implementation

CHAPTER 10: CONCLUSIONS

10.1 Conclusions

293. WeCARE, Phase-I project plays an important role in the national economy, improved lifestyle, reduced travel time with less cost connecting of 4 Western districts GCMs and adjacent roads of Bangladesh. The project will have few environmental and social impacts during the construction and operation periods as discussed in **Chapter 7**. Assuming effective implementation of the mitigation measures and monitoring requirements as outlined in the ESMP, the project is not expected to have significant adverse ES impacts. It should also be pointed out that the environmental and social benefits are likelyto be important; an all-weather transport route will link major population and agricultural product centers in the west of Bangladesh. The potential for congestion will be reduced which will ultimately reduce vehicle emissions due to increased and more regular speeds and the air quality adjacent to the road will improve.

294. The proposed road will enhance the trade activities of the country and provide a smooth and safe traveling corridor. The project will have overall positive impacts with few negative impacts. Most of these negative impacts are mainly construction related and can be mitigated by the successful implementation of the ESMP. There will be some residual impact for significant negative impacts, which will be compensated by environmental enhancement measures recommended in the ESMP. No long-term and significant adverse environmental impacts are however envisaged for the operation phase of the project. Hence, the project is environmentally and socially feasible provided that the mitigation measures are properly implemented during the Project execution.

295. Major environmental and social impacts of the project would be solid waste, wastewater pollution, drainage system, ambient air emission, and noise pollution, loss of some trees, and electric poles shifting, hamper pedestrian movement, occupational health and safety issue, sanitation, and loss of livelihood. In the post-construction/ operation phase the impact is due to the generation of solid waste, wastewater, dust and gaseous emission and noise from the vehicle movement. These problems would be overcome by taking proper mitigation measures as stated in ESMP. There are also very significant positive impacts during construction like local people's job opportunities and increase business opportunities.

296. The Socioeconomic profile deals with various socio-economic details of the surveyed households (437 HHs covering 1609 people for RAP-1, 281 HHs covering 826 people from RAP-2, 647 HHs covering 2289 peoples for RAP-3, and 688 HHs covering 2277 people for RAP-4) based on the finding of the survey. Detail of the socio-economic study prepared in 4 RAPs and is presented in separate reports. For details of Rap please Visit the Link

RAP 2 - LGED CW-06

https://oldweb.lged.gov.bd/UploadedDocument/ProjectLibraryGallery/1973/RAP%202%20-%20LGED%20CW-06.pdf

Bangla Executive summary of RAP-2

https://oldweb.lged.gov.bd/UploadedDocument/ProjectLibraryGallery/1972/Bangla%20Executive%20summary%20of%20RAP-2.pdf

Resettlement Action Plan (RAP-1) of WeCARE

https://oldweb.lged.gov.bd/UploadedDocument/ProjectLibraryGallery/1852/Resettlement%20Action%20Plan%20(RAP-1)%20of%20WeCARE.pdf

Executive Summary of RAP Report-1 (Bangla)_WeCARE

https://oldweb.lged.gov.bd/UploadedDocument/ProjectLibraryGallery/1817/Executive%20Summary%20of%20RAP%20Report-1%20(Bangla)_WeCARE.pdf

297. During stakeholder consultation meeting the local people showed interest in the project considering the need for national development. ESMP if properly implemented and followed by the Environmental and Social Monitoring Plan during the pre-construction, construction, operation and decommissioning phases will ensure taking corrective measures.

10.2 Recommendations

298. The following are recommendations that should be followed by the project authority during the construction and operation of the project: With the study of the project, the following issues are recommended based on field observation and interviews with stakeholders:

a. To follow the ESMP during pre-construction, construction and operation phases strictly.

b. Follow strictly the ES monitoring plan.

c. Findings and suggestions of ESIA study in project planning, design and operation should be considered and implemented with strong monitoring by the supervision consultants.

d. Establishing Institutional arrangements with proper logistics and training for Environment, Social, Health and Safety in the Project Management Unit during the pre-construction, construction and operation phases of the project.

e. The proposed project should be implemented safely and, in an environment friendly manner.

f. During the construction and operation phases, local employment including vulnerable PAPs especially women will be given priority.

g. To evaluate the true consequences of the project, Stakeholder consultations should be continued during the construction and operation of the project at regular intervals. The stakeholder consultation should address the following issues while doing future consultations.

h. Avoid Social Conflict

i. Adequate safety system for working people by using PPE at the construction site.

j. Safety signage to be displayed with visible to access in the project area.

k. Project area shall be restricted to movement of general people to avoid risk.

l. Barrier /cordon up to be implemented in project area as safety precaution of site.

m. Traffic movement should be controlled by using safety sign or by flagman.